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GROUNDWATER TECHNOLOGY ®

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AQUIFER TESTING AND GROUNDWATER FLOW MODELING REPORT MARATHON OIL COMPANY INDIAN BASIN REMEDIATION PROJECT 18 MILES NORTHWEST OF CARLSBAD, NEW MEXICO JUNE 1995

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EXECUTIVE SUMMARY

Groundwater Technology, Inc. (Groundwater Technology) conducted aquifer testing in June 1995 and groundwater flow modeling in July and August 1995 for Marathon Oil Company's Indian Basin Gas Plant. The objectives for the aquifer testing and groundwater flow modeling were to:

- Determine aquifer parameters: transmissivity, storage coefficients, and hydraulic conductivities; and,
- Simulate pumping scenarios that capture the dissolved plume.

Step-drawdown testing was conducted to determine an optimum pumping rate for a constant-rate pumping test and well efficiency. A well efficiency of 24% was calculated at a pumping rate of 20.6 gpm. Well efficiency decreased at rates above 21 gpm.

Constant rate testing was conducted for a period of 24 hours at a average rate of 20.6 gpm. Significant drawdown (>0.6 feet) was measured 280 feet from the pumping well. Wells >1000 feet from the pumping well recorded minimal drawdown. Pumping test data were analyzed using various analytical techniques to determine aquifer properties of transmissivity, storage coefficient, and hydraulic conductivity. Assuming an aquifer thickness of 53 feet (equivalent to the pumping well screened interval), an average transmissivity of 18,300 gpd/ft, storage coefficient of 4.1×10^{-4}, and hydraulic conductivity of 350 gpd/ft^2 were calculated.

Groundwater flow modeling was simulated using QuickFlow (Rumbaugh, 1991), a two-dimensional analytical groundwater flow model. Several pumping and injection scenarios were simulated showing possible configurations that could be used to establish capture of the dissolved-phase plume and enhance PSH recovery by creating a cone of depression.

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1.0 INTRODUCTION

Between July 20-22, 1995, Groundwater Technology, Inc. (Groundwater Technology) performed aquifer testing at the Marathon Oil Company (Marathon) Indian Basin Remediation Project site (the site) located 18 miles northwest of Carlsbad, New Mexico (Figure 1). Aquifer tests performed included a step-drawdown test, a constant-rate aquifer test and a recovery test. The objectives for this phase of work were to:

- Perform a step-drawdown test to evaluate recovery well performance and to establish a pumping rate to be used for constant-rate aquifer testing;
- Define aquifer transmissivity and storage coefficients in the area influenced by pumping;
- Use the aquifer test results to simulate groundwater flow in the area impacted by a natural gas condensate and brine release;
- Recommend a well spacing, well construction, and pump sizing that will maximize plume capture while minimizing the volume of treated water; and,
- Use the flow model to simulate pumping and injection scenarios that will effectively capture the plume.

2.0 AQUIFER TEST PROCEDURES

2.1 Step-Drawdown Test

On June 20, 1995, Groundwater Technology began a step-drawdown aquifer test in well MW-72. The step-drawdown test was used to estimate the specific capacity of the pumped well at different pumping rates and to predict a pumping rate that maximizes well performance. In the step-drawdown test, the well was pumped at successively higher rates and the drawdown for each rate, or step, was recorded. Recovery well MW-72 was pumped at four steps at pumping rates of 11.7, 14.7, 19.3, and 24.3 gallons per minute (gpm). Each step was pumped for 60 minutes. Drawdown in MW-72, MW-73, and MW-74 was monitored using an In-Situ Hermit SE 2000 electronic data logger and pressure transducers (Appendix A). Measurements were occasionally taken manually using a Keck interface probe and are included in Appendix B. The purpose of the hand measurements was to provide a check of the transducer calibration and to provide instant feedback on the area affected and the magnitude of the drawdown at various pumping rates. The results of the step-drawdown test are presented in Section 3.3 of this report.

2.2 Constant-Rate Aquifer Test

A constant-rate aquifer test on well MW-72 was started at 0130 on June 21, 1995. This test was used to estimate the aquifer transmissivity and storage coefficient. Well MW-72 was pumped at a constant rate, and drawdown in the pumping well and observation wells was measured at appropriate intervals. During the test, the following five types of data were collected to aid in the interpretation of the aquifer test results:

- Drawdown was measured in the pumping well and six observation wells (MW-73, MW-74, MW-75, MW-58, MW-59, MW-61A) completed in the pumped zone. Pressure transducers and electronic data loggers were used in the pumping well and three observation wells. Water levels in all six observation wells were measured with an interface probe. Well completions and boring logs for the pumped well and six observation wells are included as Appendix C.

- Measurement of flow using an in-line centrifugal flow meter provided instant flow rates and total volume for average flow rate determination over longer periods of time.

- Water quality parameters pH, specific conductance, and temperature were recorded at one- to two-hour intervals.

- Barometric pressure measurements during the time prior to, during and after pumping were acquired from the Carlsbad Airport.

- Background water-level measurements were made in well MW-71, located approximately 4500 feet away from the pumping well MW-72, to evaluate the effects of barometric pressure fluctuations on water levels.

3.0 AQUIFER TEST RESULTS

3.1 Assumptions

The assumptions used for non-steady state aquifer test analyses are:

1. The water-bearing formation is uniform in character and the hydraulic conductivity is the same in all directions.
2. The formation is uniform in thickness and infinite in areal extent.
3. The formation receives no recharge from any source.
4. The pumped well penetrates, and receives water from, the full thickness of the water-bearing formation.
5. The water removed from storage is discharged instantaneously when the head is lowered.
6. The pumping well is 100% efficient.
7. All water removed from the well comes from aquifer storage.
8. Laminar flow exists throughout the well and aquifer.
9. The water table or potentiometric surface has no slope.

Although these assumptions are not true for aquifers outside of a laboratory setting, the non-steady state equations provide a good estimate of the aquifer transmissivity and storage.

The primary assumption that is not true and which may have an effect on the results of this test is that the pumping well is not fully penetrating the thickness of the aquifer. Since the Queen Aquifer is probably several hundred feet thick at this site, and contamination occurs only in the uppermost part of the aquifer, a fully penetrating well is not practical, or necessary. Also, it is unlikely that vertical flow exists during pumping from the deepest portion of the aquifer. Furthermore, it is impossible to evaluate the depth where vertical flow does not occur using the existing wells on site. For this analysis, it is assumed the upward vertical flow from the lower portion of the aquifer is negligible in comparison to the horizontal flow in the screened interval of MW-72. Therefore, the transmissivities presented in this report are for the upper 53 feet of the aquifer, not for the entire aquifer thickness.

3.2 Corrections to Data

During the pumping test, the transducer cable in MW-73 slipped twice late in the constant-rate test. Since drawdown was very slow and the interval between readings was only ten minutes, the data were corrected by assuming that there was no drawdown during the ten-minute interval when the cable slipped.

3.3 Analysis of the Step-Drawdown Test

Four steps of pumping were conducted at pumping rates ranging from 11.7 to 24.3 gpm. The specific capacity (pumping rate divided by drawdown) of each well after 60 minutes of pumping ranged from 1.1 to 2.1 gpm/ft. A table summarizing the results of the step test is located in Appendix D. Also in Appendix D, discharge is graphed against drawdown. This graph shows that the drawdown increases at a higher rate per gpm at a pumping rate of approximately 21 gpm indicating that the well inefficiency increases at pumping rates above 21 gpm. However, it should noted that the graph in Appendix D also shows that a line which passes though the origin and pumping rate of 11.7 gpm has a lower slope and therefore higher well efficiency than pumping rates above 11.7 gpm. MW-72 was not pumped at rates below 11.7 gpm during step testing due to excessive pressures (>200 psi) on the PVC discharge line.

Well efficiency is defined as the theoretical specific capacity, Q/s, divided by the actual specific capacity where Q = flow rate, in gpm, and s= drawdown, in feet. The theoretical specific capacity is estimated using transmissivity, T, and is defined by the equation:

$$\frac{Q}{s} = \frac{T}{2000}$$

The actual specific capacity is:

$$\frac{Q}{s} = 2.1\ \frac{gpm}{ft}$$

Well efficiency is calculated as:

$$\frac{2.1\ gpm/ft}{8.6\ gpm/ft} = 24\%$$

3.4 Analysis of the Constant-Rate Aquifer Test

Prior to analyzing time-drawdown data for this aquifer test (Appendix E), the following data were reviewed to qualitatively assess their effect on the time-drawdown data:

- Water quality during pumping;

- Flow rates; and,
- Barometric pressure changes.

3.4.1 Water Quality During Pumping

Groundwater quality parameters specific conductance, pH, and temperature were measured on hourly to bi-hourly intervals (Appendix B). Specific conductance ranged from 1124 to 1284 mmhos/cm. There are no apparent trends in the specific conductance data. pH ranged from 7.01 to 8.10 during the period of pumping. The pH values dropped from 8.1 at the start of the test to 7.14 after 1.5 hours of pumping. pH values remained relatively constant after 1.5 hours of pumping. Temperature fluctuated from 61.7 F to 75.7 F during the period of pumping. Water temperature variations generally paralleled ambient air temperature during the period of pumping. It is unlikely that actual groundwater temperature varied to this extent. Measured variations are more likely the result of warming and cooling trends of the sample container and temperature probe.

3.4.2 Flow Rates

Groundwater discharge from the pumping well was measured to determine: 1) instantaneous flow rate using a stopwatch and the in-line flowmeter; and, 2) average flow rate using hourly flow meter readings. By this method the flow volume was measured over a short period of time (usually 30 seconds to 1 minute), then divided by the time period to provide an instantaneous flow measurement. The flow meter was also used to measure the total volume of water discharged during pumping. Meter readings were recorded at approximately hourly intervals and an average flow rate during the previous hour was calculated (Appendix B). A total of 29,646.3 gallons of water was pumped during 1,440 minutes of pumping for an average flow rate of 20.6 gpm. Variations in the instantaneous and average flow rates were generally less than 10% more or less than the initial recorded rate, ranging from 18.7 to 21.5 gpm.

In Appendix E, drawdown data for MW-72, MW-73, MW-74, and, MW-75 are plotted against time of pumping on a linear scale. It is apparent from these graphs that there is a variation in the drawdown. This variation is most likely the result of minor fluctuations in the pumping rate. A comparison of these graphs shows that this variation occurred in each well and the variations are parallel. The magnitude of the variation is largest in the pumping well (MW-72). The magnitude of the variation is approximately equal in MW-73 and MW-75 and the timing of the response parallels the response in the pumping well. The magnitude of the response in MW-74 is less than in the pumping well, but greater than the response in MW-73 and MW-75. This response may indicate that MW-74 may not be as well connected via the fractured bedrock network to the pumping well as MW-73 and MW-75.

3.4.3 Barometric Pressure Changes

Barometric pressure changes were obtained from the National Climatic Data Center for the Carlsbad Airport. An attempt to collect background water level using a dedicated pressure transducer prior to and during the test at well MW-71, located 4,500 feet away from MW-72 was unsuccessful. The cause of the failure is unknown. However, post-test water-levels were made in MW-71 and correlated with barometric variations (Appendix F). Barometric variation during the post-test monitoring period was 0.09 inches of mercury (0.17 feet of water) and the water level in the well varied 0.12 feet of water. However, as shown in Appendix F, it is apparent that the water levels and barometric variations do not correlate. This data indicates that the natural water table at this site is not measurably affected by barometric variation, therefore barometric corrections to the pumping test data were not made. To further support this conclusion, barometric pressure variation is plotted against the drawdown data collected during the pumping test in Appendix E. These graphs in Appendix E illustrate the variation in drawdown that occurred during the pumping test, but it is apparent that the variations do not correlate with the barometric variations.

3.5 Methods of Analysis

The Queen Aquifer is present in fractured dolomite and dolomitic sandstone. Fractured aquifer test solutions take into account the effects of a dual porosity system, the porosity of the fractures, and the porosity of the formation matrix. Four methods have been identified that are appropriate for the determination of transmissivity and storage coefficients for the Queen Aquifer at this site. They are:

- Bourdet-Gringarten (1980) curve-fitting method (for observation wells);
- Kazemi et al. (1969) straight-line method (for observation wells);
- Theis (1935);
- Cooper-Jacob (1946); and,
- Theis (1935) recovery.

Transmissivity was not determined using data from the pumping well (MW-72) because of the large well inefficiencies that resulted in excessive drawdown in the well. In addition, data from wells MW-75, MW-58, MW-59, and MW-61A were also not included in the analysis because of insufficient drawdown. Wells MW-73 and MW-74 were the only wells that provided sufficient drawdown and recovery data for analysis.

3.5.1 *Bourdet-Gringarten (1980) Method*

The Bourdet-Gringarten (1980) Method showed that the dual-porosity behavior of a fractured aquifer occurs only in a restricted area around the pumped well. Outside that area, the drawdown behavior is that of an equivalent unconsolidated, homogeneous, isotropic confined aquifer representing both the fracture and matrix flow. Since the Queen aquifer is unconfined, the drawdown values were corrected to account for the reduction in aquifer thickness due to dewatering. This method was only used for the analysis for drawdown data in MW-73 (108 feet from the pumping well). Data from well MW-74 (280 feet from the pumping well) was not analyzed using this method because dual-porosity effect at this distance from the pumping well was not observed.

Using the Bourdet-Gringarten Method, the early drawdown data in observation wells is matched to a normal Theis curve. The resulting transmissivity value is representative of the fracture transmissivity (T_f). The resulting storage coefficient is representative of the fracture storage (S_f). The late drawdown data is also matched to a normal Theis curve. The transmissivity value for the late data is also representative of the fracture transmissivity. The storage coefficient for the late data is equal to the sum of the fracture storage and the matrix storage ($S_f + S_m$). The Theis curve match for both the early and late drawdown data for MW-73 are shown in Appendix G.

3.5.2 *Kazemi et al. (1969) Method*

The Kazemi et al. (1969) Method is a solution for determination of fracture transmissivity (T_f), fracture storage (S_f) and matrix storage (S_m) in observation wells. When using this method, the drawdown data are plotted on a semi-log plot. The early drawdown data are matched to a straight line and solved for Cooper-Jacob's (1946) straight-line approximation to determine fracture transmissivity and fracture storage. The late drawdown data are also matched to a straight line to determine fracture transmissivity and matrix storage using Jacob's equation. This method was used for data for well MW-73 because the double straight-line effect was observed in the semi-log plots of drawdown (Appendix G).

3.5.3 *Theis (1935) Method*

The Theis Method is used to determine aquifer transmissivity and storage coefficient from confined isotropic, homogeneous aquifers under nonsteady-state flow. The Theis method can be used for unconfined aquifers if the drawdown is relatively small in comparison to the total aquifer thickness and if the drawdown data are corrected for the decreasing aquifer thickness that occurs over time during pumping. This method was used to analyze the drawdown data from well MW-74 because the effects of the dual porosity system are greatly diminished at distances from the pumped well (280 feet) and are difficult to measure on a log-log plot of the time-drawdown data. The Theis curve match and solutions for

transmissivity and storage coefficient for well MW-74 data are included in Appendix G.

3.5.4 Cooper-Jacob (1946) Method

The Cooper-Jacob (1946) Method is also used to determine aquifer transmissivity and storage coefficient from confined isotropic, homogeneous aquifers under nonsteady-state flow. The Cooper-Jacob method can be used for unconfined aquifers if the drawdown is relatively small in comparison to the total aquifer thickness and if the drawdown data are corrected for the decreasing aquifer thickness that occurs over time. This method is a straight-line matching technique where late time-drawdown data are plotted on a semi-log plot. The slope of the matched line is used to solve the Cooper-Jacob equation for transmissivity. The semi-log plot and match line are included in Appendix G.

3.5.5 Theis (1935) Recovery Method

The Theis Recovery (1935) Method is applicable to confined and unconfined aquifers with partially- or fully-penetrating wells. Recovery data are not significantly affected by minor variations in the pumping rate or multiple aquifer complexities such as dual-porosity, partial penetration, low well efficiencies, etc. For these reasons, the recovery data are frequently the most reliable sources of transmissivity. In this test, the recovery data from MW-73 and MW-74 were analyzed. The late recovery data (time of recovery increases to the left) show a slight drop in water level in both MW-73 and MW-74 at $t/t' = 8$ (time of recovery = 200 minutes). This slight decline in water level is about 0.05 feet and may be attributable to the resaturation of the matrix blocks (Appendix G). Transmissivity was calculated using the recovery data after 200 minutes ($t/t' < 8$). Recovery data are presented in tabular format in Appendix H.

The graph and table in Appendix H for MW-72 show that water levels rose above the pre-pumping water level within 2 minutes after turning the pump off. This anomaly is caused by low well efficiency and the absence of a check valve above the pump. The graph for MW-75 shows that the water level continued to decline after the pump was turned off. This condition commonly occurs when the aquifer has a limited extent (i.e., low flow boundary) and the water level towards the cone of depression is lower than that in the outlying well. When this occurs, the outlying well (MW-75) continues to react as though the pump is still pumping and the aquifer is not supplying water at a consistent rate.

3.6 Aquifer Parameters

Table 1 summarizes the analysis results of the MW-72 constant-rate aquifer test. The results are based on the assumption that the aquifer is 53 feet thick and that upward vertical flow is negligible in comparison to horizontal flow during the test. This assumption is made because drawdown is very small in comparison to the saturated thickness of the screened interval of MW-72. Variability in the transmissivities most likely

results from heterogeneity in the aquifer and the degree of connection between fractures. Data from the wells greater than 280 feet from MW-72 were not analyzed due to the very small measured drawdown and variability in the measurements. However, these data are most useful for estimating capture zones.

A summary of aquifer parameters for the various methods of analysis is provided in Table 1. Estimated transmissivities from the various methods of analysis used range from 13,500 to 25,300 gallons per day per foot (gpd/ft). The storage coefficient of the fractures range from 3.6×10^{-4} to 4.8×10^{-4} and averaged 4.1×10^{-4}. The storage coefficient of the formation matrix, as determined by the Bourdet-Gringarten (1980) and the Kazemi et al. (1969) Methods, is 1.2×10^{-2}. Hydraulic conductivity values range from 260 to 480 gpd/ft^2 and have a mean of 350 gpd/ft^2 based on a 53-foot-thick aquifer.

4.0 GROUNDWATER FLOW SIMULATIONS

Groundwater flow modeling and particle tracking was used to examine the feasibility of establishing groundwater control and contaminant capture through installation of a dual-phase condensate/ groundwater extraction and treatment system. The primary objectives of groundwater flow modeling are to:

- Demonstrate capture of dissolved-phase hydrocarbons,
- Maximize the cone of depression in the area of phase-separated hydrocarbons to enhance product recovery by use of a dual pump system,
- Assess the return of treated groundwater to the Queen Aquifer to meet the State Engineer's requirements for water appropriation.

While groundwater modeling provides a basis for conceptual design of the extraction system, real-time operational data will allow optimization of the extraction system's performance through field adjustments of flow rates, and/or through the installation of additional extraction points. In addition, the accuracy and defensibility of the model will increase once the system is operated and additional data are used to calibrate the model.

4.1 Groundwater Modeling Analysis

The QuickFlow model (Rumbaugh, 1991) was used to simulate groundwater flow conditions associated with the extraction systems considered. QuickFlow is an analytical model capable of evaluating steady-state, two-dimensional flow in homogeneous and isotropic aquifers. Although Groundwater Technology does not believe that the Queen Aquifer at this site is homogeneous or isotropic, these assumptions must be made unless the heterogeneity and anisotropy can be more fully characterized. Ultimately, actual measured drawdown data based on full system capacity will determine if additional pumping wells are needed. Based on the aquifer test results presented in this report and the assumptions of homogeneity and isotropy, the groundwater model presented provides a starting point for groundwater remedial activities. The input parameters for this model are based on existing groundwater gradients, field data regarding well pumping capacities, and the results of the aquifer test data analysis presented in Section 3.6. Locations of proposed extraction wells are based in part on existing well locations and in areas suspected of having phase-separated hydrocarbons (PSH) according to fluid gauging results from June 1995. Simulated injection wells were located in upgradient and cross-gradient directions that enhance the capture zone while maintaining a proximal location to the treatment system.

The fractured nature of this aquifer was not modeled. For long pumping times it is assumed that the aquifer behaves as an unconfined aquifer whose transmissivity equals that of the fractures and whose storage is equal to the sum of the fracture and matrix storage. This model is based on the higher average conductivity value (52 ft/day) obtained from MW-74.

A pre-pumping potentiometric surface map was prepared based on water levels collected in November 1991 (Figure 2). The groundwater flow model was calibrated to simulate the general flow direction and gradient for the site. The radius of influence goals for the groundwater flow simulations are based on the maximum dissolved benzene concentration and condensate distribution shown on Figure 3.

4.2 Modeling Results

Three configurations of groundwater extraction and injection were simulated based on the November 1991 gradient and the results of the aquifer test presented in this report. They are:

- July 1995 Extraction Scenario, includes 9 extraction wells (Figure 4);
- Extraction/Injection Scenario 1, includes 9 extraction wells and 3 injection wells (Figure 5); and
- Extraction/Injection Scenario 2, includes 8 extraction wells and 2 injection wells (Figure 6).

4.2.1 July 1995 Extraction Scenario

Figure 4 shows the location of the groundwater extraction well system for July 1995. The total well pumping rate is 67.5 gpm from 9 extraction wells. A list of extraction wells and the pumping rate per well used in the capture zone simulation are provided on Table 2. Existing wells and known pumping rates were used in the simulation. The drawdown below static condition at the center of the cone of depression is approximately 2.4 feet. Actual well drawdown may increase due to turbulent flow in the aquifer adjacent to the well. Simulated drawdown at MW-62 is approximately 1.1 feet below the simulated static water level.

4.2.2 Extraction/Injection Scenario 1

Figure 5 shows the proposed groundwater extraction/injection well system for Scenario 1. The total well pumping rate is 180 gpm from 9 extraction wells. A list of extraction and injection wells and the pumping rate per well used in the capture zone simulation are provided on Table 3. Known well capacities are used

for existing wells MW-72, MW-75, and MW-76. The drawdown below static condition at the center of the cone of depression is approximately 2.6 feet. Simulated drawdown at MW-62 is approximately 2.1 feet below the simulated static water level. In this scenario, 180 gpm is reinjected into the aquifer through 3 injection wells.

4.2.3 Extraction/Injection Scenario 2

Figure 6 shows the proposed groundwater extraction/injection well system for Scenario 2. The total well pumping rate is 160 gpm from 8 extraction wells. A list of extraction and injection wells and the pumping rate per well used in the capture zone simulation are provided on Table 4. Known well capacities are used for existing wells MW-72, MW-75, and MW-76. The drawdown below static condition at the center of the cone of depression is approximately 3.2 feet. Simulated drawdown at MW-62 is approximately 2.1 feet below the simulated static water level. In this scenario, 75% of the extracted water, or 120 gpm, is reinjected into the aquifer through two injection wells. The other 30% of extracted water is assumed to be diverted for manufacturing processes. The increase in the cone of depression over Scenario 1, while reducing total extraction by 20 gpm, is most likely the result of the significant decrease (60 gpm) in injected water volume.

5.0 WELL COMPLETION RECOMMENDATIONS

Based on our previous experience with large groundwater treatment systems in environments with significant biofouling problems, Groundwater Technology makes the following recommendations regarding extraction well completions:

- Set 10 inch steel surface casing to seal off upper perched zones from the pumped zone;
- Complete the well as an open borehole drilled with a minimum 7 7/8 inch bit to a depth of approximately 220 feet;
- Set a lockable steel upright at the surface; and
- Install a 1.5 to 2-inch ID PVC access pipe to the side of the borehole. The tube should be screened from TD to 5 feet above the static fluid level.

These recommendations will provide Marathon with the most cost-effective groundwater extraction wells and provide the lowest future maintenance costs. The open borehole completion will reduce the surface area for fouling to accumulate. If fouling causes decreased well yields, the borehole can be cleaned through the use of jetting tools, swabs, or chemicals. The access tube is an inexpensive way to gauge the well while eliminating the possibility of entanglement with wiring and piping for the pump. If a dual pump system is installed in the extraction wells, Groundwater Technology recommends that electrical switches (sensitive to changes in electrical conductivity) be used to detect condensate rather than mechanical switches. The elimination of a mechanical part that can become fouled may reduce maintenance costs.

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Table 1
Summary of Calculated Aquifer Parameters

Well ID	Method of Analysis	T_f gpd/ft	S_f	S_m	K gpd/ft^2
MW-73	Boulten-Gringarten (1980)	13,500	4.8×10^{-4}	1.3×10^{-2}	260
MW-73	Kazemi et al. (1969)	16,200	3.8×10^{-4}	1.1×10^{-2}	310
MW-73	Theis (1935) Recovery	18,100	--	--	340
MW-74	Theis (1935)	17,900	4.2×10^{-4}	--	340
MW-74	Cooper-Jacob (1946)	18,700	3.6×10^{-4}	--	350
MW-74	Theis (1935) Recovery	25,300	--	--	480
	Mean Values	18,300	4.1×10^{-4}	1.2×10^{-2}	350

Note: Hydraulic conductivity values assume aquifer thickness = 53 feet.

Table 2

Pumping Rates for Existing Extraction Wells in July 1995.

Extraction Wells	Simulated Pumping Rates (gpm)
SW-1	7.9
MW-58	2.2
MW-59	2.3
MW-61A	8.0
MW-62	3.3
MW-65A	5.6
MW-68	3.1
MW-72	15.1
MW-75	20

Table 3

Pumping Rates for Extraction and Injection Wells, Scenario 1.

Extraction Wells	Simulated Pumping Rates (gpm)
EW-1	20
EW-2	20
EW-3	20
EW-4	20
EW-5	20
EW-6	20
MW-72*	20
MW-75*	20
MW-76	20
Injection Wells	**Simulated Injection Rate (gpm)**
IW-1	60
IW-2	60
IW-3	60

* Existing Well Capable of Producing the Simulated Flow Volume

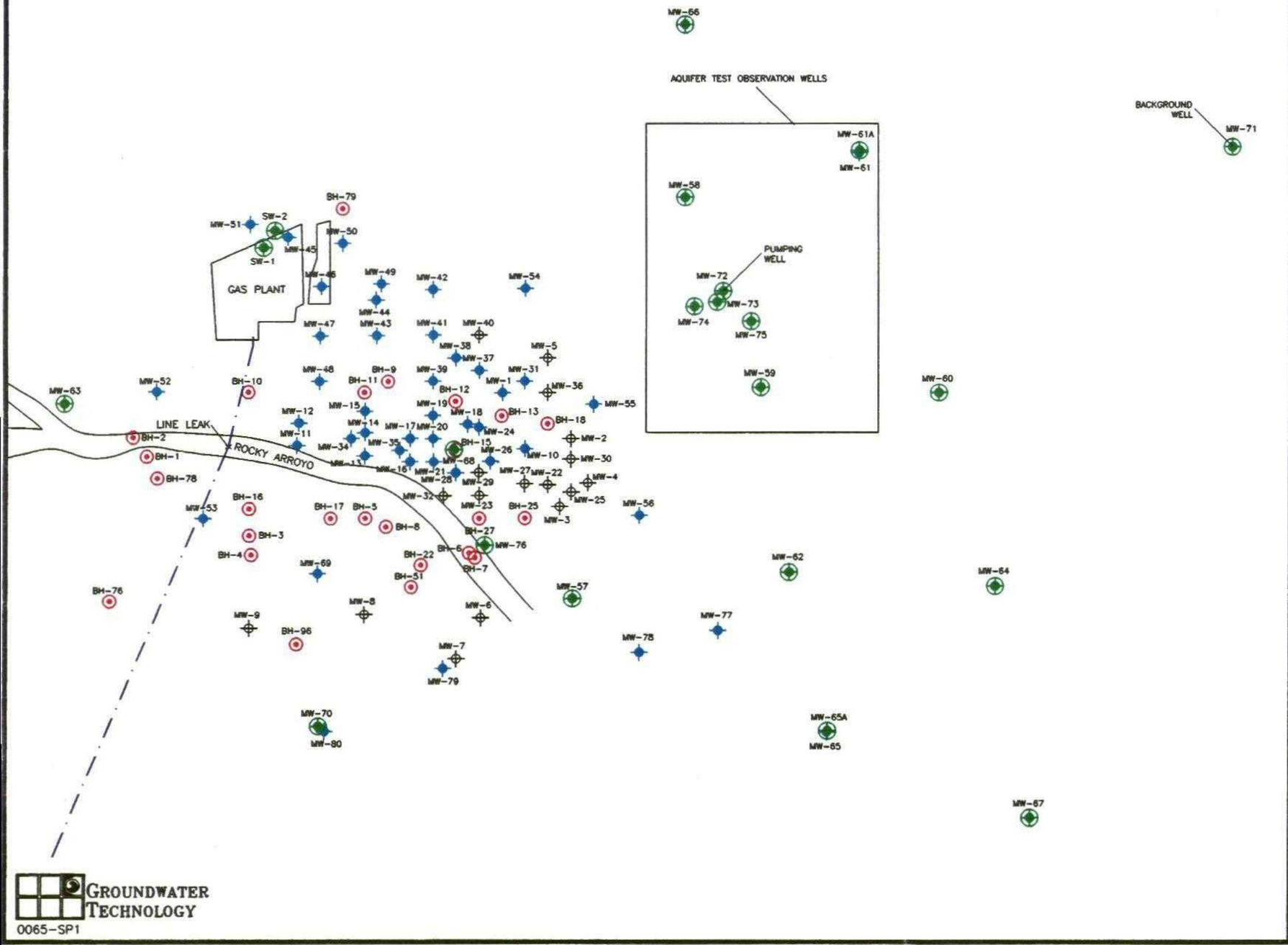
Table 4

Pumping Rates for Extraction and Injection Wells, Scenario 2.

Extraction Wells	Simulated Pumping Rates (gpm)
EW-1	20
EW-2	20
EW-3	20
EW-4	20
EW-5	20
MW-72*	20
MW-75*	20
MW-76	20
Injection Wells	**Simulated Injection Rate (gpm)**
IW-1	60
IW-2	60

* Existing Well Capable of Producing the Simulated Flow Volume

FIGURES



EXPLANATION

- UPPER AQUIFER MONITOR WELL
- LOWER AQUIFER MONITOR WELL
- MONITOR WELL (DRY)
- BOREHOLE
- CONDENSATE LINE

GROUNDWATER TECHNOLOGY

0065-SP1

MARATHON OIL COMPANY
INDIAN BASIN REMEDIATION PROJECT
INDIAN BASIN, NEW MEXICO
053350072

DRAWN BY: D. BUSH DATE: 06-12-95
DRAFTED BY: DEN HOLMES DATE: 06-12-95
CHECKED BY:_____ DATE:_____

SITE PLAN

FIGURE 1

Figure 1. Site plan of Marathon Oil Company's Indian Basin Remediation Project, Indian Basin, New Mexico.

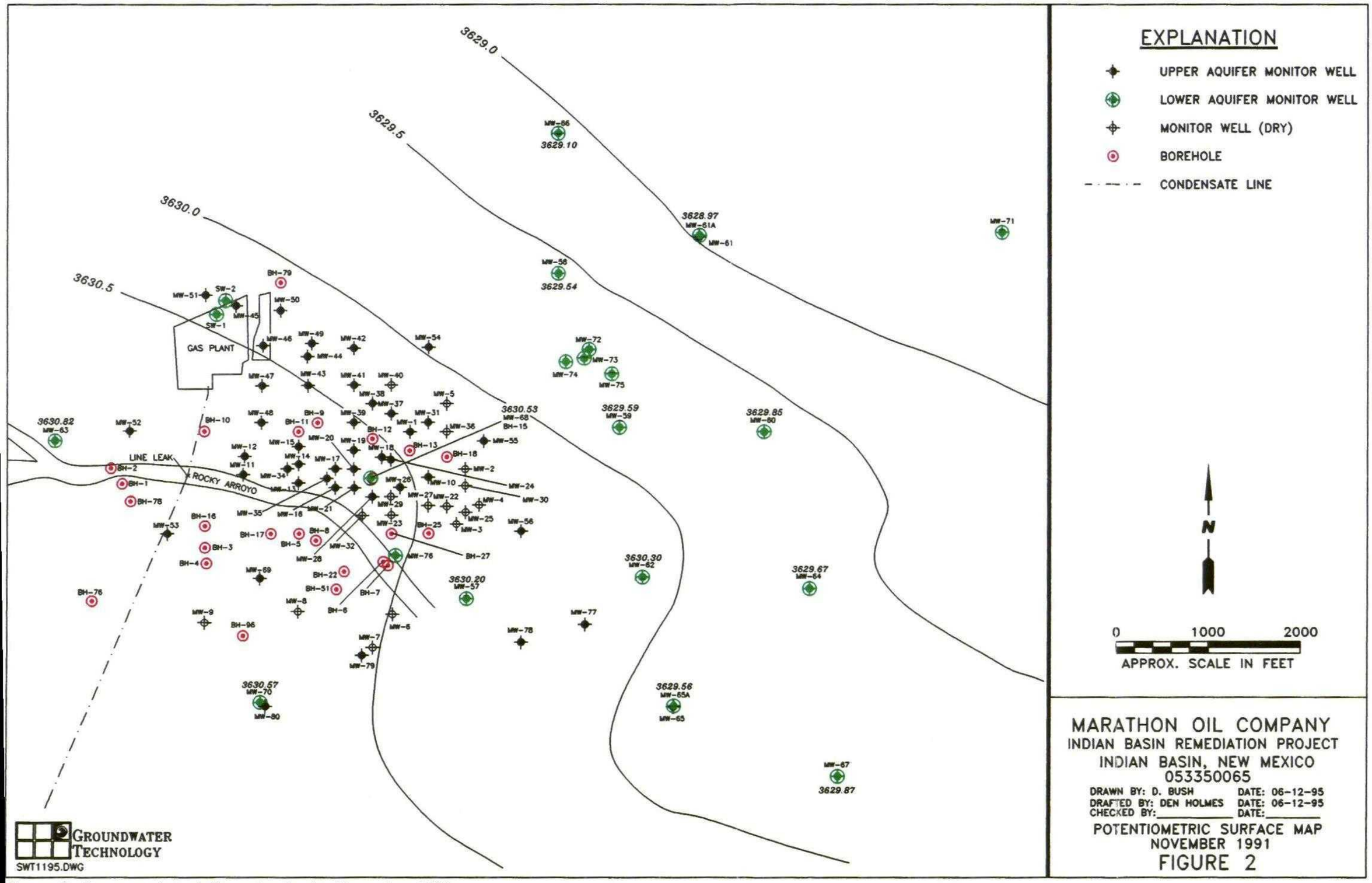
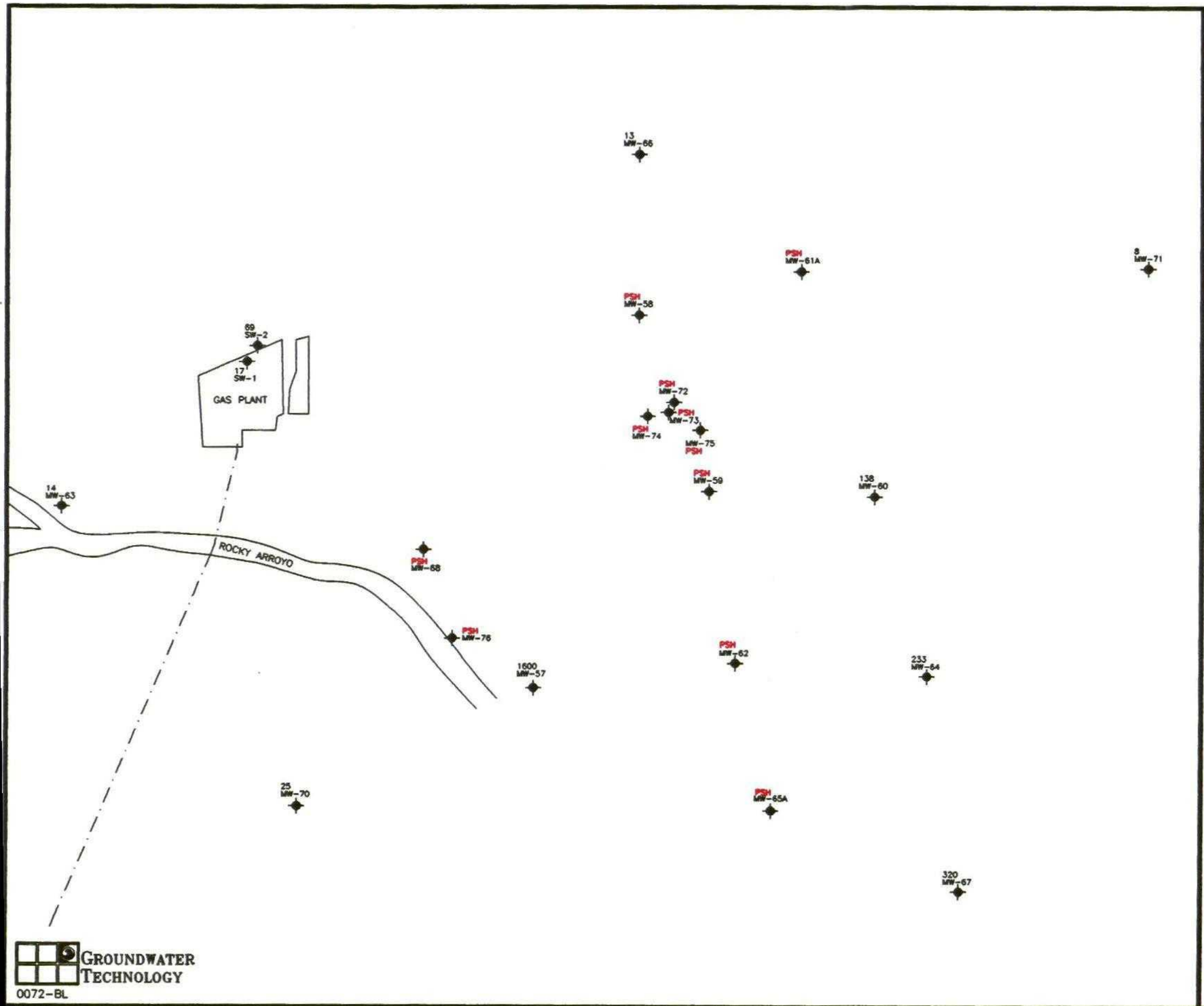


Figure 2. Pre-pumping static water levels, November 1991.



EXPLANATION

- LOWER QUEEN MONITOR WELL
- 2000 — MAXIMUM BENZENE CONCENTRATION DETECTED (parts per billion)
- PSH — PHASE-SEPARATED HYDROCARBONS
- CONDENSATE PIPELINE

N

0 1000 2000

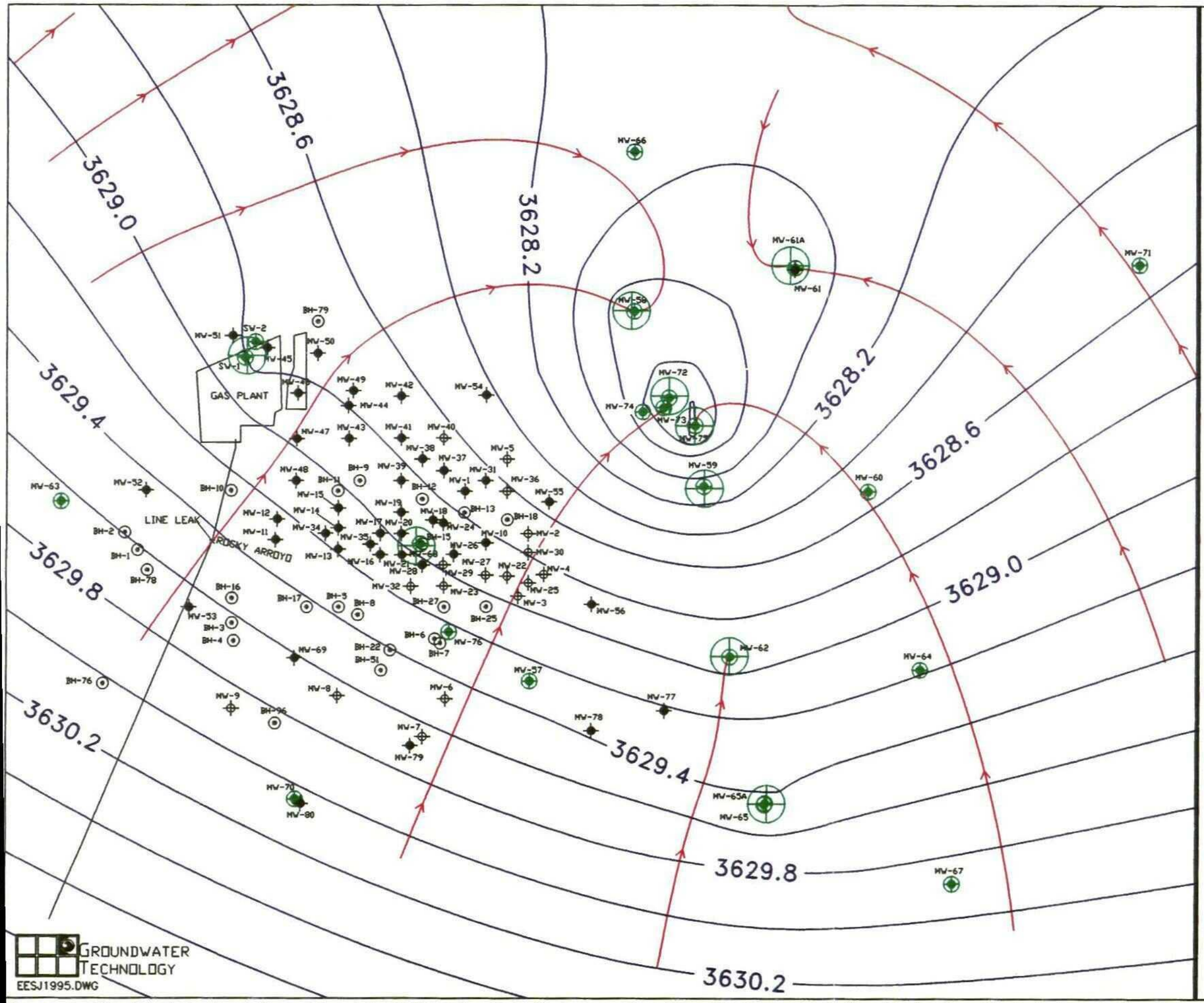
APPROX. SCALE IN FEET

MARATHON OIL COMPANY
INDIAN BASIN REMEDIATION PROJECT
INDIAN BASIN, NEW MEXICO
053350072

DRAWN BY: S. BROTHERS DATE: 08-10-94
DRAFTED BY: DEN HOLMES DATE: 08-11-94
CHECKED BY:_____ DATE:_____

CONCENTRATION MAP
FIGURE 3

Figure 3. Maximum dissolved benzene concentrations and phase-separated hydrocarbons in the lower Queen aquifer at Marathon Oil Company's Indian Basin Remediation Project, Indian Basin, New Mexico, September, 1991 – July, 1995.



EXPLANATION

- UPPER AQUIFER MONITOR WELL
- LOWER AQUIFER MONITOR WELL
- MONITOR WELL (DRY)
- BOREHOLE
- CONDENSATE LINE
- 3628.6 POTENTIOMETRIC SURFACE ELEVATION
- FLOW LINES
- EXTRACTION WELL

AQUIFER PARAMETERS

K = 52 ft/day
I = 2 x 10^{-4}
S = 4 x 10^{-4}
n = 0.02
b = 53'
total Q = 67.5 gpm

NOTE: FLOW RATES FOR INDIVIDUAL WELLS SHOWN ON TABLE 2.

N

0 1000 2000

APPROX. SCALE IN FEET

MARATHON OIL COMPANY
INDIAN BASIN REMEDIATION PROJECT
INDIAN BASIN, NEW MEXICO
053350072

DRAWN BY: D. BUSH DATE: 06-12-95
DRAFTED BY: DEN HOLMES DATE: 06-12-95
CHECKED BY:_____ DATE:_____

EXISTING EXTRACTION SIMULATION, JULY 1995

FIGURE 4

Figure 4. Simulated Capture Zone Map July 1995 Extraction System – Marathon Oil Company Indian Basin Gas Plant, Indian Basin, New Mexico

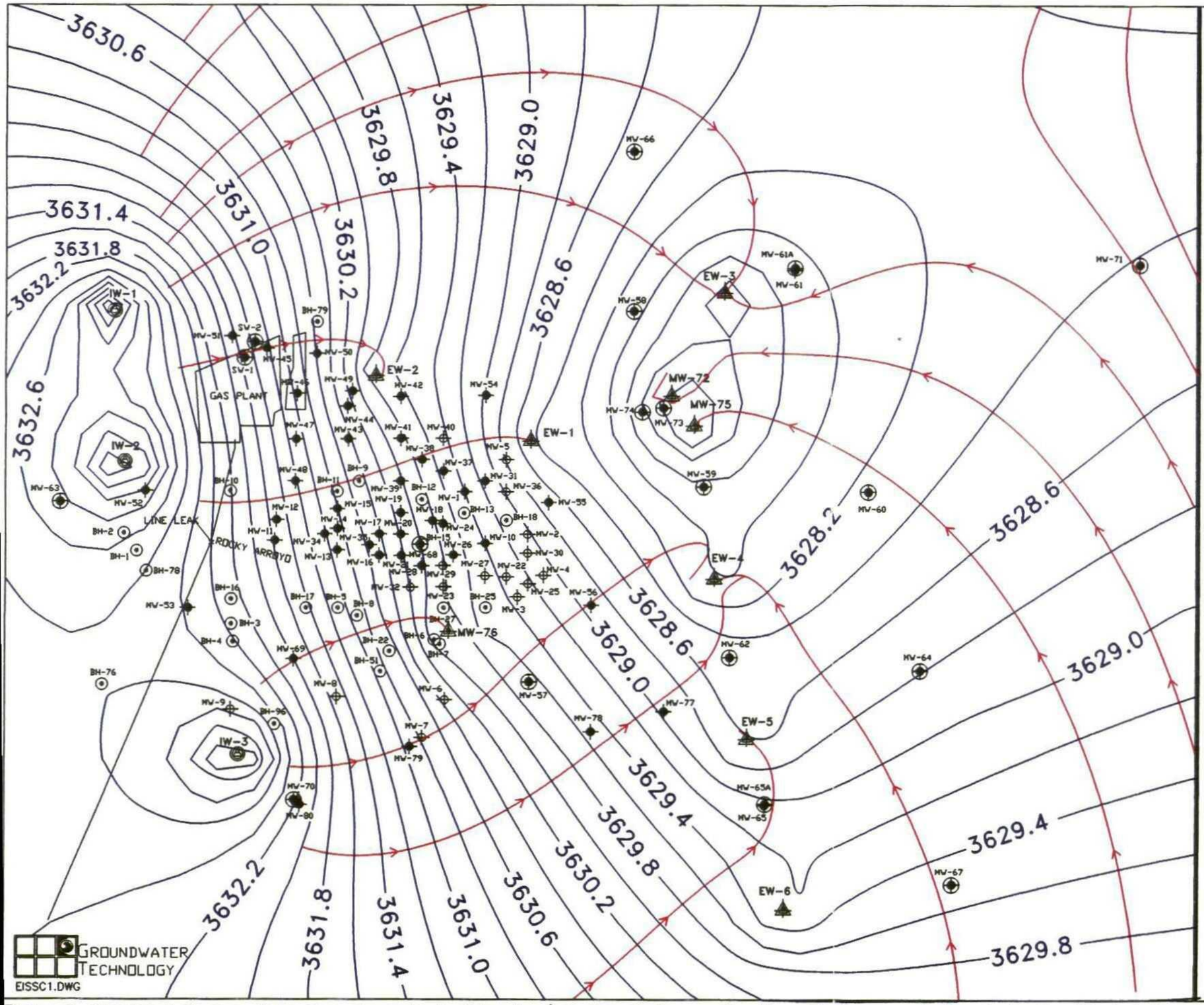


Figure 5. Simulated Capture Zone Map, Scenario 1, Extraction/Injection System – Marathon Oil Company Indian Basin Gas Plant, Indian Basin, New Mexico

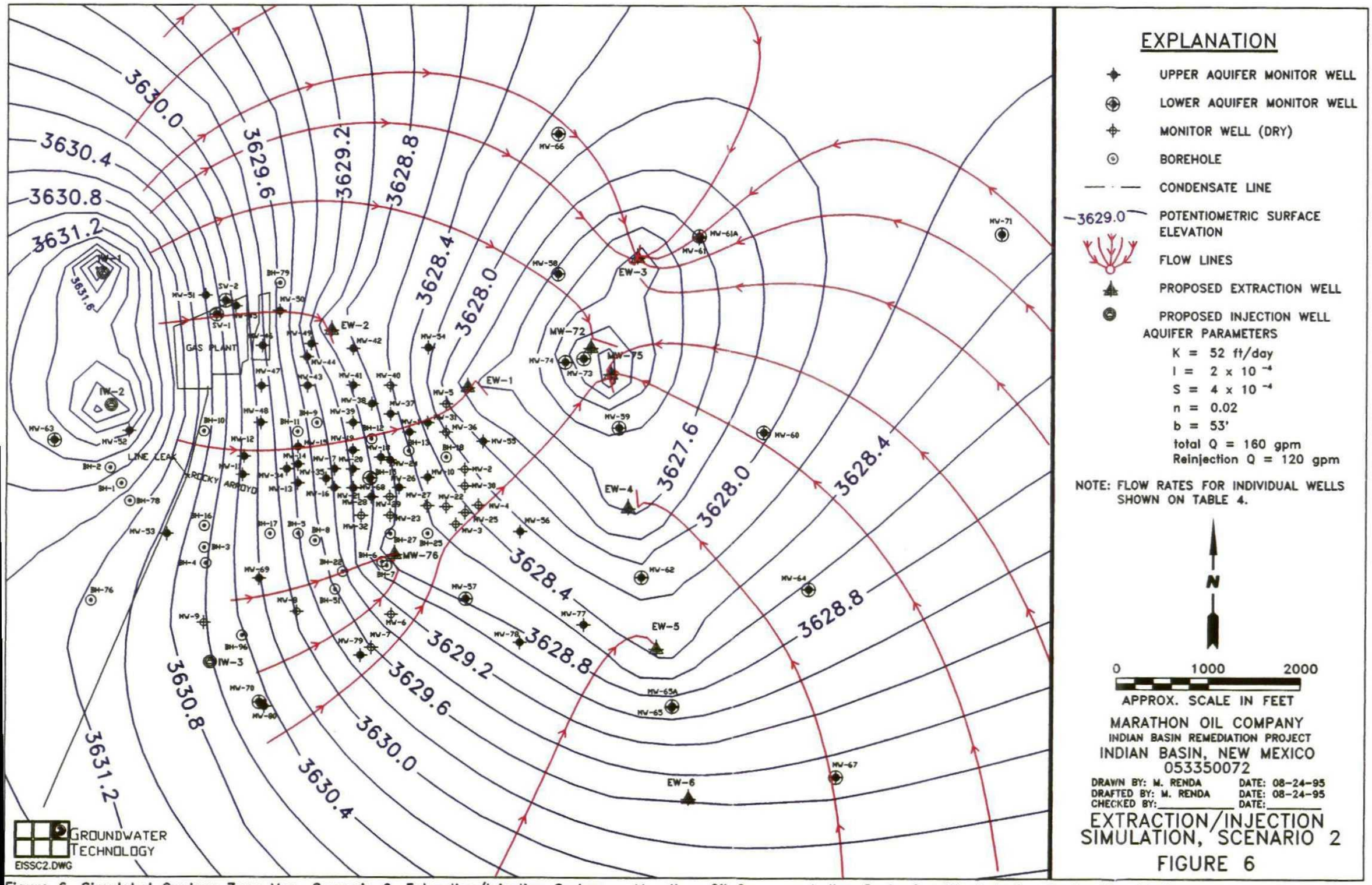


Figure 6. Simulated Capture Zone Map, Scenario 2, Extraction/Injection System – Marathon Oil Company Indian Basin Gas Plant, Indian Basin, New Mexico

TABLES

Table 1

Summary of Calculated Aquifer Parameters

Well ID	Method of Analysis	T_f gpd/ft	S_f	S_m	K gpd/ft^2
MW-73	Boulten-Gringarten (1980)	13,500	4.8×10^{-4}	1.3×10^{-2}	260
MW-73	Kazemi et al. (1969)	16,200	3.8×10^{-4}	1.1×10^{-2}	310
MW-73	Theis (1935) Recovery	18,100	--	--	340
MW-74	Theis (1935)	17,900	4.2×10^{-4}	--	340
MW-74	Cooper-Jacob (1946)	18,700	3.6×10^{-4}	--	350
MW-74	Theis (1935) Recovery	25,300	--	--	480
	Mean Values	18,300	4.1×10^{-4}	1.2×10^{-2}	350

Note: Hydraulic conductivity values assume aquifer thickness = 53 feet.

Table 2

Pumping Rates for Existing Extraction Wells in July 1995.

Extraction Wells	Simulated Pumping Rates (gpm)
SW-1	7.9
MW-58	2.2
MW-59	2.3
MW-61A	8.0
MW-62	3.3
MW-65A	5.6
MW-68	3.1
MW-72	15.1
MW-75	20

Table 3

Pumping Rates for Extraction and Injection Wells, Scenario 1.

Extraction Wells	Simulated Pumping Rates (gpm)
EW-1	20
EW-2	20
EW-3	20
EW-4	20
EW-5	20
EW-6	20
MW-72*	20
MW-75*	20
MW-76	20
Injection Wells	**Simulated Injection Rate (gpm)**
IW-1	60
IW-2	60
IW-3	60

* Existing Well Capable of Producing the Simulated Flow Volume

Table 4

Pumping Rates for Extraction and Injection Wells, Scenario 2.

Extraction Wells	Simulated Pumping Rates (gpm)
EW-1	20
EW-2	20
EW-3	20
EW-4	20
EW-5	20
MW-72*	20
MW-75*	20
MW-76	20
Injection Wells	**Simulated Injection Rate (gpm)**
IW-1	60
IW-2	60

* Existing Well Capable of Producing the Simulated Flow Volume

APPENDIX A

STEP TEST DATA

SE2000
Environmental Logger
06/20 12:51

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74

Step 1 06/20 11:35:01

11.7 GPM

Elapsed Time	MW-72	MW-73	MW-74
0.0000	0.052	0.009	0.047
0.0083	0.052	0.009	0.044
0.0166	1.028	0.009	0.044
0.0250	0.120	0.009	0.047
0.0333	0.581	0.009	0.047
0.0416	0.778	0.014	0.044
0.0500	0.937	0.009	0.047
0.0583	1.125	0.014	0.047
0.0666	1.298	0.014	0.047
0.0750	1.499	0.014	0.044
0.0833	1.663	0.014	0.047
0.0916	1.836	0.014	0.044
0.1000	1.994	0.014	0.044
0.1083	2.167	0.014	0.044
0.1166	2.336	0.014	0.047
0.1250	2.513	0.014	0.047
0.1333	2.658	0.014	0.044
0.1416	2.821	0.014	0.047
0.1500	2.994	0.014	0.047
0.1583	3.152	0.014	0.047
0.1666	3.316	0.014	0.044
0.1750	3.460	0.014	0.044
0.1833	3.618	0.014	0.044
0.1916	3.772	0.014	0.044
0.2000	3.940	0.014	0.044
0.2083	4.094	0.018	0.047
0.2166	4.247	0.014	0.044
0.2250	4.372	0.014	0.041
0.2333	4.535	0.014	0.044
0.2416	4.689	0.014	0.047
0.2500	4.833	0.014	0.044
0.2583	4.982	0.018	0.041
0.2666	5.121	0.014	0.044
0.2750	5.275	0.018	0.047
0.2833	5.419	0.018	0.047
0.2916	5.544	0.018	0.044
0.3000	5.688	0.018	0.044
0.3083	5.836	0.018	0.044
0.3166	5.971	0.018	0.044
0.3250	6.110	0.014	0.044
0.3333	6.240	0.014	0.044
0.3500	6.503	0.014	0.044
0.3666	6.772	0.014	0.047
0.3833	7.046	0.014	0.041

Elapsed Time	MW-72	MW-73	MW-74
0.4000	7.305	0.018	0.041
0.4166	7.564	0.014	0.041
0.4333	7.823	0.018	0.041
0.4500	8.082	0.018	0.044
0.4666	8.326	0.018	0.041
0.4833	8.561	0.018	0.041
0.5000	8.806	0.018	0.044
0.5166	9.041	0.018	0.041
0.5333	9.280	0.018	0.044
0.5500	9.501	0.023	0.041
0.5666	9.731	0.023	0.041
0.5833	9.942	0.023	0.041
0.6000	10.162	0.023	0.041
0.6166	10.378	0.023	0.038
0.6333	10.599	0.023	0.044
0.6500	10.805	0.028	0.038
0.6666	11.020	0.028	0.044
0.6833	11.221	0.028	0.041
0.7000	11.437	0.028	0.041
0.7166	11.643	0.028	0.041
0.7333	11.849	0.028	0.038
0.7500	12.045	0.028	0.041
0.7666	12.247	0.033	0.041
0.7833	12.438	0.033	0.038
0.8000	12.620	0.033	0.041
0.8166	12.812	0.033	0.038
0.8333	12.989	0.033	0.041
0.8500	13.180	0.033	0.038
0.8666	13.362	0.037	0.038
0.8833	13.549	0.037	0.041
0.9000	13.736	0.037	0.038
0.9166	13.908	0.037	0.041
0.9333	14.099	0.037	0.038
0.9500	14.281	0.037	0.038
0.9666	14.458	0.037	0.034
0.9833	14.631	0.042	0.041
1.0000	14.827	0.042	0.038
1.2000	16.932	0.052	0.038
1.4000	18.567	0.061	0.034
1.6000	19.986	0.075	0.034
1.8000	18.877	0.090	0.031
2.0000	17.410	0.094	0.034
2.2000	16.061	0.109	0.034
2.4000	14.822	0.118	0.034
2.6000	13.712	0.128	0.031
2.8000	12.735	0.142	0.031
3.0000	11.820	0.146	0.028
3.2000	11.035	0.156	0.031
3.4000	10.335	0.165	0.034
3.6000	9.707	0.170	0.034
3.8000	9.218	0.180	0.031
4.0000	8.753	0.189	0.031
4.2000	8.345	0.194	0.031
4.4000	8.034	0.199	0.034
4.6000	7.688	0.199	0.041
4.8000	7.381	0.199	0.047
5.0000	7.094	0.203	0.053
5.2000	6.883	0.208	0.053

Elapsed Time	MW-72	MW-73	MW-74
5.4000	6.695	0.208	0.057
5.6000	6.508	0.213	0.060
5.8000	6.345	0.213	0.060
6.0000	6.230	0.213	0.063
6.2000	6.110	0.213	0.066
6.4000	6.019	0.213	0.069
6.6000	5.942	0.213	0.072
6.8000	5.851	0.213	0.072
7.0000	5.793	0.208	0.076
7.2000	5.793	0.208	-0.123
7.4000	5.683	0.213	-0.133
7.6000	5.654	0.213	-0.139
7.8000	5.630	0.208	-0.142
8.0000	5.611	0.208	-0.142
8.2000	5.606	0.208	-0.145
8.4000	5.577	0.208	-0.142
8.6000	5.510	0.203	-0.139
8.8000	5.534	0.208	-0.136
9.0000	5.529	0.208	-0.133
9.2000	5.544	0.208	-0.120
9.4000	5.500	0.208	-0.133
9.6000	5.486	0.208	-0.136
9.8000	5.520	0.208	-0.136
10.0000	5.472	0.208	-0.139
12.0000	5.433	0.203	-0.123
14.0000	5.462	0.208	-0.111
16.0000	5.428	0.213	-0.101
18.0000	5.472	0.208	-0.111
20.0000	5.515	0.213	-0.088
22.0000	5.539	0.213	-0.095
24.0000	5.510	0.213	-0.079
26.0000	5.548	0.218	-0.072
28.0000	5.539	0.218	-0.072
30.0000	5.544	0.222	-0.076
32.0000	5.563	0.222	-0.060
34.0000	5.544	0.222	-0.066
36.0000	5.620	0.222	-0.047
38.0000	5.616	0.222	-0.057
40.0000	5.644	0.227	-0.038
42.0000	5.678	0.227	-0.034
44.0000	5.664	0.227	-0.057
46.0000	5.683	0.222	0.063
48.0000	5.630	0.222	0.072
50.0000	5.640	0.227	0.063
TEP 1 -RECOVERY			
0.0000	5.136	0.227	0.180
0.0083	5.001	0.227	0.180
0.0166	4.920	0.227	0.180
0.0250	4.708	0.227	0.180
0.0333	4.665	0.227	0.180
0.0416	4.569	0.227	0.180
0.0500	4.459	0.227	0.180
0.0583	4.382	0.227	0.180
0.0666	4.267	0.227	0.180
0.0750	4.180	0.227	0.180
0.0833	4.113	0.227	0.180
0.0916	3.964	0.227	0.180
0.1000	3.873	0.227	0.180

Elapsed Time	MW-72	MW-73	MW-74
0.1083	3.801	0.232	0.180
0.1166	3.724	0.227	0.180
0.1250	3.637	0.227	0.180
0.1333	3.599	0.227	0.180
0.1416	3.460	0.227	0.180
0.1500	3.354	0.227	0.184
0.1583	3.344	0.227	0.184
0.1666	3.176	0.227	0.184
0.1750	3.172	0.232	0.184
0.1833	3.018	0.227	0.180
0.1916	2.893	0.227	0.180
0.2000	2.888	0.227	0.184
0.2083	2.758	0.227	0.184
0.2166	2.730	0.227	0.180
0.2250	2.633	0.227	0.180
0.2333	2.552	0.227	0.184
0.2416	2.350	0.227	0.184
0.2500	2.456	0.227	0.184
0.2583	2.259	0.227	0.184
0.2666	2.235	0.227	0.180
0.2750	2.187	0.227	0.184
0.2833	2.023	0.232	0.184
0.2916	2.052	0.227	0.180
0.3000	1.922	0.227	0.184
0.3083	1.903	0.227	0.187
0.3166	1.850	0.227	0.184
0.3250	1.773	0.227	0.180
0.3333	1.634	0.227	0.184
0.3500	1.490	0.227	0.187
0.3666	1.379	0.227	0.184
0.3833	1.331	0.227	0.184
0.4000	1.134	0.227	0.184
0.4166	0.966	0.227	0.184
0.4333	0.894	0.227	0.180
0.4500	0.745	0.227	0.184
0.4666	0.677	0.227	0.184
0.4833	0.552	0.227	0.184
0.5000	0.403	0.227	0.180
0.5166	0.322	0.227	0.180
0.5333	0.197	0.227	0.184
0.5500	0.100	0.227	0.184
0.5666	0.057	0.227	0.180
0.5833	-0.057	0.222	0.180
0.6000	-0.221	0.222	0.184
0.6166	-0.259	0.222	0.184
0.6333	-0.346	0.222	0.180
0.6500	-0.447	0.222	0.184
0.6666	-0.577	0.227	0.184
0.6833	-0.668	0.222	0.177
0.7000	-0.716	0.222	0.184
0.7166	-0.793	0.222	0.180
0.7333	-0.860	0.222	0.180
0.7500	-0.957	0.222	0.180
0.7666	-1.038	0.222	0.180
0.7833	-1.139	0.222	0.180
0.8000	-1.197	0.222	0.180
0.8166	-1.269	0.218	0.180
0.8333	-1.370	0.218	0.180

Elapsed Time	MW-72	MW-73	MW-74
0.8500	-1.438	0.218	0.180
0.8666	-1.529	0.218	0.180
0.8833	-1.577	0.218	0.180
0.9000	-1.693	0.218	0.180
0.9166	-1.784	0.218	0.177
0.9333	-1.813	0.213	0.180
0.9500	-1.866	0.213	0.180
0.9666	-1.948	0.213	0.180
0.9833	-2.063	0.213	0.180
1.0000	-2.073	0.213	0.180
1.2000	-2.838	0.199	0.184
1.4000	-3.343	0.184	0.190
1.6000	-3.820	0.175	0.187
1.8000	-4.195	0.165	0.187
2.0000	-4.456	0.151	0.190
2.2000	-4.696	0.142	0.193
2.4000	-4.879	0.132	0.193
2.6000	-5.000	0.118	0.193
2.8000	-5.101	0.109	0.199
3.0000	-5.188	0.099	0.199
3.2000	-5.236	0.085	0.199
3.4000	-5.241	0.075	0.203
3.6000	-5.221	0.066	0.196
3.8000	-5.168	0.056	0.196
4.0000	-5.091	0.047	0.193
4.2000	-4.980	0.037	0.193
4.4000	-4.846	0.033	0.184
4.6000	-4.711	0.023	0.177
4.8000	-4.547	0.018	0.168
5.0000	-4.359	0.009	0.165
5.2000	-4.157	0.004	0.161
5.4000	-3.883	0.000	0.161
5.6000	-3.584	-0.004	0.158
5.8000	-3.295	-0.009	0.152
6.0000	-3.021	-0.014	0.145
6.2000	-2.756	-0.018	0.142
6.4000	-2.506	-0.018	0.142
6.6000	-2.246	-0.023	0.142
6.8000	-2.010	-0.023	0.142
7.0000	-1.784	-0.023	0.145
7.2000	-1.577	-0.018	0.145
7.4000	-1.390	-0.023	0.139
7.6000	-1.212	-0.023	0.136
7.8000	-1.048	-0.023	0.130
8.0000	-0.894	-0.018	0.123
8.2000	-0.755	-0.018	0.123
8.4000	-0.634	-0.018	0.123
8.6000	-0.524	-0.018	0.114
8.8000	-0.432	-0.018	0.114
9.0000	-0.351	-0.014	0.114
9.2000	-0.283	-0.014	0.114
9.4000	-0.226	-0.014	0.120
9.6000	-0.177	-0.009	0.123
9.8000	-0.129	-0.009	0.130
10.0000	-0.100	-0.009	0.133
12.0000	0.019	0.004	0.111
14.0000	0.057	0.014	0.139
16.0000	0.052	0.014	0.126

Elapsed Time	MW-72	MW-73	MW-74
18.0000	0.062	0.014	0.101
20.0000	0.057	0.009	0.104
22.0000	0.048	0.009	0.095
24.0000	0.062	0.009	0.095

SE2000
Environmental Logger
06/20 14:48

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74

Step 2 06/20 13:40:01

14.7 GPM

Elapsed Time	MW-72	MW-73	MW-74
0.0000	1.038	-0.009	-0.003
0.0083	1.245	-0.009	-0.003
0.0166	1.384	-0.009	0.000
0.0250	1.552	-0.009	0.000
0.0333	1.725	-0.004	-0.003
0.0416	1.884	-0.004	-0.003
0.0500	2.062	-0.009	-0.003
0.0583	2.220	-0.004	0.000
0.0666	2.369	-0.004	0.000
0.0750	2.523	-0.004	0.000
0.0833	2.720	-0.004	-0.003
0.0916	2.859	-0.004	-0.003
0.1000	3.023	-0.004	0.000
0.1083	3.157	-0.004	0.003
0.1166	3.340	-0.004	-0.003
0.1250	3.469	-0.004	-0.003
0.1333	3.637	-0.004	0.000
0.1416	3.777	-0.004	0.000
0.1500	3.930	-0.004	-0.003
0.1583	4.065	-0.009	-0.006
0.1666	4.219	-0.004	-0.006
0.1750	4.372	-0.004	-0.003
0.1833	4.516	-0.004	0.000
0.1916	4.655	-0.004	-0.003
0.2000	4.790	-0.009	-0.006
0.2083	4.944	-0.009	-0.003
0.2166	5.073	-0.004	-0.003
0.2250	5.222	-0.009	-0.003
0.2333	5.356	-0.009	-0.006
0.2416	5.505	-0.004	-0.003
0.2500	5.625	-0.004	-0.003
0.2583	5.784	-0.004	-0.003
0.2666	5.904	-0.004	-0.006
0.2750	6.052	-0.004	-0.006
0.2833	6.153	-0.004	-0.003
0.2916	6.316	-0.004	-0.006
0.3000	6.431	-0.004	-0.006
0.3083	6.575	-0.004	-0.006
0.3166	6.710	-0.004	-0.006
0.3250	6.820	-0.004	-0.006
0.3333	6.959	-0.004	-0.006
0.3500	7.204	-0.004	-0.006
0.3666	7.468	-0.004	-0.006
0.3833	7.717	-0.004	-0.006

Elapsed Time	MW-72	MW-73	MW-74
0.4000	7.962	-0.004	-0.006
0.4166	8.202	0.000	-0.006
0.4333	8.446	0.000	-0.009
0.4500	8.681	0.000	-0.006
0.4666	8.906	0.000	-0.006
0.4833	9.127	0.000	-0.006
0.5000	9.367	0.000	-0.003
0.5166	9.573	0.000	-0.006
0.5333	9.798	0.004	-0.009
0.5500	10.004	0.000	-0.009
0.5666	10.225	0.004	-0.009
0.5833	10.440	0.004	-0.009
0.6000	10.665	0.004	-0.009
0.6166	10.881	0.004	-0.006
0.6333	11.087	0.004	-0.009
0.6500	11.293	0.004	-0.009
0.6666	11.499	0.004	-0.009
0.6833	11.700	0.009	-0.009
0.7000	11.902	0.009	-0.009
0.7166	12.098	0.009	-0.009
0.7333	12.289	0.009	-0.006
0.7500	12.467	0.009	-0.006
0.7666	12.663	0.009	-0.012
0.7833	12.831	0.009	-0.009
0.8000	13.027	0.014	-0.009
0.8166	13.194	0.014	-0.009
0.8333	13.386	0.014	-0.009
0.8500	13.563	0.014	-0.006
0.8666	13.740	0.014	-0.009
0.8833	13.917	0.014	-0.009
0.9000	14.085	0.018	-0.009
0.9166	14.267	0.018	-0.012
0.9333	14.434	0.018	-0.009
0.9500	14.616	0.018	-0.012
0.9666	14.798	0.018	-0.009
0.9833	14.970	0.023	-0.009
1.0000	15.138	0.023	-0.009
1.2000	17.228	0.033	-0.003
1.4000	18.791	0.042	-0.009
1.6000	19.876	0.052	-0.012
1.8000	18.657	0.061	-0.015
2.0000	17.429	0.075	-0.009
2.2000	16.271	0.085	-0.006
2.4000	15.176	0.094	-0.006
2.6000	14.243	0.099	-0.006
2.8000	13.381	0.113	0.000
3.0000	12.634	0.128	-0.003
3.2000	11.930	0.137	-0.003
3.4000	11.303	0.146	-0.006
3.6000	10.752	0.151	-0.003
3.8000	10.186	0.161	-0.009
4.0000	9.966	0.165	-0.015
4.2000	9.544	0.170	-0.015
4.4000	9.184	0.175	-0.015
4.6000	8.791	0.180	-0.015
4.8000	8.686	0.184	-0.019
5.0000	8.456	0.184	-0.015
5.2000	8.350	0.189	-0.015

Elapsed Time	MW-72	MW-73	MW-74
5.4000	8.595	0.194	-0.009
5.6000	8.753	0.194	-0.006
5.8000	8.945	0.194	-0.003
6.0000	9.050	0.199	0.000
6.2000	9.151	0.199	0.006
6.4000	9.276	0.199	0.009
6.6000	9.367	0.203	0.015
6.8000	9.439	0.203	0.019
7.0000	9.501	0.203	0.022
7.2000	9.563	0.208	0.025
7.4000	9.625	0.213	0.025
7.6000	9.678	0.213	0.025
7.8000	9.678	0.213	0.015
8.0000	9.697	0.218	0.009
8.2000	9.649	0.218	0.006
8.4000	9.673	0.213	0.009
8.6000	9.611	0.218	0.003
8.8000	9.597	0.222	0.000
9.0000	9.582	0.227	0.003
9.2000	9.597	0.227	0.006
9.4000	9.597	0.227	0.012
9.6000	9.558	0.232	0.019
9.8000	9.563	0.232	0.025
10.0000	9.558	0.232	0.028
12.0000	9.467	0.241	0.034
14.0000	9.482	0.251	0.047
16.0000	9.501	0.256	0.060
18.0000	9.501	0.256	0.082
20.0000	9.693	0.265	0.060
22.0000	9.788	0.265	0.085
24.0000	9.784	0.275	0.101
26.0000	9.764	0.279	0.104
28.0000	9.798	0.284	0.117
30.0000	9.755	0.284	0.130
32.0000	9.769	0.289	0.114
34.0000	9.764	0.289	0.117
36.0000	9.784	0.289	0.120
38.0000	9.764	0.293	0.145
40.0000	9.822	0.298	0.136
42.0000	9.808	0.293	0.145
44.0000	9.832	0.298	0.145
46.0000	9.808	0.298	0.126
STEP2 - RECOVERY			
0.0000	8.830	0.303	0.165
0.0083	8.662	0.303	0.161
0.0166	8.571	0.303	0.158
0.0250	8.384	0.303	0.161
0.0333	8.297	0.308	0.165
0.0416	8.082	0.303	0.165
0.0500	8.043	0.308	0.165
0.0583	7.856	0.308	0.161
0.0666	7.731	0.308	0.165
0.0750	7.818	0.308	0.168
0.0833	7.367	0.308	0.168
0.0916	7.372	0.308	0.165
0.1000	7.175	0.308	0.161
0.1083	7.137	0.308	0.165
0.1166	7.022	0.308	0.165

Elapsed Time	MW-72	MW-73	MW-74
0.1250	6.849	0.308	0.168
0.1333	6.743	0.308	0.165
0.1416	6.623	0.308	0.165
0.1500	6.479	0.308	0.165
0.1583	6.379	0.308	0.168
0.1666	6.211	0.308	0.168
0.1750	6.163	0.308	0.165
0.1833	6.014	0.308	0.165
0.1916	5.923	0.308	0.165
0.2000	5.740	0.308	0.168
0.2083	5.654	0.308	0.168
0.2166	5.467	0.308	0.165
0.2250	5.443	0.308	0.165
0.2333	5.304	0.308	0.168
0.2416	5.212	0.308	0.165
0.2500	5.088	0.308	0.165
0.2583	5.035	0.308	0.165
0.2666	4.862	0.308	0.165
0.2750	4.737	0.308	0.165
0.2833	4.627	0.308	0.165
0.2916	4.463	0.308	0.168
0.3000	4.420	0.308	0.168
0.3083	4.382	0.308	0.168
0.3166	4.257	0.308	0.165
0.3250	4.180	0.308	0.168
0.3333	4.074	0.308	0.168
0.3500	3.911	0.308	0.161
0.3666	3.753	0.308	0.168
0.3833	3.537	0.308	0.165
0.4000	3.368	0.308	0.165
0.4166	3.181	0.308	0.168
0.4333	3.037	0.308	0.165
0.4500	2.888	0.308	0.168
0.4666	2.725	0.303	0.165
0.4833	2.537	0.308	0.168
0.5000	2.398	0.303	0.165
0.5166	2.220	0.308	0.168
0.5333	2.134	0.303	0.165
0.5500	1.990	0.303	0.168
0.5666	1.826	0.303	0.168
0.5833	1.682	0.303	0.161
0.6000	1.552	0.303	0.168
0.6166	1.437	0.303	0.165
0.6333	1.326	0.303	0.168
0.6500	1.163	0.303	0.165
0.6666	1.072	0.303	0.168
0.6833	0.951	0.303	0.168
0.7000	0.817	0.303	0.168
0.7166	0.759	0.303	0.168
0.7333	0.605	0.303	0.168
0.7500	0.480	0.298	0.168
0.7666	0.442	0.303	0.168
0.7833	0.312	0.298	0.168
0.8000	0.235	0.298	0.171
0.8166	0.134	0.298	0.168
0.8333	0.038	0.298	0.171
0.8500	-0.091	0.298	0.171
0.8666	-0.144	0.298	0.171

Elapsed Time	MW-72	MW-73	MW-74
0.8833	-0.269	0.298	0.171
0.9000	-0.365	0.298	0.171
0.9166	-0.418	0.298	0.171
0.9333	-0.524	0.293	0.171
0.9500	-0.581	0.293	0.171
0.9666	-0.663	0.293	0.174
0.9833	-0.793	0.293	0.168
1.0000	-0.822	0.293	0.174
1.2000	-1.851	0.279	0.171
1.4000	-2.467	0.265	0.171
1.6000	-3.026	0.251	0.177
1.8000	-3.473	0.241	0.184
2.0000	-3.849	0.227	0.184
2.2000	-4.099	0.213	0.180
2.4000	-4.350	0.199	0.184
2.6000	-4.528	0.184	0.180
2.8000	-4.653	0.170	0.177
3.0000	-4.735	0.156	0.174
3.2000	-4.812	0.142	0.174
3.4000	-4.850	0.132	0.165
3.6000	-4.841	0.118	0.158
3.8000	-4.807	0.109	0.149
4.0000	-4.749	0.099	0.142
4.2000	-4.658	0.090	0.136
4.4000	-4.537	0.080	0.133
4.6000	-4.398	0.071	0.139
4.8000	-4.244	0.061	0.139
5.0000	-4.061	0.052	0.139
5.2000	-3.868	0.042	0.142
5.4000	-3.584	0.037	0.142
5.6000	-3.295	0.033	0.145
5.8000	-3.030	0.028	0.142
6.0000	-2.766	0.023	0.145
6.2000	-2.520	0.018	0.145
6.4000	-2.284	0.014	0.145
6.6000	-2.058	0.009	0.145
6.8000	-1.842	0.004	0.142
7.0000	-1.630	0.004	0.136
7.2000	-1.442	0.000	0.136
7.4000	-1.260	0.000	0.139
7.6000	-1.091	0.000	0.136
7.8000	-0.933	0.000	0.133
8.0000	-0.788	0.000	0.130
8.2000	-0.658	-0.004	0.130
8.4000	-0.553	0.000	0.120
8.6000	-0.452	0.000	0.111
8.8000	-0.370	0.000	0.104
9.0000	-0.298	0.000	0.101
9.2000	-0.240	0.004	0.098
9.4000	-0.192	0.004	0.095
9.6000	-0.153	0.004	0.092
9.8000	-0.120	0.004	0.085
10.0000	-0.086	0.004	0.079
12.0000	0.014	0.018	0.066
14.0000	0.028	0.018	0.092
16.0000	0.033	0.018	0.085
18.0000	0.024	0.014	0.050
20.0000	0.028	0.014	0.060

Elapsed Time	MW-72	MW-73	MW-74
22.0000	0.014	0.018	0.041
24.0000	0.024	0.009	0.053
26.0000	0.014	0.004	0.053
28.0000	0.004	0.004	0.022
30.0000	0.004	0.004	0.019
32.0000	0.009	0.000	0.015
34.0000	-0.004	-0.004	-0.003
36.0000	0.004	-0.004	0.025
38.0000	-0.014	-0.004	0.000
40.0000	-0.019	-0.009	-0.003
42.0000	-0.014	-0.014	0.000
44.0000	-0.009	-0.014	0.003
46.0000	-0.019	-0.014	-0.022
48.0000	-0.024	-0.018	-0.019

SE2000
Environmental Logger
06/20 17:14

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74

Step 3 06/20 15:30:00

19.3 GPM

Elapsed Time	MW-72	MW-73	MW-74
0.0000	-0.028	-0.014	-0.019
0.0083	-0.028	-0.018	-0.019
0.0166	1.139	-0.014	-0.019
0.0250	0.394	-0.018	-0.015
0.0333	0.471	-0.014	-0.015
0.0416	0.673	-0.014	-0.015
0.0500	0.850	-0.014	-0.019
0.0583	0.995	-0.014	-0.015
0.0666	1.187	-0.014	-0.015
0.0750	1.350	-0.018	-0.012
0.0833	1.523	-0.014	-0.019
0.0916	1.687	-0.014	-0.015
0.1000	1.845	-0.014	-0.015
0.1083	2.009	-0.014	-0.015
0.1166	2.167	-0.014	-0.019
0.1250	2.331	-0.014	-0.019
0.1333	2.485	-0.014	-0.015
0.1416	2.624	-0.014	-0.015
0.1500	2.782	-0.014	-0.015
0.1583	2.951	-0.014	-0.015
0.1666	3.085	-0.014	-0.012
0.1750	3.244	-0.014	-0.012
0.1833	3.378	-0.014	-0.015
0.1916	3.537	-0.014	-0.015
0.2000	3.671	-0.014	-0.012
0.2083	3.839	-0.014	-0.012
0.2166	3.974	-0.014	-0.015
0.2250	4.118	-0.014	-0.015
0.2333	4.262	-0.014	-0.012
0.2416	4.396	-0.014	-0.015
0.2500	4.555	-0.014	-0.019
0.2583	4.679	-0.014	-0.009
0.2666	4.823	-0.014	-0.009
0.2750	4.944	-0.014	-0.009
0.2833	5.097	-0.009	-0.015
0.2916	5.227	-0.014	-0.015
0.3000	5.371	-0.014	-0.009
0.3083	5.481	-0.009	-0.009
0.3166	5.635	-0.014	-0.015
0.3250	5.760	-0.014	-0.015
0.3333	5.918	-0.009	-0.012
0.3500	6.153	-0.009	-0.015
0.3666	6.403	-0.009	-0.012
0.3833	6.643	-0.009	-0.012

Elapsed Time	MW-72	MW-73	MW-74
0.4000	6.906	-0.009	-0.012
0.4166	7.161	-0.009	-0.012
0.4333	7.410	-0.009	-0.015
0.4500	7.650	-0.009	-0.012
0.4666	7.890	-0.009	-0.019
0.4833	8.130	-0.009	-0.012
0.5000	8.360	-0.009	-0.019
0.5166	8.600	-0.009	-0.015
0.5333	8.810	-0.009	-0.015
0.5500	9.036	-0.009	-0.015
0.5666	9.247	-0.004	-0.022
0.5833	9.448	-0.004	-0.015
0.6000	9.649	-0.004	-0.015
0.6166	9.865	-0.004	-0.019
0.6333	10.076	-0.004	-0.019
0.6500	10.287	-0.004	-0.015
0.6666	10.483	-0.004	-0.019
0.6833	10.694	0.000	-0.015
0.7000	10.895	0.000	-0.019
0.7166	11.097	0.000	-0.019
0.7333	11.284	0.000	-0.019
0.7500	11.480	0.000	-0.019
0.7666	11.652	0.000	-0.019
0.7833	11.839	0.004	-0.015
0.8000	12.021	0.000	-0.019
0.8166	12.184	0.004	-0.019
0.8333	12.380	0.004	-0.019
0.8500	12.548	0.004	-0.019
0.8666	12.735	0.004	-0.015
0.8833	12.907	0.004	-0.019
0.9000	13.099	0.004	-0.019
0.9166	13.271	0.009	-0.015
0.9333	13.453	0.009	-0.019
0.9500	13.621	0.009	-0.019
0.9666	13.783	0.009	-0.019
0.9833	13.951	0.009	-0.019
1.0000	14.109	0.009	-0.019
1.2000	15.980	0.018	-0.022
1.4000	17.587	0.028	-0.022
1.6000	18.982	0.037	-0.019
1.8000	19.876	0.052	-0.012
2.0000	20.392	0.056	-0.006
2.2000	20.826	0.075	-0.003
2.4000	20.454	0.085	-0.003
2.6000	19.732	0.094	-0.003
2.8000	19.006	0.104	-0.003
3.0000	18.318	0.113	-0.003
3.2000	17.783	0.123	-0.003
3.4000	17.524	0.132	-0.003
3.6000	17.328	0.137	-0.006
3.8000	17.137	0.146	-0.003
4.0000	16.984	0.156	0.000
4.2000	16.845	0.161	0.000
4.4000	16.597	0.170	0.003
4.6000	16.362	0.175	0.003
4.8000	16.138	0.175	0.006
5.0000	15.951	0.189	0.003
5.2000	15.793	0.194	0.003

Elapsed Time	MW-72	MW-73	MW-74
5.4000	15.611	0.203	0.003
5.6000	15.487	0.208	0.006
5.8000	15.358	0.213	0.009
6.0000	15.233	0.218	0.006
6.2000	15.109	0.222	0.006
6.4000	15.009	0.227	0.012
6.6000	14.918	0.232	0.012
6.8000	14.836	0.237	0.015
7.0000	14.769	0.237	0.015
7.2000	14.712	0.241	0.022
7.4000	14.654	0.246	0.022
7.6000	14.607	0.246	0.028
7.8000	14.563	0.246	0.025
8.0000	14.520	0.251	0.025
8.2000	14.477	0.256	0.028
8.4000	14.453	0.256	0.025
8.6000	14.401	0.260	0.025
8.8000	14.377	0.260	0.022
9.0000	14.358	0.265	0.015
9.2000	14.319	0.270	0.012
9.4000	14.305	0.270	0.009
9.6000	14.272	0.270	0.012
9.8000	14.252	0.275	0.015
10.0000	14.248	0.275	0.019
12.0000	14.190	0.284	0.038
14.0000	14.195	0.293	0.060
16.0000	14.214	0.303	0.060
18.0000	14.238	0.312	0.079
20.0000	14.295	0.317	0.098
22.0000	14.291	0.322	0.092
24.0000	14.295	0.327	0.095
26.0000	14.310	0.331	0.101
28.0000	14.334	0.331	0.098
30.0000	14.362	0.336	0.139
32.0000	14.382	0.341	0.139
34.0000	14.396	0.346	0.130
36.0000	14.391	0.341	0.126
38.0000	14.444	0.350	0.145
40.0000	14.420	0.350	0.158
42.0000	14.396	0.355	0.063
44.0000	14.463	0.350	0.171
46.0000	14.458	0.355	0.187
48.0000	14.453	0.355	0.171
50.0000	14.468	0.360	0.149
52.0000	14.429	0.360	0.111
54.0000	14.429	0.365	0.114
56.0000	14.444	0.365	0.126
58.0000	14.463	0.369	0.158
60.0000	14.482	0.374	0.155
STEP 3 - RECOVERY			
0.0000	14.477	0.374	0.155
0.0083	14.496	0.379	0.155
0.0166	14.468	0.374	0.155
0.0250	14.482	0.374	0.158
0.0333	15.243	0.374	0.155
0.0416	13.841	0.374	0.152
0.0500	14.138	0.374	0.155
0.0583	13.826	0.374	0.155

Elapsed Time	MW-72	MW-73	MW-74
0.0666	13.678	0.374	0.155
0.0750	13.491	0.379	0.155
0.0833	13.295	0.374	0.155
0.0916	13.147	0.374	0.155
0.1000	12.993	0.374	0.155
0.1083	12.797	0.374	0.152
0.1166	12.649	0.374	0.155
0.1250	12.467	0.374	0.155
0.1333	12.266	0.374	0.155
0.1416	12.093	0.374	0.155
0.1500	11.945	0.374	0.155
0.1583	11.782	0.374	0.155
0.1666	11.600	0.374	0.155
0.1750	11.485	0.374	0.155
0.1833	11.274	0.374	0.155
0.1916	11.111	0.374	0.155
0.2000	10.987	0.374	0.155
0.2083	10.800	0.374	0.155
0.2166	10.689	0.374	0.155
0.2250	10.565	0.374	0.155
0.2333	10.383	0.374	0.155
0.2416	10.239	0.374	0.155
0.2500	10.100	0.374	0.155
0.2583	9.990	0.374	0.158
0.2666	9.803	0.374	0.155
0.2750	9.659	0.374	0.155
0.2833	9.573	0.379	0.155
0.2916	9.424	0.374	0.158
0.3000	9.204	0.374	0.155
0.3083	9.122	0.374	0.155
0.3166	8.983	0.374	0.155
0.3250	8.748	0.374	0.155
0.3333	8.772	0.379	0.158
0.3500	8.441	0.374	0.155
0.3666	8.225	0.374	0.155
0.3833	7.914	0.374	0.155
0.4000	7.645	0.374	0.155
0.4166	7.386	0.374	0.155
0.4333	7.156	0.374	0.155
0.4500	6.911	0.374	0.155
0.4666	6.657	0.379	0.155
0.4833	6.388	0.374	0.155
0.5000	6.249	0.374	0.155
0.5166	5.880	0.374	0.158
0.5333	5.769	0.374	0.155
0.5500	5.467	0.374	0.155
0.5666	5.260	0.374	0.155
0.5833	5.059	0.374	0.155
0.6000	4.814	0.374	0.155
0.6166	4.607	0.374	0.155
0.6333	4.473	0.374	0.155
0.6500	4.247	0.374	0.155
0.6666	4.050	0.374	0.155
0.6833	3.830	0.374	0.155
0.7000	3.719	0.374	0.155
0.7166	3.570	0.374	0.155
0.7333	3.383	0.374	0.155
0.7500	3.205	0.374	0.155

Elapsed Time	MW-72	MW-73	MW-74
0.7666	3.066	0.369	0.155
0.7833	2.854	0.369	0.155
0.8000	2.691	0.369	0.155
0.8166	2.609	0.369	0.158
0.8333	2.432	0.369	0.158
0.8500	2.297	0.369	0.158
0.8666	2.187	0.369	0.158
0.8833	2.038	0.369	0.158
0.9000	1.908	0.369	0.158
0.9166	1.749	0.369	0.158
0.9333	1.596	0.369	0.158
0.9500	1.499	0.365	0.158
0.9666	1.374	0.369	0.158
0.9833	1.259	0.365	0.158
1.0000	1.129	0.365	0.158
1.2000	-0.067	0.360	0.158
1.4000	-0.981	0.350	0.161
1.6000	-1.803	0.336	0.161
1.8000	-2.405	0.322	0.161
2.0000	-2.939	0.308	0.161
2.2000	-3.338	0.293	0.161
2.4000	-3.661	0.279	0.161
2.6000	-3.921	0.260	0.161
2.8000	-4.123	0.246	0.161
3.0000	-4.268	0.232	0.158
3.2000	-4.359	0.218	0.158
3.4000	-4.427	0.199	0.155
3.6000	-4.455	0.189	0.155
3.8000	-4.460	0.175	0.155
4.0000	-4.422	0.161	0.152
4.2000	-4.369	0.151	0.149
4.4000	-4.277	0.137	0.145
4.6000	-4.162	0.128	0.145
4.8000	-4.027	0.118	0.142
5.0000	-3.878	0.109	0.139
5.2000	-3.690	0.099	0.139
5.4000	-3.411	0.090	0.136
5.6000	-3.136	0.085	0.136
5.8000	-2.876	0.075	0.133
6.0000	-2.626	0.071	0.136
6.2000	-2.385	0.061	0.136
6.4000	-2.159	0.056	0.136
6.6000	-1.938	0.052	0.139
6.8000	-1.721	0.047	0.139
7.0000	-1.519	0.047	0.139
7.2000	-1.337	0.042	0.139
7.4000	-1.159	0.037	0.139
7.6000	-0.990	0.037	0.136
7.8000	-0.831	0.037	0.136
8.0000	-0.687	0.033	0.133
8.2000	-0.557	0.033	0.126
8.4000	-0.447	0.033	0.126
8.6000	-0.355	0.033	0.123
8.8000	-0.274	0.033	0.120
9.0000	-0.211	0.033	0.117
9.2000	-0.153	0.033	0.117
9.4000	-0.110	0.033	0.117
9.6000	-0.076	0.037	0.114

Elapsed Time	MW-72	MW-73	MW-74
9.8000	-0.048	0.037	0.114
10.0000	-0.024	0.037	0.114
12.0000	0.052	0.042	0.104
14.0000	0.062	0.042	0.088
16.0000	0.062	0.037	0.082
18.0000	0.057	0.037	0.072
20.0000	0.052	0.033	0.063
22.0000	0.048	0.028	0.057
24.0000	0.043	0.028	0.047
26.0000	0.038	0.028	0.041
28.0000	0.038	0.028	0.034
30.0000	0.033	0.028	0.034
32.0000	0.033	0.028	0.028
34.0000	0.028	0.028	0.025
36.0000	0.033	0.028	0.025
38.0000	0.028	0.028	0.022
40.0000	0.033	0.033	0.025
42.0000	0.033	0.033	0.025
44.0000	0.033	0.033	0.028
46.0000	0.028	0.033	0.028
48.0000	0.024	0.028	0.022
50.0000	0.019	0.023	0.025
52.0000	0.014	0.018	0.022

SE2000
Environmental Logger
06/20 19:11

Setups:	INPUT 1	INPUT 2	INPUT 3
Type	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74

Step 4 06/20 17:40:01

24.3 GPM

Elapsed Time	MW-72	MW-73	MW-74
0.0000	1.014	-0.004	0.000
0.0083	1.177	-0.004	0.000
0.0166	1.346	-0.004	-0.003
0.0250	1.509	-0.004	0.000
0.0333	1.668	-0.004	0.000
0.0416	1.821	-0.004	0.000
0.0500	1.970	-0.004	0.000
0.0583	2.139	-0.004	0.000
0.0666	2.288	-0.004	0.000
0.0750	2.456	-0.004	0.000
0.0833	2.600	-0.004	0.000
0.0916	2.758	-0.004	0.003
0.1000	2.893	-0.004	0.003
0.1083	3.056	-0.004	0.003
0.1166	3.205	-0.004	0.003
0.1250	3.344	-0.004	0.003
0.1333	3.489	-0.004	0.003
0.1416	3.609	-0.004	0.003
0.1500	3.772	-0.004	0.003
0.1583	3.902	-0.004	0.003
0.1666	4.065	-0.004	0.000
0.1750	4.190	-0.004	0.003
0.1833	4.329	-0.004	0.003
0.1916	4.468	-0.004	0.003
0.2000	4.598	-0.004	0.000
0.2083	4.751	-0.004	0.003
0.2166	4.881	-0.004	0.003
0.2250	5.035	-0.004	0.003
0.2333	5.131	-0.004	0.003
0.2416	5.284	-0.004	0.003
0.2500	5.424	0.000	0.003
0.2583	5.548	0.000	0.003
0.2666	5.683	0.000	0.003
0.2750	5.788	0.000	0.003
0.2833	5.937	0.000	0.000
0.2916	6.047	0.000	0.003
0.3000	6.201	-0.004	0.003
0.3083	6.307	0.000	0.003
0.3166	6.441	0.000	0.003
0.3250	6.556	0.000	0.000
0.3333	6.686	0.000	0.003
0.3500	6.930	0.000	0.003
0.3666	7.151	0.000	0.000
0.3833	7.415	0.000	0.006

Elapsed Time	MW-72	MW-73	MW-74
0.4000	7.645	0.000	0.003
0.4166	7.904	0.000	0.003
0.4333	8.130	0.000	0.000
0.4500	8.355	0.000	0.003
0.4666	8.585	0.000	0.003
0.4833	8.786	0.004	0.003
0.5000	9.007	0.000	0.000
0.5166	9.218	0.004	0.003
0.5333	9.434	0.004	0.003
0.5500	9.640	0.004	0.000
0.5666	9.860	0.004	0.003
0.5833	10.052	0.004	0.003
0.6000	10.253	0.004	0.003
0.6166	10.440	0.004	0.006
0.6333	10.632	0.004	0.003
0.6500	10.824	0.009	0.003
0.6666	11.010	0.009	0.003
0.6833	11.207	0.009	0.003
0.7000	11.398	0.009	0.000
0.7166	11.581	0.009	0.003
0.7333	11.758	0.014	0.003
0.7500	11.921	0.014	0.003
0.7666	12.107	0.014	0.003
0.7833	12.304	0.014	0.003
0.8000	12.486	0.014	0.003
0.8166	12.620	0.014	0.003
0.8333	12.797	0.018	0.003
0.8500	12.979	0.018	0.003
0.8666	13.151	0.018	0.003
0.8833	13.290	0.018	0.003
0.9000	13.467	0.018	0.003
0.9166	13.635	0.018	0.003
0.9333	13.807	0.023	0.003
0.9500	13.960	0.023	0.003
0.9666	14.114	0.023	0.006
0.9833	14.257	0.023	0.003
1.0000	14.425	0.028	0.006
1.2000	16.444	0.033	0.003
1.4000	17.959	0.042	0.003
1.6000	19.245	0.052	0.006
1.8000	18.977	0.066	0.003
2.0000	18.810	0.075	0.003
2.2000	18.777	0.085	0.003
2.4000	18.772	0.094	0.003
2.6000	18.996	0.099	0.006
2.8000	19.197	0.109	0.006
3.0000	19.474	0.118	0.003
3.2000	19.684	0.128	0.006
3.4000	19.899	0.137	0.003
3.6000	20.095	0.146	0.000
3.8000	20.282	0.151	0.012
4.0000	20.444	0.165	0.006
4.2000	20.635	0.170	0.009
4.4000	20.778	0.175	0.006
4.6000	20.922	0.184	0.006
4.8000	21.022	0.189	0.009
5.0000	21.156	0.194	0.009
5.2000	21.304	0.203	0.009

Elapsed Time	MW-72	MW-73	MW-74
5.4000	21.370	0.208	0.012
5.6000	21.466	0.213	0.012
5.8000	21.576	0.213	0.015
6.0000	21.662	0.222	0.015
6.2000	21.729	0.227	0.019
6.4000	21.815	0.222	0.019
6.6000	21.886	0.232	0.022
6.8000	21.967	0.241	0.022
7.0000	22.020	0.241	0.022
7.2000	22.020	0.246	0.022
7.4000	22.130	0.251	0.025
7.6000	22.196	0.256	0.025
7.8000	22.258	0.260	0.028
8.0000	22.268	0.260	0.025
8.2000	22.301	0.265	0.028
8.4000	22.363	0.265	0.034
8.6000	22.402	0.270	0.028
8.8000	22.426	0.275	0.031
9.0000	22.464	0.279	0.034
9.2000	22.483	0.275	0.038
9.4000	22.502	0.275	0.034
9.6000	22.507	0.279	0.034
9.8000	22.540	0.284	0.041
10.0000	22.569	0.284	0.038
12.0000	22.650	0.303	0.034
14.0000	22.712	0.317	0.057
16.0000	22.702	0.327	0.072
18.0000	22.688	0.331	0.082
20.0000	22.674	0.346	0.085
22.0000	22.669	0.350	0.104
24.0000	22.655	0.355	0.111
26.0000	22.621	0.365	0.114
28.0000	22.645	0.365	0.120
30.0000	22.607	0.369	0.133
32.0000	22.550	0.374	0.142
34.0000	22.521	0.379	0.142
36.0000	22.502	0.379	0.149
38.0000	22.578	0.379	0.155
40.0000	22.564	0.384	0.158
42.0000	22.559	0.384	0.165
44.0000	22.516	0.388	0.161
46.0000	22.478	0.398	0.168
48.0000	22.483	0.403	0.168
50.0000	22.526	0.403	0.171
52.0000	22.464	0.407	0.177
54.0000	22.469	0.407	0.184
56.0000	22.459	0.407	0.184
58.0000	22.406	0.407	0.187
60.0000	22.411	0.412	0.184
STEP 4 - RECOVERY			
0.0000	22.392	0.412	0.187
0.0083	22.392	0.412	0.187
0.0166	22.612	0.412	0.184
0.0250	22.177	0.412	0.184
0.0333	21.972	0.412	0.187
0.0416	21.934	0.412	0.184
0.0500	21.676	0.412	0.184
0.0583	21.552	0.412	0.184

Elapsed Time	MW-72	MW-73	MW-74
0.0666	21.390	0.412	0.187
0.0750	21.179	0.412	0.187
0.0833	20.988	0.412	0.184
0.0916	20.788	0.412	0.187
0.1000	20.592	0.412	0.187
0.1083	20.430	0.412	0.187
0.1166	20.186	0.412	0.184
0.1250	19.981	0.412	0.184
0.1333	19.785	0.412	0.187
0.1416	19.603	0.412	0.187
0.1500	19.403	0.412	0.187
0.1583	19.197	0.412	0.184
0.1666	19.049	0.412	0.184
0.1750	18.796	0.412	0.184
0.1833	18.600	0.412	0.184
0.1916	18.418	0.412	0.184
0.2000	18.251	0.412	0.187
0.2083	18.060	0.412	0.187
0.2166	17.840	0.412	0.184
0.2250	17.687	0.412	0.184
0.2333	17.491	0.412	0.184
0.2416	17.309	0.412	0.187
0.2500	17.132	0.412	0.187
0.2583	16.936	0.412	0.184
0.2666	16.731	0.412	0.184
0.2750	16.530	0.412	0.184
0.2833	16.343	0.412	0.184
0.2916	16.161	0.412	0.184
0.3000	15.994	0.412	0.184
0.3083	15.793	0.412	0.184
0.3166	15.635	0.412	0.184
0.3250	15.453	0.412	0.187
0.3333	15.238	0.412	0.184
0.3500	14.874	0.412	0.184
0.3666	14.559	0.412	0.187
0.3833	14.243	0.412	0.180
0.4000	13.841	0.412	0.187
0.4166	13.510	0.412	0.184
0.4333	13.132	0.412	0.184
0.4500	12.792	0.412	0.180
0.4666	12.495	0.412	0.184
0.4833	12.155	0.412	0.184
0.5000	11.849	0.412	0.184
0.5166	11.552	0.412	0.184
0.5333	11.202	0.412	0.184
0.5500	10.886	0.412	0.184
0.5666	10.622	0.412	0.184
0.5833	10.364	0.412	0.184
0.6000	10.081	0.412	0.187
0.6166	9.822	0.412	0.184
0.6333	9.530	0.412	0.180
0.6500	9.266	0.412	0.184
0.6666	9.012	0.412	0.184
0.6833	8.767	0.412	0.187
0.7000	8.465	0.412	0.184
0.7166	8.240	0.412	0.180
0.7333	8.024	0.412	0.184
0.7500	7.818	0.412	0.184

Elapsed Time	MW-72	MW-73	MW-74
0.7666	7.516	0.412	0.184
0.7833	7.257	0.412	0.180
0.8000	7.002	0.412	0.184
0.8166	6.863	0.412	0.184
0.8333	6.599	0.412	0.180
0.8500	6.335	0.412	0.184
0 8666	6.100	0.412	0.180
0.8833	5.879	0.412	0.180
0.9000	5.688	0.412	0.180
0.9166	5.443	0.412	0.184
0.9333	5.265	0.412	0.180
0.9500	5.040	0.407	0.180
0.9666	4.833	0.407	0.180
0.9833	4.660	0.407	0.180
1.0000	4.454	0.407	0.180
1.2000	2.552	0.403	0.177
1.4000	1.091	0.398	0.177
1.6000	0.009	0.388	0.177
1.8000	-0.851	0.379	0.180
2.0000	-1.577	0.365	0.177
2.2000	-2.154	0.350	0.177
2.4000	-2.568	0.336	0.177
2.6000	-2.934	0.322	0.174
2.8000	-3.223	0.303	0.174
3.0000	-3.444	0.289	0.174
3.2000	-3.608	0.275	0.174
3.4000	-3.714	0.256	0.174
3.6000	-3.786	0.241	0.171
3.8000	-3.825	0.232	0.171
4.0000	-3.839	0.213	0.168
4.2000	-3.810	0.203	0.168
4.4000	-3.757	0.189	0.165
4.6000	-3.680	0.175	0.161
4.8000	-3.570	0.165	0.161
5.0000	-3.440	0.156	0.161
5.2000	-3.233	0.146	0.158
5.4000	-2.982	0.137	0.155
5.6000	-2.746	0.128	0.155
5.8000	-2.515	0.118	0.155
6.0000	-2.294	0.109	0.149
6.2000	-2.082	0.104	0.149
6.4000	-1.875	0.094	0.149
6.6000	-1.669	0.090	0.145
6.8000	-1.486	0.080	0.145
7.0000	-1.303	0.080	0.142
7.2000	-1.130	0.075	0.142
7.4000	-0.961	0.071	0.139
7.6000	-0.807	0.066	0.139
7.8000	-0.658	0.061	0.136
8.0000	-0.528	0.061	0.136
8.2000	-0.408	0.061	0.133
8.4000	-0.307	0.056	0.130
8.6000	-0.226	0.056	0.130
8.8000	-0.153	0.056	0.126
9.0000	-0.096	0.056	0.126
9.2000	-0.052	0.056	0.123
9.4000	-0.014	0.056	0.123
9.6000	0.014	0.056	0.123

Elapsed Time	MW-72	MW-73	MW-74
9.8000	0.038	0.056	0.120
10.0000	0.052	0.056	0.120
12.0000	0.110	0.056	0.104
14.0000	0.115	0.052	0.092
16.0000	0.100	0.047	0.082
18.0000	0.091	0.037	0.066
20.0000	0.081	0.028	0.057
22.0000	0.072	0.033	0.047
24.0000	0.062	0.023	0.038
26.0000	0.052	0.018	0.031
28.0000	0.048	0.018	0.022
30.0000	0.043	0.014	0.015

APPENDIX B

HAND MEASUREMENTS FOR STEP TESTS AND CONSTANT RATE TEST

WELL GAUGING DATA FORM

IENT: MOC

SITE: IBGP

ROJECT NO.: 053358072

DATE: 6/20/95

RECORDED BY: CAM

INTERFACE PROBE NO.: ORS

INTERFACE PROBE CORRECTION: 0 FT.

WEATHER:

24.5

Time 4th Step 2hr 9pm

WELL NUMBER	WELL DIAMETER (INCH)	Elapsed WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-74			1736		187.93				Static
			1740		←				Start
		5	1745		187.95				
		8	1748		187.97				
		11	1751		187.95				
			18:09		188.07				
			1824		188.10				
			1839		188.13				
							TOTAL GALLONS BAILED		

REMARKS:

PUMPING TEST RECORD

PUMPING WELL NO. MW-72

Project #: _____

Project Name/Location: _____

_____

Pumping Well Depth : _____ = Ch. _____

Observation Wells #: _____ = Ch. _____

____ = Ch. _____ #____ = Ch. _____

Select Unit

PW-Initial Water Level: _____ Ft/m

PW-Final Water Level: _____ Ft/m

Total Drawdown: _____ Ft/m

Total Recover: _____ Ft/m

Date/Time PT - Start: ____/_____

Date/Time PT - Stopped: ____/_____

Total Pumping duration: _____

Discharge Rate (DR) : Step No._____

Final DR: _____ gpm/Lpm

Date/Time Recovery Start: ____/_____

Date/Time Recovery Stopped: ____/_____

Total Volume Pumped: _____ g/Ft^3/m^3

Total Recovery duration: _____

Designed by: _____ Monitored By: _____ Checked By: _____ Date: _____

Remarks: Initial Meter Reading 10388024.8

_____

Well #: MW-72				GW-Quality				Discharge Rate			
	Water Level			Field Measurement				Field Measurement			
Time (2400hrs)	~~Data~~ Data logger ~~Probe~~	Level Probe WL	~~Draw-down~~ PRODUCT (s)	Time (2400 hrs)	pH (1-14)	EC ~~ms/cm~~ µs/cm	T°C (T°F)	Time (2400 hrs)	Flow-Meter	Rate (gpm)	Avg Rate from Meter Readings
0028	~~14837~~ 28.10	196.63	190.77	0152	8.10	1209	66.2				
0200	15.501							0135		21.1	
								0144	10388283		18.7
								0149		20.5	
								0157		21.0	
								0204		21.1	
				0212	7.60	1176	64.4	0212		21	

Initial

Well #: MW-72				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe	Draw-down (s)	Time (2400 hrs)	pH (1-14)	EC ~~ms/cm~~ µS/cm	T°C (T°F)	Time (2400 hrs)	Flow-Meter	Rate (gpm)
				0309	7.14	1124	63.1	0309		21.4
				0406	7.13	1162	63.6	0406		21.1
				0523	7.21	1195	63.0	0523		20.8
				0605	7.08	1246	61.7	0605		21.0
0620	15.65			0719	7.27	1263	67.2	0719		20.8
				0832	5.91	1284	74	0832	~~1039764~~ 0.5	20.7
				1107	5.81	1240	75.7	1106	1039952.5	20.9
				1355	7.01	1215	74.6	1514	1040508 4.5	20.4
				1643	7.08	1166	74.4	1643	1040683.8	20.7
1653	15.81			1856	7.10	1127	71.0		1040970.0	20.4
				2011	7.24	1141	71.7		1041123.8	~~20.4~~
2017				2058	7.59	1140	70.7	2017	1041369.3	20.5
				0107	7.14	1191	69.9	0042	1041678.8	20.4
								0130	1041767.1	

18.7
19.7
21.5
~~20.5~~

Well #: MW-59				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe PL	~~Drawdown~~ WL ~~(ft)~~	Time (2400 hrs)	pH (1-14)	EC ms/cm	T°C T°F	Time (2400 hrs)	Flow-Meter	Rate (gpm)
Initial 6/20 0053		190.97	193.14							
0200		190.97	193.15							
0300		190.98	193.16							
0353		191.00	193.17							
0515		191.01	193.17							
0555		191.01	193.18							
0701		191.03	193.19							
0913		191.03	193.18							
1141		191.02	193.18							
1341		191.01	193.18							
1635		191.04	193.20							
1926		191.02	193.20							
2024		191.03	193.20							
2239		191.05	193.20							
6/21 0046		191.02	193.18							
* 0142		191.05	193.22							
0311		191.03	193.19							
0417		191.00	193.16							
0533		191.01	193.17							

* Recovery Start 0130

Well #: MW-61A				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe WL	Draw-down (s)	Time (2400 hrs)	pH (1-14)	EC ms/cm	T°C T°F	Time (2400 hrs)	Flow-Meter	Rate (gpm)
Initial 0041		187.91								
6/20 0248		187.91								
0343		187.91								
0503		187.91								
0545		187.92								
0650		187.93								
0857		187.95								
1131		187.93								
1330		187.87								
1617		187.89								
1914		187.91								
2029		187.94								
2250		187.95								
6/21 0052		187.94								
☆ 0146		187.94								
0320		187.93								
0424		187.92								
0540		187.92								

☆ Recovery Start 0130

Well #: MW-58				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe PL	~~Draw-down~~ WL	Time (2400 hrs)	pH (1-14)	EC ms/cm	T°C T°F	Time (2400 hrs)	Flow-Meter	Rate (gpm)
Initial 6/20 0047		195.89	197.64							
0152		195.89	197.64							
0253		195.91	197.65							
0348		195.91	197.67							
0508		195.91	197.67							
0549		195.93	197.69							
0655		195.93	197.72							
0905		195.94	197.72							
1136		195.93	197.70							
1334		195.92	197.69							
1629		195.94	197.73							
1919		195.93	197.71							
2034		195.93	197.70							
2246		195.95	197.74							
6/21 0056		195.96	197.75							
☆ 0153		195.96	197.74							
0327		195.93	197.71							
0429		195.91	197.67							
0544		195.92	197.68							

☆ Recovery Start 0130

Well #: MW-74				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe BOL	~~Drawdown (ft)~~	Time (2400 hrs)	pH (1-14)	EC ms/cm	T°C T°F	Time (2400 hrs)	Flow-Meter	Rate (gpm)
Initial 0037	17.67	187.86								
-20 0139		187.93								
0142		187.90								
0209		187.93								
0231		187.94								
0331		187.93								
0436		188.00								
0532		187.97								
★ 0641		188.47								
0842		188.43								
★ 1124		188.47								
★ 1349		188.51								
★ 1611		188.58								
★ 1906		188.61								
★ 2018		188.59								
★ 2224		188.62								
6-21 ★ 0100		188.59								

★ used Keck IP

Well #: MW-73				GW-Quality				Discharge Rate		
	Water Level			Field Measurement				Field Measurement		
Time (2400hrs)	Data logger	Level Probe PL	~~Draw-down~~ ~~ft~~ WL	Time (2400 hrs)	pH (1-14)	EC ms/cm	T°C T°F	Time (2400 hrs)	Flow-Meter	Rate (gpm)
Initial 0031	26.96	191.65	192.31							
6-20 0138		191.42	192.59							
0141		191.46	192.63							
0144		191.94	192.05							
0207		192.05	192.70							
0234		192.07	192.72							
0333		192.09	192.75							
0449		192.11	192.75							
0537		192.12	192.78							
0636		192.13	192.79							
0838		192.14	19280							
11.13		19214	14280							
1351		192.11	192.77							
1605		192.12	192.75							
1901		192.15	192.81							
2015		192.14	192.80							
2225		192.19	192.84							
6-21 0105		192.18	192.84							
* 0136		191.87	192.52							

* Recovery Start 0130

WELL GAUGING DATA FORM

CLIENT: ARC
SITE: IGCP
PROJECT NO.: 053350072
DATE: 6/20/95

RECORDED BY: CAM
INTERFACE PROBE NO.: Keck
INTERFACE PROBE CORRECTION: 0 FT.
WEATHER: Sunny

11.7
Elapsed Time / Step 10 gpm DTW Corrected

WELL NUMBER	WELL DIAMETER (INCH)	WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-73		—	0730		192.25	191.65	0.60	191.72	Static
		3	1136	~~1138~~	192.53	191.87	0.66	192.04	Start 1135
		8	1143		192.53	191.88	0.65	192.02	
		11	1146		192.53	191.88	0.65	192.02	
		14	1149		192.53	191.88	0.65	192.02	
		25	12:00		192.54	191.89	0.65	193.04	
		43	1218		192.55	191.90	0.65	193.05	
		56	1231		192.55	191.90	0.65	193.05	
									Stop 1235

TOTAL GALLONS BAILED

REMARKS:

WELL GAUGING DATA FORM

IENT: MOC
SITE: IBGP
PROJECT NO.: 053350072
DATE: 6/20/95

RECORDED BY: CAM
INTERFACE PROBE NO.: ORS
INTERFACE PROBE CORRECTION: 0 FT.
WEATHER: Sunny

Elapsed 1ST Steps at 11.7 gpm

WELL NUMBER	WELL DIAMETER (INCH)	Time WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-74			0725		187.54				Static
		6	1141		187.87				Step Start 1135
		10	1145		187.89				
		13	1148		187.91				
		15	1150		187.92				
		26	12:01		187.95				
		45	1220		187.99				
		57	1232		188.01				
									Stop 1235
							TOTAL GALLONS BAILED		

REMARKS:

WELL GAUGING DATA FORM

CLIENT: MOC — RECORDED BY: Cam

SITE: IGCP — INTERFACE PROBE NO.: Keck

PROJECT NO.: 053350072 — INTERFACE PROBE CORRECTION: 0 FT.

DATE: 6/20/95 — WEATHER: Sunny

14.7

2 Step 1 gpm

WELL NUMBER	WELL DIAMETER (INCH)	Elapsed Time WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	DTW Corrected ~~GALLONS~~ OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-73			1338		192.30	191.65	0.65	192.80	Before Step
		0	1340		~~192.45~~	~~191.78~~ Clean			Start
		2	1342		192.45	191.78	0.67	192.97	
		6	1346		192.53	191.87	0.66	193.04	
		8	1348		192.55	191.90	0.65	193.05	
		11	1351		192.56	191.91	0.65	193.06	
		13	1353		192.58	191.92	0.66	193.09	
		22	1402		192.60	191.94	0.66	193.11	
		31	1411		192.62	191.97	0.65	193.12	
		48	1428		192.63	191.98	0.65	193.13	
		56	1436		192.64	191.98	0.66	193.15	
									Stop 1440
							TOTAL GALLONS BAILED		

REMARKS:

WELL GAUGING DATA FORM

CLIENT: MOC
SITE: IBGP
PROJECT NO.: 053350072
DATE: 6/20/95

RECORDED BY: BMM
INTERFACE PROBE NO.: OF 5
INTERFACE PROBE CORRECTION: 0 FT.
WEATHER: Sunny

14.7
Elapsed 2 Step @ 9 gpm

WELL NUMBER	WELL DIAMETER (INCH)	Time WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-74			1339		187.89				Before Step 2
		0.	1340		~~187.90~~ 187.90				Start
		4	1344		187.90				
		7	1347		187.92				
		9	1349		187.93				
		12	1352		187.96				
		15	1355		187.97				
		23	1403		188.00				
		32	1412		188.03				
		50	1430		188.06				
		58	1438		188.07				
									Step 1440

TOTAL GALLONS BAILED

REMARKS:

WELL GAUGING DATA FORM

CLIENT: MOC

SITE: IBGP

PROJECT NO.: 053350072

DATE: 6/20/95

RECORDED BY: CAM

INTERFACE PROBE NO.: Keck

INTERFACE PROBE CORRECTION: 0 FT.

WEATHER:

Elapsed Time 3 Step 19.3 gpm DTW Corrected

WELL NUMBER	WELL DIAMETER (INCH)	WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-73			1530		~~192.41~~	~~191.73~~ CAM			Start
		2	1532		192.41	191.73	0.68	192.94	
		5	1535		192.52	191.86	0.66	193.03	
		8	1538		192.58	191.92	0.66	193.09	
		21	1551		192.67	192.00	0.67	193.19	
		38	16:08		192.69	192.05	0.64	193.18	
		57	1627		192.71	192.05	0.66	193.22	
			1630						Stop
							TOTAL GALLONS BAILED		

REMARKS:

WELL GAUGING DATA FORM

CLIENT: MOC
RECORDED BY: CAM
SITE: IBGP
INTERFACE PROBE NO.: ORS
PROJECT NO.: 053500.72
INTERFACE PROBE CORRECTION: 0 FT.
DATE: 6/20/96
WEATHER:

3 Step 19.3 ppm

WELL NUMBER	WELL DIAMETER (INCH)	WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-14			1530						Start
		3	1533		187.90				
		6	1536		187.92				
		9	1539		187.93				
		23	1553		188.02				
		40	16:10		188.06				
		58	1628		188.09				
			1630						Stop
							TOTAL GALLONS BAILED		

REMARKS:

WELL GAUGING DATA FORM

CLIENT: MDC
RECORDED BY: CAM
SITE: IBGP
INTERFACE PROBE NO.: Keck
PROJECT NO.: 053350072
INTERFACE PROBE CORRECTION: 0 FT.
DATE: 6/20/95
WEATHER:

Time 4/12 Step 243 2k GPM

WELL NUMBER	WELL DIAMETER (INCH)	ELAPSED WELL DEPTH (FEET)	TIME OF READING (HH:MM)	DEPTH OF WELL FROM TOP OF CASING (FEET)	DEPTH TO WATER FROM TOP OF CASING (FEET)	DEPTH TO PRODUCT FROM TOP OF CASING (FEET)	PRODUCT THICKNESS (FEET)	GALLONS OF PRODUCT BAILED	COMMENTS (WATER IN MANHOLE/ LOCK OR CAP MISSING)
MW-73			1735	1	192.33	191 68			Static
			1740		—	—			Start
		4	1744		192.51	191.85			
		6	1746		192.59	191.93			
		9	1749		192.64	191.97			
			1807		192.72	191.96			
			1822		192.74	192.07			
			1837		192.76	192.09			

TOTAL GALLONS BAILED

REMARKS:

APPENDIX C

WELL COMPLETION RECORDS AND LITHOLOGIC LOGS

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 84 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3821.60	
	0	CLAYEY SILT:	ML
	5.0	SILTSTONE:	SILTSTONE
	10.0	DOLOMITE:	DOLOMITE
	15.0	DOLOMITE:	DOLOMITE
	18.0	DOLOMITE:	DOLOMITE
	20.5	DOLOMITE:	SANDSTONE
	22.0	SANDSTONE:	DOLOMITE
	28.0	DOLOMITE:	SANDSTONE
	30.0	SANDSTONE:	SANDSTONE
	35	SANDSTONE:	
	42.0		SANDSTONE
	44.0	SANDSTONE:	SANDSTONE
	48.0	SANDSTONE:	SANDSTONE
		SANDSTONE:	
	56.0	SANDSTONE:	SANDSTONE
	65.0	SANDSTONE:	SANDSTONE
	70		
	76.0	DOLOMITE:	DOLOMITE
	82.0	SANDSTONE:	SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
	94.0		
	97.0	SANDSTONE:	SANDSTONE
	100.0	DOLOMITE:	DOLOMITE
	104.0		DOLOMITE
	105	DOLOMITE:	DOLOMITE
		DOLOMITE:	
	112.0	SANDY DOLOMITE:	DOLOMITE
	118.0	SANDY DOLOMITE:	DOLOMITE
	124.0	DOLOMITE:	DOLOMITE
	135.0		DOLOMITE
	138.0	DOLOMITE:	DOLOMITE
	140	DOLOMITE:	DOLOMITE
	142.0	SANDY DOLOMITE:	DOLOMITE
	164.0	SILTSTONE:	SILTSTONE
	172.0		
	175	DOLOMITE:	DOLOMITE
▽ 190.55			
	192.0	DOLOMITE:	DOLOMITE
	198.0	DOLOMITIC LIMESTONE:	LIMESTONE
	202.0	LIMESTONE:	LIMESTONE
▽ 207.4	205.0	LIMESTONE:	LIMESTONE
	207.0	LIMESTONE:	LIMESTONE
	210	SANDSTONE:	SANDSTONE
	216.0	T.D. 216.0'	
	245		

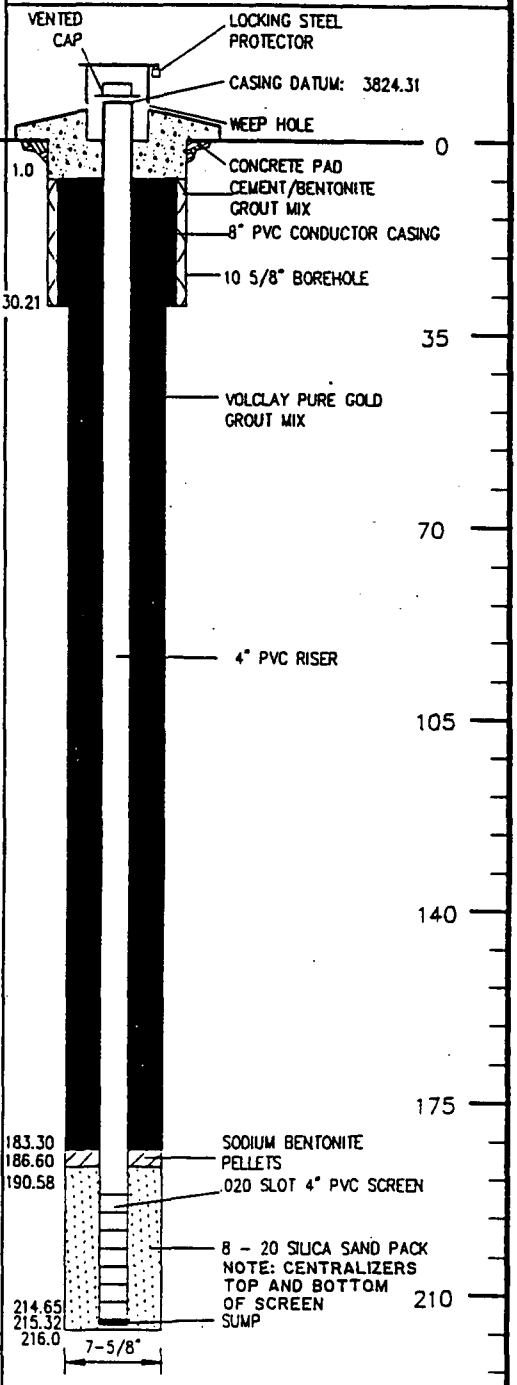
GRAPHIC LOG

SAMPLE INTERVAL

"N" VALUE

SEE BORING RECORD FOR DETAILED DESCRIPTION

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-58 (BH-84)*

	CONDUCTOR INSTALLED
DATE DRILLED	6/31/91 — 6/27/91
DRILLING METHOD	7-5/8" AIR HAMMER
DRILLED BY	BOYLES BROS.
LOGGED BY	CHR
CHECKED BY	BJS
DRAWN BY:	SAR

PAGE 1 OF

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3821.60	
	0	CLAYEY SILT: LIGHT BROWN, 7.5YR 6/3. 30% CLAY, 60% SILT, FIRM TO LOOSE, FRIABLE, 10% CALICHE DEPOSITS, DRY	ML
	5	SILTSTONE: LIGHT GRAY, 5YR 7/1, SLIGHTLY HARD, FRIABLE, DRY, WEATHERED APPEARANCE, SILICEOUS	SILTSTONE
	10	DOLOMITE: SANDY, LIGHT GRAY, 5Y 7/1, AND LIGHT BROWNISH GRAY 10YR 6/2, VERY SLIGHTLY CALCAREOUS, HARD, DRY, DENSE, SCATTERED HEMATITE ~ 5% THROUGHOUT	SANDY DOLOMITE
	15	DOLOMITE: 10YR 6/1, GRAY, VERY HARD, VERY FINE MICROCRYSTALLINE, DENSE, CHERTY, DRY, FRACTURED INTERVAL FROM 15.0–15.2', AND 16.2–16.4', DRY	DOLOMITE
	18.0	DOLOMITE: AS ABOVE, INTERBEDDED WITH SANDSTONE, VERY FINE GRAIN, LIGHT BROWNISH GRAY, 10YR 6/2, AND PALE BROWN, 10YR 6/3, SILICEOUS CEMENT, DRY, DENSE	DOLOMITE /SANDSTONE
	20		
	20.5	SANDSTONE: PALE BROWN, 10YR 6/3, AND GRAYISH BROWN, 2.5YR 5/2, ARGILLACEOUS, MODERATELY SOFT, SILICEOUS CEMENT, DRY	SANDSTONE
	22.0	DOLOMITE, LIGHT GRAY, VERY FINE CRYSTALLINE, VERY SLIGHTLY SANDY, SLIGHTLY CALCAREOUS, 10 YR 7/1, VERY HARD, DENSE, DRY, INTERBEDDED WITH SANDSTONE, AS ABOVE, BELOW 25.0'	DOLOMITE
	25		
	28.0	SANDSTONE: GRAY, 2.5YR N6/0, AND GRAYISH BROWN, 10 YR 5/2, VERY FINE GRAIN, SLIGHTLY CALCAREOUS CEMENT, MODERATELY CEMENTED, MODERATELY HARD, SLIGHTLY FRIABLE, DENSE	SANDSTONE
	30	SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, AND PALE BROWN, 10YR 6/3, SLIGHTLY HARD TO SOFT, VERY FINE GRAIN, VERY SLIGHTLY CALCEREOUS, PREDOMINATELY SILICEOUS, DRY, MASSIVE, WEAKLY CEMENTED	SANDSTONE
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 14.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	0.0	GC	14.0
8	0.0	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.0	GC	22.0
12	0.0	GC	24.0
13	0.0	GC	26.0
14	0.0	GC	28.0
15	0.0	GC	30.0
16	2.0	GC	32.0
17	79.0	GC	34.0
18	0.0	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

AIR HAMMER TO T.D.

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR/WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-1895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	SANDSTONE, AS ABOVE BUT BECOMING VERY POORLY CEMENTED TO UNCONSOLIDATED BELOW 40.0', SILTY	SANDSTONE			18	0.0	GC	36.0	35
						19	0.0	GC	38.0	
						20	0.0	GC	40.0	
	40					21	115.0	GC	42.0	40
	42.0	SANDSTONE: LIGHT GRAY 7.5 YR N 7/0, SLIGHTLY DOLOMITIC, SILICEOUS, VERY FINE GRAIN, MODERATELY HARD, FRIABLE, DRY	SANDSTONE			22	91.8	GC	44.0	
	44.0	SANDSTONE: LIGHT BROWN, 7.5 YR 6/3, SILICEOUS, VERY FINE GRAIN, VERY POORLY CEMENTED, DRY, SILTY	SANDSTONE			23	0.0	GC	46.0	
	45					24	0.0	GC	48.0	45
	48.0	GRADING TO SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, HARD, DRY, WELL CEMENTED	SANDSTONE			25	0.0	GC	50.0	
	50					26	122.0	GC	52.0	50
						27	13.9	GC	54.0	
	55					28	260.0	GC	56.0	55
	56.0	SANDSTONE: BROWN, 7.5 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY	SANDSTONE			29	0.0	GC	58.0	
						30	0.0	GC	60.0	
	60					31	0.0	GC	62.0	60
						32	0.0	GC	64.0	
	65					33	0.0	GC	66.0	65
		SANDSTONE: BROWN, 7 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY, INTERBEDDED WITH MINOR DOLOMITIC SANDSTONE	SANDSTONE			34	152.0	GC	68.0	
						35	0.0	GC	70.0	
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SANDSTONE: CONTINUED FROM PREVIOUS PAGE	SANDSTONE			36	0.0	GC	72.0	70
						37	146.0	GC	74.0	
	75					38	0.0	GC	76.0	75
	76.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERT, HARD, DRY	DOLOMITE			39	0.0	GC	78.0	
	80					40	0.0	GC	80.0	80
	82.0	SANDSTONE: LIGHT GRAY, 7.5 YR N 7/0, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, MODERATELY HARD, FRIABLE, DRY	SANDSTONE			41	0.0	GC	82.0	
	84.0	SANDSTONE: GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, VERY FINE GRAIN, MOIST	SANDSTONE			42	0.0	GC	84.0	
	85	BELOW 88.0', SANDSTONE AS ABOVE INTER-BEDDED WITH SANDSTONE, 7.5 YR N 7/0, VERY FINE GRAIN, VERY SLIGHTLY DOLO-MITIC, MODERATELY SILICEOUS CEMENT, FRIABLE, THINLY BEDDED				43	0.0	GC	86.0	85
						44	0.0	GC	88.0	
						45	0.0	GC	90.0	
	90					46	47.4	GC	92.0	90
						47	0.0	GC	94.0	
	94	SANDSTONE: DOLOMITIC, GRAY, 10 YR 6/1, MODERATELY HARD, VERY FINE GRAIN, MODERATELY CEMENTED, DRY	DOLOMITIC SANDSTONE			48	18.3	GC	96.0	
	95									95
	97	DOLOMITE: GRAYISH BROWN,, 10 YR 5/2, PREDOMINATELY MICROCRYSTALLINE, TRACE FINE CRYSTALLINE SLIGHTLY SANDY DOLO-MITE, HARD, DENSE, DRY	DOLOMITE			49	66.1	GC	98.0	
						50	0.0	GC	100.0	
	100	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MICROCRYSTALLINE, SOME FINE CRYSTALLINE WITH SANDY TEXTURE, HARD, DENSE, DRY, VERY SLIGHTLY CALCAREOUS	DOLOMITE			51	0.0	GC	102.0	100
						52	0.0	GC	104.0	
	104	SEE NEXT PAGE	DOLOMITE			53	0.0	GC	105.0	
	105									105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	DOLOMITE: GRAYISH BROWN, 10YR 5/2, AND BROWN, 10 YR 5/3, MICROCRYSTALLINE, CHERTY, DENSE, HARD, DRY, INTERBEDDED WITH SILTSTONE, MINOR DUSKY YELLOWISH GREEN, 5 GY 5/2, SOFT, FISSILE	DOLOMITE			53	0.0	GC	106.0	105
						54	0.0	GC	108.0	
						55	0.0	GC	110.0	
	110	BECOMING VERY SILTY DOLOMITE BELOW, 110.0'				56	0.0	GC	112.0	110
	112.0	SANDY DOLOMITE: LIGHT GRAY, 10 YR 6/1, COARSELY CRYSTALLINE, DENSE, HARD, DRY, INTERBEDDED WITH SILT, LIGHT GRAY 10 YR 7/1, VERY SOFT, UNCONSOLIDATED POWDERY IN CUTTINGS, DRY	SANDY DOLOMITE			57	0.0	GC	114.0	
	115					58	246.0	GC	116.0	115
						59	78.0	GC	118.0	
	118.0	SANDY DOLOMITE: GRAY, 7.5 YR N 6/0, FINE CRYTSTALLINE, SANDY, DULL APPEARANCE, HARD, MASSIVE, DRY	SANDY DOLOMITE			60	223.0	GC	120.0	
	120					61	0.0	GC	122.0	120
						62	0.0	GC	124.0	
	124.0	DOLOMITE: LIGHT GRAY, 10 YR 6/1, MICROCRYSTALLINE, DENSE, CHERTY, HARD, DRY, VERY SLIGHTLY SILTY	DOLOMITE			63	0.0	GC	126.0	
	125					64	0.0	GC	128.0	125
						65	0.0	GC	130.0	
	130					66	0.0	GC	132.0	130
						67	0.0	GC	134.0	
	135	DOLOMITE: LIGHT GRAY, 10 YR 6/1, MICROCRYSTALLINE, DENSE, CHERTY, HARD, DRY, SOME VERY SLIGHTLY SILTY	DOLOMITE			68	0.0	GC	136.0	135
						69	0.0	GC	138.0	
	138.0	DOLOMITE, AS ABOVE, INTERBEDDED WITH SANDSTONE, GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, DRY	DOLOMITE WITH INTERBEDDED SANDSTONE			70	0.0	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
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DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	(CONTINUED FROM PREVIOUS PAGE)	DOLOMITE			71	0.0	GC	142.0	140
	142.0	SANDY DOLOMITE: LIGHT BROWNISH GRAY 10 YR 6/2, VERY FINE CRYSTALLINE, SLIGHTLY SILTY, DENSE, HARD, DRY	SANDY DOLOMITE			72	0.0	GC	144.0	
	145					73	0.0	GC	146.0	145
						74	0.0	GC	148.0	
						75	0.0	GC	150.0	
	150	SANDY DOLOMITE, AS ABOVE, GRADING TO GRAY, 7.5 YR N 6/0, HARD, DRY, MASSIVE, DENSE				76	0.0	GC	152.0	150
						77	0.0	GC	154.0	
	155					78	0.0	GC	156.0	155
						79	0.0	GC	158.0	
						80	0.0	GC	160.0	
	160					81	1.4	GC	162.0	160
						82	1.4	GC	164.0	
	164.0	SILTSTONE: WHITE 10 YR 8/2, TO PINKISH WHITE 7.5 YR 8/2, INTERBEDDED WITH DOLOMITE, VERY FINE CRYSTALLINE, DENSE, HARD, SILTSTONE, VERY POORLY CEMENTED, POWDERY IN SAMPLES, LOOSE, DRY, CALCAREOUS WITH INCREASING DOLOMITE BELOW 168.0'	SILTSTONE WITH INTERBEDDED DOLOMITE			83	2.8	GC	166.0	
	165					84	0.0	GC	168.0	165
						85	0.0	GC	170.0	
	170					86	1.4	GC	172.0	170
	172.0		DOLOMITE & SANDY DOLOMITE			87	0.0	GC	174.0	
	175					88	0.0	GC	175.0	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
										BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
		GROUND SURFACE: 3821.60								
	175	DOLOMITE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE CRYSTALLINE TO MICRO-CRYSTALLINE, DENSE, HARD, DRY, INTER-BEDDED WITH SOME DOLOMITE, SANDY, VERY PALE BROWN, 10 YR 7/3, POORLY CEMENTED, VERY SLIGHTLY CALCAREOUS, DRY, MASSIVE	DOLOMITE & SANDY DOLOMITE			88	0.0	GC	176.0	175
						89	0.0	GC	178.0	
						90	0.0	GC	180.0	
	180					91	0.0	GC	182.0	180
						92	0.0	GC	184.0	
	185					93	1.4	GC	186.0	185
						94	0.0	GC	188.0	
▽190.55						95	0.0	GC	190.0	
	190					96	0.0	GC	192.0	190
	192.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERTY, DENSE, MASSIVE, HARD, DRY	DOLOMITE			97	0.0	GC	194.0	
	195					98	0.0	GC	196.0	195
						99	0.0	GC	198.0	
	198.0	DOLOMITIC LIMESTONE: PINK, 7.5 YR 8/3, AND PINKISH GRAY, 7.5 YR 7/2, SOFT, MODERATELY HARD, CHALKY, FINE CRYSTALLINE, DRY, HYDROCARBON ODOR IN SAMPLE #100	DOLOMITIC LIMESTONE			100	25.0	GC	200.0	
	200					101	21.0	GC	202.0	200
	202.0	LIMESTONE: WHITE, 10 YR 8/2, SOFT, ARGILLACEOUS, VERY CHALKY WITH FAIR HYDROCARBON ODOR IN SAMPLE #103	LIMESTONE			102	2.8	GC	204.0	
	205	LIMESTONE: AS ABOVE, AND VERY SANDY LIMESTONE, VERY PALE BROWN, 10 YR 8/3 AND WHITE 10 YR 8/2, FAIR HYDROCARBON ODOR, MODERATELY CONSOLIDATED, VERY SLIGHTLY MOIST	LIMESTONE SANDY			103	280.0	GC	206.0	205
▽207.4	207.0	SEE NEXT PAGE FOR DESCRIPTION	SANDSTONE			104	245.0	GC	208.0	
						105	29.5	GC	210.0	
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY CHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE:- LIGHT BROWNISH GRAY, 10 YR 6/2, DOLOMITIC, VERY POORLY CEMENTED, MEDIUM GRAINED, SOME FINE GRAINED, POORLY GRADED, ANGULAR	SANDSTONE			106	1.0	GC	212.0	
						107	0.0	GC	214.0	
	215	VERY PERMEABLE, SATURATED, NO HYDROCARBON ODOR DETECTED				108	0.0	GC	216.0	
	216.0	T.D. 216.0' BOREHOLE MAKING LARGE AMOUNT OF WATER								
	200									
	225									
	230									
	235									
	240									
	245									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY CHR
CHECKED BY BJS
DRAWN BY: SAR

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(405) 321-1885

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #85 FOR MORE DETAILED LITHOLOGIC DESCRIPTION.	
		GROUND SURFACE: 3816.60	
	0		
	3.0	CLAYEY SILT:	ML
		DOLOMITE:	DOLOMITE
	8.0		
	11.0	SILTSTONE:	SILTSTONE
		SANDSTONE:	SANDSTONE
	16.0		
		DOLOMITE:	DOLOMETE
	20.0	SANDSTONE:	SANDSTONE
	30.0		
	30 32.0	SANDSTONE:	SANDSTONE
		DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	47.0		
		SANDSTONE:	SANDSTONE
	48.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	60		
	74.0	CHERTY DOLOMITE:	DOLOMITE
	79.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
	87.0		
	90	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	96.0	CHERTY DOLOMITE:	DOLOMITE
	100.0	CHERTY DOLOMITE:	DOLOMITE
	110.0	DOLOMITE:	DOLOMITE
	116.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	120		
	122.0	DOLOMITE:	DOLOMITE
	128.0		
	130.5	SANDY DOLOMITE:	SANDY DOL.
		DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	135.5	DOLOMITE:	DOLOMITE
	141.6	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	150		
	152.0	DOLOMITE:	DOLOMITE
	180		
▽ 191.00 7/4/91 ▽ 200.00	190.0		
	192.0	DOLOMITIC LIMESTONE:	DOL./LIME.
	194.0	DOLOMITE:	DOLOMITE
		LIMESTONE:	LIMESTONE
	201.0		
	204.0	SANDY DOLOMITE:	SAND/DOL.
		SANDSTONE:	SANDSTONE
	208.0		
	210		

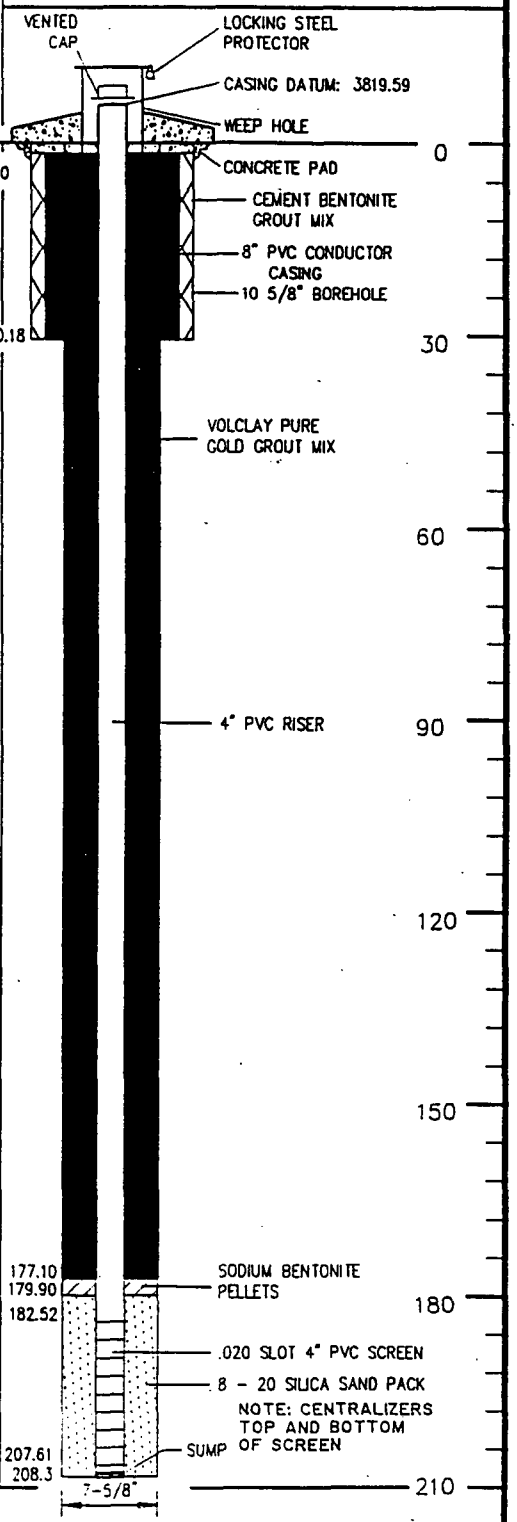
GRAPHIC LOG

SAMPLE INTERVAL

SEE BORING RECORD FOR DETAILED DESCRIPTION

"N" VALUE

WELL COMPLETION DETAIL



T.D. 208.3' FEET, W/L 1 HR. AFTER DRILLING 191 FEET,, 0.9 FEET. OF FLOATING PRODUCT

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-1805

JOB NAME/NUMBER MARATHON

BORING NUMBER MW-59 (BH-85)

CONDUCTOR INSTALLED

DATE DRILLED 7/5/91 6/28/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY CHR

CHECKED BY BJS

DRAWN BY: BDR

BORING RECORD

3813.6

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3816.60		
	0	CLAYEY SILT: LIGHT BROWN, 7.5YR 6/3, 10% CLAY, SOFT, VERY FRIABLE, DRY	ML	
	3.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, VERY FINE CRYSTALLINE TO MICROCRYSTALLINE, CHERTY, DENSE, DRY	DOLOMITE	
	8.0	SILTSTONE: YELLOW 10YR 7/8, LIMONITIC, SILICEOUS CEMENT, SLIGHT BANDED APPEARANCE, MODERATELY HARD, DRY	SILTSTONE	
	11.0	SANDSTONE: LIGHT GRAY, 2.5YR 7/2, TO LIGHT BROWNISH GRAY, 2.5Y 6/2, VERY FINE GRAIN, SILICEOUS CEMENT, DENSE, DRY	SANDSTONE	
	16.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, MICRO - CRYSTALLINE, WITH TRACE OF COARSELY CRYSTALLINE DOLOMITE, DENSE, DRY, INTERBEDDED WITH MINOR SILTSTONES AND SANDSTONES, AS ABOVE	DOLOMITE	
	20	SANDSTONE: PINKISH GRAY, 7.5YR 6/2, VERY FINE GRAIN, VERY SILTY, MASSIVE, SLIGHTLY HARD, FRIABLE, SLIGHTLY CALCAREOUS CEMENT, PREDOMINATELY SILICEOUS, DRY	SANDSTONE	
	30	SANDSTONE: VERY FINE GRAIN, SILTY, 10YR 5/2, GRAYISH BROWN, MODERATELY HARD, DRY, WEAKLY CEMENTED	SANDSTONE	
	32.0	DOLOMITIC SANDSTONE: VERY FINE GRAINED SILICA SAND, 2.5YR 5/2, GRAY BROWN, MODERATELY HARD, SLIGHT CONDENSATE ODOR, SLIGHTLY MOIST, MINOR INTERBEDS AT 10YR 5/1, GRAY, HARD DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE	
	35			

OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	2.4	GC	12.0
7	0.0	GC	14.0
8	19.9	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.0	GC	22.0
12	14.2	GC	24.0
13	0.0	GC	26.0
14	0.0	GC	28.0
15	3.9	GC	30.0
16	9.0	GC	32.0
17	44.0	GC	34.0
18	65.0	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

AIR HAMMER DRILLING

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
CC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3816.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	CONTINUED FROM PREVIOUS PAGE	DOLOMITIC SANDSTONE			18	65.0	GC	36.0	
						19	34.9	GC	38.0	
						20	98.0	GC	40.0	
	40					21	23.2	GC	42.0	
						22	27.0	GC	44.0	
	45					23	18.6	GC	46.0	
	47.0					24	7.8	GC	48.0	
	48.0	SANDSTONE: VERY FINE GRAIN SILICA SAND, WELL SORTED, WEAKLY CEMENTED, SILTY, 2.5Y 5/2, GRAYISH BROWN, SLIGHTLY MOIST	SANDSTONE							
		DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 10YR 5/1, GRAY WITH MINOR 10YR 3/1, VERY DARK GRAY, VERY FINE GRAIN SANDSTONE INTERBEDS, MODERATELY HARD, MASSIVE, COLOR VARIES FROM 10Y 5/1, GRAY, TO 2.5Y 4/2, DARK GRAY WITH DEPTH, MINOR VERY FINE GRAIN IRON PYRITE OBSERVED	DOLOMITIC SANDSTONE			25	28.0	GC	50.0	
	50					26	20.0	GC	52.0	
						27	37.0	GC	54.0	
	55					28	21.0	GC	56.0	
						29	88.0	GC	58.0	
						30	56.0	GC	60.0	
	60					31	36.0	GC	62.0	
						32	278.0	GC	64.0	
	65					33	28.0	GC	66.0	
						34	22.0	GC	68.0	
	70					35	106.0	GC	70.0	

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	70	GROUND SURFACE: 3816.60	
		CONTINUED FROM PREVIOUS PAGE	DOLOMITIC SANDSTONE
		AFTER 72.0 FEET, ABUNDANT IRON OXIDE STAINING	
	74.0	CHERTY DOLOMITE: 2.5Y 5/2, GRAYISH BROWN, VERY HARD, CONCOIDIAL FRACTURES	DOLOMITE
	75		
	79.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA SAND, VERY HARD, 2.5Y 5/2, GRAYISH BROWN, 10YR 6/1, LIGHT GRAY TO GRAY, AND 10YR 4/2, DARK GRAYISH BROWN, MINOR IRON OXIDE STAINING, DRY, MINOR CHERTY DOLOMITE INTER-BEDS	DOLMITIC SANDSTONE
	80		
	84.0	SANDSTONE: VERY FINE GRAIN SILICA, MODERATELY HARD, SLIGHT CARBONATE CEMENT, IRON OXIDE STAINING, SILTY, 2.5Y 6/2, LIGHT BROWNISH GRAY, DRY	SANDSTONE
	85		
	87.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA SAND, MODERATELY HARD, 2.5 Y 4/2, DARK GRAYISH BROWN	DOLMITIC SANDSTONE
	90		
		AFTER 94.0', ABUNDANT HEMATITE	
	95		
	96.0	CHERTY DOLOMITE: HARD, CONCOIDAL FRACTURES, DRY, 10 YR 6/3, PALE BROWN, MINOR IRON OXIDE STAINING	DOLOMITE CHERTY
	100		
		CHERTY DOLOMITE: 10 YR 6/3, PALE BROWN, VERY HARD, HIGHLY FRACTURED, HORIZONTAL FRACTURES AT 100.2',100.3',100.6',100.8',101.0', 101.2',101.6',101.8', AND102.0', VERTICAL FRAC-TURE BETWEEN 100.5–102.3', IRON OXIDE STAIN. CALCITE AND MINOR MANGANESE OXIDE ALONG FRACTURES, HIGHLY FRACTURED BETWEEN 102.3–104.9', VERTICAL FRACTURED BETWEEN 104.9 AND 107.3'	CHERTY DOLOMITE
	105		

GRAPHIC LOG

OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	108.0	GC	72.0
37	75.0	GC	74.0
38	13.0	GC	76.0
39	10.0	GC	78.0
40	16.0	GC	80.0
41	18.0	GC	82.0
42	48.0	GC	84.0
43	52.0	GC	86.0
44	66.0	GC	88.0
45	132.0	GC	90.0
46	23.0	GC	92.0
47	26.0	GC	94.0
48	8.0	GC	96.0
49	35.0	GC	98.0
50	19.0	GC	100.0
51	9.0	2.3	101.0
52	21.0		102.3
53	3.8	5.0	104.3
54	3.2		

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	105	CONTINUED FROM PREVIOUS PAGE	CHERTY DOLOMITE
	110	DOLOMITE: 10 YR 8/2, LIGHT BROWNISH GRAY, GRADATIONAL CONTACT WITH CHERTY DOLOMITE, SUGARY, VERY HARD, FRACTURES LARGELY REPLACED WITH CALCITE, MINOR CHLORITE, IRON OXIDE, DRY	DOLOMITE
	115		
	116.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 10 YR 3/1, VERY DARK GRAY, MODERATELY HARD, DRY, MINOR 10 YR 5/2, GRAYISH BROWN DOLOMITE INTERBEDS AFTER 120.0', COLOR CHANGE TO 10 YR 5/2, GRAYISH BROWN, DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE
	120		
	122.0	DOLOMITE: MICROCRYSTALLINE, 10 YR 5/2, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, DRY MINOR IRON OXIDE STAINING AFTER 128.0'	DOLOMITE
	125		
	128.0	SANDY DOLOMITE: VERY FINE GRAIN SAND, GRADATIONAL CONTACT WITH DOLOMITE, 10 YR 5/2, GRAYISH BROWN, HARD, DRY	SANDY DOLOMITE
	130		
	130.5	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA, VERY HARD, 5 Y 6/1, LIGHT GRAY TO GRAY, AFTER 133.0', DISCONTINUOUS BANDS OF 10 YR 3/1, VERY DARK GRAY COLOR, HORIZONTAL FRACTURES AT 130.2',130.5',131.1',133.1',134.4', AND 134.9'	DOLOMITIC SANDSTONE
	135		
	135.5	DOLOMITE: MICROCRYSTALLINE AND SUGARY, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, ABUNDANT FRACTURES LARGELY FILLED WITH CALCITE, IRON PYRITE, AND MANGANESE OXIDE, OCCASIONAL VERY THIN INTERBEDS OF DOLOMITIC SANDSTONE, 2.5 Y 5/2, GRAYISH BROWN AND 5 YR 5/2, REDDISH GRAY, 10 YR 5/1, GRAY ALONG FRACTURES, FRACTURES 135.3',135.7',136.1',136.6',136.9',137.5',	DOLOMITE
	140		

OVM SOIL GAS PPM X 10.3 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
54	3.2		106.3
55	4.0		107.3
56	9.2	5.0	109.3
57	2.8		111.3
58	30.0		112.3
59	30.0	GC	114.0
60	70.0	GC	116.0
61	181	GC	118.0
62	385.0	GC	120.0
63	64.0	GC	122.0
64	71.0	GC	124.0
65	61.0	GC	126.0
66	76.0	GC	128.0
67	53.0	GC	130.0
NS		5.0	135.0
NS		4.7	139.7

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY CHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	140	CONTINUED FROM PREVIOUS PAGE 137.9', 138.6', 140.1', 141.0', 141.3', AND 141.5'	DOLOMITE
	141.6	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 2.5 Y 5/2, GRAYISH BROWN, MASSIVE, VERY HARD, WELL CEMENTED, HORIZONTAL FRACTURES AT 141.6', 142.3', 143.3', AND 143.8', FRACTURES LARGELY CEMENTED WITH CALCITE, ABUNDANT VERY FINE PYRITE, HIGHLY WEATHERED SILTY SANDSTONE INTERBEDDED BETWEEN 143.4' AND 143.7', ABUNDANT IRON OXIDE STAINING AND IRON PYRITE WITHIN INTERBED.	DOLOMITIC SANDSTONE
	145	AFTER 148.0', 10YR 5/2, GRAYISH BROWN	
	150		
	152	DOLOMITE: MICROCRYSTALLINE, 10YR 6/2, LIGHT BROWNISH GRAY, VERY HARD, DRY, MINOR INTERBEDS OF 10YR 3/1, GRAY, VERY FINE GRAIN SANDSTONE	DOLOMITE
	155	MINOR INTERBED OF 2.5Y 7/4, PALE YELLOW SILTY SANDSTONE @ 162.0'	
	160		
	165		
	170		
	175		

GRAPHIC LOG

OVM SOIL GAS PPM x 18.3

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS		5.3	143.4
68	5.0		143.7
NS			145.0
69	3.2	GC	148.0
70	42.0	GC	150.0
71	263.0	GC	152.0
72	48.0	GC	154.0
73	66.0	GC	156.0
74	44.0	GC	158.0
75	67.0	GC	160.0
76	33.0	GC	162.0
77	137.0	GC	164.0
78	108.0	GC	166.0
79	80.0	GC	168.0
80	64.0	GC	170.0
81	44.0	GC	172.0
82	23.0	GC	174.0
83	127.0	GC	175.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	175	CONTINUED FROM PREVIOUS PAGE	DOLOMITE
	180	SUGARY WITH MINOR IRON PYRITE AFTER 180.0'	
	185	AFTER 186.0' MINOR IRON OXIDE STAINING	
▽ 191.0	190	DOLOMITIC LIMESTONE: 7.5YR 8/4, PINK, 7.5YR 7/2, PINKISH GRAY, HARD, SATURATION AND STRONG CONDENSATE ODOR AT 191.0', AFTER 192.0', NO OBVIOUS SATURATED, CHALKY, MICROCRYSTALLINE	DOLOMITIC LIMESTONE
	192	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, MICROCRYSTALLINE, DRY	DOLOMITE
	194		
	195	LIMESTONE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, CHALKY IN CUTTINGS, DRY, STRONG CONDENSATE ODOR	LIMESTONE
▽ 200.0	200	SATURATION AFTER 200.0'	
	201	SANDY DOLOMITE: VERY FINE GRAIN SAND, MICROCRYSTALLINE, 10YR 6/2 LIGHT BROWNISH GRAY, SATURATED, CONDENSATE ODOR	SANDY DOLOMITE
	204		
	205	SANDSTONE: CARBONATE CEMENT, VERY FINE GRAIN SAND, 10YR 7/3, VERY PALE BROWN, CONDENSATE ODOR, HARD, SATURATED, MINOR IRON OXIDE STAINNING, HIGHLY CEMENTED AFTER 206.0', INTERBEDDED 10YR 5/1, GRAY SANDSTONE	SANDSTONE
	208	T.D. 208.0' WATER LEVEL 1 HOUR AFTER DRILLING 191.0', 0.9' OF FLOATING PRODUCT	
	210		

GRAPHIC LOG: OVM SOIL GAS PPM x 18.3 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
83	127.0	GC	176.0
84	10.0	GC	178.0
85	15.0	GC	180.0
86	2.0	GC	182.0
87	11.0	GC	184.0
88	6.0	GC	186.0
89	2.6	GC	188.0
90	3.5	GC	190.0
91	660.0	GC	192.0
92	572.0	GC	194.0
93	619.0	GC	196.0
94	273.0	GC	198.0
95	143.0	GC	200.0
96	343.0	GC	202.0
97	591.0	GC	204.0
98	297.0	GC	206.0
99	44.0	GC	208.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)
- GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

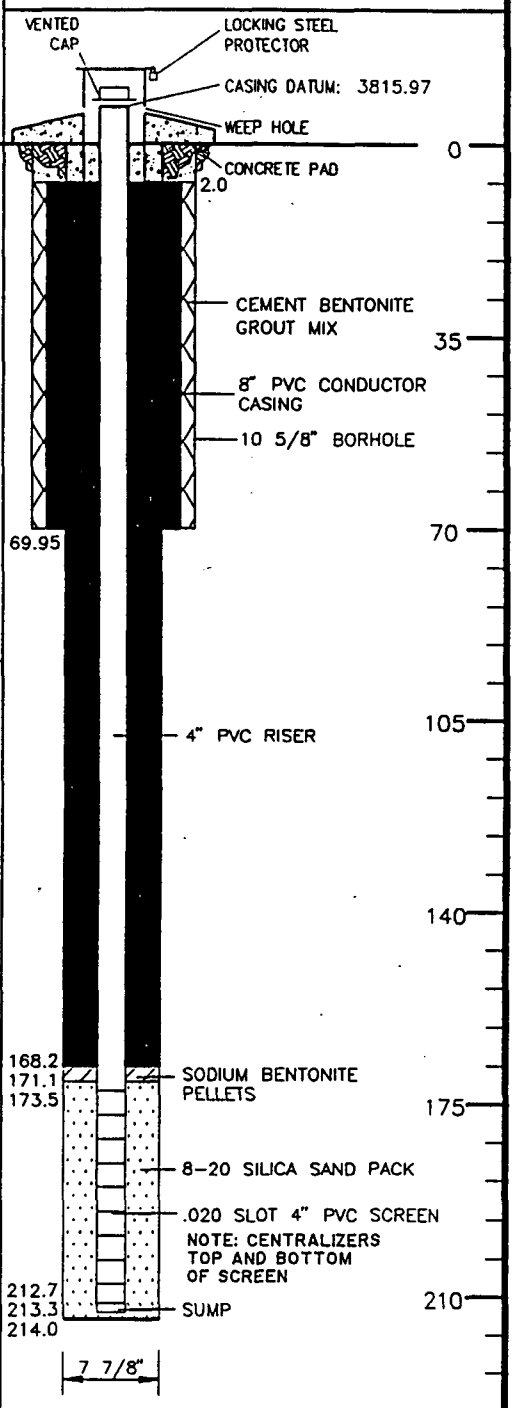
DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #87A FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3813.6				
	0					
	1.0	CLAYEY SILT:	ML			
		SANDSTONE:	SANDSTONE			
	9.0	DOLOMITE:	DOLOMITE			
	15.0	SANDSTONE:	SANDSTONE			
	23.0	SANDSTONE:	SANDSTONE			
	35	SANDSTONE:	SANDSTONE			
	70	SANDSTONE:	SANDSTONE			
	77.0	SANDY DOLOMITE:	SDY.DOLO			
	83.0	SANDSTONE:	SANDSTONE			
	95.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	101.0	SANDY DOLOMITE:	SDY.DOLO			
	105					
	107.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	111.0	SANDSTONE:	SANDSTONE			
	122.0	SANDY DOLOMITE:	SDY.DOLO			
	131.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	140					
	141.0	SANDY DOLOMITE:	SDY.DOLO			
	147.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	149.0	SANDSTONE:	SANDSTONE			
	171.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	175	DOLOMITIC SANDSTONE:	DOLO.SS			
▽ 182.62	185.0					
	187.0	SANDSTONE:	SANDSTONE			
▽ 194.0		SANDY DOLOMITE:	SANDY DOLOMITE			
	206.0					
	210	SANDSTONE:	SANDSTONE			
	214.0	SANDSTONE:	SANDSTONE			
		BORING TERMINATED AT 214.0'				
		NOTE: SEE LOG BH-87A FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-61A (BH-87A)***

CONDUCTOR INSTALLED

DATE DRILLED 7/15/91 7/13/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROTHERS

LOGGED BY MJL

CHECKED BY BJS

DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	GROUND SURFACE: 3813.60	
	0	CLAYEY SILT: BROWN, 10 YR 5/3, VERY FINE QUARTZ, DRY, VERY LOW PLASTICTIY 70% SILT, 30% CLAY	ML
	1.0	SANDSTONE: GRAY TO DARK GRAY, 10 YR 6/1 TO 4/2, QUARTZ, VERY FINE GRAIN, WELL SORTED, MINOR BIOTITE, WEAKLY TO MODERATELY CEMENTED, FRIABLE, NONCALCAREOUS	SAND-STONE WITH INTER-BEDDED DOLO.
	5	INTERBEDDED THIN, DOLOMITE BELOW 5.0', LIGHT GRAY, 2.5 YR 7/2, MICRO-CRYSTALLINE, CONCOIDAL FRACTURE	
	9.0	DOLOMITE: LIGHT GRAY TO LIGHT BROWN-ISH GRAY, 10 YR 7/2 TO 6/2, MICRO-CRYSTALLINE, MASSIVE, CONCOIDAL FRACTURE INTERBEDDED WITH SANDY DOLOMITE, GRAY 10 YR 6/1, VERY FINE GRAIN	DOLO. WITH INTER-BEDDED SANDY DOLO.
	10		
	15	SANDSTONE: LIGHT OLIVE GRAY, 5 YR 5/2 TO LIGHT OLIVE BROWN, 5 YR 5/6, QUARTZ, VERY FINE GRAIN, WEAKLY CEMENTED, ABUNDANT, Fe STAIN INTERBEDDED SANDY DOLOMITE FROM 17.0' TO 23.0', LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE GRAIN TO MICROCRYSTALLINE, MASSIVE, HARD	SAND-STONE WITH INTER-BEDDED SANDY DOLO.
	20		
	23.0	SANDSTONE: LIGHT BROWNISH GRAY TO GRAYISH BROWN, 2.5 YR 6/2 TO 5/2, QUARTZ, VERY FINE GRAIN, WELL SORTED, ROUND TO SUBROUND, MODERATELY TO WEAKLY CEMENTED, NONCALCAREOUS, YELLOWISH BROWN, 10 YR 5/4 BELOW 28.0', VERY POORLY CEMENTED, LOOSE, LIGHT GRAY, 2.5 YR 7/N FROM 31' TO 35.3', MODERATELY HARD, WELL CEMENTED, NONCALCAREOUS	SAND-STONE
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM x 18.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	10.7	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.4	GC	10.0
6	0.2	GC	12.0
7	0.4	GC	14.0
8	1.1	GC	16.0
9	0.0	GC	18.0
10	2.6	GC	20.0
11	3.5	GC	22.0
12	211	GC	24.0
13	109	GC	26.0
14	3.1	GC	28.0
15	22.1	GC	30.0
16	38.0	GC	32.0
17	20.5	GC	34.0
18	22.3	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-1895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	SANDSTONE: LIGHT BROWNISH GRAY, 2.5 YR 6/2, QUARTZ, VERY FINE GRAIN, VERY POORLY TO WEAKLY CEMENTED BELOW 35.0', STRUCTURELESS, MOIST, MINOR Fe STAIN	SAND-STONE			18	22.3	GC	36.0	
						19	5.3	GC	38.0	
	40					20	11.4	GC	40.0	
						21	11.8	GC	42.0	
						22	10.0	GC	44.0	
	45					23	17.6	GC	46.0	
						24	18.1	GC	48.0	
						25	13.6	GC	50.0	
	50	GRAYISH BROWN, 2.5 YR 5/2 BELOW 48.0', MOIST				26	90.4	GC	52.0	
		MODERATELY WELL CEMENTED FROM 49.0' TO 51.0', DRY WELL CEMENTED BELOW 51.0', HARD, MASSIVE, SATURATION AT GRADATIONAL CHANGE, VERY DARK GRAYISH BROWN TO GRAY, 10 YR 3/2 TO 5/1, MASSIVE				27	49.9	GC	54.0	
▽56.0	55					28	16.1	GC	56.0	
						29	2.9	GC	58.0	
						30	2.4	GC	60.0	
	60					31	4.2	GC	62.0	
						32	15.1	GC	64.0	
	65					33	8.5	GC	66.0	
		BORING TERMINATED AT 70.0' REEM HOLE TO 10"				34	8.6	GC	68.0	
	70					35	6.2	GC	70.0	

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SANDSTONE: VERY DARK GRAYISH BROWN, 10 YR 3/2, VERY FINE GRAIN, MODERATELY CEMENTED, MODERATELY HARD, DRY	SANDSTONE			36	5.5	GC	72.0	
						37	8.0	GC	74.0	
	75					38	114.6	GC	76.0	
	77.0	SANDY DOLOMITE: GRAY 10 YR 5/1, VERY FINE GRAIN TO CRYSTALLINE, HARD, MASSIVE	SANDY DOLOMITE			39	57.5	GC	78.0	
						40	4.2	GC	80.0	
	80					41	2.6	GC	82.0	
	83.0	SANDSTONE: GRAY, 10 YR 5/1, QUARTZ, VERY FINE TO FINE GRAIN, WELL SORTED, ROUND TO SUBROUND, NONCALCAREOUS, MODERATELY TO WELL CEMENTED, MASSIVE	SANDSTONE			42	25.2	GC	84.0	
	85					43	26.4	GC	86.0	
						44	241	GC	88.0	
						45	62.2	GC	90.0	
	90					46	89.5	GC	92.0	
						47	265	GC	94.0	
	95	DOLOMITIC SANDSTONE: GRAY, 10 YR 6/1, VERY FINE GRAIN TO CRYSTALLINE, NONCALCAREOUS, MASSIVE, HARD	DOLOMITIC SANDSTONE			48	62.4	GC	96.0	
						49	14.9	GC	98.0	
						50	18.8	GC	100	
	100									
	101.0	SANDY DOLOMITE: LIGHT GRAY, 10 YR 6/1, CRYSTALLINE, MINOR VERY FINE SAND, MASSIVE, HARD, CONCOIDAL FRACTURE	SANDY DOLOMITE			51	10.7	GC	102	
						52	13.4	GC	104	
	105					53	11.1	GC	105	

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	105	SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, CRYSTALLINE, MINOR VERY FINE SAND, MASSIVE, HARD, CONCOIDAL FRACTURE	SANDY DOLOMITE
	107.0	DOLOMITIC SANDSTONE W/ INTERBEDDED SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 5/1, MASSIVE	DOLOMITIC SAND-STONE W/INTER-BEDDED SANDY DOLO.
	110		
	111.0	SANDSTONE: LIGHT GRAY, 10 YR 7/1, QUARTZ, VERY FINE GRAIN, WELL SORTED, MINOR BIOTITE, MODERATELY WELL CEMENTED	SANDSTONE
	115		
	120		
	122.0	SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 6/1 TO 6/2, VERY FINE GRAIN TO MICROCRYSTALLINE, MASSIVE, HARD	SANDY DOLOMITE
	125		
	130		
	131.0	DOLOMITIC SANDSTONE: GRAY, 10 YR 5/1, VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED	DOLOMITIC SANDSTONE
	135		
	140		

GRAPHIC LOG

OVM SOIL GAS PPM x 18.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
53	11.1	GC	106
54	8.7	GC	108
55	9.4	GC	110
56	147	GC	112
57	140.1	GC	114
58	124	GC	116
59	34.4	GC	118
60	115.9	GC	120
61	213.9	GC	122
62	16.7	GC	124
63	12.3	GC	126
64	3.8	GC	128
65	0.4	GC	130
66	2.4	GC	132
67	0.4	GC	134
68	7.6	GC	136
69	56.8	GC	138
70	139.3	GC	140

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	140	DOLOMITIC SANDSTONE: GRAY, 10 YR 5/1 VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED, MASSIVE	DOLOMITIC SANDSTONE
	141.0	SANDY DOLOMITE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 5/1 TO 7/2, VERY FINE GRAIN TO CRYSTALLINE, HARD, MASSIVE	SANDY DOLOMITE
	145		
	147.0	DOLOMITIC SANDSTONE: GRAY 10 YR 5/1, VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED, MASSIVE	DOLOMITIC SANDSTONE
	149.0	SANDSTONE: YELLOWISH GRAY, 5 Y 7/2 QUARTZ, VERY FINE GRAIN, MODERATELY WELL SORTED, WEAKLY CEMENTED, ABUNDANT BIOTITE, NONCALCAREOUS ABUNDANT K-FELDSPAR BELOW 152', FINE TO VERY FINE GRAIN, MODERATELY WELL SORTED, MODERATELY WELL TO WELL CEMENTED	SANDSTONE
	150		
	155	VERY THIN SANDY MUDSTONE SEAM AT 156.5', MOIST, BANDED LIGHT GRAY TO DARK GRAY, ORGANIC ODOR INTERBEDDED WHITE TO VERY LIGHT GRAY, N/8 TO N/9 SANDSTONE FROM 157' TO VERY FINE GRAIN, VERY WELL SORTED, WEAKLY TO MODERATELY CEMENTED	
	160		
	165	FINE TO MEDIUM GRAIN FROM 170' TO 171', MODERATELY SORTED, VERY PALE BROWN TO BROWNISH YELLOW, 10 YR 7/4 TO 6/6	
	170		
	171.0	DOLOMITIC SANDSTONE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, VERY FINE GRAIN TO CRYSTALLINE, MODERATELY HARD, MASSIVE	DOLOMITIC SANDSTONE
	175		

GRAPHIC LOG

OVM SOIL GAS PPM x 18.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
71	39.2	GC	142
72	37.8	GC	144
73	15.4	GC	146
74	18.3	GC	148
75	119.9	GC	150
76	83.2	GC	152
77	71.6	GC	154
78	31.7	GC	156
79	119.5	GC	158
80	221.8	GC	160
81	75.6	GC	162
82	32.0	GC	164
83	167.3	GC	166
84	360	GC	168
85	245.9	GC	170
86	13.8	GC	172
87	13.4	GC	174
88	7.8	GC	175

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
CC: CRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-1895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175	DOLOMITIC SANDSTONE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2. VERY FINE GRAIN TO CRYSTALLINE. MODERATELY HARD, MASSIVE	DOLOMITIC SANDSTONE			88	7.8	GC	176	175
						89	113.7	GC	178	
						90	190.9	GC	180	
	180					91	14.3	GC	182	180
▽ 182.62						92	10.0	GC	184	
	185	SANDSTONE: GRAYISH BROWN, 10 YR 5/4 QUARTZ, VERY FINE GRAIN, WELL SORTED. MODERATELY WELL CEMENTED	SANDSTONE			93	127.3	GC	186	185
	187.0	SANDY DOLOMITE: DOLOMITIC SANDSTONE. GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, INTERBEDDED UNITS 1.5 FT. THICK, CRYSTALLINE TO VERY FINE GRAIN, MASSIVE	SANDY DOLOMITE W/INTER-BEDDED DOLOMITIC SANDSTONE			94	29.0	GC	188	
						95	6.9	GC	190	
	190					96	46.1	GC	192	190
▽ 194						97	2.4	GC	194	
	195	SATURATED BELOW 194.0' NO ODOR				98	1.3	GC	196	195
						99	0.0	GC	198	
						100	15.8	GC	200	
	200	FRACTURED BELOW 200'				101	0.6	GC	202	200
						102	0.4	GC	204	
	205					103	0.4	GC	206	205
	206.0	SANDSTONE: VERY PALE BROWN TO BROWNISH YELLOW, 10 YR 6/3 TO 6/6. MEDIUM TO COARSE GRAIN, ANGULAR TO SUBROUND, VERY POORLY SORTED. CALCAREOUS, SATURATED, ABUNDANT ANGULAR DOLOMITE AND LIMESTONE FRAGMENTS	SANDSTONE			104	0.0	GC	208	
						105	1.1	GC	210	
	210									210

- SPLIT-SPOON SAMPLER
- STANDARD PENETRATION TEST
- UNDISTURBED SAMPLE
- WATER TABLE (24 HOURS)
- WATER TABLE (TIME OF BORING)
- LABORATORY TEST LOCATION
- PENETROMETER (TONS/SQ. FT.)
- GC: GRAB COMPOSIT

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JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY DEPTH	REMARKS
		GROUND SURFACE: 3813.60							BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: PALE BROWN TO BROWNISH YELLOW, 10 YR 6/3 TO 6/6, MEDIUM TO COARSE GRAIN, VERY POORLY SORTED, ANGULAR TO SUBROUND, CALCAREOUS, SATURATED, ABUNDANT, ANGULAR DOLOMITE AND LIMESTONE FRAGMENTS, MODERATELY WELL CEMENTED, HARD	SANDSTONE			106	0.8	GC 212	
						107	0.4	GC 214	
	214.0	BORING TERMINATED AT 214.0'							
	215								
	220								
	225								
	230								
	235								
	240								
	245								

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

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& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *MARATHON/91029*

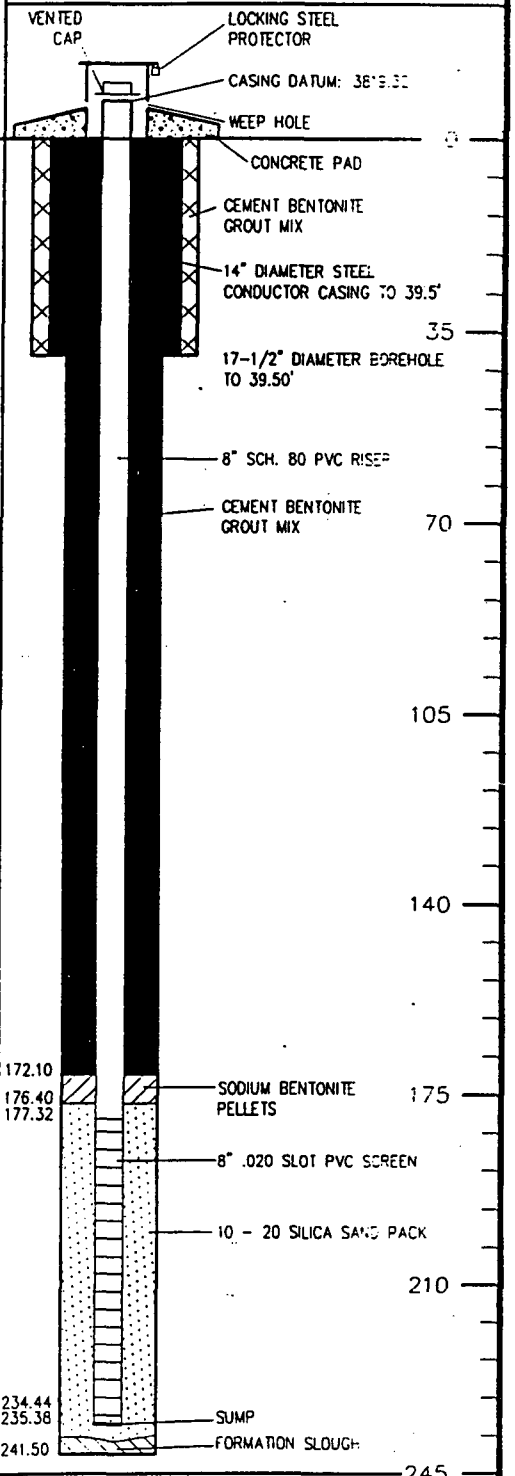
BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		Start: 19:05 Stop: 20:00 (8/25/93) Resume: 15:00 (8/29/93) GROUND SURFACE: 3818.61				
	0	SILTY SAND	SM		1 GC	
	7.0	DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE			
	15.0		SANDSTONE			
	18.0	SANDSTONE	SANDY DOLOMITE		10 GC	
	21.0	SANDY DOLOMITE	SANDSTONE			
	25.0	SANDSTONE	DOLOMITIC SANDSTONE			
	35	DOLOMITIC SANDSTONE			20 GC	
	41.0	SANDSTONE	SANDSTONE			
	55.0	DOLOMITE	DOLOMITE		30 GC	
	59.0	SANDSTONE	SANDSTONE			
	70				40 GC	
	81.0	DOLOMITE	DOLOMITE			
	89.0	SANDY DOLOMITE	SANDY DOLOMITE		50 GC	
	101.0	DOLOMITE	DOLOMITE			
	105				60 GC	
	140				70 GC	
					80 GC	
	159.0		DOLOMITIC SANDSTONE			
	161.0	DOLOMITIC SANDSTONE	DOLOMITE			
	165.0	DOLOMITE	DOLOMITIC SANDSTONE			
	169.0	DOLOMITIC SANDSTONE	DOLOMITE		90 2.0	
	175	DOLOMITE				
8/30/93 ▽ 188.85					100 GC	
	198.0		DOLOMITIC LIMESTONE			
	200.0	DOLOMITIC LIMESTONE	DOLOMITE			
	207.0	DOLOMITE				
	210	DOLOMITIC LIMESTONE	DOLOMITIC LIMESTONE		110 GC	
▽ 220.0	219.0					
	220.0	DOLOMITE	DOLOMITE LIMESTONE			
	226.0	LIMESTONE				
		SANDSTONE	SANDSTONE		120 GC	
		FOR COMPLETE LITHOLOGICAL DESCRIPTION SEE BH-99				
	241.5	BORING TERMINATED AT 241.5 FEET			125 GC NR	
	245					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER **MARATHON 9311601T3**

BORING NUMBER **MW-72 (BH-99)**

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93116B99
DRAWN BY: TAH
PAGE 1 OF 1

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 19:05 Stop: 20:00 (8/25/93) GROUND SURFACE: 3818.61	
	0	SILTY SAND: 10YR6/3 PALE BROWN, VERY FINE GRAINED SAND, VERY DRY, ABUNDANT INTERMIXED SANDY DOLOMITE	SM
	7.0	DOLOMITIC SANDSTONE: 10YR6/1 GRAY TO 10YR7/1 LIGHT GRAY, MASSIVE, VERY FINE GRAINED SAND, VERY HARD, NONCALCAREOUS	DOLOMITIC SANDSTONE
	15	SANDSTONE: 2.5Y7/3 PALE YELLOW, VERY FINE GRAINED QUARTZ SAND, VERY SOFT, FRIABLE, DRY, NONCALCAREOUS	SANDSTONE
	18.0	SANDY DOLOMITE: 10YR6/1 GRAY, VERY FINE GRAINED SAND, CONCHOIDAL FRACTURE, MASSIVE	SANDY DOLOMITE
	21.0	SANDSTONE: 2.5Y7/3 PALE YELLOW, VERY FINE GRAINED QUARTZ SAND, VERY SOFT, FRIABLE, DRY, NONCALCAREOUS	SANDSTONE
	25	DOLOMITIC SANDSTONE: 10YR6/1 GRAY, VERY FINE GRAINED SAND, NONCALCAREOUS, VERY HARD	DOLOMITIC SANDSTONE
	30	INTERBEDDED WITH SANDSTONE FROM 30.0 FEET TO 36.0 FEET, 2.5Y8/3 PALE YELLOW, SOFT, FRIABLE, NONCALCAREOUS	
	35		

GRAPHIC LOG

OVM SOIL GAS PPM x 7.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	13.3	GC	2.0
2	3.4	GC	4.0
3	3.4	GC	6.0
4	0	GC	8.0
5	0	GC	10.0
6	6.8	GC	12.0
7	3.4	GC	14.0
8	3.4	GC	16.0
9	3.4	GC	18.0
10	3.4	GC	20.0
11	10.3	GC	22.0
12	120.6	GC	24.0
13	51.7	GC	26.0
14	96.5	GC	28.0
15	62.1	GC	30.0
16	10.3	GC	32.0
17	17.2	GC	34.0
18			

REMARKS

BACKGROUND OVM READING:
SOIL: 3.2-6.4 PPM
AIR: 3.2-6.4 PPM

3811.6

3791.6

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER **MARATHON 9311601T1**

BORING NUMBER **BH-99 (MW-72)**

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93116B99
DRAWN BY: TAH
PAGE 1 OF 7

BORING RECORD

Start: 19:05
Stop: 20:00 (8/25/93)
Resume: 15:00 (8/29/93)

GROUND SURFACE: 3818.61

OVM SOIL GAS SURVEY PPM X 7.0

BACKGROUND OVM READING: SOIL: 3.2-6.4 PPM AIR: 3.2-6.4 PPM

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE NUMBER	OVM READING	RECOVERY	SAMPLE DEPTH
	35	CONTINUED			113.7	GC	36.0
				19	20.6	GC	38.0
	40			20	10.3	GC	40.0
	41.0	SANDSTONE: 10YR7/2 LIGHT GRAY, VERY FINE GRAINED QUARTZ SAND, DRY, FRIABLE, VERY POORLY CEMENTED, NONCALCAREOUS	SANDSTONE	21	6.4	GC	42.0
				22	6.4	GC	44.0
	45			23	6.4	GC	46.0
				24	61.2	GC	48.0
				25	6.4	GC	50.0
	50			26	12.9	GC	52.0
				27	6.4	GC	54.0
	55	DOLOMITE: 10YR7/2 LIGHT GRAY, MASSIVE, CRYSTALLINE, MINOR FINE GRAINED SAND	DOLOMITE	28	9.6	GC	56.0
				29	12.9	GC	58.0
	59.0			30	16.1	GC	60.0
	60	SANDSTONE: 10YR7/1 LIGHT GRAY, VERY FINE GRAINED QUARTZ SAND, NONCALCAREOUS, FRIABLE, DRY INTERBEDDED WITH THIN SANDY DOLOMITE FROM 61.0 FEET TO 62.0 FEET AND 71.0 FEET TO 72.0 FEET	SANDSTONE	31	12.2	GC	62.0
				32	51.6	GC	64.0
	65			33	6.2	GC	66.0
				34	3.4	GC	68.0
				35	9.6	GC	70.0
	70						

REMARKS

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *MARATHON 9311601T1*

BORING NUMBER *BH-99 (MW-72)*

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: TAH
DRAWING NO. 93116939
PAGE 2 OF 7

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 19:05 Stop: 20:00 Resume: 15:00 (8/29/93) GROUND SURFACE: 3818.61	
	70	CONTINUED	
	75		
	80		
	81.0	DOLOMITE: 10YR7/2 LIGHT GRAY TO 10YR6/2 LIGHT BROWNISH GRAY, MASSIVE, CRYSTALLINE, MICROCRYSTALLINE FROM 84.0 FEET TO 86.0 FEET, VERY HARD, CONCHOIDAL FRACTURE	DOLOMITE
	85		
	89.0	SANDY DOLOMITE: 10YR7/1 LIGHT GRAY, MINOR VERY FINE GRAINED SAND, MASSIVE, VERY HARD, CONCHOIDAL FRACTURE	SANDY DOLOMITE
	90		
	95		
	100		
	101.0	DOLOMITE: 10YR7/2 LIGHT GRAY TO 10YR6/2 LIGHT GRAYISH BROWN, CRYSTALLINE TO MICROCRYSTALLINE, CONCHOIDAL FRACTURE, VERY HARD, MASSIVE VERY DENSE FROM 104.0 FEET TO 117.0 FEET, MICROCRYSTALLINE	DOLOMITE
	105		

GRAPHIC LOG

OVM SOIL GAS SURVEY PPM X 7.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	12.9	GC	72.0
37	12.9	GC	74.0
38	9.6	GC	76.0
39	3.2	GC	78.0
40	116.2	GC	80.0
41	25.8	GC	82.0
42	6.4	GC	84.0
43	6.4	GC	86.0
44	99.9	GC	88.0
45	12.9	GC	90.0
46	119.3	GC	92.0
47	19.3	GC	94.0
48	25.8	GC	96.0
49	22.5	GC	98.0
50	32.2	GC	100.0
51	29.0	GC	102.0
52	6.5	GC	104.0

REMARKS

BACKGROUND OVM READING
SOIL: 3.2-6.4 ppm
AIR: 3.2-6.4 ppm

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

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3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER MARATHON 9311601T1

BORING NUMBER BH-99 (MW-72)

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: TAH
DRAWING NO. 93116B99

BORING RECORD

Start: 19:05
Stop: 20:00 (8/25/93)
Resume: 15:00 (8/29/93)

GROUND SURFACE: 3818.61

BACKGROUND OVM READING: SOIL: 3.2-6.4 PPM AIR: 3.2-6.4 PPM

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS SURVEY PPM x 7.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
	105	CONTINUED				53	3.2	GC	106.0	105
						54	3.2	GC	108.0	
						55	3.2	GC	110.0	
	110					56	3.2	GC	112.0	110
						57	3.2	GC	114.0	
						58	3.2	GC	116.0	
	115					59	22.5	GC	118.0	115
		SANDY FROM 118.0 FEET TO 125.0 FEET, MINOR VERY FINE GRAINED SAND				60 NO 61	58.0	GC	120.0	
	120					62 NO 63	38.7	GC	122.0	120
						64 NO 65	29.0	GC	124.0	
	125					66 NO 67	41.9	GC	126.0	125
						68 NO 69	6.4	GC	128.0	
						70	3.2	GC	130.0	
	130					71	3.2	GC	132.0	130
						72	3.2	GC	134.0	
	135					73	3.2	GC	136.0	135
		SANDY FROM 136.0 FEET TO 138.0 FEET, MINOR VERY FINE GRAINED SAND				74	3.2	GC	138.0	
		NOTE: NO SAMPLES NUMBERED 61, 63, 65, 67, AND 69				75	3.2	GC	140.0	
	140									140

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

MARATHON

JOB NAME/NUMBER 93116011

BORING NUMBER BH-99 (MW-72)

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93116899
DRAWN BY: TAH

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 19:05 Stop: 20:00 (8/25/93) Resume: 15:00 (8/29/93) GROUND SURFACE: 3818.61	
	140	CONTINUED	
	145		
		SANDY FROM 149.0 FEET TO 153.0 FEET, MINOR VERY FINE GRAINED SAND	
	150		
	155		
	159.0	DOLOMITIC SANDSTONE: 10YR7/2 LIGHT GRAY, VERY FINE GRAINED SAND, NONCALCAREOUS, MASSIVE, HARD	DOLOMITIC SANDSTONE
	160		
	161.0	DOLOMITE: 10YR7/2 LIGHT GRAY, MINOR VERY FINE GRAINED SAND FROM 161.0 FEET TO 165.0 FEET, MASSIVE	DOLOMITE
	165	DOLOMITIC SANDSTONE: 10YR7/2 LIGHT GRAY, VERY FINE GRAINED SAND, NONCALCAREOUS, HARD, MASSIVE	DOLOMITIC SANDSTONE
	169.0	DOLOMITE: 10YR7/2 LIGHT GRAY, CRYSTALLINE, MASSIVE, HARD, CONCHOIDAL FRACTURE	DOLOMITE
	170		
	175		

GRAPHIC LOG

OVM SOIL GAS SURVEY PPM x 7.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
76	12.9	GC	142.0
77	3.2	GC	144.0
78	3.2	GC	146.0
79	3.2	GC	148.0
80	3.2	GC	150.0
81	3.2	GC	152.0
82	3.2	GC	154.0
83	3.2	GC	156.0
84	6.4	GC	158.0
85	3.2	GC	160.0
86	3.2	GC	162.0
87	3.2	GC	164.0
88	3.2	GC	166.0
89	3.2	GC	168.0
90	12.2	GC	170.0
91	22.5	GC	172.0
92	19.3	GC	174.0

REMARKS

BACKGROUND OVM READING.
SOIL: 3.2-6.4 PPM
AIR: 3.2-6.4 PPM

140 145 150 155 160 165 170 175

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER MARATHON 9311601T1

BORING NUMBER BH-99 (MW-72)

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93116B99
DRAWN BY: TAH

BORING RECORD

Start: 19:05
Stop: 20:00 (8/25/93)
Resume: 15:00 (8/29/93)

GROUND SURFACE: 3818.61

OVM SOIL GAS SURVEY PPM X 7.0 (2 4 6 8 10 12 14 16 18)

BACKGROUND OVM READING: SOIL: 3.2-6.4 PPM AIR: 3.2-6.4 PPM

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH
	175	CONTINUED		93	3.2	GC	176.0
				94	22.5	GC	178.0
	180			95	9.6	GC	180.0
				96	3.2	GC	182.0
				97	3.2	GC	184.0
	185			98	3.2	GC	186.0
8/30/93 ▽ 188.85				99	3.2	GC	188.0
				100	29.5	GC	190.0
	190			101	6.4	GC	192.0
				102	3.2	GC	194.0
	195			103	3.2	GC	196.0
				104	3.2	GC	198.0
	198.0	DOLOMITIC LIMESTONE: 10YR7/2 LIGHT GRAY, MICROCRYSTALLINE TO CHALKY, EFFERVESCENT WITH 10% HYDROCHLORIC ACID	DOLOMITIC LIMESTONE	105	3.2	GC	200.0
	200	DOLOMITE: 10YR7/2 GRAY, MICROCRYSTALLINE, MASSIVE WITH CONCHOIDAL FRACTURES	DOLOMITE	106	3.2	GC	202.0
				107	3.2	GC	204.0
	205			108	3.2	GC	206.0
				109	3.2	GC	208.0
	207.0	DOLOMITIC LIMESTONE: 10YR7/2 LIGHT GRAY, MICROCRYSTALLINE, CHALKY INTERBEDDED WITH DOLOMITE FROM 209.0 FEET TO 210.0 FEET	DOLOMITIC LIMESTONE	110	3.2	GC	210.0
	210						

REMARKS

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK & ASSOCIATES, INC.
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3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

MARATHON

JOB NAME/NUMBER 93116011

BORING NUMBER BH-99 (MW-72)

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: TAH

DRAWING NO. 93116899

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		Start: 19:05 Stop: 20:00 (8/25/93) Resume: 15:00 (8/29/93)	
		GROUND SURFACE: 3818.61	
	210	CONTINUED	
		INTERBEDDED WITH SANDSTONE FROM 211.0 FEET TO 214.0 FEET	
	215		
	219.0	DOLOMITE: 10YR7/2 LIGHT GRAY, MASSIVE, MICROCRYSTALLINE	DOLOMITE
▽ 220.0	220	LIMESTONE: 10YR7/2 LIGHT GRAY, SATURATED	LIMESTONE
		DOLOMITIC FROM 222.0 FEET TO 224.0 FEET	
		SANDY FROM 224.0 FEET TO 226.0 FEET, VERY FINE GRAINED SAND	
	225		
	226.0	SANDSTONE: 2.5Y7/3 TO 8/2 PALE YELLOW, VERY FINE GRAINED QUARTZ SAND, CALCIUM CARBONATE, CEMENT, HARD, WELL CEMENTED, MOIST	SANDSTONE
		INTERBEDDED WITH THIN LIMESTONE FROM 226.0 FEET TO 232.0 FEET, SATURATED	
	230		
	235		
	240		
	241.5	BORING TERMINATED AT 241.5 FEET	
	245		

GRAPHIC LOG

OVM SOIL GAS SURVEY PPM x 7.0
2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
111	3.2	GC	212.0
112	3.2	GC	214.0
113	3.2	GC	216.0
114	3.2	GC	218.0
115	3.2	GC	220.0
116	3.2	GC	222.0
117	3.2	GC	224.0
118	3.2	GC	226.0
119	3.2	GC	228.0
120	3.2	GC	230.0
121	3.2	GC	232.0
122	25.8	GC	234.0
123	3.2	GC	236.0
124	3.2	GC	238.0
125	3.2	GC	240.0
NR		GC	241.5

REMARKS

BACKGROUND OVM READING:
SOIL: 3.2-6.4 PPM
AIR: 3.2-6.4 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
CC: CRAB COMPOSITE

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3995

JOB NAME/NUMBER *MARATHON 9311601T1*

BORING NUMBER *BH-99 (MW-72)*

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY TAH
DRAWING NO. 93116899
PAGE 7 OF 7

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well MW-73

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad NM Proj. No. 023350052
Surface Elev. _____ Total Hole Depth 220 ft. Diameter 7.875 in.
Top of Casing _____ Water Level Initial 205 ft. Static _____
Screen: Dia _____ Length _____ Type/Size _____
Casing: Dia 8.625 in. Length 10 ft. Type Steel
Fill Material _____ Rig/Core Failing 1500
Drill Co. WT Water Well Service Method Air Rotary
Driller Dave Gann Log By Bob Davis Date 11/29-30/94 Permit # _____
Checked By Mike Marinville License No. _____

See Site Map For Boring Location

COMMENTS:

Well located 100 feet S of MW-72. Set 10 feet 8 5/8" surface CSG to 7 feet below grade after reaming hole to 12 1/4" to a depth of 7 feet. From 7 feet to 220 feet is open borehole.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3 Not to scale						SPUD 0800 11/29/94 About 1 ft. alluvium before encountering bedrock. Rate of penetration about 30 ft/hr.
0						**0-10 ft:** DOLOMITE, medium light gray (N8), hard, interbedded with calcareous, SANDSTONE, pale olive (5 yr 5/2), soft, friable. Rate of penetration about 30 ft/hr (0'- 20')
10		0				**10-20 ft:** Dolomitic SANDSTONE, light gray (N7), moderately soft, moderate friable, dry, slightly calcareous interbedded with DOLOMITE, gray (10 yr 6/1), very hard, conchoidal fractures. Rate of penetration = 30 ft/hr.
20		0				**20-30 ft:** Dolomitic SANDSTONE, fine grained, light gray (N7), moderately soft, friable, dry, slightly calcareous interbedded with occassional DOLOMITE, medium light gray (N5), hard, conchoidal fractures. Rate of penetration = 30 ft/hr.
24						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-73

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*
Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
24						0905–0930 = 25 minutes ty change Subs, bit & connect next 30' stand. Continue drilling at 0930, depth 30 feet.
26						
28						
30		0				**30–40 ft:** SANDSTONE, fine grained, very light gray (N8), soft, friable, slightly calcareous, dry, interbedded with minor DOLOMITE, yellowish gray (5 yr 7/2), hard, conchoidal fractures.
32						
34						
36						Rate of penetration = 30 ft/hr.
38						
40		0				**40–50 ft:** Sandy DOLOMITE, very light gray (N8), moderately hard, dry, non-calcareous.
42						
44						Rate of penetration about 30 ft/hr.
46						
48						
50		0				**50–60 ft:** SANDSTONE, light gray (N7), fine grained, moderately soft, friable, non-calcareous interbedded with sandy DOLOMITE, very light gray (N8), moderately hard, dry, non-calcareous.
52						
54						Rate of penetration about 20 ft/hr.
56						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
56						
58						
60		0				**60–70 ft:** Dolomitic SANDSTONE, light gray (N7), fine grained, moderately hard, dry noncalcareous interbedded with sandy DOLOMITE, medium light gray (N5), hard, crystalline.
62						
64						Rate of penetration about 38 ft/hr.
66						
68						
70		0				**70–80 ft:** Sandy DOLOMITE as above interbedded with dolomite, light gray, (N7), hard, brittle, conchoidal fractures, dry.
72						
74						Rate of penetration about 30 ft/hr.
76						
78						
80		0				**80–90 ft:** DOLOMITE, light brownish gray (5 yr 6/1) very hard, crystalline, conchoidal fractures.
82						
84						Rate of penetration about 18 ft/hr.
86						
88						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
88						
90		0				**90–100 ft:** Sandy DOLOMITE, light gray (N7), modertely hard, crystalline, minor fine grained sand, conchoidal fractures, dry. **Note:** Cuttings are predominately powder (98%).
92						
94						Drilled 45 minutes with only 8 feet penetration.
96						
98						
100		0				**100–110 ft:** DOLOMITE, light brownish gray (5 yr 6/1) very hard, conchoidal fractures, interbedded sandy dolomite, light gray (N7), moderately hard, moderately hydrocarbon odor (PID = 0.0 ppm).
102						
104						1345–1430 Rig down – replaced JAWS gripping KB worn out. Downtime of 45 minutes. 1430 resumed drilling.
106						
108						Rate of penetration about 13 ft/hr.
110		0				**110–120 ft:** Sandy DOLOMITE, as above.
112						
114						Rate of penetration about 20 ft/hr.
116						
118						
120		0				

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
120		0				**120–130 ft:** Sandy DOLOMITE, as above, interbedded with light brownish gray (5 yr 6/1), very hard, conchoidal fractures, moderate hydrocarbon odor, cuttings predominately "rock flour."
122						
124						Rate of penetration about 15 ft/hr.
126						
128						
130		16.4				**130–140 ft:** Sandy DOLOMITE, interbedded with dolomite, as above.
132						
134						Rate of penetration 15 ft/hr.
136						
138						
140		0				**140–150 ft:** DOLOMITE, as above.
142						Rate of penetration 40 ft/hr.
144						Rig shutdown for the day at 1700 hours.
146						11/30/94 Began setting up at 0645 hours, drilling at 0655. Found water in the hole.
148						0710 – Water in fuel filter – trying to fix problem – shutdown – had to go to town for new filters. Rig down for 2 hours 5 minutes.
150		0				0915 – Resume drilling. Rate of penetration 40 ft/hr.
152						**150–160 ft:** Dolomitic SANDSTONE, very light gray (N8), fine grained, moderately hard, non-calcareous, no hydrocarbon odor.

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
152						
154						Rate of penetration 17 ft/hr.
156						
158						
160		0				**160–170 ft:** Dolomitic SANDSTONE as above, with occassional sandy DOLOMITE, light gray (N7) moderately hard, non-calcareous, no hydrocarbon odor.
162						
164						Rate of penetration about 9 ft/hr.
166						
168						
170		0				**170–180 ft:** Lithology, as above, with minor dolomite, light brownish gray (5 yr 6/1), hard, brittle, conchoidal fractures, no hydrocarbon odor.
172						
174						
176						
178						
180		0				**180–190 ft:** DOLOMITE, light brownish gray (5 yr 6/1), very hard, microcrystalline, conchoidal fractures, no hydrocarbon odor, slightly calcareous (effervescent with 10% HCL).
182						
184						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
184						Rate of penetration about 11 ft/hr.
186						
188						
190		0				**190–200 ft:** DOLOMITE, as above, moderate–strong hydrocarbon odor.
192						
194						
196		354 0				Rate of penetration about 40 ft/hr.
198						
200		6				**200–210 ft:** DOLOMITE, as above, moderate–strong hydrocarbon odor, saturated, interbedded with dolomitic LIMESTONE, light gray (N7) chalky.
202						
204						▽ Water at 205 feet.
206						
208						Rate of penetration about 27 ft/hr.
210		0				**210–220 ft:** Dolomitic LIMESTONE, light gray (N7), chalky, saturated moderate hydrocarbon odor.
212						
214						
216						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-73**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad NM* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
216						
218						
220		0				Reached TD (220 ft) at 1415 hours. Reamed hole to 7" with 12 1/2" bit. Set 8 5/8" CSG to 7 feet with 3 feet above surface. Set CSG with 1 sack bentonite and 4 sacks ready mix cement. Moved Rig to MW-74 location at 1550 hours.
222						
224						
226						
228						
230						
232						
234						
236						
238						
240						
242						
244						
246						
248						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-74**

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052
Surface Elev. _____ Total Hole Depth 220 ft. Diameter 7.875 in.
Top of Casing _____ Water Level Initial 115 ft. Static _____
Screen: Dia _____ Length _____ Type/Size _____
Casing: Dia 8.625 in. Length 9.5 ft. Type Steel
Fill Material _____ Rig/Core Failing 1500
Drill Co. WT Water Well Service Method Air Rotary
Driller Dave Gann Log By Bob Davis Date 11/30-12/06/94 Permit # _____
Checked By Vickie Marcantel License No. _____

See Site Map For Boring Location

COMMENTS:

MW-74 located approximately 200 ft SW of MW-73. 8 5/8" surface casing set to 7 ft below ground. From 7 feet to 220 feet is open borehole.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3 Not to scale						SPUD 1600 hours 11/30/94 Rate of penetration about 40 ft/hr.
0						**0-0.5 ft:** Approximately 4-6 " alluvium before bedrock.
2						**0.5-10 ft:** LIMESTONE, pinkish gray (5 yr 8/1), very hard, high effervescence with 10% HCL, dry, interbedded with DOLOMITE, light brown (5 yr 6/4), hard, brittle, conchoidal fractures, no hydrocarbon odor and SANDSTONE, pale yellowish brown (10 yr 6/2), fine grained, soft, friable, noncalcareous, dry.
4						
6						Rate of penetration about 40 ft/hr.
8						
10		0				**10-20 ft:** SANDSTONE/LIMESTONE/DOLOMITE, as above.
12						
14						
16						Shutdown Rig at 1700 hours 11/30/94. Resume drilling at 0645 12/01/94. 0715-0830 Rig shutdown - change out jaws - downtime 1.25 hours.
18						
20		0				**20-30 ft:** Dolomitic SANDSTONE, yellowish gray (5 yr 8/1), fine grained, hard, non-calcareous.
22						
24						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-74**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
24						
26						
28						Change bit at 30 feet, resume drilling at 0935. Repack Kelley swivel, change filters and pull down. 0.75 hours down. Rate of penetration 60 ft/hr.
30		0				**30–40 ft:** Dolomitic SANDSTONE, as above, interbedded with sandstone, yellowish gray (5 yr 8/1), fine grained, moderately hard, non-calcareous, dry.
32						
34						Rate of penetration about 24 ft/hr.
36						
38						
40		0				**40–50 ft:** SANDSTONE, yellowish gray (5 yr 8/1), very fine grained, moderately soft, moderately friable, dry interbedded with sandy sandy dolomite, very light gray (N8), moderately hard, microcrystalline, conchoidal fractures.
42						
44						
46						Rate of penetration 20 ft/hr.
48						
50		0				**50–60 ft:** SANDSTONE, as above.
52						
54						Rate of penetration about 30 ft/hr.
56						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-74

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company

Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
56						
58						
60		0				**60–70 ft:** Sandy DOLOMITE, very light gray (N8), moderately hard to hard, microcrystalline, interbedded with minor SANDSTONE, yellowish gray (5 yr 8/1), moderately soft, moderately friable, dry, non-calcareous, no hydrocarbon odor.
62						
64						
66						Rate of penetration about 24 ft/hr.
68						
70		0				**70–80 ft:** Sandy DOLOMITE, very light gray (N8), hard, brittle, microcrystalline, dry, no hydrocarbon odor.
72						
74						Rate of penetration about 17 ft/hr.
76						
78						
80		0				**80–90 ft:** DOLOMITE, light brownish gray (5 yr 6/1), hard, brittle microcrystalline, conchoidal fractures, dry, no hydrocarbon odor.
82						
84						Rate of penetration about 17 ft/hr.
86						
88						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well MW-74

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
88						
90		0				**90–100 ft:** DOLOMITE interbedded with sandy dolomite, very light gray (N8), hard, brittle, dry, no hydrocarbon odor.
92						
94						
96						
98						
100		0				**100–110 ft:** DOLOMITE, light brownish gray (5 yr 6/1) to very light gray (N8), hard, microcrystalline, conchoidal fractures, dry, faint hydrocarbon odor.
102						
104						Rate of penetration about 30 ft/hr.
106						
108						
110		0				**110–120 ft:** DOLOMITE, as above, with minor sandy dolomite, light gray (N7), moderately hard, microcrystalline, saturated, no hydrocarbon odor.
112						
114						
116		0				▽ Water at 115 feet with moderate–strong hydrocarbon odor; PID=0.0 ppm.
118						Rate of penetration about 12 ft/hr.
120		0				

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-74

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
120		0				**120–130 ft:** DOLOMITE and sandy dolomite, as above.
122						
124						Rate of penetration about 30 ft/hr.
126						
128						
130		0				**130–140 ft:** DOLOMITE, light brownish gray (5 yr 6/1) to very light gray (N8), hard, microcrystalline, conchoidal fractures, no hydrocarbon odor.
132						At 132 feet driller had to add water to system to remove cuttings. Abundant sand, fine grained, quartz, non-calcareous.
134						
136						Rate of penetration about 15 ft/hr.
138						
140		0				**140–150 ft:** DOLOMITE/SAND, as above, no hydrocarbon odor.
142						
144						Rate of penetration about 30 ft/hr.
146						
148						
150		0				**150–160 ft:** Abundant SAND with minor DOLOMITE.
152						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-74**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
152						
154						
156						
158						
160		0				**160–170 ft:** SANDSTONE, yellowish gray (5 yr 7/2), fine grained, quartz grains, noncalcareous, interbedded with DOLOMITE, pale yellowish brown (10 yr 6/2), hard, cherty, conchoidal fractures, no hydrocarbon odor.
162						
164						
166						
168						At 1605 hours pulled out of hole to run surface CSG, ream top hole to 7 feet with 12.25 " bit. Set 10 feet of 8 5/8" CSG to 7 feet below grade. Resume drilling 12/05/94 at 1215 hours.
170		0				**170–180 ft:** DOLOMITE, pale yellowish brown (10 yr 6/2) hard, cherty, microcrystalline, conchoidal fractures, no hydrocarbon odor.
172						
174						Rate of penetration about 15 ft/hr.
176						
178						
180		0				**180–190 ft:** DOLOMITE, as above.
182						
184						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well MW-74

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
184						Rate of penetration 15 ft/hr.
186						
188						
190		0				**190–200 ft:** DOLOMITE, as above.
192						1400 hours at 192 feet, hydraulic pump failed. Rig down until pump can be replaced. Resumed drilling at 1615 hours on 12/06/94.
194						
196						Rate of penetration about 20 ft/hr.
198						
200		0				**200–210 ft:** DOLOMITE, as above, interbedded with LIMESTONE, light gray (N7), hard, crystalline, high effervescence with 10% HCL, no hydrocarbon odor.
202						
204						Rate of penetration about 30 ft/hr.
206						
208						
210		0				**210–220 ft:** SANDSTONE, yellowish gray (5 yr 7/2), fine grained, moderately hard, brittle, calcareous, quartz grains, no hydrocarbon odor, interbedded with DOLOMITE, as above.
212						
214						Rate of penetration about 40 ft/hr.
216						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-74**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
216						
218						
220		0				Total depth at 1800 hours on 12/06/94. TD = 220 feet.
222						
224						
226						
228						
230						
232						
234						
236						
238						
240						
242						
244						
246						
248						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well MW-75

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052
Surface Elev. _____ Total Hole Depth 220 ft. Diameter 7.875 in.
Top of Casing _____ Water Level Initial 85 ft. Static _____
Screen: Dia _____ Length _____ Type/Size _____
Casing: Dia 8.625 in. Length 10 ft. Type Steel
Fill Material _____ Rig/Core Failing 1500
Drill Co. WT Water Well Service Method Air Rotary
Driller Ronny Keith Log By Bob Davis Date 12/02-08/94 Permit # _____
Checked By Vickie Marranville License No. _____

See Site Map For Boring Location

COMMENTS:

400 ft Southwest of MW-73. 8 5/8" surface CSG set to 10 feet below grade. Surface CSG is 27" above grade. From 10 feet to 220 feet is open borehole.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2.25 Not to scale						SPUD 12/02/94 0935 hours
0						**0–4 ft:** Alluvium, silty SAND, pale yellowish brown, (10 yr 6/2), fine grained, soft, friable, dry.
2						Rate of penetration about 40 ft/hr.
4						**4–10 ft:** Silty SAND, pale yellowish brown (10 yr 6/2), fine grained, soft, friable, dry. LIMESTONE, very pale orange (10 yr 8/2) hard, (high effervescence with 10% HCL) dry. DOLOMITE, light brownish gray (5 yr 6/1), very hard, crystalline, conchoidal fractures , dry.
6						
8						
10		0				**10–20 ft:** Sandy DOLOMITE, light gray (N7), fine to medium quartz grains, hard, conchoidal fractures, dry.
12						
14						
16						Rate of penetration about 30 ft/hr.
18						
20		0				**20–30 ft:** SANDSTONE, yellowish gray (5 yr 8/1) to light brownish gray (5 yr 6/1), fine grained quartz sand, moderately hard to hard, non-calcerous, dry with minor sandy DOLOMITE, light gray (N7), fine grained quartz sand, hard, brittle, conchoidal fractures, dry, no hydrocarbon odor.
22						
24						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-75

Project MOC/Indian Basin Gas Plant Owner Marathon Oil Company
Location Indian Basin, Carlsbad, New Mexico Proj. No. 023350052

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
24						Rate of penetrationabout 24 ft/hr.
26						
28						
30		0				**30–40 ft:** SANDSTONE, light gray (N7) to light brownish gray (5 yr 6/1), fine grained, moderately hard to soft, friable, dry, noncalcareous, with minor sandy DOLOMITE, as above.
32						
34						
36						Rate of penetration about 30 ft/hr.
38						
40		0				**40–50 ft:** SANDSTONE/sandy DOLOMITE, as above.
42						Change jaws on kelly. Down 55 minutes (1130-1225).
44						
46						
48						
50		0				**50–60 ft:** SANDSTONE, pale yellowish brown (10 yr 6/2) to light gray (N7), very fine grained, soft, friable, dry, noncalcareous, no hydrocarbon odor.
52						
54						Rate of penetration about 30 ft/hr.
56						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-75

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
56						
58						
60		0				**60–70 ft:** With sandy DOLOMITE, light gray (N7) fine grained quartz, very hard, conchoidal fractures, dry, no hydrocarbon odor.
62						
64						Rate of penetration about 30 ft/hr.
66						
68						
70		0				**70–80 ft:** SANDSTONE,as above.
72						
74						Rate of penetration about 24 ft/hr.
76						
78						
80		0				**80–90 ft:** SANDSTONE interbedded with DOLOMITE, light brownish gray (5 yr 6/1), very hard, microcrystalline, conchoidal fractures, and sandy DOLOMITE, light gray (N7) fine grained quartz, very hard conchoidal fractures, saturated, no hydrocarbon odor.
82						
84						▽ Water at 85 feet, no hydrocarbon odor. Add water to air system to bring up cuttings. Distint "oily" sheen on water from the borehole.
86						
88						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-75

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
88						
90		0				**90–100 ft:** DOLOMITE/sandy dolomite (as above) with minor SANDSTONE.
92						
94						Rate of penetration about 30 ft/hr.
96						
98						
100						**100–110 ft:** DOLOMITE, grayish orange (10 yr 7/4), hard, crystalline (many rhomdohedral crystals visable with hand lens), conchoidal fractures, saturated, no hydrocarbon odor.
102						
104						
106						Pulled out of hole to set surface CSG – 8 5/8" CSG to 10 feet BG. Grout with 1 sack bentonite, 7 sacks reedy mix cement. Rig down at 1630 hours 12/06/94. Resume drilling at 1320 hours 12/07/94.
108						
110		0				**110–120 ft:** DOLOMITE, grayish orange (10 yr 7/4) to pale yellowish brown (10 yr 6/2), very hard, microcrystalline, occassionally cherty, conchoidal fractures, saturated, no hydrocarbon odor.
112						
114						
116		0				Rate of penetration about 12 ft/hr.
118						
120		0				

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-75**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
120		0				**120–130 ft:** DOLOMITE, as above, interbedded with SANDSTONE, pale yellowish brown (10 yr 6/2), very fine grained quartz, occassionally silty, soft, friable, saturated, non-calcareous.
122						
124						Black liquid (hydrocarbons ?) observed mixed with water, hydrocarbon odor but no PID readings.
126						
128						Rate of penetration about 15 ft/hr.
130		0				**130–140 ft:** DOLOMITE as above.
132						
134						
136						
138						
140		0				Black sheen on water, moderate hydrocarbon odor, PID = 0.0 ppm.
142						**140–150 ft:** DOLOMITE, light brownish gray (5 yr 6/1), hard, microcrystalline, occassionally cherty, conchoidal fractures, saturated, no hydrocarbon odor.
144						
146						Rate of penetration about 15 ft/hr.
148						
150		0				**150–160 ft:** DOLOMITE, as above, interbedded with SANDSTONE, pale yellowish brown (10 yr 6/2), moderately hard, moderately friable, very fine grained, non-calcareous, saturated, no hydrocarbon odor.
152						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well MW-75

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*
Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
152						
154						
156						
158						
160		0				**160–170 ft:** DOLOMITE with minor sandstone, as above, no hydrocarbon odor.
162						
164						Rate of penetration about 11 ft/hr.
166						
168						
170		0				**170–180 ft:** DOLOMITE, pale yellowish brown (10 yr 6/2), hard, microcrystalline, cherty, conchoidal fractures, interbedded with dolomitic SANDSTONE, fine quartz grains, very hard, non-calcareous, saturated, no hydrocarbon odor.
172						
174						Rate of penetration about 10 ft/hr.
176						
178						
180		0				**180–190 ft:** DOLOMITE, as above, no hydrocarbon odor.
182						
184						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-75**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
184						Rate of penetration about 11 ft/hr.
186						
188						
190		0				**190–200 ft:** DOLOMITE, as above, moderately strong hydrocarbon odor.
192						
194						Rate of penetration about 11 ft/hr.
196						
198						
200		75.1				**200–210 ft:** DOLOMITE, as above, strong hydrocarbon odor.
202						
204						
206						
208						Rate of penetration about 30 ft/hr.
210		709				**210–220 ft:** SANDSTONE, pale yellowish brown, (10 yr 6/2), fine quartz grains, moderately soft, moderately friable, occassional vugs of secondary euhedral quartz crystals, calcareous cement, saturated, moderate hydrocarbon odor, minor DOLOMITE, as above, LIMESTONE, light gray (N7), hard, microcrystalline, massive.
212						
214						Drill break at 211 feet and approximately 8 inches, possible small sandstone stringer.
216						

Drilling Log

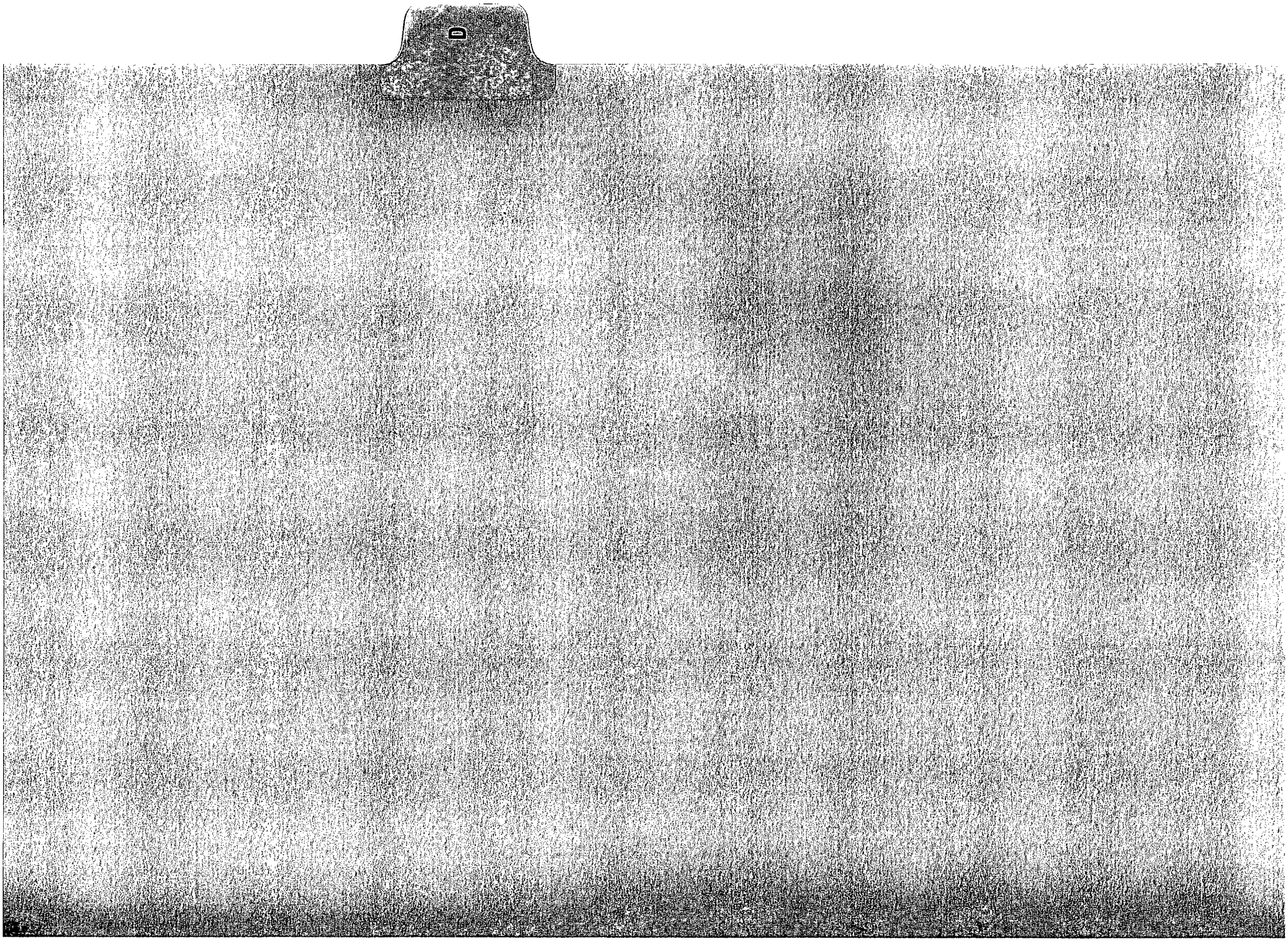
GROUNDWATER TECHNOLOGY

Monitoring Well **MW-75**

Project *MOC/Indian Basin Gas Plant* Owner *Marathon Oil Company*

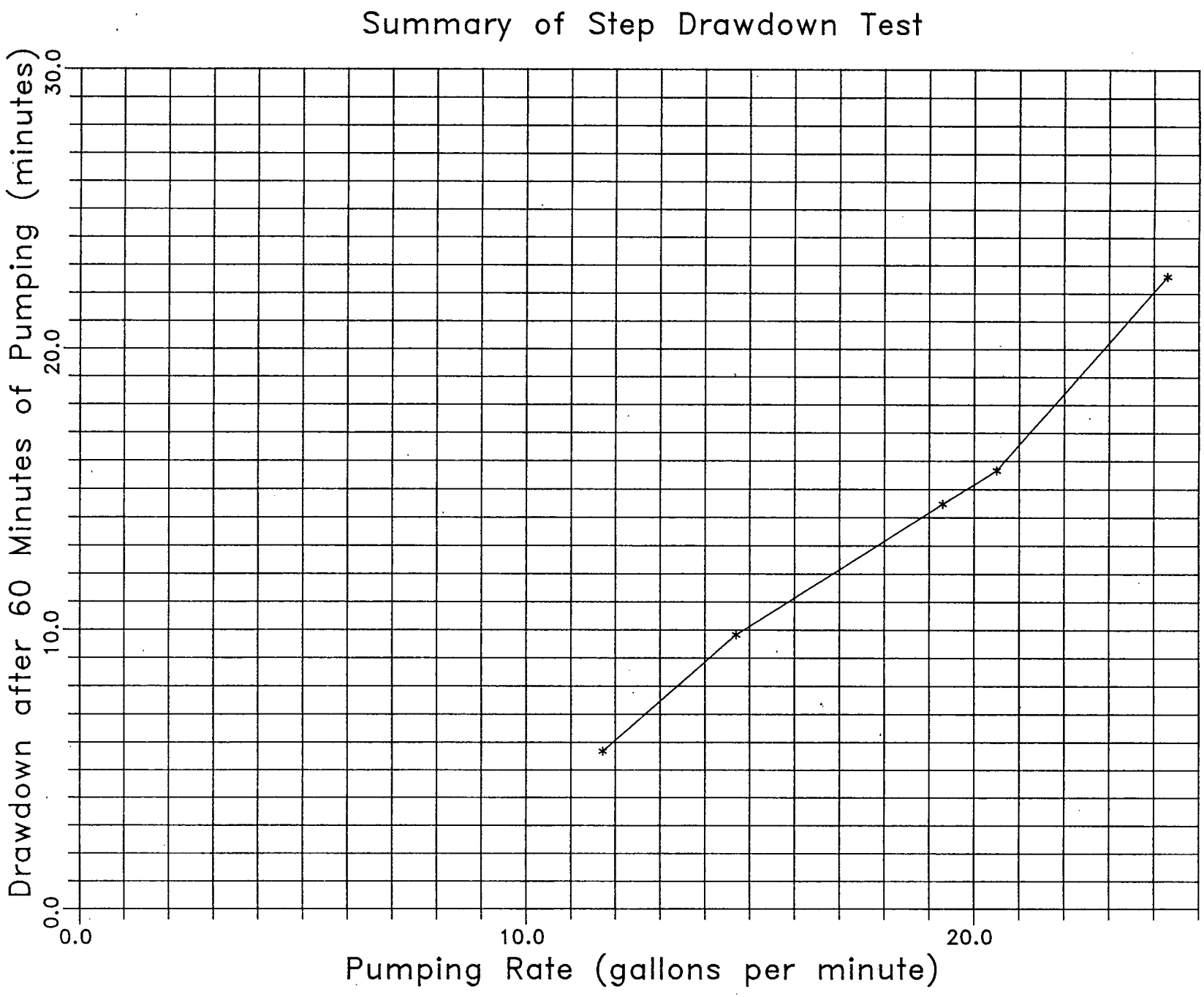
Location *Indian Basin, Carlsbad, New Mexico* Proj. No. *023350052*

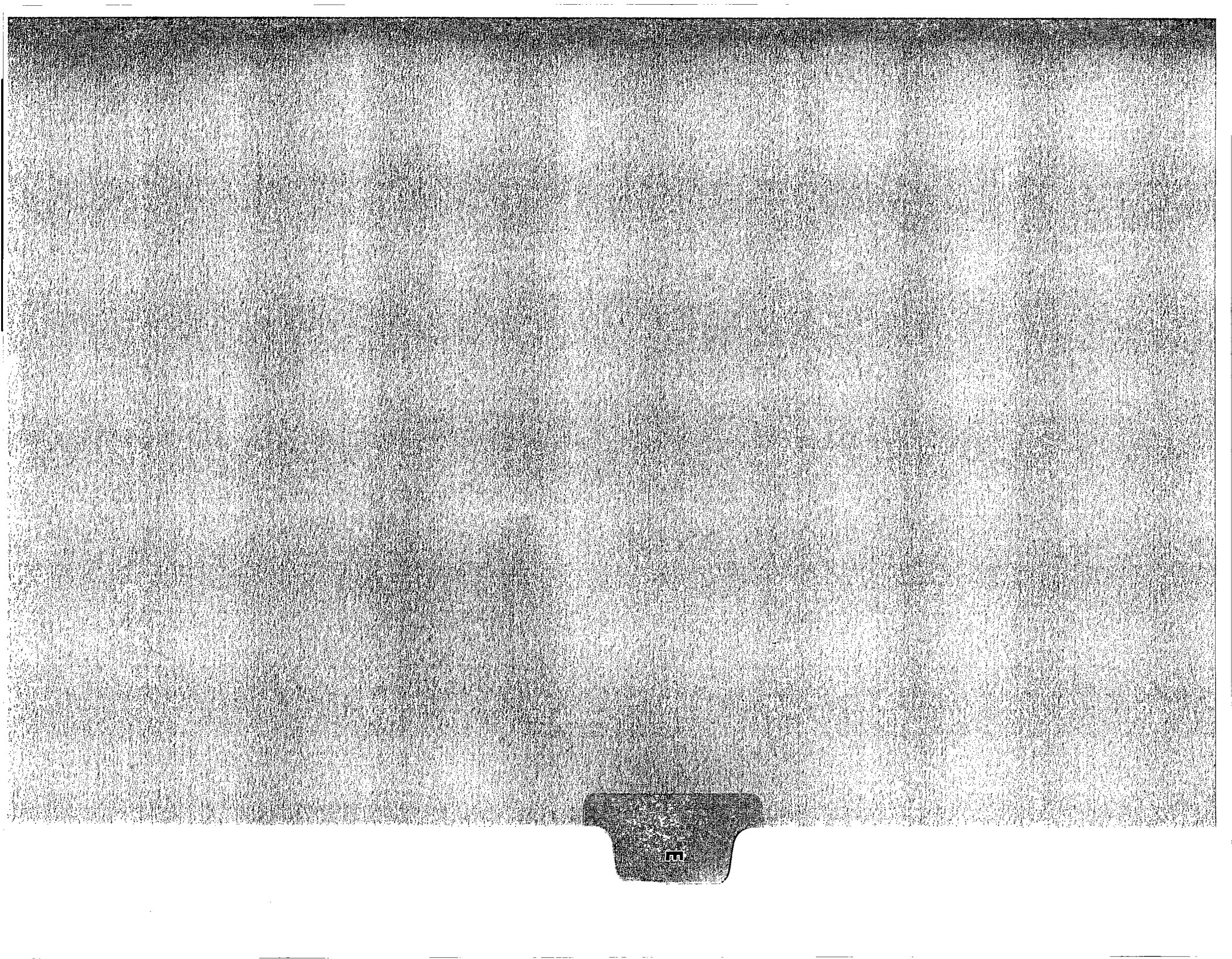
Depth (ft.)	Well Completion	PID (ppm)	Sample ID / Blow Count / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
216						
218						Well TD at 220 ft. at 1100 hours 12/08/94.
220		3.2				
222						
224						
226						
228						
230						
232						
234						
236						
238						
240						
242						
244						
246						
248						



APPENDIX D

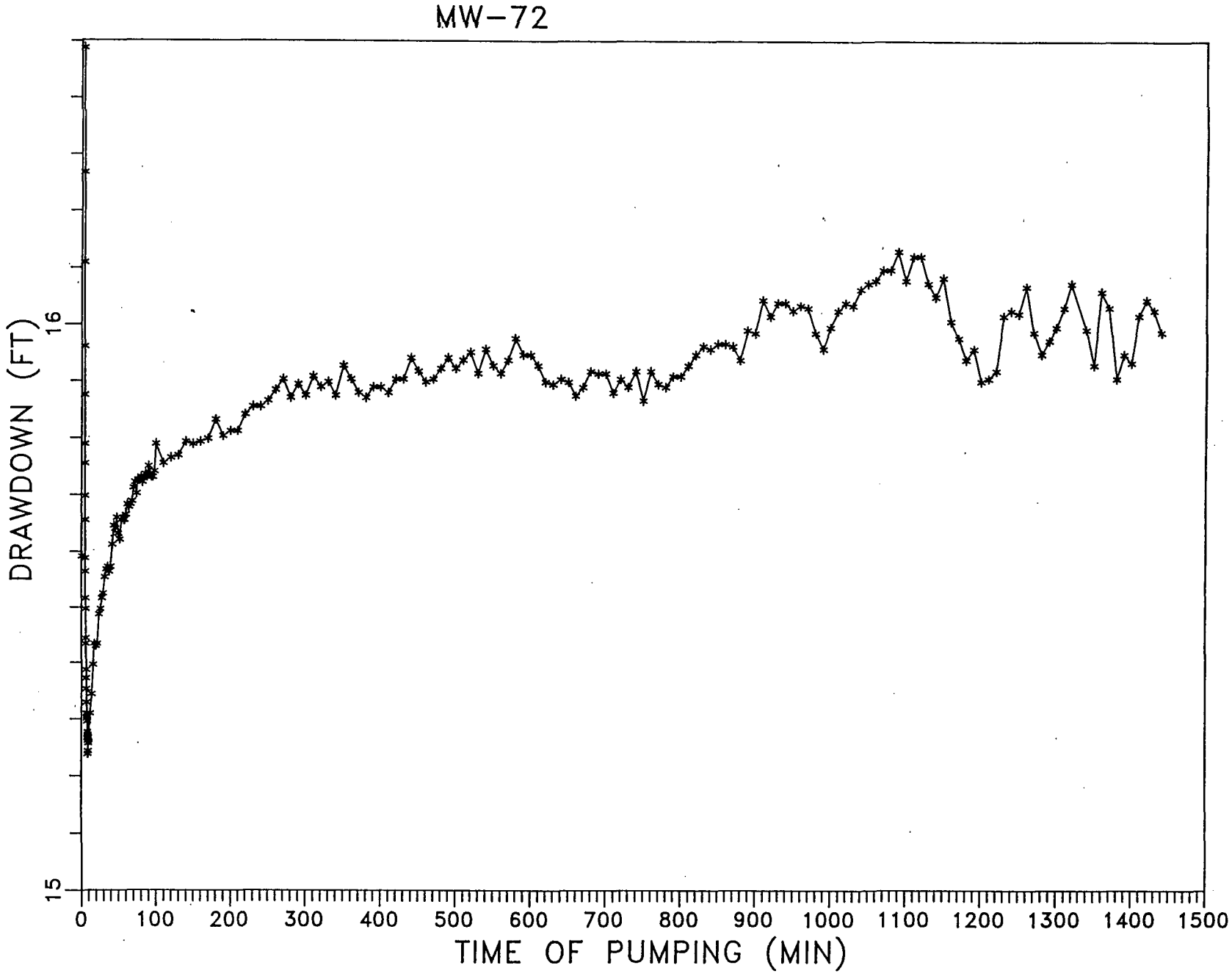
STEP TEST RESULTS

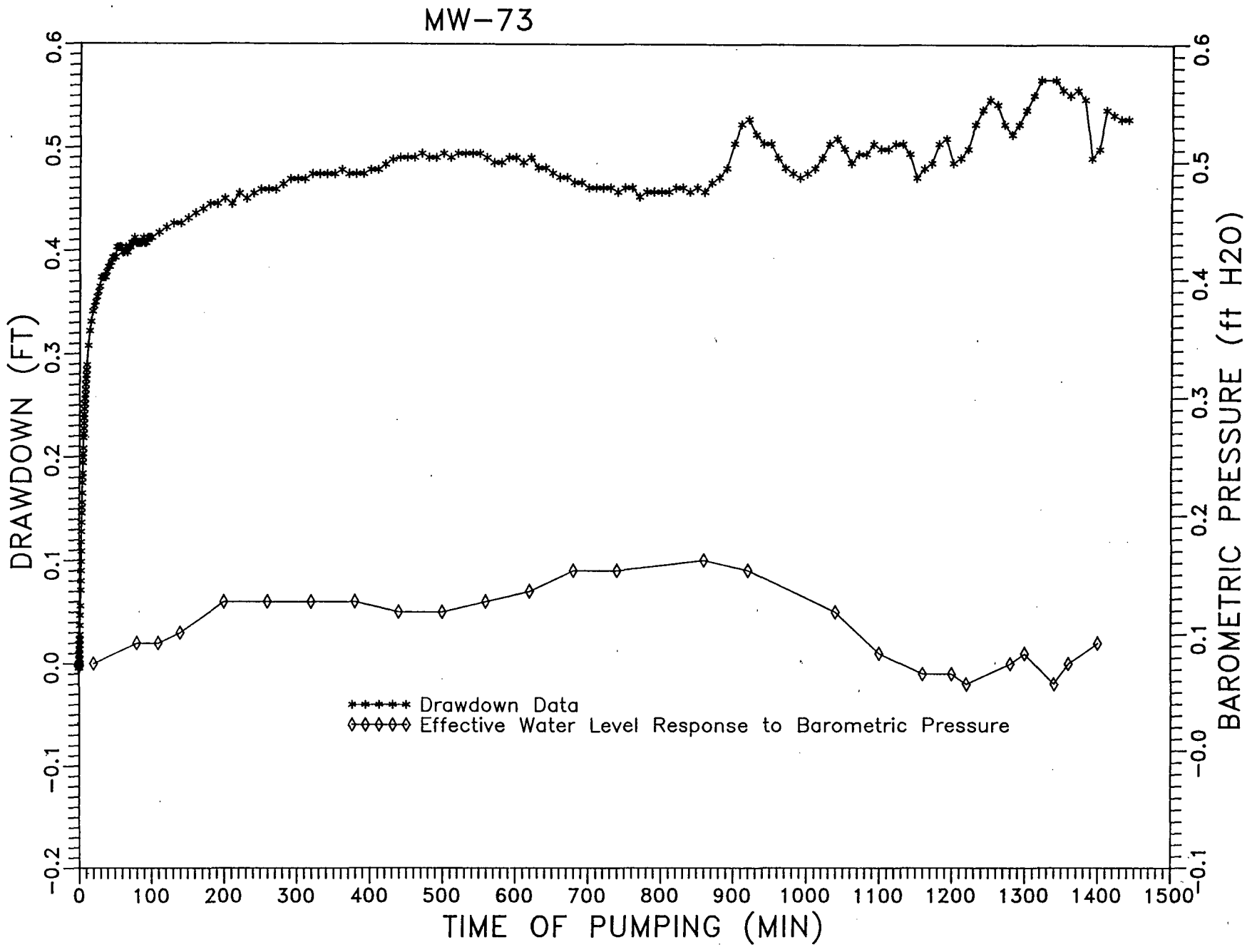

Summary of Step Drawdown Test
Drawdown after 60 Minutes of Pumping (minutes)
30.0
20.0
10.0
0.0
0.0
10.0
20.0
Pumping Rate (gallons per minute)

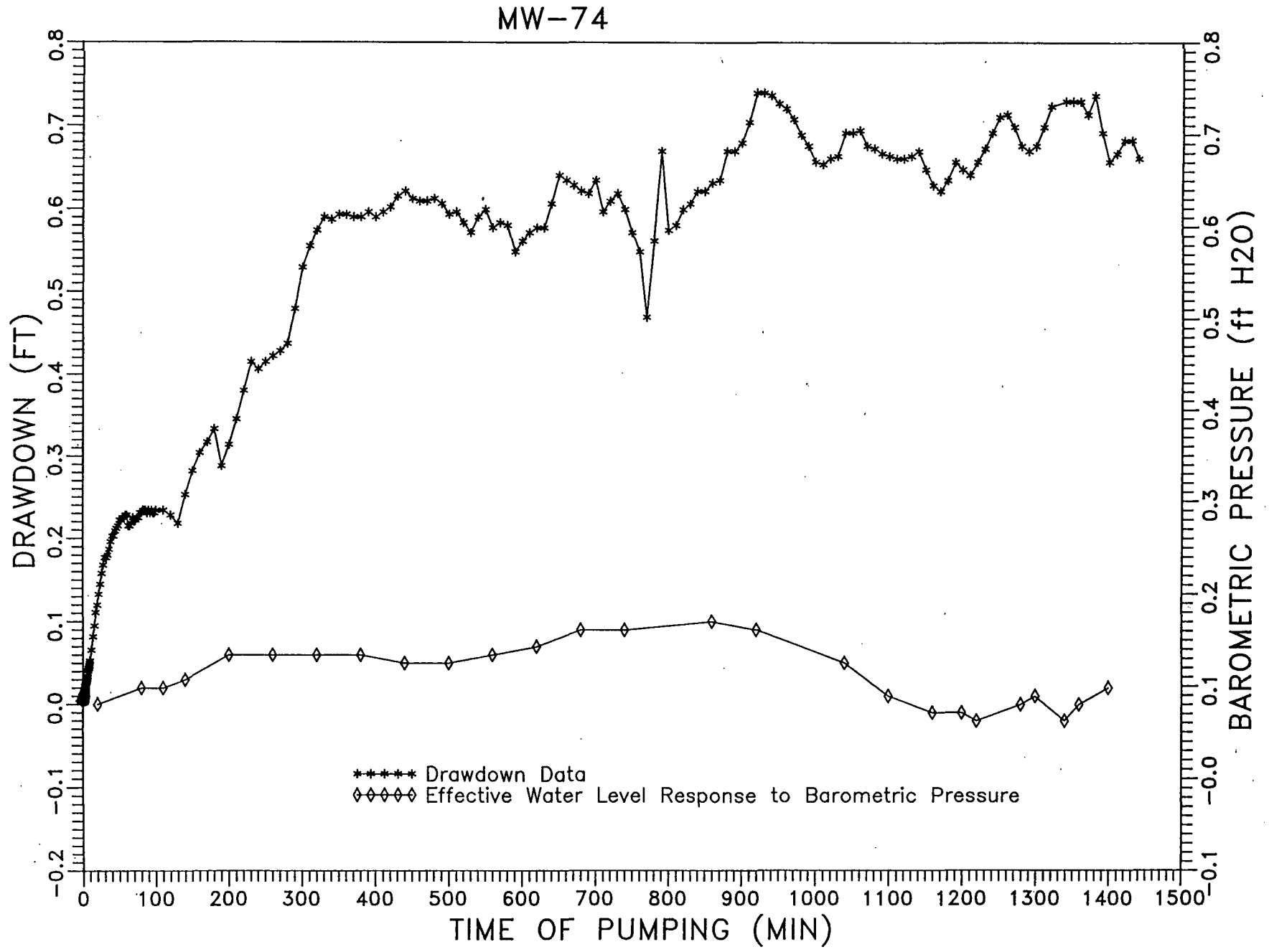


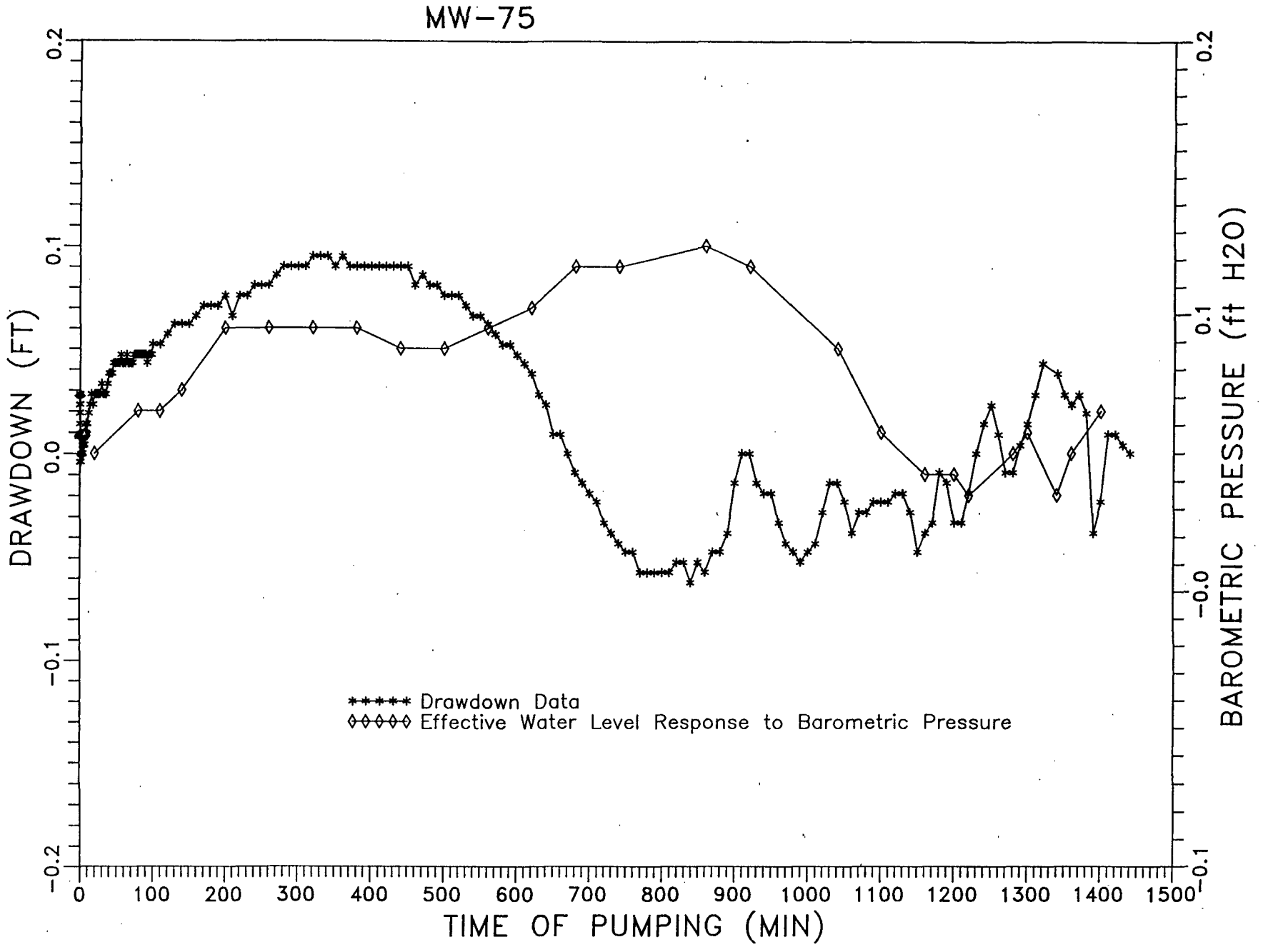
APPENDIX E

PUMPING TEST DATA


MW-72
DRAWDOWN (FT)
16
15
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME OF PUMPING (MIN)


MW-73
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Drawdown Data
Effective Water Level Response to Barometric Pressure

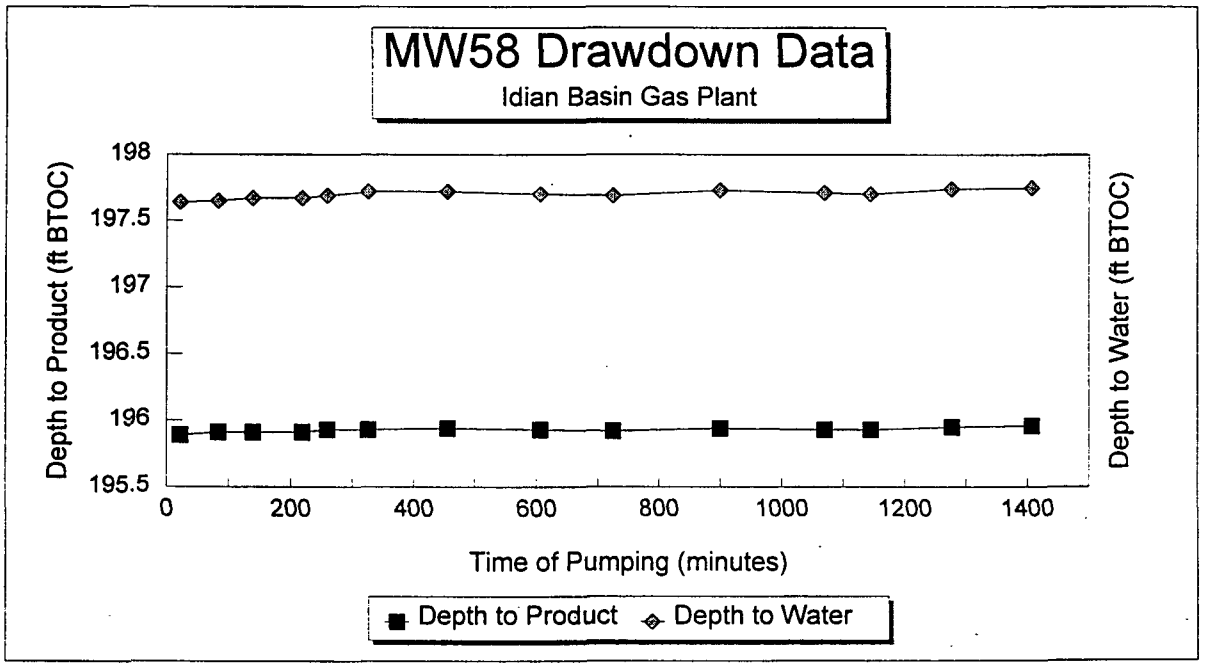

MW-74
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
Drawdown Data
Effective Water Level Response to Barometric Pressure
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500


MW-75
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
0.2
0.1
0.0
-0.1
-0.2
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Drawdown Data
Effective Water Level Response to Barometric Pressure

Time-Drawdown Data MW-58
Marathon Indian Basin Gas Plant
Pumping Test
Artesia, New Mexico

Initial PL	195.9
Initial WL	197.6
Corrected Fluid Lev	196.28

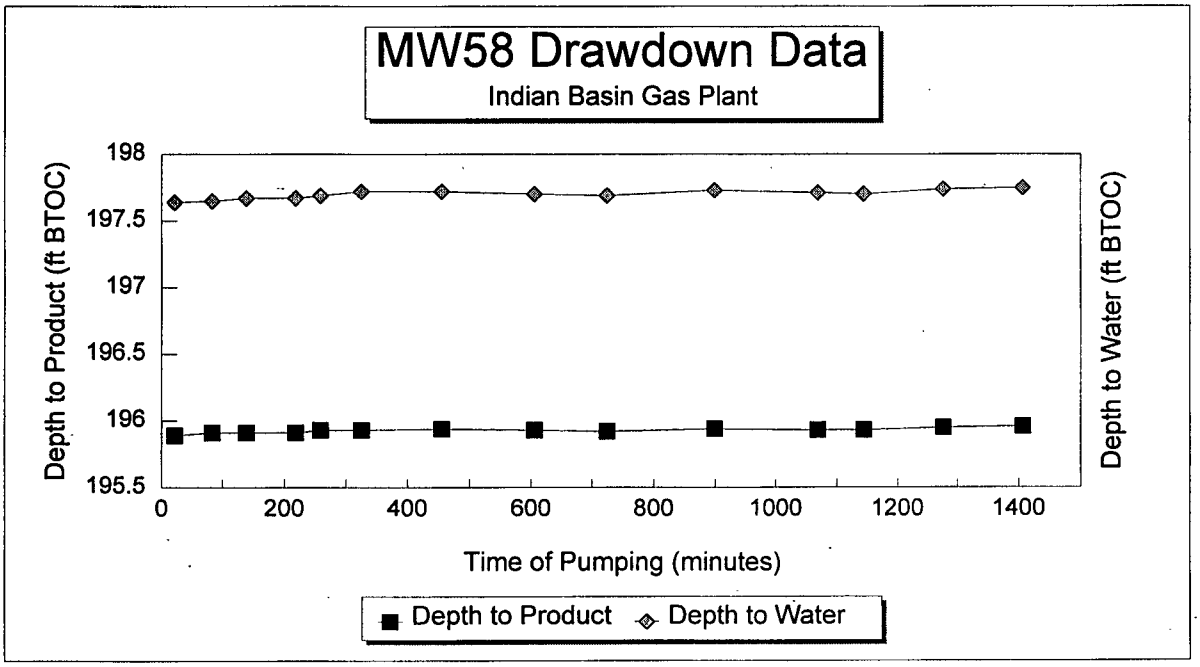
Time (min)	Corrected Drawdown (ft)	Depth to Product (ft BTOC)	Depth to Water (ft BTOC)	Product Thickness (ft)	Corrected Fluid Level (ft)	Time Hours	Time Minutes
22	0.00	195.89	197.64	1.75	196.28	1	52
83	0.02	195.91	197.65	1.74	196.29	2	53
138	0.03	195.91	197.67	1.76	196.30	3	48
218	0.03	195.91	197.67	1.76	196.30	5	8
259	0.05	195.93	197.69	1.76	196.32	5	49
325	0.05	195.93	197.72	1.79	196.32	6	55
455	0.06	195.94	197.72	1.78	196.33	9	5
606	0.05	195.93	197.7	1.77	196.32	11	36
724	0.04	195.92	197.69	1.77	196.31	13	34
899	0.06	195.94	197.73	1.79	196.33	16	29
1069	0.05	195.93	197.71	1.78	196.32	19	19
1144	0.05	195.93	197.7	1.77	196.32	20	34
1276	0.07	195.95	197.74	1.79	196.34	22	46
1406	0.08	195.96	197.75	1.79	196.35	0	56



Time-Drawdown Data MW-58
Marathon Indian Basin Gas Plant
Pumping Test
Artesia, New Mexico

Initial PL	195.89
Initial WL	197.64
Corrected Fluid Lev	196.28

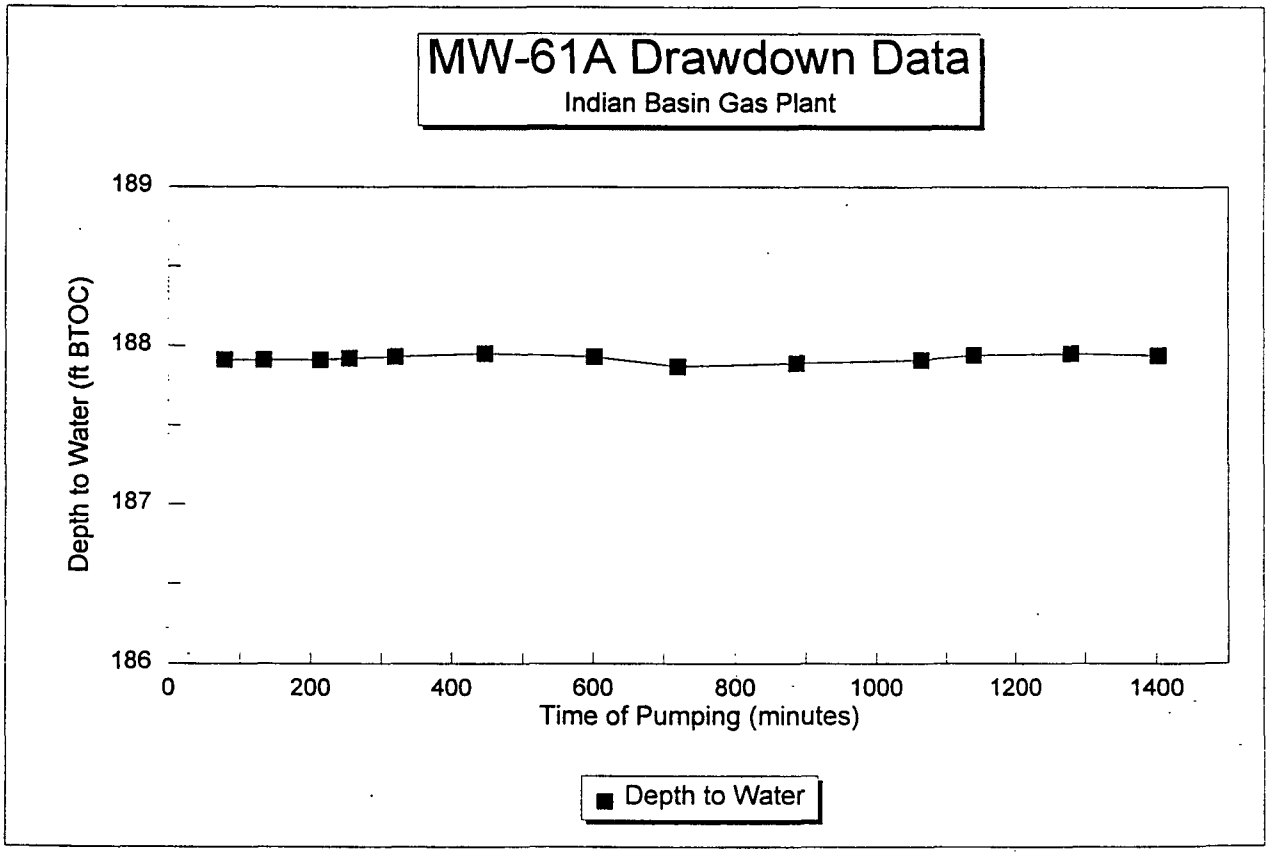
Time (min)	Corrected Drawdown (ft)	Depth to Product (ft BTOC)	Depth to Water (ft BTOC)	Product Thickness (ft)	Corrected Fluid Level (ft)	Time Hours	Time Minutes
22	0.00	195.89	197.64	1.75	196.28	1	52
83	0.02	195.91	197.65	1.74	196.29	2	53
138	0.03	195.91	197.67	1.76	196.30	3	48
218	0.03	195.91	197.67	1.76	196.30	5	8
259	0.05	195.93	197.69	1.76	196.32	5	49
325	0.05	195.93	197.72	1.79	196.32	6	55
455	0.06	195.94	197.72	1.78	196.33	9	5
606	0.05	195.93	197.70	1.77	196.32	11	36
724	0.04	195.92	197.69	1.77	196.31	13	34
899	0.06	195.94	197.73	1.79	196.33	16	29
1069	0.05	195.93	197.71	1.78	196.32	19	19
1144	0.05	195.93	197.70	1.77	196.32	20	34
1276	0.07	195.95	197.74	1.79	196.34	22	46
1406	0.08	195.96	197.75	1.79	196.35	0	56



Time-Drawdown Data MW-61A
Marathon Indian Basin Gas Plant
Pumping Test
Artesia, New Mexico

Initial PL NA
Initial WL 187.91

Time (min)	Drawdown (ft)	Depth to Product (ft BTOC)	Depth to Water (ft BTOC)	Time Hours	Time Minutes
78	0.00	NA	187.91	2	48
133	0.00	NA	187.91	3	43
213	0.00	NA	187.91	5	3
255	0.01	NA	187.92	5	45
320	0.02	NA	187.93	6	50
447	0.04	NA	187.95	8	57
601	0.02	NA	187.93	11	31
720	-0.04	NA	187.87	13	30
887	-0.02	NA	187.89	16	17
1064	0.00	NA	187.91	19	14
1139	0.03	NA	187.94	20	29
1280	0.04	NA	187.95	22	50
1402	0.03	NA	187.94	0	52



Constant Rate Aquifer Test Data
Marathon Indian Basin Gas Plant
Artesia, NM

SE2000
Environmental Logger
06/21 01:30

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74	MW-75

Step 0 06/21 01:30:01

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
0.0000	0.975	-0.004	0.006	-0.004
0.0083	1.139	-0.004	0.006	0.009
0.0166	1.278	-0.004	0.006	0.019
0.0250	1.427	-0.004	0.006	0.023
0.0333	1.605	-0.004	0.006	0.023
0.0416	1.740	-0.004	0.006	0.028
0.0500	1.894	-0.004	0.006	0.028
0.0583	2.014	0.000	0.006	0.028
0.0666	2.182	0.000	0.006	0.028
0.0750	2.316	0.000	0.006	0.028
0.0833	2.489	0.000	0.006	0.028
0.0916	2.614	0.000	0.006	0.028
0.1000	2.739	0.000	0.006	0.028
0.1083	2.903	0.000	0.006	0.028
0.1166	3.051	0.000	0.006	0.028
0.1250	3.191	0.000	0.006	0.028
0.1333	3.296	0.000	0.006	0.028
0.1416	3.450	0.000	0.006	0.028
0.1500	3.580	0.000	0.009	0.028
0.1583	3.738	0.000	0.006	0.028
0.1666	3.844	0.000	0.006	0.028
0.1750	3.983	0.000	0.009	0.028
0.1833	4.118	0.000	0.006	0.028
0.1916	4.267	0.000	0.006	0.028
0.2000	4.387	0.000	0.009	0.028
0.2083	4.483	0.000	0.006	0.028
0.2166	4.641	0.000	0.006	0.028
0.2250	4.766	0.000	0.006	0.028
0.2333	4.905	0.000	0.006	0.028
0.2416	5.016	0.000	0.009	0.028
0.2500	5.145	0.000	0.006	0.028
0.2583	5.275	0.000	0.006	0.028
0.2666	5.409	0.000	0.006	0.028
0.2750	5.524	0.000	0.006	0.028
0.2833	5.635	0.000	0.009	0.028
0.2916	5.779	0.000	0.009	0.028
0.3000	5.904	0.000	0.009	0.028
0.3083	6.019	0.000	0.006	0.028
0.3166	6.115	0.000	0.006	0.023
0.3250	6.259	0.000	0.009	0.028

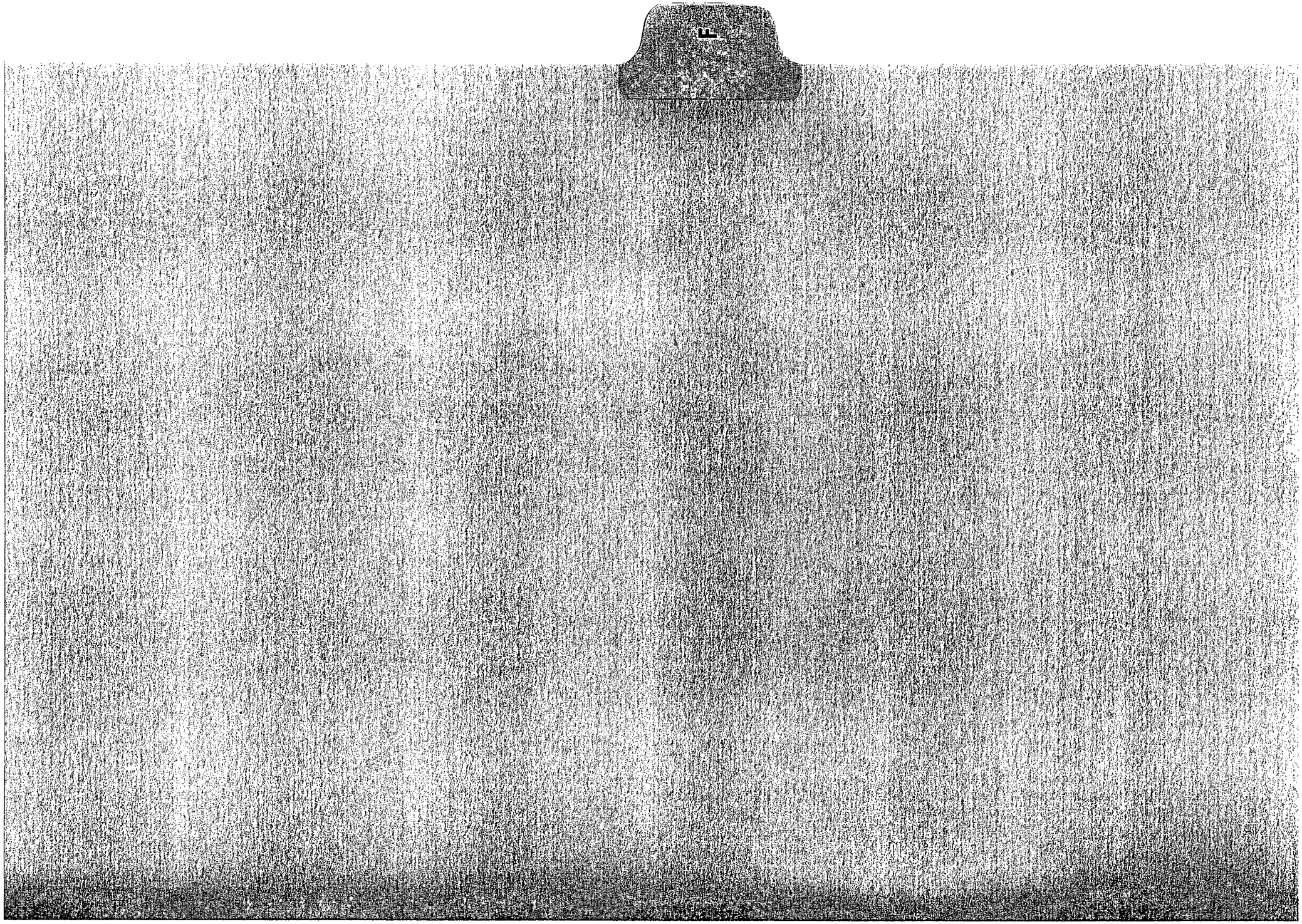
ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
0.3333	6.364	0.000	0.006	0.028
0.3500	6.590	0.000	0.006	0.014
0.3666	6.835	0.000	0.006	0.009
0.3833	7.060	0.000	0.006	0.009
0.4000	7.300	0.000	0.006	0.009
0.4166	7.525	0.004	0.006	0.009
0.4333	7.732	0.004	0.009	0.009
0.4500	7.952	0.004	0.006	0.009
0.4666	8.144	0.004	0.009	0.009
0.4833	8.360	0.004	0.009	0.009
0.5000	8.566	0.004	0.006	0.009
0.5166	8.782	0.004	0.006	0.009
0.5333	8.993	0.004	0.006	0.009
0.5500	9.194	0.004	0.009	0.009
0.5666	9.386	0.009	0.009	0.009
0.5833	9.592	0.004	0.009	0.009
0.6000	9.779	0.009	0.006	0.009
0.6166	9.961	0.009	0.009	0.009
0.6333	10.129	0.009	0.009	0.009
0.6500	10.301	0.009	0.009	0.009
0.6666	10.507	0.009	0.006	0.009
0.6833	10.675	0.009	0.006	0.009
0.7000	10.867	0.009	0.006	0.009
0.7166	11.058	0.014	0.009	0.009
0.7333	11.226	0.014	0.006	0.009
0.7500	11.394	0.014	0.009	0.009
0.7666	11.571	0.014	0.009	0.009
0.7833	11.715	0.014	0.006	0.009
0.8000	11.892	0.018	0.009	0.009
0.8166	12.041	0.018	0.009	0.009
0.8333	12.208	0.018	0.009	0.009
0.8500	12.361	0.018	0.009	0.009
0.8666	12.524	0.018	0.009	0.009
0.8833	12.687	0.023	0.006	0.009
0.9000	12.864	0.023	0.009	0.009
0.9166	13.013	0.023	0.009	0.009
0.9333	13.142	0.023	0.009	0.009
0.9500	13.305	0.023	0.009	0.009
0.9666	13.444	0.023	0.009	0.009
0.9833	13.578	0.028	0.009	0.009
1.0000	13.726	0.028	0.009	0.009
1.2000	15.592	0.037	0.006	0.000
1.4000	17.051	0.047	0.009	0.000
1.6000	18.309	0.056	0.009	-0.004
1.8000	18.887	0.071	0.009	0.000
2.0000	18.887	0.080	0.012	0.000
2.2000	18.447	0.090	0.012	0.000
2.4000	18.079	0.099	0.012	0.000
2.6000	17.730	0.109	0.012	0.000
2.8000	17.453	0.118	0.012	0.000
3.0000	17.190	0.128	0.015	0.000
3.2000	16.908	0.137	0.019	0.000
3.4000	16.669	0.146	0.019	0.004
3.6000	16.487	0.151	0.022	0.004
3.8000	16.267	0.156	0.022	0.004
4.0000	16.109	0.165	0.025	0.000
4.2000	15.961	0.175	0.025	0.004

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
4.4000	15.875	0.180	0.025	0.004
4.6000	15.789	0.184	0.025	0.004
4.8000	15.755	0.194	0.028	0.004
5.0000	15.698	0.199	0.028	0.004
5.2000	15.655	0.203	0.028	0.004
5.4000	15.588	0.208	0.028	0.004
5.6000	15.564	0.218	0.028	0.004
5.8000	15.516	0.222	0.031	0.009
6.0000	15.497	0.222	0.031	0.009
6.2000	15.434	0.227	0.031	0.009
6.4000	15.444	0.232	0.034	0.009
6.6000	15.372	0.237	0.034	0.004
6.8000	15.387	0.241	0.038	0.009
7.0000	15.353	0.246	0.038	0.009
7.2000	15.329	0.251	0.041	0.009
7.4000	15.329	0.251	0.041	0.009
7.6000	15.310	0.256	0.044	0.009
7.8000	15.301	0.251	0.044	0.009
8.0000	15.305	0.260	0.044	0.009
8.2000	15.296	0.265	0.044	0.014
8.4000	15.267	0.265	0.044	0.009
8.6000	15.277	0.270	0.047	0.009
8.8000	15.272	0.275	0.047	0.009
9.0000	15.238	0.275	0.047	0.014
9.2000	15.243	0.279	0.050	0.014
9.4000	15.262	0.279	0.050	0.014
9.6000	15.262	0.284	0.053	0.014
9.8000	15.257	0.284	0.053	0.014
10.0000	15.267	0.289	0.053	0.014
12.0000	15.310	0.308	0.066	0.019
14.0000	15.344	0.322	0.082	0.023
16.0000	15.396	0.331	0.095	0.028
18.0000	15.434	0.341	0.111	0.023
20.0000	15.430	0.346	0.120	0.028
22.0000	15.434	0.350	0.133	0.028
24.0000	15.487	0.355	0.145	0.028
26.0000	15.497	0.360	0.158	0.028
28.0000	15.516	0.365	0.168	0.028
30.0000	15.525	0.374	0.177	0.033
32.0000	15.554	0.374	0.177	0.028
34.0000	15.568	0.374	0.180	0.028
36.0000	15.573	0.374	0.187	0.028
38.0000	15.564	0.379	0.196	0.033
40.0000	15.573	0.384	0.203	0.038
42.0000	15.612	0.384	0.203	0.038
44.0000	15.645	0.388	0.209	0.038
46.0000	15.640	0.393	0.212	0.043
48.0000	15.659	0.393	0.215	0.043
50.0000	15.631	0.393	0.222	0.043
52.0000	15.621	0.403	0.222	0.043
54.0000	15.655	0.403	0.225	0.043
56.0000	15.659	0.403	0.225	0.047
58.0000	15.655	0.403	0.228	0.043
60.0000	15.664	0.398	0.228	0.043
62.0000	15.683	0.398	0.215	0.043
64.0000	15.678	0.403	0.215	0.047
66.0000	15.683	0.398	0.218	0.043

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
68.0000	15.688	0.403	0.225	0.043
70.0000	15.712	0.403	0.222	0.043
72.0000	15.722	0.407	0.222	0.043
74.0000	15.702	0.407	0.225	0.047
76.0000	15.726	0.412	0.225	0.047
78.0000	15.726	0.407	0.231	0.047
80.0000	15.731	0.407	0.231	0.047
82.0000	15.722	0.407	0.234	0.047
84.0000	15.731	0.407	0.234	0.047
86.0000	15.736	0.407	0.234	0.047
88.0000	15.731	0.412	0.231	0.047
90.0000	15.750	0.407	0.234	0.047
92.0000	15.736	0.407	0.231	0.043
94.0000	15.731	0.412	0.234	0.047
96.0000	15.731	0.412	0.231	0.047
98.0000	15.741	0.412	0.231	0.047
100.000	15.789	0.412	0.234	0.052
110.000	15.755	0.417	0.234	0.052
120.000	15.765	0.422	0.228	0.057
130.000	15.769	0.426	0.218	0.062
140.000	15.793	0.426	0.253	0.062
150.000	15.789	0.431	0.282	0.062
160.000	15.793	0.436	0.304	0.066
170.000	15.798	0.440	0.317	0.071
180.000	15.832	0.445	0.333	0.071
190.000	15.803	0.445	0.288	0.071
200.000	15.812	0.450	0.314	0.076
210.000	15.812	0.445	0.345	0.066
220.000	15.841	0.455	0.380	0.076
230.000	15.855	0.450	0.415	0.076
240.000	15.616	0.455	0.406	0.081
250.000	15.626	0.459	0.415	0.081
260.000	15.645	0.459	0.422	0.081
270.000	15.664	0.459	0.428	0.086
280.000	15.631	0.464	0.437	0.090
290.000	15.655	0.469	0.479	0.090
300.000	15.635	0.469	0.529	0.090
310.000	15.669	0.469	0.555	0.090
320.000	15.650	0.474	0.574	0.095
330.000	15.659	0.474	0.590	0.095
340.000	15.635	0.474	0.587	0.095
350.000	15.688	0.474	0.593	0.090
360.000	15.664	0.478	0.593	0.095
370.000	15.640	0.474	0.590	0.090
380.000	15.631	0.474	0.590	0.090
390.000	15.650	0.474	0.596	0.090
400.000	15.650	0.478	0.590	0.090
410.000	15.640	0.478	0.596	0.090
420.000	15.664	0.483	0.602	0.090
430.000	15.664	0.488	0.615	0.090
440.000	15.702	14.328	0.621	0.090
450.000	15.678	0.583	0.612	0.090
460.000	15.659	0.583	0.609	0.081
470.000	15.664	0.587	0.609	0.086
480.000	15.683	0.583	0.612	0.081
490.000	15.702	0.583	0.606	0.081
500.000	15.683	0.587	0.593	0.076

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
510.000	15.698	0.583	0.596	0.076
520.000	15.712	0.587	0.583	0.076
530.000	15.674	0.587	0.571	0.071
540.000	15.717	0.587	0.590	0.066
550.000	15.688	0.587	0.599	0.066
560.000	15.674	0.583	0.577	0.062
570.000	15.698	0.578	0.583	0.057
580.000	15.736	0.578	0.580	0.052
590.000	15.707	0.583	0.548	0.052
600.000	15.707	0.583	0.561	0.047
610.000	15.688	0.578	0.571	0.043
620.000	15.659	0.583	0.577	0.038
630.000	15.655	0.573	0.577	0.028
640.000	15.664	0.573	0.606	0.023
650.000	15.659	0.568	0.640	0.009
660.000	15.635	0.564	0.634	0.009
670.000	15.650	0.564	0.628	0.000
680.000	15.678	0.559	0.621	-0.009
690.000	15.674	0.559	0.618	-0.014
700.000	15.674	0.554	0.634	-0.019
710.000	15.640	0.554	0.596	-0.023
720.000	15.664	0.554	0.609	-0.033
730.000	15.650	0.554	0.618	-0.038
740.000	15.678	0.550	0.599	-0.043
750.000	15.626	0.554	0.571	-0.047
760.000	15.678	0.554	0.548	-0.047
770.000	15.655	0.545	0.469	-0.057
780.000	15.650	0.550	0.561	-0.057
790.000	15.669	0.550	0.669	-0.057
800.000	15.669	0.550	0.574	-0.057
810.000	15.688	0.550	0.580	-0.057
820.000	15.707	0.554	0.599	-0.052
830.000	15.722	0.554	0.606	-0.052
840.000	15.717	0.550	0.621	-0.062
850.000	15.726	0.554	0.621	-0.052
860.000	15.726	0.550	0.631	-0.057
870.000	15.722	0.559	0.634	-0.047
880.000	15.698	0.564	0.669	-0.047
890.000	15.750	0.573	0.669	-0.038
900.000	15.745	0.597	0.679	-0.014
910.000	15.803	0.616	0.704	0.000
920.000	15.774	0.621	0.739	0.000
930.000	15.798	0.606	0.739	-0.014
940.000	15.798	0.597	0.736	-0.019
950.000	15.784	0.597	0.726	-0.019
960.000	15.793	0.583	0.720	-0.033
970.000	15.789	0.573	0.707	-0.043
980.000	15.745	0.568	0.688	-0.047
990.000	15.717	0.564	0.675	-0.052
1000.00	15.755	0.568	0.656	-0.047
1010.00	15.784	0.573	0.653	-0.043
1020.00	15.798	0.583	0.660	-0.028
1030.00	15.793	0.597	0.663	-0.014
1040.00	15.822	0.602	0.691	-0.014
1050.00	15.832	0.592	0.691	-0.023
1060.00	16.076	0.578	0.694	-0.038
1070.00	16.095	0.587	0.675	-0.028

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
1080.00	16.095	0.587	0.672	-0.028
1090.00	16.128	0.597	0.666	-0.023
1100.00	16.076	0.592	0.663	-0.023
1110.00	16.119	0.592	0.660	-0.023
1120.00	15.559	0.597	0.660	-0.019
1130.00	15.511	0.597	0.663	-0.019
1140.00	15.487	0.587	0.669	-0.028
1150.00	15.521	0.564	0.647	-0.047
1160.00	15.444	0.573	0.628	-0.038
1170.00	15.415	0.578	0.621	-0.033
1180.00	15.377	0.597	0.634	-0.009
1190.00	15.396	0.602	0.656	-0.014
1200.00	15.339	0.578	0.647	-0.033
1210.00	15.344	0.583	0.640	-0.033
1220.00	15.358	0.592	0.656	-0.019
1230.00	15.454	0.616	0.672	0.000
1240.00	15.463	0.630	0.691	0.014
1250.00	15.458	0.640	0.710	0.023
1260.00	15.506	0.635	0.713	0.009
1270.00	15.425	0.616	0.698	-0.009
1280.00	15.387	0.606	0.675	-0.009
1290.00	15.411	0.616	0.669	0.004
1300.00	15.434	0.630	0.675	0.014
1310.00	15.468	0.644	0.698	0.028
1320.00	15.511	0.659	0.723	0.043
1340.00	15.430	0.659	0.729	0.038
1350.00	15.368	0.649	0.729	0.028
1360.00	15.497	0.644	0.729	0.023
1370.00	15.468	0.649	0.713	0.028
1380.00	15.344	0.640	0.736	0.019
1390.00	15.387	0.583	0.691	-0.038
1400.00	15.372	0.592	0.656	-0.023
1410.00	15.454	0.630	0.666	0.009
1420.00	15.482	0.625	0.682	0.009
1430.00	15.463	0.621	0.682	0.004
1440.00	15.425	0.621	0.660	0.000



APPENDIX F

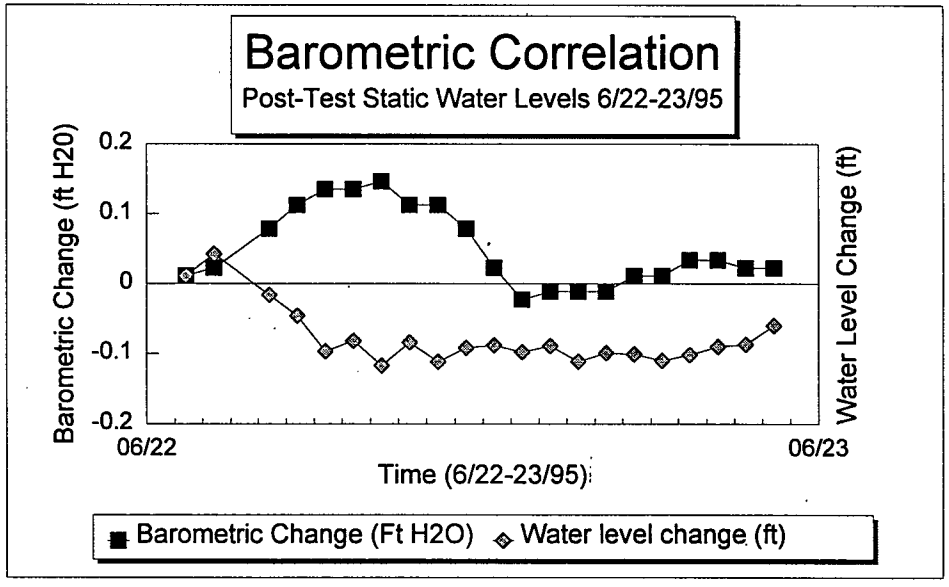
BACKGROUND WATER-LEVEL MEASUREMENTS

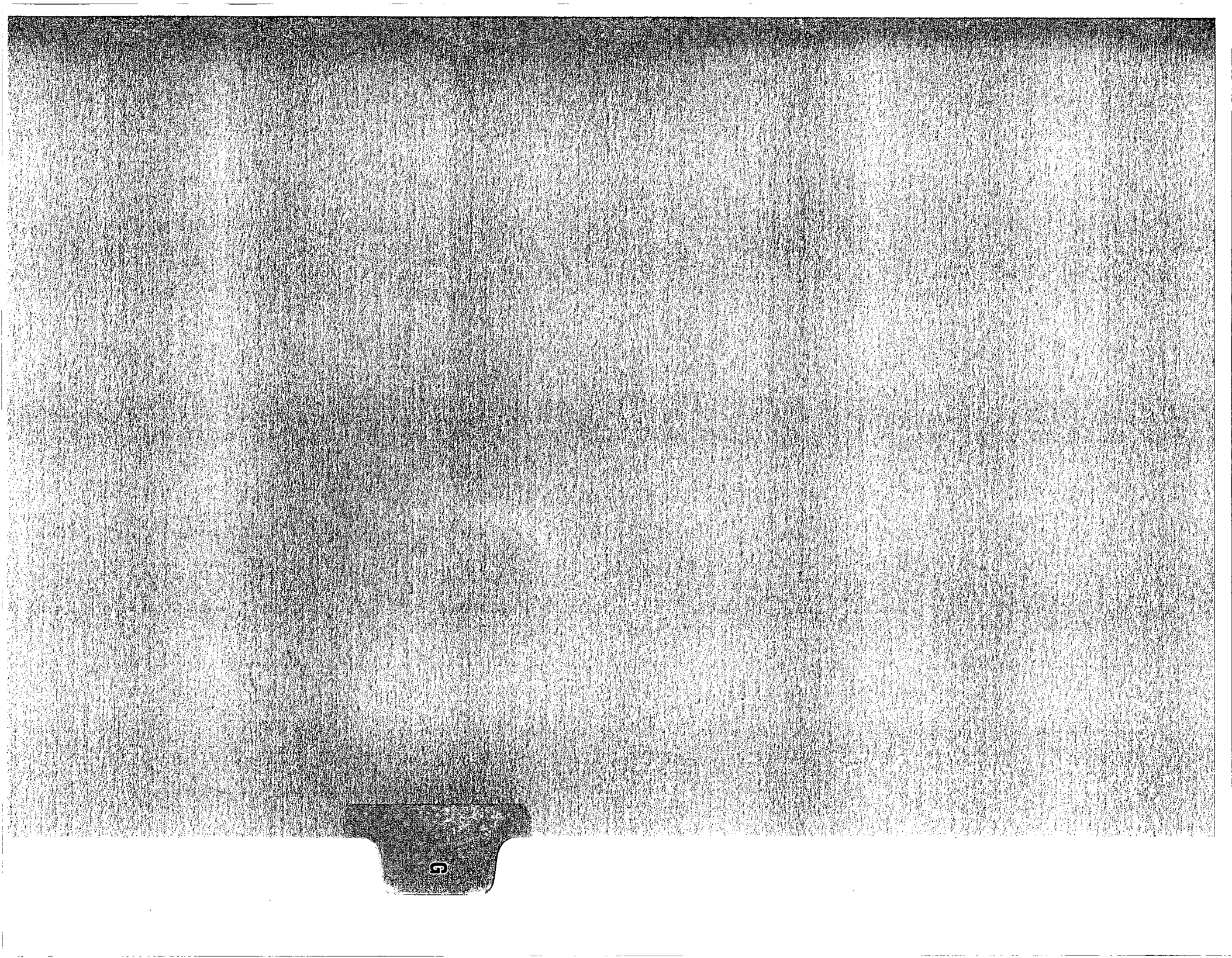
Indian Basin Gas Plant
Marathon Oil Company
Artesia, NM

Barometric efficiency determination

Barometric pressure data-Post test data

Date	Time	Barometric Pressure (In HG)	Barometric Change (Ft H2O)	Water level change
06/22/95	17:00	30.01	0.01	0
06/22/95	18:00	30.00	0.02	0.02
06/22/95	20:00	29.95	0.08	-0.016
06/22/95	21:00	29.92	0.11	-0.046
06/22/95	22:00	29.90	0.14	-0.097
06/22/95	23:00	29.90	0.14	-0.082
06/23/95	00:00	29.89	0.15	-0.117
06/23/95	01:00	29.92	0.11	-0.084
06/23/95	02:00	29.92	0.11	-0.112
06/23/95	03:00	29.95	0.08	-0.092
06/23/95	04:00	30.00	0.02	-0.088
06/23/95	05:00	30.04	-0.02	-0.075
06/23/95	06:00	30.03	-0.01	-0.078
06/23/95	07:00	30.03	-0.01	-0.1
06/23/95	08:00	30.03	-0.01	-0.088
06/23/95	09:00	30.01	0.01	-0.101
06/23/95	10:00	30.01	0.01	-0.11
06/23/95	11:00	29.99	0.03	-0.102
06/23/95	12:00	29.99	0.03	-0.09
06/23/95	13:00	30.00	0.02	-0.087
06/23/95	14:00	30.00	0.02	-0.06
06/23/95	15:00	30.01	-0.01	
06/23/95	16:00	30.01	-0.01	



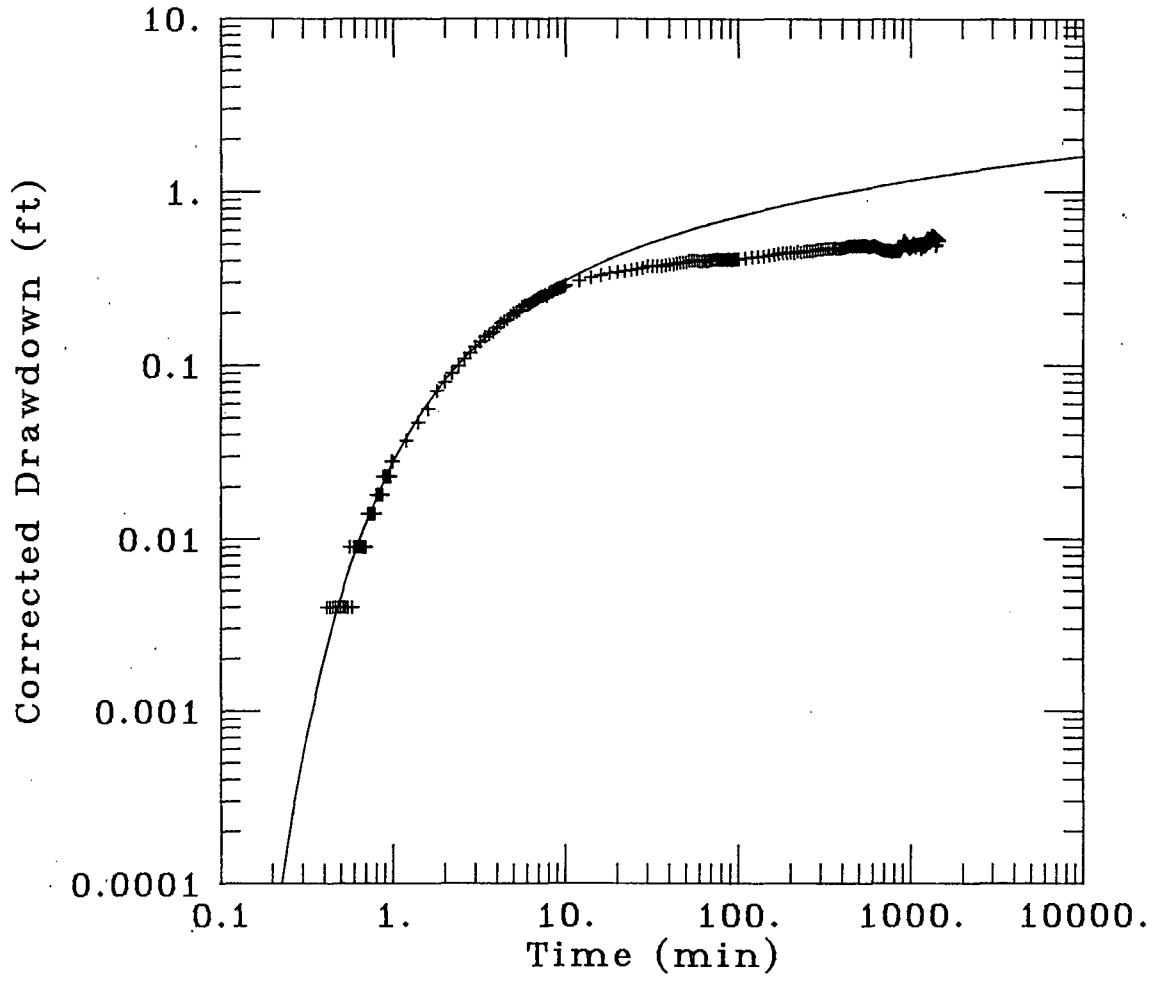


APPENDIX G

AQUIFER TEST ANALYSIS

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-73



DATA SET:
MW73P.DAT
07/26/95

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
6/21/95

TEST WELL:
MW-72

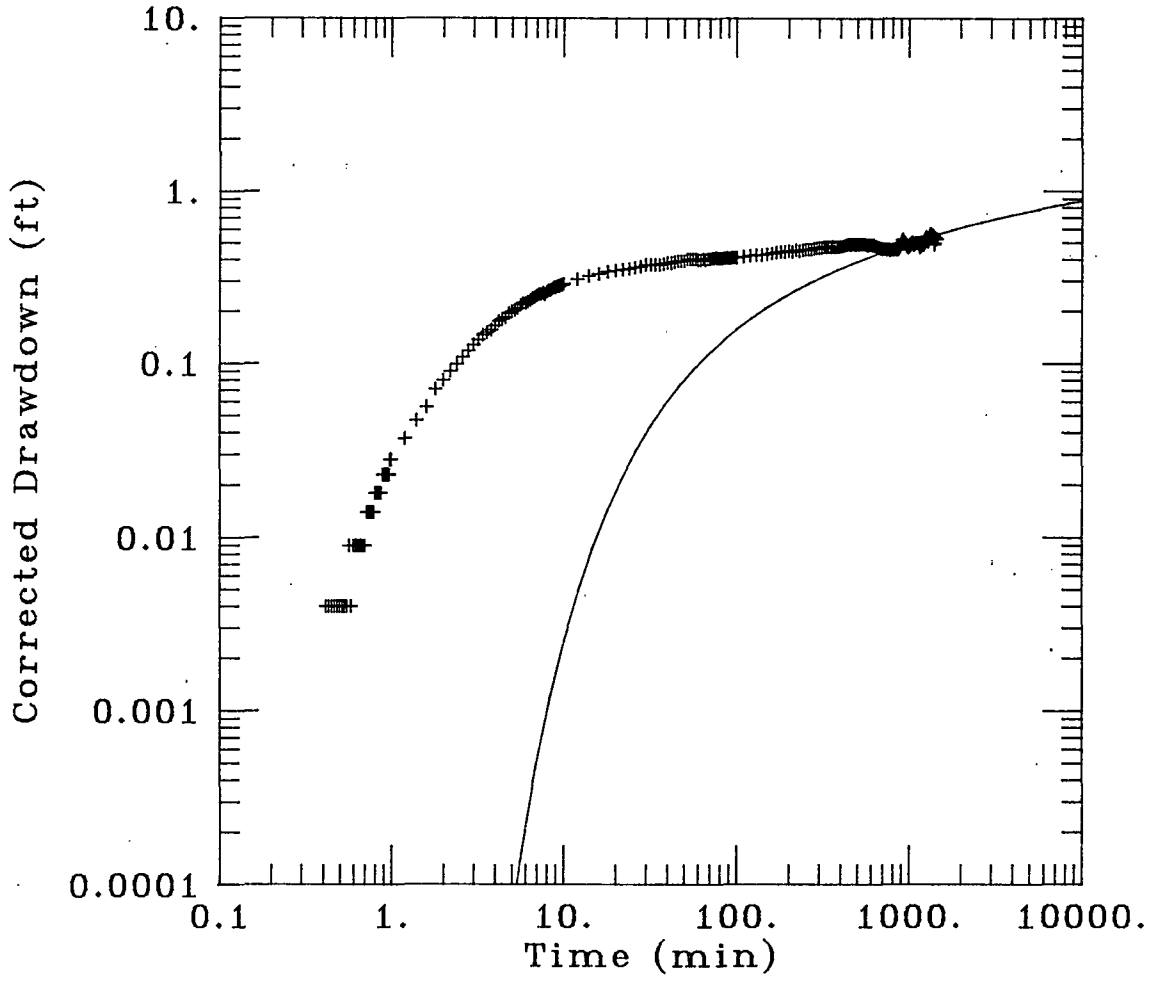
OBS. WELL:
MW-73

ESTIMATED PARAMETERS:
T = 1.174 ft^2/min
S = 0.0004862

TEST DATA:
Q = 2.75 ft^3/min
r = 108. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-73



DATA SET:
MW73P.DAT
07/26/95

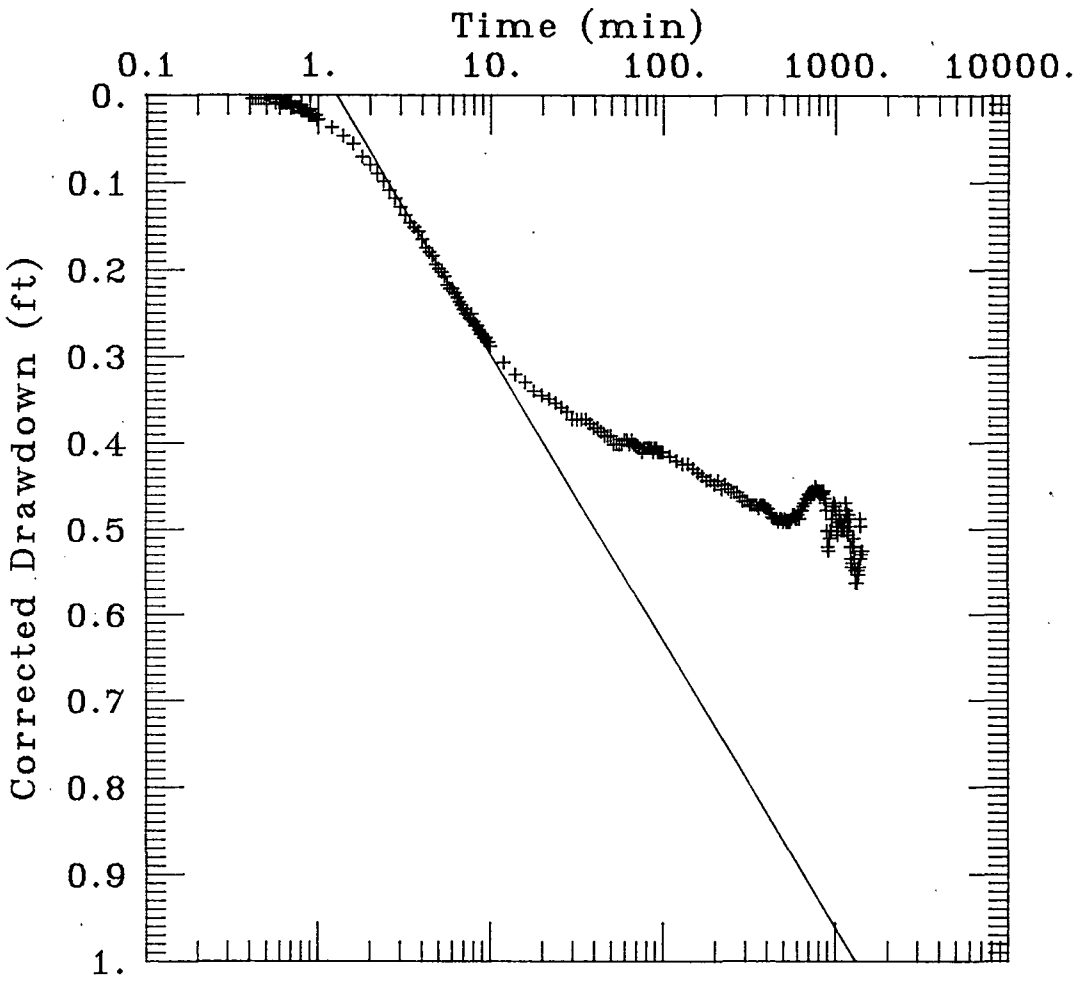
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
6/21/95
TEST WELL:
MW-72
OBS. WELL:
MW-73

ESTIMATED PARAMETERS:
T = 1.336 ft^2/min
S = 0.01266

TEST DATA:
Q = 2.75 ft^3/min
r = 108. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-73



DATA SET:
MW73P.DAT
07/26/95

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Cooper-Jacob

TEST DATE:
6/21/95

TEST WELL:
MW-72

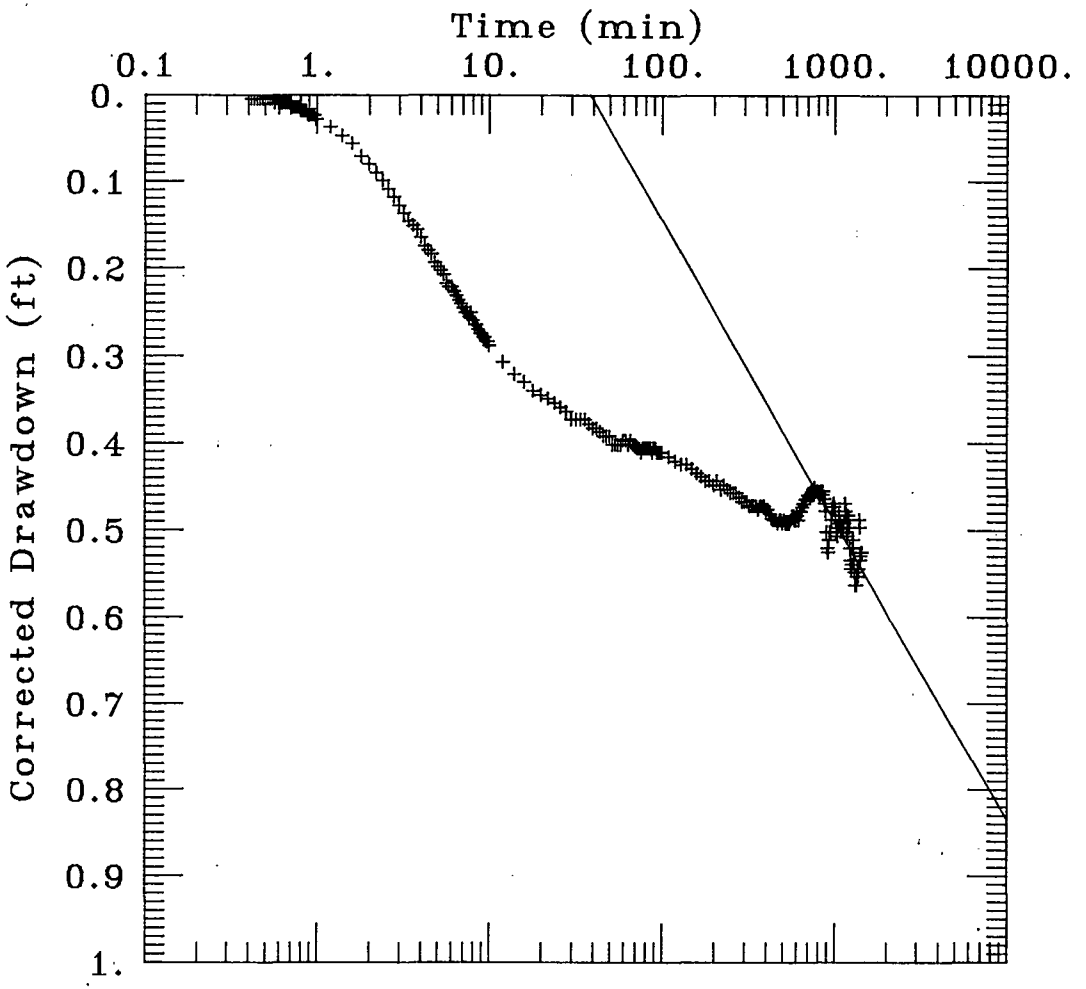
OBS. WELL:
MW-73

ESTIMATED PARAMETERS:
T = 1.551 ft^2/min
S = 0.0003803

TEST DATA:
Q = 2.81 ft^3/min
r = 108. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-73



DATA SET:
mw73p.dat
07/26/95

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Cooper-Jacob

TEST DATE:
6/21/95

TEST WELL:
MW-72

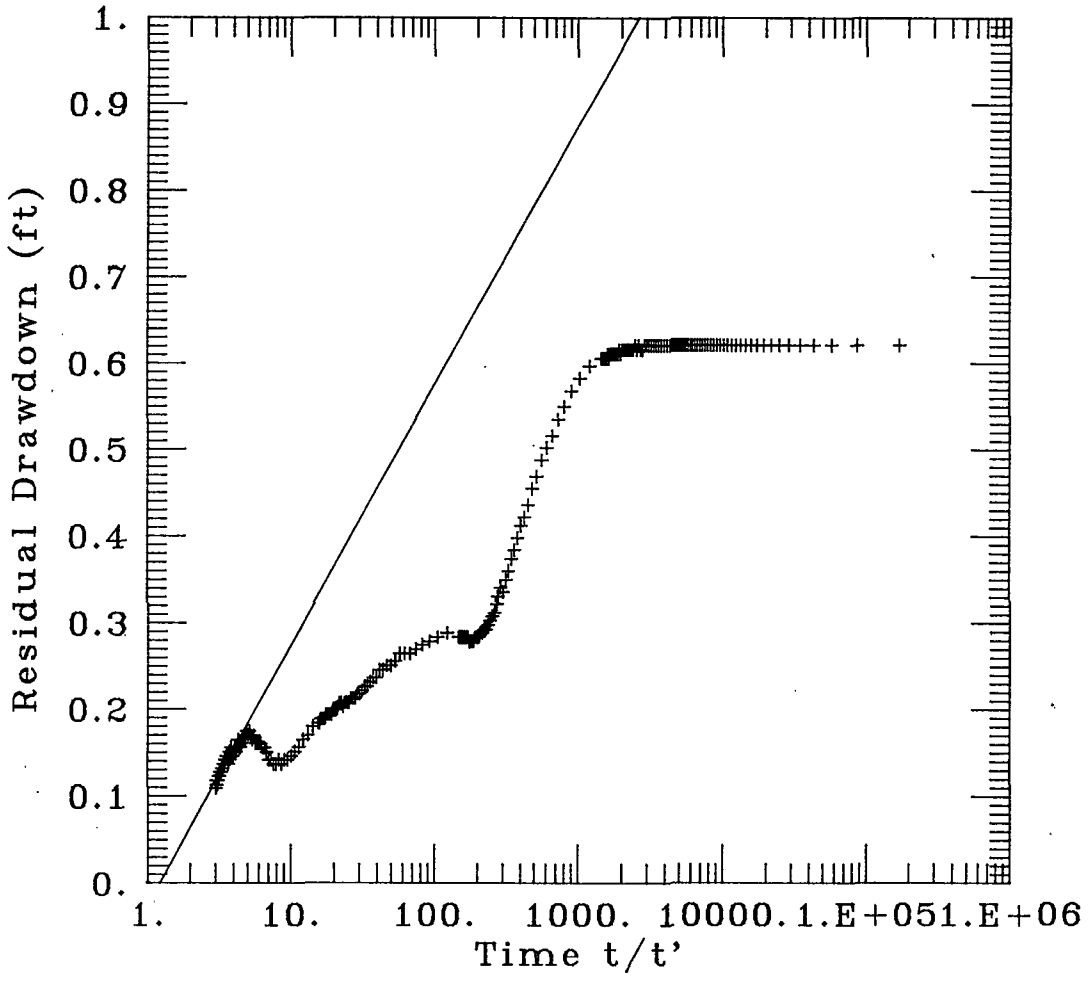
OBS. WELL:
MW-73

ESTIMATED PARAMETERS:
T = 1.461 ft^2/min
S = 0.01073

TEST DATA:
Q = 2.75 ft^3/min
r = 108. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-73 Recovery



DATA SET:
MW73R.DAT
07/26/95

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Theis Recovery

TEST DATE:
6/21/95

TEST WELL:
MW-72

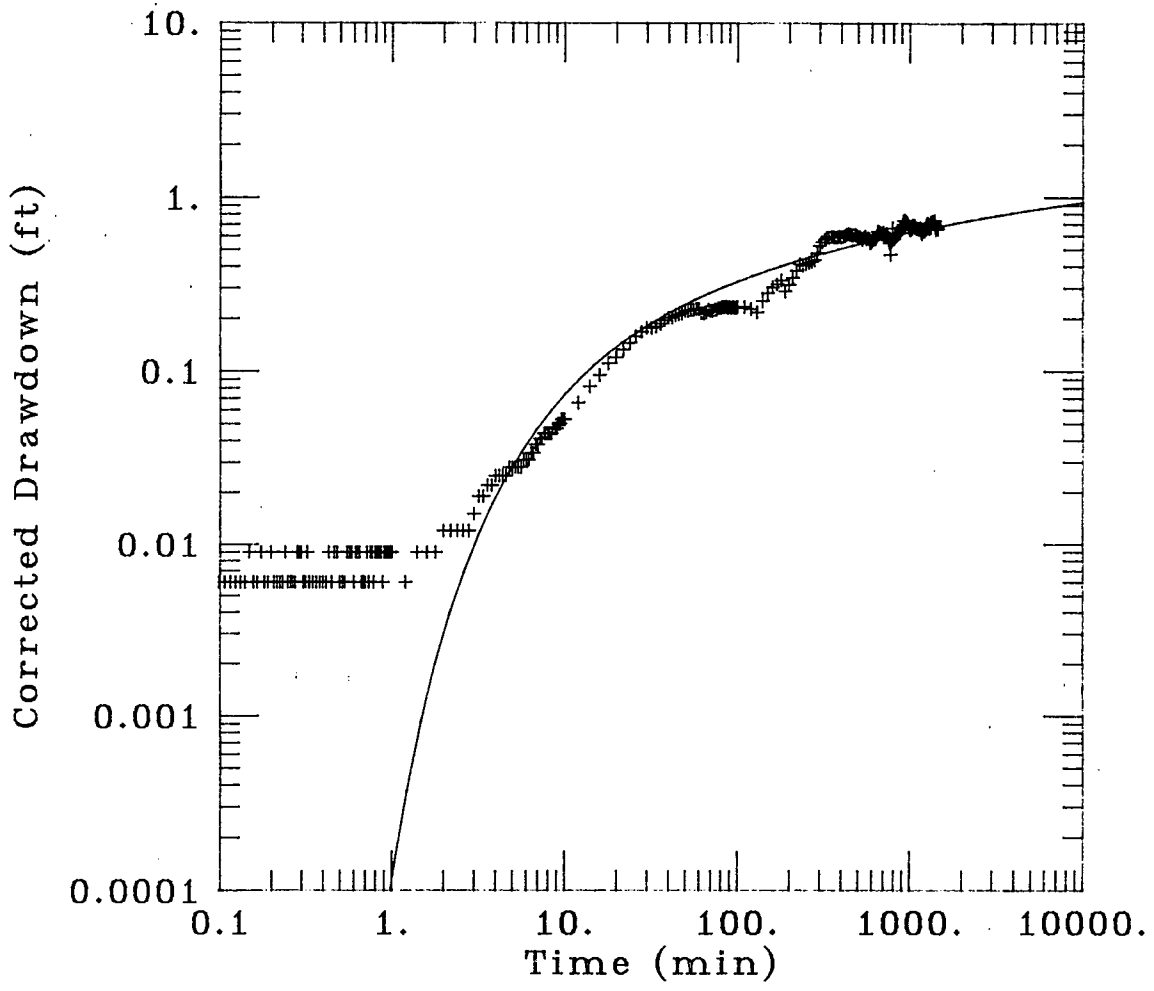
OBS. WELL:
MW-73

ESTIMATED PARAMETERS:
T = 1.68 ft^2/min
S' = 1.223

TEST DATA:
Q = 2.75 ft^3/min
t pumping = 1440. min

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-74



DATA SET:
mw74p.dat
07/28/95

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
6/21/95

TEST WELL:
MW-72

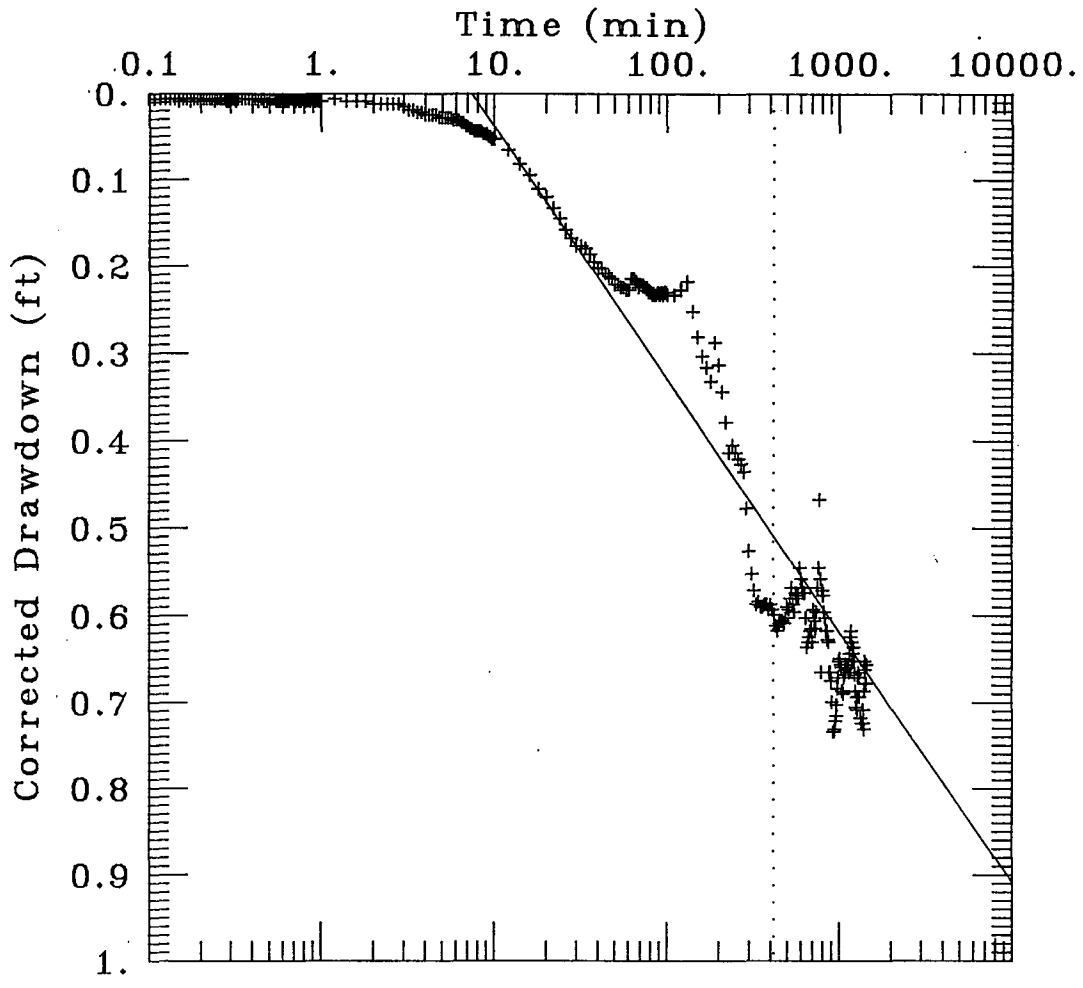
OBS. WELL:
MW-74

ESTIMATED PARAMETERS:
T = 1.662 ft^2/min
S = 0.0004162

TEST DATA:
Q = 2.75 ft^3/min
r = 280. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-74



DATA SET:
mw74p.dat
07/27/95

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Cooper-Jacob

TEST DATE:
6/21/95

TEST WELL:
MW-72

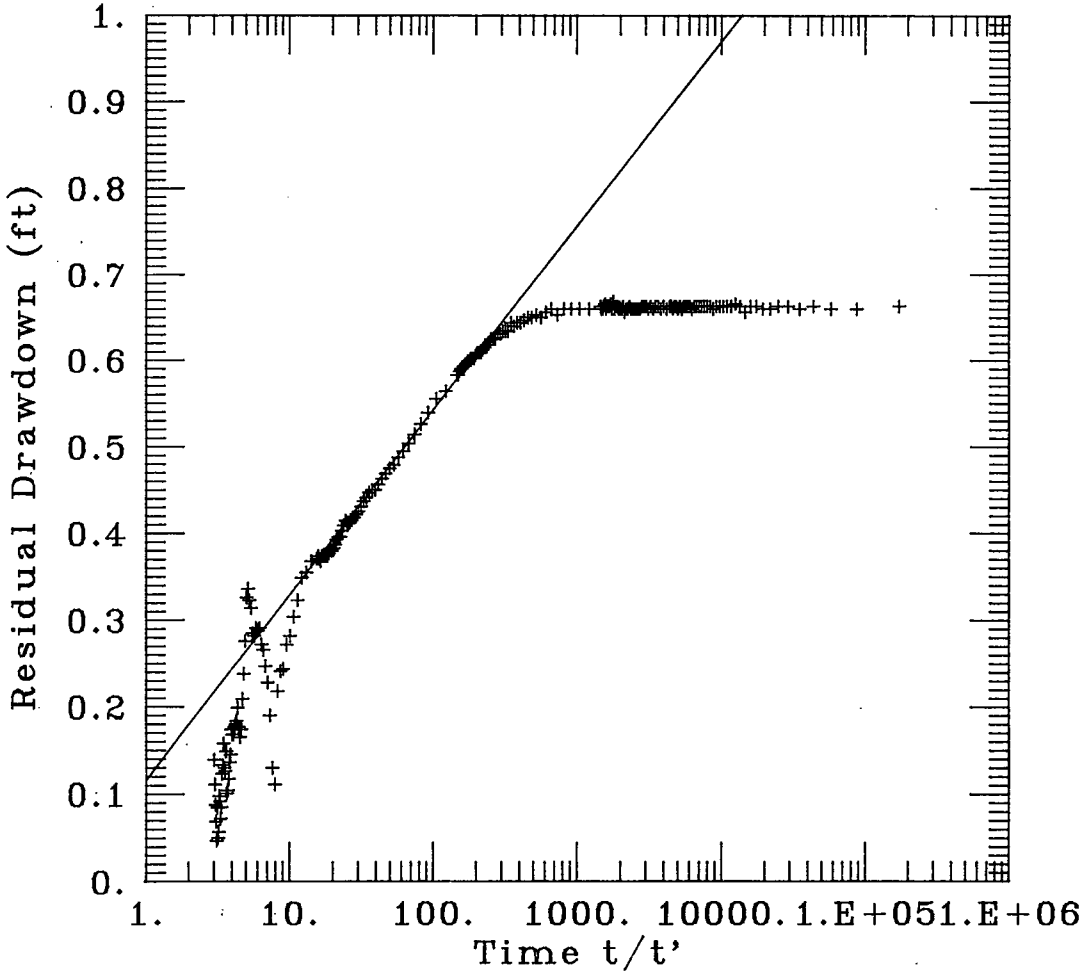
OBS. WELL:
MW-74

ESTIMATED PARAMETERS:
T = 1.74 ft^2/min
S = 0.0003661

TEST DATA:
Q = 2.75 ft^3/min
r = 280. ft
b = 53. ft

Groundwater Technology Inc.	Client: Marathon Oil Company
Project No.: 05335-0072	Location: Artesia, NM

Indian Basin Gas Plant MW-74 Recovery



DATA SET:
mw74r.dat
07/27/95

AQUIFER TYPE:
Confined
SOLUTION METHOD:
Theis Recovery
TEST DATE:
6/21/95
TEST WELL:
MW-72
OBS. WELL:
MW-74

ESTIMATED PARAMETERS:
T = 2.358 ft^2/min
S' = 0.2906

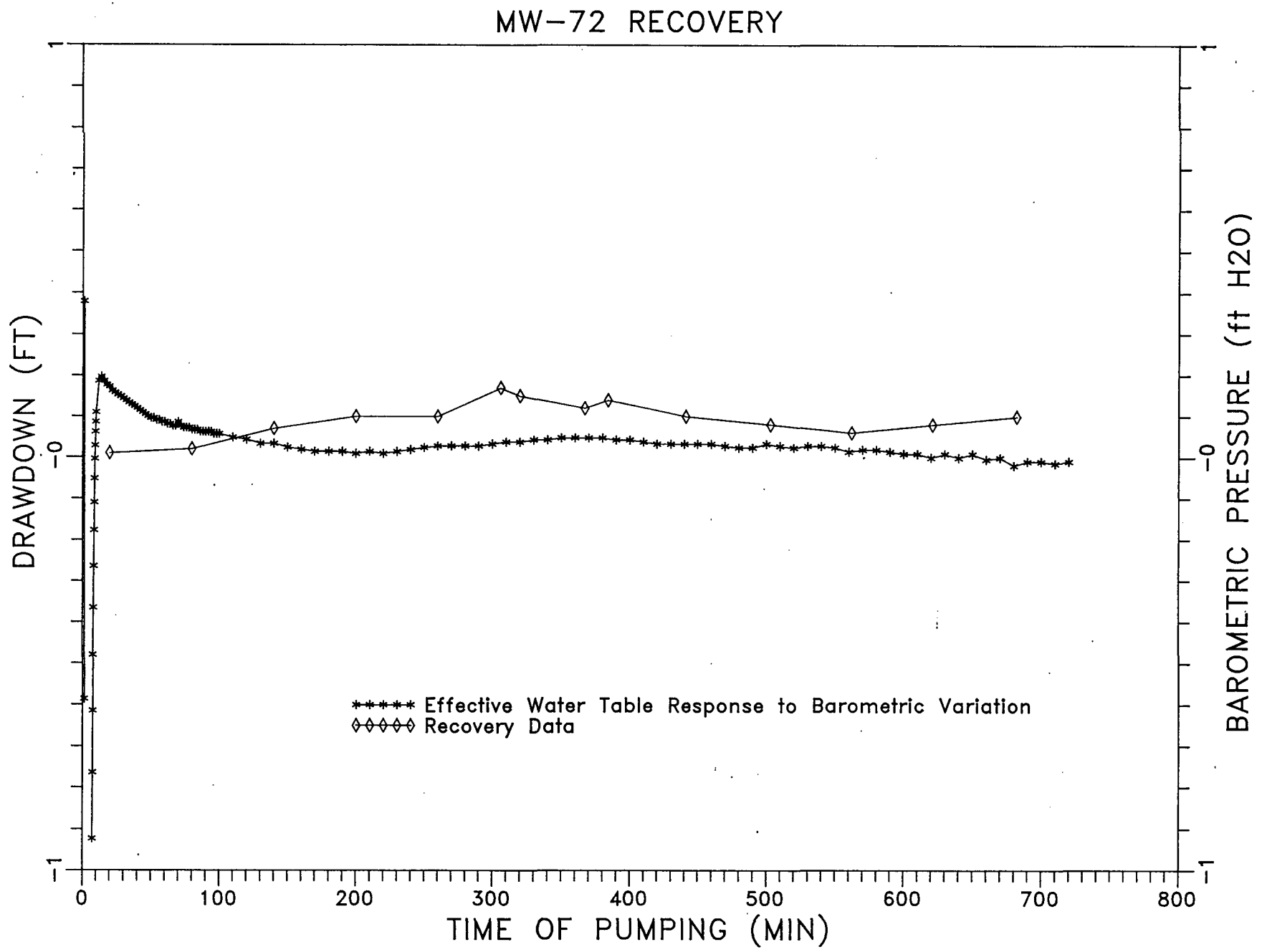
TEST DATA:
Q = 2.75 ft^3/min
t pumping = 1440. min

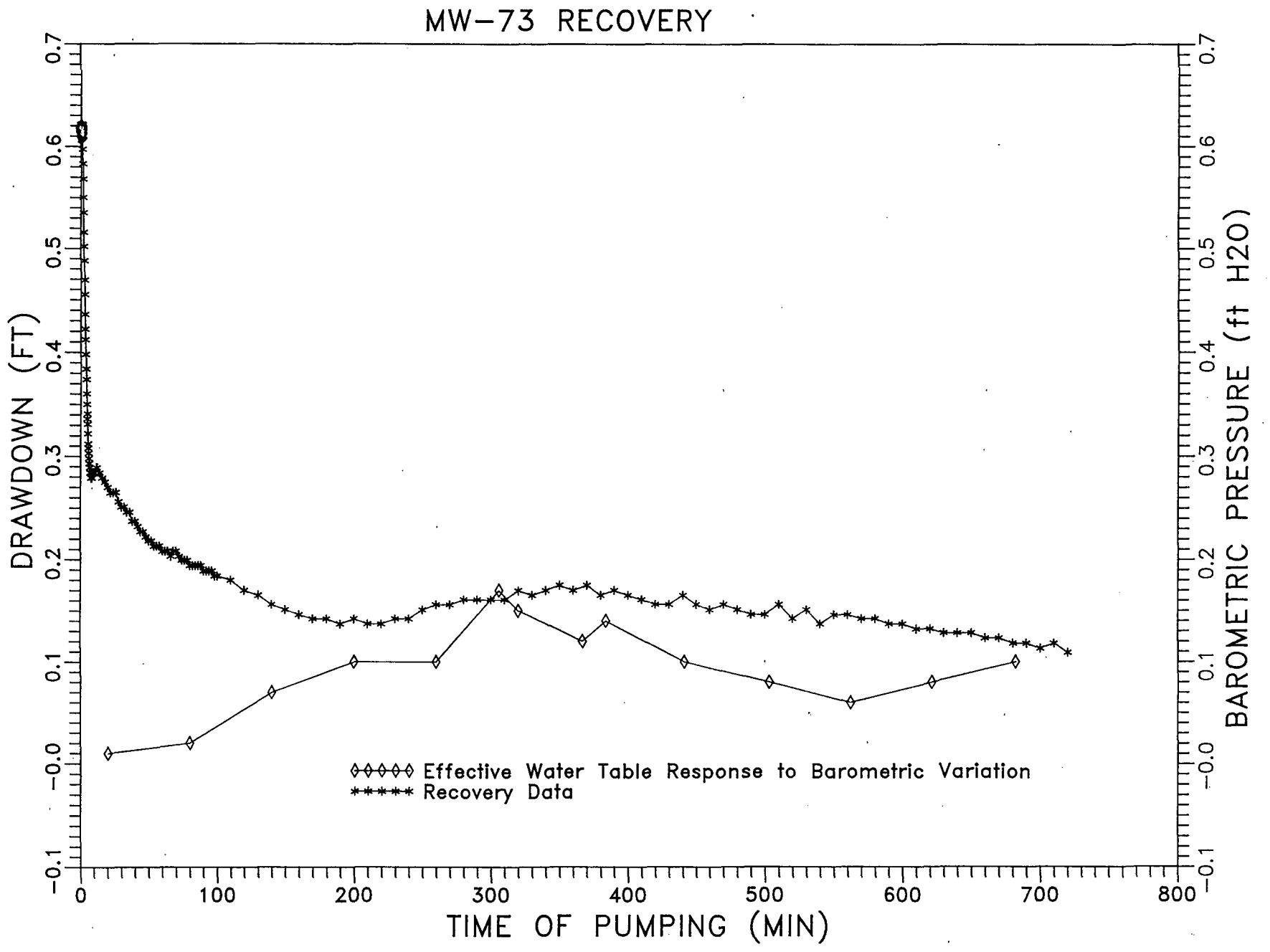
H

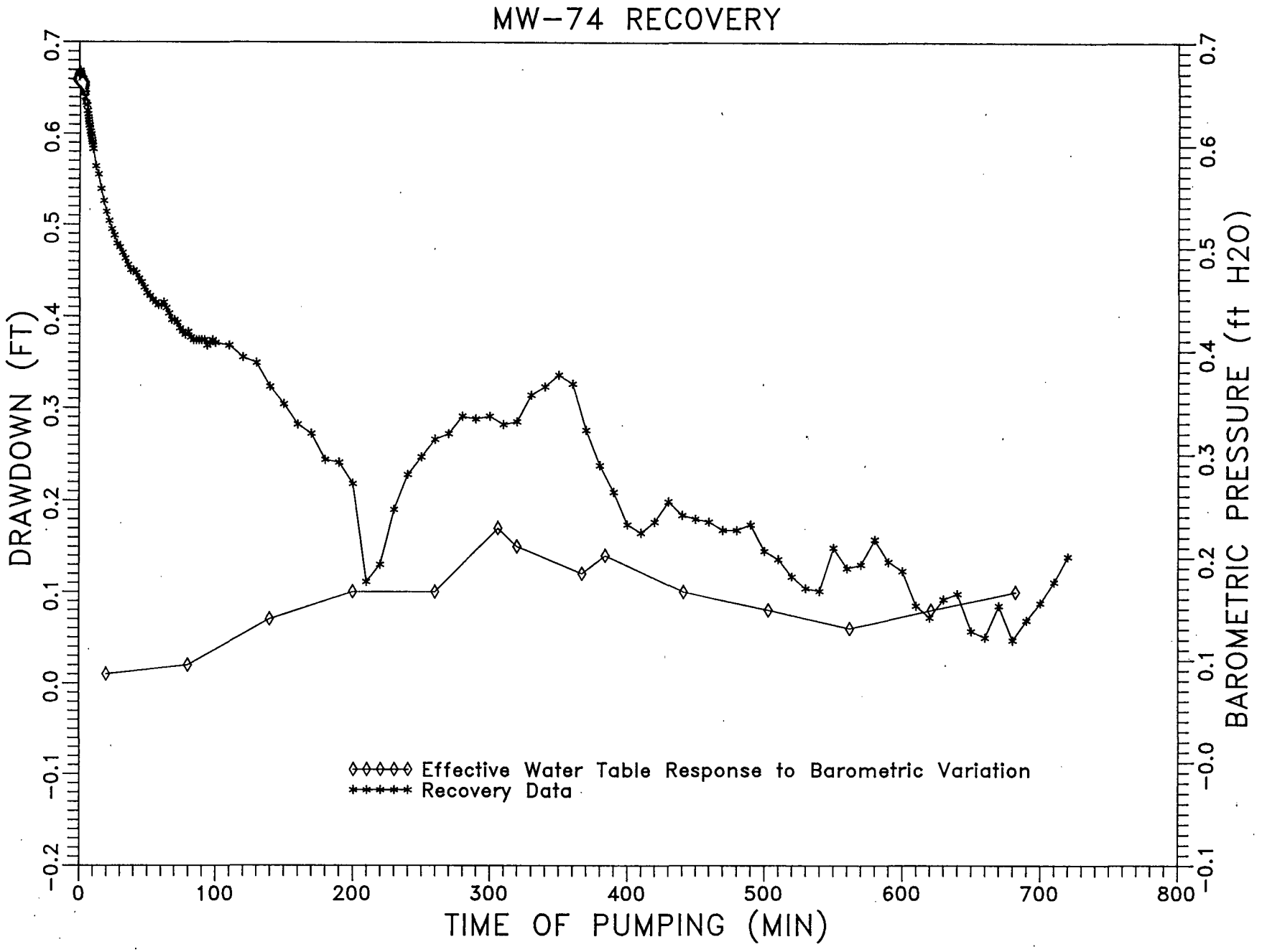
GROUNDWATER
TECHNOLOGY, INC.

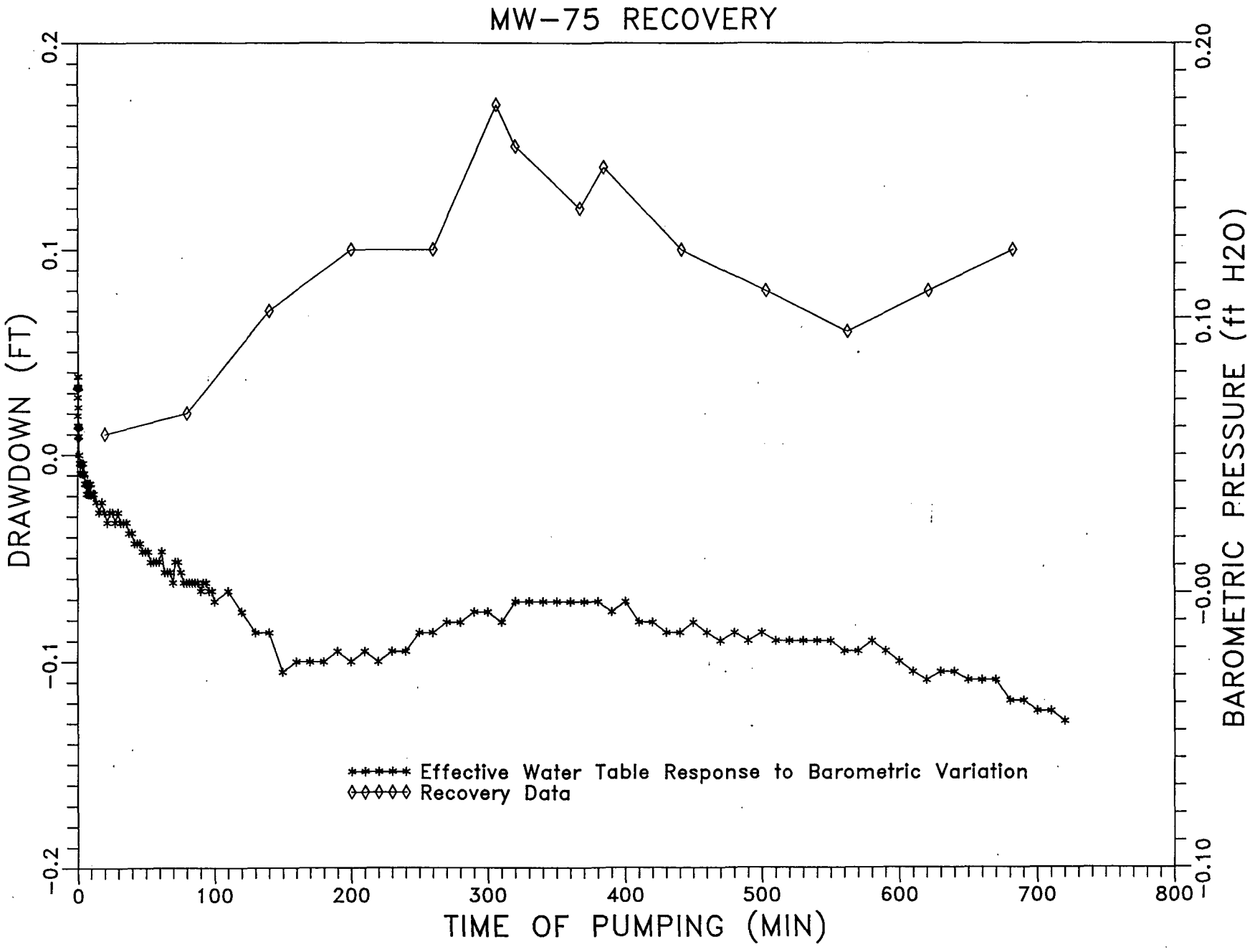
APPENDIX H

RECOVERY TEST DATA


MW-72 RECOVERY
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
0
100
200
300
400
500
600
700
800
-1
-0
-1
-0
-1
Effective Water Table Response to Barometric Variation
Recovery Data


MW-73 RECOVERY
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
0
100
200
300
400
500
600
700
800
-0.1
-0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
◊◊◊◊◊ Effective Water Table Response to Barometric Variation
***** Recovery Data


MW-74 RECOVERY
DRAWDOWN (FT)
BAROMETRIC PRESSURE (ft H2O)
TIME OF PUMPING (MIN)
0
100
200
300
400
500
600
700
800
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Effective Water Table Response to Barometric Variation
Recovery Data


MW-75 RECOVERY
DRAWDOWN (FT)
0.2
0.1
0.0
-0.1
-0.2
BAROMETRIC PRESSURE (ft H2O)
0.20
0.10
-0.00
-0.10
0
100
200
300
400
500
600
700
800
TIME OF PUMPING (MIN)
Effective Water Table Response to Barometric Variation
Recovery Data

Recovery Data
Marathon Indian Basin Gas Plant
Artesia, NM

SE2000
Environmental Logger
06/22 01:30

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	MW-72	MW-73	MW-74	MW-75

Step 1 06/22 01:30:06

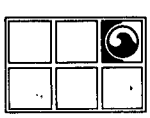
ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
0.0000	14.525	0.621	0.660	0.000
0.0083	14.415	0.621	0.663	0.014
0.0166	14.229	0.621	0.660	0.019
0.0250	13.999	0.621	0.660	0.028
0.0333	13.831	0.621	0.663	0.028
0.0416	13.673	0.621	0.660	0.033
0.0500	13.453	0.621	0.663	0.033
0.0583	13.367	0.621	0.663	0.033
0.0666	13.204	0.621	0.660	0.033
0.0750	13.017	0.621	0.660	0.033
0.0833	12.845	0.621	0.663	0.033
0.0916	12.692	0.621	0.663	0.033
0.1000	12.515	0.621	0.656	0.033
0.1083	12.381	0.621	0.663	0.033
0.1166	12.232	0.621	0.666	0.033
0.1250	12.045	0.621	0.663	0.033
0.1333	11.868	0.621	0.663	0.038
0.1416	11.763	0.621	0.663	0.033
0.1500	11.552	0.621	0.663	0.033
0.1583	11.399	0.621	0.663	0.033
0.1666	11.346	0.621	0.660	0.033
0.1750	11.173	0.621	0.663	0.033
0.1833	11.054	0.621	0.663	0.033
0.1916	10.896	0.621	0.663	0.038
0.2000	10.785	0.621	0.663	0.033
0.2083	10.589	0.621	0.663	0.033
0.2166	10.517	0.621	0.663	0.033
0.2250	10.297	0.621	0.663	0.038
0.2333	10.287	0.621	0.660	0.033
0.2416	10.105	0.621	0.663	0.033
0.2500	9.975	0.621	0.663	0.038
0.2583	9.817	0.621	0.663	0.033
0.2666	9.726	0.621	0.663	0.033
0.2750	9.582	0.621	0.660	0.033
0.2833	9.453	0.621	0.663	0.033
0.2916	9.314	0.621	0.660	0.033
0.3000	9.175	0.621	0.663	0.033
0.3083	9.065	0.621	0.663	0.033
0.3166	8.959	0.621	0.660	0.033

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
0.3250	8.772	0.621	0.663	0.033
0.3333	8.667	0.621	0.663	0.033
0.3500	8.432	0.621	0.660	0.023
0.3666	8.192	0.621	0.663	0.014
0.3833	7.914	0.621	0.660	0.014
0.4000	7.722	0.621	0.663	0.014
0.4166	7.501	0.621	0.663	0.014
0.4333	7.242	0.621	0.660	0.014
0.4500	6.988	0.621	0.663	0.014
0.4666	6.806	0.621	0.660	0.014
0.4833	6.585	0.621	0.663	0.014
0.5000	6.359	0.621	0.663	0.014
0.5166	6.100	0.616	0.663	0.014
0.5333	5.851	0.616	0.660	0.014
0.5500	5.678	0.621	0.660	0.014
0.5666	5.457	0.616	0.660	0.014
0.5833	5.275	0.621	0.660	0.014
0.6000	5.088	0.616	0.660	0.014
0.6166	4.900	0.616	0.660	0.014
0.6333	4.747	0.616	0.663	0.014
0.6500	4.588	0.616	0.660	0.014
0.6666	4.377	0.616	0.660	0.014
0.6833	4.223	0.616	0.656	0.014
0.7000	4.060	0.616	0.663	0.014
0.7166	3.945	0.616	0.660	0.014
0.7333	3.767	0.611	0.660	0.014
0.7500	3.589	0.616	0.660	0.014
0.7666	3.445	0.611	0.663	0.014
0.7833	3.301	0.611	0.663	0.014
0.8000	3.200	0.611	0.660	0.014
0.8166	3.008	0.611	0.669	0.009
0.8333	2.854	0.611	0.660	0.014
0.8500	2.730	0.611	0.666	0.014
0.8666	2.576	0.611	0.663	0.014
0.8833	2.465	0.606	0.663	0.009
0.9000	2.326	0.611	0.663	0.009
0.9166	2.206	0.606	0.660	0.009
0.9333	2.076	0.606	0.666	0.009
0.9500	1.956	0.606	0.663	0.009
0.9666	1.836	0.606	0.660	0.009
0.9833	1.711	0.606	0.660	0.009
1.0000	1.600	0.606	0.663	0.009
1.2000	0.379	0.597	0.660	0.000
1.4000	-0.586	0.583	0.660	0.000
1.6000	-1.380	0.568	0.660	-0.004
1.8000	-2.025	0.550	0.660	-0.004
2.0000	-2.564	0.535	0.653	-0.009
2.2000	-2.968	0.516	0.660	-0.004
2.4000	-3.305	0.502	0.656	-0.004
2.6000	-3.574	0.488	0.650	-0.004
2.8000	-3.772	0.469	0.653	-0.004
3.0000	-3.926	0.455	0.650	-0.004
3.2000	-4.041	0.436	0.650	-0.004
3.4000	-4.114	0.422	0.647	-0.009
3.6000	-4.152	0.412	0.644	-0.009
3.8000	-4.147	0.398	0.644	-0.009
4.0000	-4.123	0.384	0.640	-0.009

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
4.2000	-4.065	0.374	0.644	-0.009
4.4000	-3.974	0.360	0.634	-0.004
4.6000	-3.863	0.350	0.634	-0.009
4.8000	-3.733	0.336	0.634	-0.009
5.0000	-3.579	0.341	0.631	-0.009
5.2000	-3.377	0.331	0.631	-0.009
5.4000	-3.103	0.322	0.625	-0.014
5.6000	-2.838	0.312	0.625	-0.014
5.8000	-2.592	0.308	0.625	-0.014
6.0000	-2.352	0.303	0.621	-0.014
6.2000	-2.121	0.298	0.618	-0.014
6.4000	-1.904	0.293	0.615	-0.014
6.6000	-1.688	0.293	0.612	-0.014
6.8000	-1.481	0.289	0.609	-0.019
7.0000	-1.279	0.289	0.609	-0.014
7.2000	-1.096	0.284	0.609	-0.014
7.4000	-0.923	0.284	0.606	-0.014
7.6000	-0.764	0.284	0.602	-0.014
7.8000	-0.615	0.279	0.602	-0.019
8.0000	-0.480	0.279	0.602	-0.019
8.2000	-0.365	0.279	0.599	-0.019
8.4000	-0.264	0.279	0.599	-0.019
8.6000	-0.177	0.284	0.596	-0.019
8.8000	-0.110	0.284	0.593	-0.019
9.0000	-0.052	0.284	0.593	-0.014
9.2000	-0.004	0.284	0.590	-0.014
9.4000	0.028	0.284	0.590	-0.014
9.6000	0.062	0.284	0.587	-0.014
9.8000	0.086	0.284	0.583	-0.019
10.0000	0.110	0.284	0.583	-0.019
12.0000	0.187	0.289	0.564	-0.019
14.0000	0.197	0.284	0.555	-0.023
16.0000	0.187	0.279	0.539	-0.028
18.0000	0.177	0.275	0.526	-0.023
20.0000	0.173	0.270	0.514	-0.028
22.0000	0.163	0.265	0.504	-0.033
24.0000	0.158	0.265	0.495	-0.028
26.0000	0.153	0.265	0.488	-0.028
28.0000	0.149	0.256	0.479	-0.033
30.0000	0.144	0.251	0.475	-0.028
32.0000	0.139	0.251	0.469	-0.033
34.0000	0.134	0.246	0.463	-0.033
36.0000	0.129	0.246	0.456	-0.033
38.0000	0.125	0.237	0.450	-0.038
40.0000	0.120	0.237	0.450	-0.038
42.0000	0.115	0.232	0.447	-0.043
44.0000	0.110	0.227	0.441	-0.043
46.0000	0.105	0.227	0.437	-0.043
48.0000	0.100	0.222	0.431	-0.047
50.0000	0.096	0.218	0.425	-0.047
52.0000	0.096	0.218	0.422	-0.047
54.0000	0.091	0.213	0.418	-0.052
56.0000	0.091	0.213	0.415	-0.052
58.0000	0.086	0.213	0.412	-0.052
60.0000	0.086	0.208	0.412	-0.052
62.0000	0.081	0.208	0.415	-0.047
64.0000	0.081	0.208	0.409	-0.057

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
66.0000	0.076	0.203	0.403	-0.057
68.0000	0.076	0.208	0.396	-0.057
70.0000	0.086	0.208	0.396	-0.062
72.0000	0.076	0.203	0.393	-0.052
74.0000	0.072	0.199	0.387	-0.052
76.0000	0.072	0.199	0.383	-0.057
78.0000	0.072	0.199	0.380	-0.062
80.0000	0.067	0.194	0.383	-0.062
82.0000	0.067	0.194	0.377	-0.062
84.0000	0.067	0.194	0.374	-0.062
86.0000	0.062	0.194	0.374	-0.062
88.0000	0.062	0.194	0.374	-0.062
90.0000	0.062	0.189	0.374	-0.066
92.0000	0.062	0.189	0.374	-0.062
94.0000	0.062	0.189	0.368	-0.062
96.0000	0.057	0.189	0.371	-0.066
98.0000	0.057	0.184	0.374	-0.066
100.000	0.057	0.184	0.371	-0.071
110.000	0.048	0.180	0.368	-0.066
120.000	0.043	0.170	0.355	-0.076
130.000	0.033	0.165	0.349	-0.086
140.000	0.033	0.156	0.323	-0.086
150.000	0.024	0.151	0.304	-0.105
160.000	0.019	0.146	0.282	-0.100
170.000	0.014	0.142	0.272	-0.100
180.000	0.014	0.142	0.244	-0.100
190.000	0.014	0.137	0.241	-0.095
200.000	0.009	0.142	0.218	-0.100
210.000	0.014	0.137	0.111	-0.095
220.000	0.009	0.137	0.130	-0.100
230.000	0.014	0.142	0.190	-0.095
240.000	0.019	0.142	0.228	-0.095
250.000	0.024	0.151	0.247	-0.086
260.000	0.028	0.156	0.266	-0.086
270.000	0.028	0.156	0.272	-0.081
280.000	0.028	0.161	0.291	-0.081
290.000	0.028	0.161	0.288	-0.076
300.000	0.033	0.161	0.291	-0.076
310.000	0.038	0.161	0.282	-0.081
320.000	0.038	0.170	0.285	-0.071
330.000	0.043	0.165	0.314	-0.071
340.000	0.043	0.170	0.323	-0.071
350.000	0.048	0.175	0.336	-0.071
360.000	0.048	0.170	0.326	-0.071
370.000	0.048	0.175	0.276	-0.071
380.000	0.048	0.165	0.238	-0.071
390.000	0.043	0.170	0.209	-0.076
400.000	0.043	0.165	0.174	-0.071
410.000	0.038	0.161	0.165	-0.081
420.000	0.033	0.156	0.177	-0.081
430.000	0.033	0.156	0.199	-0.086
440.000	0.033	0.165	0.184	-0.086
450.000	0.033	0.156	0.180	-0.081
460.000	0.033	0.151	0.177	-0.086
470.000	0.028	0.156	0.168	-0.090
480.000	0.024	0.151	0.168	-0.086
490.000	0.024	0.146	0.174	-0.090

ELAPSED TIME	DRAWDOWN (FT)			
	MW-72	MW-73	MW-74	MW-75
500.000	0.033	0.146	0.145	-0.086
510.000	0.028	0.156	0.136	-0.090
520.000	0.024	0.142	0.117	-0.090
530.000	0.028	0.151	0.104	-0.090
540.000	0.028	0.137	0.101	-0.090
550.000	0.024	0.146	0.149	-0.090
560.000	0.014	0.146	0.126	-0.095
570.000	0.019	0.142	0.130	-0.095
580.000	0.019	0.142	0.158	-0.090
590.000	0.014	0.137	0.133	-0.095
600.000	0.009	0.137	0.123	-0.100
610.000	0.009	0.132	0.085	-0.105
620.000	0.000	0.132	0.072	-0.109
630.000	0.009	0.128	0.092	-0.105
640.000	0.000	0.128	0.098	-0.105
650.000	0.009	0.128	0.057	-0.109
660.000	-0.004	0.123	0.050	-0.109
670.000	0.000	0.123	0.085	-0.109
680.000	-0.019	0.118	0.047	-0.119
690.000	-0.009	0.118	0.069	-0.119
700.000	-0.009	0.113	0.088	-0.124
710.000	-0.014	0.118	0.111	-0.124
720.000	-0.009	0.109	0.139	-0.129



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SOIL VAPOR EXTRACTION PILOT TEST REPORT
MARATHON OIL COMPANY
INDIAN BASIN REMEDIATION PROJECT
18 MILES NORTHWEST OF CARLSBAD, NEW MEXICO
DECEMBER 1994 - JANUARY 1995

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EXECUTIVE SUMMARY

Groundwater Technology performed a series of soil vapor extraction pilot tests at the Marathon Oil Company Indian Basin Remediation Project site located 18 miles northwest of Carlsbad, New Mexico in December 1994, and January 1995. The pilot test objectives were to:

- Quantitatively evaluate the feasibility and effectiveness of soil vapor extraction technology for source reduction in the shallow zone and Lower Queen Formation; and
- Provide data necessary to evaluate the number of additional vapor extraction wells required to adequately cover the known extent of natural gas condensate in the subsurface, and to provide engineering criteria to design full scale soil vapor extraction system(s) at the site.

The following pilot tests were conducted at the site:

- Two short-term pilot tests were completed in the shallow alluvial zone;
- One short-term pre-pilot test was conducted to determine blower specifications for full-scale pilot testing within the Lower Queen Formation;
- One long-term pilot test was conducted within the Lower Queen Formation; and
- Two short-term pilot tests were conducted within the Lower Queen Formation to evaluate vapor flow, mass emissions and the effects (if any) on the shallow zone formation.

The shallow zone tests yielded useful data that will be used to design an effective soil vapor extraction system. The induced vacuum as a result of venting the shallow zone (upper alluvial zone) was observed in wells up to 151 feet away from the vapor extraction wells. The calculated shallow zone well effective radii of influence ranged approximately 64 feet to 74 feet for removal of adsorbed phase hydrocarbons at flow rates of 160 to 170 standard cubic feet per minute (scfm) and 14 to 25 inches of water applied vacuum.

The induced vacuum as a result of venting the Lower Queen Formation at 25 to 220 feet below grade was observed in wells located up to 2,000 feet away from the vapor extraction wells. The estimated effective radius of influence ranged from approximately 200 feet to 2,000 feet at flow rates

of 95 to 150 scfm and 2 to 9.5 inches of mercury applied vacuum. During testing, the induced vacuum at the monitoring wells appeared to fluctuate with changes in barometric pressure. However, two of the monitoring wells located at distances of 106 and 1,000 feet from the vent well showed no significant induced vacuum. This response suggests preferential flowpaths are present within the fractured lithology in the Lower Queen Formation. Venting within the Lower Queen Formation does not appear to have any effect on the shallow alluvial zone.

Hydrocarbon removal rates are dependent upon air flow through the subsurface and existing adsorbed phase hydrocarbon concentrations. Based on the results of pilot testing in the shallow alluvial zone, hydrocarbon removal rates of 14.6 lbs/hr and benzene removal rates of 0.07 lbs/hr are obtainable at this site at flow rates of approximately 170 scfm. Hydrocarbon removal rates from the Lower Queen Formation of 3.29 lbs/hr and benzene removal rates of 0.013 lbs/hr are obtainable at flow rates of 95 scfm.

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C VENT-ROI Analyses (VEW-1S & MW-18)
D Mass Extraction Rate Calculations
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1.0 INTRODUCTION

In December 1994 and January 1995, Groundwater Technology conducted short term and long term soil vent pilot tests at the Marathon Oil Company (MOC) Indian Basin Remediation Project site. Work was performed generally in accordance with the *Workplan for Soil Vapor Extraction Pilot Testing* (Groundwater Technology, December 1994). The objectives of the pilot testing activities were to:

- Quantitatively evaluate the feasibility and effectiveness of soil vapor extraction technology for source reduction in the shallow zone and Lower Queen Formation; and
- Provide data necessary to evaluate the number of additional vapor extraction wells required to adequately cover the known extent of natural gas condensate in the subsurface, and to provide engineering criteria to design full scale soil vapor extraction systems (SVESs) at the site.

The following activities were conducted:

- Installation of additional monitoring wells for a monitoring network in the shallow alluvial zone (MW-77 through MW-80) and in the Lower Queen Formation (MW-73 through MW-76) in November and December 1994;
- Video logging of four open boreholes to determine the occurrence, nature, and orientation of fractures in the Lower Queen Formation on January 4-5, 1995.
- Two short-term (4 to 5 hours) pilot tests on wells VEW-1S and MW-18, completed in the shallow alluvial zone on December 12-13, 1994;
- One short-term (4 hours) pre-test on well MW-73 to determine blower specifications for pilot testing on the Lower Queen wells on December 14, 1994;
- One long-term (49 hours) pilot test on well MW-73 on January 17-18, 1995; and
- Two short term (4 to 8 hours) pilot tests on wells MW-67 and MW-68 on January 20, 1995.

Pilot testing was conducted at this site to establish vacuum and flow response from the extraction wells, and determine radius of influence of the extraction wells to design an effective remedial system. Preliminary activities conducted prior to pilot testing are specified in Section 2.0. The methods used during testing are described in Section 3.0. The pilot test results are presented in Section 4.0. Preliminary design considerations are presented in Section 5.0, and report conclusions are provided in Section 6.0.

2.0 PRELIMINARY ACTIVITIES FOR PILOT TEST

Several tasks were completed before the pilot testing was performed. These tasks include regulatory notification, well installation and a downhole video survey of wells completed in the Lower Queen Formation. A summary of these activities are presented in the following sections.

2.1 Regulatory Notification

Prior to conducting field activities, Groundwater Technology contacted the New Mexico Environment Department (NMED) Air Quality Control Bureau (Mr. Jim Shively) regarding the necessity for registration or vapor abatement during the course of pilot testing. Mr. Shively indicated that no registration or vapor controls were necessary.

2.2 Well Installations

Three wells (MW-73, MW-74 and MW-75) were installed between November 29 and December 12, 1994 for pilot testing. Drilling logs have been provided in a letter report dated March 3, 1995 to MOC. Well construction information for these wells is also presented in Table 1.

2.3 Downhole Video Survey

Subsequent to drilling, a downhole video survey was conducted on January 4, 1995 in wells MW-73, MW-74, MW-75 and MW-76. The goal of this activity was to evaluate the occurrence and nature of fractures and water-bearing zones within the Lower Queen Formation. The results of this survey are presented in a letter transmittal to MOC dated January 13, 1995.

3.0 SVES PILOT TESTS

A series of soil vapor extraction pilot tests were conducted on wells installed in the shallow zone and Lower Queen Formation. The objectives of the pilot tests were to determine the following information:

- The effective radius of influence for proposed SVES's at the site;
- Engineering criteria and equipment specifications for use in designing full-scale SVES's; and
- Hydrocarbon mass extraction rates for selection of air emissions treatment methodology.

The following sections describe the pilot tests which were conducted in the shallow alluvial zone and Lower Queen Formation at the site.

3.1 Soil Vent Pilot Test Monitoring Equipment

Blower performance and vacuum were monitored using pre- and post-filter Ashcroft vacuum gauges with a range of 0 to 100 inches of water or a range of 0 to 20 inches of mercury. Air velocity measurements were obtained using a Dwyer Instruments Model 470 thermal anemometer calibrated to manufacturer's specifications. Ambient air temperature and process flow temperatures were measured using an Omega HH-70KF pocket thermometer. Organic vapor concentrations were monitored using a calibrated Photovac Microtip HS 3000 photoionization detector. A calibrated Industrial Scientific LTX-310 3-gas meter was used to monitor H_2S/LEL/O_2.

3.2 Shallow Zone Soil Vapor Extraction Pilot Tests

Two short-term soil vent pilot tests were conducted in the shallow zone at the site:

- A first test was conducted on monitoring well MW-18. This test provided radius of influence and emissions concentration data located east of the gas plant; and
- A second test was conducted on VEW-1S located approximately 1,000 feet southeast of the gas plant and north of Rocky Arroyo to determine the effective radius of influence in the shallow zone in an additional area of the site.

The location of wells used during the shallow zone pilot tests are shown on the site plan in Figure 1. A summary of screened intervals for all wells used in the pilot tests are included in Table 1. The first shallow zone pilot test was conducted using an existing monitoring well (MW-18) as the test well.

Wells MW-19, MW-20, and MW-24, located 200 to 236 feet from MW-18, were used as monitor points (Figure 1).

The existing extraction well (VEW-1S) which was previously used by ESE during their pilot testing in 1991 (ESE, 1992), was used as the second test well. Existing wells (MW-A, MW-B, MW-C, MW-2, MW-13, MW-14, MW-15, MW-33, and MW-34) were used as the observation wells to measure induced vacuum response. MW-A, MW-B and MW-C correspond to ESE wells MW-1, MW-2 and MW-3, respectively. These monitor points generally form a radial pattern around the test well at distances of 4 to 229 feet, which provided multidirectional data at varying distances from the test well.

3.2.1 Shallow Zone Pilot Testing Protocol

The shallow zone pilot tests were conducted by attaching a 5-horsepower (5 HP) regenerative vacuum blower with an explosion-proof motor to the extraction wells. The blower system included a particulate filter, vacuum gauges, and an ambient air intake valve to control flow/vacuum. Extracted vapors were direct-discharged to the atmosphere.

The duration of the pilot tests were scheduled for four to eight hours, or until induced vacuum in surrounding monitor points and offgas concentrations stabilized. The pilot test on VEW-1S was run for 5.75 hours, while the pilot test on MW-18 ran for 4.25 hours. The following parameters were monitored during the tests at 15-minute intervals for the first elapsed hour and at 30-minute intervals for the remainder of each test:

- Pre- and post-filter vacuum at the blowers;
- Induced vacuum at surrounding monitor points;
- Applied vacuum at the vapor extraction wellhead;
- Pre- and post-blower air stream temperature;
- Process air stream velocity; and
- Air effluent organic vapor concentration, H_2S, O_2 and percent LEL.

The field logs used for data collection during the pilot testing are included in Appendix A.

A pilot venting step-test was conducted on well VEW-1S to aid in specifying the optimal air flow for a full-scale SVES. During this step-test, varying degrees of vacuum (100%, 75%, 50%, and 25% of blower capacity) were applied to VEW-1S and the vacuum and air flow rate at the wellhead were measured. During each step, induced vacuum was measured in the surrounding monitor points.

One vapor sample was collected during each of the two shallow zone pilot tests on wells VEW-1S and MW-18. The air samples were collected near the end of each test for evaluation of vapor extraction well performance during the pilot tests. The vapor samples were collected in Summa Canisters from an air sampling port located on the blower exhaust stack. The vapor samples were maintained at ambient air temperatures until receipt by the laboratory. Chain-of-Custody documentation was completed for each sample collected; samples were delivered to Analytical Technologies, Inc. (ATI) within one week of collection. Vapor samples were analyzed for total nonmethane hydrocarbons (EPA TO-14), purgeable aromatics and halocarbons (EPA 8010/8020), and methane, carbon dioxide, and oxygen (GC-TCD); certified laboratory analytical testing results are presented in Appendix B.

3.3 Lower Queen Soil Vapor Extraction Pilot Tests

3.3.1 Lower Queen Pre-Pilot Test

Prior to conducting the full-scale pilot tests on the Lower Queen, a pre-pilot test was conducted on well MW-73 at the site. The objective of this pre-test was to determine the optimum blower type and size for conducting the full-scale, extended pilot tests on the Lower Queen. The pre-test was conducted on MW-73 using a 5 HP regenerative vacuum blower. The test was run for 4.25 hours over which time the blower vacuum and the air flow rate were monitored. Prior to ending the test, induced vacuum was also measured in surrounding monitoring wells (MW-72, MW-74 and MW-75) to determine the zone of influence. These data were used to size the blower equipment for the full-scale tests. The pre-test indicated a relatively moderate air flow and high vacuum pump would be required for the full-scale test.

3.3.2 Lower Queen Full-Scale Pilot Tests

Following completion of the pre-pilot test, three pilot tests were conducted to determine the feasibility and effective zone of influence while venting on the Lower Queen dolomite. Each of these tests are described below in greater detail. A summary of screened intervals for the pre-existing and recently installed wells used for the tests are included in Table 1.

One long-term pilot test was conducted in the eastern portion of the site on monitoring well MW-73 (Figure 1). A long-term test was recommended to establish flow paths via vertical and horizontal fractures in the dolomite and to observe whether or not an extended zone of influence (greater than 500 to 1,000 feet) developed over time. The duration of this test was 49 hours. One extraction well (MW-73) and two monitor points (MW-74 and MW-75) were installed to total approximate depths of 220 feet for use in this test. Existing wells MW-58, MW-59, MW-72, MW-61 and MW-61A were also used as monitor points to measure induced vacuum. These wells were used to form an array of monitor points in a radial pattern around MW-73, at distances ranging from 106 to 2,000 feet (Figure 1).

A second pilot test was performed using well MW-67 as the extraction well. The duration of this test was 8.25 hours. This test was conducted to determine air flow and offgas concentrations for venting in this area of the site. Though groundwater samples analyzed from MW-67 have yielded nondetectable (<0.5 micrograms per liter [ug/l]) benzene concentrations over the previous three quarters (October 1993 - April 1994), a very strong hydrocarbon odor emanates from this well upon removal of the well cap, indicating potential hydrocarbon impact to the vadose zone (headspace readings on drill cuttings during original well installation exceeded 290-300 ppmv at depths of approximately 58 and 94 feet).

A third pilot test was conducted on monitoring well MW-68. The purpose of this test was to determine the effect on the shallow zone while venting on the deep zone and the relative degree (if any) of interconnectedness between the two zones. MW-68 (screened from 148 to 199 feet) was used as the test well, while monitoring wells MW-8, MW-20, MW-21, MW-24, and MW-26 (screened from approximately 5 to 20 feet) were used as monitor points.

3.3.3 Lower Queen Pilot Testing Protocol

The three pilot tests performed in the Lower Queen were conducted using three Vaccon VDF 750 Venturi Pumps placed in series. The pump system is capable of an applied vacuum of 25 inches of mercury with an air flow of 120 standard cubic feet per minute (scfm). Data collected during the pre-pilot test was used to appropriately size the referenced Venturi pump system. This blower system included vacuum gauges and ambient air intake valves to control flow/vacuum. Extracted vapors were discharged directly to the atmosphere.

The pilot test on well MW-73 was conducted for 49 hours. The remaining two pilot tests on MW-67 and MW-68 were conducted for 8.25 hours and 4.25 hours, respectively. A step-test was conducted at well MW-73. During the step-test, varying degrees of vacuum (100%, 66%, and 33% blower capacities) were applied to MW-73 and the vacuum and air flow rate at the wellhead were measured. The first step (100%) was run for approximately 47 hours and the next two step-tests were run for

approximately one hour each. During each step, induced vacuum was measured in the surrounding monitoring wells. The step-test data is necessary to evaluate effective flow rates through the formation. Higher flow rates do not necessarily result in greater mass removal rates due to channeling or turbulent flow which results in less air flow contacting contaminated media. Higher air flow may also result in dilution of the volatile organic compound (VOC) levels being recovered due to more of the air flow passing through uncontaminated soils or fractures as the zone of influence extends outward to clean areas of the site. Therefore, the full-scale SVES must be optimized to achieve the most efficient and effective air flow.

The following parameters were monitored during the Lower Queen tests at approximately 15-minute intervals for the first elapsed hour, at approximately 30-minute intervals for the following two hours, and hourly for the remainder of the tests:

- Pre- and post-filter vacuum at the blowers;
- Induced vacuum at surrounding monitor points;
- Applied vacuum at the vapor extraction wellhead;
- Pre-blower air stream temperature;
- Process air stream velocity; and
- Air effluent organic vapor concentration, H_2S, O_2, and percent LEL.

The field logs used for data collection during the pilot tests are included in Appendix A.

Three vapor (effluent discharge) samples were collected during the extended Lower Queen pilot test on MW-73; samples were collected after approximately 24, 25, and 48 hours of testing. One vapor sample was collected during the Lower Queen test on well MW-67, near the end of the test. No vapor sample was collected during pilot testing on MW-68.

The vapor samples were collected in Summa Canisters from an air sampling port on the vacuum side of the Venturi pump system. The vapor samples were maintained at ambient air temperature until receipt by the laboratory. Chain-of-Custody documentation was completed for each sample collected; samples were delivered to ATI within one week of collection. Vapor samples were analyzed for total nonmethane hydrocarbons (EPA TO-14), purgeable aromatics and halocarbons (EPA 8010/8020), and methane, carbon dioxide, and oxygen (GC-TCD); results of analytical testing are discussed in Section 4 and are included in Appendix B.

4.0 SOIL VENT PILOT TEST RESULTS

The field data collected during pilot testing is presented on computer-generated soil vapor extraction pilot test field logs (Appendix A). This data has been reviewed for accuracy and used to evaluate soil vapor extraction as a feasible technology for remediation of the subsurface hydrocarbons at the MOC Indian Basin Remediation Project site.

4.1 Shallow Zone Soil Vapor Extraction Pilot Tests

Two separate pilot tests were conducted at VEW-1S and MW-18 completed in the shallow zone at a depth of 18 to 60 feet below grade. The tests indicate soil vapor extraction is an acceptable remedial technology for remediation of the subsurface hydrocarbons. The pilot testing results are presented below.

4.1.1 MW-18 Pilot Test Results

The following information was collected during the 4-hour pilot test conducted on December 12, 1994 at MW-18. At 100% of the maximum obtainable vacuum, the pre-filter blower vacuum gauge reading was 14 inches of water and the post-filter vacuum gauge reading was 30 inches of water. Applied vacuum at the extraction wellhead averaged 5 inches of water. The maximum air flow converted to standard conditions was 171 scfm.

No induced vacuum was measured in the closest monitoring wells MW-19, MW-20 and MW-24 (located at a distance of 200 to 236 feet from MW-18).

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 2 ppmv to 355 ppmv. LEL readings in the process air stream ranged from 0% to 9%. No H_2S was detected.

A summary of the air sample analytical data obtained from MW-18 is provided in Table 2 and laboratory analytical reports are included in Appendix B.

4.1.2 VEW-1S Pilot Test Results

The following information was collected during the first 4 hours (constant rate) of pilot testing conducted on December 13, 1994 at VEW-1S.

At 100% of the maximum obtainable vacuum, the pre-filter blower vacuum gauge reading was 25 inches of water and the post-filter vacuum gauge reading was 40 inches of water. Applied vacuum at the extraction wellhead averaged 17 inches of water. The maximum air flow converted to standard conditions was 175 scfm.

Maximum induced vacuum measured at the monitoring wells during the test ranged from 0.2 inches of water at MW-33 and MW-34 (100 and 151 feet from VEW-1S, respectively) to 0.95 inches of water at MW-B and MW-2 (8 and 16 feet from VEW-1S, respectively). No induced vacuum was measured at monitoring wells MW-13 and MW-15 (located 175 and 229 feet from VEW-1S, respectively). Induced vacuum appeared to stabilize 2 hours into the test.

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 590 parts per million-volume (ppmv) to 1,470 ppmv. LEL readings in the process air stream were 100+% and H_2S was present between 1 and 3 ppmv.

A summary of the air sample analytical data obtained from VEW-1S is provided in Table 2 and laboratory analytical reports are included in Appendix B.

Step-down pilot test data for well VEW-1S were collected during the fifth hour of testing on December 13, 1994. The applied vacuum was decreased four times during this pilot test using a step-down approach. The pilot test evaluated induced air flow at 100%, 75% and 50% and 25% of the maximum obtainable vacuum.

The applied vacuum was progressively decreased during the step test. Air velocity was measured at the wellhead for the various applied vacuums. At applied vacuums of 13, 10, 7 and 3 inches of water, air flows of 134, 113, 84 and 45 scfm, respectively, were measured. A graph of air flow rate versus applied vacuum for the step test is included as Figure 2.

4.2 Lower Queen Soil Vapor Extraction Pilot Test Results

The Lower Queen pilot tests were conducted to evaluate the feasibility of soil vapor extraction in the Lower Queen Formation at depths ranging from 25 to 200 feet below grade. An initial pre-pilot test was performed on MW-73 to properly size the vacuum system required to conduct a full-scale pilot test at MW-73, MW-68 and MW-67. The results of the pilot tests at MW-67, MW-68 and the step pilot test at MW-73 are presented in the following sections.

4.2.1 MW-73 Lower Queen Pre-Pilot Test Results

The following information was collected during the 4-hour, pre-pilot test conducted on December 14, 1994 at MW-73. At 100% of the maximum obtainable vacuum, the pre-filter blower vacuum gauge reading was 74 inches of water and the post-filter vacuum gauge reading was 76 inches of water. Applied vacuum at the extraction wellhead averaged 76 inches of water. The maximum air flow obtained was 140 scfm.

The maximum induced vacuum measured at the surrounding monitoring wells during the test was 0.4 inches of water at MW-72 (106 feet from MW-73). Positive pressure was measured in monitoring wells during the test ranging from +0.21 in MW-74 (200 feet from MW-73) to +0.25 in MW-75 (393 feet from MW-73). Induced vacuum appeared to stabilize 2.5 hours into the test.

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 286 ppmv to 445 ppmv. LEL readings in the process air stream were 100+%. No H_2S was detected.

Based on the results of the pre-pilot test at MW-73, three Vaccon VDF 750 Venturi Pumps (aligned in series) were obtained for the full-scale pilot testing on MW-73, MW-67 and MW-68 conducted in January 1995. The results of this testing are presented in the following sections.

4.2.2 MW-73 Full-Scale Step Pilot Test Results

The following information was collected during the 49-hour step-down pilot test conducted January 17 and 18, 1995 at MW-73. The applied vacuum was decreased three times at the end of this pilot test using a step-down approach. The pilot test evaluated the effect of SVES vacuums at 100%, 66% and 33% of the maximum obtainable vacuum using the specified Venturi pump system.

At 100% of the maximum obtainable vacuum, the applied vacuum at the extraction wellhead averaged 9 inches of mercury. The maximum air flow converted to standard conditions was 96 scfm.

Maximum induced vacuum measured at the monitoring wells during the test ranged from 0.05 inches of water at MW-72 and MW-58 (106 and 1,000 feet from MW-73, respectively) to 1.55 inches of water at MW-61A (1,700 feet from MW-73). Induced vacuum was measured at all of the monitoring wells specified for the pilot test. However, an induced pressure was measured in MW-58, MW-59, MW-75 and MW-61 (for short periods of time) during the 100% test and a positive pressure was present in MW-58 and MW-75 during the step-down test at 66% and 33%. Induced vacuum did not appear to stabilize during this test.

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 286 ppmv to 315 ppmv. LEL readings in the process air stream ranged from 81% to 100+% and H_2S was not detected.

A summary of the air sample analytical data obtained from MW-73 is provided in Table 2 and laboratory analytical reports are included in Appendix B.

Following 47 hours of pilot testing at a constant vacuum rate, the applied vacuum was progressively decreased to perform the step test. Air velocity was measured at the wellhead for the various applied vacuums. At applied vacuums of 6 and 3 inches of mercury, air flows of 96 and 78 cfm, respectively, were measured. A graph of air flow rate versus applied vacuum for the step test is included in Figure 3.

4.2.3 MW-67 Full-Scale Pilot Test Results

The following information was collected during the 8-hour pilot test conducted January 20, 1995 at MW-67. The pilot test evaluated the effect of SVES vacuums at 100% of the maximum obtainable vacuum using the specified Venturi Pump system.

The maximum obtainable vacuum at the wellhead was 2 inches of mercury with a supplied pressure at the Venturi blower of 54 pounds per square inch (psi). The maximum air flow converted to standard conditions was 178 scfm.

Maximum induced vacuum measured at monitoring well MW-64 during the test was 0.5 inches of water (2,000 feet from MW-67). Induced vacuum was not observed at monitoring well MW-65 (1,950 feet from MW-67). Induced vacuum did not appear to stabilize during this test.

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 627 ppmv to 721 ppmv. LEL readings in the process air stream were greater than 100+%. No H_2S was detected.

A summary of the air sample analytical data obtained from MW-67 is provided in Table 2 and laboratory analytical reports are included in Appendix B.

4.2.4 MW-68 Full-Scale Pilot Test Results

The following information was collected during the 4-hour pilot test conducted January 20, 1995 at MW-68. The pilot test evaluated the effect on the shallow alluvial zone of applying a vacuum on a Lower Queen well at 100% of the maximum obtainable vacuum using the specified Venturi pump system.

The maximum obtainable vacuum at the wellhead continued to decrease during the test from 9 to 6.5 inches of mercury with a supplied pressure at the Venturi blower decreasing from 39 to 32 psi. The maximum air flow was 137 scfm.

The maximum induced vacuum was detected at monitoring well MW-21 only once during the test at 0.01 inches of water (200 feet from MW-68). Induced vacuum was not detected at monitoring wells MW-8, MW-20, MW-24 and MW-26 (200 to 325 feet from MW-68).

Organic vapor concentrations in the process air stream were measured to determine hydrocarbon mass removal rates. Organic vapor concentrations, based on PID readings, ranged from 538 ppmv to 673 ppmv. LEL readings in the process air stream ranged from 38% to 66%. No H_2S was detected.

An air sample was not collected during this test.

4.3 Soil Vent Pilot Test Analysis

Shallow zone and Lower Queen pilot test results are analyzed in the following sections.

4.3.1 Shallow Zone Pilot Test Analysis

During the pilot test at well VEW-1S, an induced vacuum was measured at monitoring wells located at distances less than 151 feet. However, a significant vacuum (greater than 0.1 inches of water) was not observed at a distance greater than 40 feet from the extraction well. The oxygen levels were low, which indicates there was a good surface seal in the extraction well. The high air flow rates and high petroleum hydrocarbon concentrations in the effluent indicate the well is located in high permeability soil directly impacted by the subsurface hydrocarbons.

During the pilot test at MW-18, no induced vacuum was observed in the surrounding monitoring wells. The nearest monitoring well was 200 feet from the test well. Based on this data, the radius of influence is less than 200 feet at an applied wellhead vacuum of 14 inches of water. The effluent hydrocarbon concentrations were lower than anticipated based on the location of this well; however, an interim SVES previously operated at this well and in surrounding wells MW-19 and MW-20. The relatively high oxygen concentration and low hydrocarbon concentrations in the effluent are indicative of the effect of the interim SVES on the subsurface conditions.

The data collected from the soil vent pilot tests on VEW-1S and MW-18 were analyzed using Groundwater Technology's software program, VENT-ROI Version 3.0. VENT-ROI is based on a simple one dimensional analytical model that provides a rough estimate of the effective cleanup radius (defined as "the maximum distance from a vapor extraction point through which sufficient air is drawn to remove the required fraction of contamination in the desired time"). The effective radius (R_E) is based on site-specific conditions and SVES parameters, and it is specific to the contaminant cleanup goals, and cleanup time frame (Bass, 1993).

Using VENT-ROI, data from the pilot tests were analyzed to calculate the effective radius of influence. Computer-generated output from the R_E calculations is provided in Appendix C. A summary of the calculated R_E values based on the optimum set of parameters is detailed below.

For VEW-1S, assuming a 7- to 19-foot thickness of vented soil interval, a soil gas temperature of 50°F, an air flow rate of 190 scfm, a cleanup time of 365 days, and 90% removal of benzene, the calculated interwell effective radius of influence (for volatilization plus biodegradation) for the site was approximately 64 feet at an applied vacuum of 25 inches of water column. The single well effective radius of influence was approximately 73 feet.

For MW-18, assuming a 7- to 17-foot thickness of vented soil interval, a soil gas temperature of 50°F, an air flow rate of 171 scfm, a cleanup time of 365 days, and 90% removal of benzene, the calculated interwell effective radius of influence (for volatilization plus biodegradation) for the site

was approximately 74 feet at an applied vacuum of 25 inches of water column. The single well effective radius of influence was approximately 91 feet.

Vacuum in the subsurface generally decreases exponentially with distance. The effective radius of influence was evaluated by plotting the log of the induced vacuum versus distance for VEW-1S using the maximum applied vacuum setting (Figure 4). The effective radius of influence was determined using a minimum of 0.1 inches of water to define a significant response based on previous field data collected for similar soil vapor extraction systems. A more conservative estimate of the effective radius of influence was also determined by selecting the distance which corresponds to 1% of the applied vacuum. Using these methods, the maximum radius of influence in VEW-1S ranged from approximately 57 to 85 feet at an applied vacuum of 25 inches of water. The pilot test data for MW-18 was not evaluated by this method due to the negligible induced vacuum measured at the surrounding monitoring wells.

The data collected from these pilot tests will be used to design a SVES to address the shallow zone adsorbed phase hydrocarbons.

4.3.2 Lower Queen Pilot Test Data Analysis

4.3.2.1 MW-73. The full-scale step pilot test at MW-73 was the most extensive test conducted at the site. Well MW-73 was drilled to a depth of 220 feet and the boring was left open from 10 to 220 feet below grade. Groundwater and separate-phase hydrocarbons are present at a depth of 191 feet below grade. A downhole camera survey confirmed the presence of both horizontal and vertical fractures in the carbonate rock.

As a baseline indicator, pressure in all observation wells was measured just before starting the test. Results showed positive pressure in each well, except well MW-72, where no pressure was noted throughout the test. The vapor extraction test began under an applied vacuum of 9.5 inches of mercury. Within three hours, induced vacuum was observed in each of the observation wells. As the test progressed, monitoring wells MW-61 and MW-61A (located approximately 2,000 feet from MW-73) were included in the monitoring schedule due to the measured apparent influence at these locations. A significant vacuum was detected in these wells after 14 hours of extraction.

As monitoring continued, a fluctuation in induced vacuum was observed at the monitoring wells after 24 hours. The induced vacuum began to rise and fall in a cyclical pattern, similar to ambient temperature fluctuations. In order to evaluate this phenomenon further, barometric pressure data

from the National Weather Service Carlsbad station were obtained for comparison to observed vacuum fluctuations. The data suggest that the changes in barometric pressure are responsible for the vacuum fluctuations observed during testing. Figure 5 illustrates the relationship between induced vacuum and barometric pressure during testing.

A significant induced vacuum (greater than 0.1 inches of water) was measured in MW-74, MW-75, MW-58, MW-61A and MW-61 during the constant rate (100% applied vacuum) portion of the test. This data indicates that the extraction well exerted influence at a distance of 2,000 feet with an applied wellhead vacuum of 9 inches of mercury. However, little or no induced vacuum was detected at MW-72 and MW-59 (located 106 and 1,000 feet from MW-73) possibly due to the complex (fractured) lithology at the site. The data collected from this test can be used to design a SVES to remediate liquid and vapor phase natural gas condensate in the Lower Queen Formation at the site.

4.3.2.2 MW-68. The pilot test conducted at MW-68 test was not successful. The objective of this test was to determine if venting in the Lower Queen zone would impact the shallow alluvial zone. An induced vacuum was not detected in the shallow monitoring wells selected for the test. However, the closest monitoring well was 200 feet from MW-68 and it may be possible that the wells were outside the effective radius of influence at that distance and depth. The hydrocarbon mass removal rate was not calculated, but appears to be similar to the rate determined for MW-73 based on field readings. These limited data suggest that wells must be completed in both zones to completely remediate the subsurface hydrocarbons.

4.3.2.3 MW-67. The objective of the pilot test conducted at MW-67 was to determine air flow and offgas concentrations to effectively design a full-scale SVES. The extraction flow rate from this well was high (170 scfm), hydrocarbon mass emissions reached 3.29 pounds per hour (lbs/hr), oxygen levels were low (11%) and carbon dioxide levels high (6.8%). A consistent induced vacuum was not observed at any of the monitoring wells; however, the nearest well was located 1,950 feet from MW-67. The data indicate soil vapor extraction techniques should be effective for remediation of subsurface hydrocarbons in the Lower Queen Formation at this area of the site.

4.4 Hydrocarbon Mass Extraction Rates

Based on air effluent analytical results from wells MW-18, VEW-1S, MW-73 and MW-67, hydrocarbon mass extraction rates were calculated for BTEX and total non-methane hydrocarbons. The hydrocarbon mass extraction rates are presented in Table 3. Mass extraction rate calculations are provided in Appendix D.

Calculated mass extraction rates during the shallow zone pilot tests range from 0.95 to 14.63 lbs/hr for total non-methane hydrocarbons and 0.00063 to 0.07 lbs/hr for benzene.

The calculated mass extraction rates range from 0.035 to 3.29 lbs/hr for total non-methane hydrocarbons and 0.00035 to 0.013 lbs/hr for benzene in the Lower Queen zone

5.0 PRELIMINARY DESIGN CONSIDERATIONS

Based on the results of pilot testing conducted at the site, preliminary design parameters can be evaluated and proposed. Vapor extraction is a viable in-situ remedial technology for the Indian Basin Remediation Project. Separate SVES appear necessary to remediate the shallow zone and the Lower Queen Formation. Both vapor extraction and air injection wells should be considered when designing the systems to treat the hydrocarbon mass. Air injection may increase the mass removal efficiency for the proposed systems.

5.1 Vacuum Pump Size

The step pilot test results from the tests conducted at VEW-1S and MW-73 provide a basis for vacuum pump sizing for the shallow and Lower Queen zones, respectively. Figures 2 and 3 illustrate the relationship between induced vacuum versus air flow rate for these tests. High flow rates at relatively low vacuums can be achieved in the shallow zone, while low flow rates with a higher vacuum will be required for remediation in the Lower Queen zone. The shallow zone and Lower Queen zone pump sizing information is presented below.

5.1.1 Shallow Zone

Figure 2 illustrates the relationship between air flow and induced vacuum during pilot testing in the shallow zone. The air flow rate increases almost linearly with induced vacuum up to a flow of 165 scfm. These results indicate a vacuum blower capable of sustaining more than 25 inches of water column vacuum with an air flow rate greater than 170 scfm (per well) will be required to efficiently treat the subsurface hydrocarbons.

5.1.2 Lower Queen Formation

Figure 3 illustrates that an asymptotic level between air flow and induced vacuum was reached at a vacuum of approximately 3 inches of mercury. As the air flow rate increased above 70 scfm, friction losses in the subsurface formation appeared to cause the flow rate to level off. The step test data from well MW-73 indicates that optimum vacuum pump sizing would be about 70 scfm (per well) at 3 inches of mercury. However, during the pilot test, at higher air flow rates (95 scfm) the effective radius of influence increased by a factor of 10. In order to maximize effective radius of influence, a vacuum system capable of more than 95 scfm at a vacuum above 9 inches of mercury on a per well basis may be required.

5.2 SVES Well Spacing

5.2.1 Shallow Zone

Pilot test data indicates that for the shallow zone, the effective radius of influence can be calculated using a computer program like VENT-ROI. This model was run using the data from the test on well VEW-1S. Results indicate that for 90% removal within a 2-year period, the interwell effective radius of influence is 64 feet. For 80% removal of the mass of contaminant within a 2-year period, the interwell effective radius of influence is 70 feet.

5.2.2 Lower Queen Formation

Due to the induced vacuum fluctuations observed during the 49-hour pilot test on well MW-73, a simple approach to calculating an effective radius of influence was not possible for the Lower Queen Formation. Therefore, the following assumptions were made to evaluate possible vapor extraction well spacing:

- Estimated mass of contaminant — 1.25 million gallons
- Contaminant properties — unweathered gasoline
- Estimated time for cleanup — 2 years
- Area of plume — 950 acres
- Removal mechanism — volatilization only

Based on these assumptions, the estimated well spacing is 660 feet. Because of the relatively low flow rates achieved in the fractured rock, air injection is proposed to aid in mass removal. A five-spot well placement grid over the plume could be implemented, whereby four wells could extract air while one is used to inject ambient air. Any well could be used as an injection or extraction well. The wells would be screened (or boreholes completed) wherever contaminants are found. Table 4 shows calculations of percent natural gas condensate removal with air flow required and number of wells. The table shows that in order to achieve 70% removal throughout the plume in two years, 110 wells would be needed, with 88 extracting and 22 injecting at any one time. Well spacing would be 660 feet, and the total flow rate of extracted air would be 8,800 cfm. It can be seen from Table 4 that in order to achieve 95% removal, there is an order of magnitude increase in air flow (and/or wells) needed.

5.3 Air Pollution Control Equipment

Field and laboratory data from the pilot tests confirm the need for air pollution control equipment for a system consisting of more than a few wells. Mass removal rates ranged from 1 to 14.6 lbs/hr total hydrocarbons per well. The average removal rate in the Lower Queen wells was 2.5 lbs/hr per well.

The removal rate in the upper zone was 14.6 lbs/hr per well (results for MW-18 are not included). In order to remediate the existing plume, many extraction wells will be required. If an operating system addresses the entire plume area at one time, mass removal rates will be on the order of thousands of pounds per day. The three primary control options that are most likely feasible are incineration, adsorption and condensation. Selection of the appropriate technology will be controlled primarily by the number of wells to be operated at any one time, and the resulting removal rates.

6.0 PILOT TEST CONCLUSIONS

The following conclusions are made regarding the soil vent pilot tests conducted at the site:

- The induced vacuum as a result of venting the shallow alluvial zone at 7 to 19 feet below grade at the site was measured in wells up to 151 feet away from the vapor extraction wells.
- The calculated shallow zone well effective radii of influence ranged from approximately 64 feet to 74 feet for removal of the volatile hydrocarbons at flow rates of 160 to 170 scfm and 14 to 25 inches of water applied vacuum.
- The induced vacuum as a result of venting the Lower Queen Formation at 25 to 220 feet below grade at the site was observed in wells up to 2,000 feet away from the vapor extraction wells.
- The calculated Lower Queen Formation well effective radii of influence ranged from approximately 400 feet to 2,000 feet for removal of the volatile hydrocarbons at flow rates of 95 to 150 scfm and 2 to 9.5 inches of mercury applied vacuum.
- Hydrocarbon removal rates are dependent upon air flow through the subsurface and existing adsorbed phase hydrocarbon concentrations. Based on results of these vent tests, hydrocarbon removal rates of 14.6 lbs/hr and benzene removal rates of 0.07 lbs/hr are obtainable in the shallow zone at a flow rate of approximately 170 scfm and a vacuum of 25 inches of water.
- Hydrocarbon removal rates of 3.29 lbs/hr and benzene removal rates of 0.013 lbs/hr are obtainable from the Lower Queen Formation at a flow rate of approximately 95 scfm and a vacuum of 9 inches of mercury.

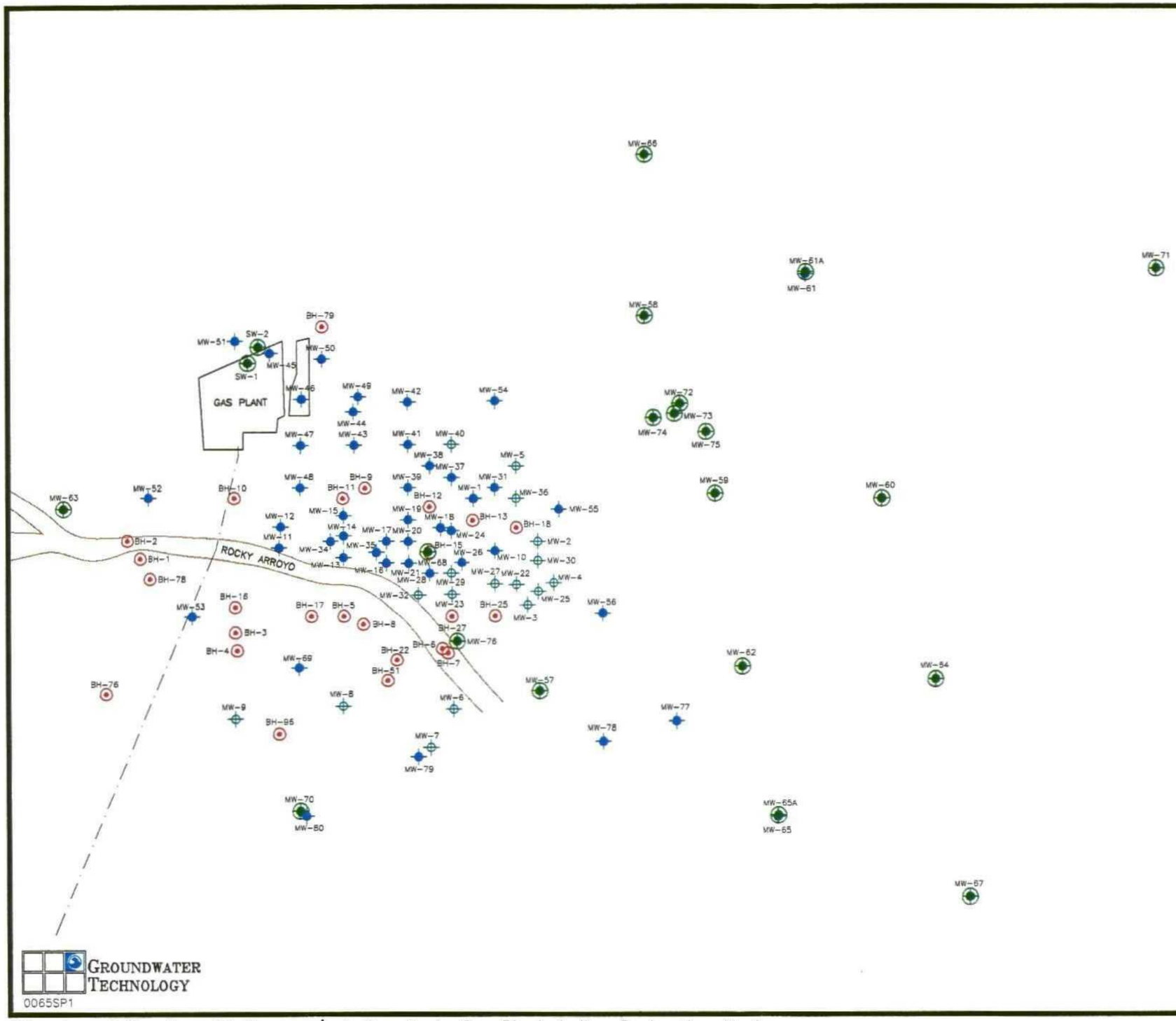
7.0 REFERENCES

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ESE, 1992, *Soil Vapor Extraction Pilot Study Indian Basin Gas Plant*, Eddy County, New Mexico.

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FIGURES



EXPLANATION

- UPPER AQUIFER MONITOR WELL
- LOWER AQUIFER MONITOR WELL
- MONITOR WELL (DRY)
- BOREHOLE
- CONDENSATE LINE

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MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT SITE

INDIAN BASIN, NEW MEXICO

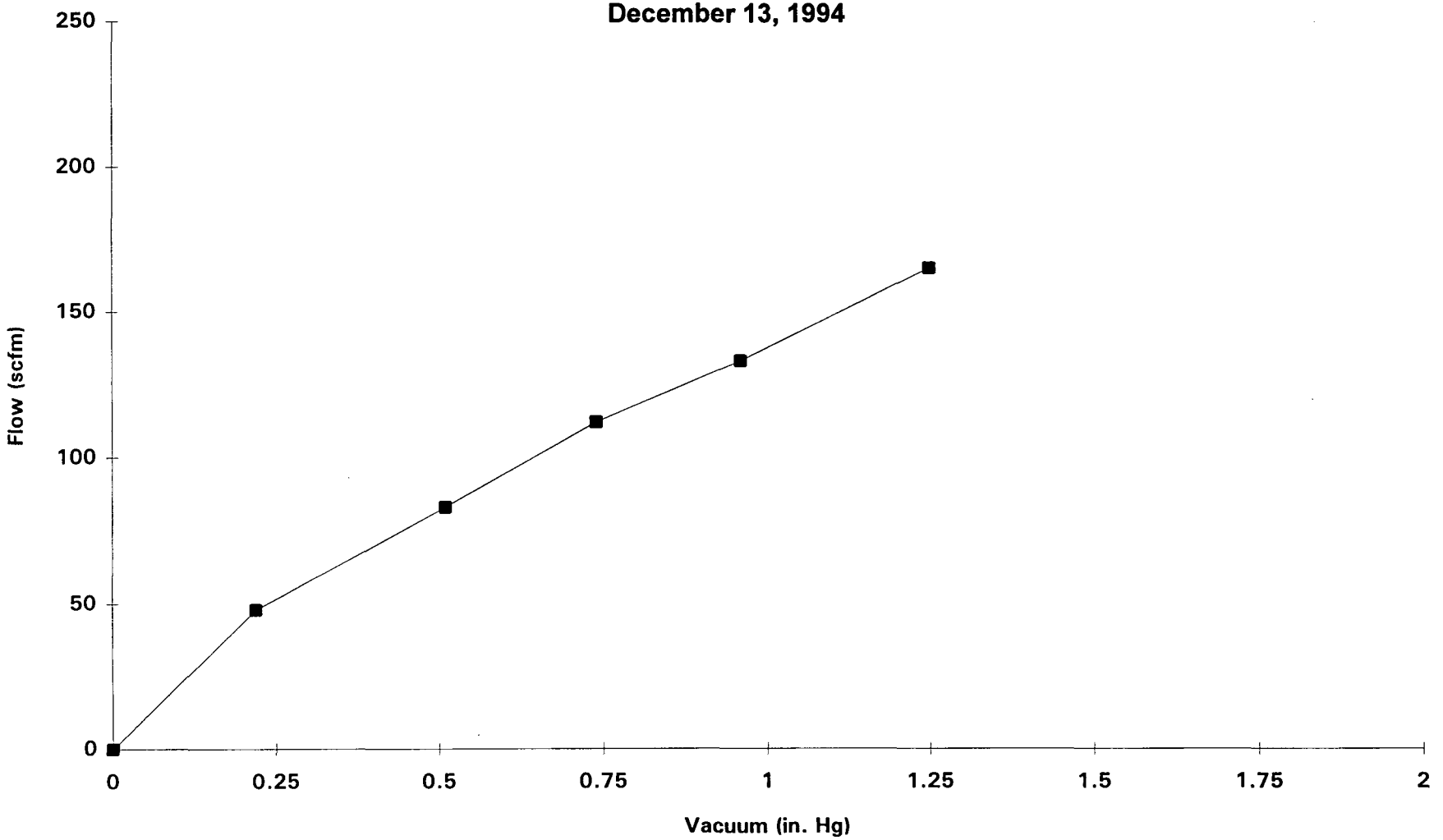
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DRAWN BY: S. BROTHERS DATE: 03-01-95
DRAFTED BY: DEN HOLMES DATE: 03-01-95
CHECKED BY:_____ DATE:_____

SITE PLAN

Site plan of Marathon Oil Company's Indian Basin Gas Plant, Indian Basin, New Mexico.

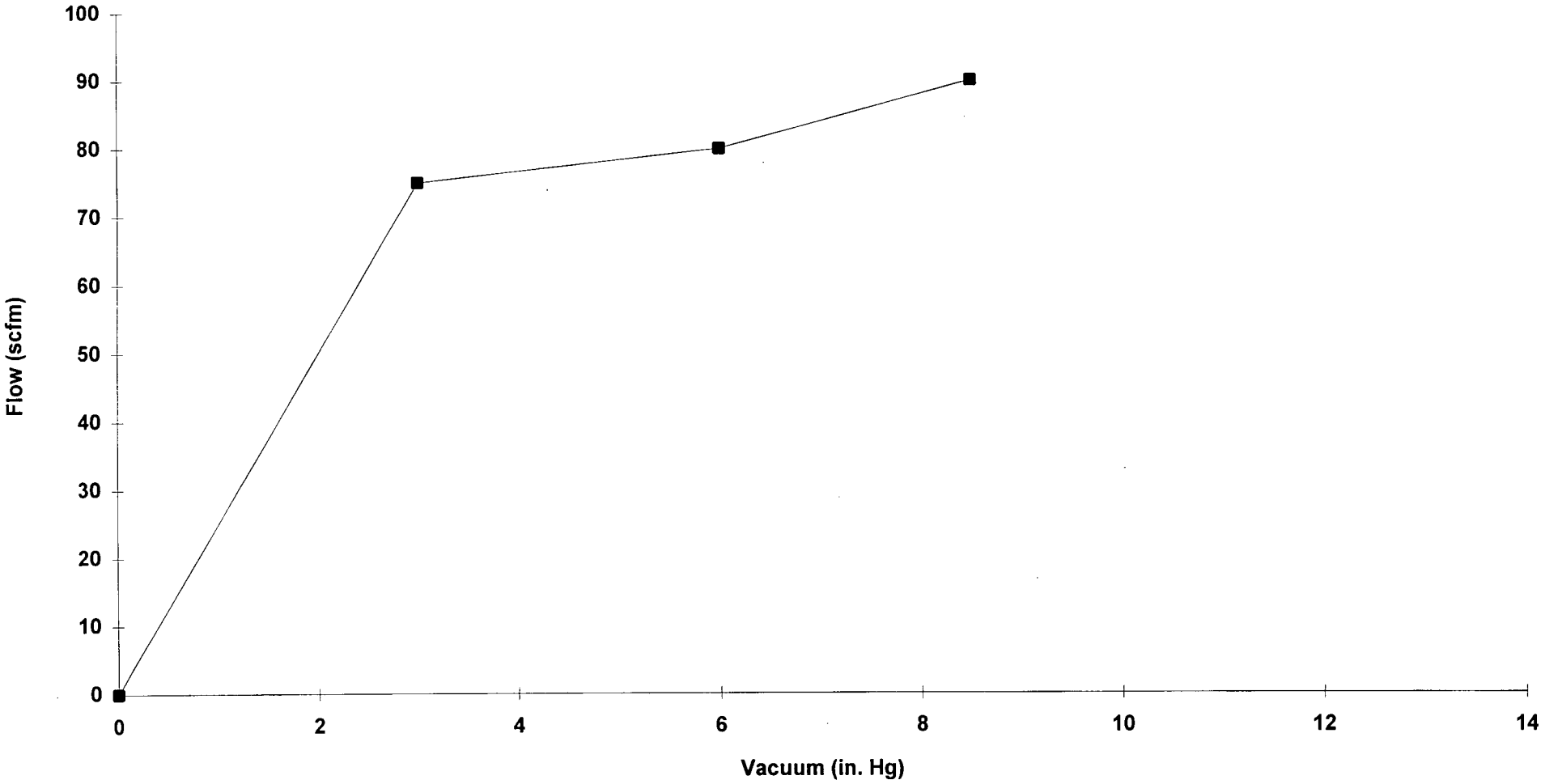
FIGURE 2
Marathon IBGP, VEW-1S
Induced Vacuum versus Flow
December 13, 1994



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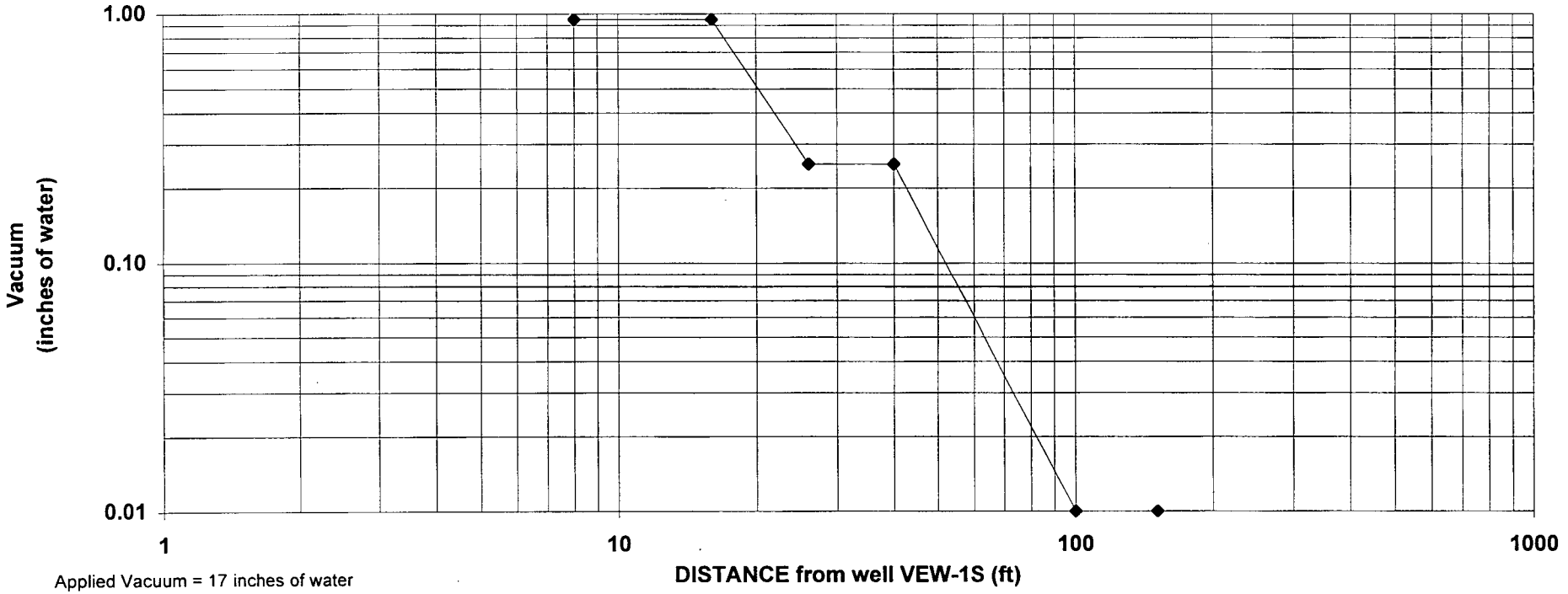
FIGURE 3
Marathon IBGP, MW-73
Induced Vacuum versus Flow
January 19, 1995



moc/fig3

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FIGURE 4
INDUCED VACUUM vs. DISTANCE
FOR SOIL VENT PILOT TEST AT VEW-1S
MARATHON, IGB
December 13, 1994

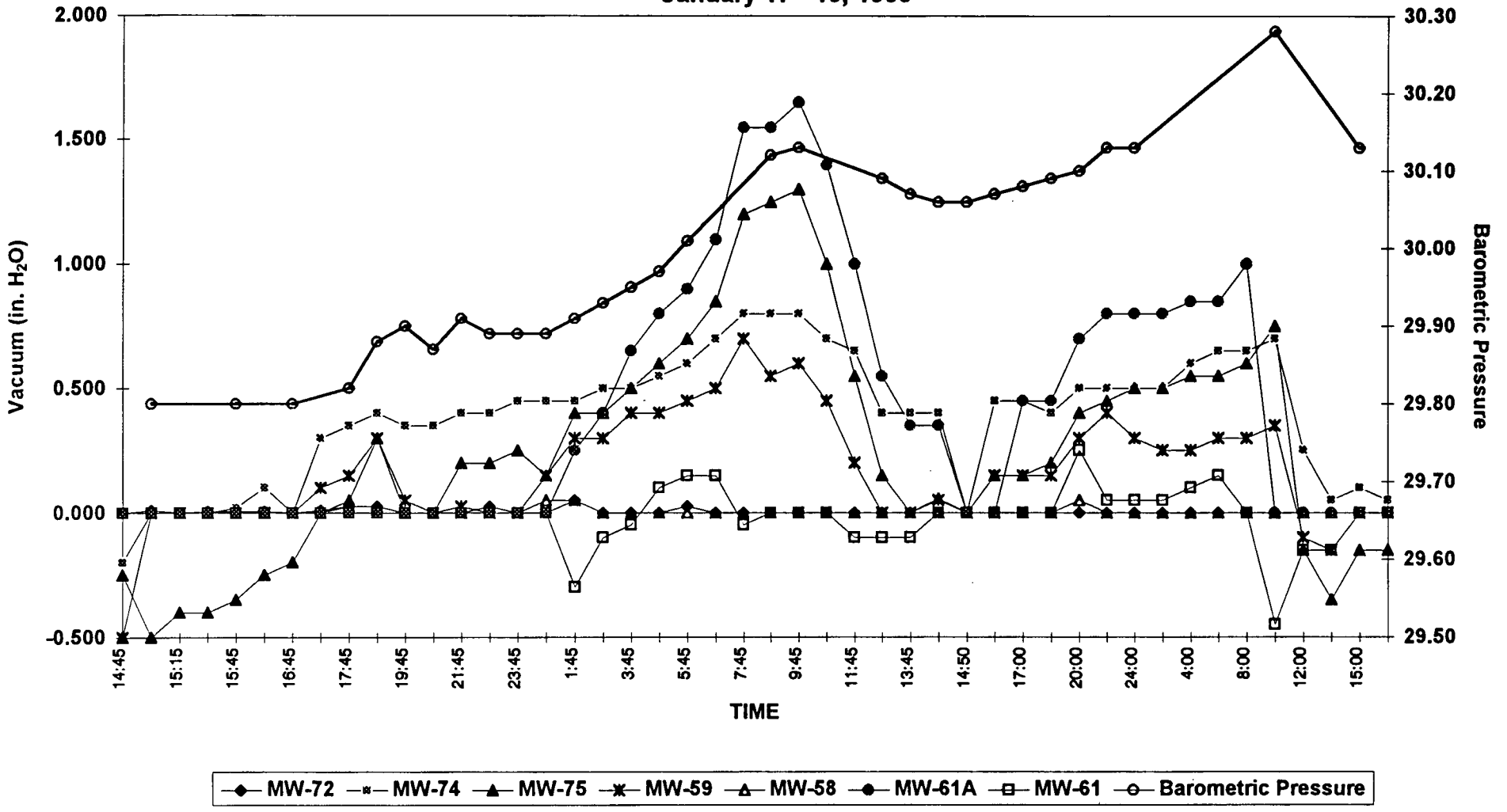


Applied Vacuum = 17 inches of water

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FIGURE 5
Marathon IBGP, MW-73
Induced Vacuum and Barometric Pressure versus Time
January 17 - 19, 1995



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TABLES

TABLE 1
WELL COMPLETION DETAILS
FOR WELLS USED IN THE
SOIL VAPOR EXTRACTION PILOT TESTS

WELL	TOTAL DEPTH (FT TOC)	TOP WELL SCREEN (FT TOC)	BOTTOM WELL SCREEN (FT TOC)	DEPTH TO WATER 4/94 (FT TOC)	APPROX. DISTANCE FROM EXTRACTION WELL (FEET)	WELL DIAM. (IN.)	COMMENTS
SHALLOW ZONE PILOT TESTS							
Pilot Test 1: VEW-1S Extraction Well:							
VEW-1S	19	7	19	NA	NA	4	Depths from grade
MW-13	22.07	11.64	21.42	Pump	175	2	
MW-14	24.30	14.18	23.63	22.78 (1/94)	40	4	
MW-15	19.47	9.39	19.17	Dry (1/94)	238	2	
MW-33	20.29	10.14	19.70	Dry (1/94)	100	2	
MW-34	20.90	10.12	19.64	Dry (1/94)	125	2	
MW-A	19.00	7.00	19.00	17	4	2	ESE MW-1
MW-B	23.00	8.00	23.00	17	8	2	ESE MW-2
MW-C	20.50	7.50	20.50	17	26	2	ESE MW-3
Pilot Test 2: MW-18 Extraction Well:							
MW-18	17.42	7.21	16.84	16.68 (12/93)	NA	4	
MW-19	19.11	8.96	18.53	NA	300	4	
MW-20	16.89	6.89	16.69	NA	300	2	
MW-24	14.09	9.05	13.67	Dry	94	2	
MW-8	15.5	4.95	14.73	Dry	250	2	

TABLE 1
WELL COMPLETION DETAILS
FOR THE WELLS USED IN THE
SOIL VAPOR EXTRACTION PILOT TESTS
(cont.)

WELL	TOTAL DEPTH (FT TOC)	TOP WELL SCREEN (FT TOC)	BOTTOM WELL SCREEN (FT TOC)	DEPTH TO WATER (FT TOC)	APPROX. DISTANCE FROM EXTRACTION WELL (FEET)	WELL DIAM. (IN.)	COMMENTS
LOWER QUEEN PILOT TESTS							
Pilot Test 1: MW-73 Extraction Well:							
MW-73	220	NA - open hole 10-220'		NA	NA	8	Open borehole
MW-74	220	NA - open hole 10-220'		NA	200	8	Open borehole
MW-75	220	NA - open hole 10-220'		NA	393	8	Open borehole
MW-58	218.71	193.29	217.36	209.06 (10/93)	1,000	4	Pump removed for Pilot Testing
MW-59	211.29	185.51	210.60	Pump	685	4	
MW-72	241.50	177.32	235.38	190.29 (12/93)	100	8	Pump removed for Pilot Testing
MW-61	56.00	44.93	55.07	45.49	1950	4	
MW-61A	214.00	173.50	213.30	182.62	2000	4	
Pilot Test 2: MW-67 Extraction Well:							
MW-67	163.00	112.01	162.34	131.14	NA	4	
MW-65	54.48	34.37	53.80	43.4	1,950	4	Pump in MW-65A - not used per MOC
MW-64	168.56	154.21	199.42	167.3	2000	4	
Pilot Test 3: MW-68 Extraction Well:							
MW-68	203.43	151.81	203.12	174.50 (10/93)	NA	4	Pump in well
MW-18	17.42	7.21	16.84	16.68 (12/93)	250	4	
MW-20	16.89	6.89	16.69	NA	200	2	
MW-21	23.31	12.74	22.88	Dry (1/94)	200	2	
MW-24	14.09	9.05	13.67	Dry	300	2	
MW-26	21.51	11.11	21.11	20.77 (1/94)	325	2	

NOTES: NA: Not available or not applicable
All depths referenced from top of casing (TOC) except where noted in comments column

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TABLE 2
SUMMARY OF AIR SAMPLE ANALYTICAL RESULTS
SOIL VENT PILOT TEST
MARATHON OIL COMPANY - INDIAN BASIN REMEDIATION PROJECT
CARLSBAD, NEW MEXICO

Sample ID	Benzene (mg/M^3)	Toluene (mg/M^3)	Ethyl-Benzene (mg/M^3)	Total Xylenes (mg/M^3)	Total Fuel (non-methane hydrocarbons) (mg/M^3)	Carbon Dioxide (%)	Oxygen (%)	Methane (%)
MW-18	1	7	<5	<2	1,500	8.2	12	1.47
VEW-1S	110	28	98	22	24,000	5.1	17	0.12
MW-73	17	<1	47	3	4,900	1.8	18	6.9
MW-73	<1	<1	<5	<2	<100	ND	23	ND
MW-73	35	19	10	<2	3,400	1.4	20	5.7
MW-67	<1	36	<5	<2	5,900	8.6	5.3	1.5

Note: Air samples analyzed in accordance with EPA method TO-14 and GC/TCD
ND = Not Detected at or above the practical quantification limit (PQL)

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TABLE 3

SUMMARY OF HYDROCARBON MASS EXTRACTION RATES
SOIL VENT PILOT TEST
MARATHON OIL COMPANY
INDIAN BASIN REMEDIATION PROJECT
CARLSBAD, NEW MEXICO

Sample ID	Pilot Test Well	Benzene (lb/hr)	Toluene (lb/hr)	Ethyl-Benzene (lb/hr)	Total Xylenes (lb/hr)	Total Fuel (lb/hr)
VEW-1S	VEW-1S	0.07	0.02	0.06	0.01	14.63
MW-18	MW-18	0.00063	0.0037	0.0044	0.0013	0.95
MW-73 (24 hrs)	MW-73	0.00035	0.0018	0.00035	0.0007	0.035
MW-73 (25 hrs)	MW-73	0.013	0.0068	0.0036	0.0007	1.2
MW-73 (48 hrs)	MW-73	0.006	0.013	0.00036	0.001	1.75
MW-67	MW-67	0.00056	0.02	0.00056	0.001	3.29

Note: Mass extraction rate calculations provided in Appendix D.

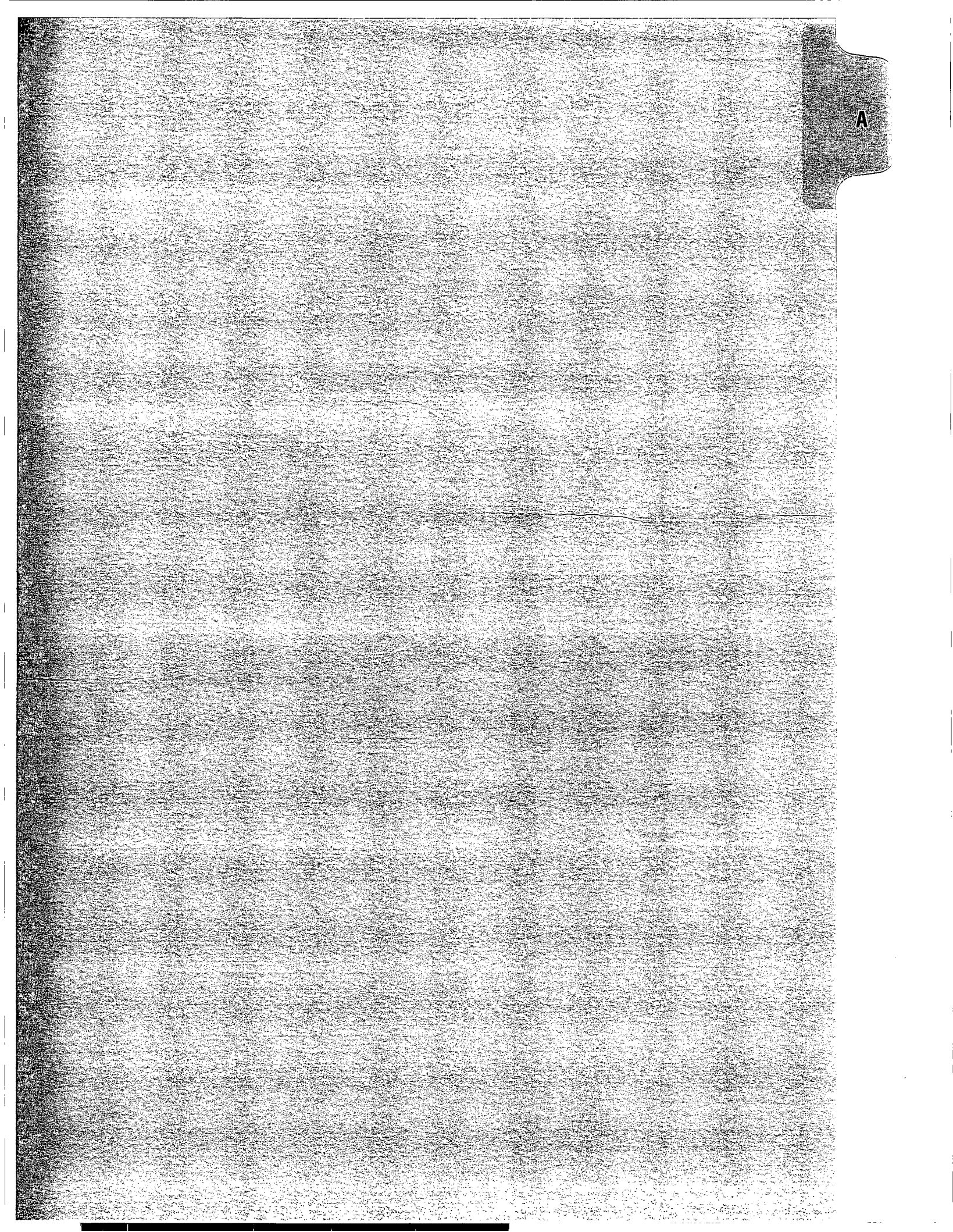
TABLE 4
Hydrocarbon Removal Calculations for Lower Queen Zone
VES Remediation

eta =	0.08	(Johnson, et al)	Pa =	760	mm Hg
Vm =	379	ft^3/lbmol	t =	1051920	min (2 yrs)
M° =	7250000	lb	Area =	41400000	ft^2

(1-M/M°) Fraction Removed	P*MW (atm)	Molecular Weight	P* (mm Hg)	Piecewise Interval Q (cfm)	Linear Total Q (cfm)	Continuous Total Q (cfm)	Model Interval Q (cfm)	Interval lbmoles HC Removed	Interval lbmoles Air Removed	HC ppmv In Air	Number of Wells*	Well Spacing (ft)
0	244.69193226	45	4132.574856	-	0	0	-	0	0	-	-	-
0.05	154.93412088	50	2354.9986374	10.537254011	10.537254011	8.4579254551	8.4579254551	7250	23475.09	308838	1	-
0.1	98.101239347	55	1355.5807619	16.64178962	27.179043631	21.815771427	13.357845972	6590.9090909	37074.9	177773	1	-
0.15	62.11577609	60	786.79983048	26.282859033	53.461902664	42.912203402	21.096431975	6041.6666667	58553.45	103182	1	-
0.2	39.330488228	65	459.86417005	41.509278431	94.971181096	76.230407775	33.318204373	5576.9230769	92475.16	60307	1	-
0.25	24.903291911	70	270.37859789	65.556802391	160.52798349	128.85081031	52.620402538	5178.5714286	146048.7	35458	2	4887.1889041
0.3	15.768274841	75	159.78518506	103.53575158	264.06373506	211.95573194	83.104921628	4833.3333333	230658.9	20954	3	3990.3730306
0.35	9.984161626	80	94.849535447	163.51700302	427.58073808	343.20573509	131.25000315	4531.25	364286.3	12439	5	3090.9296585
0.4	6.3217748536	85	56.524104573	258.24712593	685.827864	550.49265613	207.28692103	4264.7058824	575327.9	7412.7	7	2612.312352
0.45	4.0028235516	90	33.801621102	407.85714525	1093.6850093	877.86687784	327.37422172	4027.7777778	908631.9	4432.8	11	2083.9043506
0.5	2.5345091776	95	20.276073421	644.14057014	1737.8255794	1394.8984422	517.03156432	3815.7894737	1435029	2659	18	1629.062968
0.55	1.604801383	100	12.196490511	1017.3098079	2755.1353873	2211.4613257	816.56288359	3625	2266382	1599.5	28	1306.156176
0.6	1.0161286854	105	7.3548361991	1606.6667639	4361.8021513	3501.0826736	1289.6213479	3452.3809524	3579363	964.52	44	1041.9521753
0.65	0.6433927066	110	4.4452587	2537.4552276	6899.2573789	5537.818918	2036.7362444	3295.4545455	5652991	582.96	70	826.0856992
0.7	0.4073836127	115	2.6922743103	4007.4763335	10906.733712	8754.4952985	3216.6763804	3152.173913	8927932	353.07	110	658.9884174
0.75	0.2579472945	120	1.6336661982	6329.1231264	17235.856839	13834.685217	5080.1899189	3020.8333333	14100141	214.24	173	525.4738064
0.8	0.1633271556	125	0.9930291062	9995.7669655	27231.623804	21857.975894	8023.2906764	2900	22268760	130.23	274	417.54072649
0.85	0.1034155439	130	0.6045831799	15786.603489	43018.227293	34529.390606	12671.414712	2788.4615385	35169695	79.286	432	332.53108588
0.9	0.0654806893	135	0.3686320285	24932.238874	67950.466167	54541.721864	20012.331259	2685.1851852	55544516	48.343	682	264.65611719
0.95	0.0414610851	140	0.225074462	39376.205003	107326.67117	86147.774663	31606.052798	2589.2857143	87723058	29.517	1077	210.60383357
1	0.026252344	145	0.1375984925	62187.977913	169514.64908	136064.12676	49916.352101	2500	1.4E+08	18.045	1701	167.57991551

*Assumes 100 scfm per well, with one air injection for every four vapor extraction wells

GROUNDWATER TECHNOLOGY


A

APPENDIX A
SVES PILOT TEST FIELD LOGS

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Date:	12/12/94
Measured by:	CTB/DLR

Extraction Well: MW-18

Blower Specs: 5 HP Rotron

Time	Elapsed Time (min.)	Vacuum at Test Well (ins. H2O)	Pre/Post Vacuum at Blower (ins. H2O)	Pre-Blower Anemom. Reading (ft/min.)	Pre/Post Blower Temp (oF)	Vapor Concentration (Eff)				Distance from Extraction Well:					
						PID (ppmv)	LEL (%)	O_2 (%)	H_2S (ppm)	214 ft MW-19	236 ft MW-20	200 ft MW-24	ft	ft	ft
11:05		0.0	0/0		58.5/59.1	1.1	0.0	20.0		0.0	0.0	0.0			
11:15		Start Blower													
11:30		5.0	14/30	2,100	67.5/99.1	1.9	0.0	13.9	0.0	0.0	0.0	0.0			
11:45		5.0	14/30	2,100	67.5/101	3.2	0.0	14.5	0.0	0.0	0.0	0.0			
12:00		5.0	14/30	2,100	67.8/105.8	23.4	0.0	15.2	0.0	0.0	0.0	0.0			
12:15		5.0	14/30	2,250	68.0/107	53.5	0.0	15.6	0.0	0.0	0.0	0.0			
12:45		5.0	14/30	2,250	68.0/108	154	4.0	16.0	0.0	0.0	0.0	0.0			
13:15		5.0	13/29	2,250	68.0/108	221	5.0	16.3	0.0	0.0	0.0	0.0			
13:45		5.2	13/29	2,250	68.0/108	280	6.0	16.7	0.0	0.0	0.0	0.0			
14:15		5.2	14/29	2,250	66.9/105.0	336	7.0	16.8	0.0	0.0	0.0	0.0			
14:45		5.2	14/29	2,250	66.0/104	341	8.0	17.1	0.0	0.0	0.0	0.0			
15:15		5.2	14/29	2,250	65.6/103.5	355	9.0	17.1	0.0	0.0	0.0	0.0			
15:20		Collected air sample													

moc/excel
mw-18

GROUNDWATER TECHNOLOGY

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Date:	12/13/94
Measured by:	CTB/DLR

Extraction Well:	VEW-1S

Blower Specs:	5HP Rotron

Time	Elapsed Time (min.)	Vacuum at Test Well (ins. H2O)	Pre/Post Vacuum at Blower (ins. H2O)	Pre-Blower Anemom. Reading (ft/min.)	Pre/Post Blower Temp (oF)	Vapor Concentration (Eff) PID (ppmv)	LEL (%)	O_2 (%)	H_2S (ppm)	Vacuum at Observation Wells (ins. H2O) Distance from Extraction Well: 4 ft A	8 ft B	16 ft MW-2	26 ft C	40 ft MW-14	151 ft MW-34	175 ft MW-13	100 ft MW-33	229 ft MW-15
9:35		0	0.0/0.0	0/	52.5/51.0	36.7	0	20.9										
9:45	Start Blower																	
10:00		17	25/40	2,400	69/112	594	100+	8.9	1.0	0.09	0.9	0.9	0.24	0.25	0.02	0.00	0.02	0.00
10:15		17	25/40	2,400	69/114	656	100+	9.0	2.0	0.09	0.9	0.9	0.25	0.26	0.02	0.00	0.02	0.00
10:30		17	25/40	2,400	70/115	778	100+	9.8	2.0	0.09	0.9	0.9	0.24	0.26	0.02	0.00	0.02	0.00
10:45		17	25/40	2,250	70/115	868	100+	10.2	3.0	0.09	0.9	0.9	0.24	0.26	0.02	0.00	0.02	0.00
11:15		17	25/40	2,250	70/117	1011	100+	10.8	3.0	0.09	0.9	0.9	0.25	0.26	0.02	0.00	0.01	0.00
11:45		17	25/40	2,250	69/117	1141	100+	11.3	3.0	0.1	0.95	0.95	0.24	0.25	0.01	0.00	0.01	0.00
12:15		17	25/40	2,250	69/117	1149	100+	11.7	3.0	0.10	0.95	0.95	0.25	0.25	0.01	0.00	0.01	0.00
12:45		17	25/40	2,250	69/117	1245	100+	12.0	3.0	0.10	0.95	0.95	0.24	0.24	0.00	0.00	0.00	0.00
13:15		17	25/40	2,250	69/117	1365	100+	12.4	2.0	0.10	0.95	0.95	0.25	0.25	0.01	0.00	0.02	0.00
13:45		17	25/40	2,250	69/116	1470	100+	12.6	2.0	0.10	0.95	0.95	0.25	0.25	0.01	0.00	0.01	0.00
14:00	Collected Air Sample																	
14:05		Step Down To 25% Open (dilution valve)																
14:20		13	19/35	1,800	69/111	1506	96/14.5		2.0	0.08	0.75	0.75	0.19	0.2	0.00	0.00	0.00	0.00
14:25		Step Down to 50% Open																
14:40		10	14/32	1,500	69/108	1521	73/15.8		1.0	0.06	0.6	0.6	0.16	0.17	0.00	0.00	.0.	0.00
14:45		Step Down To 75% Open																
15:00		7	9/28	1,100	69/105	1390	51/17.4		0.0	0.04	0.39	0.4	0.11	0.11	0.00	0.00	0.00	0.00
15:05		Step Down To 100% Open																
15:20		3	5/25	590	68/101	1026	26/19.2		0.0	0.02	0.16	0.21	0.05	0.03				

MOC/EXCEL
VES-1S

GROUNDWATER TECHNOLOGY ®

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

PRE-TEST ON MW-73

Date:	12/14/94
Measured by:	CTB/DLR

Extraction Well:	MW-73

Blower Specs:	5HP Rotron

Time	Elapsed Time (min.)	Vacuum at Test Well (ins. H20)	Pre/Post Vaccum at Blower (ins. H20)	Pre-Blower Anemom. Reading (ft/min.)	Pre/Post Blower Temp (oF)	Vapor Concentration (Eff) PID (ppmv)	O_2 (%)	LEL (%)	H_2S (ppm)	Vacuum at Observation Wells (ins. H2O) Distance from Extraction Well: 108ft MW-72	200 ft MW-74	393 ft MW-75
10:15	Static	0		0	57.8/58.0	8.8	21	0.0		0.000	0.000	NA Still pulling pump
10:30	Start Blower											
11:00		77	74/76	1,600	62/178	352	13.6	100+	0.0	-	-	-
11:30		77	74/76	1,600	64/182	343	13.8	100+	0.0	-	-	-
12:00		77	74/76	1,600	64/179	290	13.6	100+	1.0	-	-	-
12:30		77	74/76	1,600	63/182	286	13.8	100+	1.0	-	-	-
13:00		76	73/75	1,600	64/183	445	13.8	100+	1.0	-	-	-
13:30		76	73/75	1,600	64/183	384	13.9	100+	1.0	-	-	-
14:00		76	73/75	1,600	65/183	392	13.9	100+	1.0	-	-	-
14:30		77	73/75	1,600	65/183	375	14.1	100+	1.0	0.400	.21+	.25+

GROUNDWATER TECHNOLOGY

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Date:	1/17-18/1995
Measured by:	CTB/DR/CSW

Extraction Well: MW-73

Blower Specs: Vaccon VDF 750 Venturi Pumps

Time	Elapsed Time	Vacuum at Test Well	Sup. Pres. at Blower	Pre-Blower Anemom. Reading	Pre Blower	Vapor Concentration (Eff)				Vacuum at Observation Wells (ins. H2O) Distance from Extraction Well:							
						PID	LEL	O_2	H_2S	106ft	200ft	393ft	685ft	1000ft			
	(min.)	(ins. Hg)	(PSI)	(ft/min.)	Temp (°F)	(ppmv)	(%)	(%)	(ppm)	72	74	75	59	58	61-A	61	
14:45	0									0.000	+0.20	+0.25	+0.5	+0.5			
15:00	15	9.5	58.0	1,500	57.8	298	81	20.1	0.0	0.010	0.00	+0.5	N/A	N/A			
15:15	30	9.5	58.0	1,500	56.4	302	85	20.1	0.0	0.000		+0.40					
15:30	45	9.5	58.0	1,500	56.4	307	86	20.1	0.0	0.005	0.00	+0.40					
15:45	60	9.5	58.0	1,600	56.0	309	99	19.9	0.0	0.005	0.02	+0.35	+0.10	0.000			
16:15	90	9.25	58.0	1,750	55.6	313	91	20.0	0.0	0.005	0.10	+0.25	0.000	0.000			
16:45	120	9.0	58.0	1,750	55.3	293	92	20.0	0.0		0.00	+0.20	0.000	0.000			
17:15	150	9.0	58.0	1,700	55.0	300	94	19.0	0.0	0.010	0.30	+0.0	0.100	0.000			
17:45	180	9.0	58.0	1,750	54.9	287	97	19.9	0.0	0.025	0.35	0.050	0.150	0.025			
18:45	4	9.0	58.0	1,750	54.2	300	98	19.9	0.0	0.025	0.40	0.300	0.300	0.025			
19:45	5	9.0	58.0	1,750	54.5	288	>100	19.9	0.0	0.000	0.35	0.000	0.050	N/A			
20:45	6	9.0	58.0	1,750	54.7	315	>100	19.8	0.0	0.000	0.35	0.000	N/A	N/A			
21:45	7	9.0	58.0	1,750	54.3	307	>100	19.9	0.0	0.000	0.40	0.200	0.025	N/A			
22:45	8	9.0	58.0	1,750	54.4	290	>100	19.9	0.0	0.025	0.40	0.200	0.000	0.025			
23:45	9	9.0	58.0	1,750	54.6	297	>100	20.0	0.0	0.000	0.45	0.250	0.000	0.000			
0:45	10	9.0	58.0	1,750	54.0	311	>100	19.9	0.0	0.000	0.45	0.150	0.150	0.050			
1:45	11	9.0	58.0	1,750	53.8	294	>100	19.8	0.0	0.050	0.45	0.400	0.300	0.050	0.250	+0.3	
2:45	12	9.0	58.0	1,750	52.0	304	97	20.0	0.0	0.000	0.50	0.400	0.300	0.000	0.400	+0.1	
3:45	13	9.0	58.0	1,750	53.4	304	99	20.0	0.0	0.000	0.50	0.500	0.400	0.000	0.650	+0.05	
4:45	14	9.0	58.0	1,750	53.6	300	96	19.9	0.0	0.000	0.55	0.600	0.400	0.000	0.800	0.100	
5:45	15	9.0	58.0	1,750	54.0	294	>100	20.0	0.0	0.025	0.60	0.700	0.450	0.000	0.900	0.150	
6:45	16	9.0	58.0	1,750	53.2	286	>100	20.0	0.0	0.000	0.70	0.850	0.500	0.000	1.100	0.150	
7:45	17	9.0	58.0	1,750	53.8	290	>100	19.9	1.0	0.000	0.80	1.200	0.700	0.000	1.550	+0.05	
8:45	18	9.0	58.0	1,750	54.5	310	>100	19.9	0.0	0.000	0.80	1.250	0.550	0.000	1.550	0.000	

GROUNDWATER TECHNOLOGY ®

SOIL VENTING PILOT TEST DATA (continuned)
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Date:	1/18-19/95
Measured by:	CTB/DR/CSW

Extraction Well: MW-73

Blower Specs: Vaccon VDF 750 Venturi Pumps

Time	Elapsed Time	Vacuum at Test Well	Sup. Pres. at Blower	Pre-Blower Anemom. Reading	Pre Blower	Vapor Concentration (Eff)				Vacuum at Observation Wells (ins. H2O) Distance from Extraction Well:						
						PID	LEL	O_2	H_2S	106ft	200ft	393ft	685ft	1000ft		
	(min.)	(ins. Hg)	(PSI)	(ft/min.)	Temp (°F)	(ppmv)	(%)	(%)	(ppm)	72	74	75	59	58	61-A	61
9:45	19	8.5	58.0	1,750	54.4	331	90	20.1	0.0	0.000	0.80	1.300	0.600	0.000	1.650	0.000
10:45	20	8.5	58.0	1,750	55.8	307	>100	20.0	0.0	0.000	0.70	1.000	0.450	0.000	1.400	0.000
11:45	21	9.0	58.0	1,750	55.0	299	>100	20.0	0.0	0.000	0.65	0.550	0.200	0.000	1.000	+0.1
12:45	22	8.75	58.0	1,750	56.1	302	>100	20.0	1.0	0.000	0.40	0.150	0.000	0.000	0.550	+0.1
13:45	23	8.75	58.0	1,750	56.0	300	>100	20.0	1.0	0.000	0.40	0.000	0.000	0.000	0.350	+0.1
14:45	24	8.75	58.0	1,750	56.1	303	>100	20.0	0.0	0.000	0.40	0.055	0.050	0.000	0.350	0.000
14:50	25	Air samples collected (shut compressor down to service/re-started 15:05								0.000						
16:00		8.5	58.0	1,750	54.5	313	>100	19.9	0.0	0.000	0.45	0.150	0.150	0.000		
17:00		8.5	58.0	1,750	54.3	308	>100	20.1	0.0	0.000	0.45	0.150	0.150	0.000	0.450	0.000
18:00		8.5	58.0	1,750	53.5	301	>100	20.0	0.0	0.000	0.40	0.200	0.150	0.000	0.450	0.000
20:00		8.5	58.0	1,750	53.3	300	>100	20.0	0.0	0.000	0.50	0.400	0.300	0.050	0.700	0.250
22:00		8.5	58.0	1,750	53.1	296	>100	20.0	0.0	0.000	0.50	0.450	0.400	0.000	0.800	0.050
24:00		8.5	58.0	1,750	53.1	303	>100	20.0	0.0	0.000	0.50	0.500	0.300	0.000	0.800	0.050
2:00		8.5	58.0	1,750	51.0	313	>100	20.0	0.0	0.000	0.50	0.500	0.250	0.000	0.800	0.050
4:00		8.5	58.0	1,750	52.5	313	>100	20.1	0.0	0.000	0.60	0.550	0.250	0.000	0.850	0.100
6:00		8.5	58.0	1,750	52.5	300	>100	20.0	0.0	0.000	0.65	0.550	0.300	0.000	0.850	0.150
8:00		8.5	58.0	1,750	53.5	300	>100	20.1	0.0	0.000	0.65	0.600	0.300	0.000	1.000	0.000
10:00		8.5	58.0	1,750	55.0	291	>100			0.000	0.70	0.750	0.350	0.000	-1.0	+0.45
12:00		8.5	58.0	1,750	57.0	295	82	20.0	0.0	0.000	0.25	+0.15	+0.10	+0.05	.2	+0.15
14:00		8.5	58.0	1,750	56.3	303	82	20.0	0.0	0.000	0.05	+0.35	+0.15	+0.45	.1	+0.15
15:00 [1]		6.0	>60	1,350	57.0	268	88	19.9	0.0	0.000	0.10	+0.15	0.000	+0.20	0.000	0.000
16:00 [2]		3.0	>60	1,100	56.6	189	75	20.2	0.0	0.000	0.05	+0.15	0.000	+0.10	0.000	0.000

(1) Stepped down at 14:30 after collectng 3rd air sample

(2) Stepped down at 15:30

GROUNDWATER TECHNOLOGY

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Constant Rate Test on Well 68

Date:	1/20/95
Measured by:	Briscoe/Rizzuto

Extraction Well:	MW-68

Blower Specs:	Vaccon VDF 750 Venturi Pumps

Time	Elapsed Time (min.)	Vacuum at Test Well (ins. Hg)	Supply Air (PSI)	Pre-Blower Anemom. Reading (ft/min.)	Pre Blower Temp (oF)	Vapor Concentration (Eff) PID (ppmv)	O_2 (%)	LEL (%)	H_2S (ppm)	Vacuum at Observation Wells (ins. H2O) 250ft MW-8	200ft MW-20	200ft MW-21	300ft MW-24	325ft MW-26
10:00	0	0	0	0	45	43.8	21	0.0		0	0	0	0	
10:30	10	Venturi Blowers Adjusted - Max flow with present vaccum adjusted to 1750 ft/min at 11.5" Hg												
10:45	15	9	39	1,500	59.1	673	20.2	38.0	0.0	0	0	0	0	0
11:00	30	8.5	38	1,750	60	601	20.2	38.0	0.0	0	0	0	0	0
11:15	45	8.25	37	1,750	57.5	599	20.4	52.0	0.0	0	0	0	0	0
11:30	60	8	36	1,750	57.9	602	20.4	52.0	0.0	0	0	0	0	0
12:00	90	7.75	36	1,750	55.6	562	20.2	56.0	0.0	0	0	0	0	0
12:30	120	7.5	35	1,750	59	N/A	20.1	60.0	0.0	0	0	0	0	0
13:00	150	7.5	34	1,750	56.1	542	20.1	63.0	0.0	0	0	0	0	0
13:30	180	6.5	32	1,750	56.2	538	19.9	66.0	0.0	0	0	0.01	0	0
	4 HR										0	0	0	0
	5HR													
	6HR													
	7HR	No effluent - shut down test per Dacre Bush - No Air Sample Collected												
	8HR													

MOC/EXCEL
MW-68

GROUNDWATER TECHNOLOGY

SOIL VENTING PILOT TEST DATA
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
CARLSBAD, NEW MEXICO

Constant Rate Test on Well 67

Date:	1/20/95
Measured by:	Briscoe/Rizzuto

Extraction Well:	MW-67

Blower Specs:	Vaccon VDF 750 Venturi Pumps

Time	Elapsed Time (min.)	Vacuum at Test Well (ins. Hg)	Supply Air (PSI)	Pre-Blower Anemom. Reading (ft/min.)	Pre Blower Temp (oF)	Vapor Concentration (Eff) PID (ppmv)	LEL (%)	O_2 (%)	H_2S (ppm)	Vacuum at Observation Wells (ins. H_2O) Distance from Extraction Well: 1950 ft	65		64					
	0	2.0	0.0	2,400	43	N/A	>600	14.3	3.0	0.0			+.04					
9:45	15												0.00					
20:00	30	2.0	54.0	2,400	56.8	688	N/A	2	0.0	0.0			0.05					
20:15	45	2.0	54.0	2,400	60.2	702	N/A	2	0.0	0.0			0.02					
20:30	60	2.0	54.0	2,400	N/A	690	N/A	2	0.0	0.0			0.02					
21:00	90	2.0	54.0	2,200	60.7	715	N/A	2	0.0	0.0			0.00					
21:30	120	2.0	54.0	2,200	60.4	688	>100	12.9	0.0	0.0			0.00					
22:00	150	2.0	53.0	2,200	60.1	721	>100	12.3	0.0	0.0			0.10					
23:00	180	2.0	53.0	2,200	60.3	705	>100	12.1	0.0	0.0			0.00					
24:00	4	2.0	52.0	6000+ [1]	60	694	>100	11.6	0.0	0.0			0.50					
1:00	5	2.0	52.0	6000+ [1]	54.6	701	>100	11.4	0.0	0.0			0.00					
2:00	6	2.0	51.0	2,000	50.7	653	>100	11.4	0.0	0.0			0.00					
3:00	7	2.0	51.0	2,000	50.4	688	>100	11.2	0.0	0.0			0.00					
4:00	8	2.0	51.0	2,000	50.8	627	>100	11.2	0.0	0.0			0.00					

(1) Excessive Moisture
(2) Equipment Charging

Collected air sample at end of test

GROUNDWATER TECHNOLOGY

B

APPENDIX B
LABORATORY ANALYTICAL RESULTS

RECEIVED
JAN 26 1995

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **412359**

January 23, 1995

Groundwater Technology
2501 Yale Blvd. SE #204
Albuquerque, NM 87106

Project Name/Number: MOC/INDIAN BASIN GAS PLANT 023350039.6101

Attention: Sara Brothers

On **12/14/94**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **air** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

The air samples were analyzed for methane, carbon dioxide, oxygen, hydrocarbons and BTEX. The analysis for the 8010 list (purgeable halocarbons) was not performed within the 28 day hold time. Sample "412359-01" was analyzed 8 days past ATI's recommended hold time. The data is submitted with this limitation. There is no charge for this part of the analysis.

Permanent Gases anaylses were performed by West Coast Analytical Service Inc., 9840 Alburtis Avenue, Santa Fe Springs, CA 90670. (See attachment 1)

All other analyses were performed by Anaytical Technolgoies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

CLIENT : GROUNDWATER TECHNOLOGY
PROJECT # : 023350039.6101
PROJECT NAME: MOC/INDIAN BASIN GAS PLANT

DATE RECEIVED: 12/14/94
REPORT DATE : 01/25/95

ATI ID: 412359

	ATI ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	412359-01	AT124(VEW-15-12/13/14)	AIR	12/13/94
02	412359-02	AT046(VEW-15-12/13/14)	AIR	12/13/94
03	412359-03	AT040(MW-18-12/12/15:20)	AIR	12/12/94
04	412359-04	AT103(MW-18-12/12/15:20)	AIR	12/12/94

---TOTALS---

MATRIX	#SAMPLES
AIR	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 412588
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 412359
Project Name: GROUNDWATER TECH
Project Location: N/S
Test: BETX AND TPH IN CANISTERS
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 001 Sample Date/Time: 13-DEC-94 1400
Client Sample Id: 412359-01 Received Date: 15-DEC-94

Batch: CAB237 Extraction Date: N/A
Blank: B Dry Weight %: N/A Analysis Date: 24-DEC-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	110	5	
ETHYL BENZENE	MG/M3	98	5	
TOLUENE	MG/M3	28	30	
XYLENES	MG/M3	22	10	
TOTAL PETROLEUM HYDROCARBON	MG/M3	24000	2500	
TRIFLUOROTOLUENE (PID)	%REC/SURR	108	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	112	63-135	
ANALYST	INITIALS	LKD		

Comments:
*MODIFIED T014

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 412588
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 412359
Project Name: GROUNDWATER TECH
Project Location: N/S
Test: BETX AND TPH IN CANISTERS
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 002
Client Sample Id: 412359-03
Sample Date/Time: 13-DEC-94 1520
Received Date: 15-DEC-94

Batch: CAB237
Blank: B
Dry Weight %: N/A
Extraction Date: N/A
Analysis Date: 24-DEC-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	1	1	
ETHYL BENZENE	MG/M3	7	1	
TOLUENE	MG/M3	ND	5	
XYLENES	MG/M3	ND	2	
TOTAL PETROLEUM HYDROCARBON	MG/M3	1500	500	
TRIFLUOROTOLUENE (PID)	%REC/SURR	87	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	99	63-135	
ANALYST	INITIALS	LKD		

Comments:
*MODIFIED T014

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 412588
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 412359
Project Name: GROUNDWATER TECH
Project Location: N/S
Test: BETX AND TPH IN CANISTERS

Client Sample Id:	Parameter:	Unit:	Result:
412359-01	BENZENE	MG/M3	110
	ETHYL BENZENE	MG/M3	98
	TOLUENE	MG/M3	28
	XYLENES	MG/M3	22
	TOTAL PETROLEUM HYDROCARBON	MG/M3	24000
412359-03	BENZENE	MG/M3	1
	ETHYL BENZENE	MG/M3	7
	TOTAL PETROLEUM HYDROCARBON	MG/M3	1500

Analytical Technologies, Inc.

"QC Report"

Title: Bag/Can Blank
Batch: CAB237
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 24-DEC-94 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	100
TRIFLUOROTOLUENE (PID)	%REC/SURR	95	63-135
TRIFLUOROTOLUENE (FID)	%REC/SURR	99	63-135
ANALYST	INITIALS	LKD	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Bag/Can Reagent
Batch: CAB237
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 23-DEC-94 RS Date Extracted: N/A
RSD Date Analyzed: 23-DEC-94 RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	55	110	53	106	4	18	71-138
TOLUENE	50	<5	54	108	51	102	6	17	75-130
Surrogates:									
TRIFLUOROTOLUENE (PID)				104		101			63-135

Comments:

Notes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Analytical Technologies, Inc.

"QC Report"

Title: Bag/Can Matrix
Batch: CAB237
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

Dry Weight %: N/A
Sample Spiked: 412843-6

MS Date Analyzed: 24-DEC-94
MSD Date Analyzed: 24-DEC-94

MS Date Extracted: N/A
MSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	49	98	49	98	0	20	57-140
TOLUENE	50	<5	48	96	48	96	0	15	49-144
Surrogates:									
TRIFLUOROTOLUENE (PID)				98		92			63-135

Comments:
SPIKING COMPOUND LOT #03-VW46-01 PURCHASED FROM ULTRA SCIENTIFIC
INTERNAL STANDARD LOT #03-VW45-02 PURCHASED FROM ACCUSTANDARD

Notes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501306
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 412359
Project Name: GROUNDWATER TECH
Project Location: N/S
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 001 Sample Date/Time: 13-DEC-94 1400
Client Sample Id: 412359-01 Received Date: 15-DEC-94

Batch: PHB012 Extraction Date: N/A
Blank: B Dry Weight %: N/A Analysis Date: 15-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BROMODICHLOROMETHANE	MG/M3	ND	1	
BROMOFORM	MG/M3	ND	2	
BROMOMETHANE	MG/M3	ND	2	
CARBON TETRACHLORIDE	MG/M3	ND	1	
CHLOROBENZENE	MG/M3	ND	1	
CHLOROETHANE	MG/M3	ND	5	
2-CHLOROETHYLVINYLETHER	MG/M3	ND	5	
CHLOROFORM	MG/M3	ND	2	
CHLOROMETHANE	MG/M3	ND	5	
DIBROMOCHLOROMETHANE	MG/M3	ND	5	
1,2-DICHLOROBENZENE	MG/M3	ND	2	
1,3-DICHLOROBENZENE	MG/M3	ND	2	
1,4-DICHLOROBENZENE	MG/M3	ND	2	
DICHLORODIFLUOROMETHANE	MG/M3	ND	5	
1,1-DICHLOROETHANE	MG/M3	ND	1	
1,2-DICHLOROETHANE	MG/M3	ND	1	
1,1-DICHLOROETHENE	MG/M3	ND	1	
1,2-DICHLOROETHENE (TOTAL)	MG/M3	ND	1	
1,2-DICHLOROPROPANE	MG/M3	ND	1	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
METHYLENE CHLORIDE	MG/M3	ND	5	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	1	
TETRACHLOROETHENE	MG/M3	ND	3	
1,1,1-TRICHLOROETHANE	MG/M3	ND	1	
1,1,2-TRICHLOROETHANE	MG/M3	ND	2	
TRICHLOROETHENE	MG/M3	ND	1	
TRICHLOROFLUOROMETHANE	MG/M3	ND	2	
VINYL CHLORIDE	MG/M3	ND	1	
BENZYL CHLORIDE	MG/M3**	ND	5	
BIS 2-CHLOROETHOXY METHANE	MG/M3**	ND	50	
BIS 2-CHOROISOPROPYL ETHER	MG/M3**	ND	50	
BROMOBENZENE	MG/M3**	ND	3	
CHLOROACETALDEHYDE	MG/M3**	ND	50	
CHLOROMETHYLMETHYL ETHER	MG/M3**	ND	50	
2-CHLOROTOLUENE	MG/M3**	ND	1	

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501306
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	412359
Project Name:	GROUNDWATER TECH
Project Location:	N/S
Test:	HALOGENATED VOLATILES (8010)
Analysis Method:	8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	II

Lab Id:	001	Sample Date/Time:	13-DEC-94 1400
Client Sample Id:	412359-01	Received Date:	15-DEC-94

Parameter:	Units:	Results:	Rpt Lmts:	Q:
DIBROMOMETHANE	MG/M3**	ND	5	
1,1,1,2-TETRACHLOROETHANE	MG/M3**	ND	1	
1,2,3 TRICHLOROPROPANE	MG/M3**	ND	5	
1-CHLOROHEXANE	MG/M3**	ND	5	
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	110	75-137	
ANALYST	INITIAL	LKD		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PHB012
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 15-JAN-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	UG/L	ND	1
BROMODICHLOROMETHANE	UG/L	ND	1
BROMOFORM	UG/L	ND	2
BROMOMETHANE	UG/L	ND	2
CARBON TETRACHLORIDE	UG/L	ND	1
CHLOROBENZENE	UG/L	ND	1
CHLOROETHANE	UG/L	ND	5
2-CHLOROETHYLVINYLETHER	UG/L	ND	5
CHLOROFORM	UG/L	ND	2
CHLOROMETHANE	UG/L	ND	5
DIBROMOCHLOROMETHANE	UG/L	ND	5
1,2-DICHLOROBENZENE	UG/L	ND	2
1,3-DICHLOROBENZENE	UG/L	ND	2
1,4-DICHLOROBENZENE	UG/L	ND	2
DICHLORODIFLUOROMETHANE	UG/L	ND	5
1,1-DICHLOROETHANE	UG/L	ND	1
1,2-DICHLOROETHANE	UG/L	ND	1
1,1-DICHLOROETHENE	UG/L	ND	1
1,2-DICHLOROETHENE (TOTAL)	UG/L	ND	1
1,2-DICHLOROPROPANE	UG/L	ND	1
CIS-1,3-DICHLOROPROPENE	UG/L	ND	1
TRANS-1,3-DICHLOROPROPENE	UG/L	ND	1
ETHYLBENZENE	UG/L	ND	1
METHYLENE CHLORIDE	UG/L	ND	5
METHYL T-BUTYL ETHER	UG/L	ND	5
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	1
TETRACHLOROETHENE	UG/L	ND	3
TOLUENE	UG/L	ND	5
1,1,1-TRICHLOROETHANE	UG/L	ND	1
1,1,2-TRICHLOROETHANE	UG/L	ND	2
TRICHLOROETHENE	UG/L	ND	1
TRICHLOROFLUOROMETHANE	UG/L	ND	2
VINYL CHLORIDE	UG/L	ND	1
XYLENES (TOTAL)	UG/L	ND	2
BENZYL CHLORIDE	UG/L**	ND	5
BIS(2-CHLOROETHOXY)METHANE	UG/L**	ND	50
BIS(2-CHLOROISOPROPYL)ETHER	UG/L**	ND	50
BROMOBENZENE	UG/L**	ND	3
CHLOROACETALDEHYDE	UG/L**	ND	50
CHLOROMETHYLMETHYL ETHER	UG/L**	ND	50
2-CHLOROTOLUENE	UG/L**	ND	1
DIBROMOMETHANE	UG/L**	ND	5
1,1,1,2 TETRACHLOROETHANE	UG/L**	ND	1
1,2,3 TRICHLOROPROPANE	UG/L**	ND	5
1-CHLOROHEXANE	UG/L**	ND	5
BROMOFLUOROBENZENE (PID)	%REC/SURR	97	34-161

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PHB012
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Parameters:	Units:	Results:	Reporting Limits:
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	102	75-137
ANALYST	INITIALS	KKS	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: PHB012
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 14-JAN-95 RS Date Extracted: N/A
RSD Date Analyzed: 14-JAN-95 RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
1,1-DICHLOROETHENE	50	<1	52	104	53	106	2	19	58-153
TRICHLOROETHENE	50	<1	48	96	45	90	6	10	71-127
BENZENE	50	<1	50	100	50	100	0	18	71-138
TOLUENE	50	<5	50	100	48	96	4	17	75-130
CHLOROBENZENE	50	<1	50	100	49	98	2	16	82-118
Surrogates:									
BROMOFLUOROBENZENE (PID)				102		102			34-161
BROMOFLUOROBENZENE (ELCD)				100		100			75-137

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: PHB012
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Dry Weight %: N/A
Sample Spiked: 501306-1

MS Date Analyzed: 15-JAN-95
MSD Date Analyzed: 15-JAN-95

MS Date Extracted: N/A
MSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
1,1-DICHLOROETHENE	50	<1	52	104	43	86	19	21	76-118
TRICHLOROETHENE	50	<1	47	94	43	86	9	15	75-119
BENZENE	50	19	24	10*	23	8*	22*	20	49-148
TOLUENE	50	<5	9	18*	9	18*	0	15	48-148
CHLOROBENZENE	50	<1	49	98	47	94	4	14	82-118
Surrogates:									
BROMOFLUOROBENZENE (PID)				22*		23*			34-161
BROMOFLUOROBENZENE (ELCD)				95		95			75-137

Comments:
*SURROGATE, %RECOVERIES, AND RPD'S OUTSIDE OF ACCEPTANCE LIMITS DUE TO MATRIX INTERFERENCE
SPIKING COMPOUND LOT #03-VW44-02 AND #03-VW49-01 PURCHASED FROM ULTRA SCIENTIFIC
INTERNAL STANDARD LOT #01-VW01-01 PURCHASED FROM ACCUSTANDARD

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical**Technologies,**Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information ATI ACCESSION #: 412359

CLIENT: ATI - Albuquerque | CLIENT PROJECT NUMBER:

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE							PLASTIC CONTAINERS							GLASS CONTAINERS									NOTES
	H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	
6																								6 @ 5 Summa Canisters AT124 AT123 AT095, AT040 AT046, AT103

Relinquished By:	Time	Date	Received By:	Time	Date
A. Y. Woods	1415	30 Nov 94		12:20	12/5/94

PART 2 - Sample/Project Information

PARAMETERS AND PRESERVATIVES REQUESTED

SAMPLE MATRIX CODES
DW DRINKING WATER; WW WASTEWATER; GW GROUNDWATER; AI AIR; SO SOIL; OI OIL; SW SURFACE WATER; SL SLUDGE; ST STORMWATER

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	EPA 8010	EPA 8020	EPA 25 Extraction	TO14-TNMHCS	CO, CO_2	Methane	Nitrogen	H_2S	BY GC-TCD	(*)	TOTAL # OF ~~BOTTLES~~ CANNISTERS
AT124 (VEW-15-12/13/14)	12/13/94	14:00	AIR	X	X	X	X					X	(*)	1
AT046 (VEW-15-2/13/14)	12/13/94	14:00	AIR					X	X	X	X	X		1
AT040 (MW-13-12/12/15:20)	12/12/94	15:20	AIR	X	X	X	X					X	(*)	1
AT103 (MW-13-12/12/15:20)	12/12/94	15:20	AIR					X	X	X	X	X		1
(*) ELCD/PID/FID														

Total Number of Bottles/Containers: 4

Relinquished By	Date	Time	Received By	Date	Time
	12/13/94	18:30	D. Fuller	12/14	1200

Client	Groundwater Technology		Purchase Order Number
Address	2501 Yale Blvd SE #204		Project Number 023500039.6101
City	Albuquerque	State NM Zip 87106	Project Name MOC / Indian Basin Gas Plant
Phone Number	(505) 272-3117	Fax Number (505) 242-1103	Project Location Marathon - Indian Basin Gas Plant
Project Manager	Sara Brothers		Sampled By Charles T. Briscoe

TURNAROUND TIMES	check below
Standard - 14-21 days	
RUSH (must be approved in advance)	
<- 48 hours - 2x standard price	
3-7 days - 1.5x standard price	
TCLP - 1 week rush 1.5x standard price	
QC Level none I II III IV (circle one)	

SPECIAL INSTRUCTIONS
Direct Bill Marathon
ATTN: Bob Menzie
Copies of report needed _____

FORM # 12694 — METRO PRINTING INC. HUNTSVILLE, ALABAMA 35801 WHITE — LAB CANARY — REPORT PINK — CLIENT

AnalyticalTechnologies, Inc. Albuquerque, NM

Chain of Custody

DATE 12/14/15 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	CO_2/O_2 BY GC-TCD	632/632 MOD	619/619 MOD	610/8310	methane BY GC-TCD	Nitrogen BY GC-TCD	8240 /TCLP 1311) ZHE	H_2S (D)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	BTXE - TCD	NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228		AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
412359-02	12/13	1400	air							X				X	X		X																1
04	12/12	1520	air							X				X	X		X																1

PROJECT INFORMATION	
PROJECT NUMBER:	412359
PROJECT NAME:	GT
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

DUE DATE: 12/29
RUSH SURCHARGE: 0
CLIENT DISCOUNT: 10 %

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	X
Westmont	
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: D. Letter Time: 1730
Printed Name: Diane Letter Date: 12/14/14
Analytical Technologies, Inc. Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical**Technologies,**Inc. Albuquerque, NM

Chain of Custody

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**
ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	CO_2, O_2 BY GC-TCD	632/632 MOD	619/619 MOD	610/8310	Methane BY GC-TCD	Nitrogen BY GC-TCD	8240 (TCLP 1311) ZHE	H_2S	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	BTEX GC-FID	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
(412359-02)	12/13	1400	air							X				X	X		X													1
04)	12/12	1520	air							X				X	X		X													1

PROJECT INFORMATION	
PROJECT NUMBER:	412359
PROJECT NAME:	GT
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

DUE DATE: 12/29
RUSH SURCHARGE: 0
CLIENT DISCOUNT: 10 %

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	
Westcoast	X
FIBEROUANT	

RELINQUISHED BY: 1.
Signature: D. Lutter Time: 1730
Printed Name: Dianne Lutter Date: 12/14/94
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Jennifer Holmes Time: 10:25
Printed Name: Jennifer Holmes Date: 12/15/94
Company: WCAS #28290

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

~~412588~~ DS 1-13-95

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EDA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	TO14 - TNMHCS	CO, O2	8240 (TCLP 1311) ZHE	Methane	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GCMS (624/8240)	Nitrogen	NACE	ASBESTOS	H2S	BOD	TOTAL COLIFORM	FECAL COLIFORM	EDB 504.1 - TCD	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
412359 -01	12/13	1400	air							X				X	X	X	X	X	X	X	X	X	X				X					1
-02	↓	↓																														1
-03	12/12	1520													X	X	X	X	X	X	X	X	X									1
-04	↓	↓	↓																													1

PROJECT INFORMATION	
PROJECT NUMBER:	412359
PROJECT NAME:	GT
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!
DUE DATE:	12/29
SURCHARGE:	0
DISCOUNT:	10 %

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	412588

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
HENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.

Signature: D. Mitchell Time: 1730

Printed Name: Diane Mitchell Date: 12/14/95

Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.

Signature: David R. Bass Time: 0905

Printed Name: David R. Bass Date: 12/15/95

Company: ATI / Albuquerque

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

WORK LK 1170

ATTACHMENT 1

WEST COAST ANALYTICAL SERVICE, INC.

ANALYTICAL TECHNOLOGIES
Ms. Tish Krakowski

Job # 28290
December 19, 1994

LABORATORY REPORT

Sample: 412359-02

Permanent Gases by Gas Chromatography

Date Received: 12/15/94
Date Analyzed: 12/16/94

Instrument ID: GC #1

Matrix: Air
Sample amount: 2 ml

Units: Volume percent

Compound	Concentration	Detection Limit
Oxygen and/or Argon	12.2	0.01
Nitrogen	78.2	0.01
Carbon monoxide	ND	0.01
Methane	1.47	0.0001
Carbon dioxide	8.2	0.01

WEST COAST ANALYTICAL SERVICE, INC.

ANALYTICAL TECHNOLOGIES
Ms. Tish Krakowski

Job # 28290
December 19, 1994

LABORATORY REPORT

Sample: 412359-04

Permanent Gases by Gas Chromatography

Date Received: 12/15/94
Date Analyzed: 12/16/94

Matrix: Air
Sample amount: 2 ml

Instrument ID: GC #1

Units: Volume percent

Compound	Concentration	Detection Limit
Oxygen and/or Argon	17	0.01
Nitrogen	77.8	0.01
Carbon monoxide	ND	0.01
Methane	0.12	0.0001
Carbon dioxide	5.07	0.01

WEST COAST ANALYTICAL SERVICE, INC.

ANALYTICAL TECHNOLOGIES
Ms. Tish Krakowski

Job # 28290
December 19, 1994

LABORATORY REPORT

Permanent Gases by Gas Chromatography

Duplicate Results Summary

QC Batch: 28290DUP
Date Analyzed: 12/16/94

Matrix: Air
Date Extracted: N/A
Units: Volume percent

Analyte	Sample Result	Duplicate Result	RPD
Oxygen and/or Argon	17	16.9	0.6
Nitrogen	77.8	77.3	0.6
Carbon monoxide	ND	ND	N/A
Methane	0.12	0.12	0.0
Carbon dioxide	5.07	5.66	-11

QC Limits

Analyte	RPD Warning	RPD Control
Oxygen/argon	5	8
Nitrogen	5	8
Methane	7	11
Carbon dioxide	11	17

Abbreviations Summary

General Reporting Abbreviations:

B Blank - Indicates that the compound was found in both the sample and the blank. The sample value is reported without blank subtraction. If the sample value is less than 10X the blank value times the sample dilution factor, the compound may be present as a laboratory contaminant.

D Indicates that the sample was diluted, and consequently the surrogates were too dilute to accurately measure.

DL Detection Limit - Is the minimum value which we believe can be detected in the sample with a high degree of confidence, taking into account dilution factors and interferences. The reported detection limits are equal to or greater than Method Detection Limits (MDL) to allow for day to day and instrument to instrument variations in sensitivity.

J Indicates that the value is an estimate.

ND Not Detected - Indicates that the compound was not found in the sample at or above the detection limit.

ppm parts per million (billion) in liquids is usually equivalent
ppb to mg/l (ug/l), or in solids to mg/kg (ug/kg). In the gas phase it is equivalent to ul/l (ul/m^3).

TR Trace - Indicates that the compound was observed at a value less than our normal reported Detection Limit (DL), but we feel its presence may be important to you. These values are subject to large errors and low degrees of confidence.

kg kilogram	mg milligram	l liter	m meter
g gram	ug microgram	ul microliter	

QC Abbreviations:

Control Control Limits are determined from historical data for a QC parameter. The test value must be within this acceptable range for the test to be considered in control. Usually this range corresponds to the 99% confidence interval for the historical data.

% Error Percent Error - This is a measure of accuracy based on the analysis of a Laboratory Control Standard (LCS). An LCS is a reference sample of known value such as an NIST Standard Reference Material (SRM). The % Error is expressed in percent as the difference between the known value and the experimental value, divided by the known value. The LCS may simply be a solution based standard which confirms calibration (ICV or CCV - initial or continuing calibration verification), or it may be a reference sample taken through preparation and analysis.

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

4/12588

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
412359 -01	12/13	1400	air	
-02	↓	↓	↓	
-03	12/12	1520		
-04	↓	↓	↓	

ANALYSIS REQUEST

TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EPA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	T014 - TNMHCS	CO, CO2 (e)	8240 TCLP 1311) ZHE	Methane (e)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	Nitrogen (e)	NACE	ASBESTOS	H2S (e)	BOD	TOTAL COLIFORM	FECAL COLIFORM	ANGC - TCD (e)	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
					X				X													X					1
					X				X													X					1
										X		X			X												1
										X		X			X			X									1

PROJECT INFORMATION

PROJECT NUMBER: 412359

PROJECT NAME: GT

QC LEVEL: (STD) IV

QC REQUIRED: MS MSD BLANK

TAT: (STANDARD) RUSH!

DUE DATE: 12/29

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO# LK 1170

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	412588

SAMPLES SENT TO:

SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.

Signature: Dilutha Time: 1730

Printed Name: Dilutha Date: 12/14/95

Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.

Signature: Time:

Printed Name: Date: 12/15/95

Company: ATI / Pensacola

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

4/0458

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
412359 -01	12/13	1400	air	
-02	↓	↓		
-03	12/12	1520		
-04	↓	↓	↓	

TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EDA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	TO14 - TNMHCS	CO, O2 (2)	8240 (TCLP 1311) ZHE	Methane (2)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	Nitrogen (2)	NACE	ASBESTOS (2)	H2S (2)	BOD	TOTAL COLIFORM	FECAL COLIFORM (2)	MA GC - TCD (2)	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
					X				X	X		X			X		X	X				X					1
																											1
					X				X	X		X			X		X	X				X					1
																											1

PROJECT INFORMATION	
PROJECT NUMBER:	412359
PROJECT NAME:	GT
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	41,2588

DUE DATE: 12/29
RUSH SURCHARGE: 0
CLIENT DISCOUNT: 10 %

WO#LK 1170

SAMPLES SENT TO:

SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBEROUANT	

RELINQUISHED BY: 1.
Signature: [signature] Time: 1730
Printed Name: [signature] Date: 12/14/95
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: [signature] Time: 0905
Printed Name: [signature] Date: 12/15/95
Company: ATI / Pensacola

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

4/1253

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EDA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	T014 - TNMHCS	CO2, O2 (PE)	8240 /TCLP 1311) ZHE	Methane (PE)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	Nitrogen (PE)	NACE	ASBESTOS	H2S (PE)	BOD	TOTAL COLIFORM	FECAL COLIFORM	9246 - TCD (PE)	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
412359 -01	12/13	1400	air							X				X	X	X	X		X	X			X			X	X					1
-02	↓	↓																														1
-03	12/12	1520																														1
-04	↓	↓	↓																													1

PROJECT INFORMATION	
PROJECT NUMBER:	412359
PROJECT NAME:	GT
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	42588

DUE DATE: 12/29

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO# LK 1170

SAMPLES SENT TO:

- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA X
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.

Signature: Time: 1730

Printed Name: Date: 12/14/95

Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.

Signature: Time: 0900

Printed Name: Date: 12/15/95

Company: ATI / Bustamante

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

4/12588

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
412359 -01	12/13	1400	air	
-02	↓	↓	↓	
-03	12/12	1520		
-04	↓	↓	↓	

	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EDA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	T014 - TNMHCS	Co, Ni, O2 (a)	8240 (TCLP 1311) ZHE	Methane (a)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	Nitrogen (a)	NACE	ASBESTOS	H2S (a)	BOD	TOTAL COLIFORM	FECAL COLIFORM	PAH 610 - FID (a)	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
412359 -01						X				X	X	X	X			X		X				X	X					1
-02																												1
-03											X	X	X			X		X										1
-04																												1

PROJECT INFORMATION

PROJECT NUMBER: 412359

PROJECT NAME: GT

QC LEVEL: (STD) IV

QC REQUIRED: MS MSD BLANK

TAT: (STANDARD) RUSH!

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	4
RECEIVED GOOD COND./COLD	4
LAB NUMBER	412588

DUE DATE: 12/29

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO#FLK 1170

SAMPLES SENT TO:

SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.

Signature: [signature] Time: 1730

Printed Name: Dianne Lotta Date: 12/14/95

Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.

Signature: [signature] Time: 0905

Printed Name: [signature] Date: 12/15/95

Company: ATI / Pensacola

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

4/1258

DATE 12/14/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
412359 -01	12/13	1400	air	
-02	↓	↓	↓	
-03	12/12	1520		
-04	↓	↓	↓	

ANALYSIS REQUEST

	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	EDA 8010, 8020	632/632 MOD	619/619 MOD	610/8310	T014 - TNMHCS	Cond, pH (e)	8240 (TCLP 1311) ZHE	Methane (e)	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	Nitrogen (e)	NACE	ASBESTOS	H2S (e)	BOD	TOTAL COLIFORM	FECAL COLIFORM	BTXE GC-FID (e)	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
412359 -01						X				X	X	X	X			X		X				X	X					1
-02						X				X	X	X	X			X		X				X	X					1
-03											X	X	X			X		X				X	X					1
-04											X	X	X			X		X				X	X					1

PROJECT INFORMATION

PROJECT NUMBER: 412359
PROJECT NAME: GT
QC LEVEL: (STD) IV
QC REQUIRED: MS MSD BLANK
TAT: (STANDARD) RUSH!

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	4
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	412588

DUE DATE: 12/29
RUSH SURCHARGE: 0
CLIENT DISCOUNT: 10 %

WO#LK 1170

SAMPLES SENT TO:
- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA X
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.
Signature: [signature] Time: 1730
Printed Name: Dianne Luttrell Date: 12/14/95
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: [signature] Time: 0905
Printed Name: [signature] Date: 12/15/95
Company: ATI / Pensacola

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

RECEIVED

FEB 16 1995

ATI I.D. **501382**

February 13, 1995

Groundwater Technology
2501 Yale Blvd. SE Suite 204
Albuquerque, NM 87106

Project Name/Number: MOC/INDIAN BASIN 023350039.6102

Attention: Sara Brothers

On **01/23/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **air** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

All analyses were performed by Anaytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 01/23/95
PROJECT #	: 023350039.6102		
PROJECT NAME	: MOC/INDIAN BASIN	REPORT DATE	: 02/13/95

ATI ID: 501382

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	MW-73 (AT084)	AIR	01/19/95
02	MW-67 (AT078)	AIR	01/21/95
03	MW-73 (AT 1-25)	AIR	01/18/95
04	MW-73 (AT079)	AIR	01/18/95

---TOTALS---

MATRIX	#SAMPLES
AIR	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	METHANE PLUS FIXED GASES
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	001	Sample Date/Time:	19-JAN-95 1430
Client Sample Id:	MW-73 (AT084)	Received Date:	24-JAN-95
Batch: SPA002		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	25-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
CARBON MONOXIDE	%	ND	0.05	
CARBON DIOXIDE	%	1.8	0.05	
METHANE	%	6.9	0.05	
NITROGEN	%	71	0.05	
OXYGEN	%	18	0.05	
ANALYST	INITIALS	KW		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	METHANE PLUS FIXED GASES
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	002	Sample Date/Time:	21-JAN-95 1605
Client Sample Id:	MW-67 (AT078)	Received Date:	24-JAN-95
Batch: SPA002		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	25-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
CARBON MONOXIDE	%	ND	0.05	
CARBON DIOXIDE	%	8.6	0.05	
METHANE	%	1.5	0.05	
NITROGEN	%	82	0.05	
OXYGEN	%	5.3	0.05	
ANALYST	INITIALS	KW		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	METHANE PLUS FIXED GASES
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	003	Sample Date/Time:	18-JAN-95 1450
Client Sample Id:	MW-73 (AT-25)	Received Date:	24-JAN-95
Batch: SPA002		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	25-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
CARBON MONOXIDE	%	ND	0.05	
CARBON DIOXIDE	%	ND	0.05	
METHANE	%	ND	0.05	
NITROGEN	%	77	0.05	
OXYGEN	%	23	0.05	
ANALYST	INITIALS	KW		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	METHANE PLUS FIXED GASES
Analysis Method:	ASTM D1946
Extraction Method:	N/A
Matrix:	AIR
QC Level:	N

Lab Id:	004		Sample Date/Time:	18-JAN-95 1641
Client Sample Id:	MW-73 (AT079)		Received Date:	24-JAN-95
Batch: SPA002			Extraction Date:	N/A
Blank: B	Dry Weight %:	N/A	Analysis Date:	26-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
CARBON MONOXIDE	%	ND	0.05	
CARBON DIOXIDE	%	1.4	0.05	
METHANE	%	5.7	0.05	
NITROGEN	%	72	0.05	
OXYGEN	%	20	0.05	
ANALYST	INITIALS	KW		

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: METHANE PLUS FIXED GASES

Client Sample Id:	Parameter:	Unit:	Result:
MW-73 (AT084)	CARBON DIOXIDE	%	1.8
	METHANE	%	6.9
	NITROGEN	%	71
	OXYGEN	%	18
MW-67 (AT078)	CARBON DIOXIDE	%	8.6
	METHANE	%	1.5
	NITROGEN	%	82
	OXYGEN	%	5.3
MW-73 (AT-25)	NITROGEN	%	77
	OXYGEN	%	23
MW-73 (AT079)	CARBON DIOXIDE	%	1.4
	METHANE	%	5.7
	NITROGEN	%	72
	OXYGEN	%	20

Analytical Technologies, Inc.

NITROGEN BLANK ANALYSIS

DATE: 25-JAN-95

METHOD: ASTM D1946

BATCH: SPA002 (A)

COMPOUND	UNITS	REPORTING LIMIT	RESULT
CARBON MONOXIDE	%	0.05	ND
CARBON DIOXIDE	%	0.05	ND
METHANE	%	0.05	ND
OXYGEN	%	0.05	ND

Analytical Technologies, Inc.

NITROGEN BLANK ANALYSIS

DATE: 26-JAN-95

METHOD: ASTM D1946

BATCH: SPA002 (B)

COMPOUND	UNITS	REPORTING LIMIT	RESULT
CARBON MONOXIDE	%	0.05	ND
CARBON DIOXIDE	%	0.05	ND
METHANE	%	0.05	ND
OXYGEN	%	0.05	ND

Analytical Technologies, Inc.

INITIAL CALIBRATION

DATE: 25-JAN-95

METHOD: ASTM D1946

BATCH: SPA002

COMPOUND	RF 1	RF 2	RF 3	RF 4	RF 5	AVG RF	SD	%RSD
CARBON MONOXIDE	1.76 E-5	1.77 E-5	1.76 E-5			1.76 E-5	5.80 E-7	0.33
CARBON DIOXIDE	1.32 E-5	1.34 E-5	1.35 E-5			1.34 E-5	1.53 E-7	1.1
METHANE	1.94 E-5	1.95 E-5	1.95 E-5			1.95 E-5	5.80 E-7	0.30
NITROGEN	1.72 E-5	1.89 E-5	1.65 E-5			1.75 E-5	1.23 E-7	7.0
OXYGEN	1.92 E-5	1.82 E-5	1.88 E-5			1.87 E-5	5.03 E-7	2.7

Analytical Technologies, Inc.

CONTINUING CALIBRATION

DATE: 26-JAN-95

METHOD: ASTM D1946

BATCH: SPA002

COMPOUND	RF (IC)	RF (CC)	%D	QC LIMITS
CARBON MONOXIDE	1.76 E-5	1.76 E-5	0	20%
CARBON DIOXIDE	1.34 E-5	1.32 E-5	1.5	20%
METHANE	1.95 E-5	1.95 E-5	0	20%
NITROGEN	1.75 E-5	1.73 E-5	1.1	20%
OXYGEN	1.87 E-5	1.94 E-5	3.7	20%

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946..

Analytical Technologies, Inc.

DUPLICATE SAMPLE ANALYSIS

DATE: 25-JAN-95

METHOD: ASTM D1946

LAB SAMPLE #: 501578-1

BATCH: SPA002

COMPOUND	SAMPLE RESULT	DUPLICATE RESULT	%RPD	QC LIMITS
CARBON DIOXIDE	1.85	1.85	0.54	15
METHANE	6.85	6.85	0	15
NITROGEN	70.5	69.8	1.0	15
OXYGEN	18.4	18.4	0	15

ALL RESULTS REPORTED IN %.

ND = NOT DETECTED
NC = NOT CALCULABLE

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

Analytical Technologies, Inc.

CHECK STANDARD (POST-RUN)

DATE: 26-JAN-95

METHOD: ASTM D1946

BATCH: SPA002

COMPOUND	RF (IC)	RF (PS)	%D	QC LIMITS
CARBON MONOXIDE	1.76 E-5	1.78 E-5	1.2	15%
CARBON DIOXIDE	1.32 E-5	1.33 E-5	0.76	15%
METHANE	1.95 E-5	1.96 E-5	0.51	15%
NITROGEN	1.73 E-5	1.75 E-5	1.2	15%
OXYGEN	1.94 E-5	1.96 E-5	1.0	15%

SOURCE FOR CONTROL LIMIT IS INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND ASTM D1946.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: BETX AND TPH IN CANISTERS
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 001
Client Sample Id: MW-73 (AT084)

Sample Date/Time: 19-JAN-95 1430
Received Date: 24-JAN-95

Batch: CAB027
Blank: B

Dry Weight %: N/A

Extraction Date: N/A
Analysis Date: 07-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	17	1	
ETHYL BENZENE	MG/M3	ND	1	
TOLUENE	MG/M3	47	5	
XYLENES	MG/M3	3	2	
TOTAL PETROLEUM HYDROCARBON	MG/M3	4900	500	
TRIFLUOROTOLUENE (PID)	%REC/SURR	90	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	80	63-135	
ANALYST	INITIALS	KKS		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: BETX AND TPH IN CANISTERS
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 003
Client Sample Id: MW-73 (AT-25)

Sample Date/Time: 18-JAN-95 1450
Received Date: 24-JAN-95

Batch: CAB027
Blank: A

Dry Weight %: N/A

Extraction Date: N/A
Analysis Date: 06-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	ND	1	
ETHYL BENZENE	MG/M3	ND	1	
TOLUENE	MG/M3	ND	5	
XYLENES	MG/M3	ND	2	
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	100	
TRIFLUOROTOLUENE (PID)	%REC/SURR	84	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	119	63-135	
ANALYST	INITIALS	KKS		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: BETX AND TPH IN CANISTERS
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 004 Sample Date/Time: 18-JAN-95 1641
Client Sample Id: MW-73 (AT079) Received Date: 24-JAN-95

Batch: CAB027 Extraction Date: N/A
Blank: A Dry Weight %: N/A Analysis Date: 06-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	35	1	
ETHYL BENZENE	MG/M3	10	1	
TOLUENE	MG/M3	19	5	
XYLENES	MG/M3	ND	2	
TOTAL PETROLEUM HYDROCARBON	MG/M3	3400	100	
TRIFLUOROTOLUENE (PID)	%REC/SURR	96	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	82	63-135	
ANALYST	INITIALS	KKS		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	BETX AND TPH IN CANISTERS
Analysis Method:	5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	II

Lab Id:	002		Sample Date/Time:	21-JAN-95 1605
Client Sample Id:	MW-67 (AT078)		Received Date:	24-JAN-95
Batch: CAB027			Extraction Date:	N/A
Blank: A	Dry Weight %:	N/A	Analysis Date:	06-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	MG/M3	ND	1	
ETHYL BENZENE	MG/M3	ND	1	
TOLUENE	MG/M3	36	5	
XYLENES	MG/M3	ND	2	
TOTAL PETROLEUM HYDROCARBON	MG/M3	5900	100	
TRIFLUOROTOLUENE (PID)	%REC/SURR	87	63-135	
TRIFLUOROTOLUENE (FID)	%REC/SURR	109	63-135	
ANALYST	INITIALS	KKS		

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: BETX AND TPH IN CANISTERS

Client Sample Id:	Parameter:	Unit:	Result:
MW-73 (AT084)	BENZENE	MG/M3	17
	TOLUENE	MG/M3	47
	XYLENES	MG/M3	3
	TOTAL PETROLEUM HYDROCARBON	MG/M3	4900
MW-67 (AT078)	TOLUENE	MG/M3	36
	TOTAL PETROLEUM HYDROCARBON	MG/M3	5900
MW-73 (AT079)	BENZENE	MG/M3	35
	ETHYL BENZENE	MG/M3	10
	TOLUENE	MG/M3	19
	TOTAL PETROLEUM HYDROCARBON	MG/M3	3400

Analytical Technologies, Inc.

"QC Report"

Title: Bag/Can Blank
Batch: CAB027
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 07-FEB-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	100
TRIFLUOROTOLUENE (PID)	%REC/SURR	97	63-135
TRIFLUOROTOLUENE (FID)	%REC/SURR	98	63-135
ANALYST	INITIALS	KKS	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Dry Weight %: N/A
Sample Spiked: 501578-3

MS Date Analyzed: 03-FEB-95
MSD Date Analyzed: 03-FEB-95

MS Date Extracted: N/A
MSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
1,1-DICHLOROETHENE	50	<1	47	94	43	86	9	21	76-118
TRICHLOROETHENE	50	<1	46	92	40	80	14	15	75-119
BENZENE	50	<1	50	100	50	100	0	20	49-148
TOLUENE	50	<5	51	102	51	102	0	15	48-148
CHLOROBENZENE	50	<1	51	102	51	102	0	14	82-118
Surrogates:									
BROMOFLUOROBENZENE (PID)				96		102			34-161
BROMOFLUOROBENZENE (ELCD)				93		92			75-137

Comments:
SPIKING COMPOUND LOT #01-VW08-02 AND #01-VW10-01 PURCHASED FROM ULTRA SCIENTIFIC
INTERNAL STANDARD LOT #01-VW15-02 PURCHASED FROM ACCUSTANDARD

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
3 = MICROGRAMS
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
G/M3 = MILLIGRAM PER CUBIC METER.
PMV = PART PER MILLION BY VOLUME.
G/KG = PARTS PER MILLION.
G/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS

OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.

RGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

D = NOT DETECTED ABOVE REPORTING LIMIT.

PT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

PD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

TI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

.TI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

.TI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

.TI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

.TI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

.JT = LISA THOMASON
:GH = DARREL HALSELL
'LH = TARA HELTON
:W = KAREN WADSWORTH
'V = MONIQUE VERHEYDEN
:W = STEVE WILHITE
'MP = JACKIE PRICE
:JF = STEVE FILOROMO
'L = PAUL LESCHENSKY
:W = ROBERT WOLFE
:V = BEN VAUGHN
:S = KENDALL SMITH

Analytical Technologies, Inc.

"QC Report"

Title: Bag/Can Blank
Batch: CAB027
Analysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
Extraction Method: N/A

Blank Id: A Date Analyzed: 06-FEB-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	MG/M3	ND	1
ETHYL BENZENE	MG/M3	ND	1
TOLUENE	MG/M3	ND	5
XYLENES	MG/M3	ND	2
TOTAL PETROLEUM HYDROCARBON	MG/M3	ND	100
TRIFLUOROTOLUENE (PID)	%REC/SURR	102	63-135
TRIFLUOROTOLUENE (FID)	%REC/SURR	103	63-135
ANALYST	INITIALS	KKS	

Comments:

Analytical Technologies, Inc.

"QC Report"

itle: Bag/Can Reagent
atch: CAB027
nalysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
xtraction Method: N/A

RS Date Analyzed: 06-FEB-95
RSD Date Analyzed: 06-FEB-95

RS Date Extracted: N/A
RSD Date Extracted: N/A

arameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
ENZENE	50	<1	52	104	55	110	6	18	71-138
OLUENE	50	<5	51	102	53	106	4	17	75-130
urrogates:									
RIFLUOROTOLUENE (PID)				100		101			63-135

omments:

otes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Analytical Technologies, Inc.

"QC Report"

itle: Bag/Can Matrix
atch: CAB027
nalysis Method: 5030/8020/8015/SW 846, 3rd Edition, Sep. 1986 and Rev. 1, July 1992
xtraction Method: N/A

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ry Weight %: N/A
ample Spiked: 501578-3

MS Date Analyzed: 07-FEB-95
MSD Date Analyzed: 07-FEB-95

MS Date Extracted: N/A
MSD Date Extracted: N/A

arameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
ENZENE	50	<1	54	108	48	96	12	20	57-140
OLUENE	50	<5	54	108	50	100	8	15	49-144
urrogates:									
RIFLUOROTOLUENE (PID)				92		94			63-135

omments:
SPIKING COMPOUND LOT #01-VW09-02 PURCHASED FROM ULTRA SCIENTIFIC
INTERNAL STANDARD LOT #01-VW17-02 PURCHASED FROM ACCUSTANDARD

otes:
UNITS IN MG/M3 = MILLIGRAM PER CUBIC METER N/S = NOT SUBMITTED
< = LESS THAN REPORTING LIMIT
SOURCE FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND METHOD REFERENCE.
UNITS IN UG = MICROGRAMS. N/S = NOT SUBMITTED

Analytical Technologies, Inc.

Common notation for Organic reporting

/S = NOT SUBMITTED
/A = NOT APPLICABLE
= DILUTED OUT
G/L = PARTS PER BILLION.
G/KG = PARTS PER BILLION.
G/KG = PARTS PER MILLION.
G/L = PARTS PER MILLION.
= LESS THAN DETECTION LIMIT.
= VALUES OUTSIDE OF QUALITY CONTROL LIMITS
OURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM
ND REFERENCED METHOD.
RGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.
* COMPOUNDS FLAGGED IN METHOD ARE NOT WITHIN THE FIVE POINT CURVE. THEY
RE SEARCHED FOR QUALITATIVELY.
D = NOT DETECTED ABOVE REPORTING LIMIT.

R-SHELLEY REAMSMA
C-DAVID CELESTIAL
KD-LEIGH DUVALL
M-MIKE MCKENZIE
WS-KENDALL SMITH
KS-KIMBERLY SMITH
F-GREG FOOTE
C-NICOLE CALL
A-JENNIFER ALEXANDER
AM-PENNY A. MALOUIN
CW-MARIE CLAUDIA WALTON
B-SHARON BRADDOCK
F-KAROLE FERGUSON
C-SCOTT CLARK
M-AMANDA MCCRAY

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 001
Client Sample Id: MW-73 (AT084)
Sample Date/Time: 19-JAN-95 1430
Received Date: 24-JAN-95

Batch: LUB018
Blank: A
Dry Weight %: N/A
Extraction Date: N/A
Analysis Date: 02-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BROMODICHLOROMETHANE	MG/M3	ND	1	
BROMOFORM	MG/M3	ND	2	
BROMOMETHANE	MG/M3	ND	2	
CARBON TETRACHLORIDE	MG/M3	ND	1	
CHLOROBENZENE	MG/M3	ND	1	
CHLOROETHANE	MG/M3	ND	5	
2-CHLOROETHYLVINYLETHER	MG/M3	ND	5	
CHLOROFORM	MG/M3	ND	2	
CHLOROMETHANE	MG/M3	ND	5	
DIBROMOCHLOROMETHANE	MG/M3	ND	5	
1,2-DICHLOROBENZENE	MG/M3	ND	2	
1,3-DICHLOROBENZENE	MG/M3	ND	2	
1,4-DICHLOROBENZENE	MG/M3	ND	2	
DICHLORODIFLUOROMETHANE	MG/M3	ND	5	
1,1-DICHLOROETHANE	MG/M3	ND	1	
1,2-DICHLOROETHANE	MG/M3	ND	1	
1,1-DICHLOROETHENE	MG/M3	ND	1	
1,2-DICHLOROETHENE (TOTAL)	MG/M3	ND	1	
1,2-DICHLOROPROPANE	MG/M3	ND	1	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
METHYLENE CHLORIDE	MG/M3	ND	5	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	1	
TETRACHLOROETHENE	MG/M3	ND	3	
1,1,1-TRICHLOROETHANE	MG/M3	ND	1	
1,1,2-TRICHLOROETHANE	MG/M3	ND	2	
TRICHLOROETHENE	MG/M3	ND	1	
TRICHLOROFLUOROMETHANE	MG/M3	ND	2	
VINYL CHLORIDE	MG/M3	ND	1	
BENZYL CHLORIDE	MG/M3**	ND	5	
BIS 2-CHLOROETHOXY METHANE	MG/M3**	ND	50	
BIS 2-CHOROISOPROPYL ETHER	MG/M3**	ND	50	
BROMOBENZENE	MG/M3**	ND	3	
CHLOROACETALDEHYDE	MG/M3**	ND	50	
CHLOROMETHYLMETHYL ETHER	MG/M3**	ND	50	
2-CHLOROTOLUENE	MG/M3**	ND	1	

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 001
Client Sample Id: MW-73 (AT084)
Sample Date/Time: 19-JAN-95 1430
Received Date: 24-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
DIBROMOMETHANE	MG/M3**	ND	5	
1,1,1,2-TETRACHLOROETHANE	MG/M3**	ND	1	
1,2,3 TRICHLOROPROPANE	MG/M3**	ND	5	
1-CHLOROHEXANE	MG/M3**	ND	5	
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	86	75-137	
ANALYST	INITIAL	PM		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	HALOGENATED VOLATILES (8010)
Analysis Method:	8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	II

Lab Id:	002	Sample Date/Time:	21-JAN-95 1605
Client Sample Id:	MW-67 (AT078)	Received Date:	24-JAN-95
Batch: LUB018		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	02-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BROMODICHLOROMETHANE	MG/M3	ND	1	
BROMOFORM	MG/M3	ND	2	
BROMOMETHANE	MG/M3	ND	2	
CARBON TETRACHLORIDE	MG/M3	ND	1	
CHLOROBENZENE	MG/M3	ND	1	
CHLOROETHANE	MG/M3	ND	5	
2-CHLOROETHYLVINYLETHER	MG/M3	ND	5	
CHLOROFORM	MG/M3	ND	2	
CHLOROMETHANE	MG/M3	ND	5	
DIBROMOCHLOROMETHANE	MG/M3	ND	5	
1,2-DICHLOROBENZENE	MG/M3	ND	2	
1,3-DICHLOROBENZENE	MG/M3	ND	2	
1,4-DICHLOROBENZENE	MG/M3	ND	2	
DICHLORODIFLUOROMETHANE	MG/M3	ND	5	
1,1-DICHLOROETHANE	MG/M3	ND	1	
1,2-DICHLOROETHANE	MG/M3	ND	1	
1,1-DICHLOROETHENE	MG/M3	ND	1	
1,2-DICHLOROETHENE (TOTAL)	MG/M3	ND	1	
1,2-DICHLOROPROPANE	MG/M3	ND	1	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
METHYLENE CHLORIDE	MG/M3	ND	5	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	1	
TETRACHLOROETHENE	MG/M3	ND	3	
1,1,1-TRICHLOROETHANE	MG/M3	ND	1	
1,1,2-TRICHLOROETHANE	MG/M3	ND	2	
TRICHLOROETHENE	MG/M3	ND	1	
TRICHLOROFLUOROMETHANE	MG/M3	ND	2	
VINYL CHLORIDE	MG/M3	ND	1	
BENZYL CHLORIDE	MG/M3**	ND	5	
BIS 2-CHLOROETHOXY METHANE	MG/M3**	ND	50	
BIS 2-CHOROISOPROPYL ETHER	MG/M3**	ND	50	
BROMOBENZENE	MG/M3**	ND	3	
CHLOROACETALDEHYDE	MG/M3**	ND	50	
CHLOROMETHYLMETHYL ETHER	MG/M3**	ND	50	
2-CHLOROTOLUENE	MG/M3**	ND	1	

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	501578
Client:	ANALYTICAL TECHNOLOGIES, INC.
Project Number:	023350039.6107
Project Name:	MARATHON/GTI
Project Location:	BOC/INDIAN BASIN
Test:	HALOGENATED VOLATILES (8010)
Analysis Method:	8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method:	N/A
Matrix:	AIR
QC Level:	II

Lab Id:	002	Sample Date/Time:	21-JAN-95 1605
Client Sample Id:	MW-67 (AT078)	Received Date:	24-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
DIBROMOMETHANE	MG/M3**	ND	5	
1,1,1,2-TETRACHLOROETHANE	MG/M3**	ND	1	
1,2,3 TRICHLOROPROPANE	MG/M3**	ND	5	
1-CHLOROHEXANE	MG/M3**	ND	5	
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	86	75-137	
ANALYST	INITIAL	PM		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 003 — Sample Date/Time: 18-JAN-95 1450
Client Sample Id: MW-73 (AT-25) — Received Date: 24-JAN-95

Batch: LUB018 — Extraction Date: N/A
Blank: A — Dry Weight %: N/A — Analysis Date: 03-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BROMODICHLOROMETHANE	MG/M3	ND	1	
BROMOFORM	MG/M3	ND	2	
BROMOMETHANE	MG/M3	ND	2	
CARBON TETRACHLORIDE	MG/M3	ND	1	
CHLOROBENZENE	MG/M3	ND	1	
CHLOROETHANE	MG/M3	ND	5	
2-CHLOROETHYLVINYLETHER	MG/M3	ND	5	
CHLOROFORM	MG/M3	ND	2	
CHLOROMETHANE	MG/M3	ND	5	
DIBROMOCHLOROMETHANE	MG/M3	ND	5	
1,2-DICHLOROBENZENE	MG/M3	ND	2	
1,3-DICHLOROBENZENE	MG/M3	ND	2	
1,4-DICHLOROBENZENE	MG/M3	ND	2	
DICHLORODIFLUOROMETHANE	MG/M3	ND	5	
1,1-DICHLOROETHANE	MG/M3	ND	1	
1,2-DICHLOROETHANE	MG/M3	ND	1	
1,1-DICHLOROETHENE	MG/M3	ND	1	
1,2-DICHLOROETHENE (TOTAL)	MG/M3	ND	1	
1,2-DICHLOROPROPANE	MG/M3	ND	1	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
METHYLENE CHLORIDE	MG/M3	ND	5	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	1	
TETRACHLOROETHENE	MG/M3	ND	3	
1,1,1-TRICHLOROETHANE	MG/M3	ND	1	
1,1,2-TRICHLOROETHANE	MG/M3	ND	2	
TRICHLOROETHENE	MG/M3	ND	1	
TRICHLOROFLUOROMETHANE	MG/M3	ND	2	
VINYL CHLORIDE	MG/M3	ND	1	
BENZYL CHLORIDE	MG/M3**	ND	5	
BIS 2-CHLOROETHOXY METHANE	MG/M3**	ND	50	
BIS 2-CHOROISOPROPYL ETHER	MG/M3**	ND	50	
BROMOBENZENE	MG/M3**	ND	3	
CHLOROACETALDEHYDE	MG/M3**	ND	50	
CHLOROMETHYLMETHYL ETHER	MG/M3**	ND	50	
2-CHLOROTOLUENE	MG/M3**	ND	1	

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 003
Client Sample Id: MW-73 (AT-25)
Sample Date/Time: 18-JAN-95 1450
Received Date: 24-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
DIBROMOMETHANE	MG/M3**	ND	5	
1,1,1,2-TETRACHLOROETHANE	MG/M3**	ND	1	
1,2,3 TRICHLOROPROPANE -	MG/M3**	ND	5	
1-CHLOROHEXANE	MG/M3**	ND	5	
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	83	75-137	
ANALYST	INITIAL	PM		

Comments:

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 004
Client Sample Id: MW-73 (AT079)

Sample Date/Time: 18-JAN-95 1641
Received Date: 24-JAN-95

Batch: LUB018
Blank: B

Dry Weight %: N/A

Extraction Date: N/A
Analysis Date: 03-FEB-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BROMODICHLOROMETHANE	MG/M3	ND	1	
BROMOFORM	MG/M3	ND	2	
BROMOMETHANE	MG/M3	ND	2	
CARBON TETRACHLORIDE	MG/M3	ND	1	
CHLOROBENZENE	MG/M3	ND	1	
CHLOROETHANE	MG/M3	ND	5	
2-CHLOROETHYLVINYLETHER	MG/M3	ND	5	
CHLOROFORM	MG/M3	ND	2	
CHLOROMETHANE	MG/M3	ND	5	
DIBROMOCHLOROMETHANE	MG/M3	ND	5	
1,2-DICHLOROBENZENE	MG/M3	ND	2	
1,3-DICHLOROBENZENE	MG/M3	ND	2	
1,4-DICHLOROBENZENE	MG/M3	ND	2	
DICHLORODIFLUOROMETHANE	MG/M3	ND	5	
1,1-DICHLOROETHANE	MG/M3	ND	1	
1,2-DICHLOROETHANE	MG/M3	ND	1	
1,1-DICHLOROETHENE	MG/M3	ND	1	
1,2-DICHLOROETHENE (TOTAL)	MG/M3	ND	1	
1,2-DICHLOROPROPANE	MG/M3	ND	1	
CIS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
TRANS-1,3-DICHLOROPROPENE	MG/M3	ND	1	
METHYLENE CHLORIDE	MG/M3	ND	5	
1,1,2,2-TETRACHLOROETHANE	MG/M3	ND	1	
TETRACHLOROETHENE	MG/M3	ND	3	
1,1,1-TRICHLOROETHANE	MG/M3	ND	1	
1,1,2-TRICHLOROETHANE	MG/M3	ND	2	
TRICHLOROETHENE	MG/M3	ND	1	
TRICHLOROFLUOROMETHANE	MG/M3	ND	2	
VINYL CHLORIDE	MG/M3	ND	1	
BENZYL CHLORIDE	MG/M3**	ND	5	
BIS 2-CHLOROETHOXY METHANE	MG/M3**	ND	50	
BIS 2-CHOROISOPROPYL ETHER	MG/M3**	ND	50	
BROMOBENZENE	MG/M3**	ND	3	
CHLOROACETALDEHYDE	MG/M3**	ND	50	
CHLOROMETHYLMETHYL ETHER	MG/M3**	ND	50	
2-CHLOROTOLUENE	MG/M3**	ND	1	

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 501578
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 023350039.6107
Project Name: MARATHON/GTI
Project Location: BOC/INDIAN BASIN
Test: HALOGENATED VOLATILES (8010)
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A
Matrix: AIR
QC Level: II

Lab Id: 004
Client Sample Id: MW-73 (AT079)
Sample Date/Time: 18-JAN-95 1641
Received Date: 24-JAN-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
DIBROMOMETHANE	MG/M3**	ND	5	
1,1,1,2-TETRACHLOROETHANE	MG/M3**	ND	1	
1,2,3 TRICHLOROPROPANE	MG/M3**	ND	5	
1-CHLOROHEXANE	MG/M3**	ND	5	
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	88	75-137	
ANALYST	INITIAL	SB		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Blank Id: A Date Analyzed: 02-FEB-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	UG/L	ND	1
BROMODICHLOROMETHANE	UG/L	ND	1
BROMOFORM	UG/L	ND	2
BROMOMETHANE	UG/L	ND	2
CARBON TETRACHLORIDE	UG/L	ND	1
CHLOROBENZENE	UG/L	ND	1
CHLOROETHANE	UG/L	ND	5
2-CHLOROETHYLVINYLETHER	UG/L	ND	5
CHLOROFORM	UG/L	ND	2
CHLOROMETHANE	UG/L	ND	5
DIBROMOCHLOROMETHANE	UG/L	ND	5
1,2-DICHLOROBENZENE	UG/L	ND	2
1,3-DICHLOROBENZENE	UG/L	ND	2
1,4-DICHLOROBENZENE	UG/L	ND	2
DICHLORODIFLUOROMETHANE	UG/L	ND	5
1,1-DICHLOROETHANE	UG/L	ND	1
1,2-DICHLOROETHANE	UG/L	ND	1
1,1-DICHLOROETHENE	UG/L	ND	1
1,2-DICHLOROETHENE (TOTAL)	UG/L	ND	1
1,2-DICHLOROPROPANE	UG/L	ND	1
CIS-1,3-DICHLOROPROPENE	UG/L	ND	1
TRANS-1,3-DICHLOROPROPENE	UG/L	ND	1
ETHYLBENZENE	UG/L	ND	1
METHYLENE CHLORIDE	UG/L	ND	5
METHYL T-BUTYL ETHER	UG/L	ND	5
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	1
TETRACHLOROETHENE	UG/L	ND	3
TOLUENE	UG/L	ND	5
1,1,1-TRICHLOROETHANE	UG/L	ND	1
1,1,2-TRICHLOROETHANE	UG/L	ND	2
TRICHLOROETHENE	UG/L	ND	1
TRICHLOROFLUOROMETHANE	UG/L	ND	2
VINYL CHLORIDE	UG/L	ND	1
XYLENES (TOTAL)	UG/L	ND	2
BENZYL CHLORIDE	UG/L**	ND	5
BIS(2-CHLOROETHOXY)METHANE	UG/L**	ND	50
BIS(2-CHLOROISOPROPYL)ETHER	UG/L**	ND	50
BROMOBENZENE	UG/L**	ND	3
CHLOROACETALDEHYDE	UG/L**	ND	50
CHLOROMETHYLMETHYL ETHER	UG/L**	ND	50
2-CHLOROTOLUENE	UG/L**	ND	1
DIBROMOMETHANE	UG/L**	ND	5
1,1,1,2 TETRACHLOROETHANE	UG/L**	ND	1
1,2,3 TRICHLOROPROPANE	UG/L**	ND	5
1-CHLOROHEXANE	UG/L**	ND	5
BROMOFLUOROBENZENE (PID)	%REC/SURR	102	34-161

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Parameters:	Units:	Results:	Reporting Limits:
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	87	75-137
ANALYST	INITIALS	SR	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Blank Id: B Date Analyzed: 03-FEB-95 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	UG/L	ND	1
BROMODICHLOROMETHANE	UG/L	ND	1
BROMOFORM	UG/L	ND	2
BROMOMETHANE	UG/L	ND	2
CARBON TETRACHLORIDE	UG/L	ND	1
CHLOROBENZENE	UG/L	ND	1
CHLOROETHANE	UG/L	ND	5
2-CHLOROETHYLVINYLETHER	UG/L	ND	5
CHLOROFORM	UG/L	ND	2
CHLOROMETHANE	UG/L	ND	5
DIBROMOCHLOROMETHANE	UG/L	ND	5
1,2-DICHLOROBENZENE	UG/L	ND	2
1,3-DICHLOROBENZENE	UG/L	ND	2
1,4-DICHLOROBENZENE	UG/L	ND	2
DICHLORODIFLUOROMETHANE	UG/L	ND	5
1,1-DICHLOROETHANE	UG/L	ND	1
1,2-DICHLOROETHANE	UG/L	ND	1
1,1-DICHLOROETHENE	UG/L	ND	1
1,2-DICHLOROETHENE (TOTAL)	UG/L	ND	1
1,2-DICHLOROPROPANE	UG/L	ND	1
CIS-1,3-DICHLOROPROPENE	UG/L	ND	1
TRANS-1,3-DICHLOROPROPENE	UG/L	ND	1
ETHYLBENZENE	UG/L	ND	1
METHYLENE CHLORIDE	UG/L	ND	5
METHYL T-BUTYL ETHER	UG/L	ND	5
1,1,2,2-TETRACHLOROETHANE	UG/L	ND	1
TETRACHLOROETHENE	UG/L	ND	3
TOLUENE	UG/L	ND	5
1,1,1-TRICHLOROETHANE	UG/L	ND	1
1,1,2-TRICHLOROETHANE	UG/L	ND	2
TRICHLOROETHENE	UG/L	ND	1
TRICHLOROFLUOROMETHANE	UG/L	ND	2
VINYL CHLORIDE	UG/L	ND	1
XYLENES (TOTAL)	UG/L	ND	2
BENZYL CHLORIDE	UG/L**	ND	5
BIS(2-CHLOROETHOXY)METHANE	UG/L**	ND	50
BIS(2-CHLOROISOPROPYL)ETHER	UG/L**	ND	50
BROMOBENZENE	UG/L**	ND	3
CHLOROACETALDEHYDE	UG/L**	ND	50
CHLOROMETHYLMETHYL ETHER	UG/L**	ND	50
2-CHLOROTOLUENE	UG/L**	ND	1
DIBROMOMETHANE	UG/L**	ND	5
1,1,1,2 TETRACHLOROETHANE	UG/L**	ND	1
1,2,3 TRICHLOROPROPANE	UG/L**	ND	5
1-CHLOROHEXANE	UG/L**	ND	5
BROMOFLUOROBENZENE (PID)	%REC/SURR	106	34-161

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

Parameters:	Units:	Results:	Reporting Limits:
BROMOFLUOROBENZENE (ELCD)	%REC/SURR	95	75-137
ANALYST	INITIALS	PM	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: LUB018
Analysis Method: 8010 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: N/A

RS Date Analyzed: 02-FEB-95
RSD Date Analyzed: 02-FEB-95

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
1,1-DICHLOROETHENE	50	<1	44	88	49	98	11	19	58-153
TRICHLOROETHENE	50	<1	48	96	47	94	2	10	71-127
BENZENE	50	<1	47	94	49	98	4	18	71-138
TOLUENE	50	<5	46	92	49	98	6	17	75-130
CHLOROBENZENE	50	<1	45	90	47	94	4	16	82-118
Surrogates:									
BROMOFLUOROBENZENE (PID)				95		95			34-161
BROMOFLUOROBENZENE (ELCD)				98		92			75-137

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical**Technologies,**Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

1/2

PART 1 - Bottle Shipment Information ATI ACCESSION #: 501382

CLIENT:	CLIENT PROJECT NUMBER:

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE							PLASTIC CONTAINERS							GLASS CONTAINERS									NOTES
	H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	
2																								6 L CANISTER AT078, AT084

Relinquished By:	Time	Date	Received By:	Time	Date
James R. Rumbaugh	1630	13 JA 95			

PART 2 - Sample/Project Information

SAMPLE MATRIX CODES

DW DRINKING WATER	AI AIR	SW SURFACE WATER
WW WASTEWATER	SO SOIL	SL SLUDGE
GW GROUNDWATER	OI OIL	ST STORMWATER

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	PARAMETERS AND PRESERVATIVES REQUESTED: TNMHC's	CO_2, O_2	Methane													TOTAL # OF BOTTLES
MW-73 (AT084)	1/19/95	14:30	AIR	X	X	X													1
MW-67 (AT078)	1/21/95	04:05	AIR	X	X	X													1

Total Number of Bottles/Containers:

Relinquished By	Date	Time	Received By	Date	Time
Kevin Cooke	1/23/95	0825	Kevin Cooke	1/23/95	0825
	1/23/95	0945	[illegible]	1/23/95	0945

Client	Marathon Oil Co.			Purchase Order Number	
Address	PO Box 551			Project Number	023350039.6102
City	Midland	State TX	Zip 79702	Project Name	MOC/INDIAN BASIN
Phone Number	(915) 682-1626	Fax Number ( )		Project Location	18 MILES NW OF CARLSBAD
Project Manager	Robert Mentzer JR.			Sampled By	CHARLES T. BRISCOE

TURNAROUND TIMES	check below
Standard - 14-21 days	✓
~~RUSH~~ (must be approved in advance)	
<- 48 hours - 2x standard price	
3-7 days - 1.5x standard price	
TCLP - 1 week rush 1.5x standard price	
QC Level none I II III IV (circle one)	

SPECIAL INSTRUCTIONS

TNMHC's By EPA T-0.14
Purgeable aromatics & halocarbons EPA-8010/8020
Methane, CO_2, O_2 By GC-TCD

Copies of report needed _____

Analytical**Technologies,**Inc.
11 East Olive Road • Pensacola, Florida 32514 • (904) 474-1001

CHAIN OF CUSTODY

PART 1 - Bottle Shipment Information 2/2 **ATI ACCESSION #:** 501382

CLIENT:	CLIENT PROJECT NUMBER:

QUANTITY OF SAMPLE CONTAINERS SHIPPED	PRESERVATIVE							PLASTIC CONTAINERS							GLASS CONTAINERS									NOTES
	H_2SO_4	HNO3	HCL	Zn Acetate	$Na_2S_2O_3$	Unpreserved	NaOH	8 oz.	16 oz.	32 oz.	½ gallon	1 gallon	Whirl-pak	100-ML Cup	120 ml (A)	1 liter (A)	1 liter (C)	40 ml Vial	4 oz. wm	8 oz. wm	16 oz. wm	32 oz. wm	D.I. Trip Blank	6 L CANISTER AT079, AT125
2																								

Relinquished By:	Time	Date	Received By:	Time	Date
Karen R. Rumbaugh	1630	13JA95			

PART 2 - Sample/Project Information

PARAMETERS AND PRESERVATIVES REQUESTED

SAMPLE MATRIX CODES

DW	DRINKING WATER	AI	AIR	SW	SURFACE WATER
WW	WASTEWATER	SO	SOIL	SL	SLUDGE
GW	GROUNDWATER	OI	OIL	ST	STORMWATER

SAMPLE I.D.	SAMPLE DATE	SAMPLE TIME	MATRIX	TNMHCs	CO_2, O_2	Methane	TOTAL # OF BOTTLES
MW-73 (AT1-25)	1/18/95	14:50	AIR	X	X	X	1
MW-73 (AT079)	1/18/95	16:40	AIR	X	X	X	1

Total Number of Bottles/Containers:

Relinquished By	Date	Time	Received By	Date	Time
Ken Cobb	1/23/95	08:27	Ken Cobb	1/23/95	0825
Ken Cobb	1/23/95	0945	M Mitchell	1/23/95	0945

Client	Marathon Oil Co.			Purchase Order Number	
Address	P.O. Box 551			Project Number	023350039.6102
City	Midland	State TX	Zip 79702	Project Name	MOC/INDIAN BASIN
Phone Number	(915) 682-1626	Fax Number ( )		Project Location	18 MILES NW OF CARLSBAD
Project Manager	Robert Mazzie JR.			Sampled By	BRISCOE

TURNAROUND TIMES	check below	SPECIAL INSTRUCTIONS
Standard - 14-21 days	✓	
RUSH (must be approved in advance)		TNMHC's EPA T-014
<- 48 hours - 2x standard price		Purgeable aromatics & Halocarbons EPA 8010/8020
3-7 days - 1.5x standard price		Methane, CO_2, O_2 By GC-TCD
TCLP - 1 week rush 1.5x standard price		
QC Level none I II III IV (circle one)		Copies of report needed _____

Analytical**Technologies,**Inc. Albuquerque, NM

Chain of Custody

-491510

DATE 1/28/94 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:
MITCH RUBENSTEIN

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	8240 /TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
MW-73 (ATØ84)	1/19	14:30	AIR	-01																					
MW-67 (ATØ78)	1/21	4:05	AIR	-02																					
MW-73 (ATI-25)	1/18	1450	AIR	-03																					
MW-73 (ATØ79)	1/18	1641	AIR	-04																					

PROJECT INFORMATION	
PROJECT NUMBER:	023350039.6107
PROJECT NAME:	MOC/INDIAN BASIN
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	0
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	SC1578

DUE DATE: 2/8/95 Am 2/8/95
RUSH SURCHARGE:_____
CLIENT DISCOUNT:_____%

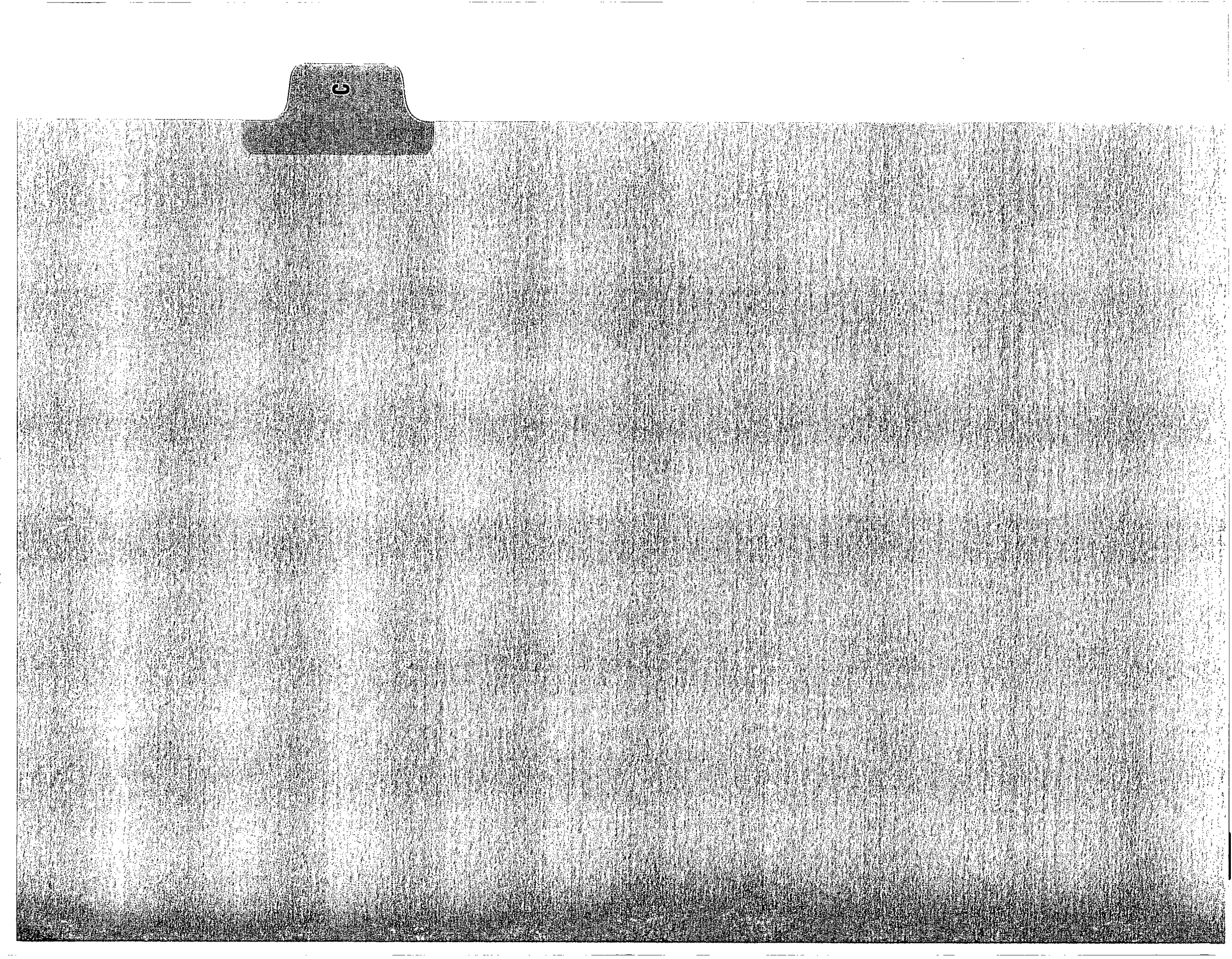
SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: [signature] Time: 5:15p
Printed Name: H Mitchell Rubenstein Date 1/28/95
Company: Analytical Technologies, Inc. Albuquerque

RECEIVED BY: (LAB) 1.
Signature: [signature] Time: 0925
Printed Name: DAVID R. BURT Date: 1/29/95
Company: ATI Labs

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:



APPENDIX C
VENT-ROI ANALYSES (VEW-1S & MW-18)

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 14 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 90 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 91.09 FEET
	INTERWELL EFFECTIVE RADIUS	= 74.57 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 69.7 FEET
	INTERWELL RADIUS OF INFLUENCE	= 47.71 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 91.09 FEET
	INTERWELL EFFECTIVE RADIUS	= 74.57 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 14 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Single Well Effective Radius	= 91.1 feet
Cleanup Goal	= 90 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 269 DAYS

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)	
Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater,
screened from 7.2 to 16.8 feet
100 by 100 foot plume requires 1 well

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 55.2 feet
Single Well Effective Radius	= 75.4 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 99 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 171.31 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 13.9 in. water column

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater,
screened from 7.2 to 16.8 feet
100 by 100 foot plume requires 1 well

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 74.6 feet
Single Well Effective Radius	= 91.1 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 90 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 171.31 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 13.9 in. water column

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 13.9 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 99 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 75.44 FEET
	INTERWELL EFFECTIVE RADIUS	= 55.24 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 69.69 FEET
	INTERWELL RADIUS OF INFLUENCE	= 47.71 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 75.44 FEET
	INTERWELL EFFECTIVE RADIUS	= 55.24 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 14 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Single Well Effective Radius	= 75.4 feet
Cleanup Goal	= 99 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 226 DAYS

GROUNDWATER TECHNOLOGY

OBSERVED AND PREDICTED FLOW RESPONSE TO APPLIED VACUUM

	Applied Vacuum (inches w.c.)	Observed Flow Response (scfm)	Predicted Flow Response (scfm)	Relative Percent Difference
1.	14	159.13	171.34	7.4 %
2.	13	170.82	159.3	-7 %
3.	14	171.15	171.34	.1 %

Mean Value of Relative Percent Difference:	.2 %
Mean Absolute Value of Relative Percent Difference:	4.8 %
Standard Deviation of Prediction:	11.9 scfm
Soil Permeability in Horizontal Direction (sq cm):	9.51E-07
Standard Deviation of Soil Permeability Estimation (sq cm):	6.8E-08
Ratio of Horizontal to Vertical Permeability:	9.7

GROUNDWATER TECHNOLOGY

ANALYSIS OF VACUUM DISSIPATION DATA FROM PILOT TEST

14 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-19	214	.001	-3
MW-20	236	.001	-3
MW-24	200	.001	-3

Additional data point based on applied vacuum:
2.8 inches of water column at 0 feet from SVE well

Slope = -.016 per foot
Intercept = 2.51 inches of water column
R squared = .982

13 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-19	214	.001	-3
MW-20	236	.001	-3
MW-24	200	.001	-3

Additional data point based on applied vacuum:
2.6 inches of water column at 0 feet from SVE well

Slope = -.015 per foot
Intercept = 2.333 inches of water column
R squared = .982

14 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-19	214	.001	-3
MW-20	236	.001	-3
MW-24	200	.001	-3

Additional data point based on applied vacuum:
2.8 inches of water column at 0 feet from SVE well

Slope = -.016 per foot
Intercept = 2.51 inches of water column
R squared = .982

Average slope from tests at 3 applied vacuums = -.016 per foot.

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 13.9 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 80 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 99.62 FEET
	INTERWELL EFFECTIVE RADIUS	= 84.56 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 69.69 FEET
	INTERWELL RADIUS OF INFLUENCE	= 47.71 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 99.62 FEET
	INTERWELL EFFECTIVE RADIUS	= 84.56 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7.2 to 16.8 feet

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 14 in. water column
Air Flow Rate per Vapor Extraction Well	= 171.3 scfm
Single Well Effective Radius	= 99.6 feet
Cleanup Goal	= 80 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 271.6 DAYS

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well MW-18.

Benzene (single component, volatile and biodegradable)	
Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater,
screened from 7.2 to 16.8 feet
100 by 100 foot plume requires 1 well

Thickness of Vented Soil Interval	= 16.8 feet
Slope of log10(P) vs Distance from Pilot Test	= .016 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 84.6 feet
Single Well Effective Radius	= 99.6 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 80 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 171.31 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 13.9 in. water column

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 24.9 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.3 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 80 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 79.19 FEET
	INTERWELL EFFECTIVE RADIUS	= 70.82 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 57.86 FEET
	INTERWELL RADIUS OF INFLUENCE	= 46.5 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 79.19 FEET
	INTERWELL EFFECTIVE RADIUS	= 70.82 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 25 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.4 scfm
Single Well Effective Radius	= 79.2 feet
Cleanup Goal	= 80 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 271.5 DAYS

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater,
screened from 7 to 19 feet
100 by 100 foot plume requires 1 well

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 70.8 feet
Single Well Effective Radius	= 79.2 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 80 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 190.26 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 24.9 in. water column

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 25 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.4 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 90 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 73.19 FEET
	INTERWELL EFFECTIVE RADIUS	= 64.24 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 57.86 FEET
	INTERWELL RADIUS OF INFLUENCE	= 46.51 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 73.19 FEET
	INTERWELL EFFECTIVE RADIUS	= 64.24 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 25 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.4 scfm
Single Well Effective Radius	= 73.2 feet
Cleanup Goal	= 90 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 269.1 DAYS

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater,
screened from 7 to 19 feet
100 by 100 foot plume requires 1 well

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 64.2 feet
Single Well Effective Radius	= 73.2 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 90 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 190.38 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 24.9 in. water column

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

EFFECTIVE RADIUS CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 25 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.4 scfm
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 99 % removal

VOLATILIZATION:	SINGLE WELL EFFECTIVE RADIUS	= 62.02 FEET
	INTERWELL EFFECTIVE RADIUS	= 51.48 FEET
BIODEGRADATION:	SINGLE WELL RADIUS OF INFLUENCE	= 57.86 FEET
	INTERWELL RADIUS OF INFLUENCE	= 46.51 FEET
VOL. PLUS BIO.:	SINGLE WELL EFFECTIVE RADIUS	= 62.02 FEET
	INTERWELL EFFECTIVE RADIUS	= 51.48 FEET

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

REMEDIATION TIME CALCULATION FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Applied Vacuum	= 25 in. water column
Air Flow Rate per Vapor Extraction Well	= 190.4 scfm
Single Well Effective Radius	= 62 feet
Cleanup Goal	= 99 % removal

TIME TO CLEANUP UNDER THESE CONDITIONS = 226 DAYS

GROUNDWATER TECHNOLOGY

RESULTS OF VENT-ROI ANALYSIS

SOIL GAS EXTRACTION RATE FOR CONVENTIONAL SOIL VAPOR EXTRACTION SYSTEM

Marathon Oil Indian Basin Gas Plant site in Carlsbad, New Mexico.
Vapor Extraction Test Well VEW-1S

Benzene (single component, volatile and biodegradable)

Molecular Weight	= 78
Vapor Pressure	= 45.5 mm Hg
Temperature Constant	= 1849 deg K
Liquid Density	= .879 g/cc
Zero Order Bioremediation Rate Constant	= 5 ppm/day
Initial Total Soil Contaminant Concentration	= 7750 ppm
Residual (Non-degradable) Soil Concentration	= 1 ppm

Vertical wells in 10.5 inch boreholes, not extending to groundwater, screened from 7 to 19 feet
100 by 100 foot plume requires 3 wells, operated simultaneously,

Thickness of Vented Soil Interval	= 19 feet
Slope of log10(P) vs Distance from Pilot Test	= .024 per ft
Soil Gas Temperature	= 50 deg F
Interwell Effective Radius	= 51.5 feet
Single Well Effective Radius	= 62 feet
Desired Time to Cleanup	= 365 days
Cleanup Goal	= 99 % removal

FLOW REQUIRED FOR SINGLE WELL AT THESE CONDITIONS	= 190.34 scfm
APPLIED VACUUM REQUIRED TO ACHIEVE THIS FLOW	= 24.9 in. water column
TOTAL FLOW REQUIRED FOR MULTIWELL SYSTEM	= 503.44 scfm

GROUNDWATER TECHNOLOGY

ANALYSIS OF VACUUM DISSIPATION DATA FROM PILOT TEST

25 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-A	4	.09	-1.046
MW-B	8	.9	-.046
MW-2	16	.9	-.046
MW-C	26	.25	-.602
MW-14	40	.26	-.585
MW-34	151	.02	-1.699
* MW-13	175	0	
MW-33	100	.02	-1.699
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
2.5 inches of water column at 0 feet from SVE well

Slope = -.012 per foot
Intercept = .693 inches of water column
R squared = .676

25 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-A	4	.095	-1.022
MW-B	8	.95	-.022
MW-2	16	.95	-.022
MW-C	26	.24	-.62
MW-14	40	.25	-.602
MW-34	151	.01	-2
* MW-13	175	0	
MW-33	100	.01	-2
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
2.5 inches of water column at 0 feet from SVE well

Slope = -.014 per foot
Intercept = .756 inches of water column
R squared = .744

25 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
MW-A	4	.1	-1
MW-B	8	.95	-.022
MW-2	16	.95	-.022
MW-C	26	.25	-.602
MW-14	40	.25	-.602
MW-34	151	.01	-2
* MW-13	175	0	
MW-33	100	.01	-2
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
2.5 inches of water column at 0 feet from SVE well

Slope = -.014 per foot
Intercept = .769 inches of water column
R squared = .751

19 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
* MW-A	4	.08	-1.097
MW-B	8	.75	-.125
MW-2	16	.75	-.125
MW-C	26	.19	-.721
MW-14	40	.2	-.699
* MW-34	151	0	
* MW-13	175	0	
* MW-33	100	0	
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
3.8 inches of water column at 0 feet from SVE well

Slope = -.031 per foot
Intercept = 2.172 inches of water column
R squared = .815

14 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
* MW-A	4	.06	-1.222
MW-B	8	.6	-.222
MW-2	16	.6	-.222
MW-C	26	.16	-.796
MW-14	40	.17	-.77
* MW-34	151	0	
* MW-13	175	0	
* MW-33	100	0	

* MW-15	229	0

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
2.8 inches of water column at 0 feet from SVE well

Slope	= -.029 per foot
Intercept	= 1.647 inches of water column
R squared	= .814

9 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
* MW-A	4	.04	-1.398
MW-B	8	.39	-.409
MW-2	16	.4	-.398
MW-C	26	.11	-.959
MW-14	40	.11	-.959
* MW-34	151	0	
* MW-13	175	0	
* MW-33	100	0	
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
1.8 inches of water column at 0 feet from SVE well

Slope = -.029 per foot
Intercept = 1.075 inches of water column
R squared = .822

5 INCHES APPLIED VACUUM:

Monitoring Well	Distance from SVE Well (ft)	Measured Vacuum (inches w.c.)	log10(Vac)
* MW-A	4	.02	-1.699
MW-B	8	.16	-.796
MW-2	16	.21	-.678
MW-C	26	.05	-1.301
MW-14	40	.03	-1.523
* MW-34	151	0	
* MW-13	175	0	
* MW-33	100	0	
* MW-15	229	0	

* = outlier, not considered in analysis
Additional data point based on applied vacuum:
1 inches of water column at 0 feet from SVE well

Slope = -.035 per foot
Intercept = .601 inches of water column
R squared = .869

Average slope from tests at 7 applied vacuums = -.024 per foot.

OBSERVED AND PREDICTED FLOW RESPONSE TO APPLIED VACUUM

	Applied Vacuum (inches w.c.)	Observed Flow Response (scfm)	Predicted Flow Response (scfm)	Relative Percent Difference
1.	25	175.7	190.39	8 %
2.	25	164.72	190.39	14.5 %
3.	25	164.72	190.39	14.5 %
4.	19	134.09	145.79	8.4 %
5.	14	113.34	108.1	-4.7 %
6.	9	84.3	69.93	-18.6 %
7.	5	45.8	39.04	-15.9 %

Mean Value of Relative Percent Difference:	.9 %
Mean Absolute Value of Relative Percent Difference:	12.1 %
Standard Deviation of Prediction:	18 scfm
Soil Permeability in Horizontal Direction (sq cm):	4.19E-07
Standard Deviation of Soil Permeability Estimation (sq cm):	6E-08
Ratio of Horizontal to Vertical Permeability:	3.3

D

GROUNDWATER
TECHNOLOGY

APPENDIX D
MASS EXTRACTION RATE CALCULATIONS

Marathon Oil SCFM Calc's for VentROI and lb/hr Air Emissions Calcs.

Extraction Well: MW-67 Monitor Date: 1/20-21/1995

Time after test started (mins)	Pipe ID (R-Herco) (inches)	Anemometer Velocity (fpm)	Actual Flow Vol. (acfm)	Pre-dilut'n air field Temp. (deg. F)	ISTP Temp. (deg. F)	Field Elev. (ft. amsl)	Field Atmos. absol. press. (in W.C.)	Pre-dilution gage vacuum (in. W.C.)	ISTP Atmos. absol. press. (in W.C.)	Standard Flow (scfm)
	4" sch 40 PVC									
30	3.998	2400	209.23	56.8	68	3500	367.36	27	406.92	178.80
120	3.998	2200	191.79	60.4	68	3500	367.36	27	406.92	162.77
360	3.998	2000	174.36	50.7	68	3500	367.36	27	406.92	150.78
480*	3.998	2000	174.36	50.8	68	3500	367.36	27	406.92	150.75

Note: * The 480 minute monitoring intervals is most representative of the 485 minute vapor sample.

Contaminant Name Name	(AT078) Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 485 min. (maximum) (lb/hr)
Benzene	<1	5.58E-04
Ethyl Benzene	<1	5.58E-04
Toluene	36	2.01E-02
Xylenes	<2	1.12E-03
TPH	5900	3.29

GROUNDWATER TECHNOLOGY

Marathon Oil SCFM Calc's for VentROI and lb/hr Air Emissions Calcs.

Extraction Well: VEW-1S Monitor Date: 12/13/94

Time after test started (mins)	Pipe ID (R-Herco) (inches)	Anemometer Velocity (fpm)	Actual Flow Vol. (acfm)	Pre-dilut'n air field Temp. (deg. F)	ISTP Temp. (deg. F)	Field Elev. (ft. amsl)	Field Atmos. absol. press. (in W.C.)	Pre-dilution gage vacuum (in. W.C.)	ISTP Atmos. absol. press. (in W.C.)	Standard Flow (scfm)
	4" sch 40 PVC									
15	3.998	2400	209.23	69	68	3500	367.36	25	406.92	175.70
120	3.998	2250	196.15	69	68	3500	367.36	25	406.92	164.72
240*	3.998	2250	196.15	69	68	3500	367.36	25	406.92	164.72
275	3.998	1800	156.92	69	68	3500	367.36	19	406.92	134.09
295	3.998	1500	130.77	69	68	3500	367.36	14	406.92	113.34
315	3.998	1100	95.90	69	68	3500	367.36	9	406.92	84.29
335	3.998	590	51.44	68	68	3500	367.36	5	406.92	45.80

Contaminant Name	Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 240 min. (lb/hr)
Benzene	110	0.07
Ethyl Benzene	98	0.06
Toluene	28	0.02
Xylenes	22	0.01
TPH	24000	14.63

Note: * The 240 minute monitoring interval was just prior to vapor sample collection event.

GROUNDWATER TECHNOLOGY

		Marathon Oil SCFM Calc's for VentROI and lb/hr Air Emissions Calcs.								
		Extraction Well:		MW-18			Monitor Date:	12/12/94		
Time after test started (mins)	Pipe ID (R-Herco) (inches)	Anemometer Velocity (fpm)	Actual Flow Vol. (acfm)	Pre-dilut'n air field Temp. (deg. F)	ISTP Temp. (deg. F)	Field Elev. (ft. amsl	Field Atmos. absol. press. (in W.C.)	Pre-dilution gage vacuum (in. W.C.)	ISTP Atmos. absol. press. (in W.C.)	Standard Flow (scfm)
	4" sch 40 PVC									
15	3.998	2100	183.08	67.5	68	3500	367.36	14	406.92	159.13
120	3.998	2250	196.15	68	68	3500	367.36	13	406.92	170.82
240	3.998	2250	196.15	65.5	68	3500	367.36	14	406.92	171.15

Contaminant Name	Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 240 min. (lb/hr)
Benzene	1	6.33E-04
Ethyl Benzene	7	4.43E-03
Toluene	<5	3.17E-03
Xylenes	<2	1.27E-03
TPH	1500	9.50E-01

Note: * The 240 minute monitoring interval was just prior to vapor sample collection event.

GROUNDWATER TECHNOLOGY

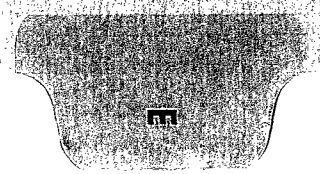
Marathon Oil SCFM Calc's for VentROI and lb/hr Air Emissions Calcs.

		Extraction Well:		MW-73			Monitor Date:	1/17-19/1995		
Time after test started (mins)	Pipe ID (R-Herco) (inches)	Anemometer Velocity (fpm)	Actual Flow Vol. (acfm)	Pre-dilut'n air field Temp. (deg. F)	ISTP Temp. (deg. F)	Field Elev. (ft. amsl)	Field Atmos. absol. press. (in W.C.)	Pre-dilution gage vacuum (in. W.C.)	ISTP Atmos. absol. press. (in W.C.)	Standard Flow (scfm)
	4" sch 40 PVC									
15	3.998	1500	130.77	57.8	68	3500	367.36	129	406.92	78.11
120	3.998	1750	152.56	55.3	68	3500	367.36	122	406.92	94.26
360	3.998	1750	152.56	54.7	68	3500	367.36	122	406.92	94.37
720	3.998	1750	152.56	52	68	3500	367.36	122	406.92	94.87
1440*	3.998	1750	152.56	56.1	68	3500	367.36	119	406.92	95.26
1620*	3.998	1750	152.56	54.3	68	3500	367.36	116	406.92	96.75
2835*	3.998	1750	152.56	56.3	68	3500	367.36	116	406.92	96.38
2950	3.998	1100	95.90	56.6	68	3500	367.36	41	406.92	78.61

Note: * The 1440, 1620, and 2835 minute monitoring intervals are most representative of the 1445, 1556, and 2865 minute vapor sample collection events respectively. The 2865 minute sample, collected on 1/19/95 @ 14:30, was the only predilution soil gas sample.

Contaminant Name Name	(AT-25) Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 1445 min. (maximum) (lb/hr)	(AT079) Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 1556 min. (lb/hr)	(AT084) Lab Analyt. Concentr'tn (mg/M^3)	Emissions at 2865 min. (lb/hr)
Benzene	<1	3.53E-04	35	1.25E-02	17	6.06E-03
Ethyl Benzene	<1	3.53E-04	10	3.58E-03	<1	3.57E-04
Toluene	<5	1.76E-03	19	6.80E-03	36	1.28E-02
Xylenes	<2	7.05E-04	<2	7.05E-04	3	1.07E-03
TPH	<100	3.53E-02	3400	1.22	4900	1.75

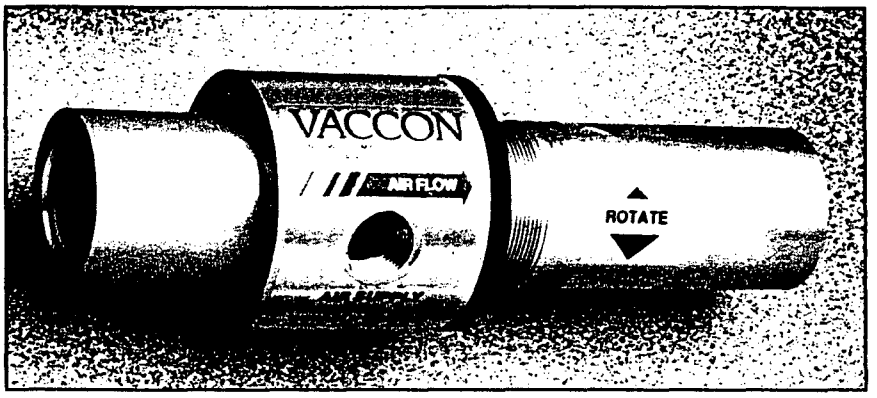
GROUNDWATER TECHNOLOGY



APPENDIX E
VACCON VDF 750 VENTURI PUMP INFORMATION

Multi Purpose Variable Vacuum Pump

Description: The VDF Series of adjustable air powered vacuum pumps provides high vacuum flow, up to 120 SCFM, from a small amount of compressed air. Products are easily adjusted to meet exact application requirements and do not require air regulators.

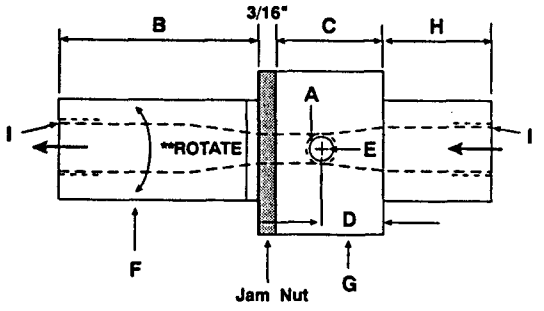


Features:

- **Non-clogging**
  Unique straight thru design allows unobstructed passage of solids.
- **Extremely Reliable**
  No maintenance/No moving parts/No electricity required. Runs cool.
- **Adjustable**
  Set it to your exact requirements. No regulator required - Performance is not pressure sensitive.
- **High Performance**
  Combination of high vacuum flows at high vacuum levels. Vacuum levels to 25 Hg, vacuum flows to 120 SCFM.

Applications:

- Evacuates large volumes of air, liquid and small materials quickly
- Ideal for dirty environments
- Lifting/positioning of porous materials
- Proportional mixing of liquids or liquids and powders



Because of the VDF Series' unique design and adjustability, maximum vacuum flow can be achieved with lower air consumption.

Model No.	Max Vacuum Level "Hg	Air Consumption SCFM *	Max Vacuum Flow SCFM	Air Consumption SCFM *
VDF 150	25	3	4	1.5
VDF 200	25	7	7	3
VDF 250	25	14	15	6
VDF 375	25	28	30	13
VDF 500	25	44	60	25
VDF 750	25	90	120	40

* Air pressure should be above 40 PSI

MODEL NO.	A BARREL ID	B	C COLLAR LENGTH	D	E INPUT (NPTF)	F BARREL OD	G COLLAR OD	H	I THREAD ID NPTF	MUFFLER	* MUFFLER LENGTH
VDF 150	.150	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	AA4	1 3/8
VDF 200	.20	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	FA51-1/4	5 3/4
VDF 250	.25	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	FA51-1/4	5 3/4
VDF 375	.375	2 3/4	1 3/4	7/8	1/4	1	1 1/2	1 1/2	3/8	FA51-3/8	5 3/4
VDF 500	.50	2 1/2	2	1	3/8	1 1/4	2	1 1/2	1/2	2020	11
VDF 750	.75	3 3/8	2	1	1/2	1 1/2	2 1/4	1 1/2	3/4	2020	11

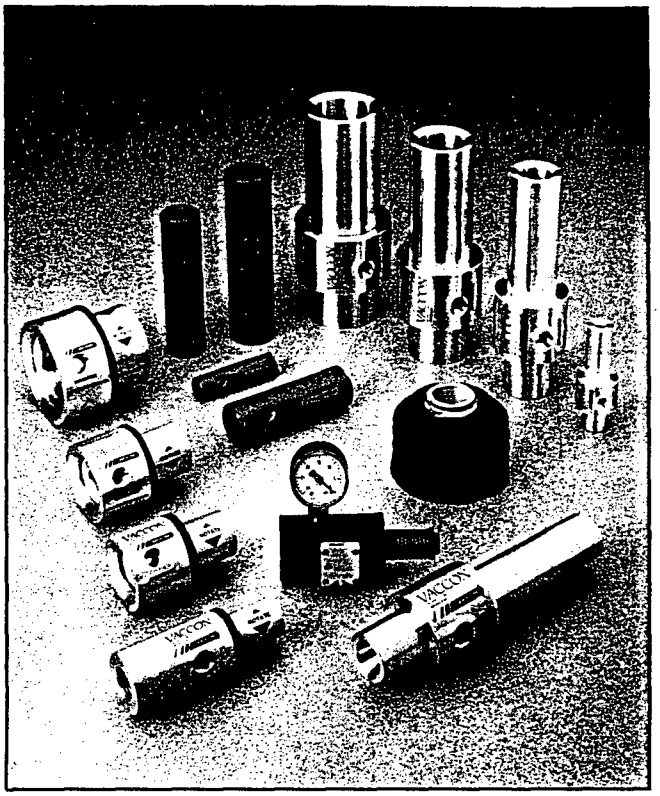
* Length the muffler adds to the total length

VACCON Co. Inc.
32 Rear Spring Street
P.O. Box 324
Medfield, MA 02052 USA
TEL 508-359-7200 FAX 508-359-0177

VACCON VACUUM PRODUCTS FOR:

Pick, Place and Hold Applications, Material Transfer, and Air Removal and Amplification

Since 1972 VACCON has been supplying manufacturing and processing industries with reliable air-powered vacuum products offering efficient operation and rugged construction. VACCON manufactures Vacuum Pumps (venturi's), Material Transfer products, Air Amplifiers and provides optional accessories such as Vacuum Cups, Sensors, Gauges, etc.



VACUUM PUMPS (Venturi's) Pages 4, 5, 6

VACCON vacuum pumps for pick, place and hold applications are a cost effective and energy efficient alternative to both electric and multi-stage air powered pumps. A wide range of sizes are available to meet most vacuum requirements and offer exceptional price/performance.

VACUUM CUPS Pages 9, 10

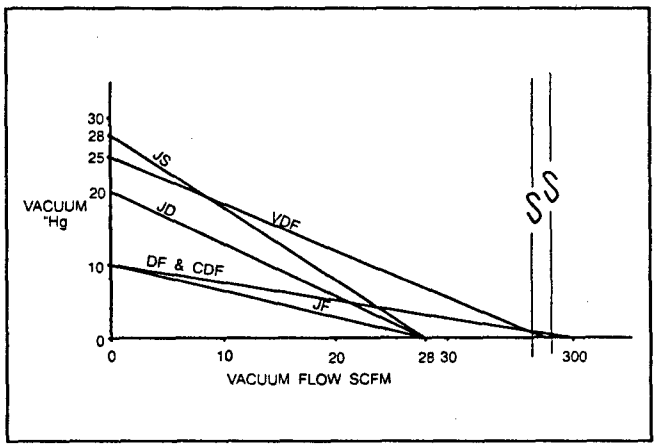
VACCON offers a broad range of vacuum cups in four distinctive styles for maximum application flexibility.

MATERIAL TRANSFER PRODUCTS Pages 11, 12

Transfer solids, granular materials and liquids using compressed air. VACCON material transfer products offer an extremely fast and economical method to transfer almost any material including small and irregular shaped parts such as automotive engine valves, granulated plastic regrind, and trimming waste.

AIR AMPLIFIERS Pages 13, 14

VACCON air amplifiers create a large flow of air from a small volume of compressed air. They provide a simple and cost effective alternative to electric blowers and raw compressed air. The output is field adjustable and can achieve amplification ratio's of up to 40:1.



MULTI-PURPOSE VARIABLE VACUUM PUMP Back Cover

High vacuum flow with high vacuum levels are possible with this field adjustable vacuum pump. Allows setting to the optimum performance needed to perform the task. No wasted energy means low air consumption.

CUSTOM PRODUCTS

For special applications, VACCON offers their design and manufacturing expertise to provide custom products and systems to solve unique application requirements.

DEFINITIONS

Model No.: Identification method used to group similar units by vacuum level and vacuum flow characteristics.

Vacuum Level: The magnitude of the suction created by the vacuum generator, measured in "Hg

"Hg: Inches of mercury is a unit used to meaure vacuum level. 29.92"Hg = 14.7 PSI is the maximum vacuum possible on a standard day. 1"Hg = 13.6" H_2O

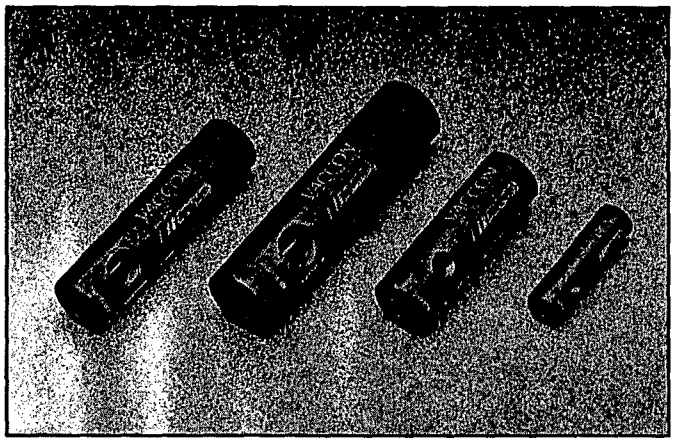
Vacuum Force: Equal to the vacuum level times the area of vacuum surface, i.e., area of vacuum cup.

Vacuum Flow: The volume of free or atmospheric air induced by the pump per unit of time. Vacuum flow is commonly given in units of SCFM (Standard Cubic Feet per Minute)

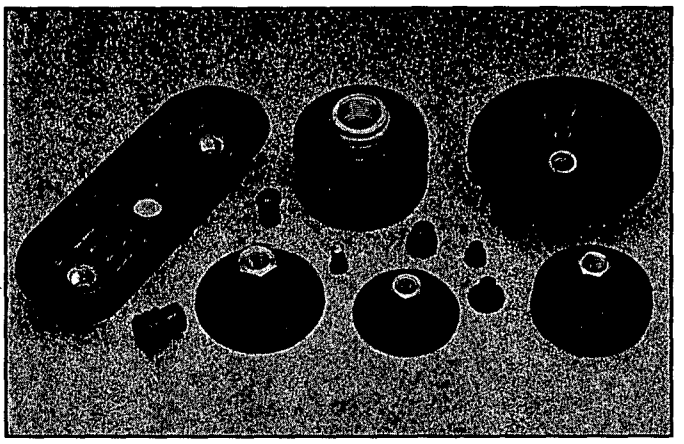
Air Consumption: The volume of compressed air required to power the pump, also measured in SCFM. Consumption varies directly with input pressure. A 1 HP compressor can supply approximately 4 SCFM @ 80 PSI.

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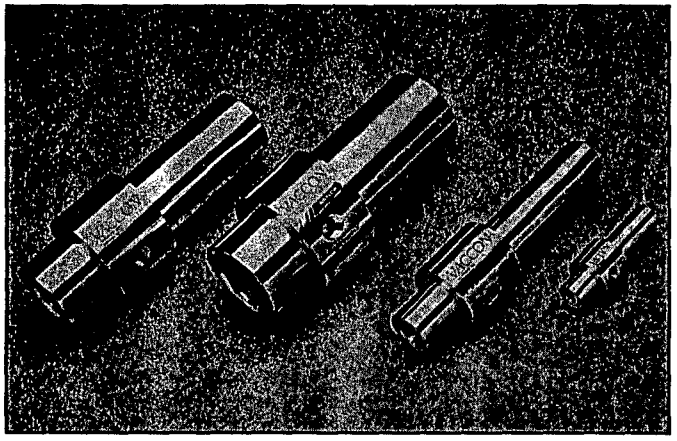
AIR POWERED
VACUUM PUMPS, CUPS & ACCESSORIES



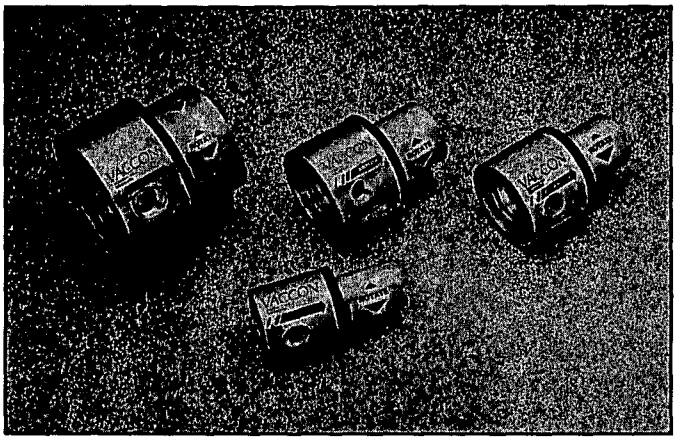
VACUUM PUMPS



VACUUM CUPS

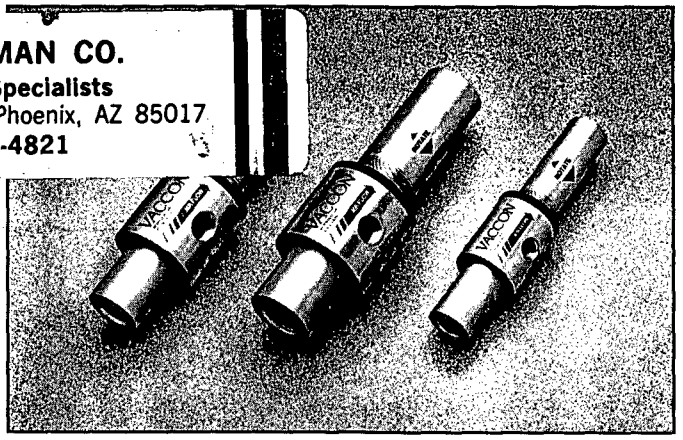


MATERIAL TRANSFER UNITS



AIR AMPLIFIERS

R. D. PLAYMAN CO.
Fluid Power Specialists
3066 W. Clarendon Phoenix, AZ 85017
(602) 265-4821



VARIABLE VACUUM PUMPS

See Back Cover

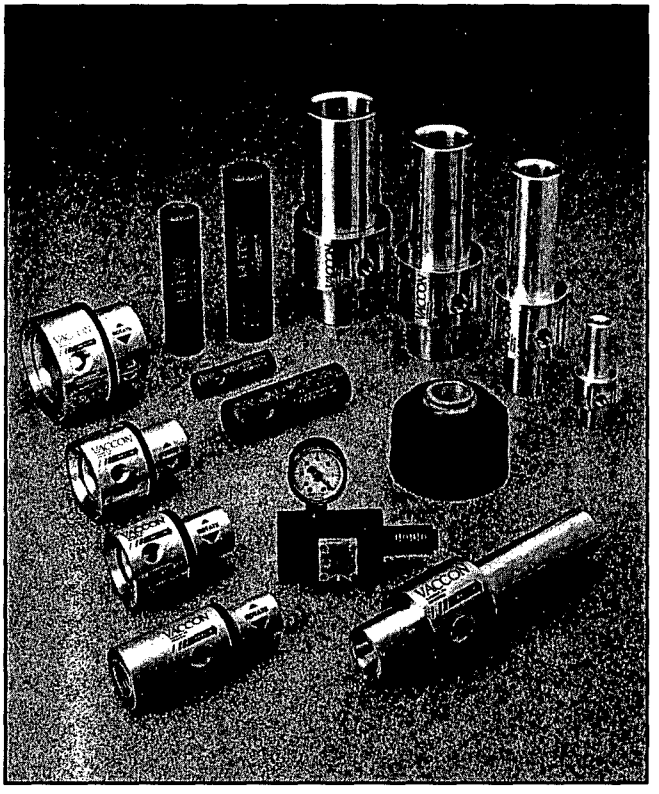
VACCON Co. Inc.

MAY 1992

VACCON VACUUM PRODUCTS FOR:

Pick, Place and Hold Applications, Material Transfer, and Air Removal and Amplification

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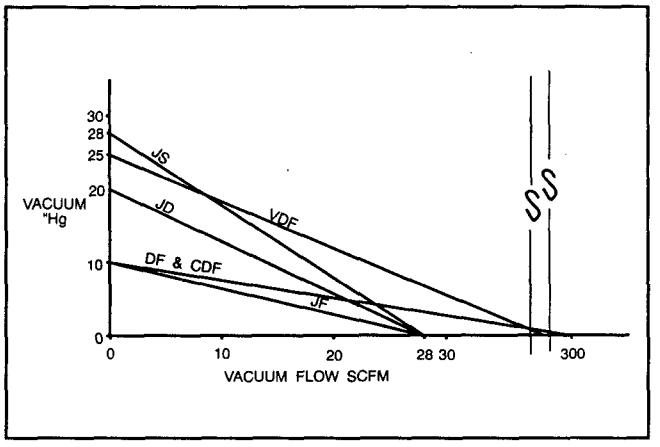
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VACCON ADVANTAGES

Air vs. Electric

HIGH RELIABILITY

Air only operation - no moving parts to fail, electrical connection not required

Compact, lightweight VACCON pumps can be positioned close to where the vacuum is required. In vacuum cup applications a separate pump can be used with each cup for increased reliability and greater holding power should one cup leak or fail.

VACCON pumps do not generate heat or vibration, this is valuable in sensitive electronic testing environments.

COST LESS TO BUY, LESS TO OPERATE

VACCON pumps cost about 1/5 the price of an equivalent electric pump.

Instant on/off VACCON pumps operate as needed, electric pumps must run continuously

EASY TO INSTALL AND MAINTAIN

VACCON pumps require 1/30 the space of an electric pump. This allows up close positioning of the pump resulting in shorter vacuum lines and faster response.

Cabinets and special supports required with most electric pump installations are not required with VACCON pumps.

VACCON pumps do not require preventive maintenance and the nuisance of daily cleaning and lubrication.

UNLIMITED APPLICATION FLEXIBILITY

VACCON pumps are quiet, reducing operator discomfort.

Control vacuum capacity by regulating input pressure.

Lightweight VACCON pumps will not cause deflection in critical installations such as robotic arms.

Wide range of VACCON products cover all vacuum applications efficiently and effectively.

COMPARE VACCON AIR POWERED VS. ELECTRIC PUMPS

ELECTRIC PUMP			MAX. VAC. LEVEL EQUIVALENT VACCON PUMP			
Approx. Size (inches)	HP	Weight Lbs.	Medium 20"Hg	High 28"Hg	Size OD Length	Weight Oz.
3x8x4	1/15	8	JD-90M	JS-90M	3/4"x2 7/8"	1.6
5x12x6	1/6	15	JD-100M	JS-100M	3/4"x2 7/8"	1.6
8x15x7	1/4	20	JD-150M	JS-150M	3/4"x2 7/8"	1.6
9x12x8	1/3	30	JD-200	JS-200	1 1/4"x4"	6.8
9x18x8*	1/2	50	JD-250	JS-250	1 1/4"x4"	6.8
10x20x15	3/4-1	80	JD-300	JS-300	1 1/4"x5"	8.5
15x20x20	1 1/2-2	125	JD-350	JS-350	1 1/2"x6"	14.5

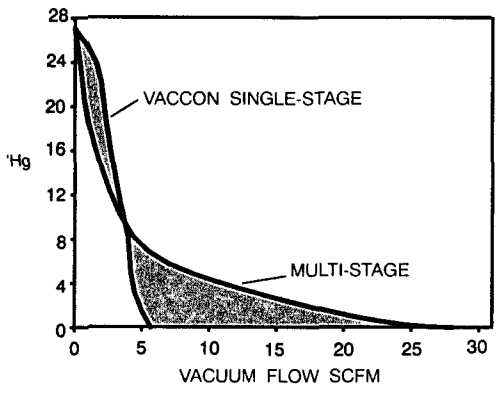
* Average cost of typical electric pump is over $400. A comparable Vaccon pump is just $110.

REPLACE YOUR ELECTRIC PUMP WITH AN EFFICIENT, LOW COST VACCON PUMP NOW!!

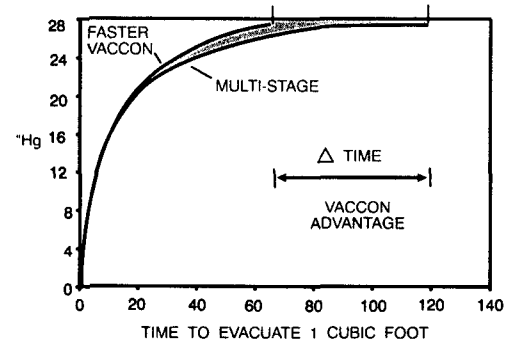
Why do single stage VACCON pumps *outperform multi-stage pumps??*

Because they have higher vacuum flow at the mid & upper vacuum levels where it counts!!

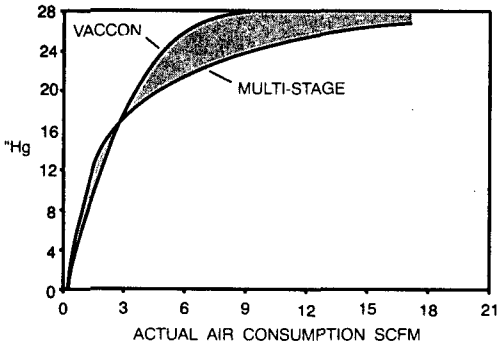
HIGHER VACUUM FLOW



EVACUATION TIME



AIR CONSUMPTION



VACUUM FLOW:

Multi-stage pumps are designed backwards, high flow at 0"Hg and very low flow at the mid to upper vacuum level range. High flow at 0"Hg is meaningless because no work is performed at this vacuum level. **VACCON pumps have considerably higher vacuum flow at the mid and upper levels** which provides faster evacuation times and higher reliability.

Vaccum Flow (SCFM) at various vacuum levels, "Hg

Model #	A/C	0	4	8	12	16	20	24	27
Vaccon JS-200	7.8	5.7	4.3	4.0	3.3	2.7	2.2	1.6	—
Multi-Stage Equiv.	8.8	28	11	4.5	2.7	1.6	.8	.4	—

EVACUATION TIME:

Multi-stage pumps require a significantly longer cycle time to evacuate a volume because the high flow stages shut down immediately leaving the low flow stage to reach the maximum vacuum level. **VACCON's superior venturi design generates high flow at the mid to upper vacuum levels providing extremely fast evacuation.**

Time (seconds) to evacuate 1 cu. ft. volume

	"Hg							
Model #	0	4	8	12	16	20	24	27
Vaccon JS-200	—	1.4	3.0	5.2	8.6	14.9	30.1	62.6
Multi-Stage Equiv.	—	.5	2.1	4.5	8.1	17	32.5	113.3

AIR CONSUMPTION:

The VACCON single stage pump evacuates air faster and more efficiently in the mid to upper vacuum levels. **The short operating time results in significant compressed air savings and faster cycle times.**

The multi-stage requires 16.6 CFM to evacuate 1 Cu.ft. to 27"Hg, (8.8 Cu.ft./60 sec x 113.3 sec = 16.6 Cu.ft.) while the VACCON JS-200 requires only 8.2 Cu.ft. to do the same job.

ACTUAL TEST RESULTS FOR EVACUATING A VACUUM PRESS

	TIME IN SECONDS		AIR CONSUMPTION (IN SCFM)	
VACUUM LEVEL IN MOLD	VACCON PUMP	MULTI-STAGE PUMP	VACCON PUMP	MULTI-STAGE PUMP
5"Hg	4	5	.83	.73
10	8	10	1.67	1.47
15	10	12	2.08	1.76
20	12	22	2.5	3.23
25	17	*	3.54	????

*Multi-stage unable to reach the upper vacuum level in the time required.

Note: If your application requires high air flow but not high vacuum consider using our air amplifiers, the CDF series on pages 13 & 14.

Vacuum Pumps

J-Series *(JS, JD, AND JF-Models)*

Description: A small, lightweight, virtually indestructible pump powered by compressed air or other gases. The transducer produces a vacuum by forcing compressed air through a limiting orifice into a venturi section. As the air exits the orifice it expands, increasing in velocity to supersonic speeds before entering the venturi section. This creates a vaccum or negative pressure at the vacuum inlet port located between the orifice and venturi section. This high velocity insures efficient and effective operation.

VACCON pumps perform trouble-free in the most ardous environments. They operate with instantaneous response in pulsed operations or on a continuous basis.

Features:

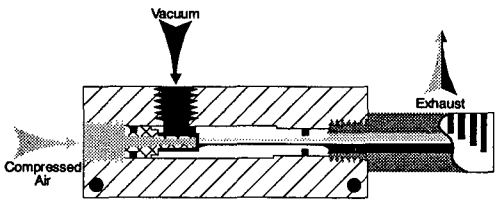
Low Cost — Low initial and operating cost

Small Size — Install close to work area

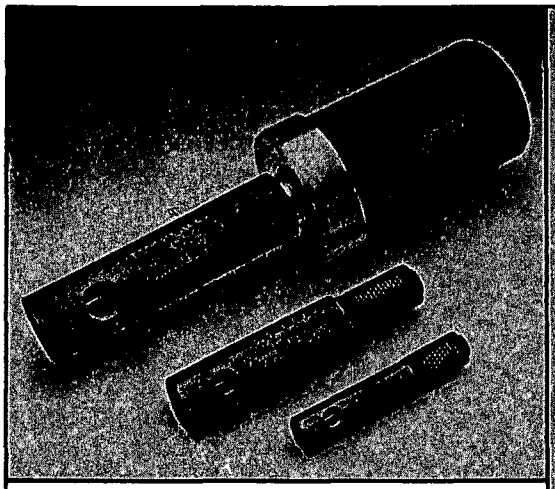
Efficient Design — Provides high performance

Instant Response — Improved productivity

J-Series



- *Standard operating supply pressure, J-Series is 80 PSI.*
- *For 60 PSI operation, just specify -60 PSI following the part no, i.e. JS-200-60 PSI.*
- *Standard material for J-Series pumps is anodized aluminum. For high temperature and/or caustic applications PVC and Stainless Steel is available on special order.*
- *J-Series pumps can be powered by liquid also. Consult Vaccon.*



JS 350, JS 200, JS 90M (shown with mufflers)

J-Series Factors in Selection

There are certain considerations that require attention to properly size a vacuum pump. The following section is a general overview of factors that apply to most pump applications.

Vacuum Level: Is directly related to the holding power of the system. Since 2"Hg = 1 PSI, increasing the vacuum level permits greater holding power.

Vacuum Force: (Vacuum level in PSI × area of vacuum surface in sq. in. = pounds of lifting force.) The weight of the object and the usable vacuum surface area must be known before selecting a pump.

Vacuum Flow: (SCFM) Vacuum flow is affected by:

Permeability — cardboard vs. steel

System Volume — vacuum lines, vessels, valves, etc.

Leakage or Designed Openings — poor connections, bad seal, holes in surface, etc.

Time Restraints — cycle time.

Combining the vacuum force and vacuum flow information previously mentioned, use the charts on the next two pages to select a J-Series pump. Remember, as model numbers increase, each unit provides greater vacuum flow at a given vacuum level.

Air Consumption: (SCFM) Select the model with the lowest air consumption that meets your requirements for vacuum force and flow.

Location: VACCON pumps are small and quiet and can normally be placed close to the work area. This gives the advantage of increasing response time and reducing the need for a larger pump.

We at **VACCON** realize that some applications have parameters that are difficult to pinpoint. Please contact your local **VACCON** distributor for assistance or call us at 508-359-7200.

Ordering Information

1. Specify Pump Model: i.e. JS-250.
2. Specify Exhaust Muffler Model: i.e. FA-51-3/8 see chart bottom page 6. Vaccon highly recommends the use of its mufflers as they reduce noise level up to 30 dB without back pressure.

JS Models

8 "Hg

Example: *JS-100* **1.6** *Reads: A* **JS-100M** *has a continuous vacuum flow of 1.6 SCFM while maintaining an 8 "Hg vacuum level.*

MODEL NO.	(SCFM) AIR CONSUMPTION · at 80 PSI ·	CONTINUOUS VACUUM FLOW (SCFM) AT VARIOUS VACUUM LEVELS							
		0"Hg	4"Hg	8"Hg	12"Hg	16"Hg	20"Hg	24"Hg	28"Hg
JS-60M	.80	.35	.31	.25	.20	.15	.10	.05	0
JS-90M	1.8	1.0	.95	.85	.7	.6	.5	.3	0
JS-100M	2.8	2.0	1.8	1.6	1.4	1.2	.9	.7	0
JS-150M	4.8	3.2	2.7	2.4	2.0	1.8	1.5	1.3	0
JS-200	7.8	5.7	4.3	4.0	3.3	2.7	2.2	1.6	0
JS-250	12.5	9.0	8.3	7.4	6.5	5.0	2.8	1.8	0
JS-300	22.0	20.0	15.0	13.0	12.0	9.0	5.7	2.7	0
JS-350	28.0	28.0	20.6	16.5	14.5	10.5	6.5	4.5	0

■ *JS-Models are ideal for holding non-porous materials such as glass and steel. The high vacuum level provides high vacuum force for lifting heavy materials and holding them securely.*

JD Models

MODEL NO.	(SCFM) AIR CONSUMPTION · at 80 PSI ·	CONTINUOUS VACUUM FLOW (SCFM) AT VARIOUS VACUUM LEVELS					
		0"Hg	4"Hg	8"Hg	12"Hg	16"Hg	20"Hg
JD-60M	.5	.38	.35	.25	.15	.05	0
JD-90M	1.4	1.2	1.0	.9	.6	.4	0
JD-100M	1.9	2.1	1.9	1.8	1.6	1.1	0
JD-150M	2.8	3.5	3.0	2.9	2.5	1.6	0
JD-200	4.8	6.0	5.1	4.7	4.0	2.5	0
JD-250	7.8	9.5	9.0	7.5	4.7	3.1	0
JD-300	12.5	20.0	18.2	14.5	8.1	4.9	0
JD-350	17.0	28.0	22.2	17.7	14.5	10.2	0

■ *JD-Models are ideal for holding porous materials such as cardboard in automatic box forming equipment.*

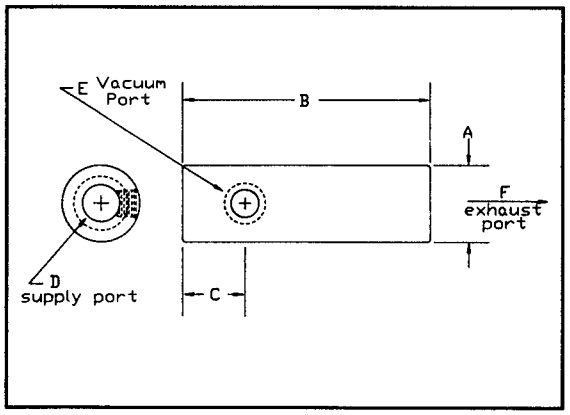
JF-Models

MODEL NO.	CONTINUOUS VACUUM FLOW (SCFM) AT VARIOUS VACUUM LEVELS				(SCFM) AIR CONSUMPTION AT 80 PSI
	0"Hg	4"Hg	8"Hg"	10"Hg	
JF-150	4.0	3.8	2.8	0	1.9
JF-250	10.0	7.2	5.0	0	4.8
JF-300	20.0	13.6	9.2	0	7.8
JF-350	28.0	17.0	12.0	0	12.5

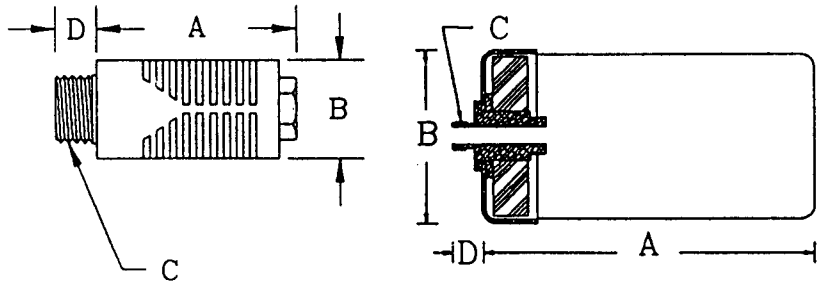
■ JF-Models are ideal for handling delicate parts without deformation by excessive vacuum.

■ The zero located in the far right column of the J-Series charts signifies a closed system. Under this condition there is zero vacuum flow and the unit will reach the maximum vacuum level listed.

J-Series Dimensions



Muffler Dimensions



AA SERIES ***FA51 SERIES***

MODEL NO.	DIMENSIONS				CONSTRUCTION			
	A	B	C	D	Body	Baffle	Screen	Filter
AA4	1.265	.706	¼" NPT	.362	Nylon	Nylon	Nylon	Felt
AA6	1.833	.955	⅜" NPT	.429	Nylon	Nylon	Nylon	Felt
FA51-⅜	5.75	3.25	⅜" NPT	.5	Steel	Foam	Steel	Paper
FA51-½	5.75	3.25	½" NPT	.5	Steel	Foam	Steel	Paper

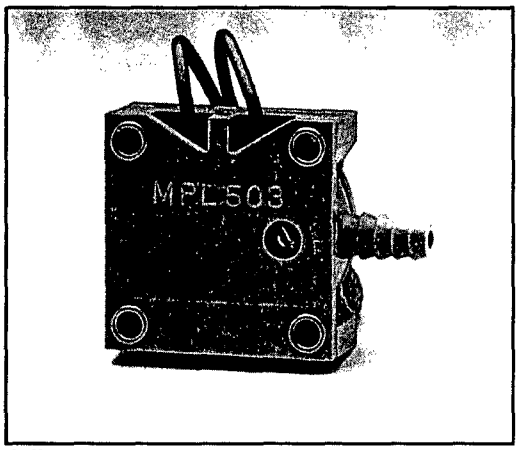
FOR JS, JD & JF PUMPS	A (in.)	B (in.)	C (in.)	D (NPT)	E (NPT)	F (NPT)	* USE MUFFLER PART NO.	LENGTH W/MUFFLER (in.)
60M, 90M, 100M, 150M	3/4	2 3/4	3/4	1/8	1/8	1/4	AA4	4 1/8
150	1 1/4	4	1	1/4	3/8	3/8	AA6	5 7/8
200	1 1/4	4	1	1/4	3/8	3/8	AA6 OR FA51-3/8	5 7/8 OR 9 3/4
250	1 1/4	4	1	1/4	3/8	3/8	FA51-3/8	9 3/4
300	1 1/4	5	1	3/8	3/8	3/8	FA51-3/8	10 3/4
350	1 1/2	6	1 1/2	1/2	1/2	1/2	FA51-1/2	11 3/4

* Note: For Ultra Quiet Operation the FA51-1/4 can be used on all of the M Series models

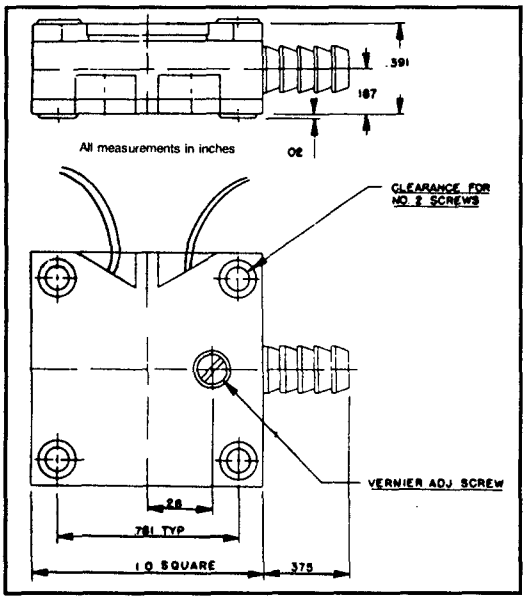
To ensure customer satisfaction and proper pump selection, VACCON offers a 30 day free trial with no cost or obligation.

5 Year Warranty

ACCESSORIES



Adjustable vacuum sensor part no. VS 4 or 5



Sensor dimensions

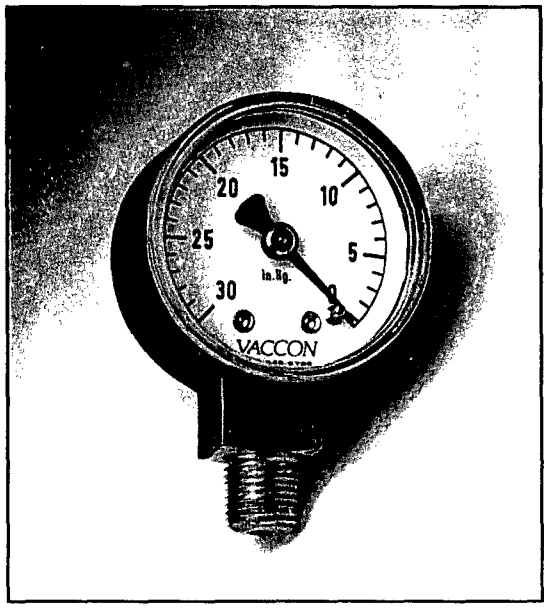
ADJUSTABLE VACUUM SENSORS

The VS 4 & VS 5 are miniature adjustable vacuum sensors, that range from 2-14.8"Hg and 7.4-30"Hg respectively. Their sensitivity and high reliability make them ideally suited for a wide variety of vacuum applications where the vacuum level requires sensing before an operation is continued. The sensors small size and integration with the JSR vacuum pumps (venturi's) make them ideal for many applications.

The vacuum sensors are normally open, diaphragm operated vacuum switches that utilize low stressed deflecting contacts instead of sliding or pivoting parts resulting in high reliability and long life. Both models feature a vernier adjustment screw to permit accurate vacuum actuation settings.

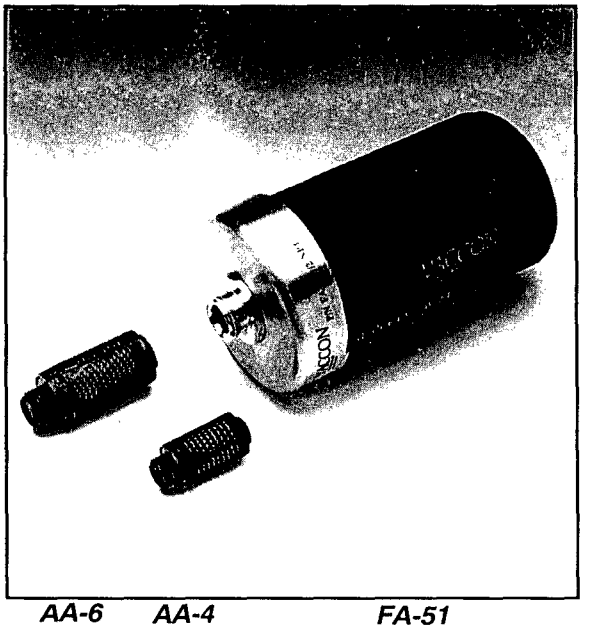
SPECIFICATIONS

Voltage	Up to 500V AC, 24V DC
Electrical Current	10 - 20 MA
Adjustment Range	VS4 2 - 14.8"Hg, VS5 7.4 - 30"Hg
Operating Temperature	-40° to 120°C (-40° to 250°F)
Burst Pressure	25 psig
Response	160 Hz (160 cycles/sec.)
Mechanical Life	100,000,000 cycles
Weight	10 grams
SIze	1" x 1" x 3/8" - w3/8" x 3/16" dia. barb
Connections	12" - #22 AWG flying leads
Internal Contacts	Gold Inlay



Vacuum gauge VG 150

Exhaust Mufflers for J-Series Pumps



AA-6 AA-4 FA-51

VACUUM CUPS

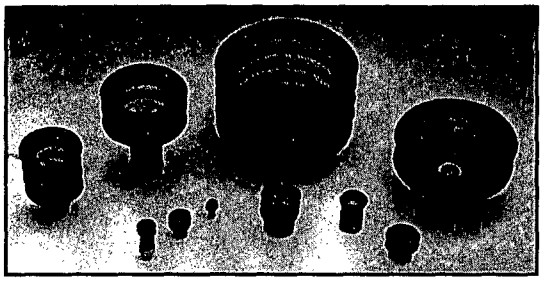
4 STYLES TO FIT YOUR APPLICATION ...BELLOWS, CLEATED, OVAL, STANDARD

AVAILABLE IN 3 MATERIALS:

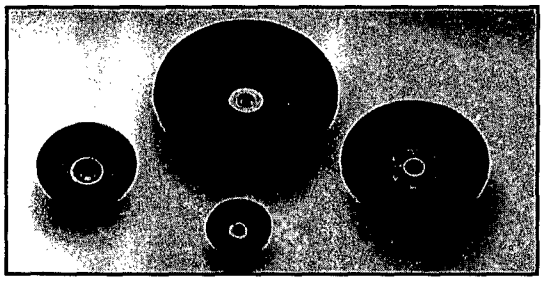
Vinyl . . . . . Durable, resists wear, up to 125°F
Silicon . . . . . High temp., FDA approved, up to 400°F (-76°F)
Polyurethane . . . . Chemically resistant up to 125°F

Diameters range from .20 - 8.5 inches

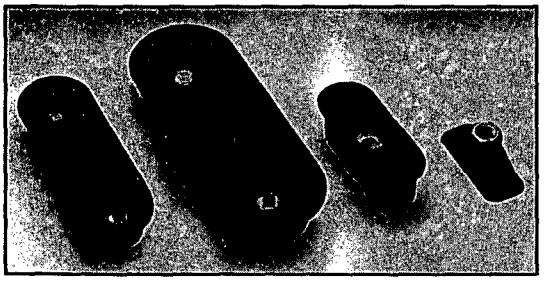
FOUR BASIC CUP STYLES



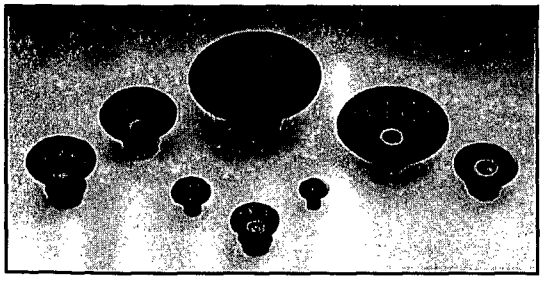
Bellows Cup - with 1,2,3 or 4 convolutions
Bellows cups have a pliable outer rim that will conform to curved or uneven surfaces while the bellows sections compensate for inconsistent stack heights. Under vacuum, the accordion-style bellows cup will collapse on contact. The collapsing action simulates a short cylinder stroke lifting the product for a short distance, possibly saving the need for a separate lifting mechanism.



Cleated Cup -
Cleated cups are strong with a rigid, low profile that will lift heavy loads. The low profile allows heavy loads to be lifted vertically without the cup "peeling" away from the product surface. These cups perform well when gripping smooth, flat heavy objects such as steel sheet, glass (television picture tubes), and coated corrugated.



Oval Cup -
Like cleated cups, oval cups have heavy load handling capacity due to their rigid design and large vacuum work area. Oval cups have the largest lifting force because they provide the most surface area, up to 60 square inches, for a given cup footprint.



Standard Cup -
Standard cups are flexible and work well in applications that do not require lifting heavy loads. In food packaging for example, a standard cup can be used to apply a label to an uneven surface such as a package of chicken.

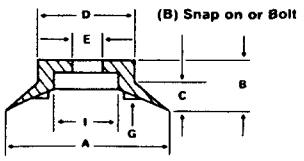
TABLE 1
VINYL VACUUM CUPS
PHYSICAL DIMENSIONS

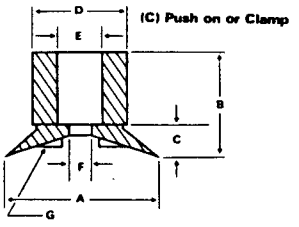
Part #	Approx. Area	A O.D.	B	C	D	E	Style
STANDARD CUPS							
VC1	.01	1/5	1/4	1/40	1/5	1/8**	B
VC25	.02	5/8	5/8	1/10	1/2	1/5**	B
VC165A	.05	3/8	1/4	1/4	3/8	7/32**	B
VC10	.3	1	1/2	1/4	3/4	1/8	B
VC11	.4	1 1/8	1/2	1/4	3/4	1/4	B
VC37A	.5	1 1/2	3/4	1/2	7/8	1/4	B
VC12	.6	1 7/16	1/2	1/2	3/4	1/4	B
VC168	.7	2	11/16	1/2	1 1/8	1/4	B
VC106	.8	2 1/2	13/16	1/2	1 1/8	1/4	B
VC30	1.1	3	1 7/16	5/8	1 1/8	1/4	C
CLEATED CUPS							
VC36B	.3	1	3/8	1/4	9/16	1/4**	B
VC59	1.3	2	5/8	1/4	1 1/2	1/4	B
VC49	2.1	2 1/2	2	7/8	1	1/4	C
VC27A	2.4	3 1/4	1	7/16	2 1/4	1/4	B
VC27	3.4	4 1/4	1	1/2	3	1/4	B
VC63	5.6	4 3/4	1 1/8	1	1 5/8	3/8	B
VC34	10.4	6 1/4	1 3/16	13/16	5	3/8	B
BELLOWS CUPS							
VC33A5	.16	3/4	1	3/4	5/8	7/16**	D3
VC33A3	.2	7/8	1	3/4	5/8	3/8**	D2
VC124	.24	1	1 3/8	5/8	5/8	3/8**	D1
VCB1	.25	1 1/4	7/8	3/4	1/2	1/8	D1
VC33A2	.25	1 1/2	1	7/8	11/16	1/4	D2
VC33A	.4	1 3/8	1 1/2	1 3/8	11/16	1/4	D3
VC32D	1.0	2	2 1/2	1 1/4	3/4	1/4	D2
VC32B	2.0	2 3/4	2	1 1/4	1	1/4	D1
VC130	4.9	3 5/16	2 3/8	2 3/16	2 3/8	3/4	D4
OVAL CUPS							
VC89	1.75	1 1/8 x 2 3/4	7/8	3/4	7/8	1/4	B
VC83	4.5	1 1/2 x 4	1	1/2	1 1/8 x 3 5/8	1/4	B
VC183	6.0	2 x 6	1	1/2	1 1/4 x 5 1/4	1/4(2)	B
VC90	12.00	3 x 8	1	1/2	2 x 7	3/8(2)	B

All NPTF fittings, molded into the cup except for ** cups which have a through hole.
All dimensions are shown in inches.

Other size cups available on request.

CUP STYLES





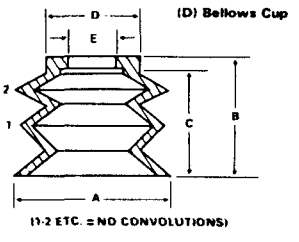


TABLE 2
SELECTION DATA FOR VACCON PUMPS/CUPS COMBINATIONS FOR *POROUS* CORRUGATED SHEET APPLICATIONS

Actual vacuum level ("Hg) achieved/calculated vacuum force (lbs.)

CUP#	O.D.	APPROX. AREA	VACUUM LEVEL ("Hg)/FORCE (lbs.) JS-90M	JS-150M	JD-90M	JD-150M	JD-200	JF-150
			STANDARD					
VC10	1	.3	23/3.5	25/3.8	17/2.6	19/2.9	20/3	10/1.5
VC10A	1	.4	22/4.4	24/4.8	17/3.4	18/3.6	20/4	10/2
VC11	1 1/8	.4	23/4.6	24/4.8	17/3.4	18/3.6	20/4	10/2
VC37A	1 1/2	.5	21/5.3	24/6.0	17/4.3	18/4.5	20/5	10/2.5
VC12	1 7/16	.6	18/5.4	24/7.2	16/4.8	18/5.4	20/6	10/3
VC30	3	1.1	14/7.7	22/12.1	15/8.3	17/9.4	19/11	10/5.5
			CLEATED					
VC59	2	1.3	14/9.1	21/13.7	15/9.8	17/11	19/12	10/6.5
VC49	2 1/2	2.1	10/10.5	18/18.9	13/13.7	15/16	18/19	9/9.5
VC27A	3 1/4	2.4	7/8.4	15/18.0	11/13.2	14/17	17/20	8/9.6
VC27	4 1/4	3.4	5/8.5	11/19.0	7/11.9	11/19	15/26	7.5/13
VC63	4 3/4	5.6	3/8.4	9/25.2	6/16.8	10/28	14/40	7/20
VC34	6 1/4	10.4	1/5.2	4/20.8	2/10.4	5/26	8/42	4/20
			BELLOWS					
VC33A	1 3/8	.4	22/4.4	25/5.0	17/3.4	18/4	20/4	10/2
VC32B	2 3/4	2.0	11/11	19/19	14/14	15/15	18/18	9/9
VC130	3 5/16	4.9	7/17.2	14/34.3	10/24.5	13/32	15/37	8/19.6
			OVAL					
VC89	1 1/8 x 2 3/4	1.75	11/10	20/18	14/12	16/14	17/15	10/8
VC83	1 1/2 x 4	4.5	7/16	14/32	10/23	13/29	15/32	8/18
VC183	2 x 6	6.0	5/15	11/33	7/21	11/33	13/39	7/21
VC90	3 x 8	12.0	3/18	7/42	4/36	7/42	10/60	6/36

NOTE: This chart is a starting point in selecting a pump/cup combination. Since cardboard can vary up to 400% in porosity, you must actually test a pump/cup combination on your cardboard to determine which combination is correct for your application.

EXAMPLE: A VC27 vacuum cup used in conjunction with a JS-150M vacuum pump will generate 11 "Hg and 18.7 lbs. of lifting force when applied to a porous sheet of corrugated.

NON-POROUS APPLICATIONS:
Equation for calculating vacuum lifting force using vacuum cups:
Note: To convert ("Hg) vacuum level into PSI divide by 2.

$$\text{Vacuum Force (lbs.)} = \frac{\text{Max. Vacuum Level ("Hg)} \times \text{Surface Area (sq. in.) of vacuum cup}}{\text{2 "Hg/1 PSI}}$$

Suggested safety Factor: 2 for cup in horizontal position.
4 for cup in vertical position.

Request VACCON application note #10 for more information on "Vacuum Pump/Cup Selection Criteria and Design Rules."

This general information is provided as reference material. The designers or users must assume all risks and VACCON will not assume any liability for damages, labor delays incidental thereto, etc.

Material Transfer
DF-Series

Description: The principle operation of the DF-Model is similar to a jet pump. Compressed air is fed into an outside annular ring that has a number of orifices leading into the main tube of the transducer. As the compressed air exits from the orifices its velocity increases to supersonic speed. The air meeting in the center of the tube rotates with a twisting motion similar to a worm screw. This cyclonic flow creates a powerful vacuum, capable of drawing particles into and through the transducer.

This device can be infinitely controlled over its entire output range by regulating input pressure. Because it has no diverging/converging sections, material is able to pass directly through the unit without interference or blockage. Its simple design and freedom of moving parts make the DF-Model an ideal device for economical, long-term, maintenance-free operation.

- Like all **VACCON** products, DF-Models have instantaneous response ideal for intermittent operations.

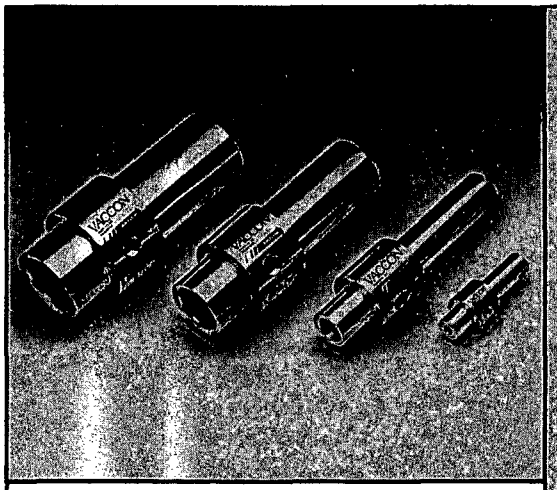
Features:

Low Cost — Low initial and operating cost

Small Size — Install close to work area

Efficient Design — Provides high performance

Instant Response — Improved productivity



DF 20-3 DF 10-3 DF 5-3 DF 1-3

DF-Series Factors in Selection

DF-Models transfer small parts, powders, continuous strips, gases and liquids. As a vacuum source, they are capable of rapid evacuation of a large volume of air to a low vacuum level. To determine the correct DF-Model, consider the following factors:

1. Inside Diameter
2. Velocity of Flow
3. Vacuum Flow
4. Vacuum Force
5. Air Consumption

1. **Inside Diameter:** Since DF-Models transfer objects directly through the unit, it is necessary to choose a model large enough to accommodate the objects without clogging. The larger the model number, the larger the inside diameter of the unit.

   NOTE: There are two operating configurations for most DF units, '-6' models have higher vacuum flows, vacuum levels, air velocities, and air consumption than the '-3' models.

2. **Velocity:** (Ft/Sec) Velocity is one of several considerations necessary to determine part-transfer rates. Velocity decreases as model number increases due to the larger flow area. It is possible to increase and decrease the velocity by regulating the input pressure.

3. **Vacuum Flow:** (SCFM) Choosing a model that will deliver adequate vacuum flow for material transfer depends on the volume and density of material involved and the time allowed to do the job. The distance the unit is from the work area affects the ability of the unit to entrain objects into the vacuum flow stream.

4. **Vacuum Level:** (″Hg) The height to which material can be elevated depends on the vacuum level and the density of the material. Remember, units with a '-6' suffix always have a higher vacuum level than a '-3', but both have the same inside diameter.

5. **Air Consumption:** (SCFM) The volume of air required to power these units increases with each size up to the DF 7-3 or 7-6. All larger models use the same amount of compressed air. However, these larger units (7's to 20's) have different vacuum flow, vacuum level, and velocity as a result of the change in inside diameter.

Performance Chart and Physical Dimensions DF-Series

Performance Data for DF-Series

Physical Dimensions

MODEL NO.	VELOCITY FT/SEC	VACUUM FLOW SCFM	VACUUM LEVEL "Hg	AIR CONSUMPTION (SCFM) @40 PSI	AIR CONSUMPTION (SCFM) @80 PSI	I.D. A	B	C	D	E	F	G	H	(NPTF I
DF 1-3	585	3	8	1.1	2	1/8	1 1/4	3/4	3 1/2	3/4	1	1 3/4	.5	1/8
DF 2-3	490	10	8	3.2	6	1/4	1 1/4	3/4	3 1/2	3/4	1	1 3/4	.5	1/8
DF 3-3	328	15	6	3.5	6	3/8	1 1/4	3/4	3 1/2	3/4	1	1 3/4	.5	1/8
DF 3-6	393	18	8	5.8	10	3/8	1 1/4	3/4	3 1/2	3/4	1	1 3/4	.5	1/8
DF 5-3	306	25	3	5.2	9	1/2	1 1/2	1	5 1/2	1	1 1/4	3 1/4	5/8	1/4
DF 5-6	362	30	10	14	24	1/2	1 1/2	1	5 1/2	1	1 1/4	3 1/4	5/8	1/4
DF 7-3	272	50	4.3	14	24	3/4	2	1 1/4	7 1/2	1 1/2	2	4	1	3/8
DF 7-6	326	60	8	28	48	3/4	2	1 1/4	7 1/2	1 1/2	2	4	1	3/8
DF 10-3	229	75	3	14	24	1	2 1/4	1 1/2	7 1/2	1 1/2	2	4	1	3/8
DF 10-6	290	95	5.8	28	48	1	2 1/4	1 1/2	7 1/2	11/2	2	4	1	3/8
DF 15-3	224	165	1.3	14	24	1 1/2	2 3/4	2	7 1/2	1 1/2	2	4	1	3/8
DF 15-6	272	200	2.5	28	48	1 1/2	2 3/4	2	7 1/2	1 1/2	2	4	1	3/8
DF 20-3	183	240	0.8	14	24	2	3 1/4	2 1/2	7 1/2	1 1/2	2	4	1	3/8
DF 20-6	229	300	1.5	28	48	2	3 1/4	2 1/2	7 1/2	1 1/2	2	4	1	3/8

These products will operate with as little as 3 PSI

All dimensions in inches

The values for velocity, vacuum flow and vacuum level are for 80 PSI input pressure.

Method of Installation:

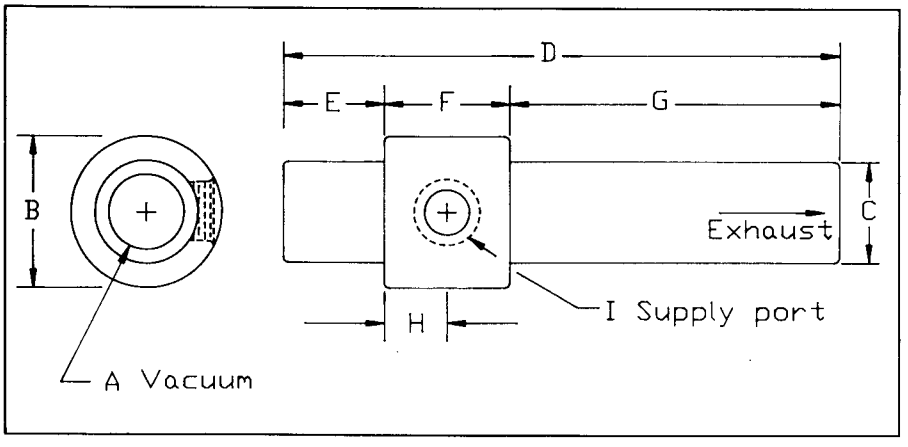
1. Attach flexible hose to both ends of product and secure with hose clamps.
2. For hard piping installation, DF models can be modified to have internal NPT threaded vacuum and exhaust ports.
3. Contact your local distributor or VACCON direct for special sizes and pricing.

DF-Models are ideal for:

- *Holding tension on material during the cutting operation. After the cut has been made the DF unit transfers the waste material to a collection bin.*
- *Vacuum filling 55 gallon drums from sump areas in one minute or less.*
- *Transferring parts to automatic machines for continuous assembly.*

Examples of specific applications of DF units include:

1. *8 DF 5-3 units were used simultaneously to deliver 8 different hypodermic needle parts to an 8 station automatic assembly machine at a rate of 300 parts per minute.*
2. *1 DF 7-3 was used to transfer plastic slugs (4" long by 1/2" wide by 1/8" thick) from a stamping press to collection bin 5' away.*
3. *1 DF 20-6 was used as a vacuum assist to a central fume removal system located 50' from machine area.*



Air Amplifier
CDF-Series

escription: This quiet transducer is essentially an air amplifier. It is capable of moving large volumes of air other gases with a low input volume of compressed air.

The CDF-Models use the "Coanda fect" for their principle of operation. ompressed air is emitted from an anular gap and passes over a curved rface into the throat of the unit. As e air passes over this curved surface, similar to an air foil, a low pressure ea is created, inducing ambient air flow into the throat with the compressed air.

A variety of operating conditions are ssible with the CDF unit. Air pressure input differences are compensated for by changing the air input p size. This is accomplished by ing your hands to rotate the throat section. No tools are required to do e job. By using high pressure air in- t, combined with a small gap setting, a large volume of low pressure flow is produced.

Features:

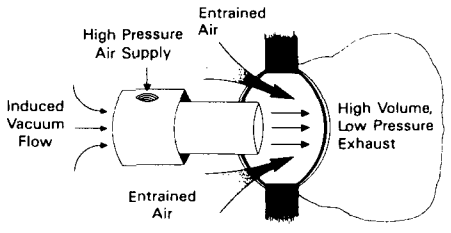
ow Cost — Low initial and operating cost

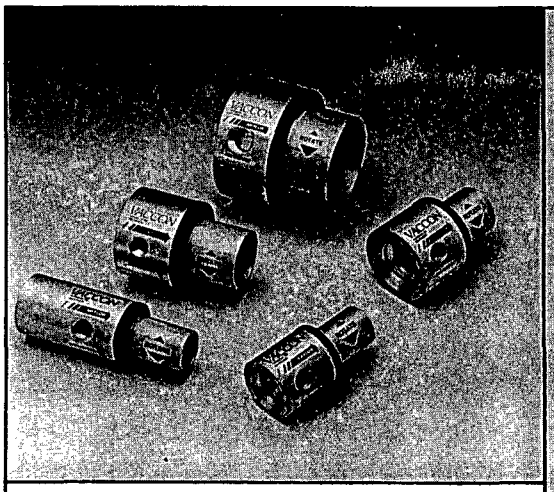
Small Size — Install close to work area

fficient Design — Provides high performance

stant Response — Improved productivity

LUSTRATION OF AIR ENTRAINMENT





CDF 500H CDF1000H CDF 2000H CDF 750H

CDF-Series Factors in Selection

CDF-Models are primarily **Air Amplifiers** with the dual capability of generating up to 8 "Hg vacuum level. The unique design and construction gives the user simple, fast, and positive means to adjust the operating characteristics of the unit. The total output of all the units can be changed by adjusting the input pressure and/or the gap opening. These options provide a wide range of operating conditions for each unit. Consider the following factors when selecting CDF-Models.

Selecting the inside diameter: Choose one which will deliver more than adequate flow for the operation. A larger inside diameter will increase total output and achieve higher amplification ratios.

Amplification: Maximum output (SCFM) is achieved for any given model by matching the input compressed air with the optimum gap setting. Amplification ratios of 40:1 (Output to Input) and more are possible when installation conditions permit entrainment of additional air at the barrel exit point. The largest model (CDF 2000) exceeds ratios of 40:1 without entrainment and with low volume input air. Lower input volumes provide the best amplification ratio. Increasing the input volume will increase the velocity and total output, but with a decrease in amplification ratio.

Entrainment: Occurs when the high velocity air exiting the unit pulls the surrounding air into the flow stream, thus adding more air to the total output.

Gap setting: Rotating the throat section increases the compressed air input opening. This in turn increases the output and the air velocity, but decreases the air amplification ratio.

CDF-Models can save a substantial amount of compressed air where high pressure air is not required but high flows are necessary.

Performance Chart and Physical Dimensions CDF-Series

Performance Data for CDF-Series

Physical Dimensions

MODEL NO.	I.D. INCHES	**INPUT SCFM	OUTPUT SCFM	VELOCITY FT/SEC	I.D. A	B	C	D	E	F	G	(NPTF) H	(NPTF) J
CDF 100	1/8	3	12	2347	1/8	1 1/4	9/16	2	1	3/4	0.13	1/8	—
		2	8	1565									
		1	6	1173									
CDF 200	1/4	3	18	860	1/4	1 1/4	9/16	2	1	3/4	0.13	1/8	—
		2	14	685									
		1	10	490									
CDF 500H†	1/2	9	75	910	1/2	1 1/2	1	4 1/8	2 5/8	1 1/2	0.2	1/4	1/2
		5	42	530									
		3	22	265									
CDF 750H†	3/4	9	110	565	3/4	2	1 1/4	4 1/8	2 5/8	1 1/2	0.2	1/4	1
		5	70	420									
		3	40	195									
CDF 1000H†	1	9	145	435	1	2 1/4	1 1/2	4 1/8	2 5/8	1 1/2	0.2	1/4	1 /14
		5	95	290									
		3	57	174									
CDF 1500H	1 1/2	9	240	314	1 1/2	2 3/4	2	4 1/8	2 5/8	1 1/2	0.2	3/8	2
		5	150	198									
		3	86	123									
CDF 2000H	2	9	350	269	2	3 1/4	2 1/2	4 1/8	2 5/8	1 1/2	0.2	3/8	2 1/2
		5	220	168									
		3	140	106									

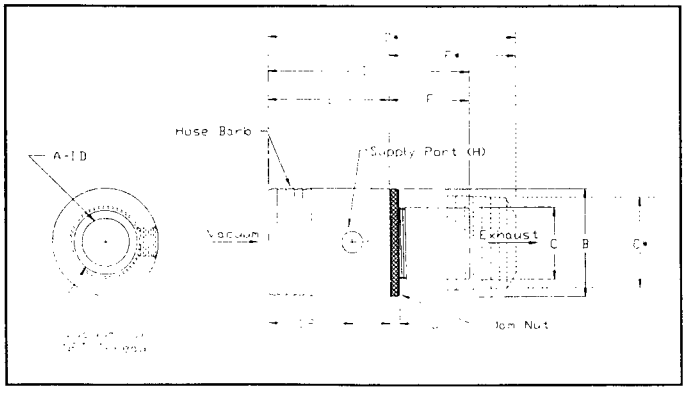
Jam nut is used to secure adjustment ** Data is at 80 PSI All dimensions in inches

CDF-Models are ideal for:

- *Replacement of electric blowers for maintenance free operation.*
- *Inflating plastic and paper bags.*
- *Removal of dust, fumes, and fine powders during filling operations.*
- *Cooling electronic components and electrical controls.*

Examples of specific applications of CDF-Models include:

1. *CDF-1000H used in a pulsed operation for inflating plastic bags on automatic food insertion machines.*
2. *CDF 1500H used to cool electronic control components in wave soldering machine. The positive pressure created by the high flow into the control cabinet kept dust and dirt from fouling the sensitive controls.*
3. *CDF 200H used to remove scrap steel from a high speed trimming machine. The variable output of the CDF unit allowed the operator to compensate for an increase or decrease in the production feed rate.*



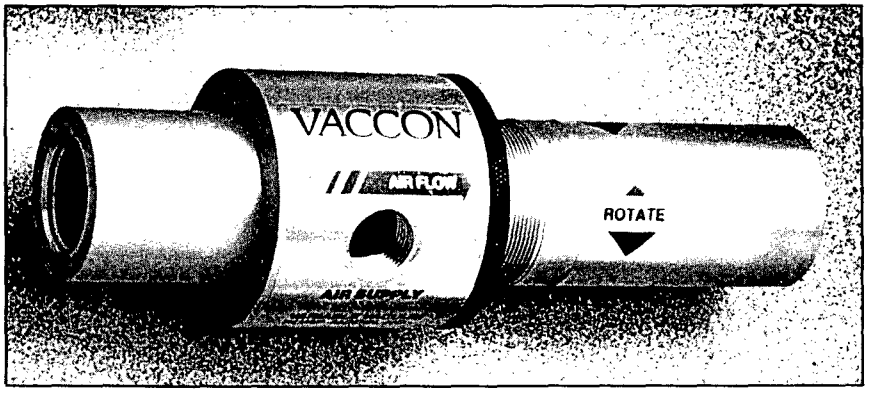
Shown with optional exhaust attachment

OPTIONAL THREADED EXHAUST ATTACHMENTS FOR MODELS CDF 500H, 750H, 1000H

THREADED EXHAUST PART NO.	† MODEL	C*	D*	F*
EPT-100	CDF 500H	1" NPT	4 5/8"	2"
EPT-107	CDF 750H	1" NPT	5 1/8"	2 1/2"
EPT-125	CDF 1000H	1 1/2" NPT	4 5/8"	2"

Multi Purpose Variable Vacuum Pump

Description: The VDF Series of adjustable air powered vacuum pumps provides high vacuum flow, up to 120 SCFM, from a small amount of compressed air. Products are easily adjusted to meet exact application requirements and do not require air regulators.

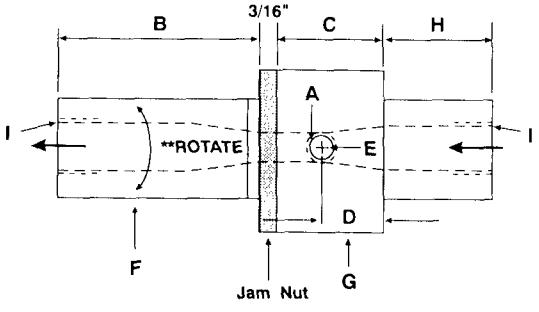


Features:

- **Non-clogging**
  Unique straight thru design allows unobstructed passage of solids.
- **Extremely Reliable**
  No maintenance/No moving parts/No electricity required. Runs cool.
- **Adjustable**
  Set it to your exact requirements. No regulator required - Performance is not pressure sensitive.
- **High Performance**
  Combination of high vacuum flows at high vacuum levels. Vacuum levels to 25 Hg, vacuum flows to 120 SCFM.

Applications:

- Evacuates large volumes of air, liquid and small materials quickly
- Ideal for dirty environments
- Lifting/positioning of porous materials
- Proportional mixing of liquids or liquids and powders



Because of the VDF Series' unique design and adjustability, maximum vacuum flow can be achieved with lower air consumption.

Model No.	Max Vacuum Level "Hg	Air Consumption SCFM *	Max Vacuum Flow SCFM	Air Consumption SCFM *
VDF 150	25	3	4	1.5
VDF 200	25	7	7	3
VDF 250	25	14	15	6
VDF 375	25	28	30	13
VDF 500	25	44	60	25
VDF 750	25	90	120	40

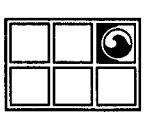
* Air pressure should be above 40 PSI

MODEL NO.	A BARREL ID	B	C COLLAR LENGTH	D	E INPUT (NPTF)	F BARREL OD	G COLLAR OD	H	I THREAD ID NPTF	MUFFLER	* MUFFLER LENGTH
VDF 150	.150	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	AA4	1 3/8
VDF 200	.20	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	FA51-1/4	5 3/4
VDF 250	.25	1 1/2	1 1/2	3/4	1/8	3/4	1 1/4	7/8	1/4	FA51-1/4	5 3/4
VDF 375	.375	2 3/4	1 3/4	7/8	1/4	1	1 1/2	1 1/2	3/8	FA51-3/8	5 3/4
VDF 500	.50	2 1/2	2	1	3/8	1 1/4	2	1 1/2	1/2	2020	11
VDF 750	.75	3 3/8	2	1	1/2	1 1/2	2 1/4	1 1/2	3/4	2020	11

* Length the muffler adds to the total length

VACCON Co. Inc.

32 Rear Spring Street
P.O. Box 324
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GROUNDWATER TECHNOLOGY ®

INDIAN BASIN GAS PLANT
REMEDIATION PROJECT
QUARTERLY REPORT

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Oil Conservation Division

FIRST QUARTER 1995
JANUARY, FEBRUARY, AND MARCH

Submitted by
Marathon Oil Company
on behalf of the
Indian Basin Gas Plant Owners

May 8, 1995

EXECUTIVE SUMMARY

The pump-and-treat groundwater remediation system is fully operational and functioning as set forth in the Treatment Project Plan document (March 1992). During the quarterly sampling event in January 1995, light nonaqueous phase liquid (condensate) was observed in nine Lower Queen wells. During the quarter, fluid recovery from six Lower Queen wells averaged 6417 barrels per week or 33.5 gallons per minute with volatile hydrocarbon compounds being removed by air stripping. Lower Queen dissolved benzene concentrations in six downgradient wells range from 0.5 to 16 micrograms per liter (ug/L) or parts per billion. Chloride concentrations in all Lower Queen wells are below the State maximum allowable concentration of 250 milligrams per liter (mg/L).

Two Shallow zone wells contained condensate in January. Shallow zone pumping continues from one well. Fluid recovery from the Shallow zone aquifer averaged 32 barrels per week. Shallow zone dissolved benzene concentrations range from 0.5 to 650 ug/L. Seven Shallow zone wells sampled in January indicate chloride concentrations above the State maximum allowable concentration of 250 mg/L.

Concentrations of benzene, toluene, ethylbenzene, total xylene, and chloride in groundwater collected from a rancher well completed in the Shallow alluvium, a rancher well completed in the Seven Rivers Formation, and surface water from the Upper Indian Hills Spring West (Rocky Arroyo spring) have not exceeded State or Federal drinking water standards.

Condensate recovery from the Lower Queen and Shallow zone for the First Quarter was 24.5 barrels. Excluding the volume volatilized by the air stripper and vapor extraction system, cumulative recovery is 3,566.4 barrels or 10.2% of the total estimated spill volume.

The vapor extraction system was not operated during the First Quarter.

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APPENDIX B BENZENE CONCENTRATION IN GROUNDWATER VS. TIME GRAPHS

APPENDIX C JANUARY 1995 LABORATORY RESULTS - PROJECT WELLS, RANCHER WELLS, PLANT WELL, AND NATURAL SPRING

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INTRODUCTION

This report summarizes groundwater and unsaturated zone treatment activities conducted during the First Quarter of 1995 in accordance with the Indian Basin Environmental Treatment Project Plan submitted on March 5, 1992 by Marathon Oil Company on behalf of the Indian Basin Gas Plant owners. Preparation of this report is also in accordance with the April 2, 1992 New Mexico Oil Conservation Division (OCD) directive for quarterly reporting of remediation project activities. Remediation activities are continuing to reduce the impact of a liquid gas condensate and brine production pipeline spill discovered in April 1991 near the Indian Basin Gas Plant.

GROUNDWATER ELEVATION

Lower Queen Aquifer

Depth-to-water measurements were acquired from nonpumping Lower Queen monitoring wells in January 1995. Table 1 presents groundwater elevations calculated from casing elevation data, depth-to-water measurements, and light nonaqueous phase liquid (LNAPL) thicknesses. Figure 1 is a potentiometric map of the Lower Queen aquifer based on depth-to-groundwater gauging conducted in January. First Quarter monitoring data indicate increasing groundwater elevations (Figure 2).

Shallow Zone

A potentiometric map was constructed using depth-to-water measurements collected from Shallow zone monitoring wells in January 1995 (Figure 3). Table 2 shows depth-to-water measurements, calculated groundwater elevations, and LNAPL thickness in Shallow zone wells. These Shallow zone data indicate increasing and decreasing groundwater elevations during the quarter (Figure 4). Increased groundwater elevations are the result of recharge from rainfall and both subsurface and surface inflow to the project area.

Groundwater Recharge (Rainfall)

Daily rainfall is gauged at the gas plant. Monthly rainfall for January, February, and March was 0.51, 0.3, and 0.01 inches, respectively (Tables 1 and 2). Cumulative rainfall for the First Quarter was 0.82 inches.

QUARTERLY SAMPLING LABORATORY RESULTS

Thirty-five Shallow zone and fourteen Lower Queen monitoring wells were gauged on January 9, 10 and 11, 1995. Twenty-one Lower Queen wells were sampled including both plant water supply wells (SW-1 and SW-2). Five of the six Lower Queen recovery wells sampled

through the downhole pumps contained condensate (MW-58, MW-59, MW-62, MW-68, and MW-72).

Eleven Shallow zone wells were sampled in January. Five of the twenty-five Shallow zone monitoring wells (including two sumps) designated for quarterly sampling in the Treatment Project Plan were sampled (see ***bolded and italicized*** well designations in Table 4). The remaining 20 Shallow zone compliance wells were either dry or bailed dry during sampling (18) or contain condensate (MW-13 and MW-69). Six Shallow zone wells other than those designated in the Treatment Project Plan were sampled (MW-39, MW-41, MW-43, MW-49, MW-61, and MW-79).

Samples were collected by Groundwater Technology, Inc. using Environmental Protection Agency (EPA) sampling protocol. Analytical Technologies, Inc. performed the BTEX (EPA Method 8020) and chloride (EPA Method 325.2) analyses. Appendix A contains summary tables of groundwater monitoring and sampling data prepared by Groundwater Technology, Inc. from notes recorded during field activities.

Tables 3 and 4 are historical summaries of quarterly benzene concentration data since September 1991 for the Lower Queen and Shallow zone wells, respectively. Benzene concentration (in ug/l) versus time graphs for each routinely sampled monitoring well are provided in Appendix B.

RANCHER WELLS, SPRING, AND PLANT WELL LABORATORY RESULTS

Monthly groundwater samples from the closest downgradient rancher well (Lyman) to the Shallow zone plume and from the Upper Indian Hills Spring West (Hendrickson and Jones, 1952) were collected on January 11 and March 9, 1995. In addition, the Biebelle rancher well, which is sampled quarterly, was sampled on January 11. The plant water supply well (SW-1), completed in the Lower Queen aquifer, is sampled and analyzed monthly. Concentrations of BTEX and chloride in groundwater collected from the Lyman and Biebelle wells and surface water from the Upper Indian Hills Spring West (Rocky Arroyo spring) did not exceed State or Federal drinking water standards during the quarter (Table 5).

The rancher well and natural spring samples were obtained using EPA sampling and handling procedures. Analytical Technologies, Inc. performed the BTEX and chloride analyses using EPA approved methods. Laboratory results of groundwater from the rancher wells and the surface water from the natural spring are transmitted to the local ranchers with letters of explanation. Copies of these letters are also provided to the OCD and the Bureau of Land Management (BLM) in Santa Fe and Roswell, New Mexico, respectively. Laboratory reports for the rancher wells, Rocky Arroyo spring, and SW-1 are included in Appendices C (January)

and D (March).

GROUNDWATER PUMPING

Lower Queen

Fluid recovery from the Lower Queen aquifer and Shallow zone is metered and reported to the State Engineer Office (SEO) in Roswell, New Mexico on a monthly basis per SEO directive. The reports filed with the SEO for First Quarter 1995 are attached in Appendix E. Figures 5, 6, and 7 are stacked bar graphs depicting weekly Lower Queen fluid recovery, weekly Shallow zone fluid recovery, and combined weekly fluid recovery from both zones, respectively.

Seven Lower Queen wells (MW-58, MW-59, MW-61A, MW-62, MW-65A, MW-68, and MW-72) were pumped for plume control during the quarter. Monthly fluid recovery for each well and the plant supply well, SW-1, is listed in the following table.

LOWER QUEEN FLUID RECOVERY

Well Number	January (Bbls)	February (Bbls)	March (Bbls)	Quarter Total (Bbls)	Average Pumping Rate (gpm)
MW-58	1433	2572	2186	6190	2.0
MW-59	2169	2968	2674	7811	2.5
MW-61A	0	3404	8302	11706	3.8
MW-62	2404	202	2710	5316	1.7
MW-65A	2428	9	5131	7568	2.5
MW-68	1782	3220	3127	8129	2.6
MW-72	16566	8280	11856	36702	11.9
SW-1	11206	7344	1264	19814	6.4
TOTAL	**37,988**	**27,998**	**37,249**	**103,234**	**33.5**

Shallow Zone

Monthly Shallow zone fluid recovery during the First Quarter from MW-69 is listed in the following table. Free-phase hydrocarbon (condensate) recovery from MW-69 during the First Quarter totaled 14.7 barrels.

SHALLOW ZONE FLUID RECOVERY

Well Number	January (Bbls) Cond./Water	February (Bbls) Cond./Water	March (Bbls) Cond./Water	Quarter Total (Bbls) Cond./Water
MW-69	3.9/84.2	5.1/155.0	4.7/178.3	13.7/417.5

GROUNDWATER TREATMENT AND PRODUCT RECOVERY

Contaminated groundwater and free-phase hydrocarbon (condensate) from seven Lower Queen recovery wells are pumped through underground piping to the treatment compound. The treatment compound includes two aboveground tanks, an oil/water separator used as a storage vessel, and an air stripper. Condensate is skimmed from one of the two aboveground tanks and transferred to the oil/water separator which serves as a condensate storage vessel. Groundwater containing dissolved-phase hydrocarbon is transferred from the first tank to the second aboveground tank. Groundwater from the second tank is pumped through the air stripper to remove dissolved-phase volatile organic compounds. Stripped volatile organic compounds are vented to the atmosphere through a stack. Treated groundwater is transferred from the air stripper to the 1200-barrel aboveground steel tank and is used as process water for the gas plant.

The measured volume of condensate recovered from Lower Queen groundwater during the First Quarter was 9.8 barrels. Cumulative condensate separated from the recovered groundwater since free-phase hydrocarbon separation began in April 1992 through the First Quarter of 1995 (three years) is 109.0 barrels.

Total condensate recovery from the Lower Queen and Shallow zone for the First Quarter was 24.5 barrels. Cumulative condensate recovered to date excluding the volume volatilized by the air stripper and vapor extraction system is 3,566.4 barrels or 10.2% of the total estimated spill volume.

VAPOR EXTRACTION SYSTEM

The vapor extraction system was not operated during the First Quarter. On May 5, 1994, the vapor extraction system ceased operation when Marathon determined that a New Mexico Air Pollution Control Bureau air emission permit is required for system operation. The system has not operated since then and is being stored at the gas plant.

OTHER ACTIVITIES

Three Lower Queen vapor extraction pilot tests were completed January 16 through 20, 1995. A 49-hour test was performed on MW-73, an 8.25-hour test was conducted on MW-67, and a 4.25-hour test was conducted on MW-68.

Lower Queen well MW-61A was converted to a downgradient monitoring well on September 13, 1994 after two consecutive quarterly laboratory analyses indicated that the benzene concentration was below the State maximum allowable concentration (MAC) of 10 ug/L. Laboratory analysis results for October 1994 indicated the benzene concentration remained below the MAC (4.8 ug/L). In January 1995, the benzene concentration in MW-61A was 16 ug/L. Since this concentration exceeds the State MAC, MW-61A was returned to service as a pumping well on February 24, 1995.

In late February and early March, two 4-inch polyvinyl chloride (PVC) sections of the contaminated groundwater gathering pipeline were replaced with 4.5-inch inside diameter polyethylene pipe. The segments replaced were from MW-65 to MW-62 and from MW-62 to the junction box of the main line to the treatment compound. Successful pressure tests of both segments were conducted at three pounds per square inch above operating pressure on March 2.

In March, reconstruction of the groundwater treatment compound was completed. The purpose of the redesign was to eliminate the accumulation of condensate in the equalization tank due to the inefficiency of the three-phase separator. The accumulation of condensate in the equalization tank caused periodic slugs of condensate to be delivered to the air stripper. The air stripper was designed to manage the flow of groundwater containing dissolved volatile organic compounds only; therefore, treatment of the water stream containing free condensate was not adequate. The design changes were necessary to eliminate the potential for condensate to enter the equalization tank. The new design allows free product to be skimmed off the top of the first of two tanks. Water containing dissolved-phase hydrocarbon is removed from the bottom of the first tank and transferred to the second tank. Water to be treated is removed from the second tank (equalization tank) and transferred to the air stripper inlet. Condensate skimmed from the first tank is transferred to the three-phase separator that now serves as a product storage vessel only. Condensate is transferred by a one-inch diaphragm pump from the three-phase separator

storage vessel at the treatment compound to the inlet condensate tank via an underground pipeline. The volume of product transferred to the inlet condensate tank is metered.

REFERENCES CITED

Hendrickson, G. E., and Jones, R. S., 1952, Geology and Ground-water Resources of Eddy County, New Mexico: New Mexico Bureau of Mines & Mineral Resources Ground-water Report 3, 169 p., 4 pls.

TABLES

TABLE 1. LOWER QUEEN DEPTH-TO-WATER, GROUNDWATER ELEVATION, CONDENSATE THICKNESS, AND RAINFALL DATA FIRST QUARTER 1995

LOWER QUEEN WELL	Top of Casing (TOC) Elev. (ft AMSL)	Total Depth from TOC (ft)	Jan-9-95				Feb-95		Mar-95	
			Depth to water (ft)	Ground-water Elev. (ft)	Depth to product (ft)	Condensate thickness (in)	Depth to water (ft)	Ground-water Elev. (ft)	Depth to water (ft)	Ground-water Elev. (ft)
MW-57	3787.70	177.20	158.77	3628.93			NG		NG	
MW-58	3824.31	218.03	p				p		p	
MW-59	3819.59	211.29	p				p		p	
MW-60	3815.28	223.00	186.81	3628.47			NG		NG	
MW-61A	3815.97	215.67	187.57	3628.40			p		p	
MW-62	3819.90	224.69	p				p		p	
MW-63	3826.16	220.49	198.20	3627.96			NG		NG	
MW-64	3798.57	201.89	169.94	3628.63			NG		NG	
MW-65A	3763.26	168.56	p				p		p	
MW-66	3828.98	235.18	201.04	3627.94			NG		NG	
MW-67	3765.87	165.77	137.09	3628.78			NG		NG	
MW-68	3797.83	203.43	p				p		p	
MW-70	3822.57	225.07	192.83	3629.74			NG		NG	
MW-71	3778.05	233.49	150.65	3627.40			NG		NG	
MW-72	3819.32	236.55	p				p		p	
MW-73	3820.09	~222.5	192.84	3627.25	192.70	1.68	NG		NG	
MW-74	3820.82	~222.5	191.39	3629.43	191.27	1.44	NG		NG	
MW-75	3816.12	~222.5	187.92	3628.20	186.86	12.72	NG		NG	
MW-76	3796.01	~222.5	165.52	3630.49	165.35	2.04	NG		NG	
SW-1	3808.19	255.00	p				p		p	
SW-2	3808.79	292.00	181.26	3627.53			NG		NG	
Monthly Rainfall (in)			0.51				0.30		0.01	

p = pump present in well
NG = Not Gauged

AMSL = Above Mean Sea Level
FP = Free Product (condensate) being recovered

TABLE 2
SHALLOW ZONE DEPTH-TO-WATER, GROUNDWATER ELEVATION, CONDENSATE THICKNESS, AND RAINFALL DATA
FIRST QUARTER 1995

Shallow Zone Well	TOC Elev. (ft AMSL)	Total Depth from TOC (ft)	Jan-9-95				Feb-95		Mar-95	
			Depth to water (ft)	Ground-water Elev. (ft)	Depth to product (ft)	Condensate thickness (in)	Depth to water (ft)	Ground-water Elev. (ft)	Depth to water (ft)	Ground-water Elev. (ft)
MW-1	3792.50	16.10	NG				NG		NG	
MW-2	3788.82	15.52	NG				NG		NG	
MW-3	3787.50	16.97	DRY				NG		NG	
MW-4	3785.88	18.68	NG				NG		NG	
MW-5	3801.69	13.05	DRY				NG		NG	
MW-6	3785.17	14.25	DRY				NG		NG	
MW-7	3784.46	17.35	DRY				NG		NG	
MW-8	3795.04	17.38	DRY				NG		NG	
MW-9	3807.85	13.79	DRY				NG		NG	
MW-10	3790.78	18.20	DRY				NG		NG	
MW-11	3806.96	24.85	DRY				NG		NG	
MW-12	3809.86	25.21	NG				NG		NG	
MW-13	3801.58	22.07	19.76	3781.82	19.55	2.52	NG		NG	
MW-14	3803.93	24.30	NG				NG		NG	
MW-15	3803.59	19.47	NG				NG		NG	
MW-16	3801.04	22.66	NG				NG		NG	
MW-17	3799.55	19.75	NG				NG		NG	
MW-18	3795.82	17.42	NG				NG		NG	
MW-19	3797.21	19.11	NG				NG		NG	
MW-20	3797.59	16.89	NG				NG		NG	
MW-21	3798.21	23.31	NG				NG		NG	
MW-22	3799.20	17.30	NG				NG		NG	
MW-23	3794.48	12.08	NG				NG		NG	
MW-24	3794.09	14.09	DRY				NG		NG	
MW-25	3786.97	10.27	NG				NG		NG	
MW-26	3793.01	21.11	NG				NG		NG	
MW-27	3790.93	18.23	NG				NG		NG	
MW-28	3797.03	18.59	NG				NG		NG	
MW-29	3794.06	14.76	DRY				NG		NG	
MW-30	3788.30	14.82	NG				NG		NG	
Monthly Rainfall (in)			0.51				0.30		0.01	

p = pump present in well
NG = Not Gauged

AMSL = Above Mean Sea Level
TOC = Top of Casing datum

TABLE 2. (CONTINUED)
SHALLOW ZONE DEPTH-TO-WATER, GROUNDWATER ELEVATION, CONDENSATE THICKNESS, & RAINFALL DATA

Shallow Zone Well	TOC Elev. (ft AMSL)	Total Depth from TOC (ft)	Jan-9-95				Feb-95		Mar-95	
			Depth to water (ft)	Ground-water Elev. (ft)	Depth to product (ft)	Condensate thickness (in)	Depth to water (ft)	Ground-water Elev. (ft)	Depth to water (ft)	Ground-water Elev. (ft)
MW-31	3791.15	19.93	NG				NG		NG	
MW-32	3797.47	16.77	DRY				NG		NG	
MW-33	3802.48	20.29	NG				NG		NG	
MW-34	3806.00	19.97	NG				NG		NG	
MW-35	3800.81	20.71	NG				NG		NG	
MW-36	3792.94	8.77	NG				NG		NG	
MW-37	3795.03	20.83	NG				NG		NG	
MW-38	3797.32	20.57	DRY				NG		NG	
MW-39	3796.20	20.54	19.57	3776.63			NG		NG	
MW-40	3803.12	14.07	NG				NG		NG	
MW-41	3799.04	24.04	19.87	3779.17			NG		NG	
MW-42	3804.73	23.59	NG				NG		NG	
MW-43	3802.05	24.55	21.44	3780.61			NG		NG	
MW-44	3804.14	25.24	21.88	3782.26			NG		NG	
MW-45	3808.68	26.62	21.78	3786.90			NG		NG	
MW-46	3805.54	20.24	DRY				NG		NG	
MW-47	3805.09	21.79	DRY				NG		NG	
MW-48	3806.18	19.98	DRY				NG		NG	
MW-49	3805.61	25.91	22.56	3783.05			NG		NG	
MW-50	3813.35	37.15	27.03	3786.32			NG		NG	
MW-51	3810.86	20.06	NG				NG		NG	
MW-52	3817.49	21.44	DRY				NG		NG	
MW-53	3809.92	15.32	DRY				NG		NG	
MW-54	3823.86	78.15	46.59	3777.27			NG		NG	
MW-55	3794.40	66.32	29.50	3764.90			NG		NG	
MW-56	3782.45	43.76	DRY				NG		NG	
MW-61	3816.20	57.97	36.03	3780.17			NG		NG	
MW-65	3763.31	57.69	56.58	3706.73			NG		NG	
MW-69p	3805.11	51.27	NG			present	NG		NG	
MW-77	3775.48	82.20	80.03	3695.45			NP		DRY	
MW-78	3785.82	86.62	86.51	3699.31			NP		DRY	
MW-79	3788.39	82.90	76.29	3712.10			NP		DRY	
MW-80	3821.64	91.80	DRY				NP		DRY	
Sump A10		13.32	DRY				NG		NG	
Sump 16A	3785.14	17.45	16.34	3768.80			NG		NG	
Monthly Rainfall (in)				0.51			0.30		0.01	

p = pump present in well

NG = Not Gauged

AMSL = Above Mean Sea Level

TOC = Top of Casing datum

TABLE 3

HISTORICAL SUMMARY OF BENZENE CONCENTRATION IN LOWER QUEEN GROUNDWATER

FIRST QUARTER 1995

	Benzene (ug/L) using EPA Method 8020 unless indicated otherwise													
WELL	Sep-91	Dec-91	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93	Jul-93	Oct-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95
MW-57	1600	350	150	948**	15.1*	21*	8*	6*	<0.5	<0.5	<0.5	0.7	1.1	4.3
MW-58	40	90	202**	178**	190*	192*	55*	25*	50*	FP	<2.5	2.0	6.7	FP
MW-59	540	420	40.4**	268**	98.8*	26*	10*	FP	10*	FP	<2.5	13	4.1	FP
MW-60	33	<1	3.5**	19**	31.7*	138*	17*	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-61A	190	10	5.0**	359**	470.1*	585*	2821*	FP	FP	FP	<0.5	<0.5	4.8	16
MW-62	2200	1400	257.5**	357**	212.3*	78*	33*	98*	10*	4.1	<2.5	4.3	13	FP
MW-63	<1	<1	4.1**	12**	4.3*	12*	7*	4*	14*	<0.5	<0.5	1.0	<0.5	<0.5
MW-64	150	130	233**	115**	14	15*	5*	2	18*	1.7	<0.5	<0.5	<0.5	12
MW-65A	680	150	25.3**	413**	10.6*	3*	4*	<1*	7*	<0.5	<0.5	<0.5	1.7	<0.5
MW-66	<1	<1	3.3**	8**	12.1*	3*	<3*	8*	13*	<0.5	<0.5	<0.5	<0.5	<0.5
MW-67	280	320	4.3*	103**	2.6*	8*	7*	7*	<0.5	<0.5	<0.5	<0.5	<0.5	1.0
MW-68	240	1900	1865**	160**	2208.2**	376*	1890*	150	374*	3000	120	260	FP	FP
MW-70	<1	<1	1.7**	<1	10.7*	<3*	9*	<1*	25*	<0.5	<0.5	<0.5	1.2	<0.5
MW-71	NI	NI	NI	NI	NI	NI	NI	NI	8*	<0.5	<0.5	<0.5	1.1	<0.5
MW-72	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	<2.5	18	FP	FP
MW-73	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP
MW-74	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP
MW-75	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP
MW-76	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP
SW-1	<1	<1	5*	17.5*	15.7*	6*	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-2	<1	<1	7.9*	7*	69.4*	47*	4	NS	NS	NS	NS	NS	NS	<0.5
Max. Conc	2200	1900	1865	948	2208	585	2821	2821	2821	3000	120	260	FP	FP

* High Performance Liquid Chromatography (HPLC)

** Average of more than one sample result using HPLC.

FP = Free Product (Condensate)

NS = Not Sampled

NI = Not Installed

TABLE 4. HISTORICAL SUMMARY OF BENZENE IN SHALLOW GROUNDWATER
FIRST QUARTER 1995

	Benzene (ug/L) using EPA Method 8020 unless indicated otherwise													
WELL	Sep-91	Dec-91	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93	Jul-93	Oct-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95
MW-1	250	200	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-2	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-3	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-4	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-5	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-6	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***NS***	***DRY***	***DRY***
MW-7	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-8	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-9	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-10	***2300***	***2300***	***1780****	***1842****	***2100***	***NS***	***NS***	***DRY***	***DRY***	***BD***	***DRY***	***DRY***	***DRY***	***DRY***
MW-11	***3000***	***3800***	***3087****	***2199****	***2942****	***2746****	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***1800***	***DRY***
MW-12	3800	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-13	***3100***	***3000***	***3492****	***2708****	***NS***	***NS***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***FP***
MW-14	5100**	NS	NS	NS	NS	NS	PUMP	PUMP	FP	FP	NS	NS	NS	NS
MW-15	5100	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-16	1700	NS	NS	NS	NS	NS	514*	DRY	DRY	DRY	NS	NS	NS	NS
MW-17	2000	NS	NS	NS	NS	NS	1500	DRY	DRY	NS	NS	NS	NS	NS
MW-18	4300	NS	2639**	2700	3300	NS	NS	DRY	VE	VE	VE	VE	NS	NS
MW-19	***4700***	***NS***	***3195****	***3000***	***3032****	***NS***	***3926****	***DRY***	***VE***	***VE***	***VE***	***VE***	***NS***	***NS***
MW-20	110	NS	NS	NS	NS	NS	NS	DRY	VE	VE	VE	VE	NS	NS
MW-21	1000	1100	NS	NS	NS	NS	114*	FP	NS	DRY	NS	NS	NS	NS
MW-22	4	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-23	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-24	***3400***	***NS***	***NS***	***4353****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-25	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-26	3100	3000	NS	2000	1992*	1708*	861*	FP	FP	FP	NS	NS	NS	NS
MW-27	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-28	2200	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-29	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-30	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-31	<1	NS	NS	332**	9*	NS	NS	DRY	DRY	NS	NS	NS	NS	NS
MW-32	***200***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-33	6300	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-34	2500	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-35	5700	NS	NS	NS	NS	NS	NS	FP	FP	FP	NS	NS	NS	NS
MW-36	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-37	150	NS	NS	NS	NS	NS	NS	27*	DRY	NS	NS	NS	NS	NS
MW-38	***15***	***15***	***51****	***37****	***166****	***NS***	***NS***	***DRY***	***BD***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***
MW-39	880	NS	NS	NS	NS	14	29*	24*	DRY	<2.5	<0.5	<0.5	DRY	<5.0
MW-40	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-41	200	170	NS	NS	NS	NS	NS	22*	DRY	5.3	0.6	1.4	3.2	13
MW-42	<1	<1	NS	NS	NS	NS	NS	NS	DRY	NS	NS	NS	NS	NS
MW-43	320	NS	NS	NS	NS	NS	NS	25*	DRY	<0.5	<0.5	<0.5	0.8	3
MW-44	***59***	***NS***	***10****	***97****	***12***	***14***	***7****	***6****	***3****	***12***	***22***	***36***	***130***	***63***
MW-45	<1	<1	NS	NS	NS	NS	NS	<3*	<3*	<0.5	<0.5	<0.5	NS	NS
MW-46	140	25	NS	NS	NS	NS	NS	NS	DRY	NS	NS	DRY	NS	NS
MW-47	2600	2200	NS	NS	NS	NS	NS	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MW-48	***<1***	***<1***	***NS***	***47****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-49	35	NS	NS	NS	NS	NS	NS	210*	68*	13	82	150	78	220
MW-50	***<1***	***<1***	***4****	***4****	***8****	***8****	***<1***	***<3****	***9****	***<0.5***	***<0.5***	***<0.5***	***<0.5***	***<0.5***
MW-51	800	<1	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
MW-52	***<1***	***NS***	***NS***	***5****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-53	***<1***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-54	***<1***	***<1***	***9****	***8****	***62****	***14****	***10****	***<3****	***17****	***8.6***	***<0.5***	***15***	***19***	***<0.5***
MW-55	***940***	***400***	***296****	***483****	***215****	***390***	***412****	***625****	***581****	***290***	***370***	***360***	***910***	***650***
MW-56	***2200***	***1000***	***NS***	***1114****	***1026****	***1128****	***VE***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-61	<1	NS	NS	NS	NS	NS	NS	NS	NS	1.4	<0.5	3.2	<5.0	<0.5
MW-65	<1	NS	NS	NS	NS	NS	NS	<3*	DRY	DRY	DRY	NS	<0.5	NS
MW-69	***2400***	***2100***	***NS***	***568****	***1598****	***1284****	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***
MW-79	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	110
SUMP A10	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***DRY***	***DRY***	***DRY***	***DRY***	***NS***	***OCI***	***DRY***
SUMP A11	1400	2900	3033**	1258**	2815*	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS
SUMP 16A	***240***	***2000***	***1233****	***1495****	***632****	***741****	***707****	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***170***	***2.0***
Lyman										<0.5	<0.5	<0.5	<0.5	<0.5
U. Indian Hills	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5

Bolded Italicized well numbers = Designated wells for quarterly sampling in Marathon Treatment Plan (March 1992)

* High Performance Liquid Chromatography (HPLC)

** Average of more than one sample result using HPLC.

NI = Not Installed

OCI = only Chloride sample

FP = Free Product (condensate

NS = Not Sample

VE = Vapor Extraction we

TABLE 5
RANCHER WELL GROUNDWATER AND NATURAL SPRING WATER SAMPLE RESULTS
FIRST QUARTER 1995

		1995														
	Probable	Jan-11					February					Mar-9				
WELL/ SPRING	Aquifer	Benzene	Toluene	Ethylbenzene	Xylenes	Chloride	Benzene	Toluene	Ethylbenzene	Xylenes	Chloride	Benzene	Toluene	Ethylbenzene	Xylenes	Chloride
Lyman	Shallow Alluvial	ND	ND	ND	ND	11.0	NS	NS	NS	NS	NS	ND	ND	ND	ND	12.0
Upper Indian Hills	Shallow Alluvial	ND	ND	ND	ND	10.0	NS	NS	NS	NS	NS	ND	ND	ND	ND	11.5
Biebelle	Seven Rivers	ND	ND	ND	ND	8.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Benzene, Toluene, Ethylbenzene, and total Xylene concentration in ug/L.

Chloride concentration in mg/L.

ND = Not Detected at method detection limit of 0.5 ug/L.

NS = Not Sampled.

FIGURES

Figure 1.
January 1995 Lower Queen Potentiometric Surface
SURFER 5.0 Kriging Function assuming 4 ft drawdown in pumping wells

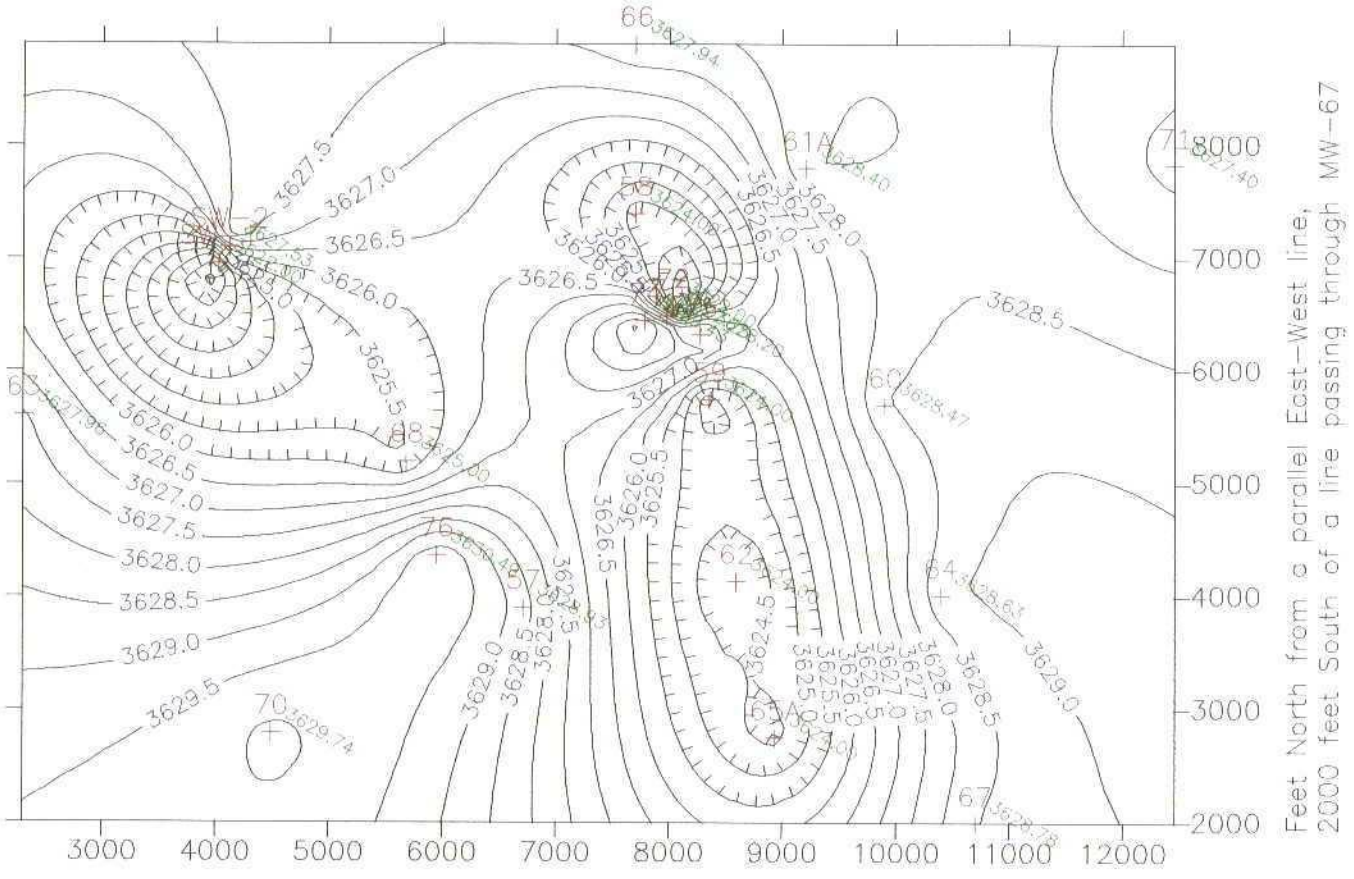


Figure 2. Lower Queen Groundwater Elevation vs. Time

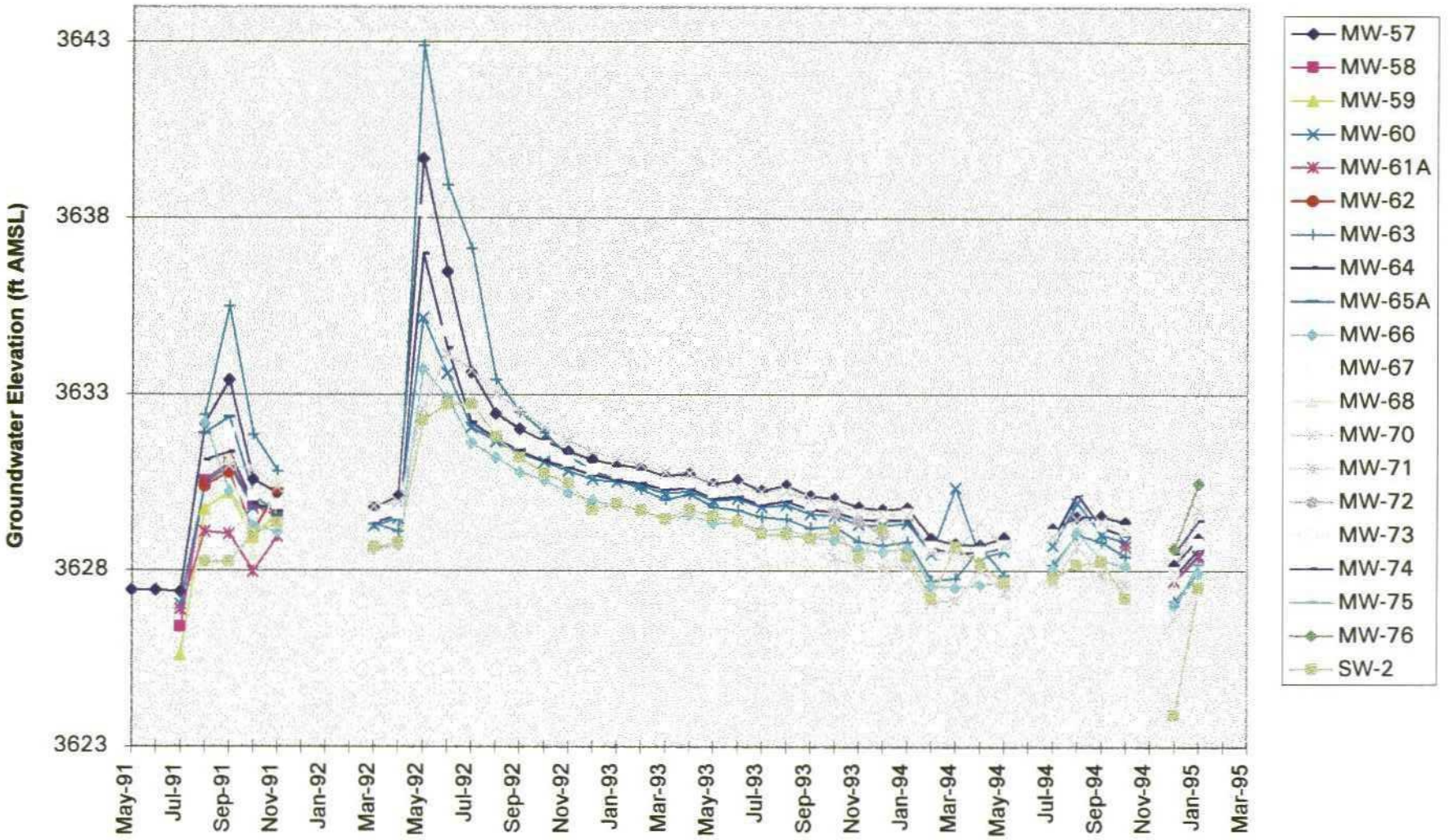


Figure 3.
January 1995 Shallow zone Potentiometric Surface
SURFER 5.0 Kriging Function

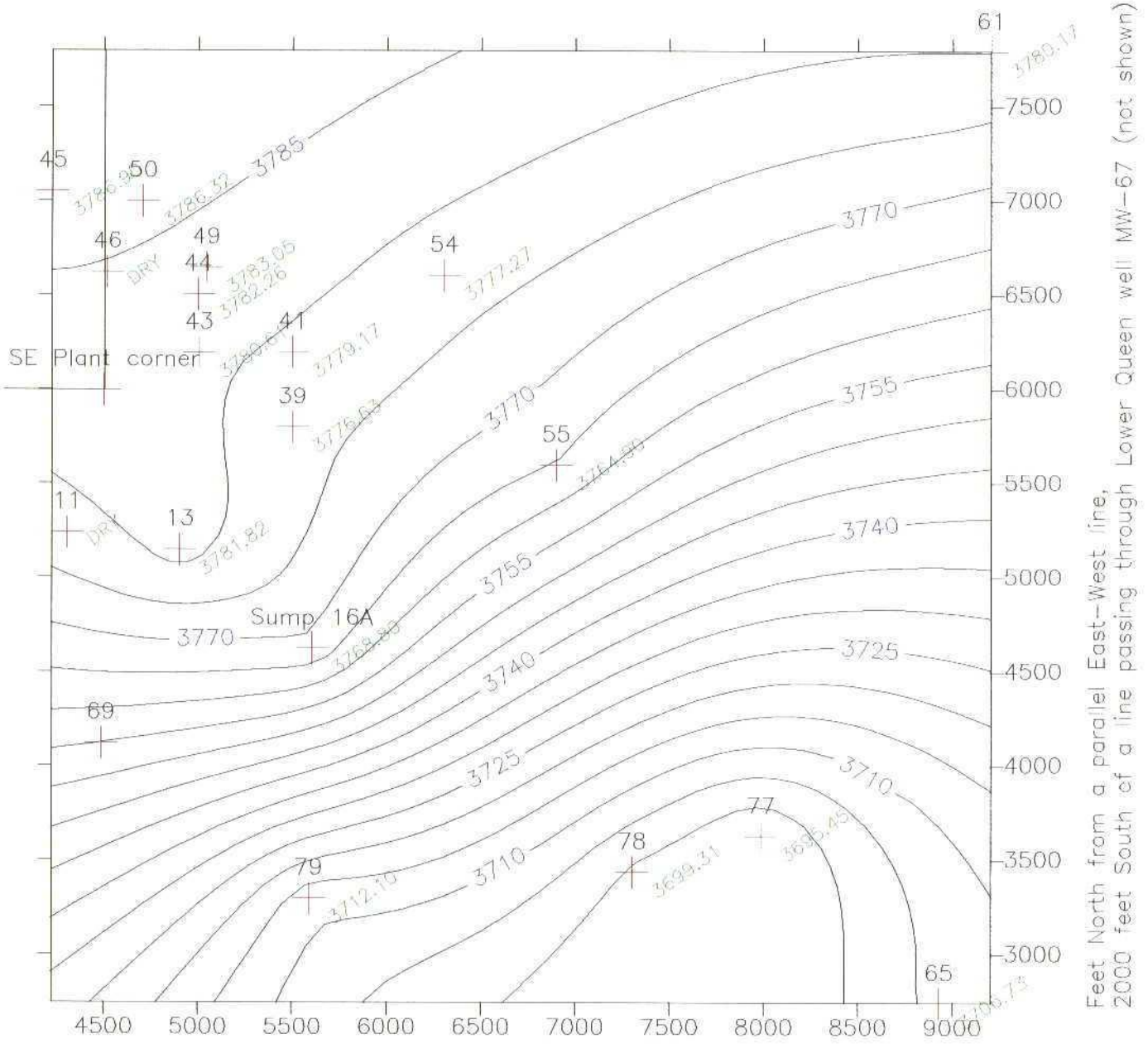


Figure 4. Shallow zone Groundwater Elevation vs. Time

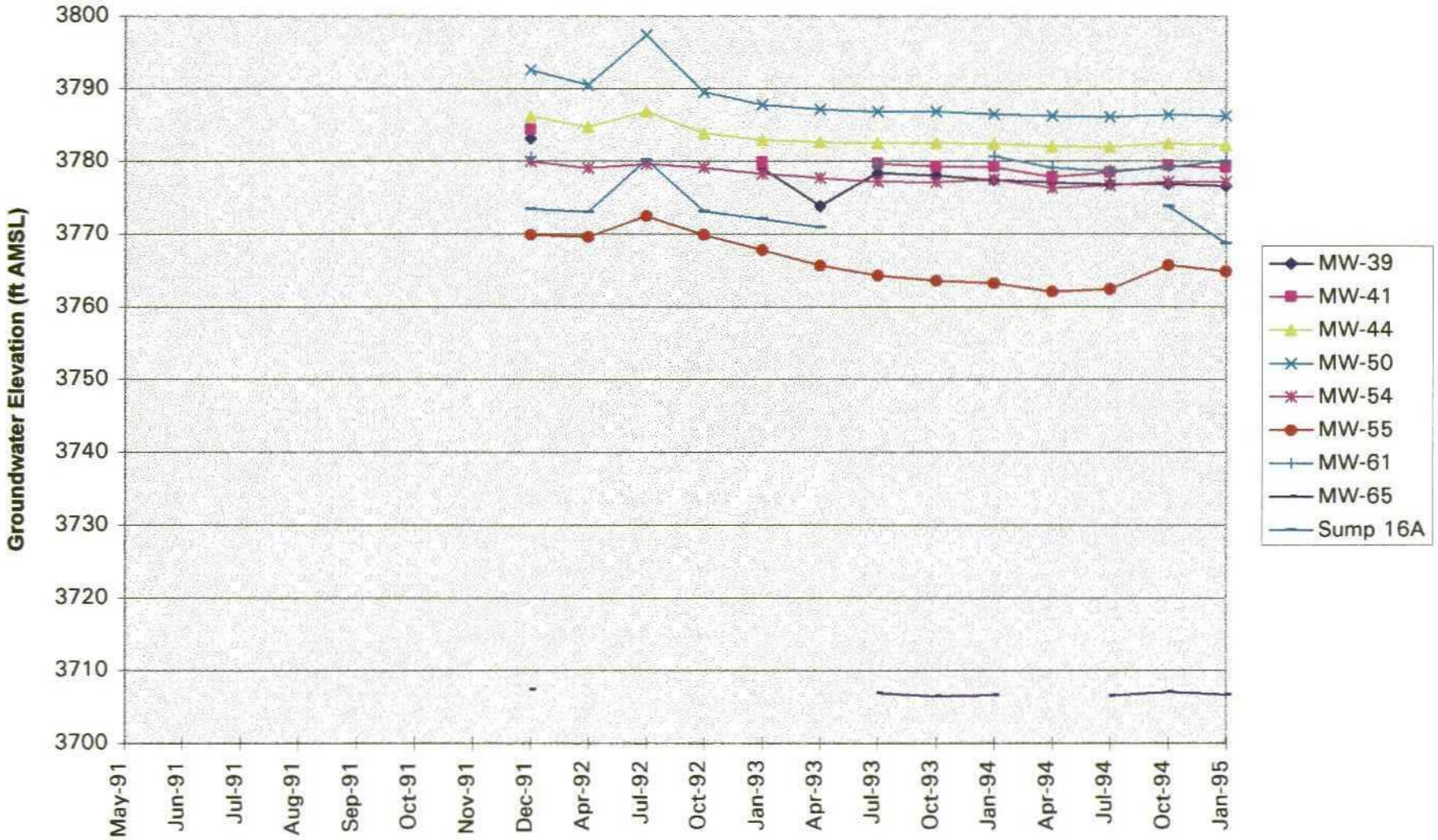
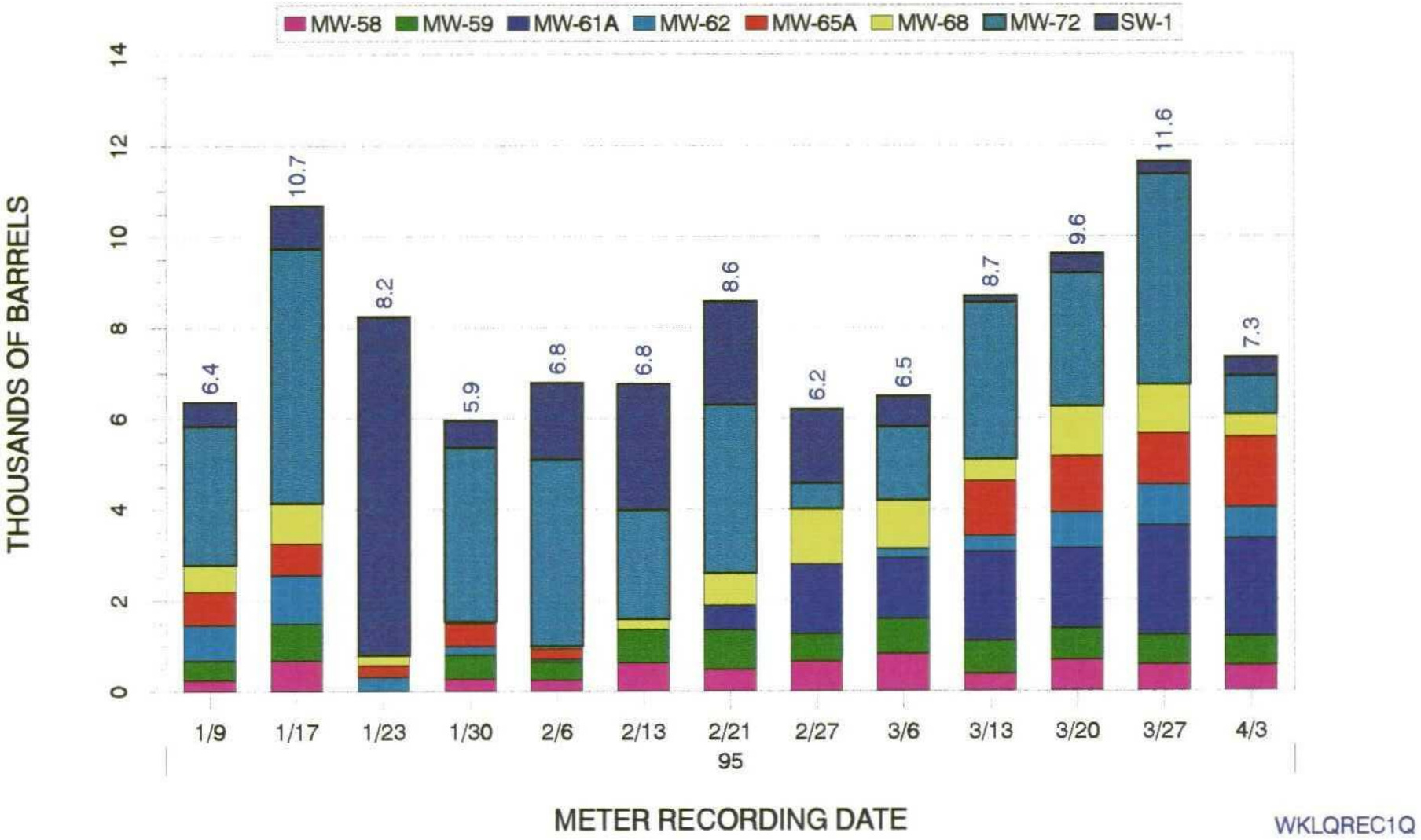


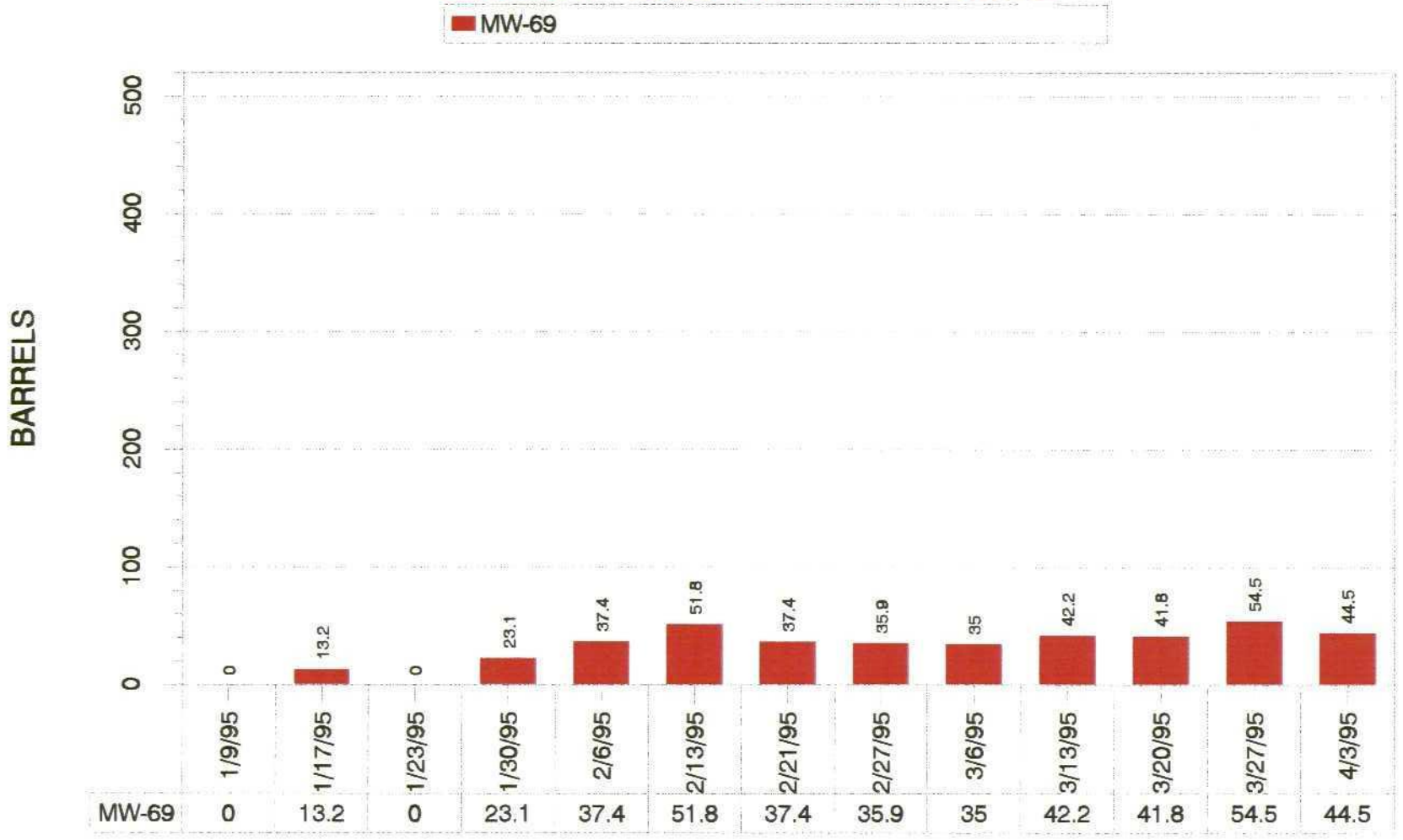
FIG4

FIGURE 5
WEEKLY LOWER QUEEN FLUID RECOVERY
FIRST QUARTER 1995



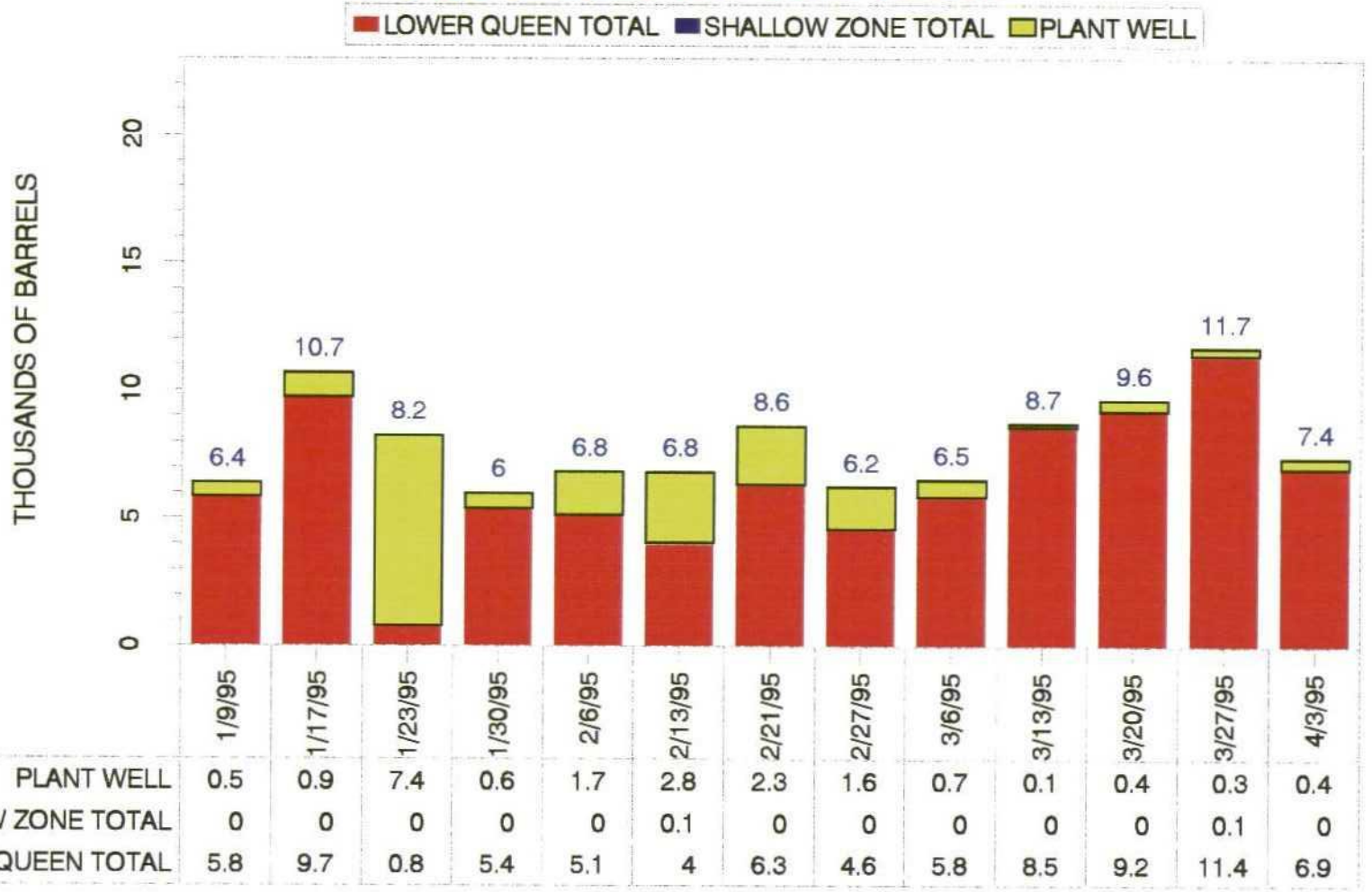
WKLQREC1Q

FIGURE 6
WEEKLY SHALLOW FLUID RECOVERY
FIRST QUARTER 1995



WKSHREC1Q

FIGURE 7
WEEKLY TOTAL FLUID RECOVERY
FIRST QUARTER 1995



	1/9/95	1/17/95	1/23/95	1/30/95	2/6/95	2/13/95	2/21/95	2/27/95	3/6/95	3/13/95	3/20/95	3/27/95	4/3/95
PLANT WELL	0.5	0.9	7.4	0.6	1.7	2.8	2.3	1.6	0.7	0.1	0.4	0.3	0.4
SHALLOW ZONE TOTAL	0	0	0	0	0	0.1	0	0	0	0	0	0.1	0
LOWER QUEEN TOTAL	5.8	9.7	0.8	5.4	5.1	4	6.3	4.6	5.8	8.5	9.2	11.4	6.9

METER RECORDING DATE

WKREC1Q

APPENDIX A

JANUARY 1995 GAUGING, PURGING, AND SAMPLING FIELD SUMMARY

GROUNDWATER TECHNOLOGY ®

Groundwater Technology, Inc.
2501 Yale Boulevard, SE, Suite 204, Albuquerque, NM 87106 USA
Tel: (505) 242-3113 Fax: (505) 242-1103

February 24, 1995

Project No. 023350059

Mr. Robert J. Menzie, Jr.
Marathon Oil Company
P.O. Box 552
Midland, TX 79702-5233

RE: Transmittal of Groundwater Monitoring and Sampling Reports

Dear Mr. Menzie:

Enclosed for your use are summary tables of groundwater monitoring and sampling data collected in January 1995 during the 1st Quarter Groundwater Sampling. If you have any questions regarding this data, or require any additional information or services, please do not hesitate to contact me at (505) 242-3113.

Sincerely,

Groundwater Technology, Inc.

Sara C. Brothers
Project Manager
Operations Manager, New Mexico

cc: Project File

FEB 27 1995

Well Gauging Data Form

Client:	Marathon Oil Company	**Recorded By:**	Charles Madewell
Site:	Indian Basin Gas Plant	**Interface Probe (IP)**	Solinst 8195 / ORS 06-01361
Project #:	023350059.60	**IP Correcton:**	Solinst 0' / ORS 0'-100' = -19', 100'-200' = -10', 200'-300' = -1' , Readings corrected.
Date:	01/09-10/95	**Weather:**	Cloudy, cool, windy

WELL NUMBER	WELL DIA. (inch)	TIME OF READING (HH:MM)	TOTAL DEPTH (feet)	DTW (feet)	DTP (feet)	PT (feet)	PTx0.73 (feet)	ADJ DTW (feet)	H_2S CONC. (ppm)	HYDROCARBON VAPOR CONC. (ppm)	COMMENTS
MW-70	4	10:45	228.14	192.83	ND	0.00	0.00	NA	0	0	Solinst
MW-80	8	11:05	91.80	DRY	ND	0.00	0.00	NA	0	0	"
MW-53	2	11:19	15.20	DRY	ND	0.00	0.00	NA	0	0	"
MW-69	4	11:22	*								* Didn't gauge per Bob M free product.
MW-09	2	11:25	13.65	DRY	ND	0.00	0.00	NA	0	0	Solinst
MW-08	2	11:30	17.24	DRY	ND	0.00	0.00	NA	0	70	"
MW-79	8	11:50	82.90	76.29	ND	0.00	0.00	NA	0	250	"
MW-07	2	11:53	17.33	DRY	ND	0.00	0.00	NA	0	0	"
MW-06	2	12:01	14.18	DRY	ND	0.00	0.00	NA	0	20	"
MW-63	4	12:38	221.88	198.20	ND	0.00	0.00	NA	0	0	"
SW-02	10	12:55	292.00	181.26	ND	0.00	0.00	NA	0	0	"
MW-52	2	12:47	21.19	DRY	ND	0.00	0.00	NA	0	0	"
MW-71	4	13:25	235.41	150.65	ND	0.00	0.00	NA	0	0	"
MW-61A	4	13:35	215.67	187.57	ND	0.00	0.00	NA	0	0	"
MW-61	4	13:44	57.97	36.03	ND	0.00	0.00	NA	0	45	"
MW-66	4	14:05	237.66	201.04	ND	0.00	0.00	NA	0	0	ORS
MW-60	4	14:25	226.08	186.81	ND	0.00	0.00	NA	0	0	Solinst
MW-64	4	14:50	204.38	169.94	ND	0.00	0.00	NA	0	500	"
MW-67	4	15:03	168.54	137.09	ND	0.00	0.00	NA	0	>10,000	" , Strong odor
MW-65	4	15:15	57.69	56.58	ND	0.00	0.00	NA	0	0	"
MW-77	8	15:25	82.20	80.03	ND	0.00	0.00	NA	0	0	"
MW-78	8	15:36	86.62	86.51	ND	0.00	0.00	NA	0	>10,000	" , Strong odor
MW-57	4	15:45	179.30	158.77	ND	0.00	0.00	NA	0	>10,000	" , " "
											NEW DATE 1/10/95
MW-55	4	08:10	66.32	29.50	ND	0.00	0.00	NA	0	0	Solinst
MW-56	4	08:20	43.76	DRY	ND	0.00	0.00	NA	0	0	"
MW-03	2	08:25	16.90	DRY	ND	0.00	0.00	NA	0	0	"
MW-10	4	08:32	18.21	18.19	ND	0.00	0.00	NA	0	0	"

Well Gauging Data Form

Client:	Marathon Oil Company	**Recorded By:**	Charles Madewell
Site:	Indian Basin Gas Plant	**Interface Probe (IP)**	Solinst 8195 / ORS 06-01361
Project #:	023350059.60	**IP Correcton:**	Solinst 0' / ORS 0'-100' = -19', 100'-200' = -10', 200'-300' = -1' , Readings corrected.
Date:	01/10-11/95	**Weather:**	Cloudy, cool, windy

WELL NUMBER	WELL DIA. (inch)	TIME OF READING (HH:MM)	TOTAL DEPTH (feet)	DTW (feet)	DTP (feet)	PT (feet)	PTx0.73 (feet)	ADJ DTW (feet)	H_2S CONC. (ppm)	HYDROCARBON VAPOR CONC. (ppm)	COMMENTS
MW-29	2	08:36	14.76	DRY	ND	0.00	0.00	NA	0	0	Solinst
SUMP-16A	24	08:48	17.45	16.34	ND	0.00	0.00	NA	0	0	"
MW-54	4	09:02	78.15	46.59	ND	0.00	0.00	NA	0	0	"
MW-05	2	09:08	12.77	DRY	ND	0.00	0.00	NA	0	0	"
MW-24	2	09:14	13.18	DRY	ND	0.00	0.00	NA	0	0	"
MW-39	4	09:20	20.54	19.57	ND	0.00	0.00	NA	0	0	"
MW-38	4	09:26	20.57	DRY	ND	0.00	0.00	NA	0	0	"
MW-41	4	09:31	24.04	19.87	ND	0.00	0.00	NA	0	0	"
MW-43	4	09:37	24.55	21.44	ND	0.00	0.00	NA	0	0	"
MW-44	4	09:43	25.24	21.88	ND	0.00	0.00	NA	0	0	"
MW-49	2	09:57	25.91	22.56	ND	0.00	0.00	NA	0	0	"
MW-32	2	10:08	15.70	DRY	ND	0.00	0.00	NA	0	0	"
MW-11	4	10:18	24.85	DRY	ND	0.00	0.00	NA	0	0	"
SUMP-A10	24	10:29	13.42	DRY	ND	0.00	0.00	NA	0	0	"
MW-48	2	10:39	19.98	DRY	ND	0.00	0.00	NA	0	0	"
MW-47	2	10:49	21.79	DRY	ND	0.00	0.00	NA	0	>10,000	"
MW-46	4	10:55	20.24	DRY	ND	0.00	0.00	NA	0	0	"
MW-50	2	11:04	37.15	27.03	ND	0.00	0.00	NA	0	0	"
MW-45	2	11:16	26.62	21.78	ND	0.00	0.00	NA	0	0	"
MW-76	8	11:46	220.00	165.52	165.35	0.17	0.12	165.64	0	9500	"
MW-74	8	12:03	220.00	191.39	191.27	0.12	0.09	191.48	0	9500	"
MW-73	8	12:11	220.00	192.84	192.70	0.14	0.10	192.94	0	>10,000	"
MW-75	8	12:24	220.00	187.92	186.86	1.06	0.77	188.69	0	>10,000	"
											NEW DATE 1/11/95
MW-13	2	16:12	22.07	19.76	19.55	0.21	0.15	19.91	0	0	Solinst

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico Date: 01/09/95

Project Number 023350059 Technician: Charles Madewell and Scott Dolittle

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (mohms/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-63	4	221.88	198.20	47	PUMP	1358	47	188	4	01/09/95 1455	7.73	0.55	62.1	4.8	MW-63
MW-66	4	237.66	201.04	75	PUMP	1608	75	190	4	01/09/95 1655	7.51	1.02	65.1	3.0	MW-66
MW-70	4	228.14	192.83	71	PUMP	1120	71	182	4	01/09/95 1230	7.92	0.55	67.2	4.8	MW-70

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 n(2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).
2 - Purge amounts are 3 well casing volumes
3 - NS: Not sampled due to insufficient recharge, NA: Not Applicable

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico Date: 01/10/95

Project Number 023350059 Technician: Charles Madewell and Scott Dolittle

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (mohms/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-39	4	20.54	19.57	2	BAIL	1615	1	NA	NA	01/10/95 1645	NA	NA	NA	NA	MW-39
MW-54	4	78.15	46.59	65	BAIL	1315	44	NA	NA	01/10/95 1500	NA	NA	NA	NA	MW-54
MW-60	4	226.08	186.81	80	PUMP	1345	80	220	2.75	01/10/95 1452	7.64	1.17	65.6	3.4	MW-60
MW-61A	4	215.67	187.57	37	PUMP	1130	38	200	3.14	01/10/95 1235	7.61	1.16	64.1	3.0	MW-61A
MW-64	4	204.38	169.94	70	PUMP	1530	70	185	3.41	01/10/95 1649	7.73	1.03	62.9	3.2	MW-64
MW-71	4	235.41	150.65	170	PUMP	0755	170	215	1.5-3.41	01/10/95 1045	7.71	1.56	67.0	3.6	MW-71

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).

2 - Purge amounts are 3 well casing volumes

3 - NS: Not sampled due to insufficient recharge, NA: Not Applicable

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico Date: 01/11/95

Project Number 023350059 Technician: Charles Madewell and Scott Dolittle

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (mohms/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-41	4	24.04	19.87	10	BAIL	1000	6	NA	NA	01/11/95 1350	NA	NA	NA	NA	MW-41
MW-43	4	24.55	21.44	7	BAIL	0830	2.5	NA	NA	01/11/95 1320	NA	NA	NA	NA	MW-43
MW-44	4	25.24	21.88	7	BAIL	0900	7	NA	NA	01/11/95 1330	NA	NA	NA	NA	MW-44
MW-49	2	25.91	22.56	2	BAIL	0930	2	NA	NA	01/11/95 1340	NA	NA	NA	NA	MW-49
MW-50	2	37.15	27.03	5	BAIL	0800	5	NA	NA	01/11/95 1310	NA	NA	NA	NA	MW-50
MW-55	4	66.32	29.50	75	PUMP	1110	76	63	5.76	01/11/95 1210	7.29	2.94	66.9	3.6	MW-55
MW-57	4	179.30	158.77	41	PUMP	0915	43	170	3.64	01/11/95 1010	7.64	0.92	63.9	3.4	MW-57
MW-61	4	57.97	36.03	45	PUMP	1255	45	52	5.62	01/11/95 1340	7.12	4.59	65.4	3.0	MW-61
MW-65	4	57.69	56.58	2.5	BAIL	1040	0.5	NA	NA	NS	NA	NA	NA	NA	MW-65
MW-67	4	168.54	137.09	65	PUMP	0730	68	150	4.02	01/11/95 0840	7.61	0.78	62.5	3.4	MW-67
MW-77	8	82.20	80.03	17	BAIL	1110	5.5	NA	NA	NS	NA	NA	NA	NA	MW-77
MW-79	8	82.90	76.29	52	BAIL	1200	12	NA	NA	01/11/95 1515	NA	NA	NA	NA	MW-79

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).

2 - Purge amounts are 3 well casing volumes

3 - NS: Not sampled due to insufficient recharge, NA: Not Applicable

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico Date: 01/11/95

Project Number 023350059 Technician: Charles Madewell and Scott Dolittle

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (mohms/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
SUMP-16A	24	17.45	16.34	78	NA	NA	0	NA	NA	01/11/95 1405	NA	NA	NA	NA	SUMP-16A
SW-02	10	292.00	181.26	1360	PUMP	1420	456	200	3.3	01/11/95 1710	7.78	1.04	62.0	3.6	SW-02

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).

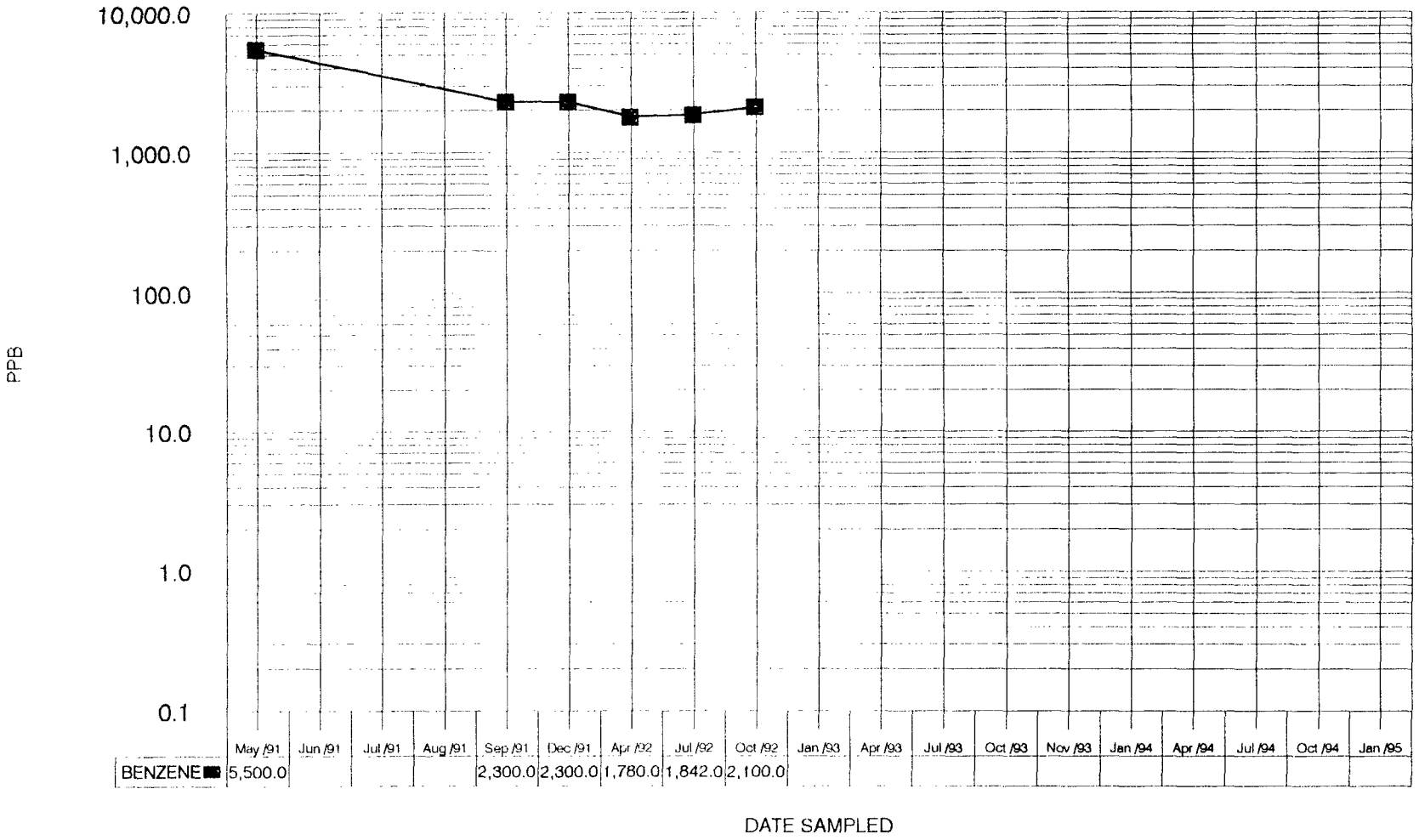
2 - Purge amounts are 3 well casing volumes

3 - NS: Not sampled due to insufficient recharge, NA: Not Applicable

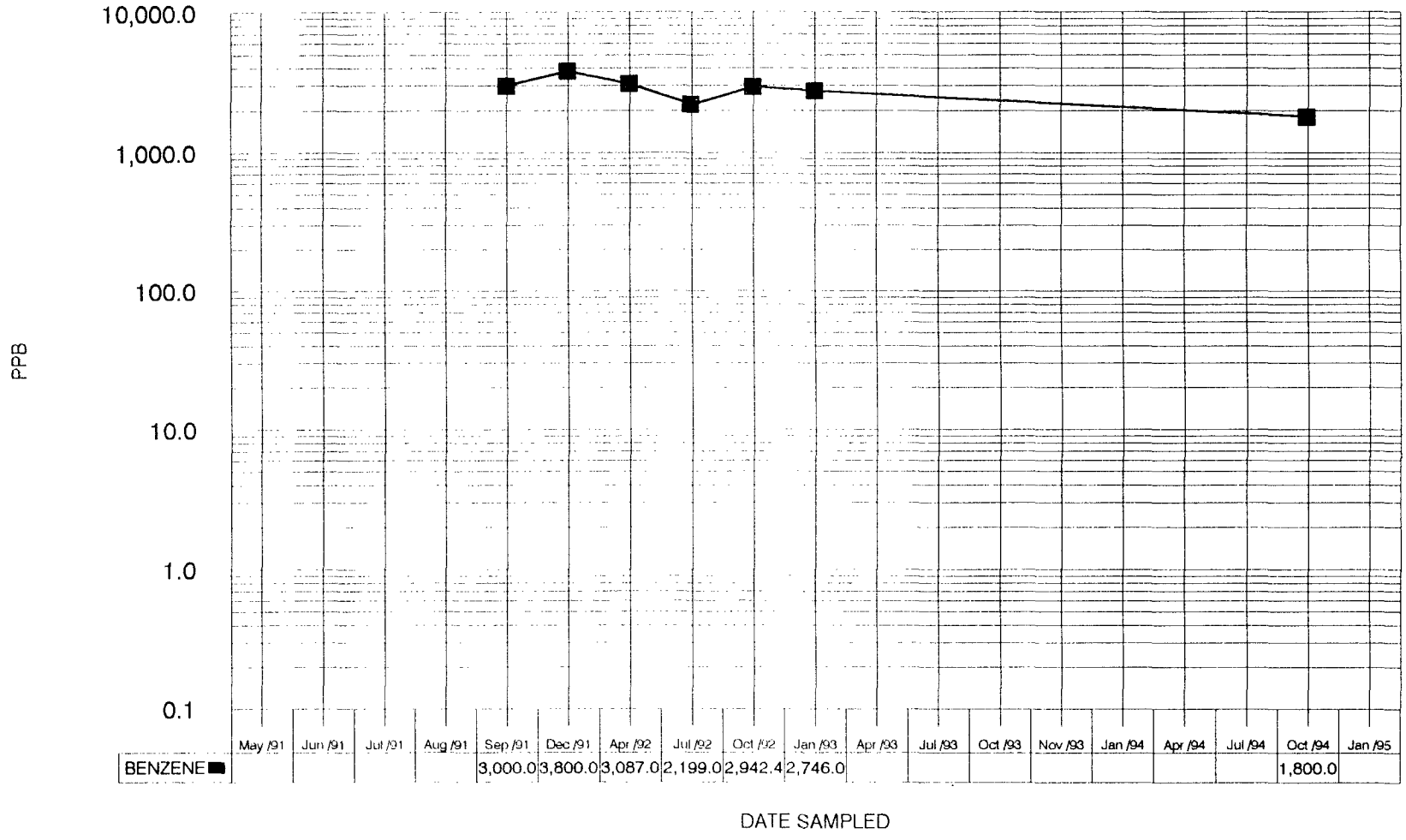
APPENDIX B

BENZENE CONCENTRATION IN GROUNDWATER VS. TIME GRAPHS

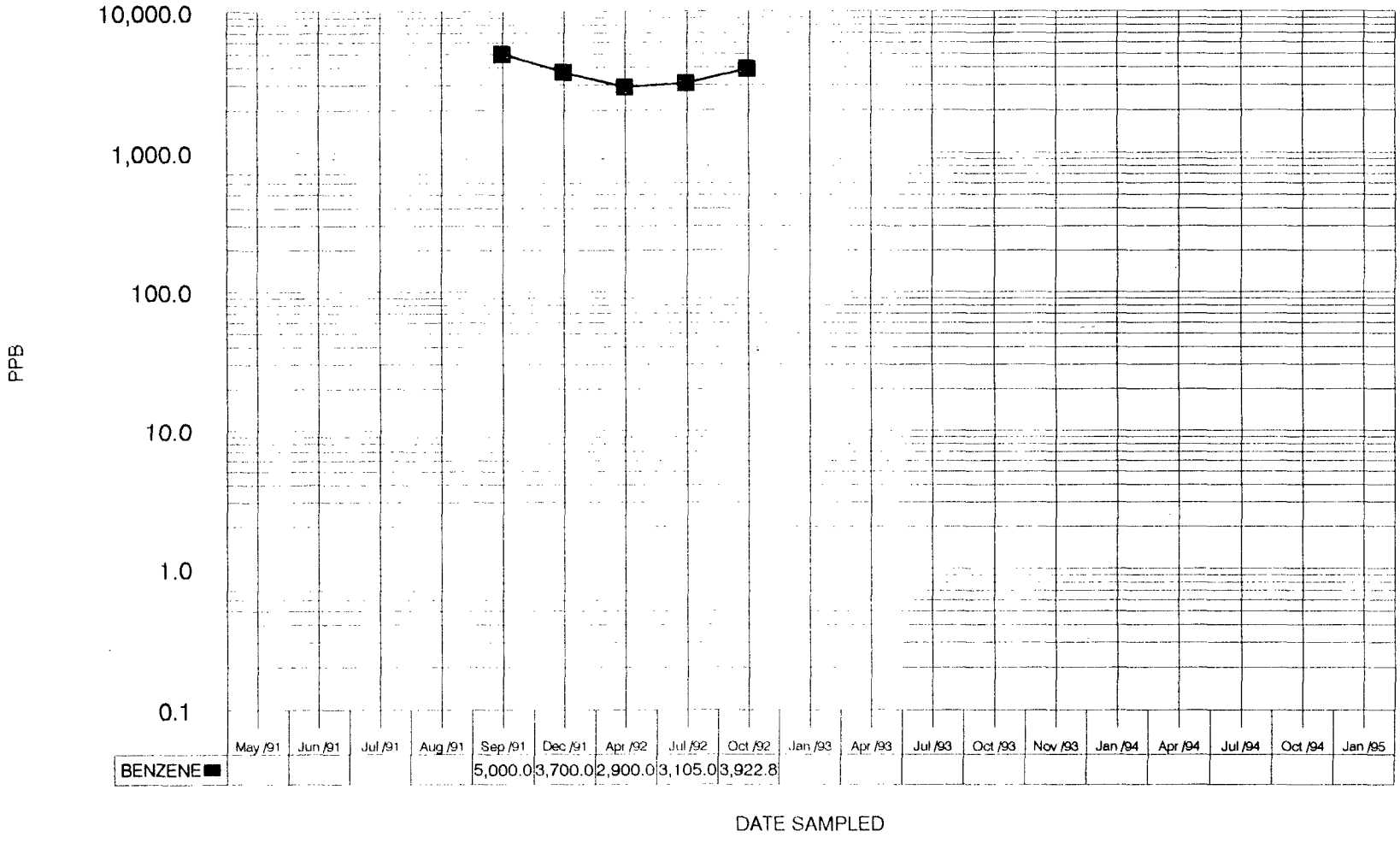
BENZENE IN GROUNDWATER
MW-10



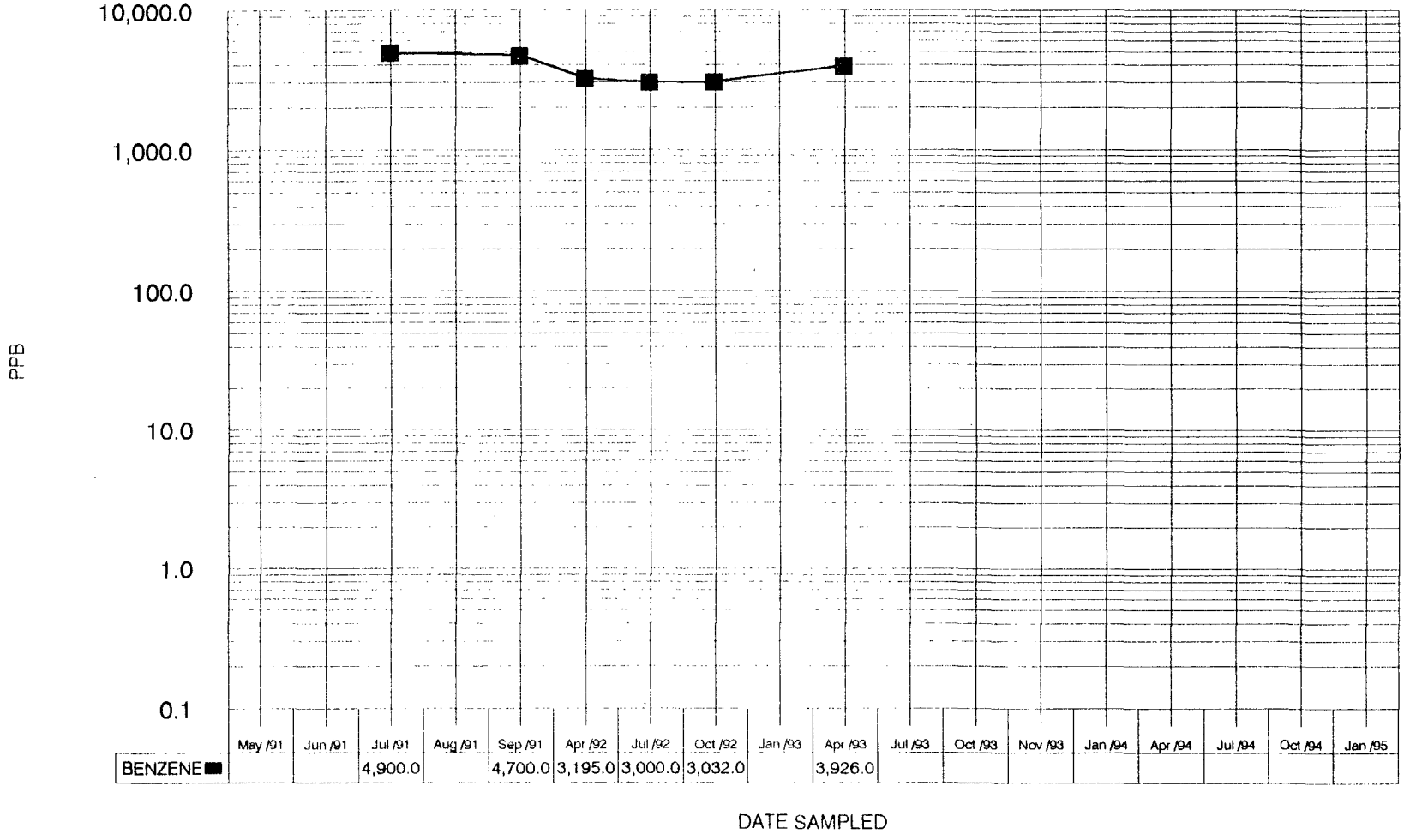
BENZENE IN GROUNDWATER
MW-11



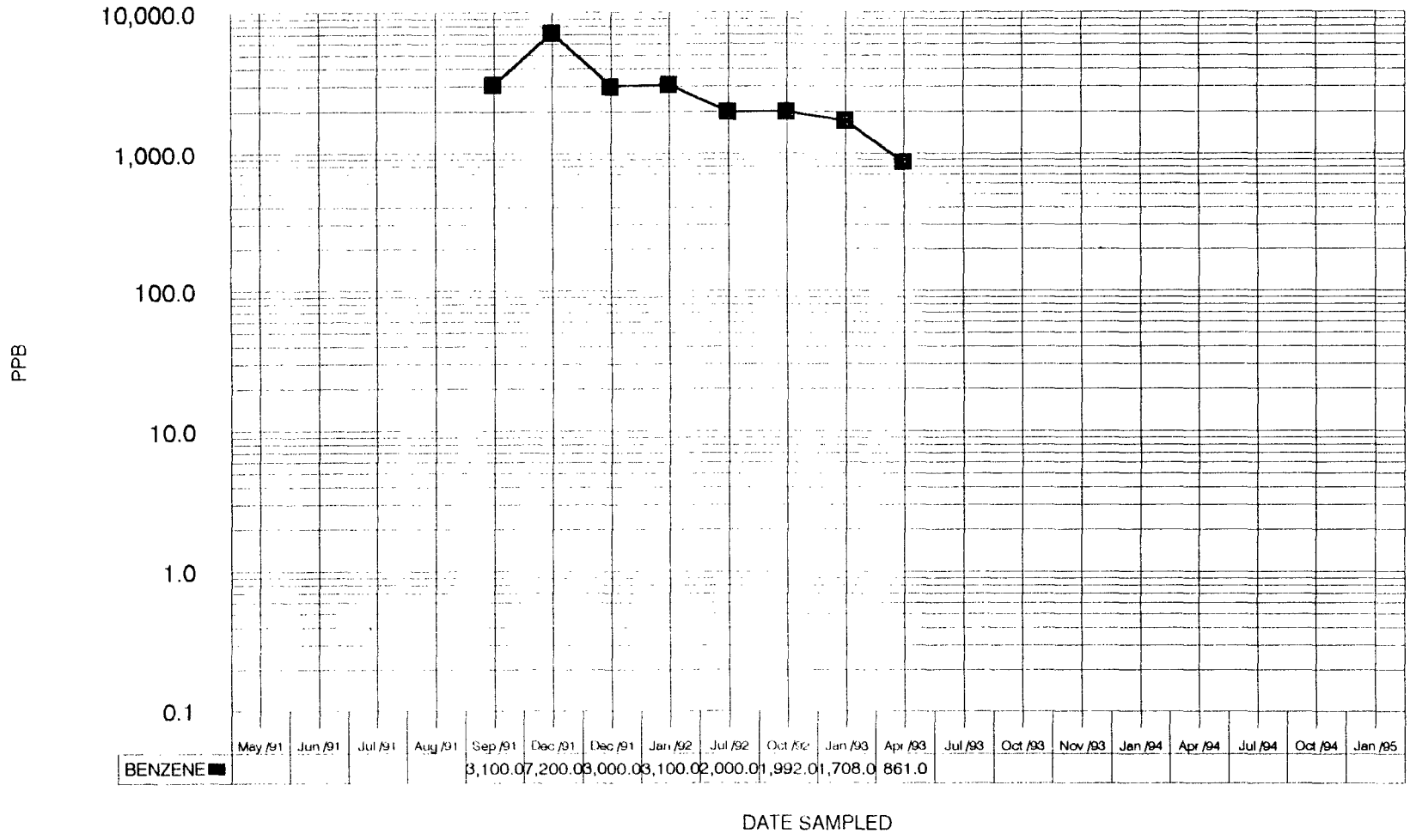
BENZENE IN GROUNDWATER
MW-18



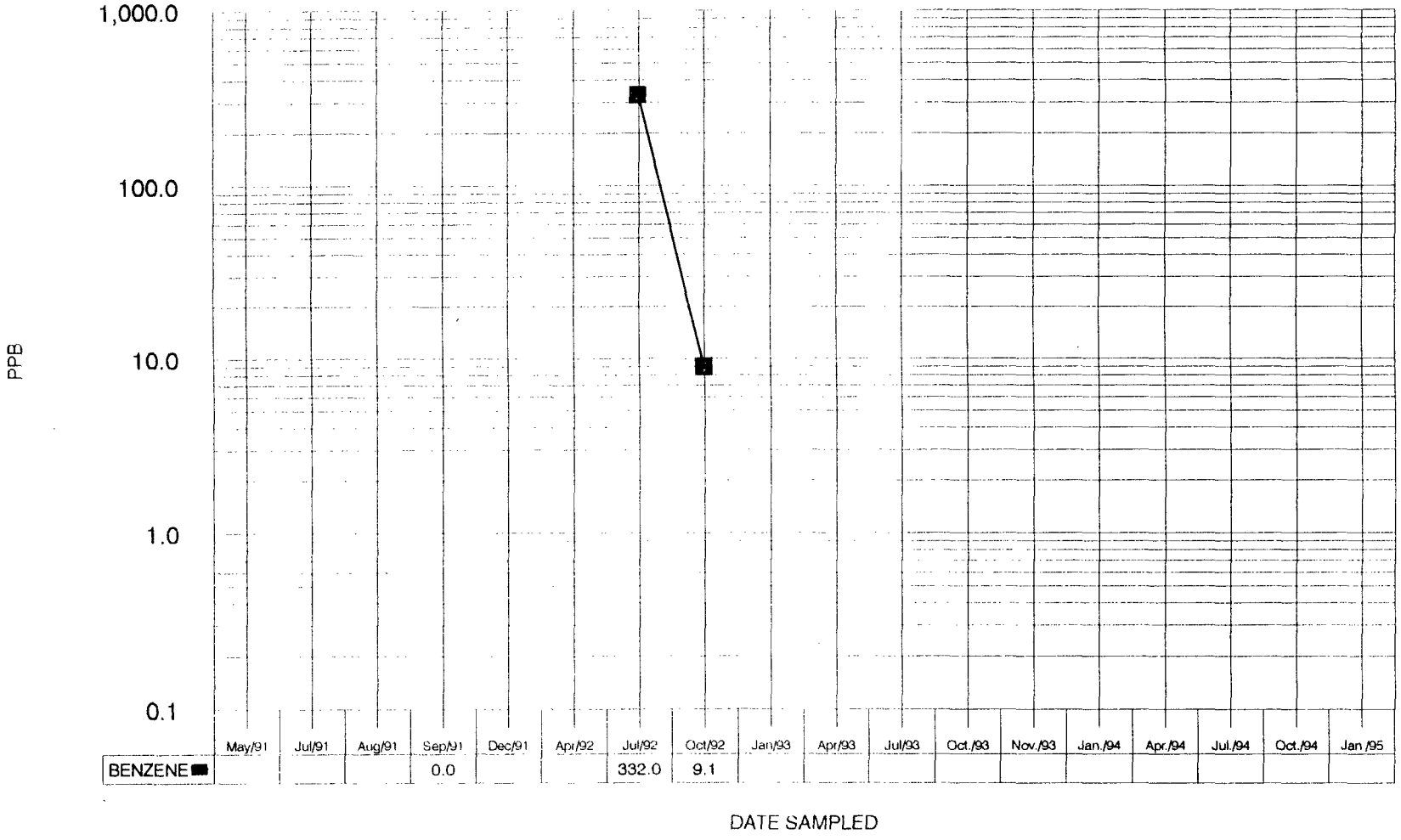
BENZENE IN GROUNDWATER
MW-19



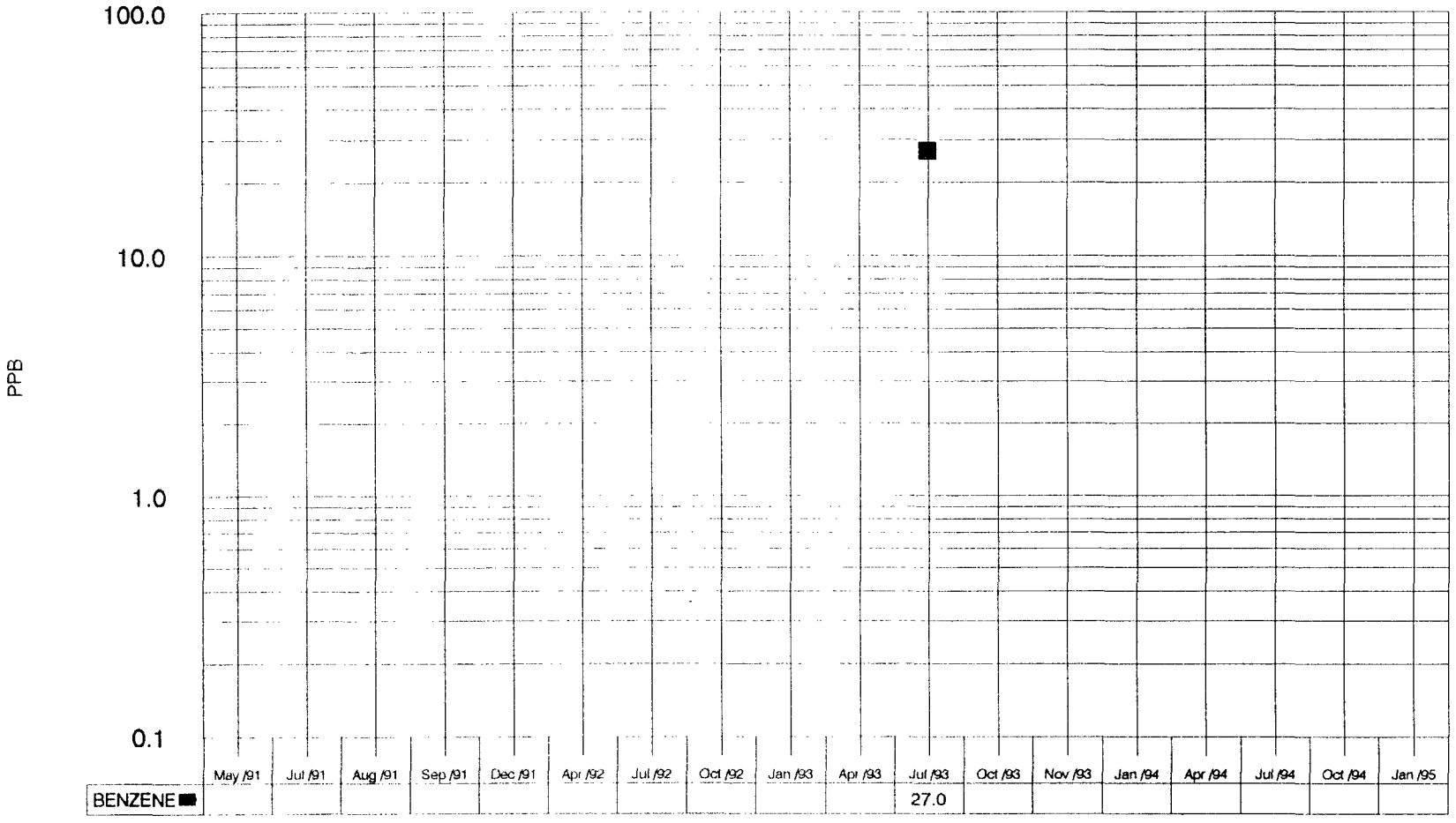
BENZENE IN GROUNDWATER
MW-26



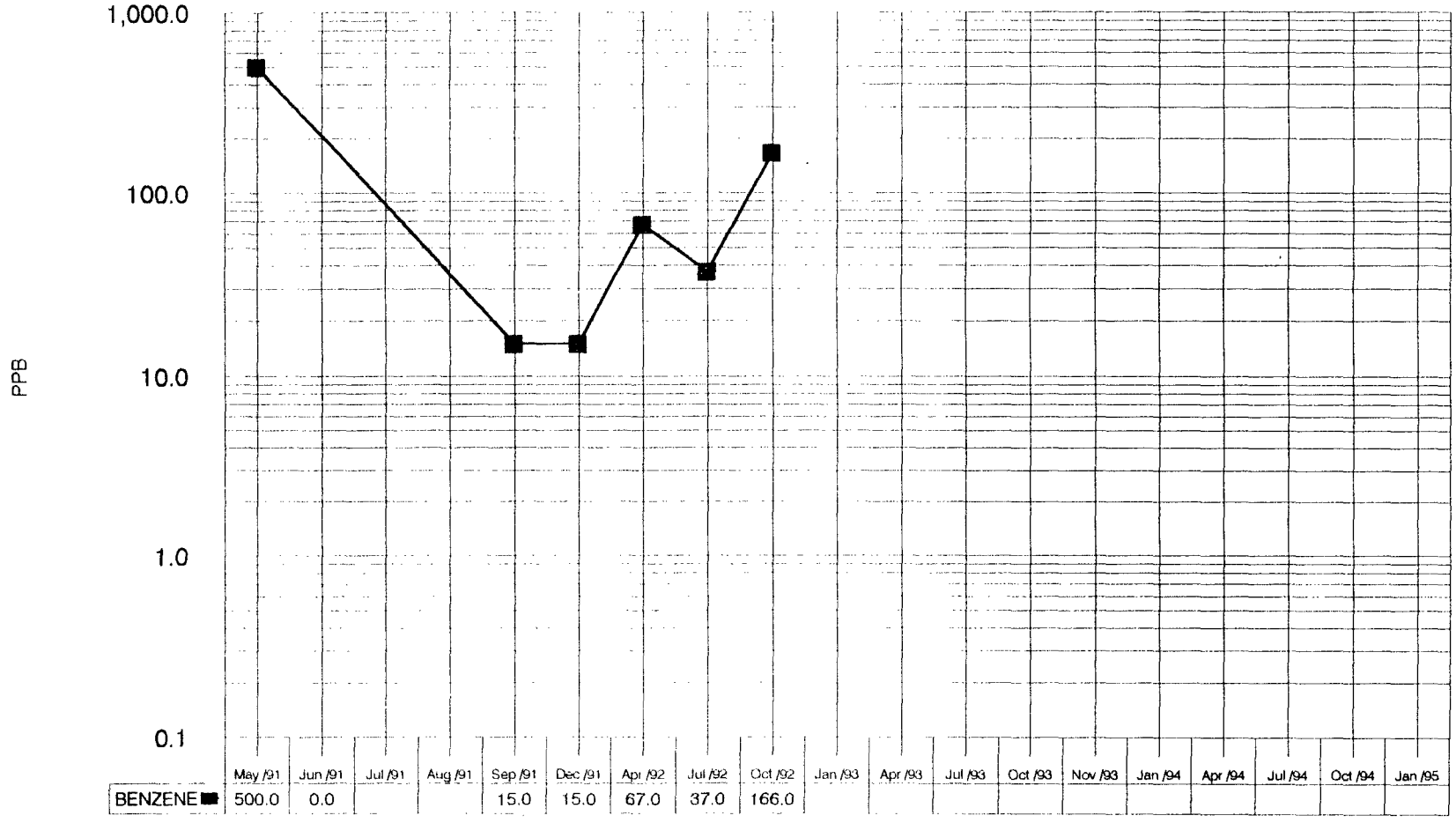
BENZENE IN GROUNDWATER
MW-31



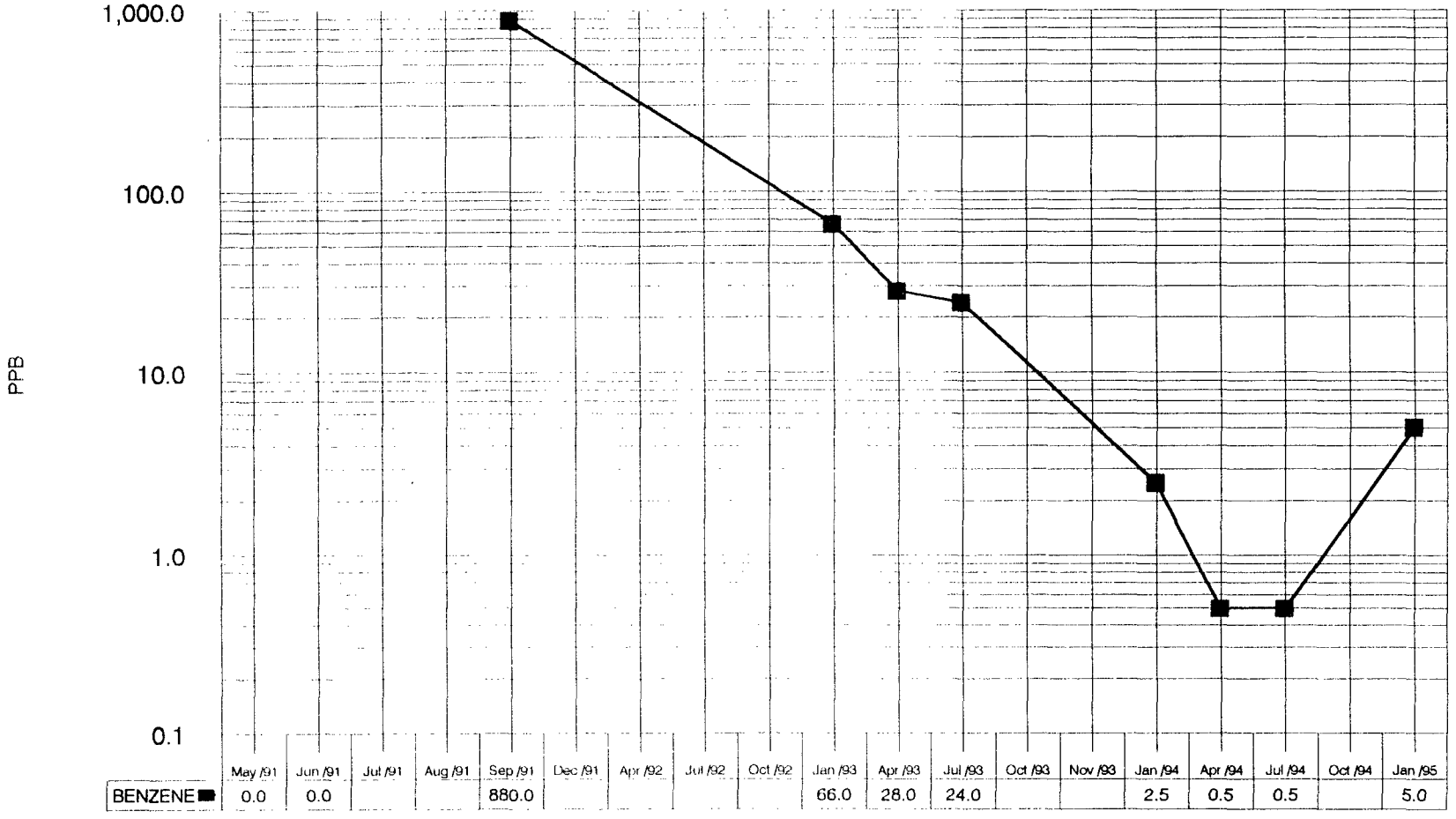
BENZENE IN GROUNDWATER
MW-37



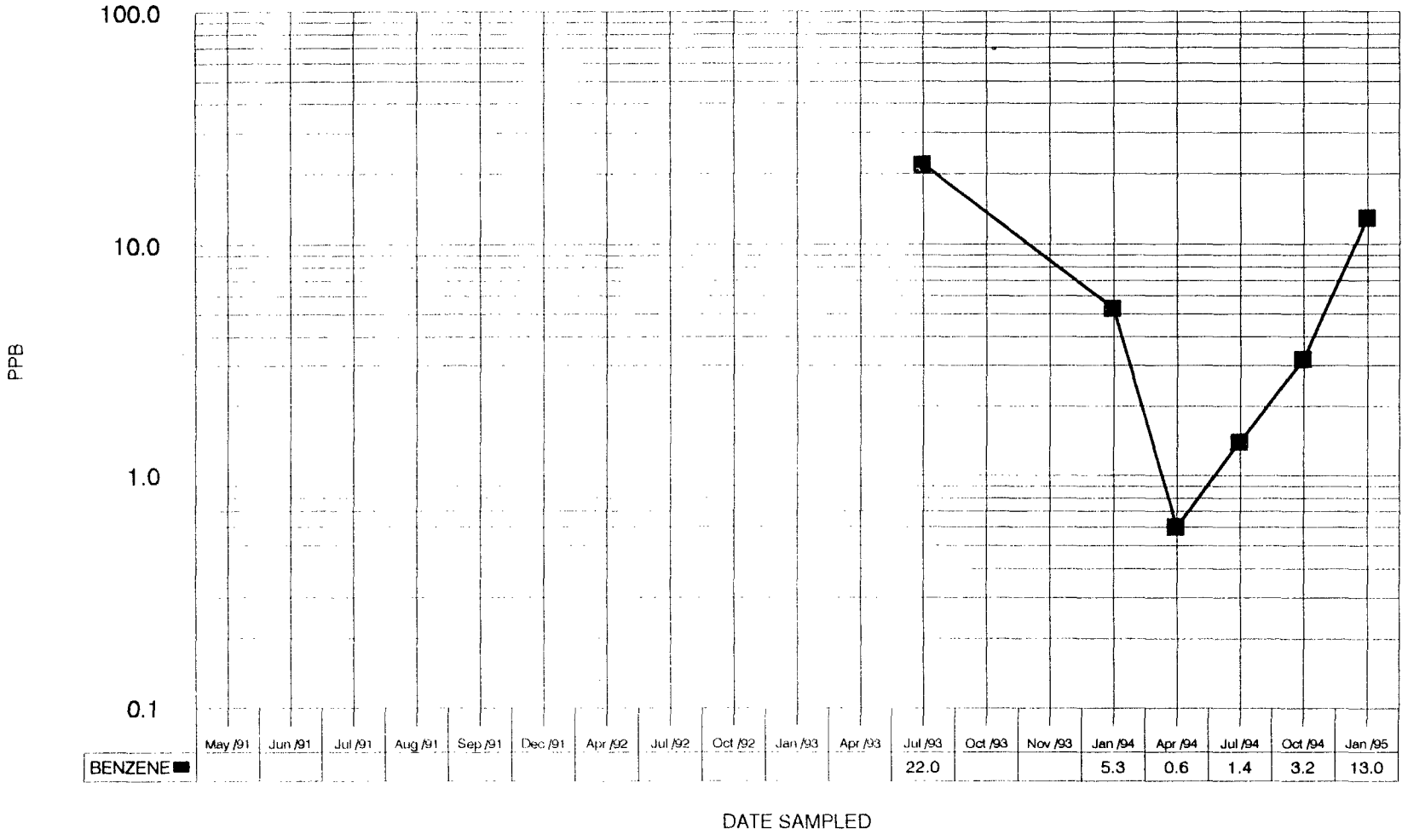
BENZENE IN GROUNDWATER
MW-38



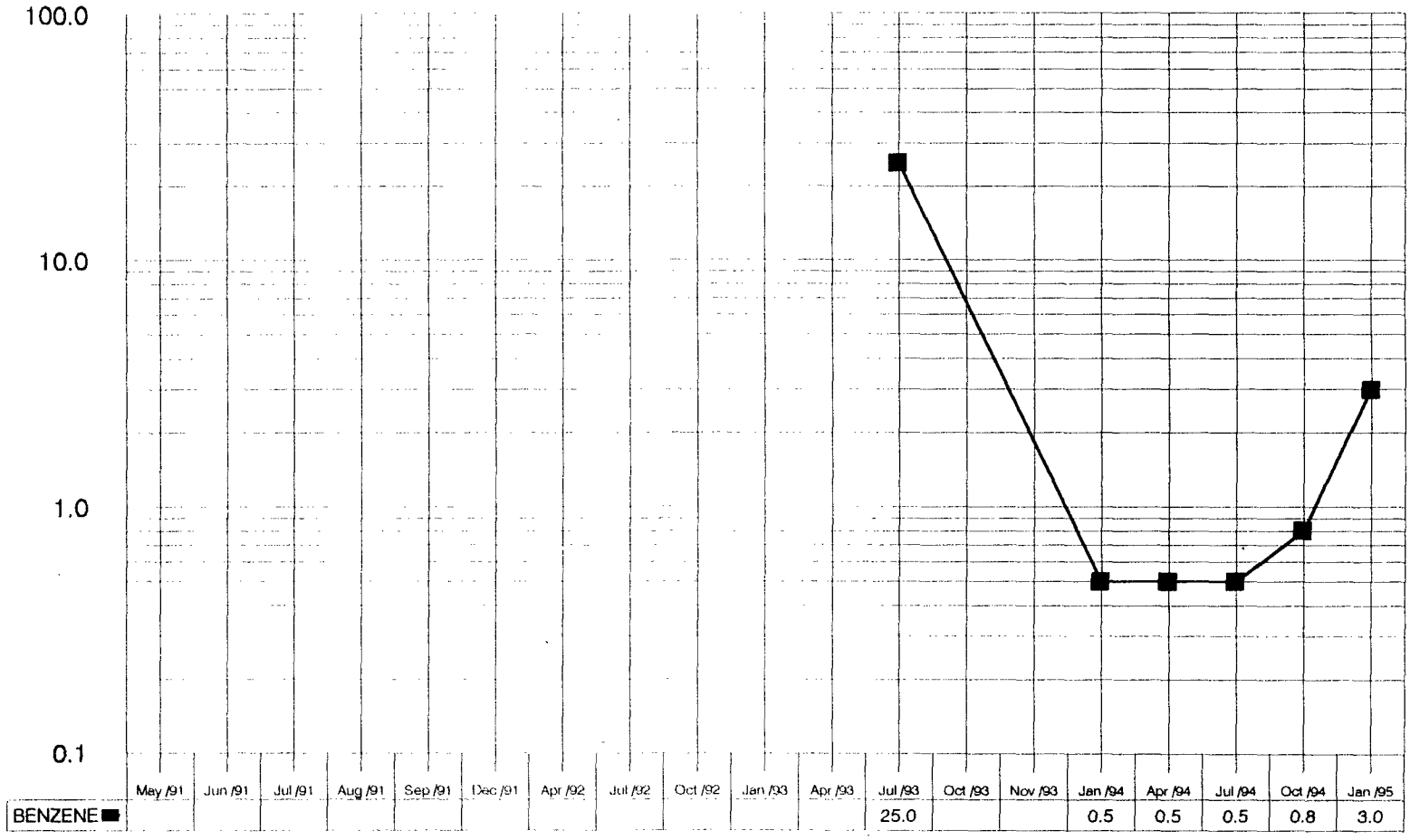
BENZENE IN GROUNDWATER
MW-39



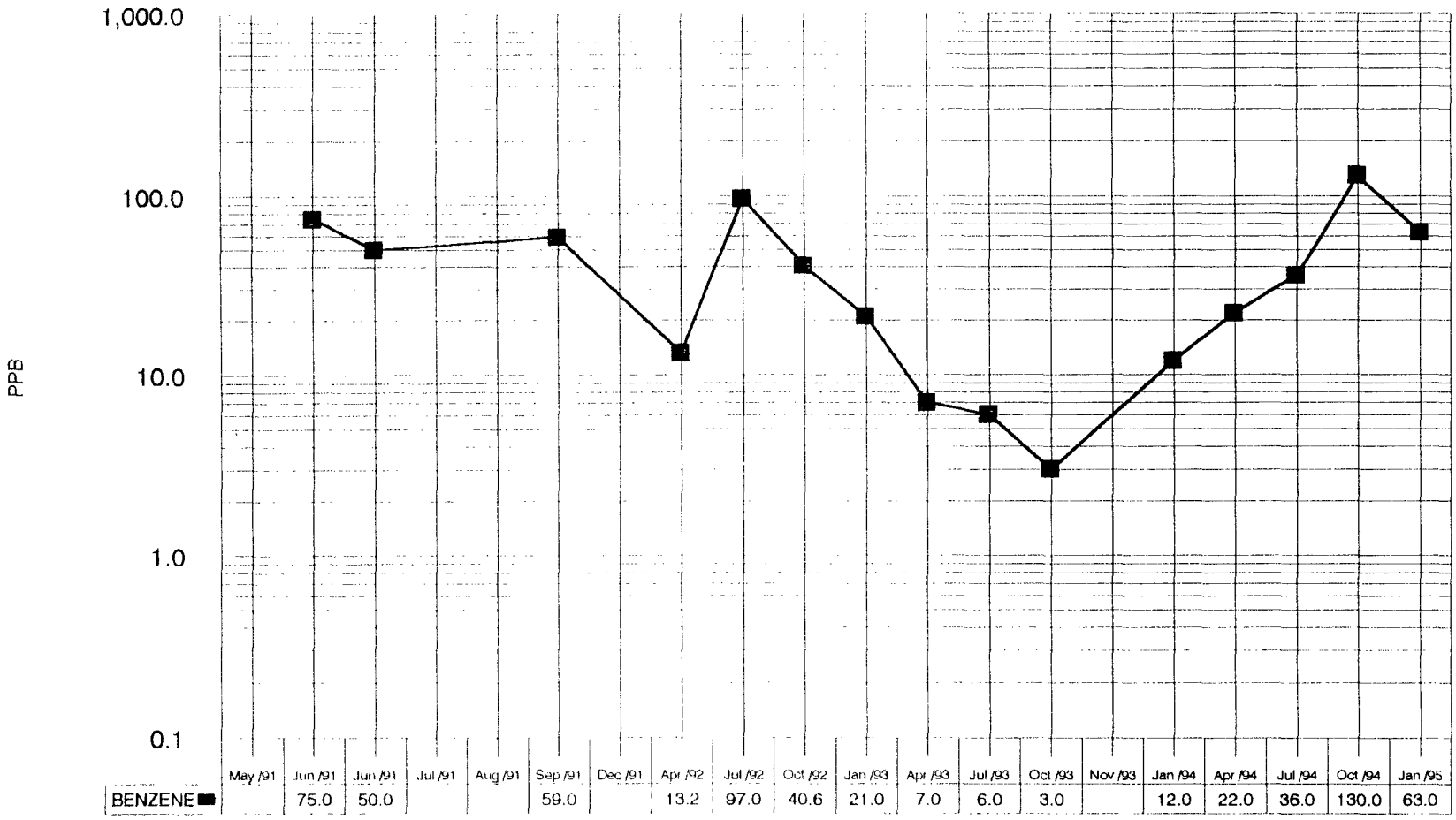
BENZENE IN GROUNDWATER
MW-41



BENZENE IN GROUNDWATER
MW-43

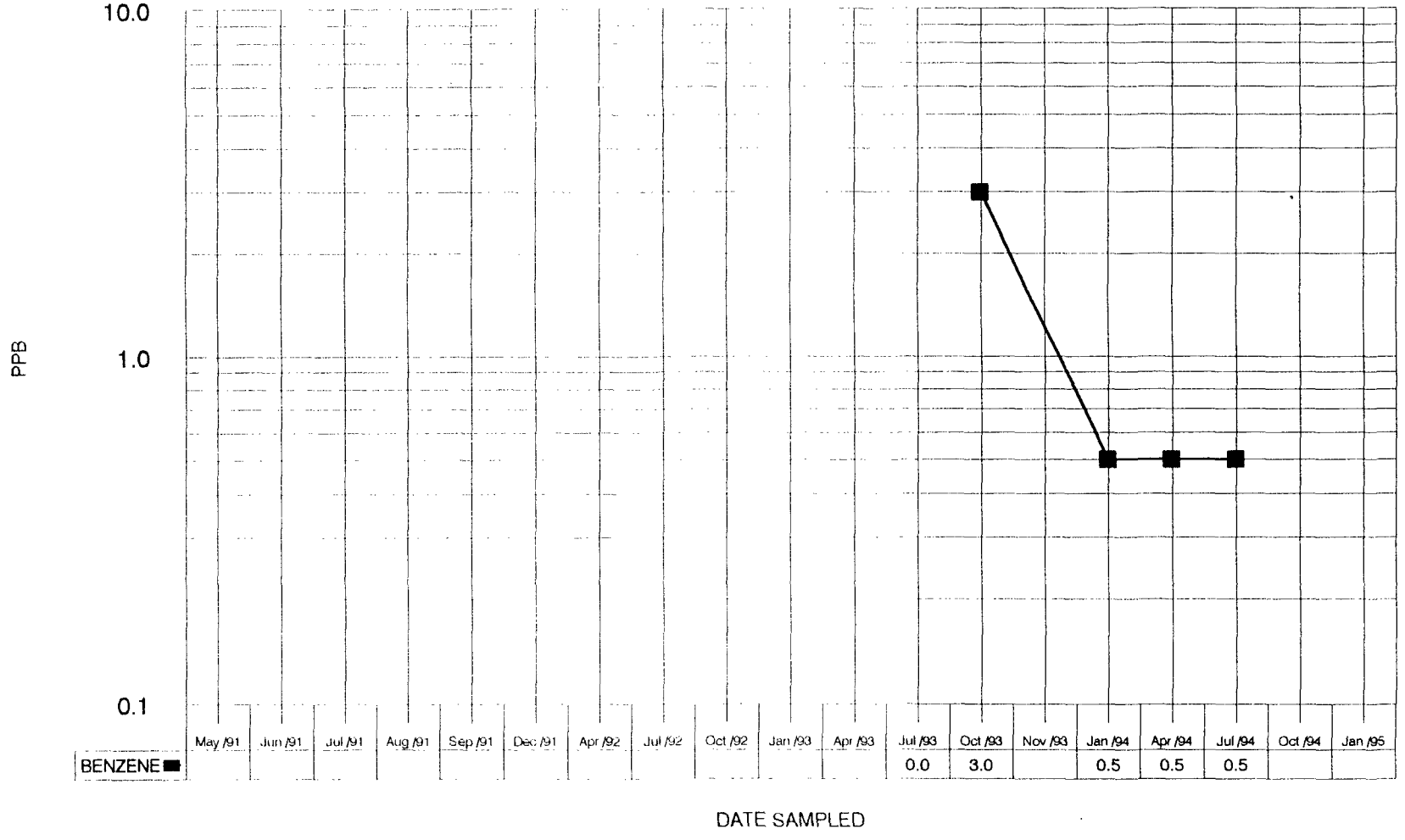


BENZENE IN GROUNDWATER
MW-44

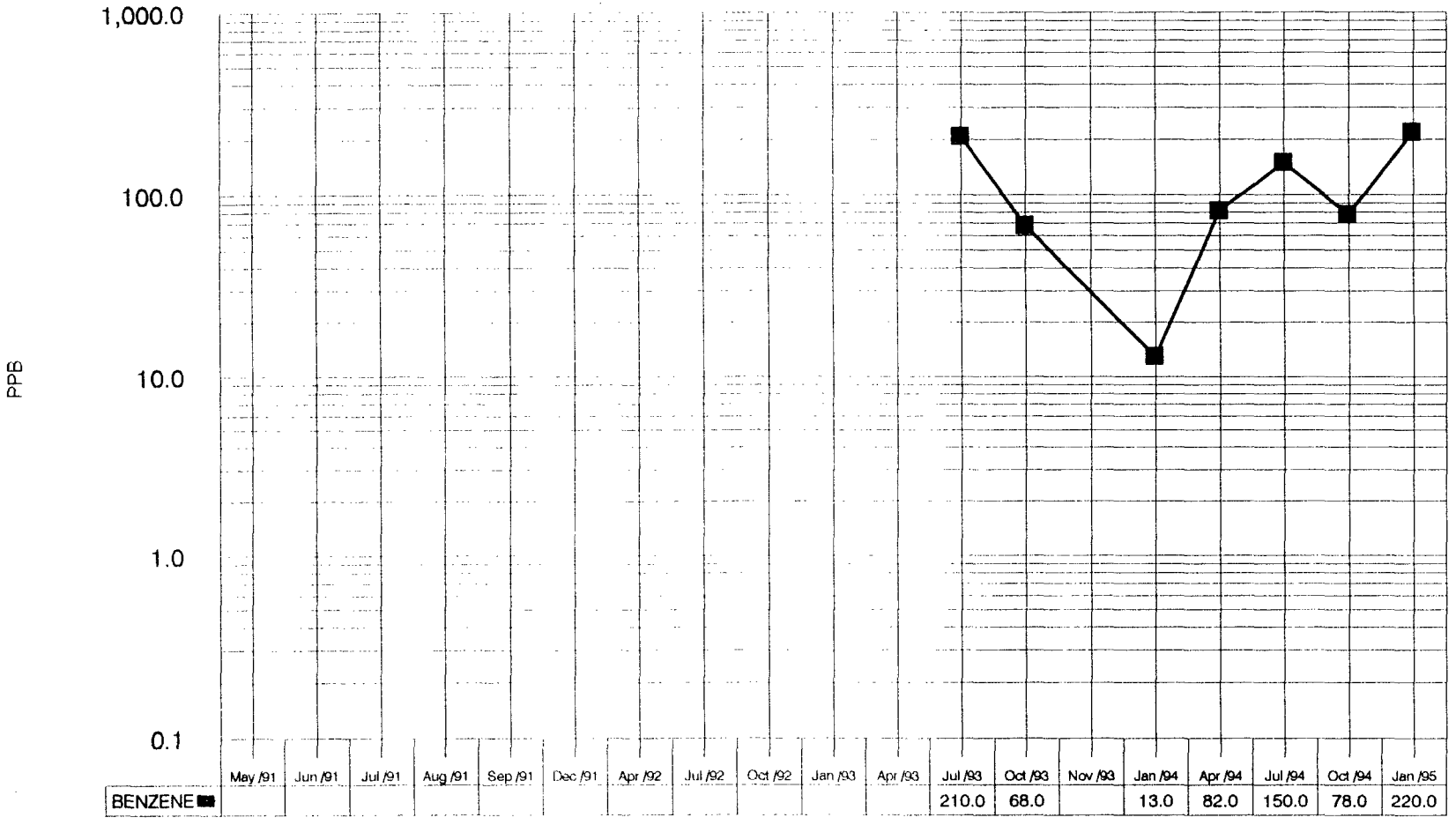


	May /91	Jun /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE		75.0	50.0			59.0		13.2	97.0	40.6	21.0	7.0	6.0	3.0		12.0	22.0	36.0	130.0	63.0

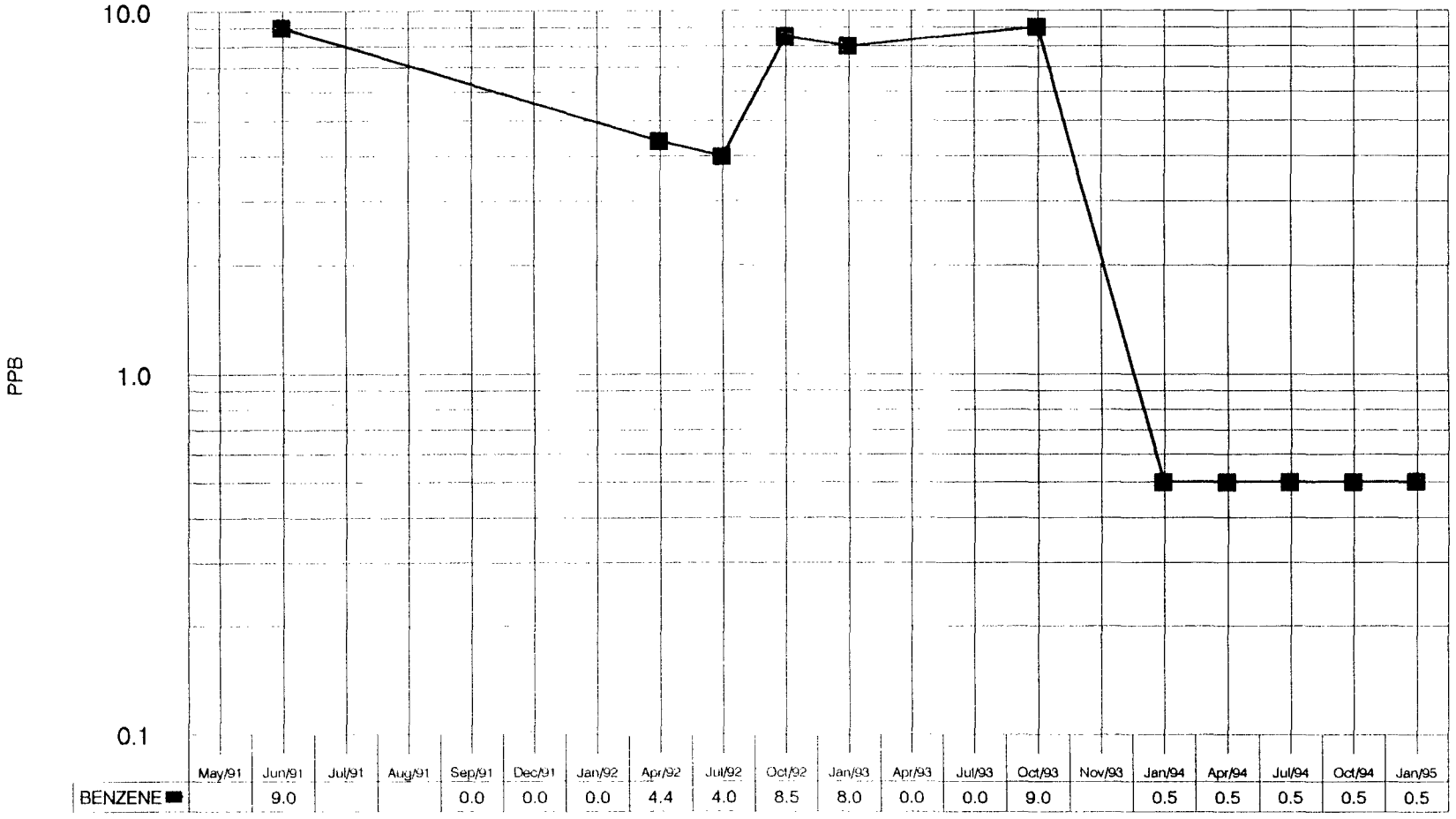
BENZENE IN GROUNDWATER
MW-45



BENZENE IN GROUNDWATER
MW-49



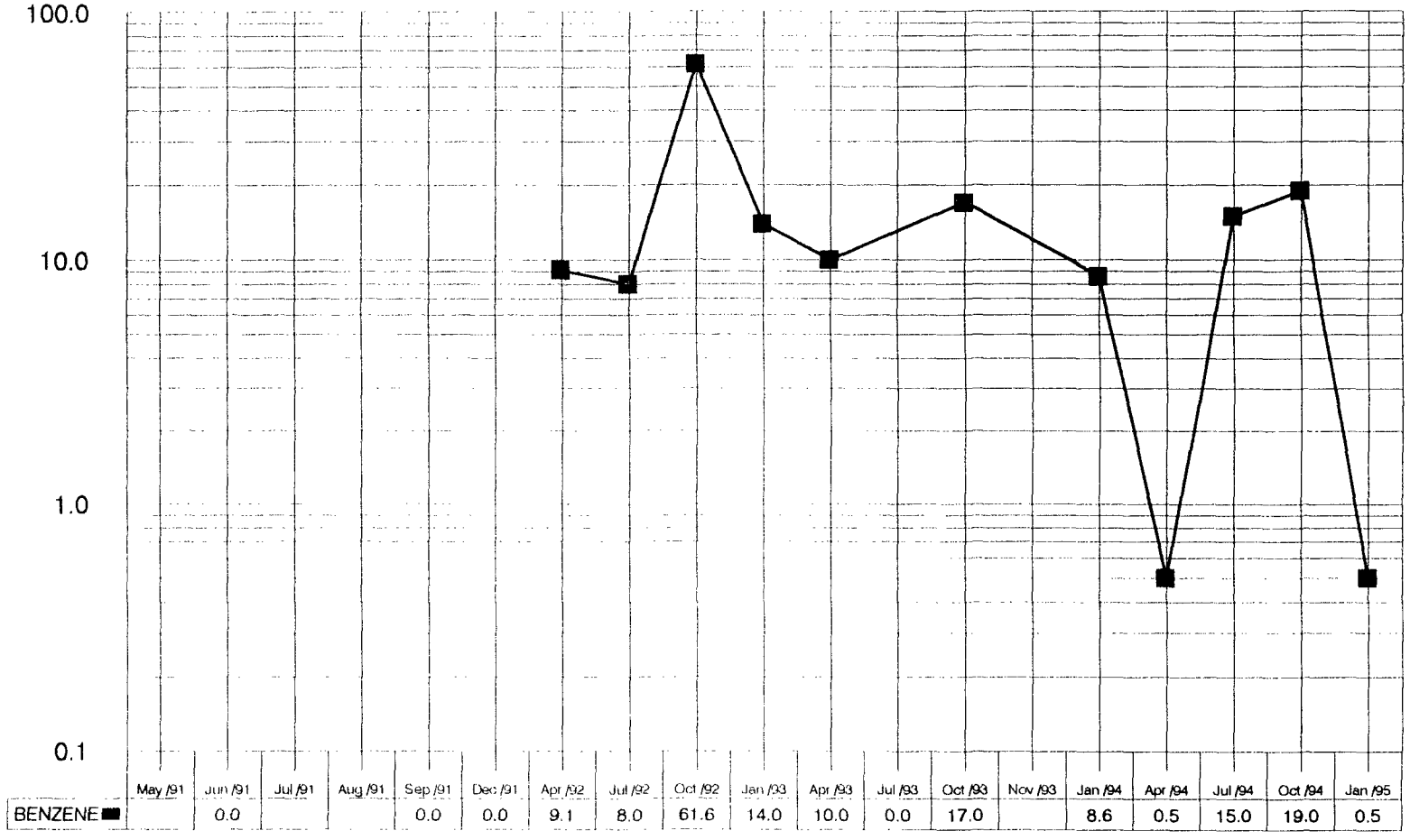
BENZENE IN GROUNDWATER
MW-50



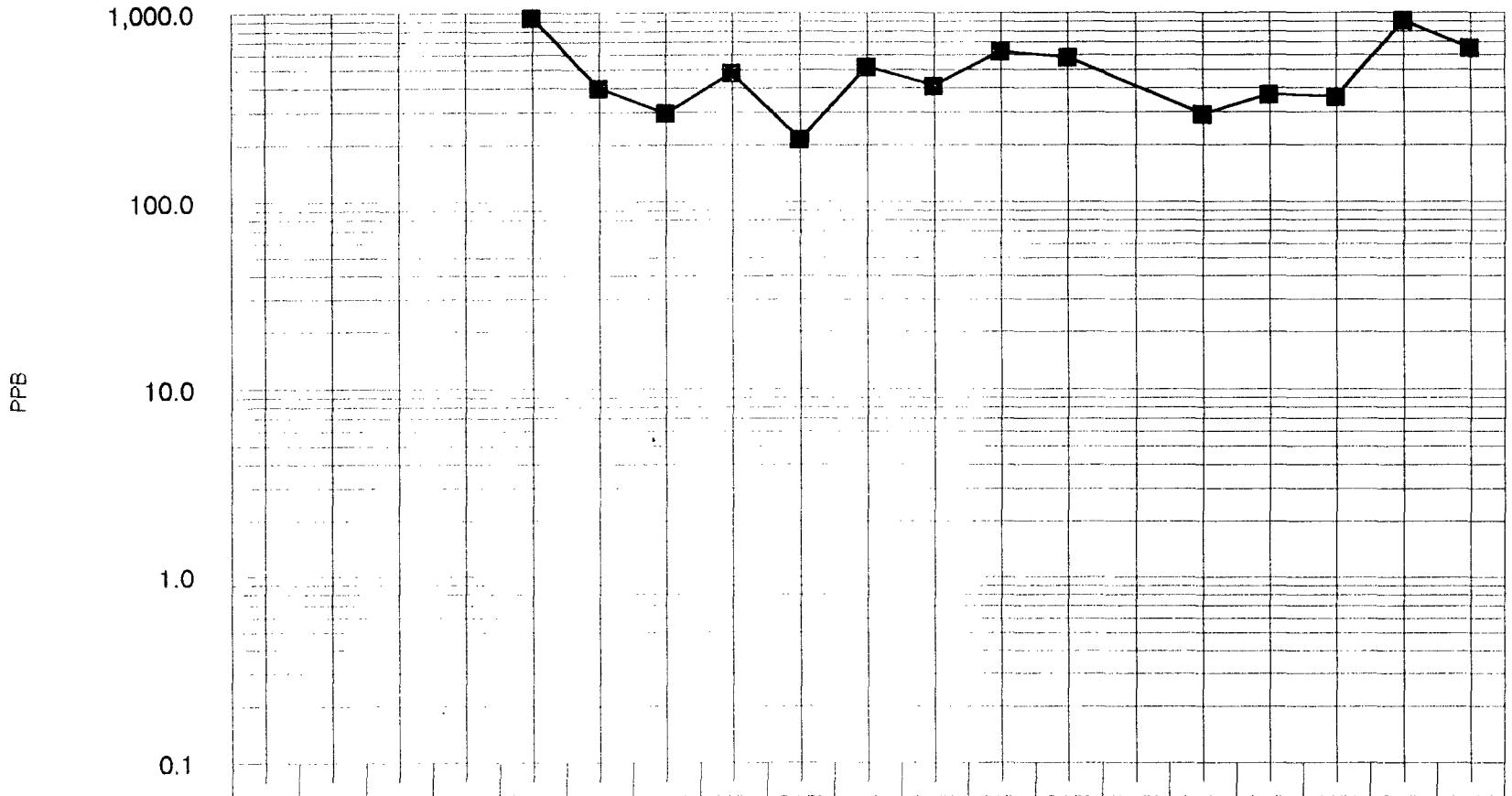
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BENZENE		9.0			0.0	0.0	0.0	4.4	4.0	8.5	8.0	0.0	0.0	9.0		0.5	0.5	0.5	0.5	0.5

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-54



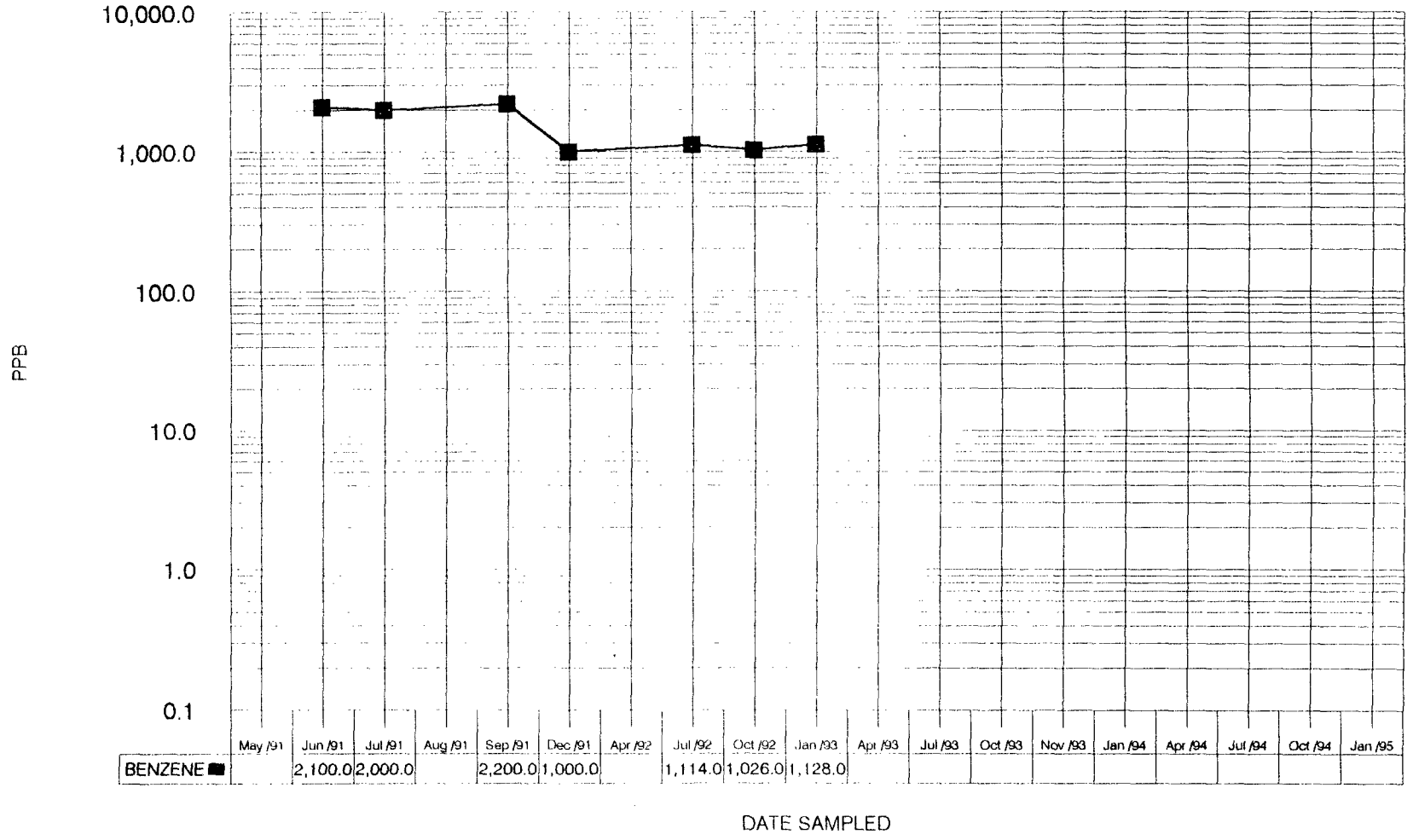
BENZENE IN GROUNDWATER
MW-55



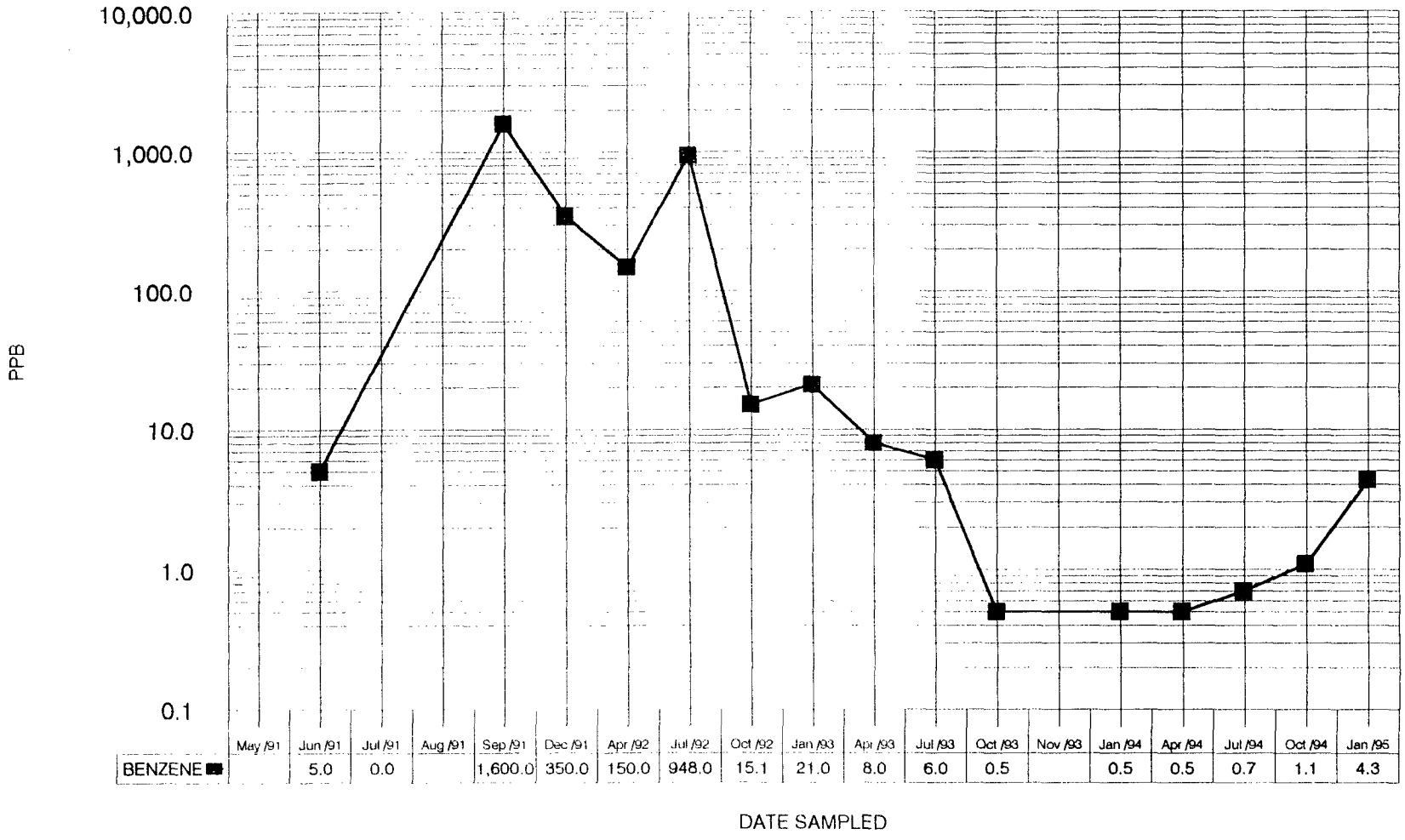
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE		0.0			940.0	400.0	295.5	483.0	214.7	518.0	412.0	625.0	581.0		290.0	370.0	360.0	910.0	650.0

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-56



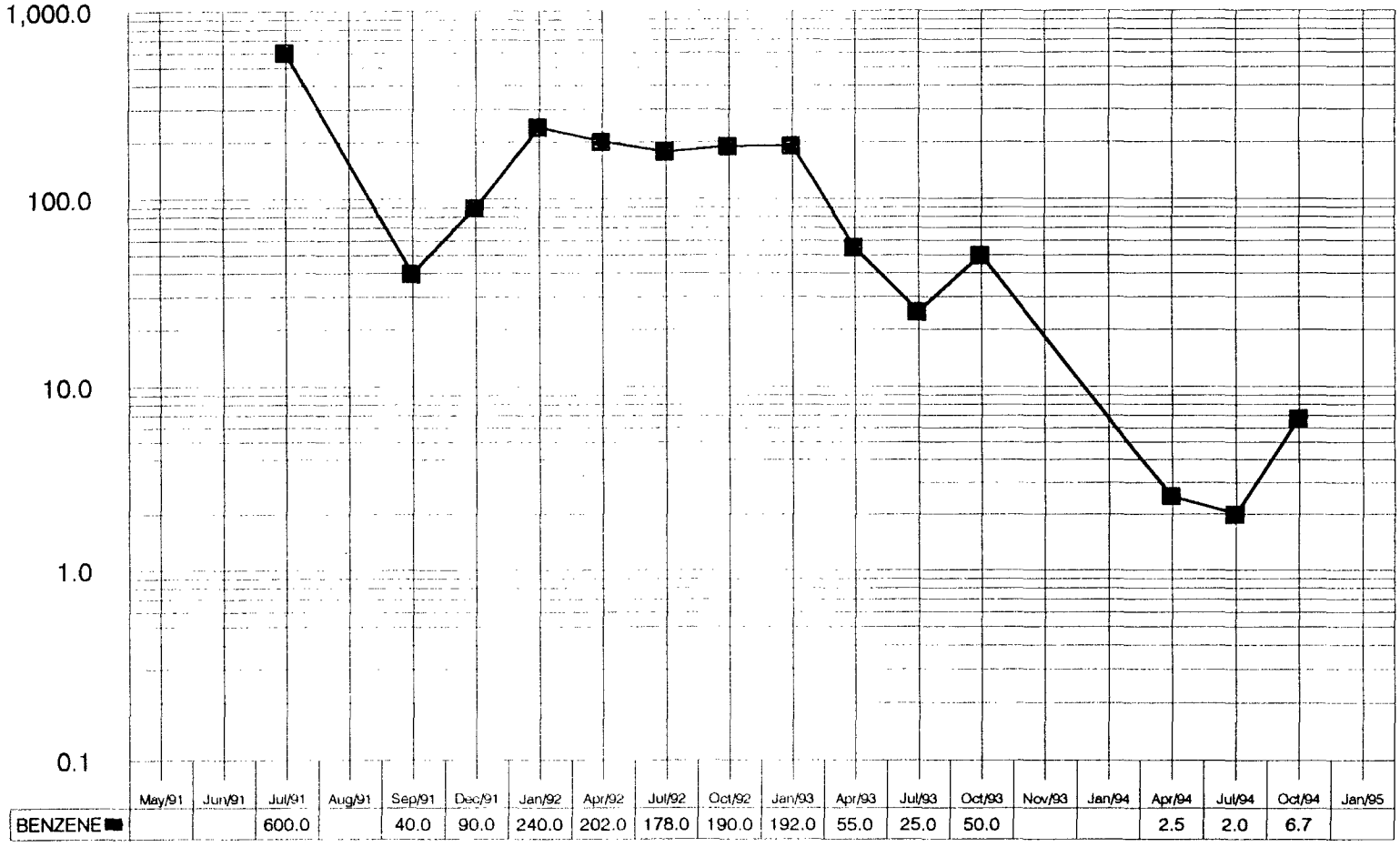
BENZENE IN GROUNDWATER
MW-57



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE		5.0	0.0		1,600.0	350.0	150.0	948.0	15.1	21.0	8.0	6.0	0.5		0.5	0.5	0.7	1.1	4.3

DATE SAMPLED

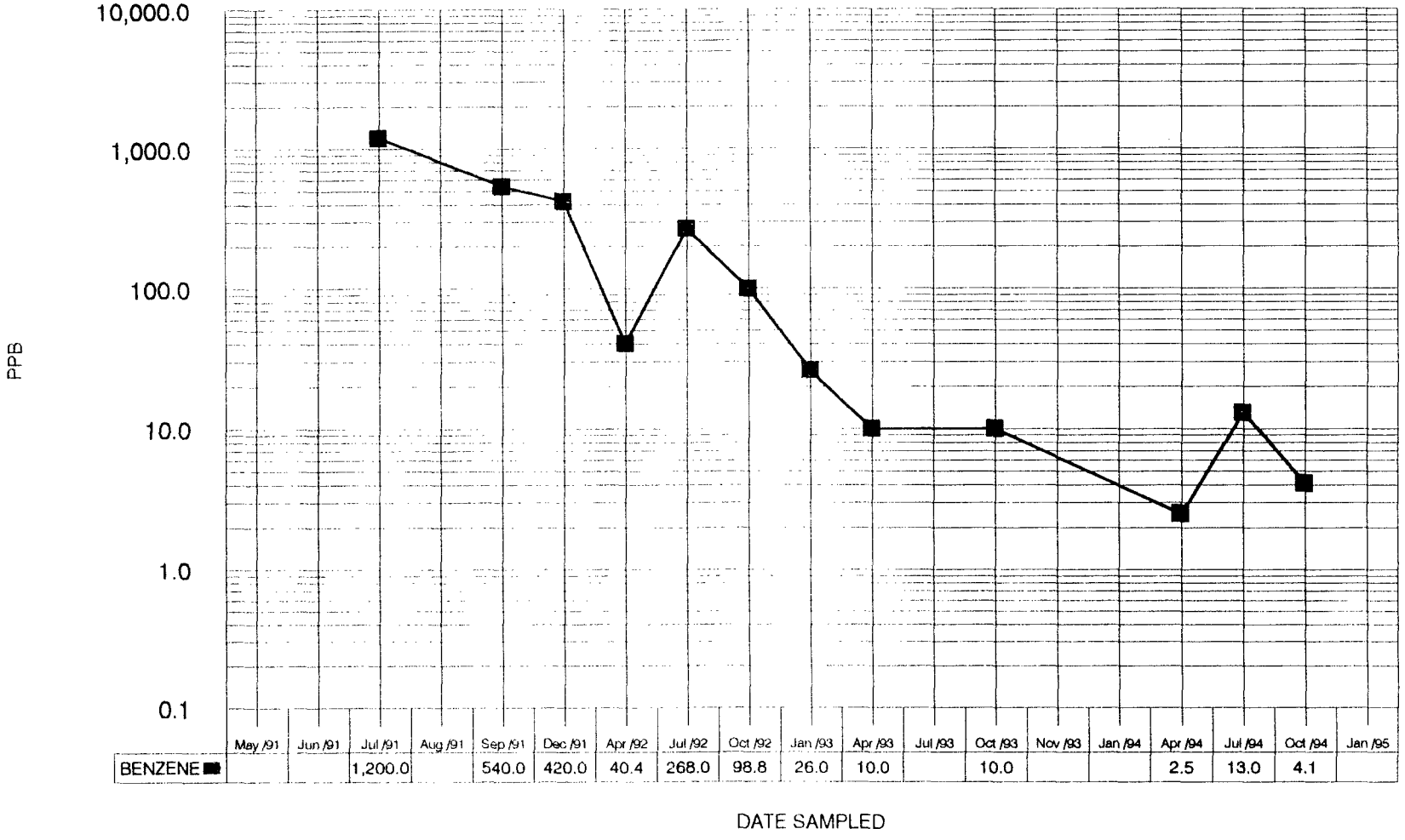
BENZENE IN GROUNDWATER
MW-58



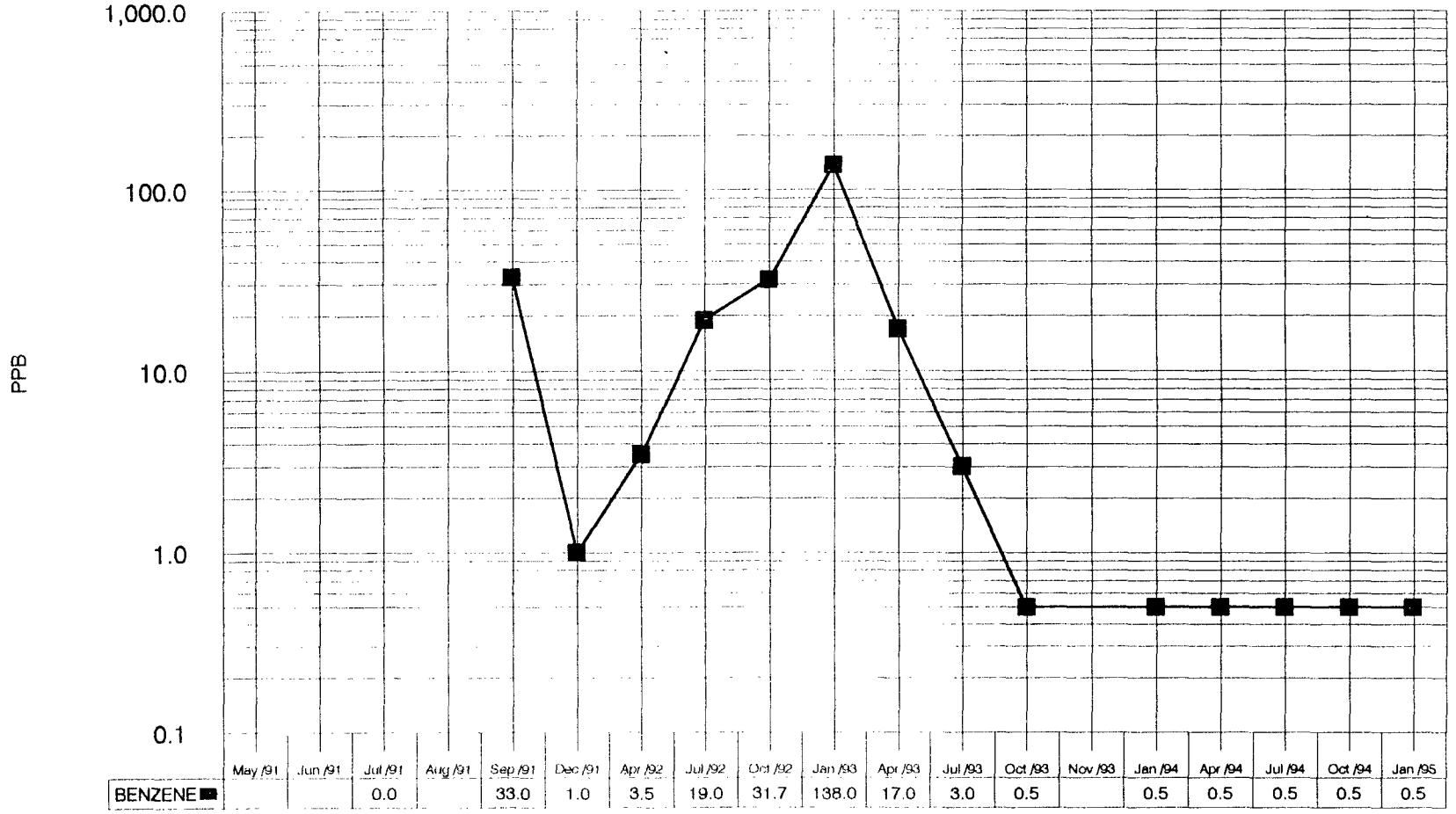
	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95
BENZENE			600.0		40.0	90.0	240.0	202.0	178.0	190.0	192.0	55.0	25.0	50.0			2.5	2.0	6.7	

DATE SAMPLED

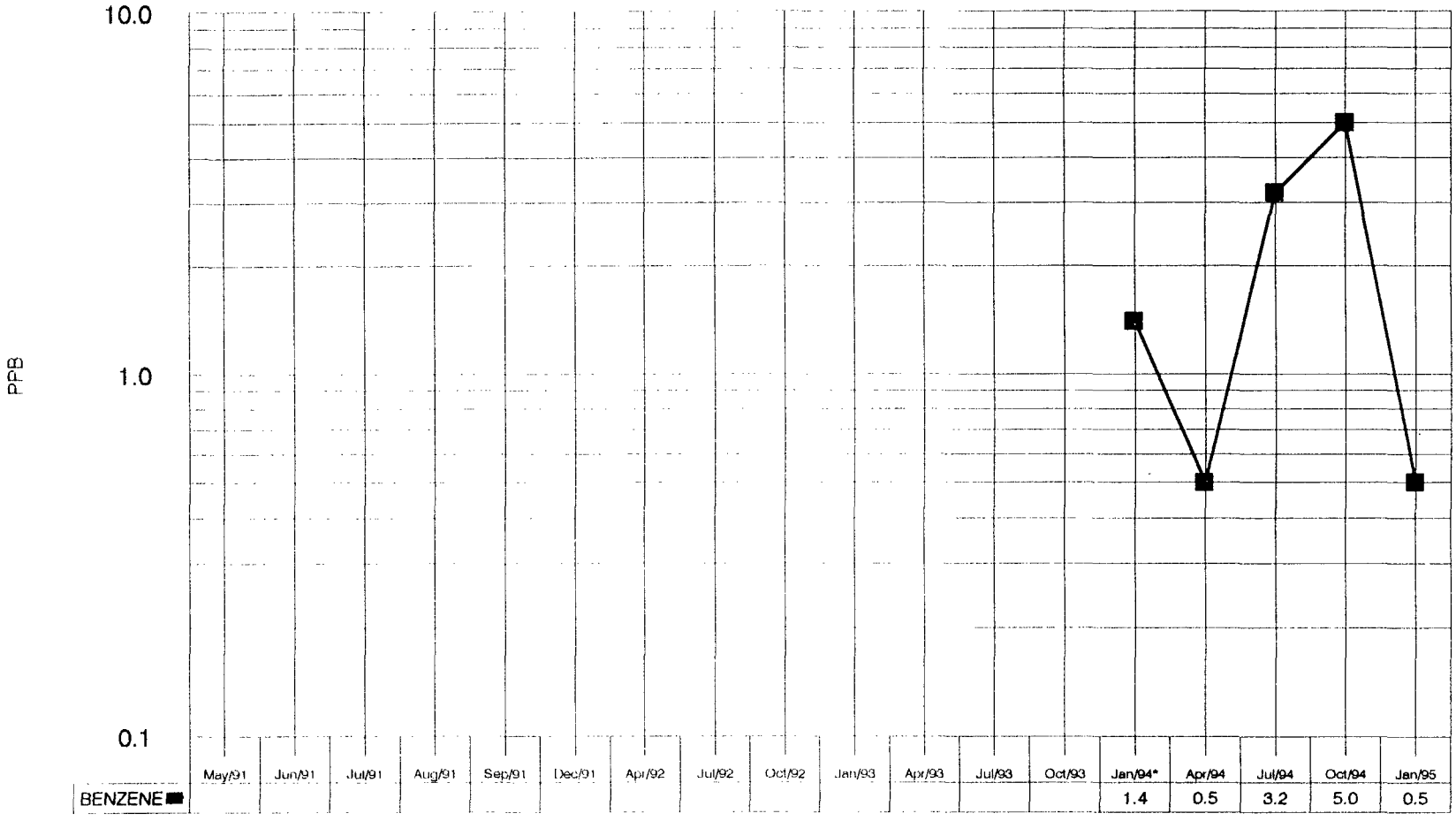
BENZENE IN GROUNDWATER
MW-59



BENZENE IN GROUNDWATER
MW-60

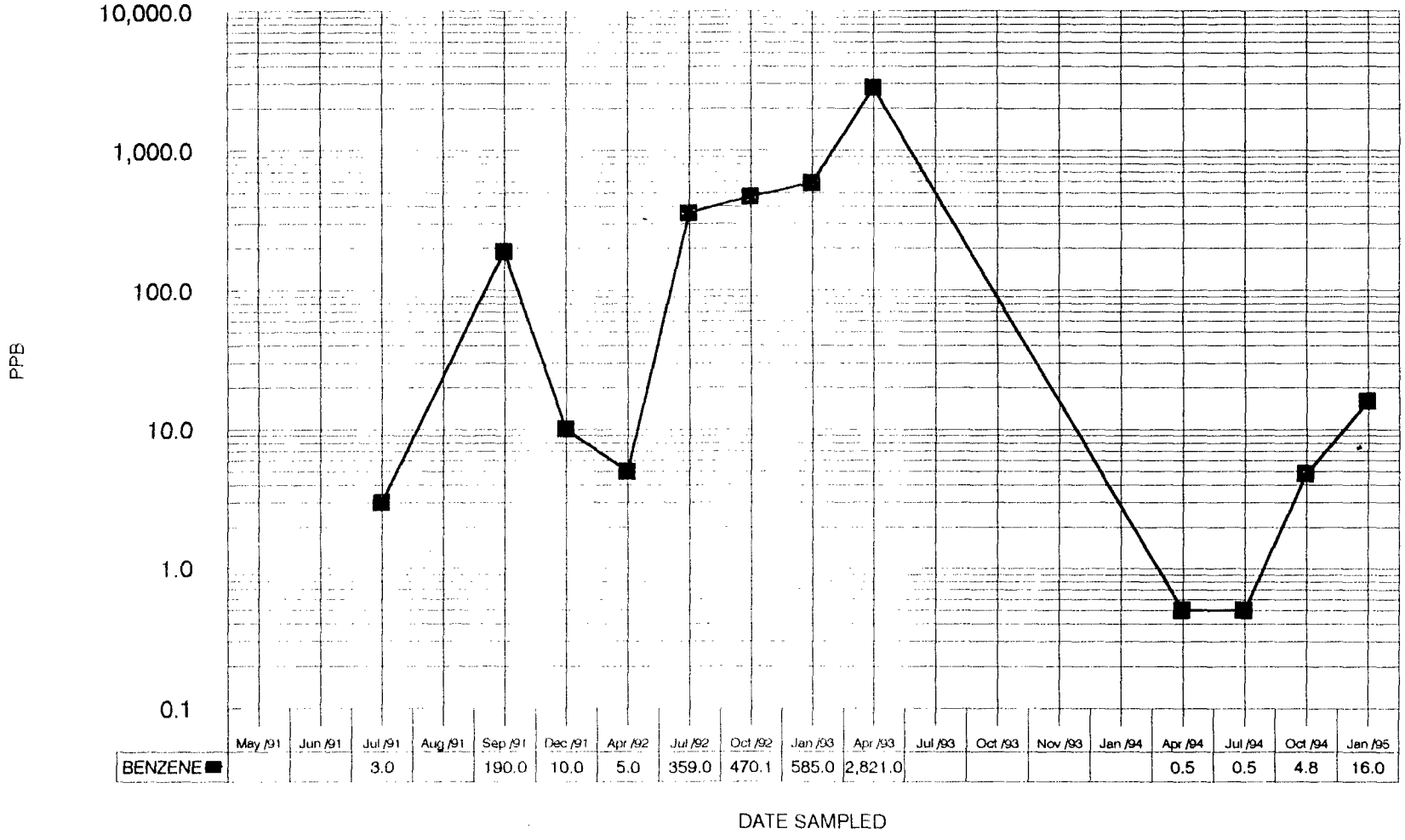


BENZENE IN GROUNDWATER
MW-61



*- Jan. 1994 was the first time this well was sampled.

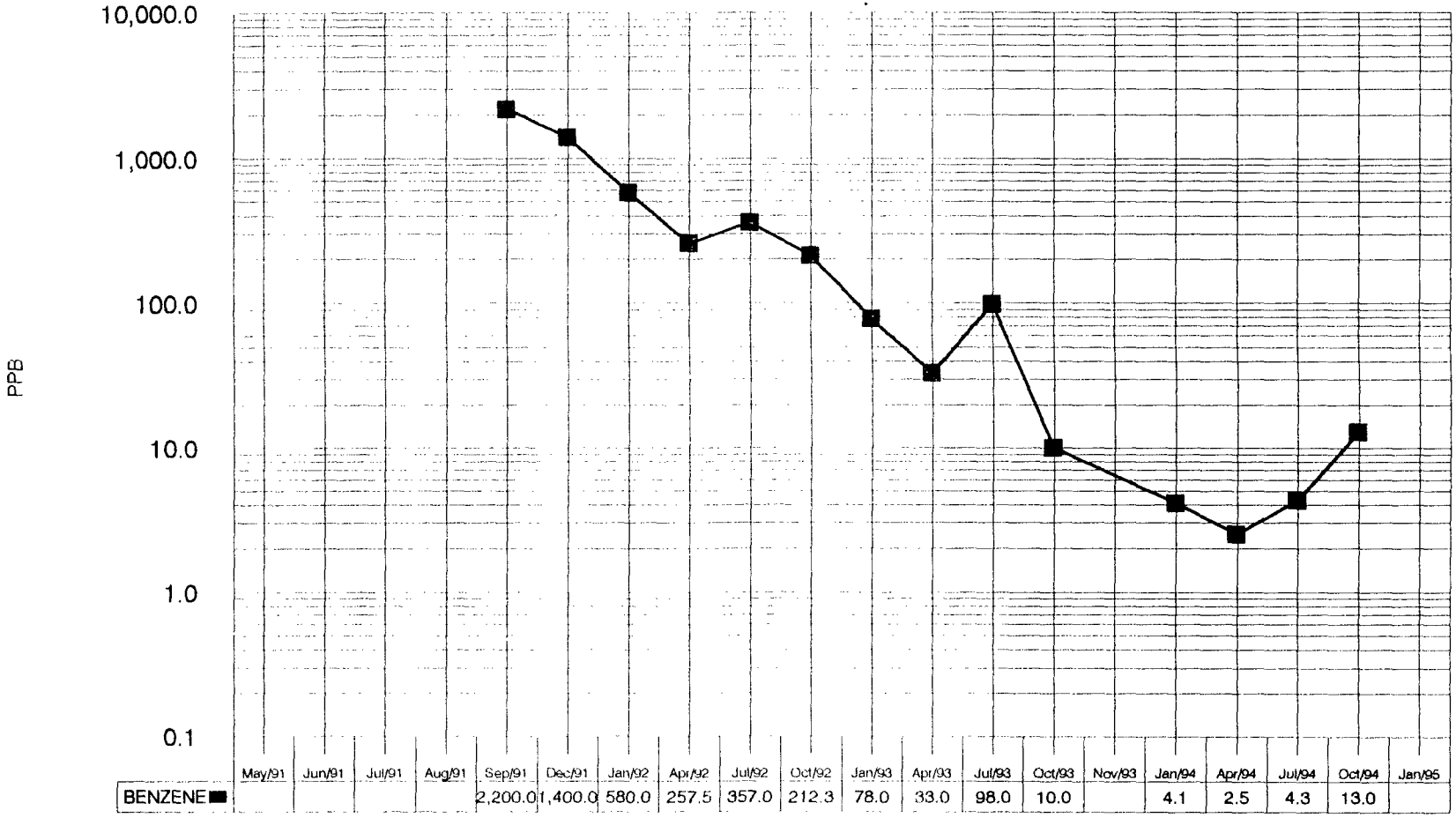
BENZENE IN GROUNDWATER
MW-61A



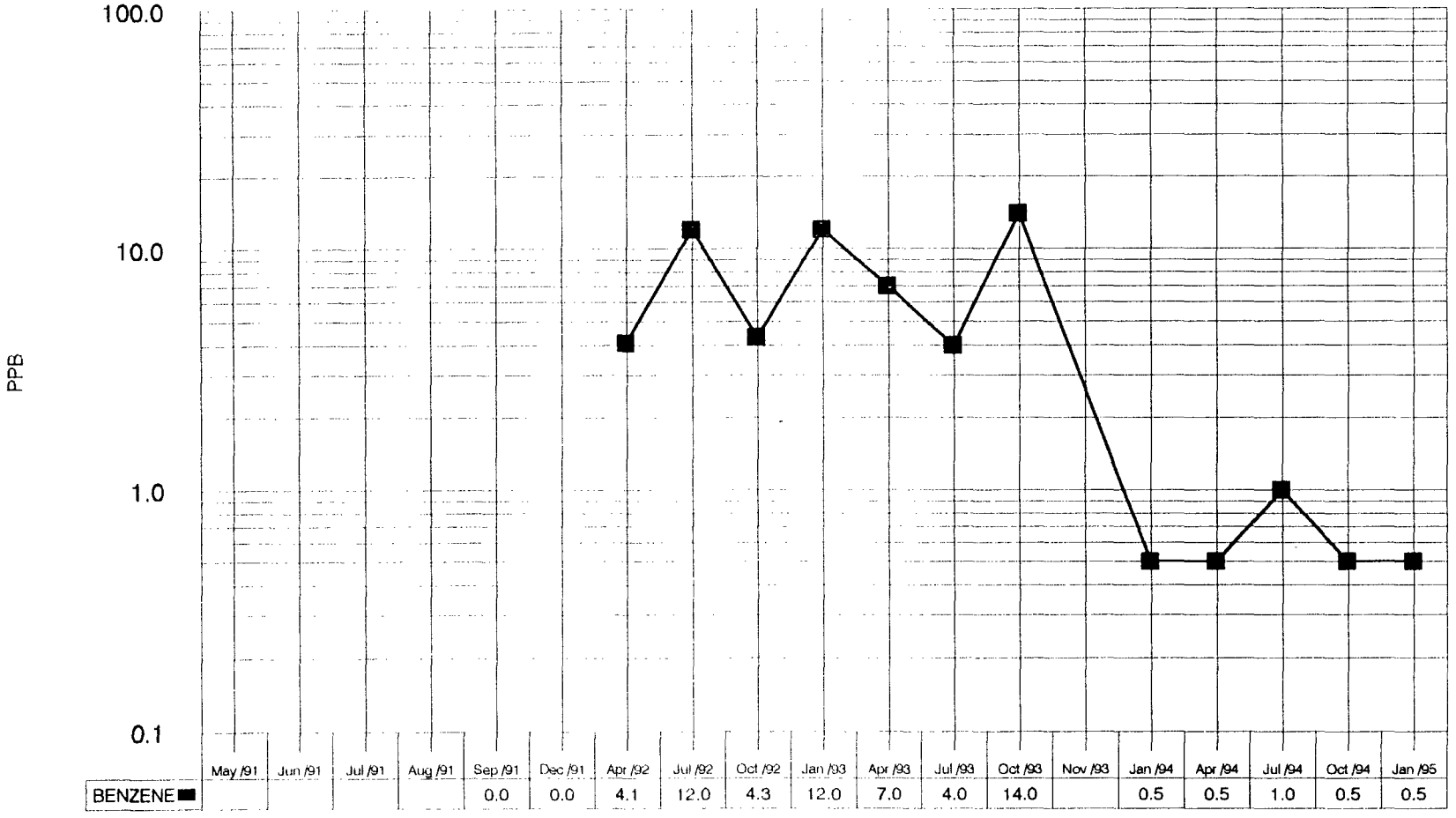
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE			3.0		190.0	10.0	5.0	359.0	470.1	585.0	2,821.0					0.5	0.5	4.8	16.0

DATE SAMPLED

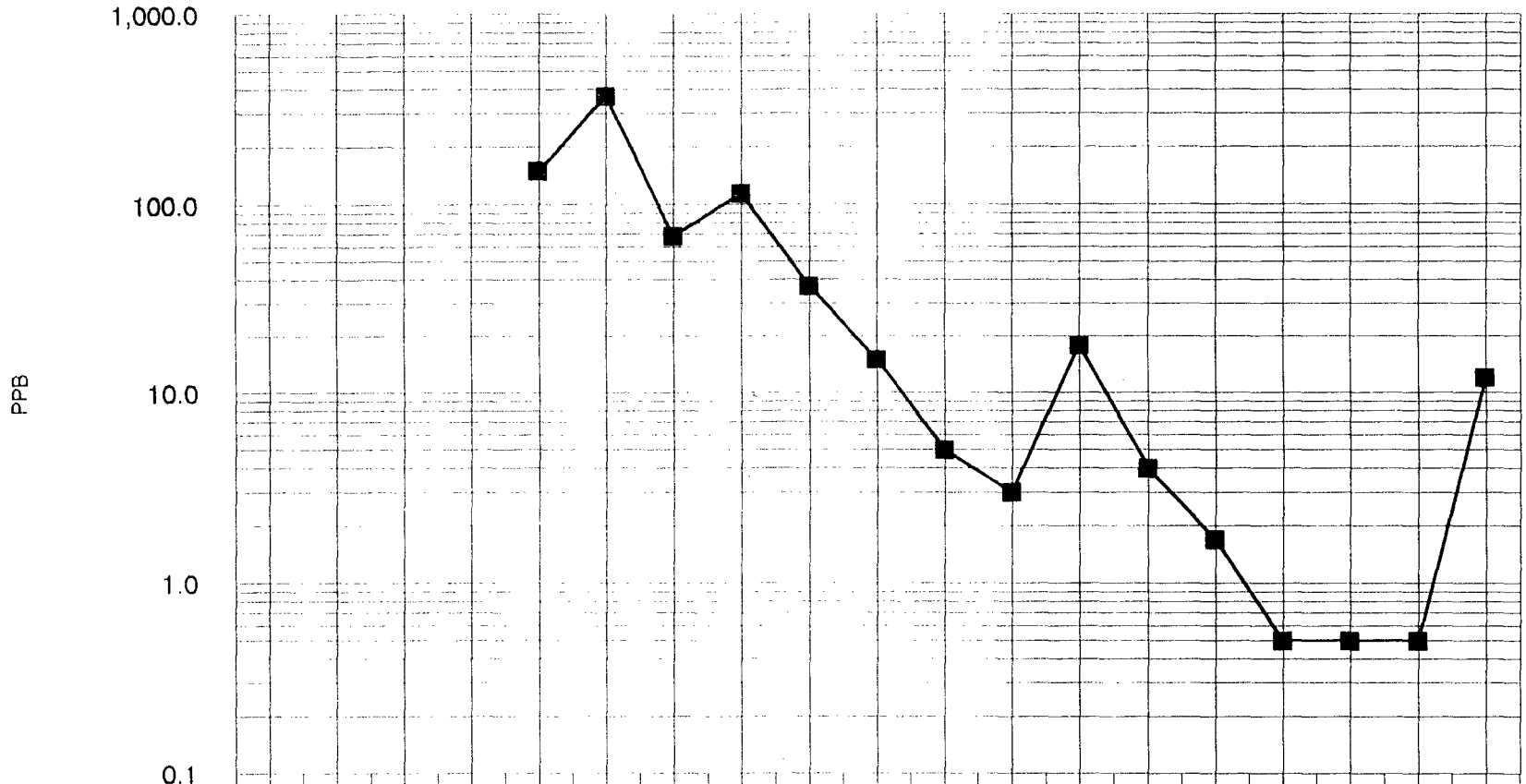
BENZENE IN GROUNDWATER
MW-62



BENZENE IN GROUNDWATER
MW-63



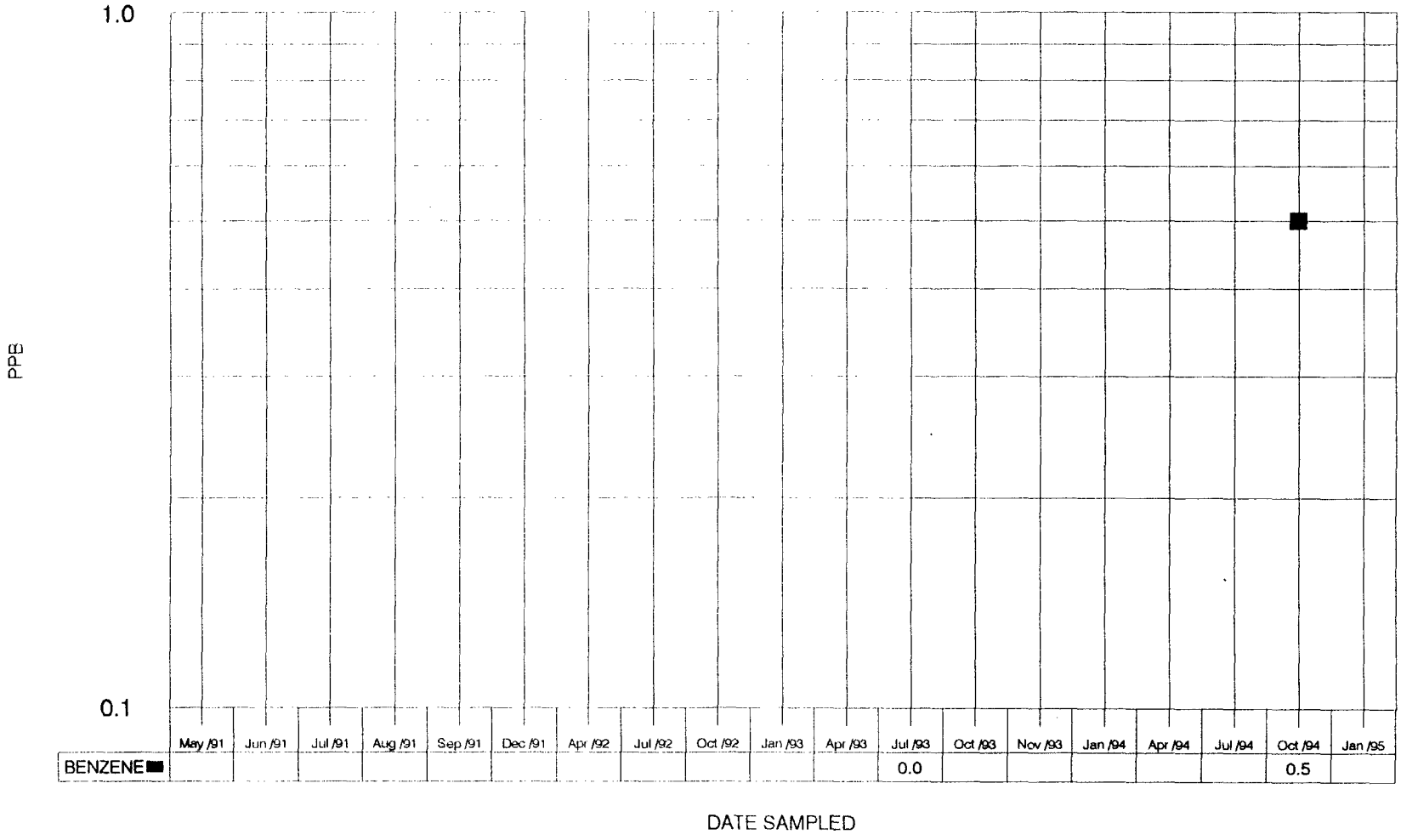
BENZENE IN GROUNDWATER
MW-64



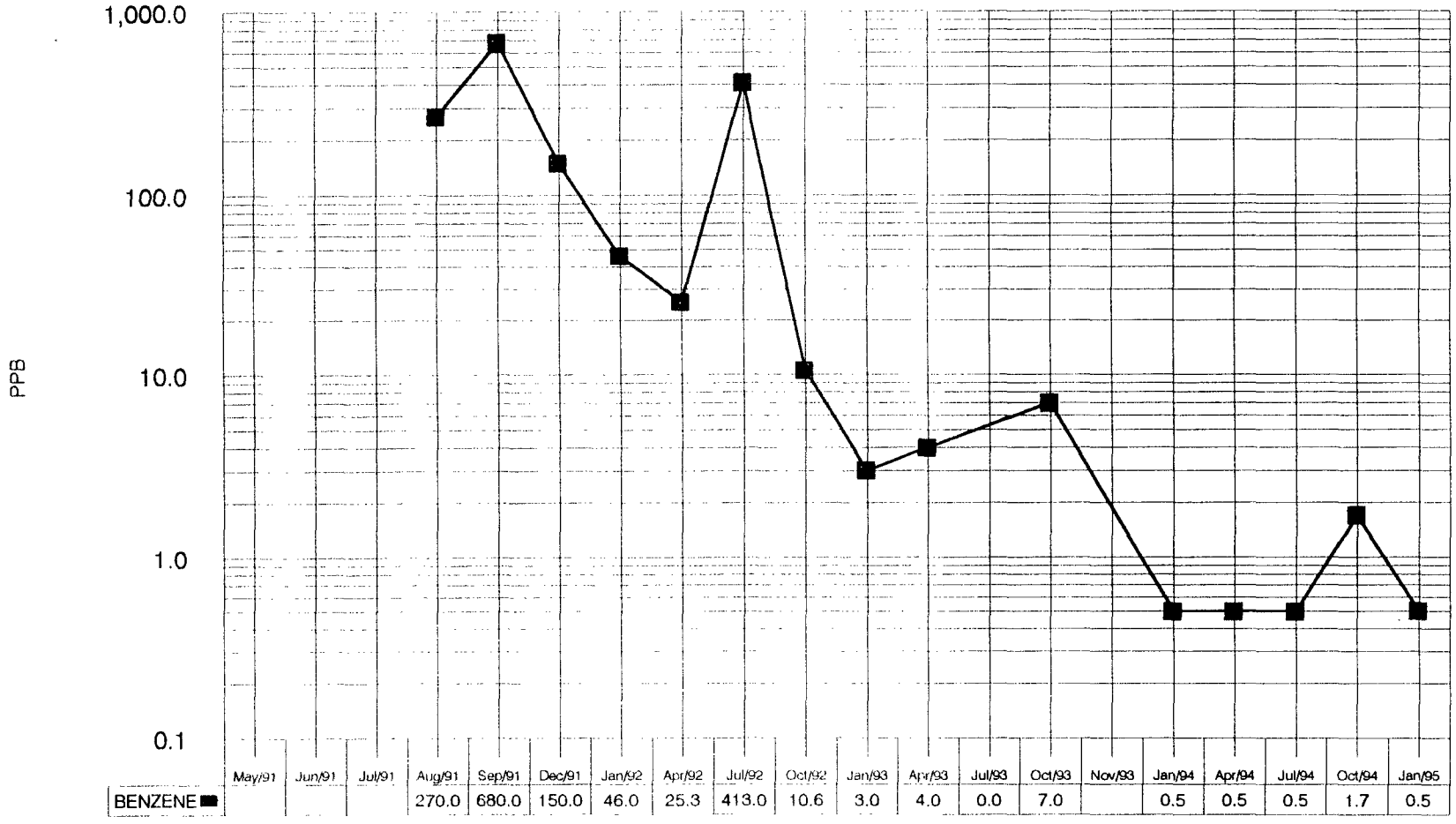
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE				0.0	150.0	370.0	68.3	115.0	37.1	15.0	5.0	3.0	18.0	4.0	1.7	0.5	0.5	0.5	12.0

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-65



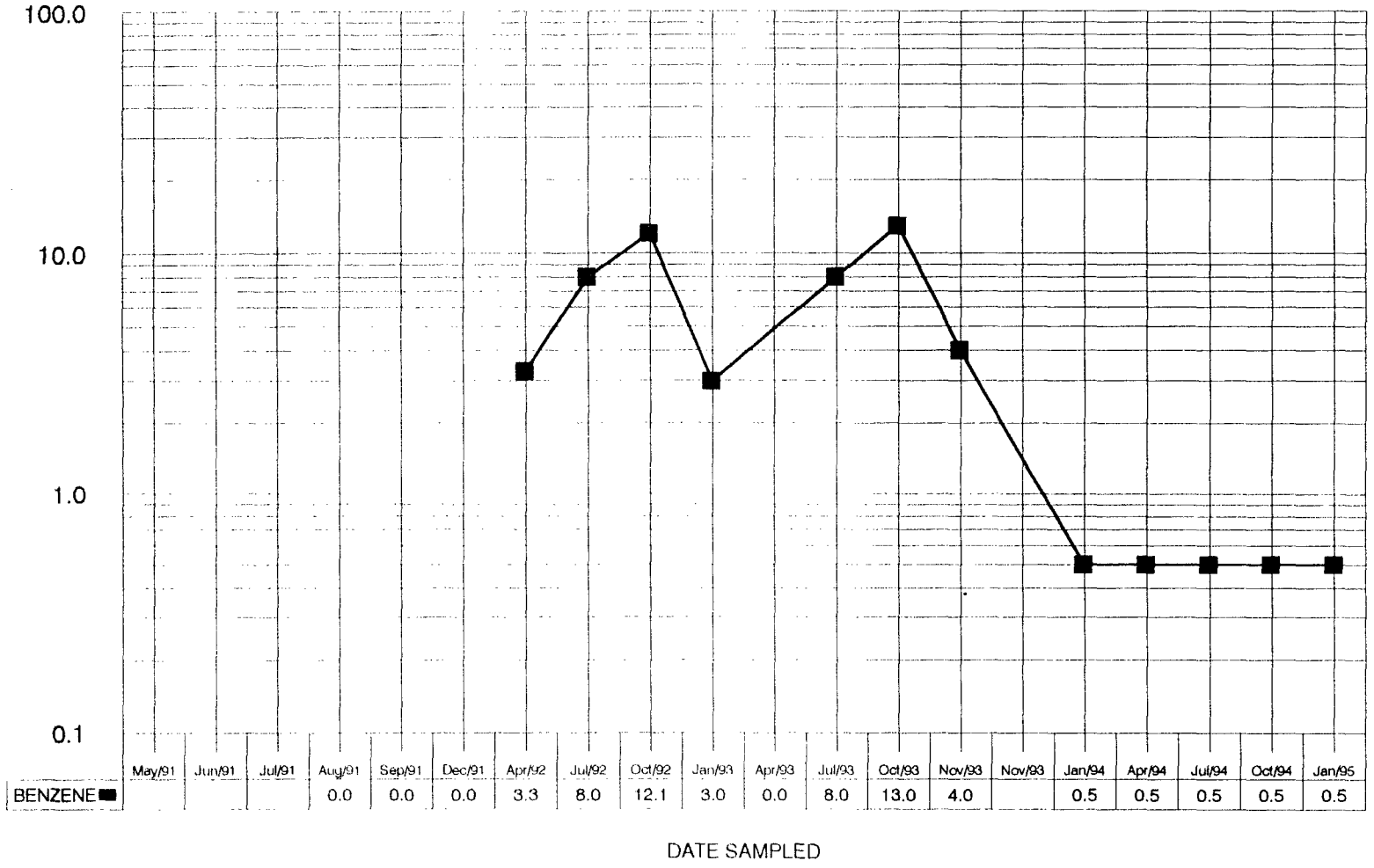
BENZENE IN GROUNDWATER
MW-65A



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95
BENZENE				270.0	680.0	150.0	46.0	25.3	413.0	10.6	3.0	4.0	0.0	7.0		0.5	0.5	0.5	1.7	0.5

DATE SAMPLED

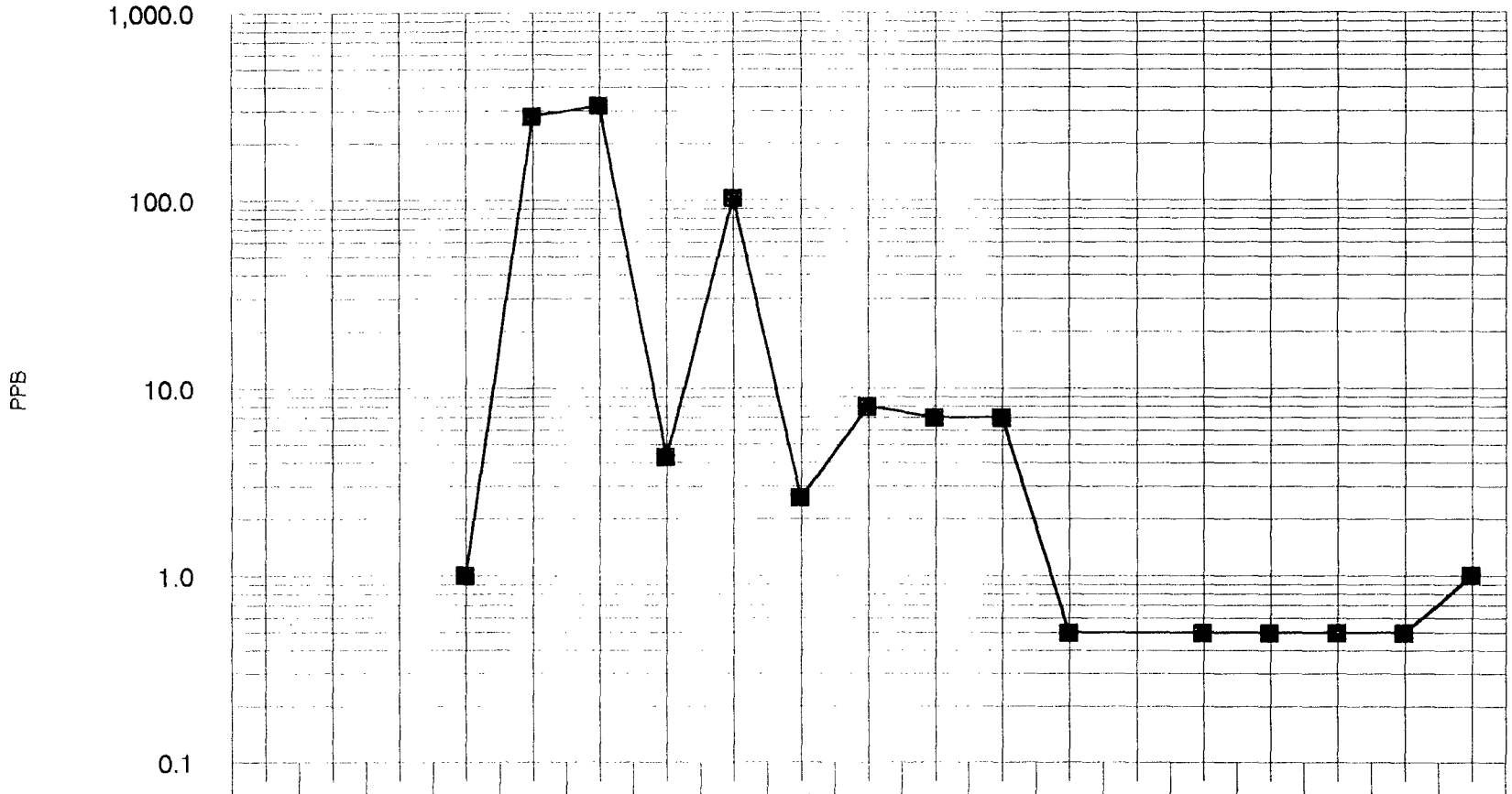
BENZENE IN GROUNDWATER
MW-66



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95
BENZENE				0.0	0.0	0.0	3.3	8.0	12.1	3.0	0.0	8.0	13.0	4.0		0.5	0.5	0.5	0.5	0.5

DATE SAMPLED

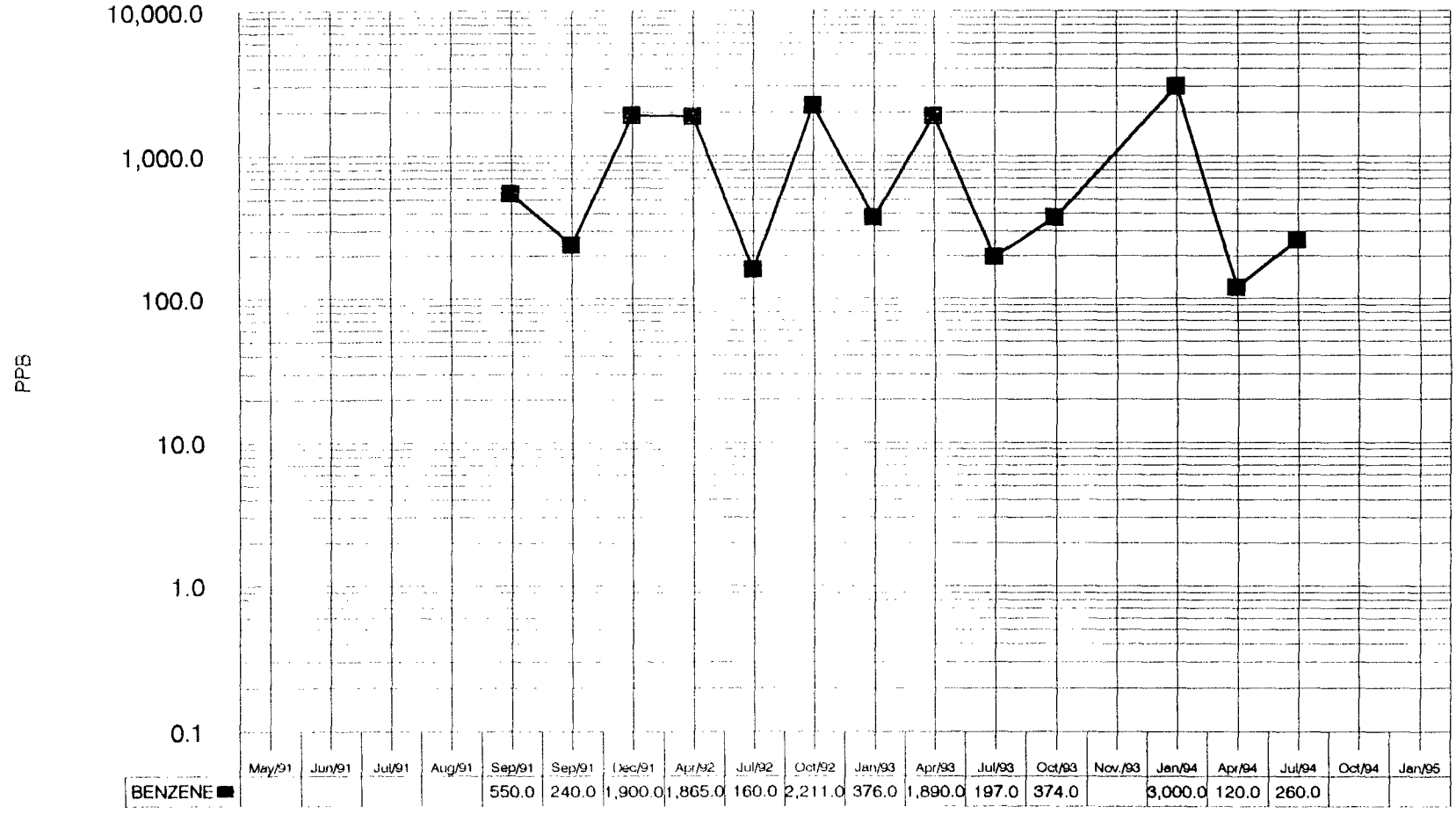
BENZENE IN GROUNDWATER
MW-67



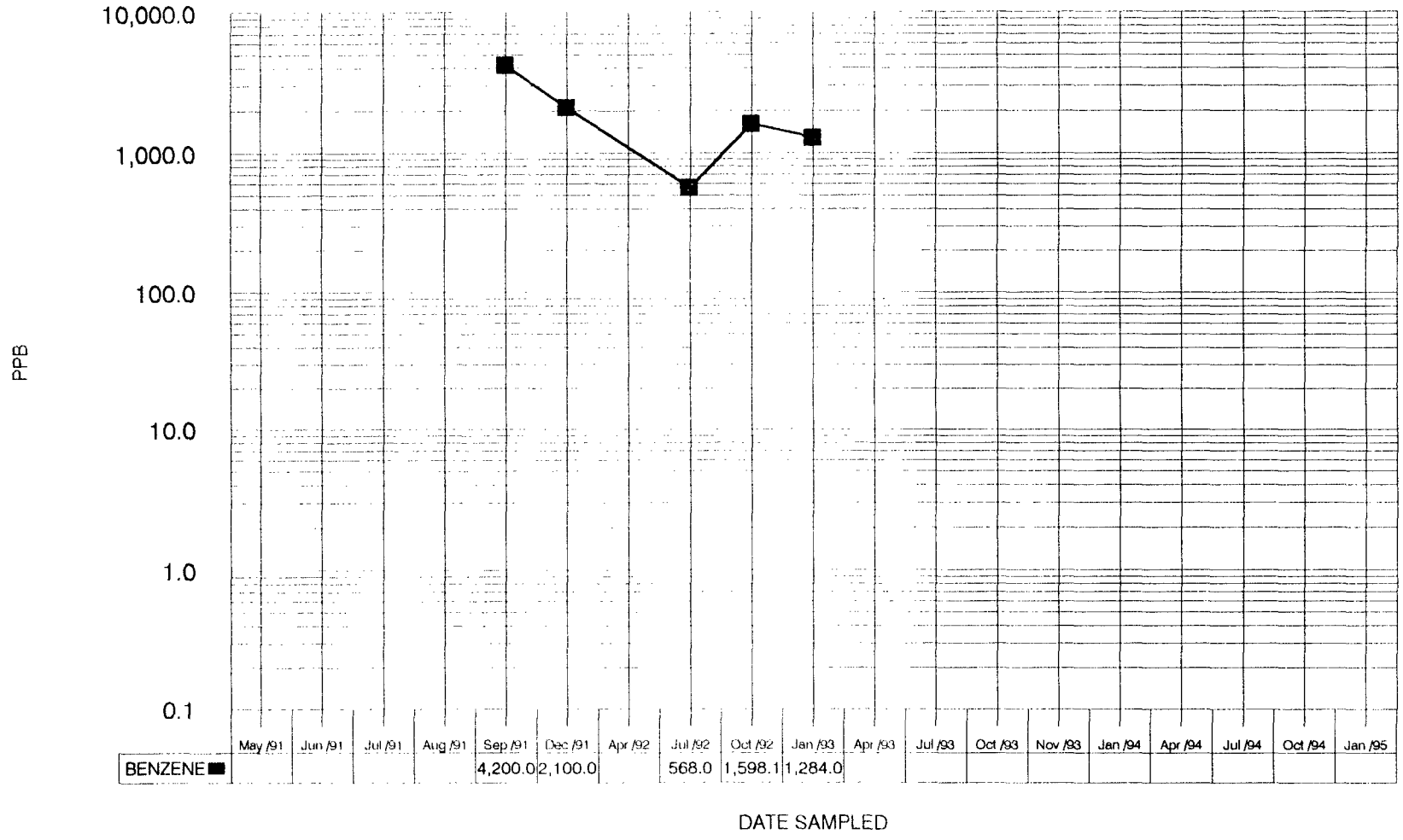
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE				1.0	280.0	320.0	4.3	103.0	2.6	8.0	7.0	7.0	0.5		0.5	0.5	0.5	0.5	1.0

DATE SAMPLED

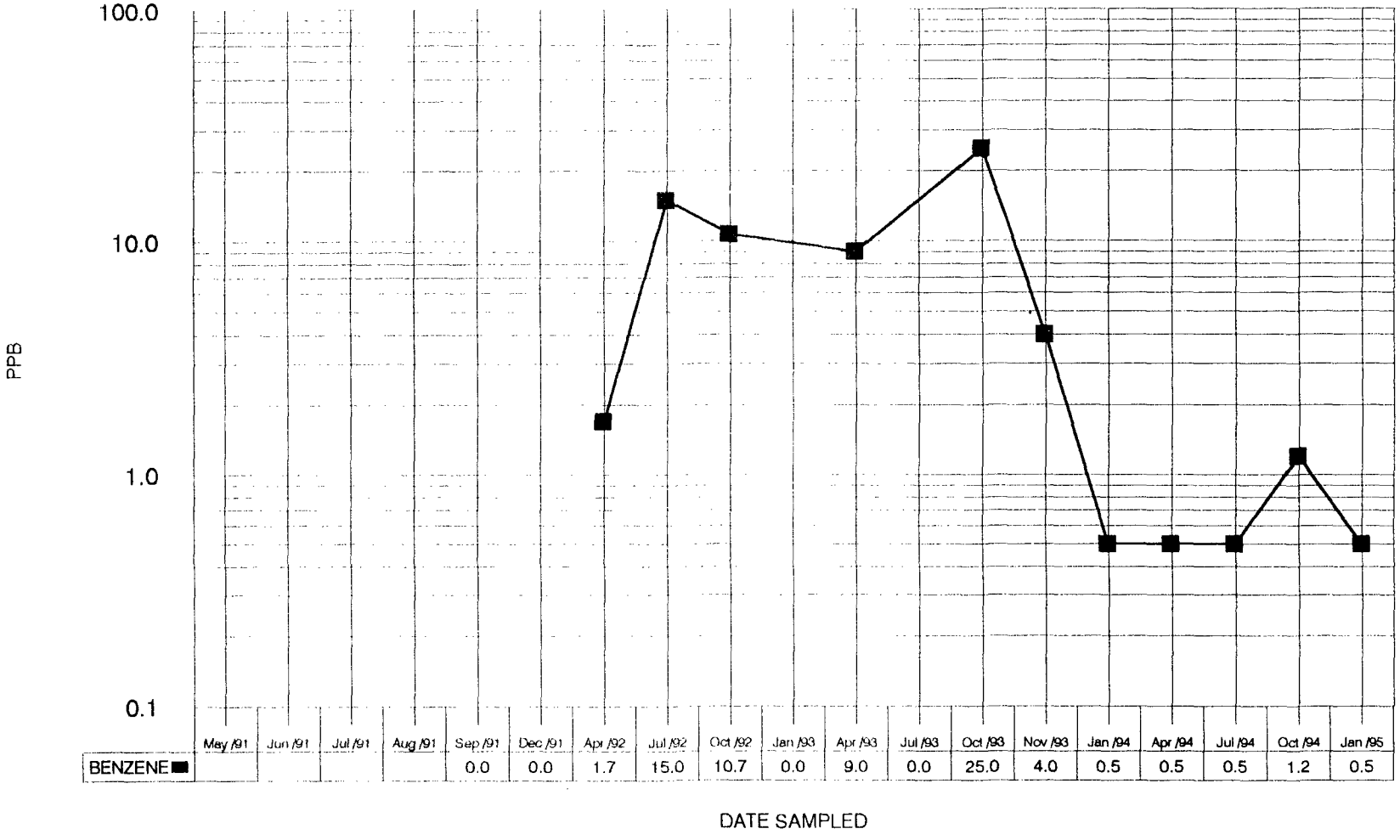
BENZENE IN GROUNDWATER
MW-68



BENZENE IN GROUNDWATER
MW-69



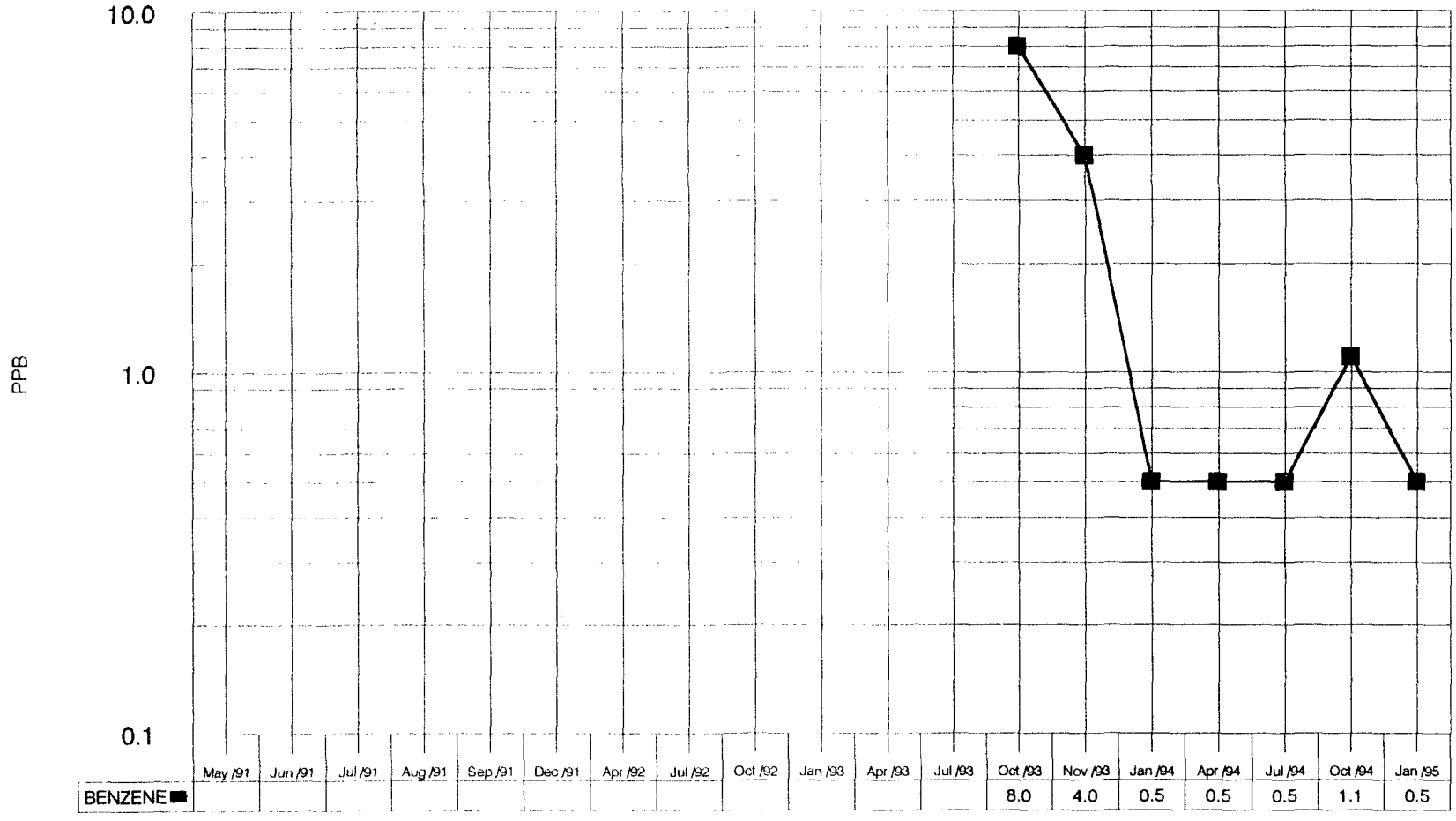
BENZENE IN GROUNDWATER
MW-70



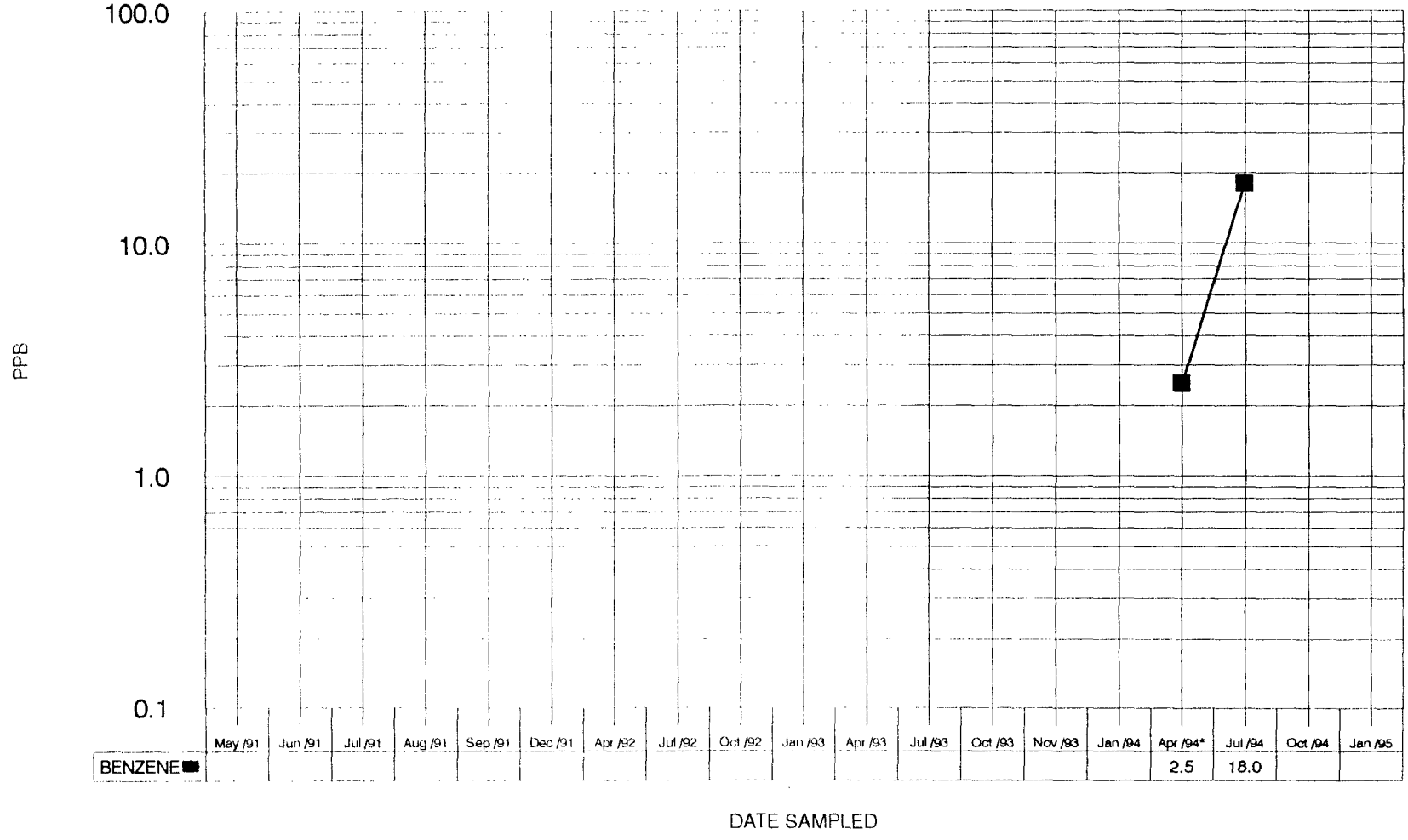
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95
BENZENE					0.0	0.0	1.7	15.0	10.7	0.0	9.0	0.0	25.0	4.0	0.5	0.5	0.5	1.2	0.5

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-71

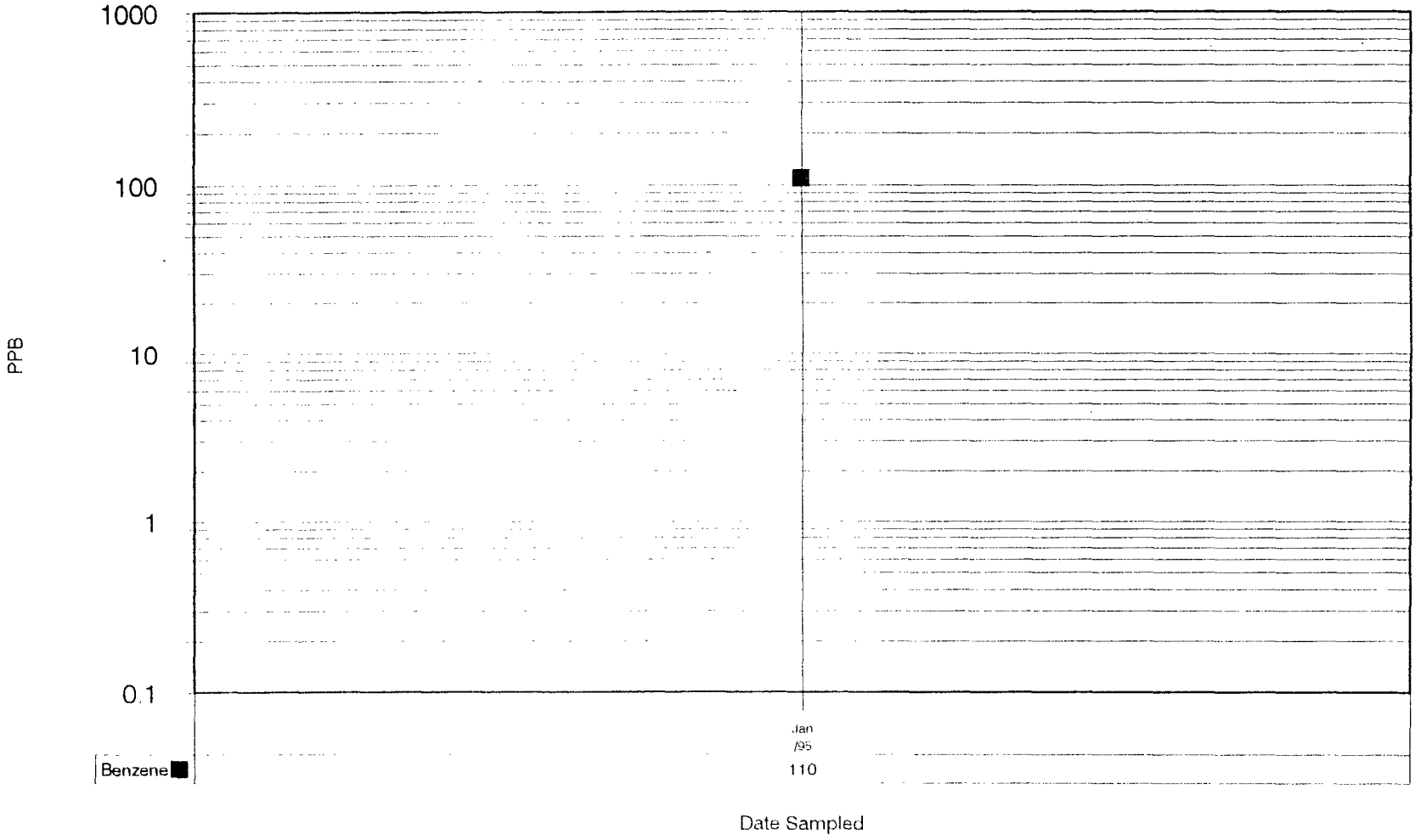


BENZENE IN GROUNDWATER
MW-72



*April 1994 was the first time this well was sampled.

BENZENE IN GROUNDWATER
MW-79



APPENDIX C

JANUARY 1995 LABORATORY RESULTS - GROUNDWATER

AND

RANCHER WELL, PLANT WELL, AND NATURAL SPRING

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. 501338

January 25, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702

Project Name/Number: IB REMEDIATION 44999

Attention: Bob Menzie

On **01/12/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

EPA Method 8020 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

Chloride analyses were performed by Analytical Technologies, Inc., 5550 Morehouse Drive, San Diego, CA.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
30	MW-50	AQUEOUS	01/11/95	NA	01/14/95	1
31	MW-43	AQUEOUS	01/11/95	NA	01/14/95	1
32	MW-44	AQUEOUS	01/11/95	NA	01/14/95	10

PARAMETER	UNITS	30	31	32
BENZENE	UG/L	<0.5	3.0	63
TOLUENE	UG/L	<0.5	<0.5	<5.0
ETHYLBENZENE	UG/L	<0.5	5.5	140
TOTAL XYLENES	UG/L	<0.5	15	26
SURROGATE:				
BROMOFLUOROBENZENE (%)		105	107	87

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 501338
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
33	MW-49	AQUEOUS	01/11/95	NA	01/14/95	10
34	MW-41	AQUEOUS	01/11/95	NA	01/15/95	10
35	SVMP-16A	AQUEOUS	01/11/95	NA	01/14/95	1

PARAMETER	UNITS	33	34	35
BENZENE	UG/L	220	13	2.0
TOLUENE	UG/L	<5.0	<5.0	5.1
ETHYLBENZENE	UG/L	46	42	2.4
TOTAL XYLENES	UG/L	97	23	32
SURROGATE:				
BROMOFLUOROBENZENE (%)		99	96	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
36	MW-79	AQUEOUS	01/11/95	NA	01/15/95	10
37	SW-2	AQUEOUS	01/11/95	NA	01/15/95	1
38	MW-67RB	AQUEOUS	01/11/95	NA	01/14/95	1

PARAMETER	UNITS	36	37	38
BENZENE	UG/L	110	<0.5	0.6
TOLUENE	UG/L	<5.0	<0.5	3.6
ETHYLBENZENE	UG/L	8.5	<0.5	1.4
TOTAL XYLENES	UG/L	61	<0.5	8.8
SURROGATE:				
BROMOFLUOROBENZENE (%)		98	114	109

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO.
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 01/12/95
REPORT DATE : 01/25/95

ATI ID: 501338

	ATI SAN DIEGO ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	501338-01	MW-58	AQUEOUS	01/11/95
02	501338-02	MW-72	AQUEOUS	01/11/95
03	501338-03	MW-59	AQUEOUS	01/11/95
04	501338-04	MW-62	AQUEOUS	01/11/95
05	501338-05	MW-65A	AQUEOUS	01/11/95
06	501338-06	MW-68	AQUEOUS	01/11/95
07	501338-07	SW-1	AQUEOUS	01/11/95
08	501338-08	STRIPPER OUTLET	AQUEOUS	01/11/95
09	501338-09	STRIPPER INLET	AQUEOUS	01/11/95
10	501338-10	LYMAN	AQUEOUS	01/11/95
11	501338-11	BIEBBLE	AQUEOUS	01/11/95
12	501338-12	ARROYO	AQUEOUS	01/11/95
13	501338-13	MW-70RB	AQUEOUS	01/09/95
14	501338-14	MW-70	AQUEOUS	01/09/95
15	501338-15	MW-63RB	AQUEOUS	01/09/95
16	501338-16	MW-63	AQUEOUS	01/09/95
17	501338-17	MW-66RB	AQUEOUS	01/09/95
18	501338-18	MW-66	AQUEOUS	01/09/95
19	501338-19	TRIP BLANK	AQUEOUS	01/05/95
20	501338-20	MW-71RB	AQUEOUS	01/10/95
21	501338-21	MW-71	AQUEOUS	01/10/95
22	501338-22	MW-61ARB	AQUEOUS	01/10/95
23	501338-23	MW-61A	AQUEOUS	01/10/95
24	501338-24	MW-60RB	AQUEOUS	01/10/95
25	501338-25	MW-60	AQUEOUS	01/10/95
26	501338-26	MW-64RB	AQUEOUS	01/10/95
27	501338-27	MW-64	AQUEOUS	01/10/95
28	501338-28	MW-54	AQUEOUS	01/10/95
29	501338-29	MW-39	AQUEOUS	01/10/95
30	501338-30	MW-50	AQUEOUS	01/11/95

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO. DATE RECEIVED : 01/12/95
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION REPORT DATE : 01/25/95

ATI ID: 501338

	ATI ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
31	501338-31	MW-43	AQUEOUS	01/11/95
32	501338-32	MW-44	AQUEOUS	01/11/95
33	501338-33	MW-49	AQUEOUS	01/11/95
34	501338-34	MW-41	AQUEOUS	01/11/95
35	501338-35	SVMP-16A	AQUEOUS	01/11/95
36	501338-36	MW-79	AQUEOUS	01/11/95
37	501338-37	SW-2	AQUEOUS	01/11/95
38	501338-38	MW-67RB	AQUEOUS	01/11/95
39	501338-39	MW-67	AQUEOUS	01/11/95
40	501338-40	MW-57RB	AQUEOUS	01/11/95
41	501338-41	MW-57	AQUEOUS	01/11/95
42	501338-42	MW-55RB	AQUEOUS	01/11/95
43	501338-43	MW-55	AQUEOUS	01/11/95
44	501338-44	MW-61RB	AQUEOUS	01/11/95
45	501338-45	MW-61	AQUEOUS	01/11/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	45

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
1	501338-01	WATER	11-JAN-95	13-JAN-95
2	501338-02	WATER	11-JAN-95	13-JAN-95
3	501338-03	WATER	11-JAN-95	13-JAN-95
4	501338-04	WATER	11-JAN-95	13-JAN-95
5	501338-05	WATER	11-JAN-95	13-JAN-95

Parameter	Units	1	2	3	4	5
CHLORIDE	MG/L	26.0	52.0	12.0	152	12.0

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
6	501338-06	WATER	11-JAN-95	13-JAN-95
7	501338-07	WATER	11-JAN-95	13-JAN-95
8	501338-10	WATER	11-JAN-95	13-JAN-95
9	501338-11	WATER	11-JAN-95	13-JAN-95
10	501338-12	WATER	11-JAN-95	13-JAN-95

Parameter	Units	6	7	8	9	10
CHLORIDE	MG/L	34.0	33.0	11.0	8.0	10.0

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
11	501338-14	WATER	09-JAN-95	13-JAN-95
12	501338-16	WATER	09-JAN-95	13-JAN-95
13	501338-18	WATER	09-JAN-95	13-JAN-95
14	501338-21	WATER	10-JAN-95	13-JAN-95
15	501338-23	WATER	10-JAN-95	13-JAN-95

Parameter	Units	11	12	13	14	15
CHLORIDE	MG/L	9.0	9.0	6.0	<5.0	32.0

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
16	501338-25	WATER	10-JAN-95	13-JAN-95
17	501338-27	WATER	10-JAN-95	13-JAN-95
18	501338-28	WATER	10-JAN-95	13-JAN-95
19	501338-29	WATER	10-JAN-95	13-JAN-95
20	501338-30	WATER	11-JAN-95	13-JAN-95

Parameter	Units	16	17	18	19	20
CHLORIDE	MG/L	20.0	20.0	32.0	194	314

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
21	501338-31	WATER	11-JAN-95	13-JAN-95
22	501338-32	WATER	11-JAN-95	13-JAN-95
23	501338-33	WATER	11-JAN-95	13-JAN-95
24	501338-34	WATER	11-JAN-95	13-JAN-95
25	501338-35	WATER	11-JAN-95	13-JAN-95

Parameter	Units	21	22	23	24	25
CHLORIDE	MG/L	280	360	389	326	90.0

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
26	501338-36	WATER	11-JAN-95	13-JAN-95
27	501338-37	WATER	11-JAN-95	13-JAN-95
[illegible]	501338-39	WATER	11-JAN-95	13-JAN-95
[illegible]	501338-41	WATER	11-JAN-95	13-JAN-95
30	501338-43	WATER	11-JAN-95	13-JAN-95

Parameter	Units	26	27	28	29	30
CHLORIDE	MG/L	36.0	81.0	<5.0	35.0	321

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
31	501338-45	WATER	11-JAN-95	13-JAN-95

Parameter	Units	31
CHLORIDE	MG/L	439

Analytical Technologies, Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

DUP/MS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D. : 501115
Project Name: MARATHON OIL

Parameters	REF I.D.	Units	Sample Result	Dup Result	RPD	Spiked Sample	Spike Conc	% Rec
CHLORIDE	501114-01	MG/L	496	488	2	538	40.0	105
CHLORIDE	501115-07	MG/L	33.0	28.0	16	72.0	40.0	98
CHLORIDE	501105-01	MG/L	207	215	4	246	40.0	98
CHLORIDE	501115-31	MG/L	439	421	4	476	40.0	93

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Sample Result - Duplicate Result)*100/Average Result

Analytical Technologies, Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

BLANK SPIKE

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D. : 501115
Project Name: MARATHON OIL

Parameters	Blank Spike ID#	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
CHLORIDE	53517	MG/L	<5.0	43.0	40.0	108
CHLORIDE	53637	MG/L	<5.0	39.0	40.0	98

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Sample Result - Duplicate Result)*100/Average Result

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
05	MW-65A	AQUEOUS	01/11/95	NA	01/12/95	1
07	SW-1	AQUEOUS	01/11/95	NA	01/12/95	1
08	STRIPPER OUTLET	AQUEOUS	01/11/95	NA	01/14/95	1

PARAMETER	UNITS	05	07	08
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	49
ETHYLBENZENE	UG/L	<0.5	<0.5	3.1
TOTAL XYLENES	UG/L	0.7	<0.5	29
*SURROGATE:				
BROMOFLUOROBENZENE (%)		105	107	91

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
09	STRIPPER INLET	AQUEOUS	01/11/95	NA	01/14/95	10
10	LYMAN	AQUEOUS	01/11/95	NA	01/13/95	1
11	BIEBBLE	AQUEOUS	01/11/95	NA	01/13/95	1

PARAMETER	UNITS	09	10	11
BENZENE	UG/L	89	<0.5	<0.5
TOLUENE	UG/L	<5.0	<0.5	<0.5
ETHYLBENZENE	UG/L	99	<0.5	<0.5
TOTAL XYLENES	UG/L	140	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		90	95	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 501338
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
12	ARROYO	AQUEOUS	01/11/95	NA	01/13/95	1
13	MW-70RB	AQUEOUS	01/09/95	NA	01/13/95	1
14	MW-70	AQUEOUS	01/09/95	NA	01/13/95	1

PARAMETER	UNITS	12	13	14
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	1.3	2.3
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	2.4
SURROGATE:				
BROMOFLUOROBENZENE (%)		106	107	102

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
15	MW-63RB	AQUEOUS	01/09/95	NA	01/13/95	1
16	MW-63	AQUEOUS	01/09/95	NA	01/13/95	1
17	MW-66RB	AQUEOUS	01/09/95	NA	01/13/95	1

PARAMETER	UNITS	15	16	17
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		106	104	108

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
18	MW-66	AQUEOUS	01/09/95	NA	01/13/95	1
19	TRIP BLANK	AQUEOUS	01/05/95	NA	01/13/95	1
20	MW-71RB	AQUEOUS	01/10/95	NA	01/13/95	1

PARAMETER	UNITS	18	19	20
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	1.4
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	2.3
SURROGATE:				
BROMOFLUOROBENZENE (%)		106	114	106

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 501338
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
21	MW-71	AQUEOUS	01/10/95	NA	01/14/95	1
22	MW-61ARB	AQUEOUS	01/10/95	NA	01/13/95	1
23	MW-61A	AQUEOUS	01/10/95	NA	01/13/95	10

PARAMETER	UNITS	21	22	23
BENZENE	UG/L	<0.5	<0.5	16
TOLUENE	UG/L	<0.5	1.4	<5.0
ETHYLBENZENE	UG/L	<0.5	0.7	30
TOTAL XYLENES	UG/L	<0.5	3.0	220
SURROGATE:				
BROMOFLUOROBENZENE (%)		104	110	104

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
24	MW-60RB	AQUEOUS	01/10/95	NA	01/13/95	1
25	MW-60	AQUEOUS	01/10/95	NA	01/14/95	1
26	MW-64RB	AQUEOUS	01/10/95	NA	01/14/95	1

PARAMETER	UNITS	24	25	26
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	2.3	<0.5	1.8
ETHYLBENZENE	UG/L	0.7	<0.5	0.5
TOTAL XYLENES	UG/L	4.4	0.6	2.4
SURROGATE:				
BROMOFLUOROBENZENE (%)		109	105	108

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 501338
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
27	MW-64	AQUEOUS	01/10/95	NA	01/14/95	1
28	MW-54	AQUEOUS	01/10/95	NA	01/14/95	1
29	MW-39	AQUEOUS	01/10/95	NA	01/14/95	10

PARAMETER	UNITS	27	28	29
BENZENE	UG/L	12	<0.5	<5.0
TOLUENE	UG/L	<0.5	<0.5	7.1
ETHYLBENZENE	UG/L	5.1	<0.5	250
TOTAL XYLENES	UG/L	13	<0.5	80
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	105	96

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
39	MW-67	AQUEOUS	01/11/95	NA	01/14/95	1
40	MW-57RB	AQUEOUS	01/11/95	NA	01/14/95	1
41	MW-57	AQUEOUS	01/11/95	NA	01/14/95	1

PARAMETER	UNITS	39	40	41
BENZENE	UG/L	1.0	<0.5	4.3
TOLUENE	UG/L	<0.5	1.6	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	1.1	0.5	1.3
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	106	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
42	MW-55RB	AQUEOUS	01/11/95	NA	01/14/95	1
43	MW-55	AQUEOUS	01/11/95	NA	01/15/95	10
44	MW-61RB	AQUEOUS	01/11/95	NA	01/15/95	1

PARAMETER	UNITS	42	43	44
BENZENE	UG/L	13	650	2.6
TOLUENE	UG/L	1.6	<5.0	1.7
ETHYLBENZENE	UG/L	32	400	9.5
TOTAL XYLENES	UG/L	2.0	41	1.9
SURROGATE:				
BROMOFLUOROBENZENE (%)		99	89	106

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
45	MW-61	AQUEOUS	01/11/95	NA	01/15/95	1

PARAMETER	UNITS	45
BENZENE	UG/L	<0.5
TOLUENE	UG/L	0.7
ETHYLBENZENE	UG/L	2.5
TOTAL XYLENES	UG/L	0.8

SURROGATE:

BROMOFLUOROBENZENE (%) 104

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011595	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/15/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		109

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011495B	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/14/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		108

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011295B	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/12/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		106

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011295	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/12/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		103

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011495	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/14/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		105

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 501338
BLANK I.D.	: 011395	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/13/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		103

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50133820	ATI I.D.	: 501338
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/13/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50133820	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	10	100	10	100	0
TOLUENE	1.4	10	11	96	11	96	0
ETHYLBENZENE	<0.5	10	9.8	98	9.9	99	1
TOTAL XYLENES	2.3	30	31	96	31	96	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50133807	ATI I.D.	: 501338
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/12/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50133807	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	10	100	10	100	0
TOLUENE	<0.5	10	9.9	99	10	100	1
ETHYLBENZENE	<0.5	10	9.7	97	9.8	98	1
TOTAL XYLENES	<0.5	30	30	100	30	100	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50133828	ATI I.D.	: 501338
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 01/14/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50133828	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	9.7	97	10	100	3
TOLUENE	<0.5	10	9.7	97	10	100	3
ETHYLBENZENE	<0.5	10	9.4	94	9.9	99	5
TOTAL XYLENES	<0.5	30	29	97	30	100	3

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc., Albuquerque, NM

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CHAIN OF CUSTODY

DATE: 1-11-95 PAGE 1 OF 1

ATI LAB I.D. 501338

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Robert D. Mercer Jr.

COMPANY: Marathon Oil Company

ADDRESS: P.O. Box 552
Midland, TX 79702-0552

PHONE: 915-687-8312

FAX: 915-687-8337

BILL TO:

COMPANY: Same

ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020)	Chloride	NUMBER OF CONTAINERS
MW-58	1-11-95	9.25a	Water	01		✓	1
MW-72		9.35a		02		✓	1
MW-59		9.40a		03		✓	1
MW-62		9.50a		04		✓	1
MW-65A		10.15a		05	✓	✓	3
MW-68		11.00a		06		✓	1
SW-1	↓	11.10a	↓	07	✓	✓	3

Petroleum Hydrocarbons (418.1); (MOD 8015) Gas/Diesel; Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020); Chlorinated Hydrocarbons (601/8010); Aromatic Hydrocarbons (602/8020); SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.; Pesticides/PCB (608/8080); Herbicides (615/8150); Base/Neutral/Acid Compounds GC/MS (625/8270); Volatile Organics GC/MS (624/8240); Polynuclear Aromatics (610/8310); SDWA Primary Standards - Arizona; SDWA Secondary Standards - Arizona; SDWA Primary Standards - Federal; SDWA Secondary Standards - Federal; The 13 Priority Pollutant Metals; RCRA Metals by Total Digestion; RCRA Metals by TCLP (1311)

PROJECT INFORMATION

PROJ. NO.: 41999

PROJ. NAME: LB Remediation

P.O. NO.:

SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	11
CUSTODY SEALS	(Y) N / NA
RECEIVED INTACT	✓
RECEIVED COLD	✓

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

Mw-59 contains 2 phases. Test water phase for chloride content.

SAMPLED & RELINQUISHED BY: 1.

Signature: [signature] Time: 11.30 am

Printed Name: R.D. Mercer Date: 1-11-95

Company: Marathon Phone: 915-687-8312

RELINQUISHED BY: 2.

Signature: [signature] Time: 16:30

Printed Name: Scott Douthitt Date: 1-11-95

Company: GTI

RELINQUISHED BY: 3.

Signature: [signature] Time: 1330

Printed Name: Charles Mackewell Date: 1/12/95

Company: GTI

RECEIVED BY: 1.

Signature: [signature] Time: 11:30

Printed Name: Scott Douthitt Date: 1-11-95

Company: GTI

RECEIVED BY: 2.

Signature: [signature] Time: 1630

Printed Name: Charles Mackewell Date: 1/11/95

Company: GTI

RECEIVED BY: (LAB) 3.

Signature: [signature] Time: 830

Printed Name: [signature] Date: 1/12/95

Analytical Technologies, Inc.

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

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CHAIN OF CUSTODY

DATE: 1-11-95 PAGE 2 OF 7

ATI LAB I.D. 50/338

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Robert J. Mercure II

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland, TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: same
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/MTBE (8020)	Chloride	NUMBER OF CONTAINERS
Stripper Outlet	1-11-95	12:30 pm	Water	08	✓		2
Stripper Inlet		12:40 pm		09	✓		2
Lyman		1:05 pm		10	✓	✓	3
Bubble		1:20 pm		11	✓	✓	3
Arroyo		1:35 pm		12	✓	✓	3

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	13
PROJ. NAME:	IB Remediation	CUSTODY SEALS	(Y) N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:		RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 3:50	Signature: [signature] Time: 16:30	Signature: [signature] Time: 13:30
Printed Name: RJ Mercure Jr. Date: 1-11-95	Printed Name: Scott Doolittle Date: 1-11-95	Printed Name: Charles Madewell Date: 1/12/95
Company: Marathon Phone: 915-687-8312	Company: GTI	Company: GTI

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: [signature] Time: 3:50	Signature: [signature] Time: 16:30	Signature: [signature] Time: 1330
Printed Name: Scott Doolittle Date: 1-11-95	Printed Name: Charles Madewell Date: 1-11-95	Printed Name: Dianne Cotter Date: 1/12/95
Company: GTI	Company: GTI	Analytical Technologies, Inc.

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CHAIN OF CUSTODY

DATE: 1/9/95 PAGE 3 OF 7

ATI LAB I.D. 501338

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Mercer

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: SAME
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/MTBE (8020)	Chloride	NUMBER OF CONTAINERS
MW-72RB	1/9/95	1248	Water	13	X		2
MW-72D		1230		14	X	X	3
MW-63RB		1430		15	X		2
MW-63		1455		16	X	X	3
MW-66RB		1700		17	X		2
MW-66		1655		18	X	X	3
Trip Blank	1/5/95	1115		19	X		1

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION

PROJ. NO.: 74999
PROJ. NAME: I.B. Remediation
P.O. NO.:
SHIPPED VIA: GTI

SAMPLE RECEIPT

NO. CONTAINERS: 16
CUSTODY SEALS: (Y) / N / NA
RECEIVED INTACT: Y
RECEIVED COLD: Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.
Signature: [signature] Time: 1330
Printed Name: Charles Mackenzie Date: 1/12/95
Company: GTI Phone: 242-3113

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 3.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY:(LAB) 3.
Signature: Time: 1330
Printed Name: Dianne Luther Date: 1/12/95
Analytical Technologies, Inc.

Analytical**Technologies,**Inc., Albuquerque, NM
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CHAIN OF CUSTODY

DATE: 1/11/95 PAGE 4 OF 7

ATI LAB I.D. 50133

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PROJECT MANAGER: Bob Meuzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland, TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: SAME
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020)	CA/Lead	NUMBER OF CONTAINERS
MW-71RB	1/10/95	1035	water	20	X		2
MW-71		1045		21	X	X	3
MW-61ARB		1210		22	X		2
MW-61A		1235		23	X	X	3
MW-60RB		1435		24	X		2
MW-60		1452		25	X	X	3
MW-64RB		1615		26	X		2
MW-64		1649		27	X	X	3

Petroleum Hydrocarbons (418.1); (MOD 8015) Gas/Diesel; Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020); Chlorinated Hydrocarbons (601/8010); Aromatic Hydrocarbons (602/8020); SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.; Pesticides/PCB (608/8080); Herbicides (615/8150); Base/Neutral/Acid Compounds GC/MS (625/8270); Volatile Organics GC/MS (624/8240); Polynuclear Aromatics (610/8310); SDWA Primary Standards - Arizona; SDWA Secondary Standards - Arizona; SDWA Primary Standards - Federal; SDWA Secondary Standards - Federal; The 13 Priority Pollutant Metals; RCRA Metals by Total Digestion; RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	20
PROJ. NAME:	IB Remediation	CUSTODY SEALS	Y / N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	GTI	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1330	Signature: Time:	Signature: Time:
Printed Name: Charles Mackwell Date: 1/12/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY:(LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 1330
Printed Name: Date:	Printed Name: Date:	Printed Name: Date: 1/12/95
Company:	Company:	Analytical Technologies, Inc.

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CHAIN OF CUSTODY

DATE: 1/10/95 PAGE 3 OF 7

ATI LAB # 501338

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Hinze

COMPANY: Marathon
ADDRESS: P.O. Box 522
Midland, TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: SAME
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-54	1/10/95	1500	Water	28
MW-39	↓	1615	↓	29

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/~~BTEX~~ (8020)	Cl Solvents	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	NUMBER OF CONTAINERS
			X	X																3
			X	X																3

PROJECT INFORMATION

PROJ. NO.: 44999
PROJ. NAME: I.B. Remediation
P.O. NO.:
SHIPPED VIA: GTI

SAMPLE RECEIPT

NO. CONTAINERS	6
CUSTODY SEALS	(Y) N / NA
RECEIVED INTACT	Y
RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1330	Signature: Time:	Signature: Time:
Printed Name: Charles Kilchrist Date: 1/10/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 1330
Printed Name: Date:	Printed Name: Date:	Printed Name: Date: 1/12/95
Company:	Company:	Analytical Technologies, Inc.

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CHAIN OF CUSTODY

DATE: 1/11/95 PAGE 6 OF 7

ATI LAB I.D. 501338

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY:
ADDRESS: SAME

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/~~MTBE~~ (8020)	Chloride	NUMBER OF CONTAINERS
MW-50	1/11/95	1310	water	30	X	X	3
mw-43		1320		31	X	X	3
MW-44		1330		32	X	X	3
mw-49		1340		33	X	X	3
MW-41		1350		34	X	X	3
SUMP-16A		1405		35	X	X	3
MW-79		1515		36	X	X	3
SW-2		1710		37	X	X	3

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	24
PROJ. NAME:	I.G. Remediation	CUSTODY SEALS	(Y) N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	GTI	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1330	Signature: Time:	Signature: Time:
Printed Name: Charles Mudewill Date: 1/12/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 1330
Printed Name: Date:	Printed Name: Date:	Printed Name: Date: 1/12/95
Company:	Company:	Analytical Technologies, Inc.

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CHAIN OF CUSTODY

DATE: 1/11/95 PAGE 7 OF 9

ATI LAB I.D.: 501338

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PROJECT MANAGER: [illegible]

COMPANY: Navajo

ADDRESS: P.O. Box 522
Midland TX 79702

PHONE: 915-687-532

FAX: 915-687-8337

BILL TO:

COMPANY: SAME

ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020)	Chlorides	NUMBER OF CONTAINERS
MW-67RB	1/11/95	0820	water	39	X		2
MW-67		0840		38	X	X	3
MW-57RB		0945		40	X		2
MW-57		1010		41	X	X	3
MW-55RB		1150		42	X		2
MW-55		1210		43	X	X	3
MW-61RB		1320		44	X		2
MW-61		1340		45	X	X	3

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION

PROJ. NO.: 414099

PROJ. NAME: T.B. Remediation

P.O. NO.:

SHIPPED VIA: GTI

SAMPLE RECEIPT

NO. CONTAINERS: 22

CUSTODY SEALS: (Y) N / NA

RECEIVED INTACT: Y

RECEIVED COLD: Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 1330	Signature: Time:	Signature: Time:
Printed Name: Charles Pollard Date: 1/12/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 240 3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: [signature] Time: 1330
Printed Name: Date:	Printed Name: Date:	Printed Name: Joanne Lutter Date: 1/12/95
Company:	Company:	Analytical Technologies, Inc.

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DATE 1/12/95 PAGE 1 OF 4

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TCX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	Cl-	632/632 MOD	619/619 MOD	610/8310		8240 /TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 225/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
501338 -01	1/11	0925	AQ	-01						X																	1
-02		0935		-02						X																	1
-03		0940		-03						X																	1
-04		0950		-04						X																	1
-05		1015		-05						X																	1
-06		1100		-06						X																	1
-07		1110		-07						X																	1
-10		1305		-08						X																	1
-11	↓	1320	↓	-09						X																	1

ANALYSIS REQUEST

PROJECT INFORMATION	
PROJECT NUMBER:	501338
PROJECT NAME:	MD
QC LEVEL:	(STD) IV
QC REQUIRED:	(MS) MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	9
CHAIN OF CUSTODY SEALS	Y
INTACT?	Y
RECEIVED GOOD COND./COLD	Y 2.6°C
LAB NUMBER	501115 Revised 1-13-95

DUE DATE: 1/25
RUSH SURCHARGE: 0
CLIENT DISCOUNT: see fax %

WO# 1217

SAMPLES SENT TO:	
SAN DIEGO	X
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	
FIBEROUANT	

RELINQUISHED BY: 1.
Signature: [signature] Time: 1730
Printed Name: Diane Lutter Date: 1/12/95
Analytical Technologies, Inc Albuquerque

RECEIVED BY: (LAB) 1.
Signature: [signature] Time: 4:30 pm
Printed Name: Chris Molzig Date: 1-13-95
Company: ATI - SD

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

[redacted] ATI L[redacted]n Dieg[redacted] 458-9[redacted] Phoen[redacted] 496-4[redacted] Seattle[redacted] 28-83[redacted] Pensac[redacted] (904) 474-[redacted] Portla[redacted] (503) 684-[redacted] Albuquerque (505) 344-3777 [redacted] DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR [redacted]

Analytical Technologies, Inc. Albuquerque, NM

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DATE 1/12/95 PAGE 2 OF 4

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	Cl⁻	532/632 MOD	619/619 MOD	610/8310			8240 /TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228		AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
501338-12	1/11	835	A-Q	-10						X																					1
-14	1/9	1230		-11						X																					1
-16		1455		-12						X																					1
-18	↓	1655		-13						X																					1
-21	1/10	1015		-14						X																					1
-23		1235		-15						X																					1
-25		1452		-16						X																					1
-27		1649		-17						X																					1
-28	↓	1500	↓	-18						X																					1

PROJECT INFORMATION	
PROJECT NUMBER:	501338
PROJECT NAME:	MD
QC LEVEL:	(STD) IV
QC REQUIRED:	(MS) MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	9
CHAIN OF CUSTODY SEALS	Y
INTACT?	Y
RECEIVED GOOD COND./COLD	Y 2.6°
LAB NUMBER	501158 Cmte 1-1345

DUE DATE: 1/26
RUSH SURCHARGE: 0
CLIENT DISCOUNT: See Fax %

per Quote

with 1217

SAMPLES SENT TO:	
SAN DIEGO	X
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: Time: 1730
Printed Name: Date 1/12/95
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Time: 4:30
Printed Name: Date: 1-13-95
Company: ATI - SD

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

DATE 1/12/95 PAGE 3 OF 4

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	Cl⁻	632/632 MOD	619/619 MOD	610/8310		8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		SOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228		AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
501338-29	1/10	1615	AQ	-19						X																					1
-30	1/11	1310		-20						X																					1
-31		1320		-21						X																					1
-32		1330		-22						X																					1
-33		1340		-23						X																					1
-34		1350		-24						X																					1
-35		1405		-25						X																					1
-36		1515		-26						X																					1
-37	↓	1710	↓	-27						X																					1

ANALYSIS REQUEST

PROJECT INFORMATION	
PROJECT NUMBER:	501336
PROJECT NAME:	MD
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	9
CHAIN OF CUSTODY SEALS	Y
INTACT?	Y
RECEIVED GOOD COND./COLD	Y 26°C
LAB NUMBER	501148 cwo 1/13/95

DUE DATE: 1/26

RUSH SURCHARGE: 0

CLIENT DISCOUNT: See Fax %

PER QUOTE

WORK 1217

SAMPLES SENT TO:
- SAN DIEGO Y
- FT. COLLINS
- RENTON
- PENSACOLA
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.
Signature: [signature] Time: 1730
Printed Name: Dan Butler Date: 1/12/95
Analytical Technologies, Inc. Albuquerque

RECEIVED BY: (LAB) 1.
Signature: [signature] Time: 4:30 pm
Printed Name: Chris Mosley Date: 1-13-95
Company: ATI-SD

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

DATE 1/12/95 PAGE 4 OF 4

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	CL —	632/632 MOD	619/619 MOD	610/8310		8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
501338-39	1/11	0840	AQ	-28						X																	1
-41		1010		-29						X																	1
-43		1210		-30						X																	1
-45	↓	1340	↓	-31						X																	1

ANALYSIS REQUEST

PROJECT INFORMATION	
PROJECT NUMBER:	501338
PROJECT NAME:	MO
QC LEVEL:	(STD) IV
QC REQUIRED:	(MS) MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	Y
INTACT?	Y
RECEIVED GOOD COND./COLD	Y 2.6°
LAB NUMBER	501158 CMW 1-13-95

DUE DATE: 1/26
RUSH SURCHARGE: 0
CLIENT DISCOUNT: See Fax

WO# 1217

PER QUOTE

SAMPLES SENT TO:
- SAN DIEGO X
- FT COLLINS
- BENTON
- PENSACOLA
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: [signature] Time: 1130	Signature: Time:
Printed Name: Dianne Keller Date: 1/12/95	Printed Name: Date
Analytical Technologies, Inc. Albuquerque	Company:
RECEIVED BY: (LAB) 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:
Company:	Company:

APPENDIX D

RANCHER WELL, PLANT WELL, AND NATURAL SPRING

MONTHLY LABORATORY RESULTS

(MARCH)

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. 503328

March 29, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB REMEDIATION 44999

Attention: Bob Menzie

On **03/10/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

Chloride analyses were performed by Analytical Technologies, Inc., 9830 S. 51st Street, Suite B-113, Phoenix, AZ.

All other analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

MR:jt

Enclosure

MCR

APR 3 1995

Environmental & Safety

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL COMPANY	DATE RECEIVED	: 03/10/95
PROJECT #	: 44999		
PROJECT NAME	: IB REMEDIATION	REPORT DATE	: 03/29/95

ATI ID: 503328

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	SW-1	AQUEOUS	03/09/95
02	LYMAN	AQUEOUS	03/09/95
03	ARROYO	AQUEOUS	03/09/95
04	STRIPPER INLET	AQUEOUS	03/09/95
05	STRIPPER OUTLET	AQUEOUS	03/09/95
06	TRIP BLANK	AQUEOUS	02/22/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	6

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 503328

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 03/10/95
REPORT DATE : 03/29/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	24	12.0	11.5

Analytical Technologies, Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION ATI I.D. : 503328

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP. RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
CHLORIDE	MG/L	50365001	113	114	0.9	215	100	102

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 503328
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	03/09/95	NA	03/14/95	1
02	LYMAN	AQUEOUS	03/09/95	NA	03/14/95	1
03	ARROYO	AQUEOUS	03/09/95	NA	03/14/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		111	113	111

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 503328

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	STRIPPER INLET	AQUEOUS	03/09/95	NA	03/14/95	10
05	STRIPPER OUTLET	AQUEOUS	03/09/95	NA	03/15/95	1
06	TRIP BLANK	AQUEOUS	02/22/95	NA	03/14/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	28	<0.5	<0.5
TOLUENE	UG/L	<5.0	<0.5	<0.5
ETHYLBENZENE	UG/L	9.5	0.8	<0.5
TOTAL XYLENES	UG/L	68	6.8	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		101	111	113

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 503328
BLANK I.D.	: 031495	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL COMPANY	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 03/14/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		112

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50332801	ATI I.D.	: 503328
CLIENT	: MARATHON OIL COMPANY	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 03/14/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50332801	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	11	110	11	110	0
TOLUENE	<0.5	10	11	110	11	110	0
ETHYLBENZENE	<0.5	10	11	110	11	110	0
TOTAL XYLENES	<0.5	30	33	110	33	110	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc., Albuquerque, NM

San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 3-9-95 PAGE 1 OF 1

ATI LAB I.D. 5033328

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland, TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: Same
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
SW-1	3-7-95	1:50 P	water	01
Lyman		2:00 P		02
Arroyo		2:20 P		03
Stripper Inlet		2:55P		04
Stripper Outlet		3:05P		05
Trip Blank	2-22-95	14:05		06

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/MTBE (8020)	Chloride	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	NUMBER OF CONTAINERS
		✓	✓	✓																3
		✓	✓	✓																3
		✓	✓	✓																3
		✓		✓																2
		✓		✓																2
		✓		✓																1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	14
PROJ. NAME:	IB Remediation	CUSTODY SEALS	(Y) N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	Greyhound	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

Trip Blank contains air bubble on 3-9.

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 4:45PM	Signature: Time:	Signature: Time:
Printed Name: RJ Menzie Jr. Date: 3-9-95	Printed Name: Date:	Printed Name: Date:
Company: Marathon Phone: 915-687-8312	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: [signature] Time: 1030
Printed Name: Date:	Printed Name: Date:	Printed Name: [signature] Date: 3/10/95
Company:	Company:	Analytical Technologies, Inc.

Analytical**Technologies,**Inc. Albuquerque, NM

Chain of Custody

DATE 3/10/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	Chloride	632/632 MOD	619/619 MOD	610/8310	8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
503328-01	3/9	1350	AQ	1						X																1
02	↓	1400	↓	2						X																1
03	↓	1420	↓	3						X																1

PROJECT INFORMATION	
PROJECT NUMBER:	503328
PROJECT NAME:	MO
QC LEVEL:	(STD) IV
QC REQUIRED:	(MS) MSD BLANK
TAT:	(STANDARD) RUSHI

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	3
CHAIN OF CUSTODY SEALS	NA
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	503328

DUE DATE: 3/24
RUSH SURCHARGE: 0
CLIENT DISCOUNT: ~~10~~ 15 %

WO# 1314

16.50 per Sample

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	X
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: Time: 1730
Printed Name: Date: 3/10/95
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time: 1137
Printed Name: Melanie Giangrazzo Date: 3/11/95
Company: ATI-Phoenix

APPENDIX E

STATE ENGINEER OFFICE FLUID RECOVERY REPORTS

Mid-Continent Region
Production United States

Marathon
Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 7, 1995

Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

Re: Indian Basin Remediation Project

Dear Mr. Torres:

The following table indicates the recorded meter readings for fluid removed from the Lower Queen monitoring wells under permit RA-5131 as of Monday, February 6, 1995. Cumulative Lower Queen fluid removal through that date is 47,562,233 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	02/06/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-58	10239118	0	6635182	6,635,182 26,922[1]	6,662,104
MW-59	10259114	0	130198*	5,468,316 83,454[1]	5,551,770
MW-61A	10239116	0	6264877	6,264,877 130,850[1]	6,395,727
MW-62	10239115	0	5498540	5,498,540 256,553[1]	5,755,093
MW-65A	10239117	0	9093504	9,093,504 39,774[1]	9,133,278
MW-68	02209213	122618	3855617	3,732,999 2,484,076[1]	6,217,075
MW-72	02881532	470	7847656	7,847,186	7,847,186
LOWER QUEEN TOTAL 47,562,233 Gallons					

* Metered units are barrels.
[1] Previously metered recovered volumes.

The following table indicates the meter readings for fluid removed from Shallow zone monitoring wells under permit RA-8015 as of Monday, February 6, 1995. The cumulative shallow fluid removal through that date is 787,598 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	02/06/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-1	.....	....	.....	6,713[1]	6,713
MW-13	02209212	98236.2	226324	243,999[1]	243,999
MW-14	02209214	0	398204.3	398,391[1]	398,391
MW-21	.....	....	....	189[1]	189
MW-35	02209212	188.8	....	98,303[1]	98,303
MW-69	.....	....	....	3700[2] 36,303[1]	40,003
SHALLOW TOTAL				787,598 Gallons	

[1] Previously metered recovered volumes.
[2] Gauged in portable fiberglass tank.

Please note the above tables have been revised to show only the meter serial numbers and readings for the meters currently installed on each well. Earlier readings from meters that have been replaced or switched to other wells have been summarized as "previously metered recovered volumes" to simplify the tables and associated footnotes.

If more information is required, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM20795/nrt

xc: L. J. Oswald - Midland
C. M. Schweser - IBGP, Lakewood

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 10, 1995

Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

Re: Indian Basin Remediation Project

Dear Mr. Torres:

The following table indicates the recorded meter readings for fluid removed from the Lower Queen monitoring wells under permit RA-5131 as of Monday, March 6, 1995. Cumulative Lower Queen fluid removal through that date is 48,476,346 gallons.

MONITORING WELL	METER SERIAL NUMBER	INITL METER START	03/06/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-58	10239118	0	6747065	6,747,065 26,922[1]	6,773,987
MW-59	10259114	0	133230*	5,595,660 83,454[1]	5,679,114
MW-61A	10239116	0	6407853	6,407,853 130,850[1]	6,538,703
MW-62	10239115	0	5506994	5,506,994 256,553[1]	5,763,547
MW-65A	10239117	0	9093675	9,093,675 39,774[1]	9,133,449
MW-68	02209213	122618	3991970	3,869,352 2,484,076[1]	6,353,428
MW-72	02881532	470	8234588	8,234,118	8,234,118
LOWER QUEEN TOTAL 48,476,346 Gallons					

* Metered units are barrels.
[1] Previously metered recovered volumes.

The following table indicates the meter readings for fluid removed from Shallow zone monitoring wells under permit RA-8015 as of Monday, March 6, 1995. The cumulative shallow fluid removal through that date is 794,322 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	03/06/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-1	—	—	—	6,713[1]	6,713
MW-13	02209212	98236.2	226324	243,999[1]	243,999
MW-14	02209214	0	398204.3	398,391[1]	398,391
MW-21	—	—	—	189[1]	189
MW-35	02209212	188.8	—	98,303[1]	98,303
MW-69	—	—	—	6724[2] 40,003[1]	46,727
SHALLOW TOTAL				794,322 Gallons	

[1] Previously metered recovered volumes.
[2] Gauged in portable fiberglass tank.

Please note the above tables have been revised to show only the meter serial numbers and readings for the meters currently installed on each well. Earlier readings from meters that have been replaced or switched to other wells have been summarized as "previously metered recovered volumes" to simplify the tables and associated footnotes.

If more information is required, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM20795/nrt

xc: L. J. Oswald - Midland
C. M. Schweser - IBGP, Lakewood

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 11, 1995

Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

Re: Indian Basin Remediation Project

Dear Mr. Torres:

The following table indicates the recorded meter readings for fluid removed from the Lower Queen monitoring wells under permit RA-5131 as of Monday, April 3, 1995. Cumulative Lower Queen fluid removal through that date is 49,987,383 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	04/03/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-58	10239118	0	6838862	6,838,862 26,922[1]	6,865,784
MW-59	10259114	0	135904*	5,707,968 83,454[1]	5,791,422
MW-61A	10239116	0	6756525	6,756,525 130,850[1]	6,887,375
MW-62	10239115	0	5620781	5,620,781 256,553[1]	5,877,334
MW-65A	10239117	0	9309188	9,309,188 39,774[1]	9,348,962
MW-68	02209213	122618	4123299	4,000,681 2,484,076[1]	6,484,757
MW-72	02881532	470	8732219	8,731,749	8,731,749
LOWER QUEEN TOTAL 49,987,383 Gallons					

* Metered units are barrels.
[1] Previously metered recovered volumes.

The following table indicates the meter readings for fluid removed from Shallow zone monitoring wells under permit RA-8015 as of Monday, April 3, 1995. The cumulative shallow fluid removal through that date is 802,008 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	04/03/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-1	——	—	—	6,713[1]	6,713
MW-13	02209212	98236.2	226324	243,999[1]	243,999
MW-14	02209214	0	398204.3	398,391[1]	398,391
MW-21	—	—	—	189[1]	189
MW-35	02209212	188.8	—	98,303[1]	98,303
MW-69	—	—	—	7686[2] 46,727[1]	54,413
SHALLOW TOTAL				802,008 Gallons	

[1] Previously metered recovered volumes.
[2] Gauged in portable fiberglass tank.

Please note the above tables have been revised to show only the meter serial numbers and readings for the meters currently installed on each well. Earlier readings from meters that have been replaced or switched to other wells have been summarized as "previously metered recovered volumes" to simplify the tables and associated footnotes.

If more information is required, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM41195/nrt

xc: L. J. Oswald - Midland
C. M. Schweser - IBGP, Lakewood
File: 576-01

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 1, 1995

RECEIVED
NOV 7 1995
Environmental Bureau
Oil Conservation Division

Mr. Roger C. Anderson
State of New Mexico, Oil Conservation Division
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Dear Mr. Anderson:

Enclosed is the Third Quarter 1995 Indian Basin Remediation Project Report. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992. Preparation of this report is also in accordance with the April 2, 1992 New Mexico Oil Conservation Division (OCD) directive for quarterly reporting of remediation project activities. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

Attachment

c: William C. Olson, Oil Conservation Division, Santa Fe

INDIAN BASIN GAS PLANT
REMEDIATION PROJECT
QUARTERLY REPORT

THIRD QUARTER 1995
JULY, AUGUST, AND SEPTEMBER

Submitted by
Marathon Oil Company
on behalf of the
Indian Basin Gas Plant Owners

November 1, 1995

EXECUTIVE SUMMARY

The pump-and-treat groundwater remediation system is fully operational and functioning as set forth in the Treatment Project Plan (March 1992). During the quarterly sampling event in July 1995, light nonaqueous phase liquid (condensate) was observed in 10 Lower Queen wells. During the quarter, total fluid recovery from eight Lower Queen recovery wells averaged 12,109 barrels per week or 50 gallons per minute with volatile hydrocarbon compounds being removed by air stripping. Lower Queen dissolved benzene concentrations in five downgradient wells range from less than 0.5 to 17 micrograms per liter (ug/L) or parts per billion. Chloride concentrations in all Lower Queen wells are below the State maximum allowable concentration of 250 milligrams per liter (mg/L).

Two Shallow zone wells contained condensate in July. Shallow zone pumping continues from one well. Fluid recovery from the Shallow zone aquifer averaged 16 barrels per week. Shallow zone dissolved benzene concentrations range from less than 0.5 to 350 ug/L. Eight Shallow zone wells sampled in July indicate chloride concentrations above the State maximum allowable concentration of 250 mg/L.

Concentrations of benzene, toluene, ethylbenzene, total xylene, and chloride in groundwater collected from a rancher well completed in the Shallow alluvium, a rancher well completed in the Seven Rivers Formation, and surface water from the Upper Indian Hills Spring West (Rocky Arroyo spring) have not exceeded State or Federal drinking water standards.

Condensate recovery from the Lower Queen and Shallow zone for the Third Quarter was 20.0 barrels. Excluding the volume volatilized by the air stripper and vapor extraction system, cumulative recovery is 3,601.1 barrels or 10.3% of the total estimated spill volume.

The vapor extraction system was not operated during the Third Quarter.

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INTRODUCTION

This report summarizes groundwater and unsaturated zone treatment activities conducted during the Third Quarter of 1995 in accordance with the Indian Basin Environmental Treatment Project Plan submitted on March 5, 1992 by Marathon Oil Company on behalf of the Indian Basin Gas Plant owners. Preparation of this report is also in accordance with the April 2, 1992 New Mexico Oil Conservation Division (OCD) directive for quarterly reporting of remediation project activities. Remediation activities are continuing to reduce the impact of a liquid gas condensate and brine production pipeline spill discovered in April 1991 near the Indian Basin Gas Plant.

GROUNDWATER ELEVATION

Lower Queen Aquifer

Depth-to-water measurements were acquired from nonpumping Lower Queen monitoring wells in July 1995. Table 1 presents groundwater and product elevations calculated from casing elevation data, depth-to-water measurements, and depth-to-product (light nonaqueous phase liquid; LNAPL) measurements. Figure 1 is a potentiometric map of the Lower Queen aquifer based on July gauging data. Third Quarter data indicate both increasing and decreasing groundwater elevations (Figure 2).

Shallow Zone

A potentiometric map was constructed using depth-to-water measurements collected from Shallow zone monitoring wells in July 1995 (Figure 3). Table 2 shows depth-to-water and depth-to-LNAPL measurements, calculated groundwater and LNAPL elevations, and LNAPL thickness in Shallow zone wells. These Shallow zone data indicate increasing and decreasing groundwater elevations during the quarter (Figure 4). Groundwater elevation changes are the result of changes in recharge from rainfall and subsurface and surface inflow to the project area.

Groundwater Recharge (Rainfall)

Daily rainfall is gauged at the gas plant. Monthly rainfall for July, August, and September was 0.5, 0.45, and 2.70 inches, respectively (Table 1). Cumulative rainfall for the Third Quarter was 3.65 inches.

QUARTERLY SAMPLING LABORATORY RESULTS

Thirty-five Shallow zone and thirteen Lower Queen monitoring wells were gauged on July 18, 19, and 20, 1995. Seventeen Lower Queen wells were sampled including plant water supply well, SW-1. Seven of the eight Lower Queen recovery wells yielded condensate when sampled

through downhole pumps set near the total depth of the recovery wells (MW-58, MW-59, MW-61A, MW-62, MW-68, MW-72, and MW-75). Groundwater extraction well MW-65A was not sampled. Three Lower Queen monitoring wells contain condensate (MW-73, MW-74, and MW-76).

Eleven Shallow zone wells were sampled in July. Five of the twenty-five Shallow zone monitoring wells (including two sumps) designated for quarterly sampling in the Treatment Project Plan were sampled (see ***bolded and italicized*** well designations in Table 4). The remaining 20 Shallow zone compliance wells were either dry or bailed dry during sampling (18) or contain condensate (MW-13 and MW-69). Six Shallow zone wells other than those designated in the Treatment Project Plan were sampled (MW-41, MW-43, MW-49, MW-61, MW-77, and MW-79). Eight Shallow zone wells sampled in July indicate chloride concentrations above the State maximum allowable concentration of 250 mg/L (MW-11, MW-41, MW-43, MW-44, MW-49, MW-50, MW-55, and MW-61.

Samples were collected by Groundwater Technology, Inc. using Environmental Protection Agency (EPA) sampling protocol. Analytical Technologies, Inc. performed the BTEX (EPA Method 8020) and chloride (EPA Method 325.2) analyses. Appendix A contains summary tables of groundwater monitoring and sampling data prepared by Groundwater Technology, Inc. from notes recorded during field activities.

Tables 3 and 4 are historical summaries of quarterly benzene concentration data since September 1991 for the Lower Queen and Shallow zone wells, respectively. Benzene concentration (in ug/l) versus time graphs for each routinely sampled monitoring well are provided in Appendix B.

Groundwater samples from the Lyman well (the closest downgradient rancher well to the Shallow zone plume), the Upper Indian Hills Spring West (Hendrickson and Jones, 1952), and the Biebelle rancher well were collected by Marathon Oil Company personnel on July 21, 1995. The rancher well and natural spring samples were obtained using EPA sampling and handling procedures. Concentrations of BTEX and chloride in groundwater collected from the Lyman and Biebelle wells and surface water from the Upper Indian Hills Spring West (Rocky Arroyo spring) did not exceed State or Federal drinking water standards during the quarter (Table 4). Laboratory reports for the rancher wells, Rocky Arroyo spring, and SW-1 are included in Appendix C.

GROUNDWATER PUMPING

Fluid recovery from the Lower Queen aquifer and Shallow zone is metered and reported to the State Engineer Office (SEO) in Roswell, New Mexico on a monthly basis per SEO directive.

The reports filed with the SEO for Third Quarter 1995 are attached in Appendix D. Figures 5, 6, and 7 are stacked bar graphs depicting weekly Lower Queen fluid recovery, weekly Shallow zone fluid recovery, and combined weekly fluid recovery from both zones, respectively.

Eight Lower Queen wells (MW-58, MW-59, MW-61A, MW-62, MW-65A, MW-68, MW-72, and MW-75) were pumped for the purpose of plume containment and condensate recovery. Weekly fluid recovery for each well and the plant supply well, SW-1, is shown in Figure 5. Free-phase hydrocarbon recovered from these wells during the quarter totaled 17.9 barrels. Weekly Shallow zone water and condensate recovery from MW-69 is shown in Figure 6. Free-phase hydrocarbon (condensate) recovery from MW-69 during the Third Quarter totaled 2.1 barrels.

GROUNDWATER TREATMENT AND PRODUCT RECOVERY

Contaminated groundwater and free-phase hydrocarbon (condensate) from seven Lower Queen recovery wells are pumped through underground piping to the treatment compound. The treatment compound includes two aboveground tanks, an oil/water separator used as a storage vessel, and an air stripper. Condensate is skimmed from one of the two aboveground tanks and transferred to the oil/water separator which serves as a condensate storage vessel. Groundwater containing dissolved-phase hydrocarbon is transferred from the first tank to the second aboveground tank. Groundwater from the second tank is pumped through the air stripper to remove dissolved-phase volatile organic compounds. Stripped volatile organic compounds are vented to the atmosphere through a stack. Treated groundwater is transferred from the air stripper to the 1200-barrel aboveground steel tank and is used as process water for the gas plant.

The measured volume of condensate recovered from Lower Queen groundwater during the Third Quarter was 17.9 barrels. Cumulative condensate recovered by the total fluids system since treatment system startup in April 1992 is 137.0 barrels.

Total condensate recovery from the Lower Queen and Shallow zone during the Third Quarter was 20.0 barrels. Cumulative condensate recovered to date excluding the volume volatilized by the air stripper and vapor extraction system is 3,601.1 barrels or 10.3% of the total estimated spill volume.

VAPOR EXTRACTION SYSTEM

The vapor extraction system was not operated during the Third Quarter. On May 5, 1994, the vapor extraction system ceased operation when Marathon determined that a New Mexico Air Pollution Control Bureau air emission permit is required for system operation. The system has not operated since then and is being stored at the gas plant.

REFERENCES CITED

Hendrickson, G. E., and Jones, R. S., 1952, Geology and Ground-water Resources of Eddy County, New Mexico: New Mexico Bureau of Mines & Mineral Resources Ground-water Report 3, 169 p., 4 pls.

TABLES

TABLE 1. LOWER QUEEN DEPTH-TO-WATER, GROUNDWATER ELEVATION, CONDENSATE THICKNESS, AND RAINFALL DATA THIRD QUARTER 1995

LOWER QUEEN WELL	Top of Casing (TOC) Elev. (ft AMSL)	Total Depth from TOC (ft)	July 18, 19, 20, 1995				Aug-95	Sep-95
			Depth to water (ft)	Ground-water Elev. (ft)	Depth to product (ft)	Condensate thickness (in)		
MW-57	3787.70	177.20	158.06	3629.64				
MW-58	3824.31	218.03	p			present		
MW-59	3819.59	211.29	p			present		
MW-60	3815.28	223.00	187.09	3628.19				
MW-61A	3815.97	215.67	p			present		
MW-62	3819.90	224.69	p			present		
MW-63	3826.16	220.49	198.49	3627.67				
MW-64	3798.57	201.89	170.24	3628.33				
MW-65A	3763.26	168.56	p					
MW-66	3828.98	235.18	201.59	3627.39				
MW-67	3765.87	165.77	137.40	3628.47				
MW-68	3797.83	203.43	p			present		
MW-70	3822.57	225.07	194.19	3628.38				
MW-71	3778.05	233.49	150.84	3627.21				
MW-72	3819.32	236.55	p			present		
MW-73	3820.09	~222.5	192.85	3627.24	192.29	6.72		
MW-74	3820.82	~222.5	188.07	3632.75		present		
MW-75	3816.12	~222.5	192.35	3623.77	187.39	59.52		
MW-76	3796.01	~222.5	168.31	3627.70	167.74	6.84		
SW-1	3808.19	255.00	p					
SW-2	3808.79	292.00	181.62	3627.17				
Monthly Rainfall (in)			0.50				0.45	2.70

p = pump present in well
TOC = top of casing
AMSL = above mean sea level

TABLE 2. SHALLOW ZONE DEPTH-TO-WATER, GROUNDWATER ELEVATION, AND CONDENSATE THICKNESS

Shallow Zone Well	TOC Elev. (ft AMSL)	Total Depth from TOC (ft)	July 18, 19, 20, 1995			
			Depth to water (ft)	Ground-water Elev. (ft)	Depth to product (ft)	Condensate thickness (in)
MW-1	3792.50	16.10	NG			
MW-2	3788.82	15.52	NG			
MW-3	3787.50	16.97	DRY			
MW-4	3785.88	18.68	NG			
MW-5	3801.69	13.05	DRY			
MW-6	3785.17	14.25	DRY			
MW-7	3784.46	17.35	DRY			
MW-8	3795.04	17.38	DRY			
MW-9	3807.85	13.79	DRY			
MW-10	3790.78	18.52	DRY			
MW-11	3806.96	24.85	23.80	3783.16		
MW-12	3809.86	25.21	NG			
MW-13	3801.58	22.07	20.36	3781.22	20.23	1.56
MW-14	3803.93	24.30	NG			
MW-15	3803.59	19.47	NG			
MW-16	3801.04	22.66	NG			
MW-17	3799.55	19.75	NG			
MW-18	3795.82	17.42	NG			
MW-19	3797.21	19.11	NG			
MW-20	3797.59	16.89	NG			
MW-21	3798.21	23.31	NG			
MW-22	3799.20	17.30	NG			
MW-23	3794.48	12.08	NG			
MW-24	3794.09	13.30	DRY			
MW-25	3786.97	10.27	NG			
MW-26	3793.01	21.11	NG			
MW-27	3790.93	18.23	NG			
MW-28	3797.03	18.59	NG			
MW-29	3794.06	14.76	DRY			
MW-30	3788.30	14.82	NG			
MW-31	3791.15	19.93	NG			
MW-32	3797.47	15.70	DRY			
MW-33	3802.48	20.29	NG			
MW-34	3806.00	19.97	NG			
MW-35	3800.81	20.71	NG			
MW-36	3792.94	8.77	NG			
MW-37	3795.03	20.83	NG			
MW-38	3797.32	20.57	DRY			
MW-39	3796.20	20.54	19.84	3776.36		
MW-40	3803.12	14.07	NG			
MW-41	3799.04	24.04	19.82	3779.22		
MW-42	3804.73	23.59	NG			
MW-43	3802.05	24.55	21.53	3780.52		
MW-44	3804.14	25.24	22.26	3781.88		
MW-45	3808.68	26.62	22.13	3786.55		
MW-46	3805.54	20.24	19.55	3785.99		
MW-47	3805.09	21.79	DRY			
MW-48	3806.18	19.98	DRY			
MW-49	3805.61	25.91	22.94	3782.67		
MW-50	3813.35	37.15	27.37	3785.98		
MW-51	3810.86	20.06	NG			
MW-52	3817.49	21.44	DRY			
MW-53	3809.92	15.32	DRY			
MW-54	3823.86	78.15	46.96	3776.90		
MW-55	3794.40	66.32	30.65	3763.75		
MW-56	3782.45	43.76	DRY			
MW-61	3816.20	57.97	36.72	3779.48		
MW-65	3763.31	57.35	57.14	3706.17		
MW-69p	3805.11	51.27	NG			present
MW-77	3775.48	82.20	80.04	3695.44		
MW-78	3785.82	86.62	86.32	3699.50		
MW-79	3788.39	82.90	77.32	3711.07		
MW-80	3821.64	91.80	DRY			
Sump A10		13.32	DRY			
Sump 16A	3785.14	17.45	17.32	3767.82		

p = pump present in well
NG = Not Gauged

AMSL = *Above Mean Sea Level*
TOC = Top of Casing datum

TABLE 3
HISTORICAL SUMMARY OF BENZENE CONCENTRATION IN LOWER QUEEN GROUNDWATER
THIRD QUARTER 1995

	Benzene (ug/L) using EPA Method 8020 unless indicated otherwise															
WELL	Sep-91	Dec-91	Apr-92	Jul-92	Oct-92	Jan-93	Apr-93	Jul-93	Oct-93	Jan-94	Apr-94	Jul-94	Oct-94	Jan-95	Apr-95	Jul-95
MW-57	1600	350	150	948**	15.1*	21*	8*	6*	<0.5	<0.5	<0.5	0.7	1.1	4.3	<0.5	<0.5
MW-58	40	90	202**	178**	190*	192*	55*	25*	50*	FP	<2.5	2.0	6.7	FP	2.2	FP
MW-59	540	420	40.4**	268**	98.8*	26*	10*	FP	10*	FP	<2.5	13	4.1	FP	FP	FP
MW-60	33	<1	3.5**	19**	31.7*	138*	17*	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-61A	190	10	5.0**	359**	470.1*	585*	2821*	FP	FP	FP	<0.5	<0.5	4.8	16	FP	FP
MW-62	2200	1400	257.5**	357**	212.3*	78*	33*	98*	10*	4.1	<2.5	4.3	13	FP	7.5	FP
MW-63	<1	<1	4.1**	12**	4.3*	12*	7*	4*	14*	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5
MW-64	150	130	233**	115**	14	15*	5*	2	18*	1.7	<0.5	<0.5	<0.5	12	18	17
MW-65A	680	150	25.3**	413**	10.6*	3*	4*	<1*	7*	<0.5	<0.5	<0.5	1.7	<0.5	<0.5	NS
MW-66	<1	<1	3.3**	8**	12.1*	3*	<3*	8*	13*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-67	280	320	4.3*	103**	2.6*	8*	7*	7*	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	1.8	<0.5
MW-68	240	1900	1865**	160**	2208.2**	376*	1890*	150	374*	3000	120	260	FP	FP	FP	FP
MW-70	<1	<1	1.7**	<1	10.7*	<3*	9*	<1*	25*	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5
MW-71	NI	NI	NI	NI	NI	NI	NI	NI	8*	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5
MW-72	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	<2.5	18	FP	FP	FP	FP
MW-73	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	FP
MW-74	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	FP
MW-75	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	FP
MW-76	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	FP	FP	FP
SW-1	<1	<1	5*	17.5*	15.7*	6*	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
SW-2	<1	<1	7.9*	7*	69.4*	47*	4	NS	NS	NS	NS	NS	NS	<0.5	NS	NS
Max. Conc.	2200	1900	1865	948	2208	585	2821	2821	2821	3000	120	260	FP	FP	FP	FP

* High Performance Liquid Chromatography (HPLC)
** Average of more than one sample result using HPLC.

FP = Free Product (Condensate)
NS = Not Sampled
NI = Not Installed

TABLE 4. HISTORICAL SUMMARY OF BENZENE IN SHALLOW GROUNDWATER

	Benzene (ug/L) using EPA Method 8020 unless indicated otherwise															
WELL	**Sep-91**	**Dec-91**	**Apr-92**	**Jul-92**	**Oct-92**	**Jan-93**	**Apr-93**	**Jul-93**	**Oct-93**	**Jan-94**	**Apr-94**	**Jul-94**	**Oct-94**	**Jan-95**	**Apr-95**	**Jul-95**
MW-1	250	200	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-2	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-3	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-4	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-5	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-6	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***
MW-7	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-8	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-9	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-10	***2300***	***2300***	***1780****	***1842****	***2100***	***NS***	***NS***	***DRY***	***DRY***	***BD***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-11	***3000***	***3800***	***3087****	***2199****	***2942****	***2746****	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***1800***	***DRY***	***NS***	***95***
MW-12	3800	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-13	***3100***	***3000***	***3492****	***2708****	***NS***	***NS***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***PUMP***	***FP***	***FP***	***FP***
MW-14	5100**	NS	NS	NS	NS	NS	PUMP	PUMP	FP	FP	NS	NS	NS	NS	NS	NS
MW-15	5100	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-16	1700	NS	NS	NS	NS	NS	514*	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-17	2000	NS	NS	NS	NS	NS	1500	DRY	DRY	NS	NS	NS	NS	NS	NS	NS
MW-18	4300	NS	2639**	2700	3300	NS	NS	DRY	VE	VE	VE	VE	NS	NS	NS	NS
MW-19	***4700***	***NS***	***3195****	***3000***	***3032****	***NS***	***3926****	***DRY***	***VE***	***VE***	***VE***	***VE***	***NS***	***NS***	***NS***	***NS***
MW-20	110	NS	NS	NS	NS	NS	NS	DRY	VE	VE	VE	VE	NS	NS	NS	NS
MW-21	1000	1100	NS	NS	NS	NS	114*	FP	NS	DRY	NS	NS	NS	NS	NS	NS
MW-22	4	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-23	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-24	***3400***	***NS***	***NS***	***4353****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-25	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-26	3100	3000	NS	2000	1992*	1708*	861*	FP	FP	FP	NS	NS	NS	NS	NS	NS
MW-27	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-28	2200	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-29	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-30	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-31	<1	NS	NS	332**	9*	NS	NS	DRY	DRY	NS	NS	NS	NS	NS	NS	NS
MW-32	***200***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-33	6300	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-34	2500	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-35	5700	NS	NS	NS	NS	NS	NS	FP	FP	FP	NS	NS	NS	NS	NS	NS

Bolded Italicized well numbers = Designated wells for quarterly sampling in Marathon Treatment Plan (March 1992)

* High Performance Liquid Chromatography (HPLC)

** Average of more than one sample result using HPLC.

NI = Not Installed

OCl = only Chloride sample

FP = Free Product (condensate)

NS = Not Sampled

VE = Vapor Extraction well

TABLE 4. HISTORICAL SUMMARY OF BENZENE IN SHALLOW GROUNDWATER (Continued)

	Benzene (ug/L) using EPA Method 8020 unless indicated otherwise															
WELL	**Sep-91**	**Dec-91**	**Apr-92**	**Jul-92**	**Oct-92**	**Jan-93**	**Apr-93**	**Jul-93**	**Oct-93**	**Jan-94**	**Apr-94**	**Jul-94**	**Oct-94**	**Jan-95**	**Apr-95**	**Jul-95**
MW-36	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-37	150	NS	NS	NS	NS	NS	NS	27*	DRY	NS	NS	NS	NS	NS	NS	NS
MW-38	***15***	***15***	***51****	***37****	***166****	***NS***	***NS***	***DRY***	***BD***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-39	880	NS	NS	NS	NS	14	29*	24*	DRY	<2.5	<0.5	<0.5	DRY	<5.0	NS	NS
MW-40	NS	NS	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-41	200	170	NS	NS	NS	NS	NS	22*	DRY	5.3	0.6	1.4	3.2	13	4.8	<0.5
MW-42	<1	<1	NS	NS	NS	NS	NS	NS	DRY	NS	NS	NS	NS	NS	NS	NS
MW-43	320	NS	NS	NS	NS	NS	NS	25*	DRY	<0.5	<0.5	<0.5	0.8	3	0.6	3
MW-44	***59***	***NS***	***10****	***97****	***12***	***14***	***7****	***6****	***3****	***12***	***22***	***36***	***130***	***63***	***19***	***5.8***
MW-45	<1	<1	NS	NS	NS	NS	NS	<3*	<3*	<0.5	<0.5	<0.5	NS	NS	NS	NS
MW-46	140	25	NS	NS	NS	NS	NS	NS	DRY	NS	NS	DRY	NS	NS	NS	NS
MW-47	2600	2200	NS	NS	NS	NS	NS	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MW-48	***<1***	***<1***	***NS***	***47****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-49	35	NS	NS	NS	NS	NS	NS	210*	68*	13	82	150	78	220	120	17
MW-50	***<1***	***<1***	***4****	***4****	***8****	***8****	***<1***	***<3****	***9****	***<0.5***	***<0.5***	***<0.5***	***<0.5***	***<0.5***	***<0.5***	***<0.5***
MW-51	800	<1	NS	NS	NS	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
MW-52	***<1***	***NS***	***NS***	***5****	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-53	***<1***	***NS***	***NS***	***NS***	***NS***	***NS***	***NS***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-54	***<1***	***<1***	***9****	***8****	***62****	***14****	***10****	***<3****	***17****	***8.6***	***<0.5***	***15***	***19***	***<0.5***	***<0.5***	***<0.5***
MW-55	***940***	***400***	***296****	***483****	***215****	***390***	***412****	***625****	***581****	***290***	***370***	***360***	***910***	***650***	***420***	***350***
MW-56	***2200***	***1000***	***NS***	***1114****	***1026****	***1128****	***VE***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***
MW-61	<1	NS	NS	NS	NS	NS	NS	NS	NS	1.4	<0.5	3.2	<5.0	<0.5	<0.5	<0.5
MW-65	<1	NS	NS	NS	NS	NS	NS	<3*	DRY	DRY	DRY	NS	<0.5	NS	NS	NS
MW-69	***2400***	***2100***	***NS***	***568****	***1598****	***1284****	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***
MW-77	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NS	NS	<0.5
MW-79	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	110	14	<5
SUMP A10	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***FP***	***DRY***	***DRY***	***DRY***	***DRY***	***NS***	***OCI***	***DRY***	***DRY***	***DRY***
SUMP A11	1400	2900	3033**	1258**	2815*	NS	NS	DRY	DRY	DRY	NS	NS	NS	NS	NS	NS
SUMP 16A	***240***	***2000***	***1233****	***1495****	***632****	***741****	***707****	***DRY***	***DRY***	***DRY***	***DRY***	***DRY***	***170***	***2.0***	***NS***	***DRY***
Lyman								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
U. Indian Hills Spring West	<1	<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Biebelle								<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Bolded Italicized well numbers = Designated wells for quarterly sampling in Marathon Treatment Plan (March 1992)

* High Performance Liquid Chromatography (HPLC)

** Average of more than one sample result using HPLC.

NI = Not Installed

OCI = only Chloride sample

FP = Free Product (condensate)

NS = Not Sampled

VE = Vapor Extraction well

FIGURES

Figure 1.
July 1995 Lower Queen Potentiometric Surface
SURFER 5.0 Kriging Function
(assumes 7 ft of drawdown in MW-72
and ~3 ft of drawdown in other recovery wells)

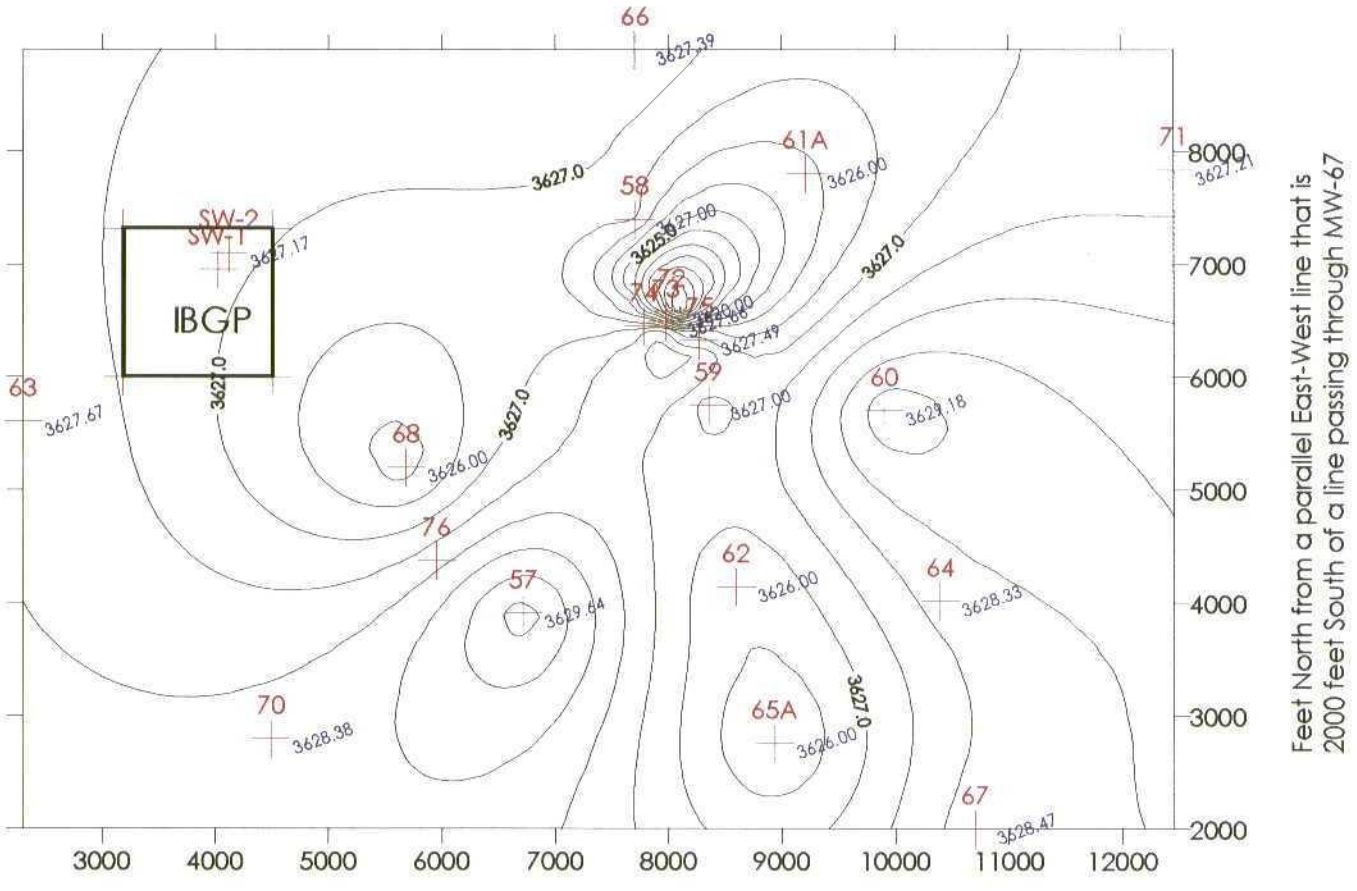


Figure 2. Lower Queen Groundwater Elevation vs. Time

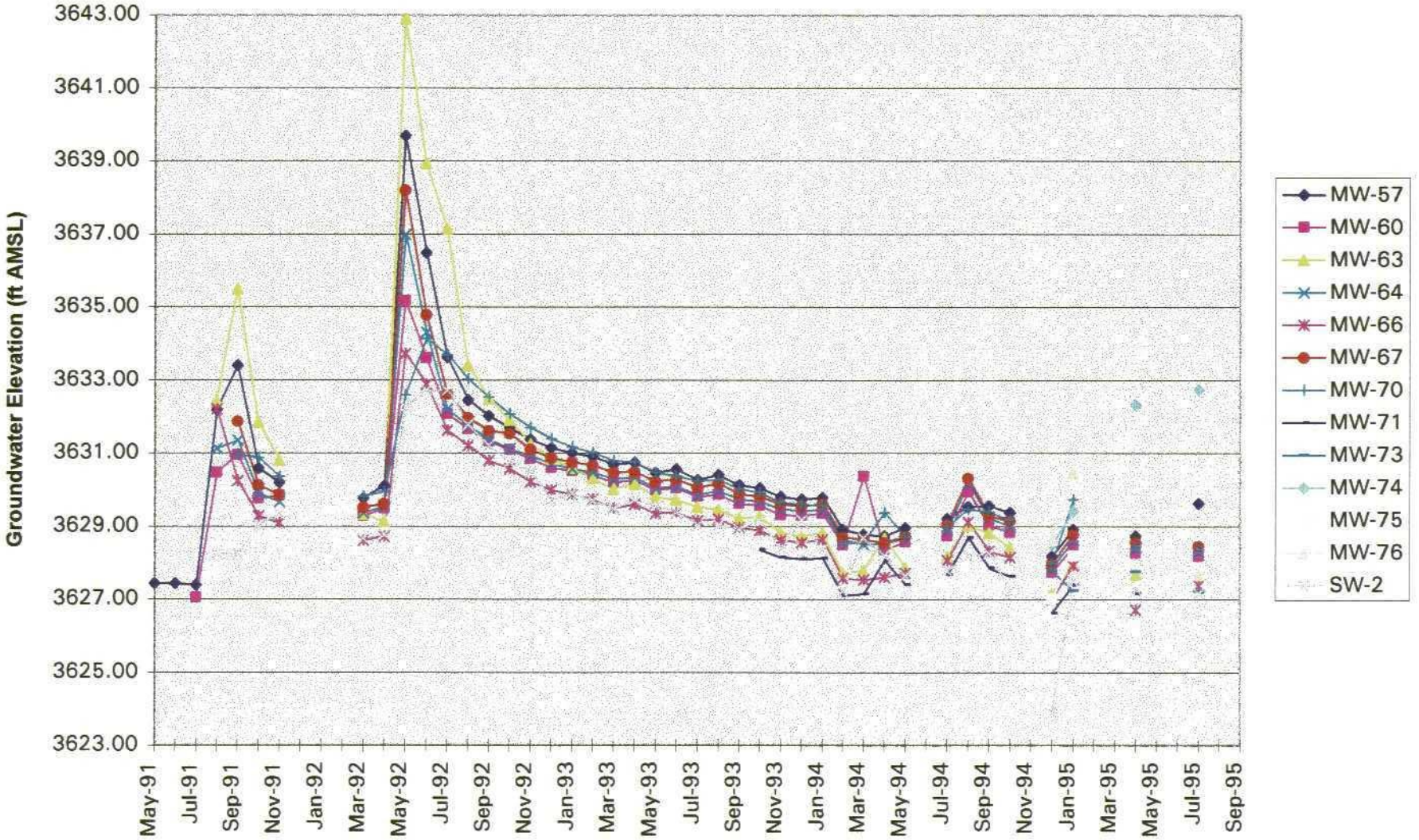


Figure 3.
July 1995 Shallow zone Potentiometric Surface
SURFER 5.0 Kriging Function
Contour Interval=5 feet
Datum is Mean Sea Level

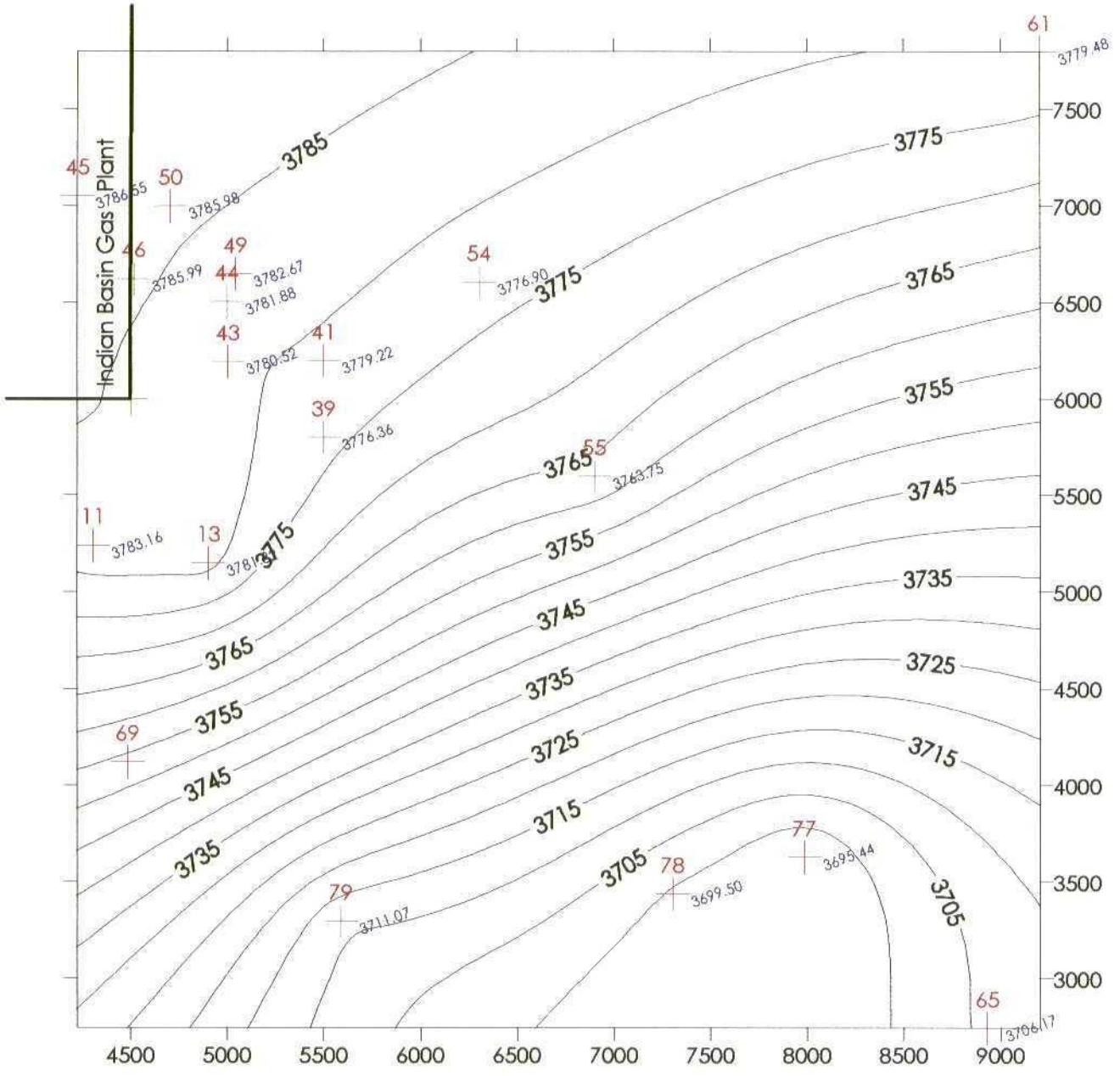


Figure 4. Shallow Zone Groundwater Elevation vs. Time

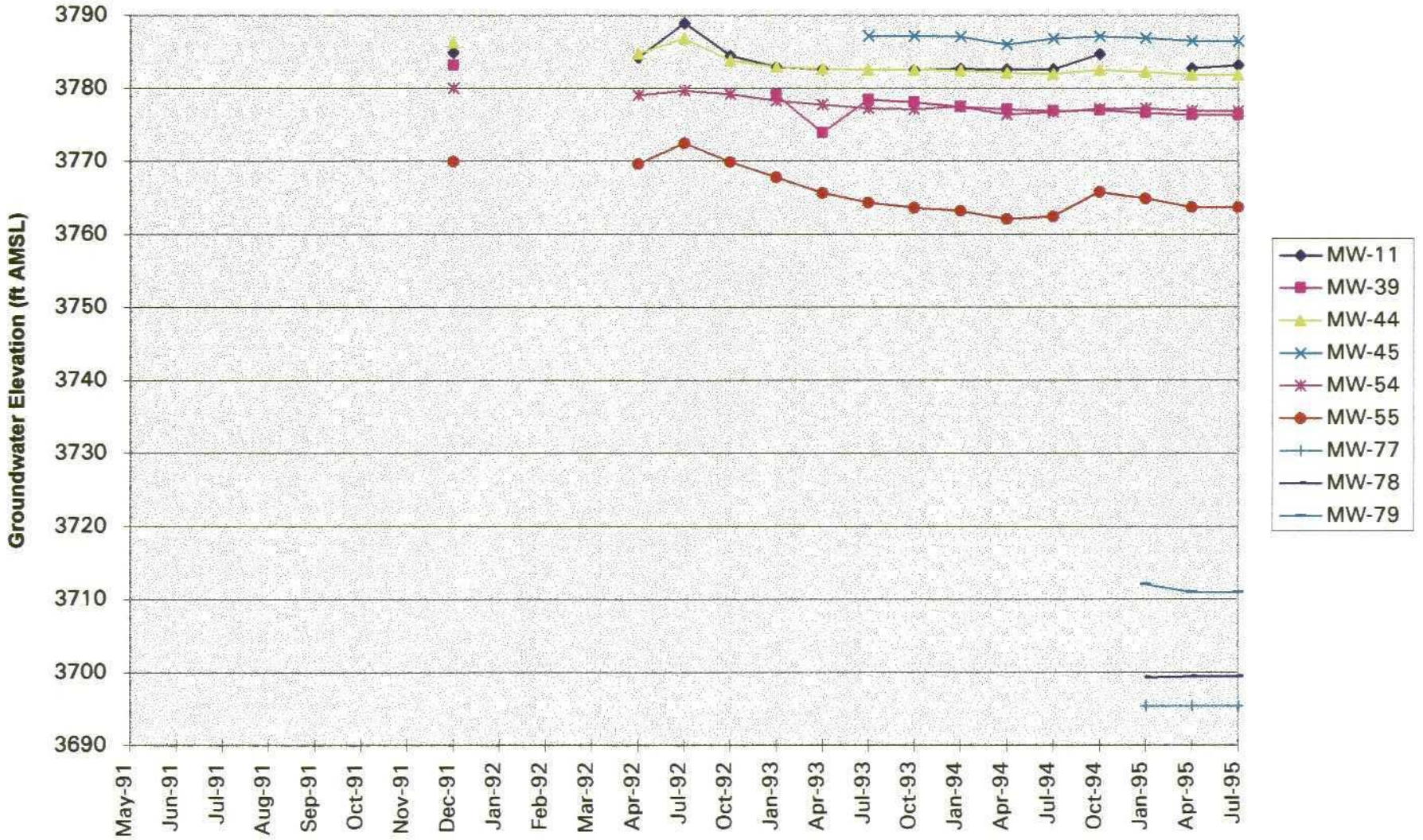
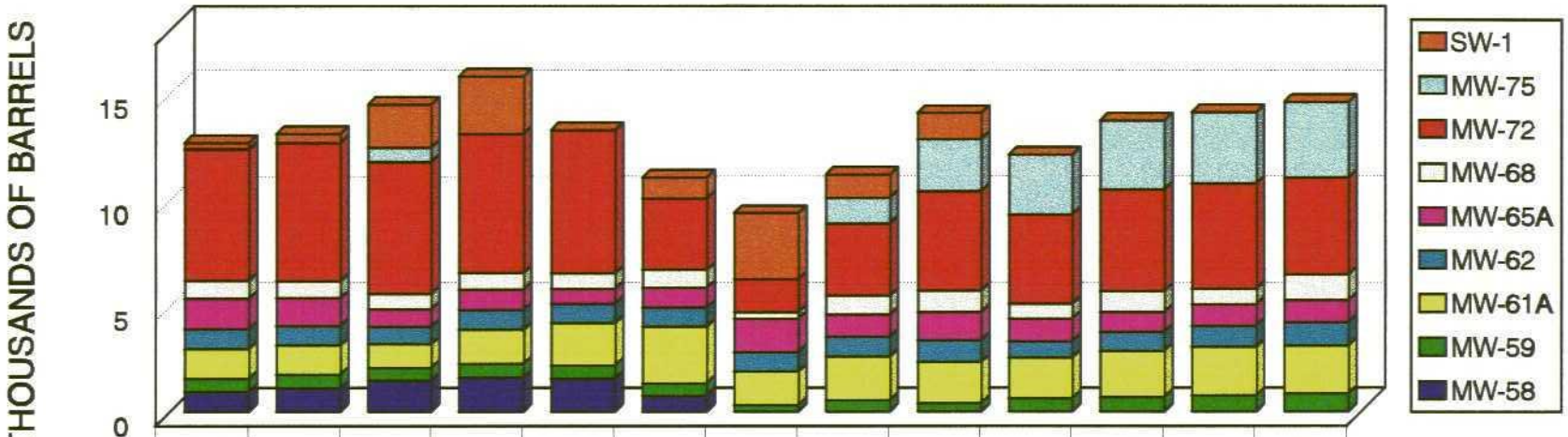


FIGURE 5

WEEKLY LOWER QUEEN FLUID RECOVERY
THIRD QUARTER 1995



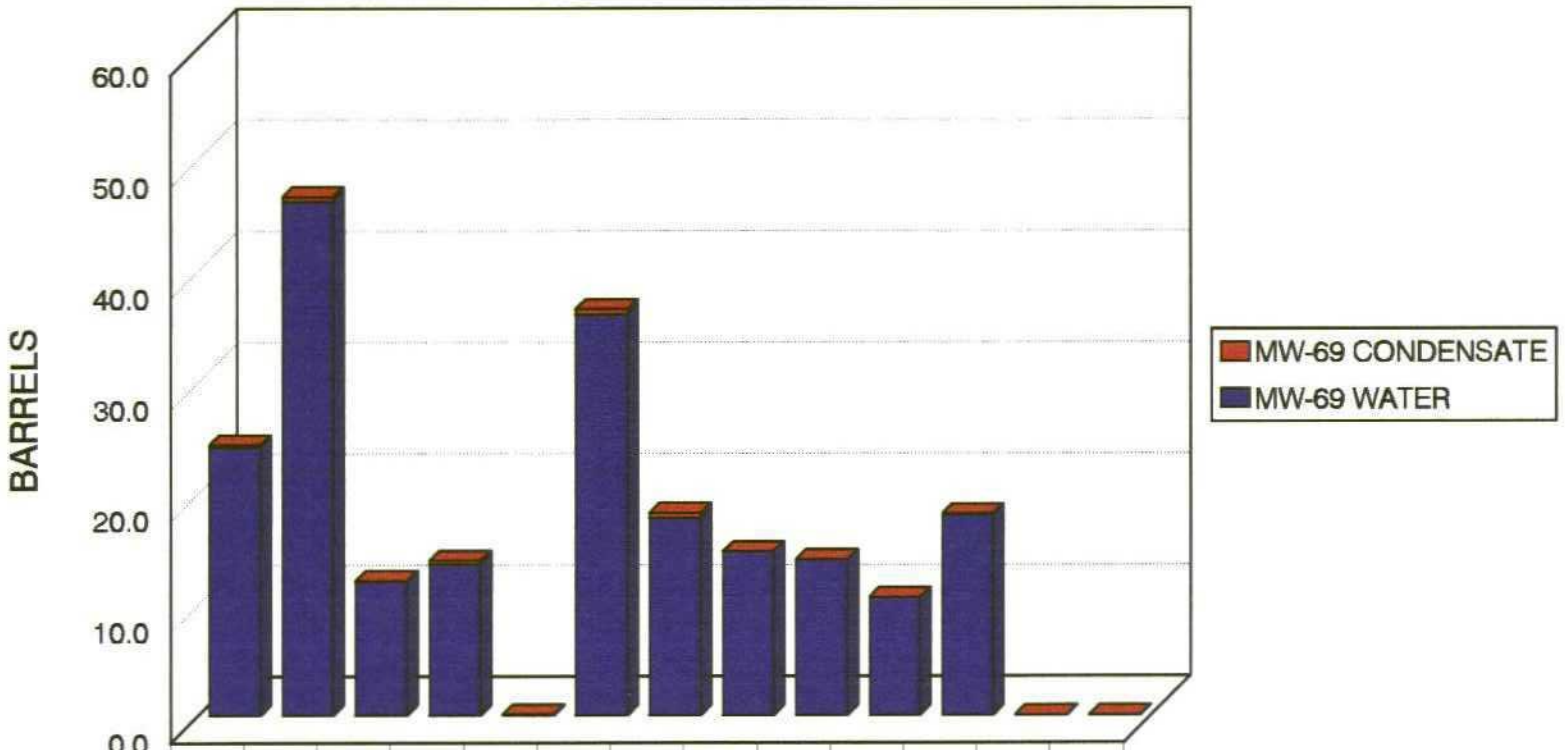
	7/10	7/17	7/24	7/31	8/7	8/14	8/21 95	8/28	9/4	9/11	9/18	9/25	10/2
SW-1	0.2874	0.4374	2.0317	2.7148	0	0.9994	3.1242	1.0865	1.2311	0	0	0	0
MW-75	0.04	0	0.6817	0	0	0	0	1.2083	2.4532	2.8125	3.2521	3.3602	3.558
MW-72	6.1562	6.5162	6.2127	6.5535	6.7398	3.3637	1.5502	3.4086	4.6709	4.2073	4.8017	4.9539	4.5544
MW-68	0.8619	0.7921	0.7377	0.7685	0.7336	0.8444	0.2957	0.8897	1.0146	0.7124	0.9674	0.7374	1.2238
MW-65A	1.4401	1.3198	0.8177	0.9767	0.7148	0.9333	1.5799	1.0513	1.3253	1.0721	0.9514	1.0174	1.0414
MW-62	0.9241	0.9003	0.8239	0.9088	0.8999	0.8955	0.9263	0.9201	1.0361	0.7492	0.8946	0.9817	1.0922
MW-61A	1.4142	1.3867	1.1201	1.6305	1.9892	2.6688	1.5709	2.0545	1.9304	1.9329	2.1661	2.2957	2.2756
MW-59	0.621	0.6333	0.5796	0.6475	0.6362	0.5904	0.2996	0.5368	0.3956	0.6117	0.6757	0.7446	0.8301
MW-58	0.9217	1.1042	1.4709	1.5924	1.5403	0.7337	0	0	0	0	0	0	0

METER RECORDING DATE

WKLQREC3Q

FIGURE 6

WEEKLY SHALLOW ZONE FLUID RECOVERY
THIRD QUARTER 1995



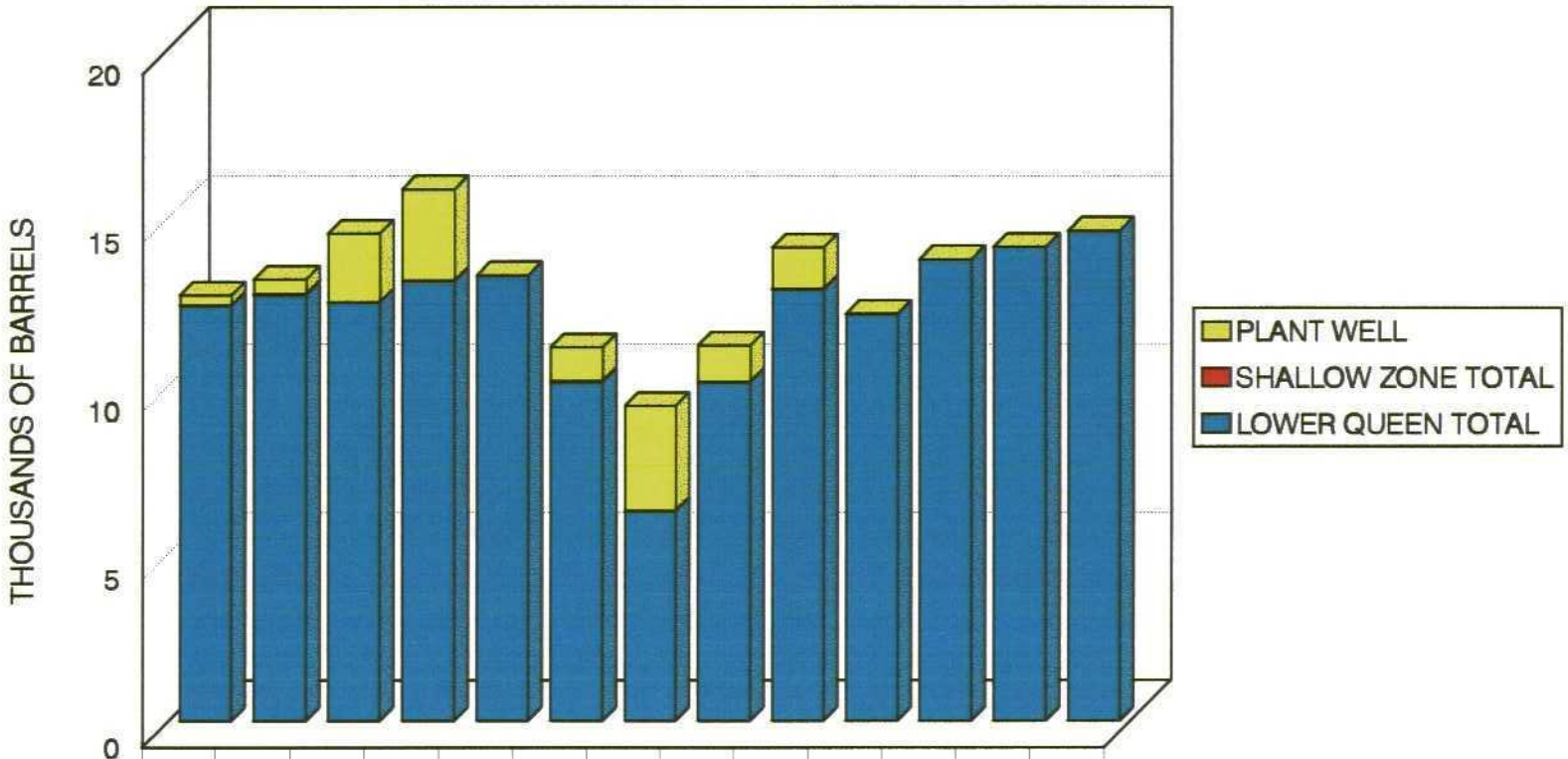
	7/10/95	7/17/95	7/24/95	7/31/95	8/7/95	8/14/95	8/21/95	8/28/95	9/4/95	9/11/95	9/18/95	9/25/95	10/2/95
MW-69 CONDENSATE	0.2	0.4	0.1	0.3	0.0	0.5	0.5	0.0	0.0	0.0	0.1	0.0	0.0
MW-69 WATER	24.1	46.2	12.0	13.6	0.1	36.0	17.7	14.7	14.0	10.6	18.0	0.0	0.0

METER RECORDING DATE

WKSZREC3Q

FIGURE 7

WEEKLY TOTAL FLUID RECOVERY
THIRD QUARTER 1995



	7/10	7/17	7/24	7/31	8/7	8/14	8/21 95	8/28	9/5	9/11	9/18	9/25	10/2
PLANT WELL	0.2874	0.4374	2.0317	2.7148	0	0.9994	3.1242	1.0865	1.2311	0	0	0	0
SHALLOW ZONE TOTAL	0.0243	0.0466	0.0121	0.0139	0.0001	0.0365	0.0182	0.0147	0.014	0.0106	0.018	0	0
LOWER QUEEN TOTAL	12.3392	12.6526	12.4443	13.0779	13.2538	10.0628	6.2226	10.0693	12.8261	12.0981	13.709	14.0909	14.5755

METER RECORDING DATE

WKREC3Q

APPENDIX A

JULY 1995 GAUGING, PURGING, AND SAMPLING FIELD SUMMARY

GROUNDWATER TECHNOLOGY ®

Groundwater Technology, Inc.
2501 Yale Boulevard, SE, Suite 204, Albuquerque, NM 87106 USA
Tel: (505) 242-3113 Fax: (505) 242-1103

August 8, 1995

Project No. 023350059

Mr. Robert J. Menzie, Jr.
Marathon Oil Company
P.O. Box 552
Midland, TX 79702-5233

RE: Transmittal of Groundwater Monitoring and Sampling Reports, Quarter 3 Data

Dear Mr. Menzie:

Enclosed for your use are summary tables of groundwater monitoring and sampling data collected in July 1995 during the 3rd Quarter Groundwater Sampling. If you have any questions regarding this data, or require any additional information or services, please do not hesitate to contact me at (505) 242-3113.

Sincerely,

Groundwater Technology, Inc.

Sara C. Brothers
Project Manager

cc: Project File

Well Gauging Data Form

Client:	Marathon Oil Company	**Recorded By:**	Charles Madewell
Site:	Indian Basin Remediation Project	**Interface Probe (IP)#:**	06-02432 ORS-Rental
Project #:	053350059.6003	**IP Correcton:**	0.00
Date:	07/18-20/95	**Weather:**	Sunny, hot

WELL NUMBER	WELL DIA. (inch)	TIME OF READING (HH:MM)	TOTAL DEPTH (feet)	DTW (feet)	DTP (feet)	PT (feet)	PTx0.73 (feet)	ADJ DTW (feet)	H_2S CONC. (ppm)	HYDROCARBON VAPOR CONC. (ppm)	COMMENTS
MW-70	4	08:35	228.14	194.19	ND	0.00	0.00	NA	0	0	
MW-80	8	08:40	91.80	DRY	ND	0.00	0.00	NA	0	0	
MW-53	2	09:28	15.20	DRY	ND	0.00	0.00	NA	0	0	
MW-69	4	--	*	--	--	--	--	--	--	--	Pump in well
MW-09	2	08:54	13.65	DRY	ND	0.00	0.00	NA	0	0	
MW-08	2	08:59	17.24	DRY	ND	0.00	0.00	NA	0	51.4	
MW-79	8		82.90	68.86	ND	0.00	0.00	NA	0	67	Time 09:07
MW-07	2	09:10	17.33	DRY	ND	0.00	0.00	NA	0	0	
MW-06	2	09:17	14.18	DRY	ND	0.00	0.00	NA	0	0	
MW-63	4	14:10	221.88	198.49	ND	0.00	0.00	NA	0	0	
SW-02	10	13:05	292.00	181.62	ND	0.00	0.00	NA	0	0	7/20/95
MW-52	2	12:35	21.19	DRY	ND	0.00	0.00	NA	0	5	7/20/95
MW-71	4	16:05	235.41	150.84	ND	0.00	0.00	NA	0	0	
MW-61A	4	--	215.67	--	ND	0.00	0.00	NA	--	--	Pump in Well
MW-61	4	14:11	57.97	37.67	ND	0.00	0.00	NA	0	0	7/20/95
MW-66	4	07:35	237.66	201.59	ND	0.00	0.00	NA	0	0	7/19/95
MW-60	4	17:26	226.08	187.09	ND	0.00	0.00	NA	0	0	
MW-64	4	17:35	204.38	170.24	ND	0.00	0.00	NA	0	0	
MW-67	4	06:30	168.54	137.40	ND	0.00	0.00	NA	0	0	7/19/95
MW-65	4	09:10	57.45	57.10	ND	0.00	0.00	NA	0	0	7/20/95 - TD 57.45
MW-77	8	15:15	82.20	79.75	ND	0.00	0.00	NA	0	0	7/20/95
MW-78	8	15:21	86.62	86.25	ND	0.00	0.00	NA	0	0	7/20/95
MW-57	4	06:40	176.60	159.06	ND	0.00	0.00	NA	0	0	7/19/95 - TD 176.60
MW-55	4	06:43	66.32	31.81	ND	0.00	0.00	NA	0	0	7/19/95
MW-56	4	15:10	43.76	DRY	ND	0.00	0.00	NA	0	700	7/20/95
MW-03	2	15:05	16.90	DRY	ND	0.00	0.00	NA	0	0	7/20/95
MW-10	4	14:45	18.52	18.22	ND	0.00	0.00	NA	0	0	7/20/95 - TD 18.32

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Well Gauging Data Form

Client:	Marathon Oil Company	**Recorded By:**	Charles Madewell
Site:	Indian Basin Remediation Project	**Interface Probe (IP)#:**	06-02432 ORS-Rental
Project #:	053350059.6003	**IP Correcton:**	0.00
Date:	07/18-20/95	**Weather:**	Sunny, hot

WELL NUMBER	WELL DIA. (inch)	TIME OF READING (HH:MM)	TOTAL DEPTH (feet)	DTW (feet)	DTP (feet)	PT (feet)	PTx0.73 (feet)	ADJ DTW (feet)	H_2S CONC. (ppm)	HYDROCARBON VAPOR CONC. (ppm)	COMMENTS
MW-29	2	14:48	14.76	DRY	ND	0.00	0.00	NA	0	0	7/20/95
SUMP-16A	24	14:55	17.45	DRY	ND	0.00	0.00	NA	0	17.2	7/20/95
MW-54	4	14:00	78.15	47.54	ND	0.00	0.00	NA	0	0	7/20/95
MW-05	2	13:42	13.10	DRY	ND	0.00	0.00	NA	0	0	7/20/95 - TD 13.10
MW-24	2	13:37	13.30	13.25	ND	0.00	0.00	NA	0	0	7/20/95 - TD 13.30
MW-39	4	13:32	20.45	19.97	ND	0.00	0.00	NA	0	0	7/20/95 - TD 20.45
MW-38	4	13:28	20.45	DRY	ND	0.00	0.00	NA	0	0	7/20/95 - TD 20.45
MW-41	4	13:25	24.04	20.29	ND	0.00	0.00	NA	0	0	7/20/95
MW-43	4	13:22	24.55	21.64	ND	0.00	0.00	NA	0	0	7/20/95
MW-44	4	13:19	25.24	22.64	ND	0.00	0.00	NA	0	0	7/20/95
MW-49	2	13:15	25.91	22.92	ND	0.00	0.00	NA	0	0	7/20/95
MW-32	2	13:47	15.70	DRY	ND	0.00	0.00	NA	0	0	7/20/95
MW-11	4	12:45	24.85	23.80	ND	0.00	0.00	NA	0	0	7/20/95
SUMP-A10	24	12:40	13.42	DRY	ND	0.00	0.00	NA	0	2	7/20/95
MW-48	2	12:50	19.98	DRY	ND	0.00	0.00	NA	0	0	7/20/95
MW-47	2	12:55	21.79	DRY	ND	0.00	0.00	NA	0	20	7/20/95
MW-46	4	12:59	19.70	19.56	ND	0.00	0.00	NA	0	35	7/20/95 - TD 19.70
MW-50	2	13:12	37.15	27.24	ND	0.00	0.00	NA	0	0	7/20/95
MW-45	2	-	26.62	--	ND	0.00	0.00	NA	0	--	7/20/95 Piping in well, not gauged
MW-76	8	8:10	220.00	168.31	167.74	0.57	0.42	168.73	0	0	7/19/95
MW-74	8	6:47	220.00	188.07	ND	0.00	0.00	NA	0	271/LEL 100%	7/19/95
MW-73	8	6:52	220.00	192.85	192.29	0.56	0.41	193.26	0	368	7/19/95 - LEL 100%
MW-75	8	7:50	220.00	192.35	187.36	4.99	3.64	195.99	0	N/A	7/19/95 * Pump - not able to gauge
MW-13	2	13:52	22.07	20.36	20.23	0.13	0.09	20.45	0	0	7/20/95

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Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico

Date: 7/18-19/95

Project Number 053350059.6003

Technician: Charles Madewell

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (us/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-63	4	221.88	198.49	47	Pump	14:44	50	220	3.5	7/18/95, 15:45	7.62	577	72.2	--	MW-63
MW-66	4	237.66	201.59	72	Pump	08:50	80	235	3.1	7/19/95, 09:50	7.30	982	68.5	--	MW-66
MW-70	4	228.14	194.19	68	Pump	12:03	72	223	4.5	7/18/95, 13:00	7.96	550	72.1	--	MW-70
MW-71	4	235.41	150.84	170	Pump	17:18	170	222	1 - 4	07/18/95, 20:10	7.34	1110	72.5	--	MW-71

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).
2 - Purge amounts are 3 well casing volumes
3 - NS: Not sampled; NA: Not Applicable

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gpsm.frm

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico

Date: 7/19-21/95

Project Number 053350059.6003

Technician: Charles Madewell

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (us/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-39	4	20.45	19.97	Insufficient water	Insufficient water	--	--	--	--	--	--	--	--	--	NS
MW-54	4	78.15	47.54	61	Bail	11:15	42	NA	NA	7/21/95, 17:46	6.67	3300	68.2	--	MW-54
MW-60	4	226.08	187.09	80	Pump	11:23	80	220	5	7/19/95, 12:15	7.35	939	71.2	--	MW-60
MW-61A	4	215.67	Pump in well	Pump in well	Pump in well	--	--	--	--	--	--	--	--	--	NS
MW-64	4	204.38	170.24	68	Pump	13:48	70	200	6.4	7/19/95, 14:90	7.38	863	70.1	--	MW-64

Comments:

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).
2 - Purge amounts are 3 well casing volumes
3 - NS: Not sampled; NA: Not Applicable
4 - *Well MW-39 not sampled due to insufficient water in well.

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Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico

Date: 7/20-21/95

Project Number 053350059.6003

Technician: Charles Madewell

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (us/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
MW-41	4	24.04	20.29	7.5	Bail	14:45	5	NA	NA	7/21/95, 17:15	6.55	2310	70.7	--	MW-41
MW-43	4	24.55	21.64	6	Bail	14:30	2.5	NA	NA	7/21/95, 17:07	6.93	2420	70.2	--	MW-43
MW-44	4	25.24	22.64	5.5	Bail	14:21	5.5	NA	NA	7/21/95, 16:58	6.75	2720	70.0	--	MW-44
MW-49	2	25.91	22.92	1.5	Bail	14:05	1.5	NA	NA	7/21/95, 16:43	6.58	4650	71.2	--	MW-49
MW-50	2	37.15	27.24	5	Bail	13:50	5	NA	NA	7/21/95, 16:35	6.86	4920	72.4	--	MW-50
MW-55	4	66.32	31.81	70	Pump	11:12	70	66	7.5	7/20/95, 11:50	7.20	2360	69.9	--	MW-55
MW-57	4	179.30	159.06	41	Pump	09:58	43.8	176	7.3	7/20/95, 10:30	7.12	748	69.6	--	MW-57
MW-61	4	57.97	37.67	41	Bail	12:10	41	NA	NA	7/21/95, 17:56	6.73	3880	70.1	--	MW-61
MW-65	4	57.45	57.10	Insufficient Water	--	--	--	--	--	--	--	--	--	--	NS
MW-67	4	168.54	137.40	63	Pump	08:16	68	165	8.5	7/20/95, 09:00	7.47	718	68.1	--	MW-67
MW-77	8	82.20	79.75	20	Bail	13:20	5	NA	NA	7/21/95, 18:12	6.88	1212	72.8	--	MW-77
MW-79	8	82.90	68.86	112	Pump	09:35	25	82	2.7	7/21/95, 10:15	7.16	938	73.2	--	MW-79

1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).
2 - Purge amounts are 3 well casing volumes
3 - NS: Not sampled; NA: Not Applicable

Well Gauging, Purging, and Sampling Monitoring Form

Project Name/Location MOC/IBGP Carlsbad, New Mexico

Date: 7/21/95

Project Number 053350059.6003

Technician: Charles Madewell

Well Number	Well Diameter (in)	Well Depth (ft)	DTW from TOC (ft)	Purge volume (gal)	Purge Method (pump/bail)	Time purging began (hh:mm)	Actual volume purged (gal)	Depth of pump (ft)	Pumping rate (gpm)	Date/time sample collected (dd/mm/yy, HH:MM)	Final pH	Final Spec. Cond. (mohms/cm)	Final Temp. (F)	Final DO (mg/l)	Sample ID
SUMP-16A	24	17.45	DRY	--	--	--	--	--	--	--	--	--	--	--	NS
SW-02	10	292.00	181.62	NS	--	--	--	--	--	--	--	--	--	--	NS
MW-11	4	24.77	23.80	2	Bail	08:00	1.5	NA	NA	7/21/95, 17:30	6.85	1972	71.4	--	MW-11

Comments:

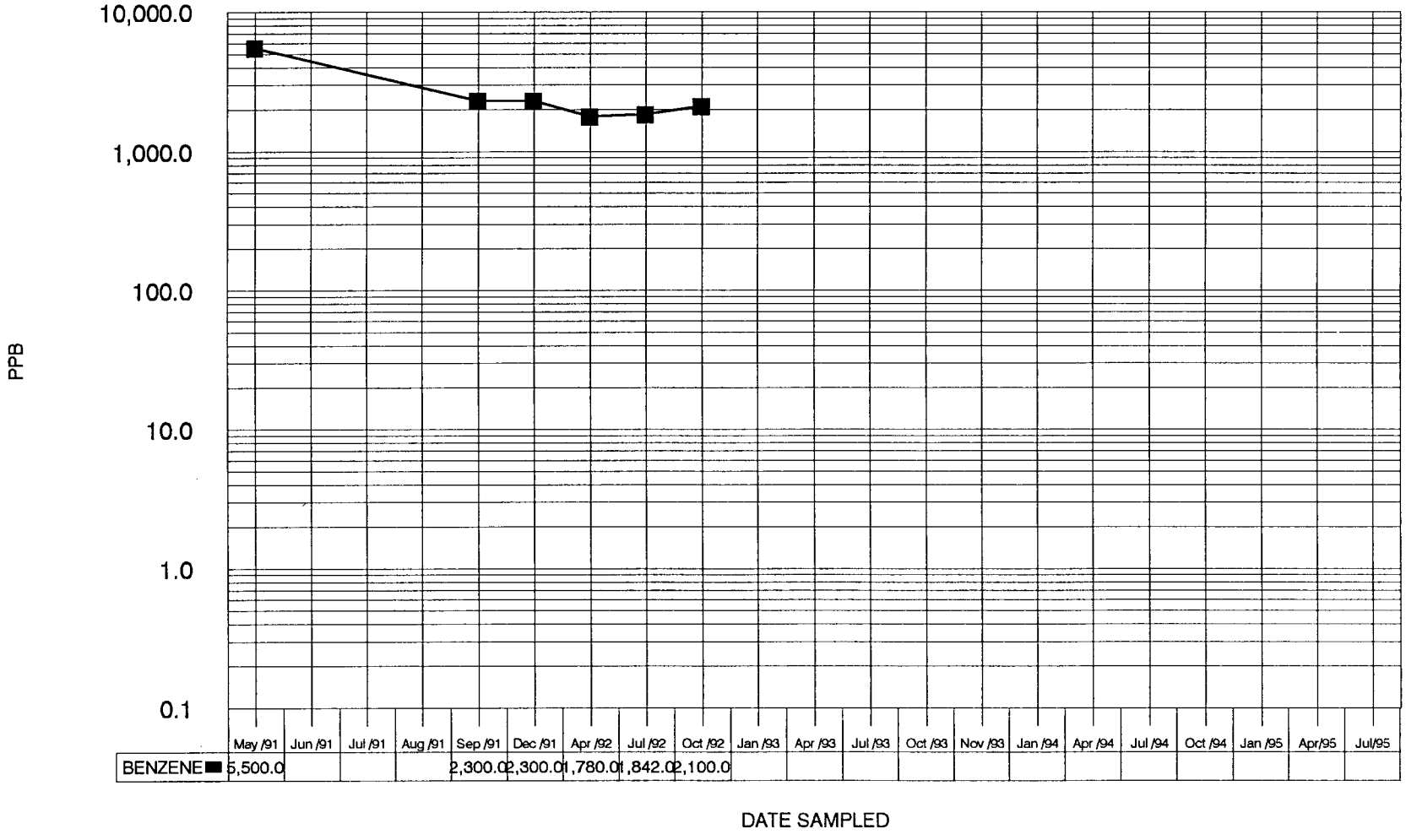
1 - All wells sampled with Teflon bailers for BTEX by EPA Method 8020 (2 x 40 ml VOA's) and Chloride (1 x 250 ml plastic).
2 - Purge amounts are 3 well casing volumes
3 - NS: Not sampled; NA: Not Applicable
4 - NS* - Well not sampled due to insufficient recharge.

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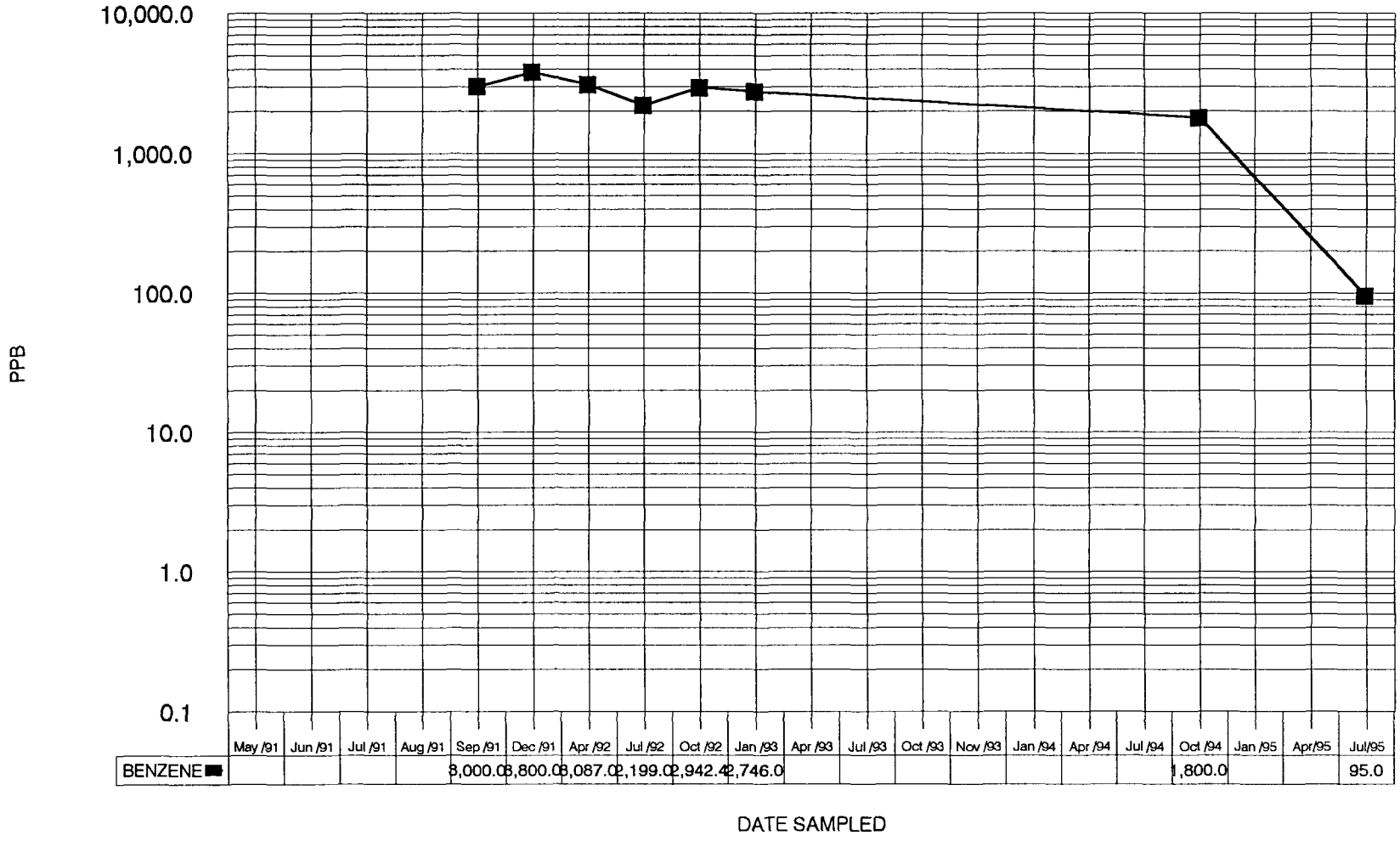
APPENDIX B

BENZENE CONCENTRATION IN GROUNDWATER VS. TIME GRAPHS

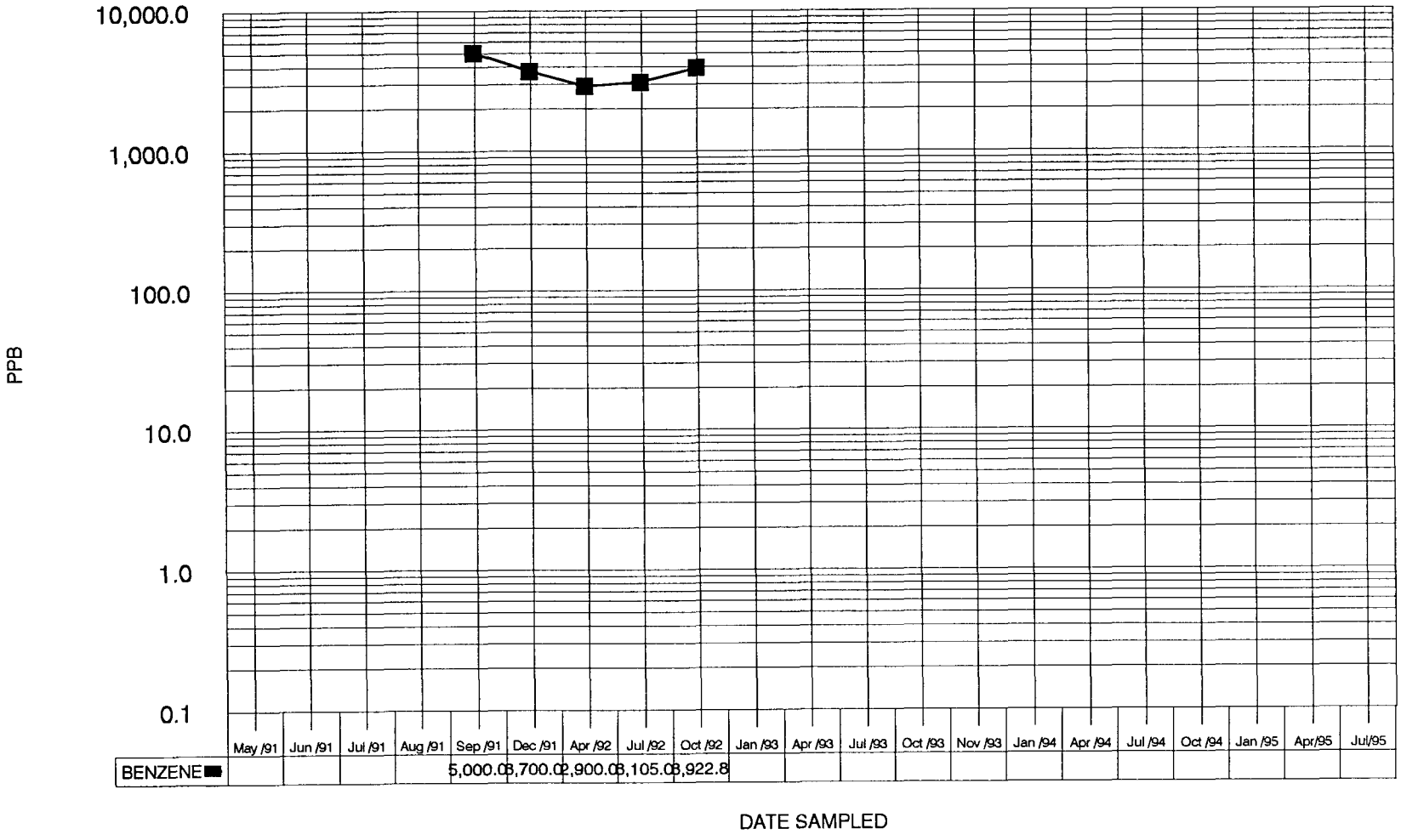
BENZENE IN GROUNDWATER
MW-10



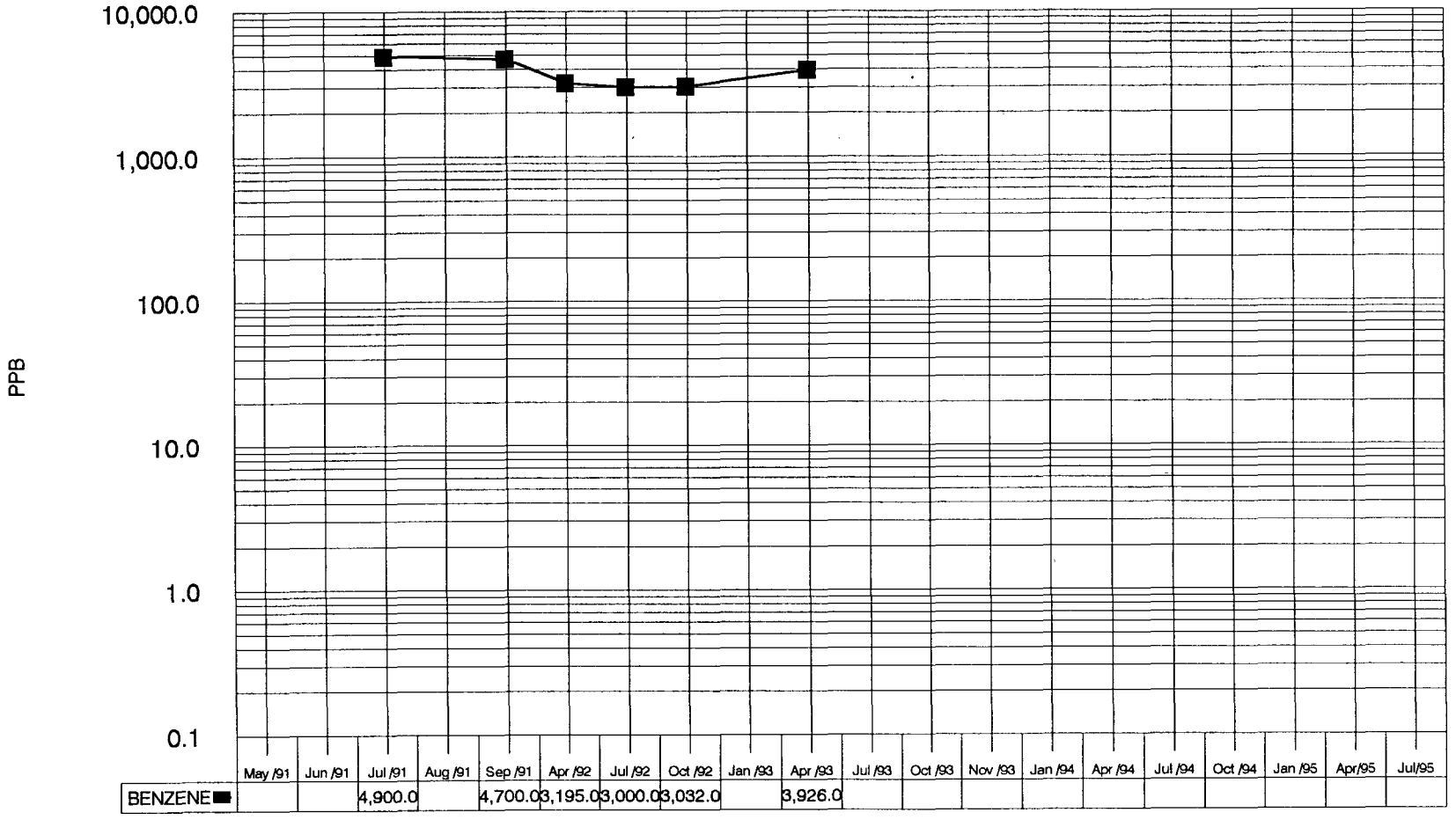
BENZENE IN GROUNDWATER
MW-11



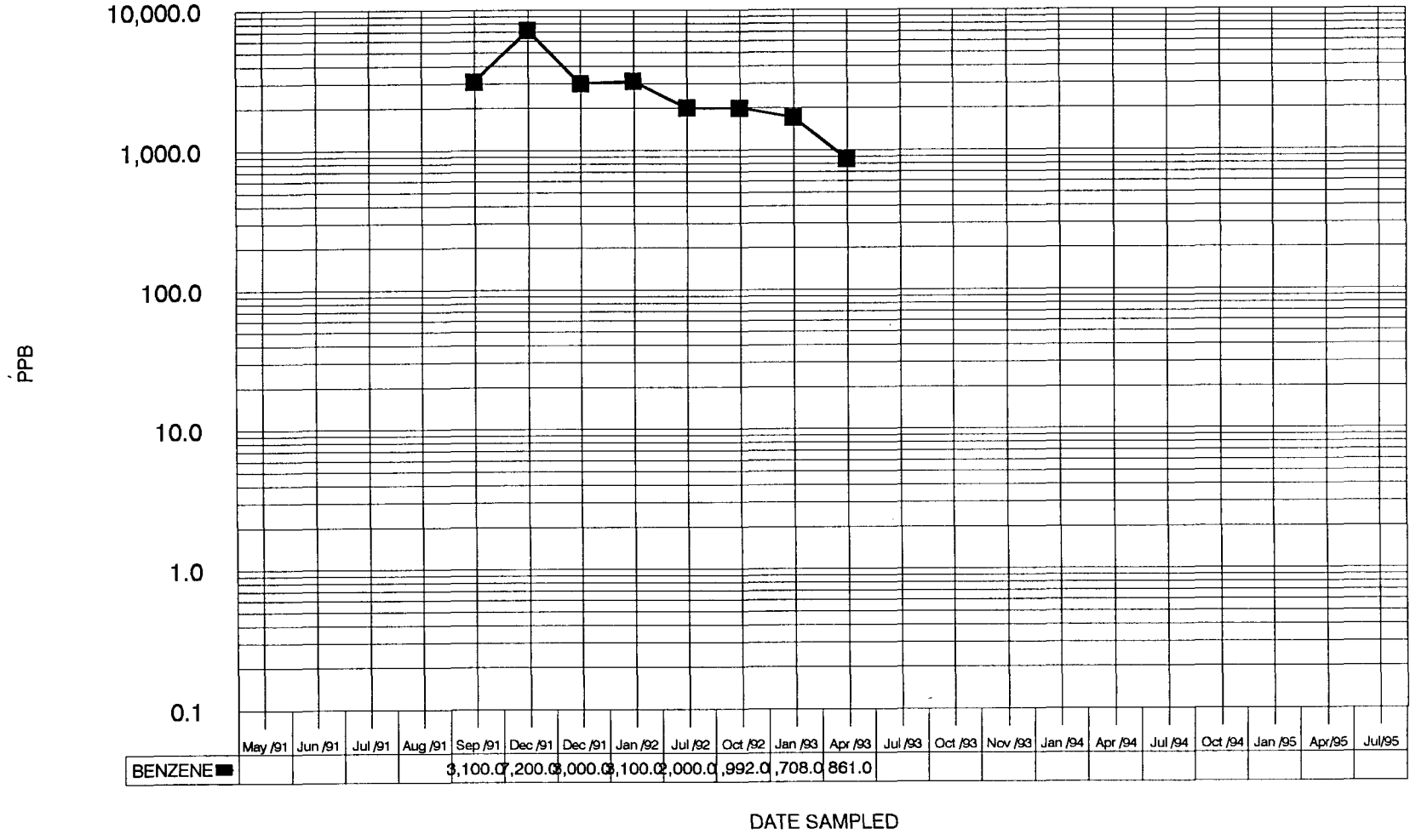
BENZENE IN GROUNDWATER
MW-18



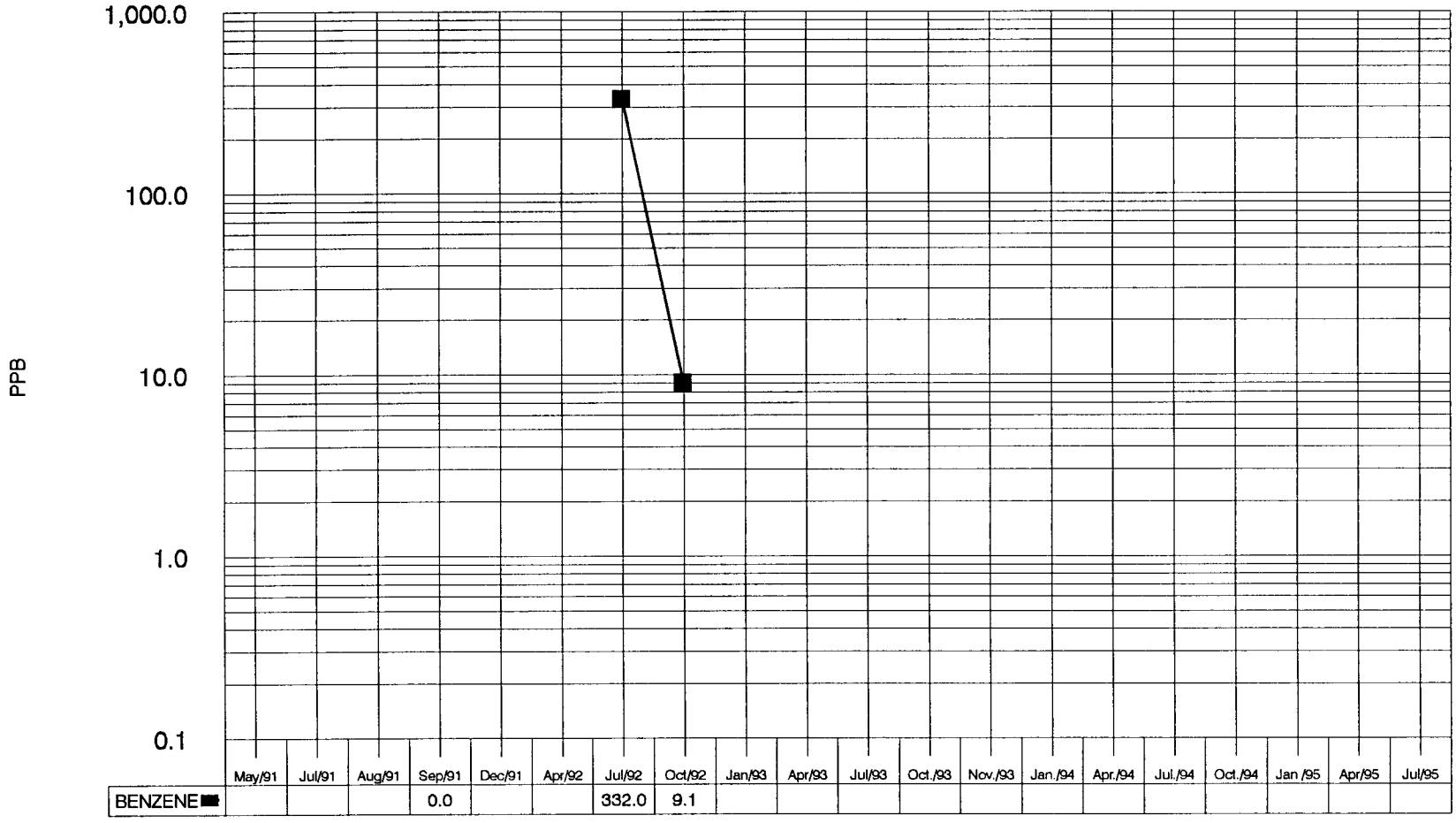
BENZENE IN GROUNDWATER
MW-19



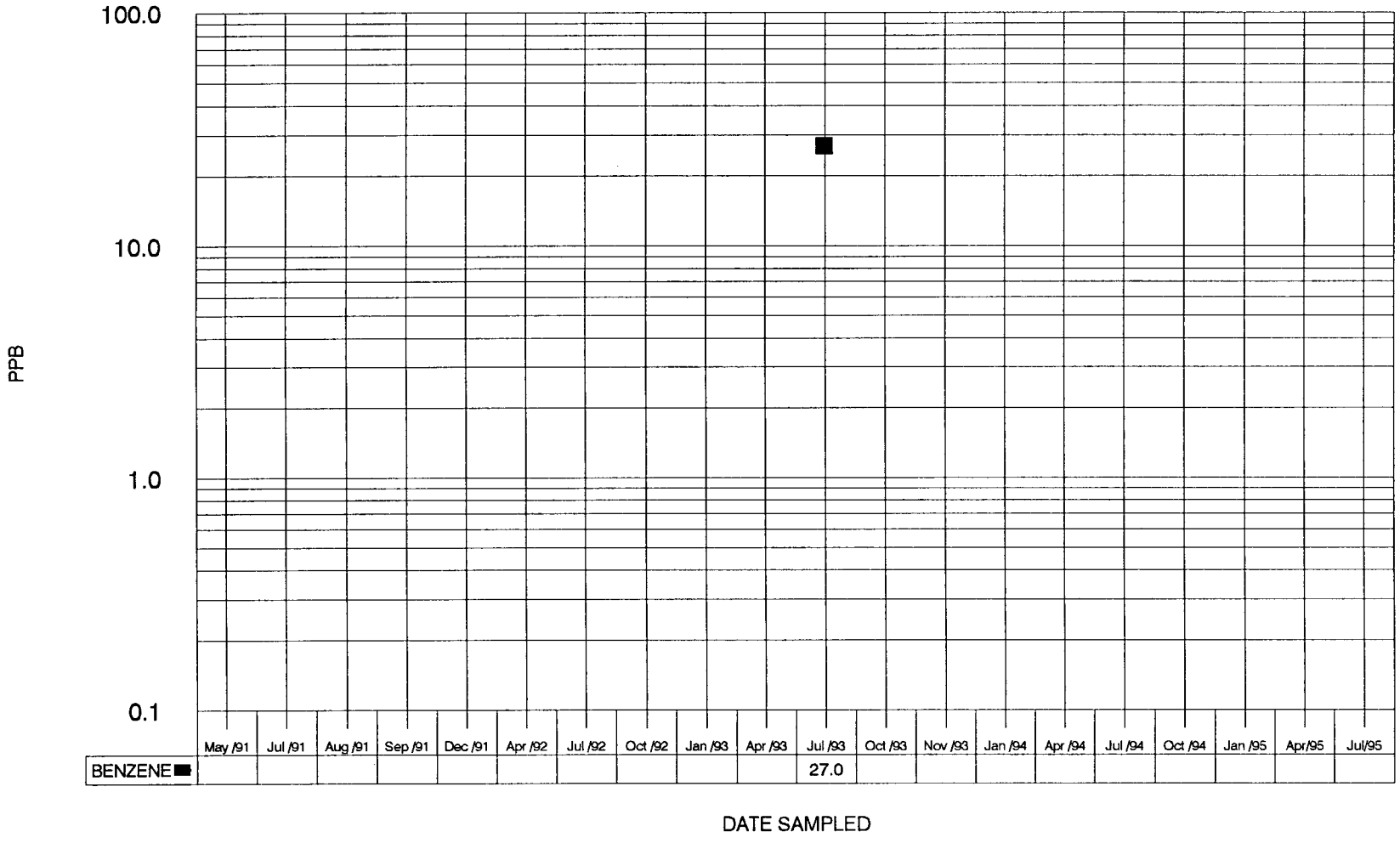
BENZENE IN GROUNDWATER
MW-26



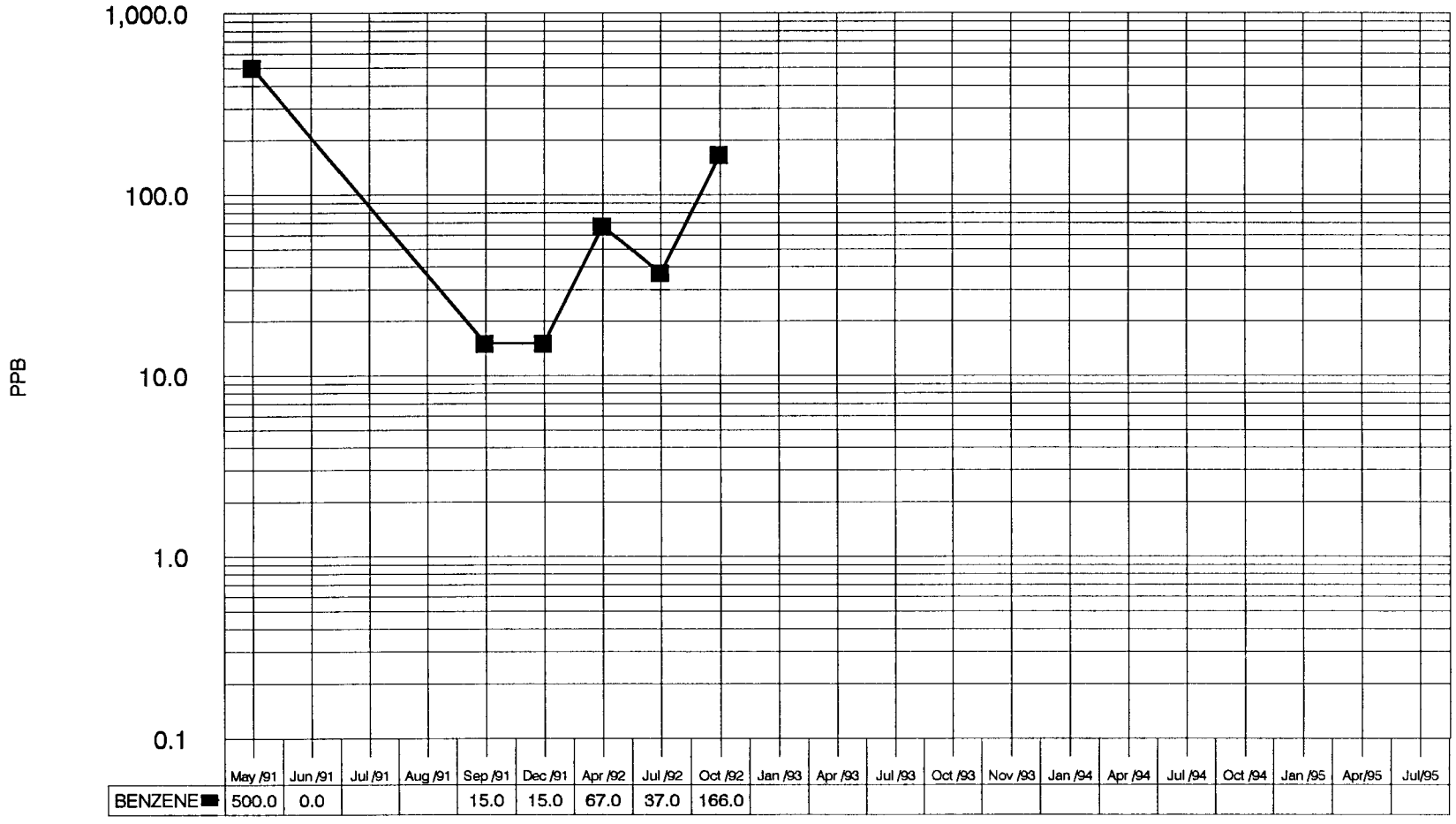
BENZENE IN GROUNDWATER
MW-31



BENZENE IN GROUNDWATER
MW-37



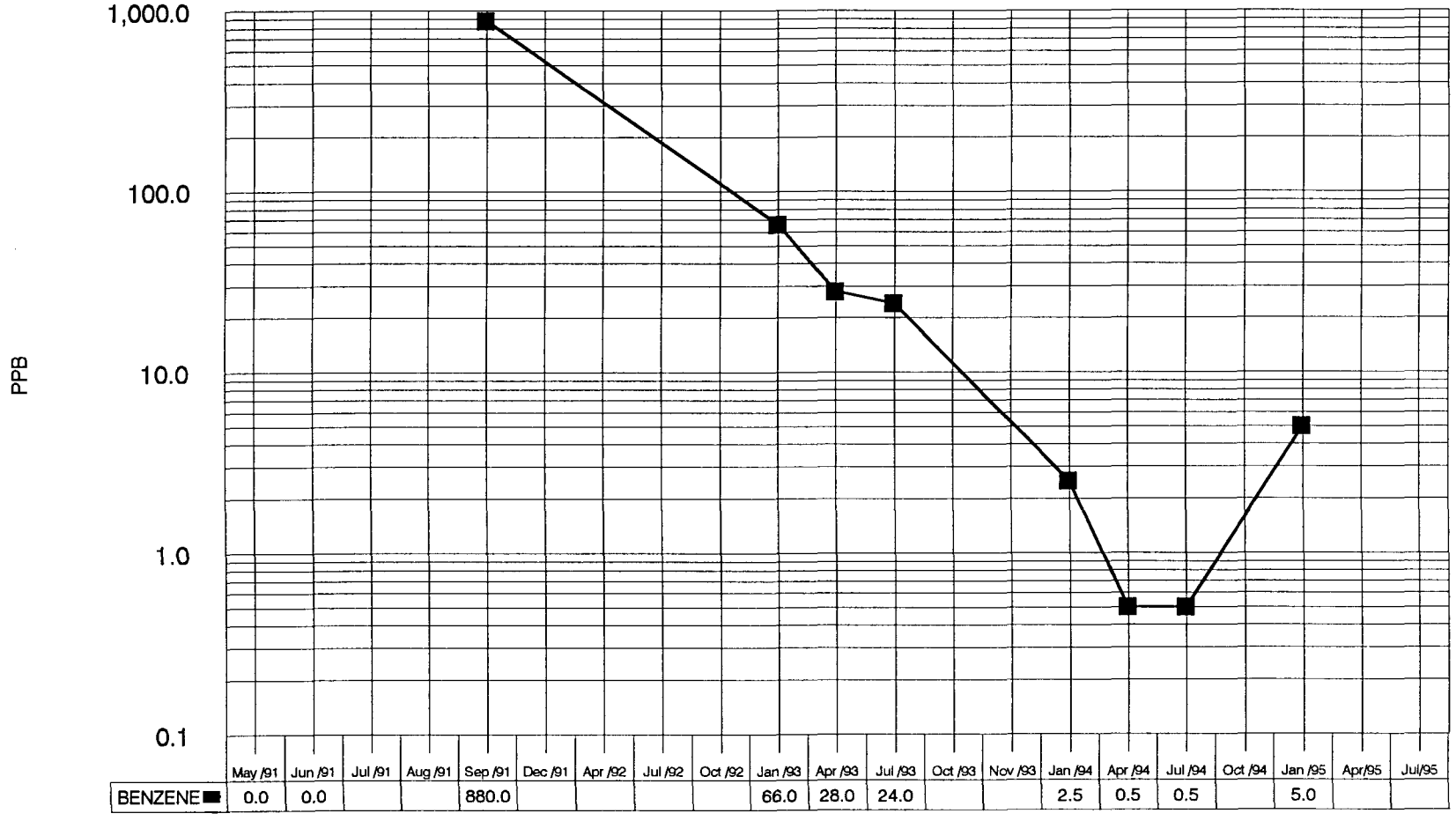
BENZENE IN GROUNDWATER
MW-38



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■	500.0	0.0			15.0	15.0	67.0	37.0	166.0												

DATE SAMPLED

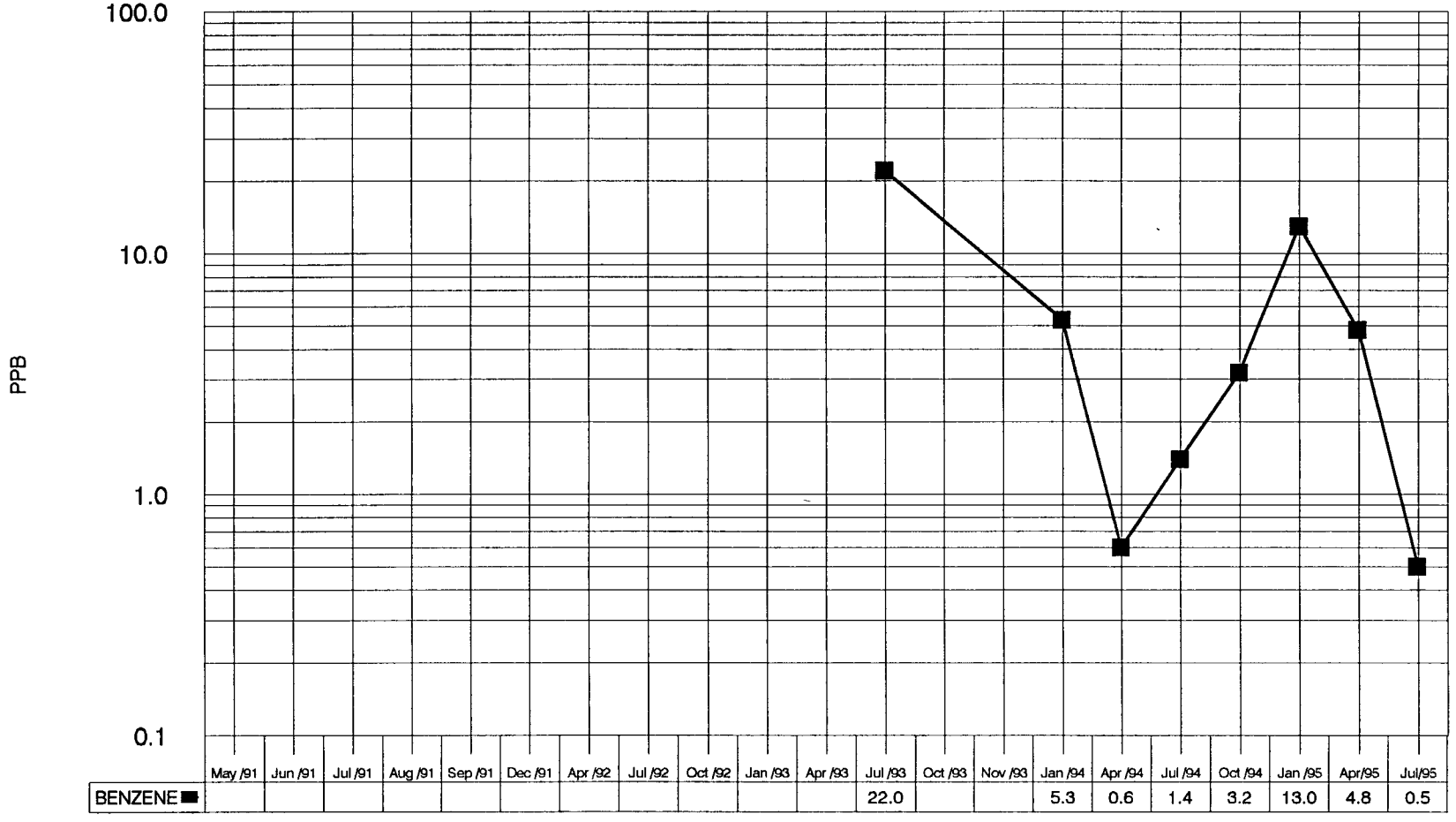
BENZENE IN GROUNDWATER
MW-39



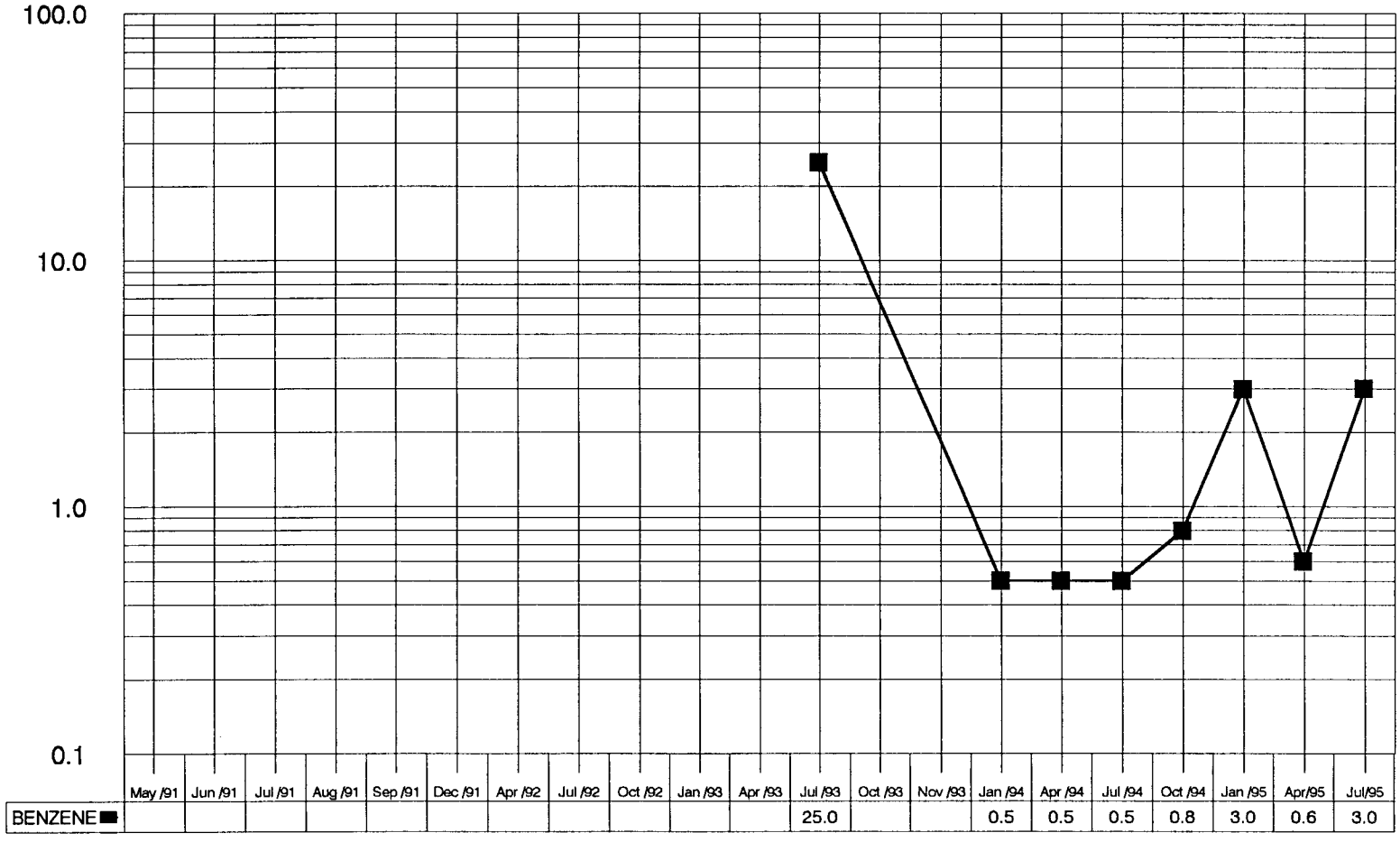
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE	0.0	0.0			880.0					66.0	28.0	24.0			2.5	0.5	0.5		5.0		

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-41



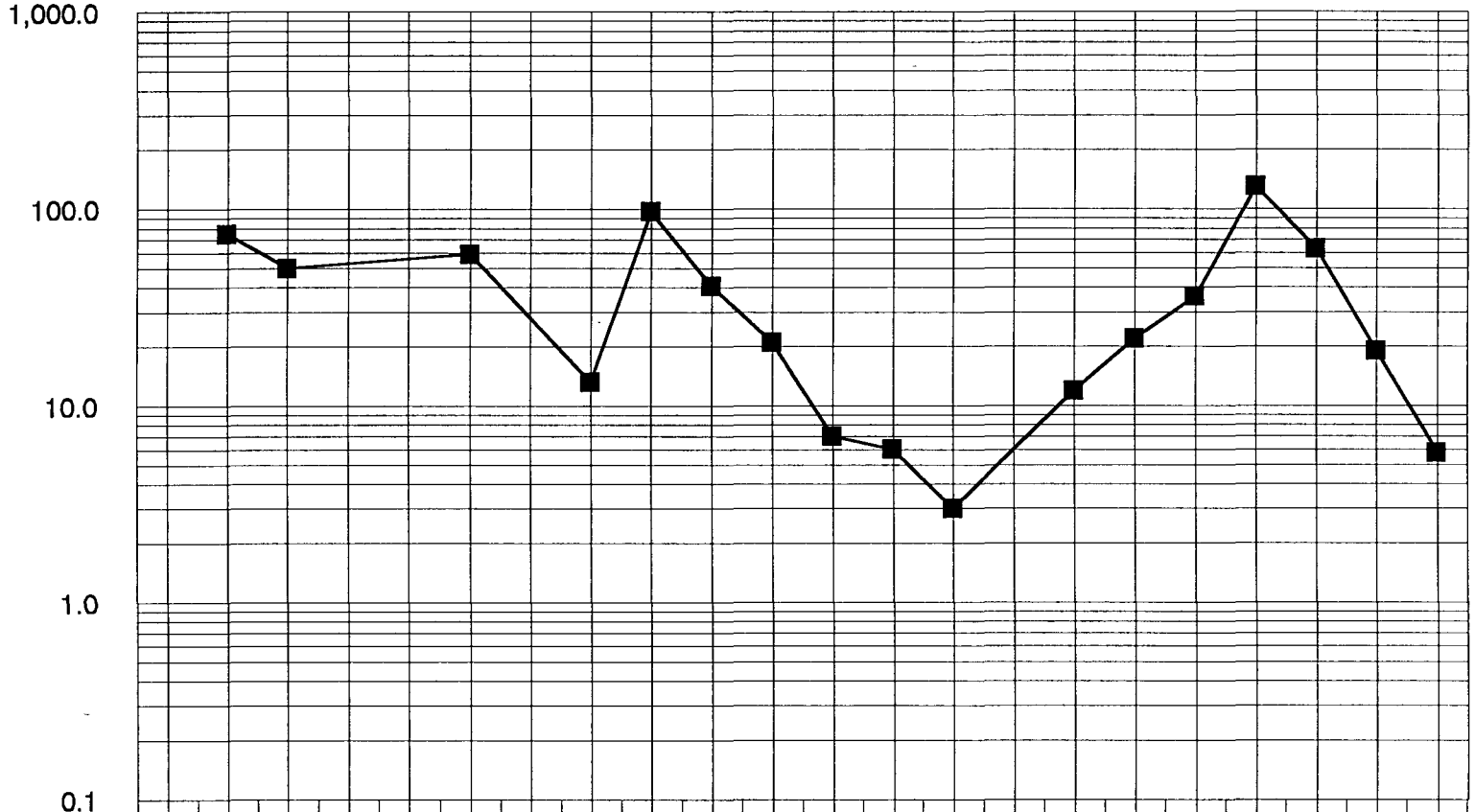
BENZENE IN GROUNDWATER
MW-43



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE												25.0			0.5	0.5	0.5	0.8	3.0	0.6	3.0

DATE SAMPLED

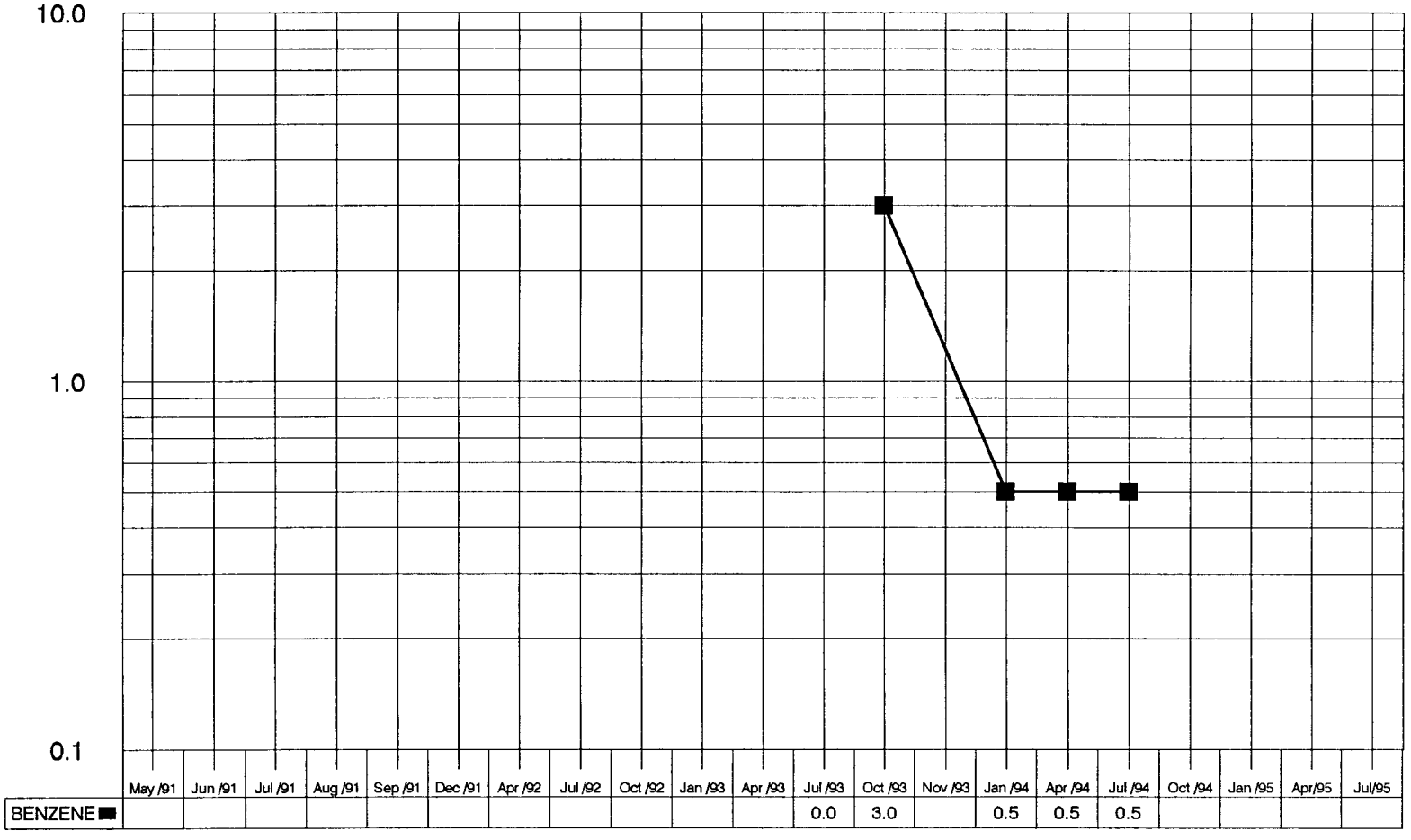
BENZENE IN GROUNDWATER
MW-44



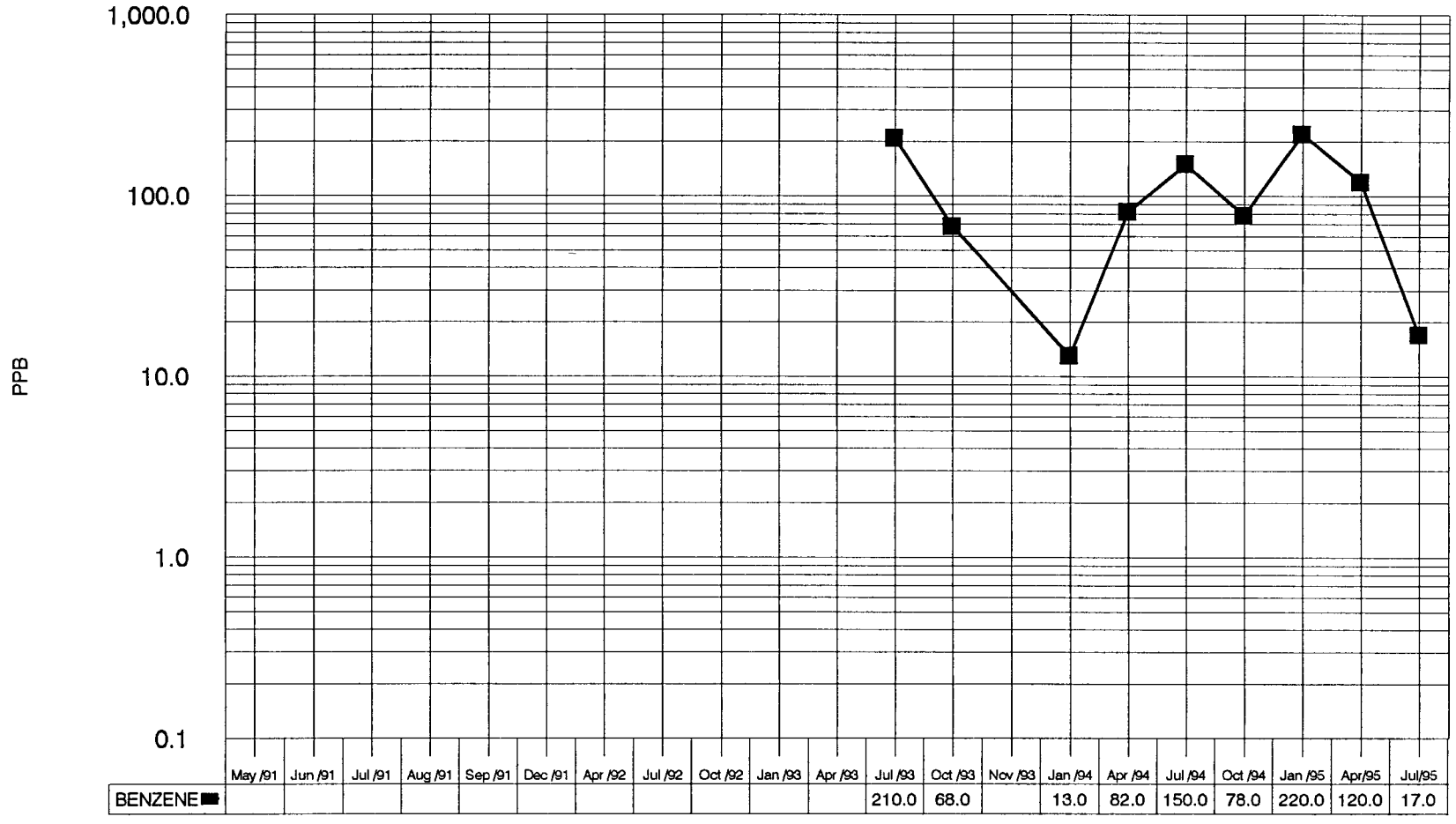
	May /91	Jun /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE		75.0	50.0			59.0		13.2	97.0	40.6	21.0	7.0	6.0	3.0		12.0	22.0	36.0	130.0	63.0	19.0	5.8

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-45



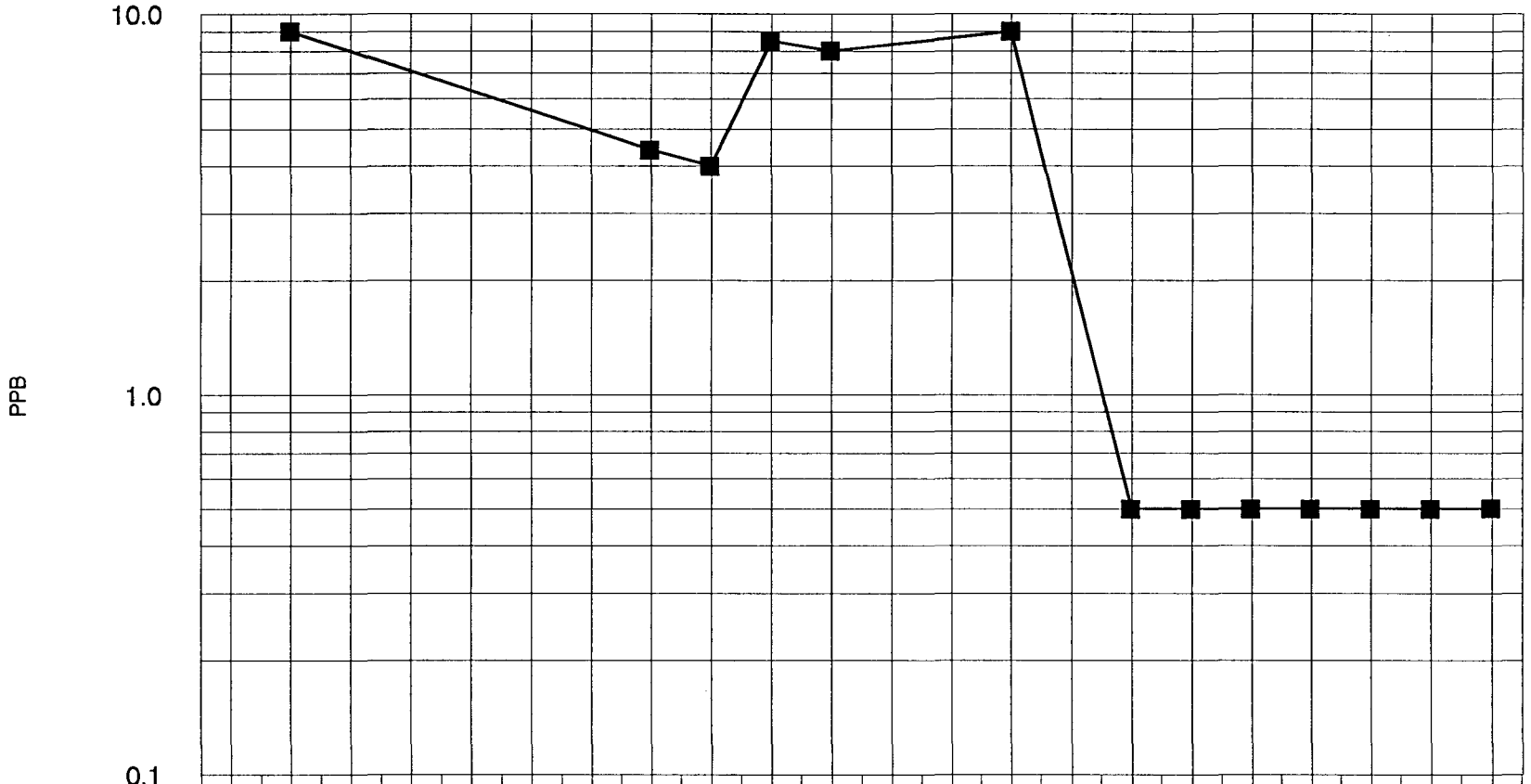
BENZENE IN GROUNDWATER
MW-49



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE												210.0	68.0		13.0	82.0	150.0	78.0	220.0	120.0	17.0

DATE SAMPLED

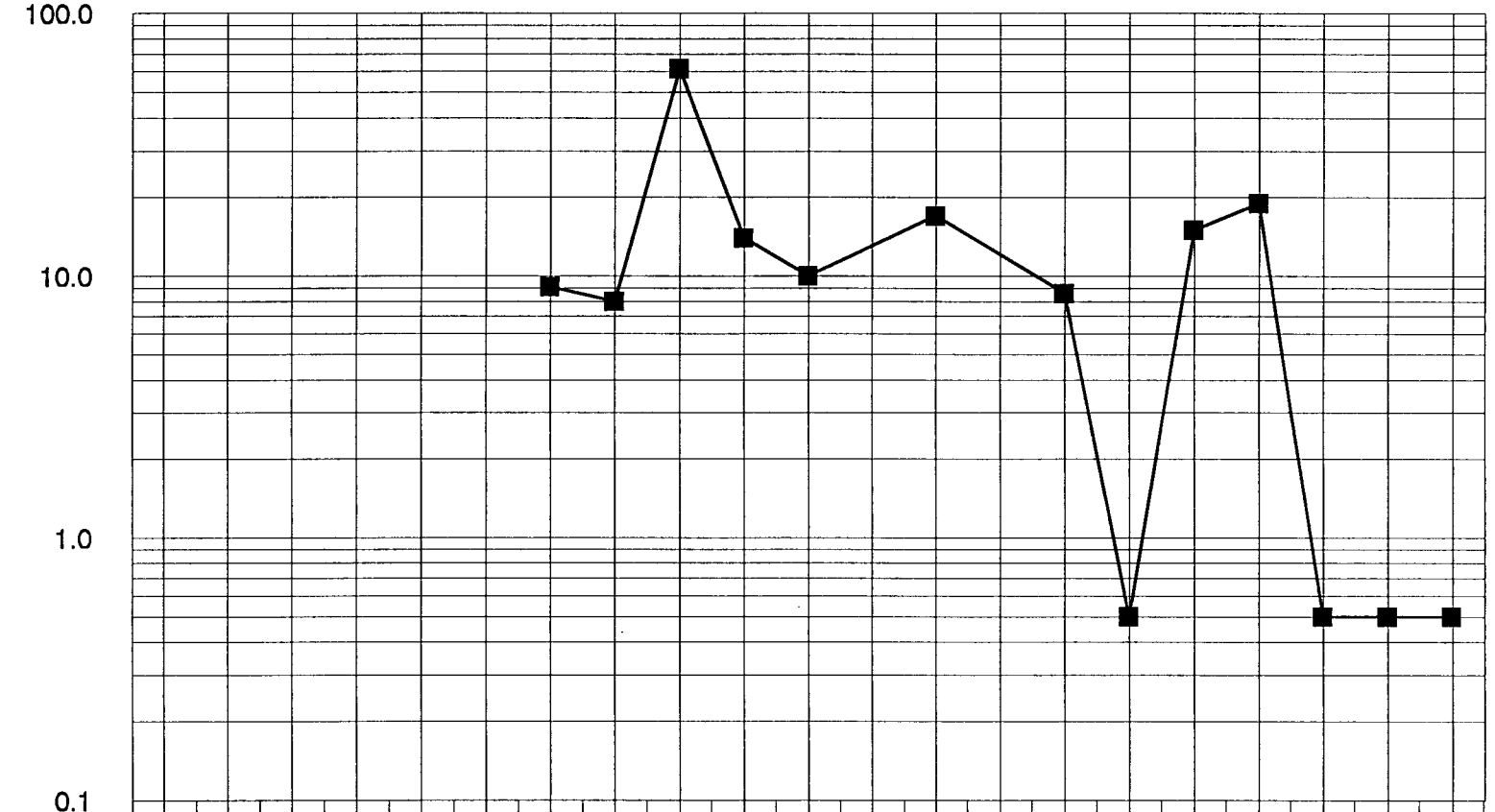
BENZENE IN GROUNDWATER
MW-50



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95	Apr/95	Jul/95
BENZENE ■		9.0			0.0	0.0	0.0	4.4	4.0	8.5	8.0	0.0	0.0	9.0		0.5	0.5	0.5	0.5	0.5	0.5	0.5

DATE SAMPLED

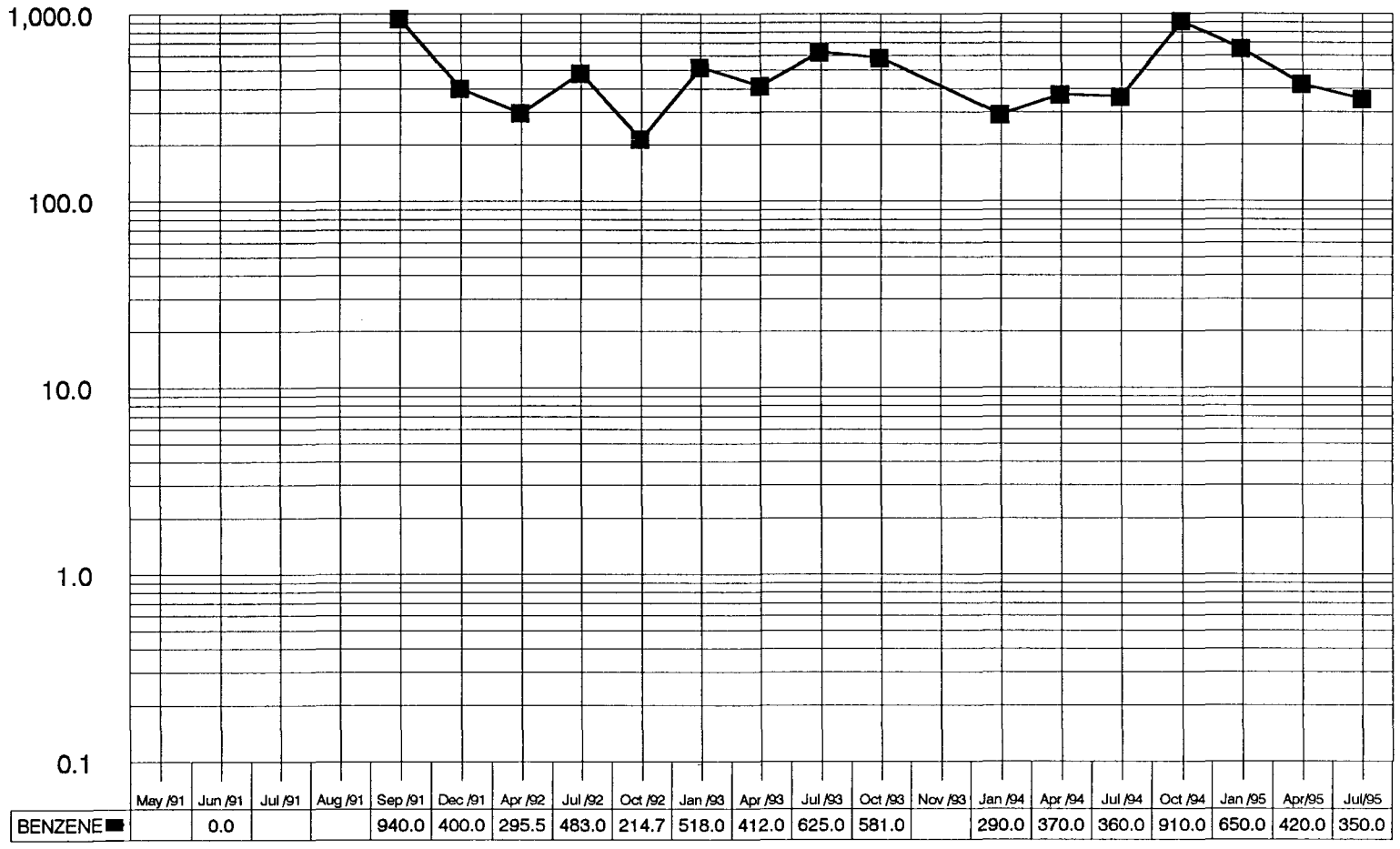
BENZENE IN GROUNDWATER
MW-54



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■		0.0			0.0	0.0	9.1	8.0	61.6	14.0	10.0	0.0	17.0		8.6	0.5	15.0	19.0	0.5	0.5	0.5

DATE SAMPLED

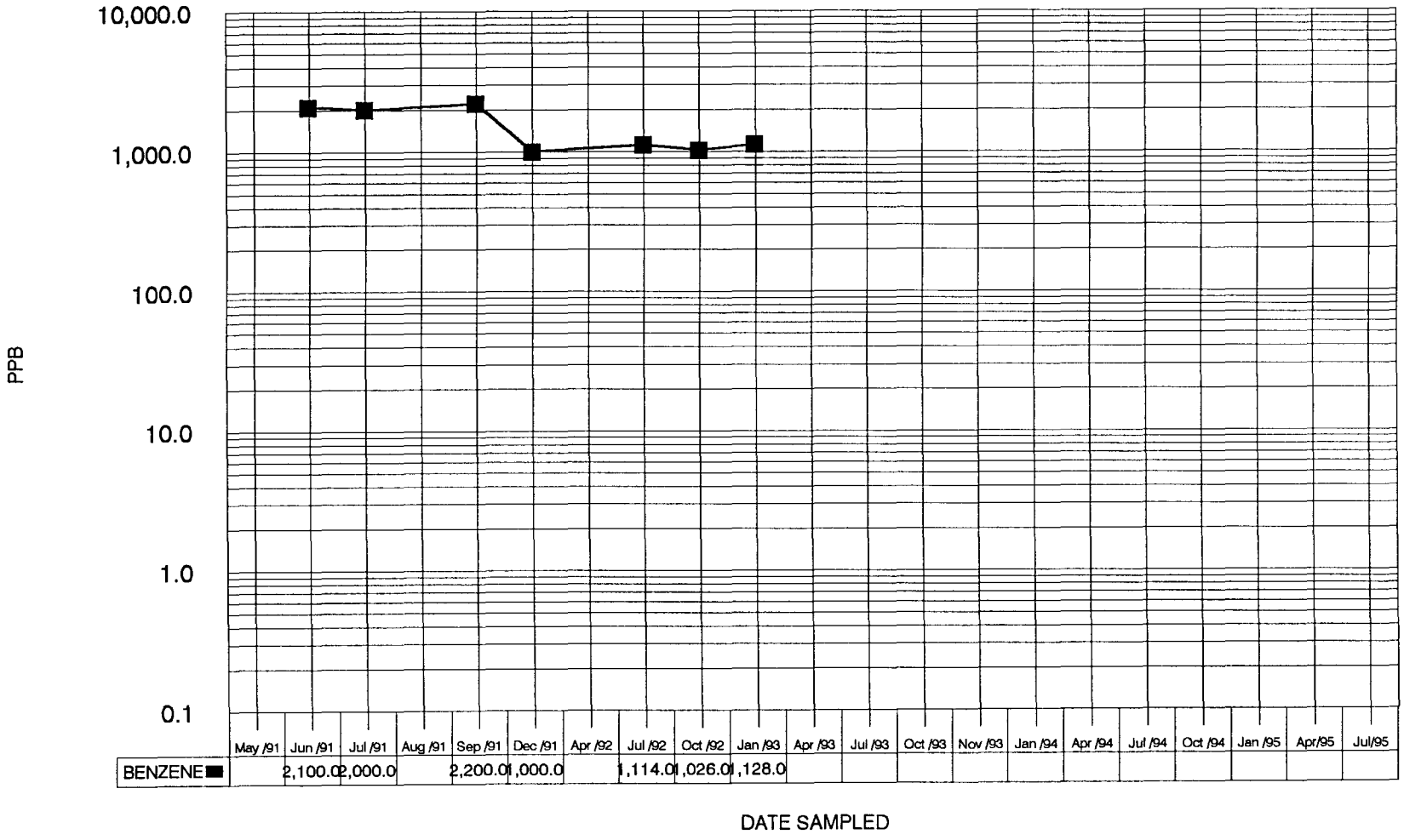
BENZENE IN GROUNDWATER
MW-55



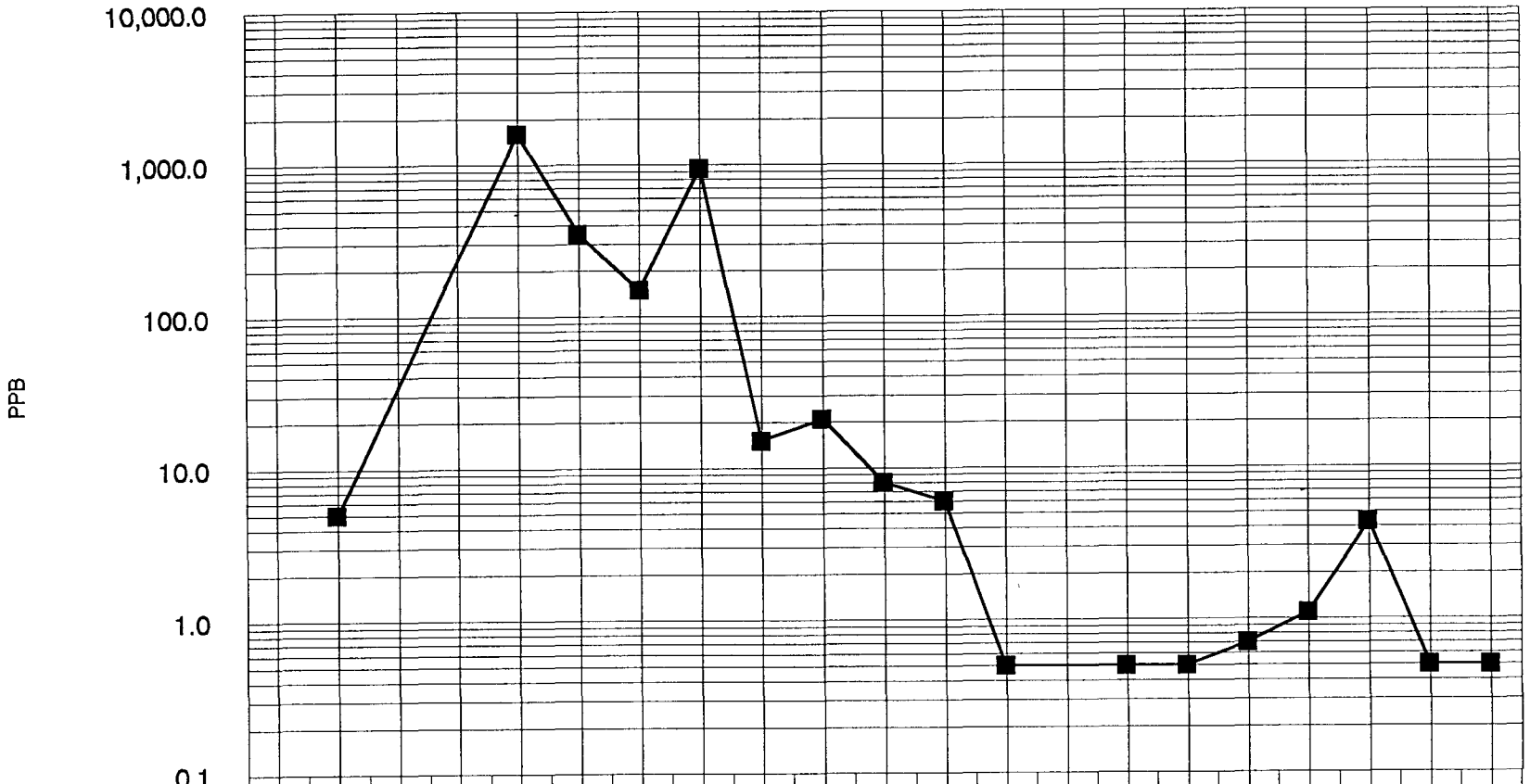
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■		0.0			940.0	400.0	295.5	483.0	214.7	518.0	412.0	625.0	581.0		290.0	370.0	360.0	910.0	650.0	420.0	350.0

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-56



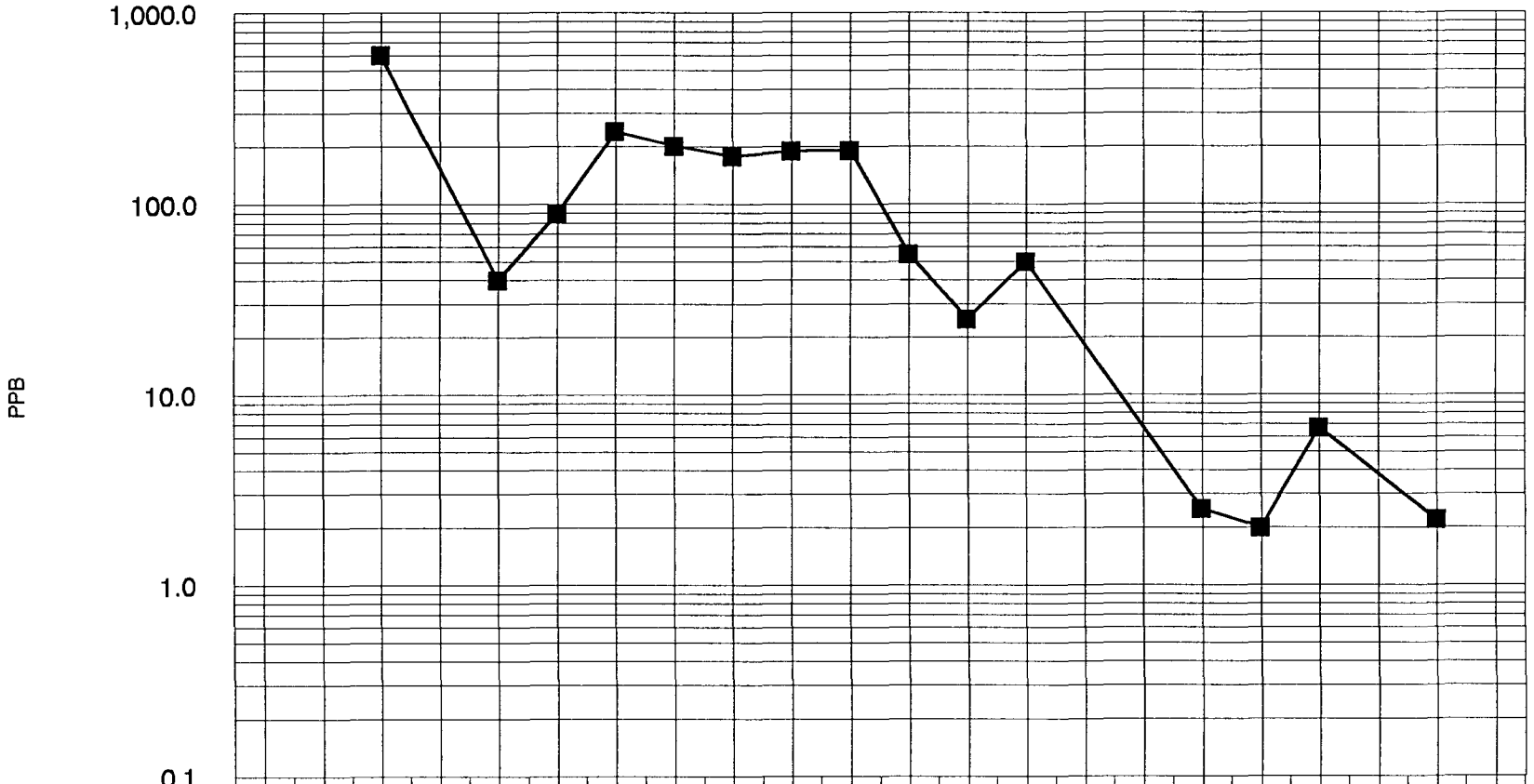
BENZENE IN GROUNDWATER
MW-57



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE		5.0	0.0		1,600.0	350.0	150.0	948.0	15.1	21.0	8.0	6.0	0.5		0.5	0.5	0.7	1.1	4.3	0.5	0.5

DATE SAMPLED

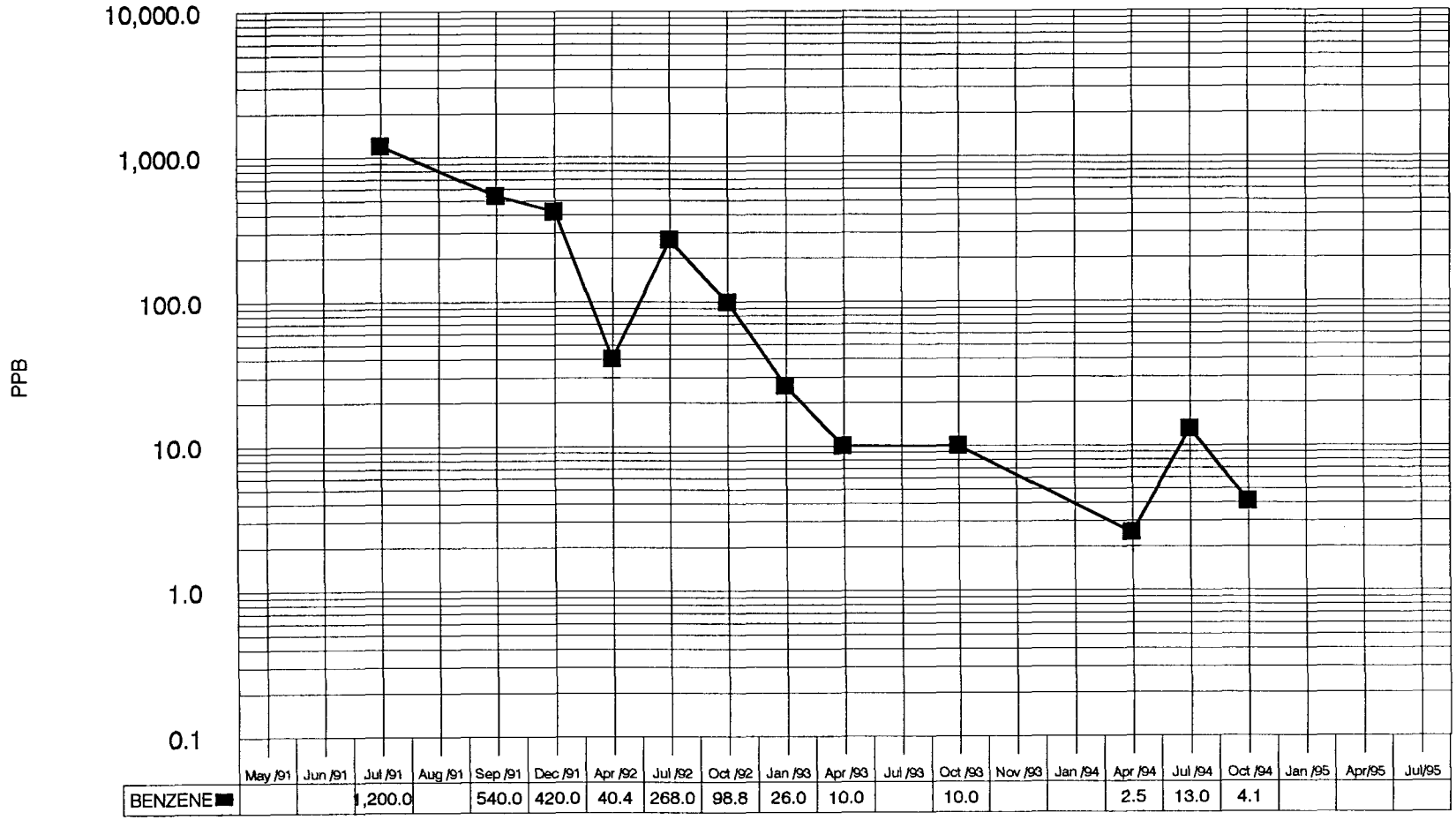
BENZENE IN GROUNDWATER
MW-58



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95	Apr/95	Jul/95
BENZENE			600.0		40.0	90.0	240.0	202.0	178.0	190.0	192.0	55.0	25.0	50.0			2.5	2.0	6.7		2.2	

DATE SAMPLED

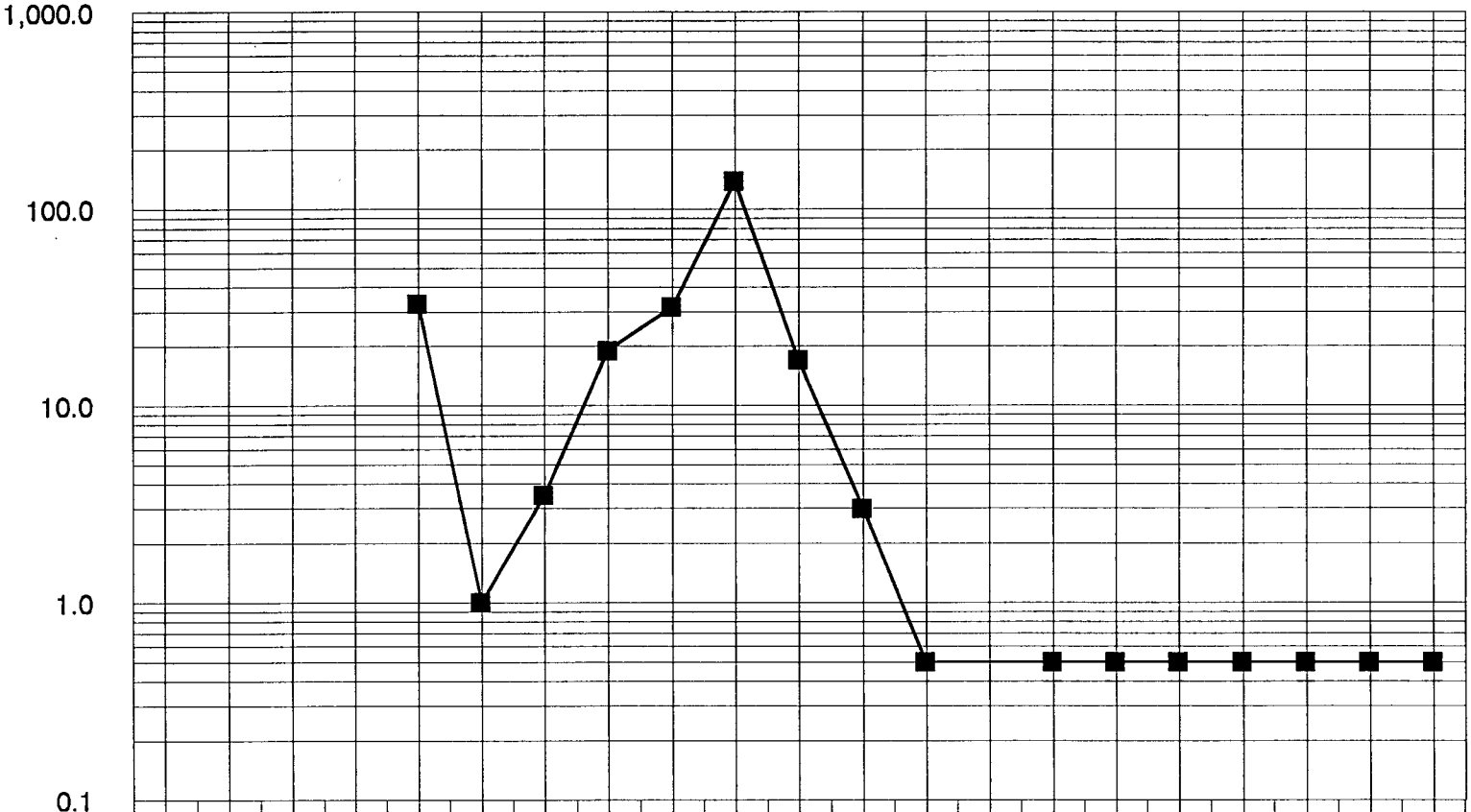
BENZENE IN GROUNDWATER
MW-59



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE			1,200.0		540.0	420.0	40.4	268.0	98.8	26.0	10.0		10.0			2.5	13.0	4.1			

DATE SAMPLED

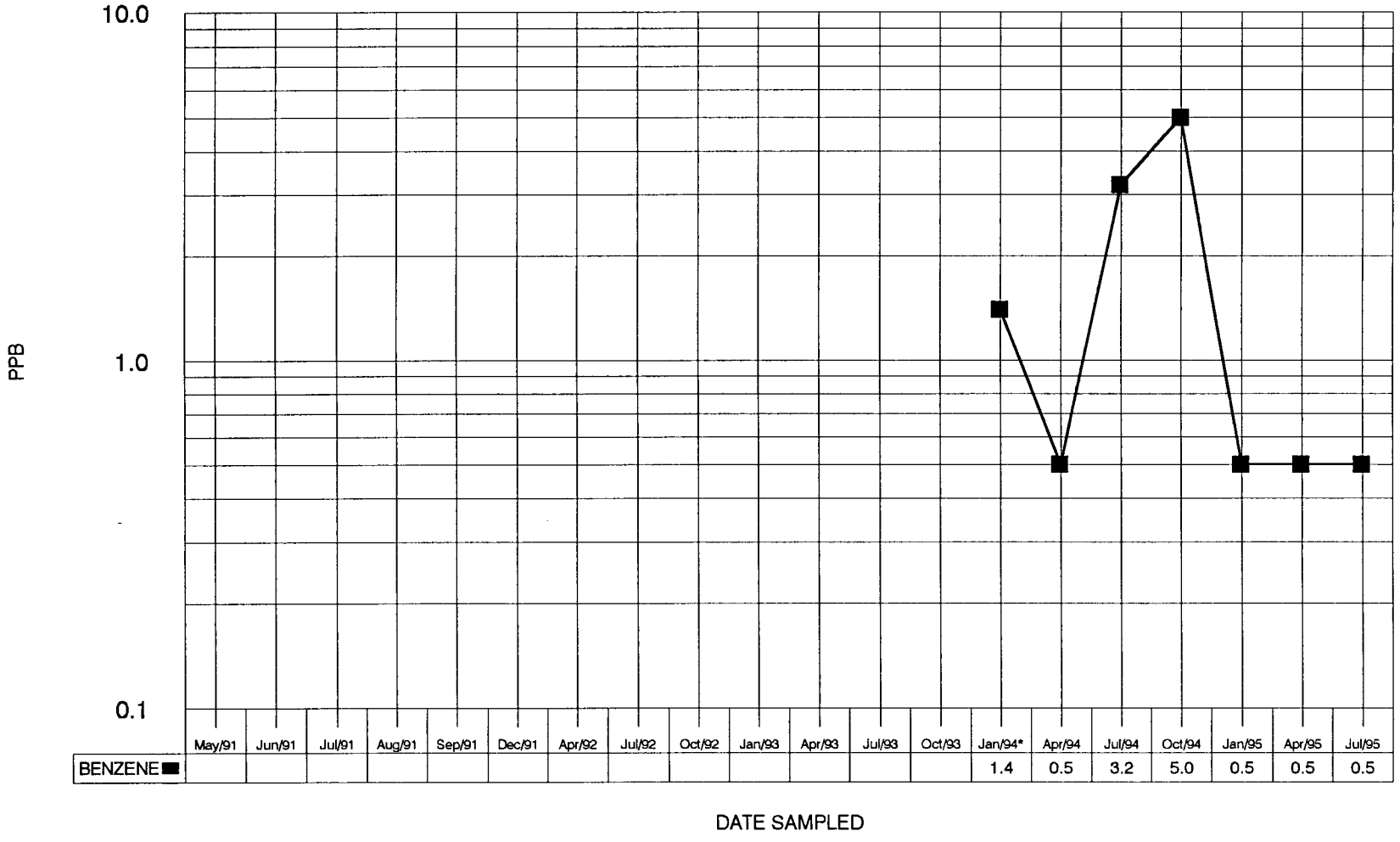
BENZENE IN GROUNDWATER
MW-60



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE			0.0		33.0	1.0	3.5	19.0	31.7	138.0	17.0	3.0	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5

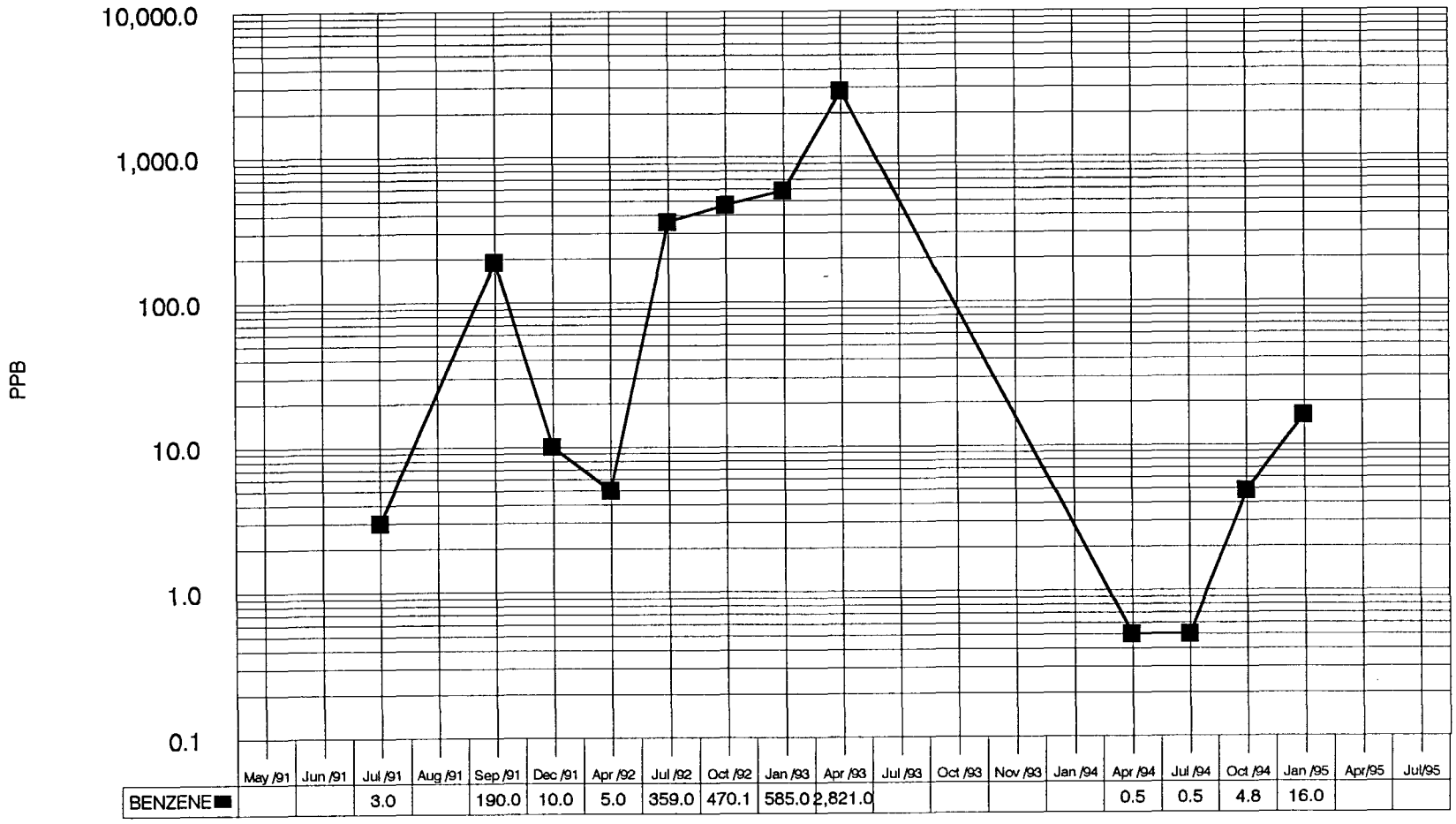
DATE SAMPLED

BENZENE IN GROUNDWATER
MW-61



*- Jan. 1994 was the first time this well was sampled.

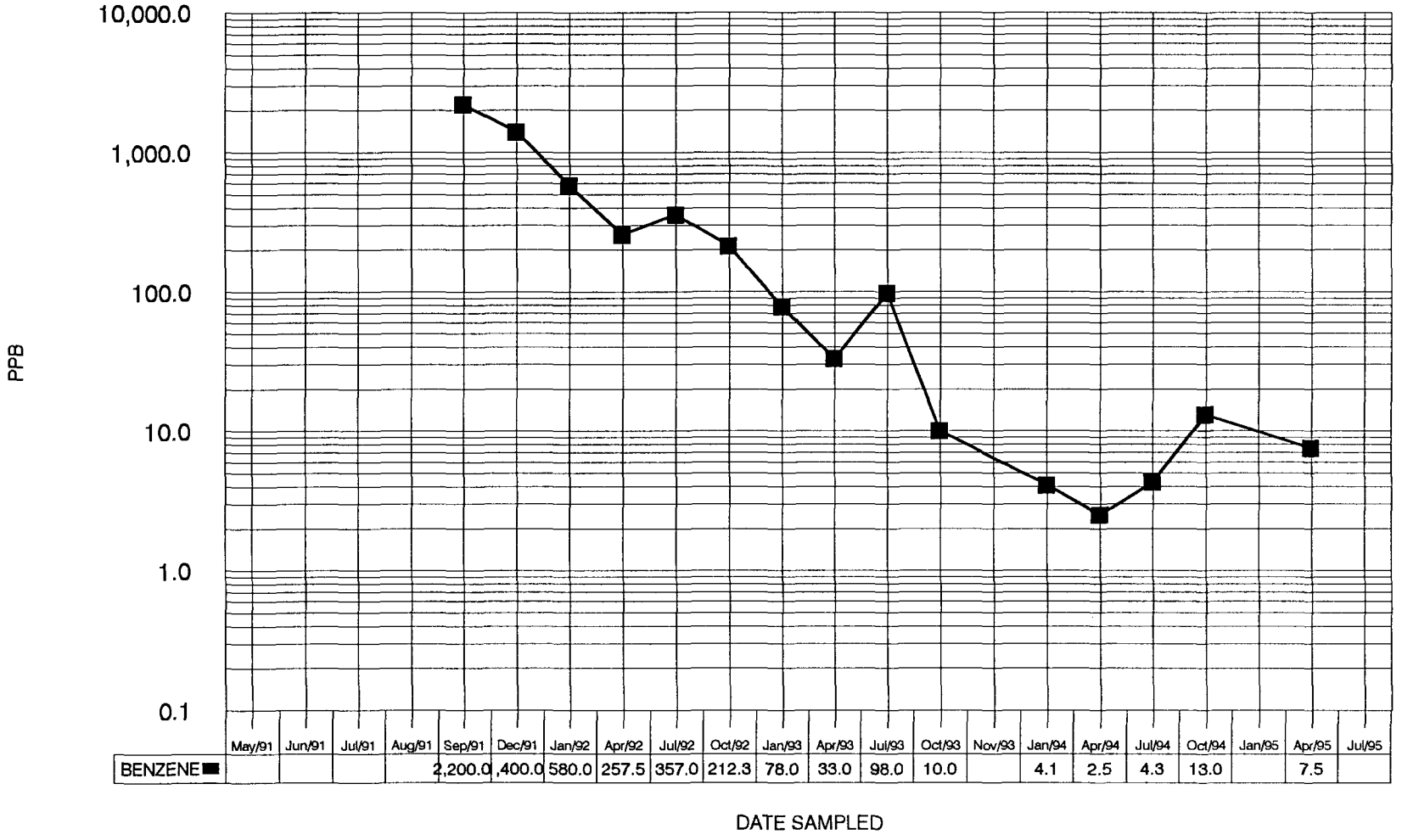
BENZENE IN GROUNDWATER
MW-61A



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE			3.0		190.0	10.0	5.0	359.0	470.1	585.0	2,821.0					0.5	0.5	4.8	16.0		

DATE SAMPLED

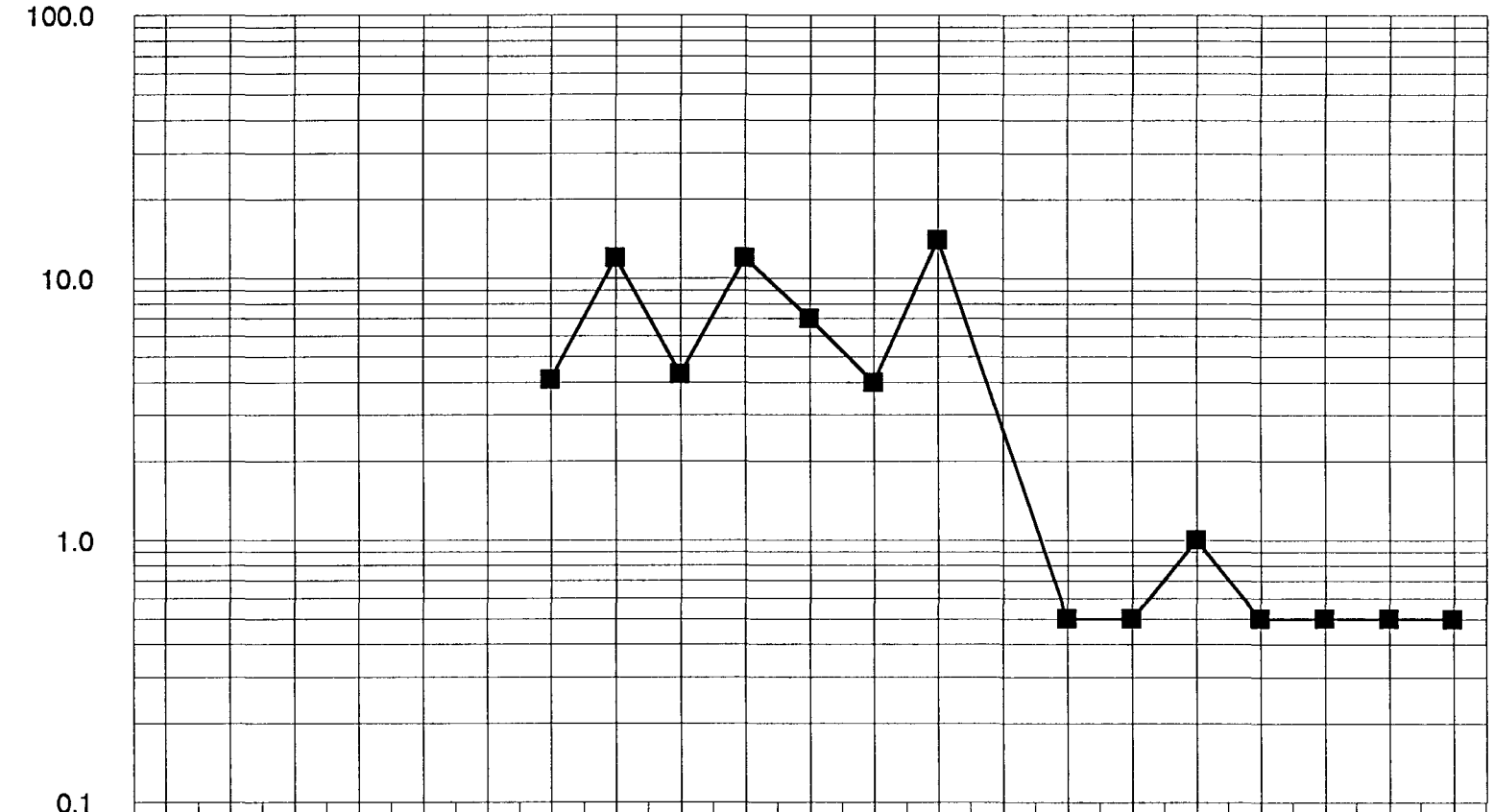
BENZENE IN GROUNDWATER
MW-62



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95	Apr/95	Jul/95
BENZENE					2,200.0	,400.0	580.0	257.5	357.0	212.3	78.0	33.0	98.0	10.0		4.1	2.5	4.3	13.0		7.5	

DATE SAMPLED

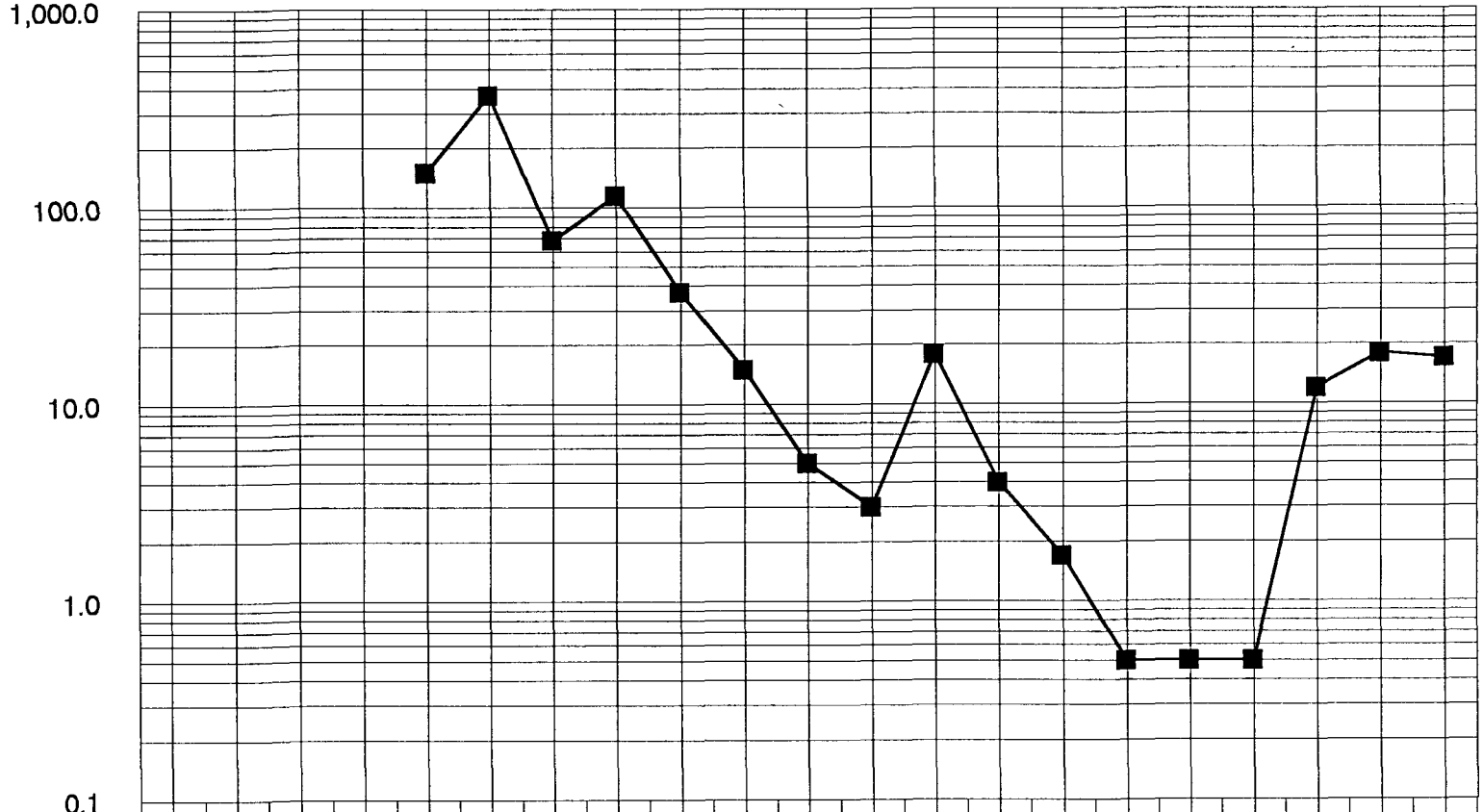
BENZENE IN GROUNDWATER
MW-63



	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■					0.0	0.0	4.1	12.0	4.3	12.0	7.0	4.0	14.0		0.5	0.5	1.0	0.5	0.5	0.5	0.5

DATE SAMPLED

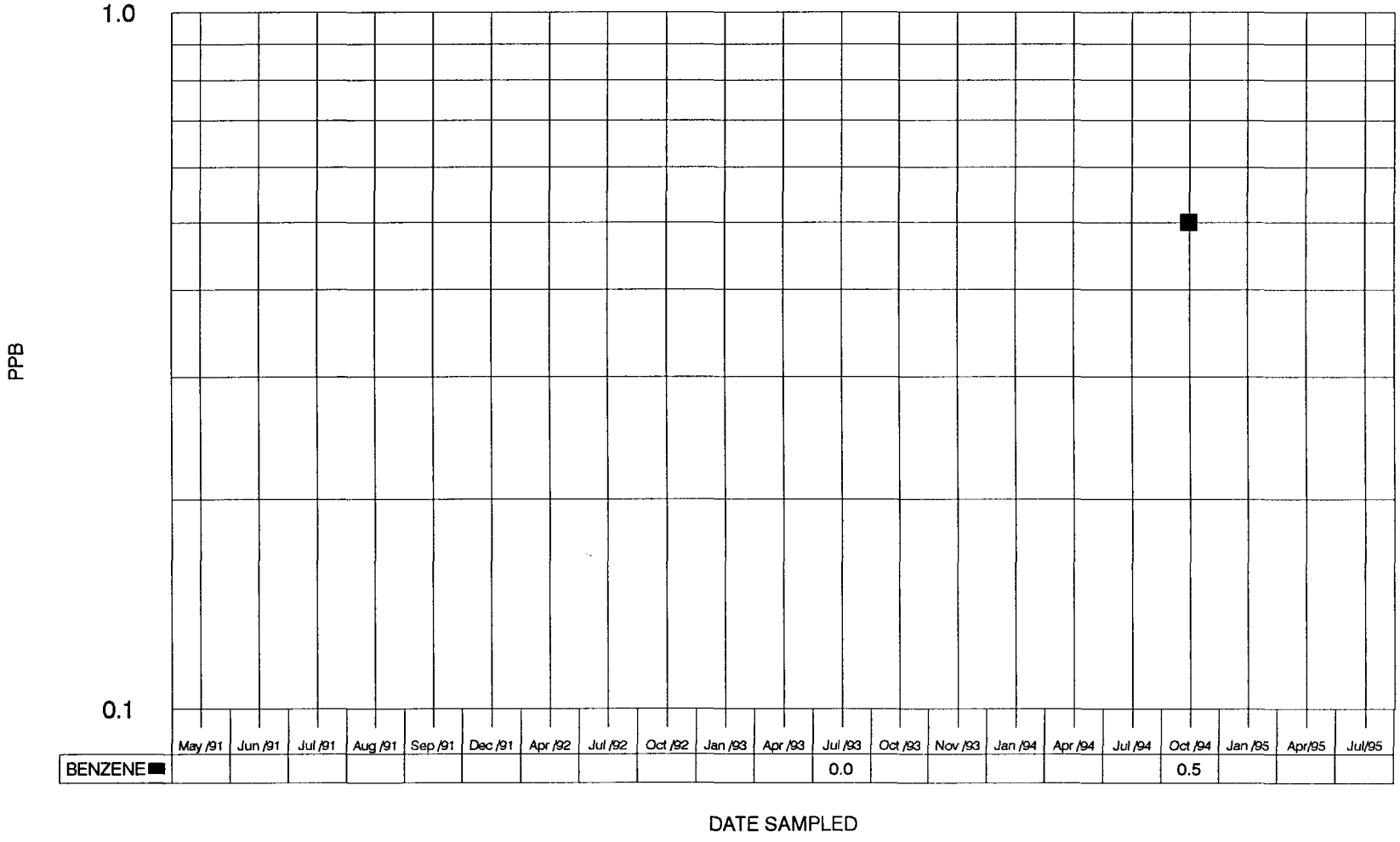
BENZENE IN GROUNDWATER
MW-64



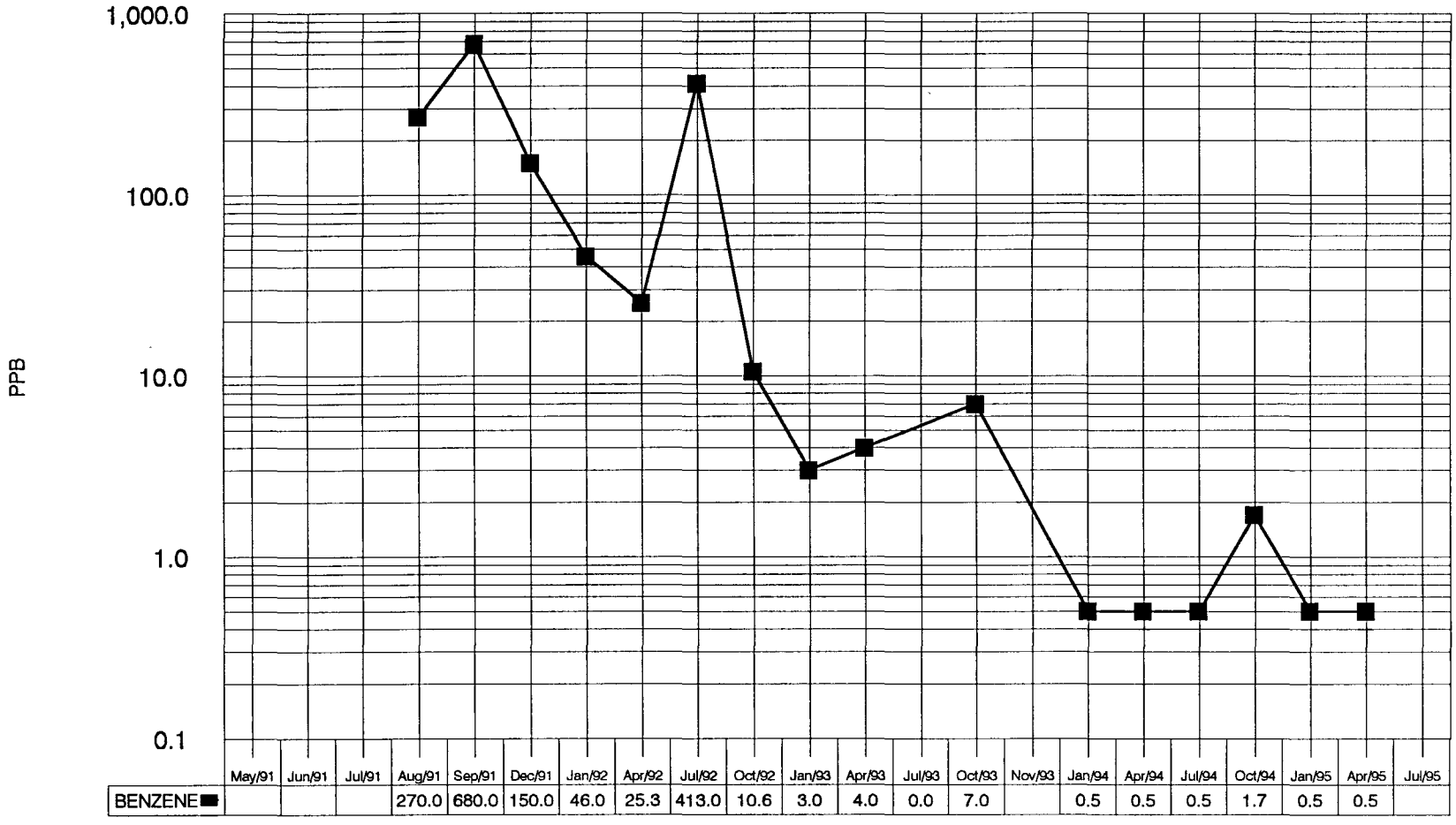
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■				0.0	150.0	370.0	68.3	115.0	37.1	15.0	5.0	3.0	18.0	4.0	1.7	0.5	0.5	0.5	12.0	18.0	17.0

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-65



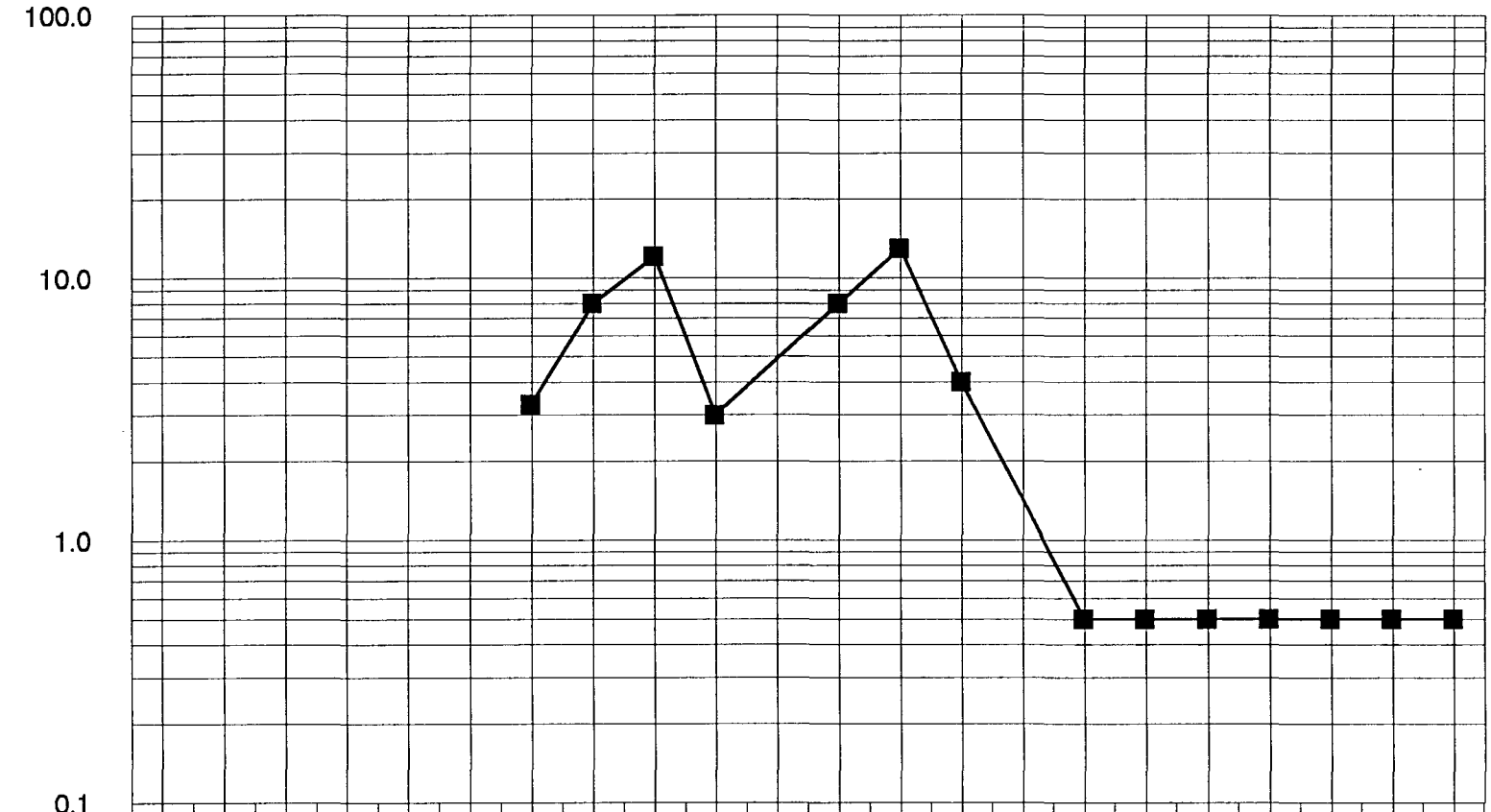
BENZENE IN GROUNDWATER
MW-65A



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Jan/92	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95	Apr/95	Jul/95
BENZENE				270.0	680.0	150.0	46.0	25.3	413.0	10.6	3.0	4.0	0.0	7.0		0.5	0.5	0.5	1.7	0.5	0.5	

DATE SAMPLED

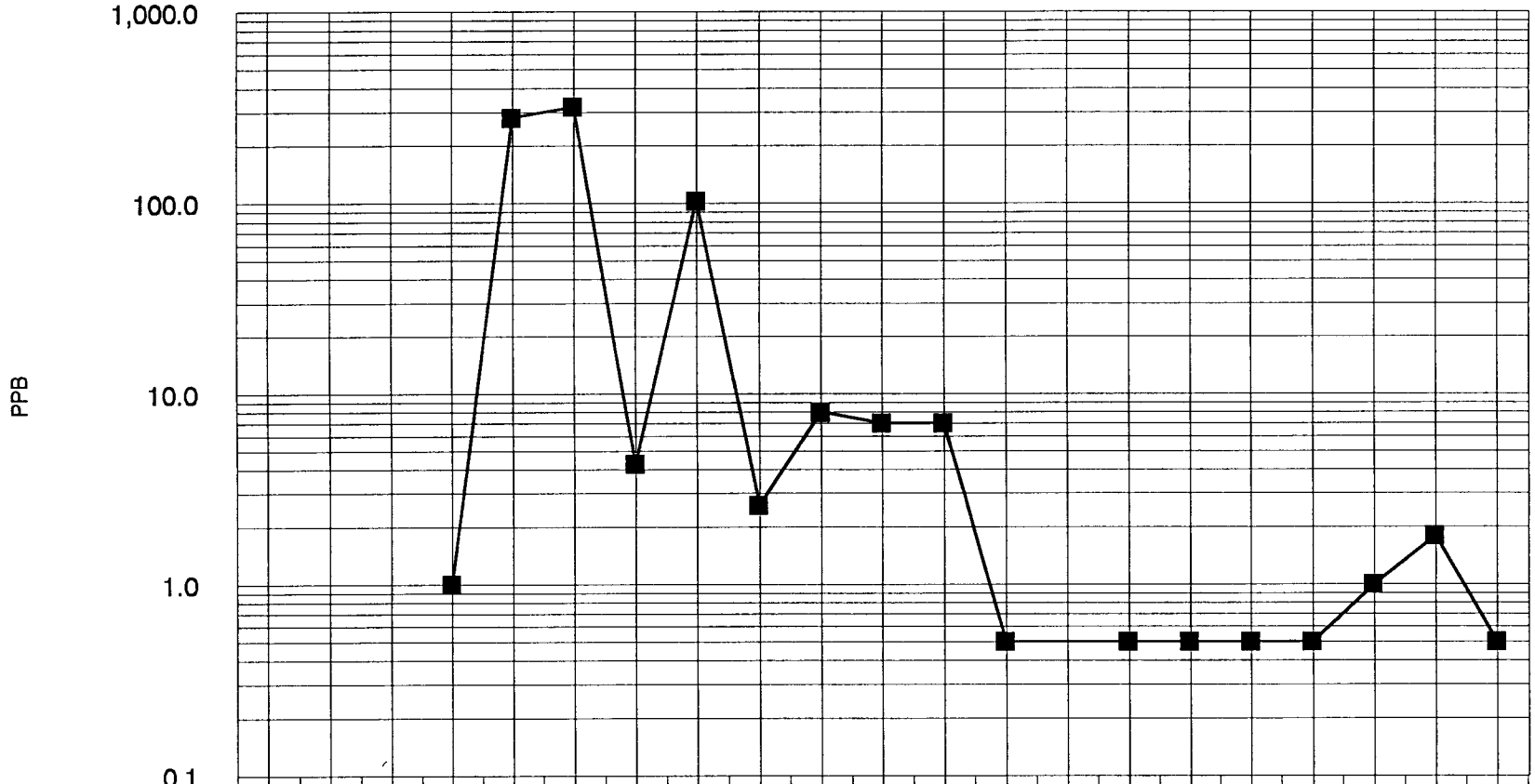
BENZENE IN GROUNDWATER
MW-66



	May/91	Jun/91	Jul/91	Aug/91	Sep/91	Dec/91	Apr/92	Jul/92	Oct/92	Jan/93	Apr/93	Jul/93	Oct/93	Nov/93	Nov/93	Jan/94	Apr/94	Jul/94	Oct/94	Jan/95	Apr/95	Jul/95
BENZENE				0.0	0.0	0.0	3.3	8.0	12.1	3.0	0.0	8.0	13.0	4.0		0.5	0.5	0.5	0.5	0.5	0.5	0.5

DATE SAMPLED

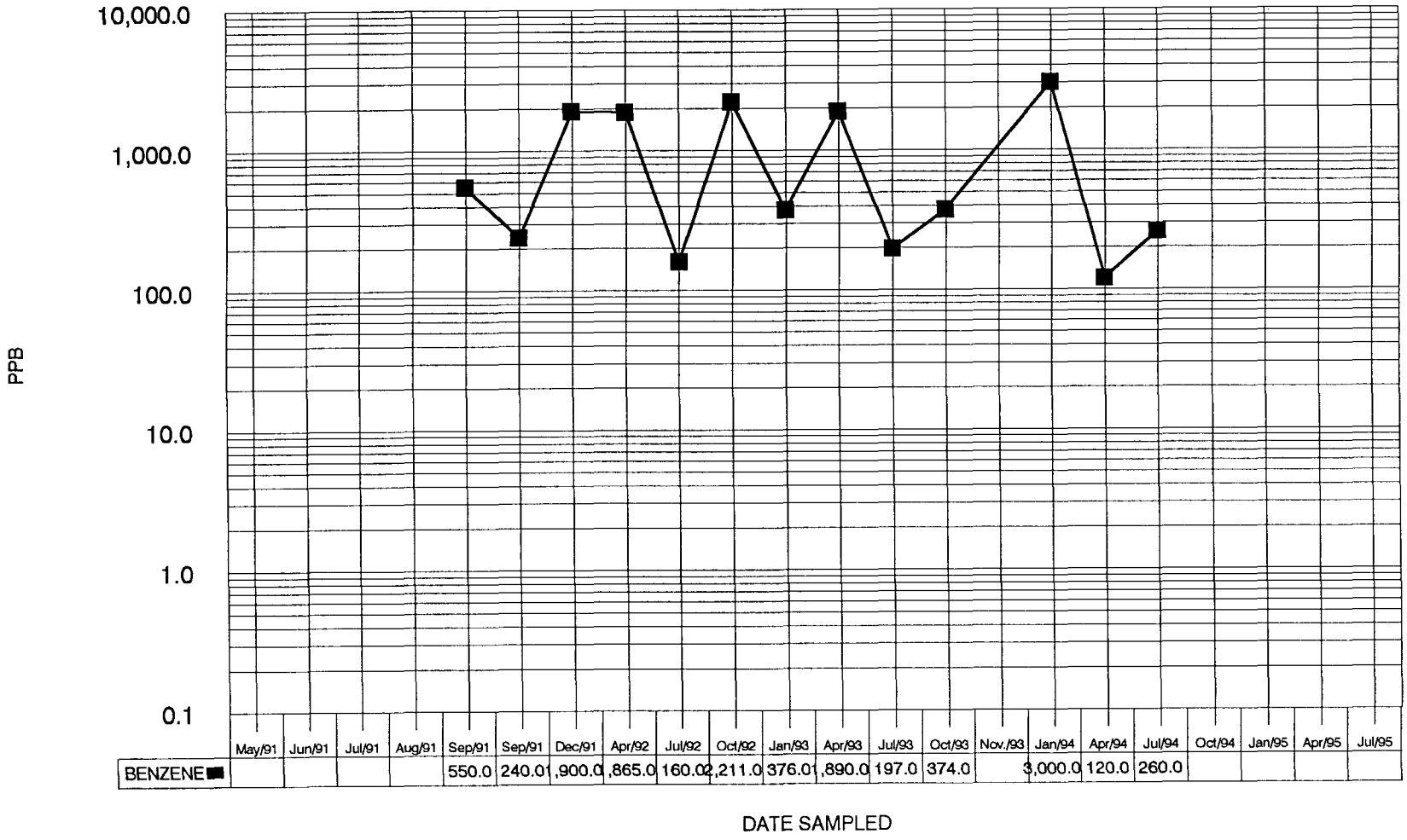
BENZENE IN GROUNDWATER
MW-67



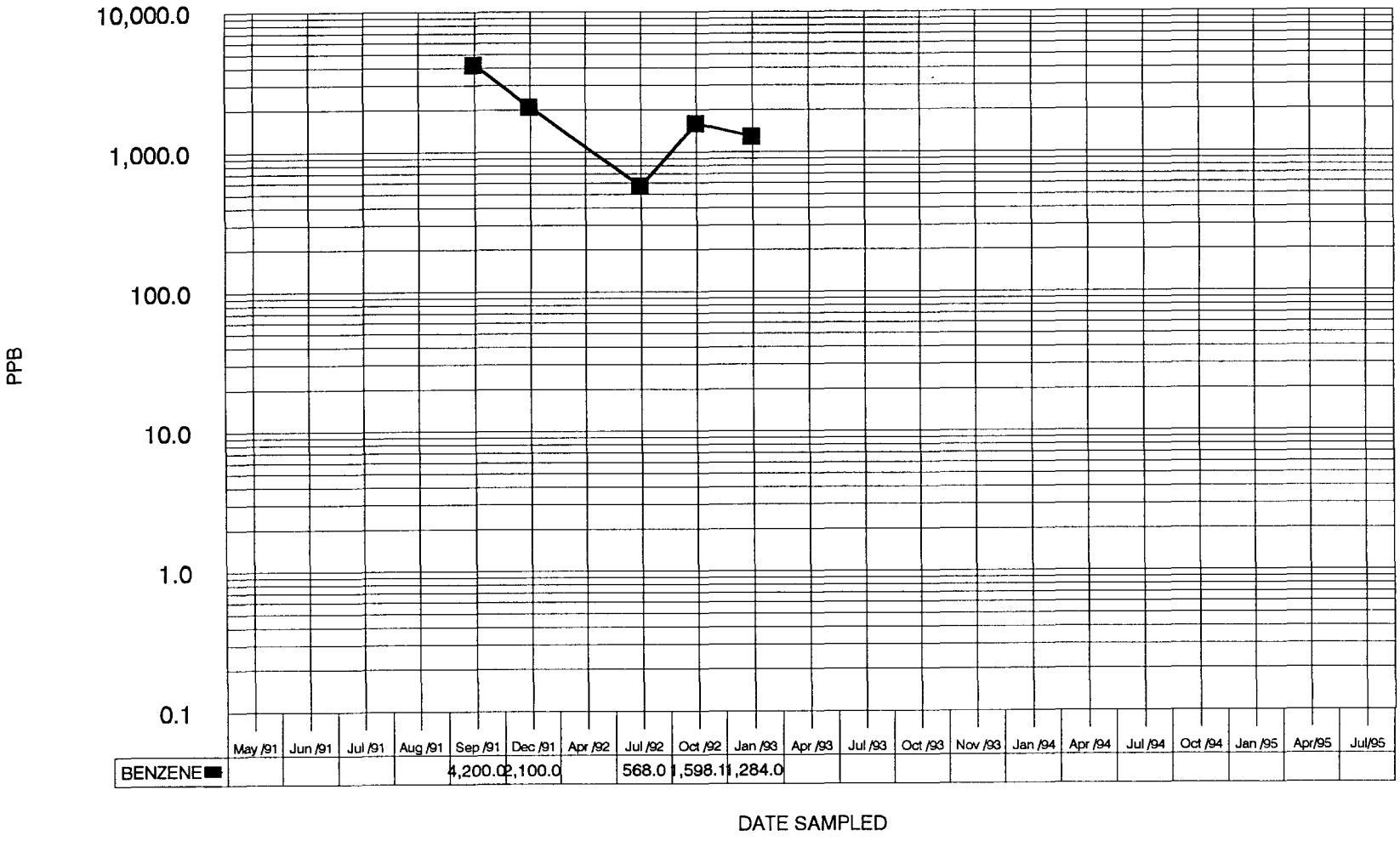
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE				1.0	280.0	320.0	4.3	103.0	2.6	8.0	7.0	7.0	0.5		0.5	0.5	0.5	0.5	1.0	1.8	0.5

DATE SAMPLED

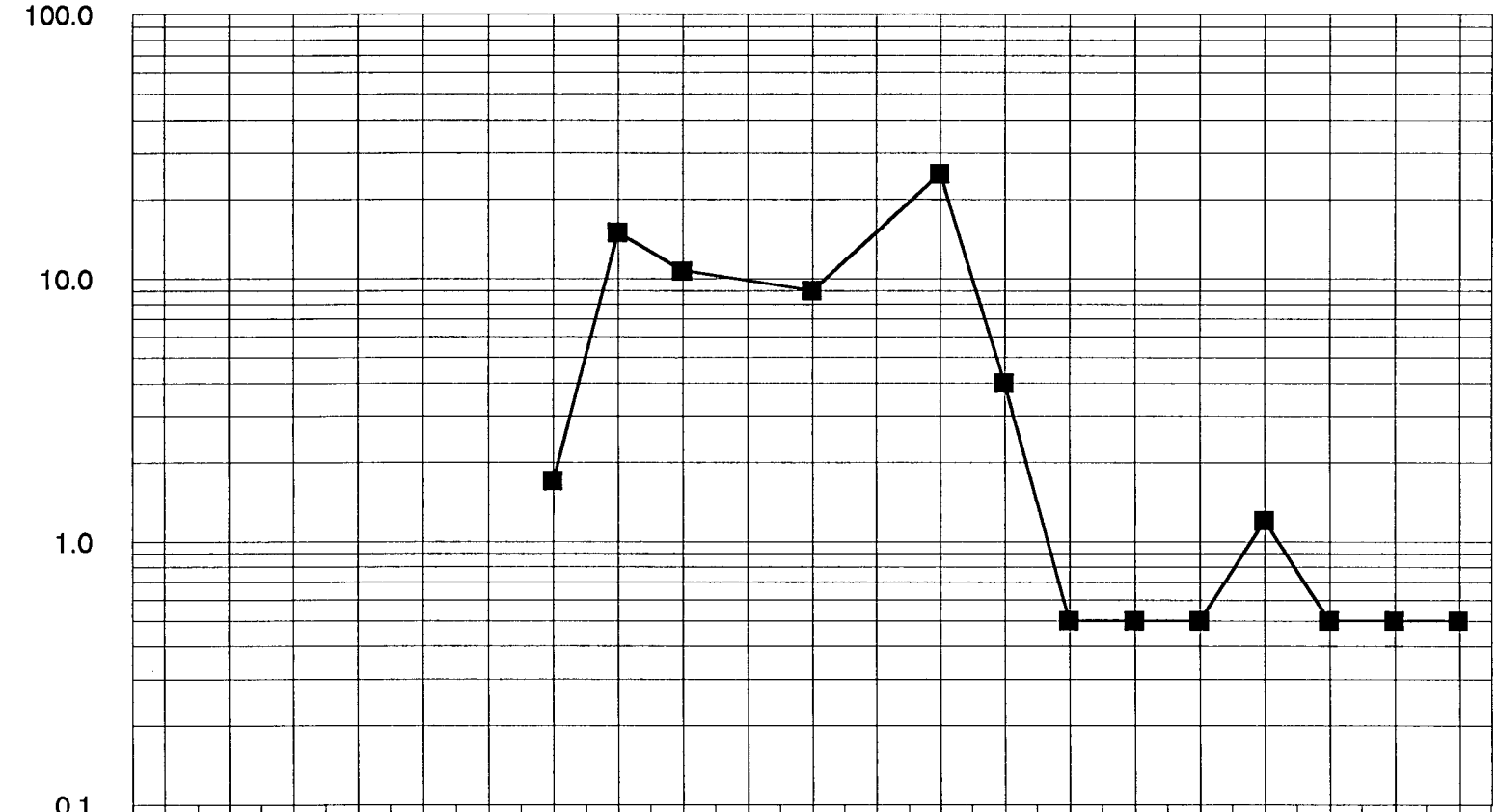
BENZENE IN GROUNDWATER
MW-68



BENZENE IN GROUNDWATER
MW-69



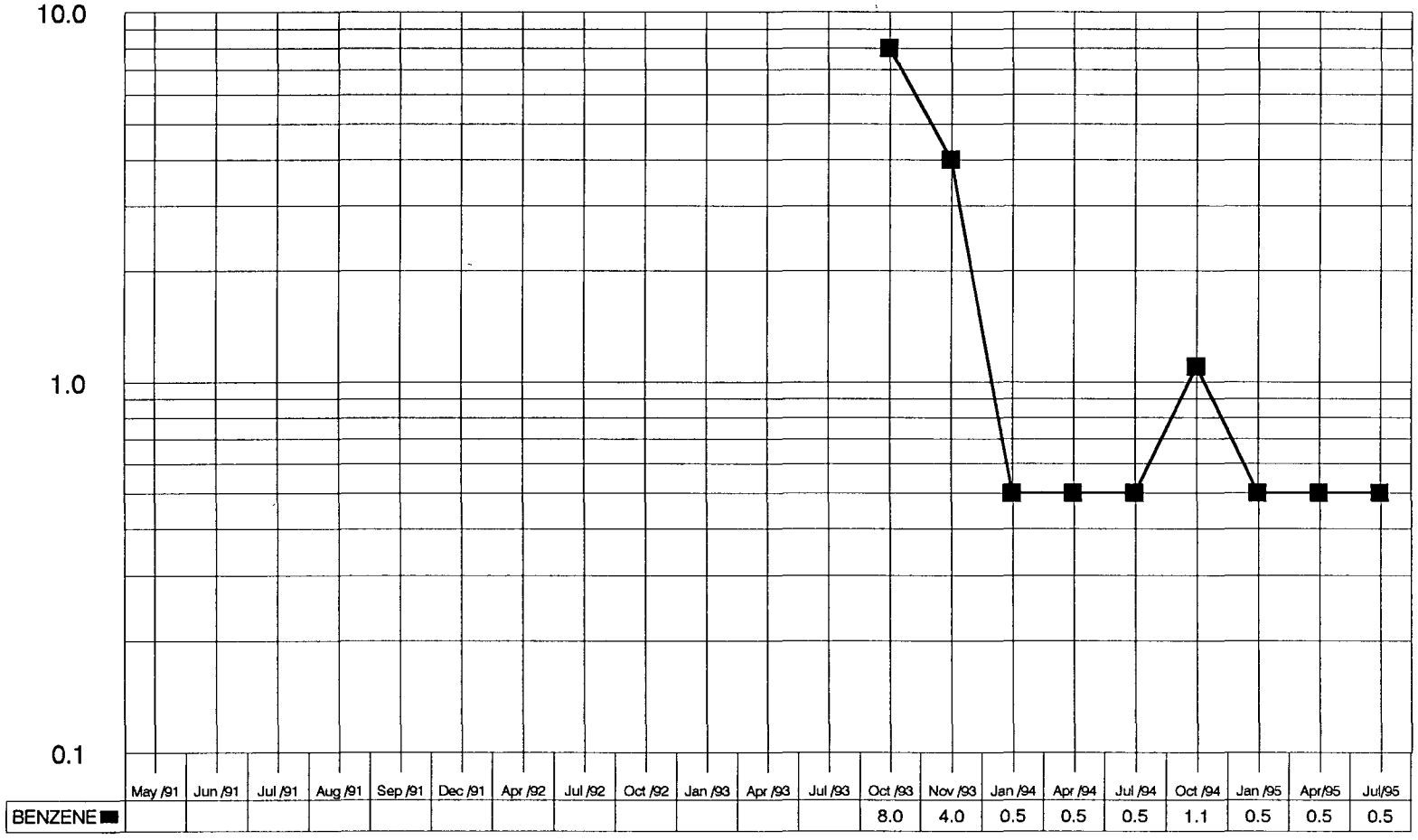
BENZENE IN GROUNDWATER
MW-70



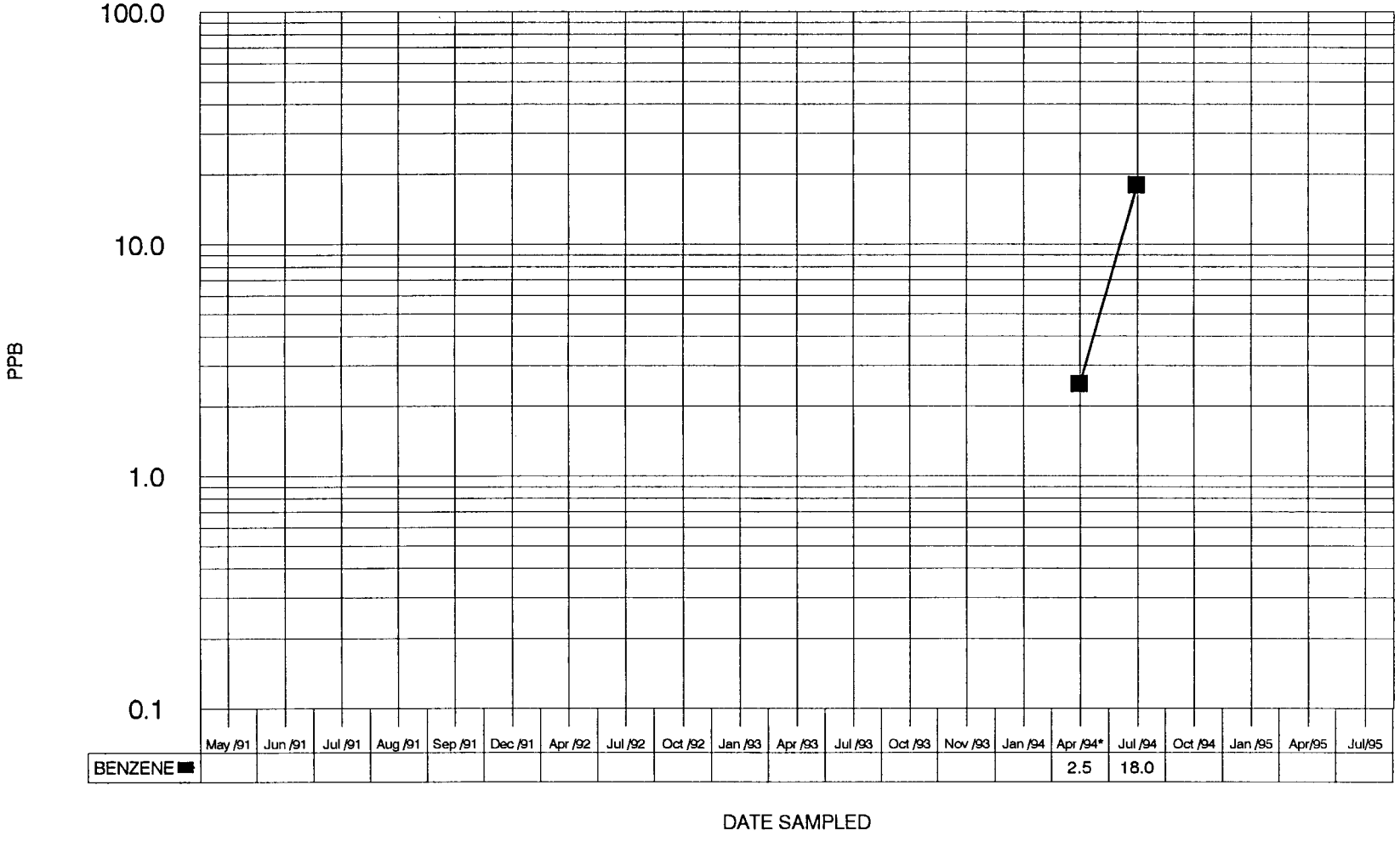
	May /91	Jun /91	Jul /91	Aug /91	Sep /91	Dec /91	Apr /92	Jul /92	Oct /92	Jan /93	Apr /93	Jul /93	Oct /93	Nov /93	Jan /94	Apr /94	Jul /94	Oct /94	Jan /95	Apr/95	Jul/95
BENZENE ■					0.0	0.0	1.7	15.0	10.7	0.0	9.0	0.0	25.0	4.0	0.5	0.5	0.5	1.2	0.5	0.5	0.5

DATE SAMPLED

BENZENE IN GROUNDWATER
MW-71

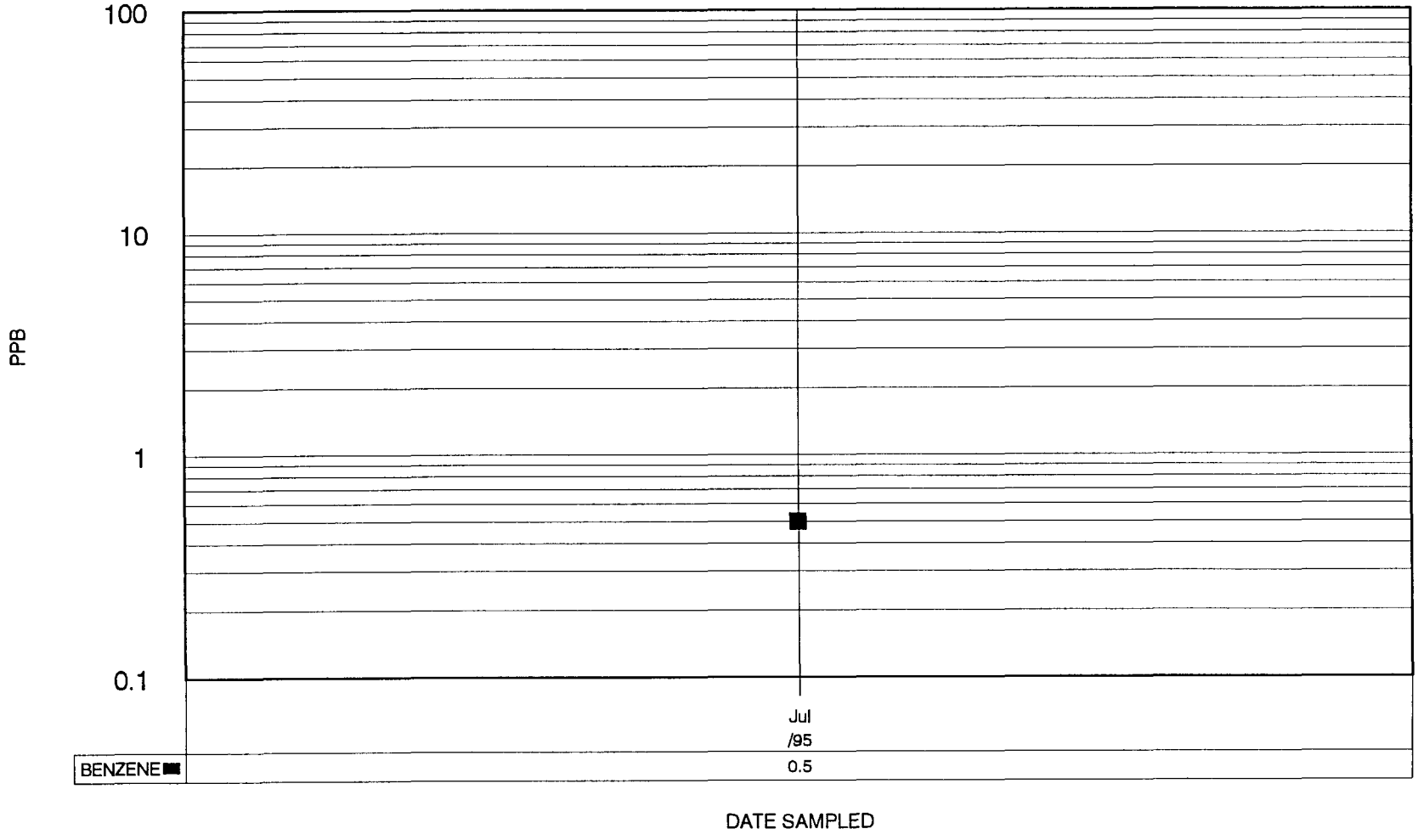


BENZENE IN GROUNDWATER
MW-72

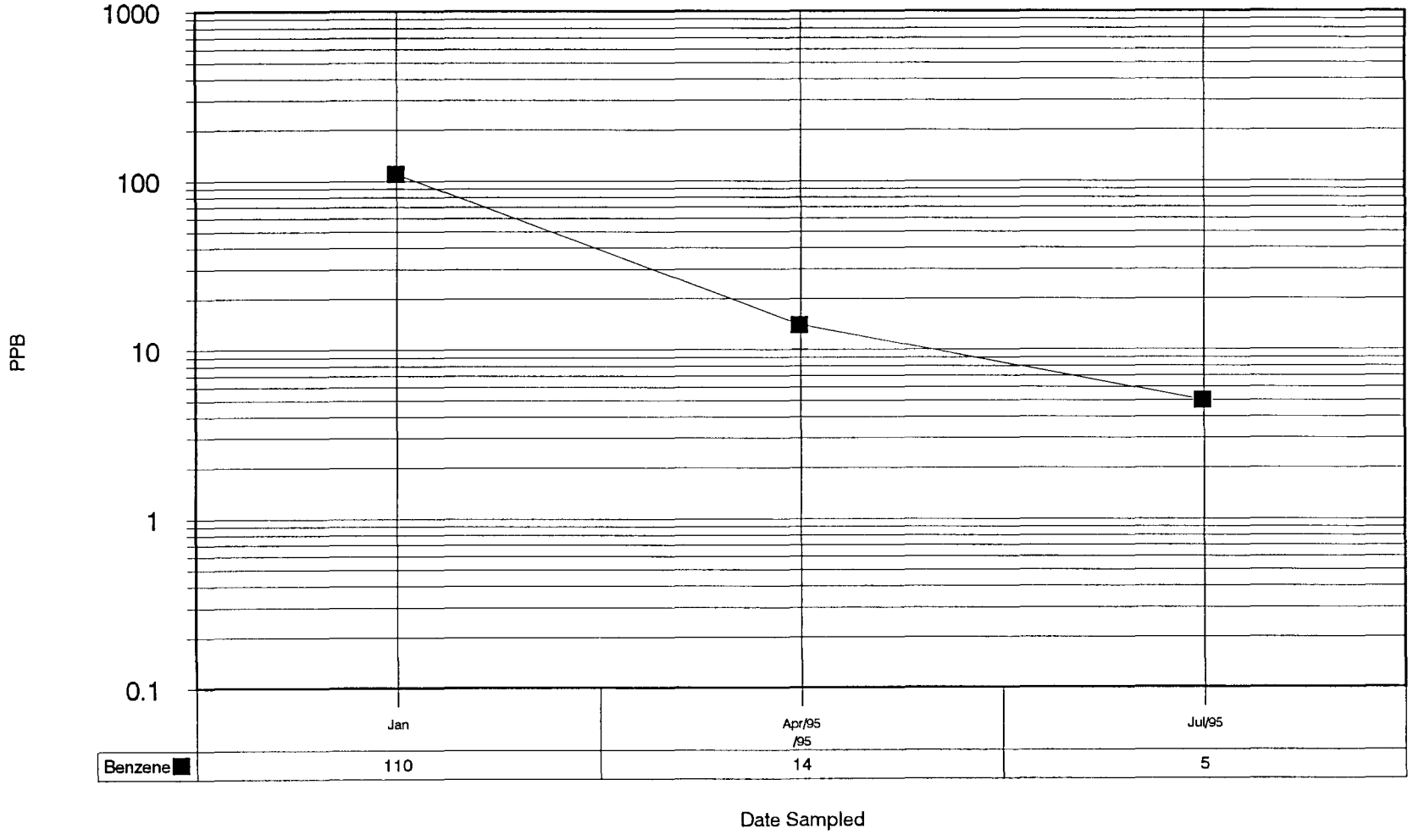


*April 1994 was the first time this well was sampled.

BENZENE IN GROUNDWATER
MW-77



BENZENE IN GROUNDWATER
MW-79



APPENDIX C

JULY 1995 LABORATORY RESULTS - GROUNDWATER

AND

RANCHER WELL, PLANT WELL, AND NATURAL SPRING

Analytical **Technologies,** Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **507393**

August 10, 1995

Marathon Oil Co.
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: INDIAN BASIN REMEDIATION 44999

Attention: Bob Menzie

On **07/24/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

EPA method 8020 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

RECEIVED
AUG 15 1995
Environmental Bureau

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO. DATE RECEIVED : 07/24/95

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION REPORT DATE : 08/10/95

ATI ID: 507393

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	507393-01	PI 071795	AQUEOUS	07/17/95
02	507393-02	PW 071795	AQUEOUS	07/17/95
03	507393-03	EB 071895	AQUEOUS	07/18/95
04	507393-04	MW-70RB	AQUEOUS	07/18/95
05	507393-05	MW-70	AQUEOUS	07/18/95
06	507393-06	MW-63RB	AQUEOUS	07/18/95
07	507393-07	MW-63	AQUEOUS	07/18/95
08	507393-08	MW-71RB	AQUEOUS	07/18/95
09	507393-09	MW-71	AQUEOUS	07/18/95
10	507393-10	MW-66RB	AQUEOUS	07/19/95
11	507393-11	MW-66	AQUEOUS	07/19/95
12	507393-12	MW-60RB	AQUEOUS	07/19/95
13	507393-13	MW-60	AQUEOUS	07/19/95
14	507393-14	MW-64RB	AQUEOUS	07/19/95
15	507393-15	MW-64	AQUEOUS	07/19/95
16	507393-16	MW-67RB	AQUEOUS	07/20/95
17	507393-17	MW-67	AQUEOUS	07/20/95
18	507393-18	MW-57RB	AQUEOUS	07/20/95
19	507393-19	MW-57	AQUEOUS	07/20/95
20	507393-20	MW-55RB	AQUEOUS	07/20/95
21	507393-21	MW-55	AQUEOUS	07/20/95
22	507393-22	MW-79	AQUEOUS	07/21/95
23	507393-23	MW-50	AQUEOUS	07/21/95
24	507393-24	MW-49	AQUEOUS	07/21/95
25	507393-25	MW-44	AQUEOUS	07/21/95
26	507393-26	MW-43	AQUEOUS	07/21/95
27	507393-27	MW-41	AQUEOUS	07/21/95
28	507393-28	MW-11	AQUEOUS	07/21/95
29	507393-29	MW-54	AQUEOUS	07/21/95
30	507393-30	MW-61	AQUEOUS	07/21/95
31	507393-31	MW-77	AQUEOUS	07/21/95
32	507393-32	TRIP BLANK	AQUEOUS	07/14/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	32

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc. "FINAL REPORT FORMAT - MULTIPLE"

Accession: 507479
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507393
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507393-05			Lab ID: 001		
CHLORIDE (325.2)	MG/L	9	2	CKW21A	
Comments:					
Client ID: 507393-07			Lab ID: 002		
CHLORIDE (325.2)	MG/L	7	2	CKW21A	
Comments:					
Client ID: 507393-09			Lab ID: 003		
CHLORIDE (325.2)	MG/L	22	2	CKW21A	
Comments:					
Client ID: 507393-11			Lab ID: 004		
CHLORIDE (325.2)	MG/L	8	2	CKW21A	
Comments:					
Client ID: 507393-13			Lab ID: 005		
CHLORIDE (325.2)	MG/L	9	2	CKW21A	
Comments:					
Client ID: 507393-15			Lab ID: 006		
CHLORIDE (325.2)	MG/L	11	2	CKW21A	
Comments:					
Client ID: 507393-17			Lab ID: 007		
CHLORIDE (325.2)	MG/L	6	2	CKW21A	
Comments:					
Client ID: 507393-19			Lab ID: 008		
CHLORIDE (325.2)	MG/L	37	2	CKW21A	

Analytical Technologies, Inc. "FINAL REPORT FORMAT - MULTIPLE"

Accession: 507479
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507393
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507393-21			Lab ID: 009		
CHLORIDE (325.2)	MG/L	300	8	CKW21A	+
Comments:					
Client ID: 507393-22			Lab ID: 010		
CHLORIDE (325.2)	MG/L	31	2	CKW21A	
Comments:					
Client ID: 507393-23			Lab ID: 011		
CHLORIDE (325.2)	MG/L	310	8	CKW21A	+
Comments:					
Client ID: 507393-24			Lab ID: 012		
CHLORIDE (325.2)	MG/L	380	8	CKW21A	+
Comments:					
Client ID: 507393-25			Lab ID: 013		
CHLORIDE (325.2)	MG/L	400	8	CKW21A	+
Comments:					
Client ID: 507393-26			Lab ID: 014		
CHLORIDE (325.2)	MG/L	270	8	CKW21A	+
Comments:					
Client ID: 507393-27			Lab ID: 015		
CHLORIDE (325.2)	MG/L	270	8	CKW21A	+
Comments:					
Client ID: 507393-28			Lab ID: 016		
CHLORIDE (325.2)	MG/L	260	8	CKW21A	+

Analytical Technologies, Inc. "FINAL REPORT FORMAT - MULTIPLE"

Accession: 507479
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507393
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507393-29			Lab ID: 017		
CHLORIDE (325.2)	MG/L	95	2	CKW21A	
Comments:					
Client ID: 507393-30			Lab ID: 018		
CHLORIDE (325.2)	MG/L	400	8	CKW21A	+
Comments:					
Client ID: 507393-31			Lab ID: 019		
CHLORIDE (325.2)	MG/L	110	2	CKW21A	
Comments:					

Analytical Technologies, Inc. "FINAL REPORT FORMAT - MULTIPLE"

Accession: 507479
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507393
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION
Test: Group of Single Wetchem

Client ID:	Lab ID:	Matrix:	Date/Time Sampled:	Date Received:
507393-05	001	WATER	18-JUL-95 1300	25-JUL-95
507393-07	002	WATER	18-JUL-95 1545	25-JUL-95
507393-09	003	WATER	18-JUL-95 2010	25-JUL-95
507393-11	004	WATER	19-JUL-95 0950	25-JUL-95
507393-13	005	WATER	19-JUL-95 1215	25-JUL-95
507393-15	006	WATER	19-JUL-95 1440	25-JUL-95
507393-17	007	WATER	20-JUL-95 0900	25-JUL-95
507393-19	008	WATER	20-JUL-95 1030	25-JUL-95
507393-21	009	WATER	20-JUL-95 1150	25-JUL-95
507393-22	010	WATER	21-JUL-95 1015	25-JUL-95
507393-23	011	WATER	21-JUL-95 1635	25-JUL-95
507393-24	012	WATER	21-JUL-95 1643	25-JUL-95
507393-25	013	WATER	21-JUL-95 1658	25-JUL-95
507393-26	014	WATER	21-JUL-95 1707	25-JUL-95
507393-27	015	WATER	21-JUL-95 1715	25-JUL-95
507393-28	016	WATER	21-JUL-95 1730	25-JUL-95
507393-29	017	WATER	21-JUL-95 1746	25-JUL-95
507393-30	018	WATER	21-JUL-95 1756	25-JUL-95
507393-31	019	WATER	21-JUL-95 1812	25-JUL-95

"Method Report Summary"

Analytical Technologies, Inc.

Accession Number: 507479
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507393
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
507393-05	CHLORIDE (325.2)	MG/L	9
507393-07	CHLORIDE (325.2)	MG/L	7
507393-09	CHLORIDE (325.2)	MG/L	22
507393-11	CHLORIDE (325.2)	MG/L	8
507393-13	CHLORIDE (325.2)	MG/L	9
507393-15	CHLORIDE (325.2)	MG/L	11
507393-17	CHLORIDE (325.2)	MG/L	6
507393-19	CHLORIDE (325.2)	MG/L	37
507393-21	CHLORIDE (325.2)	MG/L	300
507393-22	CHLORIDE (325.2)	MG/L	31
507393-23	CHLORIDE (325.2)	MG/L	310
507393-24	CHLORIDE (325.2)	MG/L	380
507393-25	CHLORIDE (325.2)	MG/L	400
507393-26	CHLORIDE (325.2)	MG/L	270
507393-27	CHLORIDE (325.2)	MG/L	270
507393-28	CHLORIDE (325.2)	MG/L	260
507393-29	CHLORIDE (325.2)	MG/L	95
507393-30	CHLORIDE (325.2)	MG/L	400
507393-31	CHLORIDE (325.2)	MG/L	110

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	CHLORIDE-A
Batch Id:	CKW21A
Blank Result:	<2
Anal. Method:	325.2
Prep. Method:	N/A
Analysis Date:	07-AUG-95
Prep. Date:	07-AUG-95

Sample Duplication

Sample Dup:	507479-1
Rept Limit:	<2
Sample Result:	8.6
Dup Result:	8.9
Sample RPD:	0.3G
Max RPD:	2
Dry Weight%	N/A

Matrix Spike

Sample Spiked:	507479-1
Rept Limit:	<2
Sample Result:	8.6
Spiked Result:	28.9
Spike Added:	20.0
% Recovery:	102
% Rec Limits:	77-130
Dry Weight%	N/A

ICV

ICV Result:	55.8
True Result:	55.0
% Recovery:	101
% Rec Limits:	90-110

LCS

LCS Result:	
True Result:	
% Recovery:	
% Rec Limits:	

Analytical Technologies, Inc.

----- Common Footnotes Wet Chem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO THE MATRIX (PRE-DIGESTION) SPIKE BEING OUTSIDE ACCEPTANCE LIMITS.
= ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE.
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX (DILUTION PRIOR TO PREPARATION).
P = ANALYTICAL (POST-DIGESTION) SPIKE
I = DUPLICATE INJECTION
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE RESULTS EXCEED THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL" SAMPLE IS NON-HOMOGENOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.

(CA) = SEE CORRECTIVE ACTIONS FORM.

SW-846, 3RD EDITION, SEPTEMBER 1986 AND REVISION 1, JULY 1992.
EPA 600/4-79-020, REVISED MARCH 1983.
STANDARD METHODS, 17TH ED., 1989
NIOSH MANUAL OF ANALYTICAL METHODS, 3RD EDITION.
ANNUAL BOOK OF ASTM STANDARDS, VOLUME 11.01, 1991.

1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.

2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND THE DUPLICATE ANALYSIS.

3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS. IF FLASHPOINT IS LESS THAN 25 DEGREES CELSIUS, THE DETECTION LIMIT BECOMES THE INITIAL STARTING TEMPERATURE.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG
SG = SCOTT GRESHAM
FB = FREDDIE BROWN
CF = CHRISTINE FOSTER
RB = REBECCA BROWN
RB = REBECCA BROWN
JHS = JOSEPH SAUNDERS
CD = CHRISTY DRAPER
TT = TONY TINEO
MM = MARY MOLONEY
NB = NANCY L. BRA
NSB = NANCY S. BUT

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	PI 071795	AQUEOUS	07/17/95	NA	07/25/95	1
02	PW 071795	AQUEOUS	07/17/95	NA	07/25/95	1
03	EB 071895	AQUEOUS	07/18/95	NA	07/25/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	0.8
TOLUENE	UG/L	<0.5	<0.5	0.6
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	11	<0.5	3.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		99	99	99

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	MW-70RB	AQUEOUS	07/18/95	NA	07/25/95	1
05	MW-70	AQUEOUS	07/18/95	NA	07/25/95	1
06	MW-63RB	AQUEOUS	07/18/95	NA	07/25/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	0.8	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	7.0	<0.5	7.4
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	94	97

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
07	MW-63	AQUEOUS	07/18/95	NA	07/25/95	1
08	MW-71RB	AQUEOUS	07/18/95	NA	07/28/95	1
09	MW-71	AQUEOUS	07/18/95	NA	07/28/95	1

PARAMETER	UNITS	07	08	09
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	1.0	0.6	1.2
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	2.2	1.9
SURROGATE:				
BROMOFLUOROBENZENE (%)		99	103	110

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
10	MW-66RB	AQUEOUS	07/19/95	NA	07/28/95	1
11	MW-66	AQUEOUS	07/19/95	NA	07/28/95	1
12	MW-60RB	AQUEOUS	07/19/95	NA	07/28/95	1

PARAMETER	UNITS	10	11	12
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	0.9	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	7.1	<0.5	0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		105	107	107

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
13	MW-60	AQUEOUS	07/19/95	NA	07/28/95	1
14	MW-64RB	AQUEOUS	07/19/95	NA	07/28/95	1
15	MW-64	AQUEOUS	07/19/95	NA	07/28/95	1

PARAMETER	UNITS	13	14	15
BENZENE	UG/L	<0.5	<0.5	17
TOLUENE	UG/L	4.9	0.5	1.1
ETHYLBENZENE	UG/L	<0.5	<0.5	9.8
TOTAL XYLENES	UG/L	<0.5	4.9	23
SURROGATE:				
BROMOFLUOROBENZENE (%)		105	106	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
16	MW-67RB	AQUEOUS	07/21/95	NA	07/28/95	1
17	MW-67	AQUEOUS	07/21/95	NA	07/28/95	1
18	MW-57RB	AQUEOUS	07/21/95	NA	07/28/95	1

PARAMETER	UNITS	16	17	18
BENZENE	UG/L	0.8	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	2.0	0.6	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		102	101	109

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
19	MW-57	AQUEOUS	07/20/95	NA	07/28/95	1
20	MW-55RB	AQUEOUS	07/20/95	NA	07/28/95	1
21	MW-55	AQUEOUS	07/20/95	NA	07/28/95	10

PARAMETER	UNITS	19	20	21
BENZENE	UG/L	<0.5	1.9	350
TOLUENE	UG/L	0.8	<0.5	<5.0
ETHYLBENZENE	UG/L	<0.5	2.2	270
TOTAL XYLENES	UG/L	<0.5	<0.5	22
SURROGATE:				
BROMOFLUOROBENZENE (%)		108	105	89

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
22	MW-79	AQUEOUS	07/21/95	NA	07/29/95	10
23	MW-50	AQUEOUS	07/21/95	NA	07/29/95	1
24	MW-49	AQUEOUS	07/21/95	NA	07/29/95	1

PARAMETER	UNITS	22	23	24
BENZENE	UG/L	<5.0	<0.5	17
TOLUENE	UG/L	74	<0.5	<0.5
ETHYLBENZENE	UG/L	7.7	<0.5	3.5
TOTAL XYLENES	UG/L	62	<0.5	3.4
SURROGATE:				
BROMOFLUOROBENZENE (%)		88	100	94

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
25	MW-44	AQUEOUS	07/21/95	NA	07/29/95	1
26	MW-43	AQUEOUS	07/21/95	NA	07/29/95	1
27	MW-41	AQUEOUS	07/21/95	NA	07/29/95	1

PARAMETER	UNITS	25	26	27
BENZENE	UG/L	5.8	3.0	<0.5
TOLUENE	UG/L	<0.5	4.0	<0.5
ETHYLBENZENE	UG/L	16	5.8	1.1
TOTAL XYLENES	UG/L	5.6	5.9	6.3
SURROGATE:				
BROMOFLUOROBENZENE (%)		80	107	92

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
28	MW-11	AQUEOUS	07/21/95	NA	07/28/95	1
29	MW-54	AQUEOUS	07/21/95	NA	07/31/95	1
30	MW-61	AQUEOUS	07/21/95	NA	07/29/95	1

PARAMETER	UNITS	28	29	30
BENZENE	UG/L	95	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	4.4	<0.5	<0.5
TOTAL XYLENES	UG/L	250	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		90	98	100

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507393

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
31	MW-77	AQUEOUS	07/21/95	NA	07/29/95	1
32	TRIP BLANK	AQUEOUS	07/14/95	NA	07/31/95	1

PARAMETER	UNITS	31	32
BENZENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5
ETHYLBENZENE	UG/L	1.9	<0.5
TOTAL XYLENES	UG/L	2.8	<0.5
SURROGATE:			
BROMOFLUOROBENZENE (%)		92	97

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507393
BLANK I.D.	: 072995	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/29/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		104

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507393
BLANK I.D.	: 072895B	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/28/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		105

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507393
BLANK I.D.	: 072595	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/25/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		96

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507393
BLANK I.D.	: 073195	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/31/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50739318	ATI I.D.	: 507393
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/29/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50739318	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	11	110	11	110	0
TOLUENE	<0.5	10	11	110	11	110	0
ETHYLBENZENE	<0.5	10	11	110	11	110	0
TOTAL XYLENES	<0.5	30	33	110	33	110	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50739302	ATI I.D.	: 507393
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/28/95
PROJECT NAME	: INDIAN BASIN REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50739302	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	11	110	11	110	0
TOLUENE	<0.5	10	11	110	11	110	0
ETHYLBENZENE	<0.5	10	11	110	11	110	0
TOTAL XYLENES	<0.5	30	32	107	33	110	3

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

AnalyticalTechnologies, Inc., Albuquerque, NM

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CHAIN OF CUSTODY

DATE: 7/17-18/95 PAGE 1 OF 4

ATI LAB I.D. 507393

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland, TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: SAME AS ABOVE
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/ (8020)	Cl. Iveride	NUMBER OF CONTAINERS
DI 071795	7/17/95	1600	Water	-01	X	X	2
PW 071795	7/17/95	1610		-02	X	X	2
EB 071895	7/18/95	1100		-03	X	X	2
MW-70RB		1255		-04	X		2
MW-70		1300		-05	X	X	3
MW-63RB		1515		-06	X		2
MW-63		1545		-07	X	X	3
MW-71RB		1955		-08	X		2
MW-71		2010		-09	X	X	3

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	82
PROJ. NAME:	Indian Basin Remediation	CUSTODY SEALS	Y / N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	GTI	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Charles Goodwell Date: 7/24/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 0940
Printed Name: Date:	Printed Name: Date:	Printed Name: Andrew Parker Date: 7/24
Company:	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc., Albuquerque, NM

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CHAIN OF CUSTODY

DATE: 7/19-20/95 PAGE 2 OF 4

ATI LAB I.D. 507393

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland, TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO: SAME AS ABOVE
COMPANY:
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/~~MTBE~~ (8020)	Chloride	NUMBER OF CONTAINERS
MW-66RB	7/19/95	0940	Water	-10	X		2
MW-66		0950		-11	X	X	3
MW-60RB		1205		-12	X		2
MW-60		1215		-13	X	X	3
MW-64RB		1425		-14	X		2
MW-64		1440		-15	X	X	3
MW-67RB	7/20/95	0840		-16	X		2
MW-67		0900		-17	X	X	3
MW-57RB		1020		-18	X		2

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1) | (MOD 8015) Gas/Diesel | Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020) | Chlorinated Hydrocarbons (601/8010) | Aromatic Hydrocarbons (602/8020) | SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg. | Pesticides/PCB (608/8080) | Herbicides (615/8150) | Base/Neutral/Acid Compounds GC/MS (625/8270) | Volatile Organics GC/MS (624/8240) | Polynuclear Aromatics (610/8310) | SDWA Primary Standards - Arizona | SDWA Secondary Standards - Arizona | SDWA Primary Standards - Federal | SDWA Secondary Standards - Federal | The 13 Priority Pollutant Metals | RCRA Metals by Total Digestion | RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	
PROJ. NAME:	Indian Basin Remediation	CUSTODY SEALS	Y / N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	GTI	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Charles Mladenell Date: 7/24/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY:(LAB) 3.
Signature: Time:	Signature: Time:	Signature: Andrew Lackey Time: 0940
Printed Name: Date:	Printed Name: Date:	Printed Name: Andrew Lackey Date: 7/24
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

AnalyticalTechnologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 7/20-21/95 PAGE 3 OF 4

ATI LAB I.D. 507393

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland, TX 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: As Above
ADDRESS: Same

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-57	7/20/95	1030	Water	-19
MW-55RB		1135		-20
MW-55		1150		-21
MW-79	7/21/95	1015		-22
MW-50		1635		-23
MW-49		1643		-24
MW-44		1658		-25
MW-43		1707		-26
MW-41		1715		-27

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE~~MTBE~~ (8020)	Chloride	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	NUMBER OF CONTAINERS
			X	X																3
			X																	2
			X	X																3
			X	X																3
			X	X																3
			X	X																3
			X	X																3
			X	X																3
			X	X																3

PROJECT INFORMATION

PROJ. NO.: 44999
PROJ. NAME: Indian Basin Remediation
P.O. NO.:
SHIPPED VIA: GTI

SAMPLE RECEIPT

NO. CONTAINERS	
CUSTODY SEALS	(Y) N / NA
RECEIVED INTACT	Y
RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Charles Madewell Date: 7/24/95	Printed Name: Date:	Printed Name: Date:
Company: GTI Phone: 242-3413	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 0940
Printed Name: Date:	Printed Name: Date:	Printed Name: Andrew Parker Date: 7/24
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

Analytical Technologies, Inc., Albuquerque, NM

San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 7/21/95 PAGE 4 OF 4

ATI LAB I.D. 507393

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon
ADDRESS: P.O. Box 552
Midland, Tx 79702
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: SAME
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE/MTBE (8020)	Chloride	NUMBER OF CONTAINERS
MW-11	7/21/95	1730	Water	-28	X	X	3
MW-54		1746		-29	X	X	3
MW-61		1756		-30	X	X	3
MW-77		1812		-31	X	X	3
Trip Blank	7/14/95	1720	Water	-32	X		1

Petroleum Hydrocarbons (418.1); (MOD 8015) Gas/Diesel; Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020); Chlorinated Hydrocarbons (601/8010); Aromatic Hydrocarbons (602/8020); SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.; Pesticides/PCB (608/8080); Herbicides (615/8150); Base/Neutral/Acid Compounds GC/MS (625/8270); Volatile Organics GC/MS (624/8240); Polynuclear Aromatics (610/8310); SDWA Primary Standards - Arizona; SDWA Secondary Standards - Arizona; SDWA Primary Standards - Federal; SDWA Secondary Standards - Federal; The 13 Priority Pollutant Metals; RCRA Metals by Total Digestion; RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	
PROJ. NAME:	Indian Basin Remediation	CUSTODY SEALS	(Y) N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:	GTF	RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Charles Madewell Date: 7/24/95	Printed Name: Date:	Printed Name: Date:
Company: GTF Phone: 242-3113	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY:(LAB) 3.
Signature: Time:	Signature: Time:	Signature: Andrew Parker Time: 0940
Printed Name: Date:	Printed Name: Date:	Printed Name: Andrew Parker Date: 7/24
Company:	Company:	Analytical Technologies, Inc.

AnalyticalTechnologies, Inc. Albuquerque, NM

K/M McNeill

Chain of Custody

DATE 7/24 PAGE 1 OF 3

NETWORK PROJECT MANAGER: ~~LETITIA KRAKOWSKI~~

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:
K/M McNeill

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
507393- 05	7/18	1300	AQ	1
-07	7/18	1545	AQ	2
-09	7/18	2010	AQ	3
-11	7/19	0950	AQ	4
-13	7/19	1215	AQ	5
-15	7/19	1440	AQ	6
-17	7/20	0900	AQ	7
-19	7/20	1030	AQ	8
-21	7/20	1150	AQ	9

ANALYSIS REQUEST

TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	Chloride	8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
								✓													1
								✓													1
								✓													1
								✓													1
								✓													1
								✓													1
								✓													1
								✓													1
								✓													1

PROJECT INFORMATION	
PROJECT NUMBER:	507393
PROJECT NAME:	Indian Basin Remediation
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	507479

DUE DATE: 8/7
RUSH SURCHARGE:
CLIENT DISCOUNT: Quote %

IWO# KM692

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: Andrew Parker Time: 1710
Printed Name: Andrew Parker Date: 7/24
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Time: 0914
Printed Name: Date: 7/25/95
Company: ATI - FL

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

Analytical**Technologies,**Inc. Albuquerque, NM

Chain of Custody

DATE 7/24 PAGE 2 OF 2

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	Chloride	8240 /TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
507393 - 22	7/21	1615	AQ	10									✓													1
-23	7/21	1635	AQ	11									✓													1
-24	7/21	1643	AQ	12									✓													1
-25	7/21	1658	AQ	13									✓													1
-26	7/21	1707	AQ	14									✓													1
-27	7/21	1715	AQ	15									✓													1
-28	7/21	1730	AQ	16									✓													1
-29	7/21	1746	AQ	17									✓													1
-30	7/21	1756	AQ	18									✓													1

PROJECT INFORMATION	SAMPLE RECEIPT	
PROJECT NUMBER:	TOTAL NUMBER OF CONTAINERS	
PROJECT NAME:	CHAIN OF CUSTODY SEALS	
QC LEVEL: STD. IV	INTACT?	
QC REQUIRED: MS MSD BLANK	RECEIVED GOOD COND./COLD	
TAT: STANDARD RUSH!	LAB NUMBER	507479

DUE DATE: _____

RUSH SURCHARGE: _____

CLIENT DISCOUNT: _____ %

SAMPLES SENT TO:
- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA
- PORTLAND
- PHOENIX
- FIBEROUANT

RELINQUISHED BY: 1.

Signature: Time:

Printed Name: Date

Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.

Signature: Time:
Robert Sa 07:4

Printed Name: Date:
K. ELSPERMAN 7/25/95

Company:
ATI - FL

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

Analytical**Technologies,**Inc. Albuquerque, NM

Chain of Custody

DATE 7/24 PAGE 1 OF 3

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
507393-31	7/21	1812	AQ	19

TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	Chloride	8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
								1													1
								X													
								X	AQ												
								X	7/24												

PROJECT INFORMATION	
PROJECT NUMBER:	
PROJECT NAME:	
QC LEVEL: STD. IV	
QC REQUIRED: MS MSD BLANK	
TAT: STANDARD RUSH!	

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	507429

DUE DATE: _____

RUSH SURCHARGE: _____

CLIENT DISCOUNT: _____ %

SAMPLES SENT TO:
- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.

Signature: Time:

Printed Name: Date

Analytical Technologies, Inc. Albuquerque

RECEIVED BY: (LAB) 1.

Signature: Time:
Robert Simon 0914

Printed Name: Date:
R. ELSPERMAN 7/25/10

Company:
ATI - FL

RELINQUISHED BY: 2.

Signature: Time:

Printed Name: Date

Company:

RECEIVED BY: (LAB) 2.

Signature: Time:

Printed Name: Date:

Company:

Analytical **Technologies,** Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **507392**

August 10, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB REMEDIATION 44999

Attention: Bob Menzie

On **07/24/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

EPA method 8020 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

MCR
AUG 15 1995
Environmental & Safety

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO. DATE RECEIVED : 07/24/95
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION REPORT DATE : 08/10/95

ATI ID: 507392

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	507392-01	SW-1	AQUEOUS	07/21/95
02	507392-02	STRIP OUTLET	AQUEOUS	07/21/95
03	507392-03	STRIP INLET	AQUEOUS	07/21/95
04	507392-04	BIEBBLE	AQUEOUS	07/21/95
05	507392-05	ARROYO	AQUEOUS	07/21/95
06	507392-06	LYMAN	AQUEOUS	07/21/95
07	507392-07	TRIP BLANK	AQUEOUS	07/14/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507392-01			Lab ID: 001		
CHLORIDE (325.2)	MG/L	25	2	CKW21B	
Comments:					
Client ID: 507392-04			Lab ID: 002		
CHLORIDE (325.2)	MG/L	10	2	CKW21B	
Comments:					
Client ID: 507392-05			Lab ID: 003		
CHLORIDE (325.2)	MG/L	12	2	CKW21B	
Comments:					
Client ID: 507392-06			Lab ID: 004		
CHLORIDE (325.2)	MG/L	11	2	CKW21B	
Comments:					

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem

Client ID:	Lab Matrix: ID:	Date/Time Sampled:	Date Received:
507392-01	001 WATER	21-JUL-95 1220	25-JUL-95
507392-04	002 WATER	21-JUL-95 1300	25-JUL-95
507392-05	003 WATER	21-JUL-95 1325	25-JUL-95
507392-06	004 WATER	21-JUL-95 1345	25-JUL-95

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
507392-01	CHLORIDE (325.2)	MG/L	25
507392-04	CHLORIDE (325.2)	MG/L	10
507392-05	CHLORIDE (325.2)	MG/L	12
507392-06	CHLORIDE (325.2)	MG/L	11

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	CHLORIDE-A
Batch Id:	CKW21B
Blank Result:	<2
Anal. Method:	325.2
Prep. Method:	N/A
Analysis Date:	07-AUG-95
Prep. Date:	07-AUG-95

Sample Duplication

Sample Dup:	507461-1
Rept Limit:	<2
Sample Result:	124
Dup Result:	126
Sample RPD:	2
Max RPD:	13
Dry Weight%	N/A

Matrix Spike

Sample Spiked:	507461-1
Rept Limit:	<2
Sample Result:	124
Spiked Result:	141
Spike Added:	20F
% Recovery:	85
% Rec Limits:	77-130
Dry Weight%	N/A

ICV

ICV Result:	55.8
True Result:	55.0
% Recovery:	101
% Rec Limits:	90-110

LCS

LCS Result:	
True Result:	
% Recovery:	
% Rec Limits:	

Analytical **Technologies,** Inc. ----- Common Footnotes Wet Chem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO THE MATRIX (PRE-DIGESTION) SPIKE BEING OUTSIDE ACCEPTANCE LIMITS.
= ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE.
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX (DILUTION PRIOR TO PREPARATION).
P = ANALYTICAL (POST-DIGESTION) SPIKE
I = DUPLICATE INJECTION
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE RESULTS EXCEED THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL" SAMPLE IS NON-HOMOGENOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.

(CA) = SEE CORRECTIVE ACTIONS FORM.

SW-846, 3RD EDITION, SEPTEMBER 1986 AND REVISION 1, JULY 1992.
EPA 600/4-79-020, REVISED MARCH 1983.
STANDARD METHODS, 17TH ED., 1989
NIOSH MANUAL OF ANALYTICAL METHODS, 3RD EDITION.
ANNUAL BOOK OF ASTM STANDARDS, VOLUME 11.01, 1991.

1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.

2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND THE DUPLICATE ANALYSIS.

3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS. IF FLASHPOINT IS LESS THAN 25 DEGREES CELSIUS, THE DETECTION LIMIT BECOMES THE INITIAL STARTING TEMPERATURE.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG
SG = SCOTT GRESHAM
FB = FREDDIE BROWN
CF = CHRISTINE FOSTER
RB = REBECCA BROWN
RB = REBECCA BROWN
JHS = JOSEPH SAUNDERS
CD = CHRISTY DRAPER
TT = TONY TINEO
MM = MARY MOLONEY
NB = NANCY L. BRA
NSB = NANCY S. BUT

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	07/21/95	NA	07/25/95	1
02	STRIP OUTLET	AQUEOUS	07/21/95	NA	07/25/95	10
03	STRIP INLET	AQUEOUS	07/21/95	NA	07/26/95	10

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<5.0	58
TOLUENE	UG/L	<0.5	<5.0	<5.0
ETHYLBENZENE	UG/L	<0.5	<5.0	68
TOTAL XYLENES	UG/L	<0.5	33	270
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	88	94

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	BIEBBLE	AQUEOUS	07/21/95	NA	07/25/95	1
05	ARROYO	AQUEOUS	07/21/95	NA	07/25/95	1
06	LYMAN	AQUEOUS	07/21/95	NA	07/25/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	96	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
07	TRIP BLANK	AQUEOUS	07/14/95	NA	07/25/95	1

PARAMETER	UNITS	07
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%) 89

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507392
BLANK I.D.	: 072595	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/25/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		96

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 507392
BLANK I.D.	: 072695	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/26/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5
SURROGATE:		
BROMOFLUOROBENZENE (%)		92

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 50739205	ATI I.D.	: 507392
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 07/25/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50739205	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	10	100	10	100	0
TOLUENE	<0.5	10	10	100	10	100	0
ETHYLBENZENE	<0.5	10	10	100	10	100	0
TOTAL XYLENES	<0.5	30	31	103	31	103	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc., Albuquerque, NM

San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 7-21-95 PAGE 1 OF 1

ATI LAB I.D. 507392

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: 125 W. Missouri St.
Midland, TX 79701
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: same
ADDRESS:

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020)	Chloride	NUMBER OF CONTAINERS
SW-1	7-21-95	12:20p	Water	-01	✓	✓	3
Strip outlet		12:30p		-02	✓		2
Strip inlet		12:35p		-03	✓		2
Biebble		1:00p		-04	✓	✓	3
ARRoyo		1:25p		-05	✓	✓	3
Lyman		1:45p		-06	✓	✓	3
Trip Blank	7/11/95	1720	Water	-07	✓		1

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1)
(MOD 8015) Gas/Diesel
Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)
Chlorinated Hydrocarbons (601/8010)
Aromatic Hydrocarbons (602/8020)
SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
Volatile Organics GC/MS (624/8240)
Polynuclear Aromatics (610/8310)
SDWA Primary Standards - Arizona
SDWA Secondary Standards - Arizona
SDWA Primary Standards - Federal
SDWA Secondary Standards - Federal
The 13 Priority Pollutant Metals
RCRA Metals by Total Digestion
RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	25/7
PROJ. NAME:	IB Remediation	CUSTODY SEALS	Y / N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:		RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Bigo Aguilera Time: 2:00 PM	Signature: RJ Menzie Time: 4:00 pm	Signature: Time: 09:30
Printed Name: BIGO AGUILERA Date: 7-21-95	Printed Name: RJ Menzie Date: 7-21-95	Printed Name: Charles Maddell Date: 7-24-95
Company: MARATHON Phone: 505 687 2621	Company: Marathon	Company: GTI

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY:(LAB) 3.
Signature: RJ Menzie Time: 2:00 pm	Signature: Time: 4:00 pm	Signature: Anderbuke Time: 0935
Printed Name: RJ Menzie Date: 7-21-95	Printed Name: Charles Maddell Date: 7-21-95	Printed Name: Anderbuke Date: 7/24
Company: Marathon	Company: GTI	Analytical Technologies, Inc.

AnalyticalTechnologies, Inc. Albuquerque, NM

Chain of Custody

DATE 7/24 PAGE 1 OF 1

KIM McNeill

NETWORK PROJECT MANAGER: ~~LETITIA KRAKOWSKI~~

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:
KIM McNeill

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
507392-01	7/21	12:20	AQ	1
-04	↓	1300	↓	2
-05		1325		3
-06	↓	1345	↓	4

	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	Chloride EPA 325.2	8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
507392-01									✓													
-04									✓													
-05									✓													
-06									✓													

PROJECT INFORMATION

PROJECT NUMBER: 507392
PROJECT NAME: IB Remediation
QC LEVEL: STD IV
QC REQUIRED: MS MSD BLANK
TAT: STANDARD RUSH!

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	Y
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	507486

DUE DATE: 8/14
RUSH SURCHARGE:
CLIENT DISCOUNT: Quote %

IWO# KM619

SAMPLES SENT TO:

SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.
Signature: Andrew Parker Time: 1710
Printed Name: Andrew Parker Date: 7/24
Analytical Technologies, Inc.
Albuquerque

RECEIVED BY: (LAB) 1.
Signature: Robert Elsperman Time: 0914
Printed Name: R. ELSPERMAN Date: 7/25/95
Company: ATI - FL

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date
Company:

RECEIVED BY: (LAB) 2.
Signature: Time:
Printed Name: Date:
Company:

APPENDIX D

STATE ENGINEER OFFICE FLUID RECOVERY REPORTS

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 9, 1995

Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

Re: Indian Basin Remediation Project

Dear Mr. Torres:

The following table indicates the recorded meter readings for fluid removed from the Lower Queen monitoring wells under permit RA-5131 as of Monday, August 7, 1995. Cumulative Lower Queen fluid removal through that date is 57,790,408 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	08/07/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-58	10239118	0	7404855	7,404,855 26,922[1]	7,431,777
MW-59	10259114	0	146506*	6,153,252 83,454[1]	6,236,706
MW-61A	10239116	0	8114008	8,114,008 130,850[1]	8,244,858
MW-62	10239115	0	6237239	6,237,239 256,553[1]	6,493,792
MW-65A	10239117	0	262459	10,262,459 39,774[1]	10,302,233
MW-68	02209213	122618	4686768	4,564,150 2,484,076[1]	7,048,226
MW-72	02881532	470	12033286	12,032,816	12,032,816
LOWER QUEEN TOTAL 57,790,408 Gallons					

* Metered units are barrels.
[1] Previously metered recovered volumes.

The following table indicates the meter readings for fluid removed from Shallow zone monitoring wells under permit RA-8015 as of Monday, August 7, 1995. The cumulative shallow fluid removal through that date is 823,807 gallons.

MONITORING WELL	METER SERIAL NUMBER	INIT'L METER START	08/07/95 METER READING	FLUID REMOVED (Gal)	PER-WELL FLUID REMOVED (Gal)
MW-1	——	—	—	6,713[1]	6,713
MW-13	02209212	98236.2	226324	243,999[1]	243,999
MW-14	02209214	0	398204.3	398,391[1]	398,391
MW-21	—	—	—	189[1]	189
MW-35	02209212	1881.8	—	98,303[1]	98,303
MW-45	10239114	2421861	2421861	0	0
MW-51	02209214	398208	398208	0	0
MW-69	—	—	—	4074[2] 72, 138[1]	76,212
SHALLOW TOTAL				823,807 Gallons	

[1] Previously metered recovered volumes
[2] Gauged in portable fiberglass tank.

Please note the above tables have been revised to show only the meter serial numbers and readings for the meters currently installed on each well. Earlier readings from meters that have been replaced or switched to other wells have been summarized as "previously metered recovered volumes" to simplify the tables and associated footnotes.

If more information is required, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM50995/nrt

xc: L. J. Oswald - Midland
C. M. Schweser - IBGP, Lakewood
File: 576-01

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

September 13, 1995

Mr. Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

RE: Revised Report for SEO permits RA-5131 and RA-8015

Dear Mr. Torres:

This is a revised report for SEO permits RA-5131 and RA-8015 for the month of August. Although the meter readings are accurate in the September 11 letter which this letter report replaces, an error was discovered today in the spreadsheet from which this report is generated. Please note the change in MW-65A total fluid removed and the revised total for permit RA-5131. The following table indicates recorded meter readings for fluid removed from Lower Queen recovery wells under permit RA-5131 as of Tuesday, September 5, 1995.

Recovery Well	Meter Serial Number	Initial Meter Start	Meter Units	Previously Metered Fluid Removed (gal)	Meter Turnover Additional Fluid Removed (gal)	8/7/95 Meter Reading	9/5/95 Meter Reading	Aug-95 Fluid Removed (gal)	Per-well Cumulative Fluid Removed (gal)
MW-58	10239118	0	gal	26922	0	7404855	7437047	32192	7463969
MW-59	10259114	0	bbl	83454	0	146506	148578	87024	6323730
MW-61A	10239116	0	gal	130850	0	8114008	8459437	345429	8590287
MW-62	10239115	0	gal	256553	0	6237239	6395694	158455	6652247
MW-65A	10239117	0	gal	39774	10000000	262459	465725	203266	10505499
MW-68	2209213	122618	gal	2484076	0	4686768	4814165	127397	7175623
MW-72	2881532	470	gal	12032816	0	12033286	12579011	545725	12578541
MW-75	2877269	1291	bbl	0	0	1291	5674	184086	184086
TOTAL									59473982

The following table indicates recorded meter readings for fluid removed from Shallow zone recovery wells under permit RA-8015 as of Tuesday, September 5, 1995.

Recovery Well	Meter Serial Number	Initial Meter Start	Meter Units	Previously Metered Fluid Removed (gal)	Meter Turnover Additional Fluid Removed (gal)	8/7/95 Meter Reading	9/5/95 Meter Reading	Aug-95 Fluid Removed (gal)	Per-well Cumulative Fluid Removed (gal)
MW-1	-	-	gal	6713	0	-	-	0	6713
MW-13	2209212	98236	gal	243999	0	226324	226324	0	243999
MW-14	2209214	0	gal	398391	0	398204	398204	0	398391
MW-21	-	-	gal	189	0	-	-	0	189
MW-35	2209212	1882	gal	98303	0	-	-	0	98303
MW-45	10239114	2421861	gal	0	0	2421861	2421861	0	0
MW-51	2209214	398208	gal	0	0	398208	398208	0	0
MW-69	-	-	-	76212	0	-	-	3503	79715
TOTAL									827310

If you have any questions or require additional information, please contact me (915-687-8312).

Sincerely,

Robert J. Mezie, Jr.
Production Environmental Representative

c: C. M. Schweser
File 576-01

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

October 9, 1995

Mr. Ramon Torres
State Engineer Office
1900 West Second Street
Roswell, New Mexico 88201

RE: Report for SEO permits RA-5131 and RA-8015

Dear Mr. Torres:

This is a report for SEO permits RA-5131 and RA-8015 for the month of September. The following table indicates recorded meter readings for fluid removed from Lower Queen recovery wells under permit RA-5131 as of Monday, October 2, 1995.

Recovery Well	Meter Serial Number	Initial Meter Start	Meter Units	Previously Metered Fluid Removed (gal)	Meter Turnover Additional Fluid Removed (gal)	9/5/95 Meter Reading	10/2/95 Meter Reading	Sep-95 Fluid Removed (gal)	Per-well Cumulative Fluid Removed (gal)
MW-58	10239118	0	gal	26922	0	7437047	7437047	0	7463969
MW-59	10259114	0	bbl	83454	0	148578	151439	120162	6443892
MW-61A	10239116	0	gal	130850	0	8459437	8823592	364155	8954442
MW-62	10239115	0	gal	256553	0	6395694	6551836	156142	6808389
MW-65A	10239117	0	gal	39774	10000000	465725	637182	171457	10676956
MW-68	2209213	122618	gal	2484076	0	4814165	4961831	147666	7323289
MW-72	2881532	470	gal	12032816	0	12579011	13356733	777722	13356263
MW-75	2877269	1291	bbl	0	0	5674	18657	545286	729372
TOTAL									61756572

The following table indicates recorded meter readings for fluid removed from Shallow zone recovery wells under permit RA-8015 as of Monday, October 2, 1995.

Recovery Well	Meter Serial Number	Initial Meter Start	Meter Units	Previously Metered Fluid Removed (gal)	Meter Turnover Additional Fluid Removed (gal)	9/5/95 Meter Reading	10/2/95 Meter Reading	Sep-95 Fluid Removed (gal)	Per-well Cumulative Fluid Removed (gal)
MW-1	-	-	gal	6713	0	-	-	0	6713
MW-13	2209212	98236	gal	243999	0	226324	226324	0	243999
MW-14	2209214	0	gal	398391	0	398204	398204	0	398391
MW-21	-	-	gal	189	0	-	-	0	189
MW-35	2209212	1882	gal	98303	0	-	-	0	98303
MW-45	10239114	2421861	gal	0	0	2421861	2421861	0	0
MW-51	2209214	398208	gal	0	0	398208	398208	0	0
MW-69	-	-	-	79715	0	-	-	1201	80916
TOTAL									828511

If you have any questions or require additional information, please contact me (915-687-8312).

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

c: C. M. Schweser
File 576-01