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# REPORTS

DATE:

1998

**1998 Annual Groundwater Monitoring and Sampling Report  
GPM – Monument Booster Station  
Lea County, New Mexico**

**OCTOBER 15, 1998**

*Prepared For:*

**GPM Gas Corporation  
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Odessa, Texas 79762**



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ENVIRONMENTAL BUREAU  
OIL CONSERVATION DIVISION

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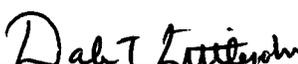
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## 1.0 Executive Summary

BDM International, Inc., a wholly owned subsidiary of TRW Inc. (TRW), was retained by GPM Gas Corporation (GPM) to perform the sampling and monitoring operations at the Monument Booster Station. This 1998 annual report documents the two semi-annual sampling events performed by TRW at the GPM Monument Booster Station on January 23, 1998 and August 3, 1998. The report also contains the historical groundwater elevation and analytical data since the beginning of the project in May 1995. This monitoring and sampling program was conducted in accordance with the guidelines specified by Mr. Bill Olson of the New Mexico Oil Conservation Division (OCD) in his letters dated January 31, 1997 and March 25, 1998.

Based on the sampling and monitoring data to date, the following conclusions relevant to groundwater conditions and remediation system performance at the Monument Booster Station are evident:

- BTEX concentrations in all of the sampled monitoring wells remained well below New Mexico Water Quality Control Commission (WQCC) standards with the exception of benzene in MW-7 (0.094 mg/L).
- Benzene concentrations in MW-7 fluctuate over time but have declined from a high of 1.130 mg/L on January 17, 1996 to its lowest concentration of 0.094 mg/L on August 3, 1998.
- Benzene levels in MW-3 have increased slightly from less than the detection limit of 0.001 mg/L during all previous sampling events to a level of 0.007 mg/L during the August 3, 1998 event.
- As of August 3, 1998, a total of approximately 106 gallons of free product (condensate) has been removed from monitoring wells MW-1 and MW-5 using a combination of gravity siphoning, hand bailing, passive skimmer, and pneumatic pump recovery methods.
- The dissolved-phase hydrocarbons in groundwater are contained within the boundaries of the facility.
- The fact that there has been no increase of BTEX concentrations over detection limits in downgradient monitoring wells MW-4 and MW-6 is strong evidence that natural attenuation processes have kept the plume from migrating. It is expected that benzene levels in downgradient well MW-3 will return to levels near or below the detection limit during subsequent sampling events.
- Continued semi-annual monitoring is necessary to demonstrate that the plume is maintaining a steady state or receding condition and to evaluate the effectiveness of intrinsic bioremediation in limiting the migration or elimination of the dissolved hydrocarbon plume.

The following recommendations are suggested for the remediation system and monitoring operations at the Monument Booster Station.

- Continue free product recovery operations since the present system has been effective in recovering free product from MW-1 and MW-5.
- Continue the sampling and monitoring program on a semi-annual basis. The next sampling event is scheduled during the first quarter of 1999.

**2.0 Chronology of Events**

- July 1992            Benge Construction Company of Lovington, New Mexico removed three underground storage tanks (USTs) near the main compressor building for ENRON at the Hobbs Compressor Station #2). The USTs formally contained used oil and pipeline liquids (oil and/or natural gas liquid condensate). Hydrocarbon-impacted soils were removed from the used oil and pipeline liquids UST tank holds.
- February 4, 1994    Geoscience Consultants Ltd (GCL) installed two monitoring wells (MW-1 and MW-2) during a subsurface investigation for ENRON. Hydrocarbon-impacted groundwater was confirmed in MW-1.
- May 17, 1994        Benge Construction Company returned during a subsurface investigation conducted by Daniel B. Stevens and Associates (DBS&A) and removed an additional amount of hydrocarbon-impacted soils from the pipeline liquids and used oil UST tank holds. The amount of hydrocarbon-impacted soils removed from the used oil and pipeline liquids UST tank holds in 1992 and 1994 was not well documented, however it was estimated by DBS&A that a total of 1,064 cubic yards were excavated from the two tank holds based on the amount of backfill required to fill the excavations.
- May 16-19, 1994    Six soil borings (SB-1 through SB-6) were completed as temporary drive point wells for ENRON by DBS&A to delineate the horizontal extent of hydrocarbon-impacted soils and groundwater.
- October 7, 1994     The OCD requested ENRON to provide a work plan to completely define the extent of groundwater contamination at the Hobbs Compressor Station #2 site.
- November 1994      GPM Gas Corporation (GPM) acquired ownership and operation of the Monument Booster Station (formerly Hobbs Compressor Station #2) from ENRON.
- February 23, 1995   GPM submitted a subsurface investigation work plan to the OCD to address the groundwater conditions at Monument Booster Station.
- April 5, 1995        The OCD approved the subsurface investigation work plan for Monument Booster Station.
- May 8-10, 1995      GCL completed a subsurface investigation for GPM to delineate the extent of the hydrocarbon-impacted groundwater. The investigation included the installation and sampling of four monitoring wells (MW-1D, MW-3, MW-4, and MW-5) and one soil boring (SB-7).
- July 28, 1995        GPM submitted the *Subsurface Investigation and Preliminary Remedial Response* report for the Monument Booster Station to the OCD.
- August 24, 1995     The OCD approved GPM's recommendations for remedial action. The OCD requested a work plan for an additional monitoring well, new recovery well and product recovery system.

- September 29, 1995 GPM submitted the *Remediation and Monitoring Work Plan for the Monument Booster Station* to the OCD.
- October 25, 1995 The OCD approved the remediation and monitoring work plan for Monument Booster Station.
- November 14-16, 1995 GCL installed two additional monitoring wells (MW-6 and MW-7) and conducted the fourth quarter 1995 sampling event at Monument Booster Station.
- January 18, 1996 GCL conducted the first quarter 1996 sampling event at Monument Booster Station.
- April 24, 1996 GCL conducted the annual (second quarter 1996) sampling event at Monument Booster Station. The annual report included recommendations to the OCD for remedial response.
- January 22, 1997 BDM International, Inc. (formerly GCL) conducted the first quarter 1997 sampling event at Monument Booster Station.
- January 31, 1997 The OCD completed the review of the annual report for the second quarter 1996 sampling event and approved the groundwater monitoring modifications for Monument Booster Station.
- January 31, 1997 BDM International, Inc. (BDM) and GPM installed an automated pneumatic product recovery pump system in monitoring wells MW-1 and MW-5 to replace the hand bailing and gravity siphoning techniques used previously.
- August 11, 1997 BDM conducted the annual (third quarter 1997) sampling event at Monument Booster Station.
- January 23, 1998 TRW conducted the semi-annual (first quarter 1998) sampling event at Monument Booster Station.
- August 3, 1998 TRW conducted the annual (third quarter 1998) sampling event at Monument Booster Station.

### 3.0 Procedures

Prior to sampling, the on-site monitoring wells (MW-1 through MW-7) were gauged for depth to groundwater using a Heron Model H.01L oil/water interface probe. Immediately prior to collecting groundwater samples during the January 23, 1998 sampling event, each monitoring well was purged of a minimum of three well casing volumes of water using clean, decontaminated PVC bailers. During the August 3, 1998 sampling event, the monitoring wells were purged using a submersible (Grunfos RediFlo2) pump. A total of 104 gallons and 154 gallons of water was purged from monitoring wells MW-1D, MW-2, MW-3, MW-4, MW-6, and MW-7 during the January 23, 1998 and August 3, 1998 sampling events, respectively. Groundwater samples were obtained using a new, decontaminated, disposable bailer for each well after purging. Groundwater parameters, including pH, conductivity, temperature, and dissolved oxygen (DO) were measured after purging using a Hydac Model 910 pH/conductivity meter and a YSI Model 51B and Hanna DO meter.

The first set of water samples were transferred into air-tight, septum-sealed, 40-ml glass VOA sample vials with zero head space for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method 8020. A duplicate sample of MW-7 was collected during both sampling events. The next set of water samples were transferred into appropriately preserved containers for analysis of nitrate (NO<sub>3</sub>) and sulfate (SO<sub>4</sub>), to assess the efficacy of intrinsic bioremedial activity currently taking place. During the annual sampling event on August 3, 1998, a third and fourth set of water samples were transferred into appropriately preserved containers for analysis of major ions (chloride, fluoride, and total dissolved solids) and WQCC metals (aluminum, arsenic, boron, chromium, iron, and manganese). A summary of purging and sampling methods is provided in Table 1 below. Chain-of-custody (COC) forms documenting sample identification numbers, collection times, and delivery times to the laboratories were completed for each set of samples. The water samples were placed in an ice-filled cooler immediately after collection and shipped to Trace Analysis, Inc. of Lubbock, Texas for laboratory analysis.

**Table 1**  
**Summary of Purging and Sampling Methods**

Monitoring Well No.	Sample Date	Purge Method	Purge Volume (gallons)	Sampling Method	Groundwater Analytes
MW-1D	1/23/98	Bailer	7	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	18	Disposable bailer	BTEX, Metals, Ions, Bio-indicators
MW-2	1/23/98	Bailer	22*	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	35	Disposable bailer	BTEX, Metals, Ions, Bio-indicators
MW-3	1/23/98	Bailer	13*	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	15*	Disposable bailer	BTEX, Metals, Ions, Bio-indicators
MW-4	1/23/98	Bailer	12*	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	15*	Disposable bailer	BTEX, Metals, Ions, Bio-indicators
MW-6	1/23/98	Bailer	25	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	35	Disposable bailer	BTEX, Metals, Ions, Bio-indicators
MW-7	1/23/98	Bailer	25	Disposable bailer	BTEX and Bio-indicators
	8/3/97	Pump	36	Disposable bailer	BTEX, Metals, Ions, Bio-indicators

\* Indicates monitoring well was bailed dry.  
 BTEX - benzene, toluene, ethylbenzene, xylenes  
 WQCC Metals - Al, As, B, Cr, Fe, and Mn  
 Ions - F, Cl, NO<sub>3</sub>, SO<sub>4</sub>, and TDS  
 Bio-indicators - DO, NO<sub>3</sub>, SO<sub>4</sub>  
 MW-1 and MW-5 not sampled due to presence of product.

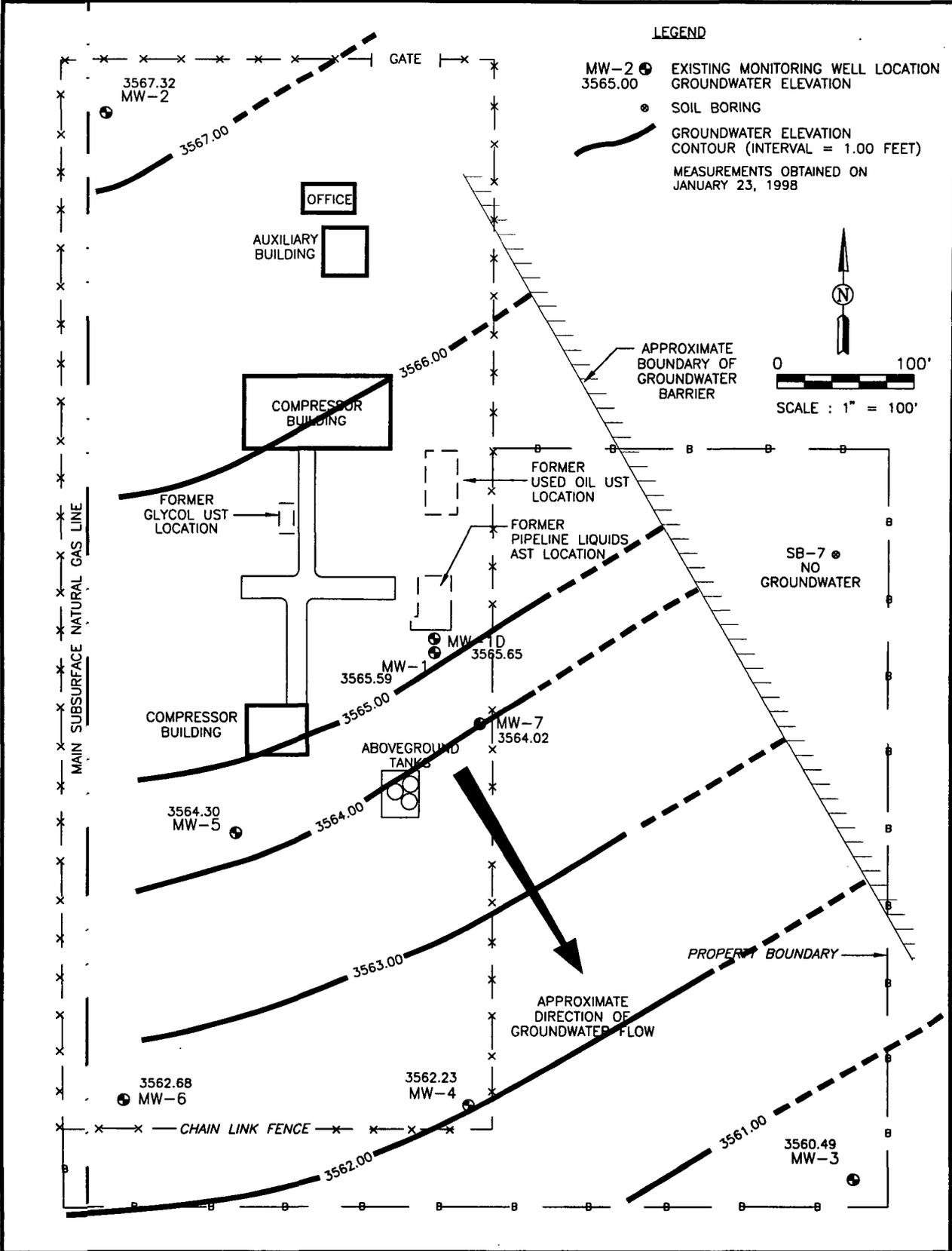
#### 4.0 Groundwater Elevations, Hydraulic Gradient and Flow Direction

Based on the most recent gauging data collected by TRW on August 3, 1998, the groundwater conditions at the Monument Booster Station are characterized below.

- The depth to the water table across the site varies from approximately 21 to 27 feet below ground surface
- The hydraulic gradient is approximately 0.007 feet/foot
- The direction of groundwater flow is to the southeast

The direction of groundwater flow and hydraulic gradient have remained consistent for the past three and a half years. Groundwater elevation maps depicting the water table elevation and direction of groundwater flow using the gauging data obtained during the two 1998 sampling events are presented in Figure 1a (January 23, 1998) and Figure 1b (August 3, 1998).

Figure 2 depicts the changes in groundwater elevations in monitoring wells MW-1 through MW-7 with time. Historical groundwater elevations and depth to water measurements are summarized in Table 2.

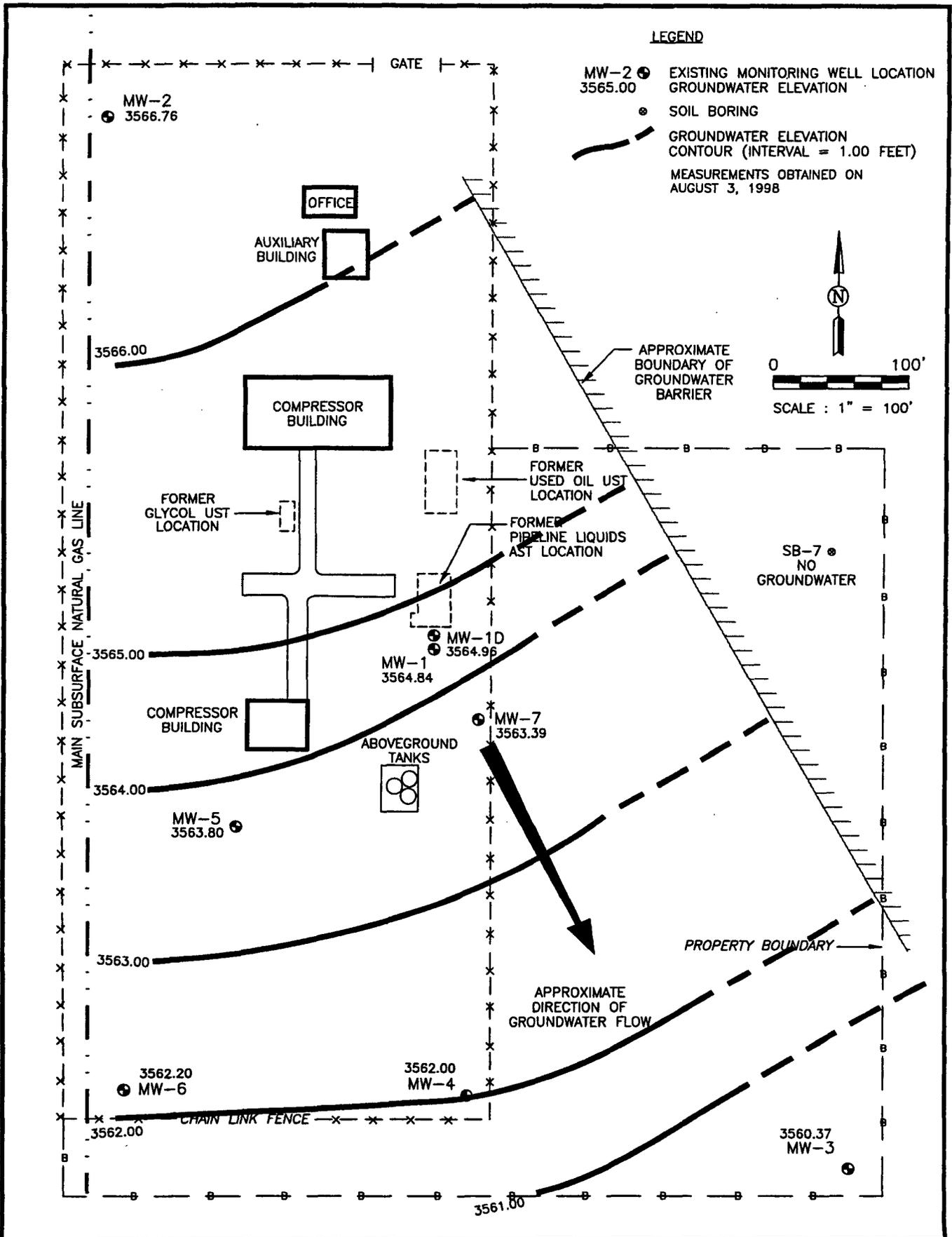


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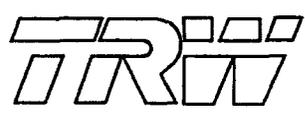


CLIENT: GPM GAS CORPORATION	
DATE: 01/23/98	REV. NO.:
AUTHOR: GJV	DRN BY: DAG
CK'D BY: MWS	FILE: GWEL0198

**FIGURE 1a**  
**MONUMENT**  
**BOOSTER STATION**  
**GROUNDWATER ELEVATION**  
**MAP**



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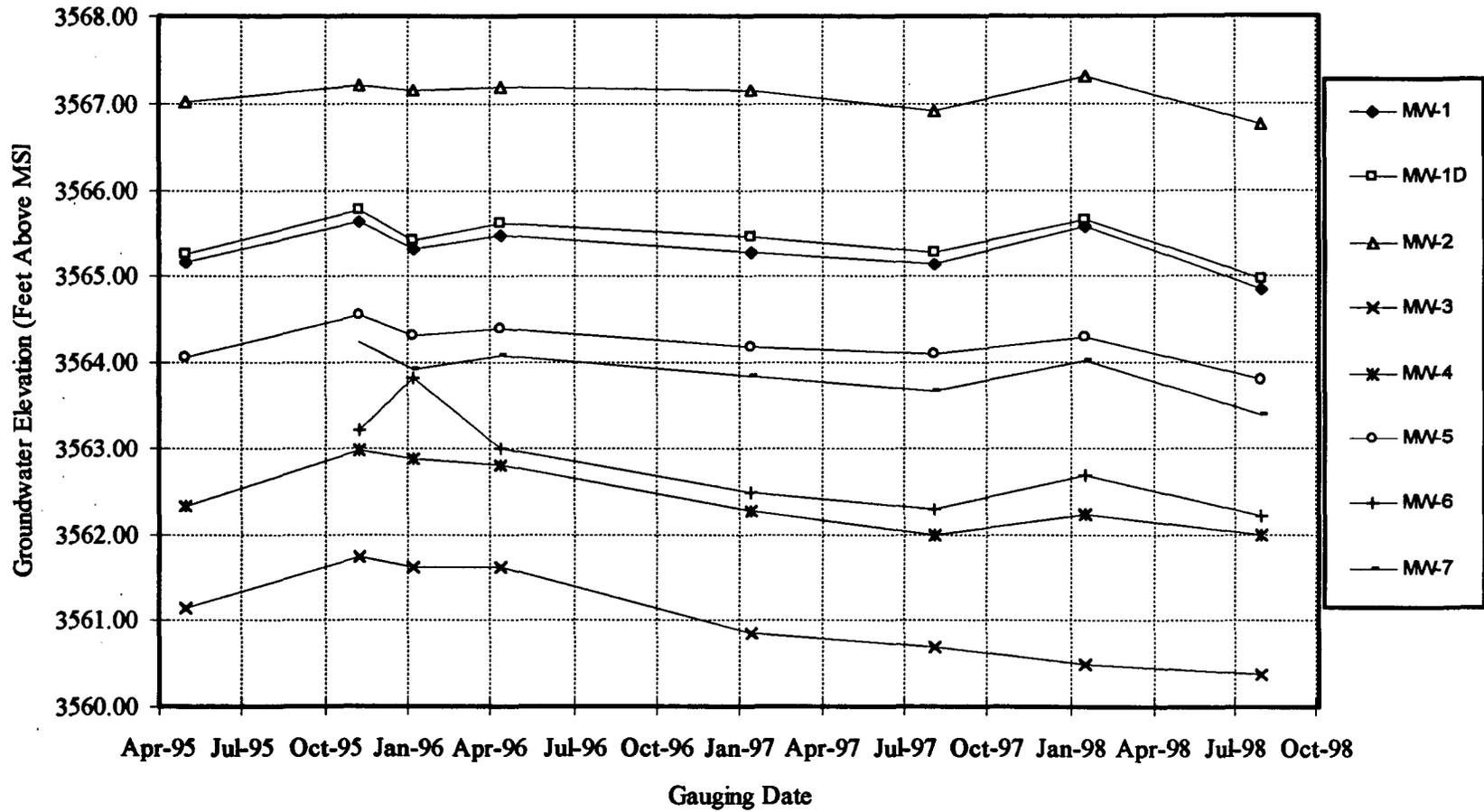


CLIENT: GPM GAS CORPORATION	
DATE: 08/03/98	REV. NO.:
AUTHOR: GJV	DRN BY: DAG
CK'D BY: MWS	FILE: GWEL0898

**FIGURE 1b**  
**MONUMENT**  
**BOOSTER STATION**  
**GROUNDWATER ELEVATION**  
**MAP**

FIGURE 2

GROUNDWATER ELEVATION VS. TIME



**Table 2**  
**Summary of Groundwater Elevations**  
**Monument Booster Station**

Monitoring Well Number	Gauging Date	Ground Surface Elevations (Feet)	Top of Casing Elevations (Feet)	Groundwater Depth Below Top of Casing (Feet)	Groundwater Elevation (Feet)	PSH Thickness (Feet)
MW-1	5/16/95	3588.85	3591.15	28.05	3565.17	2.52
	11/21/95	3588.85	3591.15	27.03	3565.65	1.86
	1/18/96	3588.85	3591.15	27.62	3565.32	2.18
	4/24/96	3588.85	3591.15	27.39	3565.47	2.09
	1/22/97	3588.85	3591.15	27.68	3565.27	2.20
	8/11/97	3588.85	3591.15	26.03	3565.14	0.02
	1/23/98	3588.85	3591.15	25.63	3565.59	0.08
	8/3/98	3588.85	3591.15	26.32	3564.84	0.01
MW-1D	5/16/95	3589.06	3591.31	26.04	3565.27	0.00
	11/21/95	3589.06	3591.31	25.54	3565.77	0.00
	1/18/96	3589.06	3591.31	25.89	3565.42	0.00
	4/24/96	3589.06	3591.31	25.70	3565.61	0.00
	1/22/97	3589.06	3591.31	25.85	3565.46	0.00
	8/11/97	3589.06	3591.31	26.03	3565.28	0.00
	1/23/98	3589.06	3591.31	25.66	3565.65	0.00
	8/3/98	3589.06	3591.31	26.35	3564.96	0.00
MW-2	5/16/95	3594.13	3596.30	29.28	3567.02	0.00
	11/21/95	3594.13	3596.30	29.09	3567.21	0.00
	1/18/96	3594.13	3596.30	29.15	3567.15	0.00
	4/24/96	3594.13	3596.30	29.10	3567.20	0.00
	1/22/97	3594.13	3596.30	29.15	3567.15	0.00
	8/11/97	3594.13	3596.30	29.38	3566.92	0.00
	1/23/98	3594.13	3596.30	28.98	3567.32	0.00
	8/3/98	3594.13	3596.30	29.54	3566.76	0.00
MW-3	5/16/95	3581.46	3583.86	22.72	3561.14	0.00
	11/21/95	3581.46	3583.86	22.12	3561.74	0.00
	1/18/96	3581.46	3583.86	22.25	3561.61	0.00
	4/24/96	3581.46	3583.86	22.25	3561.61	0.00
	1/22/97	3581.46	3583.86	23.02	3560.84	0.00
	8/11/97	3581.46	3583.86	23.18	3560.68	0.00
	1/23/98	3581.46	3583.86	23.37	3560.49	0.00
	8/3/98	3581.46	3583.86	23.49	3560.37	0.00

\* Elevations initially surveyed by John W. West Engineering Company of Hobbs,

The monitoring well casings were marked on the north side to provide consistent reference points for future gauging

\*\* Groundwater Elevation Corrected for phase-separated hydrocarbons (PSH) = Top of Casing Elevation - [Groundwater Depth - (SG x PSH)  
Groundwater direction is to the southeast with a hydraulic gradient of approximately 0.007

**Table 1 (Continued)**  
**Summary of Groundwater Elevations**  
**Monument Booster Station**

Monitoring Well Number	Gauging Date	Ground Surface Elevations (Feet)	Top of Casing Elevations (Feet)	Groundwater Depth Below Top of Casing (Feet)	Groundwater Elevation (Feet)	PSH Thickness (Feet)
MW-4	5/16/95	3586.10	3588.77	26.45	3562.32	0.00
	11/21/95	3586.10	3588.77	25.79	3562.98	0.00
	1/18/96	3586.10	3588.77	25.90	3562.87	0.00
	4/24/96	3586.10	3588.77	25.98	3562.79	0.00
	1/22/97	3586.10	3588.77	26.50	3562.27	0.00
	8/11/97	3586.10	3588.77	26.77	3562.00	0.00
	1/23/98	3586.10	3588.77	26.54	3562.23	0.00
	8/3/98	3586.10	3588.77	26.77	3562.00	0.00
MW-5	5/16/95	3589.62	3592.16	28.10	3564.06	0.00
	11/21/95	3589.62	3592.16	28.24	3564.54	0.76
	1/18/96	3589.62	3592.16	28.45	3564.33	0.75
	4/24/96	3589.62	3592.16	28.41	3564.40	0.79
	1/22/97	3589.62	3592.16	28.45	3564.18	0.57
	8/11/97	3589.62	3592.16	28.13	3564.10	0.09
	1/23/98	3589.62	3592.16	27.89	3564.30	0.04
	8/3/98	3589.62	3592.16	28.79	3563.80	0.53
MW-6	11/16/95	3586.15	3587.93	24.71	3563.22	0.00
	1/18/96	3586.15	3587.93	24.11	3563.82	0.00
	4/24/96	3586.15	3587.93	24.94	3562.99	0.00
	1/22/97	3586.15	3587.93	25.44	3562.49	0.00
	8/11/97	3586.15	3587.93	25.64	3562.29	0.00
	1/23/98	3586.15	3587.93	25.25	3562.68	0.00
	8/3/98	3586.15	3587.93	25.73	3562.20	0.00
	MW-7	11/21/95	3588.06	3589.40	25.16	3564.24
1/18/96		3588.06	3589.40	25.48	3563.92	0.00
4/24/96		3588.06	3589.40	25.33	3564.07	0.00
1/22/97		3588.06	3589.40	25.56	3563.84	0.00
8/11/97		3588.06	3589.40	25.73	3563.67	0.00
1/23/98		3588.06	3589.40	25.38	3564.02	0.00
8/3/98		3588.06	3589.40	26.01	3563.39	0.00

\* Elevations initially surveyed by John W. West Engineering Company of Hobbs, NM.

The monitoring well casings were marked on the north side to provide consistent reference points for future gauging operations.

\*\* Groundwater Elevation Corrected for phase-separated hydrocarbons (PSH) = Top of Casing Elevation - [Groundwater Depth - (SG x PSH Thickness)].

Groundwater direction is to the southeast with a hydraulic gradient of approximately 0.007 feet/foot.

## 5.0 Groundwater Quality Conditions

### 5.1 Distribution of Hydrocarbons in Groundwater

A historical listing of benzene, toluene, ethylbenzene and xylene (BTEX) concentrations obtained from the on site monitoring wells is summarized in Table 3. Hydrocarbon concentration maps depicting the BTEX concentrations for the two 1998 sampling events are presented in Figure 3a (January 23, 1998) and Figure 3b (August 3, 1998). Figure 4 depicts benzene concentrations versus time in groundwater from May 1995 to August 3, 1998 for the on site monitoring wells. Based on the most recent analytical data for samples collected by TRW on August 3, 1998, the distribution of hydrocarbons at the Monument Booster Station is described below.

- BTEX concentrations in all of the sampled monitoring wells remained well below New WQCC standards with the exception of benzene in MW-7 (0.094 mg/L).
- Benzene concentrations in MW-7 fluctuate over time but have declined from a high of 1.130 mg/L on January 17, 1996 to its lowest concentration of 0.094 mg/L on August 3, 1998.
- Benzene levels in MW-3 have increased slightly from less than the detection limit of 0.001 mg/L during all previous sampling events to a level of 0.007 mg/L during the August 3, 1998 event.

### 5.2 Distribution of Dissolved WQCC Metals and Ions in Groundwater

Historical groundwater sample analytical results for New Mexico Water Quality Control Commission (WQCC) metals and ions are presented in Tables 4 and 5, respectively. The WQCC standards are also listed in the tables for comparison. Constituents with concentrations above the WQCC standards are highlighted in boldface type. The laboratory reports and COC documentation are included in Appendix A.

The WQCC metal results for the 1998 annual sampling event indicate no constituents exceeded the WQCC standards with the exception of manganese in MW-1D, MW-6, and MW-7, and iron in MW-7.

The elevated levels of manganese in MW-1D (0.22 mg/L), MW-6 (0.36 mg/L) and MW-7 (0.41 mg/L) may be due to the reduced chemical environment caused by the presence of dissolved hydrocarbons. Under this condition, certain metal ions (particularly manganese and iron) have a greater affinity to go into the dissolved state resulting in higher concentrations. In contrast, non-impacted wells MW-2, MW-3, and MW-4 have no detectable concentrations of manganese. Based on the results of the metal analyses during the 1998 annual sampling event, the groundwater in the site area is not adversely affected or impacted with dissolved metals.

The major ion analyses for the annual 1998 sampling event indicate no constituents exceeded the WQCC standards with the exception of fluoride in MW-1d (2.4 mg/L), MW-2 (1.8 mg/L), MW-3 (1.6 mg/L), and MW-7 (1.8 mg/L). Fluoride concentrations during the annual sampling event remain near or slightly above the WQCC standard of 1.6 mg/L as compared to the initial sampling event in May 1995. Since fluoride is not a constituent for the gas processing activities on site, its presence is likely due to natural conditions as it is a common natural occurrence in groundwater (USGS Water-Supply Paper 2254, 1989, pgs.120-123).

**Table 2**  
**Summary of Dissolved BTEX Concentrations**  
**Monument Booster Station**

Monitoring Well	Sampling Date	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)
MW-1D	5/16/95	0.018	0.006	0.015	0.016
	11/15/95	0.003	< 0.001	0.002	0.001
	1/18/96	0.004	< 0.001	0.003	0.009
	4/24/96	< 0.001	< 0.001	< 0.001	< 0.001
	1/22/97	0.001	< 0.001	0.001	< 0.001
	8/11/97	< 0.001	< 0.001	< 0.001	< 0.001
	1/23/98	< 0.001	< 0.001	< 0.001	< 0.001
	8/3/98	< 0.001	< 0.001	< 0.001	< 0.001
MW-2	5/16/95	< 0.001	< 0.001	< 0.001	< 0.001
	11/15/95	0.044*	0.002*	0.006*	0.009*
	1/18/96	< 0.001	< 0.001	< 0.001	< 0.001
	4/24/96	< 0.001	< 0.001	< 0.001	< 0.001
	1/22/97	< 0.001	< 0.001	< 0.001	< 0.001
	8/11/97	< 0.001	< 0.001	< 0.001	< 0.001
	1/23/98	< 0.001	< 0.001	< 0.001	< 0.001
	8/3/98	< 0.001	< 0.001	< 0.001	< 0.001
MW-3	5/16/95	< 0.001	< 0.001	< 0.001	< 0.001
	11/15/95	< 0.001	< 0.001	< 0.001	< 0.001
	1/18/96	< 0.001	< 0.001	< 0.001	< 0.001
	4/24/96	< 0.001	< 0.001	< 0.001	< 0.001
	1/22/97	< 0.001	< 0.001	< 0.001	< 0.001
	8/11/97	< 0.001	< 0.001	< 0.001	< 0.001
	1/23/98	< 0.001	< 0.001	< 0.001	< 0.001
	8/3/98	0.007	< 0.001	< 0.001	< 0.001
MW-4	5/16/95	< 0.001	< 0.001	< 0.001	< 0.001
	11/15/95	0.045*	0.002*	0.006*	0.010*
	1/18/96	0.003	< 0.001	< 0.001	< 0.001
	4/24/96	< 0.002	< 0.002	< 0.002	< 0.002
	1/22/97	0.002	< 0.001	< 0.001	< 0.001
	8/11/97	0.001	< 0.001	< 0.001	< 0.001
	1/23/98	< 0.001	< 0.001	< 0.001	< 0.001
	8/3/98	< 0.001	< 0.001	< 0.001	< 0.001
MW-5	5/16/95	0.265	0.009	0.261	0.050
MW-6	11/16/95	0.003	< 0.001	0.001	0.003
	1/17/96	0.002	< 0.001	< 0.001	< 0.001
	4/24/96	< 0.001	< 0.001	< 0.001	< 0.001
	1/22/97	0.001	< 0.001	< 0.001	< 0.001
	8/11/97	< 0.001	< 0.001	< 0.001	0.001
	1/23/98	< 0.001	< 0.001	< 0.001	< 0.001
	8/3/98	< 0.001	< 0.001	< 0.001	< 0.001
MW-7	11/15/95	0.465	< 0.001	0.205	0.163
	1/17/96	1.130	0.003	0.476	0.365
	4/24/96	0.585	< 0.002	0.251	0.013
	1/22/97	0.896	< 0.005	0.240	0.330
	8/11/97	0.317	0.020	0.155	0.049
	1/23/98	0.876	< 0.005	0.486	0.181
	8/3/98	0.094	< 0.005	0.064	0.007
WQCC Standards		0.010	0.75	0.75	0.62

Analyses performed by Trace Analysis, Inc., Lubbock, Texas.

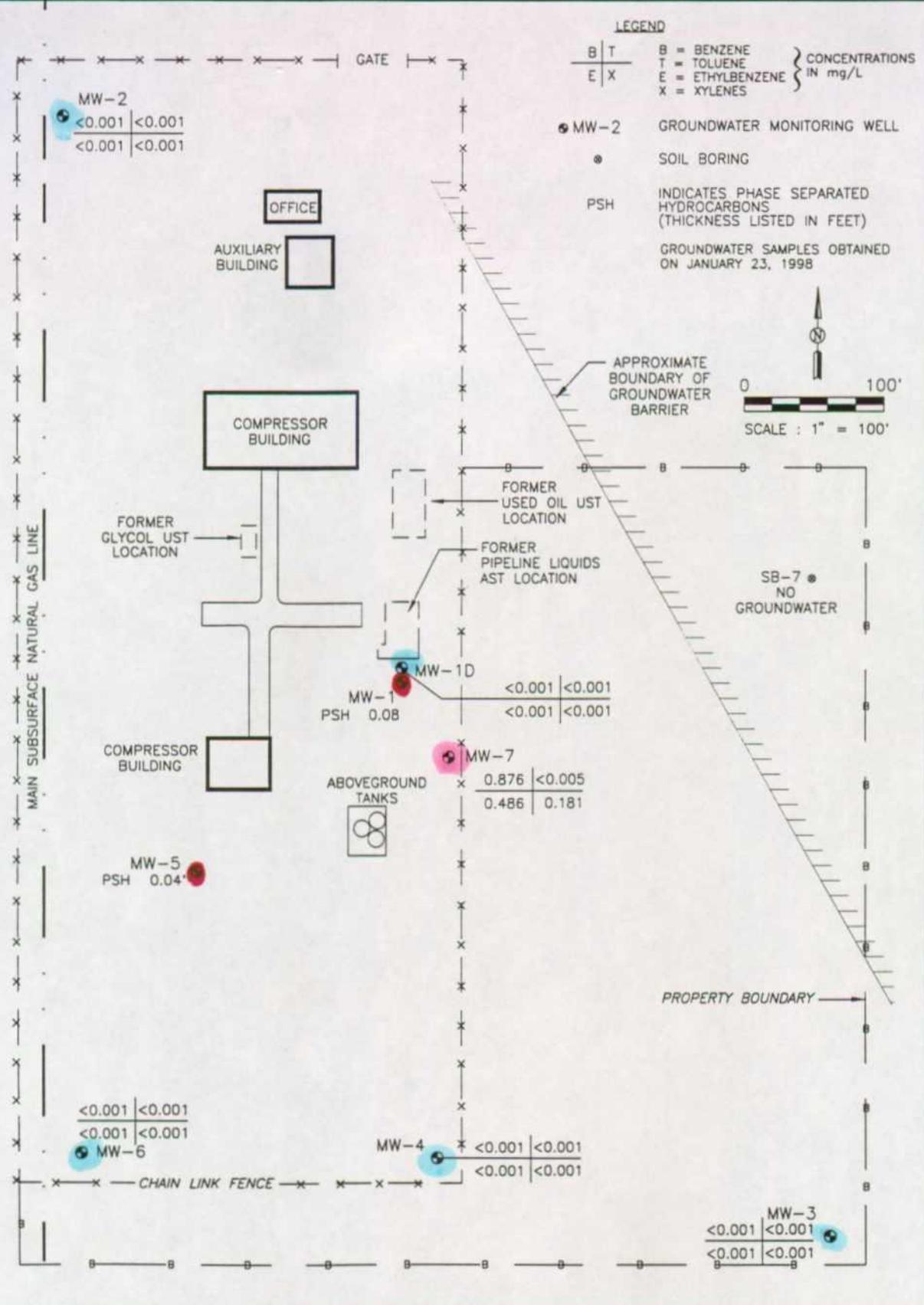
All samples analyzed for BTEX using EPA Method 8020 except for samples obtained on May 16, 1995 (EPA Method 8240).

Values listed in boldface type indicate concentrations exceed New Mexico Water Quality Control Commission (WQCC) standards.

Monitoring wells MW-1 and MW-5 (after May 16, 1995) were not sampled (due to presence of phase-separated hydrocarbons).

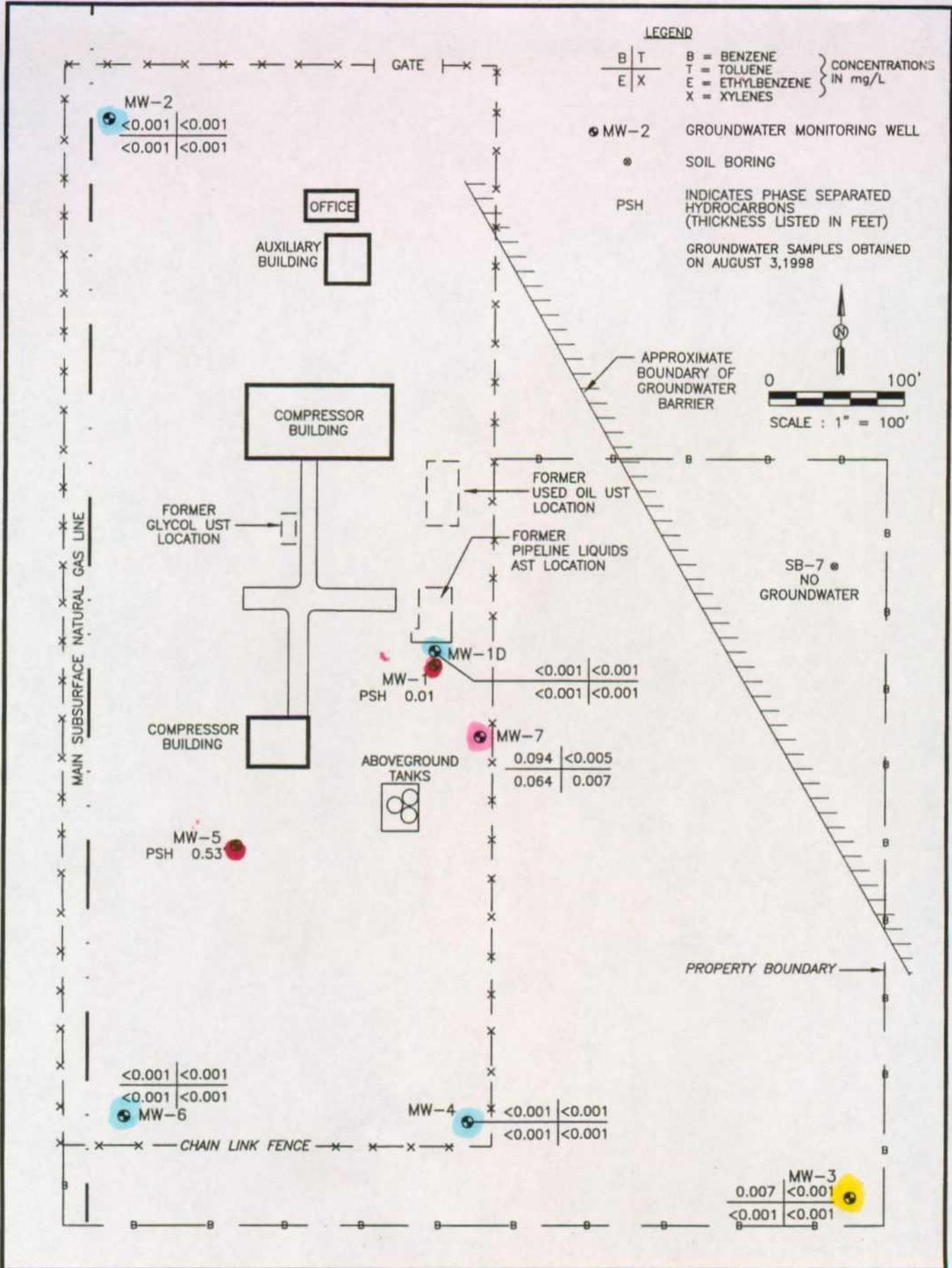
\* BTEX cross-contamination occurred on samples obtained from monitoring wells MW-2 and MW-4 during the November 15, 1995 sampling event.

P2398\1\BTEX0198.DWG



CLIENT: GPM GAS CORPORATION	DATE: 01/23/98	REV. NO.:
AUTHOR: GJV	DRN BY: DAG	
CK'D BY: MWS	FILE: BTEX0198	

**FIGURE 3a**  
**MONUMENT**  
**BOOSTER STATION**  
**BTEX CONCENTRATION MAP**



P2398\11\BTEX0898.DWG



CLIENT: GPM GAS CORPORATION

DATE: 08/03/98

AUTHOR: GJV

CK'D BY: MWS

REV. NO.:

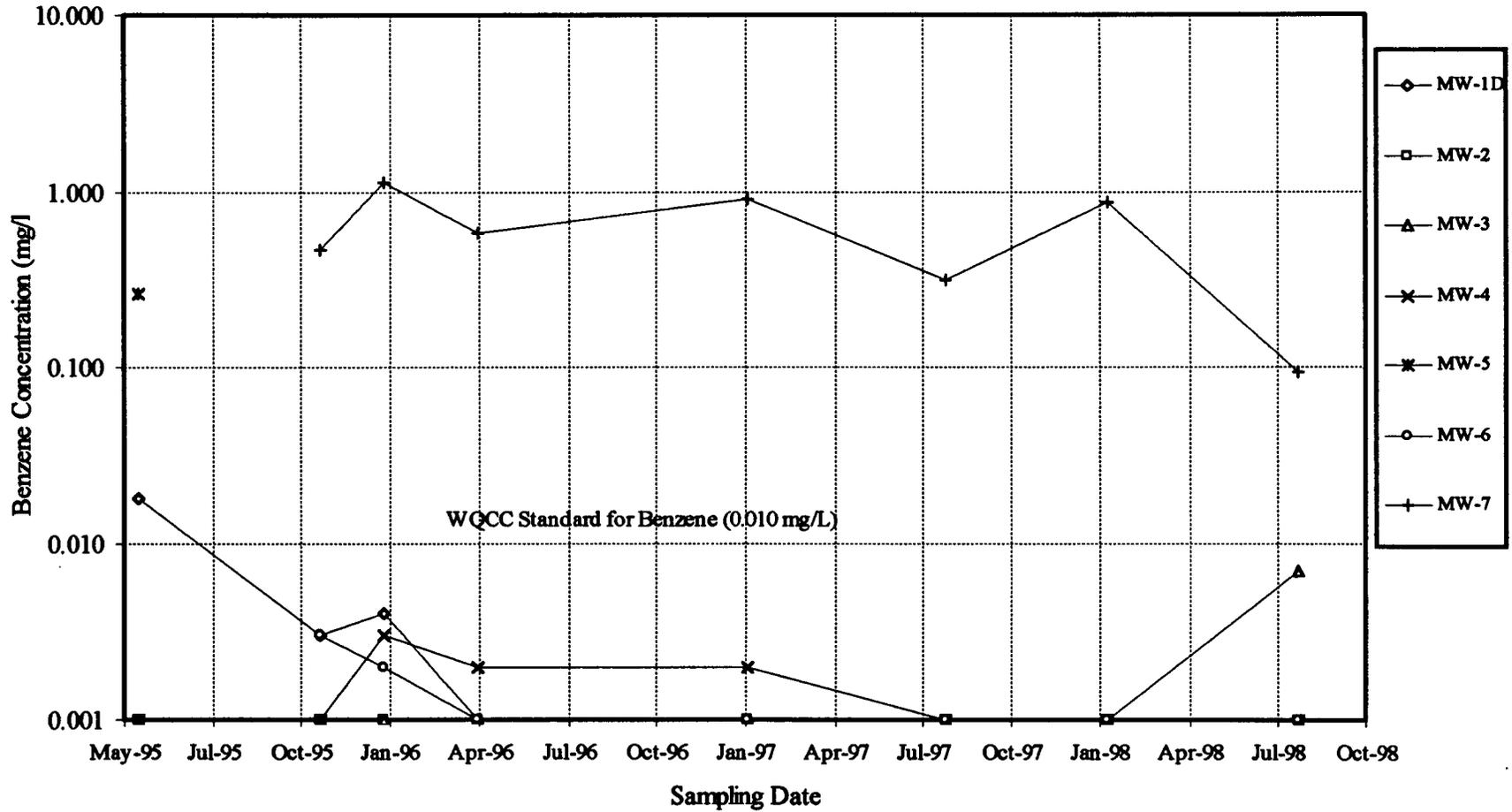
DRN BY: DAG

FILE: BTEX0898

**FIGURE 3b**  
**MONUMENT**  
**BOOSTER STATION**  
**BTEX CONCENTRATION MAP**

FIGURE 4

Benzene Versus Time



**Table 4**  
**Summary of Metal Analytical Results**

Constituent	Date	MW-1 (mg/L)	MW-1D (mg/L)	MW-2 (mg/L)	MW-3 (mg/L)	MW-4 (mg/L)	MW-5 (mg/L)	MW-6 (mg/L)	MW-7 (mg/L)	WQCC Standards (mg/L)
Aluminum (Al)	05-16-96	0.55	1.34	13.10	0.88	8.04	0.24	---	---	5
	04-24-96	NS	0.2	<0.2	<0.2	<0.2	NS	0.2	0.3	
	08-11-97	NS	<0.2	0.32	<0.2	<0.2	NS	0.23	<0.2	
	08-03-98	NS	<0.1	0.17	1.7	0.10	NS	<0.1	0.14	
Arsenic (As)	05-16-96	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	---	---	0.1
	04-24-96	NS	0.012	0.011	0.019	0.008	NS	0.238	0.004	
	08-11-97	NS	<0.1	<0.1	<0.1	<0.1	NS	<0.1	<0.1	
	08-03-98	NS	<0.1	<0.1	<0.1	<0.1	NS	<0.1	<0.1	
Boron (B)	05-16-96	0.85	0.22	0.37	0.09	0.14	0.39	---	---	0.75
	04-24-96	NS	0.11	0.38	<0.03	0.06	NS	0.22	0.6	
	08-11-97	NS	<0.2	<0.2	<0.2	<0.2	NS	0.79	<0.2	
	08-03-98	NS	<0.75	<0.75	<0.75	<0.75	NS	<0.75	<0.75	
Chromium (Cr)	05-16-96	0.01	<0.01	0.02	0.01	0.02	0.02	---	---	0.05
	04-24-96	NS	<0.05	0.06	<0.05	<0.05	NS	0.06	<0.05	
	08-11-97	NS	<0.05	<0.05	<0.05	<0.05	NS	<0.05	<0.05	
	08-03-98	NS	<0.05	<0.05	<0.05	<0.05	NS	<0.05	<0.05	
Iron (Fe)	05-16-96	25.58	4.6	5.82	0.53	4.68	1.75	---	---	1
	04-24-96	NS	0.06	0.07	0.17	0.08	NS	0.15	<0.03	
	08-11-97	NS	0.28	0.24	0.14	0.08	NS	0.21	0.43	
	08-03-98	NS	<0.1	<0.1	0.55	<0.1	NS	0.26	6.1	
Manganese (Mn)	05-16-96	0.67	0.31	0.12	0.08	0.11	0.58	---	---	0.2
	04-24-96	NS	0.37	<0.01	<0.01	<0.01	NS	0.28	0.38	
	08-11-97	NS	0.35	<0.01	<0.01	<0.01	NS	0.30	0.37	
	08-03-98	NS	0.22	<0.1	<0.1	<0.1	NS	0.36	0.41	

Analyses performed by Trace Analysis, Inc. using EPA Methods 200.7, 239.2, 270.2, 272.2, and 6010B

Standards Bold values indicate concentrations exceed New Mexico Water Quality Control Commission (WQCC) groundwater standards as listed as specified in Regulation 3-103.

NS Indicates monitoring well was not sampled (due to presence of free product).

— Indicates monitoring well was installed after this sampling date.

Samples were not filtered on 05-17-95, therefore results indicate total (dissolved and undissolved) metal concentrations.

Samples were filtered with a 45 mm element on 04-24-96, 08-11-97, and 08-03-98, therefore results indicate dissolved metal concentrations.

Dissolved oxygen readings measured using a YSI Model 51B or comparable model dissolved oxygen meter.

**Table 5**  
**Summary of Major Ion Analytical Results**  
**Monument Booster Station**

Constituent	Date	MW-1 (mg/L)	MW-1D (mg/L)	MW-2 (mg/L)	MW-3 (mg/L)	MW-4 (mg/L)	MW-5 (mg/L)	MW-6 (mg/L)	MW-7 (mg/L)	WQCC Standards (mg/L)
Chloride (Cl)	05-16-95	NS	77	<b>812</b>	188	152	80	---	---	250
	04-24-96	NS	124	<b>314</b>	134	167	NS	186	143	
	08-11-97	NS	180	200	140	140	NS	160	180	
	08-03-98	NS	120	240	160	160	NS	150	160	
Fluoride (F)	05-16-95	NS	<b>1.8</b>	1.1	<b>1.8</b>	1.2	1.4	---	---	1.6
	04-24-96	NS	1.6	1.1	1.5	1.1	NS	0.9	<b>1.8</b>	
	08-11-97	NS	1.9	1.3	1.5	1.1	NS	0.85	<b>1.8</b>	
	08-03-98	NS	<b>2.4</b>	<b>1.8</b>	<b>1.6</b>	1.3	NS	1.3	<b>1.8</b>	
Nitrate (NO <sub>3</sub> -N)	05-16-95	NS	1.37	7.42	5.62	3.69	0.56	---	---	10.0
	04-24-96	NS	<0.1	0.3	0.3	0.1	NS	<0.1	<0.1	
	08-11-97	NS	<1.0	9	9.4	<1.0	NS	<1.0	<1.0	
	01-23-98	NS	2.8	30	15	1	NS	0.28	0.39	
	08-03-98	NS	4.0	4.0	4.0	2.9	NS	<1.0	<1.0	
Sulfate (SO <sub>4</sub> )	05-16-95	NS	174	509	115	136	67	---	---	600
	04-24-96	NS	169	443	95	115	NS	70	149	
	08-11-97	NS	110	290	75	96	NS	37	76	
	01-23-98	NS	190	230	240	180	NS	230	180	
	08-03-98	NS	100	220	80	100	NS	45	90	
Total Dissolved Solids (TDS)	05-16-95	NS	634	<b>1,478</b>	516	716	692	---	---	1,000
	04-24-96	NS	702	<b>1,318</b>	598	759	NS	929	828	
	08-11-97	NS	770	<b>1,100</b>	670	800	NS	810	860	
	08-03-98	NS	640	930	640	750	NS	870	800	

Analyses performed by Trace Analysis, Inc. using EPA Methods 160.1 and 300.

New Mexico Water Quality Control Commission (WQCC) Standards are listed as specified in Regulation 3-103.

--- Indicates monitoring well was installed after this sampling date.

NS Indicates monitoring well was not sampled (due to presence of free product).

Values in boldface type indicate concentrations exceed WQCC groundwater standards.

## 6.0 Intrinsic Bioremediation Assessment

Electron acceptors can be used by in situ microorganisms to achieve significant hydrocarbon degradation, therefore our suite of analytes included dissolved oxygen, (DO), sulfate (SO<sub>4</sub>) and nitrate as nitrogen(NO<sub>3</sub>). Electron acceptor results (biological parameters) are summarized in Table 6. Changes in dissolved oxygen, nitrate and sulfate concentrations with time are depicted in Figures 5, 6, and 7, respectively.

Hydrocarbon-impacted wells (MW-1D and MW-7) are compared against non-impacted wells (MW-2, MW-3, MW-4, and MW-6) to observe whether or not significant differences are observed in electron acceptor concentrations that may be related to subsurface biodegradation. The following trends in the electron acceptor data are observed:

- Generally, dissolved oxygen levels have been lower within the hydrocarbon-impacted plume area compared to the downgradient and upgradient wells indicating active aerobic biodegradation conditions.
- Nitrate and sulfate concentrations fluctuate over time therefore no trend relationships are noted. However, the presence of these constituents as electron acceptors indicate their availability for by micro-organisms in the course of hydrocarbon degradation.

**Table 6**  
**Summary of Biological Parameter Results**  
**Monument Booster Station**

Monitoring Well	Sampling Date	Dissolved Oxygen (mg/L)	Nitrate - NO <sub>3</sub> (mg/L)	Sulfate - SO <sub>4</sub> (mg/L)
MW-1D	5/16/95	1.05	1.37	174
	11/15/95	1.26	< 0.01	119
	1/18/96	4.8	0.6	168
	4/24/96	2.6	< 0.1	169
	1/22/97	7.0	< 0.1	83
	8/11/97	3.6	< 0.1	110
	1/23/98	4.6	2.8	190
	8/3/98	2.16	4.0	100
MW-2	5/16/95	6.48	7.42	509
	11/15/95	6.13	NA	NA
	1/18/96	6.2	NA	NA
	4/24/96	1.5	0.3	443
	1/22/97	9.0	2.1	310
	8/11/97	7.6	9.0	290
	1/23/98	8.2	30.0	230
	8/3/98	7.00	4.0	220
MW-3	5/16/95	6.85	5.62	115
	11/15/95	1.29	NA	NA
	1/18/96	4.9	NA	NA
	4/24/96	1.0	0.3	95
	1/22/97	8.75	2.7	76
	8/11/97	9.2	9.4	75
	1/23/98	7.7	15	240
	8/3/98	3.43	4.0	80
MW-4	5/16/95	4.85	3.69	136
	11/15/95	1.3	NA	NA
	1/18/96	4.0	NA	NA
	4/24/96	1.9	0.1	115
	1/22/97	9.0	< 0.1	100
	8/11/97	3.5	< 0.1	96
	1/23/98	7.0	1	180
	8/3/98	3.66	2.9	100
MW-6	11/15/95	5.4	0.06	233
	1/18/96	4.1	< 0.05	93
	4/24/96	1.7	< 0.1	70
	1/22/97	11.0	< 0.1	37
	8/11/97	3.7	< 1.0	37
	1/23/98	4.7	0.28	230
	8/3/98	1.96	< 1.0	45
	MW-7	11/15/95	1.6	5.0
1/18/96		4.8	6.54	180
4/24/96		2.1	0.2	149
1/22/97		13.2	< 0.1	25
8/11/97		3.0	< 1.0	76
1/23/98		4.1	0.39	180
8/3/98		1.9	< 1.0	90

Analyses performed by Trace Analysis, Inc., Lubbock, Texas.

Dissolved oxygen (DO) readings obtained with ICM Model 31250, Hanna, and YSI Model 51B DO meters.

NA indicates monitoring well was not analyzed for this constituent.

Monitoring wells MW-6 and MW-7 installed on November 15, 1995.

Monitoring wells MW-1 and MW-5 were not analyzed due to presence of phase-separated hydrocarbons.

Figure 5

Dissolved Oxygen Concentrations Versus Time

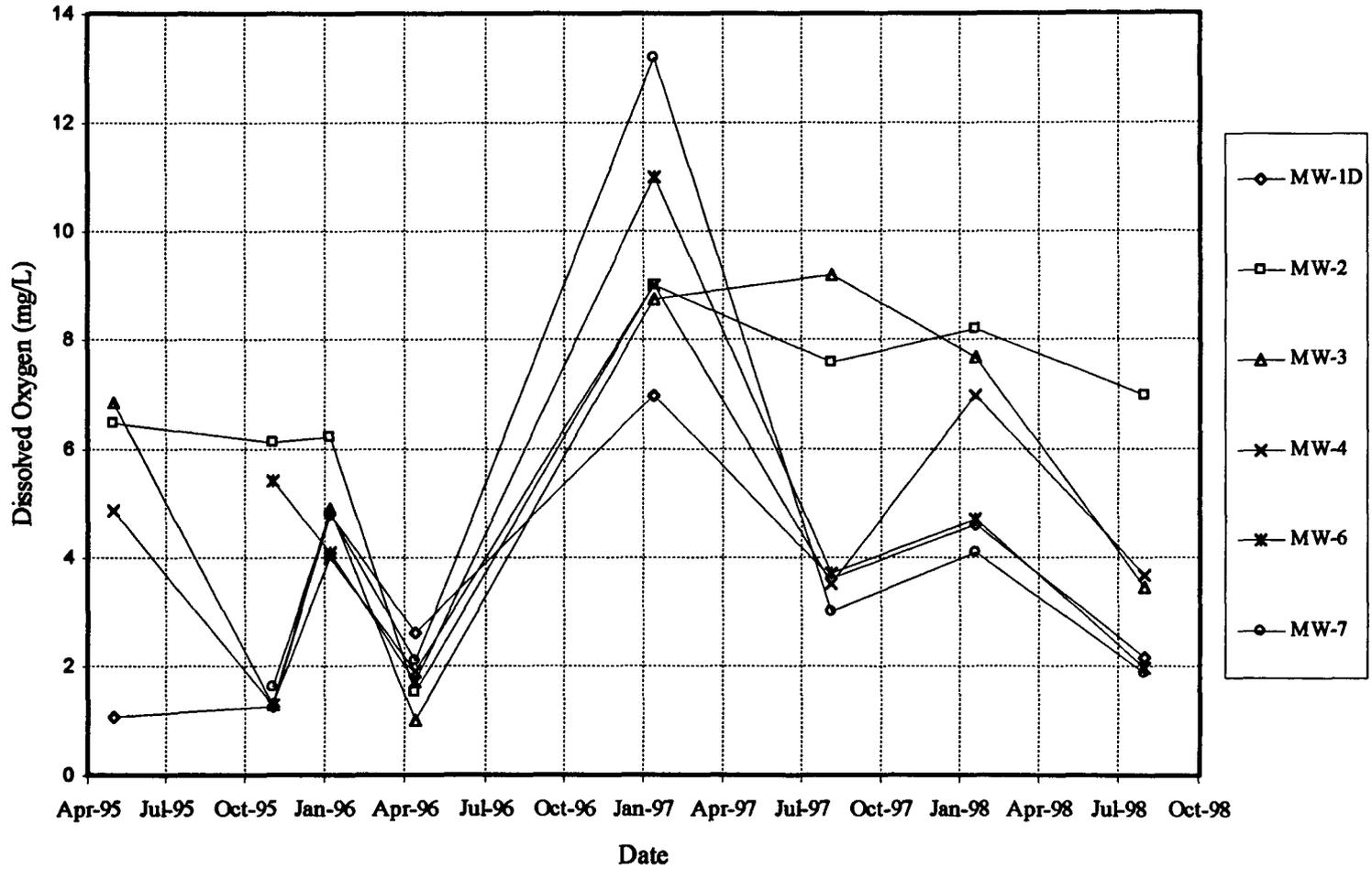


Figure 6

Nitrate Concentrations Versus Time

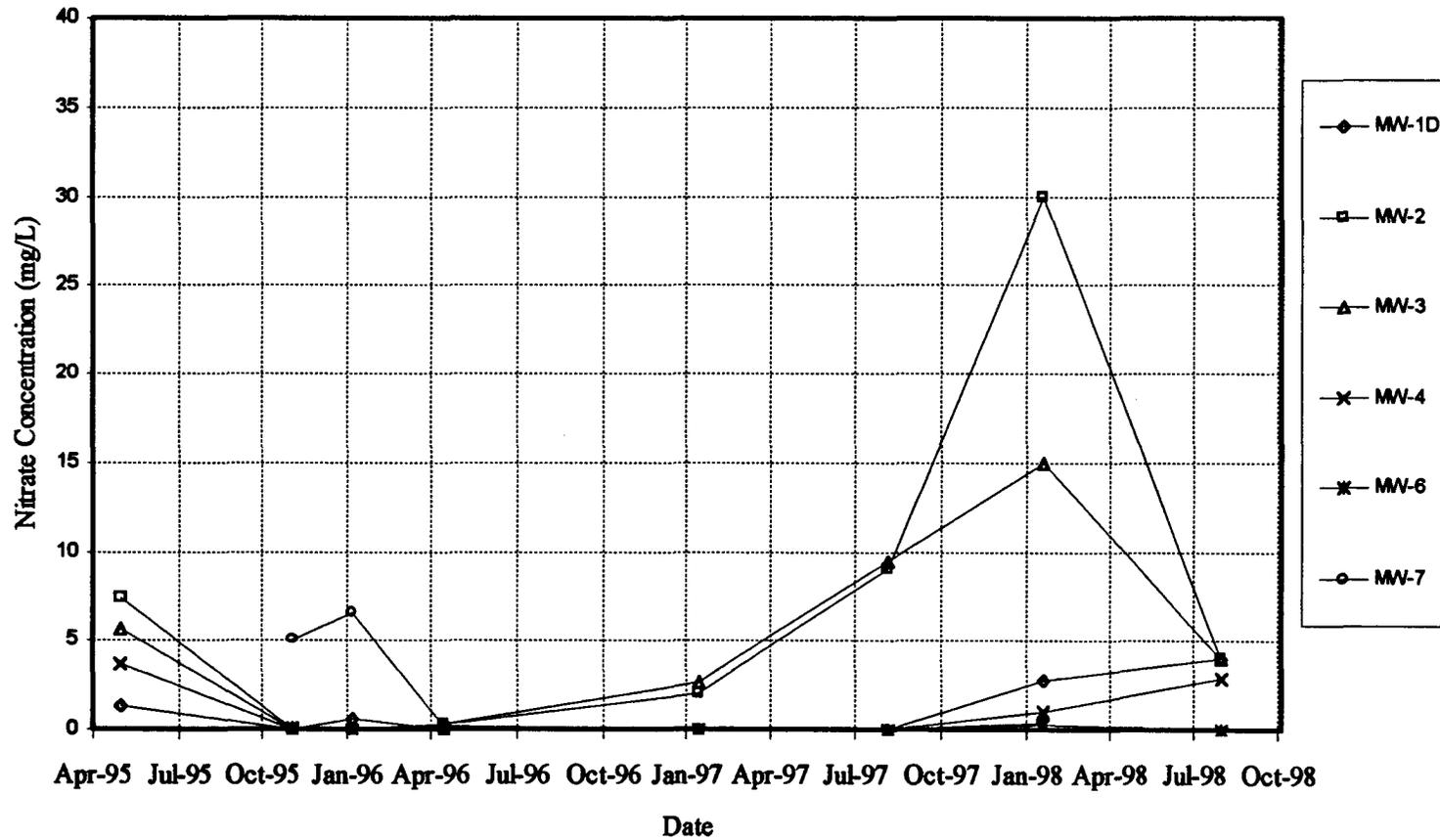
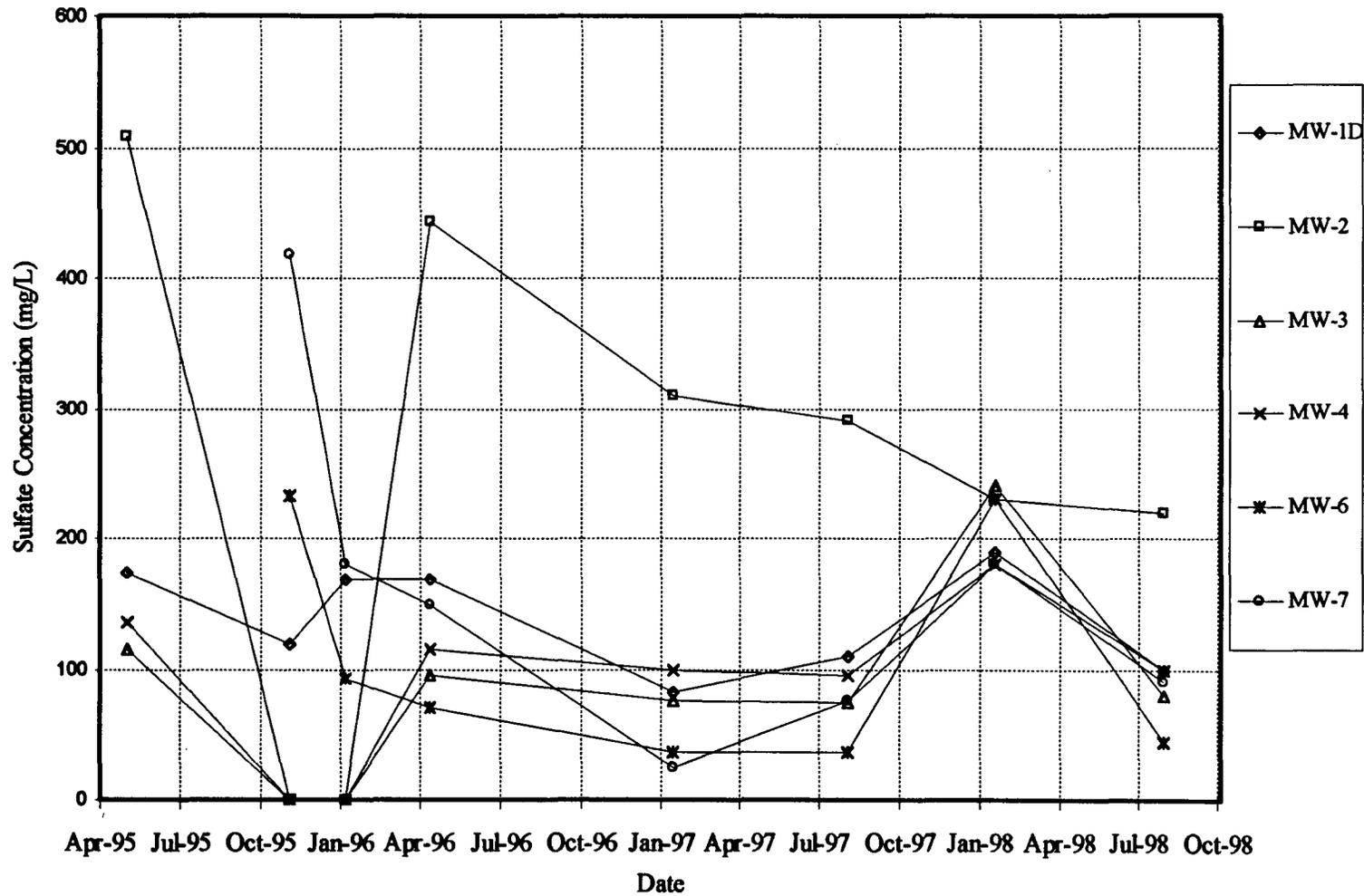


Figure 7

Sulfate Concentration Versus Time



7.0 Remediation System Performance

The remediation system at the Monument Booster Station consists of one Xitech pneumatic product recovery system and one passive skimmer. The Xitech product recovery pumps were installed in monitoring wells MW-1 and MW-5 on January 31, 1997 to replace the hand bailing and gravity siphoning techniques used previously. On March 13, 1998 the Xitech pump in MW-5 was removed to be used at another facility (Lee Plant) and replaced with a passive skimmer. As of August 3, 1998, a total of approximately 106 gallons of free product (condensate) have been removed from monitoring wells MW-1 and MW-5. The product recovery systems at Monument Booster Station have been successful at removing product from MW-1 and MW-5. Product recovery volumes are listed in Table 7.

Table 7 Product Recovery Volumes GPM - Monument Booster Station			
Date	Product Recovery Method	Product Recovered (Gallons)	Cumulative Product Recovered (Gallons)
MW-1			
7/24/95	Bail	10	10
7/25/95	SWAP	1	11
7/27/95	SWAP	1	12
3/8/96	Pump	12	24
1/27/97	Pump	4	28
1/31/97	Pump	2	30
2/7/97	Pump	2	32
2/19/97	Pump	10	42
8/11/97	Pump	23	65
1/23/98	Pump	20	85
8/3/98	Pump	9	94
9/18/98	Pump	3	97
MW-5			
2/7/97	Pump	2	2
2/19/97	Pump	0	2
8/11/97	Pump	6	8
1/23/98	Pump	0.5	8.5
9/18/98	Skimmer	0.7	9.2
<b>Total Volume of Product Recovered On Site:</b>			<b>106.2</b>
Product recovery methods used:			
Bail: Hand bailing using PVC bailer			
SWAP: Gravity siphon demonstration			
Pump: Xitech ADJ 1000 Smart Skimmer (Product Recovery System)			
Skimmer: Passive bailer with hydrophobic filter			

## 8.0 Conclusions

Conclusions relevant to groundwater conditions and the remediation performance at the Monument Booster Station are presented below.

- A benzene concentration of 0.094 mg/L in MW-7 was the only occurrence in which WQCC standards were exceeded.
- Benzene concentrations in MW-7 fluctuate over time but have declined from a high of 1.130 mg/L on January 17, 1996 to it's lowest concentration of 0.094 mg/L on August 3, 1998.
- Benzene levels in MW-3 have increased slightly from less than the detection limit of 0.001 mg/L during all previous sampling events to a level of 0.007 mg/L during the August 3, 1998 event.
- The dissolved-phase hydrocarbons in groundwater are contained within the boundaries of the facility.
- Based on the results of the metal analyses during the annual sampling event, the groundwater in the site area is not adversely affected or impacted with dissolved metals.
- As of August 3, 1998, a total of approximately 106 gallons of free product (condensate) has been removed from monitoring wells MW-1 and MW-5 using a combination of gravity siphoning, hand bailing, passive skimmer, and pneumatic pump recovery methods.
- The fact that there has been no increase of BTEX concentrations over detection limits in downgradient monitoring wells MW-4 and MW-6 is strong evidence that natural attenuation processes have kept the plume from migrating. It is expected that benzene levels in downgradient well MW-3 will return to levels near or below the detection limit during subsequent sampling events.
- Continued semi-annual monitoring is necessary to demonstrate that the plume is maintaining a steady state or receding condition and to evaluate the effectiveness of intrinsic bioremediation in limiting the migration or elimination of the dissolved hydrocarbon plume.

**9.0 Recommendations**

The following recommendations are proposed for the remediation system and monitoring operations at the Monument Booster Station.

- Continue free product recovery operations since the present system has been effective in recovering free product from MW-1 and MW-5.
- Continue the sampling and monitoring program on a semi-annual basis. The next sampling event is scheduled during the first quarter of 1999.

**APPENDIX A**

**Laboratory Analytical Reports**

**and**

**Chain of Custody Documentation**



BDM International, Inc.  
 415 West Wall  
 Suite 1818  
 Midland, TX 79701  
 (915) 682-0008  
 FAX: (915) 682-0028

157

13231

# Chain of Custody

Date 8-4-98 Page 1 of 1

Lab Name <u>Trace Analysis, Inc</u> Address <u>6701 Aberdeen Av</u> <u>Lubbock, TX 79424</u> Telephone <u>(806) 794-1296</u>			Analysis Request																									
Samplers (SIGNATURES) <i>[Signature]</i>			Halogenated Volatiles 601/6010	Aromatic Volatiles 602/6020 <u>BTEX</u>	Phenols, Sub Phenols 604/6040	Pesticides/PCB 608/6080	Polynuclear Aromatic Hydrocarbons 610/6310	Volatile Compounds GC/MS 624/6240	Base/Neu/Acid Compounds GC/MS 625/6270	Total Organic Carbon (TOC) 415/9060	Total Organic Halides (TOX) 9020	Petroleum Hydrocarbons 418.1 TPH/BTEX Modified 8015	TCLP - Vol., Semi-Vol. Herbicides, Pesticides	TCLP - Metals	RCRA Metals (8)	Priority Pollutant Metals (13)	CAM Metals (18) TTLC/STLC	Flash Point	Corrosivity	Reactivity	Oil & Grease	Cyanide Total/Amenable	Chemical Oxygen Demand (COD)	<u>Metals</u> Al, As, B, Cr, Fe, Mn <u>max: Cl, F, SO<sub>4</sub>, NO<sub>3</sub></u>	<u>TDS</u>	Number of Containers		
Sample Number	Matrix	Location																										
<u>104514</u> 9808031100	Water	MW-2		✓																					✓	✓	✓	7
515 9808031155	Water	MW-3		✓																					✓	✓	✓	7
516 9808031230	Water	Duplicate		✓																								2
517 9808031325	Water	MW-4		✓																				✓	✓	✓	7	
518 9808031430	Water	MW-6		✓																				✓	✓	✓	7	
519 9808031500	Water	MW-1d		✓																				✓	✓	✓	7	
520 9808031600	Water	MW-7		✓																				✓	✓	✓	7	
521 9808031610	Water	Rinsate		✓																								2
522 341 A	Water	Trip Blank		✓																								1

Project Information		Sample Receipt		Relinquished By 1.		Relinquished By 2.		Relinquished By 3.	
Project <u>Monument Booster Sta.</u>	Total No. of Containers			<i>[Signature]</i> <u>6:30pm</u>		<i>[Signature]</i> <u>6:45AM</u>			
Project Director <u>Gil Van Deventer</u>	Chain of Custody Seals			<i>[Signature]</i> <u>8/7/98</u>		<i>[Signature]</i> <u>8/7/98</u>			
Charge Code No. <u>LRMDNU-20-300</u>	Rec'd Good Condition/Cold			<i>[Printed Name]</i> <u>TRW (BDM)</u>		<i>[Printed Name]</i> <u>TRACE ANALYSIS</u>			
Shipping ID. No.	Conforms to Record			<i>[Company]</i>		<i>[Company]</i>			
Via <u>Greyhound</u>	Lab No.			<i>[Signature]</i> <u>6:30pm</u>		<i>[Signature]</i>		<i>[Signature]</i>	
Special Instructions/Comments: <u>Bill direct to GPM (Mel Driver)</u> <u>Detection Limit ≤ NMWQCC</u>				<i>[Printed Name]</i> <u>HELEN SHELTON</u>		<i>[Printed Name]</i> <u>HELEN SHELTON</u>		<i>[Printed Name]</i> <u>Jane Taylor</u>	
				<i>[Company]</i> <u>TRACE ANALYSIS</u>		<i>[Company]</i> <u>TRACE ANALYSIS</u>		<i>[Company]</i> <u>Trace Analysis</u>	

Distribution: White, Canary-Laboratory BDM

47 samples - HC

1c

8/24



# TRACE ANALYSIS, INC.

6701 Aberdeen Avenue      Lubbock, Texas 79424      806•794•1296      FAX 806•794•1298

ANALYTICAL RESULTS FOR  
 BDM International  
 Attention Gil VanDeVenter  
 415 W. Wall, Suite 1818  
 Midland TX 79701

Lab Receiving # : 9808000157  
 Sampling Date: 8/3/98  
 Sample Condition: Intact and Cool  
 Sample Received By: JT

Date: Aug 17, 1998  
 Date Rec: 8/8/98  
 Project: LRMONU-20-300  
 Proj Name: Moument Booster Station  
 Proj Loc: N/A

TA#	Field Code	MATRIX	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL- BENZENE (mg/L)	M, P, O XYLENE (mg/L)	TOTAL BTEX (mg/L)
104514	9808031100-MW-2	Water	<0.001	<0.001	<0.001	<0.001	<0.001
104515	9808031155-MW-3	Water	0.007	<0.001	<0.001	<0.001	0.007
104516	9808031230-Duplicate	Water	0.104	<0.001	0.077	0.008	0.189
104517	9808031325-MW-4	Water	<0.001	<0.001	<0.001	<0.001	<0.001
104518	9808031430-MW-6	Water	<0.001	<0.001	<0.001	<0.001	<0.001
104519	9808031500-MW-1d	Water	<0.001	<0.001	<0.001	<0.001	<0.001
104520	9808031600-MW-7	Water	0.094	<0.005	0.064	0.007	0.165
104521	9808031610-Rinsate	Water	<0.001	<0.001	<0.001	<0.001	<0.001
104522	341A-Trip Blank	Water	<0.001	<0.001	<0.001	<0.001	<0.001
Method Blank			<0.001	<0.001	<0.001	<0.001	
Reporting Limit			0.001	0.001	0.001	0.001	
QC			0.100	0.097	0.099	0.308	

RPD	0	0	0	0
% Extraction Accuracy	107	104	106	113
% Instrument Accuracy	100	97	99	103

TEST	PREP METHOD	PREP DATE	ANALYSIS METHOD	ANALYSIS COMPLETED	CHEMIST	QC: (mg/L)	SPIKE: (mg/L)
BTEX	EPA 5030	8/12/98	EPA 8021B	8/12/98	JG	0.100 ea	0.1 ea

*BL*  
 \_\_\_\_\_  
 Director, Dr. Blair Leftwich

*8-17-98*  
 \_\_\_\_\_  
 Date



6701 Aberdeen Avenue

Lubbock, Texas 79424

806•794•1296

FAX 806•794•1298

August 20, 1998  
 Receiving Date: 08/08/98  
 Sample Type: Water  
 Charge Code No: LRMONU-20-300  
 Project Location: NA  
 COC# 13231

ANALYTICAL RESULTS FOR  
 BDM INTERNATIONAL, INC.  
 Attention: Gil Van Deventer  
 415 West Wall, Suite 1818  
 Midland, TX 79701

Sampling Date: 08/03/98  
 Sample Condition: Intact & Cool  
 Sample Received by: JT  
 Project Name: Monument Booster Sta.

TA#	FIELD CODE	TOTAL As (mg/L)	TOTAL Cr (mg/L)	TOTAL Al (mg/L)	TOTAL Fe (mg/L)	TOTAL Mn (mg/L)	TOTAL B (mg/L)
T104514	MW-2 9808031100	<0.10	<0.05	0.17	<0.10	<0.10	<0.75
T104515	MW-3 9808031155	<0.10	<0.05	1.7	0.55	<0.10	<0.75
T104517	MW-4 9808031325	<0.10	<0.05	0.10	<0.10	<0.10	<0.75
T104518	MW-6 9808031430	<0.10	<0.05	<0.10	0.26	0.36	<0.75
T104519	MW-1d 9808031500	<0.10	<0.05	<0.10	<0.10	0.22	<0.75
T104520	MW-7 9808031600	<0.10	<0.05	0.14	6.1	0.41	<0.75
ICV		0.98	1.0	1.0	1.0	0.97	1.0
CCV		0.98	1.0	1.0	1.0	0.97	1.0
REPORTING LIMIT		0.10	0.05	0.10	0.10	0.10	0.75
RPD		0	0	0	0	0	0
% Extraction Accuracy		95	95	100	90	90	95
% Instrument Accuracy		98	100	100	100	97	100
PREP DATE		08/08/98	08/08/98	08/08/98	08/08/98	08/08/98	08/08/98
ANALYSIS DATE		08/12/98	08/12/98	08/12/98	08/12/98	08/12/98	08/12/98

METHODS: EPA SW 846-3015, 6010B.  
 CHEMIST: RR  
 TOTAL METALS SPIKE: 2.0 mg/L As, Cr, Al, Fe, Mn, B.  
 TOTAL METALS CV: 1.0 mg/L As, Cr, Al, Fe, Mn, B.

  
 Director, Dr. Blair Leftwich

  
 Date

# TRACE ANALYSIS, INC.

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 4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944  
 E-Mail: lab@traceanalysis.com

## ANALYTICAL RESULTS FOR BDM INTERNATIONAL

Attention: Gil Van Deventer  
 415 W. Wall, Suite 1818  
 Midland, TX 79701

August 20, 1998  
 Receiving Date: 08/08/98  
 Sample Type: Water  
 Charge Code No: LRMONU-20-300  
 Project Location: NA  
 COC# 13231

Sampling Date: 08/03/98  
 Sample Condition: Intact & Cool  
 Sample Received by: JT  
 Project: Monument Booster Sta.

TA#	FIELD CODE	FLUORIDE (mg/L)	CHLORIDE (mg/L)	N03-N* (mg/L)	S04 (mg/L)	TDS (mg/L)
T104515	MW-3 9808031155	1.6	160	4.0	80	640
T104517	MW-4 9808031325	1.3	160	2.9	100	750
ICV		2.3	11	4.6	12	---
CCV		2.4	12	4.6	12	---
REPORTING LIMIT		0.1	0.5	0.2	0.5	10
RPD		0	1	1	0	2
% Extraction Accuracy		95	89	89	98	---
% Instrument Accuracy		96	96	93	99	97

PREP DATE 08/10/98 08/10/98 08/10/98 08/13/98 08/10/98  
 ANALYSIS DATE 08/10/98 08/10/98 08/10/98 08/13/98 08/10/98

\*NOTE: T104515 and T104517 out of holding time for N03-N.

METHODS: EPA 300.0, 160.1.

CHEMIST: FLUORIDE/CHLORIDE/N03-N/S04: JS TDS: RS

FLUORIDE SPIKE: 6.25 mg/L FLUORIDE.

FLUORIDE CV: 2.5 mg/L FLUORIDE.

CHLORIDE SPIKE: 31.25 mg/L CHLORIDE.

CHLORIDE CV: 12.5 mg/L CHLORIDE.

N03-N SPIKE: 12.5 mg/L N03-N.

N03-N CV: 5.0 mg/L N03-N.

S04 SPIKE: 31.25 mg/L S04.

S04 CV: 12.5 mg/L S04.



Director, Dr. Blair Leftwich

8-20-98

DATE

# TRACE ANALYSIS, INC.

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## ANALYTICAL RESULTS FOR BDM INTERNATIONAL

Attention: Gil Van Deventer  
415 W. Wall, Suite 1818  
Midland, TX 79701

August 20, 1998  
Receiving Date: 08/08/98  
Sample Type: Water  
Charge Code No: LRMONU-20-300  
Project Location: NA  
COC# 13231

Sampling Date: 08/03/98  
Sample Condition: Intact & Cool  
Sample Received by: JT  
Project: Monument Booster Sta.

TA#	FIELD CODE	FLUORIDE (mg/L)	CHLORIDE (mg/L)	N03-N* (mg/L)	S04 (mg/L)	TDS (mg/L)
T104514	MW-2 9808031100	1.8	240	4.0	220	930
ICV		2.3	11	4.6	12	---
CCV		2.4	12	4.6	12	---
REPORTING LIMIT		0.1	0.5	0.2	0.5	10
RPD		0	1	1	0	1
% Extraction Accuracy		95	89	89	98	---
% Instrument Accuracy		96	96	93	99	98
PREP DATE		08/10/98	08/10/98	08/10/98	08/13/98	08/12/98
ANALYSIS DATE		08/10/98	08/10/98	08/10/98	08/13/98	08/12/98

\*NOTE: T104514 out of holding time for N03-N.

METHODS: EPA 300.0, 160.1.

CHEMIST: FLUORIDE/CHLORIDE/N03-N/S04: JS TDS: RS

FLUORIDE SPIKE: 6.25 mg/L FLUORIDE.

CHLORIDE SPIKE: 31.25 mg/L CHLORIDE.

N03-N SPIKE: 12.5 mg/L N03-N.

S04 SPIKE: 31.25 mg/L S04.

FLUORIDE CV: 2.5 mg/L FLUORIDE.

CHLORIDE CV: 12.5 mg/L CHLORIDE.

N03-N CV: 5.0 mg/L N03-N.

S04 CV: 12.5 mg/L S04.



Director, Dr. Blair Leftwich

8-20-98

DATE



# TRACE ANALYSIS, INC.

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 4725 Ripley Avenue, Suite A    El Paso, Texas 79922    888•588•3443    915•585•3443    FAX 915•585•4944  
 E-Mail: lab@traceanalysis.com

**ANALYTICAL RESULTS FOR  
 BDM INTERNATIONAL**  
 Attention: Gil Van Deventer  
 415 W. Wall, Suite 1818  
 Midland, TX 79701

August 20, 1998  
 Receiving Date: 08/08/98  
 Sample Type: Water  
 Charge Code No: LRMONU-20-300  
 Project Location: NA  
 COC# 13231

Sampling Date: 08/03/98  
 Sample Condition: Intact & Cool  
 Sample Received by: JT  
 Project: Monument Booster Sta.

TA#	FIELD CODE	FLUORIDE (mg/L)	CHLORIDE (mg/L)	N03-N* (mg/L)	S04 (mg/L)	TDS (mg/L)
T104518	MW-6 9808031430	1.3	150	<1.0	45	870
T104519	MW-1d 9808031500	2.4	120	4.0	100	640
T104520	MW-7 9808031600	1.8	160	<1.0	90	800
ICV		2.4	12	4.6	12	---
CCV		2.3	11	5.3	12	---
REPORTING LIMIT		0.1	0.5	0.2	0.5	10
RPD		2	2	1	0	2
% Extraction Accuracy		98	90	99	98	---
% Instrument Accuracy		96	96	100	99	97
PREP DATE		08/10/98	08/10/98	08/10/98	08/13/98	08/10/98
ANALYSIS DATE		08/10/98	08/10/98	08/10/98	08/13/98	08/10/98

\*NOTE: 104518, 104519 and 104520 out of holding time for N03-N.

METHODS: EPA 300.0, 160.1.  
 CHEMIST: FLUORIDE/CHLORIDE/N03-N/S04: JS    TDS: RS  
 FLUORIDE SPIKE: 6.25 mg/L FLUORIDE.  
 CHLORIDE SPIKE: 31.25 mg/L CHLORIDE.  
 N03-N SPIKE: 12.5 mg/L N03-N.  
 S04 SPIKE: 31.25 mg/L S04.

FLUORIDE CV: 2.5 mg/L FLUORIDE.  
 CHLORIDE CV: 12.5 mg/L CHLORIDE.  
 N03-N CV: 5.0 mg/L N03-N.  
 S04 CV: 12.5 mg/L S04.

  
 \_\_\_\_\_  
 Director, Dr. Blair Leftwich

4-20-98  
 \_\_\_\_\_  
 DATE



BDM International, Inc.  
 415 West Wall  
 Suite 1818  
 Midland, TX 79701  
 (915) 682-0008  
 FAX: (915) 682-0028

13117

# Chain of Custody

Date 1-23-98 Page 1 Of 1

Lab Name <u>Trace Analysis, Inc.</u> Address <u>6701 Aberdeen</u> <u>Lybbock Tx 79424</u> Telephone <u>800 378 1298</u>			Analysis Request																						
Samplers (SIGNATURES)			Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Phenols, Sub Phenols 604/8040	Pesticides/PCB 608/8080	Polynuclear Aromatic Hydrocarbons 610/8310	Volatile Compounds GC/MS 624/8240	Base/Neu/Acid Compounds GC/MS 625/8270	Total Organic Carbon (TOC) 415/9060	Total Organic Halides (TOX) 9020	Petroleum Hydrocarbons 418.1 TPH/BTEX Modified 8015	TCLP - Vol., Semi-Vol. Herbicides, Pesticides	TCLP - Metals	FCRA Metals(8)	Priority Pollutant Metals (13)	CAM Metals (18) TTLC/STLC	Flash Point	Corrosivity	Reactivity	Oil & Grease	Cyanide Total/Amenable	Chemical Oxygen Demand (COD)	Number of Containers	
Sample Number	Matrix	Location																							
9801230950	Water	MW-4	✓									89814											✓	✓	3
9801231015	Water	MW-6	✓										15										✓	✓	3
9801231040	Water	MW-3	✓										16										✓	✓	3
9801231125	Water	MW-7	✓										17										✓	✓	3
9801231130	Water	MW-1d	✓										18										✓	✓	3
9801231215	Water	MW-7d	✓										19												2
9801231220	Water	MW-2	✓										20										✓	✓	3
98012174AB	Water	Trip blank	✓										21												2

Project Information		Sample Receipt		Relinquished By 1.		Relinquished By 2.		Relinquished By 3.	
Project <u>GPM-Monument</u>	Total No. of Containers <u>23</u>	Chain of Custody Seals <u>3</u>		<u>Gil Van Deventer 2:30pm</u> (Signature) (Time)		<u>Gil Van Deventer 1-23-98</u> (Signature) (Time)		<u>M Lopez 1-23-98</u> (Signature) (Time)	
Project Director <u>G. Van Deventer</u>	Rec'd Good Condition/Cold <u>4</u>	Conforms to Record <u>4</u>		<u>BDM International</u> (Printed Name) (Date)		<u>BDM International</u> (Printed Name) (Date)		<u>BDM International</u> (Printed Name) (Date)	
Charge Code No. <u>P/2398/6C</u>	Lab No.			Received By 1.		Received By 2.		Received By 3.	
Shipping ID. No.				<u>M Lopez</u> (Signature) (Time)		<u>M Lopez</u> (Signature) (Time)		<u>M Lopez</u> (Signature) (Time)	
Via:				<u>Trace Analysis</u> (Printed Name) (Date)		<u>Trace Analysis</u> (Printed Name) (Date)		<u>Trace Analysis</u> (Printed Name) (Date)	
Special Instructions/Comments: <u>Bill GPM direct (Mel Driver)</u>				<u>Trace Analysis</u> (Company)		<u>Trace Analysis</u> (Company)		<u>Trace Analysis</u> (Company)	

Bus 1546916764

# TRACE ANALYSIS, INC.

6701 Aberdeen Avenue

Lubbock, Texas 79424

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FAX 806•794•1298

**ANALYTICAL RESULTS FOR  
BDM INTERNATIONAL, INC.**

Attention: Gil VanDeventer  
415 West Wall, Suite 1818  
Midland, TX 79701

January 27, 1998

Receiving Date: 01/24/98

Sample Type: Water

Charge Code: P/2398/6C

Project Location: GPM - Monument

Prep Date: 01/24/98

Analysis Date: 01/24/98

Sampling Date: 01/23/98

Sample Condition: Intact & Cool

Sample Received by: ML

Project Name: GPM

TA#	FIELD CODE	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL- BENZENE (mg/L)	M,P,O XYLENE (mg/L)	TOTAL BTEX (mg/L)
T89814	9801230950 MW-4	<0.001	<0.001	<0.001	<0.001	<0.001
T89815	9801231015 MW-6	<0.001	<0.001	<0.001	<0.001	<0.001
T89816	9801231040 MW-3	<0.001	<0.001	<0.001	<0.001	<0.001
T89817	9801231125 MW-7	0.876	<0.005	0.486	0.195	1.56
T89818	9801231130 MW-1D	<0.001	<0.001	<0.001	<0.001	<0.001
T89819	9801231215 MW-7D	0.798	<0.005	0.443	0.181	1.42
T89820	9801231220 MW-2	<0.001	<0.001	<0.001	<0.001	<0.001
T89821	980112174AB Trip Blank	<0.001	<0.001	<0.001	<0.001	<0.001
QC	Quality Control	0.097	0.097	0.094	0.286	
<b>REPORTING LIMIT</b>		0.001	0.001	0.001	0.001	
<b>RPD</b>		5	6	6	6	
<b>% Extraction Accuracy</b>		93	92	89	91	
<b>% Instrument Accuracy</b>		97	97	94	95	

METHODS: EPA SW 846-8021B, 5030.

CHEMIST: JG

BTEX SPIKE AND QC: 0.100 mg/L BTEX.



Director, Dr. Blair Leftwich

1-27-98

Date

# TRACE ANALYSIS, INC.

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E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR  
BDM INTERNATIONAL  
Attention: Gil VanDeventer  
415 West Wall, Suite 1818  
Midland, TX 79701

February 13, 1998  
Receiving Date: 01/24/98  
Sample Type: Water  
Project No: P/2398/6C  
Project Location: GPM-Monument  
COC #13117

Prep Date: 02/10/98  
Analysis Date: 02/10/98  
Sampling Date: 01/23/98  
Sample Condition: Intact & Cool  
Sample Received by: ML  
Project Name: GPM Monument

TA#	FIELD CODE	NO3-N (mg/L)	SO4 (mg/L)
T89814	9801230950 MW-4	1.0	180
T89815	9801231015 MW-6	0.28	230
T89816	9801231040 MW-3	15	240
T89817	9801231125 MW-7	0.39	180
T89818	9801231130 MW-1d	2.8	190
T89820	9801231220 MW-2	30	230
QC	Quality Control	1.176	17.3
METHOD BLANK		<0.01	<1.0
REPORTING LIMIT		0.01	1.0
RPD		0	3
% Extraction Accuracy		90	91
% Instrument Accuracy		93	85

METHODS: EPA 353.3, 375.4.  
CHEMIST: NO3:RS SO4:JS  
NO3-N SPIKE AND QC: 1.333 mg/L as N.  
SULFATE SPIKE AND QC: 20 mg/L SO4.



Director, Dr. Blair Leftwich

2-13-98  
DATE

