BLACK & VEATCH

~~5728 LBJ Freeway, Suite 300, Dallas, Texas 75240, (214) 770-1500, Fax (214) 770-1549~~

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Sparton Technology
Coors Road Facility

B&V Project 26602.0100
B&V File B
September 18, 1996

Ms. Ana Marie Ortiz
Assistant General Counsel
State of New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Re: Corrective Action Proposals
Sparton Technology, Inc.
Coors Road Facility

Dear Ms. Ortiz:

On behalf of Sparton Technology, we are submitting the enclosed proposals for three corrective actions. These proposals cover:

1. Plume leading edge containment;

2. Vapor extraction system pilot testing; and

3. Expansion of Interim Measures.

We are also attaching copies of pertinent backup information for the submitted proposals. This backup information includes:

1. Updated corrective action recommendations (Black & Veatch letter of July 10, 1996);

2. Vapor extraction system pilot testing outline (Black & Veatch letter of August 12, 1996);

3. Calculations of hydraulic influence for groundwater containment wells (Black & Veatch letter of August 22, 1996);

Sparton Technology
Ms. Ana Marie Ortiz

B&V Project 26602.0100
September 18, 1996

These proposals are being submitted in response to your letter of September 12, 1996, and our continuing discussion and correspondence with NMED staff. Copies of these proposals are being sent by facsimile to expedite your review. Actual proposal documents and backup information are being transmitted by overnight mail.

If you have any questions or need further information, please call. Further note that as of September 14, 1996, our area code changed from 214 to 972.

Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.
Project Manager

bk
enclosures

cc: Mr. R. Jan Appel, Sparton Technology, Inc.
Mr. Jim Harris, Thompson and Knight
Mr. Gary Richardson, Metric Corporation

PROPOSAL

Plume Leading Edge Containment Well
Coors Road Facility
Sparton Technology, Inc.
Albuquerque, New Mexico

Prepared for:

Sparton Technology, Inc.
Rio Rancho, New Mexico

Prepared by:

Black & Veatch
Dallas, Texas

in Association With

Metric Corporation
Albuquerque, New Mexico

September 17, 1996

Objectives

The objectives for installation and operation of the plume leading edge containment well are:

1. To intercept or capture the leading edge of the contaminant plume to prevent further down-gradient migration.

2. To recover contaminated groundwater, treat and dispose to reduce the quantity of contamination.

3. To demonstrate/document the performance of the containment well in achieving the first two objectives.

4. To provide (through pump testing) confirmation of aquifer characteristics.

Definition of Plume Leading Edge

In the RCRA Facility Investigation (RFI) Report submitted to USEPA on May 21, 1992, and subsequently approved on July 1, 1992, the horizontal and vertical limits of the plume were defined by sampling and analysis through June 1991 using both on- and off-site groundwater monitoring wells. In particular, the leading edge of the plume was defined by a number of non-detect groundwater monitoring wells outside the perimeter of the plume.

Subsequent to the RFI completion, plume movement continued beyond the existing groundwater monitoring system. However, based on historic movement, groundwater gradient, and relatively constant geologic conditions, the limits of the leading edge of the plume were estimated in the May 1996 Corrective Measure Study (CMS) Report approved by USEPA on June 24, 1996. To further define the limits of the plume, five additional groundwater monitoring wells (MW-65 through MW-69) were installed around and outside the predicted limits of the plume. Well locations were chosen to provide additional definition of the horizontal and vertical extent of the leading (down-gradient) edge of the plume through non-detection. These and other non-detect wells around the leading edge provide good definition of the plume. The new well installations and subsequent sampling and analysis of these and other existing monitoring wells confirm that the plume limits shown in the CMS Report are reasonable and that the CMS conclusions about direction and rate of movement are also reasonable.

Based on the currently defined plume limits and characteristics, a single well located along Buckeye, some 500 feet north of Arrowhead (see Figure 1) is proposed for plume leading edge containment. (This is the same location shown in the July 10 B&V proposal.) Calculations of predicted well containment performance based on various methodologies and examples of field demonstrations of radius of influence were previously furnished to NMED in the B&V letter of August 22, 1996. These calculations show that a single well is capable of containing the leading edge of the plume.

Available Groundwater Monitoring Network

The attached Table 1 is a summary of monitoring points available to verify the performance (containment function) of a groundwater recovery well installed to contain the leading edge of the plume.

With respect to the attached summary (see Table 1), there are 21 groundwater monitoring wells (including 7 clusters) within 1,500 feet of the proposed recovery well (see Figure 1). These wells include 12 in the upper flow zone (UFZ), three in the upper lower flow zone (ULFZ), five in the lower lower flow zone (LLFZ), and one in the third flow zone (TFZ). There are four down-gradient, three cross-gradient, and 14 up-gradient wells.

The available monitoring network includes all wells that currently define the limits of the leading edge of the plume. The network includes all non-detect monitoring wells outside the plume and detection wells inside the plume. This combination of wells was used to define the plume and is, therefore, capable of showing successful containment performance by demonstrating inward flow (toward the recovery well) across the entire leading edge of the plume. Conversely, the existing groundwater monitoring network is also capable of detecting any deficiency of the proposed recovery well relative to containing the entire leading edge of the plume. Containment performance can be monitored thorough continuing water level observations and water quality sampling and analyses in the groundwater monitoring well network.

Groundwater Containment/Recovery Well Design

Our recommendations on groundwater recovery are similar to those in the CMS Report. The recovery well should be screened at least into the upper 30 to 35 feet of the saturated zone. Screen depth should be adjusted downward, as necessary, based on pilot hole logging to ensure screen placement into a transmissive zone. Due to the geologic anisotropy, the plume depth is very shallow (<100 ft) whereas the width (≈1,500 ft), and length (≈3,000 ft) are large. Thus, a well screened to approximately 50 percent of the plume thickness should be effective. Further, the bulk of the contamination occurs in the top of the aquifer. As a consequence, very deep well penetrations (greater screen length) are undesirable due to the potential for contaminant migration from the upper flow zone (UFZ) to the lower lower flow zone (LLFZ). For similar reasons, a pumping rate of 50 to 100 gpm (drawdown in the range of 6 to 10 feet) is also desirable. All available information indicates that this pumping rate should be more than adequate to achieve containment of the plume. The design intent is to provide sufficient drawdown to achieve containment yet avoid pulling shallow contamination deeper into the aquifer. A second design intent is to minimize the amount of "clean" water recovered by the well.

Produced water from the recovery well would be treated to meet discharge permit requirements for both air and water effluents. Treatment is proposed at the well head. This proposal assumes that treated water can be economically disposed by either discharge to the Rio Grande River by NPDES permit or through some other economic alternative such as discharge to a sanitary sewer.

Containment Demonstration

Demonstration of containment will be established by conducting a series of pumping tests during the initial startup of the groundwater recovery well. The first pump test would be a two to three day test (with a temporary pump) used to determine the required size (pumping rate) for the production pump. Time-drawdown data would be obtained from a constant-rate test at approximately 100 gpm to evaluate produced drawdown and impact to the closer monitoring wells. The resulting time-drawdown and distance-drawdown data would be analyzed to verify the design pumping rate needed to produce approximately 10 feet of drawdown in the recovery well. The data would also be used to project the edge or limit of the recovery well influence relative to plume capture/containment. The temporary pump test would also be used to establish produced water quality by sampling and laboratory analysis on a daily frequency. Flow rate, total quantity, and monitor well levels will be recorded during the pumping test.

After the production pump is installed, a long-term (approximately one month) pumping test would be conducted using the production well and the monitoring network described in Table 1. Closer monitoring wells (<750 feet horizontal distance) would be read two to four times daily for the first several days, and once daily for the rest of the first week. More distant wells would be read daily for the first week. Thereafter, all well levels would be recorded once per week for the duration of the test. This second pump test would be used to demonstrate both the performance of the recovery well/treatment system and the plume area impacted by the pumping.

Contingency

There are at least two possible scenarios that could be identified during the pumping test. The first of these is that the chosen well location may have atypical or non-representative geology such as an absence of coarser, transmissive material in the uppermost saturated zone. Such a condition has been encountered in several monitoring wells.

Pilot hole procedures and installation of a temporary pump are two ways to minimize the effect of an unexpected geologic condition. As previously noted, screen length would be extended as a first solution. In the highly unlikely event the geologic condition was vertically extensive (tens of feet), consideration would have to be given to an alternate location.

The second scenario is that the long-term pumping test of the recovery well indicates that portions of the leading edge of the plume are not being effectively intercepted. (Effective interception would be defined as demonstration of flow toward the recovery well using water level data from various monitoring wells to show an inward gradient to the recovery well, i.e., to show a cone of depression over the horizontal and vertical extent of the plume.) This scenario is also unlikely and the solution, in all probability, would be to increase the pumping rate (increase stress in the aquifer).

There is a third scenario that could appear months or years into recovery well operation. This scenario would be the appearance of contamination in a currently non-detect monitor well outside the influence area of the recovery well. The solution could involve the installation of additional monitoring wells and subsequent characterization/evaluation.

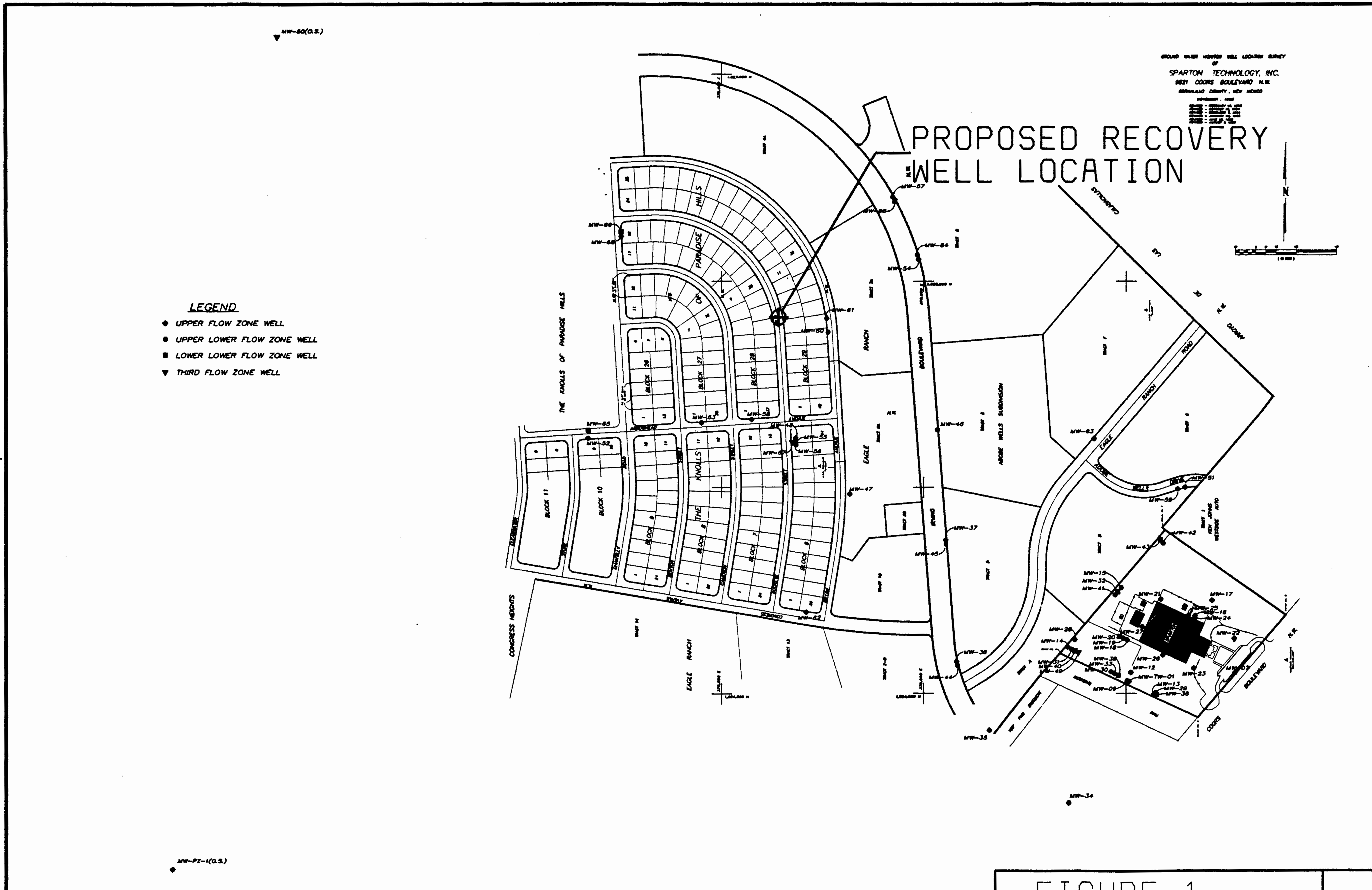
Schedule

The schedule for implementing the plume leading edge containment is a dual concurrent track. The first track is the process of obtaining the necessary permits for installing and operating the containment well system. The permits include air quality, well installation, groundwater rights, variance from zoning, public right-of-way use, and discharge (including NPDES). This first track would begin immediately upon authorization to proceed and is considered the critical path. Schedule estimates for this track are at least six months.

The second track is the actual installation and testing of the containment well system. The second track also presumes that track one will be successfully completed. Elements (and schedule estimates) for this second track are as follows:

1. Select and purchase property for the wellhead (four to six weeks).
2. Review permits status.
3. Drill and install recovery well (two months).
4. Review permits status.
5. Construct building/shelter for treatment unit (four months).
6. Acquire and install treatment equipment and discharge pipeline (one month).
7. Verify completion of permits.
8. Conduct temporary pump test and install production pump (one month).
9. Conduct production pump test (one month).
10. Evaluate and report installation and test data (two months).

Based on the above estimates, it will take at least eight months to actually begin pumping water with the permit process being the critical impact on the schedule.



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DETAILED
CHECKED
APPROVED
DATE

Black & Veatch
Dallas, Texas

PROJECT NO.
26602

FIGURE 1

RECOVERY WELL AND MONITORING NETWORK

SHEET
OF

Table 1 Summary of Groundwater Monitoring Wells Within 1500 Feet of Proposed Containment Well Location						
Monitor Well	Flow Zone	Approx. Radial Distance ft	Gradient Position	Inside Plume*	Recent Contamination History**	Cluster Well
MW 37	UFZ	1,350	Up	Yes	High, Decr	Yes
MW 45	ULFZ	1,350	Up	Yes	Low, Decr	Yes
MW 46	ULFZ	950	Up	Yes	V. High	No
MW 47	UFZ	925	Up	Yes	Low, Decr	No
MW 48	UFZ	600	Up	Yes	High, Decr	Yes
MW 52	UFZ	1,100	Down	No	ND	Yes
MW 53	UFZ	650	Cross	Yes	Low	No
MW 54	UFZ	750	Up	NA	NA	Yes
MW 55	LLFZ	600	Up	Yes	High	Yes
MW 56	ULFZ	600	Up	Yes	High	Yes
MW 57	UFZ	825	Cross	No	ND	Yes
MW 58	UFZ	500	Up	Yes	High	No
MW 60	ULFZ	250	Up	Yes	High	Yes
MW 61	UFZ	250	Up	Yes	V. High, Decr	Yes
MW 62	UFZ	1,425	Up	No	<5 µg/l	No
MW 64	ULFZ	750	Up	Yes	Low, Incr	Yes
MW 65	LLFZ	1,100	Down	No	<5 µg/l	Yes
MW 66	LLFZ	825	Cross	No	ND	Yes
MW 67	TFZ	600	Up	No	ND	Yes
MW 68	UFZ	875	Down	No	ND	Yes
MW 69	LLFZ	875	Down	No	ND	Yes

* Inside 5 µg/l contour

** Very high=>1,000 µg/l, high=>100 µg/l, low=<100 µg/l
ND=no detect, Incr=increasing trend, Decr=decreasing trend

PROPOSAL

Vapor Extraction System Pilot Testing
Coors Road Facility
Sparton Technology, Inc.
Albuquerque, New Mexico

Prepared for:

Sparton Technology, Inc.
Rio Rancho, New Mexico

Prepared by:

Black & Veatch
Dallas, Texas

in Association With

Metric Corporation
Albuquerque, New Mexico

September 17, 1996

Objective

The following proposal is a discussion of specific details and operating procedures to conduct and analyze a VES pilot test and to define the limits of elevated soil-gas volatile organic constituent (VOC) concentrations (i.e., the "soil vapor cloud") in the unsaturated subsurface at the Sparton facility. This discussion of technical details and definition of level of effort is a logical extension from the existing data base and should provide sufficient information to determine what, if any, additional work will be needed.

Soil-Gas Monitoring System

A number of monitoring points for both subsurface soil-gas characterization and for vapor extraction pilot test/production purposes have been previously proposed (B&V letter of August 12, 1996). The monitoring system included both existing groundwater monitor wells (with exposed screen) and the existing vapor cluster probe (VP-1) as well as new vapor recovery wells installed in and around the source area. Previous studies had identified highest VOC concentrations in the soil gas in the closed sump area. Concentrations dropped off by orders of magnitude with increasing horizontal distance from the sump/pond (source area).

The proposed monitoring system additions are designed to characterize the soil gas VOC concentration with respect to distance/location relative to the closed sump area. In addition, the monitoring points would be useful in evaluating the effective influence of a vapor recovery well centrally located in the closed sump (source) area. The monitoring system is shown on the attached Figure 1 and includes four existing groundwater monitoring wells (MW-17, MW-21, MW-24, MW-25, and, perhaps, MW-16 depending on seasonal water level (fluctuation), existing six-well vapor probe cluster (VP-1) and five new vapor recovery wells (VR-1 through VR-5).

The new vapor recovery wells are designed to function as both monitoring points and as potential vapor extraction/air injection wells. The new central vapor recovery well (VR-1) would be a four-inch well; the remaining new vapor recovery wells (VR-2 through VR-5) would be two-inch wells. Wells would consist of 60 feet of 0.040-inch machine slotted PVC screen surrounded by a #6 to #9 coarse sand filter. The uppermost 10 feet of each well would be a grouted surface seal to minimize air intrusion or bypassing. New wells would be installed using hollow-stem auger drilling procedures. As part of the characterization work, drilling would be monitored using field screening instruments to provide a relative comparison of soil gas VOC as a function of location, depth, and soil type. Completed wells would also be sampled and analyzed using EPA method 8010/8020 for specific VOC presence/concentration.

The proposed monitoring system is expected to confirm the significant dropoff in soil gas VOC concentration with increasing distance from the closed sump area. In addition, it should also define the area where vapor extraction and treatment would be appropriate.

The need for any additional monitoring/characterization data outside the proposed network would be based on a combination of perimeter soil-gas VOC concentrations above 10 ppm and projected edge (shape and distribution) of the "vapor cloud" extending out beyond the definition interval of the proposed network. The proposed network has maximum interwell horizontal spacings of ±100 feet in the outer perimeter. Projected vapor cloud edges extending outward less than this interwell spacing should be adequately defined.

Updated Soil-Gas Characterization

Soil-gas data from the additional new wells would be combined with the existing data base to provide a three-dimensional picture of the soil-gas "vapor cloud". This analysis and related data would be presented in the form of an update to the soil contamination characterization presented in the May 6, 1996 Corrective Measure Study (CMS) Report approved by U.S.EPA on June 24, 1996. The updated soil-gas characterization would also be used to confirm the application area for vapor extraction and the selection of the pilot test location.

Pilot Test Design

All data obtained to date and the history of the facility indicate that the closed solvent sump is the probable source of VOC observed in the soil gas. Highest soil-gas VOC concentrations occur in the immediate area of the sump with significant VOC concentration decrease observed with increasing horizontal distance from the source area. As a minimum, vapor extraction will be implemented in the sump area. Thus, the sump area is the most logical location for pilot testing.

The pilot test is proposed to define the relationship between VOC concentrations and extraction vacuum and extraction flow rates from a recovery well located directly under the sump area (see Figure 1). Monitoring points (proposed and existing) are located at varying horizontal distances and depths to allow evaluation of effective influence of the centrally located recovery well.

The pilot test is also designed as a prototype demonstration of the planned VES system to show capability for extraction and ability to meet City/County air quality requirements. Further, the pilot test will show probable production rates and estimates of required operation time.

Pilot Test Equipment

For the pilot test, we are proposing AcuVac as the subcontractor to provide necessary equipment. AcuVac is experienced in soil vapor recovery pilot testing in the Albuquerque area and they have demonstrated the ability to successfully conduct meaningful pilot tests and to meet stringent City/County emission requirements. Further, the AcuVac procedure utilizes an environmentally friendly destructive technology to efficiently remove VOC from the extracted soil gas.

The proposed extraction/destruction unit is based around a 300 cubic inch in-line six cylinder internal combustion (I.C.) engine fueled by the extracted soil-gas VOC and supplemental fuel as required. Emissions are controlled by the I.C. process and redundant catalytic converters.

A vacuum blower propelled by the I.C. engine is capable of producing well flow rates of up to 120 cfm and negative pressures of up to 15 inches of mercury. AcuVac-furnished pilot test equipment also includes: a data recording system; magnehelic pressure gauges capable of reading to 0.01 inches of water; soil gas flow measuring devices; real-time field screening/analytical equipment; temperature and barometric measurement; and sampling ports for recovery of influent samples.

Pilot Test Procedure

The pilot test is proposed to be conducted using the central four-inch recovery well (VR-1). The remaining recovery wells (VR-2 through VR-5), UFZ groundwater monitoring wells (MW-17, MW-21, MW-24, and MW-25), and vapor probe cluster (VP-1) would be used as observation points for the pilot testing (see Figure 1). The pilot testing will be conducted at several different rates of vacuum and flow (up to the maximum capability of the extraction unit) to determine the performance characteristics of the vapor recovery well/adjacent subsurface.

Prior to each individual test, depth to water, temperature and barometric pressure, and magnehelic pressure gauge readings at each monitoring point would be recorded. After the pilot test is started, extraction well vacuum and flow and extraction system operating data (including supplemental fuel flow) will be recorded. Pressure instrumentation at each of the observation wells will be monitored and recorded to determine vacuum communication with the recovery well (demonstration of radius of influence).

The produced vapor stream (influent) will be analyzed (on a real-time basis) using field screening instruments to determine variation in influent VOC concentration. At selected intervals, influent samples will also be obtained for confirmatory laboratory analyses (EPA Method 8010 and 8020). At least one confirmatory sample will be obtained for each extraction rate test. The purpose of the screening/testing will be to determine VOC concentration variation as a function of both pumping rate/vacuum and elapsed pumping duration.

Based on previous experience, the pilot test should require no more than two days of actual vapor extraction. It is anticipated that two to four extraction rates will be tested. Each extraction rate test will nominally take three to four hours. Upon completion of testing, a detailed pilot test report, including all operating and analytical data and recommendations for operating parameters and effective vacuum radius of influence, will be compiled and provided to NMED.

Pilot Test Schedule

Upon authorization to proceed, it will take from two weeks to over a month to schedule a drilling contractor to install the five vapor recovery wells. Approximately one week will be required to install the wells. Sampling and analytical testing will require several more weeks. Pilot testing can then be arranged in accordance with the subcontractor's schedule. Currently, several weeks are required to mobilize the pilot test equipment; however, once equipment is on site, the actual pilot testing can be conducted in several days. Interference with the schedule could be caused by the holiday season and possibly weather.

PROPOSAL

Expansion of Interim Measures (IM)
Coors Road Facility
Sparton Technology, Inc.
Albuquerque, New Mexico

Prepared for:

Sparton Technology, Inc.
Rio Rancho, New Mexico

Prepared by:

Black & Veatch
Dallas, Texas

in Association With

Metric Corporation
Albuquerque, New Mexico

September 17, 1996

Objectives

The objectives of this proposal are two-fold:

1. To address high volatile organic constituent (VOC) concentrations in groundwater at the location of MW-32.

2. To evaluate the cause of erratic VOC detections historically observed during periodic sampling of groundwater monitoring well MW-32.

Lower lower flow zone (LLFZ) groundwater monitoring well MW-32 has historically exhibited erratic detections of volatile organic constituents (VOC). Periodically, it exhibits anomalously high concentrations relative to surrounding adjacent wells and also periodically exhibits anomalous constituents. Further, out of 13 cluster well locations, well MW-32 is the bottom well in the only cluster showing an increase in VOC concentration with depth.

The source of the erratic detections is a matter of speculation, but would include completion problems such as a defective grout seal or a cracked well casing allowing intrusion of shallow contamination. Sampling procedures have been ruled out as a cause through detailed resampling and multiple split procedures.

One procedure to determine the cause of the erratic behavior would be to pump the well for an extended period and observe the effect on sampled water quality. If well MW-32 does represent a zone or area of higher VOC concentration, the extended pumping from this well would also be a form of source control and containment. It should be noted that MW-32 is also immediately downgradient of the source area.

Proposed IM Expansion

The current IM system recovers a total of approximately 2 gpm from the upper portion of the aquifer. The treatment capacity of the IM system is 20 gpm. Well installation data for MW-32 indicate that pumping rates of 10 to 15 gpm could possibly be achieved. Actual production rate would be determined by installing a temporary pump and conducting a limited pumping test to determine production pumping rate and drawdown. A production pump would then be sized and installed. Discharge would be routed to the existing onsite treatment unit. It should be noted that MW-32 is located almost adjacent to the treatment unit -- allowing economical, secure connection.

Production and impact on water quality would be evaluated on a periodic basis and furnished as a part of the site operation reporting.

Schedule

The current IM system is permitted for a production of 20 gpm. Adding well MW-32 to the IM system is simply a matter of conducting a limited pumping test for sizing purposes, and then installing the pump, controls, and connecting piping. It is estimated that well MW-32 could be recovering water within two months of authorization to proceed.

BLACK & VEATCH

5728 LBJ Freeway, Suite 300, Dallas, Texas 75240, (214) 770-1500, Fax: (214) 770-1549

Sparton Technology
Coors Road Facility

B&V Project 26602.0100
B&V File B
July 10, 1996

Mr. R. Jan Appel
Vice President and General Counsel
Sparton Corporation
2400 East Ganson Street
Jackson, Michigan 49202

Re: Updated Corrective Action Recommendations

Dear Mr. Appel:

As part of the continuing, phased investigation at the Coors Road facility, we have obtained additional preliminary data on the extent of soil gas and groundwater VOC concentration. In response to your request, the purpose of this letter is to briefly outline three corrective actions set forth as follows:

1. Install and operate a vapor extraction system (VES) in the immediate source area to reduce VOC concentration in the unsaturated zone.

2. Install and operate a groundwater extraction well to contain the leading edge of the defined plume.

3. Expand the existing onsite Interim Measure (IM) pump and treat system to include LLFZ well MW-32.

These recommended actions are described more fully in following sections of this letter. All of these actions are consistent with information given in the Corrective Measure Study (CMS) Report.

Vapor Extraction Systems (VES)

Preliminary analytical results from the recently installed vapor probe in the center of the source area (adjacent to the solvent sump) and the April 1996 deep soil gas investigation confirmed the findings of the RFI and CMS Reports. Specifically, elevated soil gas concentrations (above 10 ppmv) of TCE and 1,1,1-TCA are found in the immediate source area and negligible soil gas VOC concentrations are found offsite. The elevated soil gas VOC concentrations are believed to be the result of adsorption to fine-grained silts and clays in the upper 40 feet or so of the unsaturated zone.

The elevated soil gas VOC concentrations indicate that VES should be considered in the source area. As many as seven soil gas extraction wells (as shown in the attached figure) may be necessary to cover the source area with elevated soil-gas VOC concentration. The areal coverage provided by these wells indicates that further vapor probe installation in the interior source area is not warranted. Any additional soil gas monitoring, if necessary, could be provided by the individual extraction wells.

Detailed information of VES is given in the CMS Report. Extraction rates are expected to be in the range of 5 to 10 scfm per well. It is anticipated that the VES would be operated on a pulsed basis for up to three years to obtain maximum practical reduction in VOC concentration in the unsaturated zone.

Plume Containment

Based on preliminary sampling and analyses at the three new groundwater monitoring well locations that have been drilled so far -- specifically, UFZ wells MW-66 and MW-68 and TFZ well MW-67 (Sparton correspondence 5/14/96) -- the 1996 TCE plume contours given in the CMS Report seem reasonable. Based on the plume configuration, a single groundwater extraction well located along Buckeye (as shown in the attached figure) should be capable of containing the defined plume. For security, it would be advantageous to install the well on a vacant residential lot.

The partially penetrating well should be screened at least into the upper thirty to thirty-five of the saturated zone. (Upper and Lower Flow Zones). Screen depth should be adjusted, based on pilot hole logging, to assume placement in a transmissive zone. Very deep penetrations are undesirable due to the potential for contaminant migration to the Lower Lower Flow Zone (LLFZ).

Using aquifer properties given in the RFI Report and confirmed by the USGS, a pumping rate of 50 to 100 gpm would give a capture zone width (at the well) of approximately 1,500 to 2,000 feet which would adequately cover the width of the plume. Alternatively, capture zone width could be based on the 600-foot-plus radius of influence demonstrated in pumping tests reported in the RFI. The pumping rate would give a drawdown in the range of six to ten feet. The pumping rate should be adjusted to provide sufficient drawdown for containment but not so much drawdown to pull shallow contamination deeper into the aquifer.

Extracted water would be treated at the well head on the residential lot to avoid any problem with transmission of untreated water along public right-of-way. It is anticipated that the only required treatment would be air stripping to remove VOC. Air polishing of air effluent should not be required since the total VOC emissions will be less than 5 pounds per day.

Treated water could be routed from the well head treatment site to the Rio Grande in a pipeline buried in the public right-of-way. An NPDES permit would be necessary for such a discharge, as discussed in the CMS Report.

<u>Enhanced IM Recovery</u>

We continue to recommend that LLFZ groundwater monitoring well MW-32 be added to the existing onsite IM pump and treat system as detailed in the CMS Report § VIII.B.

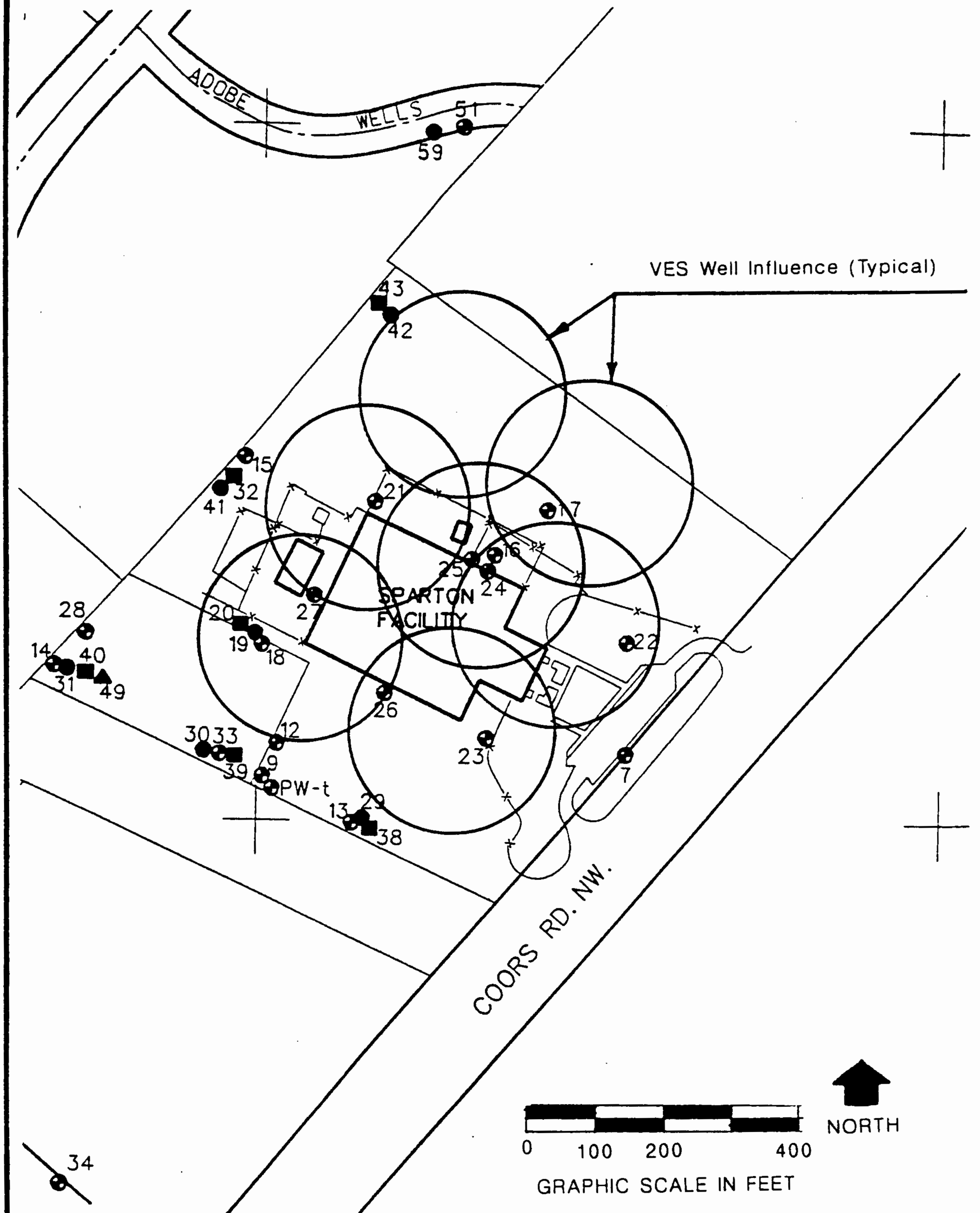
We appreciate the opportunity to provide this information. If you have any questions, please call.

Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.
Project Manager

bk
enclosures



VES - 7 WELL SYSTEM (SOURCE AREA)
SPARTON TECHNOLOGY, INC.

BY

DATE

Black & Veatch
Engineers–Architects
Dallas, Texas

BASE MAP FROM RFI - FIGURE 11

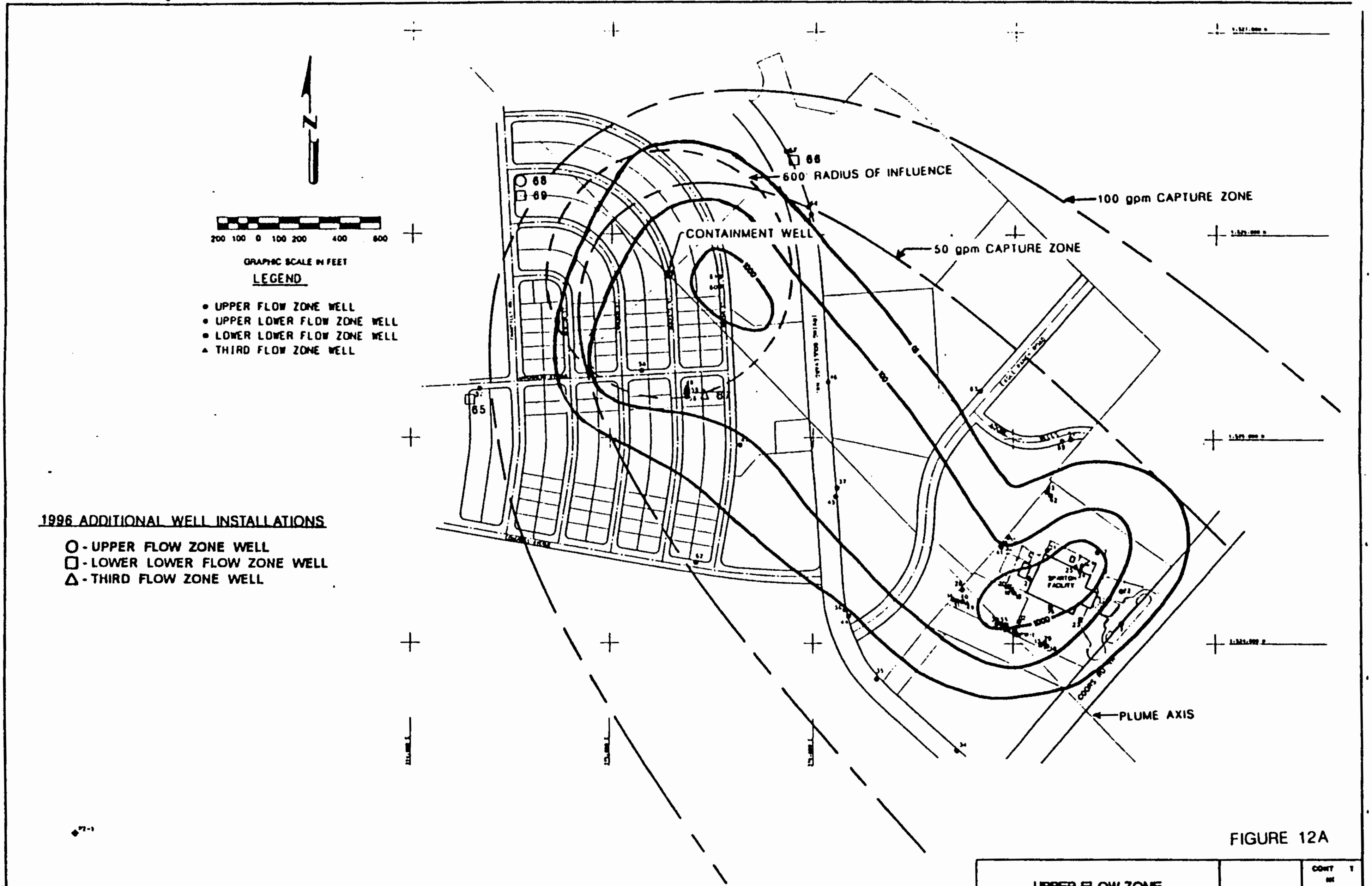


FIGURE 12A

Black & Veatch
Engineers - Architects
Dallas, Texas

PROJECT NO 026602

UPPER FLOW ZONE

TCE CONTOURS - 1996 DATA

BLACK & VEATCH

5728 LBJ Freeway, Suite 300, Dallas, Texas 75240, (214) 770-1500, Fax: (214) 770-1549

Sparton Technology
Coors Road Facility

B&V Project 26602.0100
B&V File B
August 12, 1996

Ms. Anna Marie Ortiz
Assistant General Counsel
State of New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 887502

Re: Vapor Extraction System Pilot Testing
Coors Road Facility

Dear Ms. Ortiz:

In our teleconference on August 5, 1996, we had discussions with you, Dennis McQuillan, and Rob Pine concerning pilot testing for the proposed VES. Based on those discussions, we are submitting this additional information on VES pilot testing as indicated in Jim Harris' letter of August 6, 1996. Specifically, this information covers the installation of additional vapor observation/recovery wells and pilot testing of a centrally located vapor recovery well in the sump area.

The centrally located vapor recovery well would be a 4-inch well installed in the sump area as described in our July 22, 1996, revised proposal. Additional 2-inch vapor wells (as previously described) would be installed at varying radial distances of 50 to 100 feet from the central well. A minimum of four wells would be installed at the approximate locations shown on the attached base map. These wells would be utilized as observation wells (together with the existing soil gas vapor probe VP-1 and existing groundwater monitoring wells with screen exposure above the water table) in a pilot test to evaluate production rates, radius of influence, and VOC concentration in the produced vapor stream. The additional vapor wells would also be used to further define the extent of VOC concentration in the soil gas. These wells could also be potentially used in the VES for vapor recovery and/or air introduction.

We anticipate that the pilot test would use a locally experienced subcontractor such as AcuVac to recover soil vapor from the central vapor recovery well and monitor the surrounding observation network. It is our opinion that several days of pilot testing would be required to determine recovery rates and VOC concentrations for permit purposes. Once we have reached agreement on the location and number of pilot test wells and observation points, we will submit a more detailed description of the actual pilot test procedure. At the conclusion of the pilot testing, analyses would be provided relative to the extended VES implementation.

As shown in the following table, there are potentially four groundwater monitoring wells that could be utilized in the pilot test for vapor observation wells.

GROUNDWATER MONITOR WELLS IN VAPOR RECOVERY AREA (PILOT TEST)			
	Elevation Top of Screen (ft)	July 1996 Water Level Elevation (ft)	Screen Exposure (ft)
MW-16	4979.50	4979.45	.05
MW-17*	4982.28	4979.44	2.84
MW-21*	4983.86	4979.18	4.68
MC-22	4976.06	4979.06	(3)
MW-24**	4980.30	4975.72	4.58
MW-25**	4981.31	4977.64	3.67
* Vapor sampled successfully April 1996. ** IM groundwater recovery wells.			

The four wells with good screen exposure (MW-17, MW-21, MW-24, and MW-25) were tested in April 1996 for the presence of VOC above the water table; however, VOC concentration in two of the wells, MW-24 and MW-25, could not be confirmed by laboratory analyses due to the water level being drawn above the top of the screen. It should be noted that photoionization detector readings during purging were significantly lower than comparable readings in MW-17. The locations of these four groundwater monitoring wells relative to the central vapor recovery well are shown on the attached base map. Note that two of the wells are within a 25-foot radial distance.

Sparton Technology
Ms. Anna Marie Ortiz

B&V Project 26602.0100
August 12, 1996

Two-inch vapor wells as previously described in the July 22, 1996 proposal would be installed at four locations around the central vapor well. Radial distance ranges from 50 to 100 feet as shown on the base map. The locations and radial distances conform to our previous discussion of pilot testing as described in the August 6, 1996 letter.

We trust this pilot testing information is sufficient for your needs.

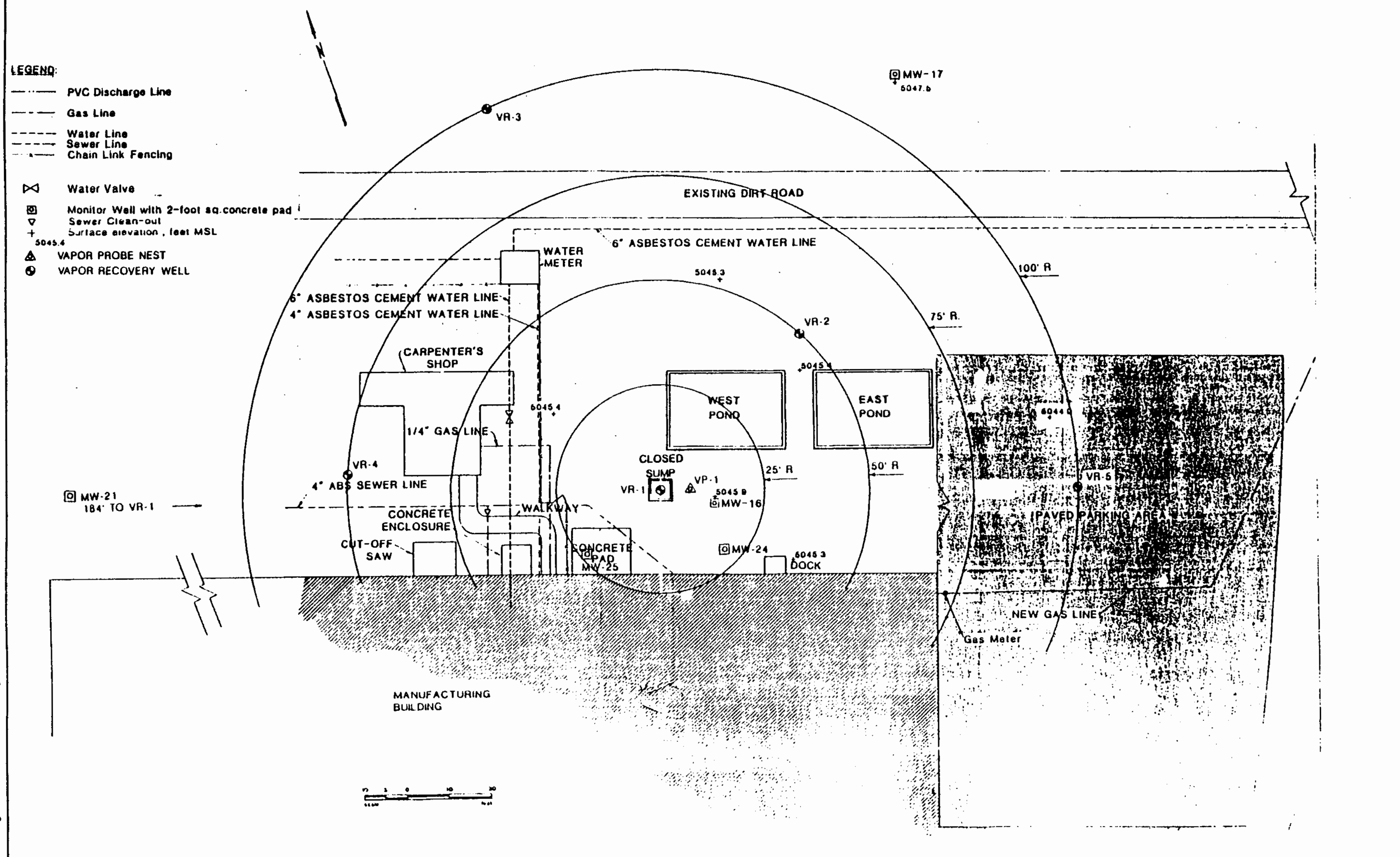
Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.
Project Manager

bk
enclosures

cc: Mr. James B. Harris
Mr. R. Jan Appel



MAP SOURCE: RCRA POST-CLOSURE PERMIT APPLICATION
HARDING LAWSON ASSOCIATES, MARCH 1986

Black & Veatch
Engineers · Architects
Dallas, Texas

PROJECT NO

SPARTON TECHNOLOGY, INC.

COORS ROAD FACILITY

VES - PILOT TEST

CONTRACT NO.

SHEET NO.

BLACK & VEATCH

5728 LBJ Freeway, Suite 300, Dallas, Texas 75240, (214) 770-1500, Fax: (214) 770-1549

Sparton Technology
Coors Road Facility

B&V Project 26602.0100
B&V File B
August 22, 1996

Ms. Anna Marie Ortiz
Assistant General Counsel
State of New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 887502

Re: Calculations of Hydraulic Influence
Groundwater Containment Wells
Coors Road Facility

Dear Ms. Ortiz:

In recent discussions with you, Dennis McQuillan, and Rob Pine, copies of our calculations of predicted groundwater containment well performance were requested. Attached to this letter are copies of the requested calculations. The calculations include:

1. Site-specific calculations of radius of influence using pump test data from the U.S. EPA-approved RFI Report (RFI Attachment 10).

2. Illustration of containment well radius of influence based on RFI pump test data and pumping duration of one day superposed on the January 1996 plume configuration from the CMS Report.

3. Confirmatory calculations of radius of influence using data from the 1995 U.S.G.S. Albuquerque Basin Model.

4. Field demonstrations of radius of influence from Intel Production wells approximately 2.5 miles north of the Sparton Facility.

Sparton Technology
Ms. Anna Marie Ortiz

B&V Project 26602.0100
August 22, 1996

5. Calculations of capture zone using conventional methodology (Fetter 1994, Grubb 1993, and others) using a range of site-specific parameters and containment pumping rates. Note that transmissivity values are from the RFI/CMS Reports and hydraulic gradient is from third quarter 1996 water level data including the recently installed monitoring wells outside the leading edge of the plume.

6. Copy of site-specific 50- and 100-gpm capture zones (T=18,000 gpd/ft) for a potential containment well superposed over the January 1996 plume configuration from CMS report.

7. Calculations of capture zone using USGS-based parameters.

8. Copy of USGS-based capture zones superposed on the January 1996 Plume footprint from the CMS Report.

We trust that the attached information will be helpful in your review.

Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.
Project Manager

bk
enclosures

cc: Mr. James B. Harris
Mr. R. Jan Appel

BLACK & VEATCH

Owner SPARTON TECHNOLOGY Computed By PLC (1)
Plant COORS ROAD Unit Date 8/6 1996
Project No. 026602.0100 File No. Verified By
Title RADIUS OF INFLUENCE Date 19
USING RFI PUMP TEST VALUES Page 1 of 3

1) PUMP TEST WAS CONDUCTED IN EARLY OCTOBER 1984.

2) PUMP TEST WAS CONDUCTED NEAR END OF IRRIGATION SEASON WHICH RUNS FROM MID-APRIL TO MID-NOVEMBER

3) IRRIGATION IS PROVIDED BY CORRALES MAIN CANAL AND RESULTS IN A TWO TO THREE FOOT INCREASE IN POTENTIOMETRIC ELEVATION

4) THE UNLINED CORRALES MAIN CANAL IS LESS THAN 700 FEET SOUTHEAST OF THE PUMPED WELL PW-1 USED IN THE PUMP TEST.

5) PUMP TEST WAS A 180-GPM CONSTANT RATE TEST WITH A 25-HOUR DURATION PRODUCING DRAWDOWN OF 24 FEET IN THE PUMPED WELL

6) NOT SURPRISINGLY, PUMP TEST DATA EXHIBITED AN "EQUILIBRIUM" SIGNATURE (CONDITION OF RECHARGE EQUAL TO PUMPING RATE) AFTER SOME 200 MINUTES OF CONSTANT RATE PUMPING

7) PUMP TEST WAS MONITORED BY THREE OBSERVATION WELLS LOCATED AT RADIAL DISTANCES OF 45, 150, AND 350 FEET FROM THE PUMPED WELL.

8) DISTANCE-DRAWDOWN DATA FROM THE OBSERVATION WELLS DEMONSTRATED A RADIUS OF INFLUENCE OF APPROXIMATELY 600 FEET

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9) PREDICTABLY, THE RADIUS OF INFLUENCE OF 600 FEET IS ALSO THE APPROXIMATE DISTANCE TO THE CORRALES MAIN CANAL AND IRRIGATED FARM LAND (DEMONSTRATED SOURCE OF RECHARGE)

10) IN THE ABSENCE OF THIS CLOSE SOURCE OF RECHARGE, THE CONE OF DEPRESSION WOULD HAVE CONTINUED TO DEEPEN AND EXPAND DURING THE PUMP TEST

11) ANALYSIS OF THE PUMP TEST DATA RESULTED IN THE FOLLOWING RECOMMENDED DESIGN PARAMETERS:

TRANSMISSIVITY, T = 18,000 gpd/ft *

STORAGE COEFFICIENT, S = 0.0025 *

12) THE RFI AND SUBSEQUENT STUDIES HAVE CONFIRMED THAT HYDROGEOLOGIC CONDITIONS DEFINED BY THE PUMP TEST ARE RELATIVELY CONSTANT OVER THE PLUME AREA.

13) THE LEADING EDGE OF THE PLUME IS SEVERAL THOUSAND FEET FROM THE RECHARGE AREA, SO RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE DESIGN PARAMETERS USING NON-EQUILIBRIUM METHODS

* SEE ATTACHED CONCLUSIONS & CALCULATIONS FROM RFI ATTACHMENT 10

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Plant ______ Unit ______ Date 8/6 1996
Project No. ______ File No. ______ Verified By ______
Title ROI USING RFI Date ______ 19 ______

14) USING THE COOPER-JACOB APPROXIMATIONS OF THE THEIS NON-EQUILIBRIUM EQUATION, THE RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE FOLLOWING:

$$R_o = \sqrt{\frac{0.3\,T\,t}{S}}$$

WHERE R_o = RADIUS OF INFLUENCE (ft)
T = TRANSMISSIVITY (gpd/ft)
t = PUMPING DURATION (days)
S = STORAGE COEFFICIENT

15) SUBSTITUTING THE PUMP TEST VALUES INTO THE ABOVE EQUATION YIELDS

$$R_o = \sqrt{\frac{0.3\,(18{,}000\ \text{gpd/ft})(t)}{0.0025}}$$

$$R_o = 1469.7\sqrt{t}$$

WHEN t =	R_o =
1 day	1470 ft
2 days	2078 ft
7 days	3,888 ft
30 days	8,050 ft
365 days	28,078 ft

16) IN CONCLUSION, RADIUS OF INFLUENCE IS AT LEAST 600 FEET ON SITE (DUE TO CORRALES MAIN CANAL). OFF-SITE, RADIUS OF INFLUENCE WILL BE LARGER.

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steady solution. However equilibrium or steady-state conditions provide a higher level of confidence in analytical results.

10. As noted in the analysis section, there is considerable ambiguity as to whether the aquifer is unconfined, partially confined or confined. However, considering the saturated thickness of the aquifer (approximately 75 feet), relatively small drawdowns at the observation wells (1.5 feet to 6 feet), and the apparent equilibrium or steady-state conditions that developed during the pumping tests, there is no significant analytical difference between confined or unconfined conditions. Indeed analysis showed differences in the order of 5% in the calculation of transmissivity. However, the calculated storage coefficient values in the range of 0.002 to 0.003 indicate essentially confined conditions. In any case, the more critical parameter, radius of influence, is well documented and not dependent on aquifer confinement evaluation.

CONCLUSIONS AND RECOMMENDATIONS

Aquifer parameters for the lower flow zones obtained from current analysis of the 1984 pumping test data are adequate for the evaluation of various remedial alternatives to be included in the Corrective Measure Study (CMS). Although these aquifer parameters were developed from on-site pumping tests, geologic correlation off-site indicates general application to the entire plume area.

A radius of influence, R_o, of approximately 600 feet has been demonstrated by both analytical methods (see Figure 23) and remote observation points during actual pumping. This value should be used in future calculations of capture area, etc. The 600-ft radius of influence reflects steady-state or equilibrium conditions; i.e., it is not a time-dependent value. It should also be noted that this radius of influence will not be affected by pumping rate.

A transmissivity, T, of 18,000 gpd/ft has generally been calculated for the data base as a whole, with lesser values in the order of 12,000 to 14,000 gpd/ft considering only PW-1 data. For conservative design, a transmissivity of 18,000 gpd/ft is recommended.

Both the HLA Report and current analysis indicate a storage coefficient, S, value in the range of 0.002 to 0.003. Some individual analyses indicate a storage coefficient an order of magnitude less. However, considering that radius of influence is well defined, a storage coefficient of 0.0025 is recommended as a conservative measure.

Finally, it should be recognized in any pumping system design that the aquifer is significantly stratified with significant anisotropy. As a result, fully penetrating pumped wells with significant drawdowns could cause downward vertical movement of contaminants from near-water-surface (UFZ) high-constituent-concentration areas.

Analysis by Pierce L. Chandler, Jr., P.E.

HDR Engineering, Inc.

May 1, 1992

SAMPLE CALCULATIONS

I. LOWER FLOW ZONES

A. Steady radial flow without vertical movement

1. Using distance-drawdown data given on Figure 23, the Transmissivity, T, may be calculated from:

$$T = \frac{2.30\ Q}{2\pi\ \Delta s/\Delta \log_{10} r}$$

(Lohman, Eq 34, units of $L^2\ T^{-1}$)

with appropriate conversions for T expressed in gallons per day per foot, the equation becomes

$$T = \frac{528\ Q}{\Delta s/\Delta \log_{10} r}$$

where Q = 180 gallons per minute and

$\Delta s/\Delta \log_{10} r$ = 5.2 feet/cycle

T = 18277 gallons per day per foot

The Storage Coefficient, S, may be determined from the calculated T; the radial distance to zero drawdown, r_o = 600 feet extrapolated from the data in Figure 23; and, the nominal time to equilibrium, t_e, of 200 minutes (0.139 days) using:

$$S = 2.25\ T \left(\frac{t}{r^2}\right)_0 \qquad \text{(Lohman, Eq 59, Dimensionless)}$$

with appropriate conversion factors for T in gallons per day per foot

$$S = \frac{0.3\ T\ t_e}{r_0^2} = \frac{0.3\ (18277\ \text{gal/day/ft})\ (0.139\ \text{days})}{(600\ \text{ft})^2}$$

S = 0.0021

note that if $t_e \approx 300$ minutes

$S \cong 0.003$

2. Using data from MW-12 and MW-13, and assuming confined conditions, Transmissivity was checked using:

$$T = \frac{2.30\ Q \log_{10}(r_2/r_1)}{2\pi\ (s_1 - s_2)}$$ (Lohman, Eq 32, L^2T^{-1} units)

in typical units,

$$T = \frac{528\ Q \log_{10}(r_{MW\text{-}13}/r_{MW\text{-}12})}{s_{MW\text{-}12} - s_{MW\text{-}13}}$$

For Q = 180 gpm
$r_{MW\text{-}12}$ = 45 feet
$r_{MW\text{-}13}$ = 150 feet
$s_{MW\text{-}12}$ = 5.9 feet
and $s_{MW\text{-}13}$ = 3.1 feet,
the calculation of T is:

$$T = \frac{528\ (180\ \text{gpm})\ \log_{10}(150\ \text{ft}/45\ \text{ft})}{5.9\ \text{ft} - 3.1\ \text{ft}}$$

T = 17,748 gal/day/ft

3. Using the MW-12 and MW-13 data, but assuming unconfined conditions; a saturated thickness, b, equal to 75 feet; and the base of the aquifer at an elevation of 4900 feet, T may be calculated using:

$$K = \frac{2.30\ Q \log_{10}(r_2/r_1)}{\pi\ (h^2_2 - h^2_1)}$$ (Lohman, Eq 31, LT^{-1} units)

and $T = Kb$

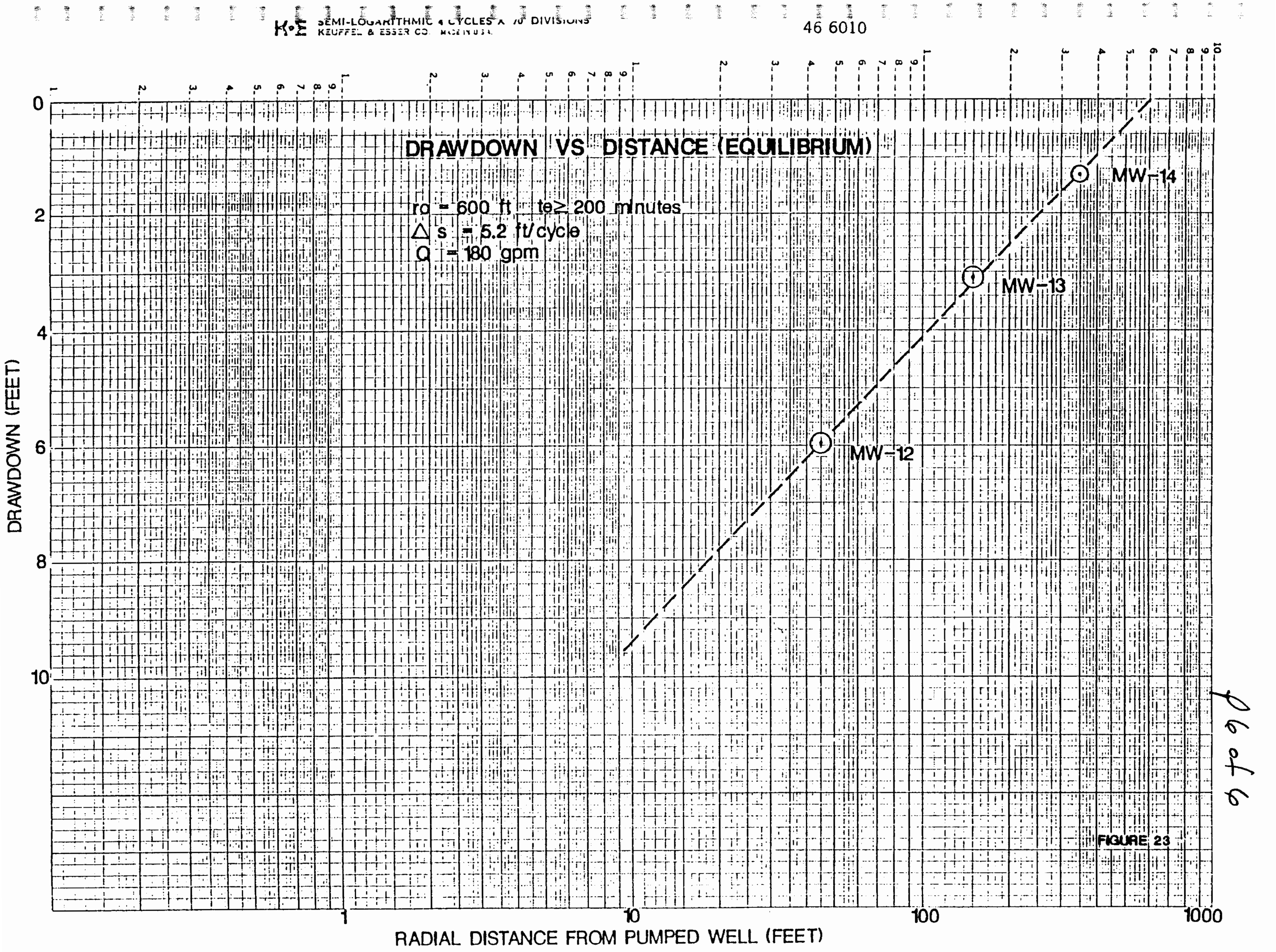
with appropriate conversion factors, the combined equation becomes:

$$T = \frac{1055\ b\ Q\ \log_{10}(r_{MW\text{-}13}/r_{MW\text{-}12})}{(h_{MW\text{-}13})^2 - (h_{MW\text{-}12})^2}$$

For Q = 180 gpm
b = 75 ft
$r_{MW\text{-}12}$ = 45 ft
$r_{MW\text{-}13}$ = 150 ft
$h_{MW\text{-}12}$ = 69.1 ft (75 ft - 5.9 ft)
$h_{MW\text{-}13}$ = 71.9 ft (75 ft - 3.1 ft)

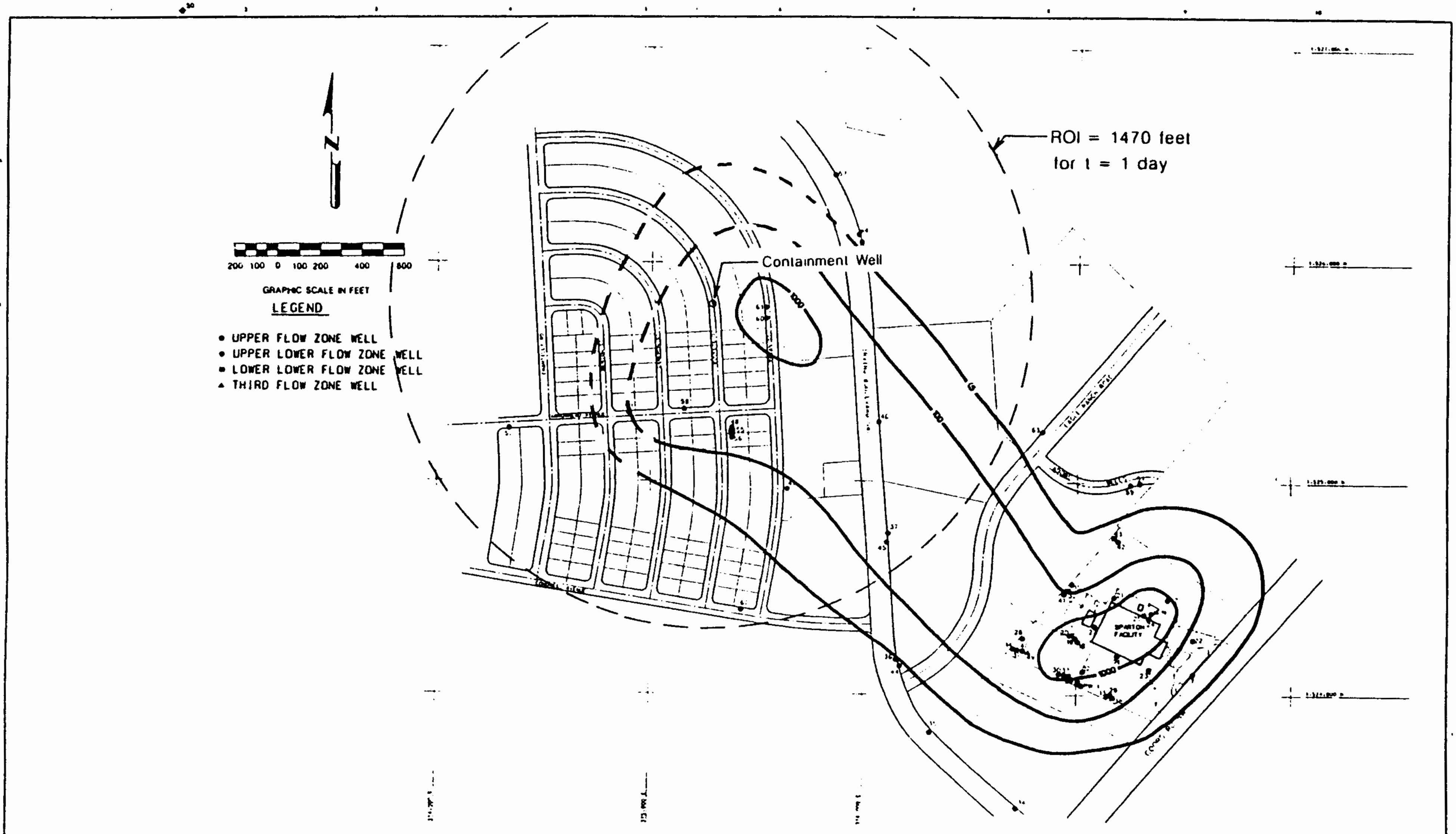
$$T = \frac{1055\ (75\ ft)\ (180\ gpm)\ \log_{10}(150\ ft/45\ ft)}{(71.9\ ft)^2 - (69.1\ ft)^2}$$

T = 18863 gal/day/ft



K•E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6010
DRAWDOWN VS DISTANCE (EQUILIBRIUM)
ro = 600 ft te≥ 200 minutes
Δ s = 5.2 ft/cycle
Q = 180 gpm
MW-14
MW-13
MW-12
DRAWDOWN (FEET)
RADIAL DISTANCE FROM PUMPED WELL (FEET)
0
2
4
6
8
10
1
10
100
1000
p 6 of 6

FIGURE 23



RADIUS OF INFLUENCE
Site Specific Parameters

FIGURE 12A

Black & Veatch
Engineers · Architects
Dallas, Texas

PROJECT NO 026602

UPPER FLOW ZONE
TCE CONTOURS - 1996 DATA

CONTRACT NO

SHEET NO

(N)

BLACK & VEATCH

Owner SPARTON TECHNOLOGY Computed By PLC (3)
Plant COORS ROAD Unit ______ Date 8/6 1996
Project No. 026602.0100 File No. ______ Verified By ______
Title RADIUS OF INFLUENCE USING 1995 USGS MODEL VALUES Date ______ 19 ___
Page 1 of 1

1) THE 1995 U.S.G.S. ALBUQUERQUE BASIN MODEL COVERS THE UPPER 1730 FEET OF THE SANTA FE GROUP AQUIFER SYSTEM USING ELEVEN LAYERS.

2) IN THE SPARTON AREA, HORIZONTAL HYDRAULIC CONDUCTIVITY, K, OF 15 FEET/DAY IS USED IN THE FIRST EIGHT MODEL LAYERS (580 TOTAL FEET) WITH ISOLATED POCKETS OF UP TO 25 FEET/DAY (SEE PAGES 26-33, USGS 1995)

3) STORAGE COEFFICIENTS IN THE MODEL WERE ESTIMATED USING A SPECIFIC STORAGE OF 2×10^{-6} PER FOOT BASED ON LOHMAN (USGS 1979)

4) RADIUS OF INFLUENCE CAN BE CALCULATED FROM THE ABOVE VALUES USING THE RELATIONSHIP:

$$R_o = \sqrt{\frac{2.25\,Tt}{S}}$$

AND REMEMBERING $T = Kb$ AND $S = S_s b$

5) SUBSTITUTING THE USGS MODEL VALUES

$$R_o = \sqrt{\frac{2.25\,(15\text{ Feet/Day})\,(\cancel{b})\,(t)}{(2\times10^{-6}/\text{Foot})\,(\cancel{b})}}$$

$$R_o = 4108\sqrt{t}$$

WHEN

$t = 1$ day	$R_o = 4108$ feet
$t = 2$ days	$R_o = 5810$ feet
$t = 7$ days	$R_o = 10{,}869$ feet
$t = 30$ days	$R_o = 22{,}500$ feet
$t = 365$ days	$R_o = 78{,}483$ feet

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Owner SPARTON TECHNOLOGY Computed By DLC
Plant COORS ROAD Unit ______ Date 8/6 19 96
Project No. 026602.0100 File No. ______ Verified By ______
Title RADIUS OF INFLUENCE Date ______ 19 ____
INTEL WELL DEMONSTRATION

1) THE IMPACT OF THE INTEL PRODUCTION WELLS ON THE AQUIFER IS MONITORED BY A NETWORK OF 3 CLUSTER WELLS (15 TOTAL WELLS) AND 15 DOMESTIC WELLS. SEE FIGURE 1 FOR LOCATION (JOHN SHOMAKER & ASSOC, MARCH 1996)

2) INTEL HAS BEEN PUMPING FROM THE THREE PRODUCTION WELLS ON A SUSTAINED BASIS SINCE EARLY SEPTEMBER 1995. COMBINED PUMPING RATE IS APPROXIMATELY 3 MGD (2080 GPM) – PRIMARILY FROM WELLS 2 AND 3. SEE FIGURE 40 (SHOMAKER, 1996)

3) PRODUCTION WELLS ARE SCREENED FROM 730 TO 2000 FEET BGS (CORRESPONDS TO USGS 1995 BASIN MODEL LAYERS 8 to 11)

4) ALL THREE CLUSTER WELL LOCATIONS SHOW INFLUENCE OF PUMPING. SEE FIGURES 22 – 24 (SHOMAKER, 1996). NOTE THAT CLUSTER B IS OVER 4000 FOOT DISTANT AND CLUSTER C IS OVER 8000-FOOT DISTANT.

5) INTEL HYDROGEOLOGIC CONDITIONS ARE MODELLED SIMILARLY TO SPARTON (USGS 1995)

6) RADIUS OF INFLUENCE IS MUCH LARGER THAN 8,000 FEET

ENCLOSURES

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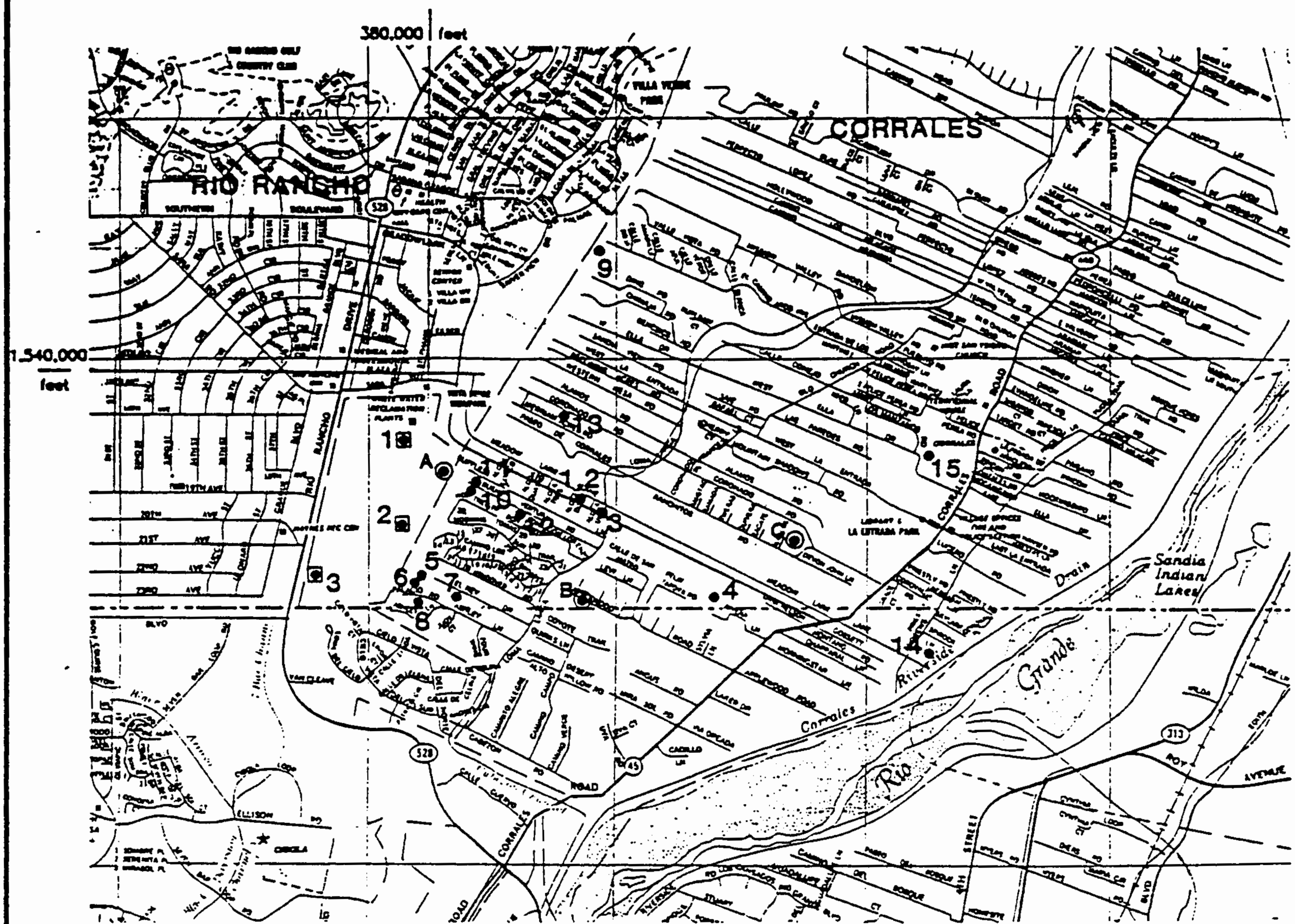


Explanation

Intel production well location

1. Intel Production Well No. 1
2. Intel Production Well No. 2
3. Intel Production Well No. 3

• domestic monitor well

1. Betsill
2. Betsill
3. Hutchinson
4. Campbell
5. Tice
6. Sheppard
7. King
8. Passage
9. Goering
10. Walker
11. Corrales
12. Rockwell
13. Swanson
14. Joseph
15. Allen

Intel monitor wells site

A. Intel monitor wells A1, A2, A3, A4, A5, A6
B. Intel monitor wells B1, B2, B3
C. Intel monitor wells C1, C2, C3, C4, C5, C6

N

0 .5 1 mile

Figure 1. Map showing locations of Intel production wells, Intel monitor wells, and domestic monitor wells.

Total daily pumping

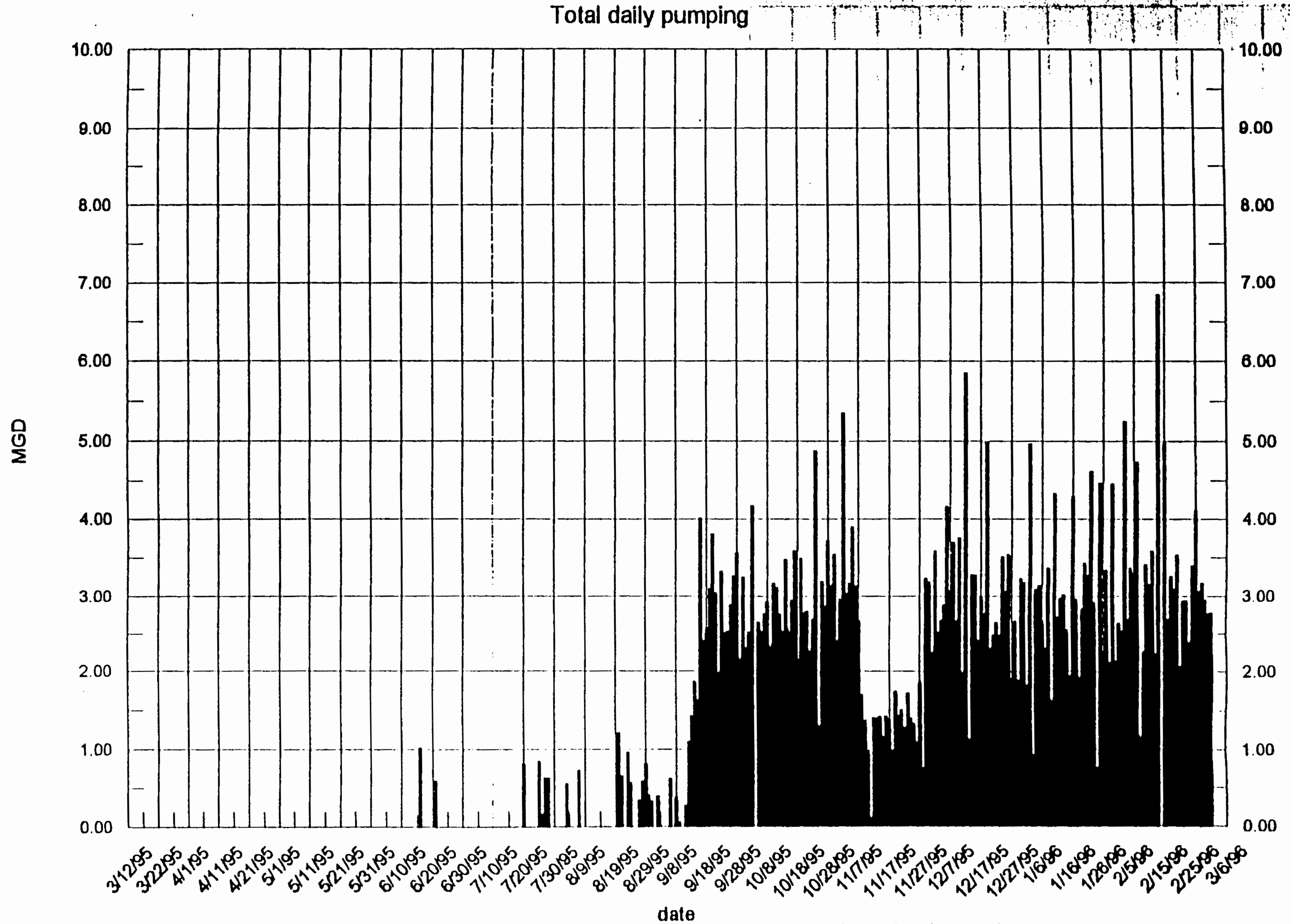


Figure 40. Total water pumped daily from the Intel production wells.

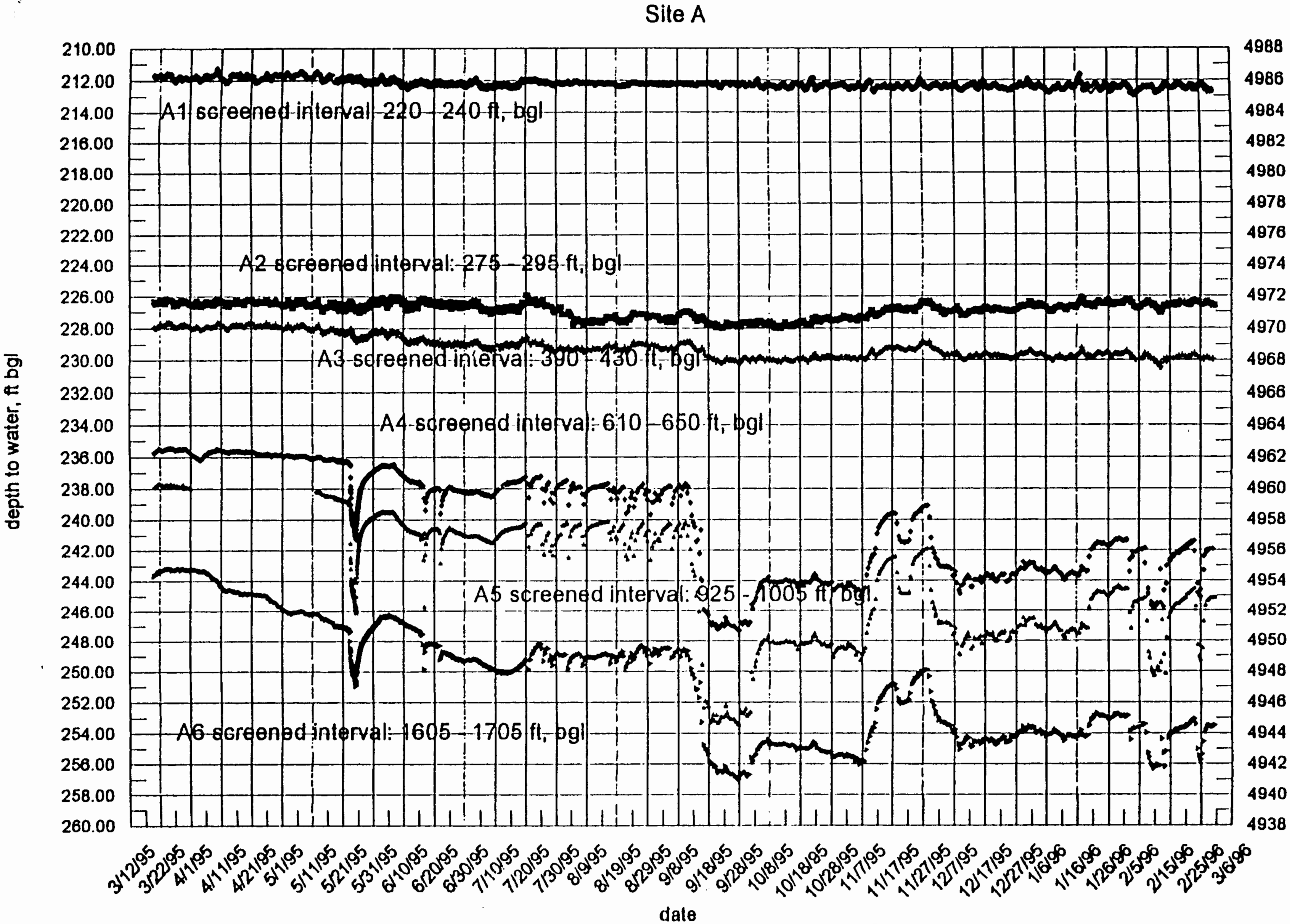


Figure 22. Hydrograph of Intel Monitor Wells, Site A.

p4 of 6

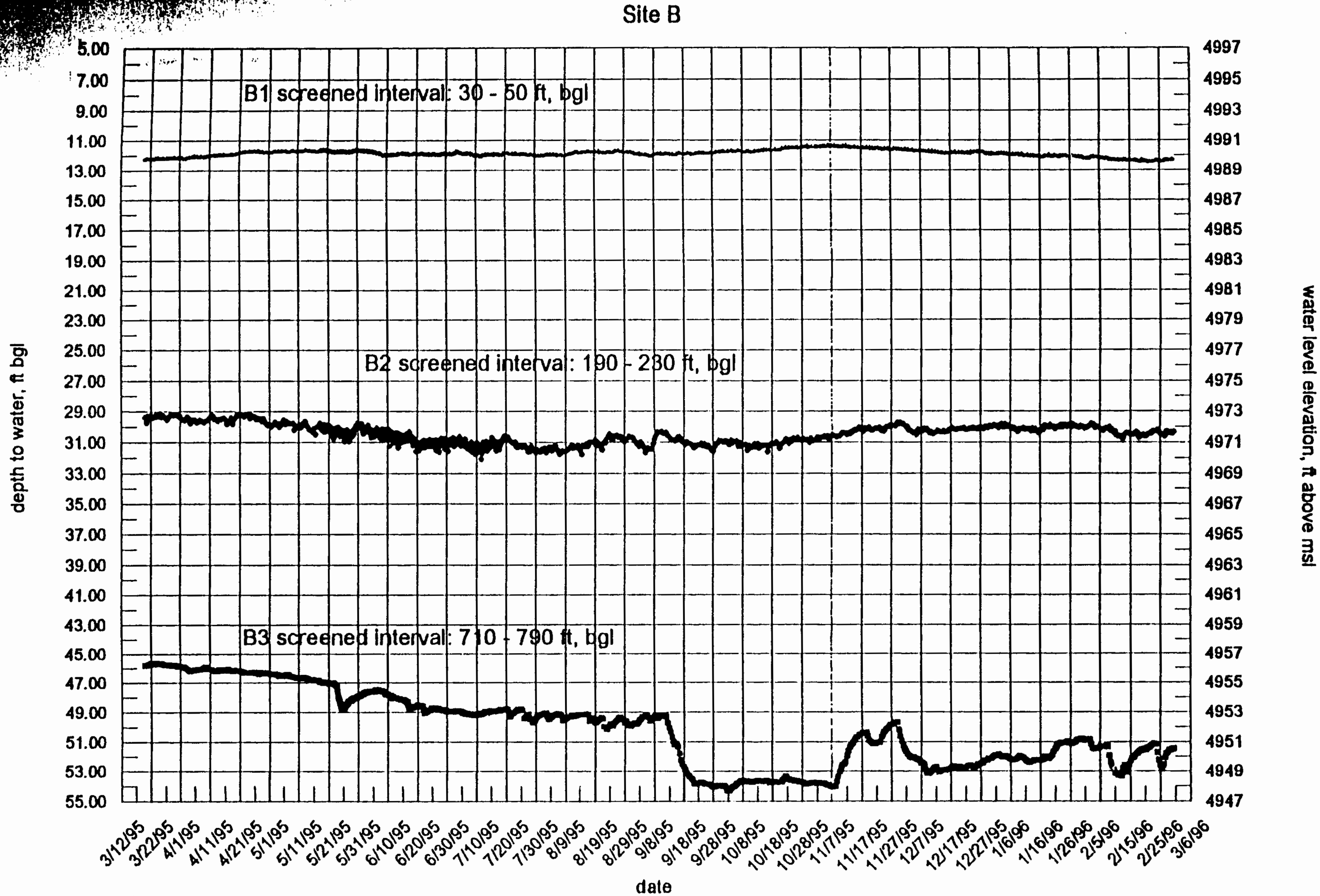


Figure 23. Hydrograph of Intel Monitor Wells, Site B.

P5 of 6

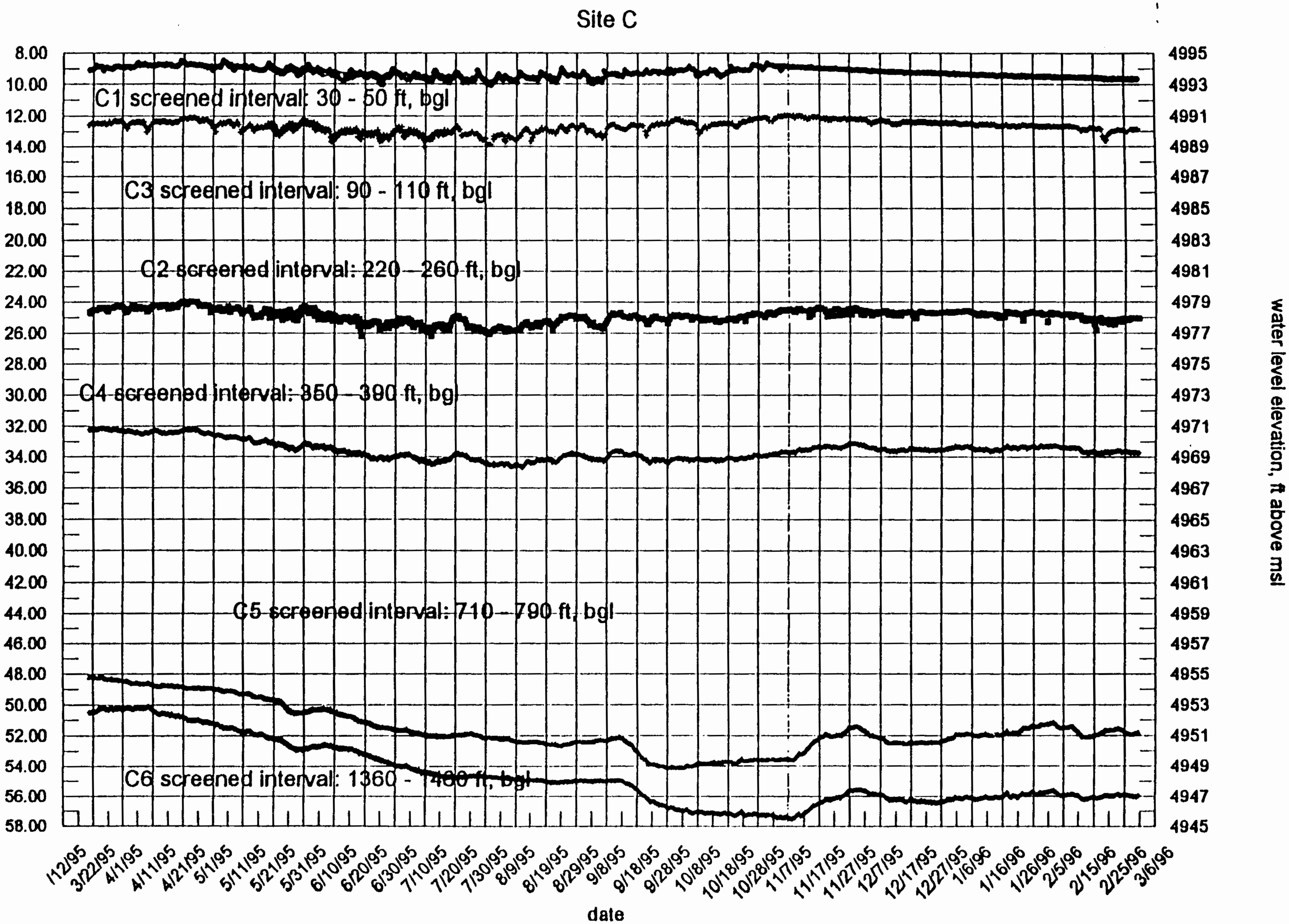


Figure 24. Hydrograph of Intel Monitor Wells, Site C.

page 36

SPARTON TECHNOLOGY, INC.

Coors Road Facility
Capture Zone Definition

Definition for the Edge of Capture Zone	Stagnation Point	Maximum width of capture Zone *
x=(-y)/[tan(2*PI*K*b*i*y/Q)] - in radians	x(0) = -Q/(2*PI*K*b*i)	y(max) = (+/-)Q/(2*K*b*i)

x = distance from pumping well (feet) - parallel to flow
y = distance from pumping well (feet) - perpendicular to flow
PI = 3.141593
K = hydraulic conductivity (feet / minute)
b = initial saturated thickness of aquifer (feet)
i = hydraulic gradient of flow field in absence of pumping (feet / feet)
Q = pumping rate (cubic feet / minute)
T = K*b = Transmissivity (square feet / minute)

Solve for Q = 10,20,50,100,200 gallons per minute
K*b = 12,000 - 18,000 gallons per day per foot (From RFI/CMS Reports)
i = 0.002 feet / feet (third Quarter 1996 water level data)

		K*b (gpd/ft) =		12,000	K*b (gpd/ft) =		15,000	K*b (gpd/ft) =		18,000
		K*b (SF/min) =		1.114	K*b (SF/min) =		1.392	K*b (SF/min) =		1.671
Q		x(0)	y(max)	y@x=0	x(0)	y(max)	y@x=0	x(0)	y(max)	y@x=0
GPM	CF/min		+/-							
10	1.34	(95.49)	300	150	(76.39)	240	120	(63.66)	200	100
20	2.67	(190.99)	600	300	(152.79)	480	240	(127.32)	400	200
50	6.68	(477.46)	1,500	750	(381.97)	1,200	600	(318.31)	1,000	500
100	13.37	(954.93)	3,000	1,500	(763.94)	2,400	1,200	(636.62)	2,000	1,000
200	26.73	(1,909.86)	6,000	3,000	(1,527.89)	4,800	2,400	(1,273.24)	4,000	2,000

Calculate edge of Capture Zone

K*b =	12,000	gpd/ft =	1.114	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(95.49)	1	(190.98)	1	(477.46)	1	(954.93)	1	(1,909.86)
	10	(95.14)	50	(186.60)	200	(449.21)	250	(933.01)	1,000	(1,732.05)
	100	(57.74)	100	(173.21)	400	(360.16)	500	(866.03)	2,000	(1,154.70)
	150	0.00	200	(115.47)	600	(194.95)	1,000	(577.35)	2,500	(669.87)
	200	115.47	300	0.00	750	0.00	1,500	0.00	3,000	0.00
	300	3E+06	400	230.94	800	84.08	2,000	1,154.70	4,000	2,309.40
			500	866.03	1,000	577.35	2,500	4,330.13	5,000	8,660.25
			600	1E+07	1,500	7E+07	3,000	3E+08	6,000	1E+09

K*b =	15,000	gpd/ft =	1.392	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(76.39)	1	(152.79)	1	(381.97)	1	(763.94)	1	(1,527.89)
	10	(75.96)	50	(147.30)	200	(346.41)	250	(736.48)	1,000	(1,303.23)
	100	(26.79)	100	(130.32)	400	(230.94)	500	(651.61)	2,000	(535.90)
	120	0.00	200	(53.59)	600	0.00	1,000	(267.95)	2,400	0.00
	200	346.41	240	0.00	750	310.66	1,200	0.00	3,000	1,242.64
	240	2E+06	400	692.82	800	461.88	1,600	923.76	3,500	3,069.42
			450	2,262.30	1,000	1,732.05	2,000	3,464.10	4,000	6,928.20
			480	7E+06	1,200	5E+08	2,400	2E+08	4,800	7E+08

K*b =	18,000	gpd/ft =	1.671	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(63.66)	1	(127.32)	1	(318.31)	1	(636.62)	1	(1,273.24)
	10	(63.14)	50	(120.71)	200	(275.28)	250	(603.55)	500	(1,207.11)
	50	(50.00)	100	(100.00)	400	(129.97)	500	(500.00)	1,000	(1,000.00)
	100	0.00	200	0.00	500	0.00	1,000	0.00	2,000	0.00
	150	150.00	300	300.00	600	194.95	1,250	517.77	2,500	1,035.53
	200	9E+20	400	2E+21	800	1,101.11	1,500	1,500.00	3,000	3,000.00
					900	3E+03	1,600	2E+03	3,500	8,449.75
					1,000	5E+21	2000	9E+21	4,000	2E+22

* C.W. Fetter, Applied Hydrogeology, pp 501 - 504, 1994.

Attachment 1 To Capture Zone Definition
p1 of 3

SPARTON TECHNOLOGY, INC.
Offsite Monitoring Well Water Level Elevations
08/02/96

MPE = Measuring Point Elevation in feet above sea level.

SR = Sounder Reading in feet.

WLE = Water Level Elevation in feet above sea level. MPE-SR=WLE.

Well No.	MPE(ft)	SR(ft)	WLE(ft.)	Date	
PZ-1	5142.22	183.75	4958.47	07/23/96	
MW-34	5034.49	58.85	4975.64	07/23/96	
MW-35	5042.50	69.70	4972.80	07/23/96	*3
MW-36					*1
MW-37					*1
MW-44	5058.75	87.43	4971.32	07/23/96	
MW-45	5089.65	120.00	4969.65	07/23/96	
MW-46	5118.98	150.46	4968.52	07/16/96	
MW-47	5155.83	187.59	4968.24	07/15/96	
MW-48	5168.31	200.79	4967.52	07/15/96	
MW-50	5211.21	249.81	4961.40	07/23/96	
MW-52	5156.79	191.70	4965.09	07/15/96	*2
MW-53	5164.24	197.48	4966.76	07/15/96	
MW-54	5097.64	130.47	4967.17	07/23/96	
MW-55	5168.61	201.79	4966.82	07/15/96	
MW-56	5168.61	201.13	4967.48	07/15/96	
MW-57	5103.54	136.78	4966.76	07/16/96	
MW-58	5168.89	201.71	4967.18	07/15/96	
MW-59	5059.18	88.55	4970.63	07/23/96	
MW-60	5134.87	167.71	4967.16	07/15/96	*2
MW-61	5135.23	168.05	4967.18	07/15/96	*2
MW-62					*1
MW-63	5065.74	90.05	4975.69	07/24/96	*3
MW-64	5097.84	130.56	4967.28	07/15/96	
MW-65	5156.45	191.60	4964.85	07/18/96	
MW-66	5103.03	137.21	4965.82	07/18/96	
MW-67	5169.21	209.11	4960.10	07/18/96	
MW-68	5165.53	201.11	4964.42	07/26/96	
MW-69	5165.46	201.15	4964.31	07/26/96	
MW-65	5156.45	191.48	4964.97	08/02/96	
MW-66	5103.03	137.28	4965.75	08/02/96	
MW-67	5169.21	209.08	4960.13	08/02/96	
MW-68	5165.53	201.11	4964.42	08/02/96	
MW-69	5165.46	201.12	4964.34	08/02/96	

*1 Airlines were installed in MW-36, 37 and 62 on 9-15-95 see AR report for WLE.

*2 New surveyed MPE for MW-52 5156.79 survey date = 6-10-96.

*3 WLE below top of pump, pull pump, SR taken next day.

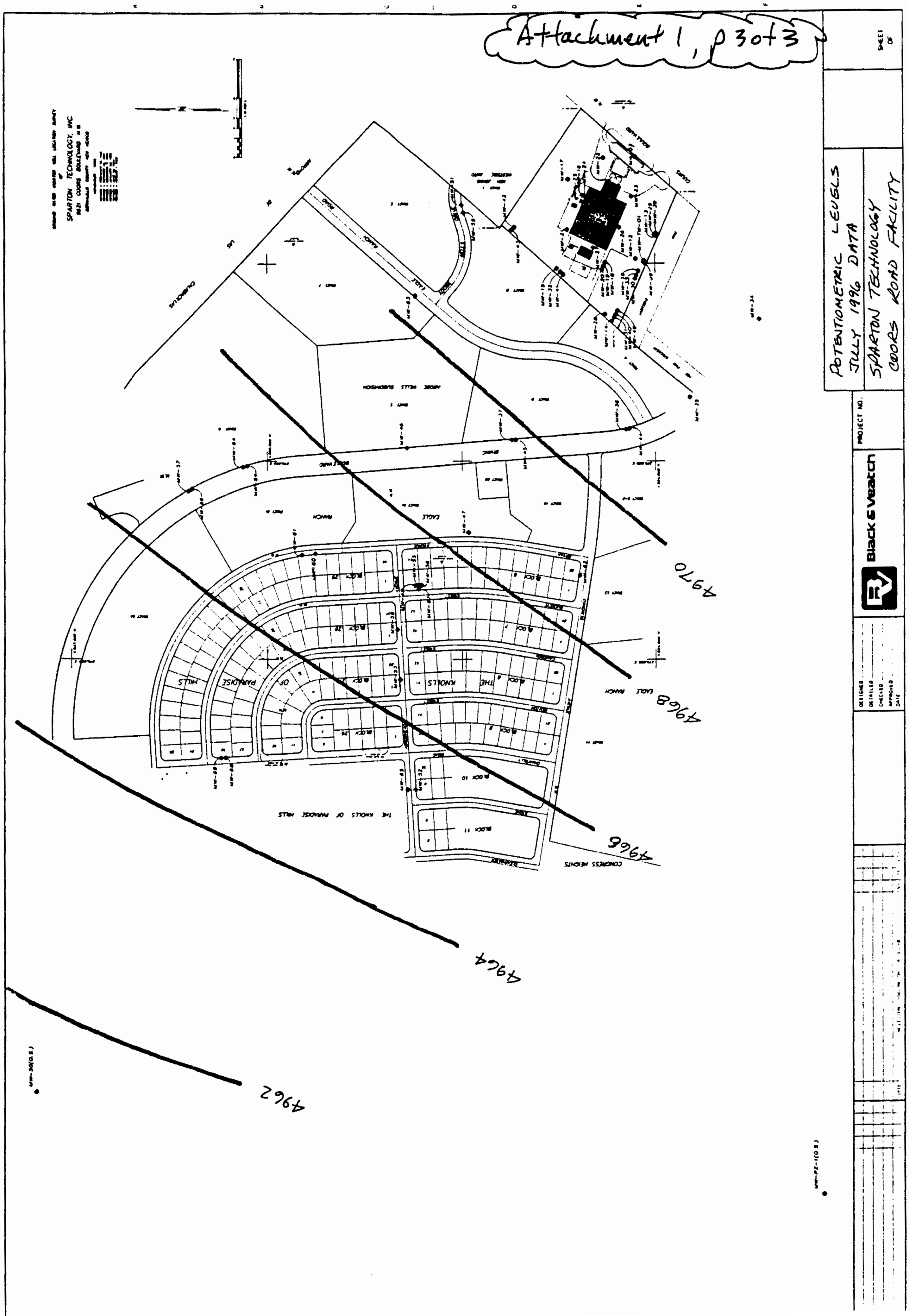
Attachment 1
p 2 of 3

SPARTON TECHNOLOGY, INC.
Onsite Monitoring Well Water Level Elevations
08/01/96

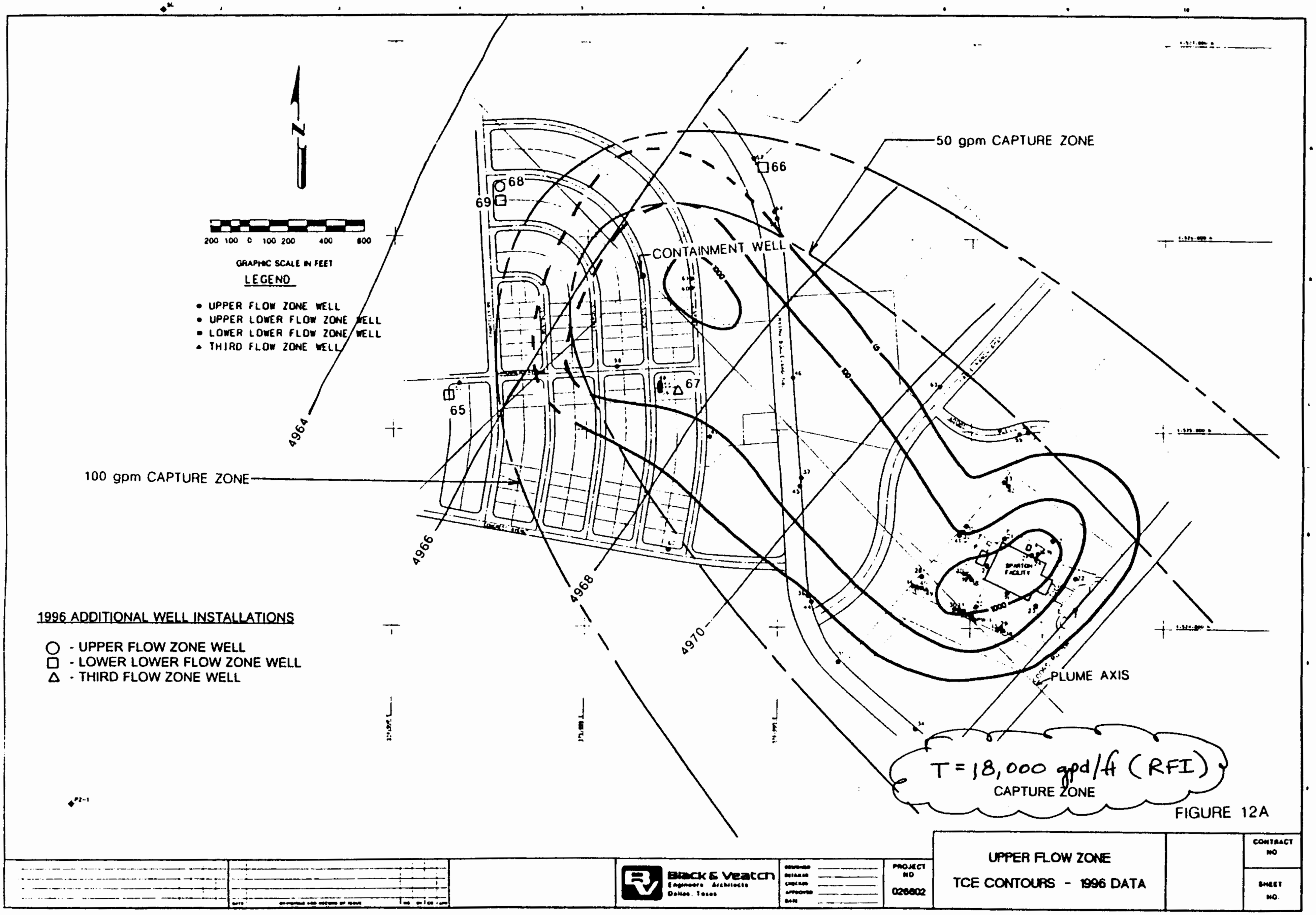
AE = Airline Elevation in feet above sea level.
AR = Airline Reading in inches of water
WLE = Water Level Elevation in feet above sea level. AE+AR/12=WLE.

Well No.	AE (ft)	AR (in)	WLE (ft.)	Date
MW-7	4973.07	67	4978.65	07/23/96
MW-9	4969.41	60	4974.41	07/17/96
MW-12	4968.17	71	4974.09	07/23/96
MW-13	4972.09	46	4975.92	07/23/96
MW-14	4970.39	27	4972.64	07/17/96
MW-15	4974.27	dry	dry	07/17/96
MW-16	4977.28	26	4979.45	07/17/96
MW-17	4978.36	13	4979.44	07/23/96
MW-19	4968.66	54	4973.16	07/17/96
MW-20	4968.07	56	4972.74	07/17/96
MW-21	4978.01	14	4979.18	07/17/96
MW-22	4975.64	41	4979.06	07/17/96
MW-29	4970.24	56	4974.91	07/23/96
MW-30	4968.89	56	4973.56	07/23/96
MW-31	4967.81	57	4972.56	07/23/96
MW-32	4968.54	46	4972.37	07/16/96
MW-33	4972.36	17	4973.78	07/23/96
MW-38	4969.14	68	4974.81	07/23/96
MW-39	4968.97	57	4973.72	07/23/96
MW-40	4968.43	51	4972.68	07/23/96
MW-41	4968.46	47	4972.38	07/23/96
MW-42	4970.34	19	4971.92	07/16/96
MW-43	4970.48	17	4971.90	07/16/96
MW-49	4967.66	55	4972.24	07/16/96
MW-36 OS	4969.19	27	4971.44	07/16/96
MW-37 OS	4967.57	27	4969.82	07/16/96
MW-51 OS	4977.04	44	4980.71	07/16/96
MW-62 OS	4966.94	27	4969.19	07/16/96
Recovery Wells *1				
PW-1	4964.71	7	4965.29	07/23/96
MW-18	4968.07	15	4969.32	07/23/96
MW-23	4973.42	30	4975.92	07/23/96
MW-24	4974.89	10	4975.72	07/23/96
MW-25	4976.06	19	4977.64	07/23/96
MW-26	4965.88	13	4966.96	07/23/96
MW-27	4972.23	13	4973.31	07/23/96
MW-28	4971.62	12	4972.62	07/23/96

*1. AE on Recovery Wells needs recalibration
OS = Offsite



Attachment 1, p 3 of 3
POTENTIOMETRIC LEVELS
JULY 1996 DATA
SPARTON TECHNOLOGY
COORS ROAD FACILITY
Black & Veatch
PROJECT NO.
SPARTON TECHNOLOGY, INC.
4970
4968
4966
4964
4962
THE KNOLLS OF PARADISE HILLS
ABOBE WELLS SUBDIVISION
EAGLE RANCH ROAD
CONGRESS HEIGHTS


50 gpm CAPTURE ZONE
CONTAINMENT WELL
100 gpm CAPTURE ZONE
PLUME AXIS
CAPTURE ZONE
4964
4966
4968
4970
1000
100
10
65
66
67
68
69
GRAPHIC SCALE IN FEET
200 100 0 100 200 400 600
LEGEND
• UPPER FLOW ZONE WELL
• UPPER LOWER FLOW ZONE WELL
• LOWER LOWER FLOW ZONE WELL
▲ THIRD FLOW ZONE WELL
1996 ADDITIONAL WELL INSTALLATIONS
○ - UPPER FLOW ZONE WELL
□ - LOWER LOWER FLOW ZONE WELL
Δ - THIRD FLOW ZONE WELL
SPARTON FACILITY
T = 18,000 gpd/ft (RFI)
FIGURE 12A
Black & Veatch
Engineers · Architects
Dallas, Texas
PROJECT NO
026602
UPPER FLOW ZONE
TCE CONTOURS - 1996 DATA
CONTRACT NO
SHEET NO.

6

SPARTON TECHNOLOGY, INC.
Coors Road Facility
Capture Zone Definition - USGS Conditions

Definition for the Edge of Capture Zone	Stagnation Point	Maximum width of capture Zone
x=(-y)/[tan(2*PI*K*b*i*y/Q)] - in radians	x(0) = -Q/(2*PI*K*b*i)	y(max) = (+/-)Q/(2*K*b*i)

x = distance from pumping well (feet) - parallel to flow
y = distance from pumping well (feet) - perpendicular to flow
PI = 3.141593
K = hydraulic conductivity (feet / minute)
b = initial saturated thickness of aquifer (feet)
i = hydraulic gradient of flow field in absence of pumping (feet / feet)
Q = pumping rate (cubic feet / minute)
T = K*b = Transmissivity (square feet / minute)

K =	15	feet per day - per USGS
b =	75	feet - per approved RFI
T = K*b =	8,416	gallons per day per foot

Solve for Q = 10,20,50,100,200 gallons per minute

i = 0.002 feet / feet (third Quarter 1996 water level data)

Q		K*b (gpd/ft) =		8,416
		K*b (SF/min) =		0.781
		x(0)	y(max)	y@x=0
GPM	CF/min		+/-	
10	1.34	(136.16)	428	214
20	2.67	(272.31)	856	428
50	6.68	(680.79)	2,139	1,070
100	13.37	(1,361.57)	4,278	2,139
200	26.73	(2,723.14)	8,555	4,278

Calculate edge of Capture Zone

K*b =	8,416	gpd/ft =	0.781	SF/min						
	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min	GPM	CF/min
Q =	10	1.34	20	2.67	50	6.68	100	13.37	200	26.73
	Y	X	Y	X	Y	X	Y	X	Y	X
	1	(136.15)	1	(272.31)	1	(680.79)	1	(1,361.57)	1	(2,723.14)
	100	(110.75)	100	(259.96)	400	(600.58)	600	(1,272.28)	1,000	(2,599.62)
	150	(76.03)	200	(221.49)	800	(334.17)	1,200	(989.32)	2,500	(1,911.34)
	200	(20.45)	300	(152.06)	1,000	(102.26)	2,000	(204.52)	3,500	(1,027.38)
	214	0.20	400	(40.90)	1,070	0.20	2,139	0.39	4,000	(409.04)
	250	7E+01	428	(0.39)	1,250	339.65	2,500	679.31	4,278	(0.00)
	300	2E+02	500	135.86	1,500	1,099.52	3,000	2,199.04	4,500	368.50
	350	5E+02	600	4E+02	2,100	4E+04	4,000	2E+04	6,000	4E+03

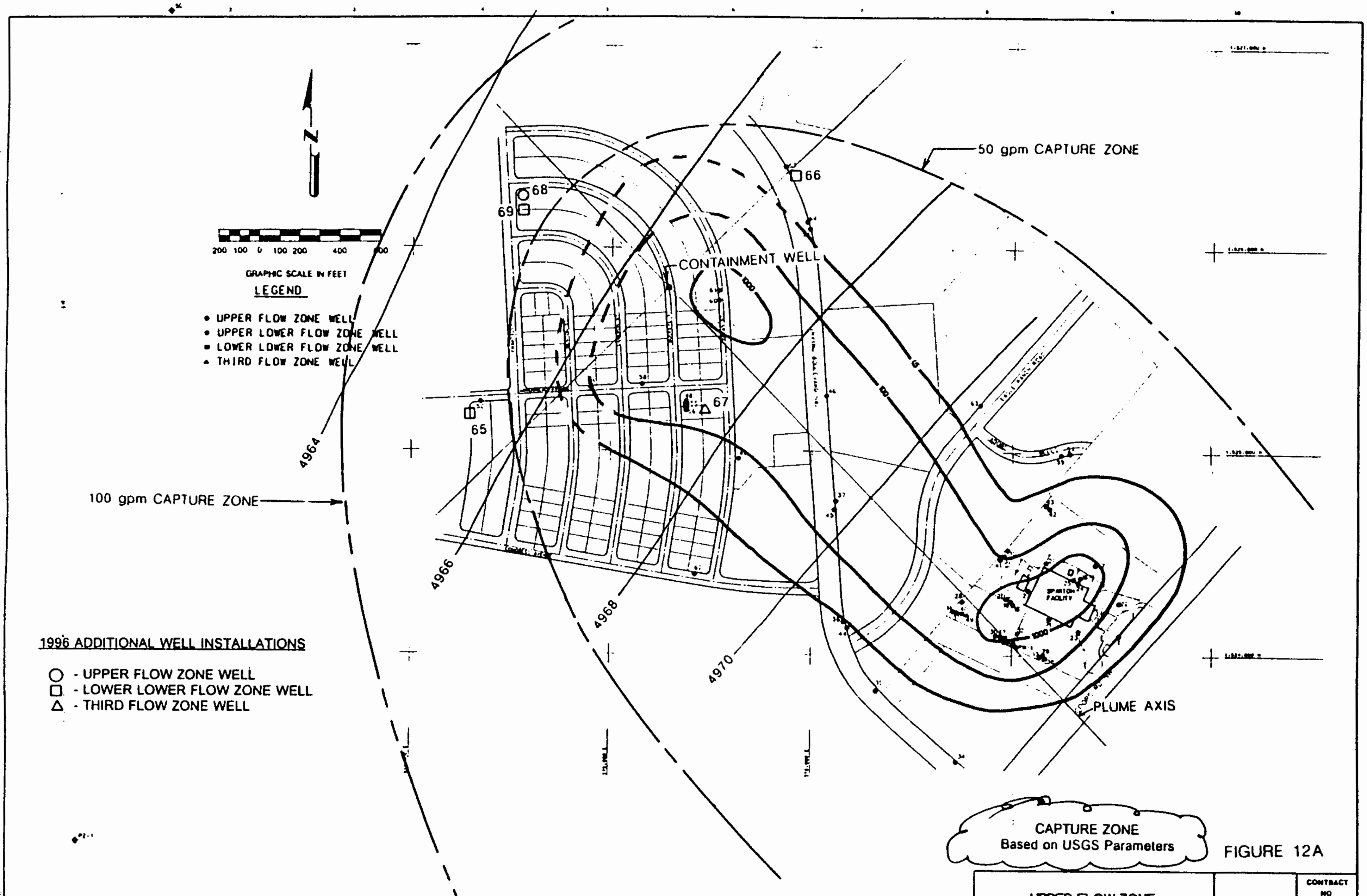


FIGURE 12A

Black & Veatch
Engineers Architects
Dallas, Texas

PROJECT NO 026602

UPPER FLOW ZONE
TCE CONTOURS - 1996 DATA

CONTRACT NO

SHEET NO

08