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REPORTS

YEAR(S):

1994

RCRA FACILITY INVESTIGATION/ CORRECTIVE MEASURES STUDY REPORT BLOOMFIELD REFINING COMPANY #50 COUNTY ROAD 4990 BLOOMFIELD, NEW MEXICO

PROJECT NO. 023353014

November 8, 1994

Prepared for:

Bloomfield Refining Company
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GROUNDWATER TECHNOLOGY

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8 November 1994

Mr. Greg J. Lyssy
Project Coordinator
RCRA Technical Section - Enforcement Branch
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

RE: Bloomfield Refining Company
#50 County Road 4990
Bloomfield, New Mexico
EPA ID# NM089416416
Administrative Order on Consent - Docket No. VI-303-H
RCRA Facility Investigation/Corrective Measures Study Report

Dear Mr. Lyssy:

Groundwater Technology, Inc. (GTI) on behalf of Bloomfield Refining Company (BRC) hereby submits three copies of the "RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) Report" for the above-referenced site. Additional wells have been proposed to the southwest of the facility (on the BLM property) to complete delineation in this direction. BRC is in the process of preparing the BLM right-of-way application and procuring an archaeological survey for this work.

Once approved by EPA, the RFI/CMS report is the final requirement of the Administrative Order on Consent. If appropriate, the Corrective Measures Implementation (CMI) would be prepared under another order or the facility's Part B/HSWA permit.

Should you have any questions concerning the report, please do not hesitate to contact me at (505) 242-3113.

Sincerely,
Groundwater Technology, Inc.

Cymantha Liakos

Cymantha Liakos
Project Manager

cc: Coby Muckelroy - NMED Hazardous Waste Bureau
Roger Anderson - NM Oil Conservation Division
Joe Warr - BRC
Chris Hawley - BRC
Dave Roderick - BRC

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1.0 INTRODUCTION

This "RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) Report" has been prepared pursuant to Attachment II - Corrective Action Plan of the Administrative Order on Consent (Docket No. VI-303-H) dated December 31, 1992 between the United States Environmental Protection Agency (USEPA) Region VI and Bloomfield Refining Company (BRC). The purpose of this report is to provide a summary and analysis of all facility investigations conducted under the "RCRA Facility Investigation: Task 2 - Work Plan" dated October 1, 1993 and approved by the USEPA in correspondence dated November 4, 1993. In addition, this report identifies and evaluates corrective action alternatives for the impacts at the BRC facility.

The RFI work was conducted in five phases, each reported to USEPA in the following submissions:

- Phase I - Soil Gas Survey - Correspondence dated February 11, 1994 and RECON^{R} "Soil Gas Survey" report dated February 2, 1994.
- Phase II - Soil Boring Investigation - Correspondence dated March 22, 1994.
- Phase III - Well Installations/Groundwater Sampling - Correspondence dated June 23, 1994 (first event) and September 30, 1994 (second event).
- Phase IV - Aquifer Testing - Report entitled "Uppermost Aquifer Hydraulic Testing and Modeling" dated July 20, 1994.
- Phase IV - Soil Vapor Extraction/Air Sparging Pilot Studies - Report entitled "Soil Vapor Extraction and Air Sparge Pilot Test Report" dated August 16, 1994.
- Phase V - Stream Sediment and Surface Water Sampling - Correspondence dated October 14, 1994.

This report is organized as follows:

- Section 1.0 contains information about the facility background and operations, and provides a summary of each of the five phases of investigation;
- Section 2.0 describes the environmental setting of the facility, including geology/hydrogeology, hydrology, soils and surface water/sediment;
- Section 3.0 discusses known and potential sources of releases to the environment and summarizes data collected in these areas;
- Section 4.0 describes contaminant characterization in soils, groundwater and surface water;
- Section 5.0 describes actual or potential receptors;

- Section 6.0 provides the investigation analysis, including a discussion of protection standards for soil and groundwater;
- Section 7.0 provides a summary of the pilot studies performed during the RFI;
- Section 8.0 discusses corrective measures; and
- Section 9.0 lists references.

1.1 Facility Background

The BRC facility is located at 50 County Road 4990 (Sullivan Road), immediately south of Bloomfield, New Mexico in San Juan County (Figure 1). The site is located on a bluff approximately 100 feet above the south side of the San Juan River, a perennial river that flows to the west. On the bluff and between the river and the process area of the facility is the Hammond Ditch, a man-made channel for irrigation water supply that borders all but the southern portion of the site. Bordering the facility is a combination of federal and private properties (Figure 2). The topography of the site is generally flat with low-lying areas to the east of the process area. The current facility layout is shown in Figure 3.

The BRC facility was originally constructed as a crude topping unit in the late 1950s by local entrepreneur Kimball Campbell. O. L. Garretson bought the facility in the early 1960s, renamed it Plateau, Inc., and sold it in 1964 to Suburban Propane of New Jersey. In November 1980, Plateau applied for a Part A Permit as a generator, storer, treater, and disposer of hazardous waste as a protective filing. Plateau later petitioned for reclassification under a generator-only status (in 1982). Bloomfield Refining Company acquired the facility from Suburban Propane (Plateau) on October 31, 1984.

The facility is currently under RCRA interim status for the operation of hazardous waste surface impoundments used to treat refinery wastewater. A Part B application was submitted in 1991 and amended in September 1994. BRC also operates under a discharge plan for the purpose of controlling potential releases to surface and groundwater, a Class I Underground Injection Well Permit, and a New Mexico Air Quality Control permit.

1.2 Phase I RFI - Soil Gas Survey

The soil gas survey was conducted between December 9 and 12, 1993 by Burlington Environmental, Inc. At each of 42 locations, soil gas samples were collected from two depths: shallow (3 to 4 feet) and deep (7.5 to 10 feet). Samples were analyzed onsite by a portable gas chromatograph for benzene, toluene, ethylbenzene and total xylenes (BTEX) and for total volatile organic content (TVOC).

The soil gas survey locations and analytical results are presented on Figure 4. Table 1 summarizes the results of soil gas sample analyses. The most impacted areas identified by the survey include the area of the flare (TVOC of 1,832 μg/L at PH-2D), the roadway south of Tanks 11 and 12 (TVOC of 1,108 μg/L at PH-15D), and the area surrounding Tanks 24 and 28 (TVOC of 6,474 μg/L at PH-22D). The results did not alter proposed soil boring (Phase II RFI) or monitoring well (Phase III RFI) locations. Results are discussed more fully in Section 3.0.

1.3 Phase II RFI - Soil Boring Investigation

Soil borings were installed in potential source areas identified by the USEPA during the 1987 inspection and in potential or suspected spill areas where data were not available from previous investigations at the facility. Drilling of the soil borings was conducted by Western Technology on February 22 and 23, 1994. Continuous split spoon sampling was conducted at each location until the cobble layer was encountered or until the boring was terminated. Samples were field screened using a photo-ionization detector (PID) and logged for lithology. One sample was selected from each boring for laboratory analysis, with the exception of B-4 from which two samples were submitted. The samples were selected based on either PID readings or the nature of the potential source of impact (e.g. surface spill versus underground lines). Samples were analyzed for volatile organic compounds (VOCs; USEPA Method 8240), semi-volatile organic compounds (SVOCs; USEPA Method 8270), total petroleum hydrocarbons (TPH; USEPA Method 418.1) and priority pollutant metals (PPM; USEPA Method 6010/7000 Series). In addition, one soil sample was analyzed for physical parameters, including: grain size distribution, dry bulk density, moisture content, ion exchange capacity, total organic carbon, pH, specific conductance, total/effective porosity and conductivity.

Figure 5 shows soil boring locations and Table 2 summarizes the results of soil sample analyses. No SVOCs or TPH were detected in any of the soil samples. Several metals were detected, but concentrations were well within the range of background concentrations in soils. Only three of the eleven soil samples contained detectable VOCs. All three samples were collected from the crude/product loading area, two from different depths of the same borehole. Sample B-4 (8-10') exhibited the highest PID reading and was found to contain detectable concentrations of BTEX compounds. Sample B-4 (10-12') contained 0.13 mg/Kg of acetone and 0.0065 mg/Kg of toluene. Sample B-3 (6-8') contained methylene chloride at 0.11 mg/Kg. These concentrations are not believed to be indicative of a release or contaminant source area requiring further delineation or remediation. No further action is proposed for these areas.

1.4 Phase III RFI - Well Installations/Groundwater Sampling

Seven groundwater monitoring wells (MW-25 through MW-31) were installed by Layne Environmental Services, Inc. from May 11 to 18, 1994, to delineate the dissolved- and separate-phase hydrocarbon (SPH) plumes at the site (Figure 5). The wells were installed to the top of the Nacimiento Formation, which appeared as a weathered limestone at each location. The surficial sediments consist of poorly graded silty sands to sands with occasional clay lenses and a cobble layer directly overlying the limestone. Table 3 provides a summary of well construction specifications for all monitoring wells on site. Wells MW-25 and MW-26 are six-inches in diameter, for possible use as recovery wells. The remaining five wells are four-inches in diameter. All seven wells are constructed of fiberglass-reinforced epoxy (FRE) materials with 0.02-inch slot screen. Wells were developed by purging following installation.

1.4.1 First Groundwater Sampling Event

All recovery wells were shut down a minimum of 24 hours prior to conducting sampling and gauging activities. On May 24, 1994, all site wells were gauged using an Interface Probe for depth to water and the presence of SPH. Measurements are shown on Table 4: Liquid Level Gauging Chart. Liquid levels were used to construct a water table contour map (Figure 6) and measurements of SPH were used to construct a SPH thickness map (Figure 7). As shown on Figure 6, groundwater flows to the west of the site, toward Hammond Ditch. Figure 7 shows that SPH thicknesses in most of the active recovery wells were noted as a sheen. Well RW-2 and associated monitoring points contained measurable SPH during the gauging event. Two of the newly installed monitoring wells contained measurable SPH: 0.17 feet in MW-27 and 0.08 feet in MW-28.

Wells which contained SPH were not sampled. All other monitoring and recovery wells were first purged of three volumes of water and sampled using disposable polyethylene bailers on 24 and 25 May 1994. In accordance with the approved work plan, newly installed wells were sampled for VOCs (USEPA Method 8240), SVOCs (USEPA Method 8270), TPH (USEPA Method 418.1) and PPM (USEPA Method 6010/7000 series). All other wells were sampled for VOCs and SVOCs only.

Two groundwater samples (MW-20 and RW-3) were also collected for analysis of water quality parameters including the following:

- pH (field determined)
- temperature (field determined)
- dissolved oxygen
- total dissolved solids (TDS)
- total organic carbon (TOC)
- alkalinity
- hardness
- specific cations (iron, manganese, magnesium, calcium, ammonium, sodium and potassium)

Groundwater samples were collected from 16 wells for laboratory analysis, including five of the newly installed wells. All other monitoring and recovery wells contained SPH, and therefore, were not sampled. Analyses were performed by Inter-Mountain Laboratories, Inc. Table 5 provides a summary of the analytical results. Figures 8 and 9 present the results of Total Targeted VOCs and SVOCs in groundwater, respectively.

Targeted VOCs were non-detectable in samples from seven wells: MW-1, MW-3, MW-5, MW-8, MW-12, MW-13 and MW-29. The only targeted VOCs detected in other wells sampled were BTEX. Benzene was the only targeted VOC detected in MW-20 at a concentration of 5.5 μg/L. MW-21 contained both benzene and ethylbenzene at 1,400 μg/L and 260 μg/L, respectively. Wells MW-11, MW-25, MW-26, RW-1 and RW-3 contained benzene, ethylbenzene and m,p-xylene. Wells MW-30 and MW-31 contained concentrations of all BTEX compounds. Non-targeted VOCs, consisting of unknown hydrocarbons and unknown aromatics, were detected in 12 of 16 wells, ranging from approximately 10 μg/L (in MW-1) to 14,000 μg/L (in MW-30).

Targeted SVOCs were non-detectable in the same seven wells that VOCs were not detected. Bis(2-ethylhexyl)phthalate was detected in one sample, RW-3, at a concentration of 16 μg/L. Chrysene was detected in one sample, RW-1, at a concentration of approximately 150 μg/L, below the method detection limit. Similarly, phenanthrene was detected in one sample, RW-1, at an approximate concentration of 130 μg/L. Two SVOCs, naphthalene and phenol, were found in MW-21, at concentrations of 17 μg/L and 13 μg/L, respectively. These compounds and one or more of the following SVOCs were found in wells MW-30, MW-31, MW-11, MW-25, MW-26, RW-1 and RW-3 at relatively low concentrations: 2,4-dimethylphenol, 2-methylnaphthalene, 2-methylphenol, 3-methylphenol.

Non-targeted SVOCs, consisting of indene, 1-methylnaphthalene, and unknown hydrocarbons, aromatics, alcohols and halogenated compounds, were detected in all of the groundwater samples ranging from approximately 10 μg/L (MW-8) to 8,500 μg/L (MW-30).

Only groundwater samples from the newly installed wells (total of six samples from five wells) were analyzed for TPH and metals. TPH was detected in three of the five wells, at 17 mg/L in MW-26, 18 mg/L in MW-30 and 11 mg/L in MW-31. Metals were detected in three of the five wells: MW-26, MW-29 and MW-30. Lead and zinc were the only metals found in MW-26 and MW-29, both at concentrations within background ranges. MW-30 contained low concentrations of arsenic, chromium, copper, lead and zinc, all within background ranges. Metals concentrations were below corresponding maximum contaminant levels (MCLs), indicating that metals are not constituents of concern at the BRC site.

Duplicate samples were collected from MW-21 and MW-26. Results of the two samples were very similar for each duplicate.

1.4.2 Second Groundwater Sampling Event

All active recovery wells were shut down a minimum of 24 hours prior to conducting gauging and sampling activities. On August 2, 1994, 21 monitoring wells, 11 recovery wells, and 3 piezometers at the site were gauged using an Interface Probe to determine the depth to water and the presence of SPH. Measurements are shown on Table 6: Liquid Level Gauging Chart. Liquid levels were used to construct a water table contour map (Figure 10) and SPH measurements were used to construct a SPH thickness map (Figure 11). As shown on Figure 10, groundwater flows to the west of the site, toward Hammond Ditch. Figure 11 shows that SPH thicknesses in most of the active recovery wells were noted as a sheen. Only well RW-17 and newly installed monitoring wells MW-27 and MW-28 contained measurable SPH during the gauging event; SPH thicknesses were less than 0.05 feet in all three wells.

On August 3 and 4, 1994, monitoring and recovery wells that did not contain SPH (total of 16) were sampled using the same procedures and analytical methods as the first event. Table 7 and Figures 12 and 13 provide a summary of the analytical results.

Targeted VOCs were non-detectable in samples from seven wells: MW-1, MW-3, MW-5, MW-8, MW-12, MW-13 and MW-29. The only targeted VOCs detected in any of the other wells sampled were BTEX. Benzene was the only targeted VOC detected in wells MW-20 and RW-1, at concentrations of 6 μg/L and 3,300 μg/L, respectively. Sample MW-21 contained both benzene and ethylbenzene at 970 μg/L and 180 μg/L, respectively. Wells MW-11, MW-25, MW-26 and RW-3 contained benzene, ethylbenzene and m,p-xylene. Wells MW-30 and MW-31 contained concentrations of all BTEX compounds.

Targeted SVOCs were non-detectable in the same seven samples that VOCs were not detected, as well as in sample MW-20. Bis(2-ethylhexyl)phthalate was detected in one sample, RW-1, at a concentration of 60 μg/L. Other SVOCs detected include naphthalene, phenol, 2,4-dimethylphenol, 2-methylnaphthalene, and 4-methylphenol/3-methylphenol.

Only groundwater samples from the newly installed wells (total of six samples, including one duplicate, from five wells) were analyzed for TPH and metals. TPH was detected in four of the five wells, at 1.4 mg/L in MW-25, 9.4 mg/L in MW-26, 50 mg/L in MW-30 and 11 mg/L in MW-31. Metals were detected in four of the five wells: MW-25, MW-26, MW-29 and MW-30. Lead was the only metal found in MW-25, and lead and zinc were the only metals found in MW-26 and MW-29, both at concentrations within background ranges. Besides lead and zinc, sample MW-30 contained arsenic at the detection limit of 0.01 mg/L; however, arsenic was not detected in the duplicate sample from this well. Metals concentrations were below corresponding MCLs in all wells sampled, indicating that metals are not constituents of concern at the BRC site. It is proposed that this parameter be eliminated from any future groundwater monitoring at the site.

Duplicate samples were collected from MW-21 and MW-30. Results of the two samples were very similar for each duplicate.

The groundwater sample analytical results indicate that BTEX are the primary constituents of concern for the site. Delineation of the horizontal extent of dissolved hydrocarbons is complete except to the southwest, further downgradient of MW-11 (which contained BTEX at 12,800 μg/L) and MW-27 (which contained SPH). Additional delineation will be proposed on the Bureau of Land Management (BLM) property to supplement this RFI work.

1.5 Phase IV RFI - Aquifer/Pilot Testing

1.5.1 Aquifer Testing

The scope of work for the pump test included a short-term step-drawdown test, followed by a long-term pumping test, data reduction, and interpretation. Field testing began June 6, 1994, and concluded June 10, 1994. The aquifer was stressed by pumping groundwater from wells RW-19 and RW-22. The response of the aquifer to the pumping was monitored by recording water levels in selected observation wells in the vicinity of the pumping wells. Figure 5 shows well locations.

To develop design parameters for a groundwater containment system in the vicinity of the liquid-phase hydrocarbon plume, hydraulic tests of existing wells were first carried out using additional monitoring points. Three monitoring points (MP), or wells, were constructed near recovery well RW-19. The first monitoring point (well MP-3) was installed 22.5 feet downgradient of recovery well RW-19; the remaining two points, wells MP-4 and MP-5, were installed approximately 24 and 44 feet crossgradient, respectively, from well RW-19. All three monitoring points (MP-3 through MP-5) were constructed of 2-inch inside diameter (ID) PVC casing, and were screened from 6 to 31 feet below grade. The locations of the monitoring points were designed to evaluate the homogeneity and isotropy of the aquifer in two perpendicular directions from pumping well RW-19.

During 5 days of field activities, from June 6 through 10, 1994, two wells were hydraulically tested using a submersible pump, an electronic data logger, and an interface probe (IP). Well RW-19 contained less than 0.5 feet of SPH, and monitoring wells MP-3 through MP-5 contained less than 0.25 feet of SPH.

Before pumping well RW-19, SPH was removed using a bailer, and monitored using the IP. During the variable-rate pumping test, well RW-19 produced 1 gpm for 1 hour (Step 1), and 2 gpm for an additional hour (Step 2). The pumping test was terminated after two hours, because the SPH thickness in the pumping well increased by a factor of ten over its pretest level, and more than doubled in nearby observation wells MP-3 and MP-4.

Well RW-22 was tested using both a variable and constant discharge rate. The discharge rates were 1, 2, and 4 gpm during the variable rate test and 4 gpm during the constant-rate test. No SPH was present in this well. Two nearby wells, RW-23 and MW-9 located at a distance of approximately 200 feet and 150 feet, respectively, from RW-22 were monitored during the pumping of well RW-22. Neither of the two wells demonstrated significant drawdown during the long-term, constant-rate pumping test.

Water level recovery data were analyzed to estimate the transmissivity of the uppermost aquifer near wells MP-5, MP-4, and RW-22. Transmissivity (T) estimates calculated at monitoring wells MP-3 and MP-4 were 1,412 ft^2/day and 1,260 ft^2/day, respectively. Hydraulic conductivity (K) was 177 ft/day and 158 ft/day, respectively. Transmissivity calculated at recovery well RW-22 was 353 ft^2/day, and hydraulic conductivity was 44 ft/day. Both values of T and K are indicative of a high-permeability saturated zone, representing sand and gravel deposits.

The fast accumulation of SPH in the cone-of-depression during pumping of well RW-19 indicates that dual liquid removal (groundwater and SPH) is a feasible active alternative for accelerated collection and removal of SPH in the aquifer. Simultaneous pumping of groundwater and SPH (using a dual pump system) can be achieved in locations containing SPH above the saturated zone. The number and locations of wells required to contain the entire plume can most accurately be determined using computer models.

Preliminary modeling of the capture zone in the vicinity of pumping well RW-22 (pumping at a rate of 4 gpm) indicates that the groundwater capture zone is circular in area. Initial expansion of the capture zone was not influenced by surface water boundaries. However, after 1 year of simulated pumping, the capture zone extends nearly to the irrigation canal and after 3 years of simulated pumping, the canal begins acting as a surface water recharge boundary, contributing to groundwater flow into well RW-22.

As concluded during pumping of well RW-19, dual liquid removal (groundwater and SPH) is feasible for this high-permeability saturated zone. The only disadvantage is the cone-of-depression (created by pumping at 4 gpm from one well) will be limited to a radial distance of approximately 30 feet. Groundwater remediation and SPH removal from the entire plume can best be achieved using a multiple well system. Interference from the cones-of-depression during simultaneous pumping of wells generally causes increased drawdown in the vicinity of the pumping wells, thereby enhancing SPH recovery.

Multiple well system simulation, as well as optimum groundwater/SPH containment and removal system design, can best be achieved using flow models. Model output can be used both for flow system engineering design and to more easily predict the progression of remediation. Therefore, modeling of the entire plume will be conducted for the Corrective Measures Implementation (CMI) plan, before installation of a groundwater containment and/or removal system.

1.5.2 Vapor Extraction/Air Sparge Pilot Testing

On May 13 through 17, 1994, Groundwater Technology supervised the installation of seven wells on the southwestern part of the BRC site for use in the aquifer testing and soil vent/air sparge pilot studies. Drilling was performed by Layne Environmental Services, Inc., the subcontracted driller, using a Drill Systems 180 air percussion drill rig. One nested vapor extraction well (VEW-1), one air sparge well (AS-1) and five monitor points (MP-1 through MP-5) were installed. Well locations are shown in Figure 14.

On June 13 through 16, 1994, Groundwater Technology conducted short-term air sparge and soil vapor extraction pilot tests at the BRC facility. The purpose of the pilot tests was to determine the following information:

- The effective radius of influence for a proposed air sparge/vapor extraction (ASVE) remediation system at the site;
- Engineering criteria and equipment specifications for use in designing a full-scale remediation system; and
- Hydrocarbon mass extraction rates for selection of air emissions treatment methodology.

Pilot testing consisted of three stages: a soil vapor extraction test, an air sparge test, and a combined air sparge/soil vent test. The tests consisted of actual field operation of a soil vacuum blower and air compressor temporarily connected to vapor extraction and air sparge wells. Induced response in the subsurface as a result of the tests was measured in surrounding monitor points. The sparge and vent tests were performed first to define the individual radii of influence and to determine the most effective operational conditions (pressure and vacuum settings) for these individual systems. The combined test documented actual field response to the optimum pressure and vacuum identified during the individual tests and allowed for balancing of the two systems.

Pilot tests at the BRC facility were performed using the newly installed air sparge (AS-1) and vapor extraction (VEW-1) wells as the test wells. Monitoring points were selected to provide multi-directional data at varying distances from the test wells, and to provide information concerning potential vertical differences in response both in the unsaturated and saturated zones. Figure 14 shows the layout of the pilot test monitoring array. The monitoring network utilized for the pilot tests consisted of five existing monitor or recovery wells (P-2, P-3, MW-4, RW-2, MW-25, and MW-26), newly installed monitor points MP-1, MP-2, and MP-4, and the soil vapor extraction nested well (VEW-1).

A complete description of the equipment setup, testing procedures and results was provided in the "Soil Vapor Extraction and Air Sparge Pilot Test Report" dated August 16, 1994. Based on the results of the pilot tests, the following conclusions were made:

- Induced vacuum as a result of venting on the shallow zone (5 to 13 feet below grade) at the site was measured in wells up to 57 feet away from the vent well. At the maximum applied vacuum of 42 inches of water column, induced vacuum response was low (less than 0.19 inches water column), reflecting the low permeability sediments (clay) characteristic of this zone. Calculated *effective* radii of influence for the shallow zone ranged from 2 feet (for removal of diesel products) to 36 feet for removal of gasoline (xylene/ethylbenzene) products.

- Induced vacuum response measured while venting on the deep zone (16 to 26 feet below grade) at a maximum applied vacuum of 21 inches water column ranged from 1.9 to 4.0 inches of water at distances of 19 to 57 feet from the vent well. Extrapolation of the observed data indicate that significant response (greater than 1% of the applied vacuum) would occur as far away as 175 feet from the vent well. Greater response to venting in the deep zone is probably attributable to the high permeability sands and gravels occurring at this depth. Calculated *effective* radii of influence for the deep zone ranged from 3 feet (for diesel) to 84 feet for removal of gasoline components.

- Aquifer sparging effectiveness was evaluated based on observed induced pressure and VOC concentrations while sparging at applied pressures of 3 to 5 psi. A conservative value of 50 feet was selected as the effective radius of influence for the sparge test, based on the observed pressure responses.

- Based on the results of the combined pilot test, a net negative vacuum was observed in all monitor points while venting at near maximum vacuum (18 inches water column) and sparging at approximately 120% (5 psi) above breakthrough pressure. This indicates that any vapors generated as a result of sparging can be captured and contained by the vacuum system. For the combined test, vacuum measured in the monitor points was generally reduced by more than one-half (when compared to the vacuum measured in these same points while venting only) as a result of sparge pressure, further confirming the effectiveness of sparging at the site.

- Hydrocarbon mass removal rates ranged from 0.20 lb/hr total fuel for the shallow zone to 5.5 lb/hr total fuel while venting and sparging on the deep zone. Elevated concentrations of methane ranging from 18 to 68% were also detected in the vented effluent and oxygen levels ranged from 4.3 to 18%.

1.6 Phase V RFI - Stream and Sediment Sampling

1.6.1 Stream Sampling

On August 10, 1994, Groundwater Technology personnel collected water samples from the San Juan River at three locations selected by EPA and BRC. These samples (SJ-1W, SJ-2W, and SJ-3W) were collected from the locations shown on Figure 15 approximately 1 foot below the water surface. In addition, between August 10 and 12, 1994, water samples HD-1W through HD-14W were collected at 14 locations in Hammond Ditch at depths ranging from 2.9 to 3.6 feet below the water surface.

Stream samples were analyzed for VOCs (USEPA Method 8240), SVOCs (USEPA Method 8270), TPH (USEPA Method 418.1), and PPM (USEPA Method 6010/7000 series). Two samples, HD-1W and HD-14W, were also analyzed for some or all of the following general water quality parameters: ammonia, nitrogen, TOC, TDS, total suspended solids, biological oxygen demand, chemical oxygen demand, and phosphorus.

1.6.2 Sediment Sampling

Between August 10 and 12, 1994, sediment samples were collected from the banks of the San Juan River and from the banks and bottom of Hammond Ditch at locations adjacent to the water sampling locations described above (Figure 16). The three San Juan River sediment samples, SJ-1S through SJ-3S, were collected from the east bank using a trowel. A trowel was also used to collect the 14 sediment samples (HD-1S through HD-14S) from the banks of Hammond Ditch. The bottom sediment samples (HD-1B through HD-14B) were collected approximately 1 foot below the bottom of the ditch, using a hand auger. Sediment samples were analyzed for VOCs, SVOCs, TPH, PPM, and TOC.

1.6.3 Results of Stream and Sediment Sampling

Tables 8 and 9 summarize the analytical results from the stream and sediment sampling, respectively. The results are also presented on Figures 15 and 16.

Excluding methylene chloride (which is believed to be a laboratory artifact), no VOCs, SVOCs or TPH were detected in surface water samples. Lead and zinc detected in three surface water samples from Hammond Ditch are consistent with naturally-occurring concentrations and are below state and federal action levels.

Again excluding methylene chloride, no VOCs, SVOCs or TPH were detected in sediment samples from the San Juan River. Toluene was the only VOC detected in three of the 28 sediment samples collected from Hammond Ditch, all bottom ("B") samples and were well below the proposed action level for toluene in soils (July 27, 1990 *Federal Register*). Phenanthrene was the only SVOC detected in two of the 28 sediment samples collected from Hammond Ditch, both bottom ("B") samples. TPH was also only detected in the same two samples. Metals concentrations in sediment samples were consistent with naturally-occurring concentrations and are not indicative of impacts from the BRC facility.

Based on the sample analytical results, neither Hammond Ditch nor the San Juan River appear to have been significantly impacted from the BRC facility. No further action will be proposed with regard to these surface water bodies as part of the corrective action program for the facility.

2.0 ENVIRONMENTAL SETTING

2.1 Geology/Hydrogeology

The BRC facility is located within the San Juan Basin, a subprovince of the Colorado Plateau physiographic province. The site is underlain by Quaternary Jackson Lake terrace deposits, consisting of 10 to 15 feet of unsaturated fines (clay and silt) to coarse-grained fluvioglacial outwash and loess. A permeable saturated cobble and sand layer directly overlies the bedrock at the site (the Tertiary Nacimiento Formation). The Nacimiento Formation is an interbedded, black carbonaceous mudstone/claystone with white, medium to coarse-grained sandstones approximately 570 feet thick in this area. The bluff that cropping out along the San Juan River near the site is similarly composed of these materials. Underlying the Nacimiento are the Ojo Alamo, Kirtland Shale, and Fruitland Formations (USEPA, 1987).

Groundwater at the site occurs at depths ranging from 6 to 40 feet below ground surface, increasing in depth from west to east across the site. Groundwater flow direction is generally to the west-northwest, toward the Hammond Ditch and San Juan River. BRC dikes the Hammond Ditch during the non-irrigation season (October 15 through April 15) to maintain a mounding effect of the ditch, thereby inhibiting northward groundwater flow. Groundwater in the perched aquifer migrates through the permeable sands, silts and cobble zone along the relatively impermeable Nacimiento Formation, which is reported to dip toward the north. Groundwater seeps along the bluff occur at the interface between the cobble zone and the Nacimiento. Two water table contour maps from the May and August 1994 monitoring events are presented as Figures 6 and 10.

From the aquifer testing conducted as part of the Phase IV RFI, transmissivity, hydraulic conductivity and storativity values were calculated for the uppermost aquifer:

Summary of Hydraulic Properties of the Uppermost Aquifer

Well No.	Transmissivity (Ft^2/day)	Hydraulic Conductivity (Ft/day)	Storativity (Dimensionless)
MP-3	1412	177	0.015
MP-4	1260	158	0.003
RW-22	353	44	NA

The transmissivity and hydraulic conductivity values calculated for wells MP-3 and MP-4 are relatively high, representing permeable sand and gravel. However, the presence of SPH within the cone-of-depression may reduce the total porosity available for groundwater recovery and accelerate the water level recovery rate. This accelerated recovery may create false or exaggerated high transmissivity values which may be 50 to 100 percent higher than the actual water-only transmissivity value at the saturated zone.

The storativity values calculated for wells MP-3 and MP-4 are indicative of unconfined to semi-confined conditions in the tested saturated zone. The presence of SPH on the water table may have led to the storativity values indicative of semi-confined conditions. No distinct impermeable geologic unit was present above the aquifer which could cause a confining condition.

2.2 Hydrology

Surface waters in the vicinity of the facility include the San Juan River (to the north) and the Hammond Ditch (Figure 3). The Town of Bloomfield, and surrounding areas, derive their potable water from the San Juan River, which is controlled by the Navajo Dam (ERM, 1991). The San Juan River level is approximately 75 feet lower than Hammond Ditch, and Hammond Ditch in turn is approximately 25 feet lower than the grade level in the northwestern part of the refinery. Water within Hammond Ditch, an unlined man-made channel used for irrigation and watering of livestock, is not intended for human consumption.

The Hammond Ditch, along with the surface impoundments that are part of refinery operations, contribute to local groundwater recharge at the site. As the elevation of the Nacimiento Formation increases toward the southern portion of the site, the perched water table dissipates (well MW-6 in this area has been dry since 1984). The Hammond Ditch (unlined in the vicinity of BRC) is actively flowing during the irrigation season (April 15 through October 15), but is diked by BRC during the non-irrigation season. When full, the Hammond Ditch creates a mounding effect, reducing groundwater flow to the west. Seepage from the ditch has not been quantified at this time but is known to be substantial based on numerous seeps along the San Juan River bluff.

Stormwater is collected in the curbed, concrete paved process areas connected to sewers leading to the wastewater treatment system. Other sewers outside the paved areas collect stormwater runoff and channel it to the facility's wastewater treatment system. Some areas not served by sewers collect process and stormwater in sumps, which are then emptied by vacuum truck for delivery to the wastewater treatment system. Tank berms and dikes are used to control other stormwater runoff.

2.3 Soils

The BRC site is underlain by 5 to 15 feet of sandy silt (USCS classification "ML"). A clay layer ("CL") was encountered in several boreholes directly overlying the silty sand ("SM") and/or cobble layer ("GW"). The more permeable silty sand or cobble layer overlies the Nacimiento Formation. A soil property analysis was performed as part of the Phase II RFI, with results as follows:

- pH = 7.4
- moisture content = 1.9%
- bulk density = 1.66
- total porosity = 35%
- effective porosity = 24%
- hydraulic conductivity = 2.0×10^{-04} cm/sec
- electrical conductivity = 0.55
- cation exchange capacity = 7.04
- grain size distribution = 68% sand, 32% silt/clay

Concentrations of metals detected during chemical analyses of soil samples were within the range of naturally-occurring metals. The metals detected and concentration ranges are shown below:

METAL	CONCENTRATION RANGE (mg/kg)
Beryllium	ND to 1.2
Cadmium	0.77 to 4.5
Chromium	ND to 11
Copper	ND to 12
Lead	ND to 11
Nickel	1.6 to 10
Thallium	ND to 25
Zinc	8.0 to 46

2.4 Surface Water and Sediment

There are two surface water bodies in the vicinity of the BRC site: the Hammond Ditch and the San Juan River. Both water bodies flow from east to west along the northern edge of the facility.

Hammond Ditch

The Hammond Ditch is a man-made irrigation channel, which is in-use from April 15 through October 15. The ditch is approximately 20 feet wide with water between 2.5 and 4 feet deep during the irrigation season. The ditch is hydraulically connected to the shallow water table at the site. During the non-irrigation season, BRC dikes the ditch to maintain a mounding effect of the ditch, thereby inhibiting northward groundwater flow. From the Phase V RFI sediment sampling, bottom sediment (silty sands) was measured to be between one and two feet thick.

A water sample from Hammond Ditch (HD-14W) was analyzed for certain water quality parameters, with the following results:

- Total Ammonia = <0.05 mg/L
- Nitrate and Nitrite as N = <0.01 mg/L
- Nitrogen, Total Kjendahl = <0.1 mg/L
- Chemical Oxygen Demand = 2.7 mg/L
- Phosphorus = 0.23 mg/L
- Total Dissolved Solids = 170 mg/L
- Total Suspended Solids = 6 mg/L

In addition, several parameters were field-tested during the collection of surface water samples. The ranges of these parameters are shown below.

HAMMOND DITCH SURFACE WATER PARAMETERS

PARAMETER	RANGE
pH (S.U.)	8.00 to 9.07
Temperature (°F)	63.2 to 75.3
Conductivity (μs/cm)	231 to 280
Dissolved Oxygen (mg/L)	8.0 to 9.9
Flow Velocity (feet/second)	0.76 to 1.53
Water Depth (feet)	2.5 to 3.6

<u>San Juan River</u>

The San Juan River flows from Navajo Lake, east of Farmington, to Lake Powell in Utah. The river is a source of potable water for the surrounding communities. In addition, it is used for recreational purposes (i.e., fishing, rafting).

A water sample from the San Juan River (SJ-1W) was analyzed for certain water quality parameters, with the following results:

- Ammonia as N = <0.05 mg/L
- Biological Oxygen Demand = 9.8 mg/L
- Total Organic Carbon = 3.3 mg/L
- Nitrate and Nitrite as N = <0.05 mg/L
- Nitrogen, Total Kjendahl = <0.1 mg/L
- Chemical Oxygen Demand = 4.5 mg/L
- Phosphorus = 0.58 mg/L
- Total Dissolved Solids = 220 mg/L
- Total Suspended Solids = 130 mg/L

In addition, several parameters were field-tested during the collection of surface water samples. The ranges of these parameters are shown below.

SAN JUAN RIVER SURFACE WATER PARAMETERS

PARAMETER	RANGE
pH (S.U.)	7.65 to 8.25
Temperature (°F)	70.6 to 78.0
Conductivity (μs/cm)	319 to 363
Dissolved Oxygen (mg/L)	8.4 to 9.0
Flow Velocity (feet/second)	0.64 to 2.65
Water Depth (feet)	1 to 1.5

3.0 SOURCE CHARACTERIZATION

BRC considers product releases (both documented and undocumented) to be the source of soil and groundwater contamination at the site. Documented releases were listed in the Task I report. Undocumented releases are believed to have occurred in the process and bulk storage tank areas during the many years of operation of the refinery. In 1987 the facility established a more rigorous inspection/maintenance and repair program for storage tanks and associated piping. In addition, records of all reportable releases have been maintained since BRC acquired the refinery in 1984.

The Task 1 RFI Report (Description of Current Conditions) provided a detailed description of each source area, unit/disposal area characteristics, and waste characteristics. The facility was divided into four geographic areas, encompassing historical release areas, product storage areas, process areas and solid waste management units, and hazardous waste management units. Information on these source areas and corresponding soil and groundwater characterization data are described in this section.

SOLID WASTE MANAGEMENT UNITS/POTENTIAL SOURCE AREAS

UNIT	UNIT TYPE	CHARACTERIZATION
GEOGRAPHIC AREA 1		
API Oil/Water Separator	Process Unit	None needed-Structure intact.
Oily Water Ponds (SOWP and NOWP)	RCRA-regulated SWMUs since Sept 25, 1990	Underliner soil samples and downgradient wells MW-9, MW-20 and RW-18 monitored quarterly.
Spent Caustic Tank	Product Tank	None needed-new tank and concrete dike.
Former Drum Storage Area	SWMU (EPA's RFA)	Wells RW-1 and P-1.
Crude Unit	Spill Area (Documented)	None. Access Limited.
Tanks 3, 4, 5 Areas and Former Tanks 6 and 7 Areas	Spill Area (Suspected) - Tank Leaks Known	Wells MW-9, RW-18, RW-22 and RW-23.
Overall Geographic Area 1 (Process Area)	Spill Area (Suspected)	Seven RWs, 3 piezometers, 4 MWs, SVE and AS pilot test wells/monitor points

UNIT	UNIT TYPE	CHARACTERIZATION
GEOGRAPHIC AREA 2		
Tank 19 Area	Spill Area (Documented)	RWs 14 and 15 - active recovery. Soil Gas Survey.
Tanks 21 and 22 Area	Spill Area (Documented)	MW-29 & Soil Gas Survey.
Tank 26 Area	Spill Area (Documented)	RW-16 - active recovery & Soil Gas Survey.
Underground Piping (minimal)	SWMU (EPA's RFA)	RWs 14, 15, 16, 17 - active recovery - & Soil Gas Survey.
Aboveground Storage Tanks	Spill Area (Suspected) - Tank Leaks Known	RWs 14, 15, 16, 17 - active recovery and MW-21, MW-29 and MW-30. Soil Gas Survey.
GEOGRAPHIC AREA 3		
Transportation Terminal Sump	SWMU (EPA's RFA)	B-1 and B-2.
Heat Exchanger Bundle (HEB) Cleaning Area	SWMU (EPA's RFA)	MW-13 and good condition.
Crude Loading Area	Spill Area (Documented)	B-3 and B-4 & Soil Gas Survey.
Product Loading Rack	Spill Area (Documented) - Paved area	B-3 and B-4 & Soil Gas Survey.
Underground Piping	SWMU (EPA's RFA)	B-3 and B-4 & Soil Gas Survey.
GEOGRAPHIC AREA 4		
Evaporation Ponds (north and south)	SWMU (EPA's RFA)	B-5, B-6, B-7, and B-9. MW-1 and MW-5 sampled semi-annually.
Landfill (wastepile)	Alleged RCRA-regulated SWMU	1985 soil samples, 1990 delisting char. composite soil samples, and MW-8.
Landfill Pond	Alleged RCRA-regulated SWMU	1985 soil samples.
Fire Training Area	SWMU (EPA's RFA)	B-7, B-9, B-9 and B-10.
Spray Irrigation Area	SWMU (EPA's RFA)	MW-5 sampled semi-annually.

RW = Recovery or pumping well.
MW = Monitoring well.

3.1 Geographic Areas

The facility has been divided into four geographic areas which are shown on Figure 17 and are discussed below. In June 1987, an USEPA-led investigation identified 13 areas as Solid Waste Management Units (SWMUs), five of which were further classified as RCRA-regulated SWMUs. These include the two oily water ponds (NOWP and SOWP), the clay-lined evaporation ponds (north and south), the landfill, and the landfill pond. Since that time, it has been determined that the clay-lined evaporation ponds are not RCRA-regulated SWMUs. Clean closure for the landfill pond was approved by the NMED on January 28, 1994.

3.1.1 Area 1

Area 1 is located on the northeast corner of the site and includes the following units:

- The API Oil/Water Separator and the NOWP and SOWP;
- The Spent Caustic Tank;
- The Former Drum Storage Area(s) (warehouse yard);
- The Major Processing Units; and
- Tank Area for Tanks 3, 4, and 5 and Former Location of Tanks 6 and 7.

As mentioned previously, the NOWP and SOWP are considered RCRA-regulated SWMUs since D018 (benzene-contaminated) wastes are treated in these units. The API separator is considered a process unit and the spent caustic tank is currently for product storage. The former drum storage area in the warehouse yard was not used for waste storage. The crude unit is the site of a documented spill that occurred in 1986. Other spills, although undocumented, undoubtedly occurred during the long history of the refinery and the process areas. The tank areas for Tanks 3, 4, and 5 and the former location of Tanks 6 and 7 are also considered probable source areas.

Several monitoring wells (MW-4, MW-7, MW-9 and MW-20), recovery wells (RW-1, RW-2, RW-3, RW-18, RW-19, RW-22 and RW-23) and piezometers (P-1, P-2 and P-3) are located in Area 1. Discernable thicknesses of SPH historically have been observed in many of these wells. Recovery wells RW-2, RW-18 and RW-19 are currently active in the facility's hydrocarbon recovery system. Because SPH has been measured in MW-4, RW-2, RW-19, and RW-18, the entire eastern portion of Area 1 is known to be impacted. The source(s) of this impact are assumed to be product releases (documented and undocumented) from storage and processing areas over the many years of the refinery operations. The sources of the subsurface contamination in this area are not considered to be limited to the SWMUs discussed in this section. It is likely that a portion of the subsurface contamination migrated from other areas.

3.1.1.1 Wastewater Treatment System: API Separator, SOWP, and NOWP

The wastewater treatment system, which includes the API separator, the south oily water pond (SOWP), and the north oily water pond (NOWP), treats approximately 80 gallons per minute (gpm) of water. The separator, considered a process unit, is a double-chambered steel-reinforced concrete tank that acts as a physical separator of water and oil. Oil is skimmed in the separator and returned to the refinery process, water underflows a weir to the SOWP, and sludges accumulate in the bottom.

The facility drainage system, consisting of a network of tank farm sumps which are emptied by vacuum truck and sewer lines within the process areas, leads directly to the API separator unit. Accumulated API sludge is normally cleaned out annually (never less frequently than every two years) and is shipped offsite to a permitted hazardous waste disposal facility. The API separator discharges water to the SOWP and NOWP, which are operated in series and equipped with aerators to biologically treat the wastewater. The facility retrofitted these impoundments with a new HDPE double liner system during the first quarter of 1994 to meet minimum technology requirements (MTRs) for hazardous waste treatment impoundments.

After aeration and biological treatment, water is discharged to the evaporation ponds (either the clay-lined north and south evaporation ponds or the HDPE double-lined north and south evaporation ponds). The total daily discharge averages 115,200 gallons. BRC received a permit for a Class I underground injection well (dated November 5, 1993). The well installation was completed on January 12, 1994. Construction of associated aboveground facilities is ongoing and is expected to be complete by mid-November 1994. Once the injection well is fully operational, the clay-lined evaporation ponds and the spray irrigation area will be taken out of service.

The oily water ponds were cleaned out in 1982, lined with 100-mil HDPE liners, and recently double-lined (April 1994). A french drain system, consisting of 4-inch diameter PVC perforated pipe draining to a nearby observation well, was installed beneath the ponds to detect leakage. Leakage was detected in the system soon after its installation, so the ponds were emptied and the liners repaired. Daily monitoring of the ponds is conducted to insure no overbanking of the ponds occurs.

Some of the sludges removed from the SOWP and NOWP in 1982 were disposed onsite into the "landfill", which has been identified by the USEPA as a RCRA-regulated SWMU because of the presence of these sludges (see Area 4).

Soil beneath the ponds was sampled in 1985 (E-S, 1986) as part of a closure plan for the units. A total of thirteen soil samples were collected from beneath the two ponds and analyzed for BTEX, phenolics, total chromium and total lead. Only one soil sample contained a detectable concentration of BTEX constituents, which consisted of 7.4 μg/kg of total xylenes in sample 51469-17. Phenolics were non-detectable in all samples. Chromium and lead levels were well within the range of background concentrations of these metals in soils.

One soil sample (51469-23) was also analyzed for "Skinner List" parameters (a subset of Appendix VII parameters that are expected to be present at a petroleum refinery). None of these parameters, which include VOCs and SVOCs, were detected.

Monitoring wells MW-9 and MW-20 and recovery well RW-18 are located downgradient of the wastewater treatment units. SPH was detected in MW-9 and RW-18 during the first and second groundwater sampling events conducted during the Phase III RFI. Therefore, these wells were not sampled. Well MW-20 was sampled during both events. The only targeted VOC detected during either event was benzene at 5.5 μg/L (first event) and 6 μg/L (second event). No targeted SVOCs were detected during either event.

During the 1987 EPA inspection, it was noted that the good condition of the liners, the fact that overtopping of the ponds was not occurring, and the presence of the leak detection system all serve to minimize the possibility of migration of hazardous substances from the ponds to the soil, surface water, or groundwater. No further investigation or remediation is proposed to specifically address the API separator, the NOWP or the SOWP.

3.1.1.2 Spent Caustic Tank

The contents of the spent caustic tank that had been located near the API separator were sampled during a 1984 USEPA inspection and were found to have a pH of 12.8, thereby rendering the material hazardous based on its characteristic of corrosivity (EPA, 1987). The material also contained levels of reactive sulfides. Since the storage of this waste was not included in the facility's RCRA permit application, this finding was cited in the 3008 Compliance Order issued by USEPA.

Ensuing discussions resolved that BRC would not store corrosive or reactive wastes for more than 90 days at the facility.

In 1986, the caustic tank was cleaned out and the material was shipped to a hazardous waste disposal facility. In early 1987, a new spent caustic tank was installed to the west of the SOWP and NOWP. The tank (12 feet in diameter, 20 feet in height) rests on a concrete pad and is surrounded by a concrete containment wall. A transfer pump to remove spent caustic from the tank is located within the containment area. Currently, spent caustic is a product shipped to a pulp paper plant.

During the 1987 USEPA inspection, it was noted that the tank appeared to be in good structural condition with no signs of leakage, and that it was unlikely that releases from the tank would occur. No further investigation or remediation is proposed to specifically address the spent caustic tank.

3.1.1.3 Drum Storage Areas

North Bone Yard

Several areas where drums were stored at the facility were noted during the 1984 inspection by the USEPA, including the north bone yard located north of the clay-lined evaporation ponds (Area 4). In July 1987, BRC removed the drums from this area to the area west of the refinery offices. Currently only empty drums are stored in the north bone yard. Monitoring well MW-1 is located in the north bone yard and is sampled on a semi-annual basis as part of the facility's discharge plan compliance requirements. Dissolved hydrocarbon concentrations in MW-1 historically have been low or non-detectable. No targeted VOCs or SVOCs were detected during the first or second groundwater sampling events conducted as part of the RFI. No further investigation or remediation is proposed for the north bone yard.

Warehouse Yard

During the 1987 inspection, drum storage for solvents and oils used in the refinery processes had been consolidated to the fenced area west of the refinery office (warehouse yard). In 1988, the facility again upgraded its drum storage area by constructing a metal frame storage shed with concrete flooring and curbing and a collection trench. This project was part of the facility's program to convert to bulk storage and minimize drummed chemicals. Drums containing primarily lube oils are currently stored on a rack in the shed. For the most part, chemicals used in the refinery processes are stored in the process areas in portafeed tanks or stainless-steel totes.

Recovery well RW-1 and piezometer P-1 are located in the warehouse yard. Well RW-1 is connected to the hydrocarbon recovery system but is not currently active since SPH has not been detected in this well for several consecutive monitoring events and the recovery well is installed in the office and warehouse leachfield. RW-1 was sampled during both events of the Phase III RFI. Benzene (2,800 μg/L), ethylbenzene (80 μg/L) and m,p-xylene (40 μg/L) were the targeted VOCs detected during the May event. Benzene (3,300 μg/L) was the only targeted VOC detected during the August event. Naphthalene, 2-methylnaphthalene, chrysene, and phenanthrene were the targeted SVOCs detected during the May event. Naphthalene, 2-methylnaphthalene and bis-(2-ethylhexyl)phthalate were detected during the August event. This area will be incorporated into the remediation program for the site.

90-day Hazardous Waste Storage Area

Drums of hazardous wastes are stored in an indoor, 90-day storage room in the east end of an auxiliary warehouse building (Area 3). The room is fully enclosed and has a concrete floor in good structural condition. The only drums stored in this area are those containing wastes awaiting off-site shipment to a hazardous waste disposal area. During the 1987 inspection, it was noted that releases of waste from this drum storage area were unlikely to occur. No further investigation or remediation is proposed for the 90-day waste storage area.

3.1.1.4 Crude Unit and Other Process Units

As discussed in Section 1.5 above, a spill near the crude unit was reported in April 1986. A total of 200 barrels of diesel fuel were spilled, 150 of which were not recovered. The area has since been paved with concrete. The AS/SVE pilot testing (Phase IV RFI) was conducted in this area of the site, indicating these technologies are applicable for site soils and the contaminants of concern.

Screening of soils using a PID was conducted during the installation of the monitoring point MP-3 and vapor extraction well VEW-1. Samples exhibiting the highest PID readings (MP-3-27 from 27 feet and VEW-1-24 from 24 feet, both corresponding with the water table interface) were submitted for laboratory analysis of VOCs. Xylenes were the only targeted VOCs detected in MP-3-27 and VEW-1-24 (1.4 mg/kg and 0.5 mg/kg, respectively). The estimated non-targeted VOC concentration in MP-3-27 and VEW-1-24 was 70 mg/kg and 80 mg/kg, respectively.

This area and other adjacent process areas at the site will be incorporated into the remediation program.

3.1.1.5 Tanks 3, 4, 5, 6, and 7

Tanks 6 and 7 were removed from service in mid-1987 because of corrosion and generally poor structural condition. Tanks 3, 4, and 5 have capacities of 420,000 gallons each and currently contain JP4 Jet Fuel (Tanks 3 and 4) and premium unleaded gasoline (Tank 5). The two recovery wells, RW-22 and RW-23, installed in this area under the "Interim Measures Work Plan" were used to characterize this area. Both wells contained a sheen during the May and August groundwater monitoring events and were therefore not sampled. This area will be incorporated into the remediation program for the site.

3.1.2 Area 2

A second geographic area of the facility consists of the main AST farm. The documented product releases in Area 2 are:

- Inside the Tank 19 Berm;
- Inside the Berms for Tanks 21 and 22; and
- Inside the Tank 26 Berm;

Product releases (documented and undocumented) from the ASTs and associated piping are believed to be the source of subsurface impacts at the BRC facility. Spills occurred in several of the tank berms in the past. Additional and more substantial product releases have been documented as likely because of tank floor leaks detected during routine inspections.

Shallow and deep soil gas samples were collected and analyzed at 33 locations in the AST area (Figure 4) as part of the Phase I RFI. From the soil gas survey, elevated BTEX and Total VOC concentrations were measured at locations PH-15, PH-20 and PH-22 through PH-26, generally higher in the deeper samples. The area of impact according to the results of the soil gas survey is concentrated in the southwestern portion of the tank farm area (near Tanks 23 through 27).

There are four recovery wells (RW-14 through RW-17) and five monitoring wells (MW-21, MW-25, MW-29, MW-30 and MW-31) in Area 2. Monitoring well MW-21 is sampled as part of the RCRA groundwater monitoring compliance. Discernable thicknesses of SPH historically have been observed in the all of the recovery wells which are currently active in the facility's hydrocarbon recovery system. The recovery and monitoring wells were gauged during the May and August events (Phase III RFI). The four recovery wells contained a hydrocarbon sheen during both events and were therefore not sampled. The five monitoring wells were sampled during both the May and August events.

No targeted VOCs or SVOCs were detected in MW-29 during either of the Phase III RFI sampling events. Only two targeted VOCs were detected in well MW-21 for both the May and the August sampling events: benzene (1,400 μg/L in May and 970 μg/L in August) and ethylbenzene (260 μg/L in May and 180 μg/L in August). Only two targeted SVOCs were detected in well MW-21 for both the May and the August sampling events: naphthalene (18 μg/L in May and 10 μg/L in August) and phenol (13 μg/L in May and 11 ppb in August).

Three targeted VOCs were detected in MW-25 during both the May and the August sampling events: benzene (88 μg/L and 120 μg/L), ethylbenzene (42 μg/L and 55 μg/L), and m,p-xylene (81 μg/L and 23 μg/L). Naphthalene (97 μg/L and 80 μg/L) and 2-methylnaphthalene (63 μg/L and 22 μg/L) were detected during both sampling events in MW-25; 2,4-dimethylphenol was also detected during the May event at 17 μg/L.

MW-30 contained elevated concentrations of BTEX constituents during both Phase III RFI sampling events (totaling 50,000 μg/L in May and 39,800 μg/L in August). Similarly, MW-31 contained elevated concentrations of BTEX constituents during both events (totaling 64,800 μg/L in May and 43,700 μg/L in August). Lower levels of SVOCs were also detected in both MW-30 and MW-31 during both Phase III sampling events, including naphthalene, 2-methylnaphthalene, 2,4-dimethylphenol, 3-methylphenol, and phenol.

The source(s) of impact in Area 2 are product releases from storage tanks and associated piping. This area will be incorporated into the remediation program for the site.

3.1.3 Area 3

Area 3 is the portion of the site to the south of Sullivan Road and includes the following units:

- Transportation Terminal Sump;
- Heat Exchanger Bundle (HEB) Cleaning Area and RCRA 90-day Area;
- Crude Loading Area;
- Product Loading Rack; and
- Underground Piping.

The transportation terminal sump and HEB cleaning areas were identified in the 1987 EPA CME as potential SWMUs but were not considered RCRA-regulated units. The crude loading area was the site of a spill, and the product loading rack and underground piping are considered additional potential sources because of the nature of the activities conducted at these sites.

There are two monitoring wells (MW-13 and MW-6) in Area 3. Monitoring well MW-6 has been dry since its installation in 1984. Monitoring well MW-13 was sampled during both Phase III sampling events and contained no detectable concentrations of targeted VOCs or SVOCs.

3.1.3.1 Transportation Terminal Sump

An earthen sump was located to the south of the liquid propane gas (LPG) bullets in the southern portion of the refinery (south of Sullivan Road) and was used as a truck cleaning area at one time. The area was backfilled with soil in 1986 and is no longer used. It was noted during the 1987 inspection that although the terminal area was located outside the floodplain, the potential for leaching and migration of hazardous constituents was possible since no liners or containment features were documented for the area.

Two soil borings, designated B-1 and B-2, were installed in this area during the Phase II RFI. Samples were collected continuously from the surface to 12 feet at each location and screened with a PID. Samples were selected from the 2.5-4.5' interval from B-1 based on a detectable PID reading (3.5 units), and from the 10-12' interval from B-2. Samples were analyzed for VOCs, SVOCs, TPH and PPM. No concentrations of the organic parameters were detected in either sample, and metals concentrations were within background ranges. No further investigation or remediation is proposed for this area of the site.

3.1.3.2 Heat Exchanger Bundle (HEB) Cleaning Area

The HEB cleaning area is located to the south of Sullivan Road in a room on the east end of the auxiliary warehouse. The room is fully enclosed with sheet metal walls and a concrete floor. A concrete sump in the floor of the cleaning area collects sludges generated during cleaning of the bundles. The sludges are then transported to a hazardous waste facility offsite. Monitoring well MW-13 is located downgradient (to the west) of this area. It was deemed unlikely during the USEPA-led 1987 inspection that the HEB cleaning area would be a source area for transmittal of hazardous constituents to soil, surface water, or groundwater because of the good structural condition of the unit. The downgradient monitoring well, MW-13, was sampled during both of the Phase III RFI events, and no targeted VOCs or SVOCs were detected. No further investigation or remediation is proposed for this area of the site.

3.1.3.3 Crude and Product Loading Areas and Underground Lines

The crude and product loading areas and underground lines are locations of known or suspected releases. Two soil borings, designated B-3 and B-4, were installed in this area during the Phase II RFI. Samples were collected continuously from the surface to 12 feet at each location and screened with a PID. No detectable PID readings were observed at the B-3 location, while PID readings ranged from 5.2 to 45 units at the B-4 location. Samples were selected from the 6-8' interval from B-3 based on the depth of underground lines in this area, and from the 10-12' interval from B-4 based on the highest PID reading (45 units). Samples were analyzed for VOCs, SVOCs, TPH and PPM.

Methylene chloride at 0.11 mg/kg was the only VOC detected in B-3. Low concentrations of BTEX constituents were detected in B-4. No SVOCs or TPH were detected in either sample, and metals were within background ranges. These concentrations are not believed to be indicative of a contaminant source requiring further delineation or remediation. No further action is proposed for these areas.

3.1.4 Area 4

The fourth geographic area includes the following units:

- Evaporation Ponds (north and south);
- Landfill;
- Landfill Pond;
- Fire Training Area; and
- Spray Irrigation Area.

The clay-lined evaporation ponds were considered by USEPA to be RCRA-regulated units during the 1987 USEPA inspection, but it has since been determined that they are non-regulated units. The landfill and landfill runoff pond were identified in the 1987 EPA CME report as RCRA-regulated SWMUs, although BRC has not agreed to this opinion. The fire training and spray irrigation areas were identified as non RCRA-regulated SWMUs by USEPA.

There are four monitoring wells (MW-1, MW-3, MW-5 and MW-8) in Area 4. None of these wells has ever contained discernable thicknesses of SPH. Wells MW-1 and MW-5 are sampled semi-annually as part of the facility's discharge plan compliance requirements for the following parameters:

- water level,
- pH,
- total dissolved solids (TDS),
- BTEX
- chlorinated purgeable volatile hydrocarbons,
- phenol,
- cyanide,
- iron, manganese, sulfate, nitrate/nitrite as N, ammonia, total Kjeldahl N,
- arsenic, barium, boron, cadmium, chromium, and lead.

All four wells were sampled during both events of the Phase III RFI. No targeted VOCs or SVOCs were detected in any of the wells during either event.

3.1.4.1 Evaporation Ponds

Treated wastewater from the NOWP is transferred first to the south evaporation pond, then into the north evaporation pond, both of which are located to the east of the AST area. The earthen dikes and bottoms of the ponds are lined with 4 to 6 inches of bentonite. The units are inspected daily to assure no overtopping of the ponds occurs. Water is removed from the ponds through evaporation or is transferred to the spray irrigation area to the southeast of the refinery. The two ponds are scheduled to be decommissioned in early 1995 upon startup and operation of the new underground injection well.

Studies using neutron logging, thermonics, and radioactive tracers to determine seepage patterns indicated that water seeps from the ponds at a rate of approximately 10 to 20 gpm. Once the ponds are taken out of service, seepage is expected to be limited to major rainfall events.

It was noted during the 1987 inspection that the ponds lie outside of the floodplain, they were observed to be in good condition, and daily inspections of freeboard are conducted by the facility. The USEPA inspection concluded that it was unlikely that hazardous constituents would be transferred to surface waters by overbanking of the ponds. However, because of the seepage of water from the ponds, the units were identified as potential sources of soil or groundwater contamination.

Monitoring well MW-1 is located north (downgradient) of these ponds and is sampled on a semi-annual basis according to the facility's discharge plan approval requirements noted above. Concentrations of hydrocarbon contamination historically have been low to non-detectable. This well was sampled during both events of the Phase III RFI and did not contain detectable concentrations of targeted VOCs or SVOCs.

Four soil borings, designated B-5, B-6, B-7 and B-9, were installed in this area during the Phase II RFI. Samples were collected continuously from the surface to between 8 and 12 feet at each location and screened with a PID. No detectable PID readings were observed at the B-5, B-7 or B-9 locations, while PID readings were low (4 units) to non-detectable at the B-6 location. Samples were selected from the 2-4' interval from B-5, B-6 and B-9 based on the suspected source of contamination (overflow) and PID readings in B-6; the 6-8' sample was selected from B-7 due to a noted change in lithology. Samples were analyzed for VOCs, SVOCs, TPH and PPM.

No concentrations of VOCs, SVOCs or TPH were detected in any of the soil samples. Metals concentrations were within background ranges. No further investigation or remediation is proposed for this area of the site.

3.1.4.2 Landfill and Landfill Pond

The "landfill" is the low-lying area to the east of the process area into which sludges and contaminated soils from the SOWP and NOWP were placed in 1982.

Soils in the landfill and landfill pond areas were sampled in 1985 (E-S, 1986) as part of a closure plan for the units. Eight samples in the landfill area and seven samples in the landfill pond area were collected and analyzed for BTEX, phenolics, total chromium and total lead. Only one soil sample contained a detectable concentration of BTEX constituents, which consisted on 1.3 μg/kg of benzene in sample 51469-13 taken from the landfill pond. Phenolics were non-detectable in all samples. Chromium and lead levels were well within the range of background concentrations of these metals in soils.

One soil sample (51469-23) from the landfill pond was also analyzed for "Skinner List" parameters (a subset of Appendix VII parameters that are expected to be present at a petroleum refinery.) None of these parameters, which include VOCs and SVOCs, were detected. In January 1994, the NMED approved clean closure of the landfill pond.

During the 1987 inspection, it was noted that runoff from the landfill was unlikely to reach surface waters since it is a low-lying area relative to the rest of the surrounding property. However, based on soil and water sampling conducted by USEPA in 1984, this area was noted as a potential source for soil and groundwater. Since 1987, the landfill has undergone the rigors of a delisting petition filed in 1991 (ERM, 1991). Composite soil samples were collected and analyzed for the following parameters:

- ignitability
- corrosivity
- reactivity (cyanide/sulfide)
- total metals
- metals in Toxicity Characteristics Leachate Procedure (TCLP) leachate (TCLP metals)
- EP Toxicity metals
- total pesticides
- total herbicides
- TCLP organics
- total organic carbon (TOC)
- oil and grease
- cyanide
- Appendix VIII constituents

In early 1993, USEPA requested additional sampling in support of the petition, which will be conducted by BRC. This SWMU has been subjected to extensive investigation and is being further characterized as part of the delisting process. In addition, as stated above, monitoring well MW-8 was included in both Phase III groundwater sampling events and did not contain detectable concentrations of VOCs or SVOCs during either event. No further investigation or remediation is proposed for this area of the site.

3.1.4.3 Fire Training Area

The fire-training area is located to the east of the north evaporation pond in the northeast corner of the site. It is used to practice extinguishing fires similar to those that might occur at the facility. The area includes a fuel tank on the south end of the training area, and diesel fuel, gasoline, and other fuels are used to set the fires for training. The area is covered with gravel, and tanks and vessels in which the fires are set are distributed across the area. During the 1987 CME inspection, black oily stains were noted on the ground around several of the vessels. The area is outside the floodplain, but because of limited containment features, runoff from this area may be transported to surface waters, including Hammond Ditch. It was further noted during the 1987 CME that it is possible that organic compounds used during training exercises may leach to soil and groundwater.

Because of the lack of soil data in this vicinity, four soil borings (designated B-7, B-8, B-9 and B-10) were installed in this area during the Phase II RFI. Samples were collected continuously from the surface to between 10 and 12 feet at each location and screened with a PID. No detectable PID readings were observed at the B-7, B-9 or B-10 locations, while one detectable PID reading (1 unit) was observed at B-8. Samples were selected from the 6-8' interval based on a noted change in lithology in B-7 and the detectable PID reading in B-8. The 2-4' interval was selected from B-9 due to the nature of the suspected source (surface spills). The 10-12' interval was selected from B-10 due to a noted change in lithology (from silty sand to clay and cobbles). Samples were analyzed for VOCs, SVOCs, TPH and PPM.

No concentrations of VOCs, SVOCs or TPH were detected in any of the soil samples. Metals concentrations were within background ranges. No further investigation or remediation is proposed for this area of the site.

3.1.4.4 Spray Irrigation Area

The spray irrigation area is located to the southeast of the refinery and consists of a 10-acre parcel of land onto which water from the north evaporation pond is sprayed through stationary sprinkler heads (mainly from March through October). The area is diked to prevent runoff. It was noted during the 1987 inspection that contamination of surface waters by flooding or runoff from the spray irrigation field was not likely.

Monitoring well MW-5, which is sampled on a semi-annual basis as part of the facility's discharge plan, is located downgradient from this area. This well was also sampled during both Phase III RFI groundwater sampling events. No targeted VOCs or SVOCs were detected during either event. The spray irrigation area will be taken out of service once the facility's injection well is operational. No further investigation or remediation is proposed for this area of the site.

4.0 CONTAMINANT CHARACTERIZATION

4.1 Groundwater Contamination

As previously described, two comprehensive groundwater monitoring events (May and August 1994) were conducted during the Phase III RFI to characterize groundwater at the site. SPH has consistently been measured in wells MW-9, MW-27, MW-28, RW-2, RW-14 through RW-19, RW-22, and RW-23. The thickness of SPH varies due to the operation of recovery systems in most of the recovery wells. The recovery systems had been removed from recovery wells for several days prior to the gauging of wells during the May groundwater sampling event. From this gauging information, SPH was thickest (0.8 feet) in RW-2 and nearby wells MW-4 (0.58 feet) and P-2 (0.32 feet). The SPH plume has been delineated in all directions except to the southwest of the facility on the BLM property. Additional delineation will be conducted in this area to supplement the RFI. Water table depression has been shown to be effective in SPH recovery from pump tests performed during the Phase IV RFI.

As shown by the water table contours in Figures 6 and 10, groundwater flows to the west-northwest, toward the Hammond Ditch, at a gradient between 0.004 and 0.0009. Groundwater movement is influenced by: the subsurface geology and topography of the Nacimiento Formation (movement is faster in the gravel/cobble zone directly above the Nacimiento Formation than the overlying less permeable sediments); the water level in the Hammond Ditch (mounding provides a barrier to groundwater movement); infiltration from the raw water ponds; and pumping from the recovery systems in several recovery wells onsite. Other possible influences include underground lines and the El Paso Natural Gas (EPNG) pipeline (which may present a preferential pathway for migration to the southwest).

Vertical distribution of groundwater impacts is effectively limited by the physical characteristics of the underlying Nacimiento Formation. The Nacimiento Formation has an extremely low permeability and has exhibited an upward vector of groundwater movement. Groundwater contamination has been delineated horizontally based on topography to the northwest (the bluff overlooking the San Juan River); non-detectable concentrations in monitoring wells to the northeast, east, and south; and, the absence of the shallow groundwater aquifer to the southeast (MW-6). Horizontal delineation is incomplete to the southwest of the facility on the BLM property (MW-11, MW-26 and MW-27). Additional delineation is proposed in this area to supplement the RFI. As indicated from the Phase

IV RFI pilot test, the site geology and contaminants of concern were responsive to air sparging for the removal of dissolved hydrocarbons.

Constituents of Concern

As indicated in the Administrative Order on Consent, BRC may establish an indicator parameter list for future groundwater monitoring following the first two rounds of groundwater sampling. BTEX constituents were the only VOCs detected during either sampling event. SVOCs were detected at low concentrations in some samples. It is proposed that BTEX by USEPA Method 8020 only be utilized for future groundwater sample analyses. Analysis for SVOCs would resume for monitoring in support of site closure in the future. TPH and metals will be eliminated from the parameter list altogether.

4.2 Soil Contamination

General information about site soils is provided in Section 2.4 above. Soil impacts have been characterized and delineated in each of the source areas described under Section 3.0 above. The area of greatest impact is that associated with the SPH plume in the aboveground tank storage and product process areas of the site. SPH has migrated to the southwest of the facility where delineation is incomplete. Additional investigation is proposed in this area to supplement the RFI information. As indicated from the Phase IV RFI pilot test, the soil types and contaminants of concern were responsive to soil vapor extraction for the removal of adsorbed-phase hydrocarbons.

4.3 Surface Water and Sediment Contamination

The two surface water bodies in the vicinity of the BRC site (Hammond Ditch and the San Juan River) have been adequately characterized as reported in the Phase V RFI section (Section 1.4). General information about the surface water bodies is provided in Section 2.5. Neither water body has been significantly impacted from the BRC facility. No further action is proposed for the Hammond Ditch or the San Juan River.

5.0 POTENTIAL RECEPTORS

5.1 Groundwater

Details on ownership and construction of water wells within a one-mile radius of the site are summarized in Table 10. A total of 22 wells were identified in a well search conducted by Tierra Environmental Company, Inc. (Tierra, 1992). The locations of 18 of these wells are shown on Figure 18, since the well records for three wells (#4, 11 and 12) were not reported and the location of well #21 was reported to be located in Township 29 N, Range 11W, Section 25, which is off the map. The locations of two wells (#15 and 22) are approximate.

As shown in Figure 18, eight wells are within a one-mile radius of the center of the BRC site: #1, 3, 5, 6, 7, 13, 15 and 22. Well #1, located south of the site, is owned by C.W. Wooten. This well is double-cased and is screened between 266 and 306 feet. Well #6 is located west of the site on the opposite side of the Hammond Ditch. This well is owned by D.C. Looney and is reported to be screened between 22 and 32 feet below ground surface. Well #5 is located southwest of the site, is owned by E.H. Brown (Aztec, NM), and is reportedly cased to 20 feet. Wells #3, 7, 13, 15, and 22 are located across (north of) the San Juan River from the site. Due to their location and/or the depths of the screened intervals, none of these wells is at risk for impact from off-site migration of petroleum hydrocarbon constituents.

No evidence has been found to date indicating that water wells used for human consumption are completed in the shallow perched water-bearing zone that contains dissolved concentrations of petroleum hydrocarbon constituents at the refinery. The shallow wells depicted in Figure 18 and summarized in Table 10 are used for non-human consumption (irrigation, etc.) purposes.

The deeper aquifer, the Ojo Alamo, is used for potable water. Therefore the potential exists for migration of petroleum hydrocarbon constituents to this aquifer. However, the presence of the relatively impermeable Nacimiento Formation (approximately 570 feet thick) acting as a confining layer between the Ojo Alamo and the shallow, perched zone eliminates the possibility of downward migration of dissolved petroleum constituents.

Petroleum hydrocarbons are lighter than water tending to remain in the upper portion of the perched water zone. The lighter-than-water, non-aqueous phase liquids (LNAPLs) provide the primary source for dissolved and adsorbed-phase hydrocarbon contamination at the site. Therefore, these contaminant zones are also expected to be limited to the unsaturated zone and zone of seasonal water table fluctuation for the adsorbed-phase contamination, and the upper, perched water zone for dissolved-phase contamination.

5.2 Surface Water

The San Juan River is a source of potable water for the surrounding communities. In addition, the San Juan River is used for recreational purposes (i.e., fishing, rafting). The Hammond Ditch provides a barrier to groundwater migration between the facility and the San Juan River. Seeps from the bluff are a potential source of contamination to the San Juan River and, if impacted, will need to be controlled as part of the facility's corrective measures. Overland migration of dissolved petroleum constituents to water bodies is limited by the site-wide stormwater runoff control system.

The Hammond Ditch, because it is used for irrigation of agriculture and livestock, may be a potential pathway for transmission of hazardous constituents to sources of food for human consumption. The United States Department of the Interior - Bureau of Reclamation (USDOI - BOR) has proposed a plan to line the Hammond Ditch with impermeable materials to reduce seepage and thereby reduce the salinity of the water downstream (USDOI-BOR, January 1993). This project will eliminate the potential for impacts to the Hammond Ditch from the BRC facility.

Excluding methylene chloride, no VOCs or SVOCs were detected in any surface water samples from either the Hammond Ditch or the San Juan River during the Phase V RFI. These data suggest that the contaminant migration potential in either surface water body is minimal.

5.3 Land Use

Public property managed by the Bureau of Land Management borders the facility to the south. Undeveloped public and private lands in addition to several gravel pits border the property to the east and private undeveloped land borders the property to the west. The town of Bloomfield is located immediately north of the refinery, across the San Juan River, and has a population of approximately 5,000. The majority of the undeveloped land in vicinity of the refinery is used extensively for oil and gas production and, in some instances, grazing. U.S. Highway 44 is located approximately one-half mile west of the facility. The adjacent property owners are illustrated in Figure 2.

5.4 Demographic Profile of BRC Facility

The process areas of the facility are secure from access by the public with fencing and 24-hour surveillance. High-traffic process areas have been paved. Only facility personnel and contractors will potentially contact contaminated soils during construction or remediation projects at the facility. These projects would be performed in accordance with OSHA requirements and the site-specific Health and Safety Plan.

Contaminated soils presenting potential sources for groundwater contamination will be addressed as part of the corrective measures for the facility, but with consideration to the ongoing industrial activity at the site.

There are 96 employees at the BRC facility, 78 male and 18 female. Half of the females are of child-bearing age. The age distribution of employees is as follows:

AGE	NO. EMPLOYEES
18-30	9
31-40	45
41-50	24
51-60	14
61-	4

5.5 Endangered/Threatened Species

The portion of the San Juan River in the vicinity of the BRC facility is part of the Upper Colorado River Basin. According to information from the U.S. Fish and Wildlife Service, there are 14 species of native fish fauna in the Upper Basin. Four species, the razorback sucker, Colorado squawfish, humpback chub and bonytail, are on the federal endangered species. These species are endangered due to loss of habitat, proliferation of introduced species and other man-induced disturbances (Maddux, Fitzpatrick & Noonan, 1993). The San Juan River west of Farmington is proposed to be designated as a critical habitat for the Colorado squawfish and the razorback sucker.

BRC has inquired with the State of New Mexico Department of Game and Fish regarding threatened and endangered species in the vicinity of the facility, but no response has been received to date.

6.0 INVESTIGATION ANALYSIS

6.1 Groundwater Protection Standards

Background concentrations in groundwater in the immediate area of the BRC site are non-detectable for the organic constituents of concern (BTEX and select SVOCs), as noted by wells MW-1, MW-5 and MW-8. The only constituent with an established maximum contaminant level (MCL) is benzene at 0.005 mg/L. New Mexico has developed Human Health Standards for Groundwater in the *Water Quality Control Commission Regulations*, as amended through October 12, 1993. The maximum allowable concentrations for constituents of concern are as follows:

NMWQCC STANDARDS FOR GROUNDWATER

CONSTITUENT	HUMAN HEALTH STANDARD
Benzene	0.01 mg/L
Toluene	0.75 mg/L
Ethylbenzene	0.75 mg/L
Xylenes, total	0.62 mg/L
PAHs: total naphthalene plus monomethynaphthalenes	0.03 mg/L
Phenanthrene	Not listed
Phenol	Not listed
2,4-Dimethylphenol	Not listed
Bis(2-ethylhexyl)phthalate	Not listed
Chrysene	Not listed

In addition, proposed amendments to the regulations dated April 22, 1994 include allowing for alternative abatement standards (AAS). AAS may be petitioned for on the basis of technological achievability, cost-benefit analysis, or evaluation of hazard to public health and property damage.

The proposed Subpart S action levels in the July 27, 1990 *Federal Register* for other constituents in water are as follows:

PROPOSED SUBPART S ACTION LEVELS FOR GROUNDWATER

CONSTITUENT	PROPOSED ACTION LEVEL
Toluene	10 mg/L
Ethylbenzene	4 mg/L
Xylenes, total	70 mg/L
Naphthalene	Not listed
2-Methylnaphthalene	Not listed
Phenanthrene	Not listed
Phenol	20 mg/L
2,4-Dimethylphenol	Not listed
Bis(2-ethylhexyl)phthalate	0.003 mg/L
Chrysene	Not listed

The wells containing SPH are assumed to exceed the MCL for benzene. Of the wells sampled, wells MW-11, MW-20, MW-21, MW-25, MW-26, MW-30, MW-31, RW-1, and RW-3 contained benzene concentrations in excess of the MCL. The same wells exceeded the NM-WQCC standards for one or more constituent, except MW-20. Comparing groundwater to the proposed Subpart S action levels, wells MW-30 and MW-31 exceed the action level for toluene for both groundwater sampling events. Well RW-3 exceeded the action level for bis(2-ethylhexyl)phthalate during the first event and RW-1 exceeded it during the second event. Metals concentrations in groundwater were below MCLs in all wells during both groundwater sampling events.

BRC acknowledges that corrective measures are necessary at the site, at a minimum to remove SPH which provides a continued source of dissolved contamination. Remediation to MCLs, however, may not be technologically achievable and/or practicable. BRC may propose risk-based criteria for groundwater at a later date, once operational data from corrective measures are available.

6.2 Other Relevant Protection Standards

Cleanup criteria for constituents in soils have been established by the *New Mexico Environmental Improvement Board (NM-EIB) - Underground Storage Tank (UST) Regulations*, Part 12, as follows:

NM-EIB UST CRITERIA FOR SOILS

CONSTITUENT	STANDARD (mg/kg)
TPH	100
BTEX	50
Benzene	10

These criteria apply to UST sites only, but are sometimes used as guidelines for other petroleum-contaminated sites. No other soil standards have been established by the State of New Mexico.

The proposed Subpart S action levels in the July 27, 1990 *Federal Register* for constituents in soils are as follows:

PROPOSED SUBPART S ACTION LEVELS FOR SOILS

CONSTITUENT	PROPOSED ACTION LEVEL
Benzene	Not listed
Toluene	20,000 mg/kg
Ethylbenzene	8,000 mg/kg
Xylenes, total	200,000 mg/kg
Naphthalene	Not listed
2-Methylnaphthalene	Not listed
Phenanthrene	Not listed
Phenol	50,000 mg/kg
2,4-Dimethylphenol	Not listed
Bis(2-ethylhexyl)phthalate	50 mg/kg
Chrysene	Not listed

From the site soils data available, these proposed action levels for soils are not exceeded at the BRC site. Soils remediation will be proposed in the product storage and process areas to mitigate sources of dissolved contamination.

Surface water standards are established under the NM-WQCC *Water Quality Standards for Interstate and Intrastate Streams in New Mexico*, which is consistent with the federal Clean Water Act. Standards are provided for the following parameters:

- Stream bottom deposits
- Floating solids, oil and grease
- Color
- Odor and taste of fish
- Plant nutrients
- Hazardous substances
- Radioactivity
- Pathogens
- Temperature
- Turbidity
- Salinity
- Dissolved gases

Surface water samples from both the Hammond Ditch and the San Juan River did not contain detectable concentrations of organic constituents. Therefore, these water bodies have not been impacted by the BRC facility. Low concentrations of toluene in sediment samples from Hammond Ditch will not be addressed by corrective measures other than natural attenuation and volatilization, since if this compound is mobilized, it is expected to volatilize rapidly before exiting the site.

7.0 FIELD, LABORATORY AND/OR BENCH SCALE STUDIES

The constituents of concern at the BRC site are BTEX and several SVOCs, as previously described in this report. The BTEX compounds are sufficiently volatile to be addressed by soil vapor extraction (adsorbed-phase) and air sparging (dissolved-phase). Some SVOCs can also be removed by these technologies. Soil vapor extraction (SVE) and air sparging also serve to move oxygen through the subsurface and enhance natural biodegradation of hydrocarbons. Both BTEX and SVOCs are readily biodegradable as long as oxygen is available for micro-organisms' metabolism.

The pilot studies to determine the applicability of these technologies to the site were conducted as part of the Phase V RFI. A detailed description of these studies and the data analysis were provided in the August 16, 1994, "Soil Vapor Extraction and Air Sparge Pilot Test Report". The geology of the site was determined to be amenable to SVE (unsaturated zone) and air sparging (saturated zone). No additional testing prior to the development of the Corrective Measures Implementation (CMI) plan is proposed.

8.0 CORRECTIVE MEASURES STUDY

As part of the Task I report (Description of Current Conditions), a Pre-Investigative Evaluation of Corrective Measures was conducted. The corrective action objectives established were to: mitigate seepage to the Hammond Ditch and/or San Juan River, eliminate/mitigate SPH, remediate soil from which SPH is still produced, and reduce the concentration of dissolved hydrocarbons in groundwater beneath the site. Screening of alternatives was conducted to address each of these objectives.

8.1 Seepage

Seeps occur at the contact between the Nacimiento Formation and overlying sediments, along the bluff to the north of the facility. Three alternatives for addressing the seeps were retained for further consideration from the technology screening conducted as part of the Task I report: a grout curtain, an interceptor trench and dewatering near the seeps.

Dewatering the area between the Hammond Ditch and the seeps is not feasible at this time, since the ditch is unlined and recharges groundwater locally. Thus, dewatering might involve high volumes of water derived from the ditch, probably not allowable from ditch operators.

A grout curtain would deter migration of contaminants as a stabilization measure, but would not actively treat/remove the impacts. This measure would require substantial engineering and would be very costly to control such a small percentage of the total mass of contaminants present in the subsurface at the site.

As part of the interim measures, an interceptor trench was installed with an air sparge well (MW-24). Compressed air lines were connected to this well to initiate air sparging. Sparging was not effective when the water level was low due to insufficient saturated zone thickness, but will be re-evaluated when water levels rise (during the irrigation season).

Maintaining water in the Hammond Ditch creates a mounding effect which deters migration of contaminants. The hydrocarbon plumes on the facility side of the Hammond Ditch will be controlled (see following sections) to prevent continued sources of impact to the seeps. The existing impacts between the Hammond Ditch and the bluff will be addressed by either the air sparge interceptor trench or natural attenuation/biodegradation.

8.2 Separate Phase Hydrocarbons

Separate phase hydrocarbons present a residual source for adsorbed and dissolved phase hydrocarbon contamination, and therefore must be removed from the subsurface. Three alternatives were retained for further consideration from the technology screening matrix performed as part of the Task I report: skimming pumps, vapor extraction and Hi VAC total fluid extraction.

Hi VAC total fluid extraction was not considered further since the volume of water generated from this process would be excessive. For more permeable sediments (sands and gravels) such as are present at the BRC site, the combination of water table depression and soil vapor extraction is more effective than Hi VAC total fluid extraction.

During the Phase IV RFI aquifer test, water table depression was shown to be effective in inducing SPH flow to recovery wells for removal. Increasing the flow rate in existing recovery wells as well as evaluating the need for additional recovery wells will be conducted once the facility's injection well is operational to accommodate the increased wastewater.

In addition, soil vapor extraction pilot testing was conducted during the RFI, indicating this technology is applicable to the site and effective in removing contaminants from the subsurface. Soil vapor extraction will be applied to remove adsorbed phase hydrocarbons from unsaturated sediments at the site. This process will be enhanced by the proposed water table depression, increasing the thickness of unsaturated sediments and allowing the removal of hydrocarbons in along the capillary fringe (and SPH smear zone).

8.3 Adsorbed Phase Hydrocarbons

Two alternatives to address soils at the site were retained for further consideration from the technology screening conducted as part of the Task I report: risk assessment and *in situ* vapor extraction. Pilot testing of soil vapor extraction was conducted during the Phase IV RFI and was shown to be effective in removal of hydrocarbons from the subsurface. The site geology (sands and gravels) is sufficiently permeable for air flow, and the contaminants (primarily BTEX) are sufficiently volatile for soil vapor extraction. In addition, biodegradation of less volatile compounds (SVOCs) will be enhanced with the increased oxygen flow results from soil vapor extraction.

A risk assessment may be conducted at a later date to support technically achievable cleanup criteria, once site-specific operational data are available.

8.4 Dissolved Phase Hydrocarbons

Four alternatives to address groundwater contamination were retained for further consideration from the technology screening conducted as part of the Task I report: risk assessment, pump/treat/reinject, air sparging/soil vapor extraction, and source reduction.

A risk assessment may be conducted at a later date to support technically achievable and practicable cleanup criteria. Groundwater pump/treat/reinject (water table depression) will be conducted as indicated under the Section 8.2 to accelerate the collection and removal of SPH. Although pump and treat is effective in controlling further migration of contaminants and in source removal, it is not effective in remediating dissolved hydrocarbons. Pilot testing of air sparging and vapor extraction conducted during the Phase IV RFI showed these technologies are both applicable to the site and effective in treating dissolved phase hydrocarbons. Source reduction (removal of SPH) has been proposed (Section 8.2).

BRC plans to remove from service the clay-lined evaporation ponds, which will reduce recharge to the perched water table. In addition, water table depression as part of the SPH recovery activities will dewater the perched water table. The result will be less groundwater requiring remediation. Initially, BRC intends to expand SPH removal and implement soil vapor extraction at the site. Once the SPH has been removed and operational data are available for the soil vapor extraction system, BRC will likely conduct a risk assessment to determine site-specific cleanup criteria for groundwater. At that time, it will be evaluated whether air sparging is needed to meet the criteria, and if so, how best to implement the technology (e.g. sparge barrier wells versus site-wide sparging). Bioremediation may also be considered at that time, since it is an effective technology in treating hydrocarbon compounds.

8.5 Recommended Corrective Measures

As described above, the recommended corrective measures for the BRC site are as follows:

- Re-evaluation of the air sparge interceptor trench during higher water levels, source control and natural attenuation to address seepage;
- Water table depression and SPH removal;
- Soil vapor extraction to address adsorbed phase hydrocarbons; and
- Air sparging or bioremediation to address dissolved phase hydrocarbons.

These technologies have been shown to be technically feasible, applicable to the site conditions and contaminants of concern, and effective in meeting cleanup goals. Detailed design and implementation specifics will be developed as part of the CMI. It is expected that implementation will proceed in a phased approach, with air sparging following the removal of SPH. Risk-based cleanup criteria following the removal of SPH and soil vapor extraction system operation may indicate continued groundwater monitoring is more practicable than installation of an extensive air sparging network.

The costs to implement these corrective measures (without air sparging) are estimated below:

1. Design, Install/Upgrade Water Table Depression/SPH Recovery — $ 120,000.00
    - Four additional RWs and pumps
    - 4,000 feet of piping/trenching
    - engineering and design
    - consulting services

2. Installation of the Soil Vapor Extraction System (on and off site) — $ 800,000.00
    - 80 VEWs, 13,000 feet piping
    - 9 blowers
    - engineering and design
    - consulting
    - vapor abatement system

3. Operation, Maintenance and Monitoring (5 years) $ 400,000.00

- groundwater monitoring (semi-annual)
- O&M SPH recovery system
- O&M SVE system
- regulatory compliance (reporting)

4. Risk Assessment $ 150,000.00

TOTAL $1,470,000.00

9.0 REFERENCES

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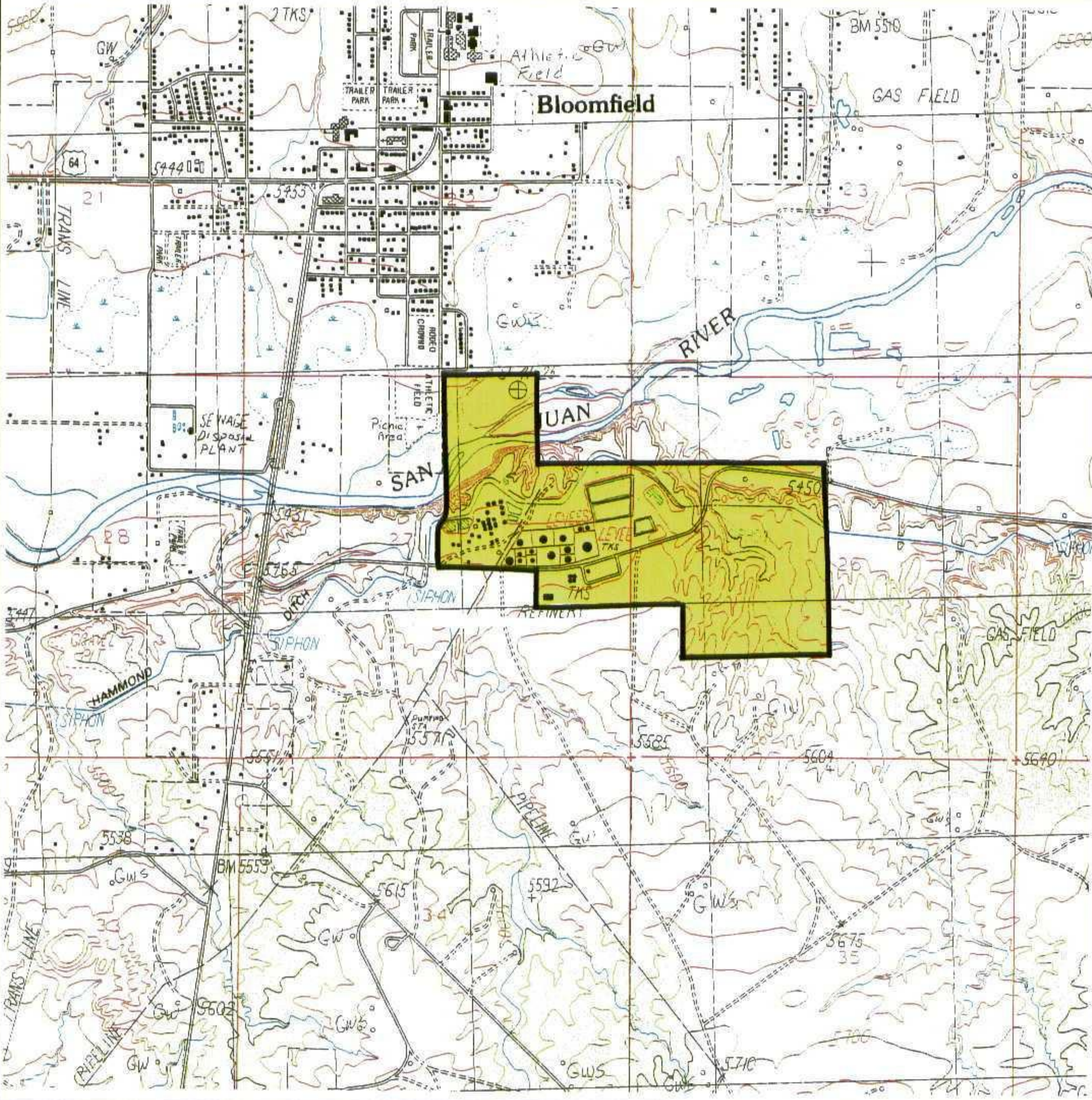


LEGEND

SITE BOUNDARY

NEW MEXICO

QUADRANGLE LOCATION

N

BLOOMFIELD, N. MEX.QUADRANGLE
PROVISIONAL EDITION
1985
36107-F8-TF-024

1000 0 2000
SCALE IN FEET

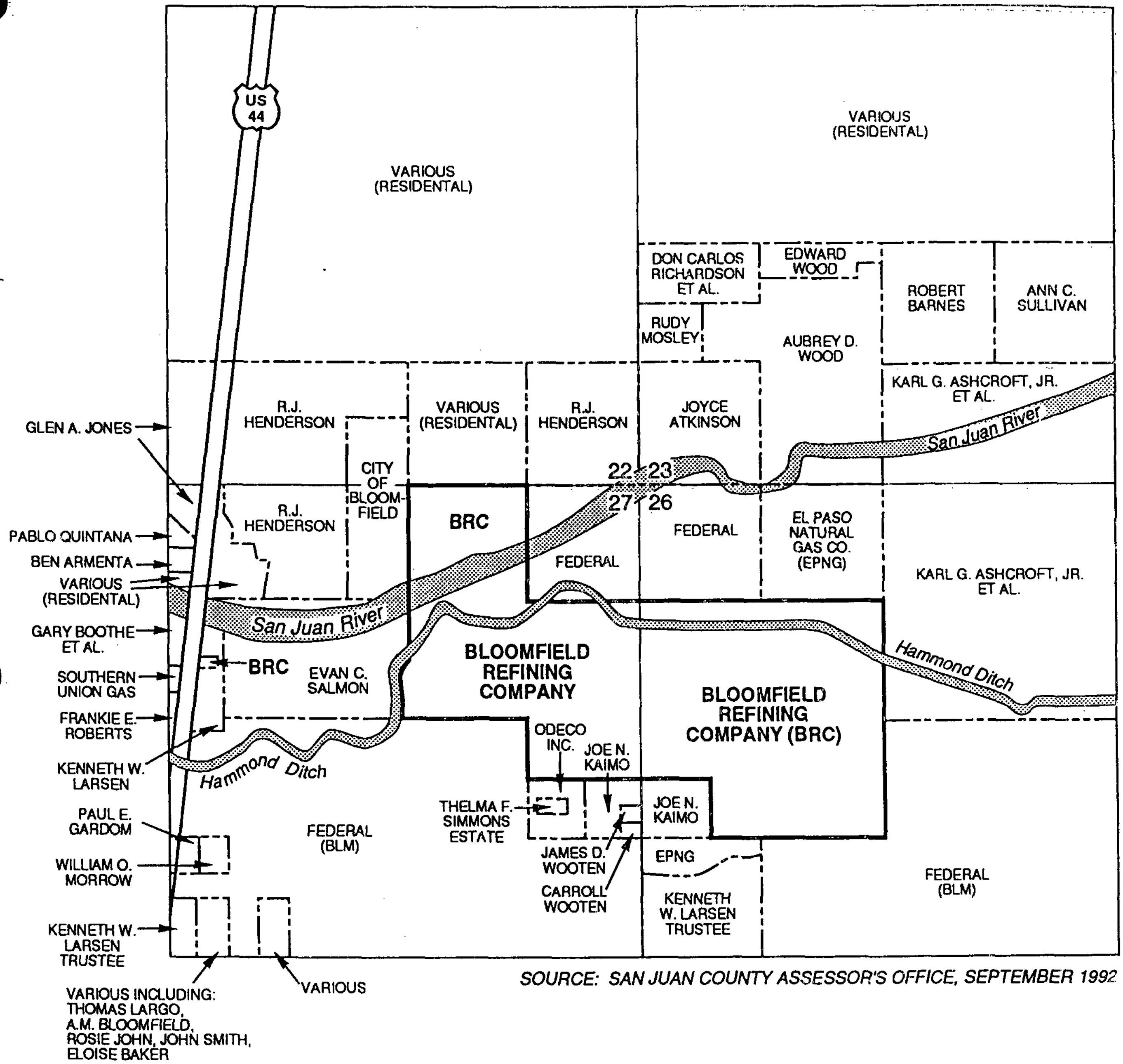
Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

SITE LOCATION

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93		FILE: BL-SITELOC
PROJECT NO.: 023353014		CONTRACT:
DRAWING. FIGURE 1		REVISION: —

T29N R11W, SEC. 22, 23, 26 & 27



SOURCE: SAN JUAN COUNTY ASSESSOR'S OFFICE, SEPTEMBER 1992

LEGEND

- - - - PROPERTY BOUNDARY LINE

——— SECTION LINE

0 1/4 1/2 MILE

SCALE

N

NOTE:
LOCATIONS OF PROPERTY BOUNDARIES, IMPROVEMENTS, AND NATURAL FEATURES ARE APPROXIMATE.

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BLOOMFIELD REFINING COMPANY AND SURROUNDING PROPERTIES

DESIGNED BY: PS	DETAILED BY: EF	CHECKED BY:
DATE: 2/9/93		FILE: BL-PropOwner
PROJECT NO.: 023353014		CONTRACT:
DRAWING: FIGURE 2		REVISION: –

NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.
5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 EXISTING MONITORING WELL
- RW-1 EXISTING RECOVERY WELL
- P-1 PROPOSED RECOVERY WELL
- MW-2 FORMER MONITORING WELL
- PH-24 PROBE HOLE LOCATION
- PROPOSED MONITORING WELL
- PROPOSED BORING
- SEDIMENT AND SURFACE WATER SAMPLE

PH-24 = PROBE HOLE NUMBER
B = BENZENE μg/l
T = TOLUENE μg/l
E = ETHYLBENZENE μg/l
X = XYLENES μg/l
TVOC = TOTAL VOLATILE ORGANIC CONTENT μg/l
S = SHALLOW PROBE (3-4 FT.)
D = DEEP PROBE (7-10 FT.)

PH-24	S	D
B	16	88
T	115	271
E	27	63
X	181	393
TVOC	721	1571

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
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BLOOMFIELD, NEW MEXICO

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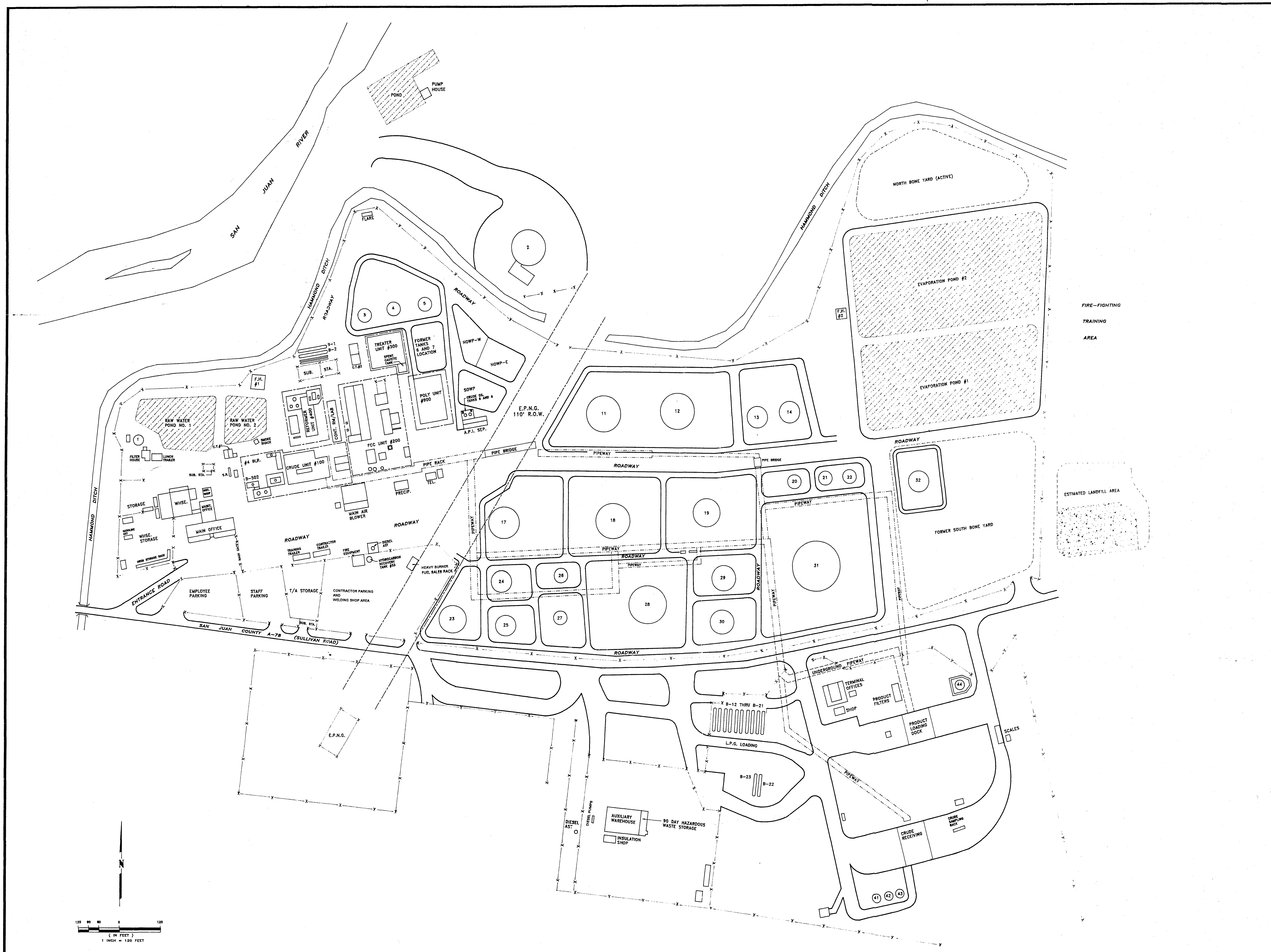
(505) 242-3113

SOIL VAPOR SURVEY RESULTS

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: FEBRUARY 14, 1994	FILE: VAPOR.DWG
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 4	REVISION:



NO.	DATE	BY	REVISION

LEGEND

PIPEWAY
UNDERGROUND PIPEWAY
FENCE

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990 BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
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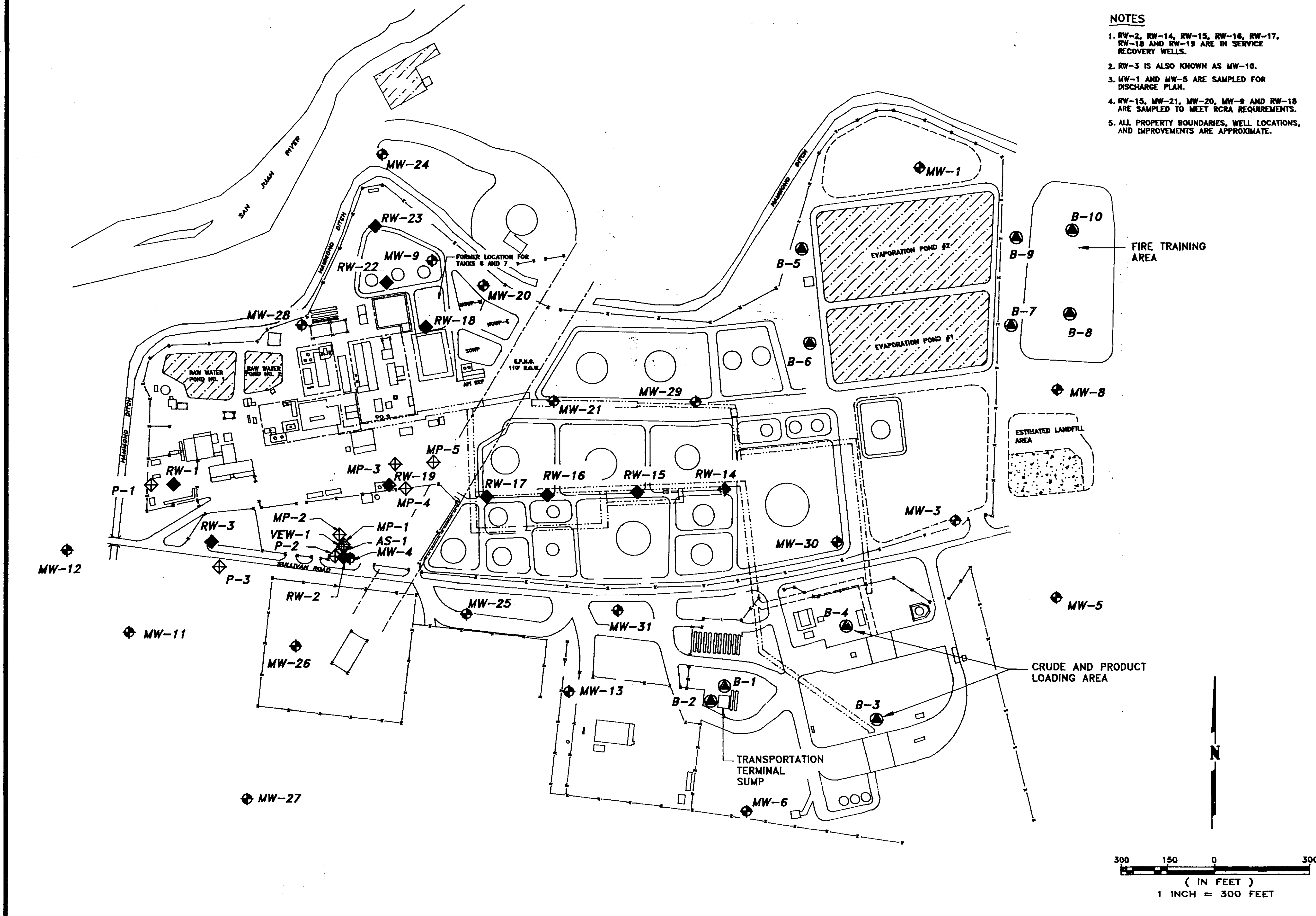
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

SITE PLAN

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: FEBRUARY-1993	FILE: SITEPLAN.DWG	
PROJECT NO.: 023353014	CONTRACT:	
DRAWING: **FIGURE 3**	REVISION:	



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.
5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- B-1 SOIL BORING
- P-1 PIEZOMETER

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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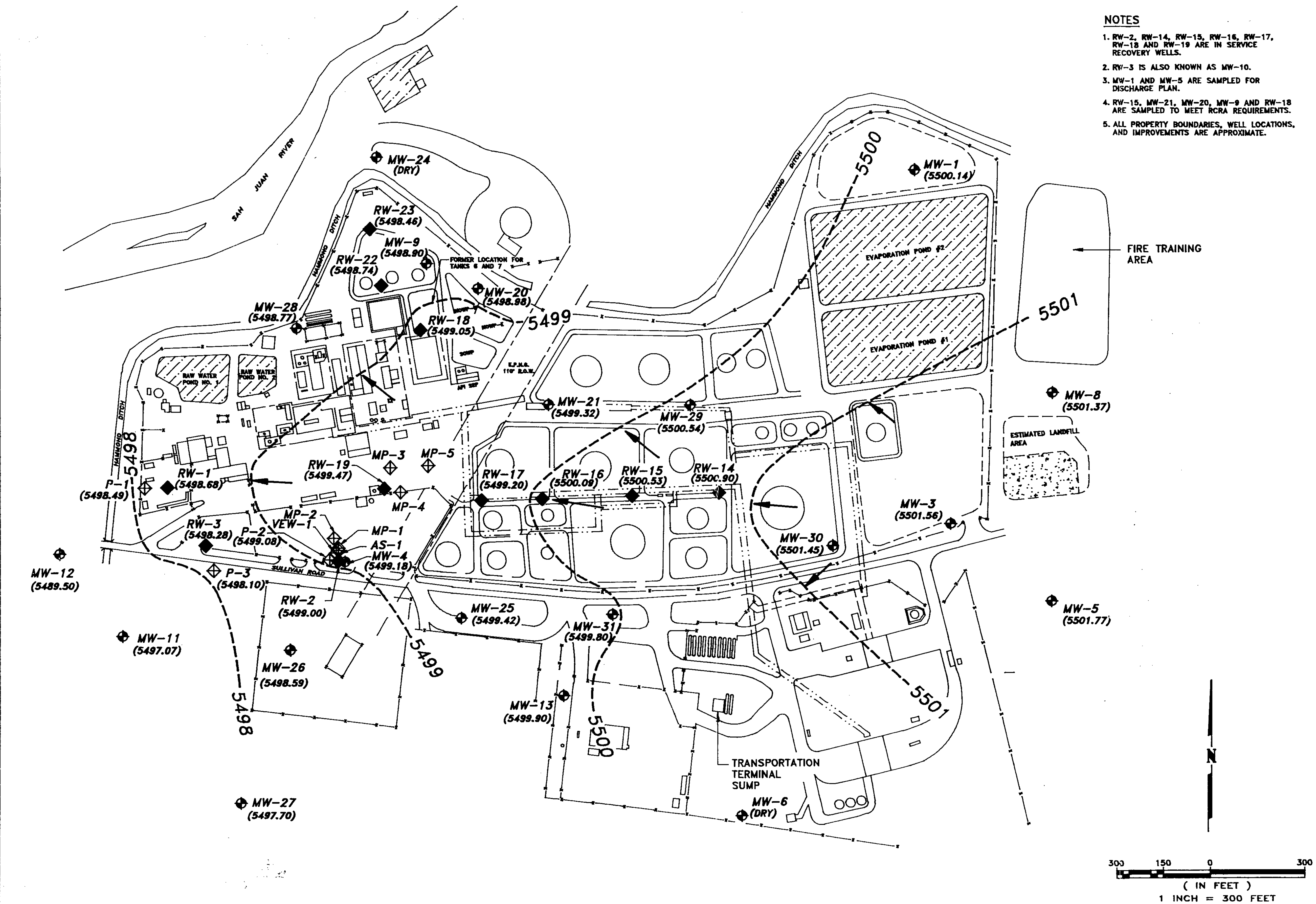
(505) 242-3113

SOIL BORING/ MONITORING WELL LOCATIONS

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: SEPT. 28, 1994	FILE: MW-LOCA	
PROJECT NO.: 023353014	CONTRACT:	
DRAWING: FIGURE 5	REVISION:	



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
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5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- PIEZOMETER
- P-1 (5501.37) WATER TABLE ELEVATION IN FEET ABOVE MSL
- INFERRED WATER TABLE ELEVATION CONTOUR
- INFERRED GROUNDWATER FLOW DIRECTION

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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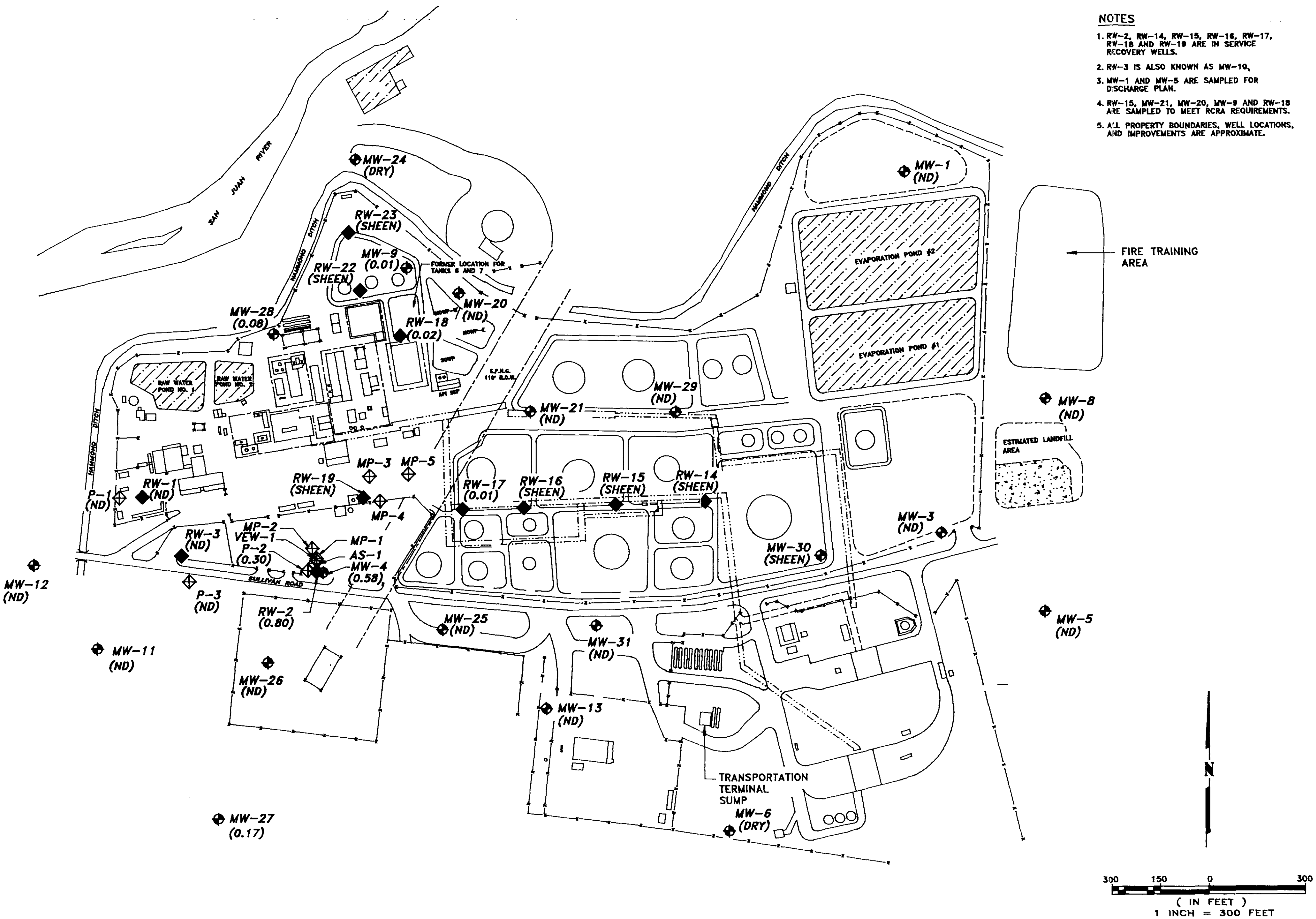
WATER TABLE CONTOUR MAP

MAY 24, 1994

PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: JUNE 10, 1994	FILE: WTCM0594
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 6	REVISION:



NOTES

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5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

- ---- PIPEWAY
- ---- UNDERGROUND PIPEWAY
- —x— FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- P-1 PIEZOMETER
- (ND)= NOT DETECTED
- (0.01)= SPH THICKNESS IN FEET

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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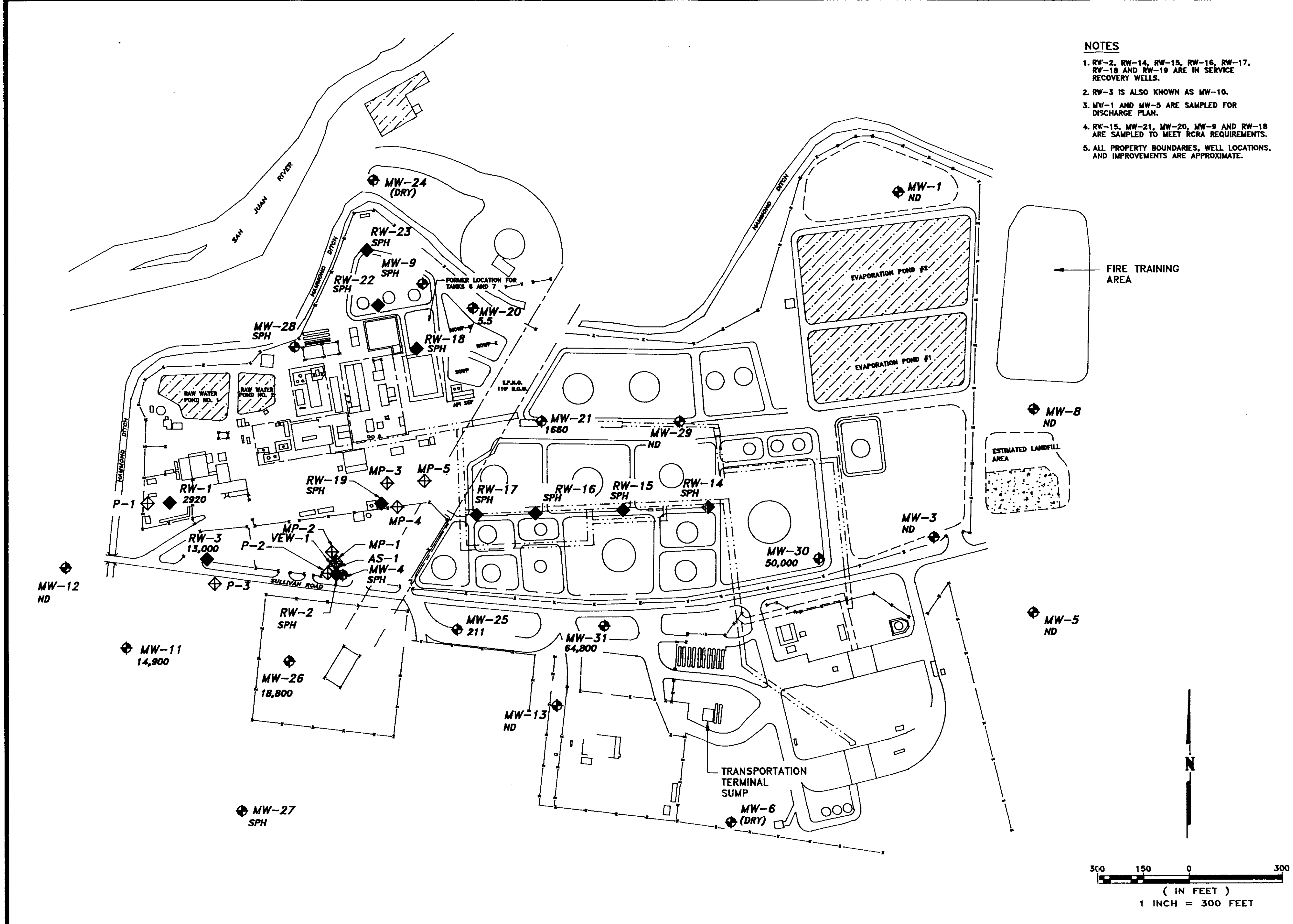
SEPARATE PHASE HYDROCARBON (SPH) THICKNESS

MAY 24, 1994
PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: JUNE 10, 1994		FILE: PSH-0594
PROJECT NO.: 023353014		CONTRACT:
DRAWING:		REVISION:

FIGURE 7



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- P-1 PIEZOMETER
- ND NOT DETECTED
- VOC VOLITALE ORGANIC COMPOUNDS
- SPH SEPARATE PHASE HYDROCARBONS

VOC CONCENTRATION IN μg/l

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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BLOOMFIELD, NEW MEXICO

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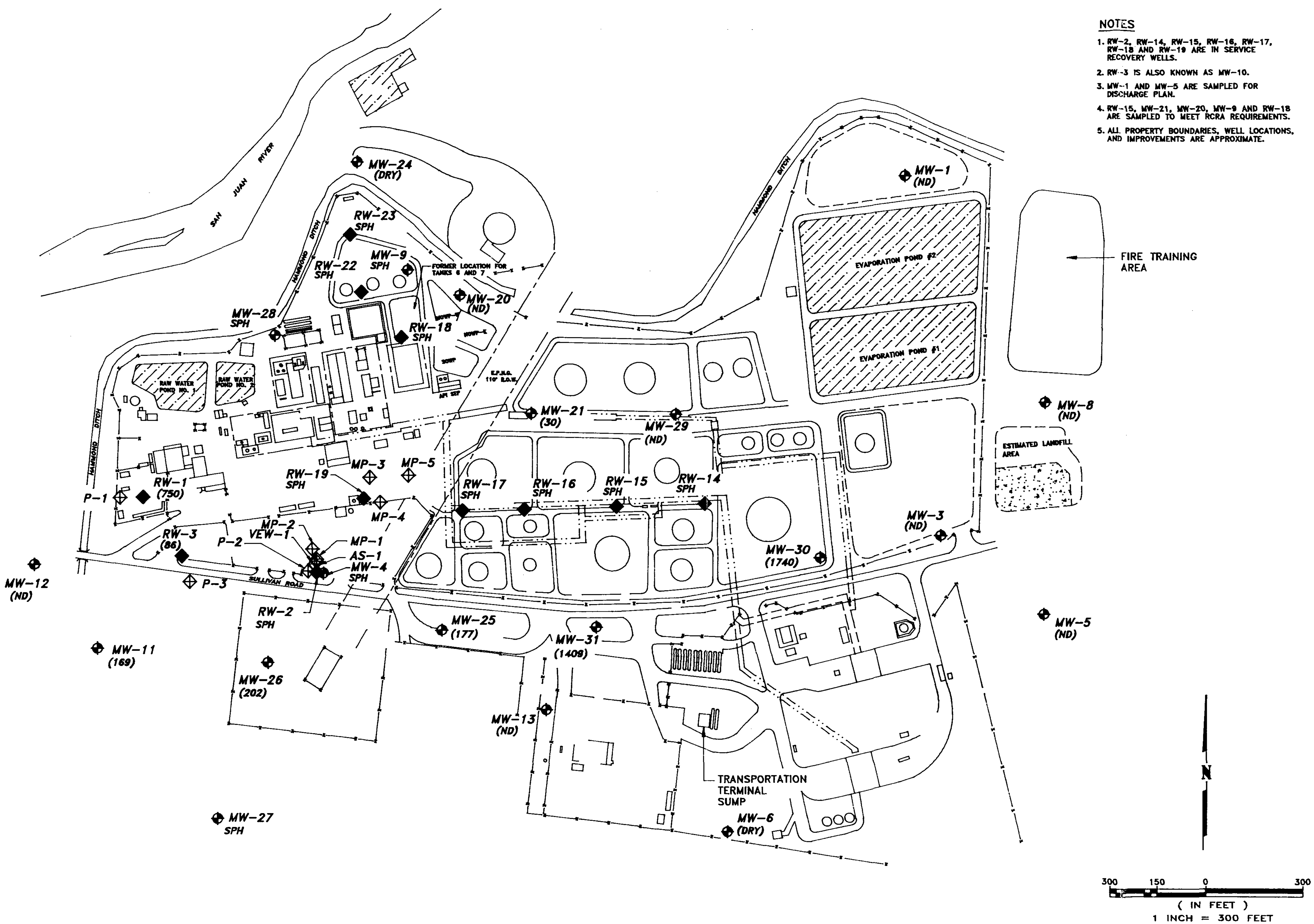
TOTAL TARGETED VOC's IN GROUNDWATER

MAY 24 & 25, 1994
PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: JUNE 22,1994	FILE: TVOC0594
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 8	REVISION:



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.
5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

—··—··—	PIPEWAY
— — — —	UNDERGROUND PIPEWAY
——x——	FENCE
MW-1	MONITORING WELL
RW-1	RECOVERY WELL
P-1	PIEZOMETER
ND	NOT DETECTED
SVOC	SEMI-VOLATILE ORGANIC COMPOUNDS
SPH	SEPARATE PHASE HYDROCARBONS
(169)	SVOC CONCENTRATION IN µg/l

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
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#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
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(505) 242-3113

TOTAL TARGETED SVOC"s IN GROUNDWATER

MAY 24 & 25, 1994

PHASE 3 RFI

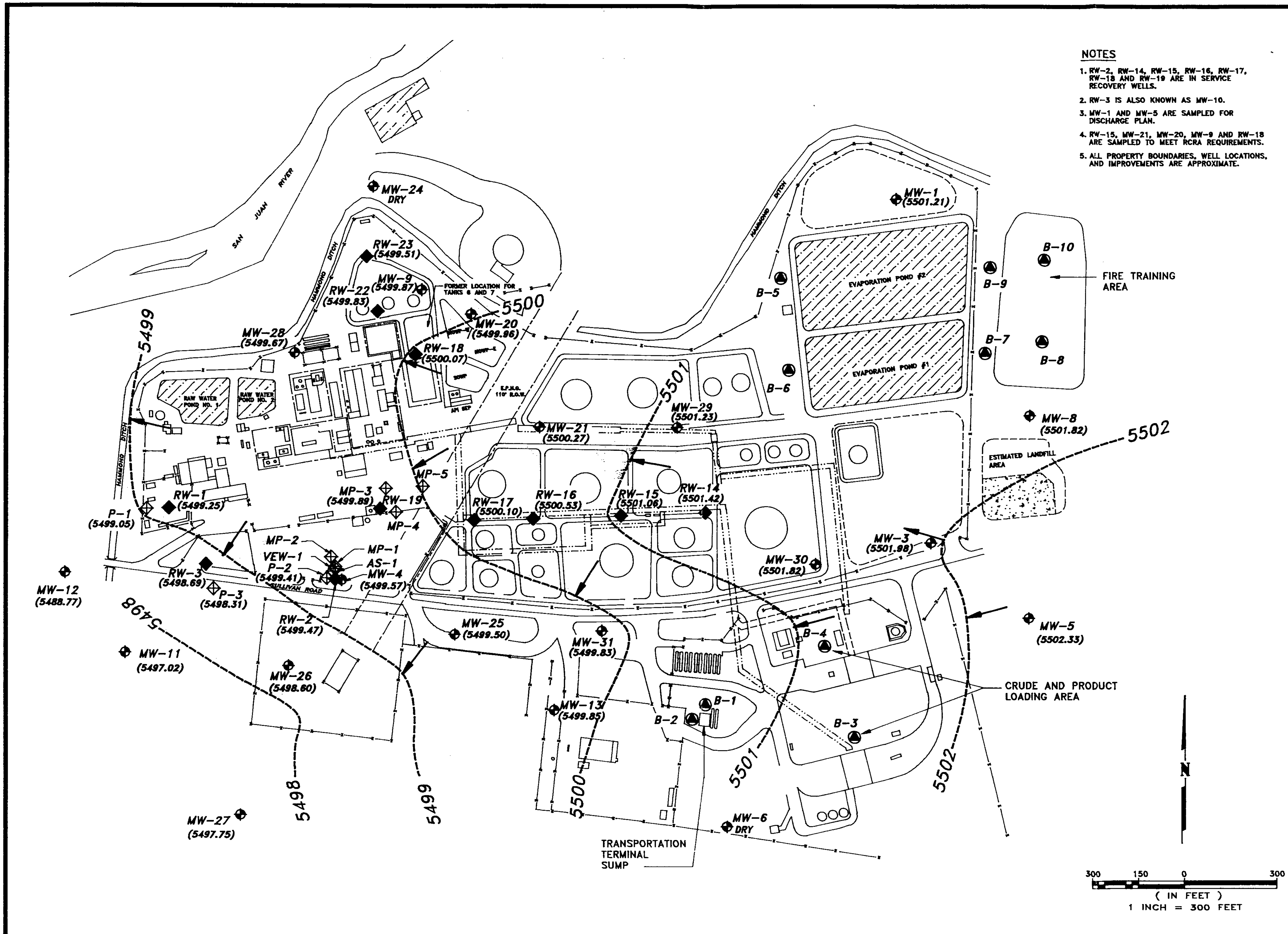
DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: JUNE 22,1994	FILE: SVOC0594
PROJECT NO.: 023353014	CONTRACT:
DRAWING:	REVISION:

FIGURE 9

NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.
5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- P-1 (5499.05) PIEZOMETER; WATER TABLE ELEVATION IN FEET ABOVE MSL
- INFERRED WATER TABLE ELEVATION CONTOUR
- INFERRED GROUND-WATER FLOW DIRECTION

ATTENTION

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SIGNATURE	DATE
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PROJECT MGR:	
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(505) 242-3113

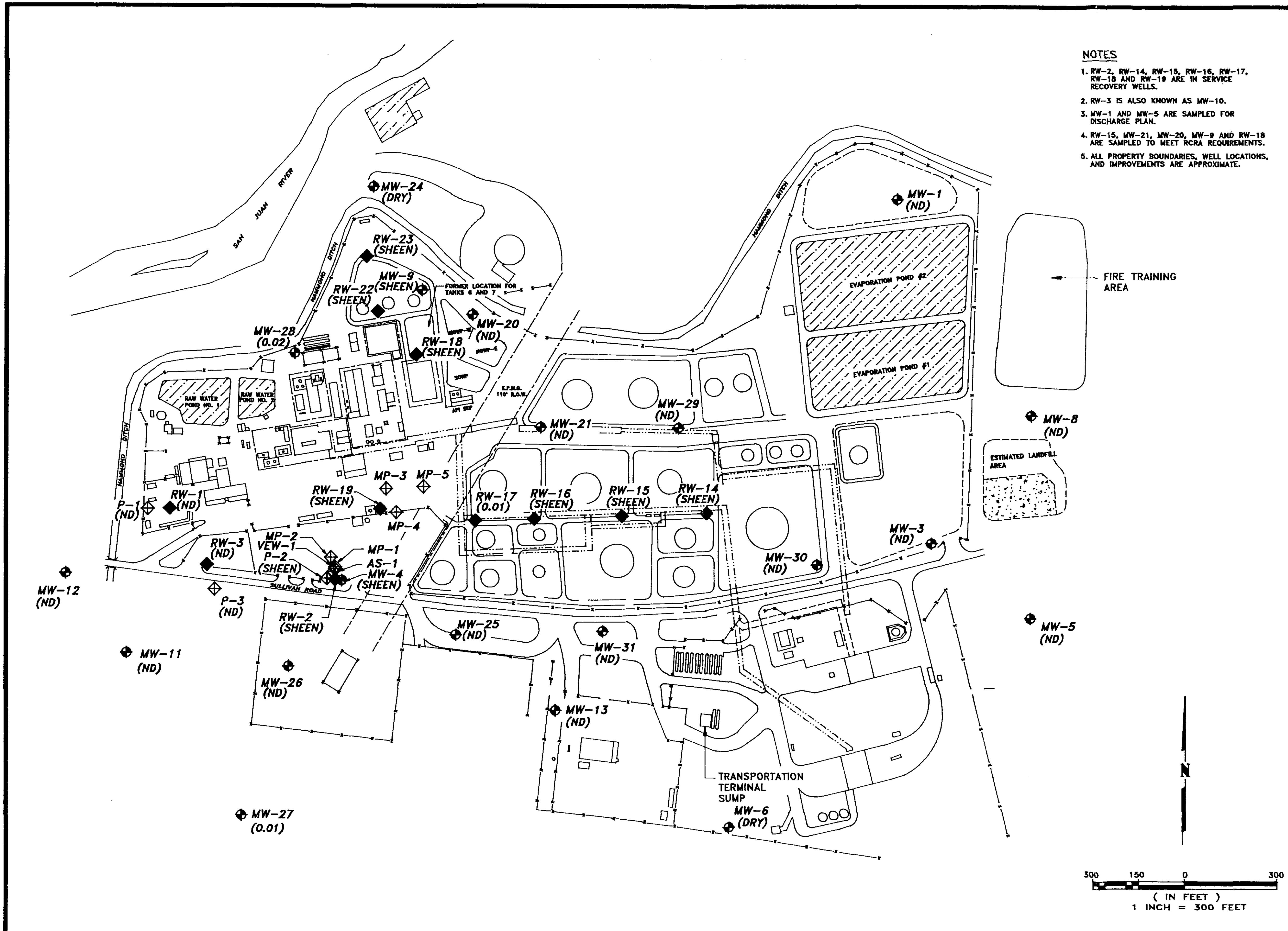
WATER TABLE CONTOUR MAP

AUGUST 2, 1994

PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: SEPT. 28, 1994	FILE: WTCM0894
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 10	REVISION:



NOTES

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5. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- P-1 PIEZOMETER
- (ND)= NOT DETECTED
- (0.01)= SPH THICKNESS IN FEET

ATTENTION

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SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

SEPARATE PHASE HYDROCARBON (SPH) THICKNESS
AUGUST 2, 1994
PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: SEPT. 28, 1994	FILE: PSH-0894
PROJECT NO.: 023353014	CONTRACT:
DRAWING:	REVISION:

FIGURE 11

NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
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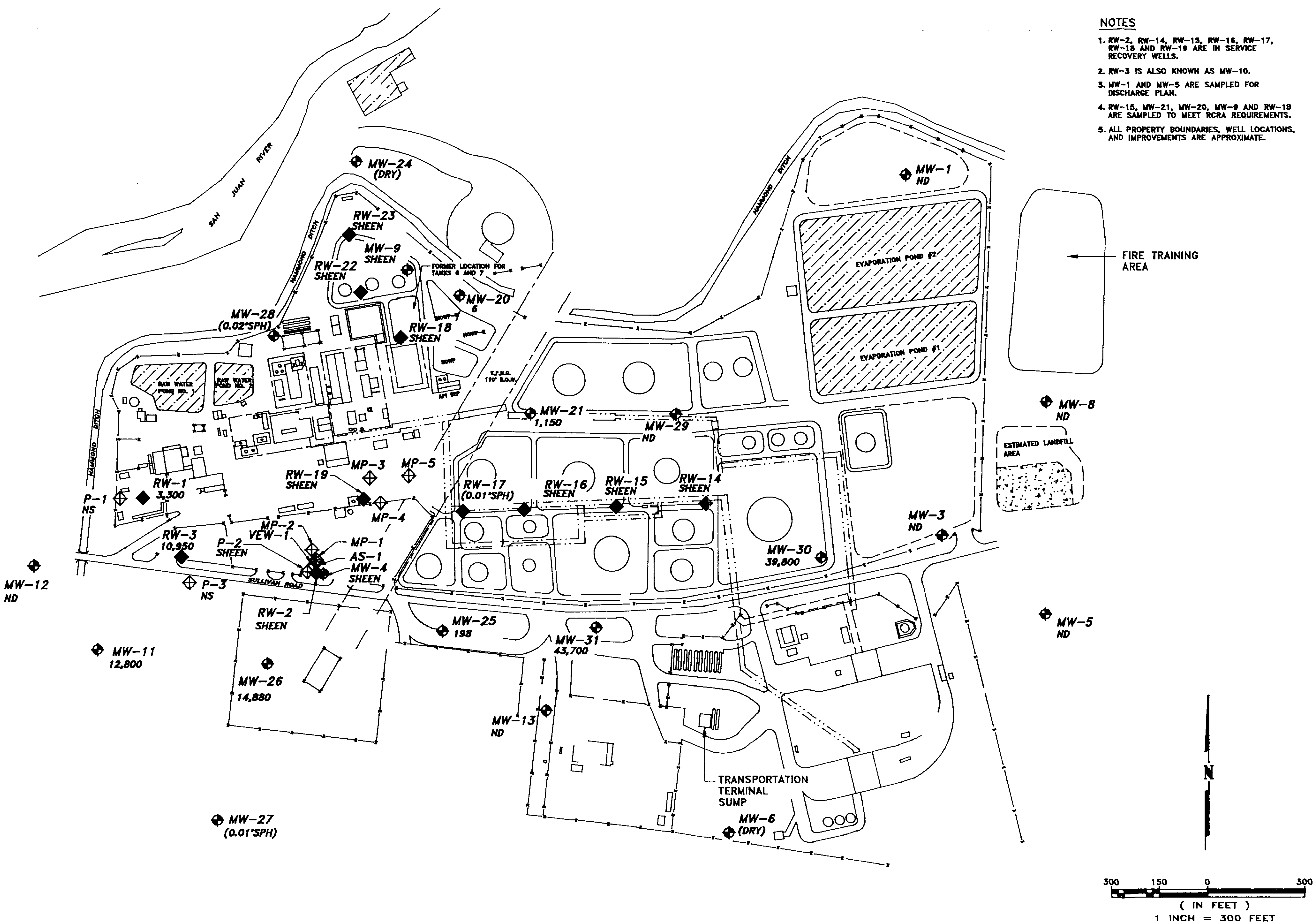


NO.	DATE	BY	REVISION

LEGEND

- —·—·—·— PIPEWAY
- — — — — UNDERGROUND PIPEWAY
- ——x—— FENCE
- MW-1 MONITORING WELL
- RW-1 RECOVERY WELL
- P-1 PIEZOMETER
- NS NOT SAMPLED
- ND NOT DETECTED
- VOC VOLATILE ORGANIC COMPOUNDS
- SPH SEPARATE PHASE HYDROCARBONS

VOC CONCENTRATION IN μg/l

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

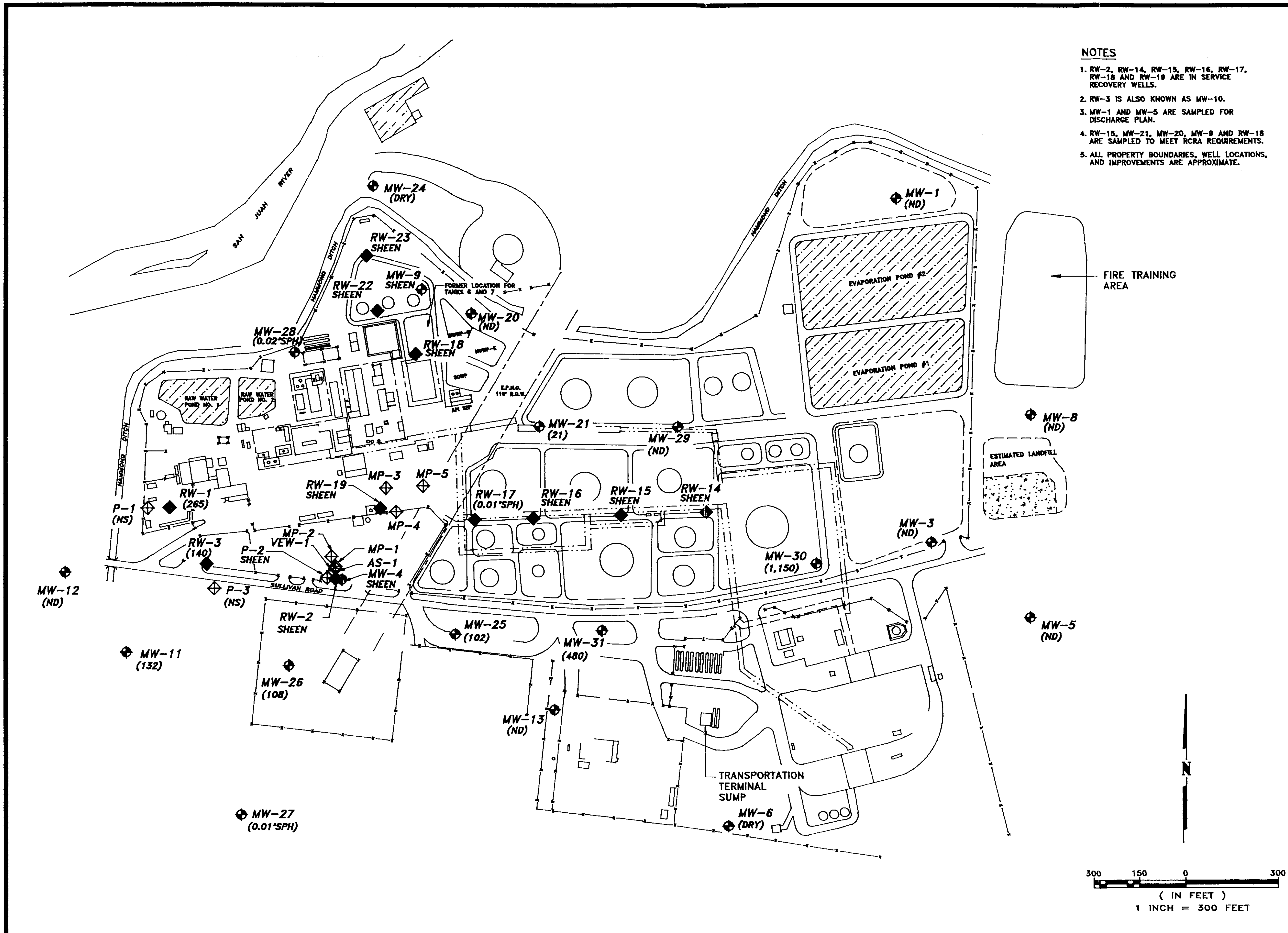
GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

TOTAL TARGETED VOC's IN GROUNDWATER

AUGUST 3 & 4, 1994
PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: SEPT. 28, 1994	FILE: TVOC0894
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 12	REVISION:



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
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NO.	DATE	BY	REVISION

LEGEND

— · · — · · —	PIPEWAY
— — — —	UNDERGROUND PIPEWAY
—— x ——	FENCE
⊕ MW-1	MONITORING WELL
◆ RW-1	RECOVERY WELL
⊕ P-1	PIEZOMETER
NS	NOT SAMPLED
ND	NOT DETECTED
SVOC	SEMI-VOLATILE ORGANIC COMPOUNDS
SPH	SEPARATE PHASE HYDROCARBONS
(108)	SVOC CONCENTRATION IN µg/l

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

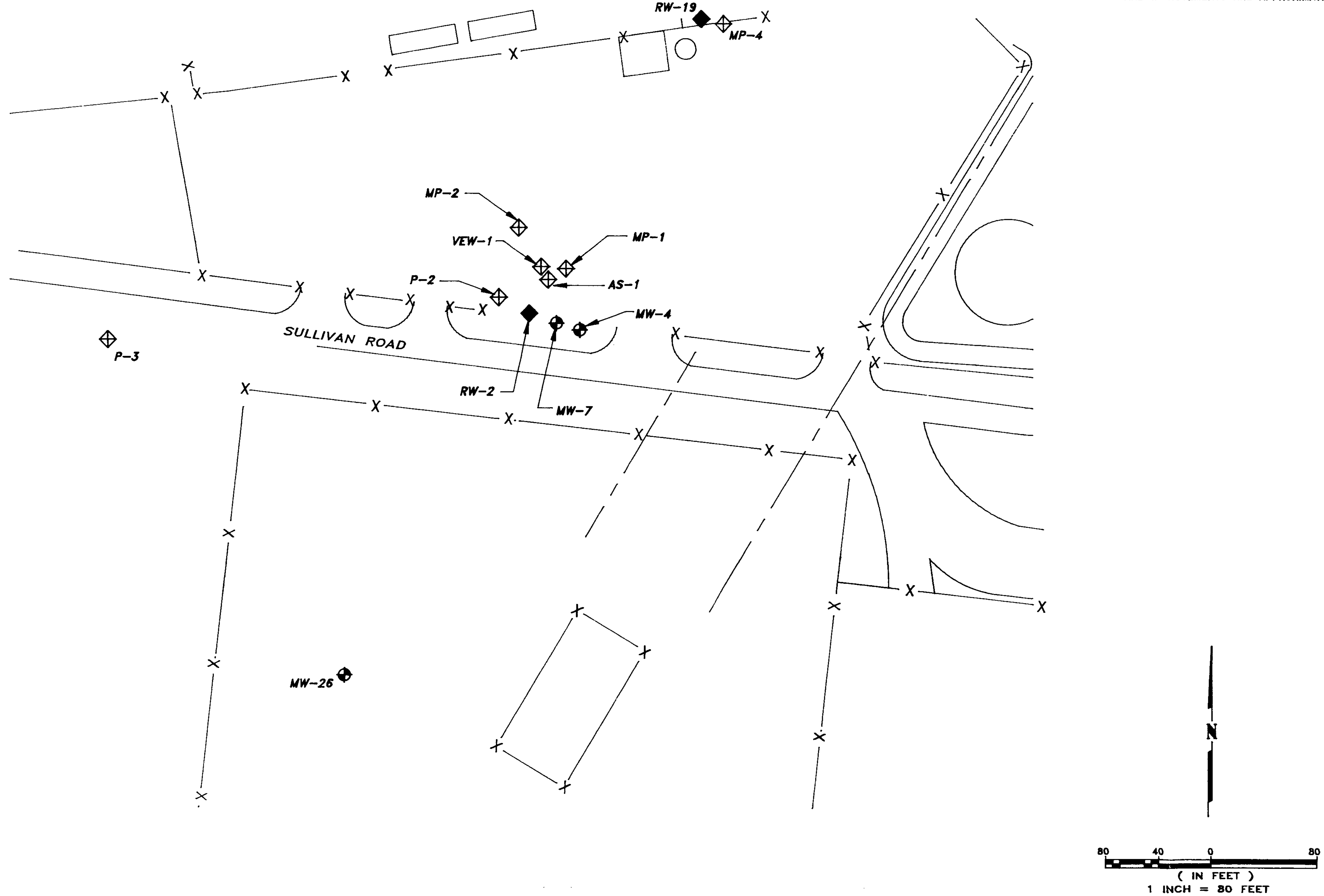
Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE. SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

TOTAL TARGETED SVOC's IN GROUNDWATER
AUGUST 3 & 4, 1994
PHASE 3 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: SEPT. 28, 1994	FILE: SVOC0894
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 13	REVISION:



NOTE

1. ALL PROPERTY BOUNDARIES, WELL LOCATIONS, AND IMPROVEMENTS ARE APPROXIMATE.

LEGEND

———	PIPEWAY
— —	UNDERGROUND PIPEWAY
—x—	FENCE
MW-1	MONITORING WELL
RW-1	RECOVERY WELL
B-1	SOIL BORING
P-1	PIEZOMETER OR MONITOR POINT
AS-1	AIR SPARGE WELL
VEW-1	VAPOR EXTRACTION WELL

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

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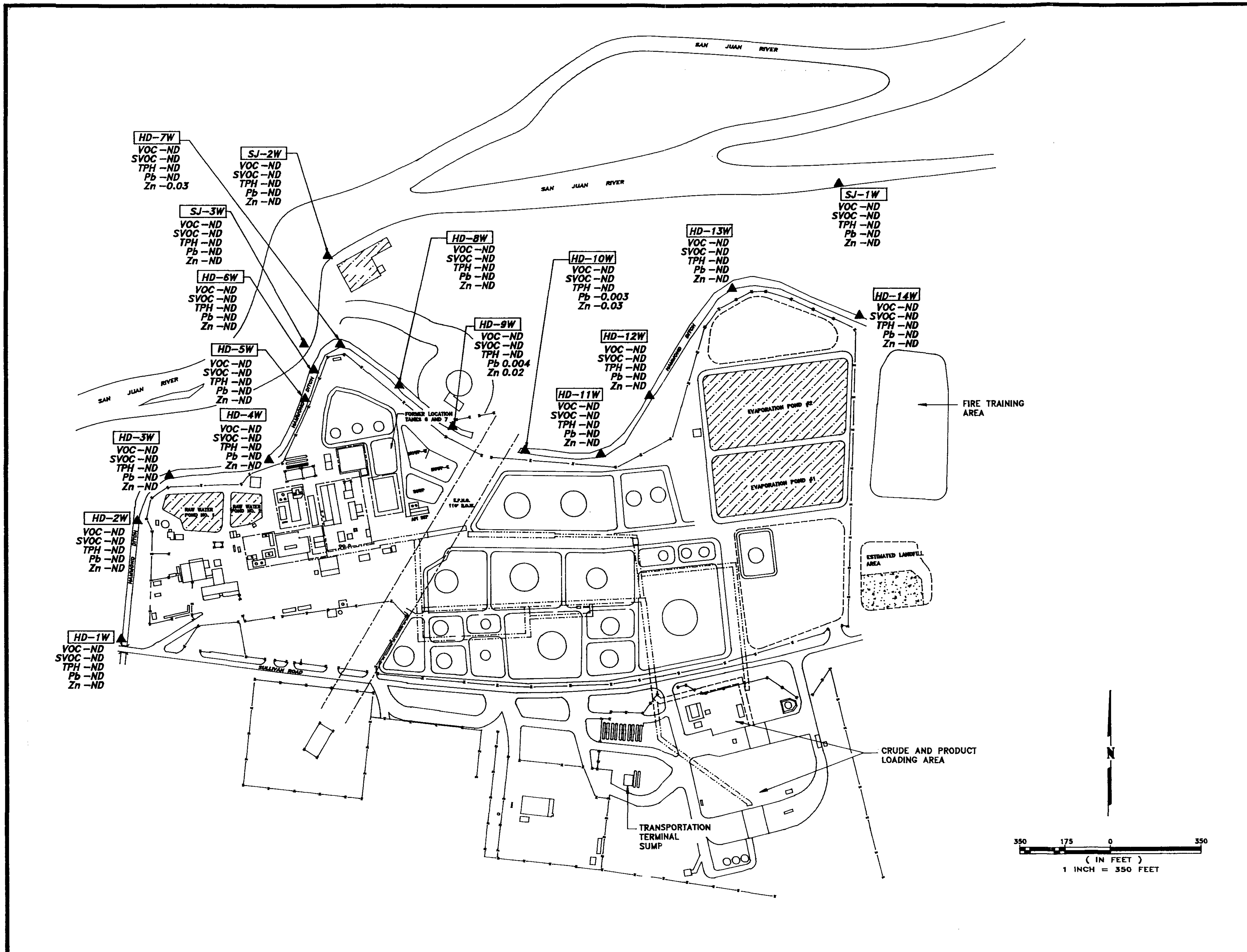
SOIL VAPOR EXTRACTION/AIR SPARGE PILOT TEST STUDY AREA

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: AUG. 9, 1994	FILE: VAPOR-EX	
PROJECT NO.: 023353014	CONTRACT:	
DRAWING: FIGURE 14	REVISION:	



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE

ND	NOT DETECTED
VOC	VOLATILE ORGANIC COMPOUNDS
SVOC	SEMI-VOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
Pb	LEAD
Zn	ZINC

METHYLENE CHLORIDE LEVELS ARE NOT SHOWN

CONCENTRATIONS ARE IN mg/L

▲ STREAM SAMPLE LOCATION (6-12" BELOW WATER LEVEL)

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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BLOOMFIELD, NEW MEXICO

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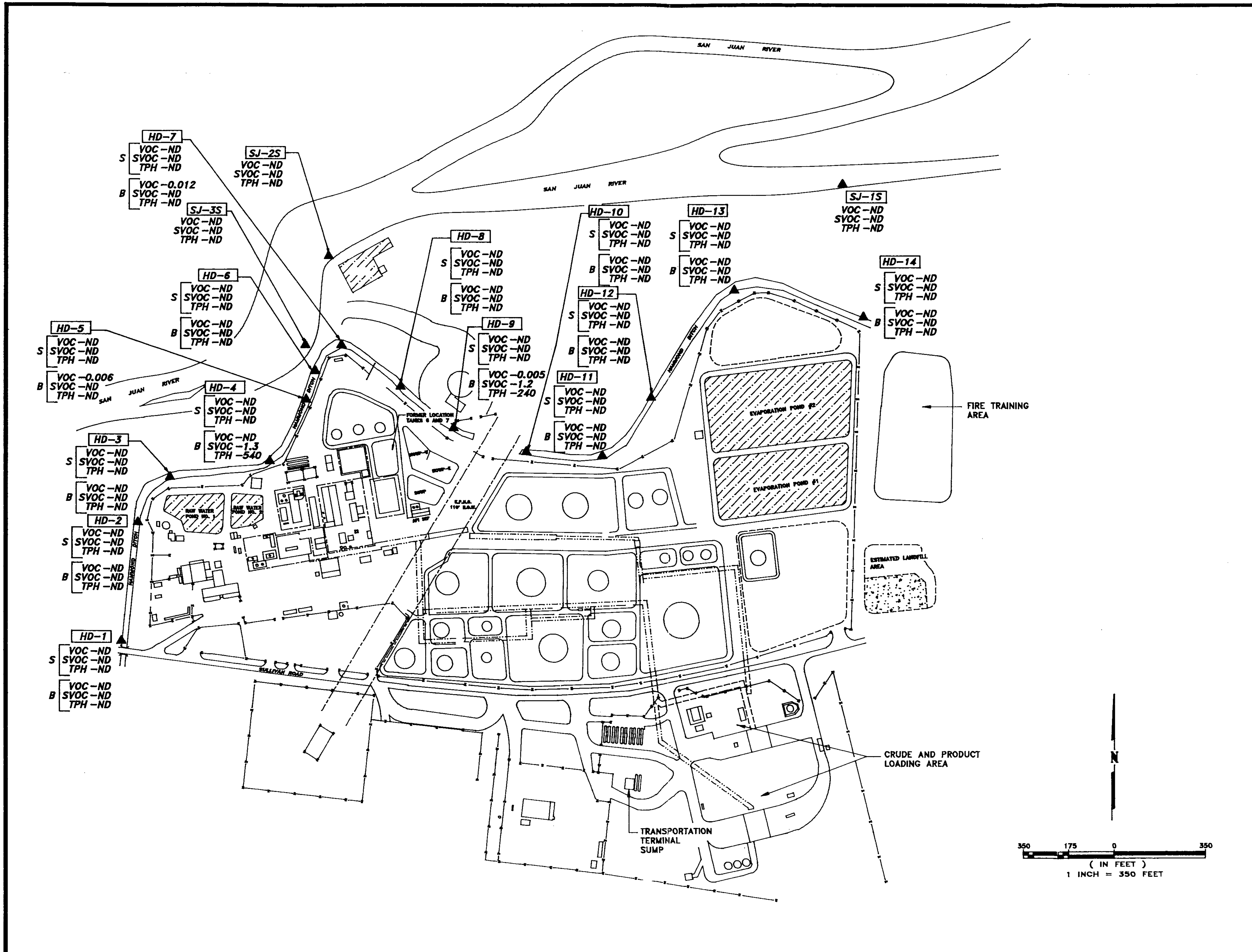
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

STREAM SAMPLE LOCATIONS AND ANALYTICAL RESULTS

PHASE 5 RFI

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: OCT. 14, 1994		FILE: STR-SAMP
PROJECT NO.: 023353014		CONTRACT:
DRAWING: FIGURE 15		REVISION:



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE
- ND — NOT DETECTED
- VOC — VOLATILE ORGANIC COMPOUNDS
- SVOC — SEMI-VOLATILE ORGANIC COMPOUNDS
- TPH — TOTAL PETROLEUM HYDROCARBONS
- S — SIDE SAMPLE
- B — BOTTOM SAMPLE

METHYLENE CHLORIDE LEVELS ARE NOT SHOWN

METALS RESULTS ARE PROVIDED IN TABLE 2

CONCENTRATIONS ARE IN mg/kg

▲ SEDIMENT SAMPLE LOCATION

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

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ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

SEDIMENT SAMPLE LOCATIONS AND ANALYTICAL RESULTS (ORGANICS ONLY)

PHASE 5 RFI

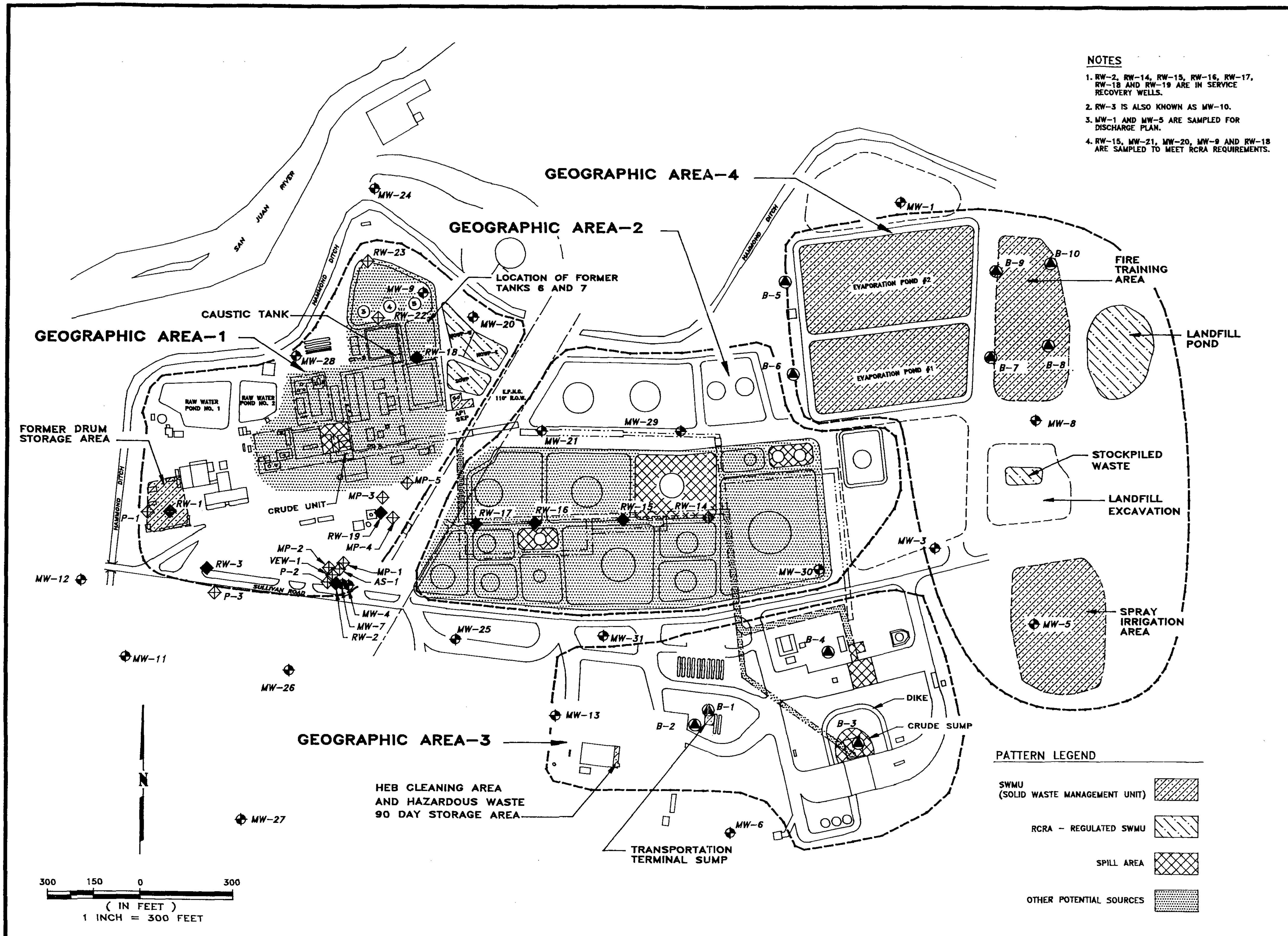
DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: OCT. 14, 1994 — FILE: SED-SAMP

PROJECT NO.: 023353014 — CONTRACT:

DRAWING: — REVISION:

FIGURE 16



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- AREA OF CONCERN
- MW-1 EXISTING MONITORING WELL
- RW-1 EXISTING RECOVERY WELL
- P-1 PROPOSED RECOVERY WELL
- B-10 SOIL BORING

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

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BLOOMFIELD, NEW MEXICO

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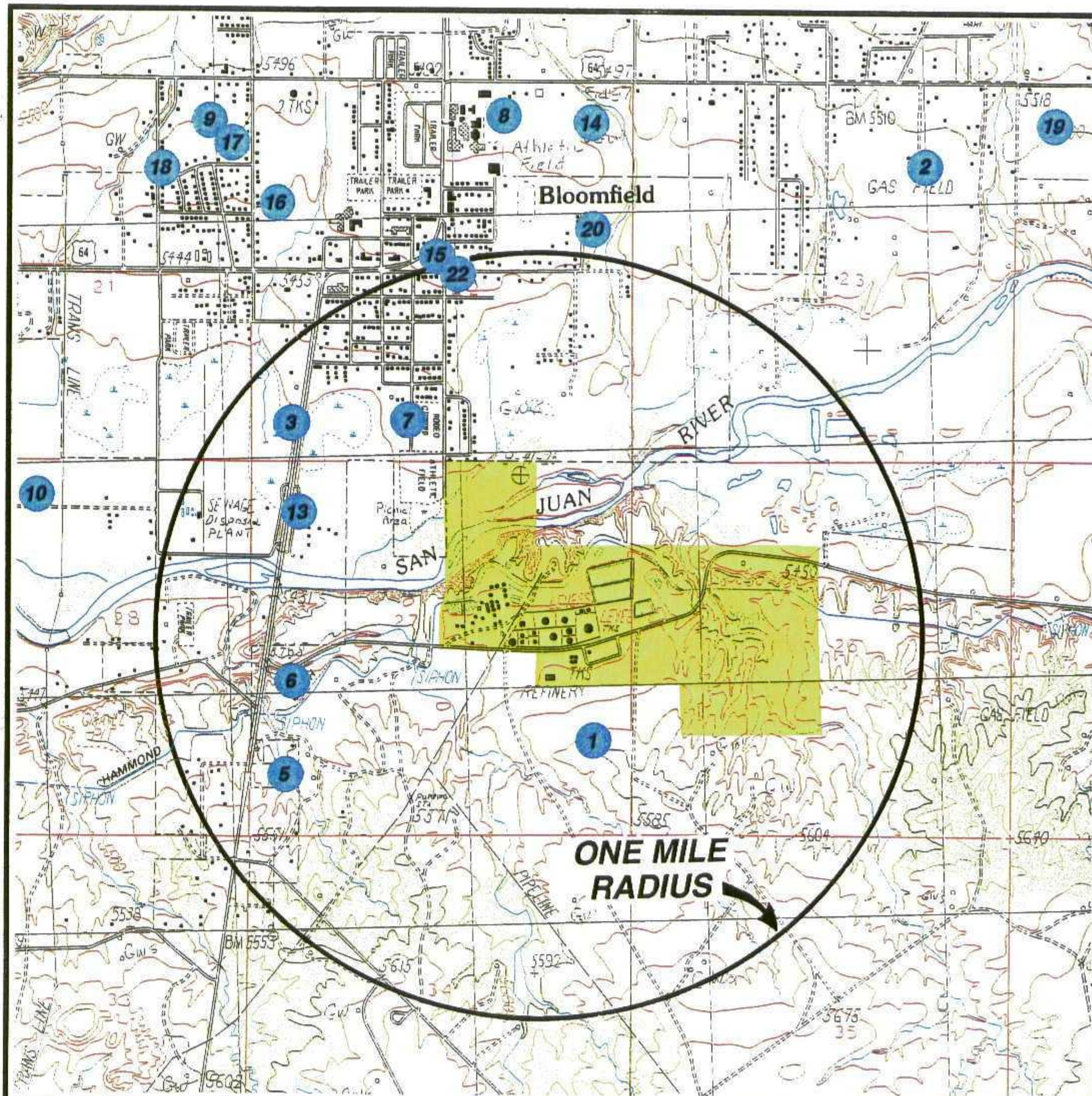
(505) 242-3113

SOLID WASTE MANAGEMENT UNITS AND POTENTIAL SOURCE AREAS

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: OCTOBER - 1994	FILE: SWMU.DWG
PROJECT NO.: 023353014	CONTRACT:
DRAWING:	REVISION:

FIGURE 17



LEGEND

SITE

WATER WELL LOCATION (SEE TABLE 1 FOR OWNER INFORMATION)

NOTES:

1) WELL NOS. 4, 11, & 12 NOT SHOWN SINCE LOCATIONS WERE NOT REPORTED ON WELL RECORDS. WELL NO. 21 IS NOT SHOWN, AS IT IS NOT IN THE VICINITY OF THE SITE.

2) WELLS NO. 15 AND 22 ARE APPROXIMATELY LOCATED.

BLOOMFIELD, N. MEX.QUADRANGLE
PROVISIONAL EDITION
1985
36107-F8-TF-024

QUADRANGLE LOCATION

N

1000 0 2000

SCALE IN FEET

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

WATER WELLS WITHIN ONE MILE OF THE FACILITY

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93		FILE: BL-WELL LOC
PROJECT NO.: 023353014		CONTRACT:
DRAWING: FIGURE 18		REVISION: —

TABLE 1

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
BLANK-01	NA	NA	12/9	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-02	NA	NA	12/9	ND	ND	ND	ND	ND	0	QC-Probe Rod Blank
SG-01	PH-01	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-02	PH-01	10	12/9	16	4	ND	ND	ND	73	Soil Gas
SG-03	PH-02	3	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-04	PH-02	8.5	12/9	121	38	35	ND	6	1832	Soil Gas
SG-05	PH-03	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-06	PH-03	8.5	12/9	ND	15	5	20	5	226	Soil Gas
SG-07	PH-04	3	12/9	1	ND	ND	ND	ND	17	Soil Gas
SG-08	PH-04	6	12/9	ND	ND	ND	ND	ND	2	Soil Gas
SG-09	PH-05	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-10	PH-05	8	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-10(D)	PH-05	8	12/9	ND	ND	ND	ND	ND	1	QC-Duplicate Injection

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
BLANK-03	NA	NA	12/9	ND	ND	ND	ND	ND	0	QC-System Blank
SG-11	PH-06	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-12	PH-06	7.5	12/9	ND	ND	ND	ND	ND	3	Soil Gas
SG-13	PH-07	3	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-14	PH-07	9	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-15	PH-08	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-16	PH-08	8	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-17	PH-09	3	12/9	ND	1	ND	ND	ND	2	Soil Gas
SG-18	PH-09	10	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-19	PH-10	10	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-20	PH-10	10	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-20(D)	PH-10	10	12/9	ND	ND	ND	ND	ND	0	QC-Dupkicate Injection
BLANK-04	NA	NA	12/9	ND	ND	ND	ND	ND	0	QC-System Blank

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-21	PH-11	3	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-22	PH-11	10	12/9	ND	ND	ND	ND	ND	3	Soil Gas
SG-23	PH-12	3	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-24	PH-12	10	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-25	PH-13	3	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-26	PH-13	10	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-27	PH-14	3	12/9	ND	ND	ND	ND	ND	1	Soil Gas
SG-28	PH-14	10	12/9	ND	ND	ND	ND	ND	0	Soil Gas
SG-28(D)	PH-14	10	12/9	ND	ND	ND	ND	ND	0	QC-Duplicate Injection
BLANK-05	NA	NA	12/9	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-06	NA	NA	12/10	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-07	NA	NA	12/10	ND	ND	ND	ND	ND	0	QC-Probe Rod Blank
SG-29	PH-15	3	12/10	ND	2	ND	ND	ND	25	Soil Gas

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-30	PH-15	9	12/10	ND	61	ND	19	9	1108	Soil Gas
SG-31	PH-16	3	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-32	PH-16	9	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-33	PH-17	3	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-34	PH-17	9	12/10	ND	ND	ND	1	ND	2	Soil Gas
SG-35	PH-18	3	12/10	ND	2	ND	1	ND	3	Soil Gas
SG-36	PH-18	9	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-37	PH-19	3	12/10	ND	3	ND	2	ND	3	Soil Gas
SG-38	PH-19	9	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-38(D)	PH-19	9	12/10	ND	ND	ND	ND	ND	0	Qc-Duplicate Injection
BLANK-08	NA	NA	12/10	ND	ND	ND	ND	ND	0	QC-System Blank
SG-39	PH-20	3	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-40	PH-20	9	12/10	ND	77	13	39	14	345	Soil Gas

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-41	PH-21	3	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-42	PH-21	9	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-43	PH-22	3	12/10	ND	ND	ND	ND	ND	0	Soil Gas
SG-44	PH-22	9	12/10	35	1508	199	2260	95	6474	Soil Gas
SG-45	PH-23	3	12/10	ND	11	3	8	2	23	Soil Gas
SG-46	PH-23	9	12/10	ND	2	ND	1	ND	3	Soil Gas
SG-47	PH-24	3	12/10	16	115	27	145	36	721	Soil Gas
SG-48	PH-24	9	12/10	88	271	63	331	62	1571	Soil Gas
SG-48(D)	PH-24	9	12/10	91	272	60	313	60	1547	QC-Duplicate Injection
BLANK-09	NA	NA	12/10	ND	ND	ND	ND	ND	0	QC-System Blank
SG-49	PH-25	3	12/10	91	76	9	55	7	41	Soil Gas
SG-50	PH-25	9	12/10	447	532	82	538	61	2519	Soil Gas
SG-51	PH-26	3	12/10	1	ND	2	11	2	36	Soil Gas

GROUNDWATER TECHNOLOGY ®

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-52	PH-26	9	12/10	27	14	ND	16	2	97	Soil Gas
SG-52(D)	PH-26	9	12/10	27	15	1	17	2	100	QC-Duplicate Injection
BLANK-10	NA	NA	12/10	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-11	NA	NA	12/11	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-12	NA	NA	12/11	ND	ND	ND	ND	ND	0	QC-Probe Rod Blank
SG-53	PH-27	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-54	PH-27	9	12/11	ND	ND	ND	ND	ND	1	Soil Gas
SG-55	PH-28	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-56	PH-28	9	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-57	PH-29	3	12/11	ND	ND	ND	1	ND	1	Soil Gas
SG-58	PH-29	9	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-59	PH-30	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-60	PH-30	9	12/11	ND	ND	ND	1	ND	1	Soil Gas

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-61	PH-31	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-62	PH-31	9	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-62(D)	PH-31	9	12/11	ND	ND	ND	ND	ND	0	QC-Duplicate Injection
BLANK-13	NA	NA	12/11	ND	ND	ND	ND	ND	0	QC-System Blank
SG-63	PH-32	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-64	PH-32	9	12/11	ND	ND	ND	2	ND	2	Soil Gas
SG-65	PH-33	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-66	PH-33	10	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-67	PH-34	3	12/11	ND	ND	ND	ND	ND	1	Soil Gas
SG-68	PH-34	9	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-69	PH-35	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas
SG-70	PH-35	9	12/11	ND	ND	ND	ND	ND	1	Soil Gas
SG-71	PH-36	3	12/11	ND	ND	ND	ND	ND	0	Soil Gas

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-72	PH-36	9	12/11	7	6	2	12	ND	35	Soil Gas
SG-72(D)	PH-36	9	12/11	7	7	2	12	ND	37	QC-Duplicate Injection
BLANK-14	NA	NA	12/11	ND	ND	ND	ND	ND	0	QC-System Blank
SG-73	PH-37	3	12/11	ND	ND	ND	3	ND	4	Soil Gas
SG-74	PH-37	9	12/11	ND	ND	ND	ND	ND	0	Soil Gas
BLANK-15	NA	NA	12/12	ND	ND	ND	ND	ND	0	QC-System Blank
BLANK-16	NA	NA	12/12	ND	ND	ND	ND	ND	0	QC-Probe Rod Blank
SG-75	PH-38	3	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-76	PH-38	8	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-77	PH-39	3	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-78	PH-40	3	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-79	PH-40	8.5	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-80	PH-41	3	12/12	ND	ND	ND	ND	ND	0	Soil Gas

TABLE 1 (Cont.)

SOIL GAS SURVEY RESULTS (DECEMBER 9-12, 1993)
BLOOMFIELD REFINING COMPAY
PHASE I RFI

SAMPLE ID	PROBE HOLE	DEPTH (FEET)	DATE	BENZENE	TOLUENE	ETHYL-BENZENE	m&p-XYLENE	o-XYLENE	TVOC	COMMENTS
SG-81	PH-41	8.5	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-82	PH-42	3	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-83	PH-42	9	12/12	ND	ND	ND	ND	ND	0	Soil Gas
SG-83(D)	PH-42	9	12/12	ND	ND	ND	ND	ND	0	QC-Duplicate Injection
BLANK-17	NA	NA	12/12	ND	ND	ND	ND	ND	0	QC-System Blank

NOTES:
NA = Not applicable
QC = Quality control
D = Duplicate analysis
ND = Not detected at lower quantifiable limit indicated in parentheses
ug/l = Micrograms per liter of headspace vapor analyzed
TVOC = Total volatile organic content

GROUNDWATER TECHNOLOGY ®

TABLE 2

SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS - FEBRUARY 1994
BLOOMFIELD REFINING COMPANY
PHASE II RFI

Volatile Organics	B-1 2.5-4.5'	B-2 10-12'	B-3 6-8'	B-4 8-10'	B-4 10-12'	B-5 2-4'	B-6 2-4'	B-7 6-8'	B-8 8-10'	B-9 2-4'	B-10 10-12'
Acetone	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	0.012	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	0.004 J	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	0.031	ND	ND	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	0.022	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	0.023	0.0065	ND	ND	ND	ND	ND	ND
Methylene Chloride	ND	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organics	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals											
Beryllium	0.66	0.53	0.54	0.53	0.76	ND	0.54	ND	0.57	ND	1.2
Cadmium	4.5	3.0	3.2	3.1	4.0	2.3	3.2	1.8	3.2	0.77	2.3
Chromium	9.7	8.5	8.0	9.9	11	7.2	8.1	5.7	9.3	ND	6.0
Copper	12	8.9	8.8	8.2	11	6.5	9.1	5.3	7.1	ND	ND

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 2 (Cont.)

SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS - FEBRUARY 1994
BLOOMFIELD REFINING COMPANY
PHASE II RFI

Volatile Organics	B-1 2.5-4.5'	B-2 10-12'	B-3 6-8'	B-4 8-10'	B-4 10-12'	B-5 2-4'	B-6 2-4'	B-7 6-8'	B-8 8-10'	B-9 2-4'	B-10 10-12'
Lead	ND	ND	ND	ND	11	ND	ND	ND	ND	ND	ND
Nickel	9.8	7.0	7.4	7.2	10	5.9	6.8	4.8	7.0	1.6	4.7
Thallium	25	15	15	19	23	16	20	14	21	ND	13
Zinc	46	34	35	32	44	26	33	21	33	8.0	22

Concentrations are shown in mg/Kg.
ND - Not Detected
J - Meets identification criteria, below detection limit

GROUNDWATER TECHNOLOGY ®

TABLE 3
SUMMARY OF FLUID LEVELS AND WELL CONSTRUCTION INFORMATION AT THE BLOOMFIELD REFINING COMPANY

WELL NO	DATE INSTALL	ELEV. T.O.P (FT)	ELEV. GROUND SURFACE (FT)	SCREENED INTERVAL BGS (FT)	ELEVATION OF SCREENED INTERVAL (FT)	TOP OF GRAVEL BGS (FT)	ELEV. TOP OF GRAVEL (FT)	TOP OF BEDROCK BGS (FT)	ELEV. TOP OF BEDROCK (FT)
MW-1	02/08/84	5515.78	5514.08	2.9-22.9	5511.13 - 5491.13	5	5509.08	22	5492.08
MW-3	02/09/84	5535.88	5534.88	18.4-38.4	5516.53 - 5496.53	27	5507.88	40	5494.88
MW-4	02/09/84	5524.46	5523.06	11.1-31.1	5511.96 - 5491.96	15	5508.06	32	5491.06
MW-5	02/06/84	5545.13	5544.13	30.6-50.6	5513.52 - 5493.52	35	5509.13	47	5497.13
MW-6	02/07/84	5551.20	5549.60	28-48	5521.57 - 5501.57	41	5508.60	49	5500.60
MW-7	02/25/86	5524.25	5523.15	49-59	5474.14 - 5464.14	17	5506.15	32	5491.15
MW-8	02/28/86	5531.17	5530.17	11.9-31.9	5518.23 - 5498.23	20	5510.17	34	5496.17
MW-9	03/03/86	5519.77	5518.07	10.3-30.3	5507.78 - 5487.78	15	5503.07	28.3	5489.77
RW-1	08/31/88	5526.01	5524.61	17.4-33	5507.21 - 5491.61	18	5506.61	32.6	5492.01
P-1	08/30/88	5524.49	5523.69	20.5-36.5	5503.19 - 5487.19	20	5503.69	36.5	5487.19
RW-2	08/29/88	5523.61	5523.11	16.5-32.2	5506.58 - 5490.88	15	5508.11	32	5491.11
P-2	08/29/88	5523.86	5523.06	16.9-32.2	5506.13 - 5490.83	13	5510.06	31.5	5491.56
RW-3	03/04/86	5516.96	5515.56	10.5-30.5	5505.03 - 5485.03	10	5505.56	23	5492.56
P-3	09/01/88	5507.31	5506.51	6.2-16.6	5500.36 - 5489.91	0	5506.51	14	5492.51
MW-11	07/31/87	5506.89	5503.29	6.1-16.1	5497.16 - 5487.16	0	5503.29	10	5493.29
MW-12	08/01/87	5498.42	5495.92	1.7-11.7	5494.2 - 5484.20	0	5495.92	10	5485.92
MW-13	09/03/88	5538.54	5535.24	28.7-44.5	5506.51 - 5490.74	27	5508.24	45	5490.24
RW-14	08/06/90	5534.13	5532.23	21.1-39.1	5511.13 - 5493.13	24	5508.23	38.5	5493.73
RW-15	08/07/90	5533.44	5531.74	21.7-39.7	5510.04 - 5492.04	19	5512.74	35	5496.74
RW-16	08/07/90	5532.09	5530.29	21.3-39.3	5508.99 - 5490.99	19	5511.29	37.5	5492.79
RW-17	08/07/90	5530.46	5528.86	19.9-35.3	5508.91 - 5490.91	25	5503.86	35.3	5493.56
RW-18	08/08/90	5526.08	5523.48	17.3-35.3	5506.13 - 5488.13	19	5504.48	29	5494.48
RW-19	08/08/90	5527.27	5525.77	15.2-33.2	5510.57 - 5492.57	20	5505.77	33	5492.77
MW-20	09/13/91	5516.46	5514.66	8.4-23.4-	5506.28 - 5491.28	11	5504.16	24	5490.66
MW-21	09/16/91	5518.62	5517.02	12.3-27.3	5504.69 - 5489.69	12	5505.02	24.5	5492.52
RW-22	07/19/93	5521.05	5518.05	14.7-30.7	5503.32 - 5487.32	15	5503.05	27	5491.05
RW-23	07/19/93	5517.74	5515.74	15.4-31.4	5500.35 - 5484.35	7	5508.74	29	5486.74
MW-24	09/15/93	5508.23	5505.23	11.8-11.8	5493.38 - 5493.38	2	5503.23	12.3	5492.88

TABLE 3
SUMMARY OF FLUID LEVELS AND WELL CONSTRUCTION INFORMATION AT THE BLOOMFIELD REFINING COMPANY
(Continued)

WELL NO	DATE INSTALL	ELEV. T.O.P (FT)	ELEV. GROUND SURFACE (FT)	SCREENED INTERVAL BGS (FT)	ELEVATION OF SCREENED INTERVAL (FT)	TOP OF GRAVEL BGS (FT)	ELEV. TOP OF GRAVEL (FT)	TOP OF BEDROCK BGS (FT)	ELEV. TOP OF BEDROCK (FT)
MW-25	05/11/94	5530.45	5527.35	22-36	5505.35 - 5491.35	25	5502.35	35	5492.35
MW-26	05/12/94	5514.54	5512.44	7-21	5505.44 - 5491.44	11	5501.44	20	5492.44
MW-27	05/18/94	5515.26	5512.46	5-20	5507.46 - 5492.46	NE	NE	17	5495.46
MW-28	05/13/94	5524.52	5522.52	18-33	5504.52 - 5489.52	17	5505.52	32	5490.52
MW-29	05/12/94	5521.55	5518.55	10-24	5508.55 - 5494.55	12	5506.55	23	5495.55
MW-30	05/13/94	5533.42	5531.42	21-36	5510.42 - 5495.42	22	5509.42	35	5496.42
MW-31	05/12/94	5532.17	5530.57	21-35	5509.57 - 5495.57	26	5504.57	34	5496.57
MP-1	05/13/94	5523.06	5523.06	5-30	5518.06 - 5493.06	17	5506.06	NE	NE
MP-2	05/16/94	5523.06	5523.06	5-30	5518.06 - 5493.06	17	5506.06	NE	NE
MP-3	05/17/94	5525.77	5525.77	11-31	5514.77 - 5494.77	22	5503.77	31	5494.77
MP-4	05/17/94	5525.77	5525.77	12-32	5513.77 - 5493.77	22	5503.77	32	5493.77
MP-5	05/17/94	5525.77	5525.77	11-31	5514.77 - 5494.77	22	5503.77	31	5494.77
VEW-1	05/17/94	5523.06	5523.06	5-13/16-26	5518.06 - 5510.06/5507.06 - 5497.06	17	5506.06	NE	NE
AS-1	05/16/94	5523.06	5523.06	29-31	5494.06 - 5492.06	17	5506.06	31	5492.06

NE = Not encountered during drilling.

Note: Ground surface and top of pipe elevations not surveyed for MP-1 through MP-5, VEW-1, and AS-1. Elevations are estimated based on survey data from nearby wells.

TABLE 4

LIQUID LEVEL GAUGING CHART - MAY 24, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Well#	Well Elevation	Depth to Water	Depth to Product	Product Thickness	Water Elevation	Product Elevation	Corrected Water Elevation
MW-1	5515.78	15.64	----	----	5500.14	----	----
MW-3	5535.88	34.32	----	----	5501.56	----	----
MW-4	5524.46	25.72	25.14	0.58	5498.74	5499.32	5499.18
MW-5	5545.13	43.36	----	----	5501.77	----	----
MW-6	5551.20	dry	----	----	----	----	----
MW-7	5524.25	25.21	----	----	5499.04	----	----
MW-8	5531.17	29.80	----	----	5501.37	----	----
MW-9	5519.77	20.88	20.87	0.01	5498.89	5498.90	5498.90
RW-1	5526.01	27.33	----	----	5498.68	----	----
P-1	5524.49	26.00	----	----	5498.49	----	----
RW-2	5523.61	25.21	24.51	0.80	5498.40	5499.10	5499.00
P-2	5523.86	25.02	24.70	0.32	5498.84	5499.16	5499.08
RW-3	5516.96	18.68	----	----	5498.28	----	----
P-3	5507.31	9.21	----	----	5498.10	----	----
MW-11	5506.89	9.82	----	----	5497.07	----	----
MW-12	5498.42	8.92	----	----	5489.50	----	----
MW-13	5538.54	38.64	----	----	5499.90	----	----
RW-14	5534.13	33.23	sheen	----	5500.90	----	----
RW-15	5533.44	32.91	sheen	----	5500.53	----	----
RW-16	5532.09	32.00	sheen	----	5500.09	----	----
RW-17	5530.46	31.27	31.26	0.01	5499.19	5499.20	5499.20
RW-18	5526.08	27.05	27.03	0.02	5499.03	5499.05	5499.05
RW-19	5527.27	27.80	----	----	5499.47	sheen	----

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 4 (Cont.)

LIQUID LEVEL GAUGING CHART - MAY 24, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Well#	Well Elevation	Depth to Water	Depth to Product	Product Thickness	Water Elevation	Product Elevation	Corrected Water Elevation
MW-20	5516.46	17.48	----	----	5498.98	----	----
MW-21	5518.62	19.30	----	----	5499.32	----	----
RW-22	5521.05	22.31	sheen	----	5498.74	----	----
RW-23	5517.74	19.28	sheen	----	5498.46	----	----
MW-24	5508.23	dry	----	----	----	----	----
MW-25	5530.45	31.03	----	----	5499.42	----	----
MW-26	5514.54	15.95	----	----	5498.59	----	----
MW-27	5515.26	17.69	17.52	0.17	5497.57	5497.74	5497.70
MW-28	5524.52	25.81	25.73	0.08	5498.71	5498.79	5498.77
MW-29	5521.55	21.01	----	----	5500.54	----	----
MW-30	5533.42	31.97	sheen	----	5501.45	----	----
MW-31	5532.17	32.37	----	----	5499.80	----	----

MEASUREMENTS ARE IN FEET.

TABLE 5 (Page 1 of 4)

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - MAY 24, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	MW-1	MW-3	MW-5	MW-8	MW-12	MW-13	MW-21	MW-21 DUP	MW-29	MW-30	MW-31
Benzene	ND	ND	ND	ND	ND	ND	1,400	1,300	ND	7,800	13,000
Ethylbenzene	ND	ND	ND	ND	ND	ND	260	260	ND	3,500	2,500
m,p-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	14,000	17,000
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	4,700	6,300
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	20,000	26,000
Non-targeted VOCs											
Unknown Hydrocarbon(s)	10	ND	ND	ND	ND	ND	ND	ND	100	9,000 (3)	ND
Unknown Aromatic(s)	ND	ND	ND	ND	ND	ND	330 (3)	320 (3)	ND	5,000 (2)	6,000 (2)
Targeted Semi-Volatile Organic Compounds											
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	77
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	580	280
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	82
3-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	70 J	210
Naphthalene	ND	ND	ND	ND	ND	ND	17	18	ND	850	650
Phenol	ND	ND	ND	ND	ND	ND	13	12	ND	80 J	110
Non-targeted SVOCs											
Unknown Alcohol	ND	ND	ND	ND	ND	130 (3)	ND	ND	ND	ND	ND
Unknown Hydrocarbon(s)	20	30 (2)	40 (2)	10	20	70 (2)	ND	50	20	ND	ND
Unknown Halogenated	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indene	ND	ND	ND	ND	ND	ND	13	13	ND	1,000	65
1-Methylnaphthalene	ND	ND	ND	ND	ND	ND	17	18	ND	3,500	100
Unknown Aromatic(s)	ND	ND	ND	ND	ND	ND	180 (3)	120 (2)	ND	4,000 (3)	4,000 (3)
Total Petroleum Hydrocarbons (mg/L)	NA	NA	NA	NA	NA	NA	NA	NA	ND	18	11

Concentrations are shown in ug/L, except for TPH which is given in mg/L.
ND - Not Detected
NA - Not Analyzed
J - Meets identification criteria, below detection limit

BRC/tables

GROUNDWATER TECHNOLOGY

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - MAY 25, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	MW-11	MW-20	MW-25	MW-26	MW-26 DUP	RW-1	RW-3
Benzene	5,000	5.5	88	4,500	4,700	2,800	8,300
Ethylbenzene	500	ND	42	1,100	1,100	80	1,100
m,p-Xylene	9,400	ND	81	12,000	13,000	40 J	3,600
o-Xylene	ND	ND	ND	100 J	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND
Non-targeted VOCs							
Unknown Hydrocarbon(s)	400	ND	ND	2,800 (2)	2,800 (2)	600 (2)	3,000 (2)
Unknown Aromatics(s)	3,900 (4)	54 (5)	770 (5)	4,000 (3)	2,900 (3)	1,100 (3)	1,600 (3)
Targeted Semi-Volatile Organic Compounds							
2,4-Dimethylphenol	59	ND	17	58	43	ND	ND
2-Methylnaphthalene	16	ND	63	41	21	300	8 J
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	16
Chrysene	ND	ND	ND	ND	ND	150 J	ND
Naphthalene	62	ND	97	84	53	170 J	46
Phenanthrene	ND	ND	ND	ND	ND	130 J	ND
Phenol	32	ND	ND	19	10	ND	16
Non-targeted SVOCs							
Unknown Alcohol	ND	20	ND	ND	ND	ND	ND
1-Methylnaphthalene	ND	ND	59	39	19	460	ND
Unknown Aromatic(s)	3,800 (4)	ND	340 (3)	2,900 (4)	1,100 (2)	ND	3,200 (4)
Unknown Hydrocarbon(s)	900	ND	70	ND	1,500 (2)	7,000 (4)	600
Total Petroleum Hydrocarbons (mg/L)	NA	NA	ND	17	14	NA	NA

Concentrations are shown in ug/L, except for TPH which is given in mg/L.
ND - Not Detected
NA - Not Analyzed
J - Meets identification criteria, below detection limit

GROUNDWATER TECHNOLOGY ®

SUMMARY OF QA/QC SAMPLE ANALYTICAL RESULTS - MAY 24 AND 25, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	TB-052494	EB-052494	TB-052594	EB-052594
Benzene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Non-targeted VOCs	ND	ND	ND	ND

Concentrations are shown in ug/L.
ND - Not Detected

TABLE 5 (Page 4 of 4)

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - MAY 24 AND 25, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Metals (mg/L)	MW-25	MW-26	MW-26 DUP	MW-29	MW-30	MW-31
Antimony	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	0.011	ND
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	0.015	ND
Copper	ND	ND	ND	ND	0.034	ND
Lead	ND	0.0059	ND	0.0057	0.0087	ND
Mercury	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND
Zinc	ND	0.035	ND	0.037	0.039	ND

Concentrations are shown in mg/L.
ND - Not Detected
J - Meets identification criteria, below detection limit

TABLE 6

LIQUID LEVEL GAUGING CHART - AUGUST 2, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Well#	Well Elevation	Depth to Water	Depth to Product	Product Thickness	Water Elevation	Product Elevation	Corrected Water Elevation
MW-1	5515.78	14.57	----	----	5,501.21	----	----
MW-3	5535.88	33.90	----	----	5,501.98	----	----
MW-4	5524.46	24.89	Sheen	----	5,499.57	Sheen	----
MW-5	5545.13	42.80	----	----	5,502.33	----	----
MW-6	5551.20	dry	----	----	----	----	----
MW-7	5524.25	25.37	----	----	5,498.88	----	----
MW-8	5531.17	29.35	----	----	5,501.82	----	----
MW-9	5519.77	19.90	Sheen	----	5,499.87	Sheen	----
RW-1	5526.01	26.76	----	----	5,499.25	----	----
P-1	5524.49	25.44	----	----	5,499.05	----	----
RW-2	5523.61	24.14	Sheen	----	5,499.47	Sheen	----
P-2	5523.86	24.45	Sheen	----	5,499.41	Sheen	----
RW-3	5516.96	18.27	----	----	5,498.69	----	----
P-3	5507.31	9.00	----	----	5,498.31	----	----
MW-11	5506.89	9.87	----	----	5,497.02	----	----
MW-12	5498.42	9.65	----	----	5,488.77	----	----
MW-13	5538.54	38.69	----	----	5,499.85	----	----
RW-14	5534.13	32.71	Sheen	----	5,501.42	Sheen	----
RW-15	5533.44	32.38	Sheen	----	5,501.06	Sheen	----
RW-16	5532.09	31.56	Sheen	----	5,500.53	Sheen	----
RW-17	5530.46	30.37	30.36	0.01	5,500.09	5,500.10	5500.10
RW-18	5526.08	26.01	Sheen	----	5,500.07	Sheen	----
RW-19	5527.27	27.38	Sheen	----	5,499.89	Sheen	----

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 6 (Cont.)

LIQUID LEVEL GAUGING CHART - AUGUST 2, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Well#	Well Elevation	Depth to Water	Depth to Product	Product Thickness	Water Elevation	Product Elevation	Corrected Water Elevation
MW-20	5516.46	16.50	----	----	5,499.96	----	----
MW-21	5518.62	18.35	----	----	5,500.27	----	----
RW-22	5521.05	21.22	Sheen	----	5,499.83	Sheen	----
RW-23	5517.74	18.23	Sheen	----	5,499.51	Sheen	----
MW-24	5508.23	dry	----	----	----	----	----
MW-25	5530.45	30.95	----	----	5,499.50	----	----
MW-26	5514.54	15.94	----	----	5,498.60	----	----
MW-27	5515.26	17.52	17.51	0.01	5,497.74	5,497.75	5497.75
MW-28	5524.52	24.87	24.85	0.02	5,499.65	5,499.67	5499.67
MW-29	5521.55	20.32	----	----	5,501.23	----	----
MW-30	5533.42	31.60	----	----	5,501.82	----	----
MW-31	5532.17	32.34	----	----	5,499.83	----	----

MEASUREMENTS ARE IN FEET.

CORRECTED WATER ELEVATION = (PRODUCT THICKNESS/1.32) + WATER ELEVATION.

TABLE 7 (Page 1 of 4)

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - AUGUST 3, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	MW-1	MW-3	MW-5	MW-8	MW-11	MW-12	MW-13	MW-20	MW-21	MW-21 DUP	MW-25	MW-26	MW-29	RW-1
Benzene	ND	ND	ND	ND	4,600	ND	ND	6	930	970	120	4,000	ND	3,300
Ethylbenzene	ND	ND	ND	ND	400	ND	ND	ND	170	180	55	880	ND	ND
m,p-Xylene	ND	ND	ND	ND	7,800	ND	ND	ND	ND	ND	23	10,000	ND	ND
Targeted Semi-Volatile Organic Compounds														
2,4-Dimethylphenol	ND	ND	ND	ND	35	ND	ND	ND	ND	ND	ND	31	ND	ND
2-Methyl naphthalene	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	22	12	ND	120
Bis-(2-ethyl hexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60
Naphthalene	ND	ND	ND	ND	58	ND	ND	ND	10	10	80	56	ND	85
Phenol	ND	ND	ND	ND	24	ND	ND	ND	11	11	ND	9 J	ND	ND
Total Petroleum Hydrocarbons (mg/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.4	9.4	ND	NA

Concentrations are shown in μg/L, except for TPH which is given in mg/L.
ND - Not Detected
NA - Not Analyzed
J - Meets identification criteria, below detection limit

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 7 (Page 2 of 4)

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - AUGUST 4, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	MW-30	MW-30 DUP	MW-31	RW-3
Benzene	6,600	7,300	9,500	7,200
Ethylbenzene	3,200	2,800	2,100	950
m,p-Xylene	13,000	12,000	11,000	2,800
o-Xylene	4,000	3,800	4,100	ND
Toluene	13,000	13,000	17,000	ND
Targeted Semi-Volatile Organic Compounds				
2,4-Dimethylphenol	ND	50 J	46	ND
2-Methylnaphthalene	320	340	110	ND
4-Methylphenol/ 3-Methylphenol	ND	ND	70	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND
Naphthalene	790	760	220	100
Phenol	ND	ND	34	40 J
Total Petroleum Hydrocarbons (mg/L)	22	50	11	NA

Concentrations are shown in $\mu g/L$, except for TPH which is given in mg/L.
ND - Not Detected
NA - Not Analyzed
J - Meets identification criteria, below detection limit
** - Coelutes with 4-Methylphenol by GC/MS

GROUNDWATER TECHNOLOGY ®

TABLE 7 (Page 3 of 4)

SUMMARY OF QA/QC SAMPLE ANALYTICAL RESULTS - AUGUST 3 AND 4, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Targeted Volatile Organic Compounds	TB-0803	EB-0803	TB-0804	EB-0804
Benzene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
m,p-Xylene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND

Concentrations are shown in μg/L.
ND - Not Detected

TABLE 7 (Page 4 of 4)

SUMMARY OF GROUNDWATER SAMPLE ANALYTICAL RESULTS - AUGUST 3 AND 4, 1994
BLOOMFIELD REFINING COMPANY
PHASE III RFI

Metals (mg/L)	MW-25	MW-26	MW-29	MW-30	MW-30 DUP	MW-31
Antimony	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	0.01	ND	ND
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND
Lead	0.004	0.004	0.014	0.007	0.009	ND
Mercury	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND
Zinc	ND	0.03	0.05	0.02	0.03	ND

Concentrations are shown in mg/L.
ND - Not Detected
J - Meets identification criteria, below detection limit

GROUNDWATER TECHNOLOGY ®

TABLE 8 (Page 1 of 3)

SUMMARY OF STREAM SAMPLE ANALYTICAL RESULTS - AUGUST 10, 11, AND 12, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	SJ-1W	SJ-2W	SJ-2WD	SJ-3W	HD-1W	HD-2W	HD-3W	HD-4W	HD-5W
VOCs (μg/L)									
Methylene chloride	13	ND	ND	ND	ND	9	32	ND	47
SVOCs (μg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/L)									
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPH (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND

Concentration units are shown in parentheses
HD-2WD and HD-9WD are duplicate samples
ND - Not Detected
VOC - Volatile Organic Compound
SVOC - Semi-volatile Organic Compound
TPH - Total Petroleum Hydrocarbons

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 8 (Page 2 of 3)

SUMMARY OF STREAM SAMPLE ANALYTICAL RESULTS - AUGUST 10, 11, AND 12, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	HD-6W	HD-7W	HD-8W	HD-9W	HD-9WD	HD-10W	HD-11W	HD-12W	HD-13W	HD-14W
VOCs (μg/L)										
Methylene chloride	15	29	37	ND	ND	ND	ND	ND	ND	ND
SVOCs (μg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/L)										
Lead	ND	ND	ND	0.004	ND	0.003	ND	ND	ND	ND
Zinc	ND	0.03	ND	0.02	ND	0.03	ND	ND	ND	ND
TPH (mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Concentration units are shown in parentheses
HD-2WD and HD-9WD are duplicate samples
ND - Not Detected
VOC - Volatile Organic Compound
SVOC - Semi-volatile Organic Compound
TPH - Total Petroleum Hydrocarbons

BRC/tables

GROUNDWATER TECHNOLOGY ®

TABLE 8 (Page 3 of 3)

SUMMARY OF STREAM SAMPLE ANALYTICAL RESULTS - AUGUST 10, 11, AND 12, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	SJ-1W	HD-14W
General Parameters (mg/L)		
Ammonia as N	<0.05	NA
Total Ammonia	NA	<0.05
Biological Oxygen Demand	9.8	NA
Carbon, Total Organic	3.3	NA
Nitrate + Nitrite as N	<0.05	<0.01
Nitrogen, Total Kjeldahl	<0.1	<0.1
Chemical Oxygen Demand	4.5	2.7
Phosphorus	0.58	0.23
Total Dissolved Solids	220	170
Total Suspended Solids	130	6

Concentration units are shown in parentheses
NA - Not Analyzed

TABLE 9 (Page 1 of 4)

SUMMARY OF SEDIMENT SAMPLE ANALYTICAL RESULTS - AUGUST 10, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	SJ-1S	SJ-2S	SJ-3S	HD-1S	HD-1B	HD-2S	HD-2B	HD-3S	HD-3B
VOCs (mg/kg)									
Methylene chloride	0.011	0.011	0.012	ND	0.007	ND	ND	0.057	0.009
SVOCs (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg)									
Arsenic	16	11	ND	16	ND	ND	ND	16	ND
Beryllium	ND	ND	ND	ND	0.9	ND	0.9	1.2	1.1
Chromium	8.6	ND	ND	6.1	9.6	6	9.4	13	11
Copper	5.8	5.6	ND	6.8	16	6.6	17	21	26
Lead	ND	ND	ND	ND	ND	ND	12	14	ND
Nickel	4.9	4.5	1.8	5.3	10	5.6	9.8	13	12
Selenium	ND	ND	ND	ND	11	ND	ND	ND	ND
Zinc	16	19	10	26	45	26	43	55	60
TOC (%)	0.1	0.2	0.1	0.4	0.7	1.0	0.6	1.4	0.9
TPH (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND

Concentration units are shown in parentheses
ND - Not Detected
VOC - Volatile Organic Compound
SVOC - Semi-volatile Organic Compound
TOC - Total Organic Carbon
TPH - Total Petroleum Hydrocarbons

GROUNDWATER TECHNOLOGY®

TABLE 9 (Page 2 of 4)

SUMMARY OF SEDIMENT SAMPLE ANALYTICAL RESULTS - AUGUST 11, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	HD-4S	HD-4B	HD-5S	HD-5B	HD-6S	HD-6B	HD-7S	HD-7B	HD-8S	HD-8B	HD-9S	HD-9B
VOCs (mg/kg)												
Methylene chloride	0.01	0.006	0.007	0.006	ND	0.005	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	0.006	ND	ND	ND	0.012	ND	ND	ND	0.005
SVOCs (mg/kg)												
Phenan threne	ND	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2
Metals (mg/kg)												
Arsenic	ND	ND	10	13	ND	10	ND	ND	15	12	ND	ND
Beryllium	ND	0.7	ND	0.9	0.6	1	0.6	1	0.8	1	ND	1
Chromium	8.2	8.8	7.1	13	18	12	7.9	12	15	20	16	17
Copper	14	180	13	18	14	18	12	19	35	17	12	18
Lead	ND	ND	11	12	ND	ND	11	16	18	ND	ND	12
Nickel	5.2	8.7	7.4	11	9.3	12	7.8	12	9.1	11	6.7	11
Zinc	69	64	43	56	43	44	37	53	180	58	44	56
TOC (%)	0.9	0.7	1.1	0.4	0.6	0.6	0.9	0.6	0.8	0.4	0.7	0.7
TPH (mg/kg)	ND	540	ND	ND	ND	ND	ND	ND	ND	ND	ND	240

Concentration units are shown in parentheses
ND - Not Detected
VOC - Volatile Organic Compound
SVOC - Semi-volatile Organic Compound
TOC - Total Organic Carbon
TPH - Total Petroleum Hydrocarbons

GROUNDWATER TECHNOLOGY ®

BRC/tables

TABLE 9 (Page 3 of 4)

SUMMARY OF SEDIMENT SAMPLE ANALYTICAL RESULTS - AUGUST 11 AND 12, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Parameter	HD-10S	HD-10B	HD-11S	HD-11B	HD-12S	HD-12B	HD-13S	HD-13B	HD-14S	HD-14B
VOCs (mg/kg)										
Methylene chloride	0.009	0.006	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg)										
Arsenic	ND	13	10	15	12	15	ND	10	ND	ND
Beryllium	ND	0.9	ND	1	0.6	1.3	ND	0.9	ND	1.1
Chromium	9.4	12	8.1	14	12	17	9.2	9.5	6.7	11
Copper	17	16	11	17	11	19	15	17	11	18
Lead	11	ND	ND	11	ND	15	ND	11	ND	11
Nickel	5.6	9.8	6.2	11	8.8	13	7.8	10	6	12
Zinc	59	38	38	51	47	58	36	39	29	50
TOC (%)	0.4	0.6	0.7	0.6	1.1	0.7	0.6	0.8	0.3	0.8
TPH (mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Concentration units are shown in parentheses
ND - Not Detected
VOC - Volatile Organic Compound
SVOC - Semi-volatile Organic Compound
TOC - Total Organic Carbon
TPH - Total Petroleum Hydrocarbons

GROUNDWATER TECHNOLOGY ®

TABLE 9 (Page 4 of 4)

SUMMARY OF QA/QC SAMPLE ANALYTICAL RESULTS - AUGUST 10, 11, AND 12, 1994
BLOOMFIELD REFINING COMPANY
PHASE V RFI

Targeted Volatile Organic Compounds	TB-0810	TB-0811	TB-0810B
Benzene	ND	ND	ND
Ethylbenzene	ND	ND	ND
m,p-Xylene	ND	ND	ND
o-Xylene	ND	ND	ND
Toluene	ND	ND	ND
Methylene chloride	55	74	54

Concentrations are shown in $\mu g/L$.
ND - Not Detected

TABLE 10 (page 1 of 4)

WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
1.	SJ-2148	C.W. Wooten	P.O. Box 1841 Bloomfield, NM 87413	S 1/2, NE 1/4, SE 1/2 Section 27 Twp 29 N Range 11-W	Nov. 1987	305'	7" steel to 39.5' 4" PVC to 266'	266'-306'
2.	SJ-1870	D.E. Walters	P.O. Box 2131 Bloomfield, NM 87413 Tract 2	NE 1/4 Section 23 Twp 29 N Range 11-W	Aug. 1984	58'	6" steel to 58'	None
3.	SJ-2026	S. Hinsen	P.O. Box 2562 Bloomfield, NM 87413	SW 1/2, SW 1/4, Section 22 Twp 29 N Range 11-W	Jan. 1986	27'	6 5/8" steel to 21'	21' to 26'
4.	SJ-2121	H. Chatto	Lot 10, Huntington Circle, Bloomfield, NM 87413	Not Reported	July 1987	30'	7" steel to 21'	21' to 26'
5.	SJ-700	E.H. Brown	Rt #1, Box 248, Aztec, NM 87410	SW 1/4, SW 1/4, NW 1/4 Section 27 Twp 29 N Range 11-W	July 1978	20'	7" steel to 20'	None
6.	SJ-2210	D.C. Looney	P.O. Box 2462 Bloomfield, NM 87413	S 1/2, NW 1/4, NW 1/4 Section 27 Twp 29 N Range 11-W	Dec. 1988	32'	6" PVC to 22'	22'-32'

GROUNDWATER TECHNOLOGY ®

TABLE 10 (page 2 of 4)

WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
7.	SJ-695	W.N. Wampler	P.O. Box 2386 Bloomfield, NM 87413, Lot 14, Block 2 of the Bloomfield Southside Add	SW 1/4, SE 1/4 Section 22 Twp 29 N Range 11-W	July 1978	34'	6" to 24'	24'to 34'
8.	SJ-796	T.P. Johnson	Tract A, Loma Addition, Bloomfield, NM 87413	NE 1/4, NW 1/4 Section 22 Twp 29 N Range 11-W	Mar. 1979	50'	5.5" to 40'	40' to 48'
9.	SJ-701	G.T. Rodriguez	P.O. Box 1071 Bloomfield, NM 87413, Lot 16, Green Valley Estates	NE 1/4, NE 1/4 Section 21 Twp 29 N Range 11-E	July 1978	70'	6 5/8" to 70'	None
10.	SJ-2330	R.H. Phelps	P.O. Box 2548 CR 5005 #65 A, Bloomfield, NM 87413	NW 1/4, NE 1/4 Section 28 Twp 29 N Range 11-W	Sept. 1991	128'	5" PVC to 107'	107' to 127'
11.	SJ-2195	M. Aronson	Bloomfield, NM 87413	Not Reported	Nov. 1988	70'	6" to 65'	65' to70'
12.	SJ-2182	M. Faverino	116 Road 5010 Bloomfield, NM 87413	Not Reported	July 1988	27'	7" to 22'	22' to 26'

TABLE 10 (page 3 of 4)

WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
13.	SJ-2227	Y. Chavez	P.O. Box 1412 Bloomfield, NM 87413 Huntington Circle	NW 1/4, NW 1/4 Section 27 Twp 29 Range 11-W	July 1989	27'	7" to 20'	20' to 24'
14.	SJ-704	C.W. Jaramillo	P.O. Box 594 Bloomfield, NM 87413 Lot 2&3, Blk 4 - Loma Vista	NE 1/4, NE 1/4 Section 22 Twp 29 N Range 11-W	July 1978	55'	6" Plastic to 35'	35' to 55'
15.	SJ-484	G.A. Chacon	P.O. Box 634 Bloomfield, NM 87413	Section 22 Twp 29 Range 11	Oct. 1977	37'	6 3/8" to 28'	28' to 34'
16.	SJ-320	M. Wileman	P.O. Box 503 Bloomfield, NM 87413	NW 1/4, SW 1/4, NW 1/4 Section 22 Twp 29 Range 11	Sept. 1977	38'	6 3/8" steel to 25'	25' to 36'
17.	SJ-1888	G.P. McKeown	P.O. Box 641 Bloomfield, NM 87106 Hwy 64, West- Broadway	NE 1/4, NE 1/4, SE 1/4 Section 21 Twp 29 Range 11	Sept. 1984	47'	7" steel to 38'	38' to 40'

TABLE 10 (page 4 of 4)

WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
18.	HC-124885	S.C. Byland	303 Chestnut, P.O. Box 11 Bloomfield, NM 87413, Lot 9, Blk 4, Wade Grand View Subdivision	NE 1/2 Section 21 Twp 29 Range 11-W	May 1985	65'	7" steel to 50'	50' to 55'
19.	SJ-1962	J.Cadvain	P.O. Box 649 Bloomfield, NM 87413	NW 1/4, NW 1/4 Section 24 Twp 24 Range 11-W	Apri. 1985	45'	7" steel to 36'	36' to 39'
20.	SJ-2138	M. Gilbert	309 S.Johnson Bloomfield, NM 87413, Lot 6, Blk 5, Turner No.2	NE 1/4, SE 1/4 Section 22 Twp 29 N Range 11-W	June 1987	40'	7" steel to 35'	35' to 39'
21.	SJ-804	C.J. Dunson	Star Route 3 Box 142-B Bloomfield, NM 87413	W 1/4 Section 25 Twp 29 N Range 11-W	Oct. 1978	37'	6" to 37'	
22.	SJ-1974	A.R. Carpenter	700 South Turner Box 16 Bloomfield, NM 87413, Lot 2, Blk 4, Southside Add	Section 22 Twp 29 N Range 11-W	June 1985	47'	6" steel to 27' 5" PVC	27' to 31' 30' to 47'

INTERIM MEASURES WORK PLAN

BLOOMFIELD REFINING COMPANY
50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

FEBRUARY 11, 1993

Prepared For:

BLOOMFIELD REFINING COMPANY
P.O. BOX 159
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INTERIM MEASURES WORK PLAN
BLOOMFIELD REFINING COMPANY
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

February 11, 1993

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1.0 INTRODUCTION

This Interim Measures (IM) Work Plan has been prepared in accordance with Part IV.1. of the Administrative Order on Consent (Docket #VI-303-H) dated December 31, 1992 between the United States Environmental Protection Agency (USEPA) Region VI and Bloomfield Refining Company (BRC). This work plan addresses the ongoing and proposed measures to mitigate current or potential threat(s) to human health and/or the environment at the BRC facility. The work plan is consistent with the requirements of the Corrective Action Plan (CAP) comprising Attachment II of the Order on Consent, and the interim measures will be incorporated into the long-term corrective measures for the BRC facility. These measures will be determined following the RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS) phases of the corrective action process.

The objectives of the ongoing and proposed interim measures are to:

- Inhibit off-site seepage of separate phase hydrocarbons (SPH) by adding new recovery points to the existing onsite recovery system;
- Continue to recover SPH to remove/reduce the source of dissolved hydrocarbons in groundwater beneath the site; and,
- Continue facility maintenance, monitoring and inspection schedules to prevent releases of product to the environment.

1.1 Background

The BRC facility consists of 287 acres and is located at #50 County Road 4990 (Sullivan Road) in Bloomfield, San Juan County, New Mexico (Figure 1). The refinery is situated on a bluff approximately 100 feet above and immediately south of the San Juan River, which flows westerly. On the bluff and between the river and the process area of the facility is the Hammond Ditch. It is an unlined, man-made channel for irrigation water supply and borders all but the southern side of the process area of the facility.

The refining facility originally consisted of a crude topping unit built by local entrepreneur Kimball Campbell in the late 1950s. The refinery was purchased by Plateau, Inc. (O.L. Garretson) in the early 1960s. Suburban Propane of New Jersey acquired Plateau in 1964 and upgraded the facility during a number of expansions between 1966 and 1984 to increase the refinery's capacity and capabilities. In 1984, Gary-Williams Energy Corporation, BRC's parent company, acquired the refinery. Bloomfield Refining Company has since continued to make many improvements to the operations.

The current facility layout is shown on Figure 3. The refinery offices are located on the western end of Sullivan Road along with warehouse space, maintenance and shop areas, a drum storage area, raw water ponds (from the San Juan River), and one cooling tower. Process units are located just east of the offices, and include: the crude unit, fluid catalytic cracker, gas con unit, treater, one cooling tower, reformer/hydrotreater, catalytic polymerization unit, and API separator and oily water ponds. Aboveground storage tanks occupy a large portion of the facility from north of the process units east along Sullivan Road. Two clay-lined evaporation ponds are located to the east of the tank farms for treated wastewater discharge, and the fire training area and "landfill" area are east of the evaporation ponds before Hammond Ditch. South of Sullivan Road are the terminals where product trucks are loaded and crude trucks are off-loaded. The spray irrigation area and double-lined evaporation ponds are located east of the terminals.

1.2 Geology/Hydrogeology

The site is underlain by Quaternary Jackson Lake Terrace deposits, consisting of 10 to 15 feet of coarse-grained glaciofluvial outwash and fine-grained wind-blown loess. These lithologies (a coarse gravel zone overlain by silts and sands) comprise the upper portions of the bluff that crops out along the San Juan River at the site. Underlying these more recent sediments is the Tertiary Nacimiento Formation, an approximately 570 foot thick interbedded, black carbonaceous mudstone/claystone and white medium to coarse-grained sandstones. This formation is prominent in the bluff. Seeps have been observed along the bluff at the contact between the Nacimiento and the more permeable overlying cobble zone. Underlying the Nacimiento Formation, at increasing depths, are the Ojo Alamo (Tertiary sandstone), Kirtland Shale and Fruitland Formations.

From monitoring well gauging, perched, shallow groundwater in the Quaternary deposits is encountered between 6 and 40 feet below ground surface, generally increasing in depth from west to east at the site. Groundwater flows to the northwest and west, toward the Hammond Ditch and San Juan River. The ditch is known to influence groundwater flow at the site; during the non-irrigation season, BRC dikes the ditch during the non-irrigation season (October 15 through April 15) to maintain a mounding effect year-round which inhibits groundwater flow to the north. In 1986, slug tests performed to estimate characteristics of the cobble zone indicated average hydraulic conductivity and transmissivity values of 2.08×10^{-4} feet/second and 171 square feet/day, respectively. The average saturated thickness was estimated at 9.6 feet. Using an estimated average gradient of 0.0025, the calculated flux over a 2,500 square foot area was 8,500 gallons per day or 6 gallons per minute (Engineering Science, 1987).

A well search conducted by Tierra Environmental Co., Inc. (Tierra, 1992) for another purpose identified 22 water wells in the vicinity of the BRC site. Based on coordinates provided, these well locations are shown on Figure 2, although locations for three wells (#4, 11 and 12) were not reported, and the locations of two wells (#15 and 22) are only approximate. Additionally, the location of well #21 is not shown (it was reported to be located in Township 29 N, Range 11W, Section 25, which is off the map). Well owner and construction information is shown in Table 1.

As shown in Figure 2, eight wells are within a one-mile radius of the BRC site: #1, 3, 5, 6, 7, 13, 15 and 22. Well #1, located south of the site, is owned by C.W. Wooten. This well is double-cased and is screened between 266 and 306 feet. Well #6 is located west of the site on the opposite side of the Hammond Ditch. This well is owned by D.C. Looney and is reported to be screened between 22 and 32 feet below ground surface. Well #5 is located southwest of the site, is owned by E.H. Brown (Aztec, NM), and is reportedly cased to 20 feet. Wells #3, 7, 13, 15, and 22 are located across (north of) the San Juan River from the site.

Based on the well locations with respect to the facility, the geology in the area, and surface water bodies, no wells are considered to be at risk and therefore no notification is required (Part C.2.d. of the CAP).

1.3 Previous Investigations

In April 1985, a RCRA 3008 Order and Consent Agreement (Docket No. RCRA VI-501-H) was issued to BRC for alleged violations that occurred during previous ownership of the facility. BRC submitted a Closure Plan in August 1986 to address the Order requirements, specifically the closure of the API wastewater ponds, the "landfill", and landfill pond. Five solid waste management units (SWMUs) were considered to be RCRA-regulated to some degree by the USEPA. These include the API wastewater ponds (South Oily Water Pond [SOWP] and the North Oily Water Pond [NOWP]), the evaporation ponds, the "landfill", and the landfill runoff pond.

SOWP and NOWP

The SOWP and NOWP were cleaned and lined in 1982. Liquids were removed and disposed off site. Solids and visually-impacted soils were landfilled on site. In October 1985, soil samples were collected through the liner of each pond for characterization purposes, and the liners subsequently repaired. The results of soil sampling were consistent with clean closure, and the closure activities were professionally certified (Engineering Science, 1986). In September 1990, BRC submitted a Part A application for these impoundments as a result of the new TC Rule for benzene. A Part B application was submitted on September 25, 1991.

Evaporation Ponds

The evaporation ponds were included in Plateau's original Part A notification as a protective filing, but withdrawn from the Part A application as a result of sample analyses. BRC confirmed in 1992 that the water and sediments in the ponds were not characteristically hazardous under current characteristic definitions.

Landfill

The material removed from the SOWP and NOWP in 1982 to the "landfill" was not hazardous based on characteristic testing. In 1991, BRC subjected the "landfill" waste to the rigors of a delisting petition (#0839) based on the fact that the waste does not contain hazardous constituents at levels of concern. USEPA's review of this petition is ongoing.

Landfill Runoff Pond

The landfill runoff pond is a natural depression created during the construction of the Hammond Ditch, when an arroyo was blocked. Soil samples were collected from this area in 1985, and results were consistent with clean closure (Engineering Science, 1986).

Groundwater Investigations

Between 1984 and 1991, 14 groundwater monitoring wells, nine recovery wells, and three piezometers were installed at the facility, either as part of the existing New Mexico Oil Conservation Division (NM-OCD) discharge plan requirements, the investigation required under the RCRA 3013 Administrative Order, or a voluntary SPH recovery activity (Figure 4). The well construction specifications are summarized in Table 2. Wells were installed to total depths between 14 (MW-12) and 62 feet (MW-7). Most wells have 10 to 20 feet of screen set directly above the Nacimiento Formation or slightly into it (generally less than 2 feet). However, MW-7 is installed 27 feet into the

Nacimiento, and is completed with 10 feet of screen. MW-6 has been dry since its installation in 1984.

Six groundwater monitoring wells (MW-1 through MW-6) were installed in February 1984 to comply with the facility's discharge plan requirements.

In April 1985, a RCRA 3013 Administrative Order (Docket No. 3013-00-185) was issued to BRC requiring an extensive groundwater investigation. The investigation was completed and a final report ("A Final Report on Section 3013 Administrative Order Work Elements") dated February 6, 1987 was submitted to EPA. The activities performed as part of this investigation included an electrical resistivity survey across the site; the installation of groundwater monitoring wells MW-7 through MW-10; liquid level gauging of wells at least monthly and groundwater sampling quarterly for one year; slug tests on three monitoring wells (MW-1, MW-2 and MW-4) to determine aquifer characteristics; and surface water sampling of the Hammond Ditch and San Juan River.

Monitoring wells MW-11 and MW-12 were installed in July and August 1987 in accordance with NM-OCD requests to delineate groundwater contamination south of Sullivan Road, on the U.S. Bureau of Land Management (BLM) property (MW-11) and north of Hammond Ditch west of the refinery (MW-12).

In July 1988, BRC conducted a soil vapor survey on the BLM property south of the BRC facility under NM-OCD supervision. Additionally two recovery wells and four piezometers were installed and MW-10 was converted to a third recovery well (RW-3). Monitoring well MW-13 was also installed at this time. Air-operated skimmer pumps were installed in the three recovery wells and the system was started up on January 4, 1989. These activities and findings were presented in a August 3, 1989 report entitled "Final Report on Soil Vapor Survey, Well Installation and Hydrocarbon Recovery System".

Additional hydrocarbon recovery wells (RW-14 through RW-19) were installed in August 1990. Each of these wells contained SPH, was equipped with a recovery pump, and plumbed to the recovery system. In September 1991, two additional monitoring wells (MW-20 and MW-21) were installed as part of the facility's RCRA groundwater monitoring program for the oily water ponds.

1.4 Groundwater Monitoring

BRC conducts groundwater monitoring and sampling of certain wells as part of the compliance requirements for the facility's discharge plan (GW-1) and for the RCRA groundwater monitoring. Monitoring wells MW-1 and MW-5 are sampled semi-annually for the following parameters as part of the discharge plan requirements, because they are located adjacent to the clay-lined evaporation ponds in the northeast portion of the facility and the spray irrigation area in the southeast portion of the facility, respectively:

- Water level
- pH
- Total dissolved solids (TDS)
- Benzene, toluene, ethylbenzene and total xylenes (BTEX)
- Chlorinated purgeable volatile hydrocarbons
- Phenol
- Cyanide
- Iron, manganese, sulfate, nitrate/nitrite as N, ammonia, total Kjeldahl N
- Arsenic, barium, boron, cadmium, chromium, lead

The monitoring requirements will change for the underground injection of water as described in Section 2.1 below (Underground Injection Well).

Wells MW-9, MW-20, MW-21, RW-15 and RW-18 were sampled quarterly during 1991 and 1992 as part of the RCRA groundwater monitoring requirements for the SOWP and NOWP. Wells MW-21 and RW-15 were established as upgradient monitoring wells, while wells MW-9, MW-20 and RW-18 were established as downgradient monitoring wells. These wells were sampled for BTEX (USEPA Method 8020); chlorinated herbicides (USEPA Method 8150); organochlorine pesticides and PCBs (USEPA Method 8080); total organic halides (TOX; USEPA Method 9020); priority pollutant metals (USEPA Method 200.7/200 series); and the drinking water parameters total organic carbon, phenols, fecal coliforms, gross alpha/beta radiation, radium 226, radium 228, flouride, nitrate/nitrite, chloride, sulfate and sodium. Due to the significant presence of SPH in both the upgradient and downgradient wells, a meaningful groundwater monitoring program for RCRA compliance is unlikely.

2.0 INTERIM MEASURES CONDUCTED TO DATE

Since BRC acquired the Bloomfield site in 1984, several measures have been taken to upgrade the facility, characterize potential impacts and institute remedial actions. Many of these activities were performed under the supervision of the NM-OCD. Prior to BRC's acquisition of the refinery, Plateau cleaned and lined the SOWP and the NOWP (November 1982). In October of 1984, BRC purchased the refinery and prepared a submittal to the USEPA to document environmental conditions at the site (January 1985). The interim measures conducted by BRC from that time to the present fall into the following categories:

- facility construction improvements/engineering upgrades;
- maintenance, monitoring and inspection practices;
- closure of SWMUs; and
- hydrocarbon recovery system installation and operation.

These measures are discussed further in Sections 2.1 through 2.4.

2.1 Facility Construction Improvements/Engineering Upgrades

The BRC facility has made numerous construction improvements and engineering upgrades since its acquisition of the refinery. Some of the improvements employed to date are listed below and described in this section.

- Relocation of the spent caustic tank onto a concrete pad with concrete retaining walls;
- Decommissioning of tanks in need of excessive repair (tanks 6 and 7);
- Relocation of the API crude tanks 8 and 9 onto concrete pads with concrete retaining walls;
- Construction of a drum storage shed and conversion to a bulk chemical storage system to minimize the use of drummed chemicals;
- Removal of two underground storage tanks (USTs) and replacement with aboveground storage tanks;
- Installation of an active, engineered cathodic protection system across storage areas onsite;
- Rebuilding of the site-wide sewer system and completion of curbed, concrete paving for all processing areas involving hydrocarbons;
- Construction of 2 each, 5-acre, double-lined (with HDPE) evaporation ponds; and

- Submittal of a permit application for an underground injection well.

In addition to these measures, BRC is planning future improvements to include:

- installation and operation of an underground injection well (in late 1993 pending permitting);
- removal from service of the clay-lined evaporation ponds;
- double-lining of the SOWP and NOWP in 1994 to comply with hazardous waste surface impoundment requirements;
- continuing paving efforts to peripheral areas; and
- reduction of emissions by installing a sulfur recovery unit and a cover for the API separator.

Spent Caustic Tank Relocation

Spent caustic is currently stored in a 16,800-gallon tank (#10) adjacent to the treater unit (Figure 3). Caustic is used to remove sulfides from various petroleum products (JP-4, Jet A, and LPG) and the spent caustic is sold to a pulp plant as a substitute for a commercial product. In July of 1986, the spent caustic tank was relocated onto a concrete pad with concrete retaining walls. The tank was cleaned and a new floor installed before relocating the tank into the new containment area.

Decommissioning of Tanks 6 and 7

In November 1987, tanks 6 and 7, which had previously stored gasoline but were out of service, were inspected and found to need extensive repair (rusted floorings in earthen diked areas). These tanks, approximately 420,000-gallon capacity each, were emptied, cleaned, sludges properly disposed offsite, and dismantled. The catalytic polymerization unit, the future (1993) diesel hydrodesulfurization unit and sulfur recovery unit now occupy or will occupy this area.

Former tanks 6 and 7 are believed to have been potential major sources of the hydrocarbon contamination present at the site. Recovery well RW-18 is located in this area and is currently operating to recover SPH.

Tanks 8 and 9 Relocation

In December 1987, tanks 8 and 9, used to recover crude from the API separator and located adjacent to the API separator (Figure 3), were taken out of service. Concrete pads and retaining walls were constructed, and the tanks were reset into the new containment area. These tanks are each reported to have a 21,000-gallon nominal capacity.

Drum Storage/Conversion to Bulk Chemicals

In April 1988, the BRC facility constructed a drum storage shed, west of the main offices and warehouse. The shed has curbed, concrete flooring with a collection trough, and is covered on three sides. In addition, BRC also completed a program in December 1990 to minimize drummed chemicals with the conversion to the use of bulk storage, stainless steel, "portafeed" tanks or totes.

By converting to bulk storage of chemicals and constructing a superior storage area for the remaining (mostly lube oils) drummed chemicals, BRC has minimized the potential for releases of hazardous substances to the environment from these sources. Bulk storage vessels are fewer in number, are reused, and are easier to inspect, maintain and handle than numerous drums.

UST Removals

In April 1988, the facility's two USTs were removed from service and replaced with aboveground storage tanks (ASTs). One UST, a 12,000-gallon diesel fuel tank, was located near the auxiliary warehouse for in-house sales to truckers. The UST was emptied, excavated, removed, and inspected. It was found to be in good condition without any indications of leaks or corrosion. Soils in the tank pit were not visibly stained. The tank pit was backfilled with clean fill and a 12,600-gallon diesel fuel AST was installed in an earthen diked area approximately 40 feet southwest of the UST location.

The second UST, a 5,000-gallon gasoline tank, was located in the warehouse yard west of the main offices and was for in-house vehicle use. This UST was emptied, excavated, removed and inspected. It was also found to be in good condition without any indications of leaks or corrosion. The tank pit was backfilled with clean fill, a concrete secondary containment system was constructed, and a 2,500-gallon, skid-mounted AST was installed.

Cathodic Protection System

An active, engineered cathodic protection system was installed at the facility in October 1988. The system is designed to prevent the corrosion of tank bottoms in the tank farm and associated underground piping (including fire and water lines). The system consists of a series of rectifiers and deep well anodes (approximately 300 feet deep) which are connected to a power source. The system polarizes the tank bottoms and piping by providing protective DC current to the structures.

Routine inspections of the rectifiers and deep ground beds are performed by BRC personnel to ensure that the system is operating properly.

Sewers and Paving

In November 1988, the facility rebuilt a significant portion of the refinery oily water sewer system and added some peripheral storm drains. All drains discharge to the API separator. At the same time, BRC added curbed, concrete paving to unpaved process areas. Other paving projects have included installing in August 1989 a concrete pad with curbing between tanks 3 and 4 for product additives and rebuilding the burner fuel rack in June 1991 with expanded concrete paving and curbing.

Installation of new sewers and paving reduces the potential for hydrocarbon releases to the environment. The concrete paving and curbing in process areas provide secondary containment for any spilled material, allowing more effective cleanups. The sewers collect stormwater runoff and channel it to the facility's wastewater treatment system so that water which potentially contacts hydrocarbons is not discharged directly to the environment.

Construction of Double-lined Evaporation Ponds

BRC has begun a program to eliminate single and unlined surface impoundments by June 7, 1994. The installation of two 5-acre, HDPE double-lined surface impoundments was completed in the southeastern portion of the property in December 1989 and September 1990. The two clay-lined evaporation ponds in the northeastern portion of the property are scheduled to be taken out of service once the underground injection well is permitted, installed and operational (anticipated to be complete by late 1993). The two hazardous waste surface impoundments, SOWP and NOWP, which receive API separator wastewater discharge, are scheduled to be double lined in 1994.

Underground Injection Well

BRC (by Tierra Environmental Co.) completed a feasibility study for a Class I underground disposal well and submitted an application to the NM-OCD for permit on September 10, 1992. The underground injection well will allow BRC to remove from service the clay-lined evaporation ponds and the spray irrigation area. The two double-lined evaporation ponds will remain in service as equilibration measures and as backup for storage of treated water.

Permit conditions are stringent. Monitoring requirements include quarterly sampling of injection fluids for aromatic and halogenated volatile hydrocarbons by USEPA Method 8010/8020 or 8240;

general water chemistry (calcium, potassium, magnesium, sodium, bicarbonate, carbonate, chloride, sulfate, TDS, pH, and conductivity); heavy metals by USEPA Method 6010, and arsenic and mercury by USEPA Methods 7060 and 7470, respectively. Certified quarterly reports will be submitted, and will include chemical analyses; monthly average, maximum and minimum values for injection pressures; flow rate and flow volume; the annular pressure; mechanical integrity testing (MIT) results within the first quarter after completion of the MIT; and well workovers, stimulations and any other tests, submitted with the first quarterly report after completion of the test or workover. In addition, monthly reports on disposal of produced water (Form D-120-A) will be submitted.

BRC will provide USEPA with updated monitoring requirements upon finalization of the discharge plan (GW-1).

2.2 Maintenance, Monitoring and Inspection Practices

Table 3 provides a list of the products stored at the facility compiled from the SARA Title III Section 312 chemical inventory. Beginning in December 1987, BRC maintained a computerized tank maintenance program which records all information pertaining to each tank. This program keeps detailed records of the following information:

- tank construction and roof type
- date installed
- capacity and dimensions
- products stored (and recent changes)
- inspection schedule (varies depending on product stored and regulatory requirements)
- findings of inspections (repairs needed, work completed)
- maintenance records (repairs or upgrades made)

By systematically maintaining thorough records and tracking inspections, BRC remains in compliance with regulatory requirements for aboveground storage of various products. The inspection and maintenance schedule also effectively serves to reduce the potential for product releases to the environment.

Bone Yard Cleanups

Two areas on site were used as "bone yards" or storage areas for a wide variety of debris (e.g., piping, drums, tanks). The northern bone yard is located north of the clay-lined evaporation ponds and is currently active for storing process equipment, piping, empty drums and recyclable materials. The southern bone yard was located to the south of the clay-lined evaporation ponds, but is no longer in use. In July of 1987, both bone yards were entirely cleaned up: a large amount of scrap metal was sold to recyclers, all asbestos insulation was removed by a qualified contractor. The southern bone yard has not been used as a bone yard since this time, and expansion of the aboveground storage has extended onto this area (tank 32).

2.3 Closure of Solid Waste Management Units

As discussed in Section 1.3, five solid waste management units (SWMUs) have been considered to be RCRA-regulated by the USEPA findings of fact. As described below and in accordance with item C.2.b of the CAP, BRC has been zealous in its efforts to close the units.

<u>SOWP and NOWP</u>

The SOWP and NOWP were cleaned and lined in 1982. Liquids were removed and disposed offsite. Solids and visually-impacted soils were landfilled onsite. Later (October 1985), soil samples were collected through the liner of each pond for characterization purposes, and then the liners were repaired. The results of soil sampling were consistent with clean closure, and the closure activities were professionally certified.

In September 1990, these impoundments entered the RCRA program with the new benzene hazardous waste listing. A Part B application was submitted on September 25, 1991. These ponds are scheduled to be upgraded in 1994 with double liners to meet the requirements of hazardous waste surface impoundments.

<u>Evaporation Ponds</u>

The clay-lined evaporation ponds located in the northeastern portion of the property were originally included in Plateau's notification as a protective filing, but withdrawn from the Part A application as a result of sample analyses. BRC confirmed these analyses by testing the water and sediments in the ponds for hazardous characteristics and found them to be non-hazardous. These units are not considered to be RCRA-regulated SWMUs, and are scheduled to be permanently closed following startup of the underground injection well (late 1993).

<u>Landfill</u>

The material removed from the SOWP and NOWP in 1982 to the "landfill" was not hazardous based on characteristic testing but was alleged to contain "K" wastes by the USEPA. In 1991, BRC subjected the "landfill" waste to the rigors of a delisting petition (#0839) based on the fact that the waste does not contain hazardous constituents at levels of concern. USEPA provided comments on the delisting petition in correspondence dated June 17, 1992 and December 29, 1992. BRC responded to these comments in correspondence dated July 20, 1992 and December 30, 1992. BRC has until about June 1993 to correct some minor deficiencies in the petition, primarily with a requirement to obtain additional sample results, to keep the petition in-process.

Landfill Runoff Pond

The landfill runoff pond is a natural depression created during the construction of the Hammond Ditch, when an arroyo was blocked. Soil samples were collected from this area in 1985, and results were consistent with clean closure. The results were submitted in a final report (Engineering Science, 1986).

2.4 Hydrocarbon Recovery System Installation and Operation

As described in Section 1.3, BRC installed two recovery wells (RW-1 and RW-2) and four piezometers and converted MW-10 to a third recovery well (RW-3) in June 1988. Air-operated skimmer pumps were installed in the three recovery wells and the system was started up on January 4, 1989. Additional hydrocarbon recovery wells (RW-14 through RW-19) were installed in August 1990. Each of these wells contained SPH, was equipped with a recovery pump, and piped to the recovery system. A total of nine recovery wells comprise the hydrocarbon recovery system, seven of which are currently active.

Figure 5 presents SPH thicknesses in wells gauged in October 1991 under non-pumping conditions. SPH was detected in decreasing order in RW-17, RW-16, RW-18, RW-19, MW-4, RW-15, RW-14, P-2, RW-2 and MW-9. The recovery system layout is presented in Figure 6 (detail shown in Figure 6A). Recovery is done by submersible pumping devices set at the water table/SPH interface. They are piped to Tank 33 (10,000 gallon capacity) or to a sewer leading to the API separator. Lines leading to Tank 33 are constructed of schedule 80 PVC, while lines from Tank 33 to the API separator are constructed of coated-and-wrapped, carbon steel.

The pumping devices are identically constructed (by the facility) in all but RW-18 (Ejector System Inc. U-3000 recovery system) and operate on a timed, cycled pumping rate (estimated at a maximum of 1/2 gallon per minute). These pumps are approximately 3 feet long, 2 3/8-inch diameter PVC or stainless steel with a top fill set at the SPH/water table interface. The pump is allowed time to fill, then a timer activates the pumping cycle and compressed air is applied to the pump, forcing the liquid to the surface. The Ejector System pump in RW-18 operates under the same principles but with air controls only, for safety reasons. RW-1 and RW-3, the inactive wells, were shut off because they do not contain SPH. Tank 33 is routinely gauged and emptied to a sewer leading to the API separator.

In accordance with item C.2.c of the CAP, BRC has an existing wastewater treatment system capable of treating groundwater from recovery wells. The system operates in accordance with federal, state and local laws under the facility's approved discharge plan issued by the NM-OCD. The system is designed to treat process water as shown in the schematic in Figure 8.

BRC has an intake in the San Juan River to provide raw water for facility processes. Water (approximately 369,000 gallons per day) is pumped from the river to the east and west raw water ponds. Water from the raw water ponds is filtered and then either channeled through softeners and to the boilers for steam generation or to the two cooling towers. The steam is used in the process units. The process wastewater is discharged to the API separator. Cooling tower blowdown is directly discharged to the API separator.

The wastewater treatment system consists of a network of tank farm sumps, which are emptied by vacuum truck, and sewer lines within the process areas which lead directly to the API separator unit. The API separator discharges to HDPE lined South and North Oily Water Ponds (SOWP and NOWP) which are equipped with aerators. The facility plans to double-line these hazardous waste impoundments in 1994.

After aeration, water is discharged to the evaporation ponds (either the clay-lined north and south evaporation ponds or the HDPE double-lined north and south evaporation ponds). The total daily discharge averages 100,800 gallons. BRC is in the process of permitting an injection well as an alternative to total evaporation of the refinery discharge. When the injection well is permitted and installed (expected by late 1993), the clay-lined evaporation ponds will be taken out of service and the double-lined evaporation ponds will serve as backup and retention ponds prior to underground injection of treated wastewater. The proposed monitoring requirements for the injection fluids are described in the following section.

3.0 PROPOSED ADDITIONAL INTERIM MEASURES

The objectives of the additionally proposed interim measures are to prevent the off-site migration of hydrocarbons by adding new recovery points to the recovery system and to effectively recover hydrocarbons to reduce the source of dissolved contamination. The Hammond Ditch surrounds the property, except to the south, and is diked during the non-irrigation season to maintain a hydrogeological barrier to contaminant movement. Investigative activities to be performed as part of the RFI will provide additional information delineating hydrocarbon plumes so that a site-wide corrective measure can be properly designed. However, since hydrocarbons have been noted in a seep along the bluff north of the facility, additional interim measures are proposed.

The additional interim measures consist of installing two recovery wells and piping to a sewer discharge location, deploying pumping systems in each well, surveying well locations and elevations, monitoring static water elevation levels, startup testing to set pump flow rates, and maintenance/monitoring of recovery operations and water elevation readings on a regular basis. These proposed interim measures can readily be incorporated into the long-term corrective measure for the BRC site.

Install Additional Recovery Wells

Two 6-inch recovery wells will be installed in the area of tanks 3, 4 and 5 as shown in Figure 6. These locations were selected based on the estimated extent of the SPH plume (Figure 5), location of the seeps along the bluff, and monitoring of RW-18, MW-9 and MW-20. SPH present in the area between the Hammond Ditch and the bluff is isolated from the existing and proposed recovery wells by the ditch. BRC plans to investigate this area with a backhoe, digging a test pit. After this investigation, a recovery well or other appropriate equipment may be installed into the pit.

The two additional recovery wells will be installed by driving casing with a 10-inch bit to the top of the Nacimiento (estimated at 30 feet BGS). Drilling activities will be supervised by a qualified geologist who will log sediments encountered and monitor for volatile hydrocarbons using a photoionization detector (PID). Well logs will be prepared to show lithologic descriptions, PID readings and well construction details.

The well construction schematic is shown in Figure 7. Approximately 25 feet of 0.020-inch slotted, 6-inch diameter fiberglass-reinforced epoxy (FRE) well screen with a section of FRE casing as the silt leg will be installed in the 10-inch borehole so that the screen extends at least 2 to 3 feet above the static water table. Sand filter pack will be installed in the annular space from the bottom of the well to approximately 5 feet above the top of the well screen. A 2-foot thick layer of bentonite will be installed above the filter pack, and the well will be grouted to the surface with a cement/bentonite mixture.

The well head will consist of a flush-mounted 3' x 3' steel roadbox or equivalent installed in a concrete pad. The road box will be installed once the piping for the pumping equipment is completed. The wells will be piped to discharge recovered groundwater and product via 2-inch diameter schedule 80 PVC line to the sewer system leading to the API separator. Each of the two wells will be equipped with pneumatic pumping systems (either total fluids or dual phase). Both water and product will be discharged to the sewer leading to the API separator for treatment.

The wells will be developed following installation by purging water from the well column until it appears sediment-free and swabbing the well using a surge-block. Purge water will be discharged to the sewer leading to the API separator. Drill cuttings will be disposed appropriately.

Deploy Pumping Systems

BRC will obtain cost quotes from pump suppliers for pneumatically operated systems. A pumping scenario to maximize SPH recovery, will be designed. Appendix A includes pump specifications for a likely system. Selected pump specifications will be provided to USEPA with a monthly progress report during implementation of the Interim Measures Work Plan.

Survey Well Locations and Elevations

A professional surveyor will be contracted by BRC to check the existing well elevations and locations, and new well elevations (ground surface, top of inner casing, top of outer casing) will be also surveyed to an accuracy of 0.01 foot and well locations to an accuracy of 0.1 foot. A scaled site plan showing surveyed well locations and the elevations will be prepared.

Gauge Liquid Levels in Wells

The existing recovery pumps will be deactivated for a period of approximately 24 hours. A comprehensive round of liquid levels will be collected from all wells at the site using an ORS Interface Probe™. This instrument is capable of detecting product layers as thin as 0.01 foot. Gauging information will be tabulated and reduced using well elevation data and a water table elevation contour map will be constructed. The water table elevation contour map will indicate static groundwater conditions prior to startup of the recovery system. Appendix B contains a sample liquid level gauging form to be completed during these monitoring events.

Startup Testing

Following the collection of static liquid levels from all site wells, BRC will conduct startup testing in the two new recovery wells in order to determine the optimum flow rates. Based on previous field studies at the site, well yields have ranged from 1.5 to 13.5 GPM. Therefore, startup step tests will be performed, pumping at different flow rate increments, to determine the rate that induces a moderate, sustained drawdown (estimated at 2 feet). The initial flow rate will be set at 0.5 GPM and will be increased at 0.5 GPM increments. The water level in the well will be monitored continuously during pumping, and the water levels at specific time intervals will be recorded. Once the optimum flow rate is determined, the pumps will be set and left to operate. The seven other recovery wells will be re-activated.

Maintenance/Monitoring

The facility maintenance personnel routinely checks the recovery equipment to be certain it is operational. Tank 33 is also checked regularly to determine when it should be discharged to the API separator. The two new recovery wells will be equipped with flow meters to monitor the volume of water and the volume of SPH pumped from each well. If pumping equipment fails, the facility maintenance personnel will make the necessary repairs and re-activate the pumps as quickly as possible. Liquid levels from all wells will be gauged once a month after startup. This information will indicate groundwater flow patterns and hydrocarbon thicknesses over time.

4.0 HEALTH AND SAFETY

BRC and its contractors will conduct all site activities in accordance with health and safety regulations set forth by 29 CFR 1910.120. The BRC facility has established rigorous in-house preventative procedures and response training. A copy of the Spill Prevention Control and Countermeasure (SPCC) plan certified by a professional engineer and a detailed site-specific Health and Safety Plan (HASP) including Material Safety Data Sheets (MSDS) are maintained onsite at all times. The site-specific HASP will be followed by all site workers during implementation of the proposed interim measure activities.

Site workers will have received OSHA health and safety training and be participating in a medical monitoring program. Each worker will read and sign the HASP before beginning field activities. The site supervisor will review the scope of activities each morning and will indicate appropriate health and safety considerations and procedures. Workers will wear Level D personal protective equipment (PPE) at a minimum, which includes a hard hat, safety glasses, steel-toed boots, gloves and a worksuit. Air monitoring using a PID will be conducted during field work to determine the need to upgrade to Level C PPE.

5.0 REPORTING

In accordance with item C.3 of the CAP, BRC will submit monthly progress reports for the first year of interim measures and quarterly thereafter. The progress reports will include the following items:

- the percentage of the IM completed
- summaries of all findings during the reporting period
- summaries of all changes made in the IM during the reporting period
- summaries of all contacts with representatives of the local community, public interest groups, or state government during the reporting period
- summaries of all problems or potential problems encountered during the reporting period
- actions being taken to rectify problems
- changes in personnel during the reporting period
- projected work for the next reporting period
- copies of daily reports, inspection reports, etc.
- copies of validated laboratory reports (quarterly)

In addition, within 60 days after the completion of the startup testing, an Interim Measures Report will be submitted to USEPA. The report will include the following items:

- synopsis of interim measures and certification of their design/construction
- explanation of any modifications to the plans and why these were necessary for the project
- listing of the criteria for judging the functioning of the interim measures and explanations of any modifications to these criteria
- results of facility monitoring, evaluating to what extent the interim measures will meet or exceed the performance criteria
- explanation of the operation and maintenance to be undertaken at the facility
- copies of inspection reports, analytical data, photographs, as-built drawings and other supporting documentation

6.0 SCHEDULE

Figure 9 presents the schedule for interim measure activities. The equipment and contractor procurement, and scheduling are allotted three weeks from USEPA's approval of the IM work plan. Well installation and development are allotted one week, and two weeks are allocated for completing the piping connections. Well gauging and surveying together will take one week, as will startup testing. System operation, maintenance, and monitoring will be an ongoing activity. Monthly progress reports will be prepared for the first year. An IM Report will be prepared and submitted to USEPA within sixty days following the completion of the startup testing. Allowing a two-week contingency, the additional recovery wells will be operational within 11 weeks and the IM Report will be submitted within 5 months of USEPA's approval.

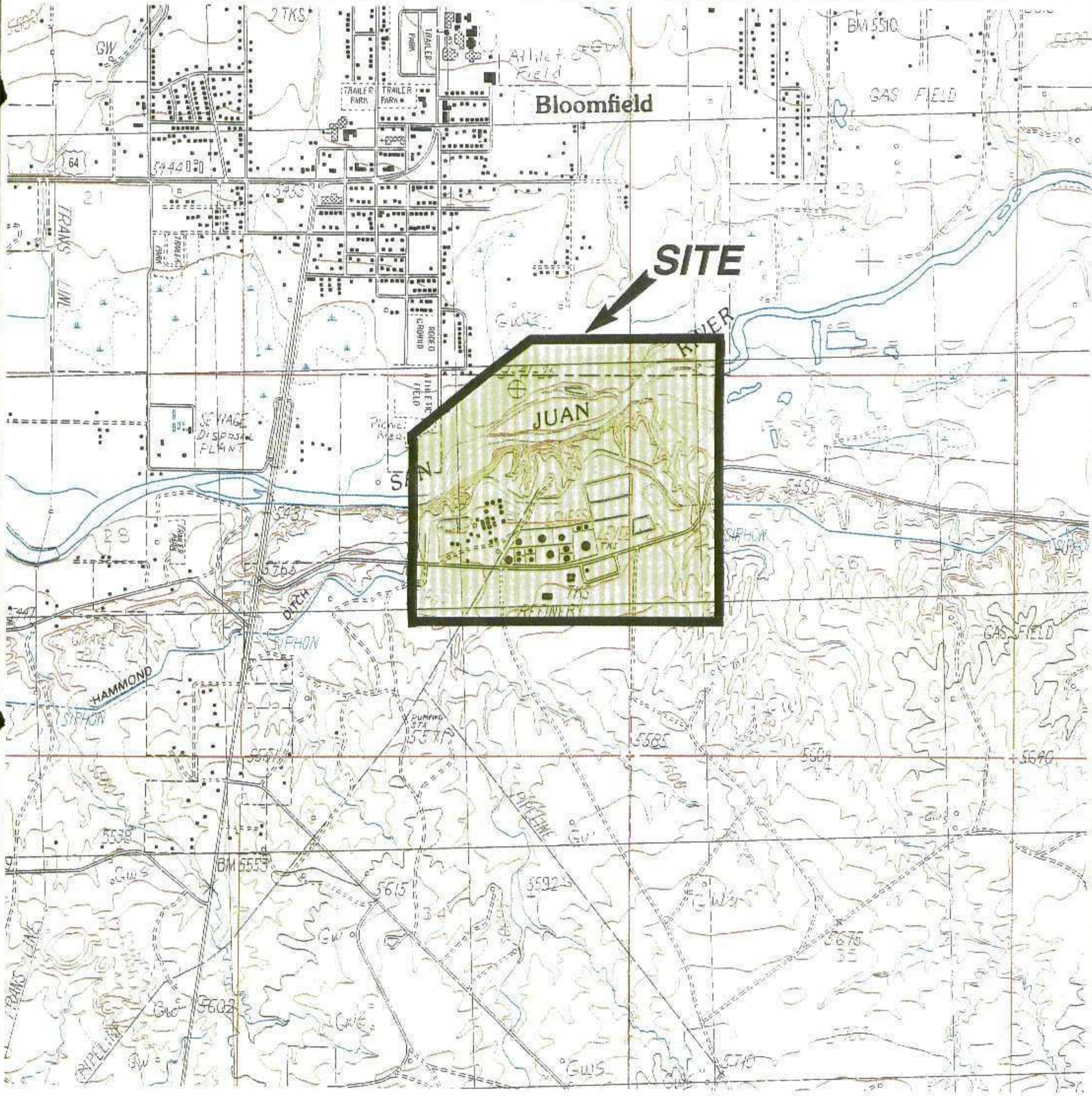
7.0 REFERENCES

Engineering Science, "Final Closure Plan for the API Wastewater Ponds, Landfill, and Landfill Pond at the Bloomfield Refinery", August 1986.

Engineering Science, "A Final Report on Section 3013 Administrative Order Work Elements", February 1987.

Geoscience Consultants, Ltd., "Final Report on Soil Vapor Survey, Well Installation and Hydrocarbon Recovery System", August 1989.

Tierra Environmental Co., Inc., "A Feasibility Study Class I Injection Well and Facilities", July 1992.



LEGEND

SITE BOUNDARY

NEW MEXICO

QUADRANGLE LOCATION

N

BLOOMFIELD, N. MEX.QUADRANGLE
PROVISIONAL EDITION
1985
36107-F8-TF-024

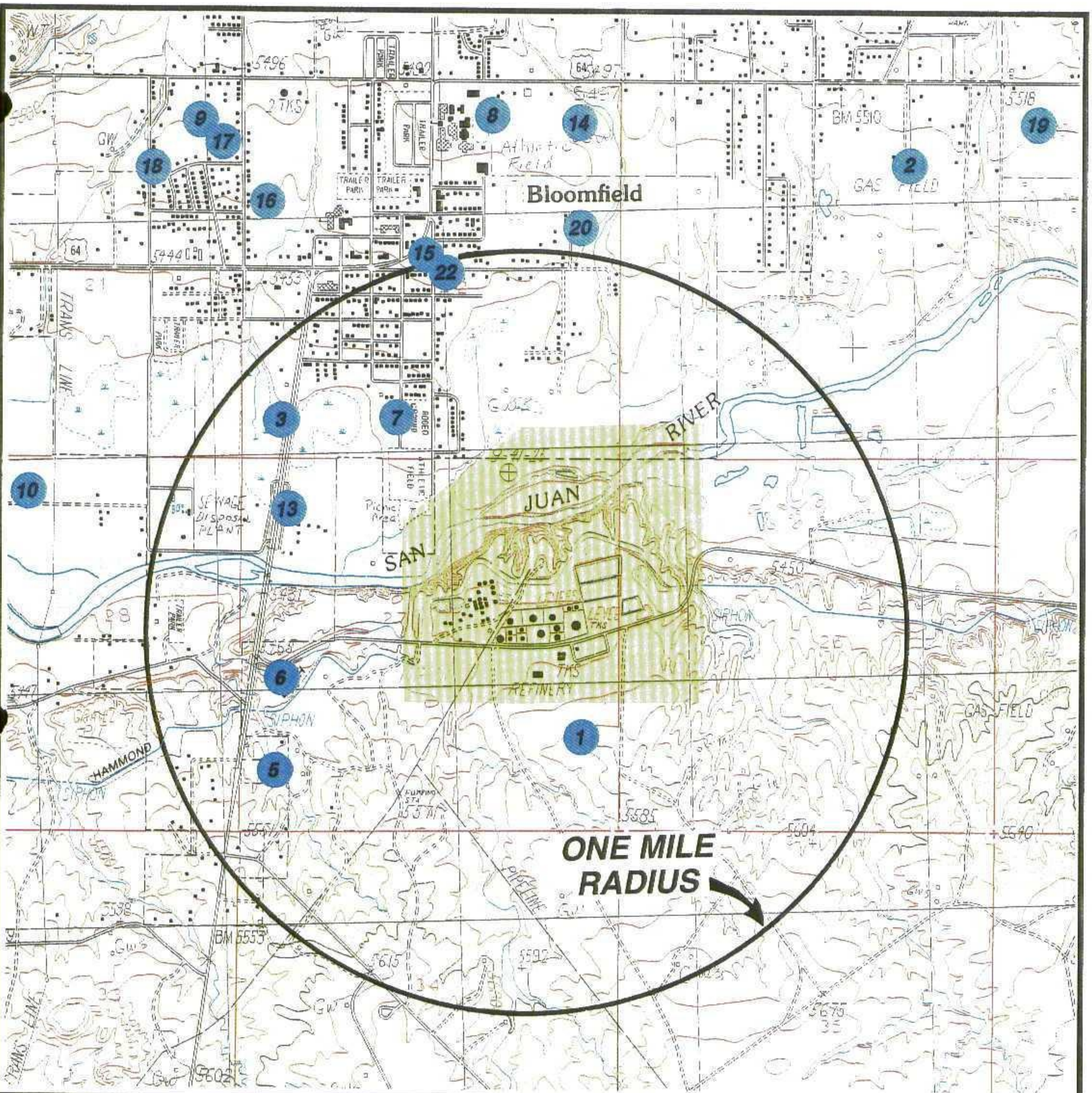
1000 0 2000
SCALE IN FEET

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

SITE LOCATION

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93		FILE: BL-SITELOC
PROJECT NO: 023353014		CONTRACT:
DRAWING: FIGURE 1		REVISION: –



LEGEND

SITE

WATER WELL LOCATION (SEE TABLE 1 FOR OWNER INFORMATION)

NOTES:
1) WELL NOS. 4, 11, & 12 NOT SHOWN SINCE LOCATIONS WERE NOT REPORTED ON WELL RECORDS. WELL NO. 21 IS NOT SHOWN, AS IT IS NOT IN THE VICINITY OF THE SITE.
2) WELLS NO. 15 AND 22 ARE APPROXIMATELY LOCATED.

BLOOMFIELD, N. MEX.QUADRANGLE
PROVISIONAL EDITION
1985
36107-F8-TF-024

QUADRANGLE LOCATION

N

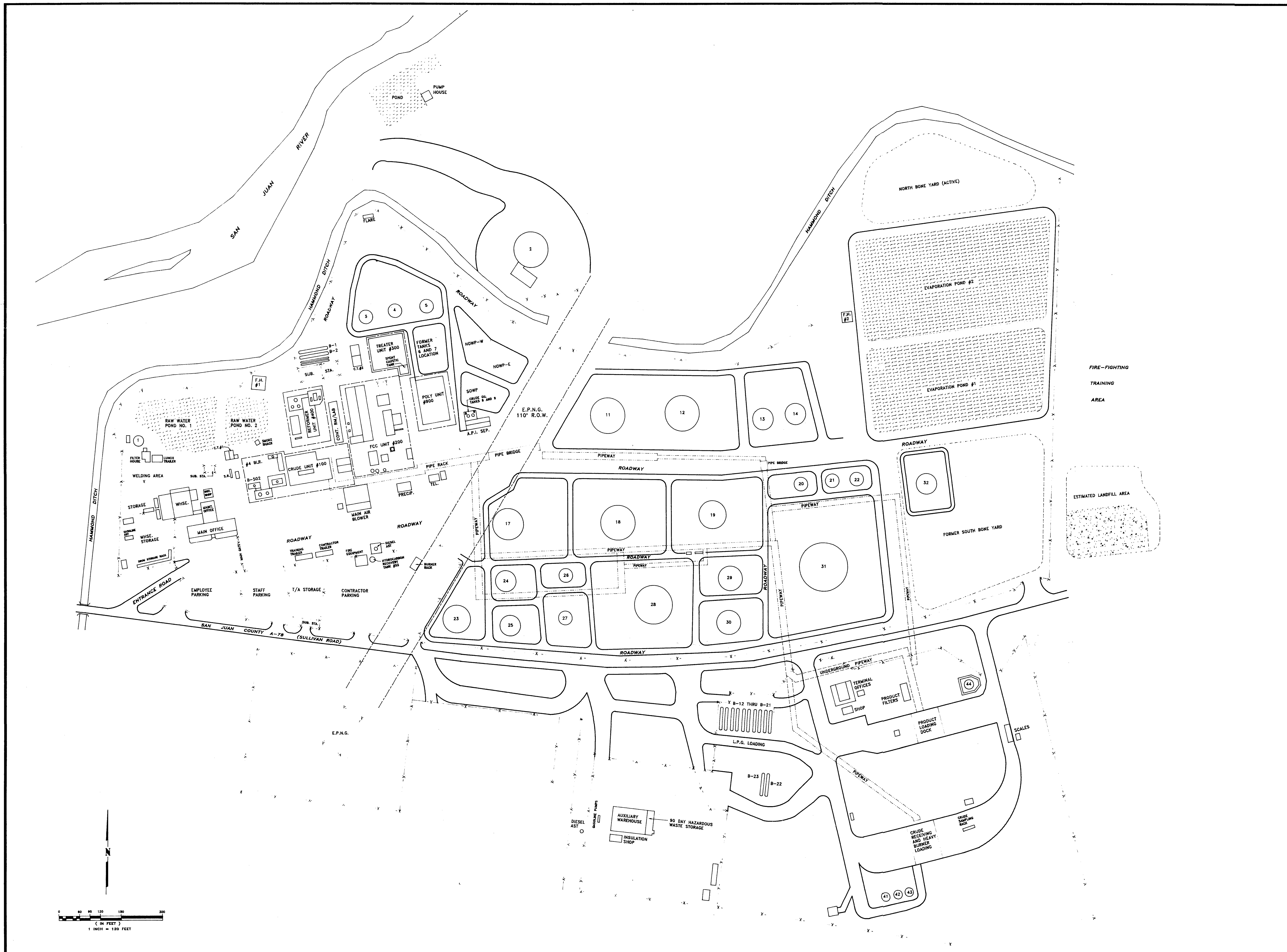
1000 0 2000
SCALE IN FEET

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

WATER WELLS WITHIN ONE MILE OF THE FACILITY

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93		FILE: BL-WELL LOC
PROJECT NO. 023353014		CONTRACT:
DRAWING: FIGURE 2		REVISION: -



NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- FENCE

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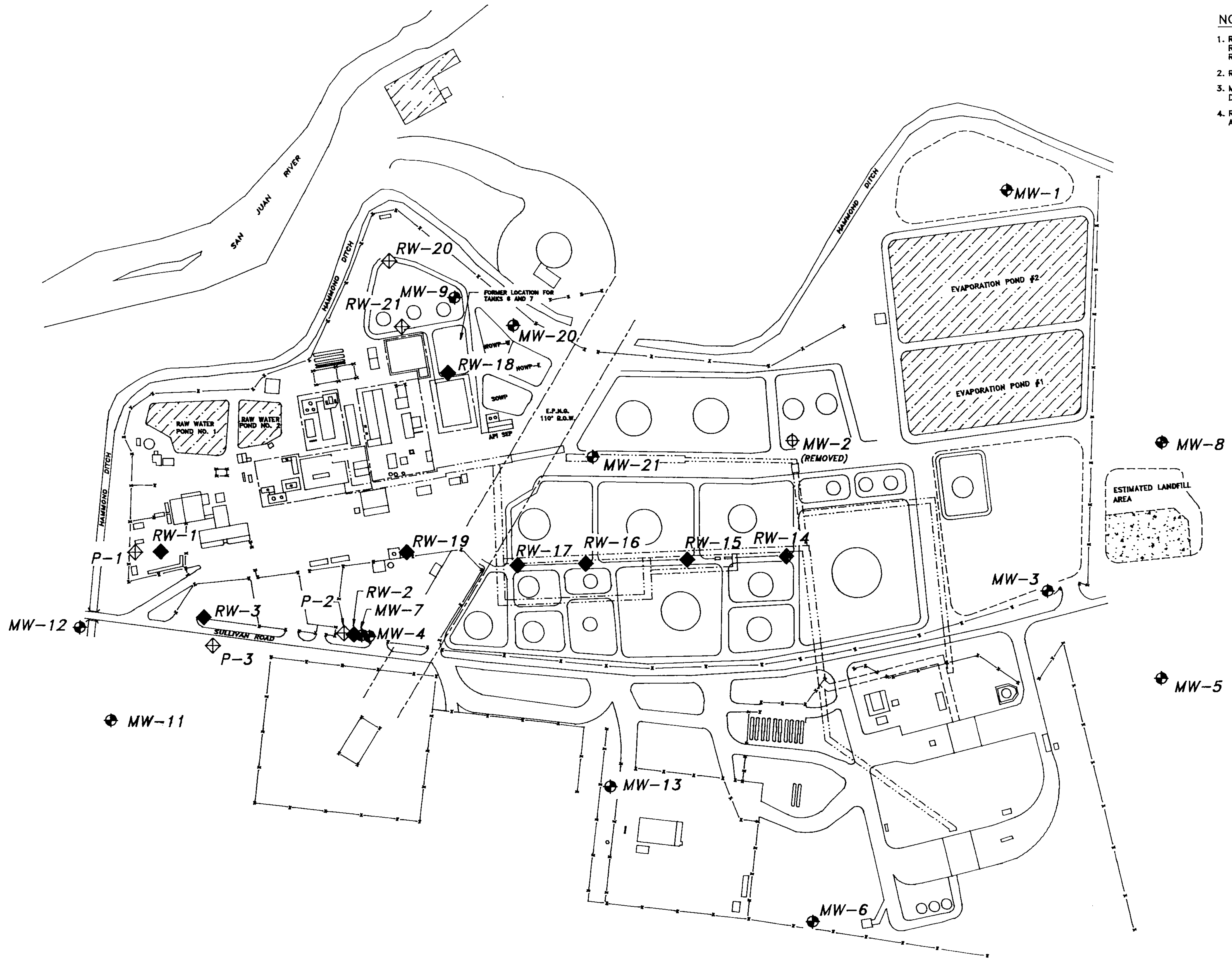
SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990 BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY, INC.
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

SITE PLAN

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: FEBRUARY-1993	FILE: SITEPLAN.DWG	
PROJECT NO.: 023353014.32	CONTRACT:	
DRAWING: FIGURE 3	REVISION:	



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.

0 150 225 300 450 750
(IN FEET)
1 INCH = 300 FEET

NO.	DATE	BY	REVISION

LEGEND

- ·—·—·— PIPEWAY
- — — — — UNDERGROUND PIPEWAY
- —x— FENCE
- MW-1 EXISTING MONITORING WELL
- RW-1 EXISTING RECOVERY WELL
- P-1 PROPOSED RECOVERY WELL
- MW-2 FORMER MONITORING WELL

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

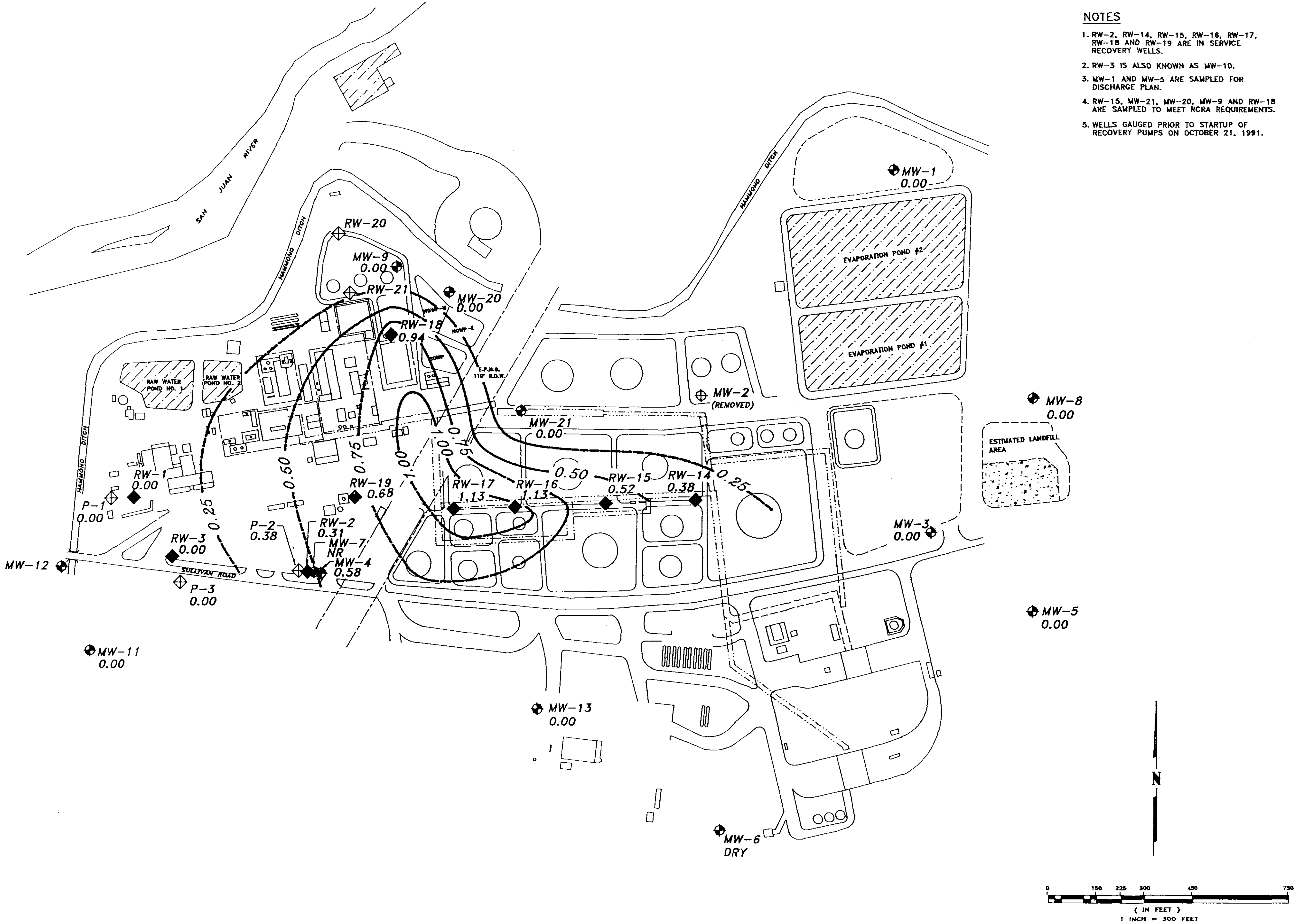
Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

WELL LOCATIONS
(EXISTING AND PROPOSED)

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:

DATE: FEBRUARY-1993	FILE: WELLS-B4.DWG
PROJECT NO.: 023353014	CONTRACT:
DRAWING: FIGURE 4	REVISION:



NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.
5. WELLS GAUGED PRIOR TO STARTUP OF RECOVERY PUMPS ON OCTOBER 21, 1991.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- MW-1 EXISTING MONITORING WELL
- RW-1 EXISTING RECOVERY WELL
- P-1 PROPOSED RECOVERY WELL
- MW-2 FORMER MONITORING WELL
- 0.00 HYDROCARBON THICKNESS (IN FEET)
- 0.25 HYDROCARBON THICKNESS CONTOUR (IN FEET) CONTOUR INTERVAL = .25 FEET

ATTENTION

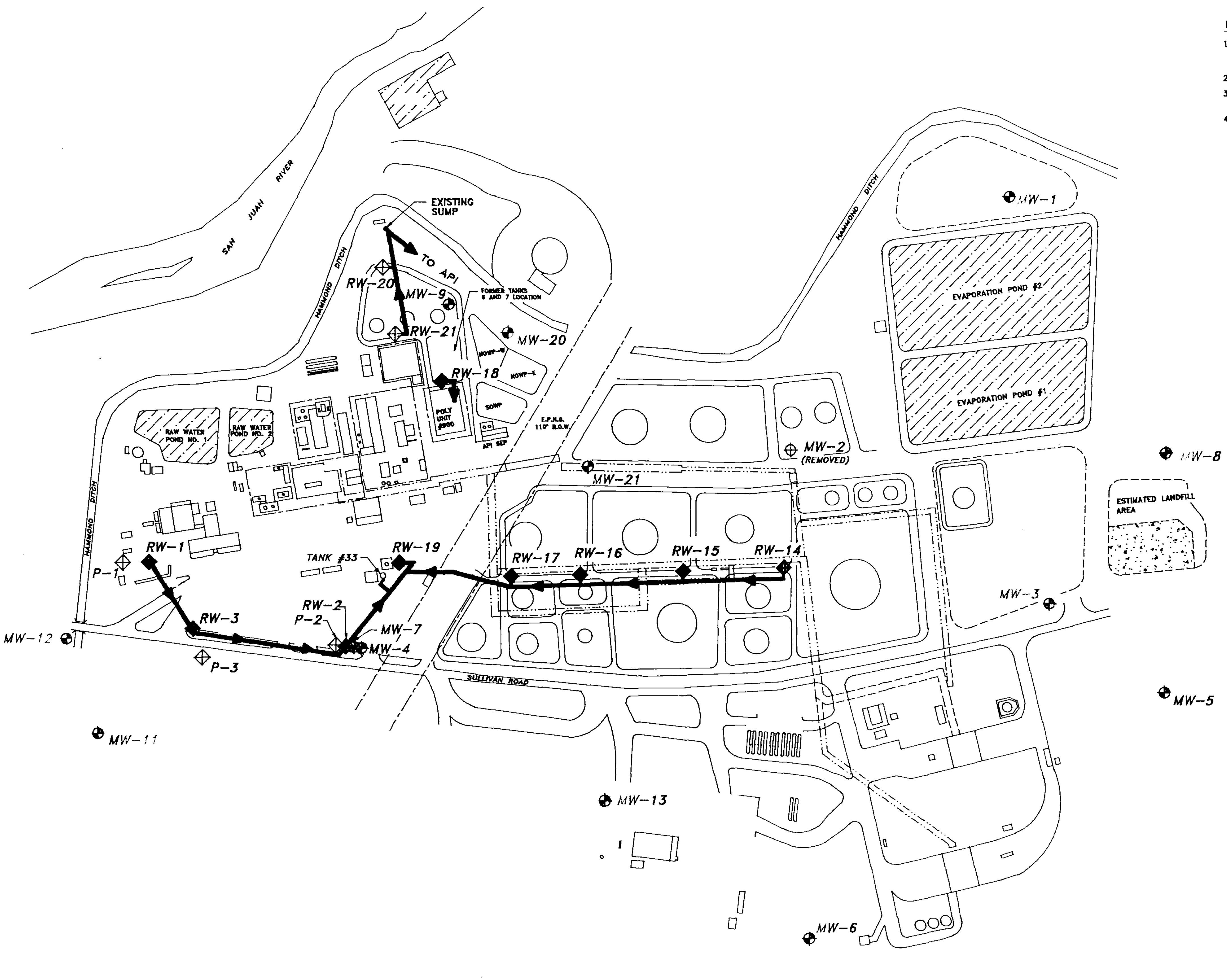
SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

SEPARATE PHASE HYDROCARBON ISOPLETH

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: FEBRUARY-1993		FILE: SPHC-B5.DWG
PROJECT NO.: 023353014		CONTRACT:
DRAWING: FIGURE 5		REVISION:



0 150 225 300 450 750

(IN FEET)

1 INCH = 300 FEET

NOTES

1. RW-2, RW-14, RW-15, RW-16, RW-17, RW-18 AND RW-19 ARE IN SERVICE RECOVERY WELLS.
2. RW-3 IS ALSO KNOWN AS MW-10.
3. MW-1 AND MW-5 ARE SAMPLED FOR DISCHARGE PLAN.
4. RW-15, MW-21, MW-20, MW-9 AND RW-18 ARE SAMPLED TO MEET RCRA REQUIREMENTS.

NO.	DATE	BY	REVISION

LEGEND

- PIPEWAY
- UNDERGROUND PIPEWAY
- RECOVERED WATER
- MW-1 EXISTING MONITORING WELL
- RW-1 EXISTING RECOVERY WELL
- P-1 PROPOSED RECOVERY WELL
- MW-2 FORMER MONITORING WELL

ATTENTION

SIGNATURE	DATE
PROJECT GEO:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

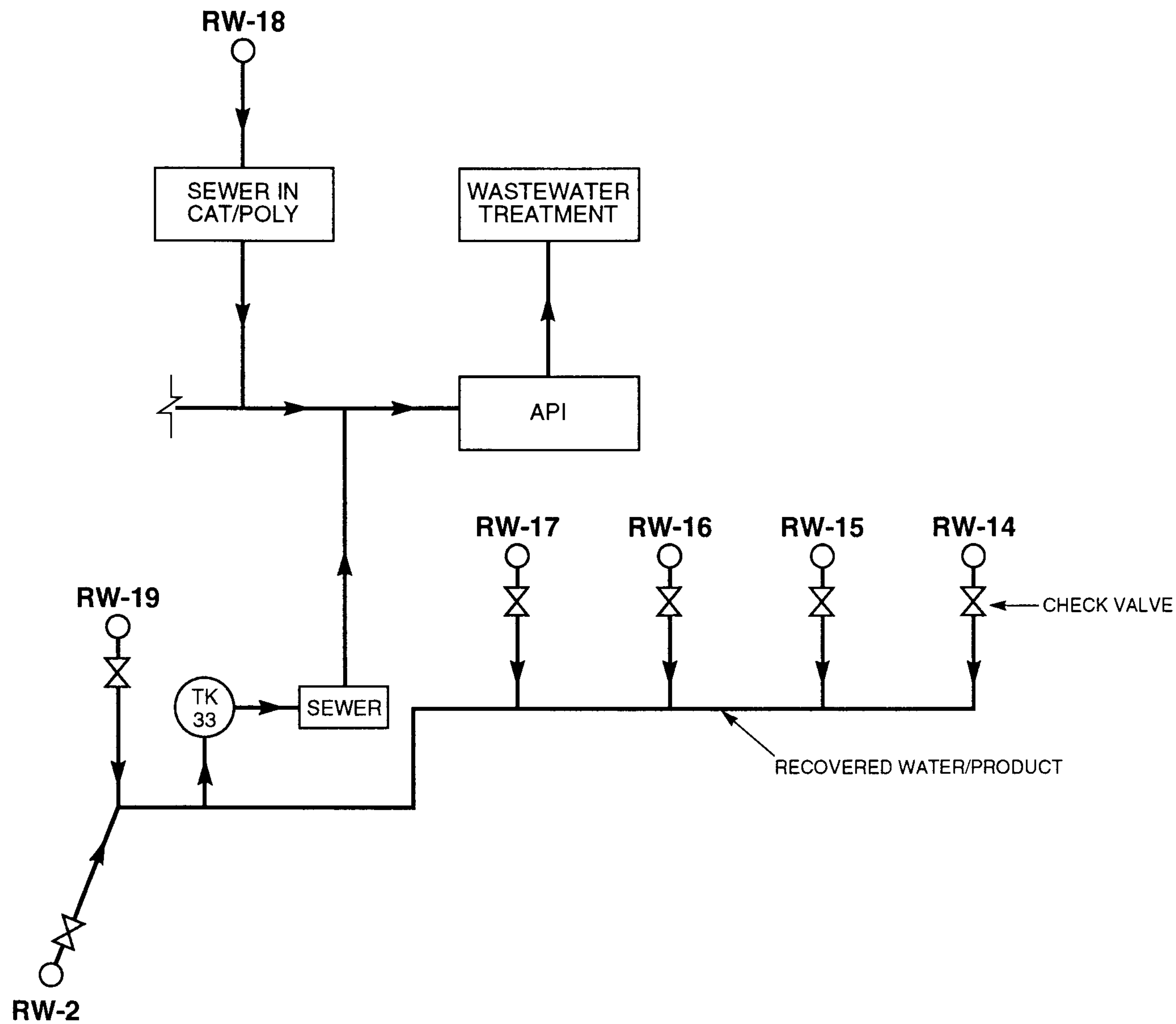
Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, NEW MEXICO 87106
(505) 242-3113

RECOVERY SYSTEM LAYOUT

DESIGNED BY:	DRAFTED BY: J. ML	CHECKED BY:
DATE: FEBRUARY-1993		FILE: RESYS-B6.DWG
PROJECT NO.: 023353014		CONTRACT:
DRAWING:		REVISION:

FIGURE 6



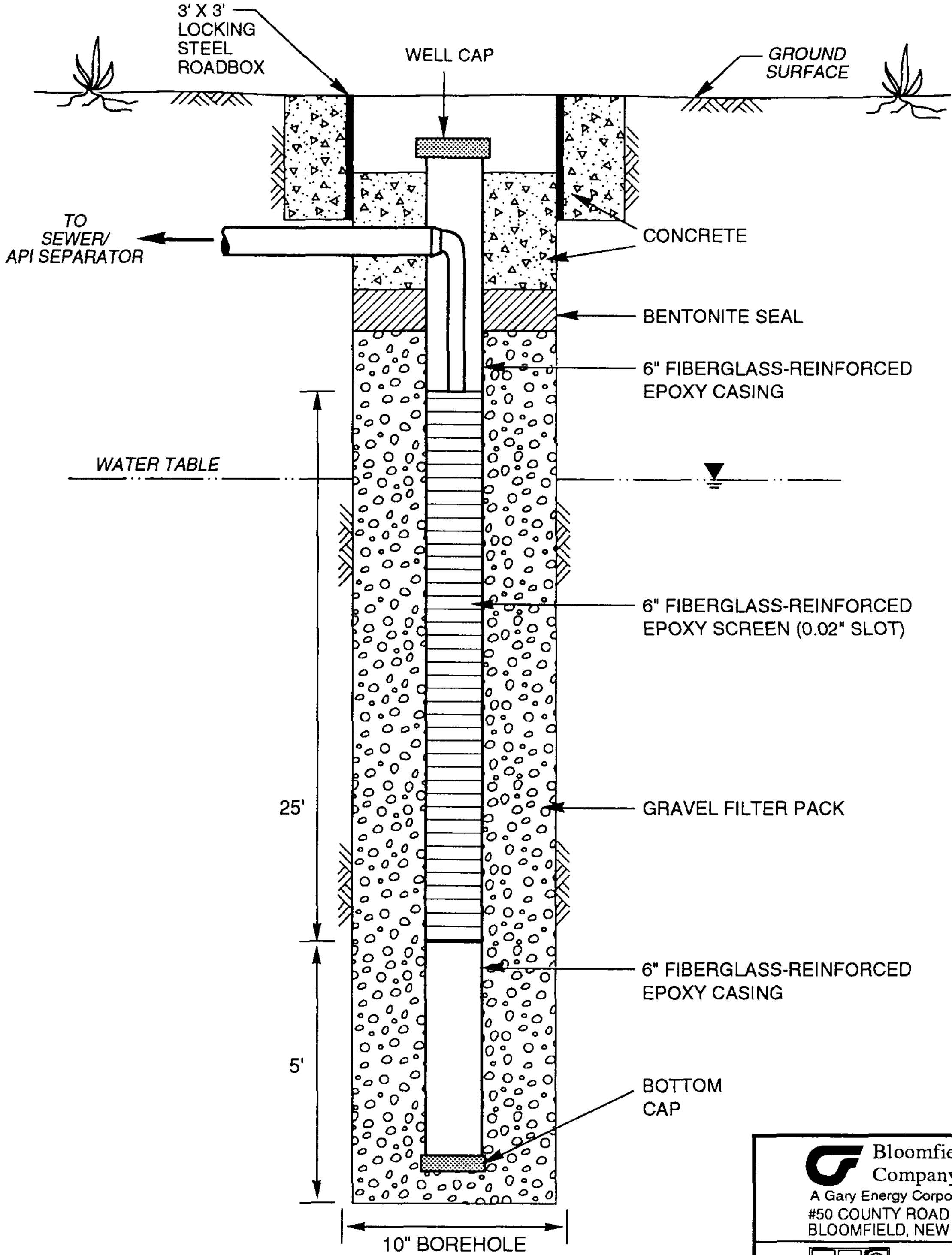
NOT TO SCALE

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

RECOVERY SYSTEM LAYOUT DETAIL

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93	FILE: BL-DETAIL	
PROJECT NO.: 023353014	CONTRACT:	
DRAWING: FIGURE 6A	REVISION: –	



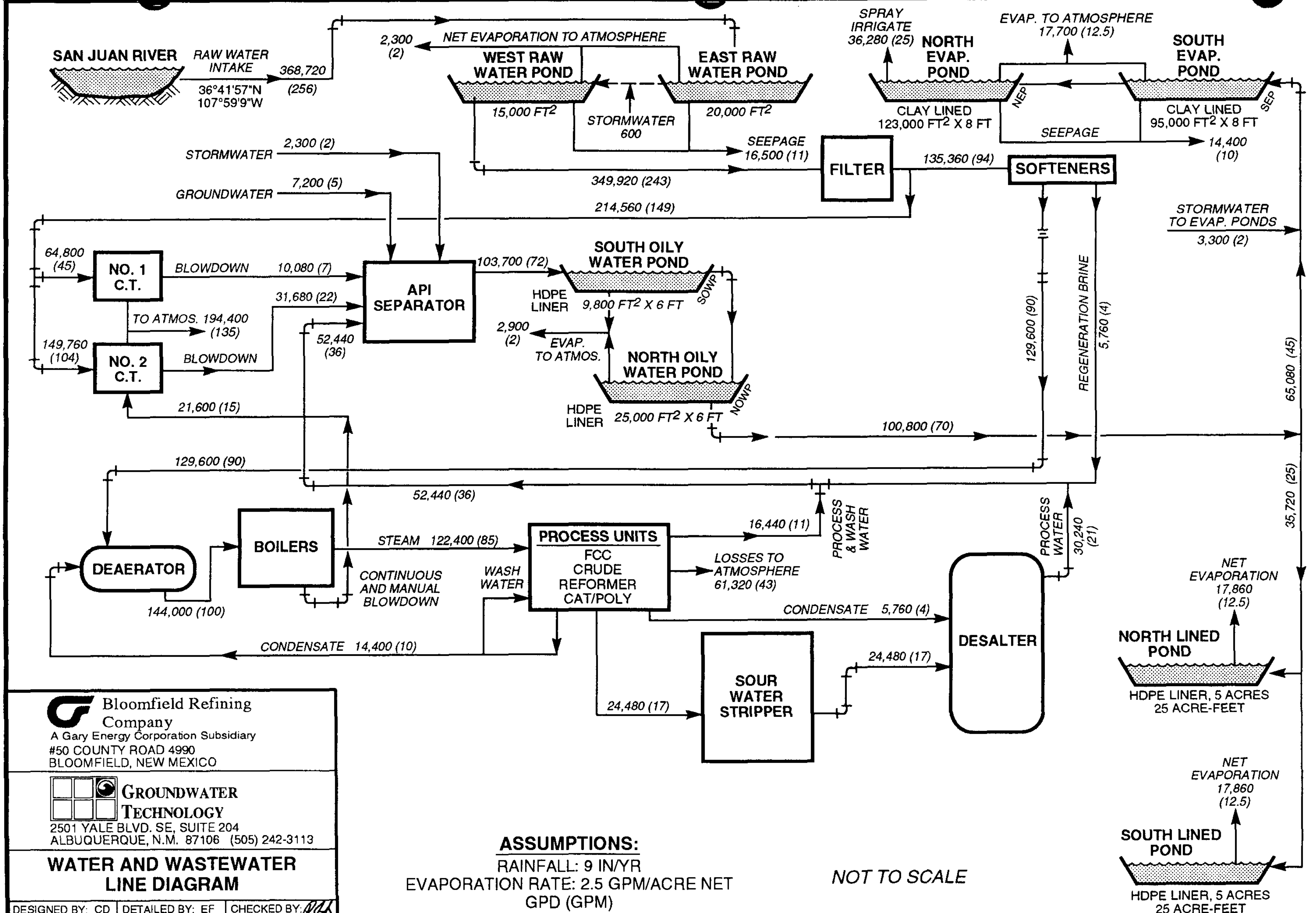
NOT TO SCALE

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

RECOVERY WELL CONSTRUCTION DIAGRAM

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93		FILE: BL-WELLCONST
PROJECT NO.: 023353014		CONTRACT:
DRAWING: FIGURE 7		REVISION: –



ASSUMPTIONS:

RAINFALL: 9 IN/YR
EVAPORATION RATE: 2.5 GPM/ACRE NET
GPD (GPM)

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary
#50 COUNTY ROAD 4990
BLOOMFIELD, NEW MEXICO

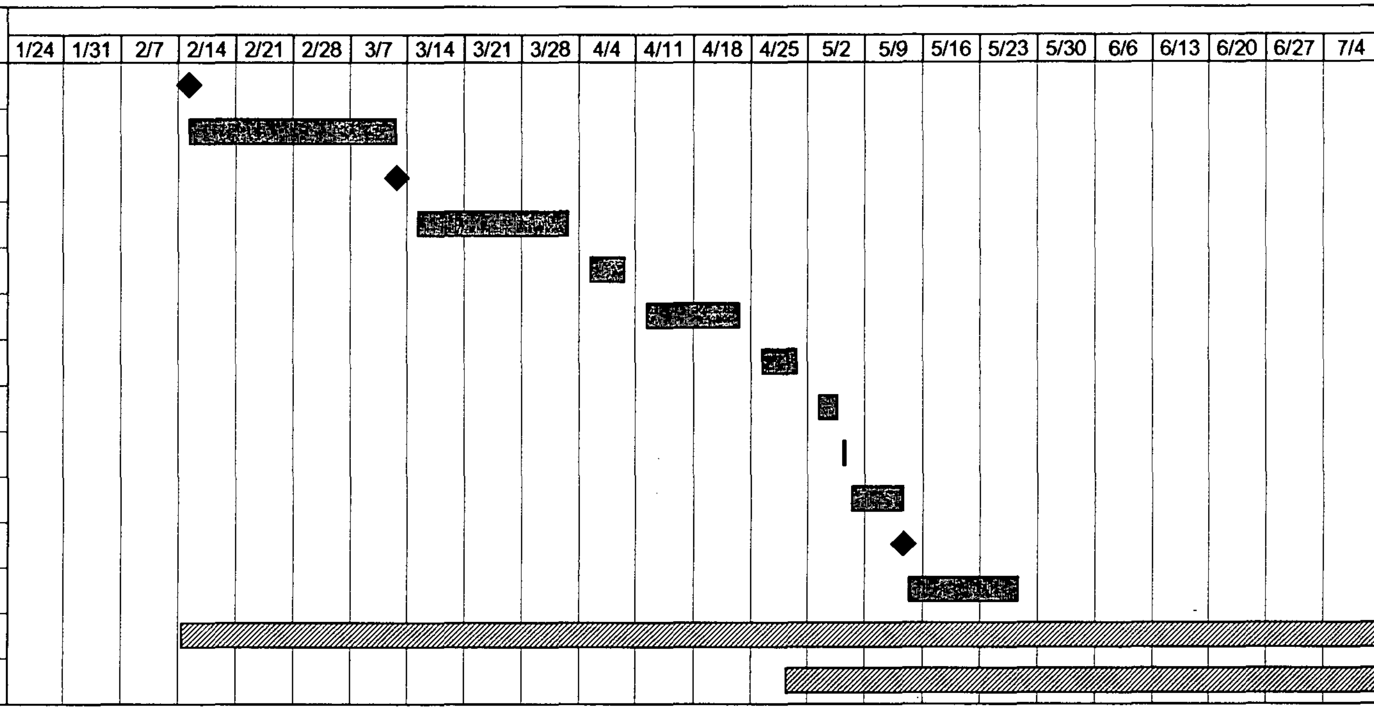
GROUNDWATER TECHNOLOGY
2501 YALE BLVD. SE, SUITE 204
ALBUQUERQUE, N.M. 87106 (505) 242-3113

WATER AND WASTEWATER LINE DIAGRAM

DESIGNED BY: CD	DETAILED BY: EF	CHECKED BY:
DATE: 2/2/93	FILE: BL-LINEDIAG	
PROJECT NO.: 023353014	CONTRACT:	
DRAWING: FIGURE 8	REVISION: –	

FIGURE 9
INTERIM MEASURES SCHEDULE
BLOOMFIELD REFINING COMPANY, BLOOMFIELD, NEW MEXICO

Name	Scheduled Start
Submit IM Work Plan	2/15/93
EPA Review of Work Plan	2/15/93
EPA Comments on Work Plan	3/12/93
Preparation/Coordination/Scheduling	3/15/93
Drill/Develop Recovery Wells	4/5/93
Complete Piping Connections	4/12/93
Install Pumping Equipment	4/26/93
Survey Well Locations/Elevations	5/3/93
Gauge Static Liquid Levels	5/6/93
Perform Startup Testing	5/7/93
Submit IM Report to EPA	5/13/93
Contingency	5/14/93
Progress Reporting	2/14/93
Operate/Maintain/Monitor	4/29/93



Critical | Noncritical | Progress | Milestone | Summary

TABLE 1
WATER WELLS IN THE VICINITY OF THE BLOOMFIELD REFINING COMPANY SITE BLOOMFIELD, NEW MEXICO

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
1.	SJ-2148	C.W. Wooten	P.O. Box 1841 Bloomfield, NM 87413	S 1/2, NE 1/4, SE 1/2 Section 27 Twp 29 N Range 11-W	Nov. 1987	305'	7" steel to 39.5' 4" PVC to 266'	266'-306'
2.	SJ-1870	D.E. Walters	P.O. Box 2131 Bloomfield, NM 87413 Tract 2	NE 1/4 Section 23 Twp 29 N Range 11-W	Aug. 1984	58'	6" steel to 58'	None
3.	SJ-2026	S. Hinsen	P.O. Box 2562 Bloomfield, NM 87413	SW 1/2, SW 1/4, Section 22 Twp 29 N Range 11-W	Jan. 1986	27'	6 5/8" steel to 21'	21' to 26'
4.	SJ-2121	H. Chatto	Lot 10, Huntington Circle, Bloomfield, NM 87413	Not Reported	July 1987	30'	7" steel to 21'	21' to 26'
5.	SJ-700	E.H. Brown	Rt #1, Box 248, Aztec, NM 87410	SW 1/4, SW 1/4, NW 1/4 Section 27 Twp 29 N Range 11-W	July 1978	20'	7" steel to 20'	None
6.	SJ-2210	D.C. Looney	P.O. Box 2462 Bloomfield, NM 87413	S 1/2, NW 1/4, NW 1/4 Section 27 Twp 29 N Range 11-W	Dec. 1988	32'	6" PVC to 22'	22'-32'

GROUNDWATER TECHNOLOGY

TABLE 1
WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
7.	SJ-695	W.N. Wampler	P.O. Box 2386 Bloomfield, NM 87413, Lot 14, Block 2 of the Bloomfield Southside Add	SW 1/4, SE 1/4 Section 22 Twp 29 N Range 11-W	July 1978	34'	6" to 24'	24'to 34'
8.	SJ-796	T.P. Johnson	Tract A, Loma Addition, Bloomfield, NM 87413	NE 1/4, NW 1/4 Section 22 Twp 29 N Range 11-W	Mar. 1979	50'	5.5" to 40'	40' to 48'
9.	SJ-701	G.T. Rodriguez	P.O. Box 1071 Bloomfield, NM 87413, Lot 16, Green Valley Estates	NE 1/4, NE 1/4 Section 21 Twp 29 N Range 11-E	July 1978	70'	6 5/8" to 70'	None
10.	SJ-2330	R.H. Phelps	P.O. Box 2548 CR 5005 #65 A, Bloomfield, NM 87413	NW 1/4, NE 1/4 Section 28 Twp 29 N Range 11-W	Sept. 1991	128'	5" PVC to 107'	107' to 127'
11.	SJ-2195	M. Aronson	Bloomfield, NM 87413	Not Reported	Nov. 1988	70'	6" to 65'	65' to70'
12.	SJ-2182	M. Faverino	116 Road 5010 Bloomfield, NM 87413	Not Reported	July 1988	27'	7" to 22'	22' to 26'

GROUNDWATER TECHNOLOGY

TABLE 1
WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
13.	SJ-2227	Y. Chavez	P.O. Box 1412 Bloomfield, NM 87413 Huntington Circle	NW 1/4, NW 1/4 Section 27 Twp 29 Range 11-W	July 1989	27'	7" to 20'	20' to 24'
14.	SJ-704	C.W. Jaramillo	P.O. Box 594 Bloomfield, NM 87413 Lot 2&3, Blk 4 - Loma Vista	NE 1/4, NE 1/4 Section 22 Twp 29 N Range 11-W	July 1978	55'	6" Plastic to 35'	35' to 55'
15.	SJ-484	G.A. Chacon	P.O. Box 634 Bloomfield, NM 87413	Section 22 Twp 29 Range 11	Oct. 1977	37'	6 3/8" to 28'	28' to 34'
16.	SJ-320	M. Wileman	P.O. Box 503 Bloomfield, NM 87413	NW 1/4, SW 1/4, NW 1/4 Section 22 Twp 29 Range 11	Sept. 1977	38'	6 3/8" steel to 25'	25' to 36'
17.	SJ-1888	G.P. McKeown	P.O. Box 641 Bloomfield, NM 87106 Hwy 64, West- Broadway	NE 1/4, NE 1/4, SE 1/4 Section 21 Twp 29 Range 11	Sept. 1984	47'	7" steel to 38'	38' to 40'

TABLE 1
WATER WELLS WITHIN ONE MILE RADIUS
BLOOMFIELD REFINING COMPANY
BLOOMFIELD, NEW MEXICO
(Continued)

	PERMIT NUMBER	WELL OWNER	ADDRESS	LOCATION	DATE	TOTAL DEPTH	CASING	SCREEN
18.	HC-124885	S.C. Byland	303 Chestnut, P.O. Box 11 Bloomfield, NM 87413, Lot 9, Blk 4, Wade Grand View Subdivision	NE 1/2 Section 21 Twp 29 Range 11-W	May 1985	65'	7" steel to 50'	50' to 55'
19.	SJ-1962	J.Cadvain	P.O. Box 649 Bloomfield, NM 87413	NW 1/4, NW 1/4 Section 24 Twp 24 Range 11-W	Aprl. 1985	45'	7" steel to 36'	36' to 39'
20.	SJ-2138	M. Gilbert	309 S.Johnson Bloomfield, NM 87413, Lot 6, Blk 5, Turner No.2	NE 1/4, SE 1/4 Section 22 Twp 29 N Range 11-W	June 1987	40'	7" steel to 35'	35' to 39'
21.	SJ-804	C.J. Dunson	Star Route 3 Box 142-B Bloomfield, NM 87413	W 1/4 Section 25 Twp 29 N Range 11-W	Oct. 1978	37'	6" to 37'	
22.	SJ-1974	A.R. Carpenter	700 South Turner Box 16 Bloomfield, NM 87413, Lot 2, Blk 4, Southside Add	Section 22 Twp 29 N Range 11-W	June 1985	47'	6" steel to 27' 5" PVC	27' to 31' 30' to 47'

TABLE 2

MONITORING WELL SPECIFICATIONS - BLOOMFIELD REFINING COMPANY

WELL ID	INSTALL DATE	GRADE ELEV (FT)	TOC ELEV (FT)	TOP SCRN ELEV (FT)	BOT SCRN ELEV (FT)	TOTAL DEPTH (FT)
MW-1	8-Feb-84	5514.07	5515.77	5511.12	5491.12	24.65
MW-2	8-Feb-84	5517.95	5519.45	5512.55	5492.55	26.90
MW-3	9-Feb-84	5534.85	5535.85	5516.50	5496.50	39.35
MW-4	9-Feb-84	5522.90	5524.30	5511.80	5491.80	32.50
MW-5	6-Feb-84	5544.10	5545.10	5513.49	5493.49	51.61
MW-6	7-Feb-84	5549.63	5551.23	5521.60	5501.60	49.63
MW-7	25-Feb-86	5522.99	5524.09	5473.98	5463.98	62.11
MW-8	28-Feb-86	5530.12	5531.12	5518.18	5498.18	34.94
MW-9	3-Mar-86	5518.00	5519.70	5507.71	5487.71	33.99
RW-1	31-Aug-88	5524.52	5525.92	5507.12	5491.52	40.98
P-1	30-Aug-88	5523.82	5524.62	5503.32	5487.32	42.45
RW-2	29-Aug-88	5522.98	5523.48	5506.98	5491.28	38.03
P-2	29-Aug-88	5522.93	5523.73	5506.33	5491.03	38.33
RW-3	4-Mar-86	5515.46	5516.86	5504.93	5484.93	33.93
P-3	1-Sep-88	5506.40	5507.20	5500.85	5490.40	22.80
MW-11	31-Jul-87	5503.23	5506.83	5498.23	5488.23	24.73
MW-12	1-Aug-87	5495.86	5498.36	5491.86	5481.86	14.22
MW-13	3-Sep-88	5535.12	5538.42	5509.59	5493.82	53.00
RW-14	6-Aug-90	5532.07	5533.97	5510.97	5492.97	43.00
RW-15	7-Aug-90	5531.62	5533.32	5509.92	5491.92	43.40
RW-16	7-Aug-90	5530.19	5531.99	5508.89	5490.89	43.10
RW-17	7-Aug-90	5528.83	5530.43	5508.88	5490.88	41.55
RW-18	8-Aug-90	5523.45	5527.05	5506.10	5488.10	40.95
RW-19	8-Aug-90	5525.58	5527.08	5510.38	5492.38	36.70
MW-20	13-Sep-91	5514.64	5516.44	5506.26	5491.26	27.18
MW-21	16-Sep-91	5517.04	5518.64	5504.71	5489.71	30.93

SOURCE: Bloomfield Refining Company Groundwater Sampling and Analysis Plan, NMD 089-416-416, 1991

TABLE 3

Tank Storage Inventory
Bloomfield Refining Company
Bloomfield, New Mexico

Tank Number	Substance	Capacity (gallons)
Pressure Vessel B1	LPG/Fuel Gas	12,012
Pressure Vessel B2	LPG/Fuel Gas	18,060
Pressure Vessel B13	Butane	21,000
Pressure Vessel B14	Butane	21,000
Pressure Vessel B15	Propane	30,000
Pressure Vessel B16	Poly feed (C3s, C4s with high olefins)	30,000
Pressure Vessel B17	Poly feed (C3s, C4s with high olefins)	30,000
Pressure Vessel B18	Poly feed (C3s, C4s with high olefins)	30,000
Pressure Vessel B19	Poly feed (C3s, C4s with high olefins)	30,000
Pressure Vessel B20	Butane	30,000
Pressure Vessel B21	Butane	30,000
Pressure Vessel B22	Saturate LPG	30,000
Pressure Vessel B23	Saturate LPG	30,000
Vessel	Oxygenated Premium Unleaded Gasoline	At truck loading rack in truck trailer. Ethanol is blended as truck is loaded.
Vessel	Oxygenated Regular Gasoline	At truck loading rack in truck trailer. Ethanol is blended as truck is loaded.
Portafeed Tank	Nalco 71-D5 Antifoam	400, cooling tower #1
Portafeed Tank	Nalco 71-D5 Antifoam	400, cooling tower #2
Portafeed Tank	Nalco 71-D5 Antifoam	400, warehouse
Portafeed Tank	Nalco 7344 Chlorine Stabilizer	400, cooling tower #1

TABLE 3 (continued)

Tank Storage Inventory
Bloomfield Refining Company
Bloomfield, New Mexico

Tank Number	Substance	Capacity (gallons)
Portafeed Tank	Nalco 7344 Chlorine Stabilizer	400, cooling tower #2
Portafeed Tank	Nalco 7344 Chlorine Stabilizer	400, warehouse
Portafeed Tank	Nalco 7356 Corrosion Inhibitor	200, cooling tower #1
Portafeed Tank	Nalco 7356 Corrosion Inhibitor	200, cooling tower #2
Portafeed Tank	Nalco 7356 Corrosion Inhibitor	200, warehouse
Portafeed Tank	Nalco 8302 Dispersant	400, cooling tower #1
Portafeed Tank	Nalco 8302 Dispersant	400, cooling tower #2
Portafeed Tank	Nalco 8302 Dispersant	400, warehouse
Portafeed Tank	Nalco Eliminol O2 Scavenger	400, boilerhouse
Portafeed Tank	Nalco Transcel 87BJ077	400, near lead house
Portafeed Tank	Nalco Transcel 87BJ077	400, near lead house
Portafeed Tank	Nalco Transcel 87BJ077	400, near lead house
Portafeed Tank	Nalco Transcel 87BJ077	400, near lead house
Portafeed Tank	Nalco Transport Plus 7200	400, boilerhouse
Portafeed Tank	Nalco Transport Plus 7200	400, warehouse
Portafeed Tank	Nalco Tri-Act 1802 Corrosion Inhibitor	400, boiler
Portafeed Tank	Nalco Tri-Act 1802 Corrosion Inhibitor	400, FCC unit
Portafeed Tank	Nalco Tri-Act 1802 Corrosion Inhibitor	400, warehouse
Portafeed Tank	Unichem 7055	521, boilerhouse
Portafeed Tank	Unichem 7227	521, boilerhouse
Portafeed Tank	Unichem 7273	218, boilerhouse

TABLE 3 (continued)

Tank Storage Inventory
Bloomfield Refining Company
Bloomfield, New Mexico

Tank Number	Substance	Capacity (gallons)
Portafeed Tank	Unichem 7375	392, boilerhouse
Portafeed Tank	Unichem 8094 Pour Depressant	3,000, near leadhouse
Cat/Poly Reactors or Bags	Phosphoric Acid Catalyst	40,000 pounds
Cat/Poly Reactors or Bags	Phosphoric Acid Catalyst	40,000 pounds
Tank	Sulfuric Acid	500, at cooling tower #1
Tank	Sulfuric Acid	500, at cooling tower #2
Tank	Texaco Gasoline Additive	2,000, at terminals
Tank	Phillips Gasoline Additive	560, at terminals
Tank	Methyl Cellosolve (2-Methoxyethanol)	60,000 pounds, in treater
Tank	Caustic Soda Solution 50% NaOH	11,000
Tank	Conoco Gasoline Additive	2,000, at terminals
Weigh Tank	Tetraethyl/Tetramethyl Lead Regular Gasoline Additive	50,000 pounds, inside lead house
Tank	Ethyl MMT Methyl-Cyclopenta-Dienyl Manganese Tricarbonyl	2,000, next to lead building
Tank	Exxon Gasoline Additive	10,000, at terminals
Vessel	Oxygenated Unleaded Gasoline	At truck loading rack in truck trailer. Ethanol is blended as truck is loaded.
Cylinder	Chlorine	150 pounds, at cooling tower #1
Cylinder	Chlorine	150 pounds, in warehouse yard
Cylinder	Chlorine	2,000 pounds, at cooling tower #2
Cylinder	Chlorine	2,000 pounds, at cooling tower #2

TABLE 3 (continued)

Tank Storage Inventory
Bloomfield Refining Company
Bloomfield, New Mexico

Tank Number	Substance	Capacity (gallons)
Treater Process Tank	Caustic dilute (NaOH)	15,000
Treater Process Tank	Caustic dilute (NaOH)	15,000
3	JP4 Jet Fuel	420,000
4	JP4 Jet Fuel	420,000
5	Premium Unleaded Gasoline	420,000
8	Crude Oil	21,000
9	Crude Oil	21,000
10	Spent Caustic Soda Solution (NaOH)	16,800
11	Reformate	2,310,000
12	Poly/Cat Gasoline	2,310,000
13	Unleaded Gasoline	1,260,000
14	Unleaded Gasoline	1,260,000
17	Reduced Crude Cat Feed	1,680,000
18	Kerosene (#1 Diesel)	2,310,000
19	#2 Diesel Fuel	1,512,000
20	Reduced Crude Cat Feed	210,000
21	Reduced Crude Cat Feed	126,000
22	Regular Gasoline Leaded	58,800
23	Base Gas/Light Natural Gasoline	1,680,000
24	Reformer Feed	420,000
25	Reformer Feed	420,000
26	Jet A Fuel	168,000

TABLE 3 (continued)

Tank Storage Inventory
Bloomfield Refining Company
Bloomfield, New Mexico

Tank Number	Substance	Capacity (gallons)
27	Burner Fuel (#6 fuel oil)	420,000
28	Crude Oil	3,360,000
29	Regular Gasoline Leaded	714,000
30	Regular Gasoline Leaded	714,000
31	Crude Oil	4,620,000
32	Premium Unleaded Gasoline	840,000
44	200 proof Fuel Alcohol 95% ethanol + 5% gasoline	84,000

CLEAN ENVIRONMENT ENGINEERS, INC.

SPECIFICATIONS FOR THE AP-4 AUTO PUMP
TOTAL FLUIDS REMOVAL

The pumping system shall remove water and product (e.g. oil, fuels, etc.) from a well casing of four (4) inch diameter or greater to depths of 250 feet. The system shall be pneumatically powered and consist of an air filter/regulator, pump, hoses and quick connect fittings.

AIR FILTER/REGULATOR

The air filter shall filter the air to 5 microns and be able to remove some oil and water from the compressed air. It shall have an automatic float drain. The regulator shall be able to regulate the compressed air from 0 to 125 psi. The air filter shall have metal bowls and both the air filter and regulator shall be able to withstand 250 psi air pressure.

PUMP

The pump shall have all pump controls inside the pump. There shall be no timers, bubblers or air valves external to the pump needed to operate the pump. The pump shall be capable of filling from its top or its bottom. The pump shall have three hoses - a hose for pressurized air to run the pump; a hose for the exhaust air to exit the pump and a hose for the fluid to be discharged from the pump. These hoses are to be attached to the pump using brass quick connect fittings with locking sleeves. The air valves inside the pump shall be a poppet design with magnets to maintain valve position.

With the hoses attached to the pump and air pressure equal to or exceeding the total developed head of the system the pump shall pump automatically whenever it fills with fluid. When the pump is empty the air from the pump shall be exhausted through the exhaust air hose, allowing fluid to enter the pump. When the pump is full, compressed air is to be fed into the pump to push the collected fluid out of the pump.

Materials of construction shall be fiberglass, stainless steel, delrin and elastomers.

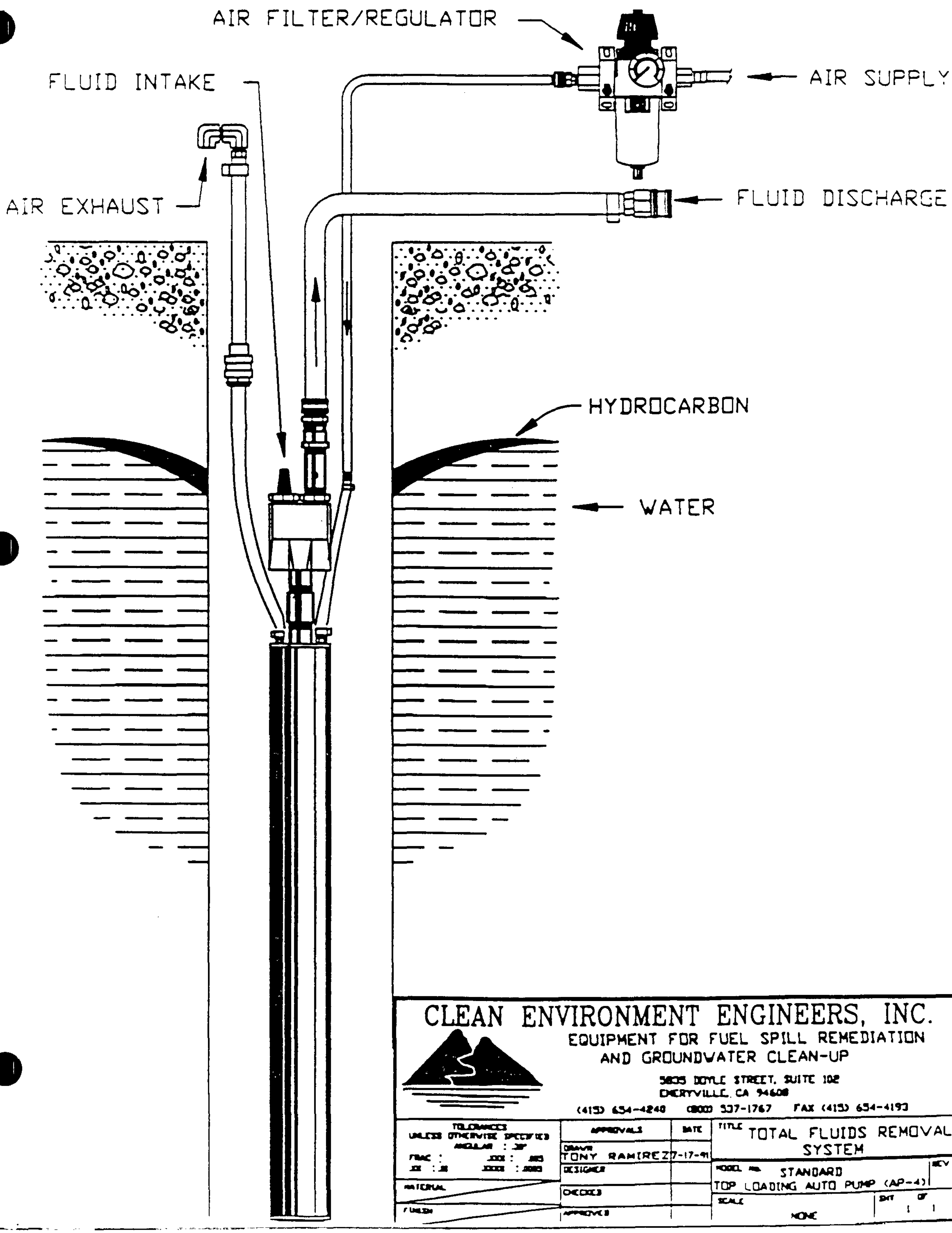
HOSES

All hoses supplied with the system shall be of industrial grade. The hoses shall equal or surpass Parker 801 hose quality. All hoses shall be color coded and equipped with non-interchangeable brass quick connect fittings.

FLOW RATES

The pump shall be able to remove 5 gallons per minute in a top-loading mode and 7 gallons per minute in a bottom-loading mode.

AP-4 STANDARD TOP LOADING AUTO PUMP TOTAL FLUIDS REMOVAL SYSTEM



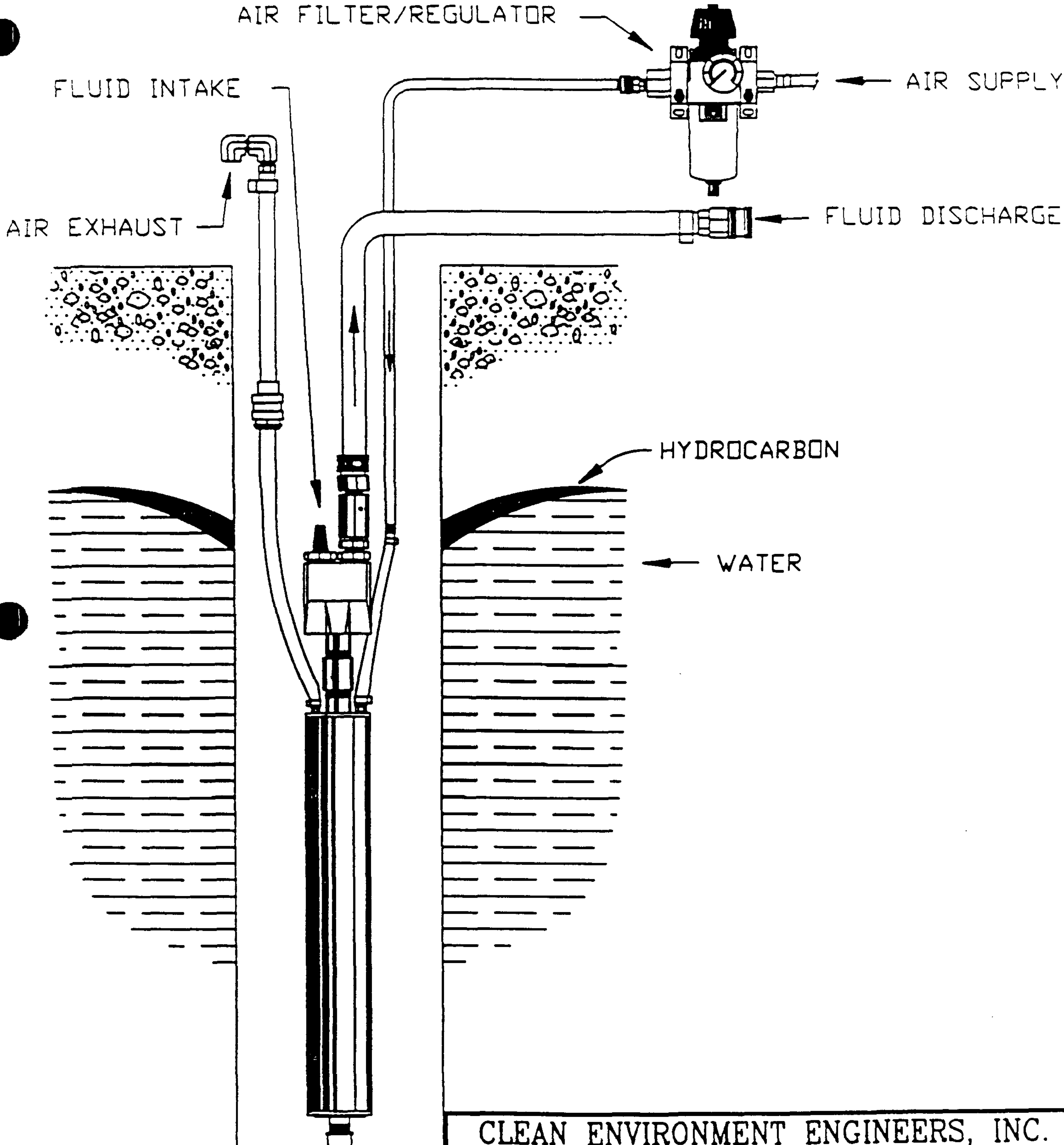
CLEAN ENVIRONMENT ENGINEERS, INC.

EQUIPMENT FOR FUEL SPILL REMEDIATION AND GROUNDWATER CLEAN-UP

5835 DOYLE STREET, SUITE 102
EMERYVILLE, CA 94608
(415) 654-4240 (800) 537-1767 FAX (415) 654-4193

TOLERANCES UNLESS OTHERWISE SPECIFIED	APPROVALS	DATE	TITLE TOTAL FLUIDS REMOVAL SYSTEM
	DRAWN TONY RAMIREZ	7-17-91	MODEL NO. STANDARD TOP LOADING AUTO PUMP (AP-4)
MATERIAL	DESIGNER		REV
	CHECKED		SCALE NONE
FINISH	APPROVED		SHT 1 OF 1

AP-4 SHORT TOP LOADING AUTO PUMP
TOTAL FLUIDS REMOVAL SYSTEM



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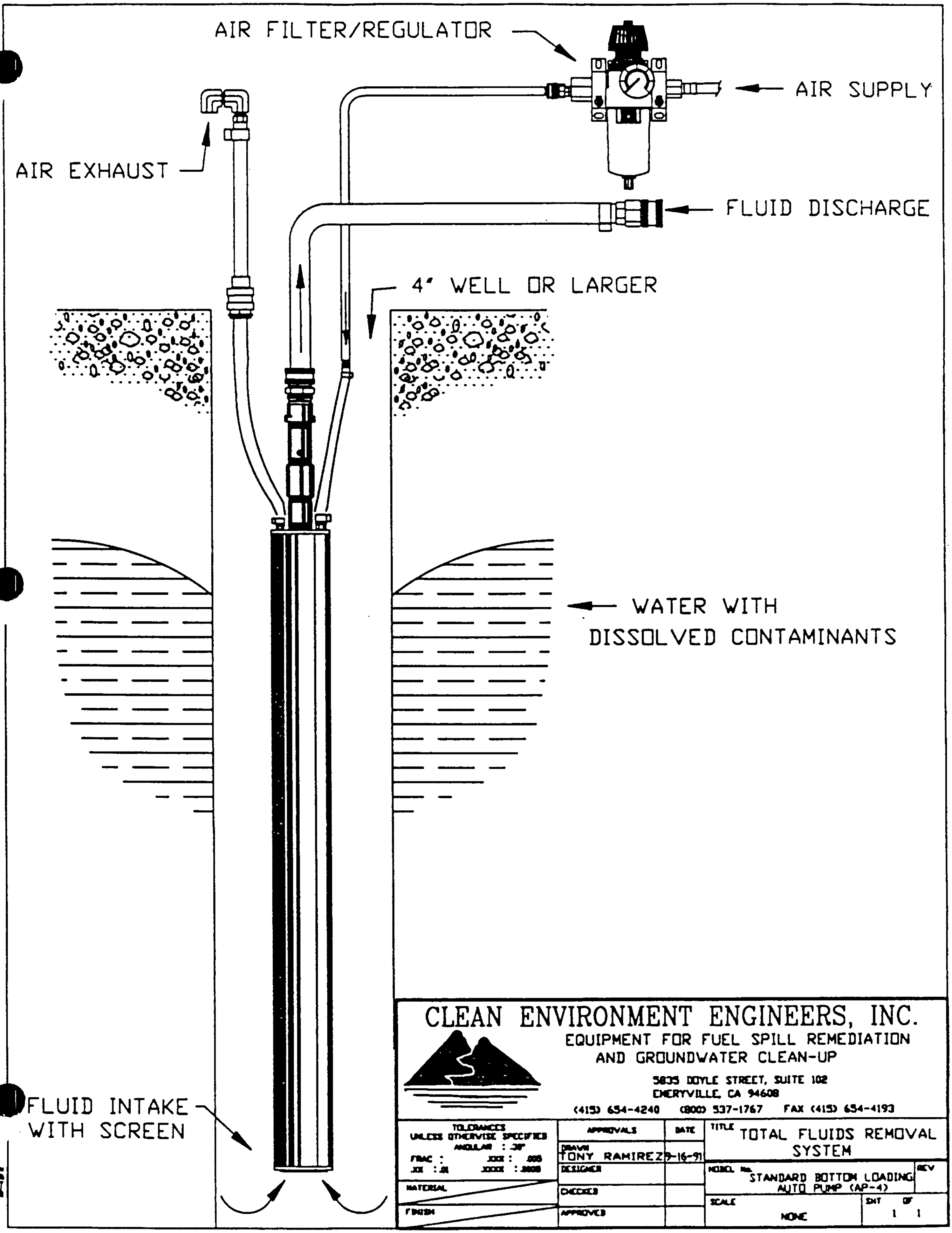
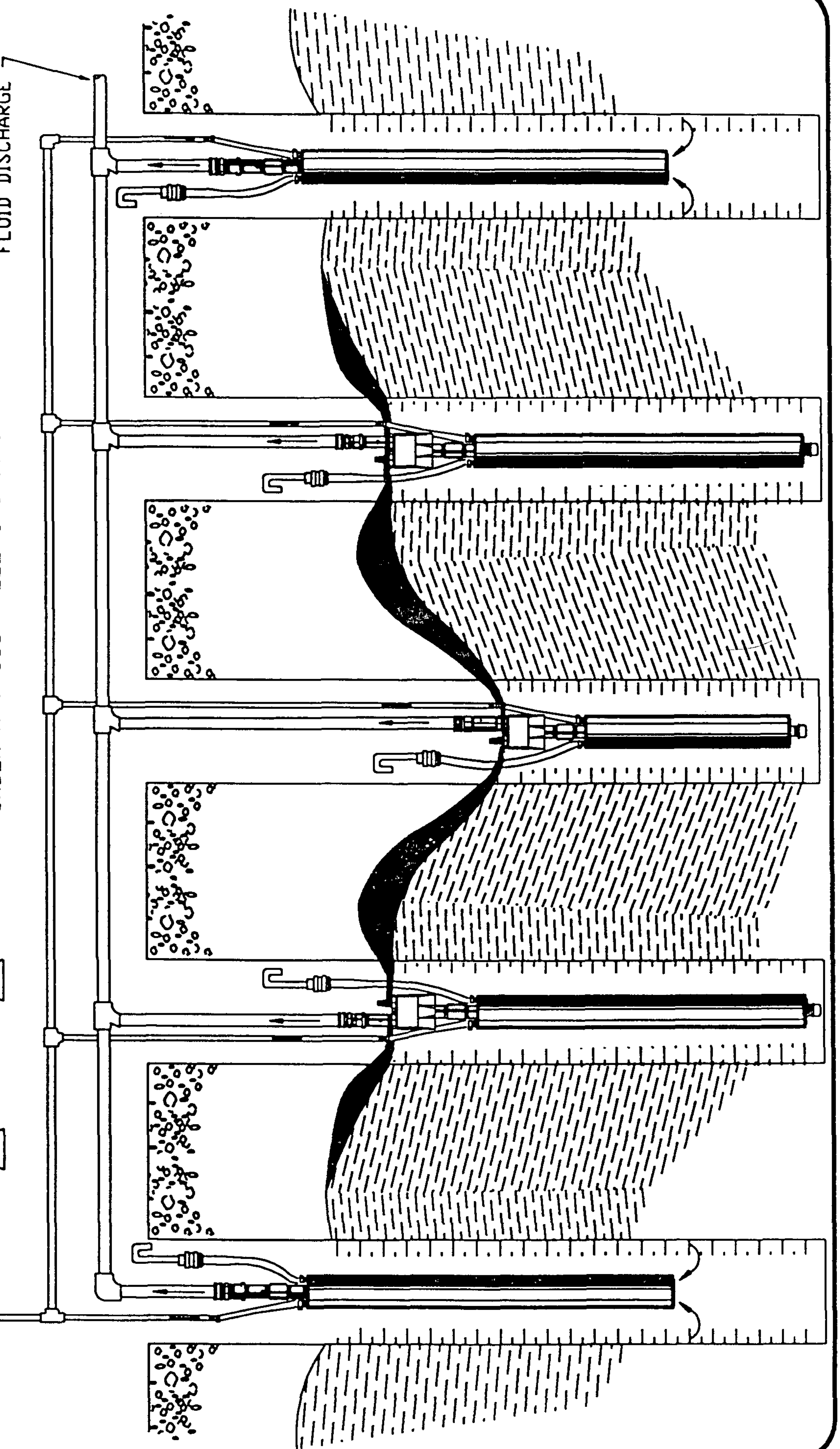
TOLERANCES UNLESS OTHERWISE SPECIFIED ANGULAR : .30° FRAC : .XXX : .005 .XX : .10 .XXXX : .0005	APPROVALS	DATE	TITLE TOTAL FLUIDS REMOVAL SYSTEM	
	DRAWN TONY RAMIREZ	7-17-91		
	DESIGNER		MODEL No. SHORT TOP LOADING AUTO PUMP (AP-4)	REV
MATERIAL	CHECKED			
FINISH	APPROVED		SCALE NONE	SHT 1 OF 1

AP-4 STANDARD BOTTOM LOADING AUTO PUMP
TOTAL FLUIDS REMOVAL SYSTEM



MULTI-WELL TOTAL FLUIDS AUTO PUMPS SYSTEM

- A SINGLE 5 MICRON OR LESS FILTER IS ADEQUATE FOR THE SYSTEM.
- EACH WELL OPERATES INDEPENDENTLY FROM ADJACENT WELLS.
- THE SYSTEM STAYS FULLY PRESSURIZED; AIR IS ONLY CONSUMED 'ON DEMAND'.
- TOP LOADERS, BOTTOM LOADERS AND PUMPS OF DIFFERENT SIZES CAN ALL BE USED SIMULTANEOUSLY.
- NO BUBBLER SENSORS ARE REQUIRED; THEREFORE THE PUMPS CAN OPERATE UNDER A VACUUM ALLOWING SOIL VENTING.



BLOOMFIELD REFINING COMPANY, BLOOMFIELD, NEW MEXICO						RECORDED BY:			
WELL GAUGING DATA FORM						INTERFACE PROBE NO.:			
DATE:						INTERFACE PROBE CORRECTION:			
PROJECT NO: 023353014						WEATHER:			

WELL ID	WELL DIAM (In.)	TOC ELEV	DTP	DTW	TD	PT	ADJ DTW	GW ELEV	TIME/COMMENTS
		FT AMSL	FT	FT	FT	FT	FT	FT AMSL	
MW-1	5	5515.77			24.65				
MW-2	5	5519.45			26.90				
MW-3	5	5535.85			39.35				
MW-4	5	5524.30			32.50				
MW-5	5	5545.10			51.61				
MW-6	5	5551.23			49.63				
MW-7	6	5524.09			62.11				
MW-8	6	5531.12			34.94				
MW-9	6	5519.70			33.99				
RW-1	4	5525.92			40.98				
P-1	4	5524.62			42.45				
RW-2	4	5523.48			38.03				
P-2	4	5523.73			38.33				
RW-3	6	5516.86			33.93				
P-3	4	5507.20			22.80				
MW-11	4	5506.83			24.73				
MW-12	4	5498.36			14.22				
MW-13	4	5538.42			53.00				
RW-14	4	5533.97			43.00				
RW-15	4	5533.32			43.40				
RW-16	4	5531.99			43.10				
RW-17	4	5530.43			41.55				
RW-18	4	5527.05			40.95				
RW-19	4	5527.08			36.70				
MW-20	4	5516.44			27.18				
MW-21	4	5518.64			30.93				