GW - 1

REPORTS

YEAR(S):

1987

A FINAL REPORT ON
SECTION 3013 ADMINISTRATIVE ORDER
WORK ELEMENTS

Prepared for

BLOOMFIELD REFINING COMPANY

Bloomfield, New Mexico

Prepared by

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CHAPTER 1

INTRODUCTION

This report submits the findings of extensive monitoring, testing, and analyses performed at the Bloomfield Refining Company, Inc. (BRC) refinery located in Bloomfield, New Mexico. Work elements described herein were established in an EPA-approved work plan to meet the directives of an administrative order issued to Gary Energy Corporation and BRC pursuant to Section 3013 of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §6934 (Docket No. RCRA-3013-00-185).

The work plan addressing the directives of the administrative order was prepared by Engineering-Science, Inc. (ES) and submitted to EPA in July 1985. The approved work plan identifies seven separate work tasks: an electrical resistivity (ER) survey, installation of groundwater monitoring wells, groundwater monitoring well sampling, groundwater monitoring well water level measurements, groundwater monitoring well slug tests, surface water sampling, and final report. The work plan also provides an explicit protocol for execution of each of the tasks.

All work tasks with the exception of the surface water sampling task have been completed. BRC staff have performed the Hammond Ditch sampling and the monitoring well sampling and level measurements, and have administered to the installation of monitoring wells 7 through 10. ES has performed the electrical resistivity survey and monitoring well slug tests. These tasks were performed consistent with the specifications in the approved work plan. A time extension has been requested for the surface water sampling task to permit sampling of the San Juan River during representative low-flow conditions (heretofore nonexistent during the 13-month work period).

In summary, BRC has executed each of the work elements of the 3013 administrative order in a timely manner and consistent with guidelines in the approved work plan. This report, which fulfills the requirements of the administrative order, presents findings of these work elements which

cumulatively suggest there are generally low contaminant levels found at the refinery. In the information that follows, chapters 2 through 7 address each of the specific work elements as required by the approved work plan. Chapters 8 and 9 contain conclusions and recommendations based on these findings.

An amendment to this report will be submitted with results of the San Juan River sampling effort, which are outstanding due to continued high flow rates. Upon submission of the amendment, the requirements of the 3013 administrative order will have been completed.

CHAPTER 2

ELECTRICAL RESISTIVITY SURVEY

BACKGROUND

The purpose of the electrical resistivity (ER) survey at the Bloomfield refinery was to develop a data base that would assist in determining the location, areal extent, and direction of migration of subsurface hydrocarbons. The survey, which was conducted during the period January 27 to February 7, 1986, in a manner consistent with the EPA-approved work plan, accomplished this purpose. Findings of the survey were sent to Mr. Steven Schwartz of EPA Region VI in February 1986 in a formal report entitled "Electrical Resistivity Survey," Bloomfield Refining Company.

METHODOLOGY

Since the ER survey technique is an indirect measurement method that reports relative changes in the electrical signature of subsurface features, the process of obtaining measurements must therefore refer to known subsurface features. Interpretations of these data are based heavily on correlation of ER measurements with verified locations and depths of known subsurface features such as subcrops, seeps, water, and, in this case, subsurface hydrocarbons. The success of the ER survey is therefore contingent on the degree to which the ER measurements can be verified to correlate with known subsurface features.

During the survey, both vertical (sounding) and horizontal (profile) measurements were made to develop the data base. These measurements were made using a Bison Model 2530B earth resistivity meter together with published techniques for performing the measurements referenced in the ER report. Investigators utilized monitoring well logs that depicted stratigraphy with respect to depth; subcrop locations of stratigraphic layers witnessed from a bluff; the location of seeps and ponds of water; the locations of visible hydrocarbon seepage in Hammond

Ditch and on the bluffs adjacent to the San Juan River; and the depth of floating hydrocarbons in monitoring well 4 (free hydrocarbon phase noted by Bloomfield staff during well samplings throughout 1986) to interpret relative changes in measurements made during the survey. The locations of measurement points are presented in Figure 2.1. Computer-enhanced interpretations of the profile measurements were generated for Figures 2.2 through 2.8. These plots provide an areal interpretation of profile ER readings for selected reference depths.

Interpretation of the sounding measurements was developed in the form of plots of apparent resistivity (measured values of ER) versus inner electrode spacing. The cumulative resistivity values displayed on these plots provide a measure of the degree of consistency of subsurface features and conditions. These plots, together with a location map showing the location of each sounding measurement, are presented as Figures 2.9 through 2.15.

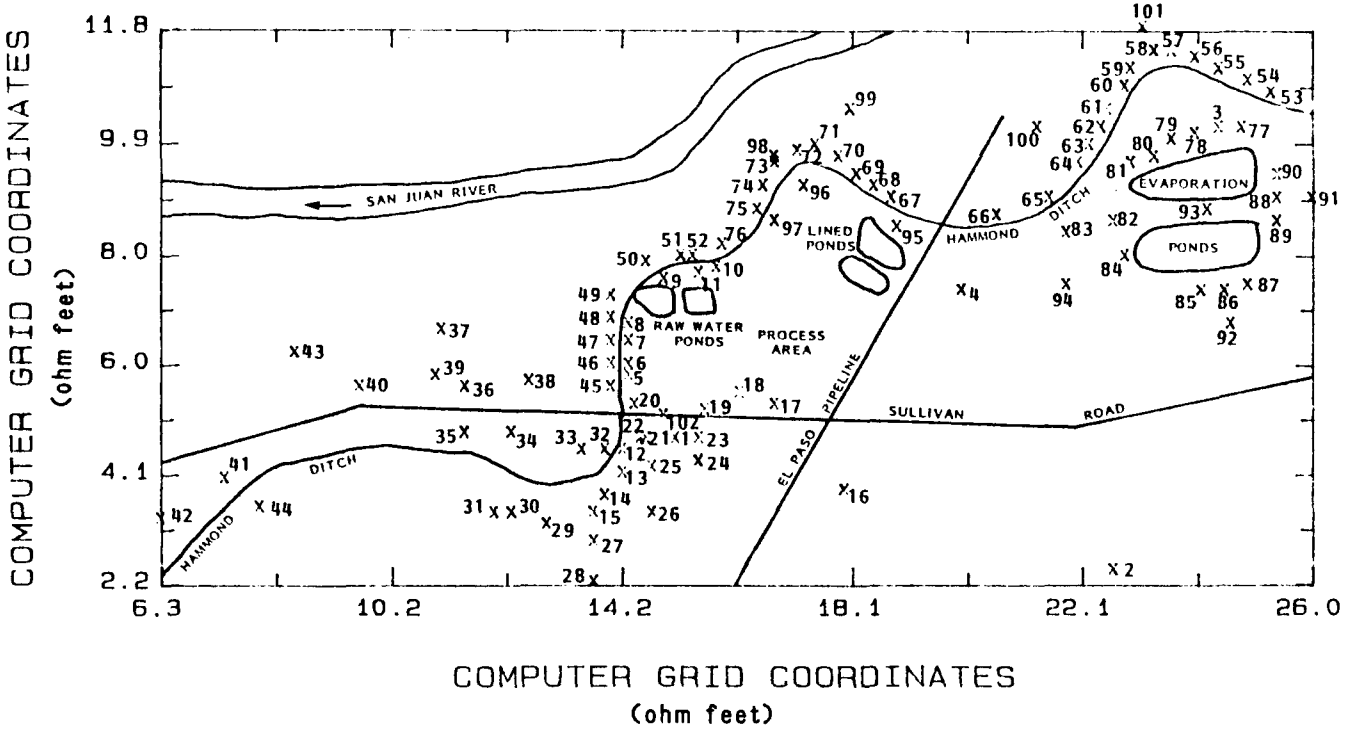
SITE GEOLOGY

Both the sounding and profile measurements presented in the report via subsurface cross sections showed the geology underlying the refinery property to be generally homogeneous and to consist of four distinct geologic units. These units are the Nacimiento Formation; a cobbles and pebbles unit; a sand, silt, and clay unit; and an alluvial fill unit. Two geologic cross sections were prepared using sounding data together with data from monitoring well logs to provide an understanding of the orientation of the geology through the BRC site. The sections were selected based on site constraints and the objective of obtaining an approximately perpendicular arrangement of the sections. The sites selected are shown on Figure 2.9 as locations A-A' and B-B'. These sections, presented by Figures 2.16 through 2.17, show the geology tends to conform to a northerly dip in the top of the Nacimiento Formation and that the surface of this formation undulates.

As suggested by Figure 2.17, the slope of the Nacimiento is not continuous. Figure 2.18, developed in a discharge plan submitted to

FIGURE 2.1

BLOOMFIELD REFINING CO.: PROFILE LOCATIONS



LEGEND

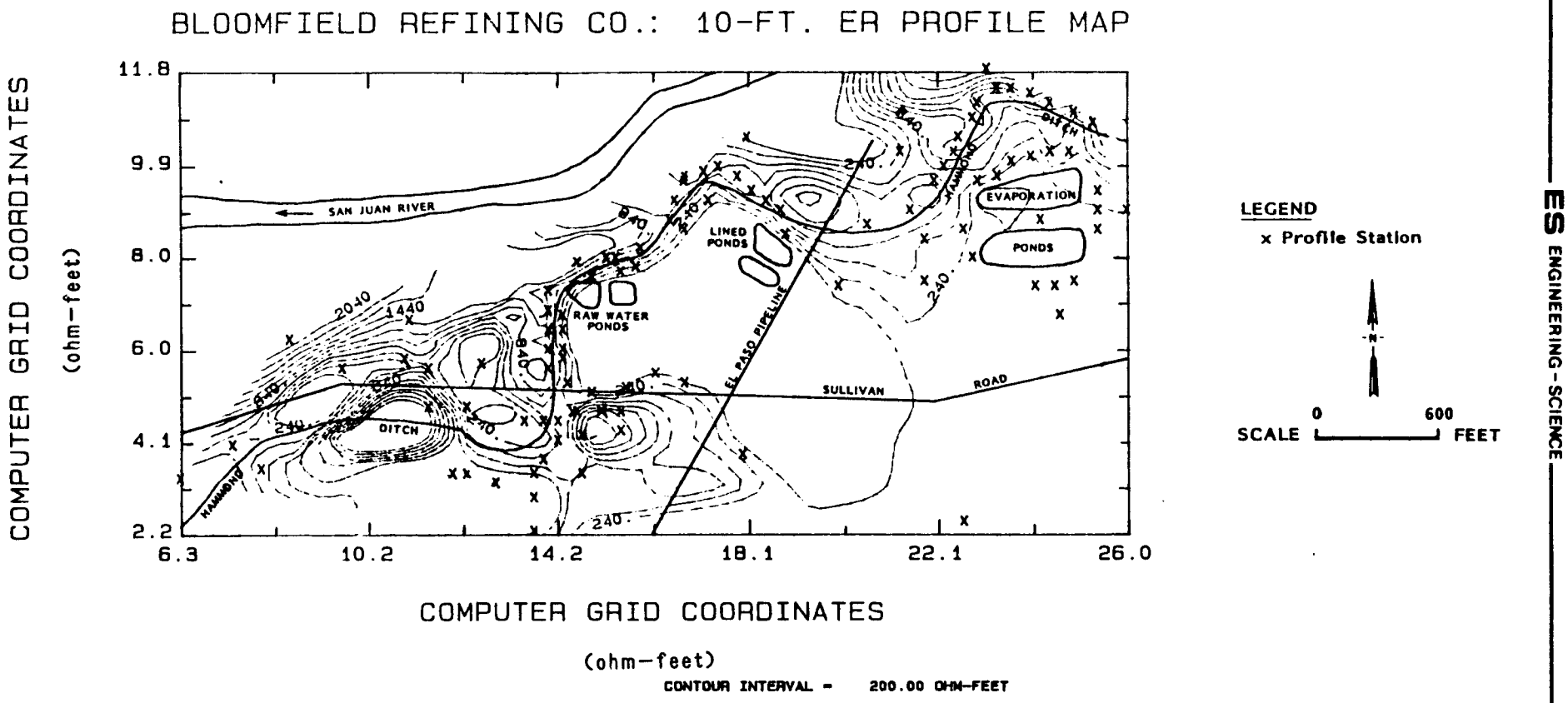
x1 Profile Station and Number

N

SCALE 0 600 FEET

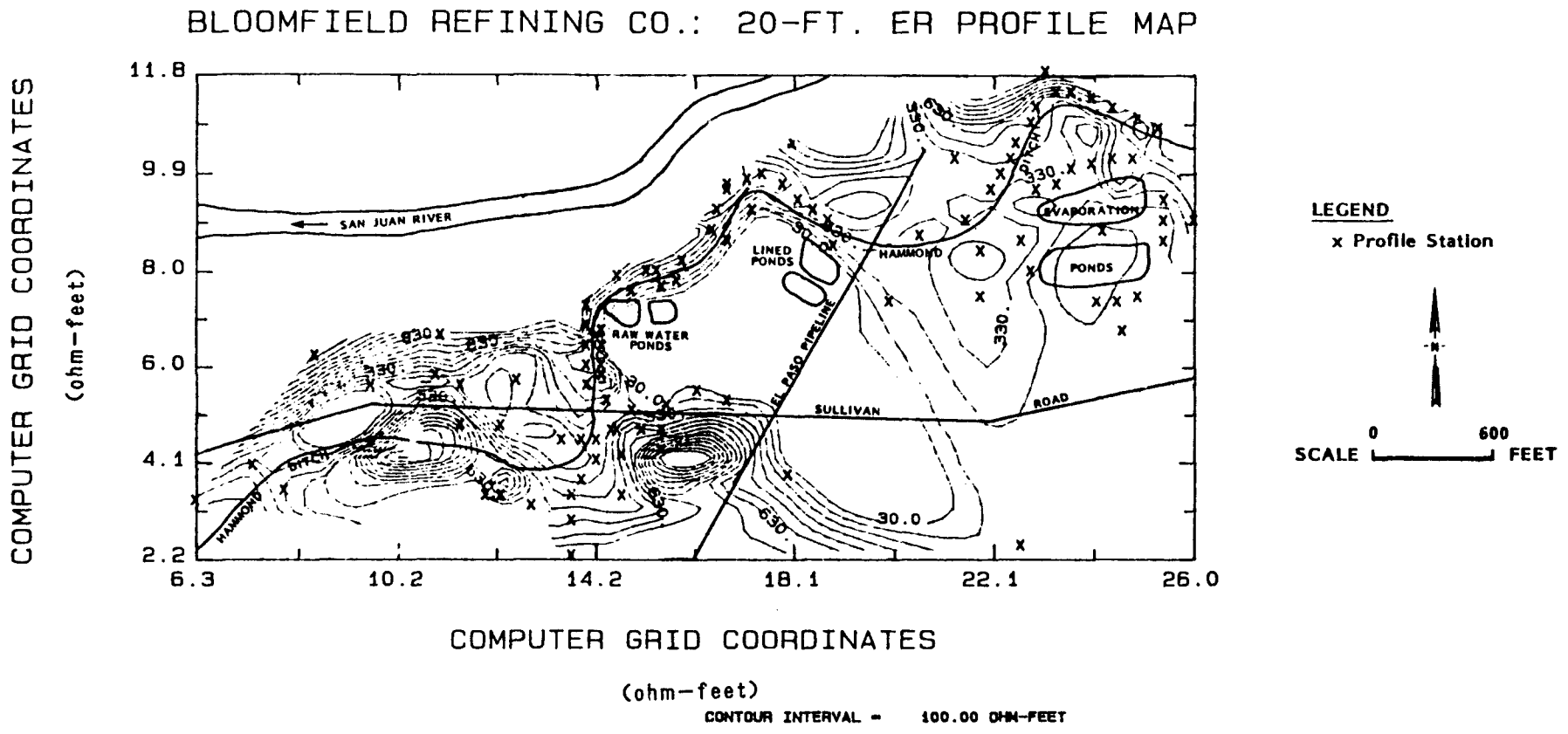
ES ENGINEERING-SCIENCE

FIGURE 2.2



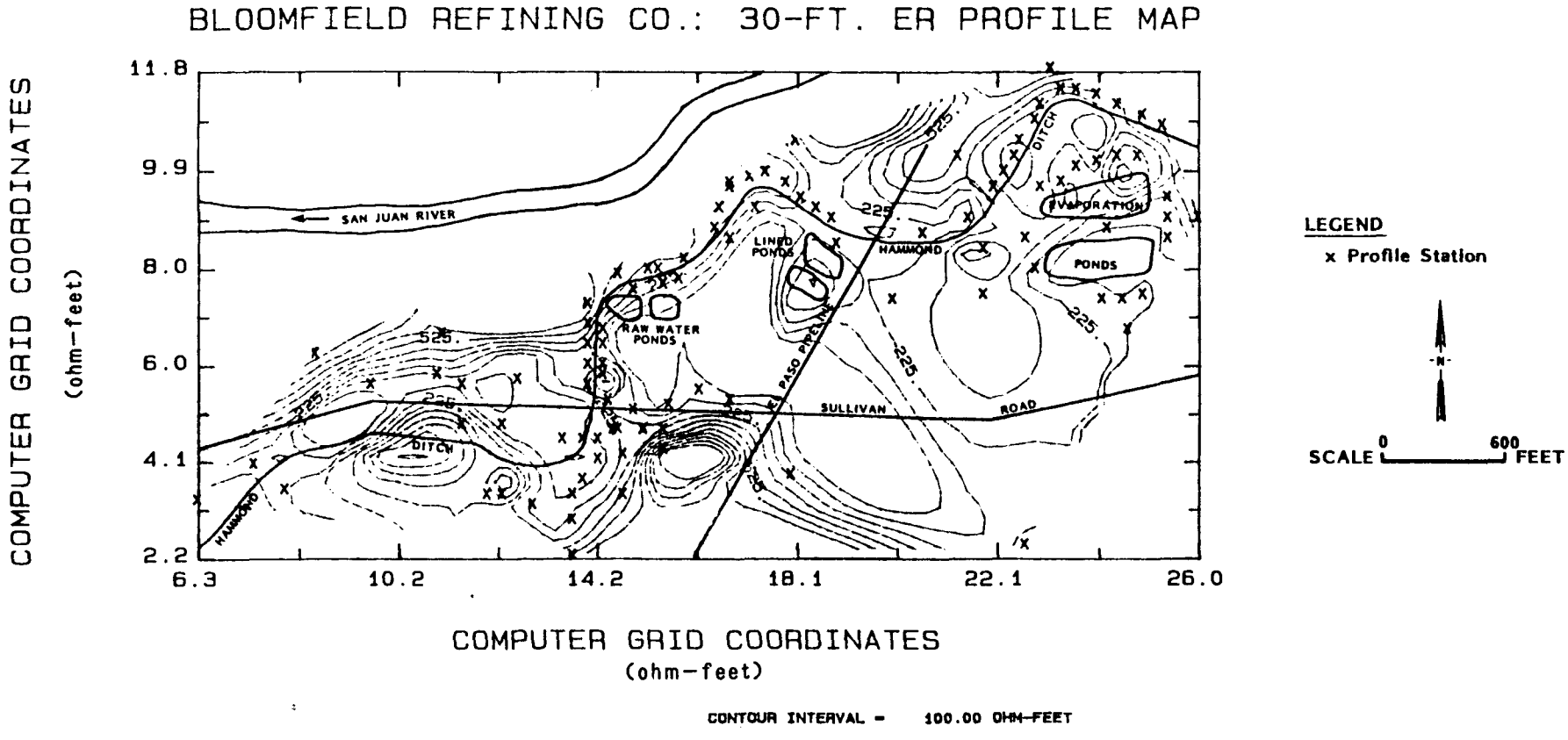
ES ENGINEERING-SCIENCE

FIGURE 2.3



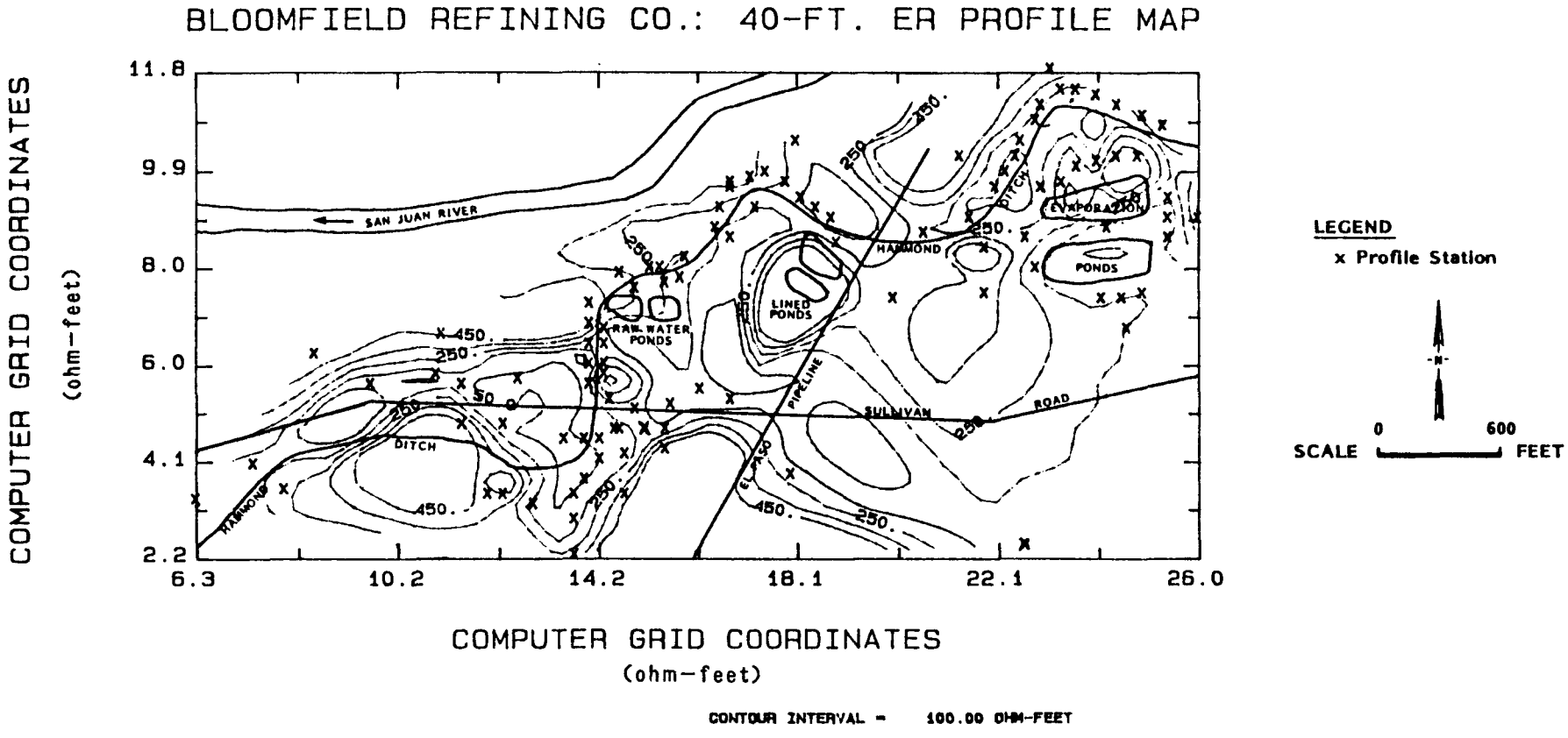
ES ENGINEERING-SCIENCE

FIGURE 2.4



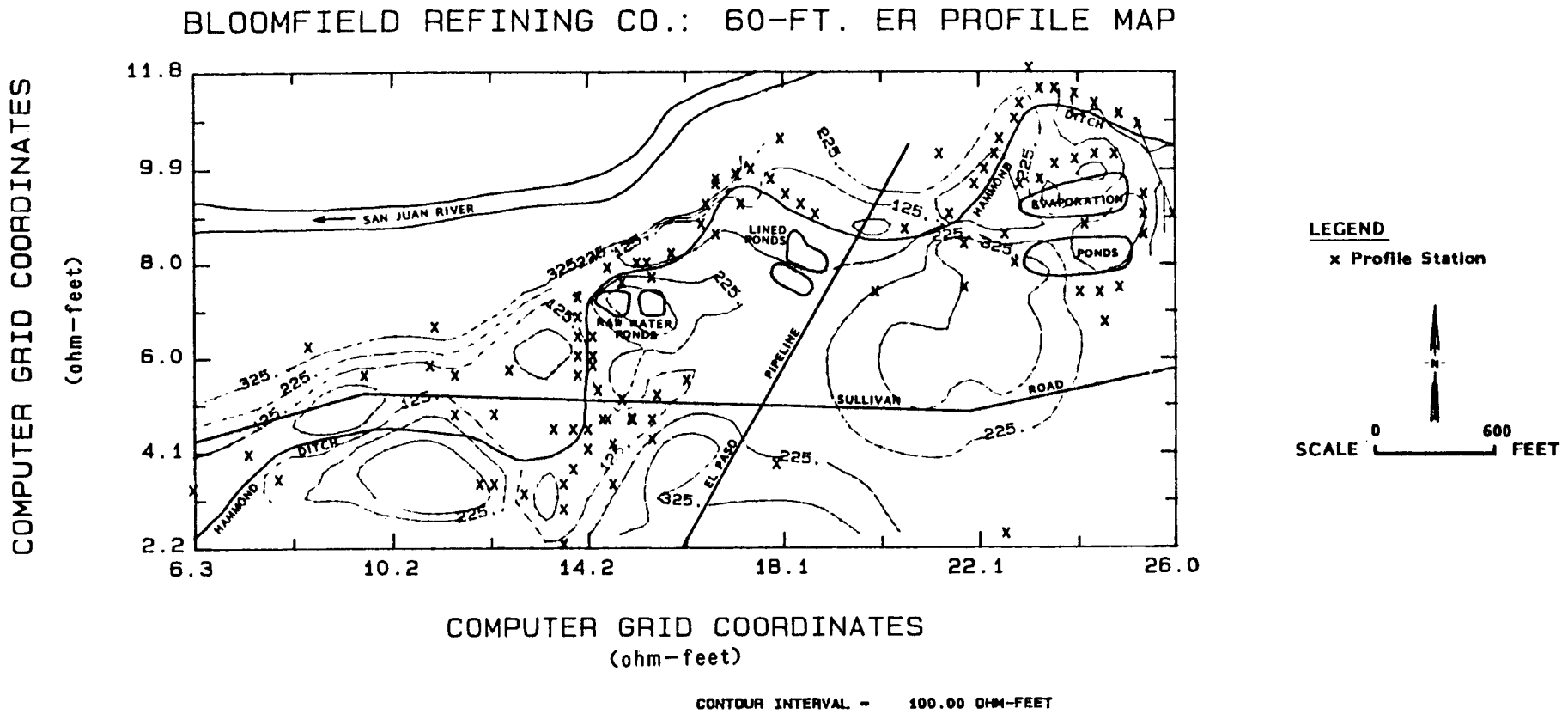
ES ENGINEERING-SCIENCE

FIGURE 2.5



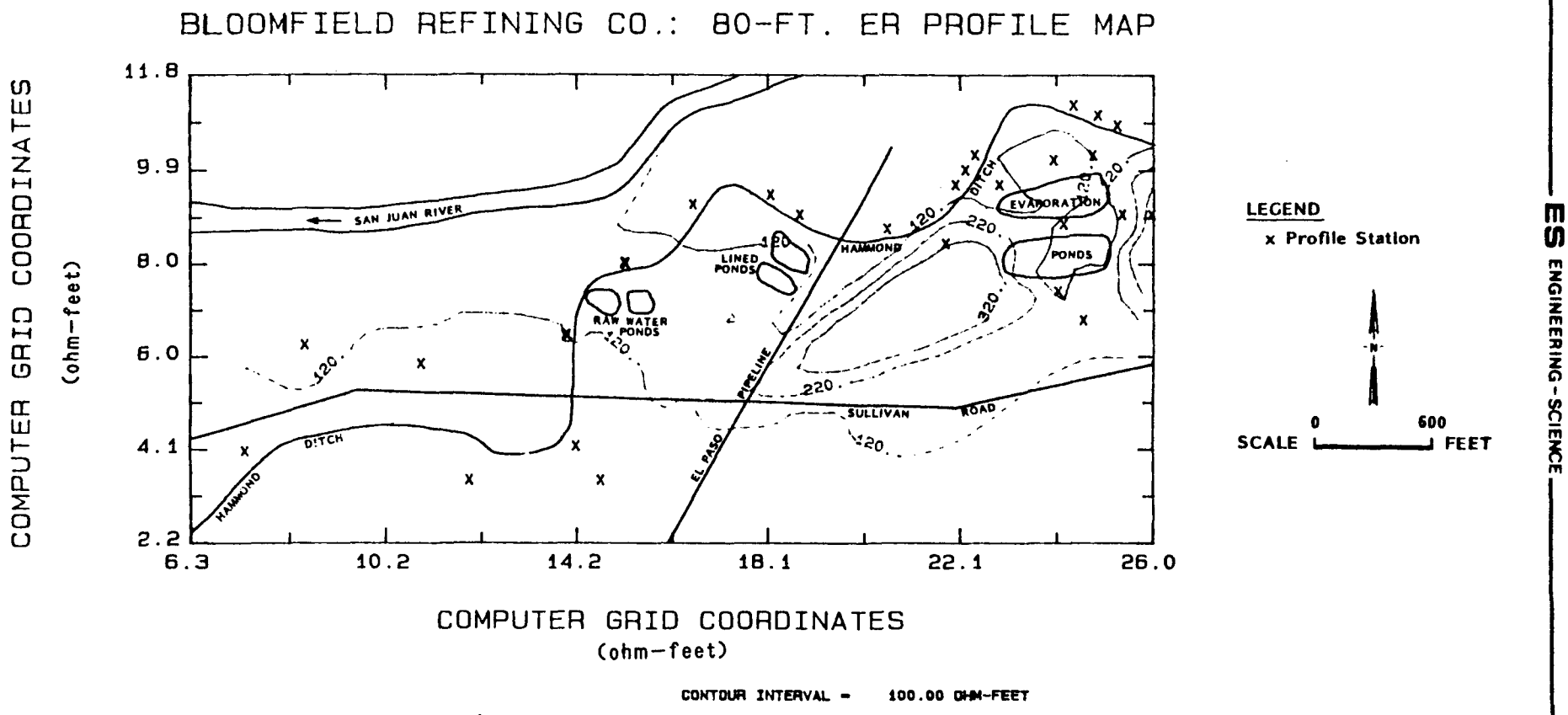
ES ENGINEERING-SCIENCE

FIGURE 2.6



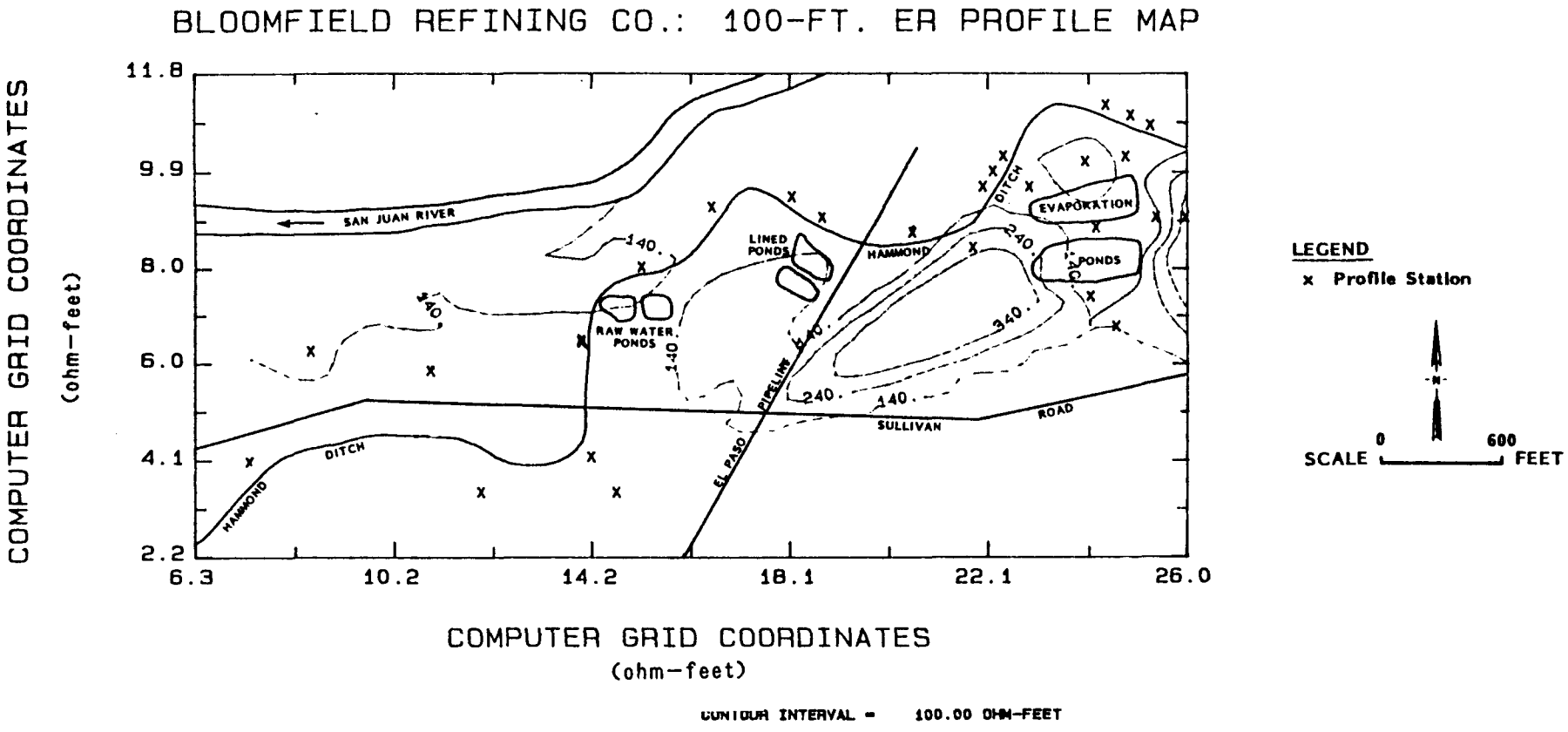
ES ENGINEERING-SCIENCE

FIGURE 2.7



ES ENGINEERING-SCIENCE

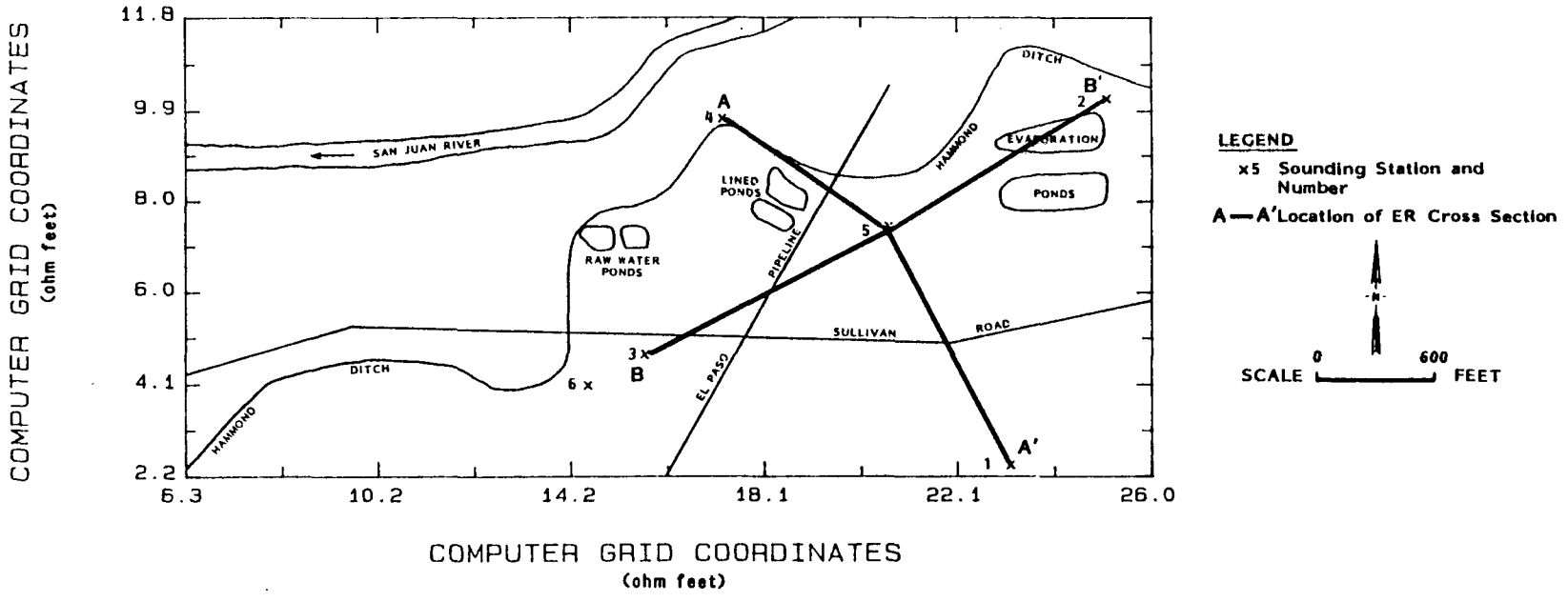
FIGURE 2.8



ES ENGINEERING-SCIENCE

FIGURE 2.9

CROSS SECTION LOCATIONS



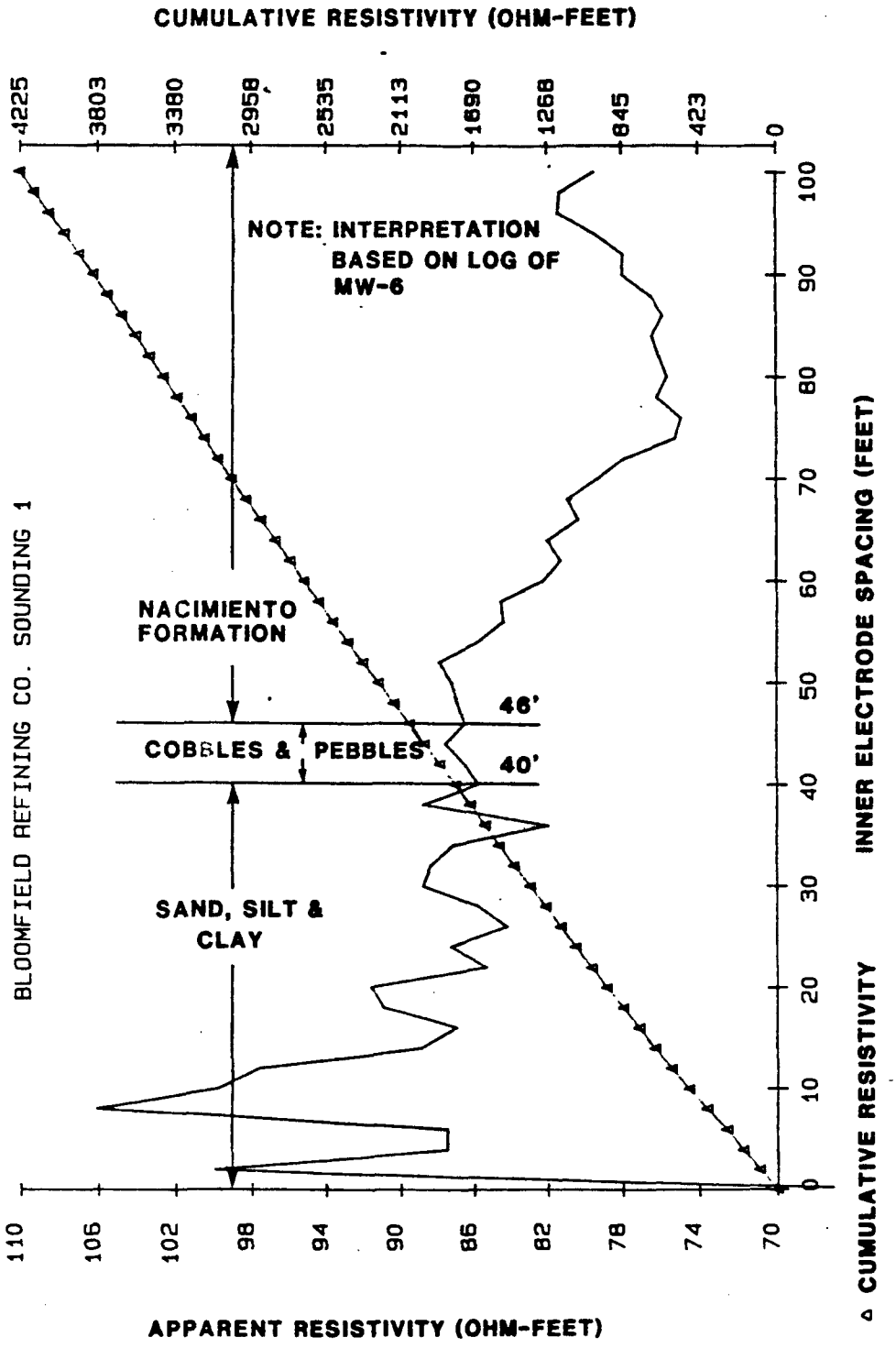

CUMULATIVE RESISTIVITY (OHM-FEET)
4225
3803
3380
2958
2535
2113
1690
1268
845
423
0
NOTE: INTERPRETATION BASED ON LOG OF MW-6
NACIMIENTO FORMATION
46'
COBBLES & PEBBLES
40'
SAND, SILT & CLAY
BLOOMFIELD REFINING CO. SOUNDING 1
110
106
102
98
94
90
86
82
78
74
70
APPARENT RESISTIVITY (OHM-FEET)
0
10
20
30
40
50
60
70
80
90
100
INNER ELECTRODE SPACING (FEET)
Δ CUMULATIVE RESISTIVITY

FIGURE 2.10

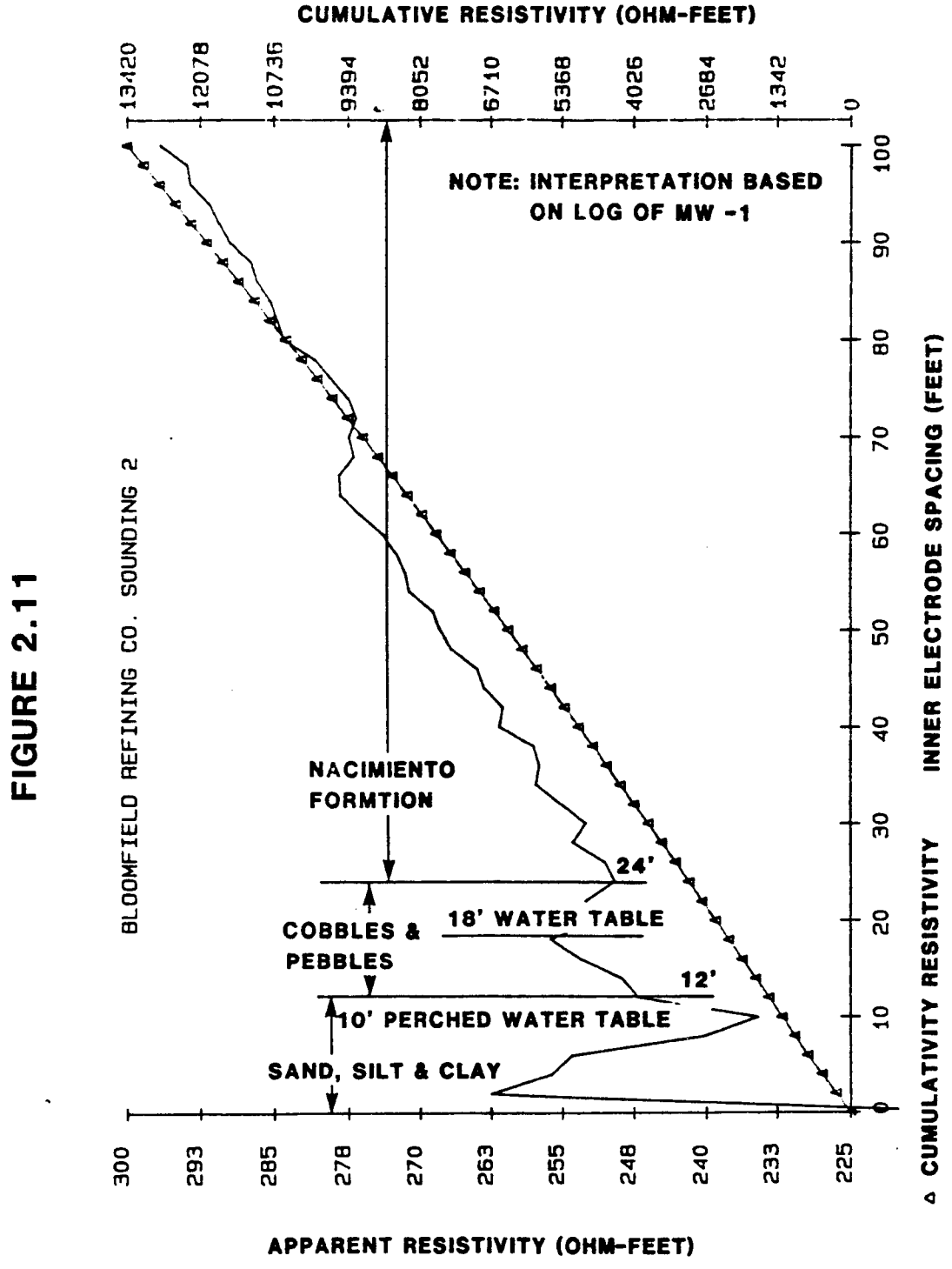

CUMULATIVE RESISTIVITY (OHM-FEET)
13420
12078
10736
9394
8052
6710
5368
4026
2684
1342
0
NOTE: INTERPRETATION BASED ON LOG OF MW -1
BLOOMFIELD REFINING CO. SOUNDING 2
NACIMIENTO FORMTION
24'
18' WATER TABLE
COBBLES & PEBBLES
12'
10' PERCHED WATER TABLE
SAND, SILT & CLAY
300
293
285
278
270
263
255
248
240
233
225
APPARENT RESISTIVITY (OHM-FEET)
100
90
80
70
60
50
40
30
20
10
0
INNER ELECTRODE SPACING (FEET)
Δ CUMULATIVITY RESISTIVITY

FIGURE 2.11

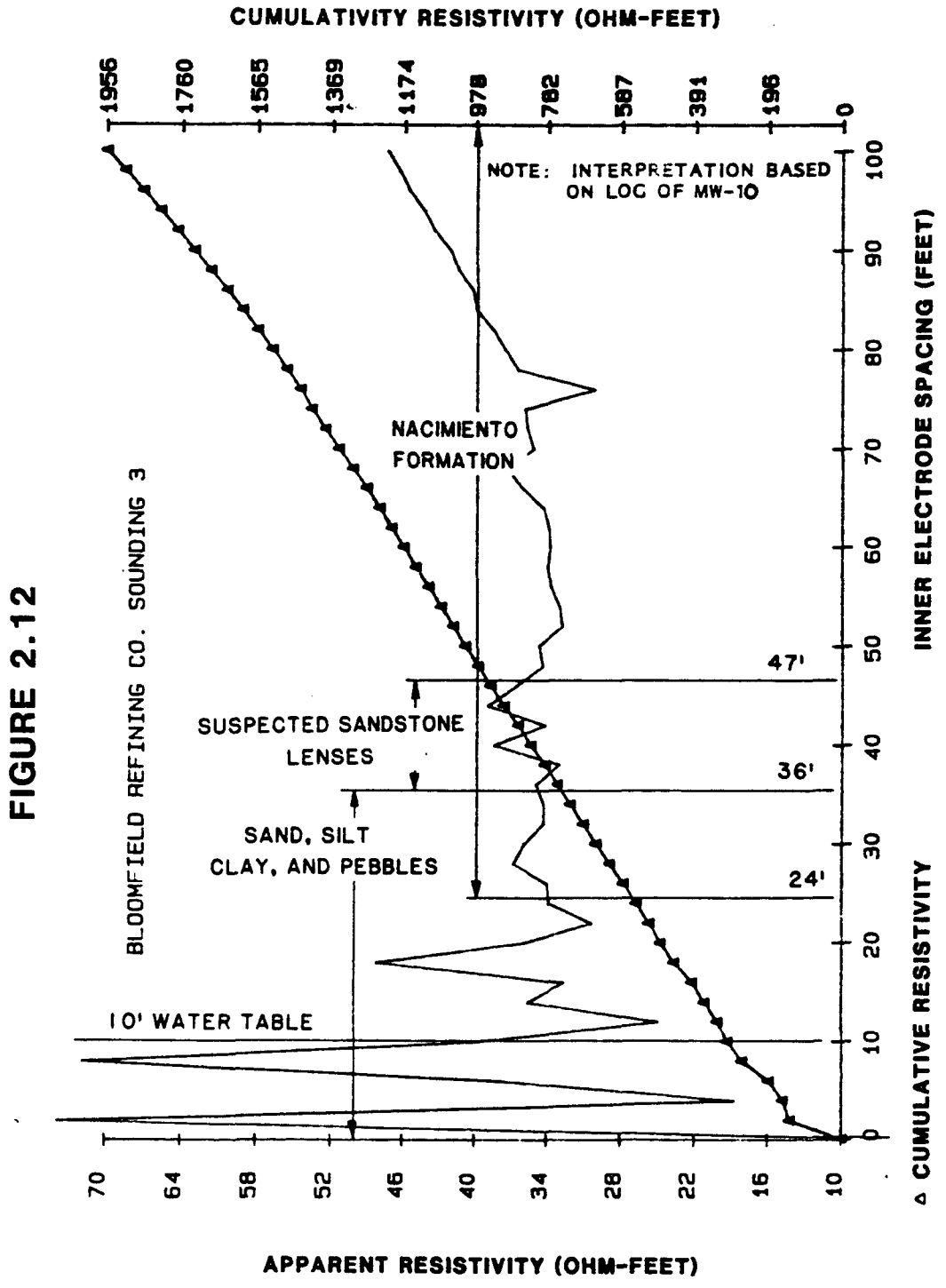

CUMULATIVITY RESISTIVITY (OHM-FEET)
1956
1760
1565
1369
1174
978
782
587
391
196
0
NOTE: INTERPRETATION BASED ON LOG OF MW-10
NACIMIENTO FORMATION
47'
SUSPECTED SANDSTONE LENSES
36'
SAND, SILT CLAY, AND PEBBLES
24'
10' WATER TABLE
BLOOMFIELD REFINING CO. SOUNDING 3
INNER ELECTRODE SPACING (FEET)
100
90
80
70
60
50
40
30
20
10
0
Δ CUMULATIVE RESISTIVITY
70
64
58
52
46
40
34
28
22
16
10
APPARENT RESISTIVITY (OHM-FEET)

FIGURE 2.12

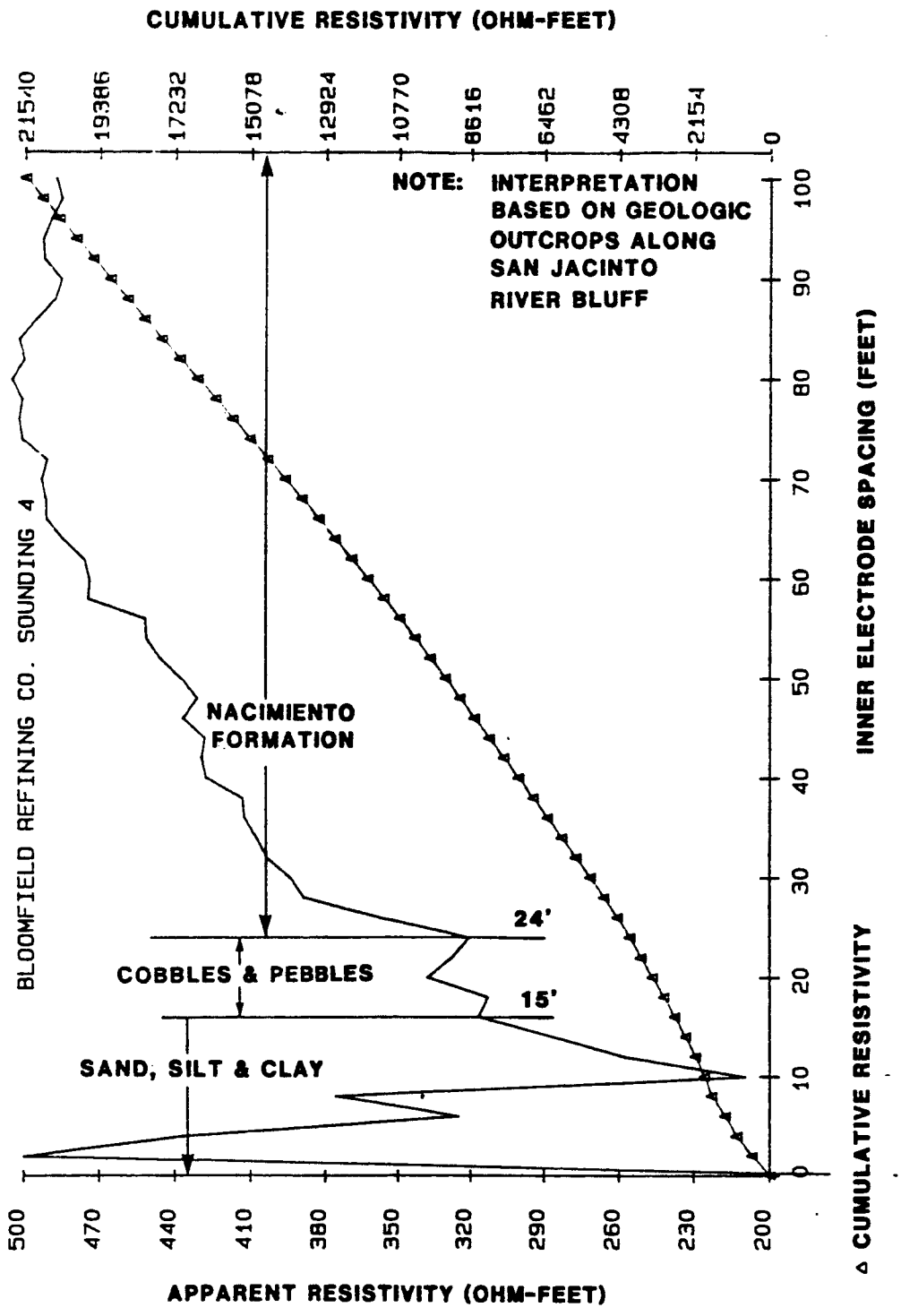

CUMULATIVE RESISTIVITY (OHM-FEET)
21540
19386
17232
15078
12924
10770
8616
6462
4308
2154
0
NOTE: INTERPRETATION BASED ON GEOLOGIC OUTCROPS ALONG SAN JACINTO RIVER BLUFF
BLOOMFIELD REFINING CO. SOUNDING 4
NACIMIENTO FORMATION
24'
COBBLES & PEBBLES
15'
SAND, SILT & CLAY
500
470
440
410
380
350
320
290
260
230
200
APPARENT RESISTIVITY (OHM-FEET)
0
10
20
30
40
50
60
70
80
90
100
INNER ELECTRODE SPACING (FEET)
Δ CUMULATIVE RESISTIVITY

FIGURE 2.13

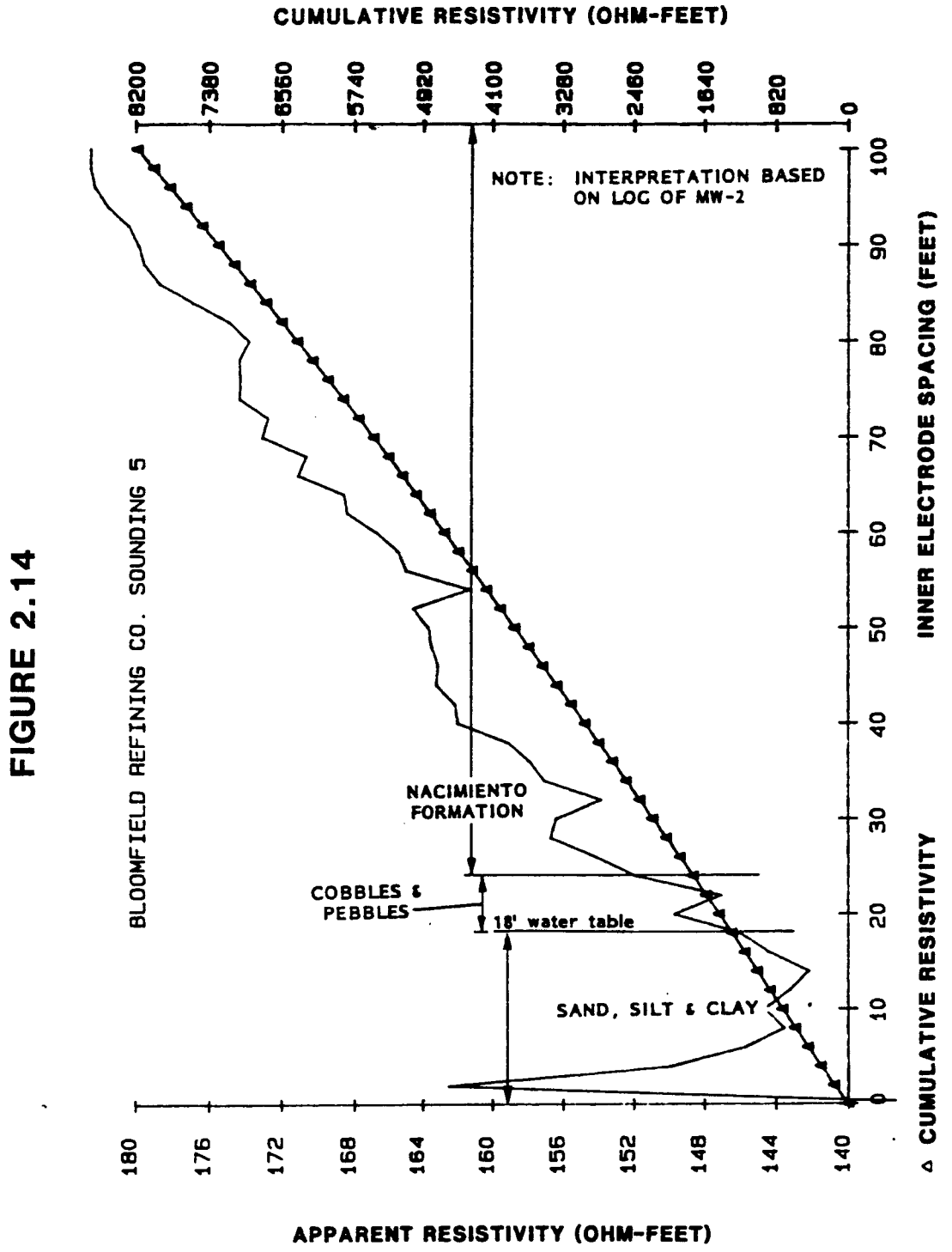

CUMULATIVE RESISTIVITY (OHM-FEET)
8200
7380
6560
5740
4920
4100
3280
2460
1640
820
0
NOTE: INTERPRETATION BASED ON LOG OF MW-2
BLOOMFIELD REFINING CO. SOUNDING 5
NACIMIENTO FORMATION
COBBLES & PEBBLES
18' water table
SAND, SILT & CLAY
INNER ELECTRODE SPACING (FEET)
100
90
80
70
60
50
40
30
20
10
0
Δ CUMULATIVE RESISTIVITY
180
176
172
168
164
160
156
152
148
144
140
APPARENT RESISTIVITY (OHM-FEET)

FIGURE 2.14

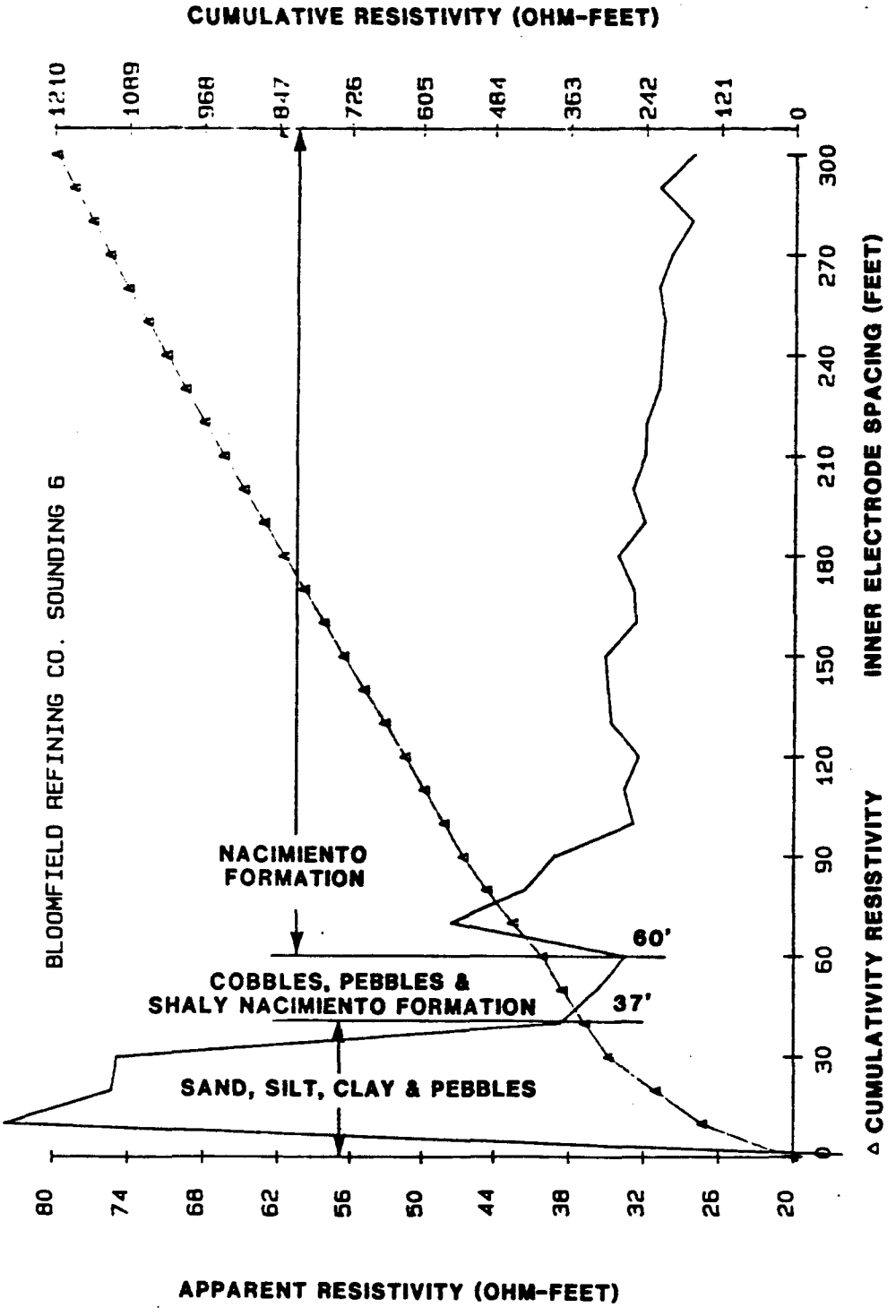

CUMULATIVE RESISTIVITY (OHM-FEET)
1210
1089
968
847
726
605
484
363
242
121
0
BLOOMFIELD REFINING CO. SOUNDING 6
NACIMIENTO FORMATION
60'
COBBLES, PEBBLES & SHALY NACIMIENTO FORMATION
37'
SAND, SILT, CLAY & PEBBLES
80
74
68
62
56
50
44
38
32
26
20
APPARENT RESISTIVITY (OHM-FEET)
0
30
60
90
120
150
180
210
240
270
300
INNER ELECTRODE SPACING (FEET)
Δ CUMULATIVITY RESISTIVITY

FIGURE 2.15

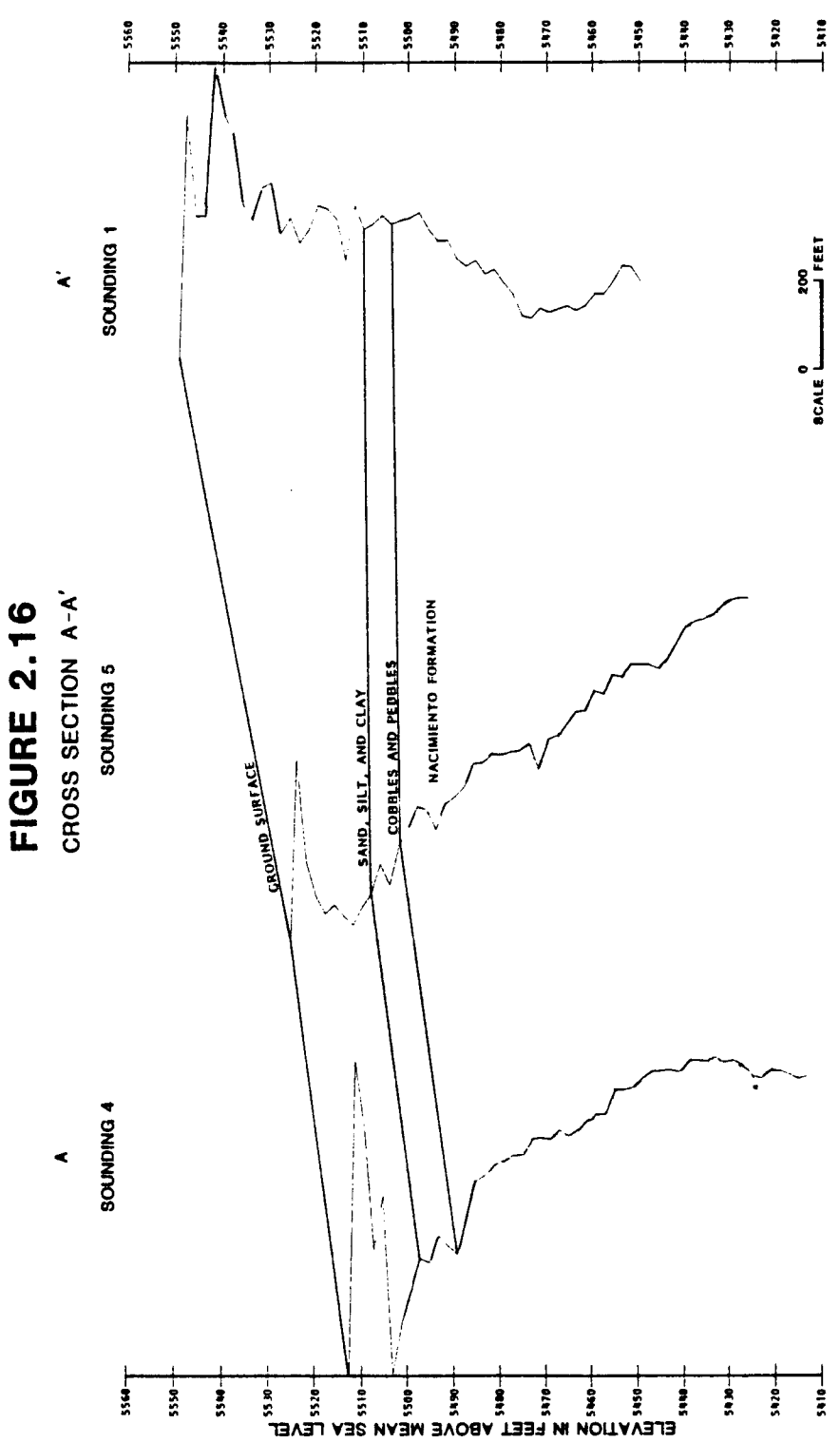


FIGURE 2.16
CROSS SECTION A-A'

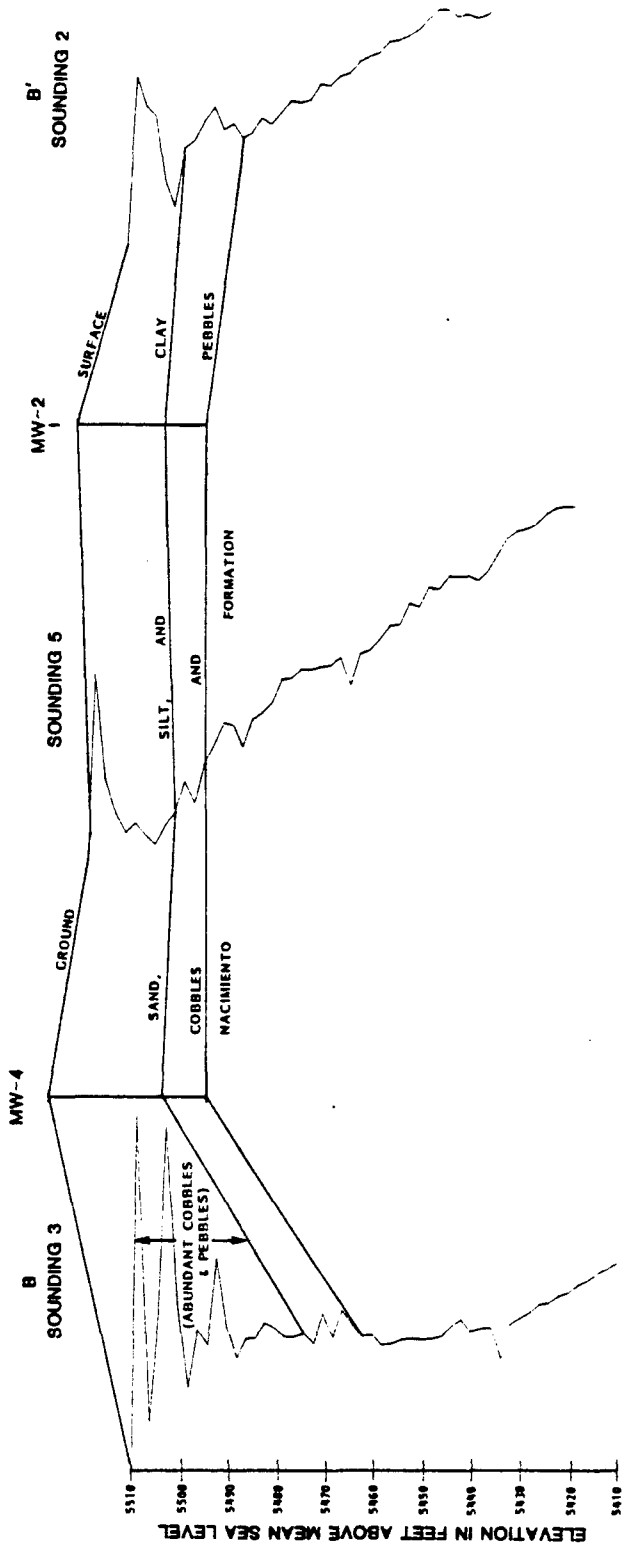


FIGURE 2.17

CROSS SECTION B-B'

FIGURE 2.18
ELEVATIONS OF THE TOP OF THE NACIMIENTO FORMATION

ARROWS INDICATE THE PROBABLE MOVEMENT OF SHALLOW GROUNDWATER ON THE DOWNSLOPE CONTACT BETWEEN THE COBBLE LAYER AND THE NACIMIENTO FORMATION

-N-

0 250 500
FEET
SCALE 1" = 250'

SAN JUAN RIVER
BLUFF
5476.5
5494.7
5469.3
5465.6
5473.5
5494.1
5460.8
5493.9
5454.3
5493.5
5493.5
5494.8
5492.2
5493.6
5500.0
APPROXIMATE REFINERY PROPERTY BOUNDARY
RUNOFF PONDS
5465.0
5466.4
5493.9
HAMMOND DITCH
5485.8
5483.8
5477.0
5492.6
5493.2
5479.7
5482.1
5484.1
EVAPORATION POND NO. 1
EVAPORATION POND NO. 2
mw2
5494.3
5497.7
INVERTED SIPHON
5493.4
5470.4
5466.3
API WASTEWATER PONDS
API SEPARATOR
RAW WATER PONDS
PROCESS UNITS
OFFICE
5494.8
5501.4
5499.4
5478.6
5493.8
5495.3
5499.8
5494.6
5500.8
5497.4
5500.9
5500.2
5504.2
5496.5
5494.4
5499.2
5495.7
5496.7
mw4
5492.3
SULLIVAN ROAD
TERMINALS
LPG BULLETS
SPRAY IRRIGATION AREA
5495.0
5502.1
AMOCO-DAVIS GAS UNIT F-1

New Mexico Oil Conservation District (NMOCD) for Plateau Refining by Dr. William Turner of American Groundwater Consultants, provides the elevations of the top of the Nacimiento. These data show the formation was subject to prehistoric erosion. This erosion created a series of subsurface channels which were filled with permeable materials by subsequent sedimentation processes. The net result of these geologic processes is the existence of a variable saturated zone thickness over the site which affects the route of groundwater movement.

DISCUSSION

The presence, areal extent, and route of migration of subsurface contamination can be interpreted from the ER data only in the context of how the ER data are either corroborated or refuted by other evidence. Since the data provide only a relative measure of resistance, the data by themselves can only suggest possible locations of subsurface hydrocarbons. Other ER signatures which can appear the same as hydrocarbon materials are changes in soil moisture, changes in soil or rock composition, or structural features. The ER data must therefore be "ground truthed" via some additional positive evidence.

The computer-generated ER profile maps should be evaluated with the understanding that the ohm-foot contours delineated on the maps constitute only an interpolation and extrapolation of the discrete ER measurements presented in Figure 2.1. The weight given to the significance of the contours should be tempered with an examination of Figure 2.1 to determine the density of ER data points in a particular area of the site.

Both the process area and refined product storage area provided little accessibility during the ER survey due to numerous pipeline interferences and structures. Therefore, the 25- to 50-ohm-foot contours representing this area are based on only a few data points.

Since relatively low ER values can suggest the presence of subsurface hydrocarbons, the areas of the BRC site showing relatively low ER

values are of interest. Based on the 10- to 40-foot depth profile maps, there are three areas showing relatively low ER values.

One area of relatively low ER contours (approximately 200 ohm-feet) exists to the west of the solar evaporation ponds and is generally oriented in a southeast to northwesterly direction and transects Hammond Ditch. In a discharge plan approved by NMOCD on June 7, 1984, the solar evaporation ponds were reported to be subject to some leakage and percolation (see references section). In addition, the area mentioned corresponds to an erosion channel in the Nacimiento (see Figure 2.18) which provides an avenue for flow from the ponds toward the San Juan River during nonirrigation periods in Hammond Ditch (see Chapter 5). The ER survey was conducted during the nonirrigation season. Thus, the low ER values may be the result of leakage of water from the ponds and not subsurface hydrocarbons.

compare with MW. results.

Another area depicted to show relatively low ER values is defined by the 25- to 50-ohm-foot contours on the 10- to 40-foot contour maps. This area includes both the process and refined product storage areas. As mentioned earlier, the exact extent of these low-valued contours is suspect because of the limited number of ER measurements in this area. Some indication of free product existed in monitoring well 4 during the ER survey, and this well was used as a frame of reference for other ER measurements in the area. However, monitoring wells 2, 3, and 5 through 10 are also screened within the same zones of low resistance included in the projected 25- to 50-foot contour areas and have not produced any indication of free product. Moreover, laboratory summaries of these wells' quarterly sampling results, shown in chapter 4, show low levels of hydrocarbon compounds.

The last location exhibiting low ER contours is off site in an area south and west of the intersection of Hammond Ditch and Sullivan Road. Based on the ER contours, these sites could represent the route of migration of groundwater measured in monitoring wells 4, 7, and 10. No significant investigation of this area is available at this time since the focus of the 3013 administrative order directives has been to

concentrate investigative efforts within the property boundaries of the refinery.

Recently, an independent assessment of offsite tracts has been initiated for the NMOCD. This study involves installation of a test recovery well in an area of low resistivity located on site near monitoring well 4. The study also involves installation of 2 monitoring wells in areas of similarly low resistivity located south and west of BRC's property. This study will examine recovery characteristics of the saturated zone and will monitor the saturated zone west of the property for subsurface hydrocarbons.

In summary, the ability to explain the existence of low ER contours is subject to procurement of additional information which is not available at this time. Monitoring data verify the low ER contours only in a localized area monitored by wells 4, 9, and 10. Available information developed from the administrative order work elements which establishes the basis for explanation of the low ER contours is provided in the following chapters.

Subsurface conditions in offsite areas have not been evaluated since investigation of these areas has been beyond the scope of work. It is recommended that investigation of the offsite areas be pursued under auspices of the NMOCD program.

CHAPTER 3

GROUNDWATER MONITORING WELLS

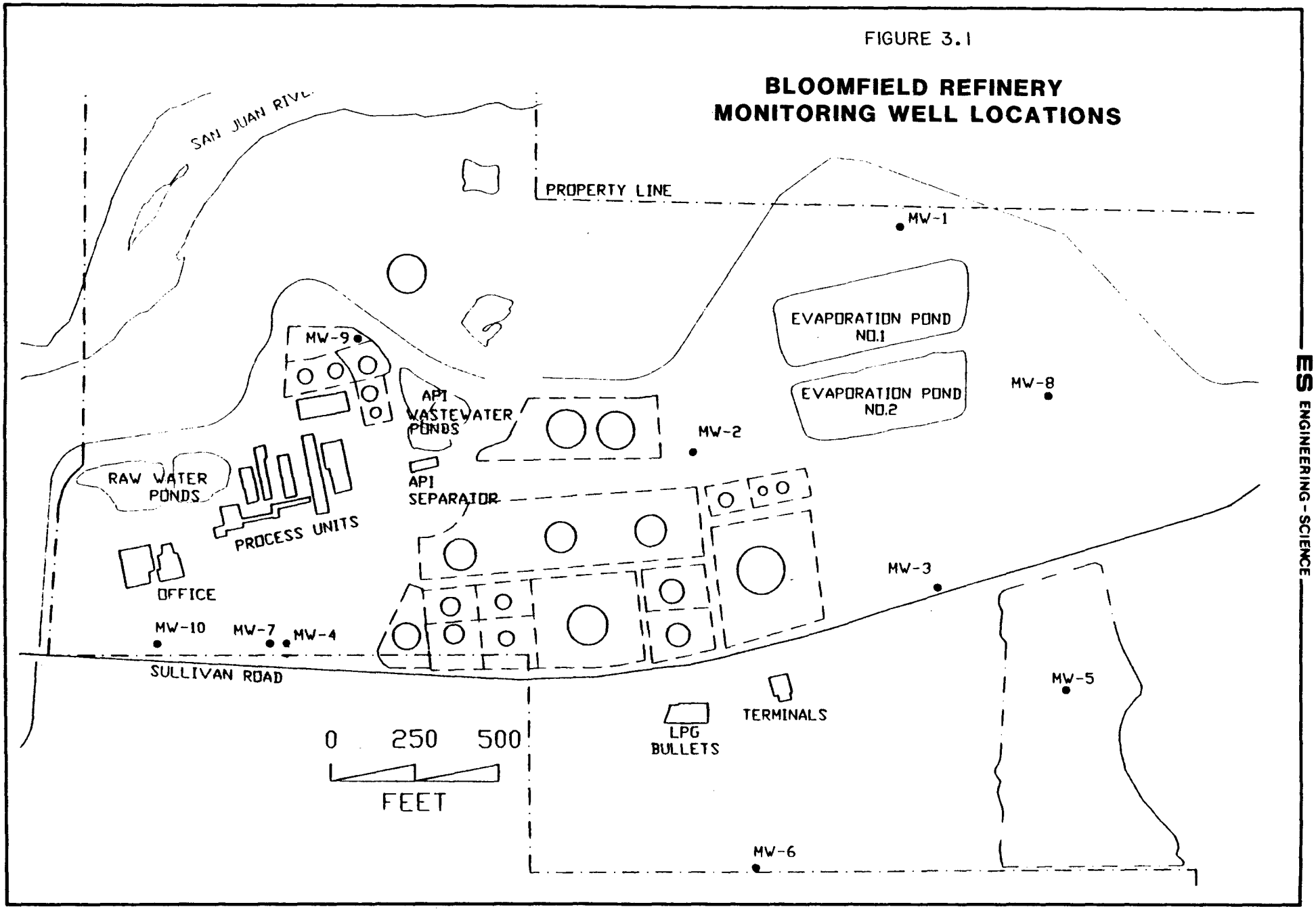
Four groundwater monitoring wells, designated 7 through 10, were installed consistent with the guidelines specified in the EPA-approved work plan. Figure 3.1 depicts the locations of these wells with respect to the pre-existing wells (1 through 6) and site features. The locations for these wells were selected in consultation with USEPA and state officials based on site information and geophysical information submitted previously. Installation of these wells took place during the period from February 26 to March 4, 1986. Boring logs prepared for each of these wells are presented in Tables 3.1 through 3.4. These logs provide both a geologic description of the strata penetrated at each well location and a description of the type of well hardware, packing, and seals installed.

Well 7 was installed to investigate possible contamination of the Nacimiento Formation by hydrocarbons. It was installed with a 10-foot stainless steel screen located in a gray to green clay at a depth range of approximately 50 to 60 feet. A sand filter pack was installed from the bottom of the boring to a depth of 45 feet. A 4-foot bentonite plug was installed on top of the sand pack, followed by a grout seal installed to the surface. The well is screened only within the Nacimiento Formation and is plugged to prevent vertical migration of hydrocarbons from above.

For completeness, lithologic logs for monitoring wells 1 through 6 have been added. These logs are as prepared by Earl & Sons, Inc. (the drillers) and are presented as Tables 3.5 to 3.10.

FIGURE 3.1

BLOOMFIELD REFINERY
MONITORING WELL LOCATIONS



ES ENGINEERING-SCIENCE

TABLE 3.1

WELL LOG FOR MONITORING WELL NUMBER 7

Drilling Date: February 25

Depth in Feet	Description
0-1	Gravel fill
1-5	Brown sandy silt and clay with small gravels
5-10	Brown sandy silt and clay, more firm and sticky
10-15	Lighter brown sandy silt and sticky clay
15-20	Lighter brown sandy silt and clay, larger cobbles and pebbles
20-25	Sand with cobbles and pebbles
25-30	Sand
26 or 27	
30-35	Greenish clay with pebbles, top of Nacimiento estimated at 32 feet
35-40	Greenish clay, few pebbles
40-45	Green to gray clay, smooth drilling
45-50	Green to gray clay, smooth drilling
50-65	Sticky gray to green clay

Elevation of Top of Pipe: 5524.09 feet

Total Depth of Casing: 62.11 feet

Description of Casing: Bottom of casing has a 2 foot stainless steel blank section for a silt trap, followed by a 10 foot section of 6" I.D. stainless steel screen, in turn followed by 6" I.D. schedule 40 PVC casing to the top of pipe. Sand was added to 45 feet below grade, bentonite to 41 feet below grade, and grout to the surface.

Screen 50-60 ft
Sand pack 45-60 ft

Type of drilling?
(Likely Air)

TABLE 3.2

WELL LOG FOR MONITORING WELL NUMBER 8

Drilling Date: February 28, 1986

Depth in Feet	Description
0-20	Light brown sandy clay, similar to that found on the ground surface
20-34	Cobbles and pebbles
29 BTW	
34	Green-gray clay and sandstone, intermixed with small pebbles and sand. Top of Nacimiento.

Elevation of Top of Casing: 5531.12 feet

Total Depth of Casing: 34.94 feet

Description of Casing: Bottom of casing has a 2 foot stainless steel blank section for a silt trap, followed by 20 feet of 6" I.D. stainless steel screen, followed by 6" I.D. schedule 40 PVC to the surface. The screened section of the hole was sanded to within 7 feet of the surface, a bentonite seal (1/2 bucket) was added and concrete was used for a surface seal.

Screened 13 - 33 feet
Sand pack 7 - 33 feet

TABLE 3.3

WELL LOG FOR MONITORING WELL NUMBER 9

Drilling Date: March 3, 1986

Depth in Feet	Description
0-5	Fill material, some rock
5-10	Sticky reddish brown silty clay
10-15	Lighter color silty clay, some pebbles
15-20	Lighter color silty clay, some pebbles
20 OTW	
20-25	Cobbles, pebbles, sand
25-30	Cobbles, greenish clay, top of Nacimiento

Elevation of Top of Casing: 5519.70 feet

Total Depth of Casing: 33.99 feet

Description of Casing: Bottom of casing has a 2 foot stainless steel blank section for a silt trap followed by 20 feet of 6" I.D. stainless steel screen, followed by 6" I.D. schedule 40 PVC to the surface. The screened section of the hole was sanded to within 7 feet of the surface, a bentonite seal (1/2 bucket) was added and concrete was used for a surface seal.

Screen 12-32
Sand 7-32

TABLE 3.4

WELL LOG FOR MONITORING WELL NUMBER 10

Drilling Date: March 4, 1986

Depth in Feet	Description
0-5	Topsoil, roadbase, reddish brown sandy clay
5-10	Reddish brown silty, sandy clay
10-15	Cobbles, pebbles
15-20	Gravel, cobbles, pebbles
20-25	Greenish clay at 23 feet, top of Nacimiento
25-30	Greenish clay, Nacimiento
30-35	Nacimiento, color changed from yellow-green to blue-gray

Elevation of Top of Casing: 5516.86 feet

Total Depth of Casing: 33.93 feet

Description of Casing: Bottom of casing has a 2 foot stainless steel blank section for a silt trap, followed by 20 feet of 6" I.D. stainless steel screen, followed by 6" I.D. schedule 40 PVC to the surface. The screened section of the hole was sanded to within 7 feet of the surface, a bentonite seal (1/2 bucket) was added and concrete was used for a surface seal.

Screen 12-32
Sand 7-32

well #10 completed in clay of Nacimento 11' in alluvium. Sand above top of screen.

TABLE 3.5

WELL LOG FOR MONITORING WELL NUMBER 1

Drilling Date: February 8, 1984
Location: 29.11.27.24221

Depth in Feet	Description
0-5	Light brown clayey sand, coarse, poorly sorted, quartzose, and slightly calcareous
5-10	Yellowish gray sandy pebbles and cobbles, poorly sorted, rounded to subrounded
10-12	Yellowish gray pebbly sand, very coarse, poorly sorted, felospathic and noncalcareous
12-22	Dark gray pebbly and sandy cobbles, some quartz pebbles, most are volcanic, subrounded cobbles and pebbles, some clay, a little water at about 16 feet
22-25	Gray-green clayey sand becoming light yellow clayey sandstone and sandy claystone

TABLE 3.6

WELL LOG FOR MONITORING WELL NUMBER 2

Drilling Date: February 7, 1984
Location: 29.11.27.24321

Depth in Feet	Description
0-5	Light yellow brown silty sandy clay, very calcareous
5-10	Light yellow brown clayey sand, subrounded to subangular, moderately to poorly sorted, very calcareous
10-15	Light brown pebbly sand, clayey, very calcareous, cobbles at 15 feet
15-20	Gray sandy pebbles, poorly sorted coarse quartzose sand, pebbles are dark gray and volcanic
20-25	Dary gray cobbles, some quartz pebbles, mostly volcanic, some sand
25-26	Yellow gray clayey sandstone and sandy claystone

TABLE 3.7

WELL LOG FOR MONITORING WELL NUMBER 3

Drilling Date: February 8, 1984
Location: 29.11.27.24443

Depth in Feet	Description
0-5	Yellow brown sandy silt and clay, very calcareous quartzose
5-10	Yellow brown sand, calcareous, silty and clayey, quartzose
10-15	Yellow brown sand, silty and clayey, fine-grained, very calcareous, quartzose
15-27	Light brown clay, sandy, very clacareous, becoming pebbly with depth
27-35	Gray yellow brown cobbly sand, coarse, poorly sorted, silty and clayey, volcanic pebbles, small amount of water at about 35 feet
35-40	Gray cobbles, pebbly and sandy, coarse sand, yellow gray clayey sandstone at about 40 feet

TABLE 3.8

WELL LOG FOR MONITORING WELL NUMBER 4

Drilling Date: February 9, 1984
Location: 29.11.27.23344

Depth in Feet	Description
0-5	Yellow gray-brown sandy silt and clay, calcareous
5-10	Yellow brown silty sandy clay and clayey silt, very slightly calcareous
10-15	Reddish yellow-brown clayey sandy silt, silty clay, fine-grained quartzose sand, noncalcareous
15-19	Light brown coarse sand with clay and pebbles, calcareous
19-25	Gray pebbly sand, very coarse, poorly sorted, some clay and silt, subrounded to subangular, quartzose, pebbles rounded, slightly calcareous
25-30	Gray cobbles and pebbles, subrounded to rounded, volcanic; at about 28 feet, hydrocarbon smell and color
30-32	Gray cobbly sand, with hydrocarbon smell and color, coarse-grained, sand is quartzose and feldspathic, subrounded and subangular quartz grains are clear
32	Yellow gray clayey sandstone

TABLE 3.9

WELL LOG FOR MONITORING WELL NUMBER 5

Drilling Date: February 6, 1984
Location: 29.11.26.31112

Depth in Feet	Description
0-5	Pale yellow brown clay, silty, some sand, calcareous
5-10	Pale yellow brown clayey sand and quartzose silt, poorly sorted, calcareous
10-15	Yellow brown sand, subrounded quartzose sand slightly calcareous
15-20	Yellow brown sand, clayey, moderately coarse-grained, very calcareous
20-25	Yellow brown sand, clayey, silty, fine- to medium-grained, moderately sorted, noncalcareous
25-35	Yellow brown sand, silty and slightly clayey, fine- to medium-grained, well sorted, subangular, noncalcareous, becoming more clayey with depth
35-37	Yellow brown pebbly and cobbly sand, clayey, calcareous
37-47	Dark gray sandy and clayey cobbles and pebbles, water at 42 feet
47-50	Dark gray cobbles with greenish clay
50-54	Green-gray pebbly clay

TABLE 3.10

WELL LOG FOR MONITORING WELL NUMBER 6 DRY

Drilling Date: February 7, 1984
Location: 29.11.27.42144 or 42233

Depth in Feet	Description
0-15	Pale yellow brown sand, clayey and silty, subangular, poorly sorted, quartzose, very calcareous, becoming more clayey with depth
15-20	Pale yellow brown silt, sandy and clayey, silt is coarse, sand is very fine, moderate sorting, quartzose and calcareous
20-25	Pale yellow sand, slightly clayey, subrounded, well sorted, quartzose, noncalcareous
25-35	Pale yellow sand, coarse- to medium-grained, quartzose, noncalcareous
35-41	Pale yellow sand, clayey, fine-grained, silty, quartzose, slightly calcareous
41-49	Gray-black cobbles and pebbles, volcanic
49-52	Gray-green clayey sandstone and sandy claystone

CHAPTER 4

GROUNDWATER MONITORING WELL SAMPLING

BACKGROUND

Based on the requirements of the approved work plan, each of the groundwater monitoring wells at the Bloomfield refinery has been sampled by Bloomfield staff quarterly over a period of 12 months. Water samples from wells 1 through 3 and 5 were analyzed for priority pollutant heavy metals, cyanide, phenols, TOC, TDS, chloride, sulfate, and volatile organics including benzene, toluene, xylene, and ethylbenzene. In addition, at monitoring well 1, selected organic priority pollutants (see Appendix A) were analyzed during the second and fourth quarters. Water samples from monitoring wells 4 and 7 through 10 were analyzed for base/neutral priority pollutants in addition to the constituents already listed. Monitoring well 6 has been dry and therefore has never yielded any water for analyses.

FINDINGS

The laboratory results corresponding to each of the quarterly sampling efforts are presented in Appendix A to this report. In addition, sampling results for Hammond Ditch (covered in chapter 7) are presented in Appendix B to this report. Summaries of these data provide concentrations of detectable substances and laboratory detection limits. Field measurements of pH, conductivity, and water levels are also included. These summaries give a concise picture of each well's performance through the sampling period in Tables 4.1 through 4.9. As a reference, Appendix C presents EPA ambient standards and criteria for superfund remedial sites.

DISCUSSION

A review of the summaries shows that monitoring wells 1, 4, 7, 8, and 10 all show appearance of low levels of priority pollutants in only a single quarter's sampling effort. The lack of consistency in appearance

TABLE 4.1

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-1

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.1	0.07		0.01
Total phenols	0.009	0.017	0.19	0.012	0.001
TOC	18	24	24	18	0.1
TDS	2,936	2,960	2,866	2,498	1
Chloride	750**	994.7	814	774	1
Sulfate	7.5**	630	673	579	1
Antimony				0.25	0.01
Arsenic		0.077	0.05		0.05
Beryllium				0.02	0.01
Cadmium	0.050				0.01
Lead	0.085	0.065	0.15		0.05
Nickel	0.08		0.07	0.06	0.06
Selenium		0.035	0.033	0.03	0.01
Zinc		0.20	0.04	0.012	0.01
Barium	NA			0.055	0.005
Manganese	NA	0.25		1.11	0.005
Aluminum	NA	2.07		4.54	0.05
Boron	NA			0.27	0.01
Molybdenum	NA			0.17	0.01
Nitrate-nitrogen	NA	0.54		2.9	0.1
1,2-dichloroethane				0.002	0.001
Physical Measurements					
pH, field, s.u.	7.30	7.25	7.27	7.19	
Conductivity		4600	4600	4400	
T.O.C. elevation, ft	5515.77	5515.77	5515.77	5515.77	

NA - Not analyzed for that date

Since heavy metals were not filtered, could have particulates dissolved in acid.

Loss - SO4, High TOC

DTG.33

TABLE 4.1 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY[1]
MW-1

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Depth to groundwater, ft	16.70	14.56	15.74	16.32	
Elevation of groundwater, ft	5499.07	5501.21	5500.03	5499.45	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.2

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-2

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.1	0.18		0.01
Total phenols	0.063	0.023	0.17	0.110	0.001
TOC	18	27	23	15	0.1
TDS	2,796	3,650	3,598	3,664	1
Chloride	200**	1,204.6	993	1,012	1
Sulfate	11.0**	1,750	1,104	1,372	1
Antimony				0.48	0.01
Arsenic		0.094	0.08		0.05
Lead	0.12		0.08		0.05
Nickel	0.07		0.12	0.08	0.06
Selenium		0.070	0.104	0.04	0.01
Silver	0.003				0.002
Zinc		0.020	0.02	0.009	0.01
Physical Measurements					
pH, field, s.u.	7.23	7.17	6.78	7.22	
Conductivity		5400	5500	5800	
T.O.C. elevation, ft	5519.45	5519.45	5519.45	5519.45	
Depth to groundwater, ft	18.80	18.27	18.23	18.4	
Elevation of groundwater, ft	5500.76	5501.18	5501.22	5501.05	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.3

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-3

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.25	0.17	0.07	0.1
Total phenols	0.006	0.006	0.082	0.012	0.001
TOC	29	17	16	12	0.1
TDS	4,836	5,362	5,514	4,860	1
Chloride	1,500**	1,584	1,290	1,290	1
Sulfate	29.5**	1,950	2,056	2,204	1
Toluene		0.003			0.001
Xylene		0.030			0.001
Antimony				0.67	0.01
Arsenic		0.15	0.21		0.05
Cadmium	0.12	0.015		0.11	0.01
Lead	0.14	0.070	0.18		0.05
Mercury	0.004				0.002
Nickel	0.08	0.08	0.14	0.10	0.06
Selenium		0.010	0.100	0.05	0.01
Zinc		0.018	0.018	0.01	0.01
Physical Measurements					
pH, field, s.u.	7.08	7.10	7.06	7.12	
Conductivity		6900	7200	6900	
T.O.C. elevation, ft	5535.85	5535.85	5535.85	5535.85	
Depth to groundwater, ft	32.94	32.80	33.08	33.05	
Elevation of groundwater, ft	5502.91	5503.05	5502.77	5502.8	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.4

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-4

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.5			0.01
Total phenols	0.633	0.430	0.085	0.096	0.001
TOC	110	130	63	170	0.1
TDS	1,868	2,266	2,398	2,128	1
Chloride	500**	989.7	754	675	1
Sulfate		12.5			1
Benzene	11.8	3.1	6.65	1.91	0.001
Toluene	7.5	0.290	0.407	1.78	0.001
Ethylbenzene	0.107	0.070	0.140	4.48	0.001
Antimony				0.40	0.01
Arsenic		0.070	0.08		0.05
Cadmium	0.060				0.01
Lead	0.074	0.066			0.05
Nickel	0.08		0.12		0.06
Selenium		0.080	0.063	0.03	0.01
Zinc		0.019	0.008	0.04	0.01
Barium	NA	3.54		2.3	0.005
Iron		12.0		18.6	0.3
Manganese		3.5		5.7	0.005
Aluminum		1.93		3.8	0.05
Boron				0.7	0.01
Fluoride		0.21			0.01
Nitrate-nitrogen	NA			0.41	0.1
2,4-Dichloro-phenol	0.200				0.001
2,4-Dimethyl-phenol		0.058			0.001
4,6-Dinitro-o-cresol	0.100				0.001
2,4-Dinitro-phenol	0.050				0.001
2-Nitrophenol		0.108	0.026		0.001
4-Nitrophenol	0.090	0.302	0.331		0.001

Low SO_4, N - High TOC
Possible reduction by bacteria (See Hem) P. 116.

TABLE 4.4 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-4

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Phenol	0.202				0.001
Benzo(a)anthracene		0.016	0.010		0.001
Chrysene		0.012			0.001
Fluorene	0.150			0.023	0.001
Naphthalene	0.036	0.019	0.015	0.036	0.001
Pyrene	0.166		0.005		0.001
2-Chlorophenol			0.001		0.001
P-chloro-m-cresol			0.045		0.001
Acenaphthene	0.044			0.049	0.001
Physical Measurements					
pH, field, s.u.	6.84	6.85	6.70	6.73	
Conductivity		3800	3900	3800	
T.O.C. elevation, ft	5524.30	5524.30	5524.30	5524.30	
Depth to groundwater, ft	24.9	24.85	24.32	24.02	
Elevation of groundwater, ft	5499.31	5499.45	5499.98	5500.28	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

Low

TABLE 4.5

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-5

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.2	0.24		0.01
Total phenols	0.006	0.007	0.034	0.021	0.001
TOC	14	21	20	9	0.1
TDS	3,840	3,778	3,184	3,788	1
Chloride	1,100**	1,339.6	1,151	1,118	1
Sulfate	14**	1,800	1,237	1,132	1
Antimony				0.5	0.01
Arsenic		0.087	0.07		0.05
Cadmium	0.10				0.01
Lead	0.16	0.055			0.05
Nickel	0.10		0.09	0.07	0.06
Selenium		0.071	0.03	0.03	0.01
Zinc	0.012	0.02	0.02	0.016	0.01
Barium				0.01	0.005
Manganese		0.025			0.005
Aluminum		2.75		4.34	0.05
Boron				0.24	0.01
Molybdenum				0.08	0.01
Fluoride		0.3		0.580	0.01
Nitrate-nitrogen		12.5		36	0.1
Physical Measurements					
pH, field, s.u.	7.23	7.18	7.19	7.28	
Conductivity		5400	6000	5700	
T.O.C. elevation, ft	5545.10	5545.10	5545.10	5545.10	
Depth to groundwater, ft	40.86	40.97	41.58	44.69	

TABLE 4.5 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-5

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Elevation of groundwater, ft	5404.24	5504.13	5503.52	5500.41	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.6

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-7

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.25	0.10		0.01
Total phenols		0.006	0.036	0.025	0.001
TOC	11	4	4	2	0.1
TDS	6,076	6,406	6,348	6,940	1
Chloride	30**	79.9	20	29	1
Sulfate	5.5**	2,400	5,802	3,630	1
Benzene	0.015		0.058	0.009	0.001
Toluene	0.053		0.006		0.001
Ethylbenzene	0.007		0.004		0.001
Antimony				0.83	0.01
Arsenic		0.36	0.22		0.05
Cadmium	0.050	0.030		0.02	0.01
Chromium		0.052		0.08	0.05
Lead		0.24	0.05	0.26	0.05
Nickel	0.08	0.07	0.08	0.07	0.06
Selenium		0.65	0.36	0.09	0.01
Silver		0.060			0.05
Zinc	0.018	0.016	0.02	0.017	0.001
4,6-Dinitro-o-cresol	0.013				0.001
Benzo(a)anthracene		0.001			0.001
Chyrsene				0.002	0.001
4-Nitrophenol			0.007		0.001
P-chloro-m-cresol			0.001		0.001
Benzo(k)fluoranthene				0.001	0.001

TABLE 4.6 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-7

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Physical Measurements					
pH, field, s.u.	12.15	11.08	11.35	10.58	
Conductivity		8100	8600	8000	
T.O.C. elevation, ft	5524.09	5524.09	5524.09	5524.09	
Depth to groundwater, ft	26.07	51.00	31.30	24.68	
Elevation of groundwater, ft	5498.02	5473.09	5492.79	5499.41	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.7

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-8

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide				0.1	0.01
Total phenols		0.005	0.097	0.042	0.001
TOC	5	13	8	8	0.1
TDS	806	2,910	2,284	3,450	1
Chloride	160**	839.7	576	913	1
Sulfate	4.0**	1,500	586	1,270	1
Ethylbenzene	0.107				0.01
Antimony				0.67	0.01
Arsenic		0.072	0.03		0.05
Lead		0.055			0.05
Nickel		0.86	0.21	0.43	0.06
Selenium		0.21		0.04	0.01
Zinc		0.020	0.02	0.016	0.01
4-Nitrophenol			0.008		0.01
Physical Measurements					
pH, field, s.u.	7.86	7.26	7.47	7.44	
Conductivity		4400	4000	5000	
T.O.C. elevation, ft	5531.12	5531.12	5531.12	5531.12	
Depth to groundwater, ft	29.15	29.08	29.00	29.02	
Elevation of groundwater, ft	5501.97	5502.04	5502.12	5502.1	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.8

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-9

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide		0.4			0.01
Total phenols	0.304	0.372	0.17	0.16	0.001
TOC	143	1,809	240	275	0.1
TDS	2,360	1,718	1,428	1,684	1
Chloride	149**	1,009.7	89	109	1
Sulfate	13.0**	114		20	1
Benzene	7.4	4	17.7	1.49	0.001
Toluene	6.3	1.7	10.6	0.754	0.001
Ethylbenzene	3.2	0.71	0.015	0.504	0.001
Antimony				0.4	0.01
Arsenic			0.02		0.05
Lead		0.059			0.05
Nickel	0.30	0.25	0.13	0.16	0.06
Selenium		0.040		0.03	0.01
Zinc	0.012	0.015	0.05	0.011	0.01
2,4-Dimethyl-phenol	0.160	0.150			0.001
Phenol	0.149	0.170	0.013	0.133	0.001
Fluorene	0.012				0.001
4-Nitrophenol			1.10		0.001
Acenaphthalene			0.028		0.001
Benzo(a)anthra-cene			0.007		0.001
Pyrene			0.010		0.001
Naphthalene				0.029	0.001

TABLE 4.8 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-9

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Physical Measurements					
pH, field, s.u.	7.01	6.98	6.89	6.91	
Conductivity		2500	2200	2600	
T.O.C. elevation, ft	5519.70	5519.70	5519.70	5519.70	
Depth to groundwater, ft	21.50	20.23	20.13	20.55	
Elevation of groundwater, ft	5498.20	5499.47	5499.57	5499.15	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

TABLE 4.9

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-10

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Laboratory Analysis (mg/l)					
Cyanide			0.050		0.01
Total phenols	0.147	0.186	0.065	0.055	0.001
TOC	34	76	125	114	0.1
TDS	1,546	2,820	2,408	3,272	1
Chloride	245**	569.8	587	457	1
Sulfate	5.3**	165		10	1
Benzene	0.093		0.041	14.1	0.002
Toluene			0.054	7.4	0.001
Ethylbenzene				0.03	0.001
Antimony				0.56	0.01
Arsenic		0.053			0.05
Beryllium				0.04	0.01
Cadmium	0.020				0.01
Lead		0.059	0.05		0.05
Nickel	0.08	0.25	0.18	0.08	0.06
Selenium		0.040	0.071	0.03	0.01
Zinc		0.015	0.16	0.01	0.01
2,4-Dimethyl-phenol	0.025				0.001
4,6-Dinitro-o-cresol	0.020				0.001
Phenol	0.090				0.001
Anthracene	0.039				0.001
Fluoranthene	0.034				0.001
Fluorene	0.033				0.001
Pyrene	0.030				0.001
2-Nitrophenol			0.002		0.001
4-Nitrophenol			0.016		0.001
Naphthalene				0.004	0.001

TABLE 4.9 (Continued)

RCRA 3013
GROUNDWATER RESULTS SUMMARY*
MW-10

Parameter	3/26/86	6/23/86	9/18/86	12/16/86	Nominal Detection Limits
Physical Measurements					
pH, field, s.u.	7.07	7.08	6.93	7.05	
Conductivity		4400	4800	5100	
T.O.C. elevation, ft	5516.86	5516.86	5516.86	5516.86	
Depth to groundwater, ft	19.20	18.75	18.11	17.56	
Elevation of groundwater, ft	5497.66	5498.11	5498.75	5499.3	

*Summary includes only pollutants determined to be present at concentrations greater than detection limits.

**Laboratory technique error detected.

of these compounds is believed to suggest the possibility of laboratory error — particularly when the reported concentration of the substance is very near detection limits.

A good example of the singularity of results is seen in Table 4.6, which reports a summary of monitoring well 7 results. Every hydrocarbon substance detected was at low levels close to the detection limit. Laboratory error may be responsible for detection of these substances.

The monitoring well sampling method is also important in assessing the significance of sample results. Basically, the technique involved BRC staff collection of a sample of water such that the air/liquid interface was acquired in the sample. This process maximized the possibility of acquiring any free-phase hydrocarbons and thus the highest concentrations in the sample. Therefore, sample concentrations for each sampling effort constitute a worst-case assessment of the well water when floating separate-phase contaminants are present.

The significance of concentrations measured at the BRC monitoring wells should be judged from two different standpoints: (1) water use, and (2) subsurface hydrocarbon contamination. From a water use standpoint, the concentrations of pollutants under the BRC site are insignificant. Groundwater is not currently used, and there are no plans for its use in the future.

The monitoring well sampling results include an indicator parameter in total organic carbon (TOC). This parameter can be useful in identifying suspected locations of significant concentrations of subsurface hydrocarbon since TOC values are generally higher in samples having free product.

A review of Tables 4.1 through 4.10 show that TOC values measured in monitoring well 4 were higher than all wells except 9 and 10. Well 9 has exhibited an indication of films of hydrocarbon material at the surface (reported by BRC staff on January 27, 1987). The fact that the TOC results from this well are the highest is consistent with an indication of films in this well. Films have also been indicated in monitoring well 10 during the third and fourth quarter sampling efforts recorded by

BRC staff January 27, 1987. This evidence is consistent with the highest TOC values recorded for these two sampling efforts. The proximity of well 10 to well 4 and the similarity of their respective TOC values during periods of indications of floating hydrocarbon evidence suggest they may be influenced by the same source of hydrocarbon material.

CHAPTER 5

GROUNDWATER MONITORING WELL WATER LEVEL MEASUREMENTS

BACKGROUND

In accordance with the EPA-approved work plan, water levels have been measured by Bloomfield staff monthly at each of the groundwater monitoring wells located on the Bloomfield refinery property. Water level measurements commenced in January 1986. Since installation of monitoring wells 7 through 10 was completed in March 1986, water level measurements for these wells commenced in March.

In addition to water level measurements made in the wells, measurements were also made on Hammond Ditch at its intersection with Sullivan Road and at a walkway bridge on refinery property. These water levels and the well water level measurements are presented in Figures 5.1 through 5.16. Hammond Ditch measurement locations are also indicated on the figures.

METHODOLOGY

Two approaches were employed to evaluate the monthly water level measurements. In the first approach, groundwater elevations measured at each well were plotted on a map of the BRC site. Then groundwater contours were drawn on these maps based on the relative orientation of measured elevations. The water levels shown by monitoring well 7 were ignored in this process because they represented water levels in the Nacimiento rather than the cobble zone (represented by the other wells). The contours were drawn using both solid and dashed lines. Solid lines constitute an interpolative estimation of groundwater gradient for the given data of groundwater elevations. The dashed lines consitute a presumption of the influences of Hammond Ditch, the evaporation pond, and spray irrigation fields on the groundwater regime. These lines also assume that no irregularities in flow patterns exist in the subsurface beneath the process and refined product storage areas. These maps are presented as Figures 5.1 through 5.16.

FIGURE 5.1

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 1/24/86 AT THE BLOOMFIELD REFINERY

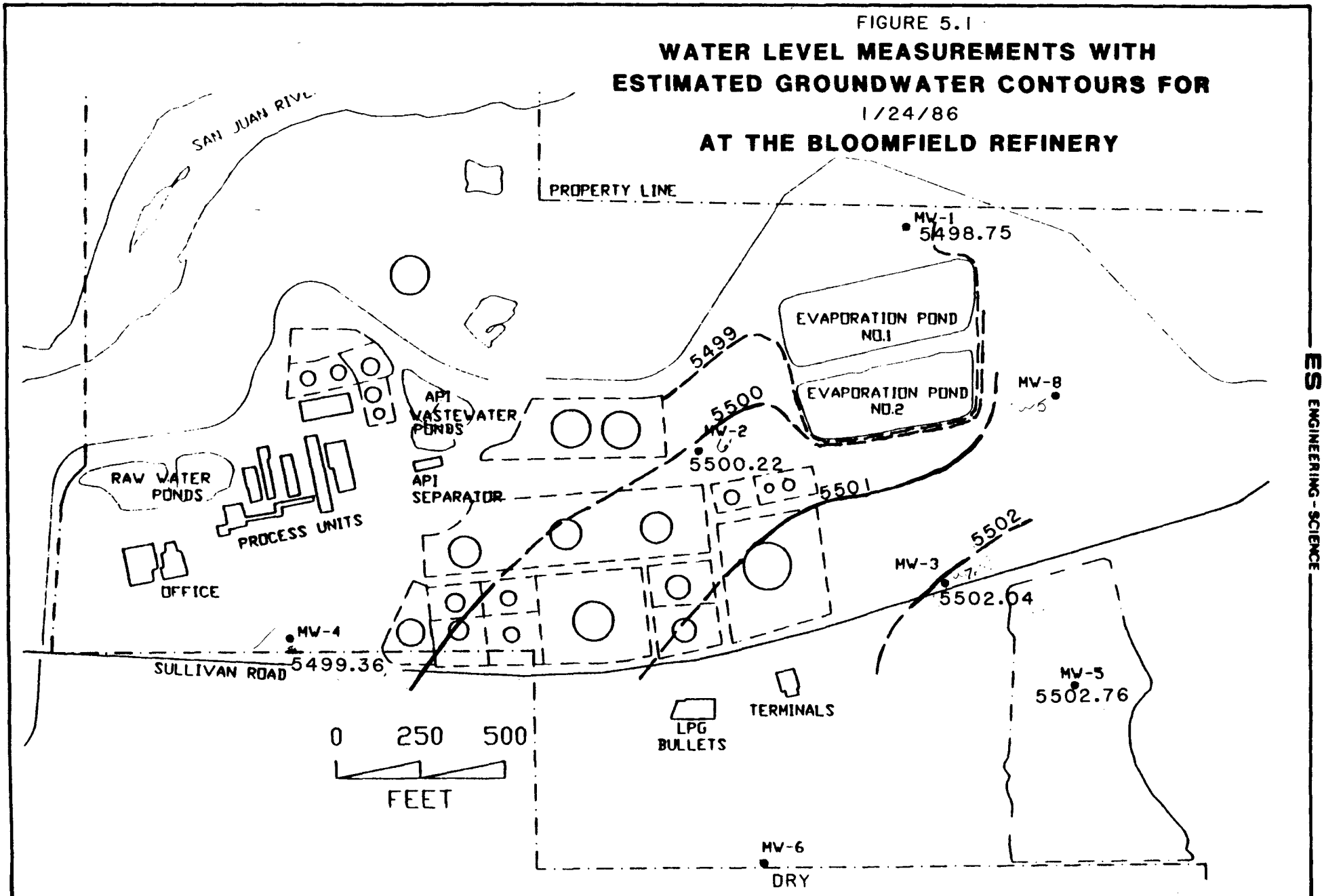


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FIGURE 5.2

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 2/20/86 AT THE BLOOMFIELD REFINERY

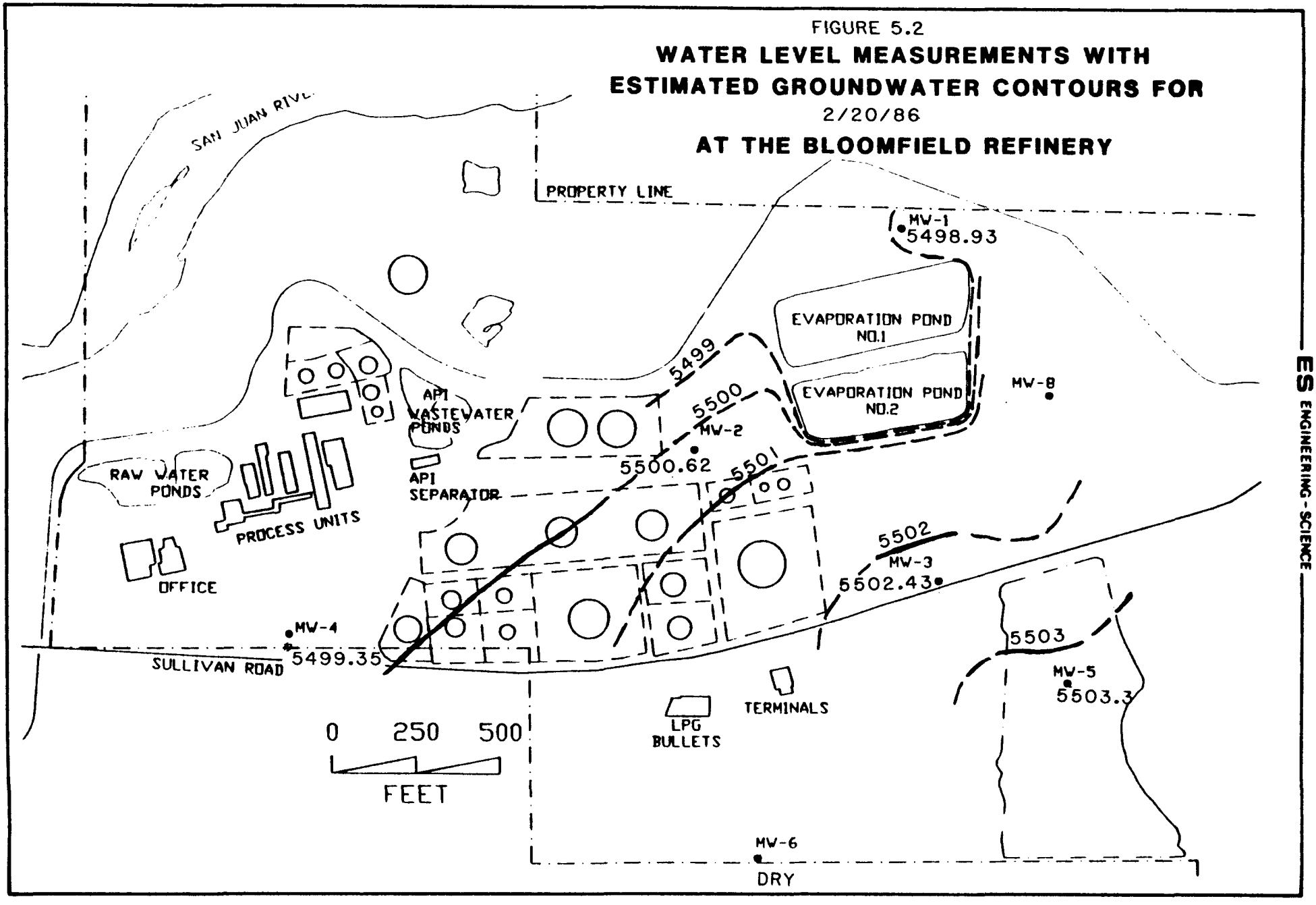

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FIGURE 5.3

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 3/21/86 AT THE BLOOMFIELD REFINERY

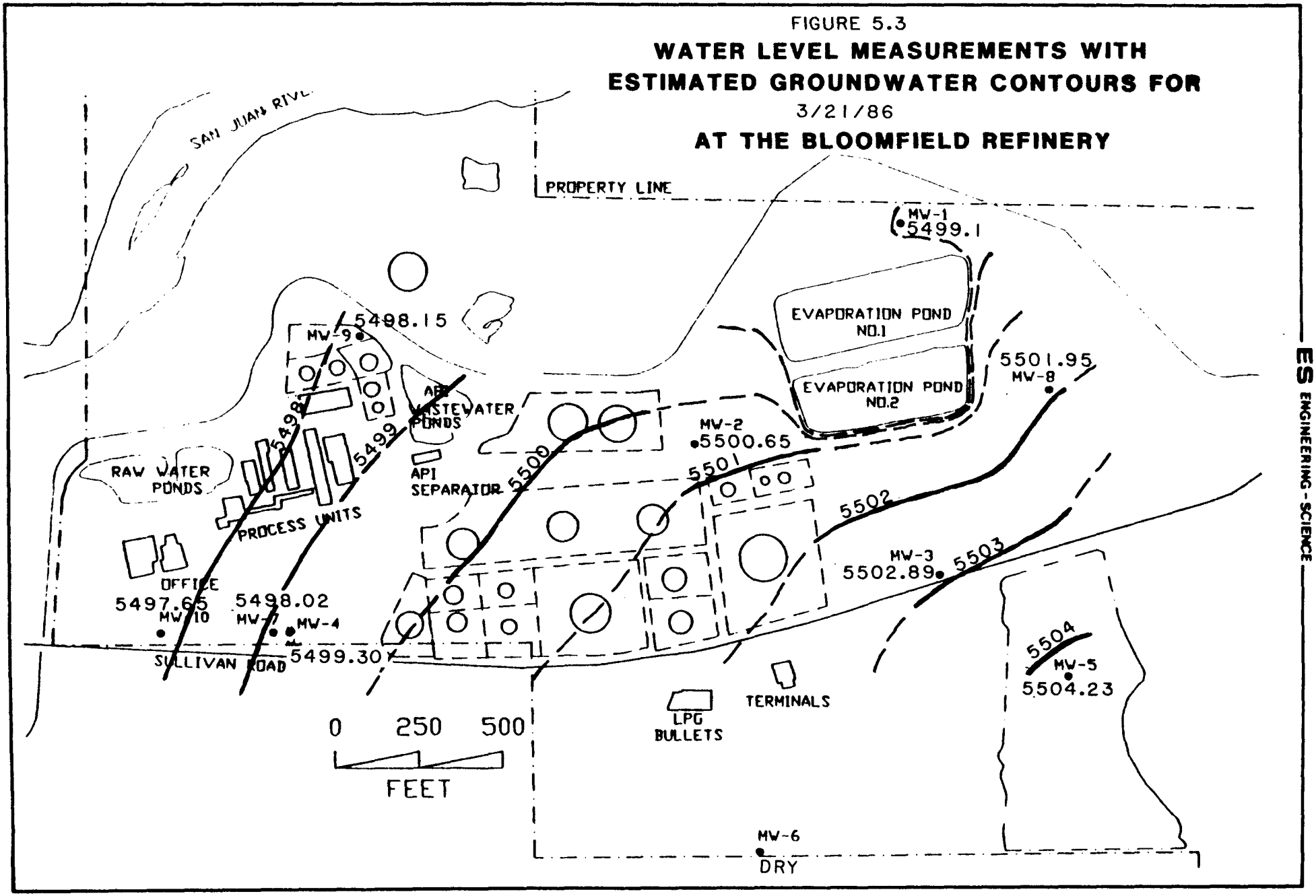

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FIGURE 5.4

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 3/26/86 AT THE BLOOMFIELD REFINERY

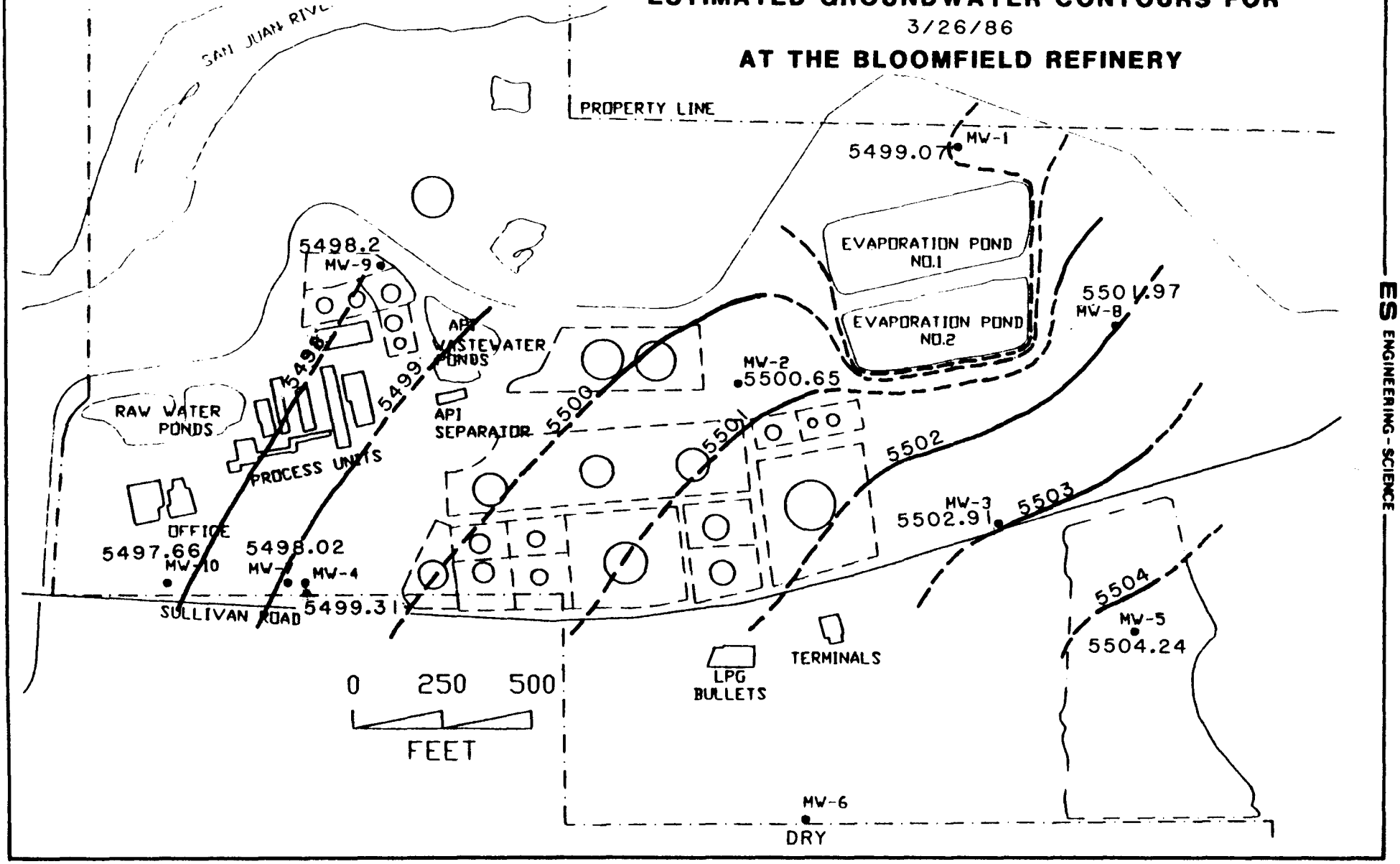

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FIGURE 5.5

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 4/4/86 AT THE BLOOMFIELD REFINERY

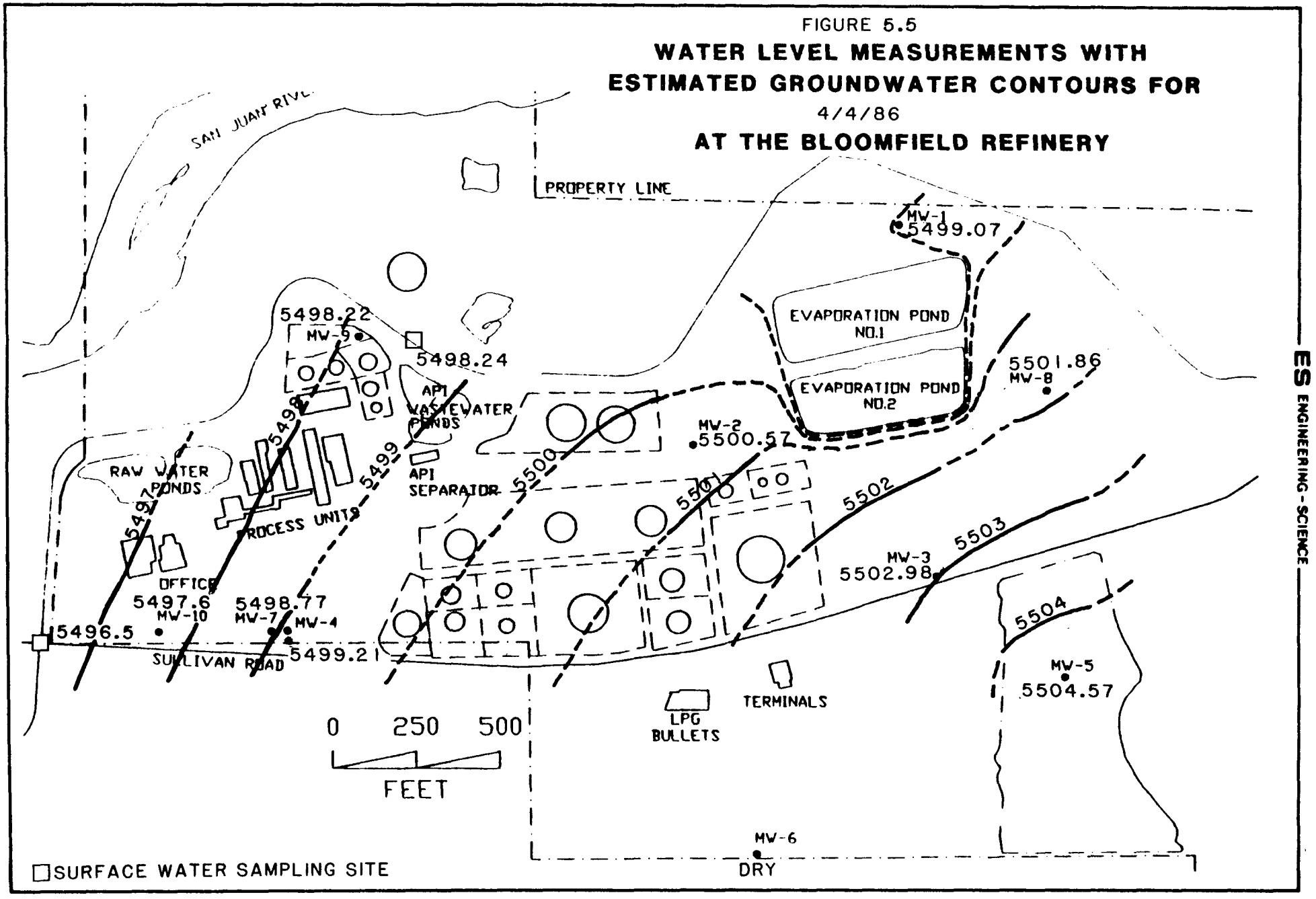

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FIGURE 5.6

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 4/18/86 AT THE BLOOMFIELD REFINERY

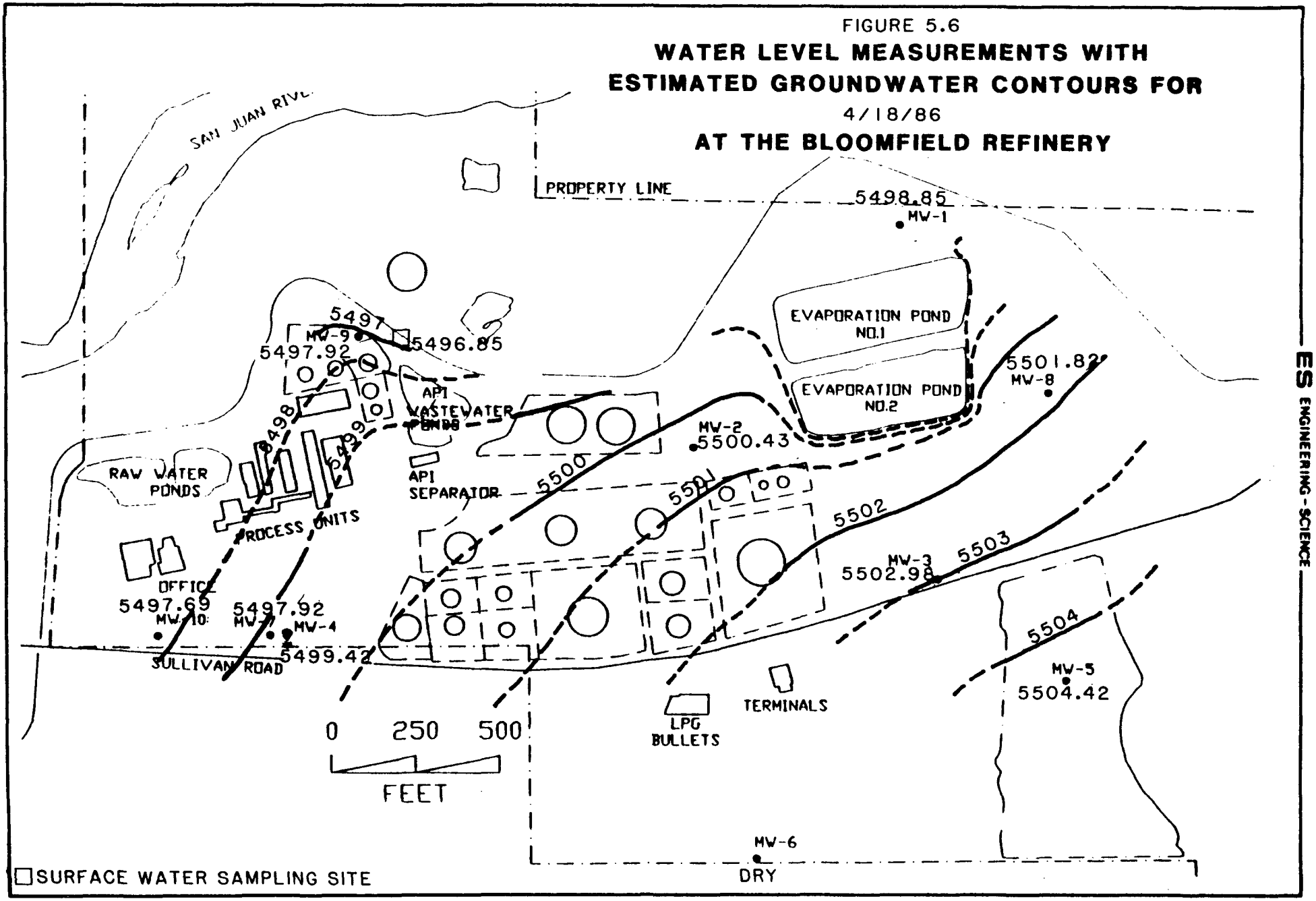

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FIGURE 5.7

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 5/5/86 AT THE BLOOMFIELD REFINERY

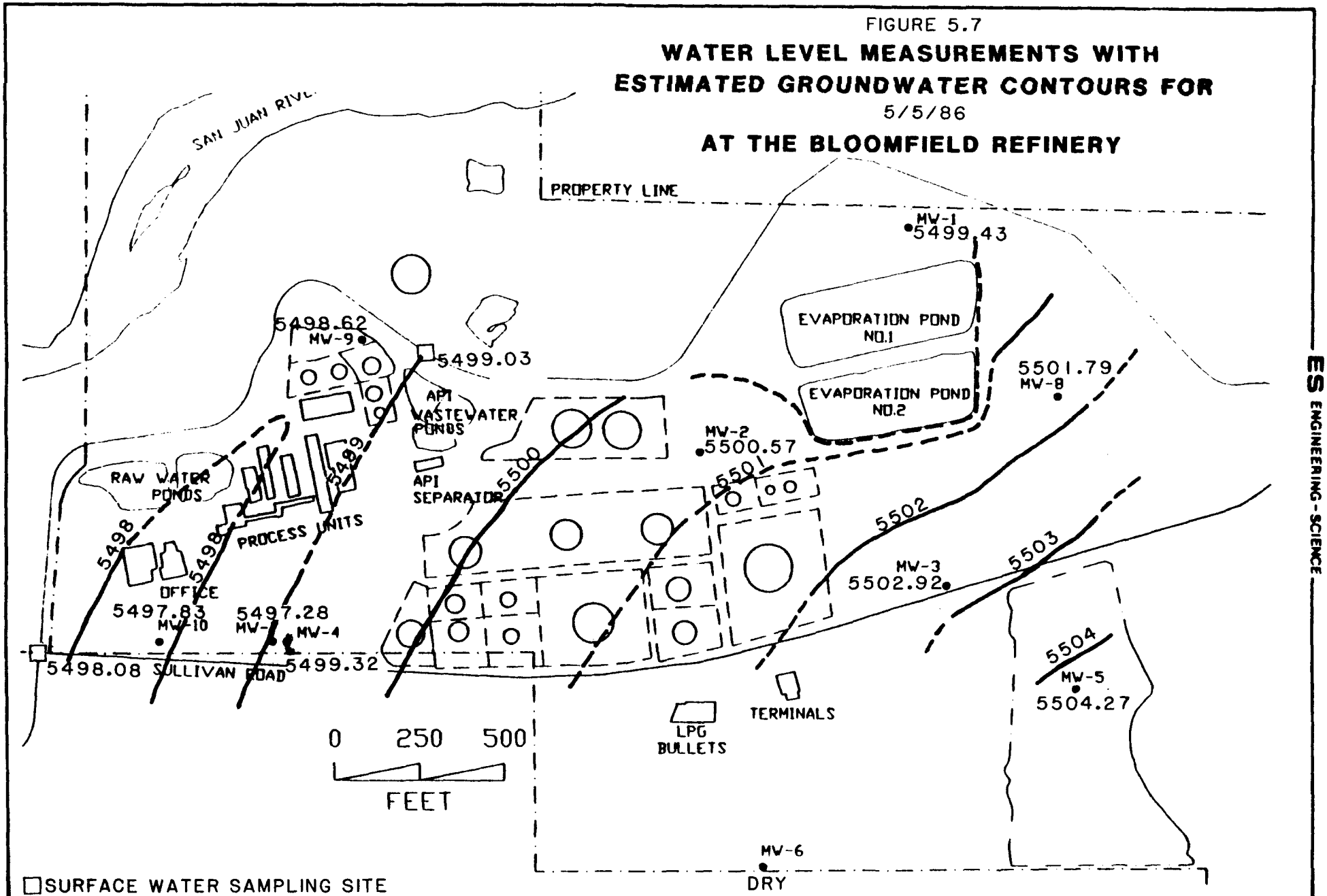

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FIGURE 5.8

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 5/21/86 AT THE BLOOMFIELD REFINERY

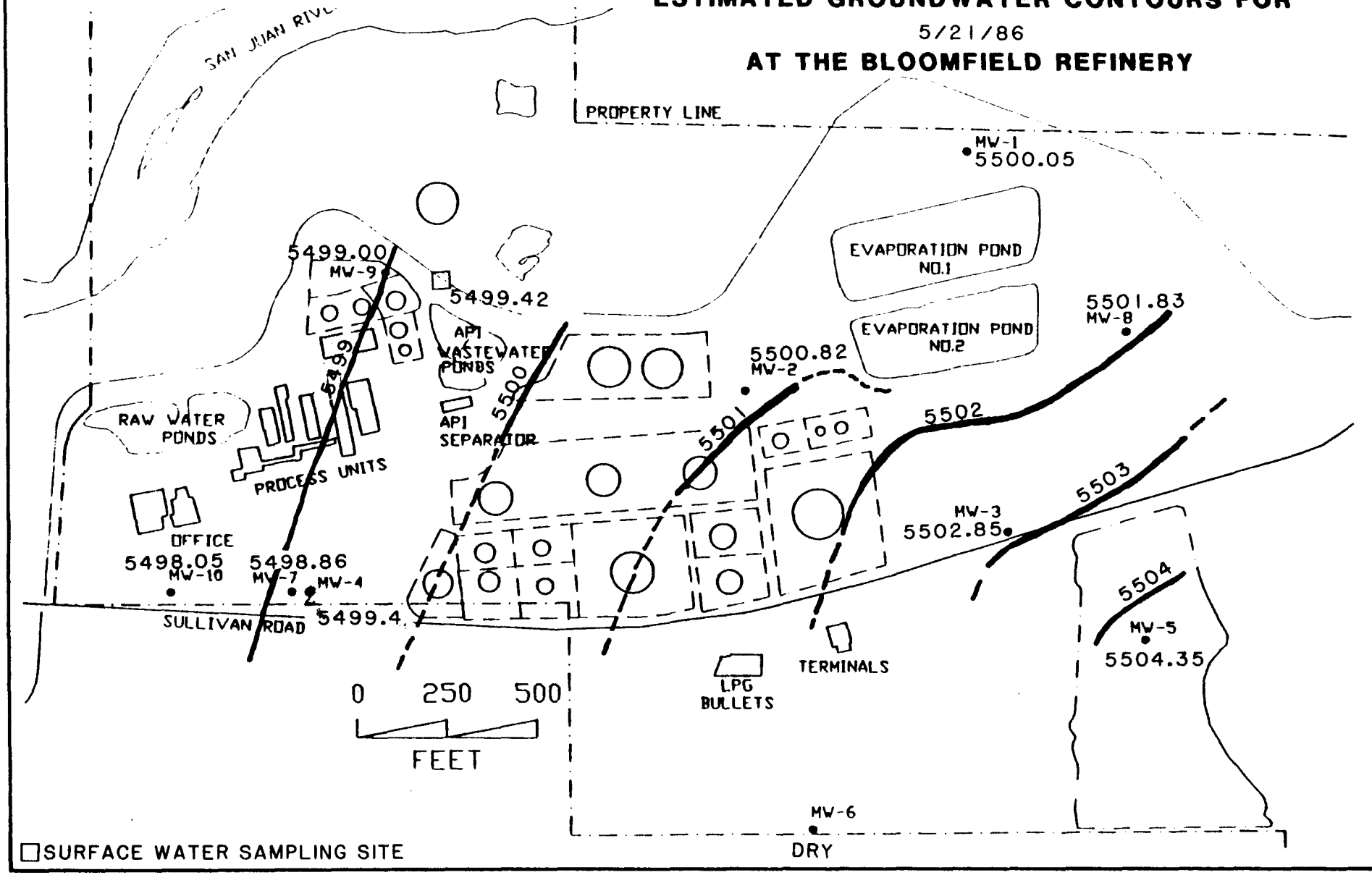

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FIGURE 5.9

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 6/4/86 AT THE BLOOMFIELD REFINERY

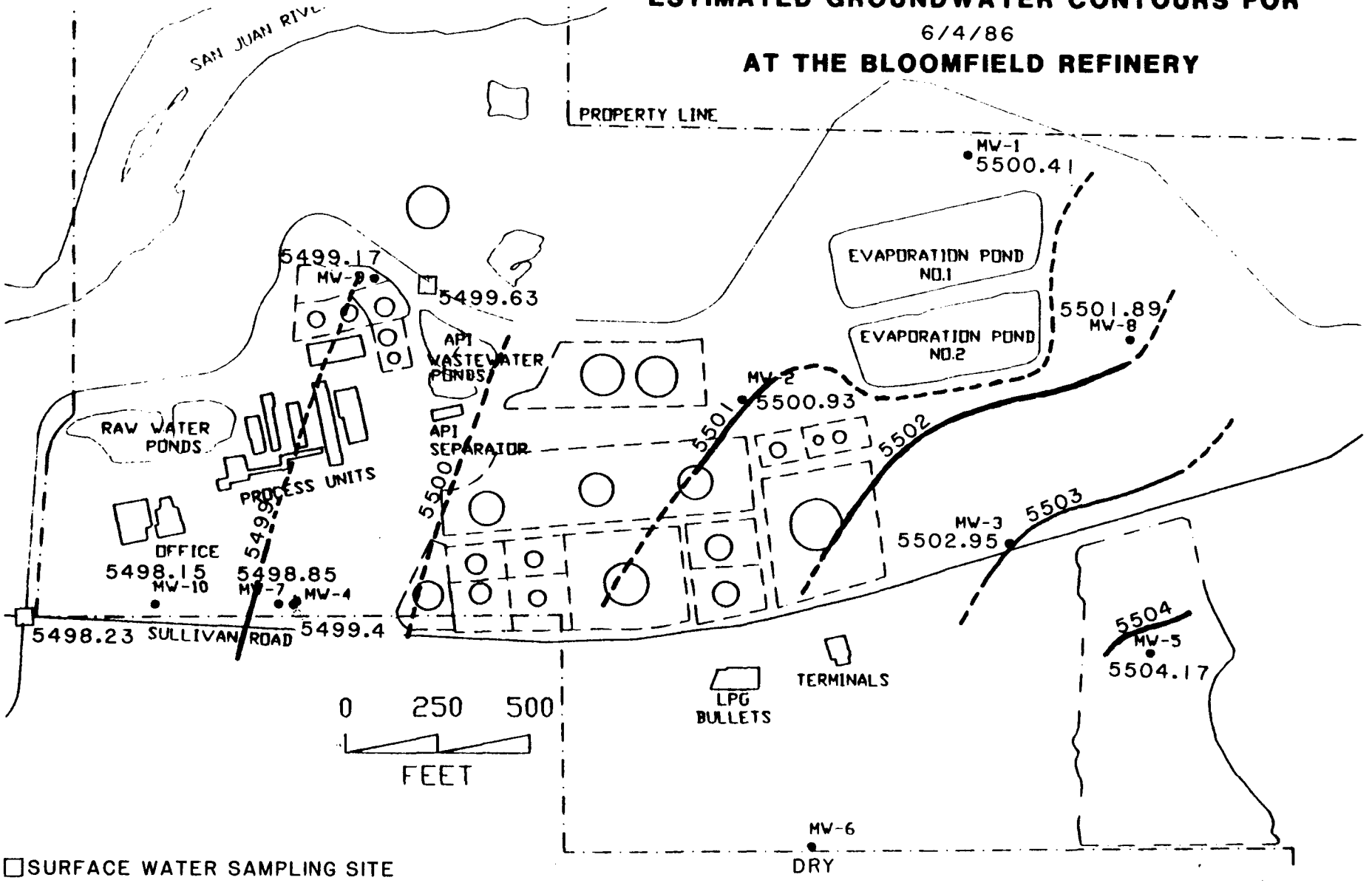

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FIGURE 5.10

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 7/8/86 AT THE BLOOMFIELD REFINERY

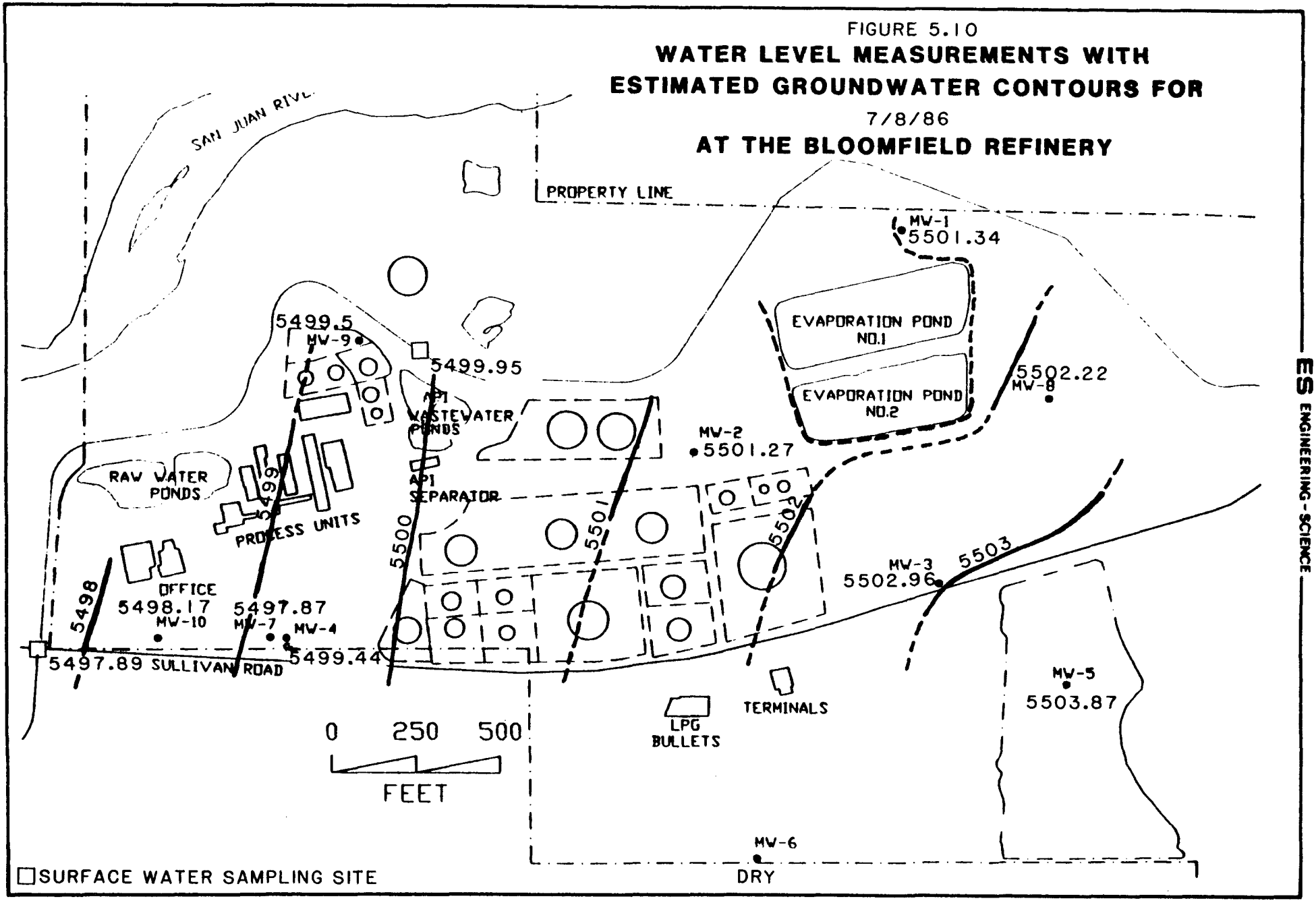

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FIGURE 5.11

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 8/4/86 AT THE BLOOMFIELD REFINERY

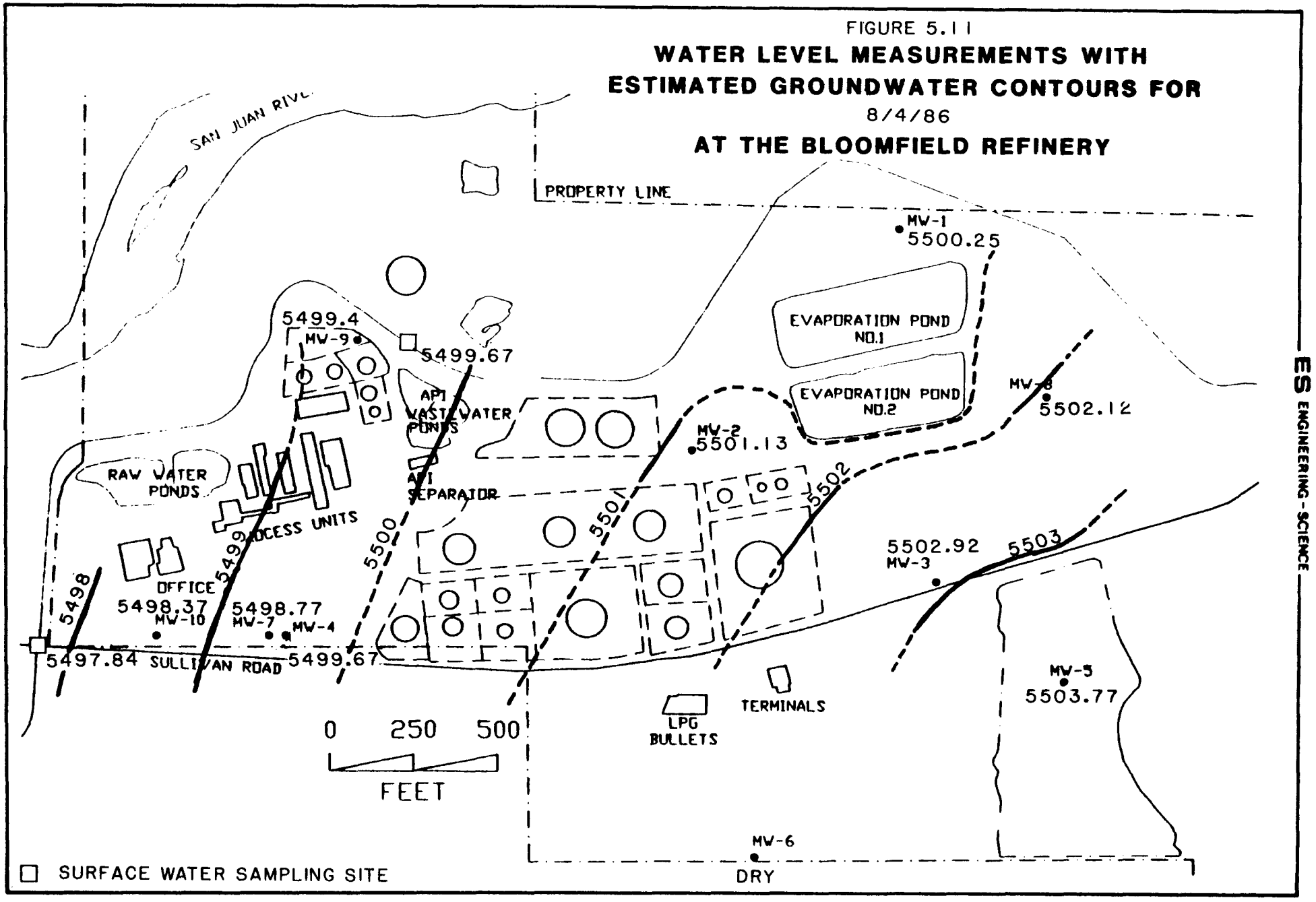

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FIGURE 5.12

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 9/2/86 AT THE BLOOMFIELD REFINERY

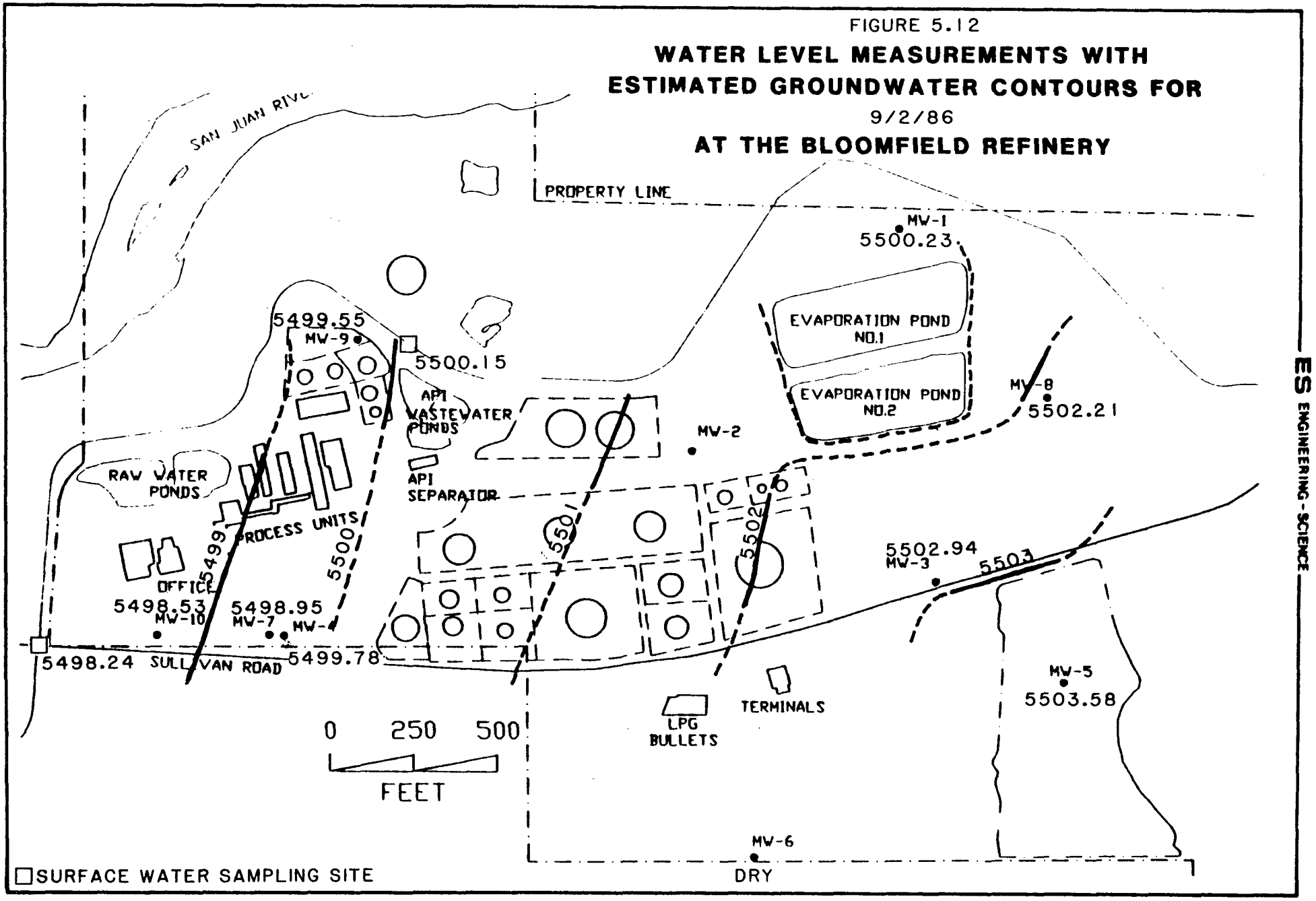

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FIGURE 5.13

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 10/8/86 AT THE BLOOMFIELD REFINERY

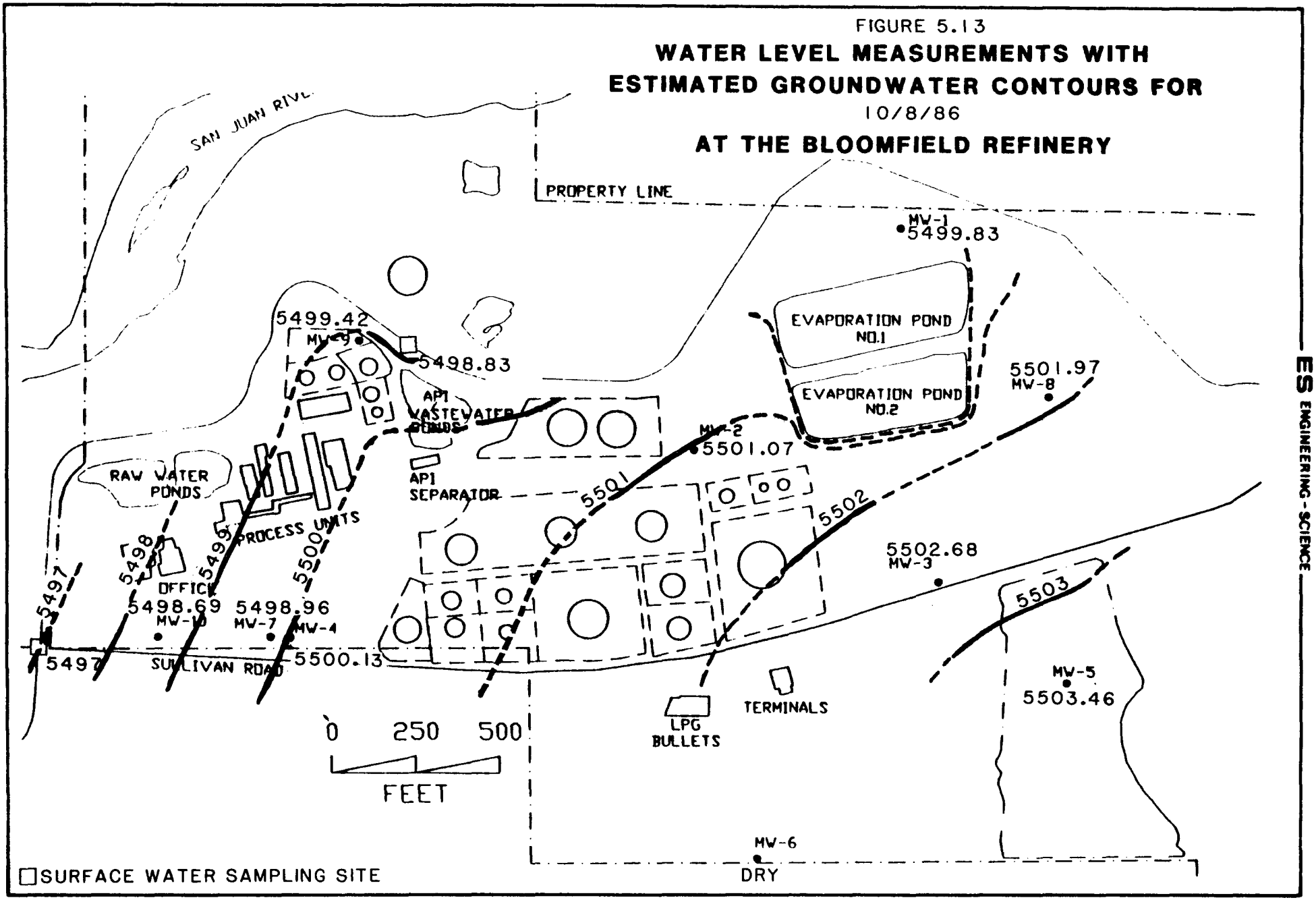

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FIGURE 5.14

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 11/7/86 AT THE BLOOMFIELD REFINERY

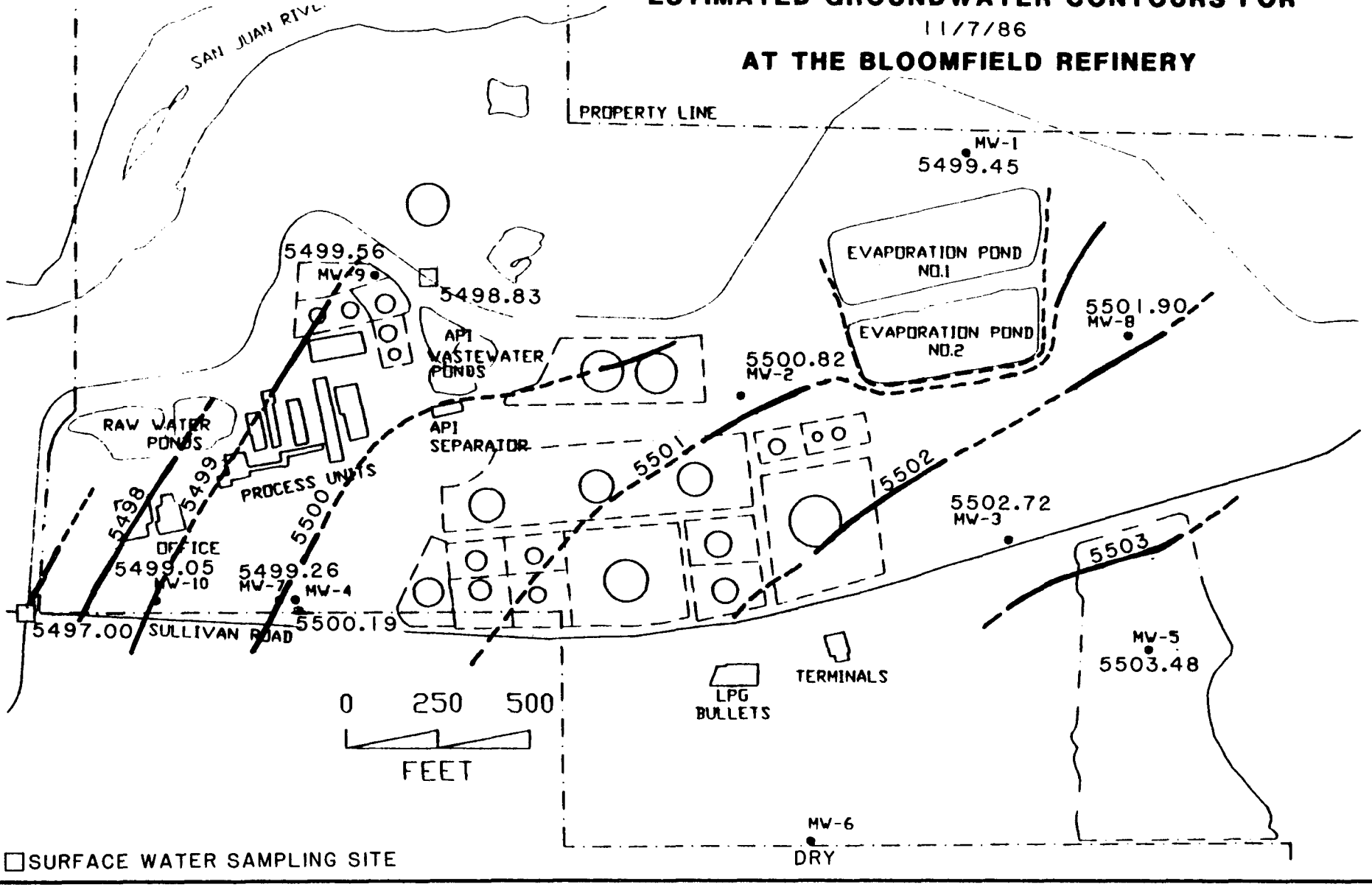

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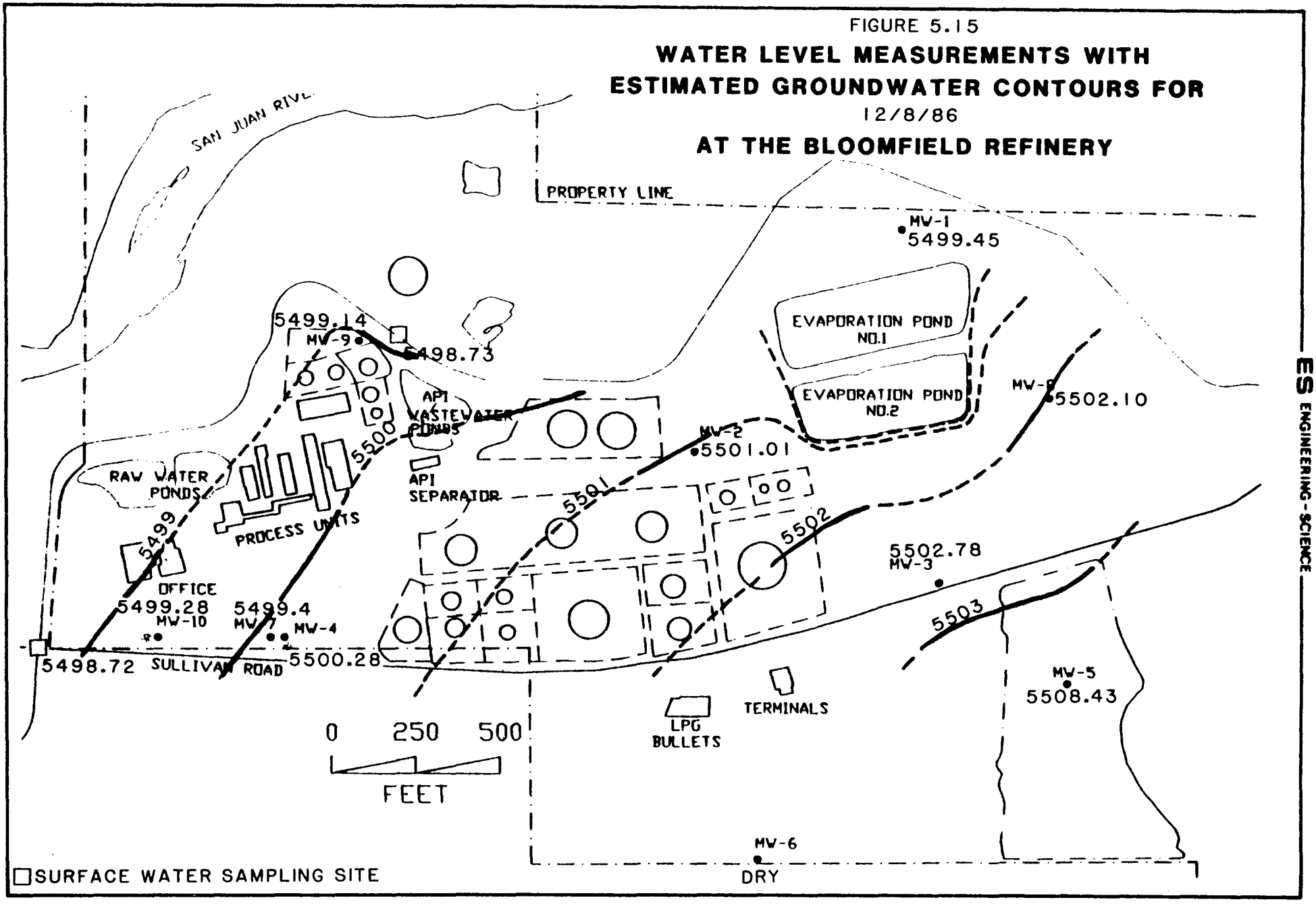
FIGURE 5.15

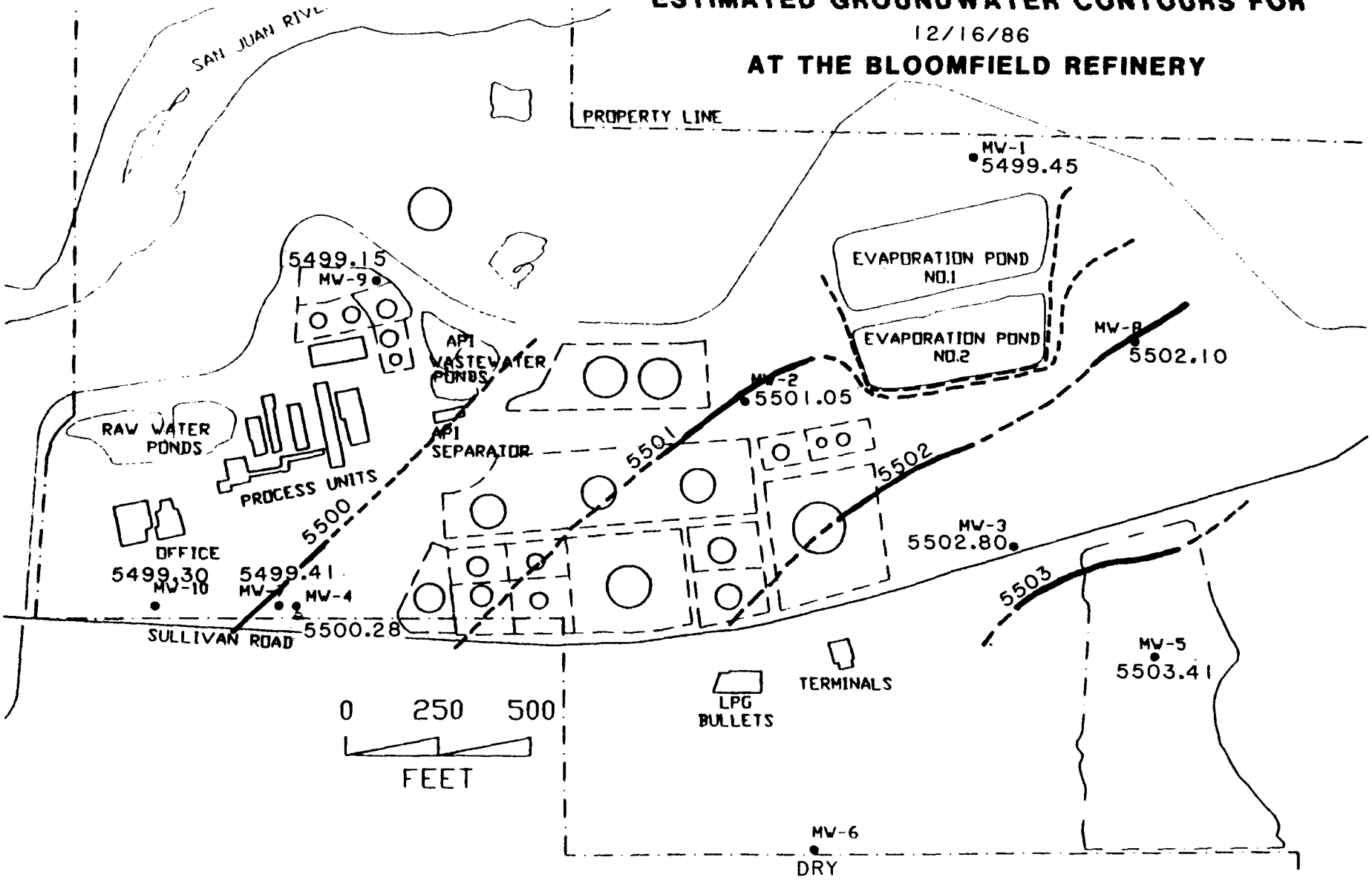
WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 12/8/86 AT THE BLOOMFIELD REFINERY



ES ENGINEERING-SCIENCE

FIGURE 5.16

WATER LEVEL MEASUREMENTS WITH ESTIMATED GROUNDWATER CONTOURS FOR 12/16/86 AT THE BLOOMFIELD REFINERY



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In the second approach, time series plots were constructed of groundwater elevations measured in each well. A listing of the plotted elevations is provided in Table 5.1. Time series plots of surface water elevations, determined by BRC staff for Hammond Ditch at both Sullivan Road and a walkway bridge located upstream on BRC property, were superimposed on monitoring wells 1, 4, 9, and 10 due to their proximity to Hammond Ditch. These plots, presented as Figures 5.17 and 5.18, were developed to evaluate the effect of Hammond Ditch on the site's groundwater. Figure 5.19 contains a comparison of the response of monitoring wells 2, 3, 5, 8, and 9. Figure 5.20 compares monitoring wells 4 and 7.

DISCUSSION

Based on the delineation of contours on Figures 5.1 through 5.16, flow through the site occurs generally in a northwesterly direction toward Hammond Ditch. However, there is an insufficient number of wells over the site to obtain more than a generalized picture of flow.

The time series plots presented in Figures 5.17 and 5.18 show that groundwater levels are definitely influenced by flow in Hammond Ditch. In Figure 5.17, water levels in Hammond Ditch at the walkway bridge are shown to be higher than water levels in monitoring well 9. This relationship means that, during irrigation season, groundwater from the site does not flow into Hammond Ditch. Instead, water flows from higher elevations in the refinery to a point where water mounded in the ditch bank precludes further flow toward the ditch. It is believed the mounding effect creates a trough in groundwater contours on the refinery side of the ditch. This trough is believed to be an avenue of transport for groundwater movement downstream along a path parallel to Hammond Ditch. The width of the trough should be locally affected by the area groundwater gradients.

The relationship of the groundwater level in monitoring wells 2, 3, 5, 8, and 9 to seasonal Hammond Ditch flows is presented in Figure 5.19. In this figure, monitoring well 9 is used as a basis of comparison from water levels presented in Figure 5.17. Based on the performance of these

TABLE 5.1

GROUNDWATER ELEVATIONS MEASURED AT BLOOMFIELD REFINING COMPANY

Date	MW-1	MW-2	MW-3	MW-4	MW-5	MW-7	MW-8	MW-9	MW-10	Hammond Ditch at Sullivan Road	Hammond Ditch at Walkway
02/23/85	5499.07	5500.55	5502.15	5499.30	5502.75						
03/18/85	5499.14	5500.82	5502.55	5499.32	5503.50						
04/11/85	5498.99	5500.62	5502.73	5499.30	5503.67						
05/31/85	5499.67	5500.97	5502.74	5499.80	5503.64						
06/14/85	5499.80	5500.99	5502.63	5499.80	5503.40						
06/26/85	5499.94	5500.98	5502.49	5499.73	5503.24						
07/10/85	5500.20	5500.99	5502.48	5499.80	5503.30						
08/02/85	5501.00	5501.25	5502.48	5499.78	5503.37						
09/17/85	5500.34	5501.05	5502.25	5499.80	5503.00						
10/09/85	5500.03	5500.87	5502.42	5499.70	5503.30						
10/24/85	5499.23	5500.43	5502.28	5499.54	5503.10						
11/08/85	5498.72	5500.05	5502.20	5499.60	5503.09						
12/17/85	5498.35	5499.85	5501.85	5499.40	5502.90						
01/08/86	5498.59	5500.08	5501.85	5499.35	5502.77						
01/24/86	5498.75	5500.22	5502.04	5499.36	5502.76						
02/20/86	5498.93	5500.62	5502.43	5499.35	5503.30						
03/21/86	5499.10	5500.65	5502.89	5499.30	5504.23	5498.02	5501.95	5498.15	5497.65		
03/26/86	5499.07	5500.65	5502.91	5499.31	5504.24	5498.02	5501.97	5498.20	5497.66		
04/04/86	5499.07	5500.57	5502.98	5499.21	5504.57	5498.77	5501.86	5498.22	5497.60	5496.50	5498.24
04/18/86	5498.85	5500.43	5502.98	5499.42	5504.42	5497.92	5501.82	5498.90	5497.69		5496.85
05/05/86	5499.43	5500.57	5502.92	5499.32	5504.27	5497.28	5501.79	5498.62	5497.83	5498.08	5499.03
05/21/86	5500.05	5500.82	5502.85	5499.40	5504.35	5498.86	5501.83	6599.00	5498.05	5498.25	5499.42
06/04/86	5500.41	5500.93	5502.95	5499.40	5504.17	5498.85	5501.89	5499.17	5498.15	5498.23	5499.63
06/23/86	5501.21	5501.18	5503.05	5499.45	5504.13						
07/08/86	5501.34	5501.27	5502.96	5499.44	5503.87	5497.87	5502.22	5499.50	5498.17	5497.89	5499.95
08/04/86	5500.25	5501.13	5502.92	5499.67	5503.77	5498.77	5502.12	5499.40	5498.37	5497.84	5499.67
09/02/86	5500.23	5501.32	5502.94	5499.78	5503.58	5498.95	5502.21	5499.55	5498.53	5498.24	5500.15
09/18/86	5500.03	5501.22	5502.77	5499.98	5503.52						
10/08/86	5499.83	5501.07	5502.68	5500.13	5503.46	5499.96	5501.97	5499.42	5498.69	5497.00	5498.83
11/07/86	5499.45	5500.82	5502.72	5500.19	5503.48	5499.26	5501.90	5499.56	5499.05	5497.00	5498.83
12/08/86	5499.45	5501.01	5502.78	5500.28	5503.43	5499.40	5502.10	5499.14	5499.28	5498.72	5498.73
12/16/86	5499.45	5501.05	5502.80	5500.28	5503.41	5499.41	5502.10	5499.15	5499.30		

NOTES:

MW-6 was dry for the entire time period.

Measurements from project startup through 7/8/86 were not stabilized due to slow recovery from well purging.

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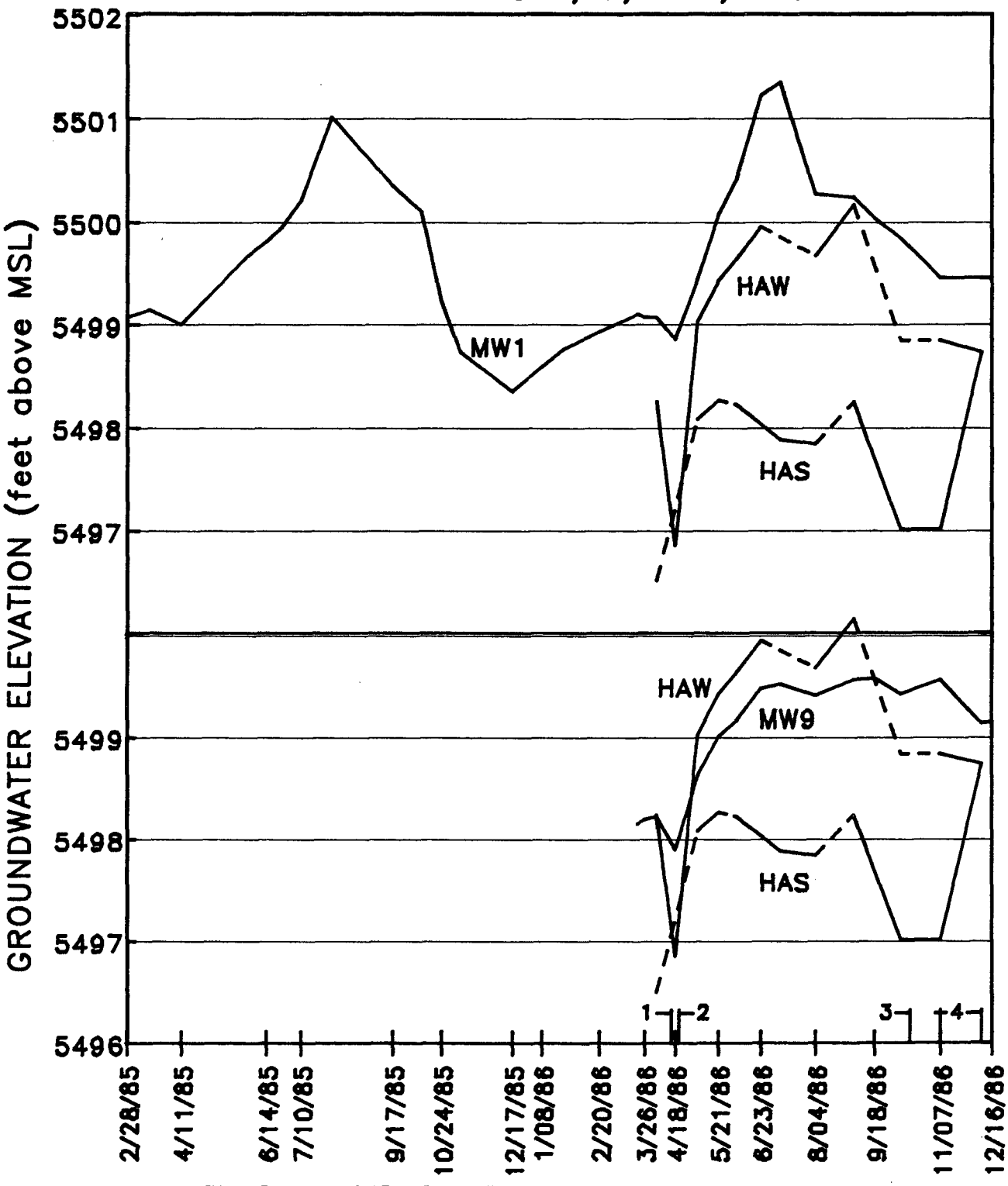
FIGURE 5.17
GROUNDWATER ELEVATIONS
BLOOMFIELD REFINING – BLOOMFIELD, NEW MEXICO
MONITORING WELLS 1, 9, HAW, HAS



1 – DITCH DIKES REMOVED 4/15/86
2 – IRRIGATION WATER RELEASES BEGUN 4/21/86
3 – IRRIGATION WATER RELEASES SUSPENDED 10/15/86
4 – IRRIGATION DITCH FILLED WITH WATER AND WATER LEVEL STABILIZED
HAW–HAMMOND DITCH AT WALKWAY BRIDGE
HAS–HAMMOND DITCH AT SULLIVAN ROAD

DSK1/BLGWA

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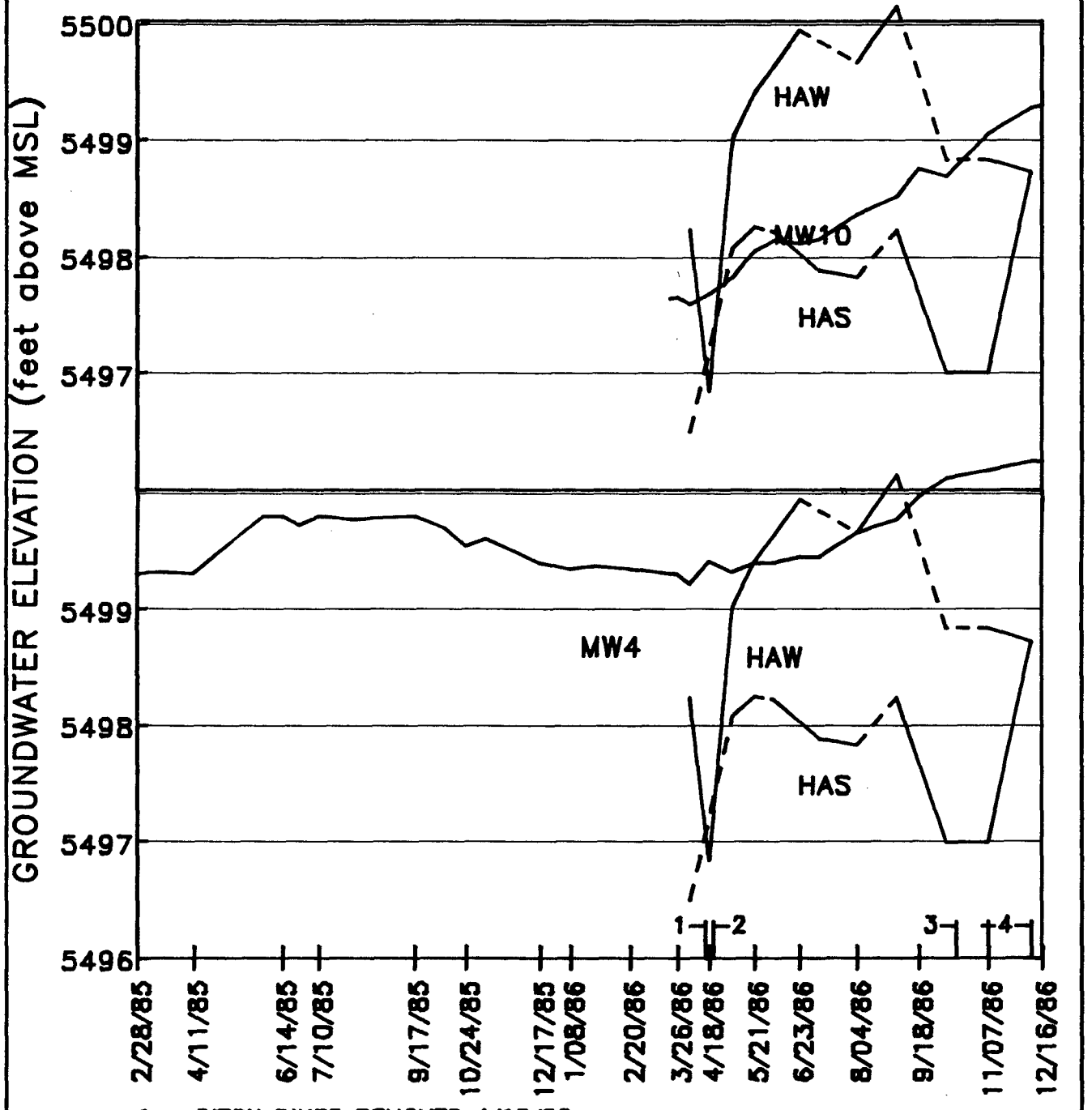
FIGURE 5.18
GROUNDWATER ELEVATIONS
BLOOMFIELD REFINING – BLOOMFIELD, NEW MEXICO
MONITORING WELLS 4, 10, HAW, HAS



1 – DITCH DIKES REMOVED 4/15/86
2 – IRRIGATION WATER RELEASES BEGUN 4/21/86
3 – IRRIGATION WATER RELEASES SUSPENDED 10/15/86
4 – IRRIGATION DITCH FILLED WITH WATER AND WATER LEVEL STABILIZED
HAW–HAMMOND DITCH AT WALKWAY BRIDGE
HAS–HAMMOND DITCH AT SULLIVAN ROAD

DSK1/BLGWB

still monitoring?

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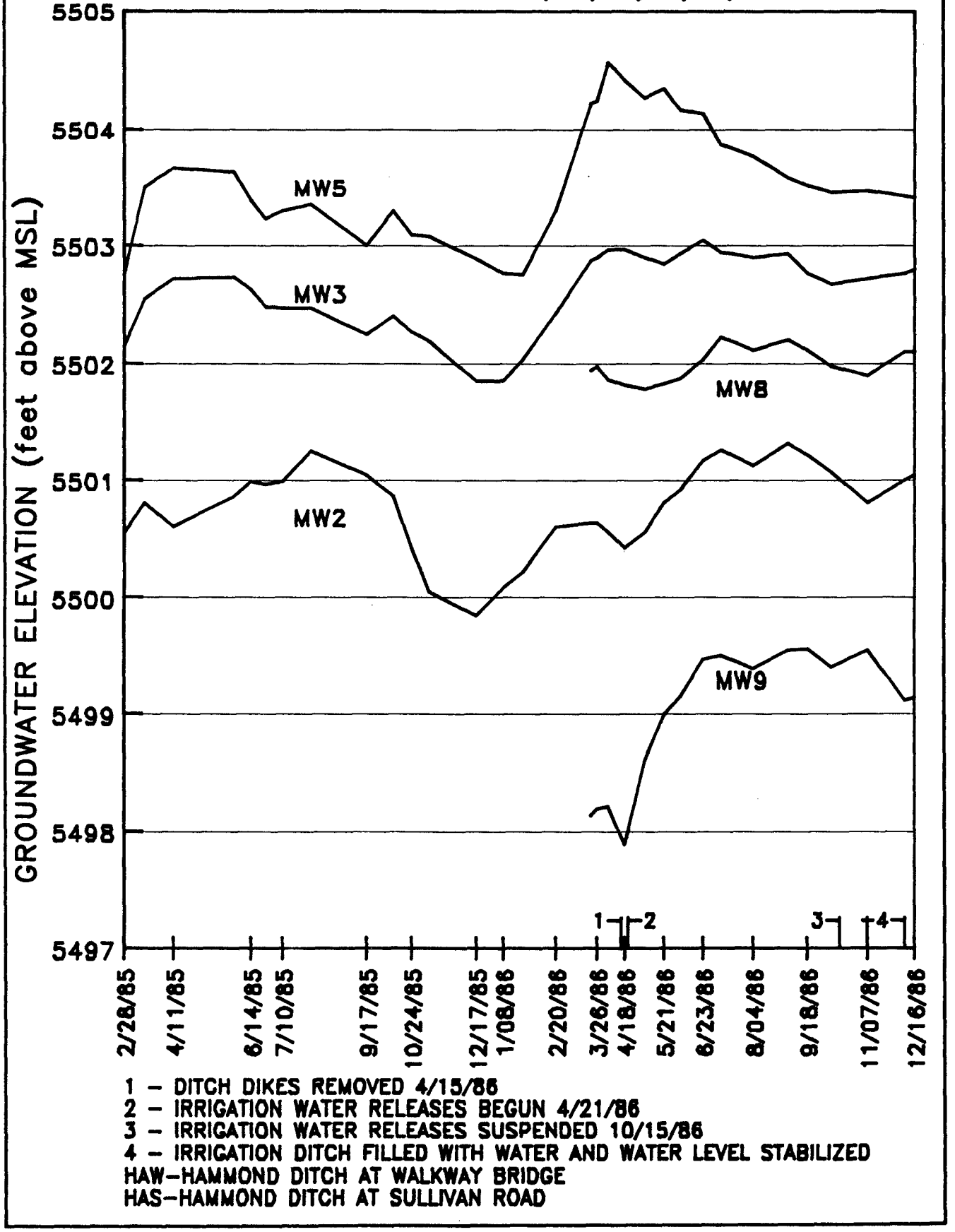
FIGURE 5.19
GROUNDWATER ELEVATIONS
BLOOMFIELD REFINING – BLOOMFIELD, NEW MEXICO
MONITORING WELLS 2, 3, 5, 8, 9,



1 – DITCH DIKES REMOVED 4/15/86
2 – IRRIGATION WATER RELEASES BEGUN 4/21/86
3 – IRRIGATION WATER RELEASES SUSPENDED 10/15/86
4 – IRRIGATION DITCH FILLED WITH WATER AND WATER LEVEL STABILIZED
HAW–HAMMOND DITCH AT WALKWAY BRIDGE
HAS–HAMMOND DITCH AT SULLIVAN ROAD

DSK1/BLGWD

wells, seasonal flows in Hammond Ditch affect these wells also. An additional year of water level data, which was also plotted, was available for wells 2, 3, and 5. The trend of the water levels in these wells is oscillatory, with periods of increasing water levels at the onset of irrigation season and corresponding decreases in water levels during nonirrigation periods.

Figure 5.20 was plotted to compare the relative water levels in wells 4 and 7 through time. Based on the performance of these wells, two trends become evident: Water levels in monitoring well 4 are consistently higher than those in monitoring well 7, and water level movements with time in monitoring well 7 appear to mimic closely those of well 4. This behavior suggests there is some small hydraulic influence at least to the superficial layers of the Nacimiento Formation. This influence is believed to be insignificant since water preferentially moves horizontally along the cobble zone/Nacimiento contact as evidenced by the seeps emerging at this contact along the bluffs of the San Juan River.

Another potentially significant facet of Figures 5.17 through 5.20 is the consistency at which reported water levels for December 1986 were approximately 1 foot higher than the water levels in January 1986. This consistency suggests that rainfall was more significant in 1986 than in 1985. Rainfall data were acquired by Bloomfield personnel. These data show that 1986 was a year of heavy rainfall. Table 5.2 shows the average total annual rainfall for the Bloomfield area is approximately 8.4 inches. This compares with 14.65 inches measured in 1986 – a 74 percent increase. Clarification of the unusual rainfall amounts in 1986 is shown in Table 5.3. This table shows that, for 9 months out of the 12, the 17-year monthly average rainfall was exceeded.

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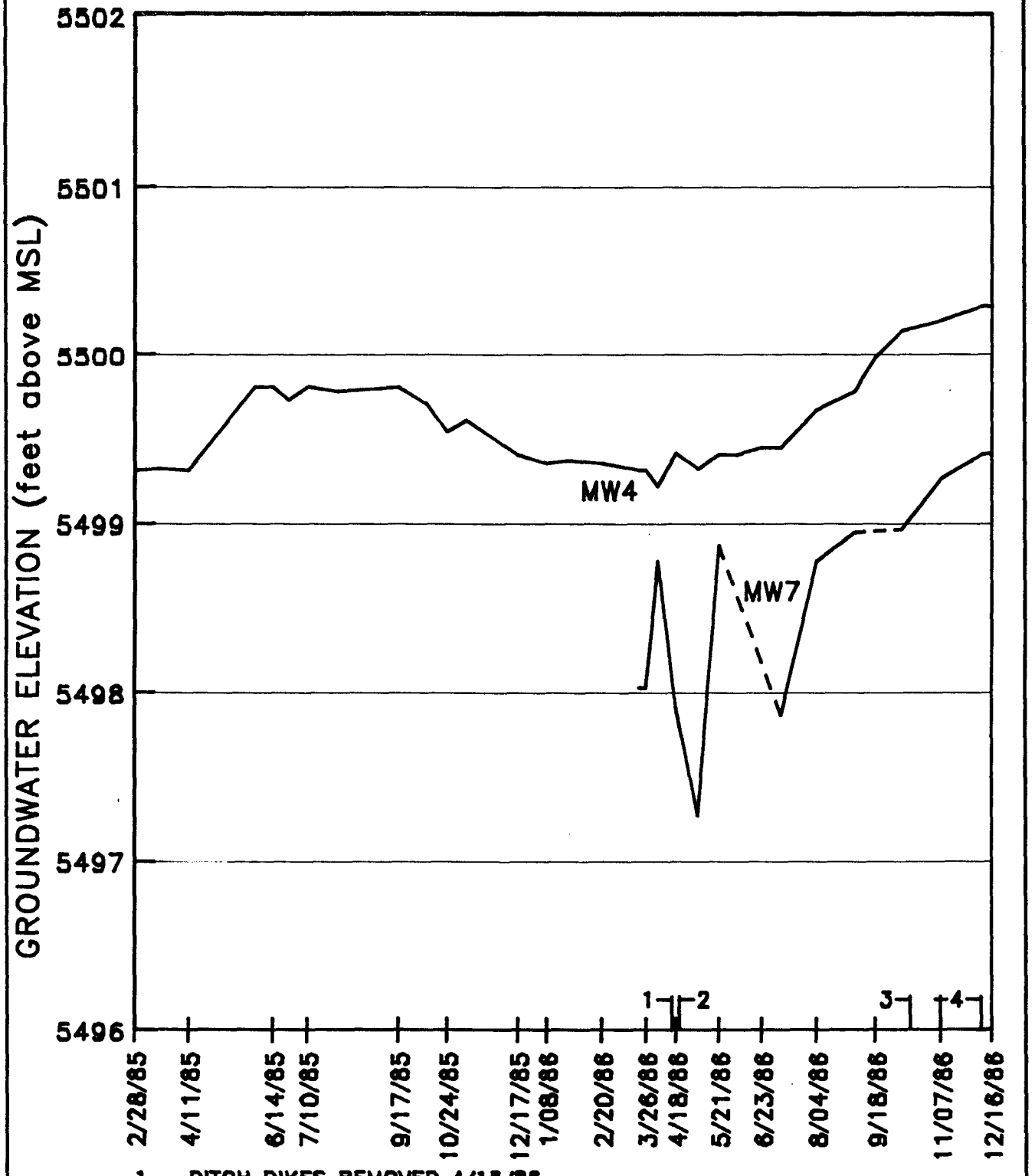
FIGURE 5.20
GROUNDWATER ELEVATIONS
BLOOMFIELD REFINING – BLOOMFIELD, NEW MEXICO
MONITORING WELLS 4 AND 7



1 – DITCH DIKES REMOVED 4/15/86
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4 – IRRIGATION DITCH FILLED WITH WATER AND WATER LEVEL STABILIZED
HAW–HAMMOND DITCH AT WALKWAY BRIDGE
HAS–HAMMOND DITCH AT SULLIVAN ROAD

DSK1/BLGWC

TABLE 5.2

HISTORICAL RAINFALL DATA FOR BLOOOMFIELD REFINERY AREA
1969 THROUGH 1986*

Month	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1980-1985 Avg.	1986
January	0.85	0.06	0.10	0.03	0.78	1.1	0.51	0.06	0.42	0.9	0.88	1.45	T	0.32	0.94	T	0.39	0.52	0.11
February	0.31	0.07	0.09	T	0.12	0.13	0.61	0.16	T	0.84	0.79	0.70	0.30	0.77	0.69	0.12	0.13	0.45	0.77
March	0.21	0.47	0.03	0.07	1.62	0.01	1.52	0.00	0.00	1.21	0.46	0.63	1.76	1.18	1.84	0.54	1.74	1.28	0.51
April	0.3	0.38	0.71	0.08	1.34	0.2	0.18	0.1	0.07	0.14	0.2	0.25	0.21	0.67	0.31	1.00	1.76	0.70	0.97
May	1.44	0.11	0.42	0.02	0.63	0.02	0.75	0.41	0.79	0.96	0.58	0.25	1.05	0.82	0.13	T	0.29	0.42	0.13
June	1.00	0.81	0.08	0.18	0.93	0.09	0.11	0.09	0.04	0.69	0.43	0.07	0.16	0.00	0.35	0.67	0.01	0,21	0.81
July	0.69	0.68	0.34	0.04	0.22	1.09	0.68	0.42	1.07	0.01	1.4	0.08	1.34	1.27	1.67	0.62	1.38	1.06	4.10
August	0.41	0.02	1.72	1.54	0.81	0.12	0.24	0.8	1.41	0.18	0.4	0.89	0.35	2.78	0.72	1.64	0.43	1.14	0.93
September	2.01	2.68	1.00	0.57	1.49	0.37	0.8	1.41	0.78	1.35	0.08	1.05	0.69	1.50	0.53	0.45	1.31	0.92	2.18
October	2.00	0.48	1.15	2.57	0.25	2.12	0.14	0.09	0.3	1.4	1.71	0.84	0.89	0.16	0.52	1.13	1.21	0.79	0.65
November	0.78	0.46	0.21	0.79	0.3	0.48	0.22	0.01	0.62	2.24	0.43	0.02	0.36	0.92	0.91	0.23	0.52	0.49	2.73
December	0.29	0.2	0.16	0.97	0.31	0.38	0.2	T	0.63	0.59	0.23	T	0.03	0.76	0.67	0.87	0.22	0.43	0.76
Total	10.29	6.42	6.01	6.86	8.8	6.11	5.96	3.55	6.13	10.51	7.59	6.23	7.14	11.15	9.28	7.27	9.39	8.41	14.65

*Data for New Mexico State University Agricultural Center at Farmington, New Mexico.

TABLE 5.3

AVERAGE TEMPERATURE AND PRECIPITATION
FOR THE BLOOMFIELD REFINING AREA*

Month	Average Precip. (inches)	Maximum Temperature (°F)	Minimum Temperature (°F)	Extreme Maximum Temperature (°F)	Extreme Maximum Year Recorded	Extreme Minimum Temperature (°F)	Extreme Minimum Year Recorded
January	0.47	39.6	18.4	61	1972 & 1975	-18	1971
February	0.30	47.0	23.1	68	1976	-3	1982
March	0.80	54.9	28.5	79	1978	6	1971
April	0.52	64.6	34.4	83	1983	16	1979
May	0.44	74.7	43.8	93	1974 & 1984	23	1975
June	0.29	85.9	52.9	100	1981	36	1979, 1980, 1981, & 1983
July	0.81	90.7	60.3	101	1971	43	1969
August	0.84	88.0	59.3	99	1969, 1970, & 1983	41	1980
September	1.04	79.9	51.2	95	1969	28	1971
October	1.11	66.3	39.3	84	1975 & 1980	18	1971
November	0.56	52.4	28.6	74	1977	1	1976
December	0.41	42.6	20.5	65	1973	-9	1978
Total	7.59	65.6	38.4				

*Seventeen-year average weather conditions, New Mexico State University Agricultural Science Center at Farmington (1969-1985).

CHAPTER 6

ESTIMATION OF COBBLE LAYER AQUIFER CHARACTERISTICS

BACKGROUND

The EPA-approved work plan included specification of work to estimate the hydraulic characteristics of the upper cobble layer. Based on installation data of monitoring wells 1 through 6, wells 1, 2, and 4 were specified to be evaluated using slug tests. These wells were identified as most likely to yield appropriate information for estimation of aquifer characteristics and subsequently contaminant transport in the subsurface.

METHODOLOGY

On April 30, 1986, ES performed slug tests on wells 1, 2, and 4. These tests were performed by adding 16, 17, and 18 gallons to each well and measuring the time required for the casing water level to fall to its previously measured static level. The time required for the water level to return to static levels ranged from 2.75 minutes for well 2 to 7 minutes for well 4. Plots of the measured water level versus time were prepared and are presented as Figures 6.1 through 6.3.

Hydraulic conductivity was calculated for each of the wells. This calculation required investigation of the status of the screen in each well during the slug test measurements. Using well log information together with measurements of the depth of the well and the depth to water, factors affecting the calculation — the degree of siltation, penetration of impermeable Nacimiento Formation, and full or partial penetration of the aquifer — were taken into consideration. The saturated zone was also estimated from these measurements to enable calculation of a transmissivity. Averages of these numbers were calculated to derive "aquifer representative" values. Storage coefficient could not be obtained from slug test data but was estimated to be approximately the same as

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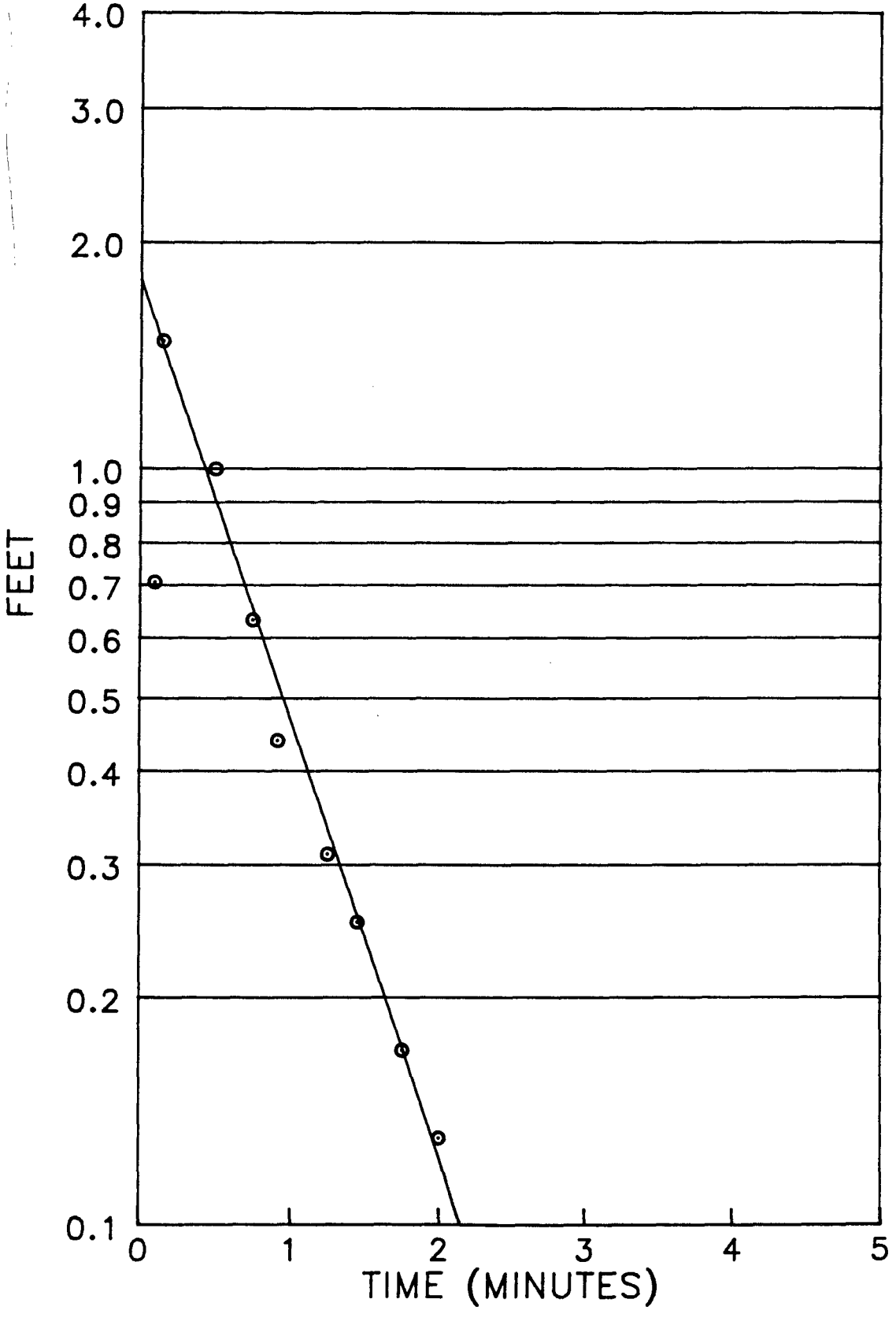
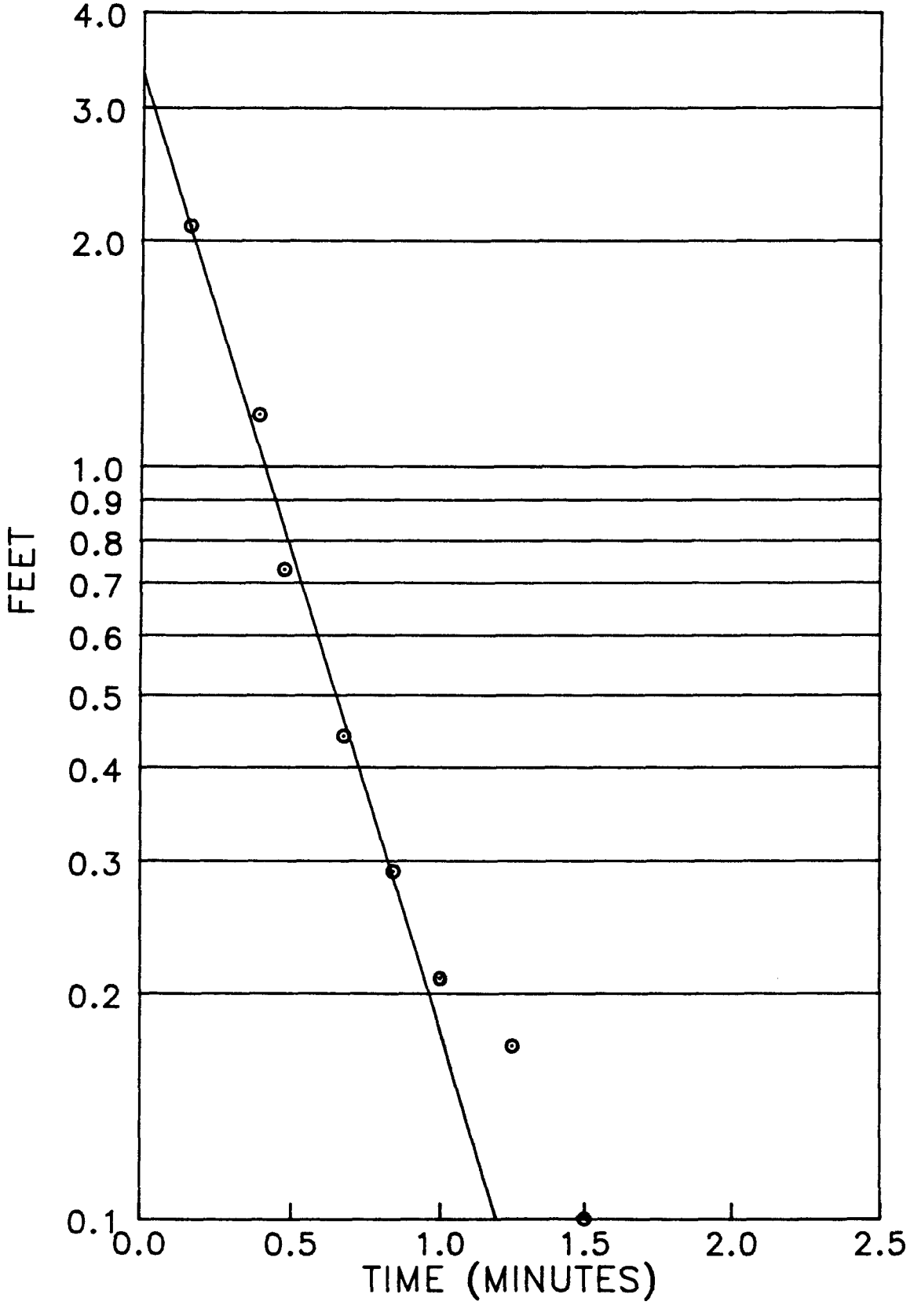
FIGURE 6.1
SLUG TEST ANALYSIS
BLOOMFIELD REFINING
MW-1



DSK1:/BL_SLUG1

ES ENGINEERING-SCIENCE

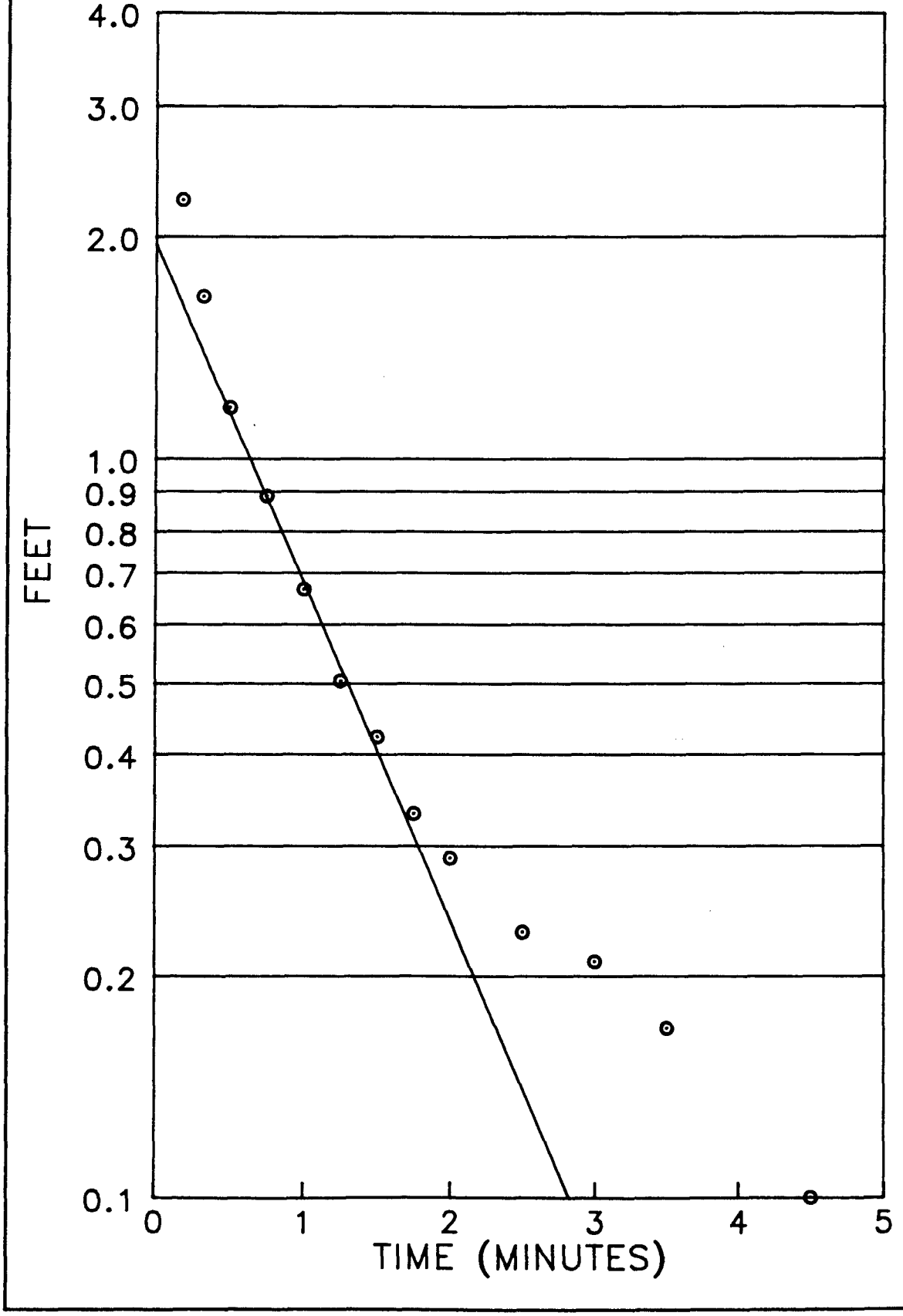
FIGURE 6.2
SLUG TEST ANALYSIS
BLOOMFIELD REFINING
MW-2



DSK1/BLSLUG2

ES ENGINEERING-SCIENCE

FIGURE 6.3
SLUG TEST ANALYSIS
BLOOMFIELD REFINING
MW-4



DSK1:/BLSLUG4

porosity. Porosity was assumed to be approximately 25 percent. A representative area of 200 feet square was assumed to provide a storage coefficient estimated to be 7.5×10^{4} gallons per foot. ! Huh?

DISCUSSION

Based on the calculations in Table 6.1, the hydraulic conductivity of the cobble zone would appear to be an average value of 2.08×10^{-4} feet per second (6.34×10^{-3} centimeters per second). However, due to the shallow saturated thickness available, the transmissivity values are quite low and average 171 square feet per day. These factors, in combination with an average gradient estimated from groundwater contour maps in chapter 5 of 0.0025 and a width of approximately 2,500 feet (projection of the refinery perpendicular to flow), suggest a daily flux of approximately 8,500 gallons per day (gpd) or about 6 gpm.

TABLE 6.1
AQUIFER CHARACTERISTICS
OF THE COBBLE ZONE

Monitoring Well Number	Estimated Saturated Thickness (feet)	Calculated Conductivity (ft/sec)	Transmissivity (square feet/day)
1	10.6	1.65×10^{-4}	151
2	9.2	3.30×10^{-4}	262
4	9.0	1.29×10^{-4}	100
Average	9.6	2.08×10^{-4} 185 ft/day	171

Range (from F. & Cherry): 60-70% silty sand
40% clean sand

$Q = 2.08 \times 10^{-4}\ ft \times 0.0025 \times 25005t \times 9.6 ft$

$= 0.0125\ \frac{ft^3}{sec} = 8065\ gpd = 5.6\ gpm$

CHAPTER 7

SURFACE WATER SAMPLING

BACKGROUND

Surface water sampling of Hammond Ditch and the San Juan River was required by the approved work plan. This sampling was specified to be accomplished during worst-case, low-flow conditions.

Low-flow conditions were determined in the work plan to be at the beginning of the irrigation season for Hammond Ditch (generally mid-April). During this period, the potential for flushing hydrocarbons downstream is the greatest. BRC installs berms in Hammond Ditch at the end of the irrigation season to retain and remove hydrocarbons that may seep into the ditch. Just before resumption of irrigation, the berms are removed. The potential for downstream contamination is therefore greatest when upstream irrigation flows are released and flush the ditch.

Low-flow conditions in the San Juan River generally occur during winter months. Precipitation is generally low during winter. Throughout 1986, flows in the river were unusually high, and low-flow conditions did not occur. Maintenance activities for Navajo Dam (controlling San Juan River flows) in April and May 1987 required lowering the upstream reservoir approximately 31 feet from normal operating level. The lowering of the reservoir has resulted in unseasonably high discharge rates from the dam, which precluded low-flow sampling efforts. Therefore, an extension for sampling of the San Juan River has been requested to permit future sampling during representative low-flow conditions.

SAMPLING PROTOCOL

The Hammond Ditch was sampled by BRC staff on April 22, 1986 within 24 hours after initiation of irrigation flows in the ditch. Flows were observed to be intermittent during this period, so a second sampling effort was conducted on April 28, 1986 to assure acquisition of a representative data set.

All samples were collected consistent with the protocol stated in the approved work plan. As specified, depth-integrated samples were collected from a location just downstream of the refinery property south of Sullivan Road, and just downstream of the API wastewater ponds.

FINDINGS

Results from both Hammond Ditch sampling efforts are contained in Appendix B to this report. Tables 7.1 and 7.2 are summaries of compounds detected during the April 22, 1986 and April 28, 1986 sampling efforts, respectively. Table 7.1 shows that very low levels of pollutants were found during worst-case conditions. Table 7.2 shows that no priority pollutants were detected during the second survey, conducted after irrigation flows had been reestablished.

The results of the April 28, 1986 survey are consistent with the finding in Chapter 5 showing that Hammond Ditch irrigation flows create a hydraulic gradient directed towards the BRC site that minimizes the potential for groundwater transport into the ditch.

TABLE 7.1

SUMMARY OF DETECTED ORGANIC COMPOUNDS
FROM HAMMOND DITCH ON 4/22/86

Laboratory Parameter	Hammond Ditch Near Sullivan Road Results (Downstream) (mg/l)	Hammond Ditch Near API Ponds Results (Upstream) (mg/l)	Detection Limits (mg/l)
Phenols	0.002	0.002	0.001
Benzene	0.006		0.001
Toluene	0.003		0.001
Anthracene	0.006		0.001
Benzo(a)anthracene	0.003		0.001
Chrysene	0.005		0.001
Fluoranthene		0.001	0.001
Naphthalene	0.13		0.001
Phenanthrene	0.008		0.001
Pyrene	0.008		0.001

TABLE 7.2

SUMMARY OF DETECTED ORGANIC COMPOUNDS
FROM HAMMOND DITCH ON 4/28/86

Laboratory Parameter	Hammond Ditch Near Sullivan Road Results (Downstream) (mg/l)	Hammond Ditch Near API Ponds Results (Upstream) (mg/l)	Detection Limits (mg/l)
NONE DETECTED			

CHAPTER 8

CONCLUSIONS

Each of the work elements specified in the approved work plan was designed to provide information that would clarify the investigation of subsurface hydrocarbons at the refinery. Based on execution of each of these work elements, the following conclusions are offered:

1. Subsurface petroleum hydrocarbons (PRODUCT) appear to be located only within geologic units composed of sand, silt, clay, and cobbles. Subsurface hydrocarbon contamination may have been the result of old spills or leaks located within the vicinity of monitoring wells 4, 9, and 10.

2. Monitoring wells 1, 2, 3, 5, 7, and 8 show low levels of indicator pollutants.

3. Monitoring well 7 shows insignificant levels of indicator pollutants. Well elevation data of wells 4 and 7 relative to changing water levels in Hammond Ditch suggest an insignificant hydraulic influence between the screened portion of well 7 in the upper Nacimiento Formation and the cobble zone monitored by well 4.

4. No monitoring well has been established in a background area to clarify the significance or insignificance of metals and salts levels reported in water analyses.

5. The ER profile maps, which provide an areal interpretation with respect to depth of discrete ER measurements, show existence of low ER contours located west of the solar evaporation ponds, underneath the process area and refined product storage areas, and offsite areas south and west of the intersection of Hammond Ditch with Sullivan Road. The presence of subsurface hydrocarbons has been indicated at monitoring wells 4, 9, and 10, but the areal extent and quantity of sources contributing to these wells are unknown. No information is available to explain the low ER contours predicted off site.

6. Hammond Ditch controls groundwater transport from the site towards the ditch during irrigation season. Elevated water levels in the ditch force groundwater that would otherwise enter the ditch to flow in a trough created by the intersecting gradients from the ditch and the refinery site.

7. Absence of water in Hammond Ditch removes the hydraulic impediment to flow towards Hammond Ditch. The extent of flow to Hammond Ditch and under or through Hammond Ditch is unknown.

8. Hammond Ditch surface water sampling showed that very low levels of pollutants are transmitted to Hammond Ditch during low-flow conditions. Nondetection of pollutants in the 4/28/86 sampling effort supports the conclusion that elevated Hammond Ditch water levels minimizes potential for transport towards the ditch.

CHAPTER 9

RECOMMENDATIONS

Based on the conclusions of the report, the following recommendations are offered:

1. During periods of nonirrigation flow, maintain elevated water levels in Hammond Ditch.

2. Pursue investigation of offsite conditions under auspices of the NMOCD.

3. Investigate information sources from which background water quality data exist or could be developed to reference the groundwater conditions beneath the BRC site.

4. Discontinue quality monitoring of all wells except 4, 10, and 9. Maintain quality monitoring of these wells on a quarterly basis for TOC.

REFERENCES

"A Work Plan for Monitoring, Testing, Analysis, and Reporting at Bloomfield Refinery." Engineering-Science, Inc. July 1985.

"Discharge Plan for a Refinery Operated by Plateau, Inc. near Bloomfield, New Mexico." American Groundwater Consultants. March 24, 1984.

"Guidance on Remedial Investigations Under CERCLA." U.S. EPA, EPA/540/6-85/002. June 1985.

APPENDIX A

MONITORING WELL SAMPLING RESULTS

FIRST QUARTER

ASSAIGAI ANALYTICAL LABORATORIES

SAMPLE DATE = 3/26/86

TO: Bloomfield Refinery
Attn: Chris Hawley
P.O. Box 159
Bloomfield, NM 87413

DATE: 14 May 1986
0502

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 1	MW 2	MW 3
CN	<0.01 mg/l	<0.01 mg/l	<0.~~10~~ 01 mg/l
Phenols	0.009 mg/l	0.063 mg/l	0.006 mg/l
TOC	18 mg/l	18 mg/l	29 mg/l
TDS	2936 mg/l	2796 mg/l	4836 mg/l
Cl	750 mg/l	200 mg/l	1500 mg/l
SO 4	7.5 mg/l	11.0 mg/l	29.5 mg/l
Benzene	ND	ND	ND
Toluene	ND	ND	ND
Xylenes	ND	ND	ND
Ethylbenzene	ND	ND	ND
Sb	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
As	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Be	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Cd	0.050 mg/l	0.060 mg/l	0.12 mg/l
Cr	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Cu	<0.03 mg/l	<0.03 mg/l	<0.03 mg/l
Pb	0.085 mg/l	0.12 mg/l	0.14 mg/l
Hg	<0.002 mg/l	0.003 mg/l	0.004 mg/l
Ni	0.08 mg/l	0.07 mg/l	0.08 mg/l
Se	<0.010 mg/l	<0.010 mg/l	<0.010 mg/l
Ag	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Tl	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Zn	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l

TO: Bloomfield Refinery

DATE: 0502 revised

SAMPLE DATE: 3/26/86

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 4	MW 5	MW 7
CN	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Phenols	0.633 mg/l	0.006 mg/l	<0.001 mg/l
TOC	110 mg/l	14 mg/l	11 mg/l
TDS	1868 mg/l	3840 mg/l	6076 mg/l
Cl	500 mg/l	1100 mg/l	30 mg/l
SO 4	0.3 mg/l	14.0 mg/l	5.5 mg/l
Benzene	11.8 mg/l	ND	0.015 mg/l
Toluene	7.5 mg/l	ND	0.053 mg/l
Xylenes	ND	ND	ND
Ethylbenzene	0.107 mg/l	ND	0.007 mg/l
Sb	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
As	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Be	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Cd	0.060 mg/l	0.10 mg/l	0.050 mg/l
Cr	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Cu	<0.03 mg/l	<0.03 mg/l	<0.03 mg/l
Pb	0.074 mg/l	0.16 mg/l	<0.050 mg/l
Hg	0.002 mg/l	<0.002 mg/l	<0.002 mg/l
Ni	0.08 mg/l	0.10 mg/l	0.08 mg/l
Se	<0.010 mg/l	<0.010 mg/l	<0.010 mg/l
Ag	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Tl	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Zn	0.012 mg/l	0.012 mg/l	0.018 mg/l
Acrolein	ND		ND
Acrylonitrile	ND		ND
Bromoform	ND		ND
Carbon Tetrachloride	ND		ND
Chlorobenzene	ND		ND
Chlorodibromomethane	ND		ND
Chloroethane	ND		ND
2-Chloroethylvinyl Ether	ND		ND
Chloroform	ND		ND
Dichlorogromomethane	ND		ND
1,1-Dichloroethane	ND		ND
1.2-Dichloroethane	ND		ND
1,1-Dichloroethylene	ND		ND
1,2-Dichloropropane	ND		ND
1,3-Dichloropropylene	ND		ND

SAMPLE DATE - 5/30/90

TO: Bloomfield Refinery

0502
Page 3 of 8

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 4	MW 5	MW 7
Methyl Bromide	ND		ND
Methyl Chloride	ND		ND
Methylene Chloride	ND		ND
1,1,2,2-Tetrachloroethane	ND		ND
Tetrachloroethylene	ND		ND
1,2-Transdichloroethylne	ND		ND
1,1,1-Trichloroethane	ND		ND
1,1,2-Trichloroethane	ND		ND
Trichloroethylene	ND		ND
Vinyl Chloride	ND		ND
Acid Compounds			
2-chlorophenol	ND		ND
2,4-dichlorophenol	0.200 mg/l		ND
2,4-dimethylphenol	ND		ND
4,6-dinitro-o-cresol	0.100 mg/l		0.013 mg/l
2,4-dinitrophenol	0.050 mg/l		ND
2-nitrophenol	ND		ND
4-nitrophenol	0.090 mg/l		ND
p-chloro-m-cresol	ND		ND
pentachlorophenol	ND		ND
Phenol	0.202 mg/l		ND
2,4,6-trichlorophenol	ND		ND
Base Neutrals			
Acenaphthene	0.044 mg/l		ND
Acenaphthylene	ND		ND
Anthracene	ND		ND
Benzidine	ND		ND
Benzo(a)anthracene	ND		ND
Benzo(a)pyrene	ND		ND
3,4-benzofluoranthene	ND		ND
Benzo(ghi)perylene	ND		ND
Benzo(k)fluoranthene	ND		ND
Bis(2-chloroethoxy)methane	ND		ND
Bis(2-chloroethyl)ether	ND		ND
Bis(2-chloroisopropyl)ether	ND		ND
Bis(2-ethylhexyl)phthalate	ND		ND
4-bromophenyl phenyl ether	ND		ND
Butylbenzyl phthalate	ND		ND
2-chloronaphtalene	ND		ND
4-chlorophenyl phenyl ether	ND		ND
Chrysene	ND		ND

SAMPLE DATE: 3/26/96

TO: Bloomfield Refinery

0502

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS					
	MW 4		MW 5		MW 7	
Dibenzo(a,h)anthracene	ND				ND	
1,2-Dichlorobenzene	ND				ND	
1,3-Dichlorobenzene	ND				ND	
1,4-Dichlorobenzene	ND				ND	
3,3-Dichlorobenzidine	ND				ND	
Diethyl phthalate	ND				ND	
Dimethyl phthalate	ND				ND	
Din-n-butyl phthalate	ND				ND	
2,4-dinitrotoluene	ND				ND	
2,6-dinitrotoluene	ND				ND	
Di-n-octyl phthalate	ND				ND	
1,2-diphenylhydrazine	ND				ND	
Fluoranthene	ND				ND	
Fluorene	0.150	mg/l			ND	
Hexachlorobenzene	ND				ND	
Hexachlorobutadiene	ND				ND	
Hexachlorocyclopentadiene	ND				ND	
Hexachloroethane	ND				ND	
Indeno(1,2,3-cd)pyrene	ND				ND	
Isophorone	ND				ND	
Naphthalene	0.036	mg/l			ND	
Nitrobenzene	ND				ND	
N-nitrosodimethylamine	ND				ND	
N-nitrosodie-n-propylamine	ND				ND	
N-nitrosodiphenylamine	ND				ND	
Phenanthrene	ND				ND	
Pyrene	0.166	mg/l			ND	
1,2,4-trichlorobenzene	ND				ND	

SAMPLE DATE: 3/26/86

TO: Bloomfield Refinery

DATE: 0502

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 8	MW 9	MW 10
CN	<0.01 mg/l	<0.01 mg/l	<0.10 mg/l
Phenols	<0.001 mg/l	0.304 mg/l	0.147 mg/l
TOC	5 mg/l	143 mg/l	34 mg/l
TDS	806 mg/l	2360 mg/l	1546 mg/l
Cl	160 mg/l	149 mg/l	245 mg/l
SO 4	4.0 mg/l	13.0 mg/l	5.3 mg/l
Benzene	ND	7.4 mg/l	0.093 mg/l
Toluene	ND	6.3 mg/l	ND
Xylenes	ND	ND	ND
Ethylbenzene	0.107 mg/l	3.2 mg/l	ND
Sb	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
As	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Be	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Cd	0.010 mg/l	0.010 mg/l	0.020 mg/l
Cr	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Cu	<0.03 mg/l	<0.03 mg/l	<0.03 mg/l
Pb	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Hg	<0.002 mg/l	<0.002 mg/l	<0.002 mg/l
Ni	<0.06 mg/l	0.30 mg/l	0.08 mg/l
Se	<0.010 mg/l	<0.010 mg/l	<0.010 mg/l
Ag	<0.050 mg/l	<0.050 mg/l	<0.050 mg/l
Tl	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l
Zn	<0.01 mg/l	0.012 mg/l	<0.01 mg/l
Acrolein	ND	ND	ND
Acrylonitrile	ND	ND	ND
Bromoform	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND
Chlorobenzene	ND	ND	ND
Chlorodibromomethane	ND	ND	ND
Chloroethane	ND	ND	ND
2-Chloroethylvinyl Ether	ND	ND	ND
Chloroform	ND	ND	ND
Dichlorogromomethane	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND
1.2-Dichloroethane	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND
1,3-Dichloropropylene	ND	ND	ND

SAMPLE DATE - 3/26/96

TO: Bloomfield Refinery

0502

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 8	MW 9	MW 10
Methyl Bromide	ND	ND	ND
Methyl Chloride	ND	ND	ND
Methylene Chloride	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND
Tetrachloroethylene	ND	ND	ND
1,2-Transdichloroethylne	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND
Trichloroethylene	ND	ND	ND
Vinyl Chloride	ND	ND	ND
Acid Compounds			
2-chlorophenol	ND	ND	ND
2,4-dichlorophenol	ND	ND	ND
2,4-dimethylphenol	ND	0.160 mg/l	0.025 mg/l
4,6-dinitro-o-cresol	ND	ND	0.020 mg/l
2,4-dinitrophenol	ND	ND	ND
2-nitrophenol	ND	ND	ND
4-nitrophenol	ND	ND	ND
p-chloro-m-cresol	ND	ND	ND
pentachlorophenol	ND	ND	ND
Phenol	ND	0.149 mg/l	0.090 mg/l
2,4,6-trichlorophenol	ND	ND	ND
Base Neutrals			
Acenaphthene	ND	ND	ND
Acenaphthylene	ND	ND	ND
Anthracene	ND	ND	0.039 mg/l
Benzidine	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND
3,4-benzofluoranthene	ND	ND	ND
Benzo(ghi)perylene	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND
Bis(2-chloroethoxy)methane	ND	ND	ND
Bis(2-chloroethyl)ether	ND	ND	ND
Bis(2-chloroisopropyl)ether	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND
4-bromophenyl phenyl ether	ND	ND	ND
Butylbenzyl phthalate	ND	ND	ND
2-chloronaphtalene	ND	ND	ND
4-chlorophenyl phenyl ether	ND	ND	ND
Chrysene	ND	ND	ND

SAMPLE DATE: 3/26/36

TO: Bloomfield Refinery

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS		
	MW 8	MW 9	MW 10
Dibenzo(a,h)anthracene	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND
3,3-Dichlorobenzidine	ND	ND	ND
Diethyl phthalate	ND	ND	ND
Dimethyl phthalate	ND	ND	ND
Din-n-butyl phthalate	ND	ND	ND
2,4-dinitrotoluene	ND	ND	ND
2,6-dinitrotoluene	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND
1,2-diphenylhydrazine	ND	ND	ND
Fluoranthene	ND	ND	0.034 mg/l
Fluorene	ND	0.012 mg/l	0.033 mg/l
Hexachlorobenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND
Hexachloroethane	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND
Isophorone	ND	ND	ND
Naphthalene	ND	ND	ND
Nitrobenzene	ND	ND	ND
N-nitrosodimethylamine	ND	ND	ND
N-nitrosodie-n-propylamine	ND	ND	ND
N-nitrosodiphenylamine	ND	ND	ND
Phenanthrene	ND	ND	ND
Pyrene	ND	ND	0.030 mg/l
1,2,4-trichlorobenzene	ND	ND	ND

ND = None Detected

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods, USEPA, SW 846, EMSL-Cincinnati, 1982.

SAMPLE DATE: 3/26/06

TO: Bloomfield Refinery

0502 revised

NOMINAL DETECTION LIMITS

CN	0.01 mg/l
Phenols	0.001 mg/l
TOC	0.1 mg/l
TDS	1 mg/l
Cl	1.0 mg/l
SO 4	1.0 mg/l
Benzene	0.005 mg/l
Toluene	0.005 mg/l
Xylenes	0.005 mg/l
Ethylbenzene	0.005 mg/l
Sb	0.01 mg/l
As	0.050 mg/l
Be	0.01 mg/l
Cd	0.002 mg/l
Cr	0.050 mg/l
Cu	0.03 mg/l
Pb	0.001 mg/l
Hg	0.002 mg/l
Ni	0.01 mg/l
Se	0.010 mg/l
Ag	0.050 mg/l
Tl	0.01 mg/l
Zn	0.01 mg/l

Detection limits for Volatiles, Acid Compounds, and Base/Neutrals are all 0.001 mg/l

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

SECOND QUARTER

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 1

ANALYTE	ANALYTICAL RESULTS	
CN	0.1	mg/l
TDS	2960	mg/l
Cl	994.7	mg/l
SO 4	630	mg/l
Phenols	0.017	mg/l
TOC	24	mg/l
Sb	<0.01	mg/l
As	0.077	mg/l
Be	<0.01	mg/l
Cd	<0.010	mg/l
Cr	<0.050	mg/l
	<0.050	mg/l duplicate
Cu	<0.03	mg/l
Pb	0.065	mg/l
Hg	<0.002	mg/l
Ni	<0.06	mg/l
Se	0.035	mg/l
Ag	<0.050	mg/l
Tl	<0.01	mg/l
Zn	0.020	mg/l
Benzene	ND	
Toluene	ND	
Xylenes	ND	
Ethylbenzene	ND	
Ba	<0.01	mg/l
Fe	<0.04	mg/l
Mn	0.25	mg/l
Al	2.07	mg/l
B	<0.01	mg/l
Co	<0.05	mg/l
Mo	<0.01	mg/l
F	0.54	mg/l
No 3 as N	0.1	mg/l
1,2-DCE	ND	
1,1-DCE	ND	
1,1,2,2-TCE	ND	
1,1,2-TCE	ND	

Field by CH 6/23/86

pH 7.25

Conductivity 4600

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 2

ANALYTE	ANALYTICAL RESULTS
CN	0.1 mg/l
TDS	3650 mg/l
Cl	1204.6 mg/l
SO 4	1750 mg/l
Phenols	0.023 mg/l
TOC	27 mg/l
Sb	<0.01 mg/l
As	0.094 mg/l
Be	<0.01 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	<0.05 mg/l
Hg	<0.002 mg/l
Ni	<0.06 mg/l
Se	0.070 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.020 mg/l
Benzene	ND
Toluene	ND
Xylenes	ND
Ethylbenzene	ND

Field by CA 6/23/86

pH 7.17

Conductivity 5400

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 3

ANALYTE	ANALYTICAL RESULTS
CN	0.25 mg/l
TDS	5362 mg/l
Cl	1584 mg/l
SO 4	1950 mg/l
Phenols	0.006 mg/l
TOC	17 mg/l
Sb	<0.01 mg/l
As	0.15 mg/l
Be	<0.01 mg/l
Cd	0.015 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.070 mg/l
Hg	<0.002 mg/l
Ni	0.08 mg/l
Se	0.10 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.018 mg/l
Benzene	ND
Toluene	0.003 mg/l
Xylenes	0.030 mg/l
Ethylbenzene	ND

Field by Clt 6/23/86

pH 7.10

Conductivity 6900

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ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
CN	0.5 mg/l
TDS	2266 mg/l
Cl	989.7 mg/l
SO 4	12.5 mg/l
Phenols	0.430 mg/l
TOC	130 mg/l
Sb	<0.10 mg/l
As	0.070 mg/l
Be	<0.1 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.066 mg/l
Hg	<0.002 mg/l
Ni	<0.06 mg/l
Se	0.080 mg/l
Ag	<0.050 mg/l
Tl	<0.1 mg/l
Zn	0.019 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	3.1 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	0.070 mg/l

Field by CH 6/24/86

pH 6.85

Conductivity 3800

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SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	0.290 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	0.058 mg/l
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	0.108 mg/l
4-Nitrophenol	0.302 mg/l
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	0.016 mg/l
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	0.023 mg/l

SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Din-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	0.019 mg/l
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND
Ba	3.54 mg/l
Fe	12.0 mg/l
Mn	3.5 mg/l
Al	1.93 mg/l
B	<0.01 mg/l
Co	<0.05 mg/l
Mo	<0.01 mg/l
F	0.21 mg/l
NO 3 as N	<0.01 mg/l

ND = None Detected

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 5

ANALYTE	ANALYTICAL RESULTS
CN	0.2 mg/l
TDS	3778 mg/l
Cl	1339.6 mg/l
SO 4	1800 mg/l
Phenols	0.007 mg/l
TOC	21 mg/l
Sb	<0.01 mg/l
As	0.087 mg/l
Be	<0.01 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.055 mg/l
Hg	<0.002 mg/l
Ni	<0.06 mg/l
Se	0.071 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Benzene	ND
Toluene	ND
Xylenes	ND
Ethylbenzene	ND
Ba	<0.01 mg/l
Fe	0.05 mg/l
Mn	0.025 mg/l
Al	2.75 mg/l
B	<0.01 mg/l
Co	<0.05 mg/l
Mo	<0.01 mg/l
F	0.30 mg/l
No 3 as N	12.5 mg/l
1,2-DCE	ND
1,1-DCE	ND
1,1,2,2-TCE	ND
1,1,2-TCE	ND

Field by CA 6/23/86

pH 7.18

Conductivity 5400

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ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 7

ANALYTE	ANALYTICAL RESULTS
CN	0.25 mg/l
TDS	6406 mg/l
Cl	79.9 mg/l
SO 4	2400 mg/l
Phenols	0.006 mg/l
TOC	4 mg/l
Sb	<0.01 mg/l
As	0.36 mg/l
Be	<0.01 mg/l
Cd	0.030 mg/l
Cr	0.052 mg/l
Cu	<0.03 mg/l
Pb	0.24 mg/l
Hg	<0.002 mg/l
Ni	0.07 mg/l
Se	0.65 mg/l
Ag	0.060 mg/l
Tl	<0.01 mg/l
Zn	0.016 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	ND

Field by CLA 6/25/86

pH 11.08

Conductivity 8100

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

SAMPLE ID: MW - 7

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	ND
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	ND
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	0.001 mg/l
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	0.002 mg/l

SAMPLE ID: MW - 7

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Din-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
CN	<0.01 mg/l
TDS	2910 mg/l
Cl	839.7 mg/l
SO 4	1500 mg/l
Phenols	0.005 mg/l
TOC	13 mg/l
Sb	<0.01 mg/l
As	0.072 mg/l
Be	<0.01 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.055 mg/l
Hg	<0.002 mg/l
Ni	0.86 mg/l
Se	0.21 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.020 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	ND

Field by Clt 6/23/86

pH 7.26
Conductivity 4400

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	ND
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	ND
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Din-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
CN	0.4 mg/l
TDS	1718 mg/l
Cl	1009.7 mg/l
SO 4	114 mg/l
Phenols	0.372 mg/l
TOC	180 mg/l
Sb	<0.01 mg/l
As	<0.05 mg/l
Be	<0.01 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.059 mg/l
Hg	<0.002 mg/l
Ni	0.25 mg/l
Se	0.040 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.015 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	4 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	0.71 mg/l

Field by CA 6/24/86

pH 6.98
Conductivity 2500

SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	1.7 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	0.150 mg/l
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	ND
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	0.170 mg/l
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Din-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected,

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
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SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
CN	<0.01 mg/l
TDS	2820 mg/l
Cl	569.8 mg/l
SO 4	165 mg/l
Phenols	0.186 mg/l
TOC	76 mg/l
Sb	<0.01 mg/l
As	0.053 mg/l
Be	<0.01 mg/l
Cd	<0.010 mg/l
Cr	<0.050 mg/l
Cu	<0.03 mg/l
Pb	0.059 mg/l
Hg	<0.002 mg/l
Ni	<0.25 mg/l
Se	0.040 mg/l
Ag	<0.050 mg/l
Tl	<0.01 mg/l
Zn	0.015 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	ND

Field by CH 6/24/86

pH 7.08

Conductivity 4400

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SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	ND
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	ND
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Din-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 23 July 1986
1030

NOMINAL DETECTION LIMITS

ANALYTE	
CN	0.01 mg/l
TDS	1 mg/l
Cl	1.0 mg/l
SO 4	1.0 mg/l
Phenols	0.002 mg/l
TOC	0.1 mg/l
Sb	0.01 mg/l
As	0.05 mg/l
Be	0.01 mg/l
Cd	0.010 mg/l
Cr	0.050 mg/l
Cu	0.03 mg/l
Pb	0.050 mg/l
Hg	0.002 mg/l
Ni	0.06 mg/l
Se	0.010 mg/l
Ag	0.050 mg/l
Tl	0.01 mg/l
Zn	0.01 mg/l
Benzene	0.001 mg/l
Toluene	0.001 mg/l
Xylenes	0.001 mg/l
Ethylbenzene	0.001 mg/l
Ba	0.01 mg/l
Fe	0.04 mg/l
Mn	0.005 mg/l
Al	0.05 mg/l
B	0.01 mg/l
Co	0.05 mg/l
Mo	0.01 mg/l
F	0.1 mg/l
No 3 as N	0.01 mg/l
1,2-DCE	0.001 mg/l
1,1-DCE	0.001 mg/l
1,1,2,2-TCE	0.001 mg/l
1,1,2-TCE	0.001 mg/l

Dectection limits for Volatiles, Base/Neutrals and Acid Compounds all 0.001 mg/l

REFERENCE:"Test Methods for Evaluting Solid Waste, Physical/Chemical Methods",USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

THIRD QUARTER

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 1

ANALYTE	ANALYTICAL RESULTS
CN	0.07 mg/l
Phenols	0.19 mg/l
TOC	24 mg/l
TDS	2866 mg/l
Cl	814 mg/l
SO 4	673 mg/l
Sb	<0.01 mg/l
As	0.05 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	0.15 mg/l
Hg	<0.002 mg/l
Ni	0.07 mg/l
Se	0.033 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.04 mg/l
Benzene	<0.001 mg/l
Toluene	<0.001 mg/l
Ethylbenzene	<0.001 mg/l
Xylenes	<0.001 mg/l

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ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 2

ANALYTE	ANALYTICAL RESULTS
CN	0.18 mg/l
Phenols	0.17 mg/l
TOC	23 mg/l
TDS	3598 mg/l
Cl	993 mg/l
SO 4	1104 mg/l
Sb	<0.01 mg/l
As	0.08 mg/l
Be	<0.01 mg/l
Cd	0.03 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	0.08 mg/l
Hg	<0.002 mg/l
Ni	0.12 mg/l
Se	0.104 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Benzene	<0.001 mg/l
Toluene	<0.001 mg/l
Ethylbenzene	<0.001 mg/l
Xylenes	<0.001 mg/l

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ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
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Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 3

ANALYTE	ANALYTICAL RESULTS
CN	0.17 mg/l
Phenols	0.082 mg/l
TOC	16 mg/l
TDS	5514 mg/l
Cl	1290 mg/l
SO 4	2056 mg/l
Sb	<0.01 mg/l
As	0.21 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	0.18 mg/l
Hg	<0.002 mg/l
Ni	0.14 mg/l
Se	0.100 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Benzene	<0.001 mg/l
Toluene	<0.001 mg/l
Ethylbenzene	<0.001 mg/l
Xylenes	<0.001 mg/l

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
CN	<0.01 mg/l
Phenols	0.085 mg/l
TOC	63 mg/l
TDS	2308 mg/l
Cl	754 mg/l
SO 4	<0.01 mg/l
Sb	<0.01 mg/l
As	0.08 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	<0.05 mg/l
Hg	<0.002 mg/l
Ni	0.12 mg/l
Se	0.063 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	<0.008 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	6.65 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	0.140 mg/l

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SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	0.407 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	0.001 mg/l
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	0.026 mg/l
4-Nitrophenol	0.331 mg/l
P-chloro-m-cresol	0.045 mg/l
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	0.010 mg/l
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chloroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 4

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Di-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	0.015 mg/l
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	0.005 mg/l
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 5

ANALYTE	ANALYTICAL RESULTS
CN	0.24 mg/l
Phenols	0.034 mg/l
TOC	20 mg/l
TDS	3184 mg/l
Cl	1151 mg/l
SO 4	1237 mg/l
Sb	<0.01 mg/l
As	0.07 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	<0.05 mg/l
Hg	<0.002 mg/l
Ni	0.09 mg/l
Se	0.030 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Benzene	<0.001 mg/l
Toluene	<0.001 mg/l
Ethylbenzene	<0.001 mg/l
Xylenes	<0.001 mg/l

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ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
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Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 7

ANALYTE	ANALYTICAL RESULTS
CN	0.10 mg/l
Phenols	0.036 mg/l
TOC	4 mg/l
TDS	6348 mg/l
Cl	20 mg/l
SO 4	5802 mg/l
Sb	<0.01 mg/l
As	0.22 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	0.05 mg/l
Hg	<0.002 mg/l
Ni	0.08 mg/l
Se	0.36 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	0.058 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	0.004 mg/l

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SAMPLE ID: MW -7

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	0.006 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	0.007 mg/l
P-chloro-m-cresol	0.001 mg/l
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 7

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Di-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
CN	<0.01 mg/l
Phenols	0.097 mg/l
TOC	8 mg/l
TDS	2284 mg/l
Cl	576 mg/l
SO 4	586 mg/l
Sb	<0.01 mg/l
As	0.03 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	<0.05 mg/l
Hg	<0.002 mg/l
Ni	0.21 mg/l
Se	<0.01 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.02 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	ND

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	ND
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	0.008 mg/l
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 8

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Di-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
CN	<0.01 mg/l
Phenols	0.17 mg/l
TOC	240 mg/l
TDS	1428 mg/l
Cl	89 mg/l
SO 4	<0.01 mg/l
Sb	<0.01 mg/l
As	0.02 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	<0.05 mg/l
Hg	<0.002 mg/l
Ni	0.13 mg/l
Se	<0.01 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.05 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	17.7 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	0.015 mg/l

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SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	10.6 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	ND
4-Nitrophenol	1.10 mg/l
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	0.013 mg/l
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	0.028 mg/l
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	0.007 mg/l
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 9

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Di-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	0.010 mg/l
1,2,4-Trichlorobenzene	ND

ND = None Detected

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
CN	0.050 mg/l
Phenols	0.065 mg/l
TOC	125 mg/l
TDS	2408 mg/l
Cl	587 mg/l
SO 4	<0.01 mg/l
Sb	<0.01 mg/l
As	0.05 mg/l
Be	<0.01 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.03 mg/l
Pb	0.05 mg/l
Hg	<0.002 mg/l
Ni	0.18 mg/l
Se	0.071 mg/l
Ag	<0.05 mg/l
Tl	<0.01 mg/l
Zn	0.16 mg/l
Volatiles	
Acrolein	ND
Acrylonitrile	ND
Benzene	0.041 mg/l
Bromoform	ND
Carbon Tetrachloride	ND
Chlorobenzene	ND
Chlorodibromomethane	ND
Chloroethane	ND
2-Chloroethylvinyl ether	ND
Chloroform	ND
Dichlorobromomethane	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloropropane	ND
1,2-Dichloropropylene	ND
Ethylbenzene	ND

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SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
Methyl Bromide	ND
Methyl Chloride	ND
Methylene Chloride	ND
1,1,2,2-Tetrachloroethane	ND
Tetrachloroethylene	ND
Toluene	0.054 mg/l
1,2-Transdichloroethylene	ND
1,1,1-Trichloroethane	ND
1,1,2-Trichloroethane	ND
Trichloroethylene	ND
Vinyl Chloride	ND
Acid Compounds	
2-Chlorophenol	ND
2,4-Dichlorophenol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
2-Nitrophenol	0.002 mg/l
4-Nitrophenol	0.016 mg/l
P-chloro-m-cresol	ND
pentachlorophenol	ND
Phenol	ND
2,4,6-Trichlorophenol	ND
Base Neutrals	
Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzidine	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
3,4-Benzofluoranthene	ND
Benzo(g,h,i)perylene	ND
Benzo(k)fluoranthene	ND
Bis(2-chloroethoxy)methane	ND
Bis(2-chlroroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
4-Bromophenyl phenyl ether	ND
Butylbenzyl phthalate	ND
2-Chloronapthalene	ND
4-Chlorophenyl phenyl ether	ND
Chrysene	ND

SAMPLE ID: MW - 10

ANALYTE	ANALYTICAL RESULTS
Dibenzo(a,h)anthracene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
3,3-Dichlorobenzidine	ND
Diethyl phthalate	ND
Dimethyl phthalate	ND
Di-n-butyl phthalate	ND
2,4-Dinitrotoluene	ND
2,6-Dinitrotoluene	ND
Di-n-octyl phthalate	ND
1,2-Diphenylhydrazine	ND
Fluoranthene	ND
Fluorene	ND
Hexachlorobenzene	ND
Hexachlorobutadiene	ND
Hexachlorocyclopentadiene	ND
Hexachloroethane	ND
Indeno(1,2,3-cd)pyrene	ND
Isophorone	ND
Naphthalene	ND
Nitrobenzene	ND
N-nitrosodimethylamine	ND
N-nitrosodie-n-propylamine	ND
N-nitrosodiphenylamine	ND
Phenanthrene	ND
Pyrene	ND
1,2,4-Trichlorobenzene	ND

ND = None Detected

TO: Bloomfield Refinery
Attn: Chris Hawley
PO Box 159
Bloomfield NM 87413

DATE: 11 November 1986
1624

SAMPLE ID: NOMINAL DETECTION LIMITS

ANALYTE	ANALYTICAL RESULTS
CN	0.01 mg/l
Phenols	0.001 mg/l
TOC	0.1 mg/l
TDS	1 mg/l
Cl	1.0 mg/l
SO 4	0.01 mg/l
Sb	0.01 mg/l
As	0.002 mg/l
Be	0.01 mg/l
Cd	0.01 mg/l
Cr	0.05 mg/l
Cu	0.03 mg/l
Pb	0.05 mg/l
Hg	0.002 mg/l
Ni	0.01 mg/l
Se	0.01 mg/l
Ag	0.05 mg/l
Tl	0.01 mg/l
Zn	0.008 mg/l

Detection limits for Volatiles, Base/Neutrals and Acid Compounds all 0.001 mg/l.

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemical Method", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

FOURTH QUARTER

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 19 January 1987
2160

SAMPLE ID: MW-1

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.012 mg/l	0.001 mg/l
TOC	18 mg/l	0.1 mg/l
TDS	2498 mg/l	1 mg/l
Cl	774 mg/l	1.0 mg/l
SO 4	579 mg/l	1.0 mg/l
Benzene	<0.001 mg/l	0.001 mg/l
Toluene	<0.001 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l
Ethyl Benzene	<0.001 mg/l	0.001 mg/l
Sb	0.25 mg/l	0.002 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	0.02 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.06 mg/l	0.06 mg/l
Se	0.03 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.012 mg/l	0.001 mg/l
Ba	0.055 mg/l	0.005 mg/l
Fe	<0.3 mg/l	0.3 mg/l
Mn	1.11 mg/l	0.005 mg/l
Al	4.54 mg/l	0.05 mg/l
B	0.27 mg/l	0.004 mg/l
Co	<0.05 mg/l	0.05 mg/l
Mo	0.17 mg/l	0.01 mg/l
NO3 as N	2.9 mg/l	0.1 mg/l
F	0.960 mg/l	0.01 mg/l
1,2-dichloroethane	0.002 mg/l	0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l	0.001 mg/l
Tetrachloroethylene	<0.001 mg/l	0.001 mg/l
Trichloroethylene	<0.001 mg/l	0.001 mg/l
CCl 4	<0.001 mg/l	0.001 mg/l

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REFERENCES: "Test Methods for Evaluatin Solid Waste,-Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refinery
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 19 January 1987
2160

SAMPLE ID: MW-2

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.110 mg/l	0.001 mg/l
TOC	15 mg/l	0.1 mg/l
TDS	3644 mg/l	1 mg/l
Cl	1012 mg/l	1.0 mg/l
SO 4	1372 mg/l	1.0 mg/l
Benzene	<0.001 mg/l	0.001 mg/l
Toluene	<0.001 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l
Ethyl Benzene	<0.001 mg/l	0.001 mg/l
Sb	0.48 mg/l	0.002 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.08 mg/l	0.06 mg/l
Se	0.04 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.009 mg/l	0.001 mg/l

REFERENCES: "Test Methods for Evaluatin Solid Waste,-Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 19 January 1987
2160

SAMPLE ID: MW-3

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	0.07 mg/l	0.01 mg/l
Phenols	0.012 mg/l	0.001 mg/l
TOC	12 mg/l	0.1 mg/l
TDS	4860 mg/l	1 mg/l
Cl	1290 mg/l	1.0 mg/l
SO_4	2204 mg/l	1.0 mg/l
Benzene	<0.001 mg/l	0.001 mg/l
Toluene	<0.001 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l
Ethyl Benzene	<0.001 mg/l	0.001 mg/l
Sb	0.67 mg/l	0.002 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	0.11 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.10 mg/l	0.06 mg/l
Se	0.05 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.010 mg/l	0.001 mg/l

REFERENCES: "Test Methods for Evaluatin Solid Waste,-Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refining
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 29 January 1987
2160 (revised)

SAMPLE ID: MW-4

ANALYTE	ANALYTICAL RESULTS
BASE NEUTRALS	
Napthalene	0.036 mg/l
Acenaphthylene	<0.001 mg/l
Acenaphthene	0.049 mg/l
Benzidine	<0.001 mg/l
3,4-benzofluoranthene	<0.001 mg/l
Bis(2-chloroethoxy)methane	<0.001 mg/l
Bis(2-chloroethyl)ether	<0.001 mg/l
Bis(2-chloroisopropyl)ether	<0.001 mg/l
Bis(2-ethylhexyl)phthalate	<0.001 mg/l
4-bromophenyl phenyl ether	<0.001 mg/l
Butylbenzyl phthalate	<0.001 mg/l
2-chloronaphthalene	<0.001 mg/l
4-chlorophenyl phenyl ether	<0.001 mg/l
1,2-dichlorobenzene	<0.001 mg/l
1,3-dichlorobenzene	<0.001 mg/l
1,4-dichlorobenzene	<0.001 mg/l
3,3-dichlorobenzidine	<0.001 mg/l
Diethyl phthalate	<0.001 mg/l
Dimethyl phthalate	<0.001 mg/l
Di-n-butyl phthalate	<0.001 mg/l
2,4-dinitrotoluene	<0.001 mg/l
2,6-dinitrotoluene	<0.001 mg/l
Di-n-octyl phthalate	<0.001 mg/l
1,2-diphenylhydrazine	<0.001 mg/l
Fluoranthene	<0.001 mg/l
Fluorene	0.023 mg/l
Hexachlorobenzene	<0.001 mg/l
Hexachlorobutadiene	<0.001 mg/l
Hexachlorocyclopentadiene	<0.001 mg/l
Hexachloroethane	<0.001 mg/l
Isophorone	<0.001 mg/l
Nitrobenzene	<0.001 mg/l
N-nitrosodimethylamine	<0.001 mg/l
N-nitrosodi-n-propylamine	<0.001 mg/l
N-nitrosodiphenylamine	<0.001 mg/l
1,2,4-trichlorobenzene	<0.001 mg/l

Phenanthrene	<0.001 mg/l
Anthracene	<0.001 mg/l
Pyrene	<0.001 mg/l
Benzo(a)anthracene	<0.001 mg/l
Chrysene	<0.001 mg/l
Benzo(k)fluoranthene	<0.001 mg/l
Benzo(a)pyrene	<0.001 mg/l
Dibenz(a,h)anthracene	<0.001 mg/l
Indeno(1,2,3-cd)pyrene	<0.001 mg/l
Benzo(g,h,i)perylene	<0.001 mg/l

ACID PRIORITY POLLUTANTS

2-chlorophenol	<0.001 mg/l
2-nitrophenol	<0.001 mg/l
Phenol	<0.001 mg/l
2,4-dimethyl phenol	<0.001 mg/l
2,4-dichloro phenol	<0.001 mg/l
2,4,6-trichloro phenol	<0.001 mg/l
P-chloro-m-cresol	<0.001 mg/l
2,4 dinitro phenol	<0.001 mg/l
Pentachloro phenol	<0.001 mg/l
4-nitro phenol	<0.001 mg/l
4,6-dinitro-o-cresol	<0.001 mg/l

VOLATILES

Acrolein	<0.001 mg/l
Acrylonitrile	<0.001 mg/l
Chlorobenzene	<0.001 mg/l
Toluene	1.78 mg/l
Benzene	1.91 mg/l
Ethyl benzene	4.48 mg/l
Tetrachloroethylene	<0.001 mg/l
Bromoform	<0.001 mg/l
Carbon tetrachloride	<0.001 mg/l
Chlorodibromomethane	<0.001 mg/l
Chloroethane	<0.001 mg/l
2-chloroethylvinyl ether	<0.001 mg/l
Chloroform	<0.001 mg/l
Dichlorobromomethane	<0.001 mg/l
Dichlorodifluoromethane	<0.001 mg/l
1,1-dichloroethane	<0.001 mg/l
1,2-dichloroethane	<0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l
1,2-dichloropropane	<0.001 mg/l

1,2-dichloropropylene	<0.001 mg/l
Methyl bromide	<0.001 mg/l
Methyl chloride	<0.001 mg/l
Methylene chloride	<0.001 mg/l
1,1,2,2-tetrachloroethane	<0.001 mg/l
1,2-trans-dichloroethylene	<0.001 mg/l
1,1,1-trichloroethane	<0.001 mg/l
1,1,2-trichloroethane	<0.001 mg/l
Trichloroethylene	<0.001 mg/l
Vinyl chloride	<0.001 mg/l

NOMINAL DETECTION LIMIT: 0.001 mg/l

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.096 mg/l	0.001 mg/l
TOC	170 mg/l	0.1 mg/l
TDS	2128 mg/l	1 mg/l
Cl	675 mg/l	1.0 mg/l
SO 4	<1 mg/l	1.0 mg/l
Sb	0.40 mg/l	0.01 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	<0.06 mg/l	0.06 mg/l
Se	0.03 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.040 mg/l	0.001 mg/l
Ba	2.3 mg/l	0.05 mg/l
Fe	18.6 mg/l	0.3 mg/l
Mn	5.70 mg/l	0.05 mg/l
Al	3.8 mg/l	0.05 mg/l
B	0.7 mg/l	0.04 mg/l
Co	<0.05 mg/l	0.05 mg/l
Mo	<0.01 mg/l	0.01 mg/l
No3 as N	<0.01 mg/l	0.01 mg/l
F	0.410 mg/l	0.01 mg/l

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemcial Methods," USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 19 January 1987
2160

SAMPLE ID: MW-5

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.021 mg/l	0.001 mg/l
TOC	9 mg/l	0.1 mg/l
TDS	3788 mg/l	1 mg/l
Cl	1118 mg/l	1.0 mg/l
SO 4	1132 mg/l	1.0 mg/l
Benzene	<0.001 mg/l	0.001 mg/l
Toluene	<0.001 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l
Ethyl Benzene	<0.001 mg/l	0.001 mg/l
Sb	0.50 mg/l	0.002 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.07 mg/l	0.06 mg/l
Se	0.03 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.016 mg/l	0.001 mg/l
Ba	0.010 mg/l	0.005 mg/l
Fe	<0.3 mg/l	0.3 mg/l
Mn	<0.005 mg/l	0.005 mg/l
Al	4.34 mg/l	0.05 mg/l
B	0.24 mg/l	0.004 mg/l
Co	<0.05 mg/l	0.05 mg/l
Mo	0.08 mg/l	0.01 mg/l
NO3 as N	36 mg/l	0.1 mg/l
F	0.580 mg/l	0.01 mg/l
1,2-dichloroethane	<0.001 mg/l	0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l	0.001 mg/l
Tetrachloroethylene	<0.001 mg/l	0.001 mg/l
Trichloroethylene	<0.001 mg/l	0.001 mg/l
CCl 4	<0.001 mg/l	0.001 mg/l

7300 Jefferson, N.E. • Albuquerque, New Mexico 87109 • (505) 345-8964

REFERENCES: "Test Methods for Evaluatin Solid Waste,-Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refining
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 29 January 1987
2160 (revised)

SAMPLE ID: MW-7

ANALYTE	ANALYTICAL RESULTS
BASE NEUTRALS	
Napthalene	<0.001 mg/l
Acenaphthylene	<0.001 mg/l
Acenaphthene	<0.001 mg/l
Benzidine	<0.001 mg/l
3,4-benzofluoranthene	<0.001 mg/l
Bis(2-chloroethoxy)methane	<0.001 mg/l
Bis(2-chloroethyl)ether	<0.001 mg/l
Bis(2-chloroisopropyl)ether	<0.001 mg/l
Bis(2-ethylhexyl)phthalate	<0.001 mg/l
4-bromophenyl phenyl ether	<0.001 mg/l
Butylbenzyl phthalate	<0.001 mg/l
2-chloronaphthalene	<0.001 mg/l
4-chlorophenyl phenyl ether	<0.001 mg/l
1,2-dichlorobenzene	<0.001 mg/l
1,3-dichlorobenzene	<0.001 mg/l
1,4-dichlorobenzene	<0.001 mg/l
3,3-dichlorobenzidine	<0.001 mg/l
Diethyl phthalate	<0.001 mg/l
Dimethyl phthalate	<0.001 mg/l
Di-n-butyl phthalate	<0.001 mg/l
2,4-dinitrotoluene	<0.001 mg/l
2,6-dinitrotoluene	<0.001 mg/l
Di-n-octyl phthalate	<0.001 mg/l
1,2-diphenylhydrazine	<0.001 mg/l
Fluoranthene	<0.001 mg/l
Fluorene	<0.001 mg/l
Hexachlorobenzene	<0.001 mg/l
Hexachlorobutadiene	<0.001 mg/l
Hexachlorocyclopentadiene	<0.001 mg/l
Hexachloroethane	<0.001 mg/l
Isophorone	<0.001 mg/l
Nitrobenzene	<0.001 mg/l
N-nitrosodimethylamine	<0.001 mg/l
N-nitrosodi-n-propylamine	<0.001 mg/l
N-nitrosodiphenylamine	<0.001 mg/l
1,2,4-trichlorobenzene	<0.001 mg/l

Phenanthrene	<0.001 mg/l
Anthracene	<0.001 mg/l
Pyrene	<0.001 mg/l
Benzo(a)anthracene	<0.001 mg/l
Chrysene	0.002 mg/l
Benzo(k)fluoranthene	0.001 mg/l
Benzo(a)pyrene	<0.001 mg/l
Dibenz(a,h)anthracene	<0.001 mg/l
Indeno(1,2,3-cd)pyrene	<0.001 mg/l
Benzo(g,h,i)perylene	<0.001 mg/l

ACID PRIORITY POLLUTANTS

2-chlorophenol	<0.001 mg/l
2-nitrophenol	<0.001 mg/l
Phenol	<0.001 mg/l
2,4-dimethyl phenol	<0.001 mg/l
2,4-dichloro phenol	<0.001 mg/l
2,4,6-trichloro phenol	<0.001 mg/l
P-chloro-m-cresol	<0.001 mg/l
2,4 dinitro phenol	<0.001 mg/l
Pentachloro phenol	<0.001 mg/l
4-nitro phenol	<0.001 mg/l
4,6-dinitro-o-cresol	<0.001 mg/l

VOLATILES

Acrolein	<0.001 mg/l
Acrylonitrile	<0.001 mg/l
Chlorobenzene	<0.001 mg/l
Toluene	<0.001 mg/l
Benzene	0.009 mg/l
Ethyl benzene	<0.001 mg/l
Tetrachloroethylene	<0.001 mg/l
Bromoform	<0.001 mg/l
Carbon tetrachloride	<0.001 mg/l
Chlorodibromomethane	<0.001 mg/l
Chloroethane	<0.001 mg/l
2-chloroethylvinyl ether	<0.001 mg/l
Chloroform	<0.001 mg/l
Dichlorobromomethane	<0.001 mg/l
Dichlorodifluoromethane	<0.001 mg/l
1,1-dichloroethane	<0.001 mg/l
1,2-dichloroethane	<0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l
1,2-dichloropropane	<0.001 mg/l

1,2-dichloropropylene	<0.001 mg/l
Methyl bromide	<0.001 mg/l
Methyl chloride	<0.001 mg/l
Methylene chloride	<0.001 mg/l
1,1,2,2-tetrachloroethane	<0.001 mg/l
1,2-trans-dichloroethylene	<0.001 mg/l
1,1,1-trichloroethane	<0.001 mg/l
1,1,2-trichloroethane	<0.001 mg/l
Trichloroethylene	<0.001 mg/l
Vinyl chloride	<0.001 mg/l

NOMINAL DETECTION LIMIT: 0.001 mg/l

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.025 mg/l	0.001 mg/l
TOC	2 mg/l	0.1 mg/l
TDS	6940 mg/l	1 mg/l
Cl	29 mg/l	1.0 mg/l
SO 4	3630 mg/l	1.0 mg/l
Sb	0.83 mg/l	0.01 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	0.02 mg/l	0.01 mg/l
Cr	0.08 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	0.26 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.07 mg/l	0.06 mg/l
Se	0.09 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.017 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemcial Methods," USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refining
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 29 January 1987
2160 (revised)

SAMPLE ID: MW-8

ANALYTE	ANALYTICAL RESULTS
BASE NEUTRALS	
Napthalene	<0.001 mg/l
Acenaphthylene	<0.001 mg/l
Acenaphthene	<0.001 mg/l
Benzidine	<0.001 mg/l
3,4-benzofluoranthene	<0.001 mg/l
Bis(2-chloroethoxy)methane	<0.001 mg/l
Bis(2-chloroethyl)ether	<0.001 mg/l
Bis(2-chloroisopropyl)ether	<0.001 mg/l
Bis(2-ethylhexyl)phthalate	<0.001 mg/l
4-bromophenyl phenyl ether	<0.001 mg/l
Butylbenzyl phthalate	<0.001 mg/l
2-chloronaphthalene	<0.001 mg/l
4-chlorophenyl phenyl ether	<0.001 mg/l
1,2-dichlorobenzene	<0.001 mg/l
1,3-dichlorobenzene	<0.001 mg/l
1,4-dichlorobenzene	<0.001 mg/l
3,3-dichlorobenzidine	<0.001 mg/l
Diethyl phthalate	<0.001 mg/l
Dimethyl phthalate	<0.001 mg/l
Di-n-butyl phthalate	<0.001 mg/l
2,4-dinitrotoluene	<0.001 mg/l
2,6-dinitrotoluene	<0.001 mg/l
Di-n-octyl phthalate	<0.001 mg/l
1,2-diphenylhydrazine	<0.001 mg/l
Fluoranthene	<0.001 mg/l
Fluorene	<0.001 mg/l
Hexachlorobenzene	<0.001 mg/l
Hexachlorobutadiene	<0.001 mg/l
Hexachlorocyclopentadiene	<0.001 mg/l
Hexachloroethane	<0.001 mg/l
Isophorone	<0.001 mg/l
Nitrobenzene	<0.001 mg/l
N-nitrosodimethylamine	<0.001 mg/l
N-nitrosodi-n-propylamine	<0.001 mg/l
N-nitrosodiphenylamine	<0.001 mg/l
1,2,4-trichlorobenzene	<0.001 mg/l

Phenanthrene	<0.001 mg/l
Anthracene	<0.001 mg/l
Pyrene	<0.001 mg/l
Benzo(a)anthracene	<0.001 mg/l
Chrysene	<0.001 mg/l
Benzo(k)fluoranthene	<0.001 mg/l
Benzo(a)pyrene	<0.001 mg/l
Dibenz(a,h)anthracene	<0.001 mg/l
Indeno(1,2,3-cd)pyrene	<0.001 mg/l
Benzo(g,h,i)perylene	<0.001 mg/l

ACID PRIORITY POLLUTANTS

2-chlorophenol	<0.001 mg/l
2-nitrophenol	<0.001 mg/l
Phenol	<0.001 mg/l
2,4-dimethyl phenol	<0.001 mg/l
2,4-dichloro phenol	<0.001 mg/l
2,4,6-trichloro phenol	<0.001 mg/l
P-chloro-m-cresol	<0.001 mg/l
2,4 dinitro phenol	<0.001 mg/l
Pentachloro phenol	<0.001 mg/l
4-nitro phenol	<0.001 mg/l
4,6-dinitro-o-cresol	<0.001 mg/l

VOLATILES

Acrolein	<0.001 mg/l
Acrylonitrile	<0.001 mg/l
Chlorobenzene	<0.001 mg/l
Toluene	<0.001 mg/l
Benzene	<0.001 mg/l
Ethyl benzene	<0.001 mg/l
Tetrachloroethylene	<0.001 mg/l
Bromoform	<0.001 mg/l
Carbon tetrachloride	<0.001 mg/l
Chlorodibromomethane	<0.001 mg/l
Chloroethane	<0.001 mg/l
2-chloroethylvinyl ether	<0.001 mg/l
Chloroform	<0.001 mg/l
Dichlorobromomethane	<0.001 mg/l
Dichlorodifluoromethane	<0.001 mg/l
1,1-dichloroethane	<0.001 mg/l
1,2-dichloroethane	<0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l
1,2-dichloropropane	<0.001 mg/l

1,2-dichloropropylene	<0.001 mg/l
Methyl bromide	<0.001 mg/l
Methyl chloride	<0.001 mg/l
Methylene chloride	<0.001 mg/l
1,1,2,2-tetrachloroethane	<0.001 mg/l
1,2-trans-dichloroethylene	<0.001 mg/l
1,1,1-trichloroethane	<0.001 mg/l
1,1,2-trichloroethane	<0.001 mg/l
Trichloroethylene	<0.001 mg/l
Vinyl chloride	<0.001 mg/l

NOMINAL DETECTION LIMIT: 0.001 mg/l

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	0.10 mg/l	0.01 mg/l
Phenols	0.042 mg/l	0.001 mg/l
TOC	8 mg/l	0.1 mg/l
TDS	3450 mg/l	1 mg/l
Cl	913 mg/l	1.0 mg/l
SO 4	1270 mg/l	1.0 mg/l
Sb	0.67 mg/l	0.01 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.43 mg/l	0.06 mg/l
Se	0.04 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.016 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemcial Methods," USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refining
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 29 January 1987
2160 (revised)

SAMPLE ID: MW-9

ANALYTE	ANALYTICAL RESULTS
BASE NEUTRALS	
Napthalene	0.029 mg/l
Acenaphthylene	<0.001 mg/l
Acenaphthene	<0.001 mg/l
Benzidine	<0.001 mg/l
3,4-benzofluoranthene	<0.001 mg/l
Bis(2-chloroethoxy)methane	<0.001 mg/l
Bis(2-chloroethyl)ether	<0.001 mg/l
Bis(2-chloroisopropyl)ether	<0.001 mg/l
Bis(2-ethylhexyl)phthalate	<0.001 mg/l
4-bromophenyl phenyl ether	<0.001 mg/l
Butylbenzyl phthalate	<0.001 mg/l
2-chloronaphthalene	<0.001 mg/l
4-chlorophenyl phenyl ether	<0.001 mg/l
1,2-dichlorobenzene	<0.001 mg/l
1,3-dichlorobenzene	<0.001 mg/l
1,4-dichlorobenzene	<0.001 mg/l
3,3-dichlorobenzidine	<0.001 mg/l
Diethyl phthalate	<0.001 mg/l
Dimethyl phthalate	<0.001 mg/l
Di-n-butyl phthalate	<0.001 mg/l
2,4-dinitrotoluene	<0.001 mg/l
2,6-dinitrotoluene	<0.001 mg/l
Di-n-octyl phthalate	<0.001 mg/l
1,2-diphenylhydrazine	<0.001 mg/l
Fluoranthene	<0.001 mg/l
Fluorene	<0.001 mg/l
Hexachlorobenzene	<0.001 mg/l
Hexachlorobutadiene	<0.001 mg/l
Hexachlorocyclopentadiene	<0.001 mg/l
Hexachloroethane	<0.001 mg/l
Isophorone	<0.001 mg/l
Nitrobenzene	<0.001 mg/l
N-nitrosodimethylamine	<0.001 mg/l
N-nitrosodi-n-propylamine	<0.001 mg/l
N-nitrosodiphenylamine	<0.001 mg/l
1,2,4-trichlorobenzene	<0.001 mg/l

Phenanthrene	<0.001 mg/l
Anthracene	<0.001 mg/l
Pyrene	<0.001 mg/l
Benzo(a)anthracene	<0.001 mg/l
Chrysene	<0.001 mg/l
Benzo(k)fluoranthene	<0.001 mg/l
Benzo(a)pyrene	<0.001 mg/l
Dibenz(a,h)anthracene	<0.001 mg/l
Indeno(1,2,3-cd)pyrene	<0.001 mg/l
Benzo(g,h,i)perylene	<0.001 mg/l

ACID PRIORITY POLLUTANTS

2-chlorophenol	<0.001 mg/l
2-nitrophenol	<0.001 mg/l
Phenol	0.133 mg/l
2,4-dimethyl phenol	<0.001 mg/l
2,4-dichloro phenol	<0.001 mg/l
2,4,6-trichloro phenol	<0.001 mg/l
P-chloro-m-cresol	<0.001 mg/l
2,4 dinitro phenol	<0.001 mg/l
Pentachloro phenol	<0.001 mg/l
4-nitro phenol	<0.001 mg/l
4,6-dinitro-o-cresol	<0.001 mg/l

VOLATILES

Acrolein	<0.001 mg/l
Acrylonitrile	<0.001 mg/l
Chlorobenzene	<0.001 mg/l
Toluene	0.754 mg/l
Benzene	1.49 mg/l
Ethyl benzene	0.504 mg/l
Tetrachloroethylene	<0.001 mg/l
Bromoform	<0.001 mg/l
Carbon tetrachloride	<0.001 mg/l
Chlorodibromomethane	<0.001 mg/l
Chloroethane	<0.001 mg/l
2-chloroethylvinyl ether	<0.001 mg/l
Chloroform	<0.001 mg/l
Dichlorobromomethane	<0.001 mg/l
Dichlorodifluoromethane	<0.001 mg/l
1,1-dichloroethane	<0.001 mg/l
1,2-dichloroethane	<0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l
1,2-dichloropropane	<0.001 mg/l

1,2-dichloropropylene	<0.001 mg/l
Methyl bromide	<0.001 mg/l
Methyl chloride	<0.001 mg/l
Methylene chloride	<0.001 mg/l
1,1,2,2-tetrachloroethane	<0.001 mg/l
1,2-trans-dichloroethylene	<0.001 mg/l
1,1,1-trichloroethane	<0.001 mg/l
1,1,2-trichloroethane	<0.001 mg/l
Trichloroethylene	<0.001 mg/l
Vinyl chloride	<0.001 mg/l

NOMINAL DETECTION LIMIT: 0.001 mg/l

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.160 mg/l	0.001 mg/l
TOC	275 mg/l	0.1 mg/l
TDS	1684 mg/l	1 mg/l
Cl	109 mg/l	1.0 mg/l
SO 4	20 mg/l	1.0 mg/l
Sb	0.40 mg/l	0.01 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	<0.01 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	0.16 mg/l	0.06 mg/l
Se	0.03 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.011 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemcial Methods," USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Bloomfield Refining
ATTN: Chris Hawley
PO Box 159
Bloomfield, NM 87413

DATE: 19 January 1987
2160

SAMPLE ID: MW-10

ANALYTE	ANALYTICAL RESULTS
BASE NEUTRALS	
Napthalene	0.004 mg/l
Acenaphthylene	<0.001 mg/l
Acenaphthene	<0.001 mg/l
Benzidine	<0.001 mg/l
3,4-benzofluoranthene	<0.001 mg/l
Bis(2-chloroethoxy)methane	<0.001 mg/l
Bis(2-chloroethyl)ether	<0.001 mg/l
Bis(2-chloroisopropyl)ether	<0.001 mg/l
Bis(2-ethylhexyl)phthalate	<0.001 mg/l
4-bromophenyl phenyl ether	<0.001 mg/l
Butylbenzyl phthalate	<0.001 mg/l
2-chloronaphthalene	<0.001 mg/l
4-chlorophenyl phenyl ether	<0.001 mg/l
1,2-dichlorobenzene	<0.001 mg/l
1,3-dichlorobenzene	<0.001 mg/l
1,4-dichlorobenzene	<0.001 mg/l
3,3-dichlorobenzidine	<0.001 mg/l
Diethyl phthalate	<0.001 mg/l
Dimethyl phthalate	<0.001 mg/l
Di-n-butyl phthalate	<0.001 mg/l
2,4-dinitrotoluene	<0.001 mg/l
2,6-dinitrotoluene	<0.001 mg/l
Di-n-octyl phthalate	<0.001 mg/l
1,2-diphenylhydrazine	<0.001 mg/l
Fluoranthene	<0.001 mg/l
Fluorene	<0.001 mg/l
Hexachlorobenzene	<0.001 mg/l
Hexachlorobutadiene	<0.001 mg/l
Hexachlorocyclopentadiene	<0.001 mg/l
Hexachloroethane	<0.001 mg/l
Isophorone	<0.001 mg/l
Nitrobenzene	<0.001 mg/l
N-nitrosodimethylamine	<0.001 mg/l
N-nitrosodi-n-propylamine	<0.001 mg/l
N-nitrosodiphenylamine	<0.001 mg/l
1,2,4-trichlorobenzene	<0.001 mg/l

Phenanthrene	<0.001 mg/l
Anthracene	<0.001 mg/l
Pyrene	<0.001 mg/l
Benzo(a)anthracene	<0.001 mg/l
Chrysene	<0.001 mg/l
Benzo(k)fluoranthene	<0.001 mg/l
Benzo(a)pyrene	<0.001 mg/l
Dibenz(a,h)anthracene	<0.001 mg/l
Indeno(1,2,3-cd)pyrene	<0.001 mg/l
Benzo(g,h,i)perylene	<0.001 mg/l

ACID PRIORITY POLLUTANTS

2-chlorophenol	<0.001 mg/l
2-nitrophenol	<0.001 mg/l
Phenol	<0.001 mg/l
2,4-dimethyl phenol	<0.001 mg/l
2,4-dichloro phenol	<0.001 mg/l
2,4,6-trichloro phenol	<0.001 mg/l
P-chloro-m-cresol	<0.001 mg/l
2,4 dinitro phenol	<0.001 mg/l
Pentachloro phenol	<0.001 mg/l
4-nitro phenol	<0.001 mg/l
4,6-dinitro-o-cresol	<0.001 mg/l

VOLATILES

Acrolein	<0.001 mg/l
Acrylonitrile	<0.001 mg/l
Chlorobenzene	<0.001 mg/l
Toluene	7.4 mg/l
Benzene	14.4 mg/l
Ethyl benzene	0.030 mg/l
Tetrachloroethylene	<0.001 mg/l
Bromoform	<0.001 mg/l
Carbon tetrachloride	<0.001 mg/l
Chlorodibromomethane	<0.001 mg/l
Chloroethane	<0.001 mg/l
2-chloroethylvinyl ether	<0.001 mg/l
Chloroform	<0.001 mg/l
Dichlorobromomethane	<0.001 mg/l
Dichlorodifluoromethane	<0.001 mg/l
1,1-dichloroethane	<0.001 mg/l
1,2-dichloroethane	<0.001 mg/l
1,1-dichloroethylene	<0.001 mg/l
1,2-dichloropropane	<0.001 mg/l

1,2-dichloropropylene	<0.001 mg/l
Methyl bromide	<0.001 mg/l
Methyl chloride	<0.001 mg/l
Methylene chloride	<0.001 mg/l
1,1,2,2-tetrachloroethane	<0.001 mg/l
1,2-trans-dichloroethylene	<0.001 mg/l
1,1,1-trichloroethane	<0.001 mg/l
1,1,2-trichloroethane	<0.001 mg/l
Trichloroethylene	<0.001 mg/l
Vinyl chloride	<0.001 mg/l

NOMINAL DETECTION LIMIT: 0.001 mg/l

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
CN	<0.01 mg/l	0.01 mg/l
Phenols	0.055 mg/l	0.001 mg/l
TOC	114 mg/l	0.1 mg/l
TDS	3272 mg/l	1 mg/l
Cl	457 mg/l	1.0 mg/l
SO 4	10 mg/l	1.0 mg/l
Sb	0.56 mg/l	0.002 mg/l
As	<0.05 mg/l	0.05 mg/l
Be	0.04 mg/l	0.01 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Cu	<0.03 mg/l	0.03 mg/l
Pb	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Ni	<0.06 mg/l	0.06 mg/l
Se	0.03 mg/l	0.002 mg/l
Ag	<0.05 mg/l	0.05 mg/l
Tl	<0.1 mg/l	0.1 mg/l
Zn	0.010 mg/l	0.001 mg/l
Xylenes	<0.001 mg/l	0.001 mg/l

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemcial Methods," USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

NOMINAL DETECTION LIMITS

Phenols	0.002 mg/l
Benzene	0.001 mg/l
Toluene	0.001 mg/l

Detection limits for Volatiles, and Base/Neutrals are all 0.001 mg/l

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

APPENDIX B

SURFACE WATER SAMPLING RESULTS
HAMMOND DITCH

ASSAIGAI ANALYTICAL LABORATORIES

HAMMOND DITCH

TO: Bloomfield Refinery
Attn: Chris Hawley
P.O. Box 159
Bloomfield NM 87413

DATE: 22 May 1986
0660 completed

SAMPLE DATE: 4/22/86

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS NEAR SULLIVAN ROAD HSRD 5	NEAR API PONDS HAPI 5
CN	<0.01 mg/l	<0.01 mg/l
Phenols	0.002 mg/l	0.002 mg/l
Sb	<0.2 mg/l	<0.2 mg/l
As	<0.050 mg/l	<0.050 mg/l
Be	<0.01 mg/l	<0.01 mg/l
Cd	<0.010 mg/l	<0.010 mg/l
Cr	<0.050 mg/l	<0.050 mg/l
Cu	<0.03 mg/l	<0.03 mg/l
Pb	<0.050 mg/l	<0.050 mg/l
Hg	<0.002 mg/l	<0.002 mg/l
Ni	<0.06 mg/l	<0.06 mg/l
Se	<0.010 mg/l	<0.010 mg/l
Ag	<0.050 mg/l	<0.050 mg/l
Tl	<0.01 mg/l	<0.01 mg/l
Zn	<0.01 mg/l	<0.01 mg/l
Acrolein	ND	ND
Acrylonitrile	ND	ND
Benzene	0.006 mg/l	ND
Bromoform	ND	ND
Carbon Tetrachloride	ND	ND
Chlorobenzene	ND	ND
Chlorodibromomethane	ND	ND
Chloroethane	ND	ND
2-Chloroethylvinyl Ether	ND	ND
Chloroform	ND	ND
Dichlorogromomethane	ND	ND
1,1-Dichloroethane	ND	ND
1.2-Dichloroethane	ND	ND
1,1-Dichloroethylene	ND	ND
1,2-Dichloropropane	ND	ND
1,2-Dichloropropylene	ND	ND
Ethylbenzene	ND	ND

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS	
	HSRD 5	HAPI 5
Methyl Bromide	ND	ND
Methyl Chloride	ND	ND
Methylene Chloride	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND
Tetrachloroethylene	ND	ND
Toluene	0.003 mg/l	Nd
1,2-Transdichloroethylne	ND	ND
1,1,1-Trichloroethane	ND	ND
1,1,2-Trichloroethane	ND	ND
Trichloroethylene	ND	ND
Vinyl Chloride	ND	ND
Acid Compounds		
2-chlorophenol	ND	ND
2,4-dichlorophenol	ND	ND
2,4-dimethylphenol	ND	ND
4,6-dinitro-o-cresol	ND	ND
2,4-dinitrophenol	ND	ND
2-nitrophenol	ND	ND
4-nitrophenol	ND	ND
p-chloro-m-cresol	ND	ND
pentachlorophenol	ND	ND
Phenol	ND	ND
2,4,6-trichlorophenol	ND	ND
Base Neutrals		
Acenaphthene	ND	ND
Acenaphthylene	ND	ND
Anthracene	0.006 mg/l	ND
Benzidine	ND	ND
Benzo(a)anthracene	0.003 mg/l	ND
Benzo(a)pyrene	ND	ND
3,4-benzofluoranthene	ND	ND
Benzo(ghi)perylene	ND	ND
Benzo(k)fluoranthene	ND	ND
Bis(2-chloroethoxy)methane	ND	ND
Bis(2-chloroethyl)ether	ND	ND
Bis(2-chloroisopropyl)ether	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND
4-bromophenyl phenyl ether	ND	ND
Butylbenzyl phthalate	ND	ND
2-chloronaphtalene	ND	ND
4-chlorophenyl phenyl ether	ND	ND
Chrysene	0.005 mg/l	ND

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS	
	HSRD 5	HAPI 5
Dibenzo(a,h)anthracene	ND	ND
1,2-Dichlorobenzene	ND	ND
1,3-Dichlorobenzene	ND	ND
1,4-Dichlorobenzene	ND	ND
3,3-Dichlorobenzidine	ND	ND
Diethyl phthalate	ND	ND
Dimethyl phthalate	ND	ND
Din-n-butyl phthalate	ND	ND
2,4-dinitrotoluene	ND	ND
2,6-dinitrotoluene	ND	ND
Di-n-octyl phthalate	ND	ND
1,2-diphenylhydrazine	ND	ND
Fluoranthene	ND	0.001 mg/l
Fluorene	ND	ND
Hexachlorobenzene	ND	ND
Hexachlorobutadiene	ND	ND
Hexachlorocyclopentadiene	ND	ND
Hexachloroethane	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND
Isophorone	ND	ND
Naphthalene	0.013 mg/l	ND
Nitrobenzene	ND	ND
N-nitrosodimethylamine	ND	ND
N-nitrosodie-n-propylamine	ND	ND
N-nitrosodiphenylamine	ND	ND
Phenanthrene	0.007 mg/l	ND
Pyrene	0.008 mg/l	ND
1,2,4-trichlorobenzene	ND	ND

ND = None Detected

REFERENCE: "Test Methods for Evaluating Solid Waste Chemical/Physical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

TO: Bloomfield Refinery

0660 completed

NOMINAL DETECTION LIMITS

CN	0.01 mg/l
Phenols	0.002 mg/l
Benzene	0.001 mg/l
Toluene	0.001 mg/l
Xylenes	0.001 mg/l
Ethylbenzene	0.001 mg/l
Sb	0.2 mg/l
As	0.050 mg/l
Be	0.010 mg/l
Cd	0.010 mg/l
Cr	0.050 mg/l
Cu	0.03 mg/l
Pb	0.050 mg/l
Hg	0.002 mg/l
Ni	0.06 mg/l
Se	0.010 mg/l
Ag	0.050 mg/l
Tl	0.01 mg/l
Zn	0.01 mg/l

Detection limits for Volatiles, Acid Compounds, and Base/Neutrals are all 0.001 mg/l

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Bloomfield Refinery
Attn: Chris Hawley
P.O. Box 159
Bloomfield NM 87413

DATE: 22 May 1986
0695
Page 1 of 3
SAMPLE DATE: 4/28/86
HAMMOND DITCH

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS	
	U4 NEAR API WASTE PONDS	D4 NEAR SULLIVAN ROAD
Phenols	0.003 mg/l	0.002 mg/l
	U6A	D6A
Acrolein	ND	ND
Acrylonitrile	ND	ND
Benzene	ND	ND
Bromoform	ND	ND
Carbon Tetrachloride	ND	ND
Chlorobenzene	ND	ND
Chlorodibromomethane	ND	ND
Chloroethane	ND	ND
2-Chloroethylvinyl Ether	ND	ND
Chloroform	ND	ND
Dichlorogromomethane	ND	ND
1,1-Dichloroethane	ND	ND
1.2-Dichloroethane	ND	ND
1,1-Dichloroethylene	ND	ND
1,2-Dichloropropane	ND	ND
1,2-Dichloropropylene	ND	ND
Ethylbenzene	ND	ND
Methyl Bromide	ND	ND
Methyl Chloride	ND	ND
Methylene Chloride	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND
Tetrachloroethylene	ND	ND
Toluene	ND	ND
1,2-Transdichloroethylene	ND	ND
1,1,1-Trichloroethane	ND	ND
1,1,2-Trichloroethane	ND	ND
Trichloroethylene	ND	ND
Vinly Chloride	ND	ND
Base Neutrals		
Acenapthene	ND	ND
Acenphthylene	ND	ND
Anthracene	ND	ND
Benzidine	ND	ND

TO: Bloomfield Refinery

0695
Page 2 of 3

ANALYTE	SAMPLE ID/ ANALYTICAL RESULTS U6A	D6A
Benzo(a)anthracene	ND	ND
Benzo(a)pyrene	ND	ND
3,4-benzofluoranthene	ND	ND
Benzo(ghi)perylene	ND	ND
Benzo(k)fluoranthene	ND	ND
Bis(2-chloroethoxy)methane	ND	ND
Bis(2-chloroethyl)ether	ND	ND
Bis(2-chloroisopropyl)ether	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND
4-bromophenyl phenyl ether	ND	ND
Butylbenzyl phthalate	ND	ND
2-chloronaphtalene	ND	ND
4-chlorophenyl phenyl ether	ND	ND
Chrysene	ND	ND
Dibenzo(a,h)anthracene	ND	ND
1,2-Dichlorobenzene	ND	ND
1,3-Dichlorobenzene	ND	ND
1,4-Dichlorobenzene	ND	ND
3,3-Dichlorobenzidine	ND	ND
Diethyl phthalate	ND	ND
Dimethyl phthalate	ND	ND
Din-n-butyl phthalate	ND	ND
2,4-dinitrotoluene	ND	ND
2,6-dinitrotoluene	ND	ND
Di-n-octyl phthalate	ND	ND
1,2-diphenylhydrazine	ND	ND
Fluoranthene	ND	ND
Fluorene	ND	ND
Hexachlorobenzene	ND	ND
Hexachlorobutadiene	ND	ND
Hexachlorocyclopentadiene	ND	ND
Hexachloroethane	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND
Isophorone	ND	ND
Naphthalene	ND	ND
Nitrobenzene	ND	ND
N-nitrosodimethylamine	ND	ND
N-nitrosodie-n-propylamine	ND	ND
N-nitrosodiphenylamine	ND	ND
Phenanthrene	ND	ND
Pyrene	ND	ND
1,2,4-trichlorobenzene	ND	ND

ND = None Detected

REFERENCE: "Test Methods for Evaluating Solid Waste Chemical/Physical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982

APPENDIX C

EPA AMBIENT STANDARDS AND CRITERIA FOR SUPERFUND REMEDIAL SITES

APPENDIX C

EPA AMBIENT STANDARDS AND CRITERIA FOR SUPERFUND REMEDIAL SITES

Chemical	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
	Safe Drinking Water Act, MCLs (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health--Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health--Adjusted for Drinking Water Only[a]	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (longer term)
Acenaphthene			20 ug/L (organoleptic)[b]	20 ug/L (organoleptic)			
Acrolein			320 ug/L	540 ug/L			
Acrylonitrile			0 (58 ng/L)[c]	0 (63 ng/L)			
Aldrin			0 (0.074 ng/L)	0 (1.2 ng/L)			
Antimony			146 ug/L	146 ug/L			
Arsenic	0.05		0 (2.2 ng/L)	0 (2.5 ng/L)			
Asbestos			0 (30,000 fibers/L)	0 (30,000 fibers/L)			
Barium	1.0						
Benzene			0 (0.66 ug/L)	0 (0.67 ug/L)		0.23	0.07
Benzidine			0 (0.12 ng/L)	0 (0.15 ng/L)			
Beryllium			0 (3.7 ng/L)	0 (3.9 ng/L)			
Cadmium	0.01		10 ug/L	10 ug/L			
Carbon monoxide		40,000 (1-hour)[d] 10,000 (8-hour)[d]					
Carbon tetrachloride			0 (0.4 ug/L)	0 (0.42 ug/L)	0.2	0.02	
Chlordane			0 (0.46 ng/L)	0 (22 ng/L)	0.0625	0.0625	0.0075
Chlorinated benzenes							
Hexachlorobenzene			0 (0.72 ng/L)	0 (21 ng/L)			
1,2,4,5-Tetrachlorobenzene			38 ug/L	180 ug/L			
Pentachlorobenzene			74 ug/L	570 ug/L			
Trichlorobenzene			Insufficient data	Insufficient data			
Monochlorobenzene			488 ug/L	488 ug/L			
Chlorinated ethanes							
1,2-Dichloroethane			0 (0.94 ug/L)	0 (0.94 ug/L)		Insufficient data	
1,1,1-Trichloroethane			18.4 mg/L	19 mg/L		1.0	
1,1,2-Trichloroethane			0 (0.6 ug/L)	0 (0.6 ug/L)			
1,1,2,2-Tetrachloroethane			0 (0.17 ug/L)	0 (0.17 ug/L)			
Hexachloroethane			0 (1.9 ug/L)	0 (2.4 ug/L)			
Monochloroethane			Insufficient data	Insufficient data			
1,1-Dichloroethane			Insufficient data	Insufficient data			
1,1,1,2-Tetrachloroethane			Insufficient data	Insufficient data			
Pentachloroethane			Insufficient data	Insufficient data			

(continued)

Chemical	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
	Safe Drinking Water Act, MCLs (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health--Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health--Adjusted for Drinking Water Only[a]	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (longer term)
Chlorinated naphthalenes			Insufficient data	Insufficient data			
Chlorinated phenols							
3-Monochlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
4-Monochlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
2,3-Dichlorophenol			0.04 ug/L (organoleptic)	0.04 ug/L (organoleptic)			
2,5-Dichlorophenol			0.5 ug/L (organoleptic)	0.5 ug/L (organoleptic)			
2,6-Dichlorophenol			0.2 ug/L (organoleptic)	0.2 ug/L (organoleptic)			
3,4-Dichlorophenol			0.3 ug/L (organoleptic)	0.3 ug/L (organoleptic)			
2,3,4,6-Tetrachlorophenol			1.0 ug/L (organoleptic)	1.0 ug/L (organoleptic)			
2,4,5-Trichlorophenol			2600 ug/L	2600 ug/L			
2,4,6-Trichlorophenol			0 (1.2 ug/L)	0 (1.8 ug/L)			
2-Methyl-4-chlorophenol			1800 ug/L (organoleptic)	1800 ug/L (organoleptic)			
3-Methyl-4-chlorophenol			3000 ug/L (organoleptic)	3000 ug/L (organoleptic)			
3-Methyl-6-chlorophenol			20 ug/L (organoleptic)	20 ug/L (organoleptic)			
Chlorophenoxys							
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.1						
2,4,5-Trichlorophenoxy-propionic acid (2,4,5-TP)	0.01						
Chloroalkyl ethers							
bis-(Chloromethyl) ether			0 (0.0038 ng/L)	0 (0.0039 ng/L)			
bis-(2-Chloroethyl) ether			0 (30 ng/L)	0 (30 ng/L)			
bis-(2-Chloroisopropyl) ether			34.7 ug/L	34.7 ug/L			
Chloroform	0.1[e]		0 (0.19 ug/L)	0 (0.19 ug/L)			
2-Chlorophenol			0.1 ug/L (organoleptic)	0.1 ug/L (organoleptic)			
Chromium Cr+6	0.05		50 ug/L	50 ug/L			
Cr+3			170 mg/L	179 mg/L			
Copper			1 mg/L (organoleptic)	1 mg/L (organoleptic)			
Cyanide			200 ug/L	200 ug/L			
DDT			0 (0.024 ng/L)	0 (>1.2 ng/L)			
Dichlorobenzenes (all isomers)			400 ug/L	470 ug/L			
Dichlorobenzidines			0 (10.3 ng/L)	0 (20.7 ng/L)			
Dichloroethylenes							
1,1-Dichloroethylene			0 (33 ng/L)	0 (33 ng/L)	1.0		0.07
1,2-Dichloroethylene			Insufficient data	Insufficient data	4.0	0.4	(cis isomer)
					2.7	0.27	(trans isomer)

(continued)

Chemical	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
	Safe Drinking Water Act, MCLs (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health--Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health--Adjusted for Drinking Water Only[a]	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (longer term)
Dichloromethane			See Halomethanes	See Halomethanes	13	1.3	0.15
2,4-Dichlorophenol			3.09 mg/L	3.09 mg/L			
Dichloropropanes/ Dichloropropenes							
Dichloropropanes			Insufficient data	Insufficient data			
Dichloropropenes			87 ug/L	87 ug/L			
Dieldrin			0 (0.071 ng/L)	0 (1.1 ng/L)			
2,4-Dimethylphenol			400 ug/L (organoleptic)	400 ug/L (organoleptic)			
2-4-Dinitrotoluene			0 (0.11 ug/L)	0 (0.11 ug/L)			
p-Dioxane					5.68	0.568	
1,2-Diphenylhydrazine			0 (42 ng/L)	0 (46 ng/L)			
Endosulfan			74 ug/L	138 ug/L			
Endrin	0.0002		1 ug/L	1 ug/L			
Ethylbenzene			1.4 mg/L	2.4 mg/L			
Ethylene glycol					19.0		5.5
Formaldehyde						0.03	
Fluoranthene			42 ug/L	188 ug/L			
Fluoride	1.4-2.4						
Haloethers			Insufficient data	Insufficient data			
Halomethanes			0 (0.19 ug/L)	0 (0.19 ug/L)			
Heptachlor			0 (0.28 ng/L)	0 (11 ng/L)			
Hexachlorobutadiene			0 (0.45 ug/L)	0 (0.45 ug/L)			
Hexachlorocyclohexanes							
Lindane (99% gamma-HCH)	0.004						
alpha-HCH			0 (9.2 ng/L)	0 (13 ng/L)			
beta-HCH			0 (16.3 ng/L)	0 (23.2 ng/L)			
gamma-HCH			0 (18.6 ng/L)	0 (26.4 ng/L)			
delta-HCH			Insufficient data	Insufficient data			
epsilon-HCH			Insufficient data	Insufficient data			
Technical-HCH			0 (12.3 ng/L)	0 (17.4 ng/L)			
Hexachlorocyclopentadiene			206 ug/L	206 ug/L			
n-Hexane					13	4.0	
Hydrocarbons (non-methane)		160 (3-hour)[d/f]					
Isophorone			5.2 mg/L	5.2 mg/L			
Kerosene/fuel oil no. 2						0.35[g]	
						0.23	

(continued)

Chemical	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
	Safe Drinking Water Act, MCLs (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health-- Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health-- Adjusted for Drinking Water Only[a]	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (longer term)
Lead	0.05	1.5 (90-day)	50 ug/L	50 ug/L			
Mercury	0.002		144 ng/L	10 ug/L			
Methoxychlor	0.1						
Methyl Ethyl Ketone						7.5	0.750
Naphthalene			Insufficient data	Insufficient data			
Nickel			13.4 ug/L	15.4 ug/L			
Nitrate (as N)	10.0						
Nitrobenzene			19.8 mg/L	19.8 mg/L			
Nitrogen dioxide		100 (1-year)[h]					
Nitrophenols							
2,4-Dinitro-o-cresol			13.4 ug/L	13.6 ug/L			
Dinitrophenol			70 ug/L	70 ug/L			
Mononitrophenol			Insufficient data	Insufficient data			
Trinitrophenol			Insufficient data	Insufficient data			
Nitrosamines							
n-Nitrosodimethylamine			0 (1.4 ng/L)	0 (1.4 ng/L)			
n-Nitrosodiethylamine			0 (0.8 ng/L)	0 (0.8 ng/L)			
n-Nitrosodi-n-butylamine			0 (6.4 ng/L)	0 (6.4 ng/L)			
n-Nitrosodiphenylamine			0 (4.9 ug/L)	0 (7.0 ug/L)			
n-Nitrosopyrrolidine			0 (16 ng/L)	0 (16 ng/L)			
Ozone		235 (1-hour)					
Particulate Matter		260 (24-hour)[d] 75 (24-hour)[i]					
Pentachlorophenol			1.01 mg/L	1.01 mg/L			
Phenol			3.5 mg/L	3.5 mg/L			
Phthalate esters							
Dimethylphthalate			313 mg/L	350 mg/L			
Diethylphthalate			350 mg/L	434 mg/L			
Dibutylphthalate			34 mg/L	44 mg/L			
Di-2-ethylhexyl-phthalate			15 mg/L	21 mg/L			
Polychlorinated biphenyls (PCBs)			0 (0.079 ng/L)	0 (>12.6 ng/L)	0.125	0.0125	
Polynuclear aromatic hydrocarbons (PAHs)			0 (2.8 ng/L)	0 (3.1 ng/L)			

(continued)

Chemical	Applicable or Relevant Requirements		Other Criteria, Advisories, and Guidance				
	Safe Drinking Water Act, MCLs (mg/L unless otherwise noted)	Clean Air Act, NAAQS (ug/m^3)	Clean Water Act, Water Quality Criteria for Human Health--Fish and Drinking Water	Clean Water Act, Water Quality Criteria for Human Health--Adjusted for Drinking Water Only[a]	Safe Drinking Water Act, Health Advisories (mg/L) 1-day	10-day	Chronic (longer term)
Radionuclides							
Radium-226 and 228	5 pCi/L						
Gross alpha activity	15 pCi/L						
Tritium	20,000 pCi/L						
Strontium-90	8 pCi/L						
Other man-made	j						
Selenium	0.01		10 ug/L	10 ug/L			
Silver	0.05		50 ug/L	50 ug/L			
Sulfur dioxide		365 (24-hour)[d] 80 (1-year)[h]					
2,3,7,8-TCDD			0 (0.000013 ng/L)	0 (0.00018 ng/L)			
Tetrachloroethylene			0 (0.8 ug/L)	0 (0.88 ug/L)	2.3	0.175	0.02
Thallium			13 ug/L	17.8 ug/L			
Toluene			14.3 mg/L	15 mg/L	21.5	2.2	0.34
Toxaphene	0.005		0 (0.71 mg/L)	0 (25.8 mg/L)			
Trichloroethylene			0 (2.7 ug/L)	(2.8 ug/L)	2.0	0.2	0.075
Trihalomethanes (total)[k]	0.1						
Vinyl chloride			0 (2.0 ug/L)	(2.0 ug/L)			
Xylenes					12	1.2	0.62
Zinc			5 mg/L (organoleptic)	5 mg/L (organoleptic)			

[a] These adjusted criteria, for drinking water ingestion only, were derived from published EPA Water Quality Criteria (45 FR 79318-79379, November 28, 1980) for combined fish and drinking water ingestion and for fish ingestion alone. These adjusted values are not official EPA Water Quality Criteria, but may be appropriate for Superfund sites with contaminated ground water. In the derivation of these values, intake was assumed to be 2 liters/day for drinking water and 6.5 grams/day for fish; human body weight was assumed to be 70 kilograms.

[b] Criteria designated as organoleptic are based on taste and odor effects, not human health effects. Health-based Water Quality Criteria are not available for these chemicals.

[c] The criterion for all carcinogens is zero; the concentration given in parentheses corresponds to a carcinogenic risk of 10^{-6}. Water Quality Criteria documents present concentrations resulting in risks from 10^{-5} to 10^{-7}. To obtain concentrations corresponding to risks of 10^{-4} and 10^{-5}, the 10^{-6} concentrations should be multiplied by 100 and 10, respectively. To obtain concentrations corresponding to risk of 10^{-7}, 10^{-6} concentrations should be divided by 10.

(continued)

[d] Annual maximum concentration not to be exceeded more than once per year.

[e] Chloroform is one of four trihalomethanes whose sum concentration must be less than 0.1 mg/L.

[f] As a guide in devising implementation plans for achieving oxidant standards.

[g] Seven-day health advisory for benzene and benzo(a)pyrene in kerosene, respectively.

[h] Annual arithmetic mean concentration.

[i] Annual geometric mean concentration.

[j] Activity corresponding to total body or any internal organ dose of 4 mrem/year.

[k] Total trihalomethanes refers to the sum concentration of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.