1R - 441

REPORTS

DATE:

12/30/2005

Mack Energy Corporation
Stage 1 Abatement Plan Proposal
Monsanto 30 State #4

IR-441

Unit P, Section 30, Township 16S, Range 37E
Lea County, New Mexico

December 30, 2005

Prepared for:

Mack Energy Corporation
P.O. Box 960
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By:

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TABLE OF CONTENTS

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II. Purpose

The purpose of this abatement plan is to propose additional investigatory work to delineate the extent of possible groundwater contamination at the subject site located at the Mack Monsanto 30 State #4 well approximate to Unit letter P, Section 30, Township 16S, Range 37E Lea County, New Mexico (Figure 1). The location is approximately five miles southeast of Lovington, NM. Previous investigation showed that a pit dug for deposition of drilling sediments released contaminates to the subsurface to a depth of at least 65 ft. below the bottom of the pit.

III. Background

In February 2004 SESI was contracted to perform a site investigation to determine the vertical extent of contamination inside a drilling pit used for drilling fluids storage at the Monsanto 30 State #4 oil well. The contaminated material was removed to a depth of approximately 15 ft.

On February 11, 2004 SESI drilled Borehole #1 to a depth of 60 ft. The samples were properly packaged and preserved and sent under chain-of-custody to Cardinal Laboratories of Hobbs, New Mexico for analysis. All samples were analyzed for Chlorides (EPA Method 4500-Cl^-B) and the uppermost sample was analyzed for TPH (EPA Method 418.1) and BTEX (EPA Method SW-846 8260).

On February 16, 2004, following receipt of the results, SESI drilled Borehole #1 an additional 10 feet to a depth of 70 feet. Grab samples were retrieved at 65 and 70 feet. As before, both samples were properly packaged and preserved and sent under chain-of-custody to Cardinal Laboratories for analysis. Following drilling, the borehole was backfilled to surface the bentonite.

Results of the soil sampling showed concentrations of chloride ranging from 5,838 mg/Kg at a distance of 5 ft. below the bottom of the pit to 3,199 mg/Kg at a depth of 65 ft. At 70 ft. (the approximate depth to water from the bottom of the pit) chloride concentration dropped to 170 mg/Kg. This information was reported to Mack Energy and the NMOCD in a report dated March 9, 2004 together with a recommendation that a 40 mil plastic liner be installed at the bottom of the pit to prevent further downward movement of chloride as a result of rainfall infiltration.

NMOCD District I approved the proposed liner installation on March 10, 2004. Work to install the liner commenced on April 21, 2004 and included doming the liner to prevent ponding of seepage water. Following liner installation the pit was backfilled with clean material and returned to its natural grade.

On May 21, 2004 a groundwater monitor well was drilled to a depth of approximately 100 ft. southeast of the pit area in the direction of the regional dip of the Ogallala formation which is the host formation for the groundwater aquifer. The well, drilled using an air rotary rig, was completed on May 29 with a hollow-

stem auger rig due to fine grained "flowing" sands collapsing the hole. It was sampled on June 1, 2004 and the water contained 580 mg/L of chloride with a total dissolved solids concentration of 1,302 mg/L, both of which are in excess of NMWQCC groundwater standards. No organics such as benzene, toluene, ethylbenzene or xylenes (BTEX) were detected in the sample. The results of the investigation were compiled and presented in a report to Mack Energy and the NMOCD dated June 9, 2004.

Further work was described in a report to Mack Energy and the NMOCD dated November 12, 2004. Two additional monitor wells were drilled during the period June 29-July 1, 2004. The assumed groundwater flow direction was southeast. MW-2 was installed upgradient to a depth of 97 ft. below land surface (BLS) and MW-3 was installed off gradient to a depth of 102 ft. BLS. The subsurface lithology at the completion depth is very fine-grained sand, generally uniform, light brown with only occasional caliche or sandstone fragments. The installed monitor wells are completed above ground in a steel protective casing at a height from 2.5 to 3 ft. above ground surface. Top of casing elevations for the three monitor wells were surveyed by Pettigrew and Associates of Hobbs to allow preparation of a groundwater contour map. The two new monitor wells were developed and sampled on July 8, 2004; depth to water in the wells was approximately 81 to 87 ft. BLS.

Following construction of a groundwater map, a fourth well was drilled on August 9 to a depth of 100 ft. The subsurface lithology was the same as for the earlier monitor wells. The well was developed and sampled on September 1, 2004. Depth to water was about 87 ft. BLS. The locations and casing elevations of the four wells are shown on Figure 2. Groundwater elevations and groundwater flow direction measured on August 24, 2004 are shown in Figure 3.

The first monitor well location was selected based on the assumed regional flow direction of groundwater, which is generally southeasterly and the same as the dip of the Ogallala formation. It shows chloride contamination in excess of groundwater standards. However, the groundwater flow direction as determined by the first three monitor wells was south-southeasterly. The fourth monitor well (MW-4) was located and drilled downgradient of the pit as determined by the groundwater contour map. This well does not show contamination.

Several reasons may be postulated for the apparent contradiction that shows chloride contamination in MW-1 and not MW-4. First, releases from the base of the pit that reached groundwater may not have reached the vicinity of MW-4. This may occur at some later date and indicates the necessity for continued monitoring of that well.

Second, there may have been some vadose zone migration, following the general dip of the sedimentary formation, that stair-steps down to the water table. Though soil sampling during drilling of monitor well MW-1 did not detect elevated chlorides in samples taken at 50, 70 and 95 ft., vadose zone migration may have occurred between the pit and well.

Water level measurements for determination of groundwater flow direction and water samples for constituent analysis were collected quarterly from October 2004 through March 2005. Commencing in April, samples were collected monthly with the results reported to the NMOCD. Results of the analyses through June

2005 showed chloride exceeding the NMWQCC standard of 250 mg/L in all samples and TDS exceeding the standard of 1,000 mg/L in all but one sample. Groundwater elevation maps for March and September 2005 are shown in Figures 4 and 5, respectively.

By letter dated September 6, 2005, the NMOCD directed Mack Energy to develop and submit a remediation plan for groundwater at the site by September 30. In a letter to Roger Anderson dated September 30, Mack Energy presented information that a remediation plan was not necessary or, at the very least, was premature given that concentrations were decreasing and may approach or drop below the regulatory levels. Mack instead proposed monthly monitoring and reporting through February 2006 with a report proposing additional steps including possible drilling of one or more monitoring wells to delineate the extent of the plume based on information available at that time.

By letter dated November 1, 2005 NMOCD disagreed with the Mack Energy response of September 30 and required an abatement plan for investigation be submitted by November 30, 2005. The date for submittal of the plan was later extended to December 31, 2005 (personal communication from Ed Martin (NMOCD) to Bob Allen (SESI).

IV. Current Conditions

Groundwater Flow

Recent groundwater level elevations taken on November 11 and December 20, 2005 show groundwater movement slightly east of south (Figures 6 and 7). These figures are also used to determine the groundwater hydraulic gradient, which is calculated by dividing the difference in hydraulic head between two contours by the distance between them. In this instance, the gradient is 1 foot/275 feet or 0.0036 which is relatively flat.

Hydraulic conductivity is a term which represents the ability of a porous medium to transmit a fluid, in this case water. The hydraulic conductivity of clean, fine-grained sand can be estimated as 24 feet/day* or 8,760 feet/year. Assuming a sand porosity of 0.25, the average linear velocity of the water containing chloride can be estimated at 126 feet/year. Due to the actual hydraulic conductivity being unknown, this value can easily be higher or lower by a factor of from 2 to 5, meaning it may be as low as 25 feet per year, or as high as 630 feet per year. However, because drilling has detected numerous lenses of cemented fine to very fine grained sandstone, the actual value is likely lower rather than higher.

The results of the estimated travel time of the groundwater will be used in determining the distance to locate additional monitorwells as described below.

Groundwater Quality

Results of water quality sampling through December 2005 show several spikes of chloride and TDS in MW-1 for the December 2004 and April 2005 analyses (Table 1 and Figure 8). Maximum chloride and TDS peaked at 1,300 mg/L and 2,738 mg/L, respectively, on December 16, 2004. State groundwater standards for the two parameters are 250 and 1,000 mg/L, respectively.

* Davis, S.N., and R.J.M. DeWiest, 1966. "Hydrogeology", John Wiley & Sons, Inc. New York.

MW-1 was sampled November 11 and again on November 17, 2005. The first November sampling was performed by SESI and the second by SESI and Eddie Seay, representing the City of Lovington. Samples were obtained following purging of at least three well volumes, preserved as required, and shipped to an analytical laboratory with a properly completed chain-of-custody. Results from both samplings show chlorides and TDS below state groundwater standards (two sample average of 145 mg/L chloride and 690 mg/L TDS).

The December sampling results for MW-1 show continued improvement of water quality with concentrations approaching background. Chloride was reported at 52 mg/L and TDS at 611 mg/L.

The analytical results lead to a hypothesis that the slug of groundwater with elevated chloride concentrations has passed by MW-1 and has migrated downgradient. If this is the case, it is unknown whether such movement is down the hydraulic gradient, as would be expected, or down the geologic gradient which is southeast. To determine the actual direction of contaminant movement and concentrations, at least three and as many as five monitor wells may be necessary to define the contaminant plume as described in the proposed Abatement Plan described below.

V. Abatement Plan

The purpose of the Stage 1 abatement plan is "to design and conduct a site investigation that will adequately define site conditions, and provide the data necessary to select and design an effective abatement option." Pursuant to OCD Rule 19.E.3, a Stage 1 abatement plan may include but not be limited to information as needed to select and implement an abatement option. Accordingly, Mack Energy Corporation will generate and include the following information and data in the report to be submitted following such site investigation as necessary to determine abatement options. Information previously generated and included with this report is expected to satisfy some to the investigation report requirements.

a. *Descriptions of the site, including a site map, and of site history including the nature of the release that caused the water pollution, and a summary of previous investigations.*

   Information satisfying some of this requirement is submitted herein, including maps, tables, and graphs. It will be updated as necessary for submittal with the Stage 1 report.

b. *Additional site investigation to define (i) site geology and hydrogeology, the vertical and horizontal extent and magnitude of vadose-zone and groundwater contamination, subsurface hydraulic conductivity, transmissivity, storativity, and rate and direction of contaminant migration, inventory of water wells inside and within one (1) mile from the perimeter of the three dimensional body where the standards set forth in [the rule] are exceeded, and location and number of such wells actually or potentially affected by the pollution; and (ii) surface-water hydrology, seasonal stream flow characteristics, groundwater/surface-water relationships, ... [Etc.].*

   Additional investigation is necessary to fill gaps in data already collected at the site, including the drilling of additional monitor wells and measurement of aquifer properties.

   Installation of additional monitor wells will be necessary to determine current conditions downgradient of the closed pit. At this time it is planned to drill and

complete only 2-inch monitor wells with a saturated water thickness of approximately ten feet. If larger diameter and deeper wells are needed in the future for groundwater extraction, they will be drilled separately.

Between three and five wells will be drilled to ascertain the location and concentration of the mobile and elevated chloride plume. The first well to be drilled (labeled MW-5 on Figure 9) will be located 100 ft. southeast of MW-1. Field measurements for chloride and specific electrical conductivity will be made on site before deciding where to drill the next well.

If groundwater chloride concentrations are background or only slightly elevated and below WQCC standards, the next well will be drilled at the location labeled MW-A (Figure 9) that is intermediate between MW-4 and new MW-5 and downgradient hydraulically from MW-1. Contamination may also be migrating downgradient from the pit toward MW-4 but because of the distance has not yet reached the monitor well. Installation of MW-D will determine if a portion of the plume is moving in that direction.

If concentrations at MW-5 are elevated, the second well will be drilled at location MW-B which is 100 ft. southeast of MW-5. MW-C will be installed if downgradient concentrations of contaminants are elevated past MW-A.

As the intent of the investigation is to locate and define the downgradient extent of the plume, decisions on drilling at the potential well sites will be made progressively following field sampling of the previously drilled well(s). The NMOCD will be notified prior to drilling the wells and sampling of the wells so that a representative may be on site to witness and/or split groundwater samples.

To determine the hydraulic conductivity and transmissivity of the sediments, groundwater slug-tests will be conducted on the monitor wells and the drawdown and recovery data analyzed with procedures commonly utilized for this purpose. Determination of storativity usually requires installation of closely spaced monitor wells so that one can serve as an observation well for the pumping well. At this location with known lithology, storativity can be estimated from technical publications and a separate monitor well located close to a test well solely for this purpose is not necessary.

c. *Monitoring program, including sampling stations and frequencies, for the duration of the abatement plan that may be modified, after approval by the Director, as additional sampling stations are created.*

Following installation of the monitoring wells, they will be developed to remove any mud, silt and sand inadvertently introduced during the drilling process. The well locations and elevations will be located and surveyed by a registered professional surveyor. Initially water levels will be measured quarterly and wells will be initially sampled quarterly for BTEX organic constituents and naphthalene, WQCC metals, and major cations and anions including chloride, sulfate and TDS. Sampling will be performed following purging to ensure a fresh sample. Following initial sampling, the wells will be sampled monthly for chloride and TDS and quarterly for major cations and anions, unless the initial analytical results indicate a more frequent sampling schedule is necessary.

d. *Quality assurance plan, consistent with the sampling and analytical techniques listed in [the Water Quality Control Commission regulations] for all work to be conducted pursuant to the abatement plan.*

Samples will be collected and handled in accordance with appropriate protocols for collection, preservation and transport of samples including maintaining a chain-of-custody and record keeping. The analytical laboratory selected to perform the analyses will be monitored for compliance with the applicable QA/QC standards.

e. *A schedule for all Stage 1 abatement plan activities, including the submission of summary quarterly progress reports, and the submission, for approval by the Director, of a detailed final site investigation report.*

It is expected that all investigation work proposed within the Stage 1 abatement plan will be completed within four months of the date of approval. Quarterly progress reports will be submitted within 30 days following the end of the previous quarter. The report will include work performed and analytical results of from testing of water quality in new and existing monitor wells. A final report will be prepared and submitted within 60 days of the completion of the work.

f. *Any additional information that may be required to design and perform an adequate site investigation.*

The information necessary to design and perform an adequate site investigation is included in the above paragraphs.

VI. Tables and Figures

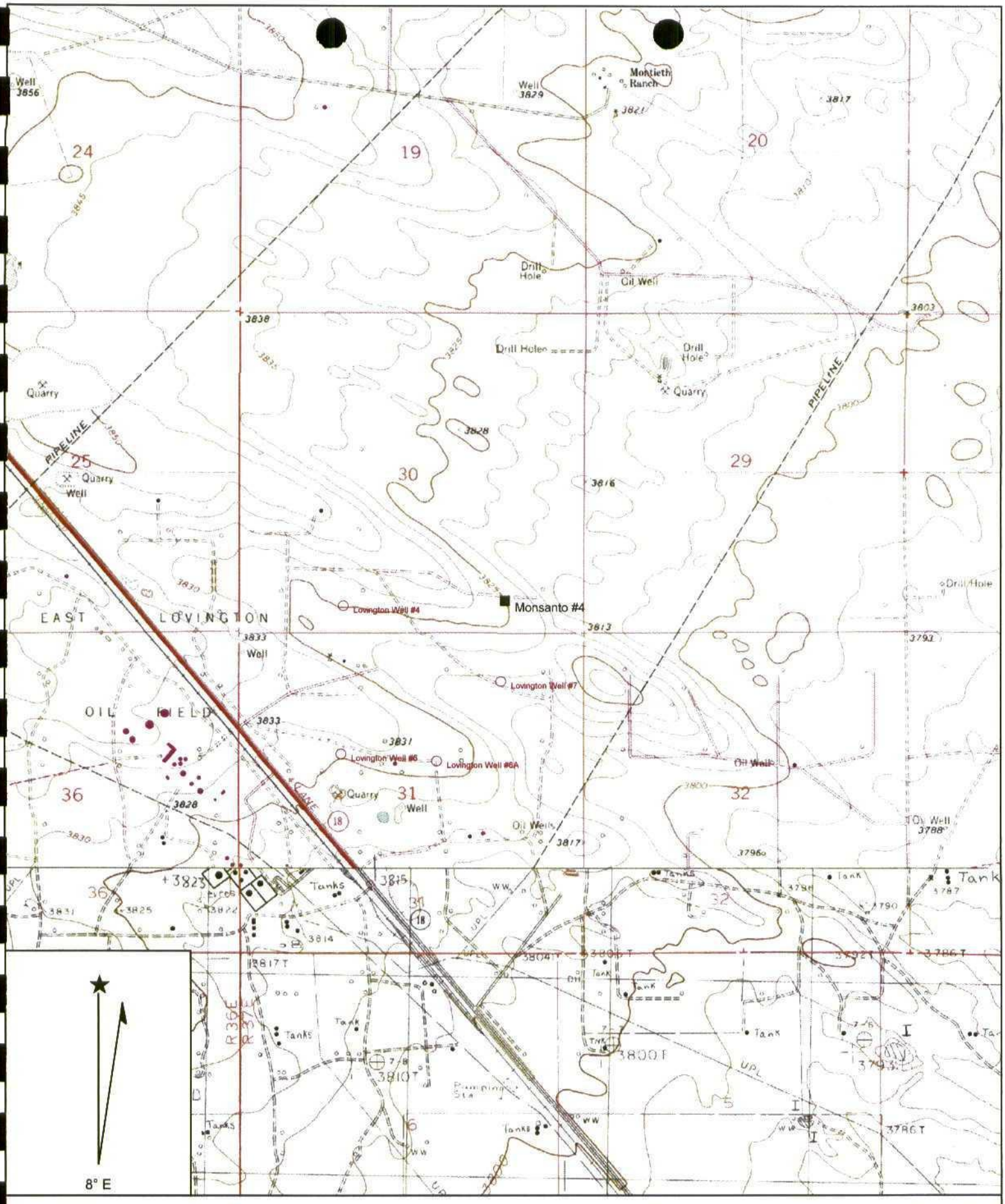
Table 1. Water Quality Sampling Results, Monsanto 30, State #4, Mack Energy Corporation

Sample Location	Date	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethyl-benzene (mg/L)	Total Xylenes (mg/L)
MW-1	06/01/04	580	47	1,302	<0.002	<0.002	<0.002	<0.006
	10/05/04	520	78	1,469	<0.002	<0.002	<0.002	<0.006
	12/16/04	1,300	100	2,738	--	--	--	--
	01/18/05	960	85.5	2,052	<0.002	<0.002	<0.002	<0.006
	03/04/05	516	49	1,393	--	--	--	--
	04/19/05	940	75	2,111	--	--	--	--
	05/27/05	380	70	953	--	--	--	--
	06/22/05	288	77	1,216	--	--	--	--
	07/22/05	412	68	1,507	--	--	--	--
	08/19/05	368	77	1,197	--	--	--	--
	09/07/05	312	--	1,140	--	--	--	--
	10/11/05	568	--	1,436	--	--	--	--
	11/11/05	140	100	670	--	--	--	--
	11/17/05	150	--	710	--	--	--	--
	12/20/05	52	89	611	--	--	--	--
MW-2	07/08/04	40	57	473	<0.002	<0.002	<0.002	<0.006
	10/05/04	44	86	502	<0.002	<0.002	<0.002	<0.006
	12/16/04	44	72	420	--	--	--	--
	01/18/05	44	58.6	480	<0.002	<0.002	<0.002	<0.006
	03/04/05	44	49	451	--	--	--	--
	04/19/05	40	44	412	--	--	--	--
	05/27/05	40	58	442	--	--	--	--
	06/22/05	32	86	488	--	--	--	--
	07/22/05	40	54	420	--	--	--	--
	08/19/05	40	67	421	--	--	--	--
	09/07/05	36	--	392	--	--	--	--
	10/11/05	--	--	--	--	--	--	--
	11/11/05	--	--	--	--	--	--	--
	11/17/05	--	--	--	--	--	--	--
	12/20/05	--	--	--	--	--	--	--
MW-3	10/06/04	32	51	423	<0.002	<0.002	<0.002	<0.006
	12/16/04	32	51	393	--	--	--	--
	01/18/05	32	39.4	428	<0.002	<0.002	<0.002	<0.006
	03/04/05	36	37	465	--	--	--	--
	04/19/05	26	47	404	--	--	--	--
	05/27/05	40	41	381	--	--	--	--
	06/22/05	24	55	408	--	--	--	--
	07/22/05	32	49	400	--	--	--	--
	08/19/05	32	56	404	--	--	--	--
	09/07/05	28	--	327	--	--	--	--
	10/11/05	--	--	--	--	--	--	--
	11/11/05	--	--	--	--	--	--	--
	11/17/05	--	--	--	--	--	--	--
	12/20/05	--	--	--	--	--	--	--

Table 1. Water Quality Sampling Results, Monsanto 30, State #4, Mack Energy Corporation

Sample Location	Date	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Benzene (mg/L)	Toluene (mg/L)	Ethyl-benzene (mg/L)	Total Xylenes (mg/L)
MW-4	09/01/04	36	49	376	<0.002	<0.002	<0.002	<0.006
	10/06/04	40	58	442	<0.002	<0.002	<0.002	<0.006
	12/16/04	40	55	408	--	--	--	--
	01/18/05	36	54.4	424	<0.002	<0.002	<0.002	<0.006
	03/04/05	36	35	398	--	--	--	--
	04/19/05	40	44	388	--	--	--	--
	05/27/05	40	56	434	--	--	--	--
	06/22/05	32	68	436	--	--	--	--
	07/22/05	44	54	433	--	--	--	--
	08/19/05	40	53	411	--	--	--	--
	09/07/05	32	--	385	--	--	--	--
	10/11/05	40	--	345	--	--	--	--
	11/11/05	28	64	340	--	--	--	--
	11/17/05	28	--	380	--	--	--	--
	12/20/05	37	61	378	--	--	--	--
NM WQCC Groundwater		**250**	**600**	**1,000**	**0.010**	**0.750**	**0.750**	**0.650**

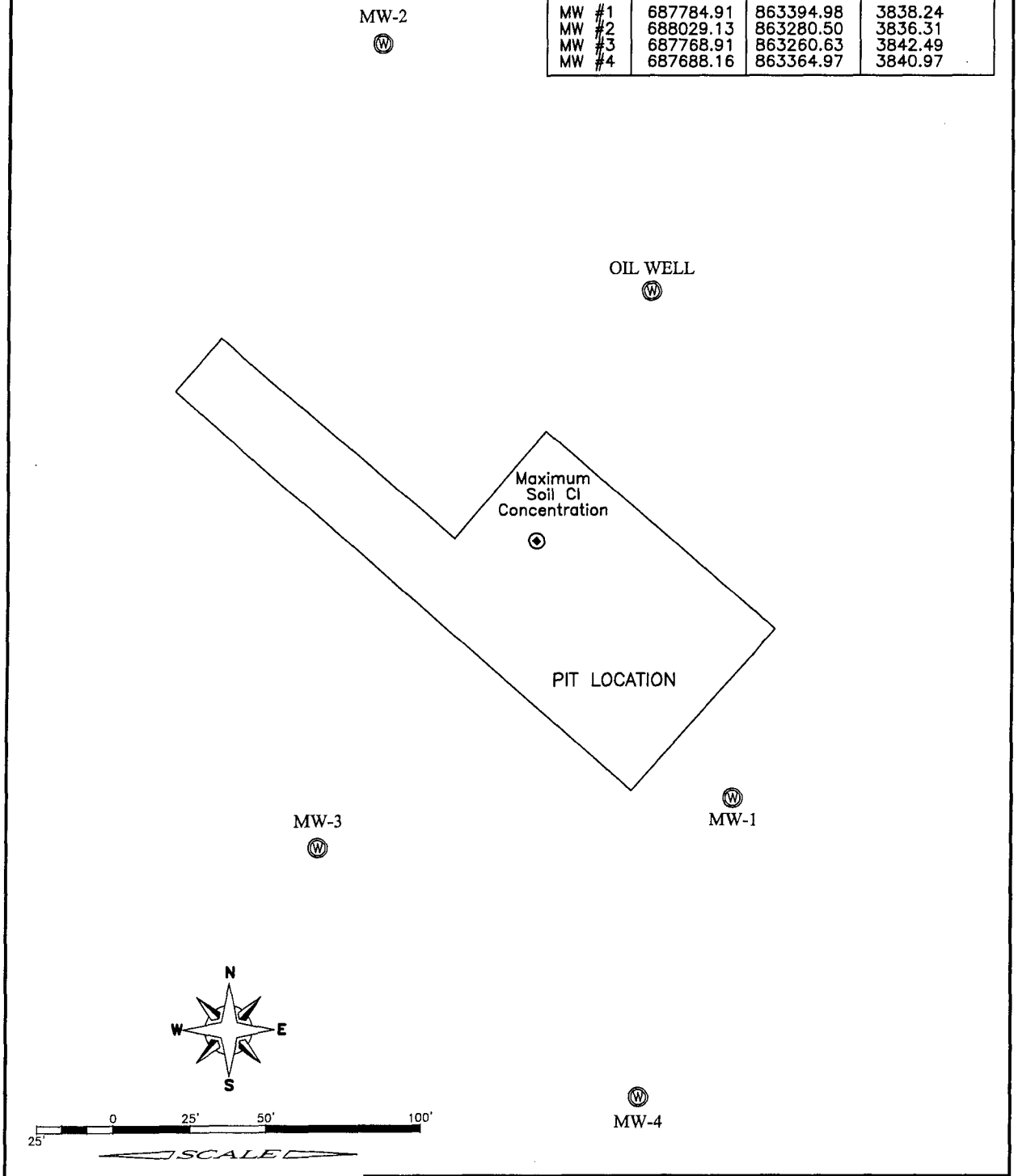
Figure 1. Vicinity Map, Monsanto 30, State #4, Mack Energy Corporation



Name: LOVINGTON
Date: 12/29/2005
Scale: 1 inch equals 2000 feet

Location: 032° 53' 13.46" N 103° 17' 5.43" W
Caption: Figure 1. Mack Energy
Monsonto 30 #4 and
Lovington Water Wells

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 (W) MONITOR WELL LOCATION

DRAWING TITLE

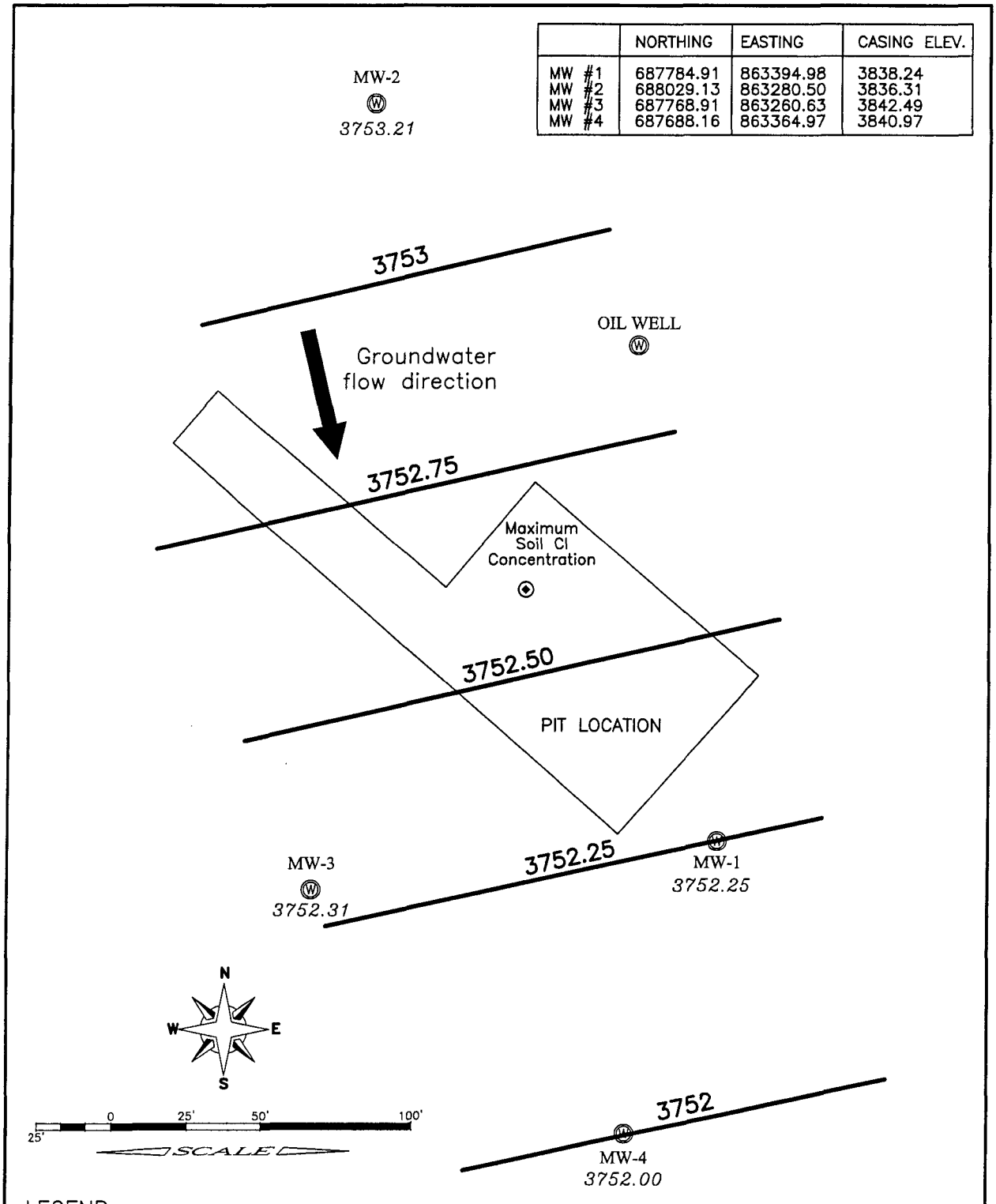
FIGURE 2

SITE PLAN

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	–	Monsanto4_5.DWG	0

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 (W) 3752.31 — MONITOR WELL LOCATION W/GROUNDWATER ELEVATION (FT. ABOVE MSL)

GROUNDWATER COUTOUR INTERVAL 0.25'

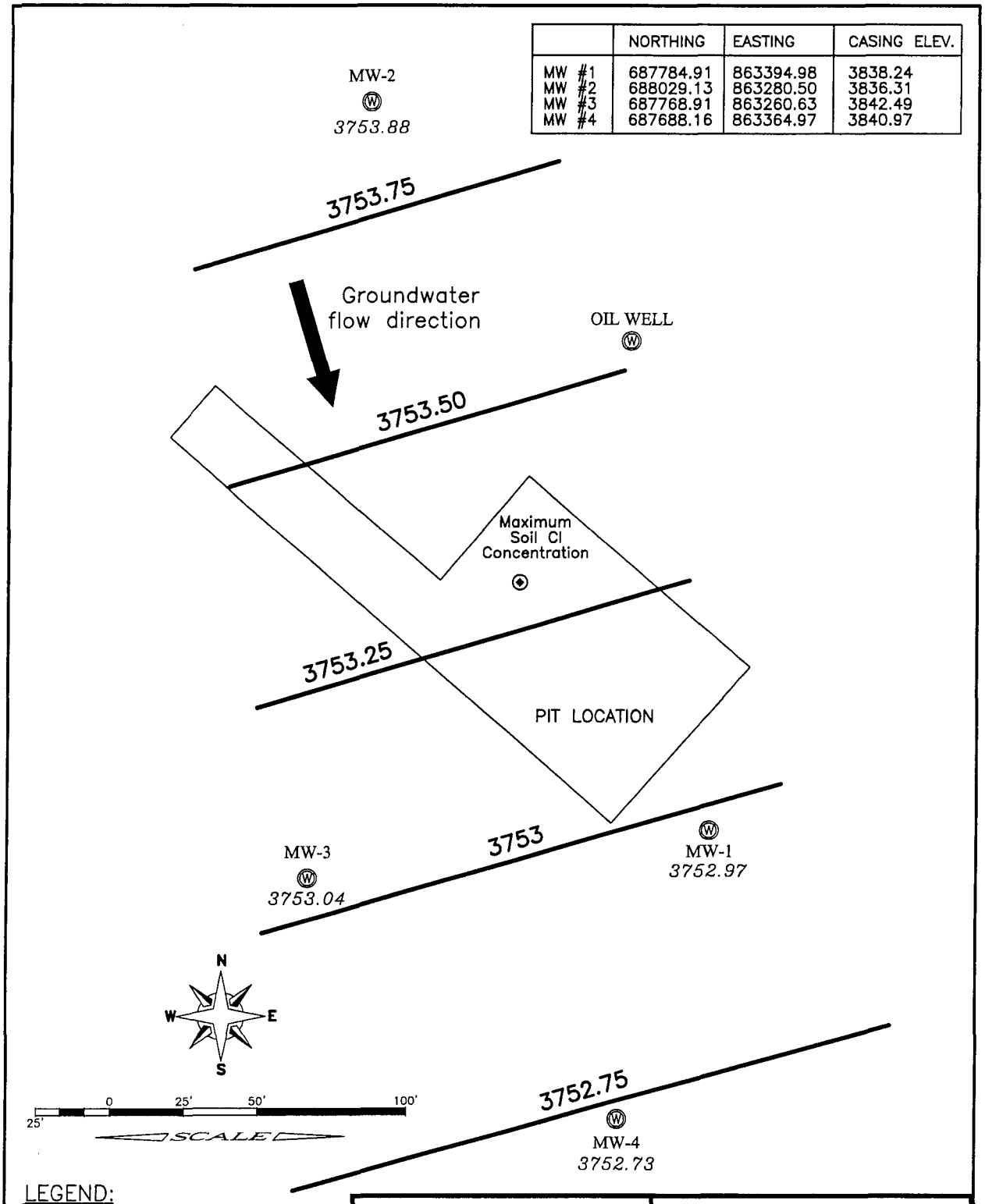
DRAWING TITLE

FIGURE 3
GROUNDWATER ELEVATION MAP
AUGUST 24, 2004

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	–	Monsanto4_5.DWG	0

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 3753.04 — MONITOR WELL LOCATION W/GROUNDWATER ELEVATION (FT. ABOVE MSL)

GROUNDWATER COUTOUR INTERVAL 0.25'

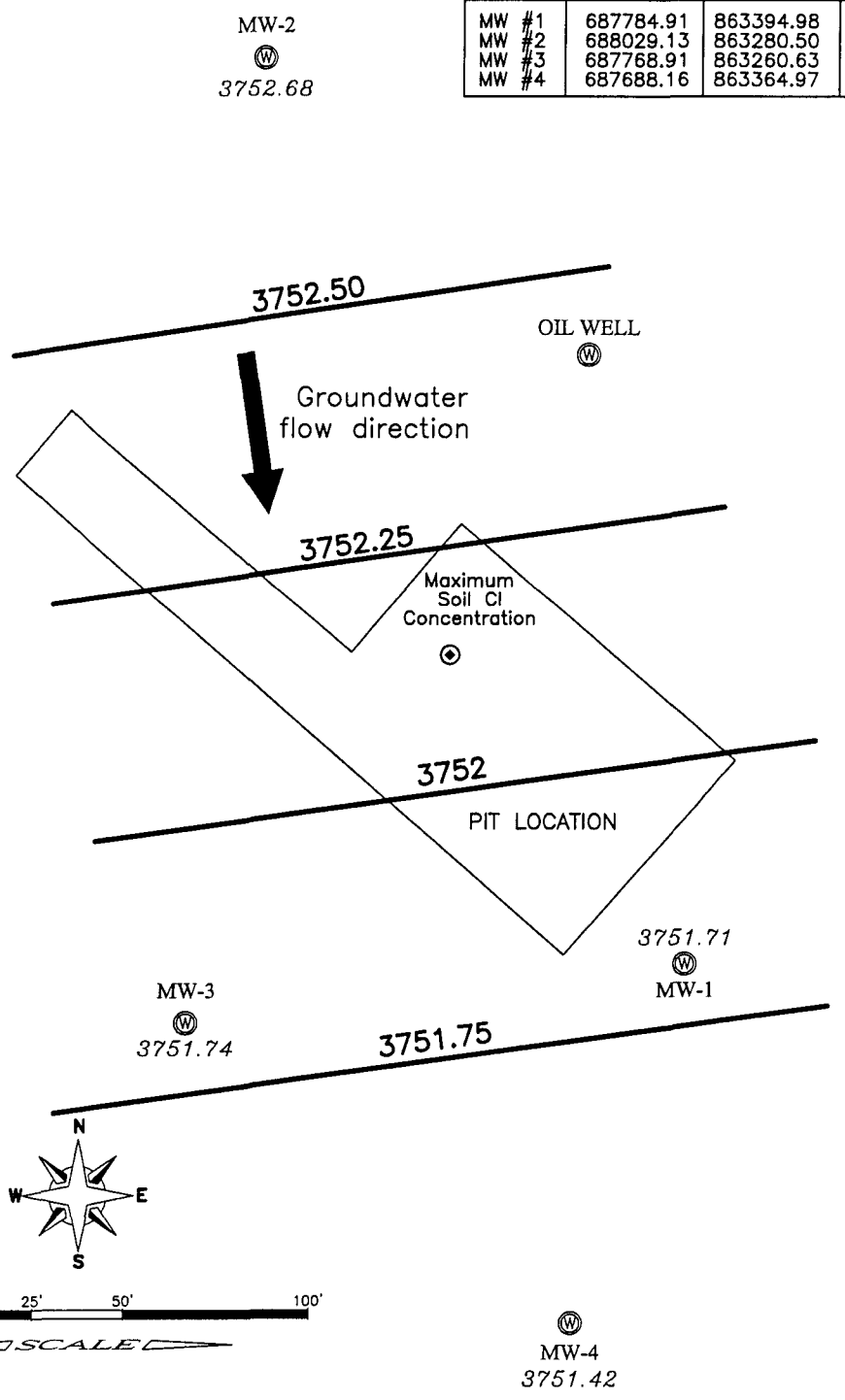
DRAWING TITLE

FIGURE 4
GROUNDWATER ELEVATION MAP
MARCH 4, 2005

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	–	Monsanto4_5.DWG	0

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 (W) 3751.81 — MONITOR WELL LOCATION W/GROUNDWATER ELEVATION (FT. ABOVE MSL)

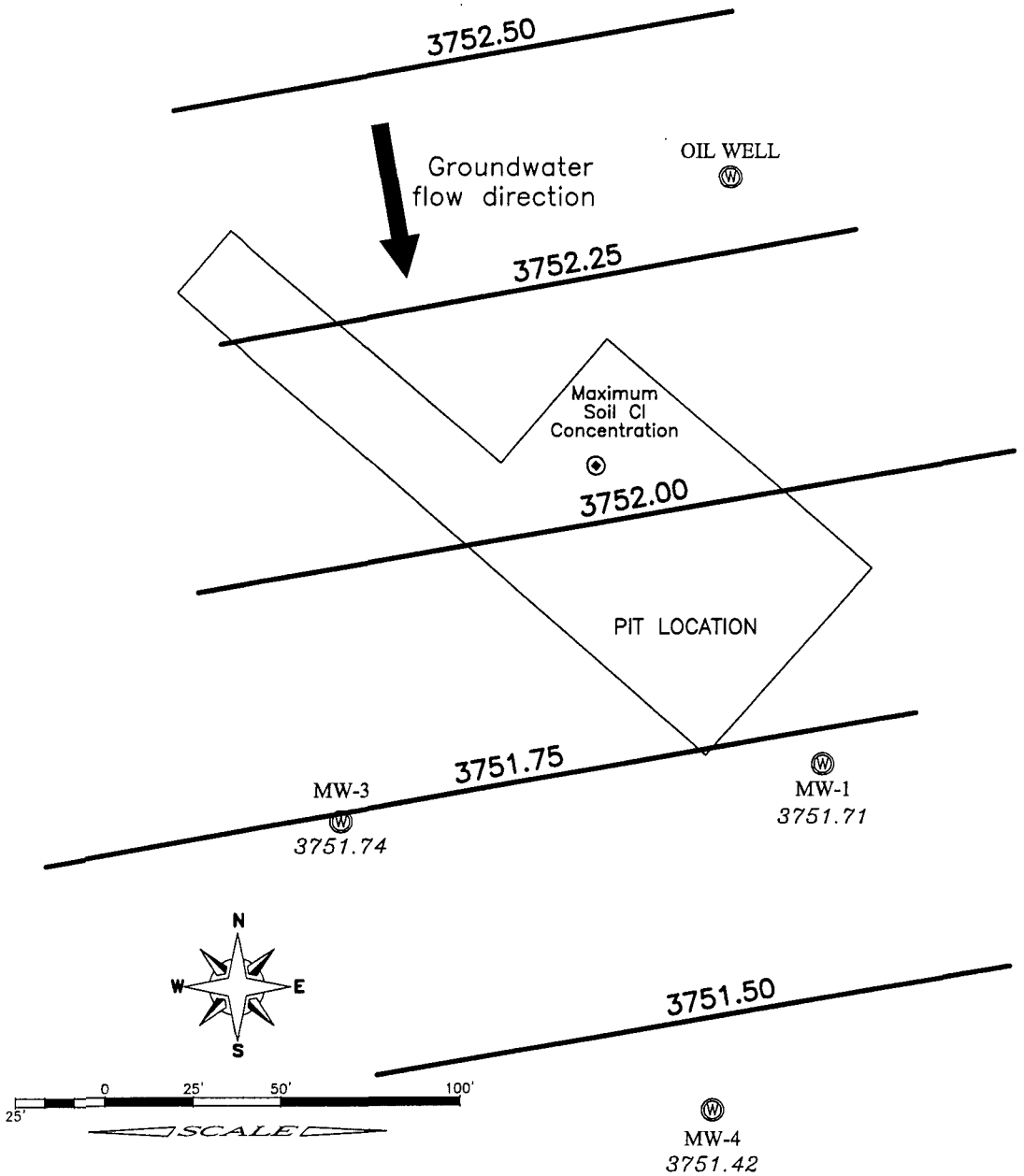
GROUNDWATER COUTOUR INTERVAL 0.25'

DRAWING TITLE: FIGURE 5 GROUNDWATER ELEVATION MAP SEPTEMBER 7, 2005

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	—	Monsanto4_5.DWG	0

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 3751.74 — MONITOR WELL LOCATION W/GROUNDWATER ELEVATION (FT. ABOVE MSL)

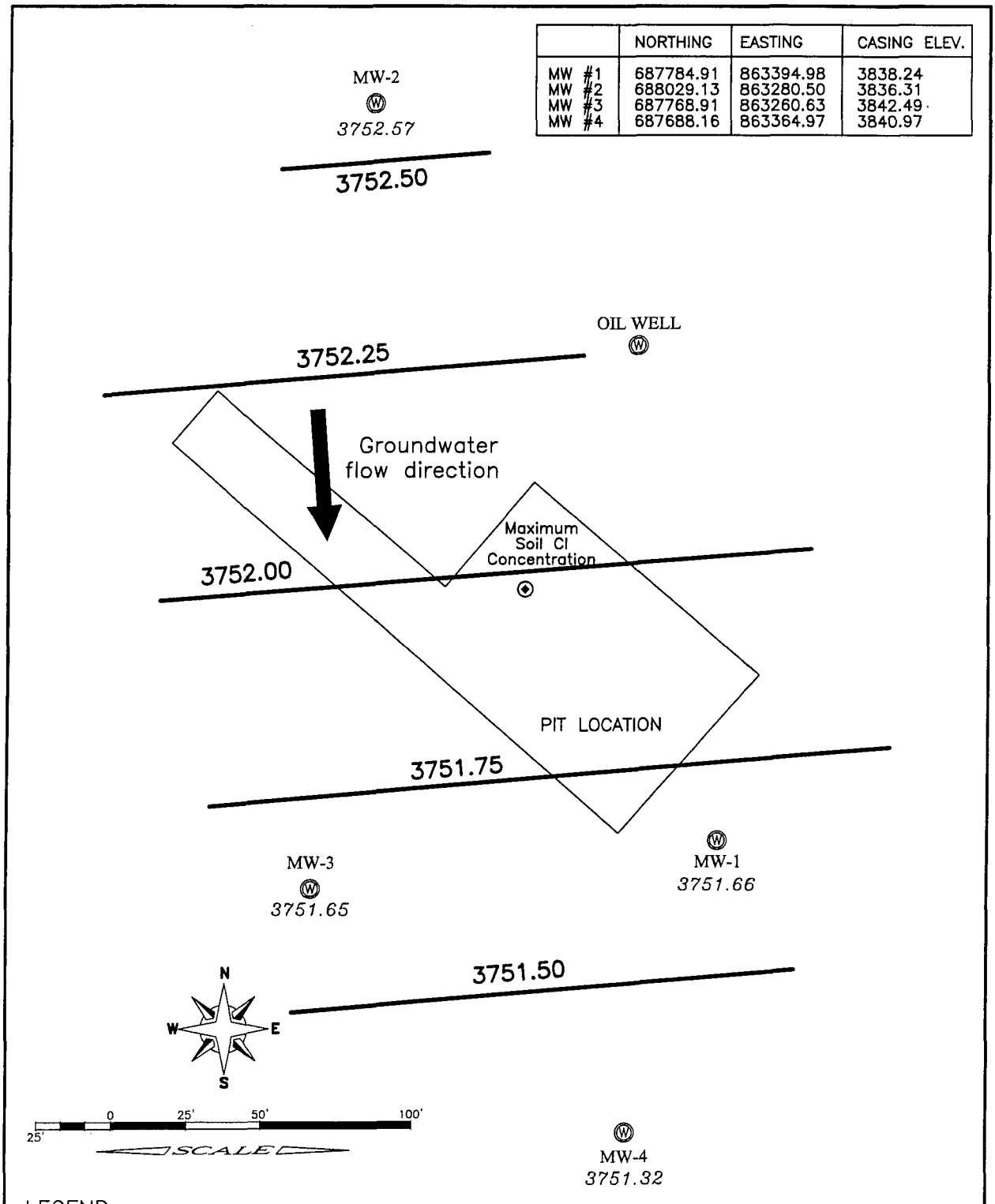
GROUNDWATER COUTOUR INTERVAL 0.25'

DRAWING TITLE: FIGURE 6 GROUNDWATER ELEVATION MAP NOVEMBER 11, 2005

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	–	Monsanto4_5.DWG	0

	NORTHING	EASTING	CASING ELEV.
MW #1	687784.91	863394.98	3838.24
MW #2	688029.13	863280.50	3836.31
MW #3	687768.91	863260.63	3842.49
MW #4	687688.16	863364.97	3840.97



LEGEND:

MW-3 (W) 3751.65 — MONITOR WELL LOCATION W/GROUNDWATER ELEVATION (FT. ABOVE MSL)

GROUNDWATER COUTOUR INTERVAL 0.25'

DRAWING TITLE: FIGURE 7 GROUNDWATER ELEVATION MAP DECEMBER 20, 2005

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 50'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	–	Monsanto4_5.DWG	0

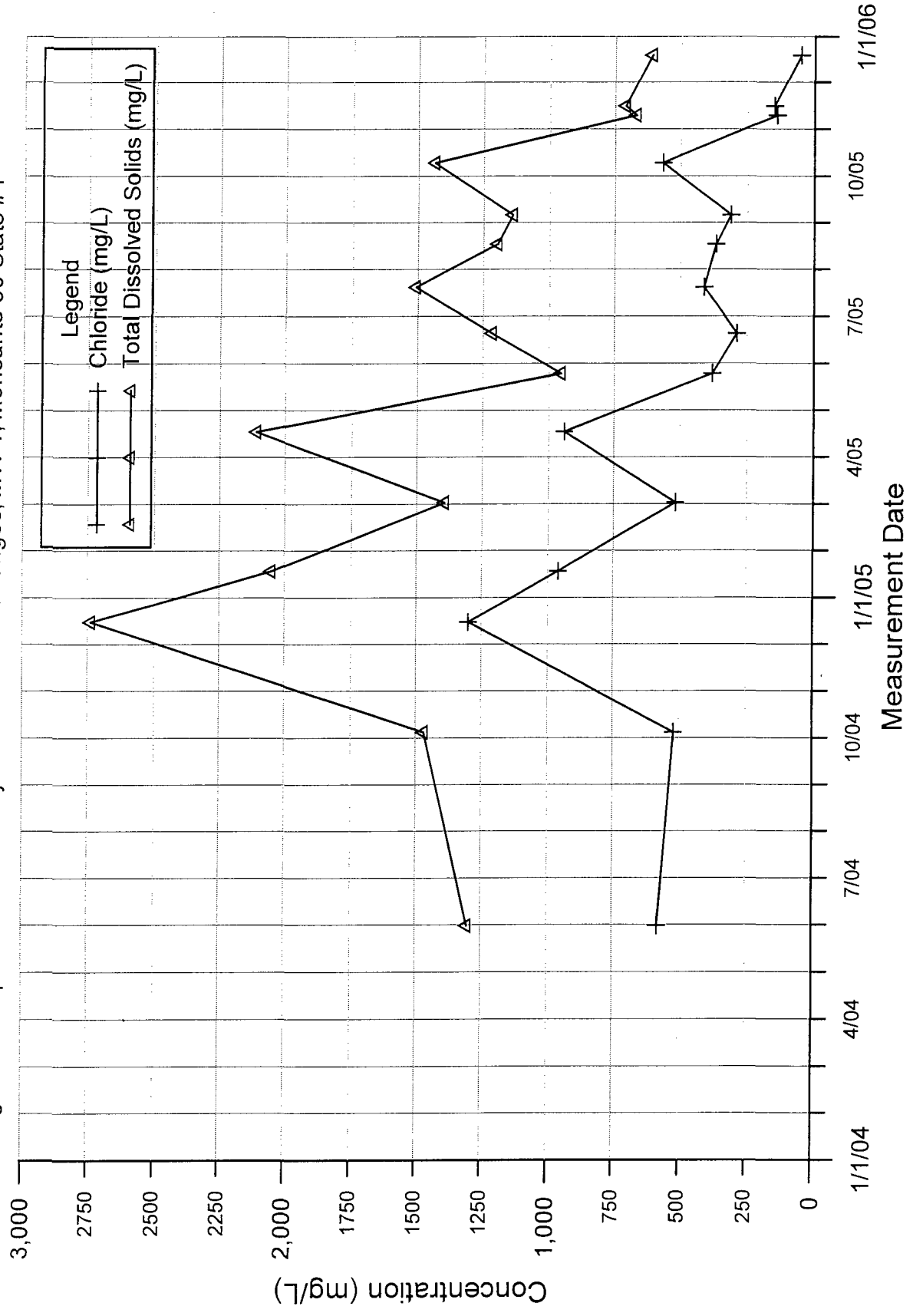
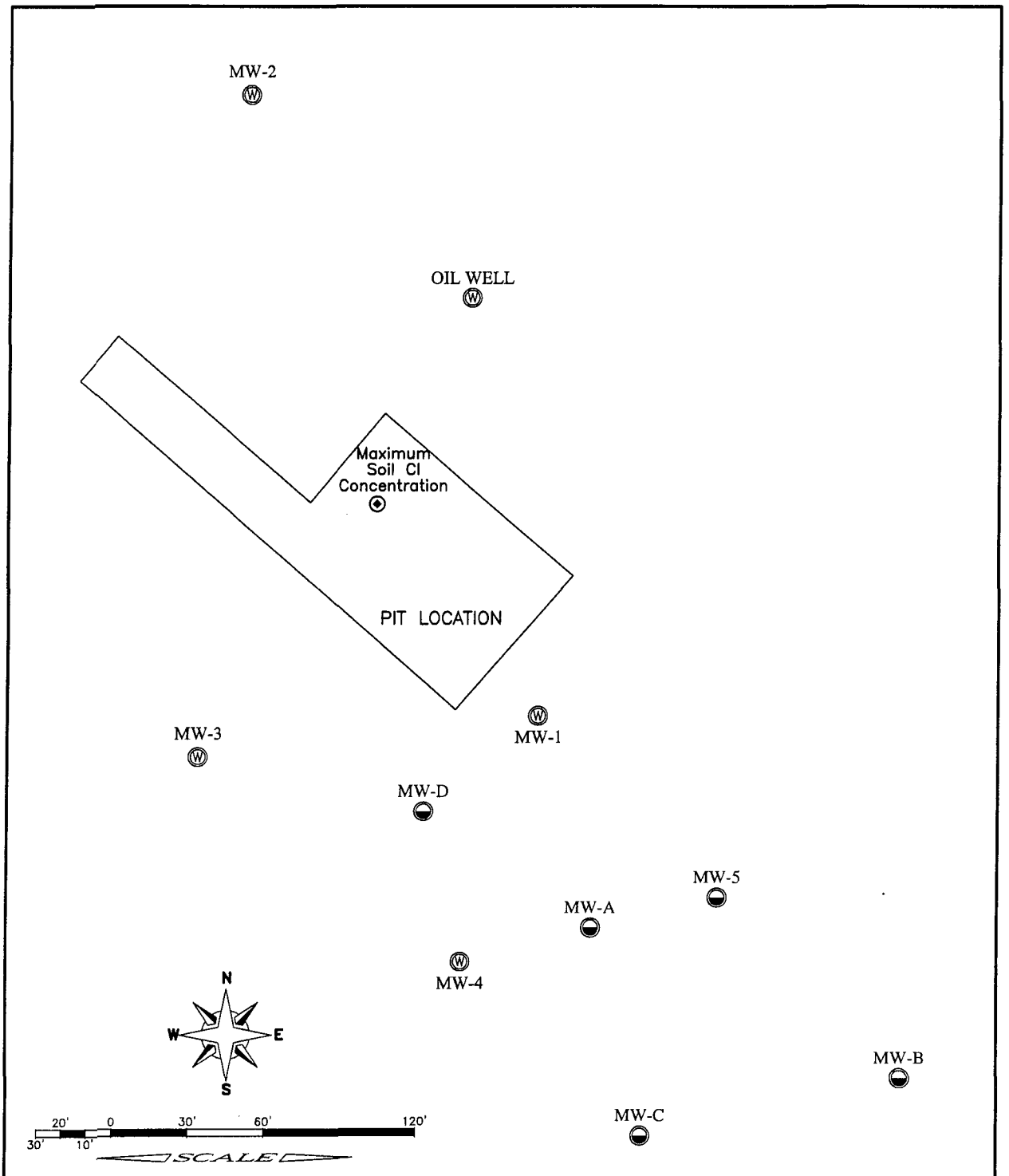


Figure 8. Graph of Water Quality Concentration Changes, MW-1, Monsanto 30 State #4



LEGEND:

MW-3 EXISTING MONITOR WELL LOCATION

MW-5 PROPOSED AND PENDING MONITOR WELL LOCATION (See text for details)

DRAWING TITLE

FIGURE 9
PROPOSED AND PENDING MONITOR WELL LOCATIONS

MACK ENERGY CORPORATION
ARTESIA, NEW MEXICO
MONSANTO 30, STATE #4

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 60'-0"	
DATE	APPR BY	DRAWING NUMBER	REV.
12-29-05	--	Monsanto4_9.dwg	0

Appendix
Groundwater Elevation Measurements, Monsanto 30, State #4, Mack Energy Corporation

Appendix - Groundwater Elevation Measurements, Monsanto 30, State #4, Mack Energy Corporation

Monitor Well Name, Total Depth Below TOC (ft.)	Elevation Top of Casing (feet)	Measurement Date	Depth to Water Below TOC (feet)	Water Level Elev. (feet)	Water Saturated Thickness (feet)	Change since last measurement (feet)
MW-1	3,838.24	07/01/04	85.99	3,752.25	15.8	- -
101.81		07/21/04	86.10	3,752.14	15.7	-0.11
		08/24/04	85.99	3,752.25	15.8	0.11
		10/05/04	86.04	3,752.20	15.8	-0.05
		12/16/04	85.82	3,752.42	16.0	0.22
		01/18/05	85.58	3,752.66	16.2	0.24
		03/04/05	85.27	3,752.97	16.5	0.31
		04/19/05	85.53	3,752.71	16.3	-0.26
		05/27/05	86.35	3,751.89	15.5	-0.82
		06/22/05	86.05	3,752.19	15.8	0.30
		07/22/05	86.39	3,751.85	15.4	-0.34
		08/18/05	86.35	3,751.89	15.5	0.04
		09/07/05	86.44	3,751.80	15.4	-0.09
		10/11/05	86.54	3,751.70	15.3	-0.10
		11/11/05	86.53	3,751.71	15.3	0.01
		11/17/05	86.54	3,751.70	15.3	-0.01
		12/20/05	86.58	3,751.66	15.2	-0.04
MW-2	3,836.31	07/02/04	83.12	3,753.19	14.8	- -
97.93		07/08/04	83.03	3,753.28	14.9	0.09
		07/21/04	83.10	3,753.21	14.8	-0.07
		08/24/04	83.10	3,753.21	14.8	0.00
		10/05/04	83.03	3,753.28	14.9	0.07
		12/16/04	82.92	3,753.39	15.0	0.11
		01/18/05	82.70	3,753.61	15.2	0.22
		03/04/05	82.43	3,753.88	15.5	0.27
		04/19/05	82.69	3,753.62	15.2	-0.26
		05/27/05	83.31	3,753.00	14.6	-0.62
		06/22/05	83.19	3,753.12	14.7	0.12
		07/22/05	83.40	3,752.91	14.5	-0.21
		08/18/05	83.43	3,752.88	14.5	-0.03
		09/07/05	83.55	3,752.76	14.4	-0.12
		10/11/05	83.63	3,752.68	14.3	-0.08
		11/11/05	83.63	3,752.68	14.3	0.00
		12/20/05	83.74	3,752.57	14.2	-0.11

Appendix - Groundwater Elevation Measurements, Monsanto 30, State #4, Mack Energy Corporation

Monitor Well Name, Total Depth Below TOC (ft.)	Elevation Top of Casing (feet)	Measurement Date	Depth to Water Below TOC (feet)	Water Level Elev. (feet)	Water Saturated Thickness (feet)	Change since last measurement (feet)
MW-3	3842.49	07/08/04	90.15	3,752.34	12.8	- -
102.92		07/09/04	90.18	3,752.31	12.7	-0.03
		07/21/04	90.32	3,752.17	12.6	-0.14
		08/24/04	90.18	3,752.31	12.7	0.14
		10/05/04	90.40	3,752.09	12.5	-0.22
		12/16/04	90.03	3,752.46	12.9	0.37
		01/18/05	89.81	3,752.68	13.1	0.22
		03/04/05	89.45	3,753.04	13.5	0.36
		04/19/05	89.73	3,752.76	13.2	-0.28
		05/27/05	90.55	3,751.94	12.4	-0.82
		06/22/05	90.27	3,752.22	12.7	0.28
		07/22/05	90.62	3,751.87	12.3	-0.35
		08/18/05	90.58	3,751.91	12.3	0.04
		09/07/05	90.68	3,751.81	12.2	-0.10
		10/11/05	90.82	3,751.67	12.1	-0.14
		11/11/05	90.75	3,751.74	12.2	0.07
		12/20/05	90.84	3,751.65	12.1	-0.09
MW-4	3,840.95	08/10/04	89.11	3,751.84	13.2	- -
102.28		08/24/04	88.95	3,752.00	13.3	0.16
		10/05/04	89.20	3,751.75	13.1	-0.25
		12/16/04	88.81	3,752.14	13.5	0.39
		01/18/05	88.55	3,752.40	13.7	0.26
		03/04/05	88.22	3,752.73	14.1	0.33
		04/19/05	88.47	3,752.48	13.8	-0.25
		05/27/05	89.38	3,751.57	12.9	-0.91
		06/22/05	89.01	3,751.94	13.3	0.37
		07/22/05	89.42	3,751.53	12.9	-0.41
		08/18/05	89.34	3,751.61	12.9	0.08
		09/07/05	89.42	3,751.53	12.9	-0.08
		10/11/05	89.52	3,751.43	12.8	-0.10
		11/11/05	89.53	3,751.42	12.8	-0.01
		11/17/05	89.54	3,751.41	12.7	-0.01
		12/20/05	89.63	3,751.32	12.7	-0.09