GW - 022

MONITORING REPORT

09/01/2006

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

September 01, 2006

Mr. Ben Stone
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Empire Abo Gas Plant Quarterly Sampling Event and Dewatering Program update.

Dear Mr. Stone:

On behalf of Frontier Field Services, R. T. Hicks Consultants, Ltd. is submitting this Quarterly Sampling and Dewatering Memo to report recent activities at the Empire Abo Gas Plant. This memo principally addresses the May 2nd and July 10th sampling events and the dewatering program.

After your review of this memo, we would like the opportunity to meet with you to discuss this memo and the feasibility of the ground water dewatering program.

Sincerely,
R.T. Hicks Consultants, Ltd.

Andrew Parker
Project Manager

Copy:
Randy McCollum (Frontier Field Services)

R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW
Suite F-142
Albuquerque, NM 87104
505-266-5004 andrew@rthicksconsult.com

Memo

To: Ben Stone

From: Andrew Parker

CC: Randy McCollum (Frontier Field Services)

Date: September 01, 2006 Sent via Email on 9/1/06

Re: Quarterly Sampling and Dewatering at Empire Abo Gas Plant

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On May 2nd and July 10th, 2006, we performed the first two of four OCD approved quarterly sampling events. We scheduled the last two sampling events for October 9th, 2006 and January 08, 2007. We sampled and gauged monitoring wells EB-05, EB-07, P-01, P-03, P-04, and P-05 and piezometer EB-06. We delivered the ground water samples to Hall Environmental Laboratories in Albuquerque for the analysis of BTEXN (Benzene, Toluene, Ethyl Benzene, Xylenes, and Naphthalene), TDS, Chloride, and Sulfate. Plate 1 shows the locations of all offsite monitoring wells.

Ground Water Monitoring and Sampling

Ground water elevations decreased from approximately 0.1 to 0.4 feet between the May and July 2006 sampling events. We observed 0.1-feet of Phase Separate Hydrocarbons (PSH) in P-03 during the July 2006 sampling event. We did not observe PSH in P-03 during the May 2006 sampling event. In addition, we did not observe PSH in the remaining wells. However, during past sampling and monitoring events, we observed 1.64-feet of PSH in monitoring well EB-03. EB-03 is not included in the current sampling and monitoring program. Table 1 shows ground water elevations for all offsite monitoring wells and Plate 2 shows ground water elevations from the July sampling event.

Monitoring wells EB-05, EB-06, EB-07, P-01, and P-05 continue to show BTEXN concentrations below laboratory detection limits. Benzene concentrations in P-03 and P-04 decreased from 11 to 3.8 ug/L and 1.5 to <1.0 ug/L, respectively. TEXN concentrations were below laboratory detection limits in all monitoring wells. TDS and Sulfate concentrations were above WQCC standards. Chloride concentrations were above WQCC standards in P-04 and below WQCC standards in the remaining monitoring wells. Table 2 shows chemical concentrations over time. Plate 2 shows Benzene concentrations in ground water observed during the July 2006 sampling event.

Dewatering Program

The extent of the observed PSH has not been determined and we believe multiple sources may exist. We believe defining all of the sources and possibly the extent of ground water impact is infeasible due to the numerous pipelines throughout the oil field, several of which show signs of surface releases. Some of these pipelines pass underneath the EAGP. Therefore, to reduce the potential for observed PSH at the EAGP migrating offsite, the OCD instructed Frontier Field Services to initiate a dewatering program at EAGP. We began to bring dewatering wells online in December 2005.

Currently, the dewatering program consists of two dewatering wells, MW-03-01 and MW-08. Plate 3 shows the location of existing and proposed dewatering wells. We delayed bringing additional wells online while we evaluated the scale (probably calcium carbonate) build-up on the plants in the evaporation pond. The scale is killing the plants where the outflow from the separation tanks enters the evaporation pond. In addition, the scaling of the plants is reducing the ability of the evaporation pond to bioremediate the observed benzene concentrations. We are considering installation of a sand filter to reduce the scaling in the evaporation pond, but a determination of its potential effectiveness has not been made at this time.

For an immediate solution to the scaling problem, we will install a pipeline directly to BP's disposal line. This will stop the scaling that is currently killing the vegetation in the pond and allow us to go ahead with the installation of additional dewatering wells. We will install a pipe on top of the pond liner from the outflow of the separation tanks to the sump at the north end of the evaporation pond; where ground water mixes with cooling tower and blowdown water before going to the BP disposal well.

The two dewatering wells pump approximately 180 barrels of water per day (bbls/day). Dewatering well MW-03-01 continuously pumps at a rate of 4.3 gpm.

Dewatering well MW-08 cycles on for approximately 2:50 (mm:ss) and cycles off for 9:50 (mm:ss) while the ground water recharges. Therefore, the average pumping rate of MW-08 is 0.9 gpm. In addition, since the initiation of the dewatering program, we have not observed a response in ground water elevations in surrounding wells.

Path Forward

We will continue with the sampling and monitoring program as discussed above. However, we will discontinue the sampling of EB-06 as it was not included in the approved ground water monitoring work plan. EB-06 was installed as an upgradient piezometer consisting of one-inch PVC with an open bottom. We elected to sample the piezometer to see if we could duplicate the 5.0 ug/L benzene concentration detected during the September 2005 sampling event. During the May and July 2006 sampling events, ground water results from EB-06 showed benzene concentrations below laboratory detection levels. We believe the 5.0 ug/L benzene concentration was due to laboratory or sampling contamination.

To further our understanding of subsurface conditions east of the EAGP and to collect data for AAS, we plan to

1. Expand the sampling program to include EB-03, EB-08, and P-02 starting with the October 9th sampling event.

2. Perform a ground water chemistry sampling event to obtain ground water chemical signatures (major anions/cations) to determine whether a hydraulic connection exists between the eastern monitoring wells and the EAGP. We will then classify the ground water into hydrochemical facies. This is the same process we did in 2004 to determine whether ground water

underneath EAGP is of the Yates Formation, Yates Formation/Produced Water, Yates Formation/Caprock Water, or Produced Water. We plan to obtain samples from some of the wells we sampled in 2004 (MW-03-03, MW-02, MW-07, MW-08, MW-02-14, MW-02-15, MW-03-02, EB-03, and EB-06, and the Caprock Water) in addition to P-02, P-03, P-04, and P-05.

In conclusion, we invite the OCD to tour the EAGP site with Randy McCollum of Frontier Field Services and Andrew Parker of Hicks Consultants. The purpose of the tour is to (re)familiarize OCD with:

- the complex karst geology of the area
- the challenges of dewatering as a result of the complex karst geology and plant infrastructure, and
- the challenges of discharging ground water into the evaporation pond without scaling the plants, separation tanks, and pipelines.

Please contact Andrew Parker at 505-350-5535 to schedule a time for touring the EAGP site.

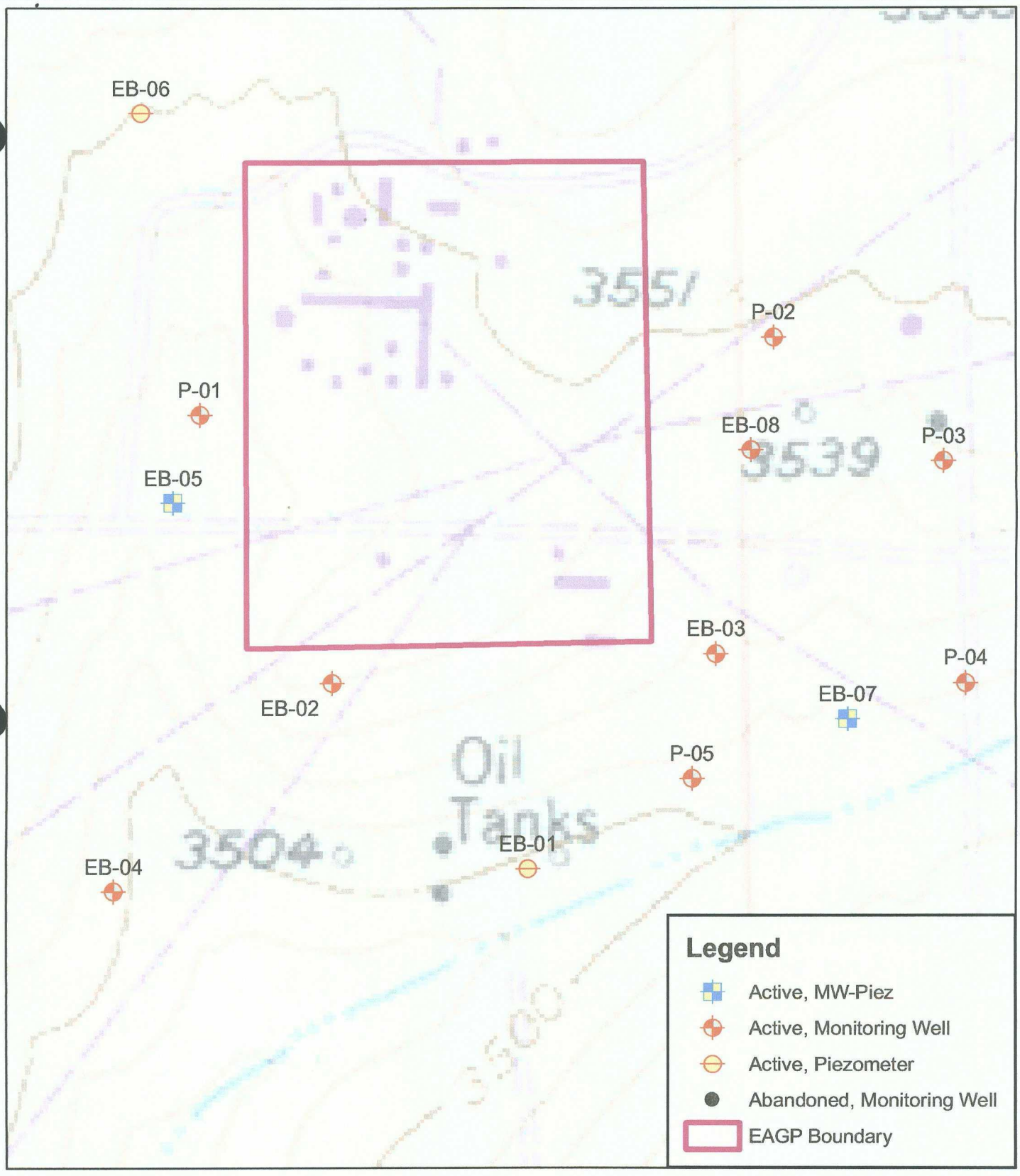
Empire Abo Gas Plant

Table 1: Ground Water Elevations over Time

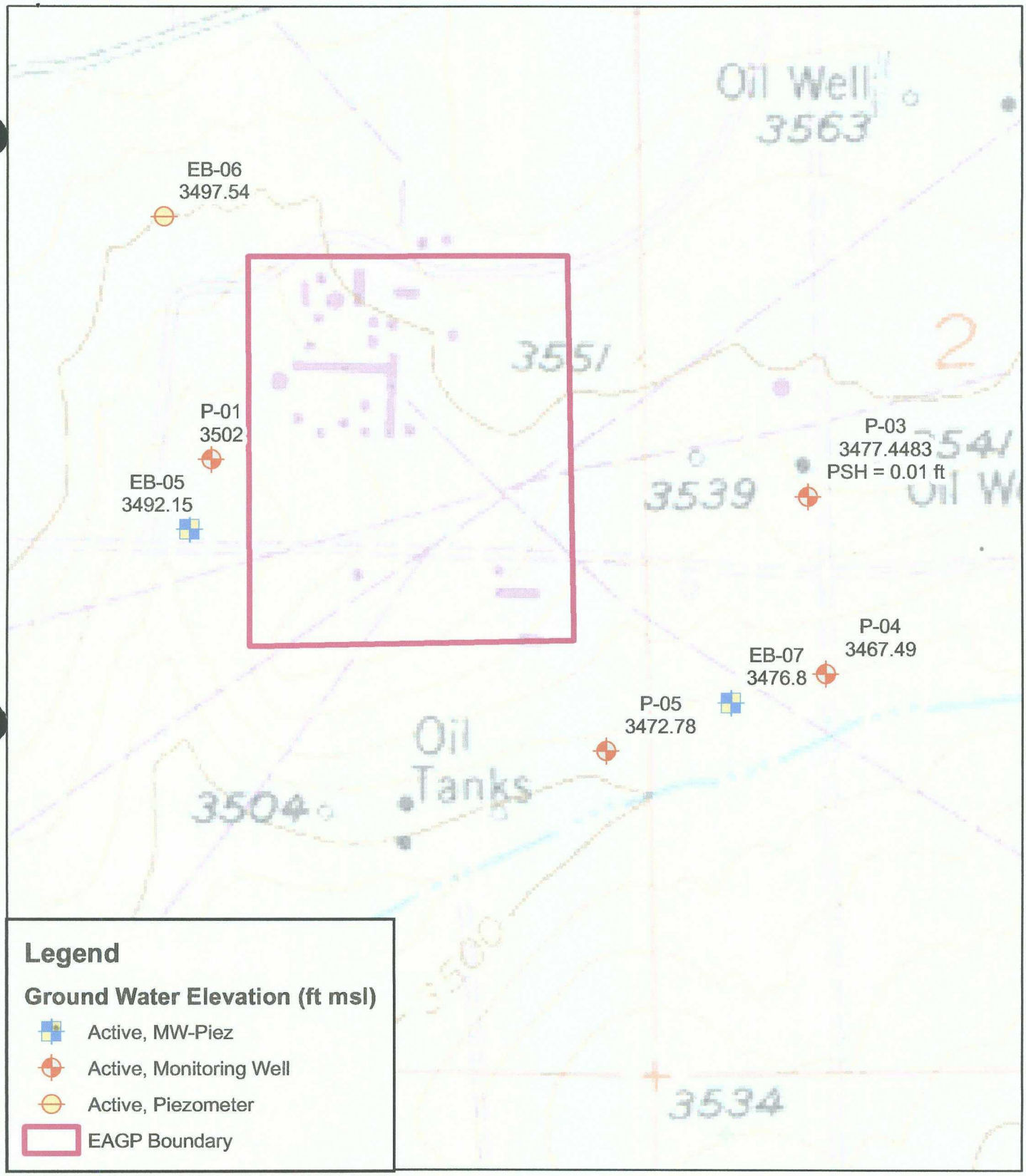
Well_ID	DATE	DTP (fbgs)	DTW (fbgs)	TOC (msl)	GW Elev (msl)	PSH (ft)
EB-01	7/24/2004		26.15	3499.25	3473.1	
	9/28/2005		28.35	3499.25	3470.9	
EB-02	3/31/2004		47.03	3539.82	3492.79	
	7/24/2004		46.87	3539.82	3492.95	
	9/28/2005		46.54	3539.82	3493.28	
EB-03	3/31/2004		46.87	3521.4	3474.53	
	4/28/2004	46.85	48	3521.4	3474.3545	1.15
	9/28/2005	44.15	45.79	3521.4	3476.9712	1.64
EB-04	3/31/2004		42.09	3503.85	3461.76	
	4/28/2004		42.21	3503.85	3461.64	
	7/20/2004		45.04	3503.85	3458.81	
	9/28/2005		41.9	3503.85	3461.95	
EB-05	4/28/2004		42.58	3526.9	3484.32	
	7/20/2004		47.05	3526.9	3479.85	
	9/28/2005		34.75	3526.9	3492.15	
	5/2/2006		34.4	3526.9	3492.5	
	7/10/2006		34.75	3526.9	3492.15	
EB-06	7/20/2004		64.33	3551.52	3487.19	
	9/28/2005		51.4	3551.52	3500.12	
	5/2/2006		53.39	3551.52	3498.13	
	7/10/2006		53.98	3551.52	3497.54	
EB-07	4/16/2004		36.4	3511.7	3475.3	
	4/28/2004		36.4	3511.7	3475.3	
	9/28/2005		33.6	3511.7	3478.1	
	5/3/2006		34.74	3511.7	3476.96	
	7/10/2006		34.9	3511.7	3476.8	
EB-08	4/16/2004		60.125	3539.83	3479.705	
	4/28/2004		60.125	3539.83	3479.705	
	7/24/2004		65.39	3539.83	3474.44	
	9/28/2005		55.25	3539.83	3484.58	
P-01	12/29/2005		30.5	3531.5	3501	
	2/28/2006		29.9	3531.5	3501.6	
	5/2/2006		29.31	3531.5	3502.19	
	7/10/2006		29.5	3531.5	3502	
P-02	12/29/2005		21.56	3551.96	3530.4	
	2/28/2006		21.9	3551.96	3530.06	
P-03	12/29/2005		63.07	3542	3478.93	
	2/28/2006		63.55	3542	3478.45	
	5/3/2006		64.11	3542	3477.89	
	7/12/2006	64.55	64.56	3542	3477.4483	0.01
P-04	12/29/2005		46.77	3514.94	3468.17	
	2/28/2006		47	3514.94	3467.94	
	5/3/2006		47.33	3514.94	3467.61	
	7/10/2006		47.45	3514.94	3467.49	
P-05	12/29/2005		37.35	3510	3472.65	
	2/28/2006		37.11	3510	3472.89	
	5/3/2006		37.1	3510	3472.9	
	7/10/2006		37.22	3510	3472.78	

Table 2: Chemisty over Time

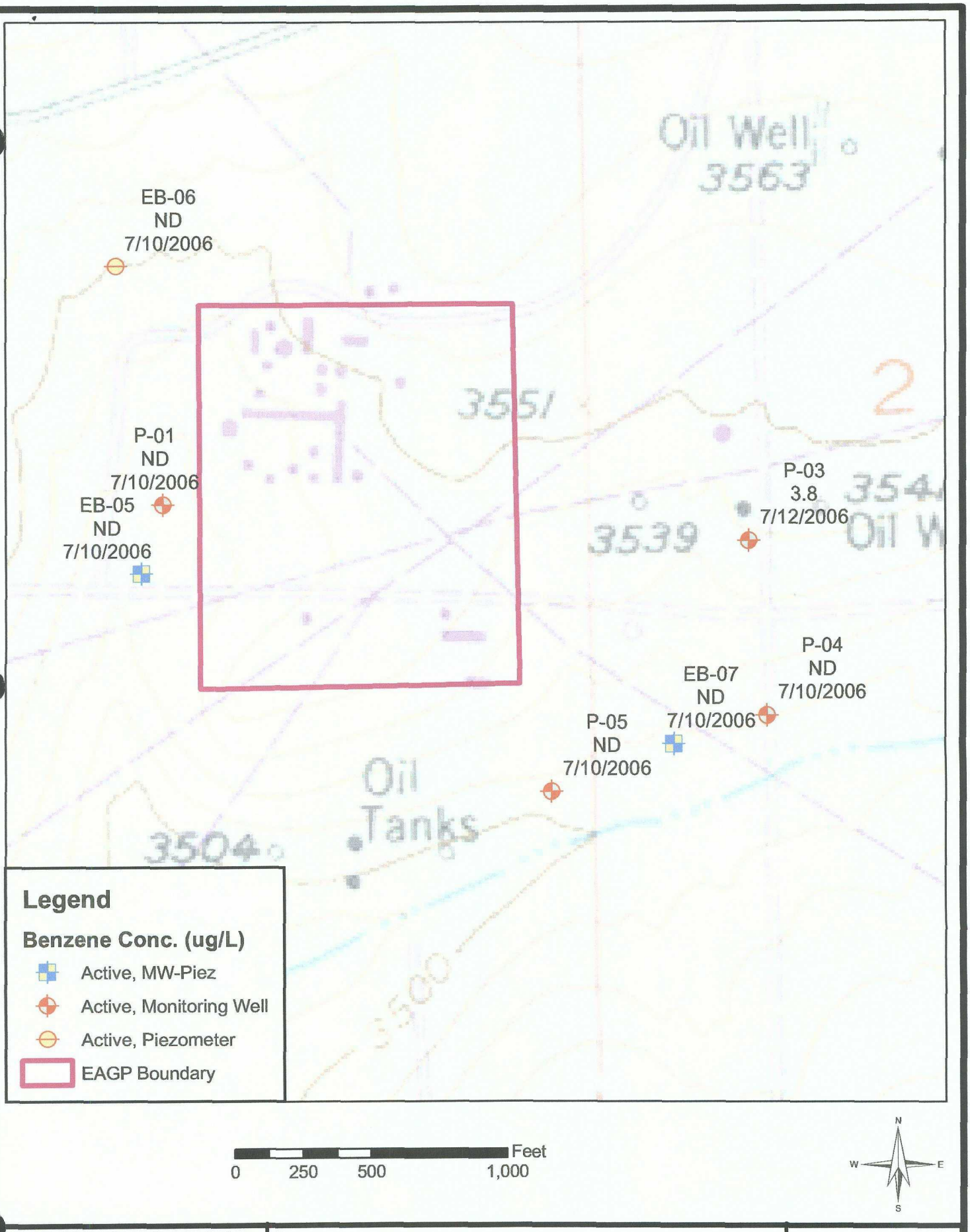
Well_ID	Date	Benzene (ug/L)	Toluene (ug/L)	Ethyl Benzene (ug/L)	Total Xylenes (ug/L)	Naphthalene (ug/L)	TDS (mg/L)	Cl (mg/L)	SO4 (mg/L)
EB-05	4/28/2004	ND	ND	ND	ND	ND	2690	92	1580
	6/23/2004	NS	NS	NS	NS	NS	2880	170	1690
	7/20/2004	NS	NS	NS	NS	NS	2810	167	1680
	9/28/2005	2	<1	<1	<2	<5	3000	279	NS
	5/2/2006	<1	<1	<1	<3	<2	2600	110	1400
	7/10/2006	<1	<1	<1	<3	<2	2500	88	1600
EB-06	6/23/2004	NS	NS	NS	NS	NS	3070	182	1820
	9/28/2005	5	<1	<1	<2	<5	2910	141	NS
	5/2/2006	<1	<1	<1	<3	<2	3100	150	1800
	7/10/2006	<1	<1	<1	<3	<2	NS	NS	NS
EB-07	4/16/2004	ND	ND	ND	ND	ND	2980	72	1490
	6/23/2004	NS	NS	NS	NS	NS	2790	75	1610
	9/28/2005	<1	<1	<1	<2	<5	2880	84.6	NS
	5/3/2006	<1	<1	<1	<3	<2	1600	3100	150
	7/10/2006	<1	<1	<1	<3	<2	3100	170	1600
P-01	12/30/2005	<1	<1	<1	<1	<2	2800	190	1300
	2/28/2006	<1	<1	<1	<1	<2	2700	130	1400
	5/2/2006	<1	<1	<1	<3	<2	2700	130	1400
	7/10/2006	<1	<1	<1	<3	<2	2500	93	1500
P-03	12/29/2005	<1	<1	<1	<1	<2	3700	200	1900
	2/28/2006	13	<1	<1	<1	<2	3800	200	1900
	5/3/2006	11	<1	<1	<3	<2	3800	190	2000
	7/12/2006	3.8	<1	<1	<3	<2	3800	220	2100
P-04	12/30/2005	<1	<1	<1	<1	<2	4000	560	1800
	2/28/2006	2	<1	<1	<1	<2	4100	480	1700
	5/3/2006	1.5	<1	<1	<3	<2	4000	460	1800
	7/10/2006	<1	<1	<1	<3	<2	3900	480	1800
P-05	12/30/2005	<1	<1	<1	<1	<2	3100	240	1500
	2/28/2006	<1	<1	<1	<1	<2	3100	200	1600
	5/3/2006	<1	<1	<1	<3	<2	3000	2	10
	7/10/2006	<1	<1	<1	<3	<2	2900	150	1600
WQCC Stand.	(blank)	10	750	750	620	NS	1000	250	600



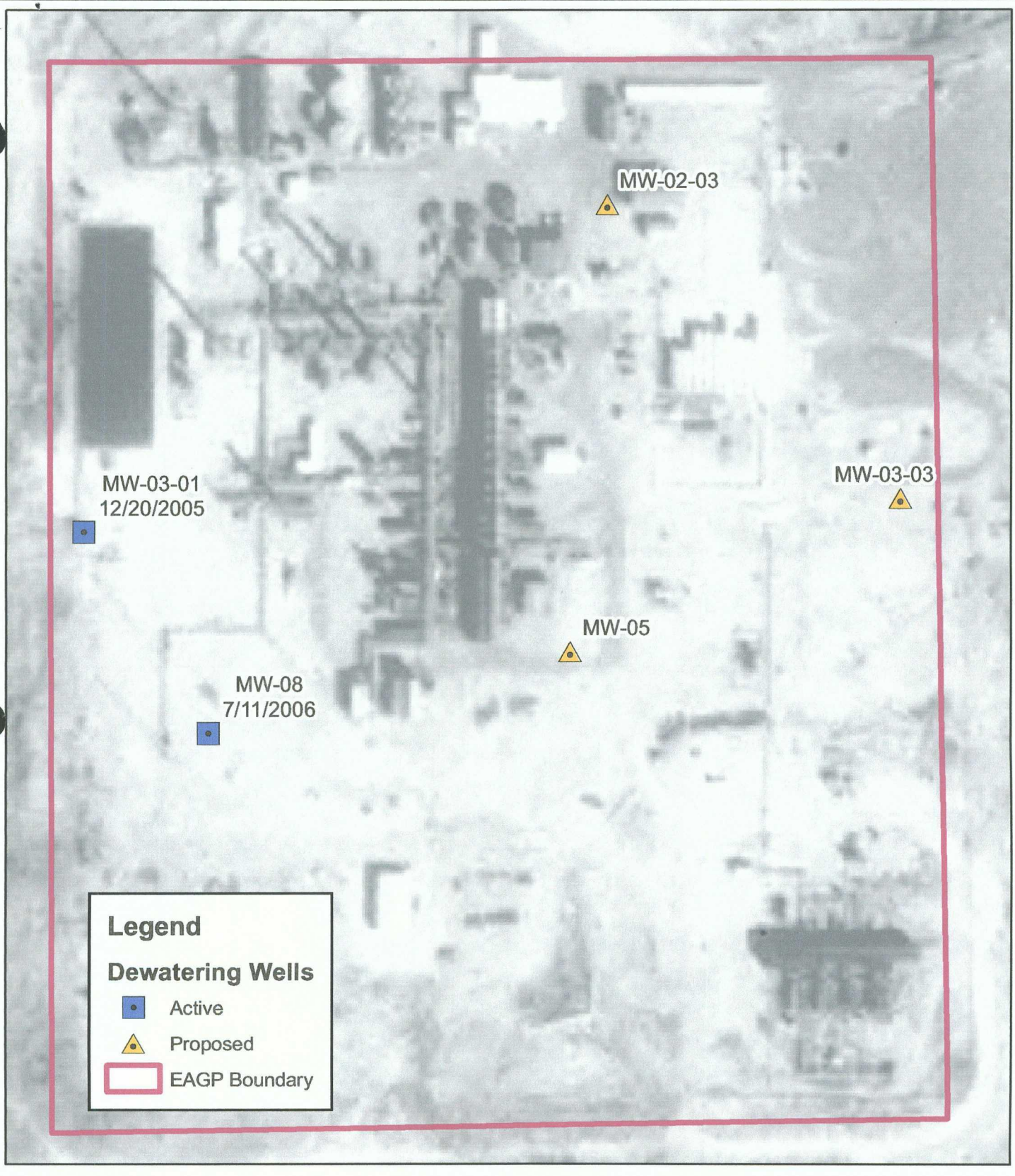
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Offsite Well Location Map	Plate 1
	Frontier Field Services: Empire Abo Gas Plant	August 2006



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Ground Water Elevation Map (July 2006)	Plate 2
	Frontier Field Services: Empire Abo Gas Plant	August 2006



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Dissolved Benzene Concentrations (ug/L: July 2006)	Plate 3
	Frontier Field Services: Empire Abo Gas Plant	August 2006



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Dewatering Wells	Plate 4
	Frontier Field Services: Empire Abo Gas Plant	August 2006