Addendum No. 1
Technical Memorandum
Remedial Design Sampling Activities

Ace Services
Colby, Kansas

December 21, 2000

Prepared for:
USEPA Region VII

7625

Prepared by:
Black & Veatch Special Projects Corp.

EPA Contract No.: 68-W5-0004
EPA Work Assignment Number: 039-RDRD-07GE
BVSPC Project No.: 46118

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1.0 Introduction

The U.S. Environmental Protection Agency (USEPA) has initiated remedial design (RD) efforts for groundwater contamination at the Ace Services site near Colby, Kansas. The RD process is the methodology that the Superfund program has established for remediating risks posed by uncontrolled hazardous waste sites. Documents detailing the methodology for preliminary RD activities at the Ace Services site consist of a work plan (WP) (BVSPC, 1999a and 1999f), a field sampling plan (FSP) (BVSPC, 1999b and 2000a), a site management plan (SMP) (BVSPC, 1999e), a quality assurance project plan (QAPP) (BVSPC, 1999c and 2000b), and a health and safety plan (HSP) (BVSPC, 1999d and 2000c).

This Addendum No. 1 to the RD sampling activities technical memorandum presents a description of field activities performed in July, August, and September 2000, as preliminary RD activities at the Ace Services site. It describes the following items:

- Installation and development of groundwater extraction and observation wells.
- Survey of newly installed extraction and observation wells.
- Analytical results of existing groundwater monitoring wells, recovery wells, water supply wells, and residential wells (September 2000).
- Description of the sampling methodologies for the various media.
- Procedures for managing derived wastes.
- Nature and extent of groundwater contamination.
- Pump test results of contaminated aquifer zones.
- Groundwater flow modeling results and extraction well field design.

The previous RD sampling activities technical memorandum (BVSPC, 2000d) presents a description of activities performed in October 1999 (Phase 1) and February 2000 (Phase 2) and should be referred to for supplemental information. Comments provided by EPA and KDHE were incorporated into the document and are included in Appendix J. The previous RD Sampling Activities Technical Memorandum describes the following items:

- Installation, development, and sampling of new groundwater wells.
- Analytical results of existing groundwater monitoring wells, recovery wells, water supply wells, and residential wells (October 1999 and February 2000).
- Descriptions of the sampling methodologies for the various media.
- Procedures for managing derived wastes.
- Evaluation of subsurface soils in historical lagoon area.
- Nature and extent of groundwater contamination.

- Survey of new monitoring wells.

1.1 Site Location and History

The Ace Services site is located near the east edge of Colby, Kansas, at 345 Convesse Street in Thomas County. The geographic coordinates for the site are approximately 100°02'10" West Longitude and 39° 23' 47" North Latitude. The site lies in the southeast quarter of Section 31, Township 7 South, Range 33 West. The facility is next to the Thomas County Mental Health Center and a hardware store. The Thomas County courthouse is approximately 2-1/2 blocks west of the site. The surrounding property is primarily light industrial and commercial, although there are some residential properties within 2 blocks of the site. A railroad right-of-way, aligned north-south, is approximately 1 block west of the site.

Northwest Manufacturing Company operated a chromium plating facility at the site from 1954 to 1969, when Ace Services was formed and began operating an electroplating facility. Ace Services operated the facility until 1989 when it forfeited its corporate status and abandoned the facility.

1.2 Purpose and Scope

The purpose and scope of this report is to describe the results of the preliminary RD investigation activities and describe revised proposed activities based on the results.

2.0 Investigation Objectives

The objective of the preliminary RD sampling efforts was to complete characterization of the chromium groundwater plume and complete characterization of aquifer characteristics. The data acquired during the preliminary RD activities will be used for design of groundwater remediation systems. The scope of the preliminary RD activities included:

- Installing and sampling new monitoring wells.
- Sampling existing monitoring wells.
- Sampling existing recovery and water supply wells.
- Sampling residential wells.
- Installing groundwater extraction and observation wells.
- Evaluation of subsurface soils in historical lagoon area.
- Survey of newly installed groundwater monitoring wells.
- Performing pumping tests of contaminated aquifer zones and measuring groundwater levels.
- Collecting subsurface soil samples for geotechnical evaluation.
- Performing a ground survey to develop a base map for design drawings.

The objectives identified above have been completed at the time of this memorandum except for the objectives listed below:

- Installing and sampling monitoring wells.
- Collecting subsurface soil samples for geotechnical evaluation.
- Performing a ground survey to develop a base map for design drawings.

Two additional groundwater monitoring well nests consisting of shallow and intermediate depth wells are to be installed south of the railroad tracks near monitoring well nests MW-11 and MW-12. Final locations of the wells will be controlled by property access restrictions and technical adequacy.

Additional subsurface soil samples may need to be collected and evaluated for geotechnical properties. The existing onsite machine shop is to be used to house the treatment system, therefore, a separate building will not be constructed. However, geotechnical information concerning the site may be needed for other structures.

The ground survey for the base map will be performed after property access has been granted by all required property owners. The base map will be provided under separate cover.

3.0 Investigation Activities

Field investigation activities for the preliminary RD efforts are discussed in this section. The following subtasks are discussed:

- Well Installation.
- Groundwater Sampling Locations and Analyses.
- Groundwater Sampling Procedures.
- Decontamination Procedures.
- Treatability Study Groundwater Sampling.
- Aquifer Pump Test.
- Numerical Computer Modeling of Groundwater Flow.

A site map illustrating the locations of all wells is presented as Figure 3-1. Final well locations were agreed to by EPA, KDHE, and the City of Colby.

The RD investigation activities discussed in this memorandum were conducted in July, August, and September 2000. Well nests EX-2, OB-1, and OB-2 were installed and developed during July 10, 2000 to July 19, 2000. Pump tests for the shallow, intermediate, and deep aquifer zones were conducted from July 31, 2000 to August 10, 2000. Groundwater sampling activities were conducted from September 18, 2000 to September 22, 2000.

3.1 Well Installation

The groundwater well construction details are described in this section. The drilling and well installation was conducted by Woofter Pump and Well, Inc., of Hoxie, Kansas, a drilling subcontractor licensed in the State of Kansas. The wells installed as part of the Phase 2 remedial design sampling activities are listed in Table 3-1. At all times during the progress of the work, precautions were used to prevent tampering with the well or the entrance of foreign material into the well. Runoff was prevented from entering the well during construction. The completed wells have a sanitary seal to prevent material from entering the wells.

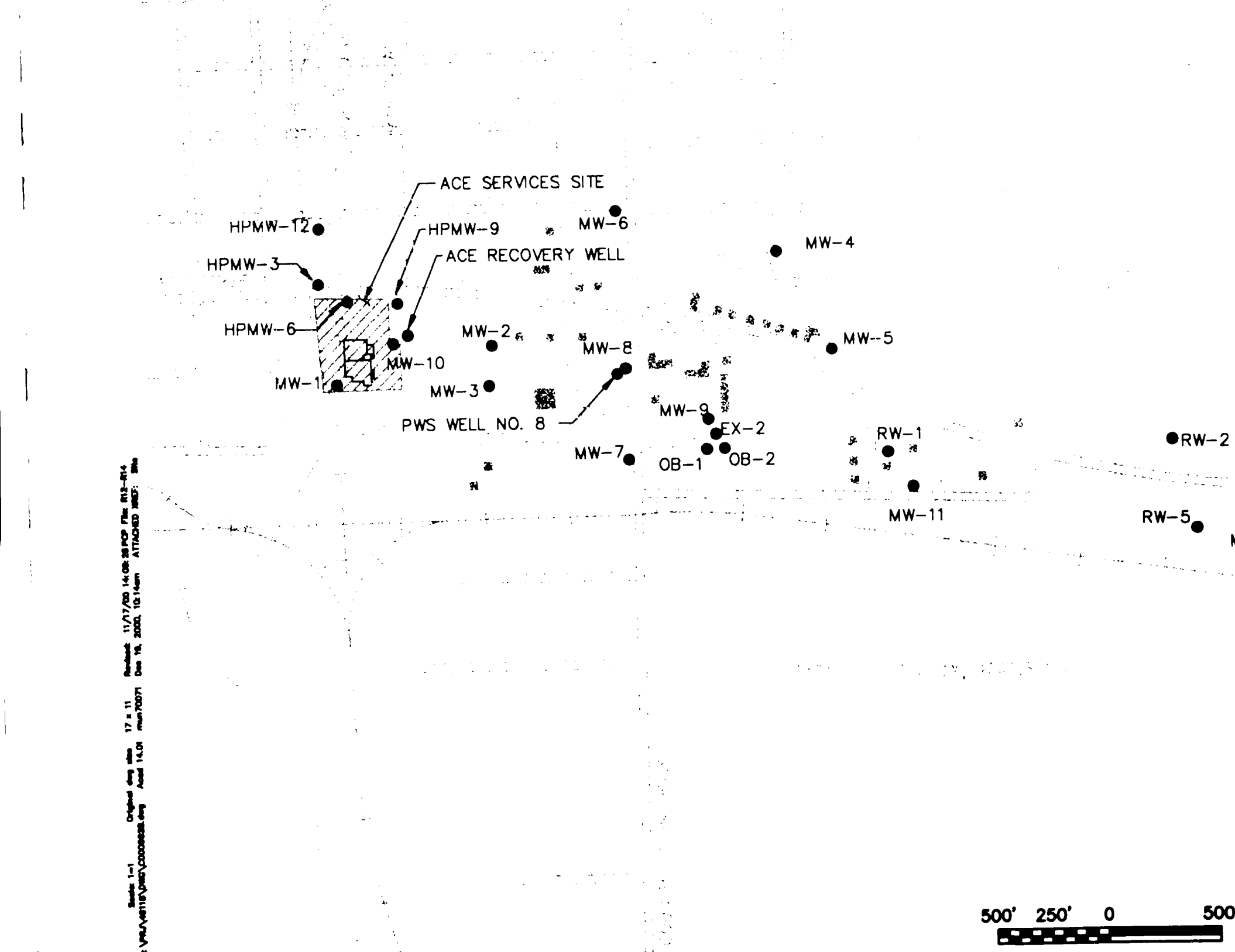

ACE SERVICES SITE
HPMW-12
HPMW-9
MW-6
MW-4
HPMW-3
ACE RECOVERY WELL
HPMW-6
MW-2
MW-8
MW--5
MW-10
MW-1
MW-3
MW-9
PWS WELL NO. 8
EX-2
RW-1
RW-2
MW-7
OB-1
OB-2
MW-11
RW-5
500' 250' 0 500

Table 3-1

Wells Installed as part of the Phase 3 Remedial Design Sampling Activities

Ace Services Site

Remedial Design

Well Number
OB-1-S
OB-1-I
OB-1-D
OB-2-S
OB-2-I
OB-2-D
EX-2-S
EX-2-I
EX-2-D

Note: EX = Extraction Well
OB = Observation Well
S = Shallow
I = Intermediate
D = Deep

3.1.1 Observation Wells

Observation wells installed for the preliminary RD efforts are listed in Table 3-1. The observation wells were constructed using 4 inch diameter, polyvinyl chloride (PVC) riser pipe and screen. The riser pipe was Schedule 40 PVC. The well screens were 20-foot-long, Schedule 40 PVC with 0.020-inch slots.

Observation wells were installed in a nested fashion and consist of three wells at various depths to respectively evaluate shallow (110 to 130 feet), intermediate (172 to 195 foot) and deep (215 to 235 feet) aquifer zones. The water table ranged in depth from approximately 108 to 113 feet below ground surface (bgs) and impermeable shale bedrock (Pierre Shale Formation) was encountered at approximately 235 feet bgs.

A test hole for each well nest was drilled from the ground surface to bedrock and logged by the onsite geologist. The lithologic information was used to select the specific screen depth for each water bearing zone and monitoring well. Screen lengths for the wells were field determined and each well was installed within the selected water bearing zone at each well nest location.

Wells within the well nest were installed so that the shallow well is upgradient of the intermediate well and the intermediate well is upgradient of the deep well. Individual wells were installed approximately 15 feet apart.

The annular space around well screens was backfilled with a silica sand filter pack that conformed to screen gradation analysis requirements of not less than 95 percent of the sand passing U S Standard Sieve No. 10 and not more than 5 percent passing U S Standard Sieve No. 20. The filter pack extended from the bottom of the borehole to a minimum of 3 feet above the top of the screen. The annular space above the filter pack was backfilled with a minimum of 5 feet of bentonite chips. The annular space above the bentonite chips to the surface was backfilled with cement/bentonite grout tremied into place. A locking above ground or, where required, flush mount cover was installed to secure the well head.

3.1.2 Extraction Wells

Extraction wells installed for the preliminary RD efforts are listed in Table 3-1. Extraction well EX-2-S was constructed using 6 inch diameter PVC riser pipe and screen. Extraction wells EX-2-I and EX-2-D were constructed using 8 inch diameter PVC riser pipe and screen. The riser pipe was Schedule 40 PVC. The well screen was constructed of Schedule 40 PVC with 0.032-inch slots.

Extraction wells were installed in a nested fashion and consist of a maximum of three wells at various depths to respectively extract contaminated groundwater at shallow (100 to 130 feet), intermediate (145 to 190 foot) and deep (195 to 235 feet) aquifer zones. Results from the plume characterization study were used to determine which aquifer zones are contaminated.

A test hole for the well nest was drilled first and logged by the onsite geologist. The boring log information was used to select the specific screen depth for each extraction well. Screen length for the wells was field determined and installed within the selected water bearing zone at each extraction well location.

Wells within the well nest were installed with the shallow well upgradient of the intermediate well and the intermediate well, upgradient of the deep well. Individual wells were installed approximately 15 feet apart. A detailed location map for observation well nests OB-1 and OB-2 and extraction well nest EX-2 is presented in Figure 3-2.

The annular space around the screen was backfilled with No. 1 Fine Washed Silica Sand filter pack. The filter pack extended from the bottom of the borehole to a minimum of 3 feet above the top of the screen. The annular space above the filter pack was backfilled with a minimum of 5 feet of bentonite chips. Remaining annular space about the bentonite seal was backfilled to the ground surface with bentonite grout. A locking flush mount cover was installed to secure the well head.

3.1.3 Boring Logs and Well Construction Logs

Boring logs and well construction logs for wells listed in Table 3-1 are provided in Appendix A and Appendix B, respectively.

3.1.4 Well Development

Well development consisted of surging and pumping the well using an electric submersible pump. The temperature, pH, specific conductivity, turbidity, dissolved oxygen (DO), and oxidation reduction potential (ORP) was monitored during pumping. Well development data was recorded in the field data sheets (Appendix C). Pumping continued until the field parameters stabilized and the water was clear and free of fines.

In all cases, care was taken not to collapse well screens during development activities, and at least half as much water as was introduced during drilling was removed during development and construction of each well. Development fluids (fluids recovered from the wells during development) were collected and managed as described in Section 4.0.

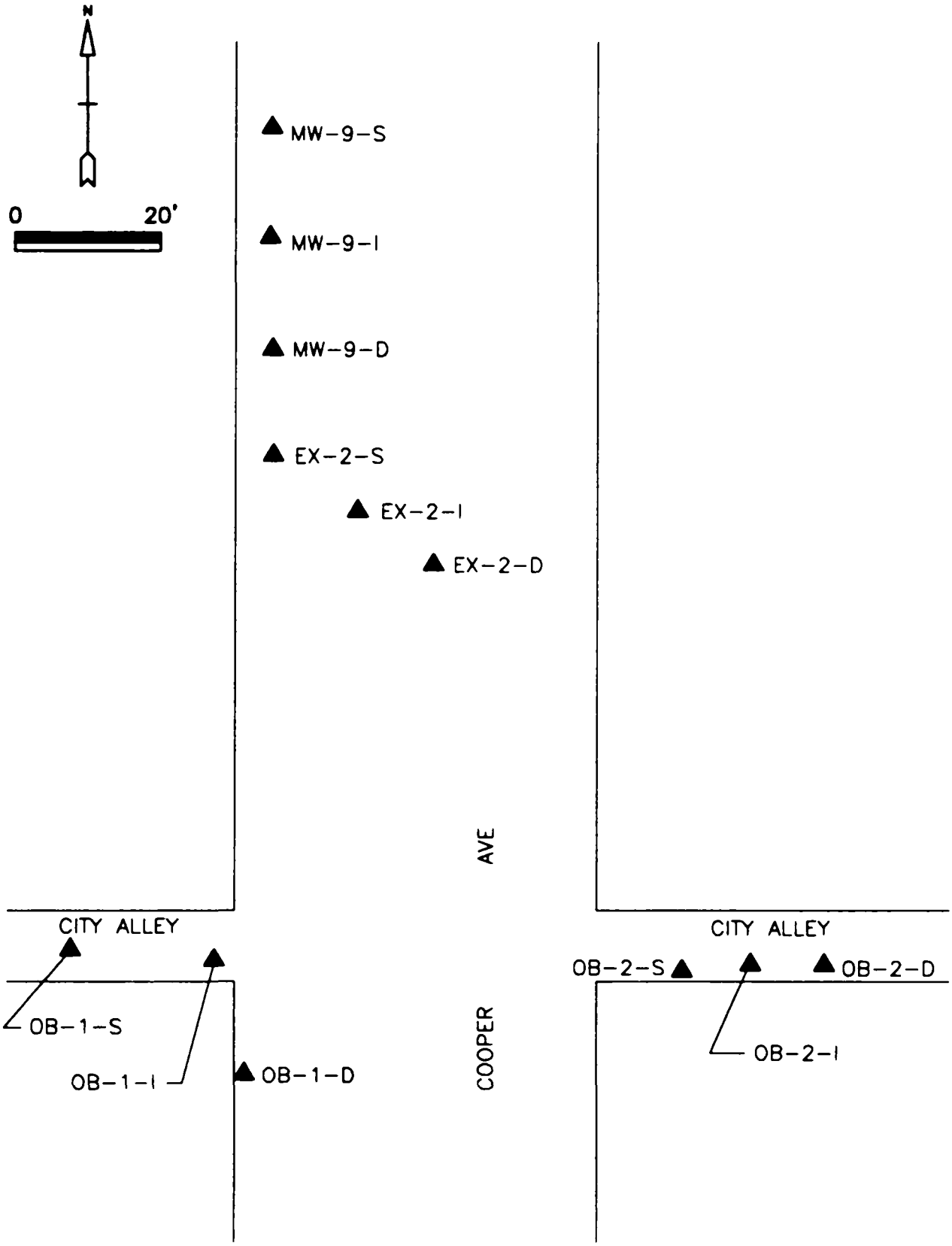


FIGURE 3-2
WELL LOCATIONS FOR
MW-9, EX-2, OB-1
AND OB-2
ACE SERVICES SITE

3.2 Sampling Locations and Analyses

The scope of the preliminary RD investigation included groundwater sampling and analysis for newly installed wells (Table 3-1) and currently existing wells (Table 3-2). The locations of the wells are shown on Figure 3-1. Groundwater samples were analyzed for total chromium (Cr). Samples from wells representative of extracted groundwater were analyzed for total chromium and hexavalent chromium. Groundwater samples were collected separately for treatability study purposes from wells EX-2-S, EX-2-I, EX-2-D, RW-6, and a composite sample from several monitoring wells. The treatability study samples were analyzed for several wet chemistry and metals parameters. Results of the samples will be discussed in the treatability study report. All samples were unfiltered.

Analytical parameters, analytical methods, sample container requirements, preservation methods, and holding times are summarized by sample media in Table 3-3. The total number of samples collected during the investigation including duplicates, blanks, and other quality control samples are summarized by sample media in Table 3-4.

3.3 Groundwater and Soil Sampling Procedures

The following general procedures were practiced when sampling:

- A clean pair of new, disposable surgical gloves were worn each time a sample was collected and equipment was deontaminated or replaced with new material between each sample.
- During the course of the field investigation, all samples were properly documented, as described in the FSP (BVSPC, 1999b), FSP Addendum (BVSPC, 2000a), QAPP (BVSPC, 1999c), and QAPP Addendum (BVSPC, 2000b). Documentation included completion of chain of custody (COC) forms, field logbook documentation, and sample labels for sample containers.
- Samples were immediately sealed, kept out of the sun, and kept cool by ice after collection.
- All samples for hexavalent chromium analysis were shipped "Next Day Air-Early A.M." by UPS for 7:30 A.M. delivery to meet the 24 hour holding time.

3.3.1 Water Level Measurement

Water levels for existing wells were measured prior to any intrusive work. The water level, time of measurement, and date were recorded.

Table 3-2
Existing Wells Sampled as part of the Remedial Design (September 2000)
Ace Services Site
Remedial Design

Well Number	Well Number
MW-1-S	MW-9-D
MW-1-I	MW-10-P
MW-1-D	MW-11-S
MW-2-S	MW-11-I
MW-2-I	MW-11-D
MW-2-D	MW-12-S
MW-3-D	MW-12-I
MW-4-S	MW-12-D
MW-4-I	Ace Recovery Well-S (ACE-R-S)
MW-4-D	Ace Recovery Well-I (ACE-R-I)
MW-5-S	Ace Recovery Well-D (ACE-R-D)
MW-5-I	PWS #8
MW-5-D	RW-1
MW-6-S	RW-2
MW-6-I	RW-3
MW-6-D	RW-4
MW-7-S	RW-5
MW-7-I	RW-6
MW-7-D	RW-8
MW-8-S	RW-9
MW-8-I	HPMW-6-S
MW-8-D	HPMW-9-S
MW-9-S	Ion Exchange Treatability Study Samples
MW-9-I	

Notes
MW = Monitoring Well
PWS = Public Water Supply
RW = Residential Well
P = Perched
HPMW = Hi-Plains Coop Monitoring Well
S = Shallow
I = Intermediate
D = Deep

Table 3-3
Analytical Parameters and Methods,
Containers, Preservatives, and Holding Times
Ace Services Site
Remedial Design

Parameter	Method[1]		Container Requirements	Preservative	Holding Time	
	Extraction	Analysis			Extraction	Analysis
Water						
Cr, total	--	6010	120 ml Poly	HNO_3, 4°C	6 months	6 months
Cr VI	--	7196A	120 ml Poly	4°C	24 hours	24 hours
Soil						
Cr, total	3050	6010	2 oz glass jar	4°C	6 months	6 months
Note 1 Level III data packages						

Table 3-4
Sample Summary
Ace Services Site
Remedial Design

Parameter	Number of Primary Samples	Number of Duplicates	Number of Rinsates	Number of Matrix Spikes[1]	Number of Matrix Spike Duplicates[1]	Total Number of Samples
Water						
Cr, total	54	6	4	[3]	[3]	64
Cr VI	11	1	1	[1]	[1]	13
Soil						
Cr, total	3	0	0	0	0	3
Note 1: MS/MSD samples are additional volume only.						

3.3.2 Well Purging/Development and Groundwater Sample Collection

Before sampling, the depth to water was measured and recorded. Using information from the well construction logs, the total volume of water in the well casing was determined. The subcontractor (Woofter Pump and Well, Inc., Hoxie, Kansas) purged the wells prior to collecting groundwater samples. The monitoring wells and the Ace Recovery Well were purged and sampled using a submersible pump and Public Water Supply Well No. 8 was sampled using its dedicated turbine pump. A water truck was used to store and transport the purge water so it could be discharged to the City of Colby's sanitary sewer system.

In addition to the collection of primary samples, quality assurance/quality control (QA/QC) samples such as equipment rinsate blanks, duplicate samples, and matrix spike (MS), and matrix spike duplicate (MSD) samples were collected.

Monitoring well purging/development data sheets were completed for each well that was developed or sampled and are provided in Appendix C.

3.3.2.1 Existing Monitoring Well Purging and Sample Collection. Most of the existing monitoring wells were purged using a high capacity (~15 gpm) submersible pump.

The remaining existing monitoring wells and the three screened intervals of the Ace Recovery Well were micropurged. The wells were micropurged at a rate less than the recharge rate of the well. The water level in the well was monitored for drawdown during micropurging. Micropurging was performed at a rate so that minimal drawdown occurred. Micropurging was performed at approximately one liter per minute (0.26 gallons per minute). The wells were micropurged from the midpoint of the screened intervals.

Field parameters (temperature, pH, specific conductivity, ORP, turbidity, and DO) were measured and recorded during both purging processes. Measurements were recorded periodically until stabilization occurred at which time purging was complete and the sample collected.

3.3.2.2 Public Supply Well No. 8 Purging and Sample Collection

The subcontractor (Woofter Pump and Well, Inc.) purged the well prior to collecting groundwater samples. The public water supply well was sampled using its dedicated turbine pump. Field parameters (temperature, pH, specific conductivity, ORP, DO, and turbidity) were measured and recorded during the purging process.

3.3.2.3 Residential Well Purging and Sample Collection. The residential wells sampled during the groundwater sampling activity are listed in Table 3-2. Addresses for the residential wells are provided on Table 3-5. The residential wells are equipped with dedicated pumps. The samples were collected from an outside tap prior to any water treatment system. Purging and sample collection procedure for the residential wells was as follows:

(1) The tap was opened and allowed to flow prior to sample collection. The field parameters (temperature, pH, specific conductivity, ORP, turbidity, and DO) were measured periodically. Purging was considered complete when the field parameters stabilized.

(2) Following the purging procedure, the flow from the tap was reduced for sample collection in order to minimize agitation and aeration.

(3) The sampler donned a clean pair of surgical gloves.

(4) At the end of the purging interval, the sample containers were filled directly from the tap.

(5) Following sample collection, sample documentation (i.e., sample number, chain-of-custody record) was completed and noted in the field logbook.

(6) The samples were placed in a cooler on ice.

3.3.3 Subsurface Soil Sampling

Soil samples were collected from drill cuttings for IDW characterization as discussed in Section 4.0. The samples were analyzed for total chromium.

3.3.4 Equipment Rinsate Blanks

Rinsate blanks were used to measure the effectiveness of pump decontamination procedures. Equipment rinsate blanks were prepared from the submersible pumps after the pumps had been decontaminated. The rinsate blanks were identified with a sample identification number. The rinsate blank number, time, and date of collection was documented in the field logbook.

3.3.5 Duplicate Samples

The purpose of duplicate samples is to assess laboratory QA/QC. Duplicate samples were collected in the field by alternately filling appropriate sample containers for the primary

Table 3-5
Residential Well Sample Codes
Ace Services Site
Remedial Design

Code	Residential Well Description
RW-1	175 Thompson
RW-2	1655 E. 4th
RW-3	1765 E. 4th
RW-4	1795 E. 4th
RW-5	1680 E. 4th
RW-6	1940 E. 4th
RW-7	2040 E. 4th
RW-8	1888 County Road 21
RW-9	2580 E. 4th

and duplicate samples. The primary sample and the duplicate samples were placed in identical containers, preserved in the same manner, and submitted for the same analyses. The duplicate groundwater samples were identified with a sample identification number. The sample location, number, and date and time of collection was documented in the field logbook.

3.3.6 Matrix Spike/Matrix Spike Duplicates

The purpose of MS/MSD samples is to evaluate effects of the sample matrix on the accuracy of the analysis. MS/MSD samples were collected in the field by alternately filling appropriate sample containers for the primary, MS, and MSD sample from the discharge hose of the pump. The primary sample, the MS sample, and the MSD samples were placed in identical containers, preserved in the same manner, and submitted for the same analyses. The MS/MSD samples were identified with a sample identification number. The sample location, number, and date and time of collection was documented in the field logbook.

3.4 Sample Numbering System

A sample numbering system was used to identify each sample submitted for chemical analysis. The purpose of the numbering system was to provide a tracking system for retrieval of information on each sample. The sample identification numbers allocated for all sampling efforts were used on sample labels, chain-of-custody records, and all other applicable documentation used during the sampling activity. A listing of all sample identification numbers was maintained in the field logbook by the field team representative.

Sample identification numbers consist of four components: a media code, a well code, the date, and the sample characteristic code. The following is an example of a completely numbered sample, with each component identified:

W-MW-1-S-091900-P,

where

W = water
MW = well type code (i.e., monitoring well),
1 = well number code
S = well interval code (shallow)
091900 = sample date code (month, day, and year sample was collected), and

P = sample characteristic code (i.e., primary).

The media codes consist of W for water or S for subsurface soil. The well type code identifies the well type: MW for monitoring well, PWS for public water supply, RW for residential well, ACE for Ace recovery well, EX for extraction wells, OB for observation wells, and HPMW for HI-Plains Coop monitoring wells. The well number code identifies the well number. The well interval code identifies the aquifer zone monitored: P for perched, S for shallow, I for intermediate, and D for deep. The sample date code identifies the data the sample was collected: 091900 is September 19, 2000. The sample characteristic code indicates whether the sample is a primary sample (P), an equipment rinsate blank (R), duplicate (D), a matrix spike (MS), or a matrix spike duplicate (MSD) sample.

3.5 Documentation

Documentation was a vital aspect of the site investigation. This section discusses pertinent documentation activities.

3.5.1 Field Logbook

Bound field logbooks were maintained by the sampling team to provide a detailed record of significant events, observations, and measurements taken during the field investigation. The field log books are intended to provide sufficient data and observations to enable the field team to reconstruct events that occurred during the project. Copies of the field logbooks kept by field personnel are presented in Appendix D.

3.5.2 Sample Labels

An adhesive sample label was placed on each sample container submitted for chemical analysis. The following information was included on each sample label:

- Site name.
- Sample number.
- Name of sampler.
- Sample collection date and time.
- Analysis requested and preservatives added.

3.5.3 Chain-of-Custody Record

Chain-of-custody procedures were employed to maintain and document continuous sample possession. A sample was considered under a person's custody if it was in that

person's physical possession, within visual sight of that person after taking physical possession, secured by that person so that the sample could not be tampered with, or secured by that person in an area that was restricted from unauthorized personnel.

A chain-of-custody record was completed for each sample shipment. Standard laboratory chain-of-custody records were used. After completion of the chain-of-custody-record, one carbonless copy of the chain-of-custody record was retained by the field crew and the remaining copies and the original were enclosed in a sealable plastic bag and secured to the inside of the shipping container lid. A separate chain-of-custody record was completed for each shipping container. Shipping containers were secured, and custody seals were placed across the container openings. The chain-of-custody record was sealed inside the shipping container, and the custody seals remained intact; therefore, the commercial carrier was not required to sign the chain-of-custody record. Copies of the chain-of-custody records are included in Appendix E.

3.5.4 Custody Seals

Custody seals were used to ensure the integrity of the samples when they remained unattended or when they were relinquished to the delivery service until they were opened by the laboratory. All samples were shipped in an insulated shipping container, and each shipping container was sealed with at least two custody seals. The seals were affixed to each shipping container so that it was necessary to break the seals to open the shipping container.

3.5.5 Airbills

An airbill was completed for each sample shipment. Priority 7:30 a.m. overnight delivery was used for samples collected in the morning and late morning delivery was used for samples collected in the afternoon to achieve the analytical holding time (24 hours) for hexavalent chromium analysis. Copies of the completed airbills are included in Appendix F.

3.6 Decontamination Procedures

Procedures for equipment decontamination were implemented to avoid cross-contamination of subsurface strata and samples of various media that are to be submitted for chemical analysis. Sampling equipment was thoroughly cleaned and decontaminated before initial use and between sample locations.

3.6.1 Initial Decontamination

Initial decontamination of the drill rig, sampling equipment, and electric pump before any wells were purged and sampled included the following:

(1) Steam clean with potable water.

(2) Circulate and rinse pump with potable water.

(3) Rinse pump with distilled water.

Initial decontamination of the split-spoon sampler included alconox wash followed by potable and distilled water rinses.

3.6.2 Intermediate Decontamination

Intermediate decontamination of the sampling equipment was required between sampling attempts. The intermediate decontamination procedures for sampling equipment was the same as those outlined in the initial decontamination.

3.6.3 Final Decontamination

Final decontamination was performed on all equipment used to drill, purge, or sample wells. The procedures used during initial decontamination were utilized during final contamination.

3.7 Site Survey Data

A location survey was conducted by Zerr Engineering of Colby, Kansas, as part of the preliminary RD investigation. Items surveyed included newly installed monitoring wells. At monitoring well locations, top of casing (TOC) elevations were measured to the closest 0.01 foot using the notched reference point for monitoring wells. Ground elevations were measured to the closest 0.01 foot. Location coordinates were also determined for the wells and are referenced to the State Plane Coordinate System. Elevations are referenced to mean sea level (msl), specifically to the National Geodetic Vertical Datum of 1929. Survey data for the wells are presented in Appendix G.

A survey of the site will be performed after all wells are installed and the site area is defined. A site map will be developed from the survey data. The site map will include locations of the wells, utilities, cultural features, and topography which will be used as a base map for engineering drawings.

3.8 Data Validation

Samples collected in October 1999 and February 2000 were sent to Analytical Management Laboratories, Inc. of Olathe, Kansas, for analyses. Once samples were received at the lab, the specified analyses were performed, and results in the form of raw laboratory data were generated. Data validation and evaluation was then performed on the raw laboratory data in accordance with EPA Contract Laboratory Program (CLP) National Functional Guidelines by Heartland Environmental Services, Inc. of St. Charles, Missouri.

Samples collected in September 2000 were sent to Southwest Laboratories of Oklahoma in Broken Arrow, Oklahoma. Once samples were received at the lab, the specified analyses were performed, and results in the form of raw laboratory data were generated. Data validation and evaluation was then performed on the raw laboratory data in accordance with EPA Contract Laboratory Program (CLP) National Functional Guidelines by Validata Chemical Services, Inc. of Lilburn, Georgia.

The objective of the data validation was to review analytical laboratory procedures and QC results to evaluate whether the data met project data quality objectives (DQOs) established in the site specific QAPP (BVSPC, 1999c and 2000b).

Results of the laboratory data assessment for the samples collected in October 1999 and February 2000 are presented in the *Data Validation Report* dated January 10, 2000 and April 20, 2000 (BVSPC, 2000e and 2000f) and the *PARCC's Report and Data Evaluation Technical Memorandum* dated June 28, 2000 (BVSPC, 2000g).

Results of the laboratory data assessment for the samples collected in September 2000 are presented in the *Data Validation Report* dated December 12, 2000 (BVSPC 2000h) and the *PARCC's Report and Data Evaluation Technical Memorandum* dated December 18, 2000 (BVSPC 2000i).

Results of the data validation and evaluation process have determined the data are defensible, were collected in accordance with the site specific QAPP and FSP, and are useable for the intended purposes.

3.9 Aquifer Pump Test

An objective of the preliminary RD efforts was to perform pump tests within the three aquifer zones. Hydrogeologic data for the pump tests were used to develop a computer flow model of groundwater flow of the site. The model results were used to estimate the number, location, and extraction rates necessary to achieve remedial action objectives.

Three pump tests were performed in July and August 2000, and evaluated in September 2000. Pump test procedures and results are discussed in the *Pump Test Results Ace Services Site Memorandum*, November 13, 2000, which is presented in Appendix H.

3.10 Groundwater Modeling

An objective of the preliminary RD efforts was to develop a numerical computer model of groundwater flow of the site. The model results were used to estimate the number, location, and extraction rates necessary to achieve remedial action objectives.

Numerical computer modeling efforts of groundwater flow of the site was performed in October and November 2000. Modeling procedures and results are discussed in the *Groundwater Modeling Activities Ace Services Site Memorandum*, December 14, 2000, which is presented in Appendix I.

4.0 Investigation Derived Waste

Investigation derived wastes (IDW) included decontamination fluids, groundwater removed from monitoring wells, drill cuttings, fluids, plastic sheeting, and personal protective equipment.

4.1 Liquids

Purging fluids, development water, and decontamination solution and rinses were collected and stored in a water tank. The fluids were then transported and discharged into the City of Colby's sanitary sewer system.

4.2 Personal Protective Equipment

All personal protective equipment (PPE) such as surgical gloves, paper towels, plastic sheeting, etc., was double bagged and disposed of as solid waste.

4.3 Drill Cuttings

Drill cuttings were placed in containment structures for characterization prior to disposal. Care was taken to exclude or remove any free liquid. A composite drill-cuttings sample was collected from the cuttings of each well nest and analyzed for total chromium for hazardous waste determination purposes. Results of the soil cuttings analyses are summarized in Table 4-1.

Analytical results determined the cuttings to be non-hazardous (i.e., less than 100 mg/kg total chromium). Once results indicated the soils were non-hazardous, the soil cuttings were spread to the ground per agreement with KDHE Bureau of Waste Management-Solid Waste Section.

Table 4-1
IDW Analytical Results
Ace Services Site
Remedial Design

Well Nest No.	Sample No.	Total Cr (mg/kg)
OB-1	S-IDW-OB-1-071300	2.4
OB-2	S-IDW-OB-2-071400	3.7
EX-2	S-IDW-EX-2-071200	3.2

5.0 Remedial Design Investigation Results

This section presents, evaluates, and interprets data collected during the preliminary RD efforts performed from July 2000 to September 2000.

5.1 Water Level Data

The Ogallala Formation is an unconfined aquifer in the Colby area. The Ogallala aquifer is the sole source of potable water for the City of Colby.

Water level data for the monitoring wells are presented in Tables 5-1 and 5-2. The groundwater elevations were determined using location survey data and water level data collected during previous RI and RD investigation activities. The predominant groundwater flow direction for September 22, 2000, for the shallow, intermediate, and deep zones is illustrated on Figures 5-1 through 5-3 respectively. Depth to groundwater in the site area is approximately 100 to 120 feet bgs. Plots of the groundwater elevation data on site maps indicate the groundwater flow direction in the three zones in the site area is predominantly to the east-southeast. Detailed hydrogeologic data are presented in Appendices H and I.

5.2 Geochemical and Biochemical Groundwater Data

Basic water quality parameters were analyzed or measured on groundwater samples to evaluate the geochemical and biochemical quality of the groundwater. The geochemical and biochemical data will be used in the design of the groundwater treatment process. Results of field parameters are presented in Table 5-3. Analytical results of samples collected specifically for design criteria will be discussed in the Treatability Study Report which will be prepared as part of the RD efforts.

5.3 Nature and Extent of Groundwater Contamination

The nature and extent of contamination in groundwater at the site was evaluated from 54 primary groundwater samples. A list of the wells sampled and the analytical results are presented in Table 5-3. Results for the duplicate samples are also included.

Table 5-1
Groundwater Elevation Data
September 18-22, 2000
Ace Services Site
Remedial Design

Well	Top of Casing Elevation (ft)	Depth to Water from Top of Casing (ft)	Groundwater Elevation (ft MSL)
MW-1-S	3140 53	107 00	3033 53
MW-2-S	3134 99	102 49	3032 5
MW-4-S	3126 62	96 02	3030 6
MW-5-S	3130 57	100 59	3029 98
MW-6-S	3136 55	104 73	3031 82
MW-7-S	3147 87	116 85	3031 02
MW-8-S	3139 57	108 28	3031 29
MW-9-S	3142 47	111 98	3030 49
MW-11-S	3148 20	119 66	3028 54
MW-12-S	3168 21	143 07	3025 14
HPMW-3-S	3138 65	105 01	3033 64
HPMW-6-S	3139 23	105 41	3033 82
HPMW-9-S	3136 61	103 37	3033 24
HPMW-12-S	3136 03	102 41	3033 62
OB-1-S	3142 71	112 08	3030 63
OB-2-S	3139 59	109 30	3030 29
EX-2-S	3142 13	111 67	3030 46
MW-1-I	3140 56	107 07	3033 49
MW-2-I	3134 90	102 80	3032 1
MW-4-I	3126 98	96 50	3030 48
MW-5-I	3130 44	100 56	3029 88
MW-6-I	3136 64	105 00	3031 64
MW-7-I	3147 70	116 65	3031 05
MW-8-I	3139 00	107 75	3031 25
MW-9-I	3142 35	111 79	3030 56
MW-11-I	3148 60	120 05	3028 55
MW-12-I	3168 29	143 42	3024 87
OB-1-I	3142 31	112 17	3030 14
OB-2-I	3138 63	108 15	3030 48
EX-2-I	3141 30	110 89	3030 41
MW-1-D	3140 10	106 56	3033 54
MW-2-D	3136 56	105 31	3031 25
MW-3-D	3137 00	104 91	3032 09
MW-4-D	3127 18	98 68	3028 5
MW-5-D	3131 07	103 20	3027 87
MW-6-D	3136 83	106 17	3030 66
MW-7-D	3147 49	117 71	3029 78
MW-8-D	3138 66	107 76	3030 9
MW-9-D	3142 13	113 32	3028 81
MW-11-D	3149 08	122 37	3026 71
MW-12-D	3168 10	144 87	3023 23
OB-1-D	3141 98	113 22	3028 76
OB-2-D	3138 11	109 56	3028 55
EX-2-D	3140 50	111 54	3028 96
MW-10-P	3123 37	dry	dry

Table 5-2
Groundwater Elevation Data
September 22, 2000
Ace Services Site
Remedial Design

Well	Top of Casing Elevation (ft)	Depth to Water from Top of Casing (ft)	Groundwater Elevation (ft MSL)
MW-1-S	3140.53	106.92	3033.61
MW-2-S	3134.99	102.51	3032.48
MW-4-S	3126.62	NA	NA
MW-5-S	3130.57	100.76	3029.81
MW-6-S	3136.55	NA	NA
MW-7-S	3147.87	116.82	3031.05
MW-8-S	3139.57	108.28	3031.29
MW-9-S	3142.47	112.95	3029.52
MW-11-S	3148.20	119.81	3028.39
MW-12-S	3168.21	143.24	3024.97
HPMW-3-S	3138.65	NA	NA
HPMW-6-S	3139.23	NA	NA
HPMW-9-S	3136.61	NA	NA
HPMW-12-S	3136.03	NA	NA
MW-1-I	3140.56	106.98	3033.58
MW-2-I	3134.90	102.78	3032.12
MW-4-I	3126.98	NA	NA
MW-5-I	3130.44	100.65	3029.79
MW-6-I	3136.64	NA	NA
MW-7-I	3147.70	116.66	3031.04
MW-8-I	3139.00	107.80	3031.2
MW-9-I	3142.35	111.81	3030.54
MW-11-I	3148.60	120.16	3028.44
MW-12-I	3168.29	143.57	3024.72
MW-1-D	3140.10	106.49	3033.61
MW-2-D	3136.56	104.99	3031.57
MW-3-D	3137.00	NA	NA
MW-4-D	3127.18	NA	NA
MW-5-D	3131.07	103.28	3027.79
MW-6-D	3136.83	NA	NA
MW-7-D	3147.49	117.67	3029.82
MW-8-D	3138.66	107.89	3030.77
MW-9-D	3142.13	113.29	3028.84
MW-11-D	3149.08	122.49	3026.59
MW-12-D	3168.10	144.65	3023.45
MW-10-P	3123.37	NA	NA

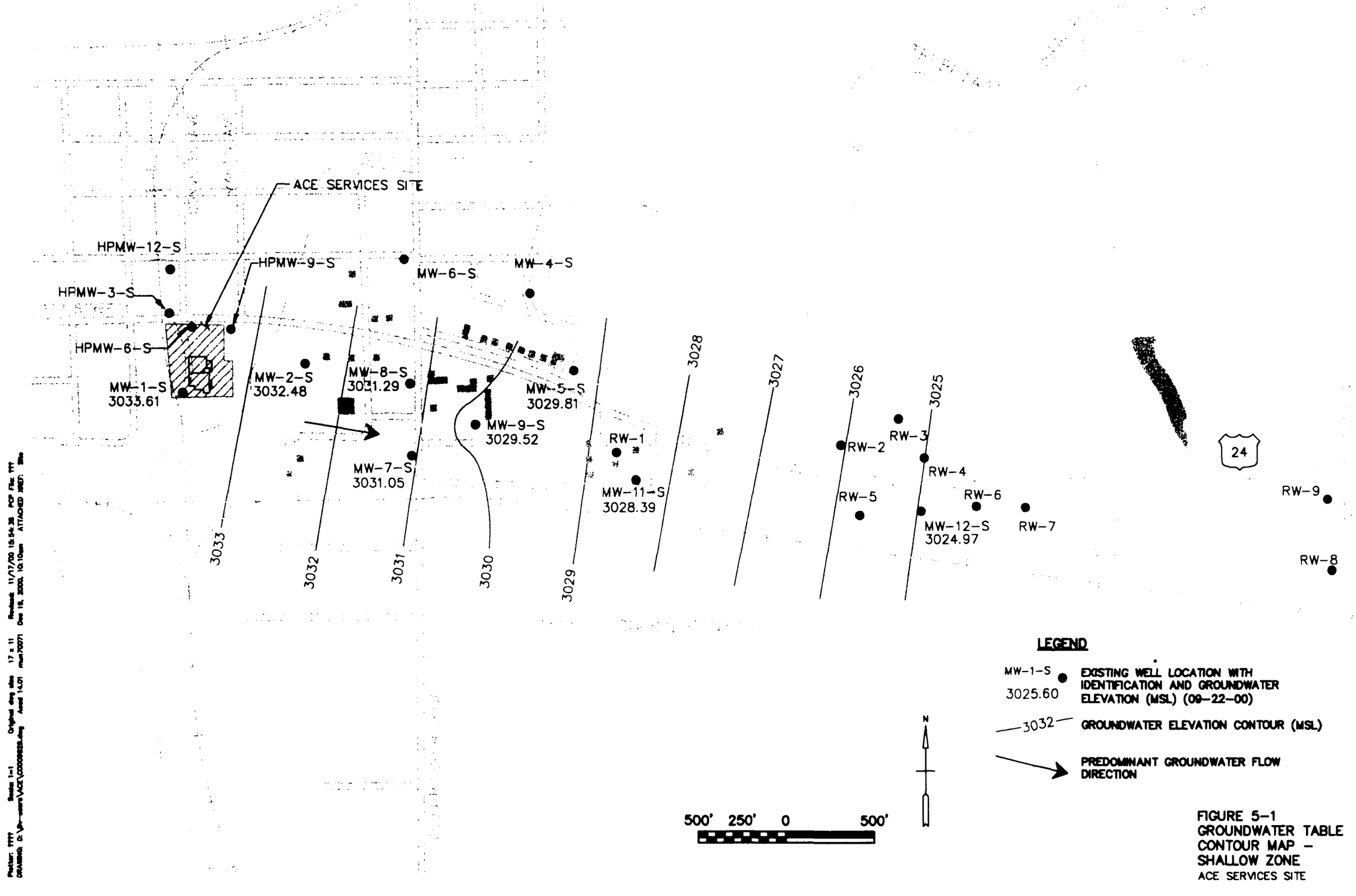


FIGURE 5-1
GROUNDWATER TABLE CONTOUR MAP - SHALLOW ZONE
ACE SERVICES SITE

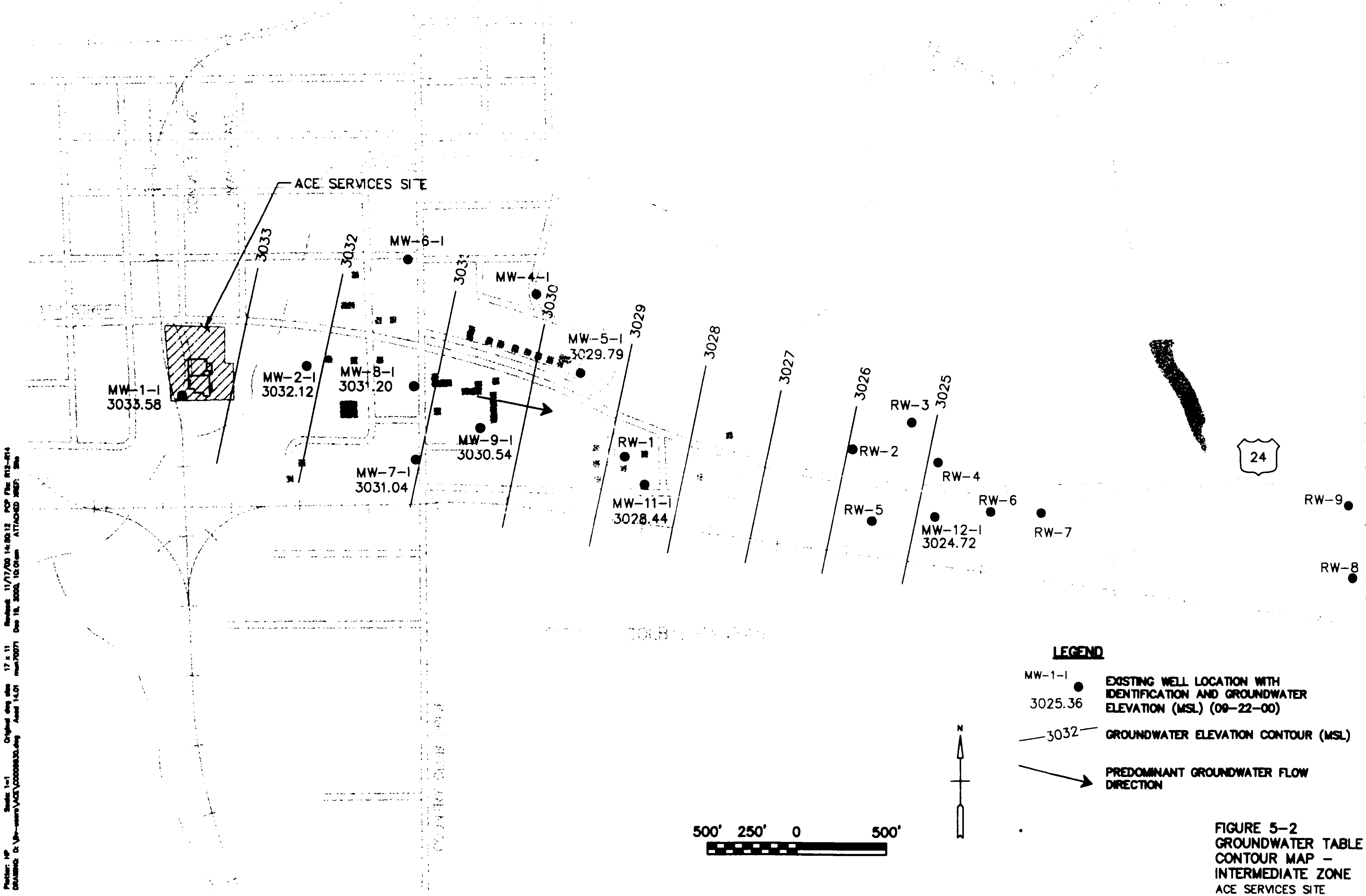


FIGURE 5-2
GROUNDWATER TABLE CONTOUR MAP - INTERMEDIATE ZONE
ACE SERVICES SITE

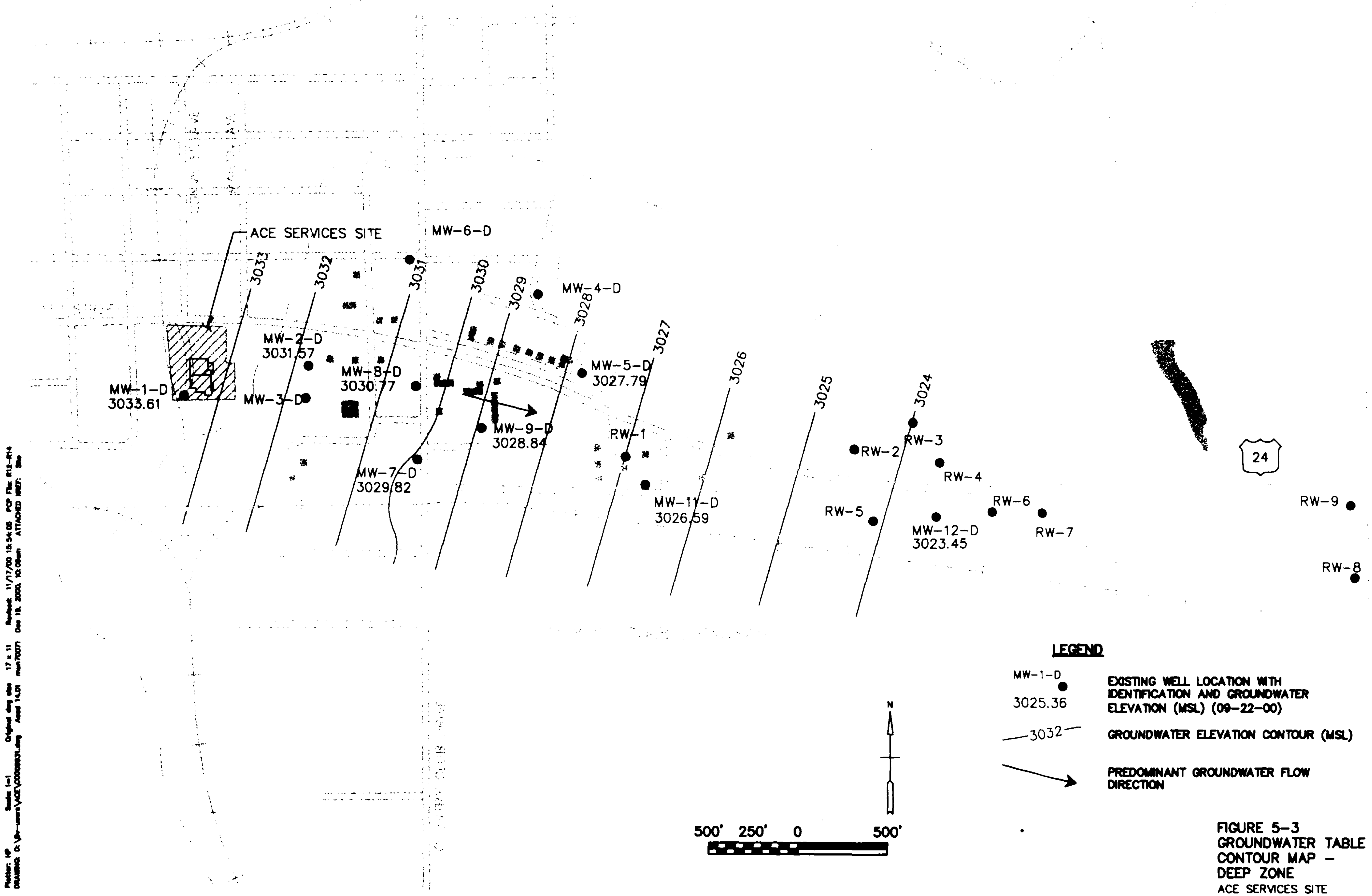


FIGURE 5-3
GROUNDWATER TABLE CONTOUR MAP - DEEP ZONE
ACE SERVICES SITE

Table 5-3
Data Summary (September 2000)
Ace Services Site
Remedial Design

Well	Total Cr (ug/L)	Hexavalent Cr (ug/L)	pH (units)	SC (umhos/cm)	Temp. (C)	DO (mg/L)	Turbidity (NTUs)	ORP (mV)
Groundwater								
MW 1 S	14		6 8	1248	20	1 1	3	77
MW 2 S	118		6 9	754	19	5 2	12	83
MW 4 S	22		6 5	1013	19	7 3	4	105
MW 5 S	3 U (3 U)		7 3	733	15	6 9	0	219
MW 6 S	66		7 4	544	20	7 6	17	70
MW 7 S	94		7 2	576	14	6 9	0	222
MW 8 S	10 U		7 2	606	15	6 4	0	212
MW 9 S	259 (300)		7 3	632	15	7 5	0	214
MW 11 S	162	170	7 2	665	15	7 2	0	220
MW 12 S	92	30	7 1	700	20	7 0	7	51
EX 2 S	532		7 3	649	15	6 9	0	216
OB 1 S	483		7 1	916	20	5 6	20	64
OB 2 S	356		7 2	940	18	6 6	6	97
HPMW 6 S	3 U		7 2	940	18	6 6	6	97
HPMW 9 S	374		6 8	950	16	0 8	0	192
ACE R S	358		6 9	1015	17	0 7	12	103
MW 1 I	6		6 7	1111	19	0 3	1	63

Table 5-3
Data Summary (September 2000)
Ace Services Site
Remedial Design

Well	Total Cr (ug/L)	Hexavalent Cr (ug/L)	pH (units)	SC (umhos/cm)	Temp. (C)	DO (mg/L)	Turbidity (NTUs)	ORP (mV)
MW 2 I	1,780	1,800	5 0	660	18	2 2	7	157
MW 4 I	35		6 6	853	19	6 1	3	115
MW 5 I	33	50 U	6 1	551	19	7 3	4	113
	[5]		7 3	480	15	7 7	0	226
MW 6 I	64		7 1	754	18	5 8	8	81
MW 7 I	36	50 U	6 9	566	20	5 6	11	61
MW 8 I	1,020		7 2	624	15	3 8	0	211
MW 9 I	4,170		7 2	592	15	4 5	1	214
MW 11 I	117 (114)	120 (120)	7 2	629	15	6 6	0	204
MW 12 I	182	180	7 4	442	15	7 5	0	192
EX 2 I	2,360	3,000	7 2	571	15	5 2	0	209
OB 1 I	197		7 3	652	18	5 6	7	54
OB 2 I	630		6 7	692	19	4 9	9	117
ACE R I	151		6 9	756	17	4 1	6	199
MW 1 D	22		7 4	428	18	7 9	3	94
MW 2 D	214	220	7 3	450	16	7 1	0	212
MW 3 D	60		7 4	410	15	7 2	0	210
MW 4 D	44		7 0	446	18	8 0	8	121
MW 5 D	4		7 4	422	16	8 0	0	199

Table 5-3
Data Summary (September 2000)
Ace Services Site
Remedial Design

Well	Total Cr (ug/L)	Hexavalent Cr (ug/L)	pH (units)	SC (umhos/cm)	Temp. (C)	DO (mg/L)	Turbidity (NTUs)	ORP (mV)
MW 6 D	211		7.4	551	17	6.7	5	75
MW 7 D	84 (80)		7.5	388	15	7.7	0	227
MW 8 D	1,630 (1610)		7.3	532	15	5.1	0	232
MW 9 D	2,040		7.4	555	15	4.4	0	217
MW 11 D	114		7.4	466	15	7.3	0	213
MW 12 D	7 U (7 U)		7.6	373	15	7.8	0	215
EX 2 D	1,920	1,930	7.1	559	15	4.9	0	48
OB 1 D	210		7.4	437	16	7.0	0	225
OB 2 D	1,120		7.1	657	19	5.6	13	61
ACE R D	61		7.2	621	17	6.3	3	87
PWS 8	2,900	3,000	7.5	587	15	6.9	4	231
Residential Wells								
RW 1	40		7.2	784	15	7.6	0	273
RW 2	3 U		7.7	410	16	8.7	0	212
RW 3	3 U		7.7	400	15	8.4	1	383
RW 4	7 U		7.7	428	15	8.5	0	274
RW 5	9 U		7.6	456	16	7.9	0	248

Table 5-3
Data Summary (September 2000)
Ace Services Site
Remedial Design

Well	Total Cr (ug/L)	Hexavalent Cr (ug/L)	pH (units)	SC (umhos/cm)	Temp. (C)	DO (mg/L)	Turbidity (NTUs)	ORP (mV)
RW 6	132		7 5	484	15	9 0	1	220
RW 8	31 U		7 4	537	16	8 4	1	274
RW 9	3 U		7 7	381	15	8 5	0	262
Rinsates								
MW R I	3 U							
MW 11 S	3 U	50 U						
OB 1 D	3 U							
OB 2 S	4							
IDW (mg/kg)								
OB 1	2							
OB 2	4							
EX 2	3							

Duplicate results in parentheses
Re-sampling in brackets
Cr = chromium
ug/L = microgram per liter
Cr VI = hexavalent chromium
SC = specific conductance
umhos/cm = micromhos per centimeter
Temp = temperature
C = Celsius
DO = dissolved oxygen
mg/L = milligram per liter
NTUs = nephelometric turbidity units
ORP = oxidation/reduction potential
mV = millivolt
MW = monitoring well
P = perched
S = shallow
I = intermediate
D = deep
ND = nondetect (detection limit)
U = qualified as nondetect
J = estimated
ARW = Ace recovery well
PWS = Public Water Supply
R = residential well
mg/kg = milligram per kilogram
IDW = investigation derived waste

Analytical results of the groundwater samples indicate the presence of chromium in groundwater. Comparing results of the total chromium and hexavalent chromium analyses indicates that most or all of the total chromium is in the hexavalent state. Hexavalent chromium (Cr (VI)) typically occurs in the dissolved state while trivalent chromium (Cr (III)) typically occurs as a precipitate or solid. The detected concentration of hexavalent chromium may exceed the total chromium concentration because the parameters were analyzed using two different methods. Data validation procedures have determined that results for both methods are within acceptable ranges of the methodologies.

The total chromium concentrations have been contoured on Figures 5-4 through 5-6 to illustrate the horizontal extent of total chromium in the aquifer in the shallow, intermediate, and deep zones. The vertical extent of hexavalent chromium in the groundwater is illustrated in Figure 5-7.

Historical results for total chromium are presented in Table 5-4.

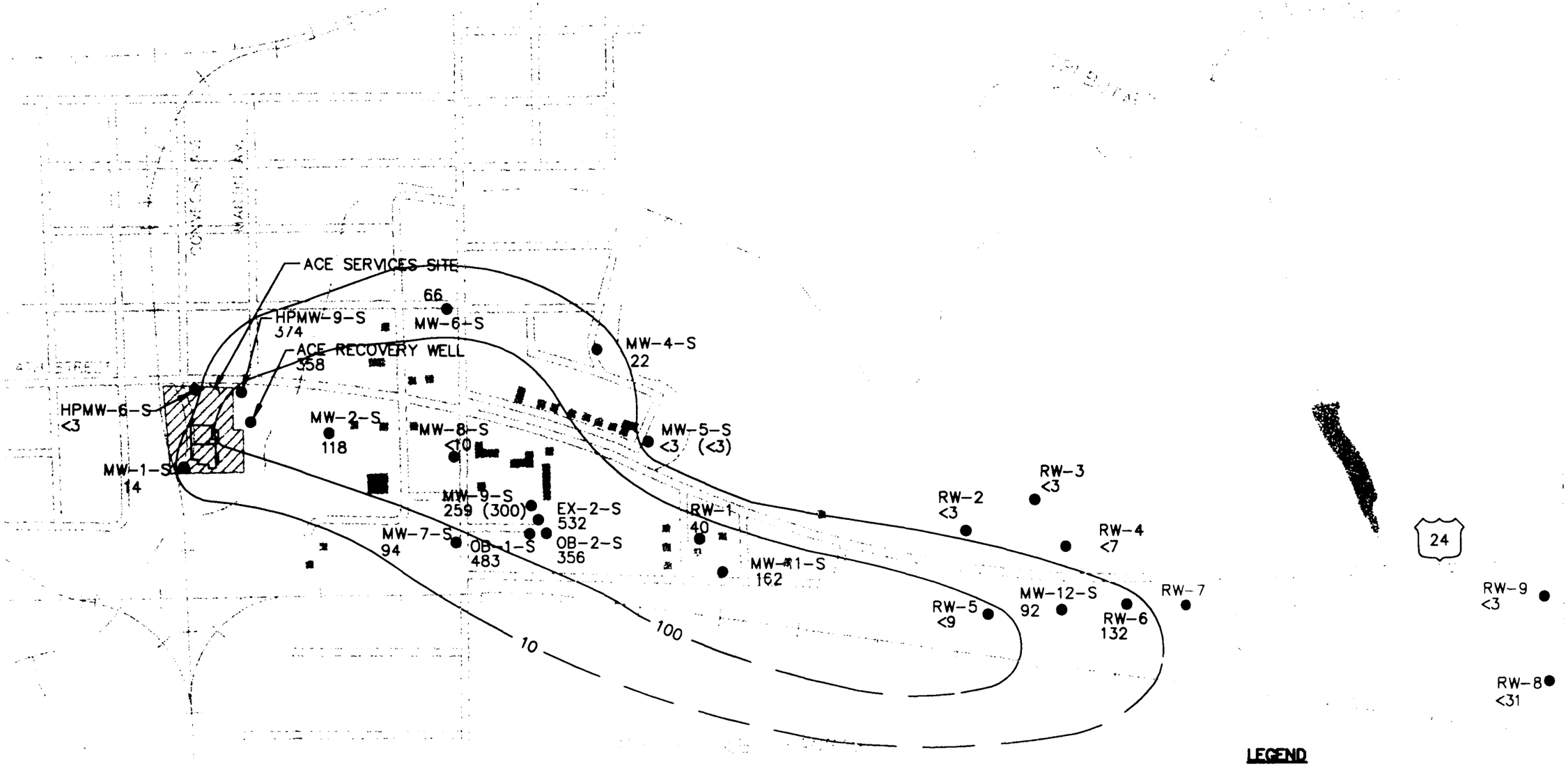
5.4 Remaining Preliminary RD Activities

Efforts for completing preliminary RD objectives are described in the RD WP (BVSPC, 1999a; 1999f), FSP (BVSPC, 1999b; 2000a), and QAPP (BVSPC 1999c; 2000b). Initial efforts were planned using information and site data available at that time. Completion in October 1999 of Phase 1 of the preliminary RD activities indicated additional monitoring wells were needed to complete characterization of the nature and extent of contamination. Completion in February 2000 of Phase 2 activities also indicated additional monitoring wells were needed to complete objectives. Phase 3 of the preliminary RD activities was completed in November 2000, results of which are discussed in this report. However, two additional monitoring well nests remain to be installed pending property access.

Phase 3 investigation activities have provided additional and more complete information concerning site characteristics and the nature and extent of contamination. The remaining preliminary RD activities include:

- Installation of two monitoring well nests; and
- Geotechnical borings
- Survey of site area to develop a base map for engineering design drawings.

Two additional monitoring well nests are to be installed to confirm the downgradient extent of the chromium plume (MW-13 and MW-14). Each monitoring well nest will consist of a shallow and intermediate well. The well nests will be installed south of the railroad tracks. Proposed locations for the two well nests are illustrated on Figure 5-8. Final locations of the wells were selected with consideration to property access restrictions.



NOTES:

WELL CONSTRUCTION DATA NOT AVAILABLE FOR RESIDENTIAL WELLS (RW). RW DATA ARE PRESENTED FOR REFERENCE ONLY AND ARE NOT CONTOURED.

500' 250' 0 500'

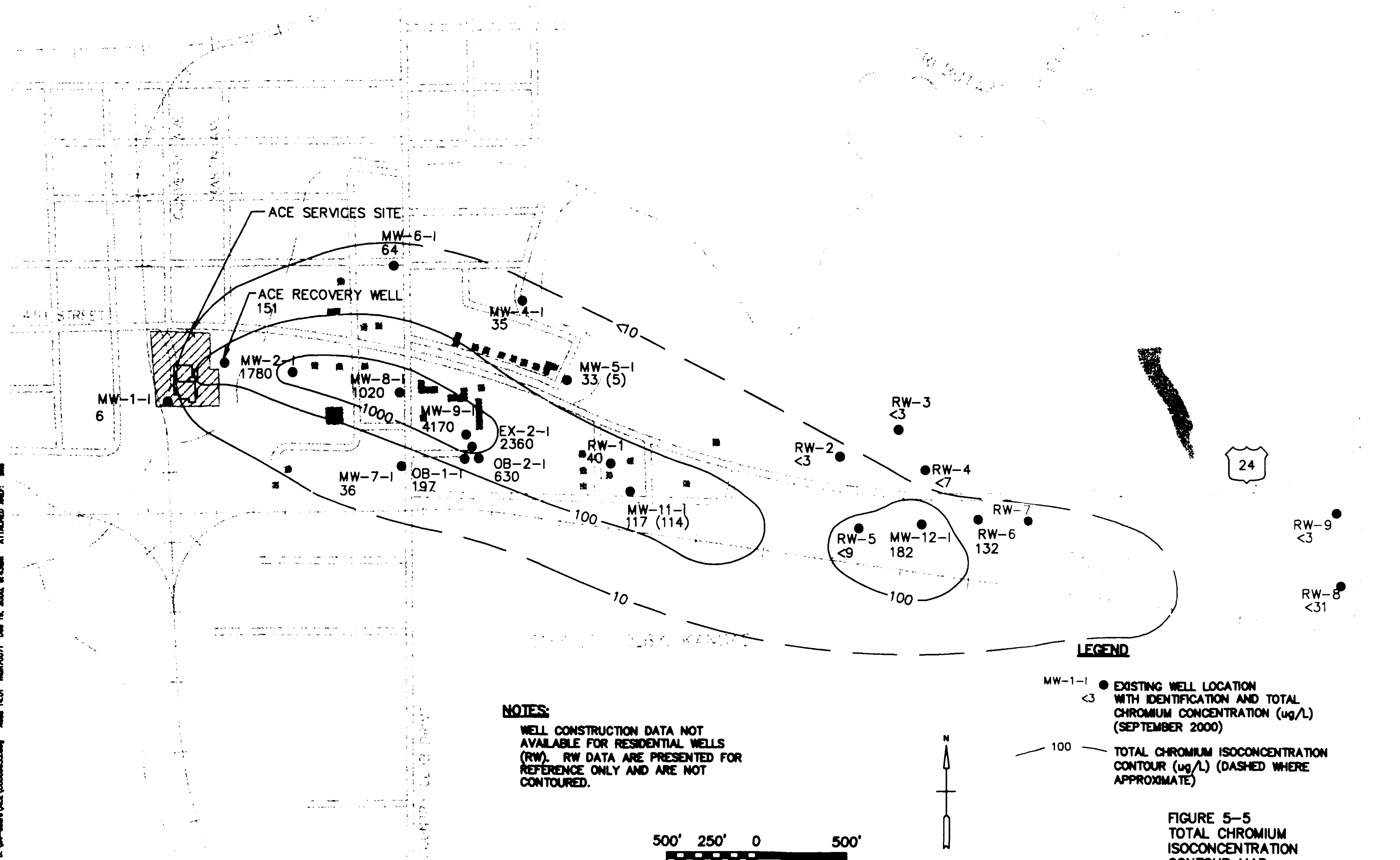
N

LEGEND

MW-1-S <3 ● EXISTING WELL LOCATION WITH IDENTIFICATION AND TOTAL CHROMIUM CONCENTRATION (ug/L) (SEPTEMBER 2000)

100 TOTAL CHROMIUM ISOCONCENTRATION CONTOUR (ug/L) (DASHED WHERE APPROXIMATE)

FIGURE 5-4
TOTAL CHROMIUM ISOCONCENTRATION CONTOUR MAP - SHALLOW ZONE
ACE SERVICES SITE



NOTES:

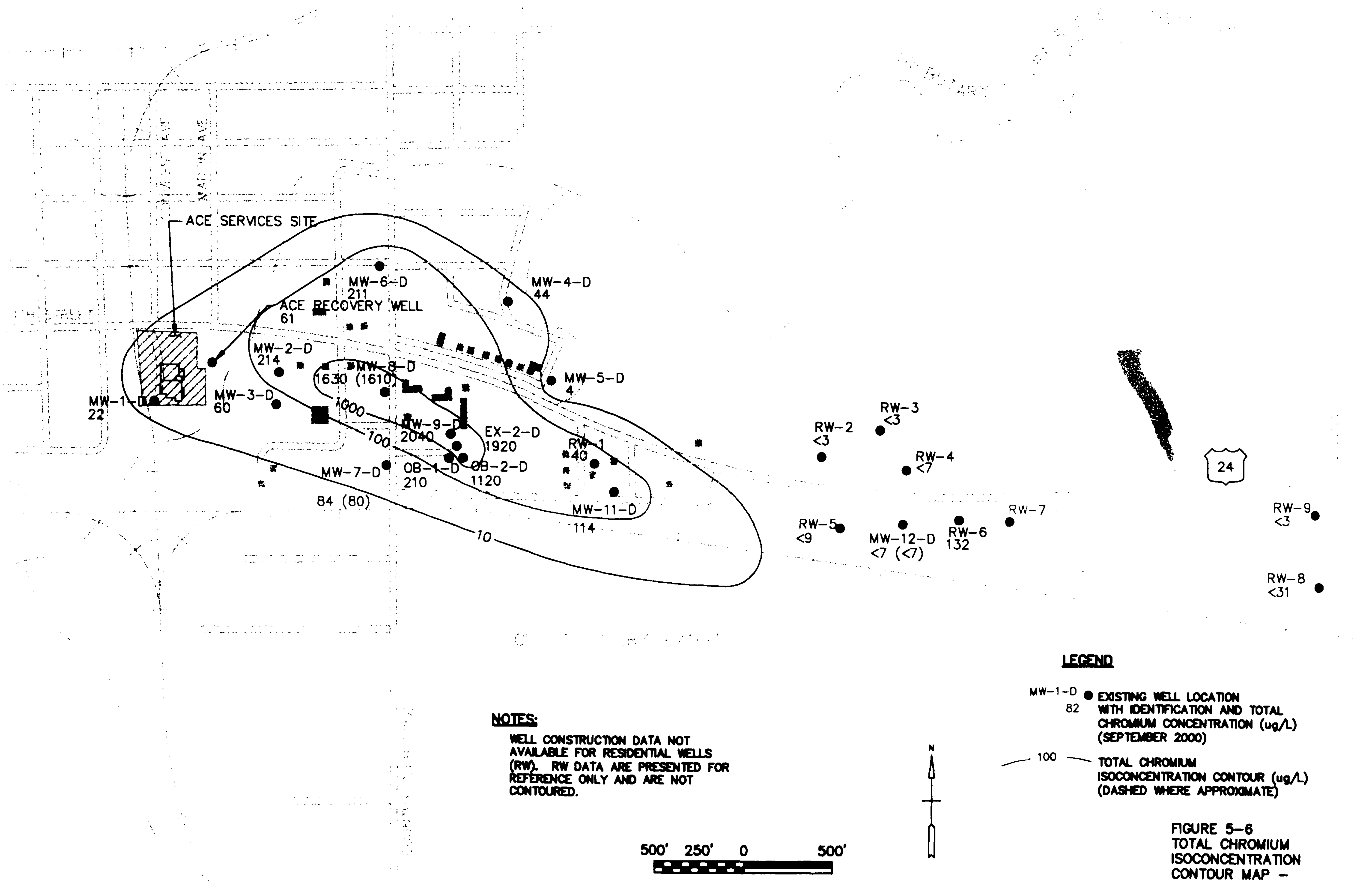
WELL CONSTRUCTION DATA NOT AVAILABLE FOR RESIDENTIAL WELLS (RW). RW DATA ARE PRESENTED FOR REFERENCE ONLY AND ARE NOT CONTOURED.

LEGEND

MW-1-I <3 ● EXISTING WELL LOCATION WITH IDENTIFICATION AND TOTAL CHROMIUM CONCENTRATION (ug/L) (SEPTEMBER 2000)

100 — TOTAL CHROMIUM ISOCONCENTRATION CONTOUR (ug/L) (DASHED WHERE APPROXIMATE)

FIGURE 5-5
TOTAL CHROMIUM ISOCONCENTRATION CONTOUR MAP – INTERMEDIATE ZONE
ACE SERVICES SITE



NOTES:

WELL CONSTRUCTION DATA NOT AVAILABLE FOR RESIDENTIAL WELLS (RW). RW DATA ARE PRESENTED FOR REFERENCE ONLY AND ARE NOT CONTOURED.

LEGEND

MW-1-D 82 ● EXISTING WELL LOCATION WITH IDENTIFICATION AND TOTAL CHROMIUM CONCENTRATION (ug/L) (SEPTEMBER 2000)

— 100 — TOTAL CHROMIUM ISOCONCENTRATION CONTOUR (ug/L) (DASHED WHERE APPROXIMATE)

FIGURE 5-6
TOTAL CHROMIUM ISOCONCENTRATION CONTOUR MAP - DEEP ZONE
ACE SERVICES SITE

A
WEST

A'
EAST

APPROXIMATE LOCATION OF WASTEWATER LAGOON PRIOR TO REMEDIATION (NOT TO SCALE)

MW-1 | ACE RECOVERY WELL | MW-2 | PWS WELL NO. 8 | MW-8 | MW-9 | MW-11 | MW-12

ELEVATION (ft, msl)

3150
3100
3050
3000
2950
2900
2850

SILT AND CLAY

OGALLALA FORMATION

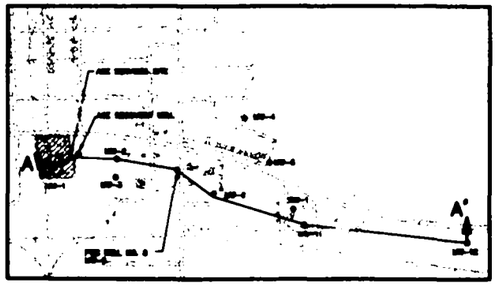
SAND AND GRAVEL WITH LOCALIZED SILT AND CLAY LENSES

14
6
10
22
358
118
100
10
<10
259 (300)
162
92
1000
2900 (3000)
1020
4170
151
1780
214
2040
100
61
1630 (1610)
117 (114)
182
100
10
114
<7 (<7)

PIERRE SHALE FORMATION

400' 200' 0 400'

HORIZONTAL SCALE



CROSS SECTION LOCATION

LEGEND

1000J (990J)
SCREEN PORTION OF WELL, TOTAL CHROMIUM CONCENTRATION (ug/L), AND DUPLICATE (SEPTEMBER 2000)

GROUNDWATER ELEVATION FOR SHALLOW ZONE (FEBRUARY 2000)

100
TOTAL CHROMIUM ISOCONCENTRATION CONTOUR (ug/L) (DASHED WHERE APPROXIMATE)

SAND PORTION OF AQUIFER BELOW WATER TABLE

FIGURE 5-7
VERTICAL EXTENT OF TOTAL CHROMIUM
ACE SERVICES SITE

Table 5-4
Summary of Historical Analytical Results
Total Chromium in Groundwater (ug/L unfiltered)
Ace Services Site

Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	6/13-15/89	4/5/90	11/9/90	12/20/90	5/23/91	12/21/94	12/12/95	1-10/96	9/23/25/96	11/3-6/97	10/99	2001	9/00
MW-1 D													ND 9	ND			ND	2.9 J	ND(10)	82		22
MW-2 D													40 118	1910			345	2,610 (2,680) [2,447]	1,200(1,200)	1180(1240)		214
MW-3 D													ND 7	ND			53	20 2	ND(10)	105		60
MW-4 S																			ND(10)	92		22
MW-5 S																			ND(10)	94		ND (3) (ND(3))
Ace Recovery Well	132-357	240	480-730	870	1400	9 915	4-985	610-734	430	95-284				135			242	283				
Ace Recovery Well (Shallow Screen)																			870	1130		358
Ace Recovery Well (Intermediate Screen)																			250	471		151
Ace Recovery Well (Deep Screen)																			60	160		61
Colby PWS Well No 8	276-1800	1100	10-990														51 / 64	680[614]	2,700(2,600)	1930(2050)		2900(3000)
Hi-Plains HPMW-6 S															ND (30)					73		ND(3)
Hi-Plains HPMW-9 S															1800					501		374
Residential Well #5										17		17					18	27 5	20	11		ND(9)
Residential Well #6																	24	32 2	60	122	104(101)	132
Residential Well #1																		43 4	40	17	36	40
Residential Well #2																	ND		ND(10)	ND(10)		ND(3)
Residential Well #3											ND		ND				ND		ND(10)	22		ND(3)
Residential Well #4																	ND		ND(10)	ND(10)		ND(3)
Colby Wrecking Co Well																	ND					
Residential Well #7																	14					
Residential Well #8																						ND(31)
Colby Implement Co Well													ND				ND					
Meadowlark Inn Well	20	20		ND			3-14	ND 4100		ND							Plugged					
Cobblestone Inn Well	ND	ND			10	ND-6	4-7	ND-12									Plugged					

J = Estimated

ND(10) = Chromium not detected at identified detection limit

a = Duplicate sample result in parentheses

b = KDHE split sample result in brackets

c = Hi-Plains Co-op Report, February 21, 1995

12-357 = Minimum-maximum range of total chromium during sampling period

MCL for Chromium = 100 ug/L

Source = KDHE 1989, KDHE 1996

The site survey base map will include the area identified as part of the site. The site survey base map will include areas where additional extraction well nests may need to be installed to achieve the active remediation goal defined in the ROD for the site.

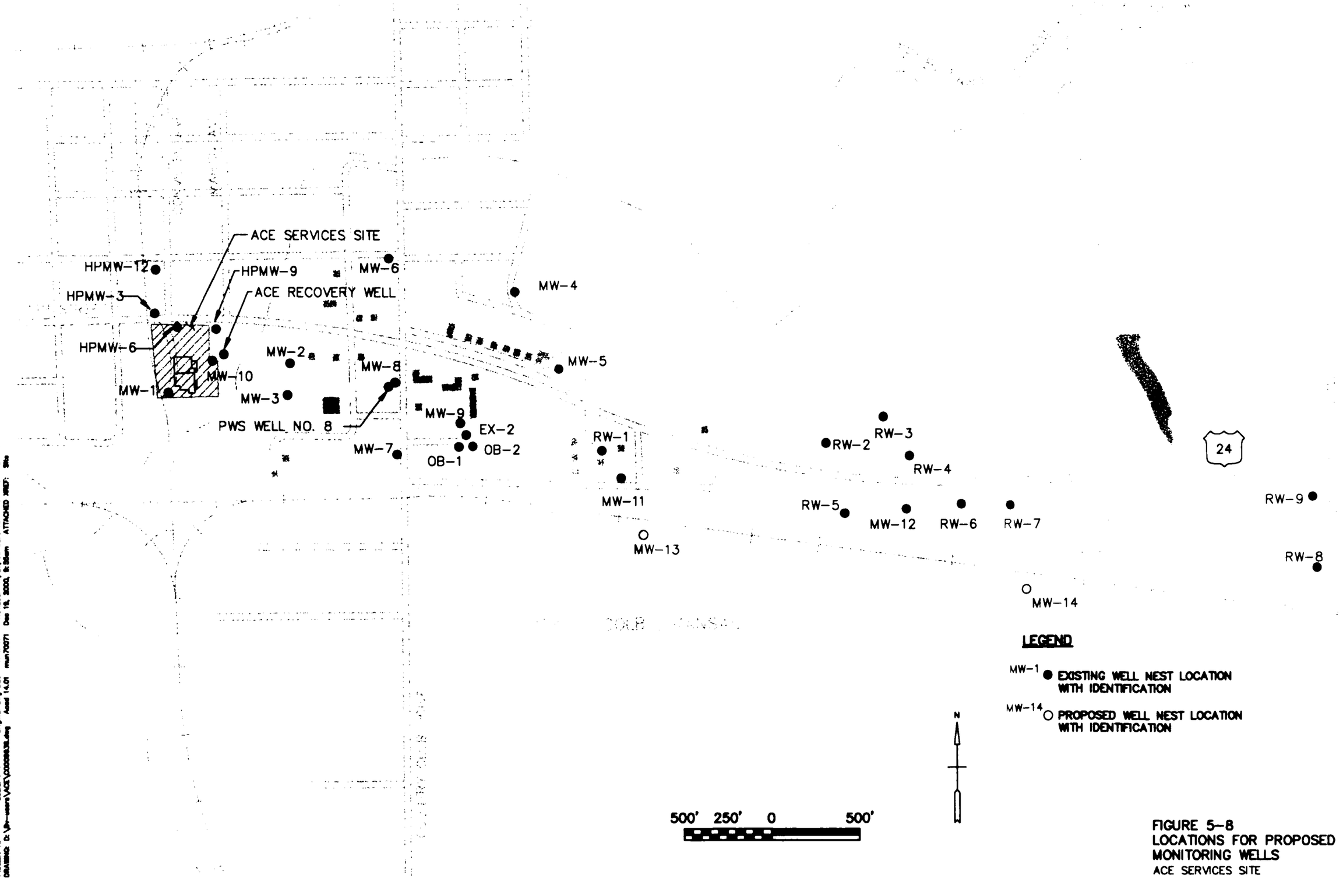


FIGURE 5-8
LOCATIONS FOR PROPOSED MONITORING WELLS
ACE SERVICES SITE

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BVSPC, 2000g. *Remedial Design PARCC's Report and Data Evaluation Technical Memorandum Groundwater Data, Ace Services Site*, prepared for USEPA Region VII, June 28, 2000.

BVSPC, 2000h. *Remedial Design Phase 3 Data Validation Report Groundwater Data, Ace Services Site*, prepared for USEPA Region VII, December 12, 2000.

BVSPC, 2000i. *Remedial Design Phase 3 PARCC's Report and Data Evaluation Technical Memorandum Groundwater Data, Ace Services Site*, prepared for USEPA Region VII, December 18, 2000.

KDHE, *Listing Site Investigation Report for the Ace Services, Inc., Site*, Colby, Kansas, May 31, 1991.

KDHE, *Preliminary Assessment and Scanning Site Investigation*, Colby Public Water Supply Well 8, Colby, Thomas County, Kansas, September 1989.

KDHE, Groundwater Analytical Results, Ace Services Inc. Site, Colby, Thomas County, Kansas, January 1996.

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Appendix A
Boring Logs

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-S
SHEET 1 OF 1

CLIENT: USEPA	PROJECT: Ace Services		PROJECT NO.: 46118
PROJECT LOCATION: Colby, Kansas	COORDINATES: N 9380.08607' E 10308.46867'	ELEVATION (DATUM): 3142.71' (msl)	TOTAL DEPTH: 13.3 FEET	DATE START: 7/12/00
SURFACE CONDITIONS: Grassy.	LOGGED BY: G. Felkner		DATE FINISH: 7/12/00
	CHECKED BY: B. Smith	APPROVED BY: B. Smith	

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD

DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
1–13			Undifferentiated Overburden (See boring log for OB-1-D).	Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid.
14–29				Bottom of boring @ 133'. Water level not recorded. Monitoring well installed on 7/12/00.

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-I
SHEET 1 OF 1

CLIENT USEPA	PROJECT Ace Services			PROJECT NO 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9378.57019' E 10328.25223'	ELEVATION (DATUM) 3142.31' (msl)	TOTAL DEPTH 198 FEET	DATE START 7/13/00
SURFACE CONDITIONS Grassy.	LOGGED BY G. Felkner			DATE FINISH 7/13/00
	CHECKED BY B. Smith	APPROVED BY B. Smith		

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG

CLASSIFICATION OF MATERIAL	REMARKS
Undifferentiated Overburden. (See boring log for OB-1-D).	Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid.
Bottom of boring @ 198'. Water level not recorded. Monitoring well installed on 7/13/00.	

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 1 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9362.49239' E 10332.46531'	3141.98' (msl)	240 FEET	7/12/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Gravel.	G. Felkner	7/12/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 0 INCHES | 2ND 0 INCHES | 3RD 0 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
1–29			GRAVEL. Clayey SILT, brown, non-plastic, (Loess). Silty CLAY, brown.	Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid. Lithology logged from cuttings.

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 2 OF 8

CLIENT USEPA	PROJECT Ace Services			PROJECT NO 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9362.49239' E 10332.46531'	ELEVATION (DATUM) 3141.98' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/12/00
SURFACE CONDITIONS Gravel.	LOGGED BY G. Felkner			DATE FINISH 7/12/00
	CHECKED BY B. Smith	APPROVED BY B. Smith		

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														31			Gravelly SAND, brown, medium grained.	
														32				
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43			Sandy CLAY, brown.	
														44				
														45				
														46				
														47				
														48				
														49				
														50			Silty CLAY, brown.	
														51				
														52				
														53			Sandy CLAY, brown.	
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 3 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9382.49239' E 10332.46531'	3141.98' (msl)	240 FEET	7/12/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Gravel.	G. Felkner	7/12/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 4 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9362.49239' E 10332.46531'	3141.98' (msl)	240 FEET	7/12/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Gravel.	G. Felkner	7/12/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
91			Clayey SAND, brown.	
92			Sandy CLAY, brown.	
93–100				
101			Silty SAND, brown.	
102–108				
109			Gravelly SAND, brown, medium grained w/some clay.	
110–119				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 5 OF 8

CLIENT USEPA		PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9382.49239' E 10332.46531'	ELEVATION (DATUM) 3141.98' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/12/00
SURFACE CONDITIONS Gravel.		LOGGED BY G. Felkner		DATE FINISH 7/12/00
		CHECKED BY B. Smith	APPROVED BY B. Smith	

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 0 INCHES | 2ND 0 INCHES | 3RD 0 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 6 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9362.49239' E 10332.46531'	3141.98' (msl)	240 FEET	7/12/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Gravel	G. Felkner	7/12/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
151			Clayey SAND, brown, fine to medium grained.	
152				
153				
154				
155				
156				
157				
158				
159				
160				
161				
162				
163				
164				
165				
166				
167				
168				
169				
170				
171				
172				
173				
174				
175				
176				
177				
178				
179			Gravelly SAND, brown.	

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 7 OF 8

CLIENT: USEPA	PROJECT: Ace Services		PROJECT NO.: 46118
PROJECT LOCATION: Colby, Kansas	COORDINATES: N 9362.49239' E 10332.46531'	ELEVATION (DATUM): 3141.98' (msl)	TOTAL DEPTH: 240 FEET	DATE START: 7/12/00
SURFACE CONDITIONS: Gravel.	LOGGED BY: G. Felkner		DATE FINISH: 7/12/00
	CHECKED BY: B. Smith	APPROVED BY: B. Smith	

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196 — Silty CLAY.
197
198
199
200
201
202
203
204
205
206 — Clayey SAND, brown, medium grained.
207
208
209

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-1-D
SHEET 8 OF 8

CLIENT: USEPA	PROJECT: Ace Services		PROJECT NO.: 46118
PROJECT LOCATION: Colby, Kansas	COORDINATES: N 9362.49239' E 10332.46531'	ELEVATION (DATUM): 3141.98' (msl)	TOTAL DEPTH: 240 FEET	DATE START: 7/12/00
SURFACE CONDITIONS: Gravel.	LOGGED BY: G. Felkner		DATE FINISH: 7/12/00
	CHECKED BY: B. Smith	APPROVED BY: B. Smith	

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
220			CLAY, brown.	
225			Gravelly SAND, brown.	
235			SHALE, grayish-green, thin bedded, (Pierre Shale Fm).	~4000 gallons water used during drilling. Bottom of boring @ 240'. Water level not recorded. Extraction well installed 7/12/00.

211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-S
SHEET 1 OF 1

CLIENT: USEPA	PROJECT: Ace Services		PROJECT NO.: 46118
PROJECT LOCATION: Colby, Kansas	COORDINATES: N 9377.06295' E 10392.88955'	ELEVATION (DATUM): 3159.59' (msl)	TOTAL DEPTH: 13 3 FEET	DATE START: 7/14/00
SURFACE CONDITIONS: Grassy.	LOGGED BY: G. Felkner		DATE FINISH: 7/14/00
	CHECKED BY: B. Smith	APPROVED BY: B. Smith	

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FT (x10) | SAMPLE TYPE | GRAPHIC LOG

CLASSIFICATION OF MATERIAL	REMARKS
Undifferentiated Overburden (See boring log for OB-2-D).	Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid.
Bottom of boring @ 133'.	Water level not recorded. Monitoring well installed on 7/14/00.

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-I
SHEET 1 OF 1

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.94194' E 10402.35013'	3138.63' (msl)	196 FEET	7/14/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy	G. Felkner	7/14/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG

CLASSIFICATION OF MATERIAL	REMARKS
Undifferentiated Overburden (See boring log for OB-2-D).	Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid.
Bottom of boring @ 196'.	Water level not recorded.
	Monitoring well installed on 7/14/00.

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 1 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

TOPSOIL.

Clayey SILT, brown, (Loess).

Boring advanced using rotary wash methods w/5-3/8" OD drag bit. Reamed boring w/8" OD drag bit using water as drilling fluid. Lithology logged from cuttings.

CLAY, brown.

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 2 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG

CLASSIFICATION OF MATERIAL	REMARKS
Clayey SAND, brown.	
Sandy CLAY, brown.	
Clayey SAND, brown, medium grained.	

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 3 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

61
62
63
64
65
66
67 — Sandy CLAY, brown.
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82 — Clayey SAND, brown, medium grained.
83
84
85
86
87
88
89

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 4 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														91				
														92				
														93			Sandy CLAY, brown.	
														94				
														95				
														96				
														97				
														98			Clayey SAND, brown, medium grained.	
														99				
														100				
														101				
														102				
														103				
														104				
														105				
														106				
														107				
														108				
														109				
														110				
														111				
														112				
														113				
														114				
														115				
														116				
														117				
														118				
														119				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 5 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
121				
122				
123				
124				
125				
126				
127				
128				
129				
130				
131				
132				
133				
134				
135				
136				
137				
138			Sandy CLAY, brown.	
139				
140				
141				
142				
143				
144				
145				
146				
147				
148				
149				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 6 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														151			Clayey SAND, brown.	
														152				
														153				
														154				
														155				
														156				
														157				
														158				
														159				
														160				
														161				
														162				
														163				
														164				
														165			Gravelly SAND; brown.	
														166				
														167				
														168				
														169				
														170				
														171				
														172				
														173			Sandy CLAY, brown, w/trace gravel.	
														174				
														175				
														176				
														177				
														178				
														179				

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 7 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG

CLASSIFICATION OF MATERIAL

REMARKS

181
182
183 — Clayey SAND, brown.
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209

BLACK & VEATCH

LOG OF BORING

BORING NO. OB-2-D
SHEET 8 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9377.88098' E 10412.45754'	3138.11' (msl)	240 FEET	7/13/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/13/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														211				
														212				
														213				
														214				
														215			CLAY, brown.	
														216				
														217				
														218				
														219				
														220			Gravelly SAND, brown.	
														221				
														222				
														223				
														224				
														225				
														226				
														227				
														228				
														229				
														230				
														231				
														232				
														233				
														234			SHALE, greenish-gray, thin bedded, (Pierre Shale Fm).	
														235				
														236				
														237				~4000 gallons water used during drilling.
														238				Bottom of boring @ 240'. Water level not recorded. Extraction well installed 7/13/00.
														239				

BLACK & VEATCH

LOG OF BORING

BORING NO. EX-2-S
SHEET 1 OF 1

CLIENT: USEPA	PROJECT: Ace Services		PROJECT NO.: 46118
PROJECT LOCATION: Colby, Kansas	COORDINATES: N 9449.78932' E 10338.29564'	ELEVATION (DATUM): 3142.13' (msl)	TOTAL DEPTH: 135 FEET	DATE START: 7/11/00
SURFACE CONDITIONS: Grassy.	LOGGED BY: G. Felkner			DATE FINISH: 7/11/00
	CHECKED BY: B. Smith	APPROVED BY: B. Smith		

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
1–13			Undifferentiated Overburden (See boring log for EX-2-D).	Boring advanced using rotary wash methods w/7½" OD drag bit. Reamed boring w/10" OD drag bit using water as drilling fluid. ~4,000 gallons of water used during drilling.
14–135				Bottom of boring @ 135'. Water level not recorded. Monitoring well installed on 7/11/00.

BLACK & VEATCH

LOG OF BORING

BORING NO. EX-2-I
SHEET 1 OF 1

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9441.91718' E 10347.99760'	3141.30' (msl)	20.0 FEET	7/11/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Gravel/Asphalt Road	G. Felkner	7/11/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
0–20			Undifferentiated Overburden (See boring log for EX-2-D).	Boring advanced using rotary wash methods w/7⅞" OD drag bit. Reamed boring w/12" OD drag bit using Bentonite/water as drilling fluid. ~4,000 gallons of water used during drilling.
20				Bottom of boring @ 200'. Water level not recorded. Monitoring well installed on 7/11/00.

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

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LOG OF BORING

BORING NO. EX-2-D
SHEET 1 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9434.31623' E 10358.43995'	3140.50' (msl)	240 FEET	7/10/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/10/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FT (x10) | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

TOPSOIL.

Clayey SILT, brown, non-plastic, (Loess).

Silty CLAY, brown.

Boring advanced using rotary wash methods w/7½" OD drag bit. Reamed boring w/12" OD drag bit using Bentonite/water as drilling fluid. Lithology logged from cuttings.

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LOG OF BORING

BORING NO. EX-2-D
SHEET 2 OF 8

CLIENT USEPA		PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9434.31623' E 10358.43995'	ELEVATION (DATUM) 3140.50' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/10/00
SURFACE CONDITIONS Grassy.		LOGGED BY G. Felkner		DATE FINISH 7/10/00
		CHECKED BY B. Smith	APPROVED BY B. Smith	

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														31			Gravelly SAND, brown, medium grained, some clay.	
														32				
														33				
														34				
														35				
														36				
														37				
														38				
														39				
														40				
														41				
														42				
														43			Sandy CLAY, brown.	
														44				
														45				
														46				
														47				
														48				
														49				
														50				
														51				
														52				
														53				
														54				
														55				
														56				
														57				
														58				
														59				

BLACK & VEATCH

LOG OF BORING

BORING NO. EX-2-D
SHEET 3 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9434.31823' E 10358.43995'	3140.50' (msl)	240 FEET	7/10/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/10/00

CHECKED BY	APPROVED BY
B. Smith	B. Smith

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | ROD RECOVERY | PERCENT RECOVERY | ROD

DEPTH IN FEET | SAMPLE TYPE | GRAPHIC LOG | CLASSIFICATION OF MATERIAL | REMARKS

61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89

Gravelly SAND, brown, medium grained.

Sandy CLAY, brown.

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LOG OF BORING

BORING NO. EX-2-D
SHEET 4 OF 8

CLIENT USEPA		PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9434.31623' E 10358.43995'	ELEVATION (DATUM) 3140.50' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/10/00
SURFACE CONDITIONS Grassy.		LOGGED BY G. Felkner		DATE FINISH 7/10/00
		CHECKED BY B. Smith	APPROVED BY B. Smith	

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119			Gravelly SAND, brown, medium grained, some clay.	

BLACK & VEATCH

LOG OF BORING

BORING NO. EX-2-D
SHEET 5 OF 8

CLIENT USEPA	PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9434.31623' E 10358.43995'	ELEVATION (DATUM) 3140.50' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/10/00
SURFACE CONDITIONS Grassy.	LOGGED BY G Felkner			DATE FINISH 7/10/00
SAMPLING	CHECKED BY B. Smith	APPROVED BY B. Smith		

SAMPLING: SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY
CORING: CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	RQD RECOVERY	PERCENT RECOVERY	RQD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
121				
122				
123				
124				
125				
126				
127				
128				
129				
130				
131			Sandy CLAY, brown.	
132				
133				
134				
135				
136			Clayey SAND, brown, medium grained.	
137				
138				
139				
140			Sandy CLAY, brown.	
141				
142				
143				
144				
145				
146			Clayey SAND, brown, medium grained.	
147				
148				
149				

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LOG OF BORING

BORING NO. EX-2-D
SHEET 6 OF 8

CLIENT	PROJECT	PROJECT NO.
USEPA	Ace Services	46118

PROJECT LOCATION	COORDINATES	ELEVATION (DATUM)	TOTAL DEPTH	DATE START
Colby, Kansas	N 9434.31623' E 10358.43995'	3140.50' (msl)	240 FEET	7/10/00

SURFACE CONDITIONS	LOGGED BY	DATE FINISH
Grassy.	G. Felkner	7/10/00

CHECKED BY B. Smith

APPROVED BY B. Smith

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
														151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179				

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LOG OF BORING

BORING NO. EX-2-D
SHEET 7 OF 8

CLIENT USEPA		PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9434.31623' E 10358.43995'	ELEVATION (DATUM) 3140.50' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/10/00
SURFACE CONDITIONS Grassy.		LOGGED BY G. Felkner		DATE FINISH 7/10/00
		CHECKED BY B. Smith	APPROVED BY B. Smith	

SAMPLING: SAMPLE TYPE | SAMPLE NUMBER | SET 0 INCHES | 2ND 0 INCHES | 3RD 0 INCHES | N VALUE | SAMPLE RECOVERY

CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
181				
182				
183				
184			SAND, brown, medium grained.	
185				
186				
187				
188				
189				
190			Clayey SAND, brown, medium grained.	
191				
192				
193				
194				
195				
196				
197				
198				
199				
200				
201				
202				
203				
204				
205				
206				
207				
208				
209				

BLACK & VEATCH

LOG OF BORING

BORING NO. EX-2-D
SHEET 8 OF 8

CLIENT USEPA		PROJECT Ace Services		PROJECT NO. 46118
PROJECT LOCATION Colby, Kansas	COORDINATES N 9434.31623' E 10358.43995'	ELEVATION (DATUM) 3140.50' (msl)	TOTAL DEPTH 240 FEET	DATE START 7/10/00
SURFACE CONDITIONS Grassy.		LOGGED BY G. Felkner		DATE FINISH 7/10/00
		CHECKED BY B. Smith	APPROVED BY B. Smith	

SAMPLING							CORING									
SAMPLE TYPE	SAMPLE NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORE SIZE	RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FT (x10)	SAMPLE TYPE	GRAPHIC LOG

CLASSIFICATION OF MATERIAL	REMARKS
Gravelly SAND, brown, medium grained.	
SHALE, greenish-gray, thin bedded, (Pierre Shale Fm).	~4000 gallons water used during drilling. Bottom of boring @ 240'. Water level not recorded. Extraction well installed 7/10/00.

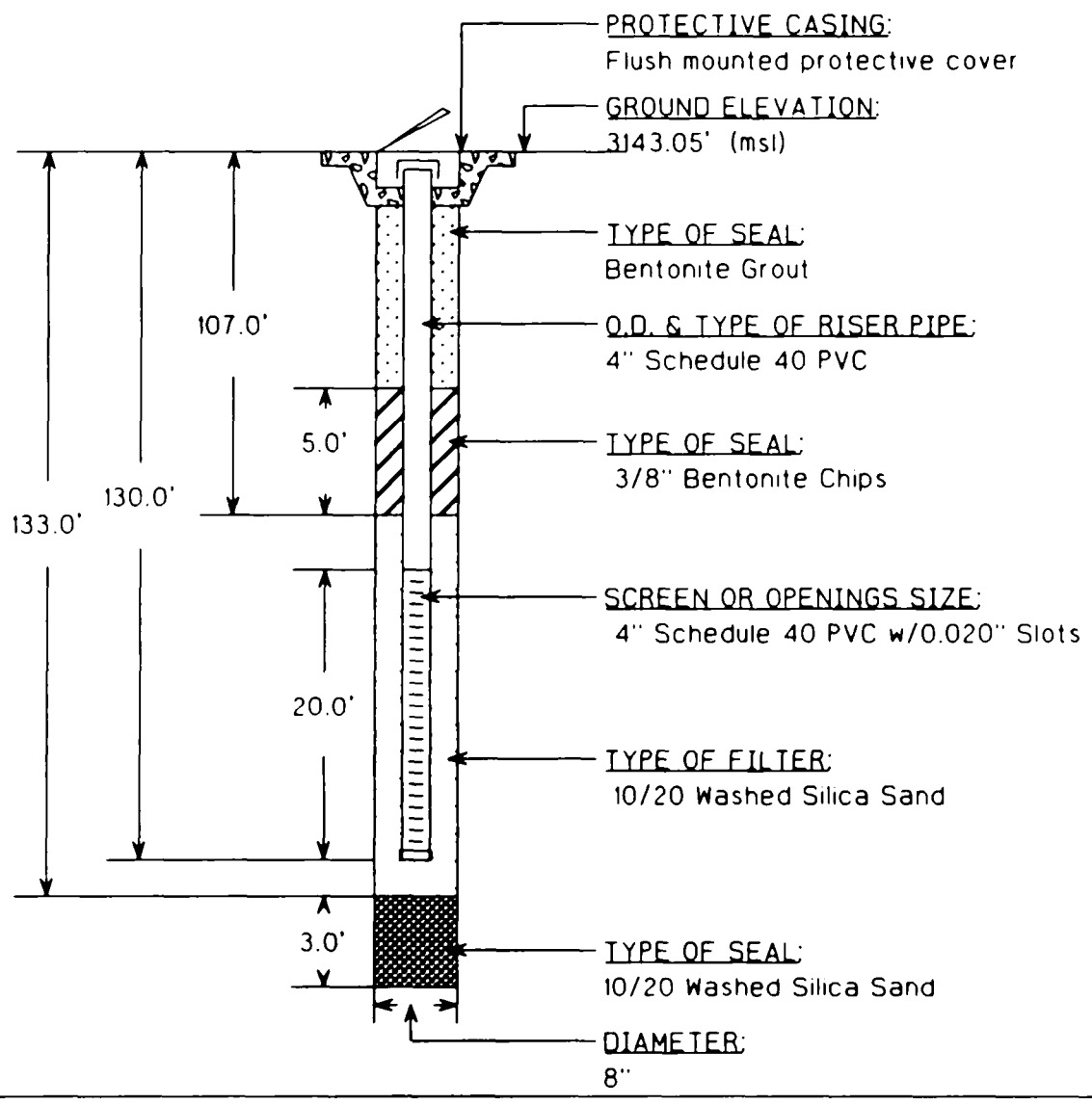
Appendix B
Well Construction Logs

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-1-S

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9380.08607' E 10308.46867'	TOP OF RISER ELEVATION (DATUM) 3142.71' (msl)	DATE 7/12/00
STRATUM MONITORED Gravelly SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION:
Boring drilled to completion; set riser pipe & screen; placed filter & seal. Grouted to 2' below ground surface.

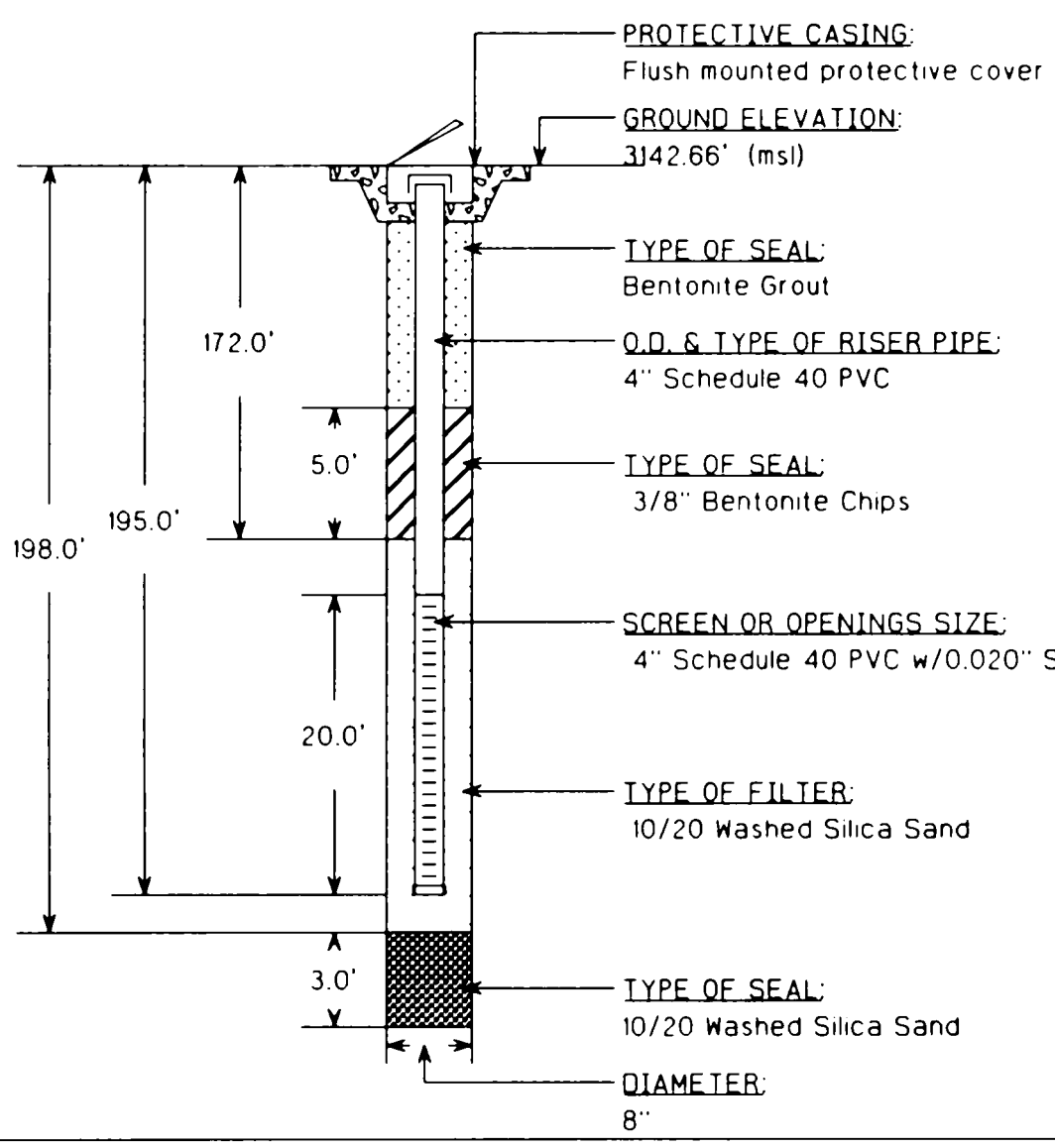
REMARKS:
Well developed by pumping ~2,525 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-1-I

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9378.57019' E 10328.25223'	TOP OF RISER ELEVATION (DATUM) 3142.31' (msl)	DATE 7/13/00
STRATUM MONITORED Clayey SAND, Gravelly SAND		LOGGED BY G Felkner	
CHECKED BY B Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION.
Boring drilled to completion, set riser pipe & screen, placed filter & seal. Grouted to 2' below ground surface.

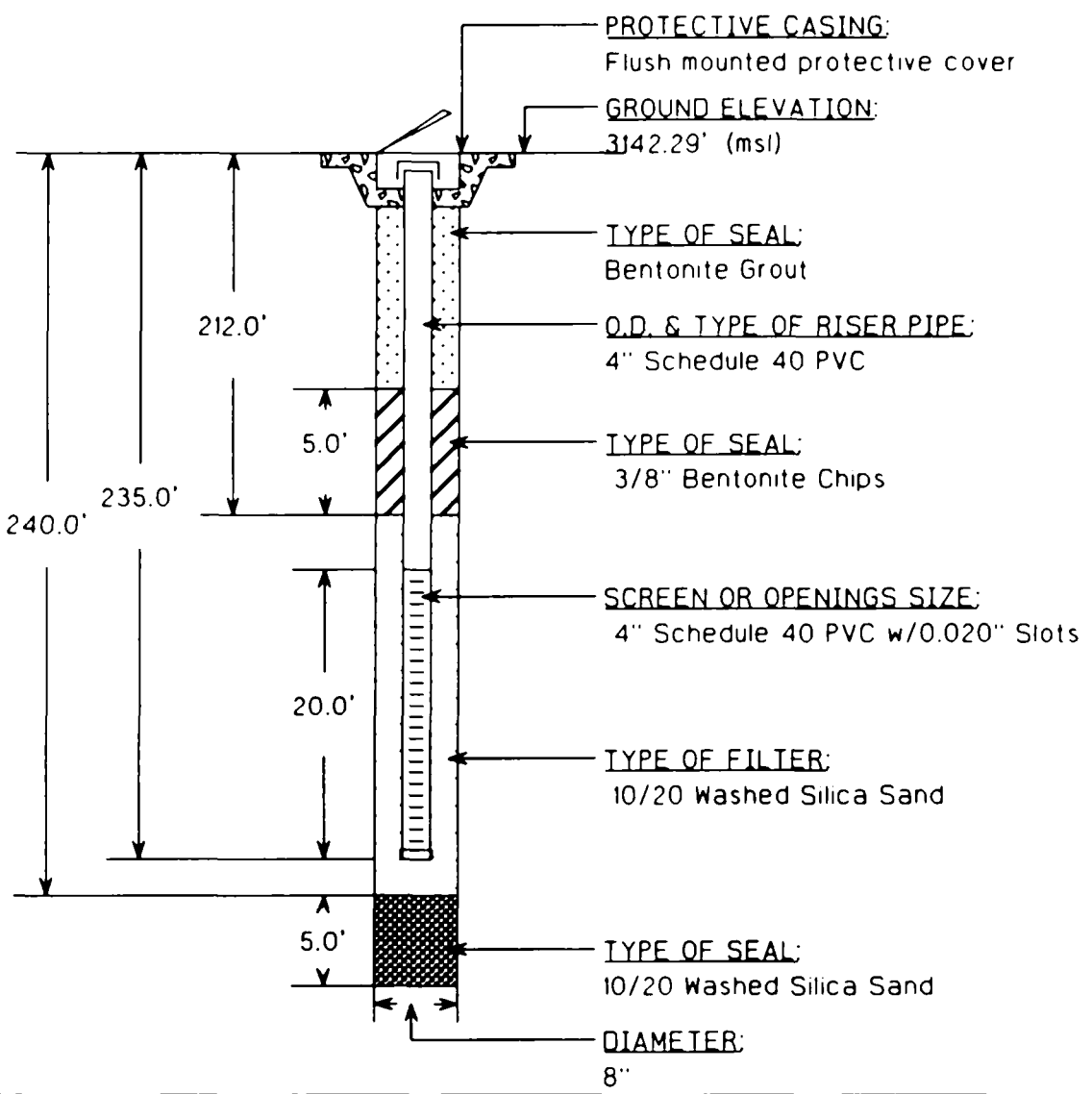
REMARKS.
Well developed by pumping ~5,115 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-1-D

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9362.49239' E 10332.46531'	TOP OF RISER ELEVATION (DATUM) 3141.98' (msl)	DATE 7/12/00
STRATUM MONITORED Clayey SAND, CLAY, Gravelly SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION:
Boring drilled to completion; set riser pipe & screen; placed filter & seal. Grouted to 2' below ground surface.

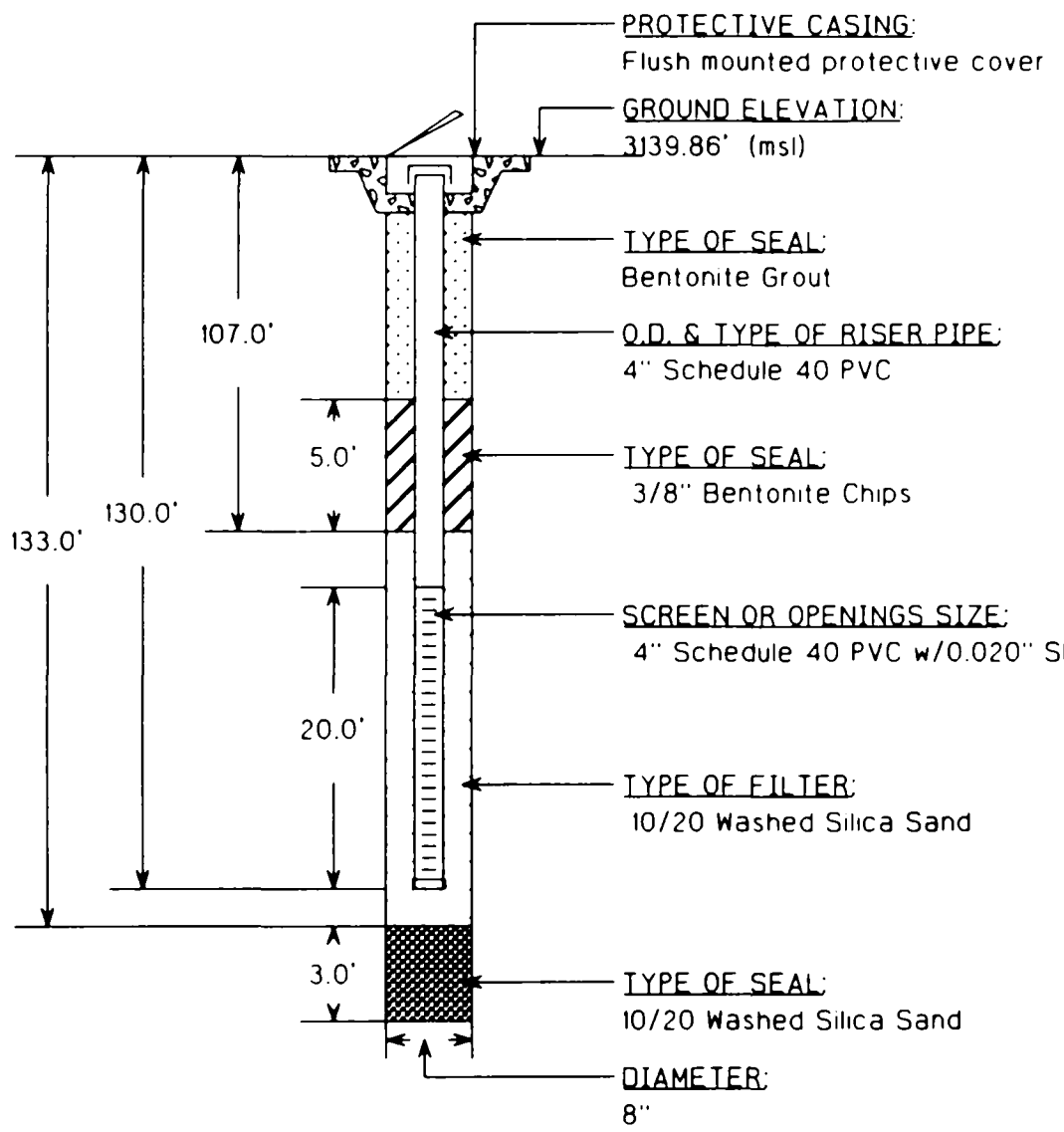
REMARKS:
Well developed by pumping ~5,500 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-2-S

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9377.06295' E 10392.88955'	TOP OF RISER ELEVATION (DATUM) 3139.59' (msl)	DATE 7/14/00
STRATUM MONITORED Clayey SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION:
Boring drilled to completion, set riser pipe & screen, placed filter & seal. Grouted to 2' below ground surface.

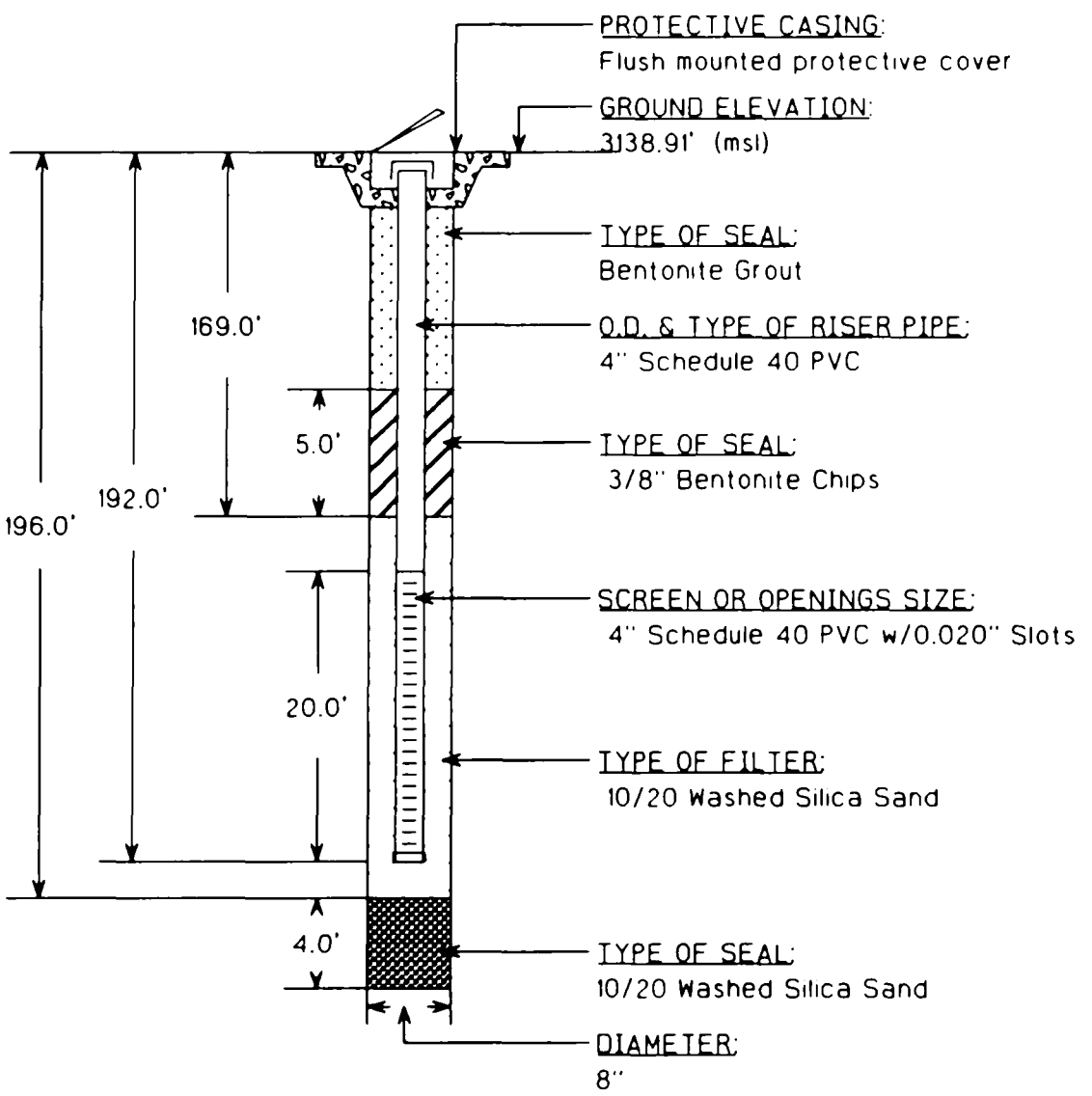
REMARKS:
Well developed by pumping ~2,900 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-2-I

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9377.94194' E 10402.35013'	TOP OF RISER ELEVATION (DATUM) 3138.63' (msl)	DATE 7/14/00
STRATUM MONITORED Sandy CLAY; Clayey SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION.
Boring drilled to completion; set riser pipe & screen; placed filter & seal. Grouted to 2' below ground surface.

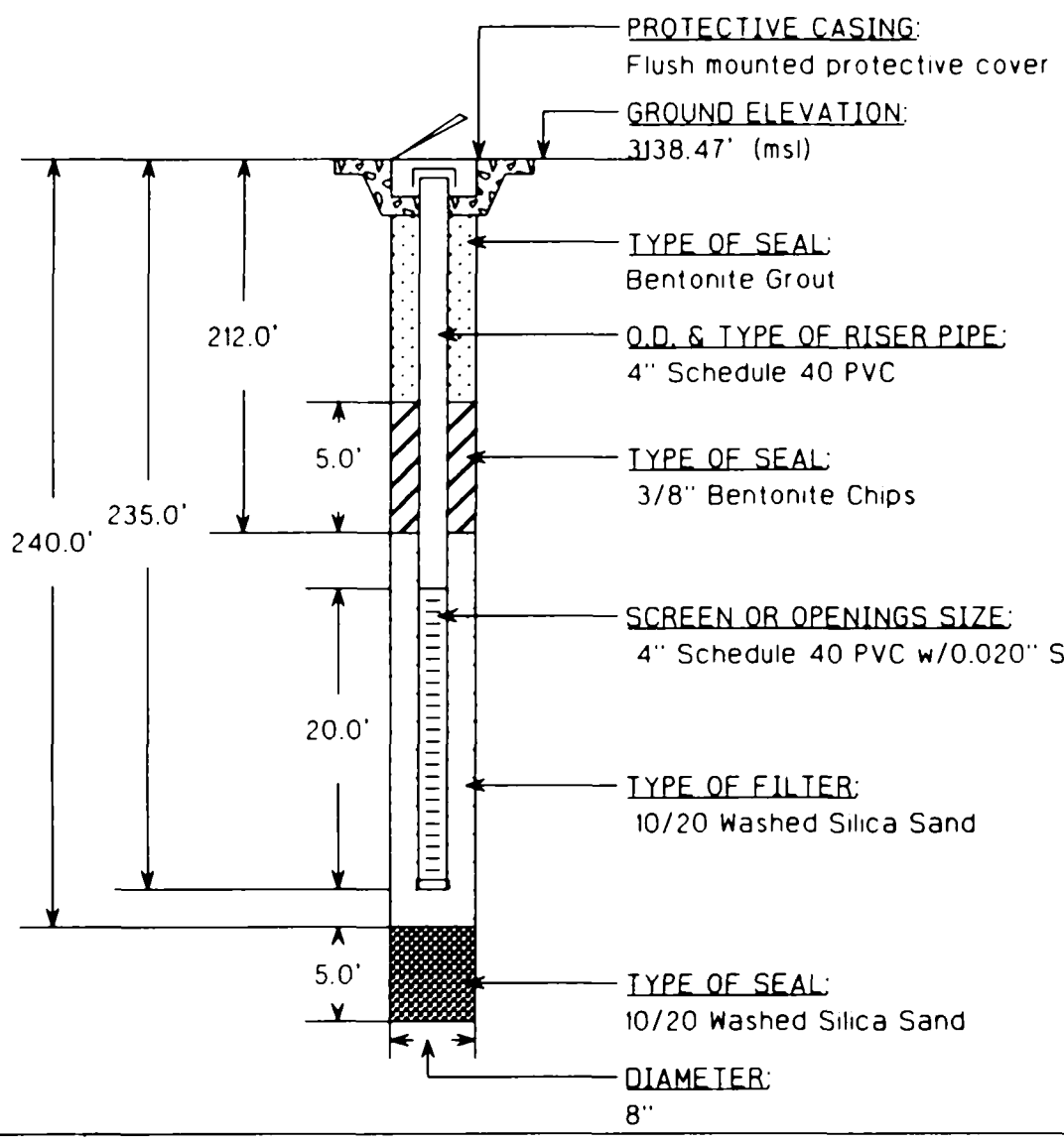
REMARKS.
Well developed by pumping ~8,500 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. OB-2-D

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9377.88098' E 10412.45754'	TOP OF RISER ELEVATION (DATUM) 3138.11' (msl)	DATE 7/13/00
STRATUM MONITORED CLAY, Gravelly SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION.
Boring drilled to completion, set riser pipe & screen, placed filter & seal. Grouted to 2' below ground surface.

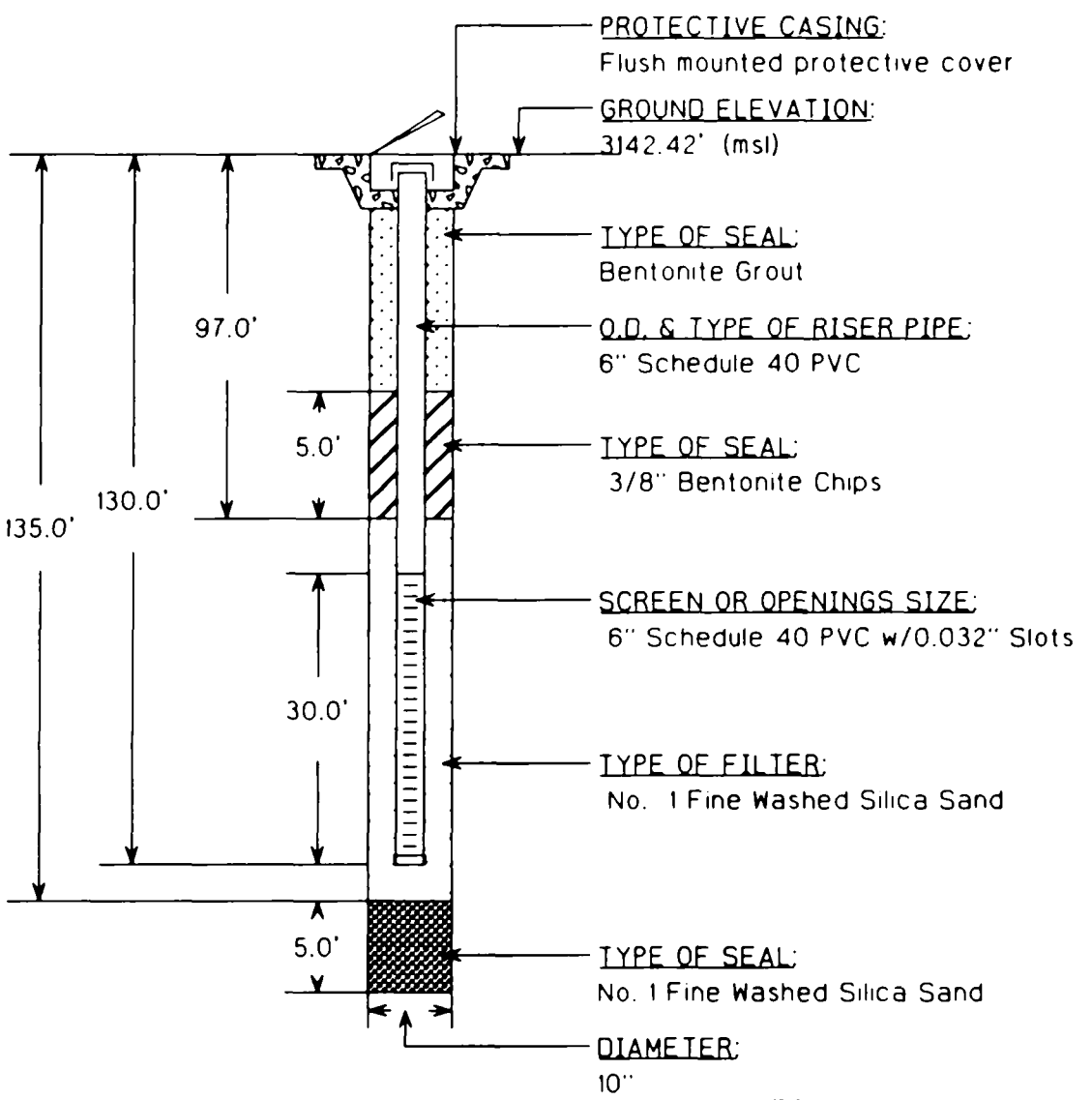
REMARKS.
Well developed by pumping ~4,680 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. EX-2-S

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9449.78932' E 10336.29564'	TOP OF RISER ELEVATION (DATUM) 3142.13' (msl)	DATE 7/11/00
STRATUM MONITORED Gravelly SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION.
Boring drilled to completion, set riser pipe & screen; placed filter & seal. Grouted to 2' below ground surface.

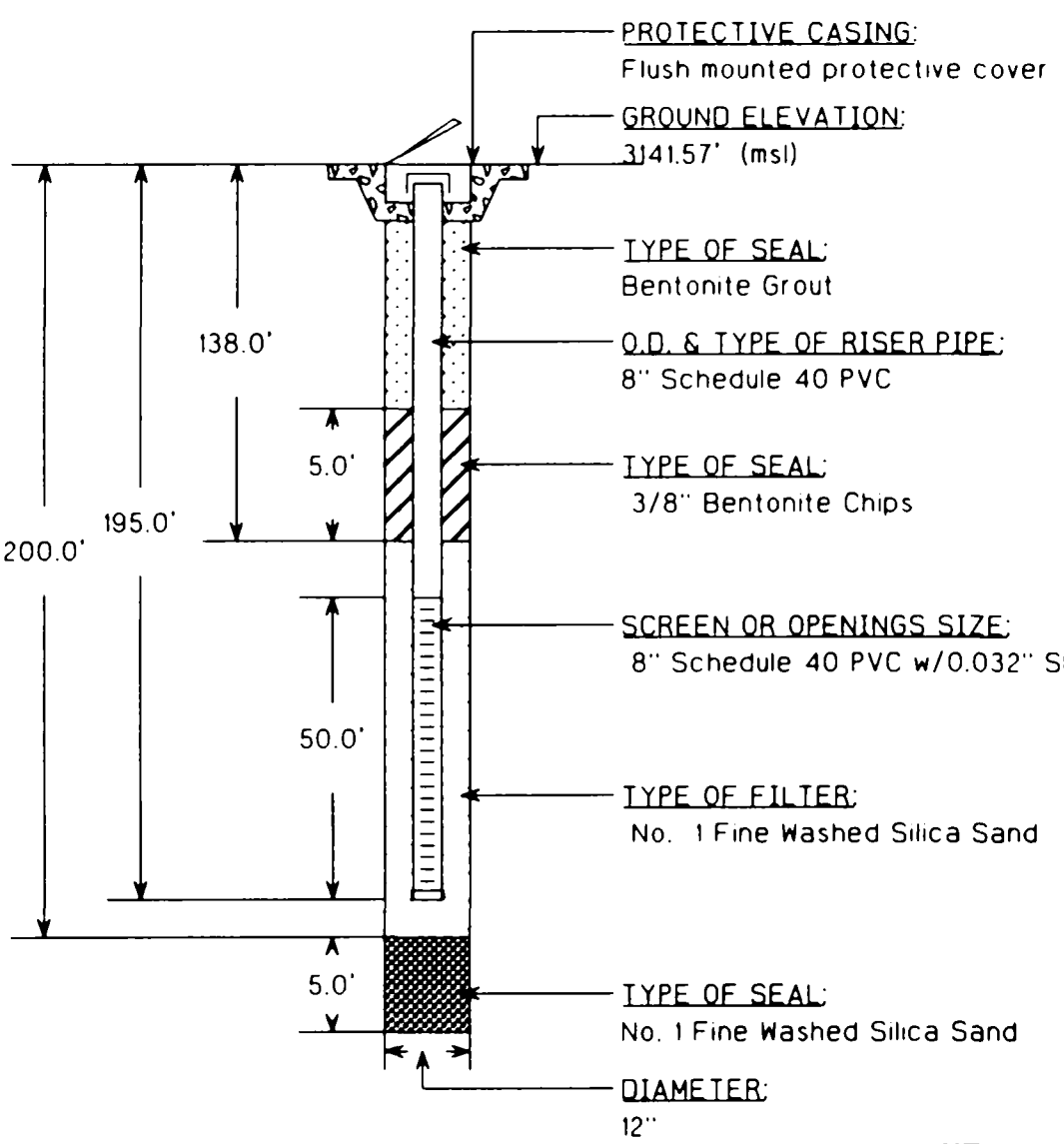
REMARKS.
Well developed by pumping ~3,260 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

NO. EX-2-I

CLIENT USEPA - Region VII		PROJECT Ace Services Site	PROJECT NO. 46118
PROJECT LOCATION Colby, KS	COORDINATES N 9441.91718' E 10347.99760'	TOP OF RISER ELEVATION (DATUM) 3141.30' (msl)	DATE 7/11/00
STRATUM MONITORED Clayey SAND		LOGGED BY G. Felkner	
CHECKED BY B. Smith		APPROVED BY B. Smith	



METHOD OF INSTALLATION.
Boring drilled to completion, set riser pipe & screen, placed filter & seal. Grouted to 2' below ground surface.

REMARKS.
Well developed by pumping ~12,375 gallons of water from well & surging.

BLACK & VEATCH

WELL INSTALLATION LOG

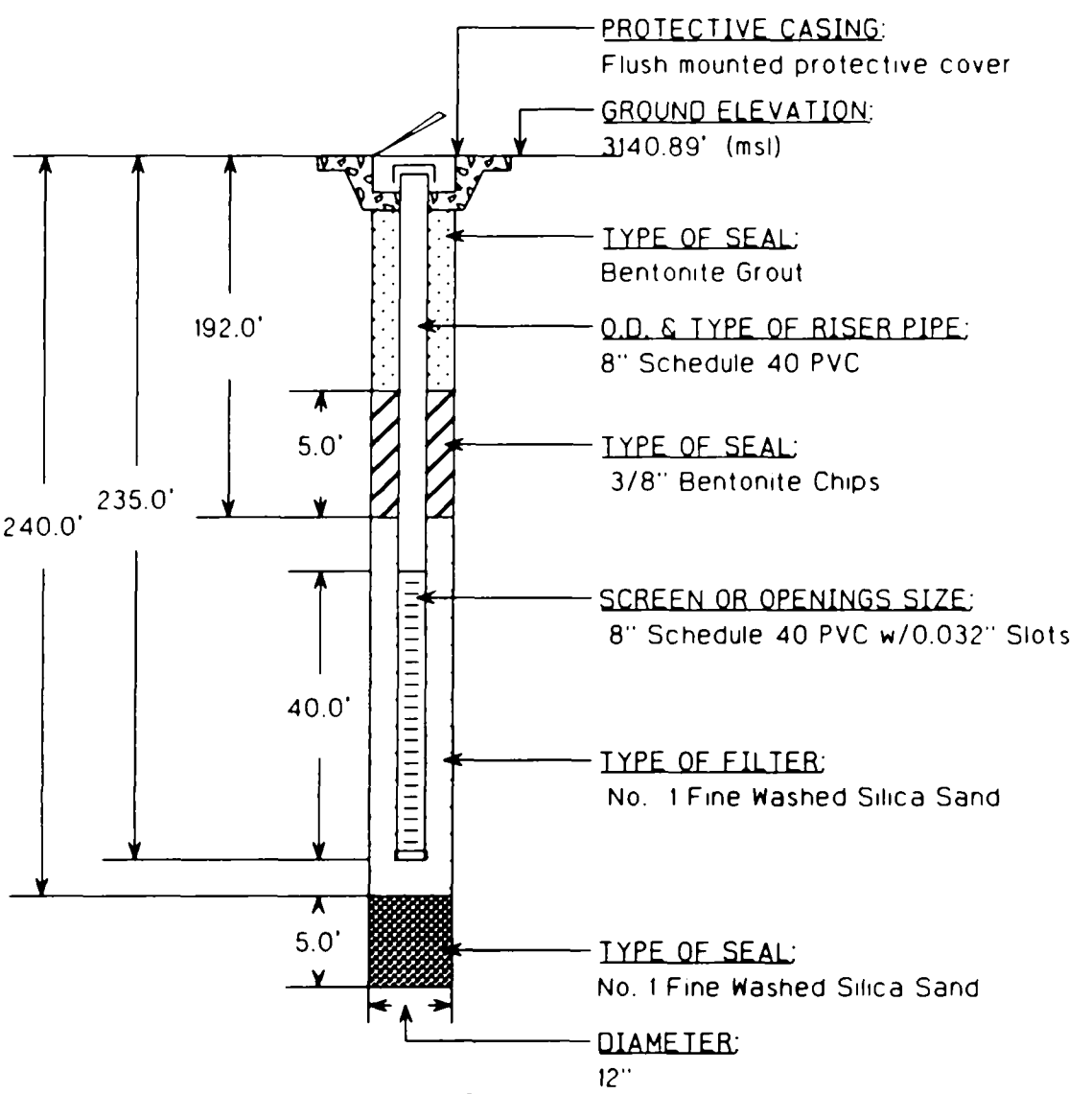
NO. EX-2-D

CLIENT	PROJECT	PROJECT NO.
USEPA - Region VII	Ace Services Site	46118

PROJECT LOCATION	COORDINATES	TOP OF RISER ELEVATION (DATUM)	DATE
Colby, KS	N 9434.31623' E 10358.43995'	3140.50' (msl)	7/10/00

STRATUM MONITORED	LOGGED BY
Clayey SAND, Gravelly SAND	G. Felkner

CHECKED BY	APPROVED BY
B. Smith	B. Smith



METHOD OF INSTALLATION:
Boring drilled to completion, set riser pipe & screen; placed filter & seal. Grouted to 2' below ground surface.

REMARKS:
Well developed by pumping ~19,500 gallons of water from well & surging.

Appendix C
Well Development/Purging Data Sheets

Black & Veatch Special Projects Corp.

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number 46118.123 | Project Name Ace Services | Date 7-18-00

Monitor Well Number OB-1-S | Field Investigator(s) G. Felkner

WELL DATA
INITIAL DEPTH 112.2' bgs
Total Depth 130'
Well Diameter 4"

Water Column Height 17.8'
Well Volume (gals) ~12
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
X Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes 36 gals Amount of Water Removed from Well ~2525 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____
Physical Appearance slight greenish tint

Remarks High range Hex Cr field test kit = 450 ppb

TIME	Temp °C	Conductivity	pH	NTUs	WL	Initial Removed gals	Flow Rate	DO	~~ORP~~
1300	Start	pumping		turbid	112.2	0	25 gpm		
1330	15.5	717	6.8	44			"	10.1	
1340	15.6	722	7.0	20			"	10.0	
1355	15.5	726	6.9	21			"	10.1	
1410	15.6	729	6.9	6		~1750	"	10.4	
1415	15.6	729	6.9	7			"	10.1	
1417	Surge	well							
1430	15.6	743	6.8	29		~2250	"	10.3	
1435	15.6	740	6.9	9			"	10.4	
1440	15.6	740	6.9	7		~2525	"	10.4	
1441	Stop	pumping							

NTU = Nephelometric turbidity units
WL = Water level

Checked By [initials] Date 8-3-00

Black & Veatch Special Projects Corp. Page 1 of 1

~~MONITORING WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	7-19-00
Monitor Well Number	**Field Investigator(s)**	
OB-1-I	G. Fekner	

WELL DATA
INITIAL DEPTH 111.45' Water Column Height 83.55'
Total Depth 195' Well Volume (gals) ~55 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes 165 gals Amount of Water Removed from Well ~5115 gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___
Physical Appearance Slight greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	~~ORP~~
Initial					111.45'	0			
0910	start pumping			turbd		0	11 gpm		
0950						~440	23 gpm		
1005	stop for 10 minutes					~550	83 gpm		
1020	15.2	556	6.9	43			"	8.8	
1050	15.2	560	7.0	6		~4285	"	membrane	
055	15.2	558	7.0	4				Lvec	
1100	15.2	560	7.0	3		~5115			
1101	stop pumping								

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 8-3-00

Black & Veatch Special Projects Corp. Page 1 of

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118.123	Ace Services	7-18-00
Monitor Well Number	**Field Investigator(s)**	
OB-1-D	G. Feltman	

WELL DATA
INITIAL DEPTH 113.82' bgs
Total Depth 235'
Well Diameter 4"
Water Column Height 121.18'
Well Volume (gals) 80 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes 240 gals Amount of Water Removed from Well ~5500 gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___
Physical Appearance Not a greenish tint as EX-2 and OB-2 wells
Remarks Hex. Cr. test >330 ppb

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0915	Start Pumping		—	—	113.8' bgs	0	35 gpm	—	—
0953			—	—	4" too small for probe	~1330 gals	78 gpm	—	—
1030	15.6	500	6.8	45	—	—	"	9.7	—
1035	15.6	500	7.0	22	—	—	"	9.6	—
1040	15.6	501	7.1	20	—	—	"	9.6	—
1045	15.6	502	7.0	18	—	—	"	9.6	—
1050	15.6	502	7.1	15	—	—	"	9.6	—
1107	lowered pump to bottom (~232')		—	—	—	—	—	—	—
1115	15.6	503	7.1	21	—	~4840	"	9.7	—
1120	15.6	503	7.1	16	—	—	"	9.6	—
1125	15.6	503	7.1	11	—	—	"	9.6	—
1126	Stop pumping		—	—	—	~5500	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DL Date 8-3-00

Black & Veatch Special Projects Corp.

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~~MONITORING WELL~~ DEVELOPMENT/~~PURGING~~ DATA

Project Number 46118
Project Name Acc Services
Date 7-18-00

Monitor Well Number OB-2-5
Field Investigator(s) G. Felkner

WELL DATA
INITIAL DEPTH 108.8'
Total Depth 130.0'
Well Diameter 4"
Water Column Height 21.2'
Well Volume (gals) ~14
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump Was Well Pumped Dry? Yes (No)

3 Well Volumes 42 gals Amount of Water Removed from Well ~2900 gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___

Physical Appearance Slight green tint

Remarks ___

TIME	Temp °C	Conductivity	pH	NTUs	WL	initial Removed	Flow Rate	DO	~~ORP~~
1540	Start	pumping	—	turbid	108.8' bgs	0	27gpm		X
1610	15.6	614	7.0	52	4" well	810 gals	"	9.6	
1625	15.9	663	7.0	5	too small		23	9.8	
1640	15.8	664	6.9	12	for probe		"	9.8	
1650	15.9	673	6.9	36	—		"	9.8	
1651	surge	well	—	—	—				
1705	15.9	684	6.9	96	—		"	9.9	
1725	15.9	686	6.9	3	—	~2650	"	10.0	
1730	15.9	686	6.9	4	—		"	9.9	
1735	15.9	686	6.9	5	—	~	"	10.1	
1737	Complete	development	—	—	—	~2926			

NTU = Nephelometric turbidity units
WL = Water level

Checked By AJ Date 8-3-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118.123	Ace Services	7-17-00
Monitor Well Number	**Field Investigator(s)**	
OB-2-I	G. Folkner	

WELL DATA
INITIAL DEPTH 107.90' Water Column Height 84.1'
Total Depth 192' Well Volume (gals) 55 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes 165 gals Amount of Water Removed from Well 8550 gals

FINAL FIELD ANALYSIS
Water Temp 15.2 °C Specific Conductance 451 micromhos pH 7.1 Turbidity 3.5
Physical Appearance Greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed gals	Flow Rate	DO	~~ORP~~
0920	Start Initial		—	—	107.90'	0	75 gpm	—	—
0950	—	—	—	—	4" too small for 2" pump	—	90 gpm	—	—
1020	15.3	450	7.1	5	—	~6300	"	7.6	—
1035	15.3	450	7.1	5	—	~6750	"	7.6	—
1040	15.2	451	7.1	35	—	~7200	"	7.6	—
1055	Stop	pumping	—	—	—	~8550	90 gpm	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AJ Date 8-3-00

Black & Veatch Special Projects Corp. Page 1 of

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	7-15-00

Monitor Well Number	Field Investigator(s)
OB-2-D	G. Felkner

WELL DATA
INITIAL DEPTH ? Water Column Height N/A
Total Depth 235' Well Volume (gals) NA
Well Diameter 4" (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes NA gals Amount of Water Removed from Well ~4680 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____
Physical Appearance Greenish tint

Remarks ~~Stuck~~

TIME	Temp °C	Conductivity	DH	NTUs	WL	Removed	Flow Rate	DO	~~ORP~~
0910	Start pumping		—	turbid	—			—	—
0955			—	—	—	~585	13 gpm	—	—
Started	pumping H2O - 1120		—	—	—			—	—
~~Hung~~ 1125	16	478	6.9	turbid	—	~1625	13 gpm		—
1135	16	474	7.0	31	—		"	6.1	—
1215	16	475	6.8	25	—	~2275	"	6.2	—
Stopped	pumping 1220 - 1230		—	—	—		"	—	—
1245	16	482	~~6.8~~ 7.0	17.4	—	~2665	"	6.3	—
—	Added	pipe	~~220~~ —	~~25~~ —	—	—	—	~~5.6~~ —	—
1430	16	477	7.0	25	—	~4030	—	6.6	—
1435	16	478	7.0	20	—	—	—	6.6	—
1440	16	~~481~~	7.0	~~18~~	—	—	—	6.7	—
1520	Stop pumping					~4680			

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 8-30

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	7-14-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-S	G. Felknen	

WELL DATA
INITIAL DEPTH 110.8' bgs
Total Depth 130.0'
Well Diameter 6"
Water Column Height 19.2'
Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
X Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump Was Well Pumped Dry? (Yes) No initially

3 Well Volumes _____ gals Amount of Water Removed from Well ~3260 gals

FINAL FIELD ANALYSIS
Water Temp _____ °C Specific Conductance _____ micromhos pH _____ Turbidity _____
Physical Appearance Greenish tint

Remarks Maximum pumping rate = 17 gpm
Hex Cr field test = >330 ppm

	TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed (gals)	Flow Rate	DO	~~ORP~~
7-14-00	1620	Initial		—	—	119.8'			—	—
	1640	Begin pumping		—	turbid	—		13 gpm	—	—
	1729	—	—	—	—	117.9'	—	13 gpm	—	—
	1753	16	566	7.2	50*	—	~949	"	7.0*	stop for day
	1800	Stop pumping								
7-15-00	0840	Start pumping		—	—	—	~1000	15.7 gpm	—	—
	0910	16	562	7.1	110*	—	~1942	15.7 gpm	7.2	—
	0920	16	565	7.1	14	—		"	7.1	—
	0950	16	564	6.9	7	116.50'	~2570	15.7 gpm	8.8	—
	1010	16	572	6.9	5.2	—	~2884	"	8.8	—
	1020	16	563	6.9	4.7	—	~3041	"	8.7	—
	1034	16	570	6.9	6.3	—	~3260		8.8	—
	1034	Stop pumping		—	—	—	~3260	—	—	—

* Turbidity meter not working properly, air in line

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 8-3-00

Black & Veatch Special Projects Corp. Page 1 of 1

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	7-15-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-I	G. Feltman	

WELL DATA
INITIAL DEPTH ~~[illegible]~~ 110.95' BGS
Total Depth 145'
Well Diameter 8"

Water Column Height _____
Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump Was Well Pumped Dry? Yes (No)

3 Well Volumes _____ gals Amount of Water Removed from Well ~12,375 gals

FINAL FIELD ANALYSIS
Water Temp _____ °C Specific Conductance _____ micromhos pH _____ Turbidity _____

Physical Appearance Greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL DTW	Removed gals	Flow Rate	DO	ORP
1325	start Pumping		Initial		107.90'		62.5 gpm		
1400	Adding pipe				123.3',	-2188	80 gpm		
1550	16	481	6.9	128	123.65',	-8250	75 gpm	7.6	
1555	Surge well by stopping pump; took ~5 minutes for water level to return to							123.6'	
1605	15.6	480	6.9	73	123.8		75 gpm	7.6	
1615	15.6	480	6.9	52	124.2'		"	7.6	
1625	15.6	480	6.9	32	124.4'	-10,875	"	7.6	
1630	15.5	479	6.9	24	124.46'		"	7.7	
1635	15.5	479	6.9	19	124.48'		"	7.7	
1640	15.5	478	6.9	19	124.50'		"	7.7	
1645	Stop pump					-12,375			

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 8-3-00

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118.123	Air Services	7-14-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-D	G. Folkner	

WELL DATA
INITIAL DEPTH 110.35' bgs — Water Column Height 124.65'
Total Depth 235.0' — Well Volume (gals)
Well Diameter 8" — (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
X Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal submersible pump — Was Well Pumped Dry? Yes (No)

3 Well Volumes _____ gals — Amount of Water Removed from Well ~19,500 gals

FINAL FIELD ANALYSIS
Water Temp 15 °C Specific Conductance 472 micromhos pH 7.2 Turbidity 8.5
Physical Appearance Greenish Tint, Hex Cr. field test kit = 1.5 mg/L Cr.⁺⁶

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1023			—	—	110.35 bgs				
1133	Begin Pumping @ 75 gpm		—	—	—		75 gpm		
1338	Still pumping, static @ top working down		—	—	—		1.5 mg/L hex Cr. field test kit		
1345	Water level 134.45'		—	—	134.45' bgs				
1400	16	476	6.8	16.1	—		75 gpm	5.06	
1417	15	473	7.0	7.4	—	105 min @ 75 gpm = 12375 gals	75 gpm	4.7	
1420	15	471	7.0	5.3	—		75 gpm	4.7	
1425	15	472	7.0	4.9	—		"	4.7	
1430	15	472	7.0	7.5	—		"	4.6	*Raised Pump 20'
1450	15	472	7.1	17.5	133.25'		"	4.6	
1457	15	472	7.0	9.8	—		"	4.6	
1511	15	472	7.2	8.5	—		"	4.6	
1512	END					261 min @ 75 gpm = 19,575 gals.			

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT — Date 8-3-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Arc Services	09-19-00

Monitor Well Number	Field Investigator(s)
MW-1-S	Kyle Madden

WELL DATA
INITIAL DEPTH 102.00' Water Column Height 18'
Total Depth 125' Well Volume (gals) ~12 gals
Well Diameter 4" (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT PHOTOGRAPH IDENTIFICATION NO.
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA Micro-Purge
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)
3 Well Volumes ~~Yes~~ NA gals Amount of Water Removed from Well ____ gals

FINAL FIELD ANALYSIS
Water Temp 19.86 °C ~~Specific~~ Conductance 1248 micromhos pH 6.80 Turbidity 2.5

Physical Appearance Normal

Remarks ~~None~~ Micro purge

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1030	measured depth to water at				107.00				
1040	pumping started and flow adjusted to					~.4L/min	↓	~~3.67~~	~~1460~~
1051	18.39	1155	6.67	4.4	107.06			3.67	1460
1057	19.64	1231	6.72	4.3	107.06			2.28	1043
1103	19.96	1252	6.75	3.0	102.06			1.79	95.6
1110	19.76	1244	6.73	2.6	107.07			1.53	89.8
1118	19.64	1242	6.72	1.8	107.06			1.21	89.4
1127	19.86	1248	6.80	2.5	107.07			1.14	76.8
1129	Sampled water for MW-1-S-091900-P					(total Cr)			

NTU = Nephelometric turbidity units
WL = Water level

Checked By [illegible] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-19-00

Monitor Well Number	Field Investigator(s)
~~MW-1-I~~ MW-1-I	Kyle Madden

WELL DATA
INITIAL DEPTH 107.07' Water Column Height _____
Total Depth 162' Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal ~~Pumping~~ Micro-Purge Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 19.10 °C Specific Conductance 1111 micromhos pH 6.73 Turbidity 0.9

Physical Appearance Normal

Remarks ~~None~~ None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1140	Depth to water measured @				107.07				
1147	Pumping Started and adjusted to 1.0 L/min						1.0 L/min		
1151	19.16	1130	6.78	1.9	107.29			0.61	117.5
1200	19.17	1129	6.76	2.7	107.41			0.47	67.4
1211	18.81	1106	6.72	1.1	107.31			0.35	69.8
1218	18.91	1107	6.72	1.8	107.39			0.31	64.5
1226	19.04	1111	6.75	1.1	107.34			0.70	75.0
1236	19.10	1111	6.73	0.9	107.30			0.28	62.7
1239	Water Sample collected W-MW-1-I-091900-P (total Cr)								
1240	30 gallons collected for treatability study								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
117118	Ace Services	09-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-1-D	Kyle Madden	

WELL DATA
INITIAL DEPTH 106.56 Water Column Height
Total Depth 220 Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 5"

METHOD OF WELL DEVELOPMENT
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal micro-Purge pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ____ gals Amount of Water Removed from Well ____ gals

FINAL FIELD ANALYSIS
Water Temp 17.62 °C Specific Conductance 428 micromhos pH 7.38 Turbidity 2.8

Physical Appearance Normal

Remarks None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
Depth to water measured at					106.56 ft				
0910	Pumping Started-Flow adjusted to 1.0 L/min								
0918	16.53	418	7.15	6.3	106.77'			7.88	183.8
0925	17.84	430	7.27	5.2	106.79			7.76	124
0929	17.69	429	7.27	4.3	106.79			7.79	116.0
0937	17.64	430	7.29	3.1	106.80			7.80	102.0
0944	17.70	429	7.29	2.3	106.79			7.82	96.5
0952	17.62	428	7.38	2.8	106.81			7.93	93.6
0953	Sampled water w-MW-1-D-091900-P (Total Cr)								

NTU = Nephelometric turbidity units
WL = Water level

Checked By DF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
MW-2-S	Kyle Madden	

WELL DATA

INITIAL DEPTH 102.49 — Water Column Height ____

Total Depth 123 — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

✓ Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Micro-Purge Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes N/A gals — Amount of Water Removed from Well N/A gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance Slightly green

Remarks none

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1051	initial depth to water at 102.49'				102.49				
1102	- Flow rate set to ~1.0 L/min						~1.0 L/min		
1107	15.64	732	6.92	17.4	102.62		~1.0 L/min	4.67	115.6
1112	16.56	746	7.05	12.2	102.62		~1.0 L/min	5.67	102.6
1120	17.44	757	7.09	11.2	102.62		~1.0 L/min	5.64	81.7
1127	18.20	763	6.85	12.6	102.62		~1.0 L/min	5.51	111.9
1135	18.34	762	7.12	11.4	102.61		~1.0 L/min	5.55	76.0
1144	18.90	765	7.15	12.1	102.61		~1.0 L/min	5.49	64.0
1152	18.68	758	7.15	11.2	102.62		~1.0 L/min	5.50	65.1
1158	18.71	754	6.87	12.4	102.62		~1.0 L/min	5.18	83.2
1202	collected 1 total Cr Sample - W-MW-2-S-092200-P								

NTU = Nephelometric turbidity units

WL = Water level

Checked By — Date

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project ~~Name~~	Date
46118	Ace Services	09/18/00
Monitor Well Number	**Field Investigator(s)**	
MW-2-I	Kyle Madden	

WELL DATA
INITIAL DEPTH 102.80'
Total Depth 195'
Well Diameter 4"
Water Column Height
Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Micro-Purge Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance Green in color

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1600	depth to water initially measured at				102.80				
1606	- starting pumping - adjusted flow rate to 10 L/min								
1614	19.72	751	5.48	8.7	102.82			2.10	309.5
1622	19.53	725	5.40	13.7	102.82			1.86	215.6
1629	18.92	693	5.42	8.0	102.82			2.10	73.8
1636	18.39	680	5.93	5.3	102.84			2.35	93.8
1644	17.64	660	4.96	6.9	102.84			2.9	157.1
1646	Samples collected @ MW-2-I-091800-P (1 total Cr, 1 Cr⁶)								
1649	15 Gallons collected for treatability Study								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-18-00
Monitor Well Number	**Field Investigator(s)**	
mw-2-D	Feltner	

WELL DATA
INITIAL DEPTH 105.31'
Total Depth 237'
Well Diameter 4"
Water Column Height 132
Well Volume (gals) ~86
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~258 gals Amount of Water Removed from Well ~635 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks Greenish tint

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1443	Initial		—	—	105.31'	—	—	—	—
1458	Start Pump		—	—	—	—	16.7 gpm	—	—
1511	15.7	431	7.3	0	—	—	"	7.8	224
1515	15.8	439	7.3	0	—	—	"	7.0	222
1519	15.9	446	7.3	0	—	—		6.8	219
1523	15.7	444	7.3	0	—	—		6.9	219
1525	15.9	448	7.3	0	—	—		6.9	217
1528	15.8	448	7.3	0	—	—		7.2	215
1532	15.8	449	7.3	0	—	—		7.0	214
1535	15.8	450	7.3	0	—	—		6.8	213
1538	15.8	450	7.3	0	—	~635		7.1	212
1540	Collect	sample	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
MW-3-D	G. Felkner	

WELL DATA

INITIAL DEPTH 104.91' BTOC — Water Column Height ~115'

Total Depth 220' — Well Volume (gals) ~117.3 gal

Well Diameter 5" — (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
x = 1.02 gal/ft @ 5"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

X Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Submersible Pump — Was Well Pumped Dry? Yes (No)

3 Well Volumes ~352 gals — Amount of Water Removed from Well ~465 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1116	Initial	W.L.	—	—	104.91'	—	—	—	—
1140	Started	pumping	—	—	—	—	15.5 gpm	—	—
1151	14.9	408	7.4	0	—	—		7.33	212
1155	14.9	409	7.4	0	—	—		7.23	212
1200	14.9	409	7.4	0	—	—		7.23	211
1203	14.9	410	7.4	0	—	—		7.22	211
1206	14.9	410	7.4	0	—	—		7.21	210
1209	14.9	410	7.4	0	—	465 gal.		7.21	210
1210	Collect	sample	—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By JF — Date 9-26-00

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-4-S	Kyle Madden	

WELL DATA
INITIAL DEPTH 96.02'
Total Depth 120'
Well Diameter 4"
Water Column Height
Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA Micro-Purge
Method of Water Removal ~~Pumping~~ Was Well Pumped Dry? Yes (No)

3 Well Volumes N/A gals Amount of Water Removed from Well N/A gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance Normal

Remarks None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1632	initial measurement of depth to water =				96.02				
1656 1644	pumping started - Flow rate adjusted to				~96.21		~1.0 L/min		
1702	19.03	1021	6.47	14.6	~96.21'			7.45	160.4
1710	18.52	1012	6.45	13.4	96.31'			7.39	136.5
1715	19.30	1032	6.52	13.2	96.31'			7.27	107.4
1720	19.41	1036	6.55	6.7	96.32'			7.29	102.2
1725	19.11	1028	6.53	5.5	96.34			7.29	1028
1730 39	18.60	1013	6.51	4.0	96.37'			7.30	105.4
1730	collected Sample W-MW-4-S-091900-P				(total Cr)				

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-4-I	Kyle Madden	

WELL DATA

INITIAL DEPTH 96.50' — Water Column Height ____

Total Depth 179' — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

X Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Micro-Purge Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals — Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance Normal

Remarks None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1526	measured depth to water				96.50'				
1537	Started pumping - Flow adjusted to				1.0 L/min		1.0 L/min		
1542	18.05	870	6.54	4.8	96.56'			6.45	180.1
1549	18.22	874	6.38	2.3	96.54'			6.38	154.5
1558	18.81	881	6.61	1.9	96.52'			6.36	134.0
1606	18.51	858	6.53	1.9	96.54'			6.25	127.2
1611	19.09	858	6.66	2.8	96.53'			6.08	117.3
1616	19.21	853	6.57	3.1	96.54'			6.05	114.5
1617	Sample collected W-MW-4-I-091900-P (Total Cr)								

NTU = Nephelometric turbidity units

WL = Water level

Checked By JF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-4-D	Kyle Madden	

WELL DATA

INITIAL DEPTH 98.68 — Water Column Height ____

Total Depth 229 — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

✓ Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA micro-Purge

Method of Water Removal Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes N/A gals — Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS

Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance Normal

Remarks None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1359	Initial Depth to water		—	—	98.68'	—	—	—	—
1420	Started pumping - Level adjusted to				1dL/min	—	1.0 L/Min	—	—
1426	17.37	424	7.18	8.9	99.67	—	—	7.72	196.3
1435	16.78	419	7.14	11.5	98.70	—	—	7.72	193.0
1445	17.49	431	7.13	14.8	98.69	—	—	7.61	144.8
1454	17.88	436	7.09	7.3	98.68	—	—	7.64	114.1
1501	18.11	440	7.02	6.3	98.67	—	—	7.60	111.2
1509	18.07	442	6.89	7.2	98.66	—	—	7.56	124.4
1515	18.36	446	6.97	7.9	98.66	—	—	7.95	121.4
1516	collected 1 sample W-MW-4-D-091900-P (total Cr)								
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units

WL = Water level

Checked By DS — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Service	9-21-00
Monitor Well Number	**Field Investigator(s)**	
MW-5-5	G. Felkner	

WELL DATA

INITIAL DEPTH 100.59' — Water Column Height ~20'

Total Depth 120' — Well Volume (gals) ~13

Well Diameter 4" — (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

X Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Submersible Pump — Was Well Pumped Dry? Yes (No)

3 Well Volumes ~40 gals — Amount of Water Removed from Well ~356 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1411	Initial	W.L			100.59'				
1440	Start	Pumping					15 gpm		
1450	15.3	720	7.3	45	(air in	with, reduce	slow)	8.28	233
1455	15.3								
1500	15.5	722	7.3	1.1		300 gals	5.6 gpm	6.98	225
1505	15.5	736	7.3	3.1				6.91	222
1507	15.4	735	7.3	1.6				6.88	221
1509	15.4	733	7.3	0		356 gals		6.87	219
1510	Collect sample and duplicate								

NTU = Nephelometric turbidity units

WL = Water level

Checked By AS — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-18-00
Monitor Well Number	**Field Investigator(s)**	
MW-5-I	Kyle Madden	

WELL DATA
INITIAL DEPTH 100.56' Water Column Height
Total Depth 185' Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ___ Air Lift
___ Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal micro-Purging Pumping Was Well Pumped Dry? Yes (NO)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___

Physical Appearance

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1300 1400	measured water depth at 100.56 feet								
1407	started pumping well - adjusted Flow to 1L/min								
1413	20.67	570.80	6.72	6.3	—			7.43	198.6
1419	19.98	567.0	6.56	10.5	—			7.33	156.3
1425	22.6	602	6.78	8.7	100.56			7.24	143.3
1431	24.7	630	6.92	7.6	100.56			7.15	144.1
1433—1440	Pump lost prime - restart & adjust to 1.0 L/min								
1445	20.38	577.0	6.43	15.3	100.58			7.22	71.5
1450	20.03	571.00	6.37	13.2	100.60			7.25	81.3
1456	19.16	559	6.23	8.5	100.60			7.30	102.5
1500	18.66	551.	6.12	4.9	100.60			7.33	112.5
1503	collected W-MW-5-I-091800-P (2 bottles - 1 Cr6, 1 total Cr)								
1505-	started collecting 30 gallons for treatability study								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-21-00
Monitor Well Number MW-5 I	**Field Investigator(s)** G. Felkner	

WELL DATA
INITIAL DEPTH 100.49'
Total Depth ~~185'~~
Well Diameter 4"
Water Column Height ~~85'~~ ~85'
Well Volume (gals) ~~55~~ 55 gals.
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes ~~~165~~ gals Amount of Water Removed from Well ~555 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance____

Remarks____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1240	Initial	WL	—	—	100.49'	—	—	—	—
1314	Start	pumping	—	—	—	—	15 gpm	—	—
1329	15.4	480	7.3	0	—	—		7.7	241
1337	15.4	480	7.3	0	—	—		7.7	234
1344	15.4	480	7.3	0	—	—		7.7	229
1349	15.4	480	7.3	0	—	~555 gal		7.7	226
1350	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-21-00
Monitor Well Number mw-5-D	**Field Investigator(s)** G. Felkner	

WELL DATA
INITIAL DEPTH 103.20' Water Column Height 127
Total Depth 230 Well Volume (gals) ~83 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal pumping Was Well Pumped Dry? Yes (No)
3 Well Volumes ~250 gals Amount of Water Removed from Well ~465 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance____

Remarks____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1120	Initial	W.L.	—	—	103.20	—	—	—	—
1131	Start	Purging	—	—	—	—	14.1 gpm	—	—
1141	15.5	409	7.44	0	—	—		8.0	203
1145	15.5	416	7.44	0	—	—		8.0	202
1150	15.5	419	7.44	0	—	—		8.0	200
1155	15.5	420	7.44	0	—	—		8.0	199
1200	15.5	421	7.43	0	—	—		8.0	199
1204	15.5	422	7.44	0	—	~465 gal		7.98	199
1205	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09/26/00
Monitor Well Number	**Field Investigator(s)**	
MW-6-S	Kyle Madden	

WELL DATA
INITIAL DEPTH ~~106.73~~ 104.73 (from orig.)
Total Depth 132
Well Diameter 4"

Water Column Height _____
Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Micro-Purging Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance Slightly colored

Remarks Lots of PVC shavings coming up into monitor - turbidity measured in drinking water (culligan water) as ~0.8

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1222	Initial measurement of depth to water = ~~106.73~~ 104.73 (from orig.)								
1237	Started pumping - adjusted flow rate to 1.0 L/min						1.0 L/min		
1249	17.32	517	7.30	64.9	104.87			7.50	130.1
1257	18.03	519	7.30	57.8	104.86			7.58	126.7
1308	20.41	546	7.39	40.8	104.88			7.71	77.0
1314	20.54	549	7.42	34.9	104.90			7.65	67.3
1323	20.33	547	7.44	24.6	104.90			7.71	63.1
1332	20.17	549	7.41	18.5	104.90			7.60	66.8
1338	19.77	544	7.39	17.1	104.89			7.62	69.6
1340	Sample collected MW-6-S-092000-P				—				

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46188	Ace Services	09-20-00
Monitor Well Number	**Field Investigator(s)**	
MW-6-I	Kyle Madden	

WELL DATA

INITIAL DEPTH 105.00 — Water Column Height ____

Total Depth 190 — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

✓ Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA MicroPurging

Method of Water Removal Pumping — Was Well Pumped Dry? Yes (NO)

3 Well Volumes ____ gals — Amount of Water Removed from Well ____ gals

FINAL FIELD ANALYSIS

Water Temp 17.84 °C — ~~Specific~~ Conductance 754 micromhos — pH 7.11 — Turbidity 8.2

Physical Appearance Normal

Remarks none

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0848	initial measurement depth to water				105.00				
0900	Starting pumping - Adjusted flow to				1.0 L/min		1.0 L/min		
0941	16.87	764	7.09	7.2	105.05			5.73	110.0
0949	17.03	766	7.09	7.6	105.03			5.69	100.6
0957	16.96	756	7.10	7.2	105.02			5.65	92.9
1006	17.17	754	7.10	8.2	105.02			5.85	84.7
1017	17.61	754	7.11	9.2	105.01			5.86	82.0
1022	17.70	754	7.11	8.0	105.01			5.74	81.0
1026	17.84	754	7.11	8.2	105.01			5.76	80.6
1028	Sample collected W-MW-6-I-~~051600~~ 092000-P (Total Cr)								

NTU = Nephelometric turbidity units

WL = Water level

Checked By AF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09/20/00

Monitor Well Number	Field Investigator(s)
MW-6~~D~~ S	Kyle Madden

WELL DATA
INITIAL DEPTH 106.17' Water Column Height _____
Total Depth 237' Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Micro-Purging Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 17.04 °C Specific Conductance 551 micromhos pH 7.41 Turbidity 4.9

Physical Appearance Normal

Remarks None

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1001042	Initial Depth to water =				106.17				
1050	started pumping - flow rate adjusted to ~1.0 L/min						~1.0L/min		
1108	15.42	474	7.33	6.2	106.15			7.02	121.7
1113	16.46	489	7.36	5.3	106.16			6.90	101.9
1118	17.27	520	7.39	11.4	106.14			6.79	85.8
1124	17.11	556	7.36	8.3	106.15			6.60	78.0
1131	17.05	554	7.35	6.2	106.17			6.62	77.7
1136	17.17	554	7.35	5.5	106.16			6.63	77.8
1140	17.04	551	7.41	4.9	106.17			6.70	75.4
1141	collected W-MW-6-D-092000-P (total Cr)				—				

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
MW-7-S	G. Felkner	

WELL DATA

INITIAL DEPTH 116.85' — Water Column Height 23'

Total Depth 140' — Well Volume (gals) ~15 gals

Well Diameter 4" — (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT — **PHOTOGRAPH IDENTIFICATION NO.**

X Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Submersible pump — Was Well Pumped Dry? Yes (No)

3 Well Volumes ~45 gals — Amount of Water Removed from Well ~480 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1005	Initial	water level	—	—	116.85'	—	—	—	—
1017	Start	pumping	—	—	—	—	15 gpm	—	—
1032	14.4	578	7.2	0	—	—	↓	8.61	221
1035	14.4	577	7.2	0	—	—		7.27	222
1038	14.3	576	7.2	0	—	—		7.04	222
1042	14.4	577	7.2	0	—	—		6.93	221
1047	14.3	576	7.2	0	—	—		6.91	221
1049	14.3	576	7.2	0	—	480 gal		6.91	222
1050	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units

WL = Water level

Checked By AT — Date 5-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	ACE Services	09-18-00

Monitor Well Number	Field Investigator(s)
MW-7-I	Kyle Madden

WELL DATA
INITIAL DEPTH 116.65'
Total Depth 90'
Well Diameter 4"
Water Column Height
Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA Micro-Purging
Method of Water Removal Pumping Was Well Pumped Dry? Yes (NO)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 20.02 °C Specific Conductance 566 micromhos pH 6.9 Turbidity 11.1

Physical Appearance Normal

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1125	total depth of well		—	—	116.65	—	—	—	—
1134	pumping water started		@	—	—	—	~1.1 L/min	—	—
1140	18.4	544	6.81	18.1	—	—	—	5.79	196
1147	18.7	554	6.90	19.8	—	—	—	5.62	118
1154	19.3	562	6.85	14.1	—	—	—	5.55	105.5
1159	19.5	563	6.84	14.5	—	—	—	5.54	101.4
12:05	19.8	566	6.84	13.6	—	—	—	5.51	83.2
1211	19.96	569	6.83	12.3	—	—	—	5.48	70.8
1216	20.02	566	6.90	11.1	—	—	—	5.63	61.2
1218	6 samples collected		2 W-MW-7I-091800-P				1 bottle = Cr6	—	—
—	—	—	2 W-MW-7I-091800-MS				1 bottle = total Cr	—	—
—	—	—	2 W-MW-7I-091800-MSD				—	—	—

1220-1248 collected 30 gallons for treatability study
NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 5-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
MW-7-D	G. Felker	

WELL DATA
INITIAL DEPTH 117.71'
Total Depth 243
Well Diameter 4"

Water Column Height 126'
Well Volume (gals) ~83 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)

3 Well Volumes ~250 gals Amount of Water Removed from Well ~465 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0835	Initial	W.L.	—	—	117.71'	—	—	—	—
0851	Start	pumping	—	—	—	—	14.1 gpm	—	—
0904	15.1	391	7.2	0	—	—	↓	8.04	236
0907	15.2	390	7.4	0	—	—		7.78	231
0910	15.2	389	7.4	0	—	—		7.70	231
0914	15.2	389	7.4	0	—	—		7.67	229
0917	15.2	389	7.5	0	—	—		7.66	229
0920	15.2	389	7.5	0	—	—		7.66	228
0924	15.2	388	7.5	0	—	465		7.65	227
0927	Collect sample and duplicate				—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AA Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-20-00
Monitor Well Number	**Field Investigator(s)**	
MW-8-S	G. Felker	

WELL DATA
INITIAL DEPTH 108.28'
Total Depth ~~132'~~ 132'
Well Diameter 4"
Water Column Height ~24'
Well Volume (gals) ~16 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)
3 Well Volumes ~48 gals Amount of Water Removed from Well ~560 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate (15 sec @ 4 gal)	DO	ORP
1447	Initial W.L.		—	—	108.28'	—	—	—	—
1505	Start	Pumping	—	—	—	—	16 gpm	—	—
1517	14.8	620	7.2	2.4	—	—		6.86	213
1523	14.8	616	7.2	0	—	—		6.56	214
1528	14.8	613	7.2	0.6	—	—		6.73	213
1532	14.8	611	7.2	0	—	—		6.68	213
1536	14.8	609	7.2	0	—	—		6.58	213
1538	14.8	609	7.2	0	—	—		6.4	213
1539	14.8	606	7.2	0	—	~560 gals		6.4	212
1540	Collect	Sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-20-00
Monitor Well Number	**Field Investigator(s)**	
MW-8-I	G. Felkner	

WELL DATA

INITIAL DEPTH 107.75' — Water Column Height ~87'

Total Depth 195 — Well Volume (gals) ~57 gal

Well Diameter 4" — (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT

X Pumping ____ Air Lift

____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA

Method of Water Removal Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes ~171 gals — Amount of Water Removed from Well ~495 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance slight green tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1606	Initial W.L.				107.75'				
1625 1641	Started	Pumping					16.5 gpm		
~~1635~~	15.1	623	7.35	0				4.33	205
1645	15.1	624	7.25	0				3.94	209
1649	15.1	624	7.2	0				3.86	210
1653	15.1	624	7.2	0				3.82	210
1654	15.1	624	7.2	0		495 gal.		3.82	211
1655	Collect	sample							

NTU = Nephelometric turbidity units

WL = Water level

Checked By JT — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-21-00
Monitor Well Number	**Field Investigator(s)**	
MW-8-D	G. Felkner	

WELL DATA
INITIAL DEPTH ~~[illegible]~~ 107.76'
Total Depth 239
Well Diameter 4"
Water Column Height ~131
Well Volume (gals) ~86
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)
3 Well Volumes ~258 gals Amount of Water Removed from Well ~650 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____
Physical Appearance Greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0800	Initial	W.L.	—	—	107.76'	—	—	—	—
0820	Start	pumping	—	—	—	—	14.5 gpm	—	—
0857	15.1	532	7.0	0	—	—	↓	5.02	233
0859	15.1	532	7.2	0	—	—	↓	4.93	232
0901	15.1	532	7.3	0	—	—	↓	5.03	231
0903	15.1	532	7.3	0	—	—	↓	5.08	232
0904	15.1	532	7.3	0	—	~650 gals	↓	5.08	232
0905	Collect	Sample + Duplicate	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DS Date 5-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-9-S	Felkner	

WELL DATA
INITIAL DEPTH 111.98'
Total Depth 132'
Well Diameter 4"
Water Column Height ~20'
Well Volume (gals) ~13 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~39 gals Amount of Water Removed from Well ~438 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1350	Initial		—	—	111.98'			—	—
1415	Start	Pumping	—	—	—		12.5 gpm	↯	—
1424	15.1	666	7.5	10	—		↓	7.9	195
1430	15.1	653	7.3	3.8	—		↓	7.6	[illegible]
1433	15.1	643	7.25	0.6	—			7.5	207
1435	15.1	663	7.24	1.2	—			7.56	208
1442	15.1	642	7.26	0	—			7.6	210
1444	15.1	620	7.25	0	—			7.4	212
1447	15.2	623	7.25	0	—			7.4	212
1450	15.1	632	7.25	0	—	~438		7.5	214
1450	Sample		—	—	—			—	—
—	—	—	—	—	—			—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-19-00
Monitor Well Number	**Field Investigator(s)**	
MW-9-I	G. Falkner	

WELL DATA
INITIAL DEPTH 111.79'
Total Depth 190
Well Diameter 4"

Water Column Height ~80'
Well Volume (gals) ~53
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~160 gals Amount of Water Removed from Well ~480 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance Greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed (25 gal/min)	Flow Rate	DO	ORP
1600			—		111.79'			—	—
1615	Start	Pumping	—		—		12 gpm	—	—
1640	15.3	591	7.4	2.1	—			4.91	204
1645	15.3	592	7.2	4.1	—			4.6	209
1647	15.2	592	7.2	6.9	—			4.6	211
1650	15.3	592	7.2	5.1	—			4.5	212
1653	15.3	592	7.2	0.9	—			4.5	214
1655	Collect	sample	—	—	—	~480 gal	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-20-00
Monitor Well Number	**Field Investigator(s)**	
MW-9-D	G Folkner	

WELL DATA
INITIAL DEPTH 113.32'
Total Depth 236
Well Diameter 4"

Water Column Height ~123'
Well Volume (gals) ~81 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~243 gals Amount of Water Removed from Well ~476 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance Greenish Tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed (22 sec.)	Flow Rate	DO	ORP
0820	Initial	W.L.	—	—	113.32'	—	—	—	—
0835	Start	pumping	—	—	—	—	13.6 gpm	—	—
0857	15.3	552	7.2	0	—	—	—	4.4	220
0903	15.3	554	7.3	0	—	—	—	4.4	216
0906	15.3	554	7.3	0	—	—	—	4.4	217
0909	15.3	555	7.4	0	—	~476	—	4.4	217
0910	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp. Page 1 of 1

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-18-00
Monitor Well Number	**Field Investigator(s)**	
MW-11-S	G Felkner	

WELL DATA
INITIAL DEPTH 119.66'
Total Depth 140
Well Diameter 4"

Water Column Height ~20
Well Volume (gals) 13
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
___ Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal pump ? Was Well Pumped Dry? Yes (No)

3 Well Volumes ~40 gals Amount of Water Removed from Well ~900 gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___

Physical Appearance ___

Remarks ___

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1241	Initial		—	—	119.66'	—	—	—	—
1255	start	pumping	—	—	—	—	15 gpm	—	—
1340	15.3	676	7.3	0	—	—	↓	7.07	226
1345	15.2	669	7.2	0	—	—		6.99	225
1347	15.1	668	7.2	0	—	—		6.98	223
1351	15.1	665	7.2	5 ?	—	—		6.99	221
1352	15.1	664	7.2	15 ?	—	—		7.18	220
1353	15.1	665	7.2	0 clear	—	900 gals	↓	7.17	220
1355	collect sample		—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT Date 9-26-00

Black & Veatch Special Projects Corp. Page 1 of 1

MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118		9-18-00

Monitor Well Number	Field Investigator(s)
MW-11-I	Erlkun

WELL DATA
INITIAL DEPTH 120.05' Water Column Height 80'
Total Depth 200' Well Volume (gals) ~13 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ___ Air Lift
___ Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible pump Was Well Pumped Dry? Yes (No)
3 Well Volumes ~157 gals Amount of Water Removed from Well ~429 gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___

Physical Appearance ___

Remarks ___

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1100	Initial		—	—	120.05'	—	14.3 gpm	—	—
1120	Start pumping		—	—	—	—	—	—	—
1136	15.7	637	7.4	C	—	—	—	6.99	209
1142	15.5	634	7.2	C	—	—	—	6.56	209
1145	15.4	631	7.2	C	—	—	—	6.59	205
1150	15.4	629	7.2	C	—	~429	—	6.55	204
1151	Grab samples		—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—
			—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AJ Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	7-21-00
Monitor Well Number	**Field Investigator(s)**	
MW-11-D	G. Felkner	

WELL DATA
INITIAL DEPTH 122.37' — Water Column Height 127'
Total Depth ~249 — Well Volume (gals) ~83 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
X Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA
Method of Water Removal Pumping — Was Well Pumped Dry? Yes (No)
3 Well Volumes ~250 gals — Amount of Water Removed from Well ~400 gals gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance____

Remarks____

16 sec.

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0944	Initial Water Level		—	—	122.37'	—	—	—	—
1000	Start Pumping		—	—	—	—	11.5 gpm	—	—
1018	15.3	466	7.4	0	—	—		7.4	207
1025	15.3	466	7.5	0	—	—		7.26	211
1027	15.3	466	7.4	0	—	—		7.26	211
1030	15.4	466	7.4	0	—	—		7.26	212
1034	15.4	466	7.4	0	—	~400 gal		7.25	213
1035	Collect sample		—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT — Date 7-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9/18/00

Monitor Well Number	Field Investigator(s)
MW12-S	Kyle Madden

WELL DATA
INITIAL DEPTH 143.07 Water Column Height _____
Total Depth 165 Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Micro-Purging Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 20.2 °C Specific Conductance 700 micromhos pH 7.1 Turbidity 7.4

Physical Appearance Normal

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
900	water level measured				143.07				
1012	Water pumping started- head ave-come								
10:24	19.3	690	7.19	18.0			1 L/min	7.11	53.0
1032	19.9	696	7.16	360				7.00	378
1038	20.1	700	7.15	7.2				7.02	55.9
10:44	20.1	698	7.13	7.2				6.98	50.4
10:49	20.3	701	7.12	7.2				6.99	52.7
10:53	20.2	700	7.10	7.4				6.97	51.3
10:54	Samples taken- W-MW-12-S-091800P for total chromium					and W-MW-12-S-091800-P and Chromium VI			
1105	15 gal collected for treatability study								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT Date 1-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	ACE Services	9/18/00
Monitor Well Number	**Field Investigator(s)**	
MW12-I	Madden / Felkner	

WELL DATA
INITIAL DEPTH 143.42' Water Column Height ~~143.42~~ 68'
Total Depth 211' Well Volume (gals) 44.4
Well Diameter 4" (x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal ~~pumping~~ Was Well Pumped Dry? Yes (No)

3 Well Volumes ~133 gals Amount of Water Removed from Well ~540 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0830	Initial	W.L. 143.42'			143.42'				
~~0925~~ 0925	Start	pumping				0	12 gpm		
0935	15.1	437	7.2	C				8.32	234
0940	15.2	439	7.3	O				7.6	221
0945	15.2	440	7.3	O				7.6	194
0900	15.2	440	7.4	O				—	—
1010	15.2	442	7.4	O		~540 gals	12 gpm	7.5	192
1010	Collect	sample W-MW-12-I-091800-P							

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-20-00

Monitor Well Number	Field Investigator(s)
MW-12-D	G Felkner

WELL DATA
INITIAL DEPTH 144.87'
Total Depth 263'
Well Diameter 4"

Water Column Height ~118'
Well Volume (gals) ~78'
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~234 gals Amount of Water Removed from Well ~350 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance Clear

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0949	Initial W.L.		—	—	144.87'	—	—	—	—
1007	Start pumping		—	—	—	—	At [redacted] 9.2 gpm	—	—
1033	15.4	369	7.6	3	—	—	—	7.8	212
1037	15.4	371	7.6	0.7	—	—	—	7.8	214
1041	15.4	372	7.6	0	—	—	—	7.8	215
1043	15.4	373	7.6	0	—	~350 gal	—	7.8	215
1045	Collect sample + duplicate				—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AT Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09.20.00

Monitor Well Number	Field Investigator(s)
ACE-R-5	Kyle Madden

WELL DATA
INITIAL DEPTH ~~10399~~ water measurement BS
Total Depth 125-135 (Shallow Screen)
Well Diameter 6"

Water Column Height
Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ___ Air Lift
___ Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA Micro-Purging
Method of Water Removal Pumping Was Well Pumped Dry? Yes (NO)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 16.98 °C Specific Conductance 1015 micromhos pH 6.88 Turbidity 11.6

Physical Appearance Slightly green

Remarks Some bubbles (pump cavitation?) periodically

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1645 Initial depth to water measured at					103.99				
1652 - pumping started - flow rate adjusted to 1 L/min							~1 L/min		
1702	16.96	964	6.85	15.9	103.99		~1 L/min	0.85	180.1
1708	16.96	991	6.83	16.2	104.00		~1 L/min	0.71	153.4
1715	17.12	1059	6.82	13.7	104.00		~1 L/min	5.81	29.7
1722	16.86	1057	6.84	10.4	104.00		~1 L/min	2.27	45.2
1727	16.89	1048	6.84	10.2	103.99		~1 L/min	0.70	111.2
1732	16.81	1030	6.86	9.4	104.00		~1 L/min	1.60	106.7
1737	16.98	1015	6.88	11.6	104.00		~1 L/min	0.73	103.2
1738	collected 1 total Cr sample - W-ACE-R-5-092000-P								

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46115	Ace Services	09-20-00
Monitor Well Number	**Field Investigator(s)**	
ACE-R-I	Kyle Mackie	

WELL DATA

INITIAL DEPTH ~~104.03 (from ground level)~~ water and bottom

Total Depth 161-171 (intermediate screen)

Well Diameter 5"

Water Column Height _____

Well Volume (gals) _____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT

PHOTOGRAPH IDENTIFICATION NO.

____ Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA Micro-Purging

Method of Water Removal ~~Pumping~~ Was Well Pumped Dry? Yes (No

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS

Water Temp_____°C Specific Conductance_____micromhos pH_____ Turbidity_____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1525 Initial	depth to water (From ground level) measured as				104.03				
1530	Pumping Started - flow rate adjusted to 104/min.						104/min.		
1541	16.24	830	6.84	31.3	104.03			2.87	135.1
1556	17.11	718	6.92	10.7	104.03			4.46	171.2
1603	17.12	748	6.94	7.2	104.03		104/min	3.99	145.1
1608	17.06	728	6.98	9.6	104.01			4.44	126.0
1617	17.07	721	6.99	8.4	104.01			4.35	106.3
1624	17.15	725	7.00	7.2	104.01			4.36	100.9
1630	17.29	756	6.85	5.8	104.00			4.05	99.0
1631	collected 1 total Cr sample ~~to MCC~~				W-ACE-R-I-092000-P				

NTU = Nephelometric turbidity units

WL = Water level

Checked By AF

Date 9-26-00

Black & Veatch Special Projects Corp.

~~MONITORING WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-21-00

Monitor Well Number	Field Investigator(s)
ACE-R-D	Kyle Malden

WELL DATA
INITIAL DEPTH 84.00'
Total Depth " 209-225 (screen Depth
Well Diameter 5"

Water Column Height
Well Volume (gals)
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
✓ Pumping ___ Air Lift
___ Surging ___ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA Micro-Purging
Method of Water Removal pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ___ °C Specific Conductance ___ micromhos pH ___ Turbidity ___

Physical Appearance green color

Remarks water level higher than yesterday by ~20' - yesterdays levels at this well may be irregular?

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0900	Initial depth to water measured at				84.00				
0910	Pumping Started - Flow rate adjusted to ~1.0L/min						~1.0L/min		
0938	16.73	691	6.65	94	~~84.46~~ 83.96'		~1.0L/min	5.52	177.4
0947	16.61	650	7.17	5.0	83.95'		~1.0L/min	5.93	113.5
0957	16.54	624	7.21	3.0	83.95		~1.0L/min	6.24	99.3
1003	16.37	619	7.21	3.5	83.95		~1.0L/min	6.33	102.0
1008	16.13	614	7.20	6.3	83.95		~1.0L/min	6.34	93.0
1013	16.82	623	7.20	5.2	83.96		~1.0L/min	6.28	87.0
1020	16.71	621	7.20	3.0	83.95		~1.0L/min	6.33	86.7
1022	Collected 1 total Cr Sample - ~~tot~~ W-ACE-R-D-092100-P								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Arco Services	9-19-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-S	G. Felker	

WELL DATA
INITIAL DEPTH 111.67'
Total Depth 130
Well Diameter 6"

Water Column Height ~20'
Well Volume (gals) ~30 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
x = 1.469 gal/ft @ 6"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pump Was Well Pumped Dry? Yes (No)

3 Well Volumes ~90 gals Amount of Water Removed from Well ~625 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance Slight greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1208	Initial		—	—	111.67'			—	—
1225	Start		—	—	—		12.5 gpm	—	—
1306	15.1	647	7.4	0	—			7.0	213
1312	15.0	653	7.3	0.5	—			7.0	215
1314	15.0	649	7.3	0	—			6.9	216
1315	Collect	sample	—	—	—	~625 gals		—	—
			—	—	—			—	—
			—	—	—			—	—
			—	—	—			—	—
			—	—	—			—	—
			—	—	—			—	—
			—	—	—			—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-19-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-I	G. Felkner	

WELL DATA

INITIAL DEPTH 110.89' — Water Column Height 85'

Total Depth 195' — Well Volume (gals) ~222

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4" 8" = 2.61 gal/ft

Well Diameter 8"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

X Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA Placed pump at screen interval

Method of Water Removal Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes ~666 gals — Amount of Water Removed from Well ~455 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance Greenish Tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0845	Initial		—	—	110.89'				
0920	Start pumping		—	—	—		13 gpm	~~6.21~~	~~220~~
0925	15.1	547	7.1	0.3	—		"	6.21	220
0931	15.1	561	7.2	0	—			5.51	213
0942	15.1	566	7.2	0	—			5.25	210
0949	15.1	568	7.2	0	—			5.70	208
0951	15.1	569	7.2	0	—			5.20	209
0953	15.1	571	7.2	0	—			5.16	209
0954	15.1	571	7.2	0	—	~455 gals		5.17	209
0955	Collect sample		—	—	—			—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units

WL = Water level

Checked By JS — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-18-00
Monitor Well Number	**Field Investigator(s)**	
EX-2-D	G. Felker	

WELL DATA
INITIAL DEPTH 111.54'
Total Depth 235'
Well Diameter [redacted] 8"

Water Column Height 123.5'
Well Volume (gals) [redacted] ~322 gals
(x)(height) x=.163 gal/ft @ 2", ~~x=.653 gal/ft @ 4"~~
8" = 2.611 gals/ft

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

Pump at top of water column

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~966 gals Amount of Water Removed from Well ~653 gals

FINAL FIELD ANALYSIS
Water Temp.____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance Greenish tint

Remarks G

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1640	Initial		—	—	111.54'			—	—
1654	Start pumping		—	—	—		12.8 gpm	—	—
1705	15.3	527	7.5	1.0	—			1	-86
1709	15.4	550	7.2	0	—			3	-68
1712	15.4	550	7.1	0	—			3.4	-62
1716	15.4	556	7.1	0	—			4.0	-50
1719	15.3	558	7.1	0	—			4.5	-35
1722	15.3	558	7.1	0.4	—			4.8	-16
1733	15.3	558	7.1	0	—			4.9	25
1737	15.3	559	7.1	0	—			4.9	35
1740	15.3	558	7.1	0	—			4.95	40
1743	15.3	559	7.1	0	—			4.9	48
Collect sample @ 1745						~653 gals			

NTU = Nephelometric turbidity units
WL = Water level

Checked By GF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46115	Ace Services	09-21-00
Monitor Well Number	**Field Investigator(s)**	
OB-1-S	Kyle Madda	

WELL DATA
INITIAL DEPTH 112.08' Water Column Height _____
Total Depth 30' Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT PHOTOGRAPH IDENTIFICATION NO.
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA Micro-Purging
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1240	initial depth to water measurement measured @				112.08				
1300	Started pumping - flow rate adjusted to ~1 L/min						1 L/min		
1313	18.75	883	7.01	25.9	112.15			5.80	125.6
1323	20.25	916	7.11	29.2	112.02			5.57	73.5
1328	19.80	912	7.05	28.5	112.02			5.59	73.7
1336	19.84	901	7.06	26.9	112.02			5.49	62.9
1342	19.84	904	7.02	24.3	112.02			5.63	62.1
1348	20.19	908	7.09	21.8	112.02			5.47	69.5
1352	20.37	916	7.07	19.6	112.02			5.59	63.7
1355	Collected Co-Total Sample W-OB-1-S-092100-P								

NTU = Nephelometric turbidity units
WL = Water level

Checked By AS Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-21-00
Monitor Well Number	**Field Investigator(s)**	
OB-1-I	Kyle Madden	

WELL DATA
INITIAL DEPTH 112.17'
Total Depth 195'
Well Diameter 4"

Water Column Height _____
Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal ~~Pumping~~ Micro-Purging Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance greenish

Remarks greenish

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1112	- measured initial depth to well			us	112.17				
1120	- started Pumping - flow adjusted to 1 L/min						1 L/min		
1131	17.41	632	7.27	21.6	112.25		1.0 L/min	5.44	110.0
1141	17.79	636	7.38	8.7	112.26		1.0 L/min	5.78	62.3
1151	17.96	639	7.30	7.7	112.24		1.0 L/min	5.65	62.3
1159	18.52	647	7.41	9.2	112.23			6.11	49.0
1206	18.52	648	7.39	9.7	112.23		1.0 L/min	5.92	49.5
1212	18.46	652	7.37	7.2	112.24		1.0 L/min	5.83	53.7
1217	18.43	652	7.32	6.7	112.24		1.0 L/min	5.63	54.1
1220	collected	W-OB-1-I-092100-P - (1 total Cr)							

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ice Services	9-21-00
Monitor Well Number	**Field Investigator(s)**	
OB-1-D	G. Felkner	

WELL DATA
INITIAL DEPTH 113.22' Water Column Height 122'
Total Depth 235' Well Volume (gals) ~80 gals
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Submersible Pump Was Well Pumped Dry? Yes (No)
3 Well Volumes ~240 gals Amount of Water Removed from Well ~510 gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1600	Initial	W.L.	—	—	113.22'	—	—	—	—
1616	Start	Pumping	—	—	—	—	15 gpm	—	—
1630	15.5	429	7.46	0	—	—		7.2	228
1633	15.5	431	7.45	0	—	—		7.1	228
1636	15.5	433	7.45	0	—	—		7.0	227
1639	15.5	435	7.44	0	—	—		7.0	227
1642	15.5	436	7.44	1.6	—	—		6.99	226
1646	15.5	436	7.44	1.4	—	—		6.98	226
1649	~~15.5~~	437	7.44	0	—	~510 gal		6.97	225
1650	Collect sample		—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-22-00
Monitor Well Number	**Field Investigator(s)**	
OB-2-S	Kyle Madden	

WELL DATA
INITIAL DEPTH 109 30' — Water Column Height ____
Total Depth 130' — Well Volume (gals) ____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
✓ Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA Micro-Purging
Method of Water Removal ~~Pumping~~ — Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals — Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS
Water Temp 18.47 °C — ~~Specific~~ Conductance 940 micromhos — pH 7.24 — Turbidity 63

Physical Appearance greenish color

Remarks greenish color

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
0851	initial measurement - depth to water				109.30				
0910	Starting Pumping								
0917	flow rate adjusted to ~1.0 L/min						~1.0 L/min		
0921	16.12	988	7.02	15.0	109.41		~1.0 L/min	7.49	171.0
2928	17.55	1002	7.12	9.9	109.44		~1.0 L/min	7.37	144.7
0935	17.43	951	7.06	7.6	109.43			8.04	144.1
0942	17.45	930	6.99	7.6	109.43			7.64	127.2
0951	18.20	955	7.01	9.2	109.38			6.97	111.6
0957	18.50	951	7.24	9.4	109.41			6.70	93.5
~~1006~~ 1014	18.04	930	~~7.12~~ 6.88	7.7	109.41			6.69	124.2
~~1008~~ 1022	18.47	940	7.24	6.3	109.39			6.63	97.0
1016	Sample collected (total cr) - W-OB-2-S-092200-P								
1022	Sample collected (Rinsate - total cr) W-OB-2-S-092200-R								

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-21-00
Monitor Well Number	**Field Investigator(s)**	
OB-2-I	Kyle Madden	

WELL DATA

INITIAL DEPTH 108.15 — Water Column Height ____

Total Depth 192 — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter 4"

METHOD OF WELL DEVELOPMENT

X Pumping ____ Air Lift

____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA

Method of Water Removal Micro Purging Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals — Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS

Water Temp ____ °C — Specific Conductance ____ micromhos — pH ____ — Turbidity ____

Physical Appearance Green color

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1612	- Initial measurement of depth to water = 108.15' (from stick up)								
1622	- pumping - flow rate set to ~1.0 L/min						~1.0 L/min		
1635	19.29	694	6.90	21.3	108.31		~1.0 L/min	5.04	102.5
1644	18.99	698	6.93	24.4	108.27		~1.0 L/min	4.92	71.7
1650	19.17	697	6.83	17.4	108.27		~1.0 L/min	5.83	96.1
1656	19.13	699	6.94	17.4	108.27		~1.0 L/min	4.87	84.2
1702	19.16	702	6.74	13.3	108.27		~1.0 L/min	5.01	106.2
1709	18.78	695	6.90	13.9	108.27			4.82	92.7
1715	18.58	692	6.71	9.3	108.27		~1.0 L/min	4.89	117.0
1717	collected sample w. OB-2-I-092100-P (total Cr)								

NTU = Nephelometric turbidity units

WL = Water level

Checked By DF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09/21-00
Monitor Well Number	**Field Investigator(s)**	
OB-2-D	Kyle Mudder	

WELL DATA

INITIAL DEPTH 109.56' — Water Column Height ____

Total Depth 135' — Well Volume (gals) ____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter ____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.

✓ Pumping ____ Air Lift

____ Surging ____ Bailing

WATER SAMPLING DATA

Method of Water Removal Micro-Purging Pumping — Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals — Amount of Water Removed from Well NA gals

FINAL FIELD ANALYSIS

Water Temp 18.76 °C — Specific Conductance 657 micromhos — pH 7.05 — Turbidity 12.5

Physical Appearance Greenish color

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1430	Initial measurement of depth to water =				109.56				
1440	Pump running - flow rate adjusted to			~1.0 L/min			~1.0 L/min		
1506	17.25	~~523~~ 523	7.04	21.7	109.57		~1.0 L/min	6.44	124.2
1513	18.50	544	7.14	19.6	109.57			6.54	106.0
1523	19.02	555	7.09	20.4	109.57			6.68	76.5
1531	19.24	558	7.19	29.9	109.57		~1.0 L/min	6.33	20.9
1540	19.3	608	7.17	16.7	109.57		~1.0 L/min	6.05	55.8
1547	19.16	626	7.08	13.9	109.57		~1.0 L/min	5.98	65.2
1552	18.76	657	7.05	12.5	109.57			5.60	60.6
1554	Total Cr Sample collected -		W-OB-2-~~X~~D-092100-D						

NTU = Nephelometric turbidity units

WL = Water level

Checked By AF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-19-00
Monitor Well Number	**Field Investigator(s)**	
PWS-8	G Felkner	

WELL DATA

INITIAL DEPTH ?

Total Depth 240'

Well Diameter

Water Column Height

Well Volume (gals)

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT

X Pumping ____ Air Lift

____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA

Method of Water Removal dedicated turbine pump Was Well Pumped Dry? Yes (No)

3 Well Volumes NA gals Amount of Water Removed from Well ~10,200 gals

FINAL FIELD ANALYSIS

Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance greenish tint

Remarks

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
start 1018	Start Pumping				?				
1019	15.29	551	7.5	29		3400 gals	in 4 min	6.66	199
1022	15.19	582	7.4	14		@ 3 tanks	850 gpm	6.19	204
start 1046									
1049	15.2	592	7.7	10			850 gpm	6.96	218
start 1050	15.3	584	7.4	5				6.90	224
start 1109							850 gpm		
1110	15.3	592	7.6	9				6.37	227
1111	15.3	587	7.5	3.6				6.89	231
1111	Collect sample					~10,200 gals			

NTU = Nephelometric turbidity units

WL = Water level

3400
10,200

Checked By

Date

Black & Veatch Special Projects Corp.

Page 1 of 1

MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Service	9-20-00
Monitor Well Number	**Field Investigator(s)**	
HP MW-6-S	G. Folkner	

WELL DATA
INITIAL DEPTH 105.41' Water Column Height ~20'
Total Depth 125' Well Volume (gals) ~13 gal
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter 4"

METHOD OF WELL DEVELOPMENT PHOTOGRAPH IDENTIFICATION NO.
X Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)
3 Well Volumes ~39 gals Amount of Water Removed from Well ~600 gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance____

Remarks____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1125	Initial	W.L.	—	—	105.4'	—	—	—	—
1140	Start	Pumping	—	—	—	—	13.3 gpm	—	—
1209	16.2	979	6.90	4	—	—	—	0.55	137
1214	16.2	981	6.85	0.4	—	—	—	0.26	114
1217	16.2	982	6.85	0.5	—	—	—	0.23	108
1219	16.2	980	6.85	0.7	—	—	—	0.21	106
1221	16.2	980	6.85	0.1	—	—	—	0.19	99.5
1223	16.2	980	6.85	0	—	—	—	0.18	96.6
1225	Collect	sample & ms/msD	—	—	—	~600 gal	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By AF Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	5-20-00

Monitor Well Number	Field Investigator(s)
HPMW-9-S	G. Felkner

WELL DATA
INITIAL DEPTH 103.37'
Total Depth 125'
Well Diameter 4"

Water Column Height ~ 22'
Well Volume (gals) ~ 14
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
X Pumping ____ Air Lift
____ Surging ____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal Pumping Was Well Pumped Dry? Yes (No)

3 Well Volumes ~ 43' gals Amount of Water Removed from Well ~ 470 gal gals

FINAL FIELD ANALYSIS
Water Temp ____ °C Specific Conductance ____ micromhos pH ____ Turbidity ____

Physical Appearance ____

Remarks ____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed (21 sx @ 4 gpm)	Flow Rate	DO	ORP
1315	Initial	W.L.	—	—	103.37'	—	—	—	—
1322	start	purging	—	—	—	—	10.9 gpm	—	—
1338	15.5	939	6.89	2.2	—	—	↓	1.3	191
1344	15.5	943	6.81	0.3	—	—	↓	0.88	191
1356	15.5	948	6.80	0	—	—	↓	1.12	192
1359	15.5	950	6.8	0	—	—	↓	0.75	192
1402	15.5	950	6.8	0	—	—	↓	0.72	192
1404	15.5	950	6.8	—	—	~ 470 gal	↓	0.75	192
1405	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 5-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-01	Kyle Madden	

WELL DATA
INITIAL DEPTH Residential — Water Column Height ____
Total Depth ____ — Well Volume (gals) ____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter ____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
____ Pumping ____ Air Lift
____ Surging ____ Bailing

WATER SAMPLING DATA
Method of Water Removal ____ Was Well Pumped Dry? Yes No

3 Well Volumes ____gals Amount of Water Removed from Well____gals

FINAL FIELD ANALYSIS
Water Temp____°C Specific Conductance____micromhos pH____ Turbidity____

Physical Appearance Clear

Remarks 175 Thompson RD - [redacted] Residence

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1541	- started	tap through	hose						
1546	- started	monitoring							
1546	15.15	791	7.19	-0.2				6.94	264.0
1551	15.11	792	7.19	-0.1				6.84	256.7
1556	15.08	783	7.23	-0.6				7.50	262.5
1601	15.11	784	7.24	-0.5				7.58	272.6
1603	- collected	1 total Cr	Sample	W-RW-01-092200-P				~~6.94~~ KEM 092200	~~264.0~~

NTU = Nephelometric turbidity units
WL = Water level

Checked By DF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-2	G. Folkner	

WELL DATA
INITIAL DEPTH Residential — Water Column Height _____
Total Depth _____ — Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter _____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____gals Amount of Water Removed from Well _____gals

FINAL FIELD ANALYSIS
Water Temp _____°C Specific Conductance _____micromhos pH _____ Turbidity _____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1449	Start	purging	—	—	—	—	—	—	—
1455	16.2	414	7.78	0	—	—	—	8.75	212
1500	15.9	413	7.64	0	—	—	—	8.75	213
1505	15.8	411	7.74	0	—	—	—	8.73	214
1509	15.8	410	7.74	0	—	—	—	8.72	212
1510	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-3	G. Felkner	

WELL DATA
INITIAL DEPTH Residential — Water Column Height _____
Total Depth _____ — Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter _____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____gals Amount of Water Removed from Well_____gals

FINAL FIELD ANALYSIS
Water Temp_____°C Specific Conductance_____micromhos pH_____ Turbidity_____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1525	Start	Pumping	—	—	—	—	—	—	—
1532	15.4	395	7.65	1.9	—	—	—	8.52	307
1536	15.4	400	7.65	0	—	—	—	8.37	431
1541	15.3	400	7.68	0	—	—	—	8.40	390
1544	15.3	400	7.67	0.9	—	—	—	8.41	383
1545	Collect	sample	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	9-22-00

Monitor Well Number	Field Investigator(s)
RW-4	G. Fetkenhour

WELL DATA
INITIAL DEPTH Residence — Water Column Height _____
Total Depth _____ — Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter _____

METHOD OF WELL DEVELOPMENT
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____gals Amount of Water Removed from Well _____gals

FINAL FIELD ANALYSIS
Water Temp _____°C Specific Conductance _____micromhos pH _____ Turbidity _____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1557	~~Start~~	~~purging~~	—	—	—	—	—	—	—
1603	16.8	441	7.73	0.6	—	—	—	8.04	278
1607	15.5	429	7.72	0	—	—	—	8.49	271
1611	15.5	432	7.73	0	—	—	—	8.13	273
1617	15.2	429	7.82	0	—	—	—	8.5	273
1619	15.2	428	7.7	0	—	—	—	8.5	274
1620	Collect	sample	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By DS — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46118	Ace Services	09-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-05	Kyle Madden	

WELL DATA
INITIAL DEPTH Residence — Water Column Height _____
Total Depth _____ — Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter _____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____ gals Amount of Water Removed from Well _____ gals

FINAL FIELD ANALYSIS
Water Temp _____ °C Specific Conductance _____ micromhos pH _____ Turbidity _____

Physical Appearance Clear

Remarks 1680 E. 4th - Havel residence personal well

took MS and MSD

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1516	- Started tap through garden hose								
1521	16.19	452	7.56	-0.6				7.57	231.4
1526	16.06	443	7.56	-0.5				7.82	235.3
1531	15.93	441	7.56	-0.4				7.83	239.6
1536	15.86	456	7.58	-0.4				7.85	248.1
1537	- 1 total Gr Sample - W-RW-05-092200-P								
1537	- took MS & MSD Samples W-RW-05-092200-MS and W-RW-05-092200-MSD								

NTU = Nephelometric turbidity units
WL = Water level

Checked By JT — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
416118	Ace Services	09-22-00

Monitor Well Number	Field Investigator(s)
1940 E. 4th - Metzler RW 06	Kyle Madden

WELL DATA
INITIAL DEPTH Residence
Total Depth _____
Well Diameter _____

Water Column Height _____
Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

METHOD OF WELL DEVELOPMENT
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____ gals Amount of Water Removed from Well _____ gals

FINAL FIELD ANALYSIS
Water Temp _____ °C Specific Conductance _____ micromhos pH _____ Turbidity _____

Physical Appearance Clear

Remarks 1940 East 4th - Metzler Residence

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1445	Started								
1450	16.34	496	7.47	11.3	—	—	—	10.30	184.5
1455	15.95	491	7.43	4.4				8.96	191.6
1500	15.49	485	7.48	2.9				9.04	206.9
1505	15.35	479	7.47	0.3				9.18	216.2
1510	15.35	484	7.47	0.6				8.97	220.3
1510 -	collected	1 total Cr sample -		W-RW-06-092200-P					

NTU = Nephelometric turbidity units
WL = Water level

Checked By DT Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING ~~WELL~~ DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
46178	Ace Services	09-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-08	Kyle Madden	

WELL DATA

INITIAL DEPTH Residence — Water Column Height _____

Total Depth _____ — Well Volume (gals) _____

(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"

Well Diameter _____

METHOD OF WELL DEVELOPMENT

_____ Pumping _____ Air Lift

_____ Surging _____ Bailing

PHOTOGRAPH IDENTIFICATION NO.

WATER SAMPLING DATA

Method of Water Removal _____ Was Well Pumped Dry? Yes No

3 Well Volumes _____gals Amount of Water Removed from Well _____gals

FINAL FIELD ANALYSIS

Water Temp _____°C Specific Conductance _____micromhos pH _____ Turbidity _____

Physical Appearance _____

Remarks Mike Smith Residence (at house)

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1630	Started tap running through hose				—				
1641	17.75	570	7.52	2.8	—			8.76	243.4
1646	16.39	547	7.48	1.9	—			8.54	277.2
1651	16.43	542	7.52	-0.6	—			8.87	274.6
1656	16.38	536	7.43	-0.7	—			8.43	276.8
1701	16.39	537	7.43	1.1	—			8.38	273.6
1702	- Sample collected (total: 6c) W-RW-08 - 092200-P								
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units

WL = Water level

Checked By AF — Date 9-26-00

Black & Veatch Special Projects Corp.

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MONITORING WELL DEVELOPMENT/PURGING DATA

Project Number	Project Name	Date
4618	Ace Services	9-22-00
Monitor Well Number	**Field Investigator(s)**	
RW-9	G. Felkner	

WELL DATA
INITIAL DEPTH New Residency — Water Column Height _____
Total Depth 5m 15, — Well Volume (gals) _____
(x)(height) x=.163 gal/ft @ 2", x=.653 gal/ft @ 4"
Well Diameter _____

METHOD OF WELL DEVELOPMENT — PHOTOGRAPH IDENTIFICATION NO.
_____ Pumping _____ Air Lift
_____ Surging _____ Bailing

WATER SAMPLING DATA
Method of Water Removal _____ Was Well Pumped Dry? Yes No
3 Well Volumes _____gals Amount of Water Removed from Well _____gals

FINAL FIELD ANALYSIS
Water Temp _____°C Specific Conductance _____micromhos pH _____ Turbidity _____

Physical Appearance _____

Remarks _____

TIME	Temp °C	Conductivity	pH	NTUs	WL	Removed	Flow Rate	DO	ORP
1638	Start	Purging	—	—	—	—	—	—	—
1644	15.66	398	7.7	2.0	—	—	—	8.70	264
1647	15.3	381	7.7	0	—	—	—	8.5	263
1649	15.2	381	7.7	0	—	—	—	8.4	262
1650	Collect Sample		—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

NTU = Nephelometric turbidity units
WL = Water level

Checked By [signature] Date 9-26-00

Appendix D
Field Logbooks

[redacted]

Walt Woofter 2/24/00

United Parcel Fee shipment back to Vendor. ALL Water levels are recorded on separate water level sheet.

[illegible signature] 7-10-00

Weather: Sunny, 70°-90°s, wind from NNW

0740 Arrive site, Alley marker still up. I set well location survey flags.

0858 Drill crew:

John Mosier
Kerry Reilley
Mark Carter
Mike Newman

Crew arrive site. Utilities out marking utilities.

Drill crew prepare to drill.

1040 Have dug mud pit for EX-2-D. We will drill EX-2-D first. Lined pit.

1059 Conduct safety meeting. Highlights include:

- hard hats
- PPE to prevent contact w/ groundwater (+3000 µg/L [illegible])
- Drink water

1105 Begin drilling EX-2-D.

1400 Reach total depth @ EX-2-D @ 240'. Shale @ 233'.

1600 Finish reaming boring to 12" dia.

1648 Still flushing [illegible] gravels from boring.

[illegible signature] 7-10-00

[signature] 7-10-00

1825 Still flushing boring and thinning drilling fluid.

1830 Starting to rain.

1940 Lowering casing @ EX-2-D.

2010 Screen and casing set to 235' ~~[illegible]~~

Begin placing sand filter pack

2050 Have placed bentonite chip seal. Begin grouting.

2130 Have placed 3 tubs grout by tremie quit for night

2132 Secure site w/ caution tape and surround pit w/ rigs also.

2135 Drill crew & myself leave site.

[signature] 7-10-00

[signature] 7-11-00

Weather: Sunny. 70's - 90's

0728 Arrive site. Drill crew preparing for day. Will finish grouting EX-2-D and drill EX-2-I.

0805 While excavating circulation pit for EX-2-I a phone line is hit. (Unmarked) Driller goes to phone company. Local businesses still have phones. Phone co. says they will call if problem.

0857 Pull rig onto EX-2-I. Have excavated pit for circulation.

0930 Begin drilling @ EX-2-I.

1124 Have reached [illegible] @ EX-2-I w/ 7½" OD bit. Begin to ream to 12" OD.

1250 Go by Doughty Implement to see about moving two combines blocking access to well locations. Went w/ Jay Wooten. Jim Doughty said he could move them in next two days.

1330 Go by Max Embree's house at G+E Farms to see about access to the farm field for wells MW-13+14

[signature] 7-11-00

[signature] 7-11-00

Mr. Embree says he would allow access if he received a yearly payment. Update both Sequent (?)

1430 Midway 1300 rig pulls off EX-2-I and onto EX-2-S to start drilling. Smeal rig pulls onto EX-2-I to set casing.

1520 Casing set to depth (195') @ EX-2-I.

Drilling EX-2-S w/ midway rig.

1600 Finish setting filter pack & bentonite chip seal @ EX-2-I.

1730* Begin to grout.

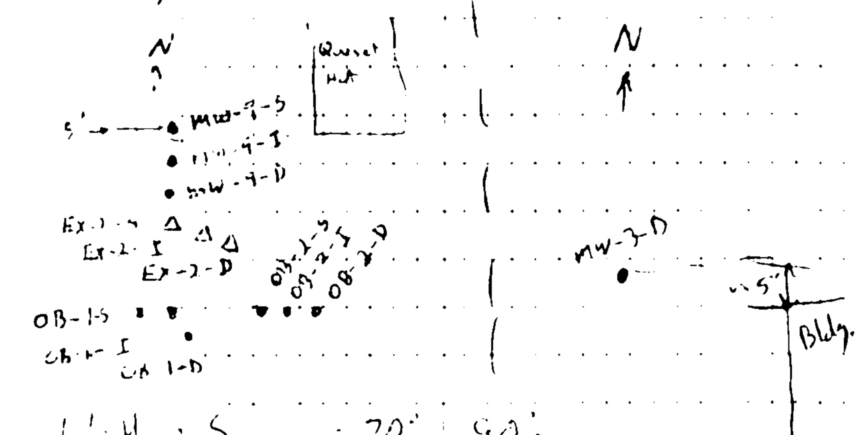
1858 Have finished drilling and flushing EX-2-S. Have also finished setting screen and riser to proper depth.

1915 Finished placing filter pack and bentonite seal. Prepare to grout.

2015 Site secured. Finished grouting EX-2-S. All left site.

[signature] 7-11-00

[signature] 7-12-00



Weather: Sunny 70's - 90's.

0740 Arrive site. Drillers have taken rig and equipment to decon.

0815 Rig pulls onto OB-1-D.

1030 Reach 240' on OB-1-D w/ 5 7/8" bit. Will now ream to 8".

1245 Finish reaming boring to 8". Begin setting screen and riser for OB-1-D.

1315 Screen & riser set @ OB-1-D. Begin to place filter + seal.

1400 Collect:
S-IDWEX2-071200

1500 Have rig over to OB-1-S. Begin drilling.

1510 Gerry Bieker (city of ...) stops by.

1655 Reach total depth @ OB-1-S w/ 8" OD bit.

[signature] 7-12-00

[signature] 7-12-00

begin to set screen + riser.

1730 Finish setting screen + riser to total depth @ OB-1-S.

1736 Relinquish soil sample to UFS.

1800 Finish placing ~~screen~~ filter pack, seal, + grout @ OB-1-S. Move rig onto OB-1-I. Driller repairing return hose on water pump.

1919 Have secured site. Locked wells. All lv. site.

[signature] 7-12-00

[signature] 7-13-00

Weather: Sunny 70's – 90's.

0745 Arrive site. Driller onsite, we will drill ~~OB~~ OB-1-I today.

0815 Call Bob Stewart. Update on progress.

1003 Reach total depth @ (198') OB-1-I w/ 8" bit. Flushing boring.

1028 ~~Begin~~ Finish flushing boring. Begin lowering casing @ OB-1-I.

1130 Finish grouting well OB-1-I. Rig gone to decon.

1212 Finish deconning. Pull rig onto OB-2-D.

1256 Begin drilling OB-2-D.

1350 Collect:

S-IDWOB1-071300

1351 Ken Wyatt (DEP) arrives site. I show Ken around site.

1500 Meet w/ Gerry Bicka (Colby) to discuss revised design. Also discuss project w/ Carolyn Armstrong.

1630 Go to county court house to get city maps.

1700 Driller have set OB-2-D, TD 240, scr 235

[signature] 7-13-00

 [signature] 7-13-00

1735 Deliver samples to UPS for shipment

1807 Rig moved over to OB-2-I. Site secured. All left site.

[signature] 7-13-00

[signature] 7-14-00

Weather Sunny 70-90°.

0740 Arrive site w/ Ken Wyatt. Dillon drilling OB-2-I and OB-2-S.

0801 Go to Ace Services Building to inspect for use as treatment plant.

0930 No one showed up to let us in Machine shop. We took outside measurements and photographs.

1010 Calibrate YSI Meter (pH + conductivity)

1023 110.55' water level BGS @ EX-2-D.

We set up to develop EX-2-D.

Driller setting pipe @ OB-2-I.

1129 Finish setting OB-2-I. Rig pulls over to OB-2-S.

1133 Start pumping EX-2-D @ 75 gpm

1512 Finish developing EX-2-D

1520 Receive soil results for IDW for EX-2. Results = 3.7 mg/kg total Cr which is less than 10 mg/kg so soil will be spread to ground.

1550 Dillon finish setting and grouting OB-2-S (10')

1554 Collect S-IDWOB2-071400

 [signature] 7-14-00

1620 110.8 lbs' WL @ EX-2-S prior to pumping

1640 Begin pumping EX-2-S.

1800 Stop pumping for day. Secure site.

[signature] 7-14-00

[signature] 7-15-00

Weather: Sunny 70°-90°

0800 Arrive site, Driller starting pumping EX-2-S @ 0810. Also setting up to pump OB-2-D.

0850 Calibrate pH. Verify conductivity calibration.

0913 Start developing OB-2-D.

0927 WL

			ID
OB-1-S	112.15'	BGS	130'
OB-1-I	111.45	↓	195'
OB-1-D	113.82'		235'
OB-2-S	108.80'		130'
OB-2-I	107.90'		192'
OB-2-D	—	pumping pipe in 4" line	235'
EX-2-S	116.90'	pumping @ 15.7 gpm	130'
EX-2-I	110.95'		195'
EX-2-D	110.65'		235'

1034 Stop pumping EX-2-S

1325 ~~Start~~ developing EX-2-I

1520 ~~Stop~~ Finish development @ OB-2-D

1645 Finish development @ ~~OB~~ - EX-2-I

1705 Site secured. all leave site.

[signature] 7-15-00

Gary Fell 7-17-00

Weather: Cloudy / rainy 60-70's

0740 Arrive site. Will decon pipe then develop next well. Driller pulling pipe from EX-2-I.

0850 Set-up to develop OB-2-I. ~~Cal~~ Check calibration of YSI meter (pH).
Raining hard.

0920 Start pumping @ OB-2-I.

1055 Finish developing OB-2-I. Driller pull pump.

1130 Its been raining hard all morning, Rig is stuck, quite a bit of runoff starting to develop. Will secure site and quit for day.

1157 Quit for day due to rain.

Gary Fell 7-17-00

Gary Fell 7-18-00

Weather: Sunny 60-90's

0740 Arrive site. Rig still stuck driller trying to pull out w/ other trucks.

0815 Get rig out and pull onto OB-1-D.

0830 Calibrate SC and verify pH calibration.

0915 Begin pumping (developing) OB-1-D.

1126 Finish developing OB-1-D. Driller go decon and set-up on OB-1-S.

1300 Start pumping @ OB-1-S.

1441 Finish developing OB-1-S. Driller breakdown to go decon.

1520 Rig pulls onto OB-2-S to develop.

1540 Start pumping OB-2-S.

1737 Finish developing OB-2-S.

1806 Secure site. All lv. for day.

Gary Fell 7-18-00

 [signature] 7-19-00

Weather: Cloudy 60-70's. Rained hard last night.
0740 Arrive site. Driller getting ready to develop well OB-1-I.
0840 Verify SC + pH calibration.
0910 Start pumping OB-1-I.
1100 Finish developing OB-1-I.
1239 Site secured. Cuttings test non-hazardous. Driller will spread to ground. Lv. site for K.C.

[signature] 7-19-00

[signature] 7-31-00

1600 Arrive site w/ Duston Marlow (B+V). Remind Duston Marlow to remain in exclusion zone.
Ron Shipley w/ Worthy Pump onsite. Review site procedure w/ Ron. Duston + I set up to perform pump test.
2213 Have set transducers in well EX-2 and MW-7, Recorder is running. Have measured lengths for transducer in wells OB-1 and OB-2.
I go to get supplies.
2330 Duston lvs site. I remain to oversee equipment while collecting steady state data.
2400 Continued 8-1-00

[signature] 7-31-00

108 Amy Tabb 8-1-00

0000 Onsite to oversee recorder measuring stream stage data at wells EX-2 and MW-9

0235 Colby Police stop by. I inform them what we are doing and that Gerry Bieker knows that we are performing pump tests. The police say OK and leave site.

0651 Dustin arrives site. Continue setting up the channel box. Check recorder which is running.

0754 Ron Shipley (Wooster) arrives site.

0954 Have finished setting up Hermit recorder and start step test.

1400 Begin pumping EX-2 @ 100.

1605 Return to hotel to program background Leveloggers.

1807 MW-7-D
W.L. 120.01 ft below TOC
Amy Tabb 8-1-00

Amy Tabb 8-1-00 109

1818 MW-6-D
WL = 106.42 ' TOC

1825 Lower Leveloggers probe to 110 ' TOC @ MW-6-D

1904 Check flow rate @ EX-2-D
= 108 gpm
L.V. site for day.
Dustin will be onsite 8-11 23:00
Wooster pump watch 23:00 → 7:00

Amy Tabb 8-1-00

[signature] 8-2-00

0700 Arrive site. Darren of Wootten pump onsite. He found everything OK.
0710 EX-2-D Pump pumping @ 105 gpm
0927 EX-2-D Pump rate @ 105 gpm
1029 EX-2-D Pump rate @ 105 gpm
1100 Discuss additional sample collection for treatability study w/ Ken Wyatt.
1130 Talk to SW Labs about analyses. FAX parameter request to Randy Staggs @ SW Labs.
1200 Return to site w/ Duston. Ron w/ Wootten onsite from 1100 to 1200.
1416 W.L. @ MW-6-D = 106.71' bTOC
1425 W.L. @ MW-7-D = 120.19' bTOC
1454 EX-2-D pump rate @ 105 gpm
1531 Call Bob Stewart (EPA) and update on progress.
1900 Lv. site for day. Duston @ site

[signature] 8-2-00

[signature] 8-3-00

Weather: Pt'ly Cloudy - Sunny 60's - 90's.
0654 Arrive site. Darren w/ Wootten Pump & Well onsite. Light rain last night.
0701 EX-2-D pumping @ 105 gpm
0830 EX-2-D pumping @ 105 gpm
1045 EX-2-D pumping @ 105 gpm
1156 Duston Marlow (PRC) arrives site.
1430 Lv. site. Duston onsite.
1837 Arrive site. Relieve Duston from oversight.
1930 Call Jay Wootten. Arrange schedule for tomorrow.
2006 EX-2-D pumping @ 105 gpm
2250 Darren of Wootten Pump arrive site. I lv.

[signature] 8-3-00

112

8-4-00

0755 Arrive site. Dust on site
0800 Collect sample
GW-EX2-D-080400-F
high range C^{14} field test
= ➔ 1.5 mg/L
(greater than)
1042 Arrive RW-6 (Metzler)
Begin pumping.
1100 Collect
GW-RW6-080400-P
1200 Weather pump arrive to pull pump and set in Ex-2-I.
1529 WL. @ MW-6-D
106.13' btoc
~~Move Leveloggr to MW-6-I~~ NS
1536 WL. @ MW-6-I
= 104.54' btoc
1600 Move & set Leveloggr to MW-6-I
2032 Pumping EX-2-I @
185 gpm
2305 Lv. site aftr Damon arrives

8-4-00

113

8-5-00

1155 Arrive site. Duston on site.
1259 Measure WL @ MW-6-I
= 104.74' btoc
1500 Duston lvs site
1510 Pumping @ EX-2-I @
185 gpm
1709 Pumping @ EX-2-I @
185 gpm
1830 Pumping @ EX-2-I @
185 gpm
2150 Pumping @ EX-2-I @
185 gpm
2300 Lv. site aftr. Weather Pump + Well employee arrives

8-5-00

[signature] 8-6-00

1200 Arrive site, Duston onsite
1316 W.L. @ MW-6-I = 104.73' BTOC
1600 Duston lv. site.
1744 Pumping @ EX-2-I @ 185 gpm
2057 Pumping @ EX-2-I @ 185 gpm
2300 Darren w/ Woofter Pump & Well arrives. I lv. site

[signature] 8-6-00

[signature] 8-7-00

1120 Arrive site. Duston onsite.
1130 Collect sample GW-EX2-I-080?00-P
Field test kit for Cr^{+6} = >4.5 mg/L (w/ dilution)
1300 Relinquish sample to hotel for Fed. Ex. pick-up.
1332 W.L. @ MW-6-I = 104.67'
1350 Woofter Pump (Ron Shipley & helper) arrive site to pull well from EX-2-I and set different pump in EX-2-S.
1600 Begin test pumping @ 30 gpm
1630 Reduce flow to 20 gpm
1700 Duston lv. site.
2335 Darren arrives site, I lv.

[signature] 8-7-00

8-8-00

1200 Arrive site. Duston is onsite.

1230 Talk w/ Sellers Tractor (Mike Johnson) (785) 402-2321 about supplying water. They said OK. Will talk more tomorrow.

1405 Pick-up Fed Ex package.

1430 Discuss changing equipment w/ UPS.

1910 Duston left site.

2240 Left site after Damon from Woolfolk Pump arrive site.

8-9-00

800 Arrive site. Duston onsite.

1330 W.L. @ MW-6-I = 104.74'

1730 Duston left site.

2240 Damon arrives site. I leave

[signature] 8-10-00

0802 Arrive site. Duston onsite.
0805 Walt Worthen (BV) arrives site.
0810 Collect
GW-EX2-S-081000-P
Field Cr^{+6} measurement = 0.8 mg/L (2x w/dilution)
1140 W.L. @ MW-6-I = 104.77'
Pull Level Logger
1200 Site cleaned and wells secure. Drop off boxes for shipment @ Comfort Inn for shipment via UPS.
1330 Call Bob Stewart w/ EIA and update on progress.
1345 Call SV laboratory to confirm sample receipt. Sample recieved ok.
1400 Head to KC, MO

[signature] 8-10-00

[signature] 9-18-00

60 70°

0750 Arrive hotel standing w/ Kyle Madden & Tapan A.
0840 Pumping @ MW-12-S and MW-12-I. Mike Kistler on site. Conduct H+S meeting.
0930 Crew #1 pumping from MW-12-I
Crew #2 pumping from MW-12-S
1010 Collect
W-MW-12-I-091800-P
1025 Crew #1 pull pipe to decon.
1100 W.L. MW-11-I = 120.05'
Crew #1 @ MW-11-I
1151 Collect
W-MW-11-I-091800-P
W-MW-11-I-091800-D
Drill crew pull pump + go decon.
1235 Collect rinsate
W-MW-11-S-091800-R
1300 Working @ MW-11-S
Crew #2 @ MW-7-I & MW-5-I
1355 Collect
W-MW-11-S-091800-P
Drillers go decon.
1413 WL 105.31' @ ~~MW-12~~ MW-2-D

[signature] 9-18-00

[signature] 9-18-00

1458 Pumping @ MW-2-D @

1540 Collect

W-MW-2-D-091800-P

1600 Crew #1 pulling pipe & going to decon

1606 Crew #2 pull onto MW-2-I

1654 Start pumping @ EX-2-D

1800 Relinquish sample to UPS.

1900 Finish ~~collect~~ clean-up of site, getting supplies, and preparing for tomorrow.

[signature] 9-18-00

[signature] 9-19-00

60-80's

0750 Arrive PWSW #8, Prepare for day

0805 Calibrate conductivity & pH.

0825 City not here yet. Crews #1 + #2 ready to go. Call city. They forgot and are on way.

0835 City realizes power meter is blown out and will have to replace. We sample EX-2-I and will return to PWS-8 later.

0845 Arrive @ EX-2-I. W.L. = 110.89'

0955 Collect

W-EX-2-I-091900-P

1012 Return to PWS-8.

1111 Collect

W-PWS-8-091900-P

Driller decon

1200 Initial W/L @ EX-2-S = 111.67'

1315 Collect

W-EX-2-S-091900-P

Driller go decon

1330 W.L. @ MW-9-S = 111.98'

[signature] 9-19-00

[signature] 9-19-00

1415 Start pumping MW-9-S
1450 Collect
W-MW-9-S-091900-P
W-MW-9-S-091900-D
1510 Start filling 6 15 gal drums for shipment to Sanco Tech for Ion Exchange treatability study.
1600 Collect:
W-IX-TS-1-091900-P
1615 Start pumping MW-9-I
1626 IX-TS sample is 650 mg/L Cr^{+6} field test
1655 Collect
W-MW-9-I-091900-P
1800 Relinquish sample to UPS.
1815 Secure site.

[signature] 9-19-00

[signature] 9-20-00

40's - 60's. Rain last night
0800 Arrive on site. Prepare for day.
0850 113.32' W.L. @ MW-9-D
0830 Verify calibration of pH and conductivity. Update Bob Stout (EPA)
0910 Collect
W-MW-9-D-092000-P
Driller go decon
0949 W.L. @ MW-12-D = 144.87'
1045 Collect
W-MW-12-D-092000-P
W-MW-12-D-092000-D
Driller go decon
1125 W.L. @ HPMW-6-S = 105.41'
1140 Start pumping HPMW-6-S
1144 W.L. @ HPMW-3-S = 105.01'
1152 W.L. @ HPMW-12-S = 107.41'
1225 Collect
W-HPMW-6-S-~~092~~ 092000-P
" -MS
" -MSD
Driller go decon
~~1447 W.L. @ MW-8-S = 108.28'~~
1405 collection is Collect
W-HPMW-9-S-092000-P

[signature] 9-20-00

124 [signature] 9-20-00

1430 ~~1430 Arrive~~ Well MW-10-P is DRY

1447 W.L. @ MW-8-S = 108.28

1505 Collect W-ACE-R-I-092000-R (Rinsate from Crew #2)

1540 Collect W-MW-8-S-092000-P
Driller decon

1606 W.L. @ MW-8-I = 107.75'

1655 Collect W-MW-8-I-092000-P
Driller decon
Begin sample management

1800 Relinquish samples to UPS for shipment.

1847 Finish securing site and getting supplies.

[signature] 9-20-00

[signature] 9-21-00 125

Weather: Sunny : 50-80s WINDY!!

0755 Arrive site.

0800 W.L. @ MW-8-D = 107.76

0820 Calibrate meter for conductivity and pH. Crew #2 has also

0905 Collect
W-MW-8-D-092100-P
W-MW-8-D-092100-D
Driller decon

0944 W.L. @ ~~MW-8~~ MW-11-D = 122.37'

1035 Collect W-MW-11-D-092100-P
Driller go decon

1120 W.L. @ MW-5-D = 103.20'

1205 Collect
~~[illegible]~~
W-MW-5-D-092100-P
Driller decon

1240 W.L. @ MW-5-I = 100.49'

1350 Collect W-MW-5-I-092100-P
Driller go decon

1411 W.L. @ MW-5-S = 100.51'

1440 Start pumping MW-5-S

[signature] 9-21-00

126 [signature] 9-21-00

1510 Collect
W-MW-5-S-092100-P
W-MW-5-S-092100-D
Driller decon
1600 W.L. @ OB-1-D = 113.22'
1650 Collect
~~[illegible]~~ W-OB-1-D-092100-P
Driller decon
1715 Collect
W-OB-1-D-092100-R
1800 Relinquish samples to UPS. Site secured.

[signature] 9-21-00

[signature] 9-22-00 127

[illegible] 50-80s
0755 Arrive [illegible] Crew #1 [illegible] [illegible]
0905 Crew #2 arrives site (Keith [illegible])
0915 Verifying conductivity + pH calibration
0835 W.L. @ MW-7-D = 117.71'
0925 Collect
W-MW-7-D-092200-P
W-MW-7-D-092200-D, driller decon
1050 Collect
W-MW-7-S-092200-P, driller decon
1116 W.L. @ MW-3-D = 104.91'
1210 Collect
W-MW-3-D-092200-P
Driller decon
1336 Check Calibrate water level meters to read the same
1340 Collect water levels
1450 Arrive Vap residence (KW-2) and start purging. Mrs. Vap says house next door (to east) on same well, 1745 E 4th (Ketchum)
1510 Collect W-RW-2-092200-P
[signature] 9-22-00

Jerry Sellers 9-22-00

1538 Spoke w/ person @ Sowers residence on phone. Person said Mr. Sowers would return on Sunday and could talk w/ him then. But could not give permission now.

1545 Collect
W-RW-3-092200-P

1600 At RW-4 (1795 E 4th)

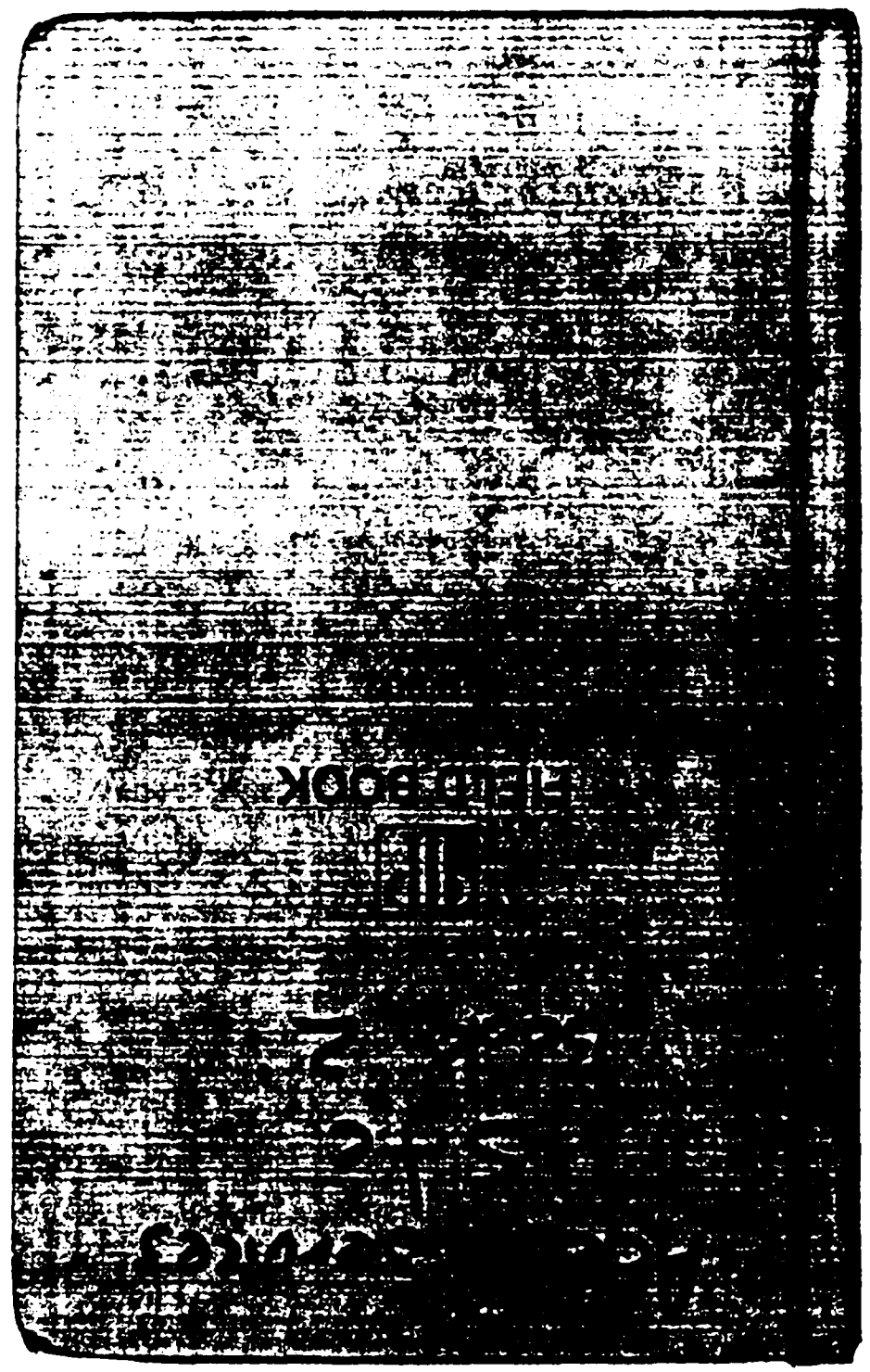
1620 ~~Collect~~ Collect
W-RW-4-092200-P

1635 Arrive RW-8. Mr. Smith said to go ahead and sample other property also.
RW-9 (2580 E. 4th)
own / Mr. + Mrs. Mike Smith
1888 County Road 21
Copley, KS 67701

1650 Collect
W-RW-9-092200-P

1800 Relinquish samples to UPS.

Jerry Sellers 9-22-00



July [illegible], 2000, [illegible] Hot slight Breeze
D. [illegible]

1.. At [illegible] @ 12:[illegible] pm
[illegible] [illegible] NEEDED [illegible]
Check equipment transducers and [illegible]
[illegible] (11-10 psi; 1 30 psi)
4:[illegible] p [illegible]
[illegible] water levels in wells

Well	Level		
MW [illegible]	111.40	FT	Datum = TOC
[illegible] -I	111.25		
[illegible]	110.[illegible]		
DB-1-S	111.[illegible]		
DB-1-I	111.[illegible]		
DB-1-D	110.11		
[illegible]	108.75		
[illegible]	107.[illegible]		
[illegible]-D	109.4[illegible]		
Ex-2-[illegible]	111.10		
[illegible]	110.[illegible]		
Ex-2-D	110.[illegible]		

STATIC WATER [illegible] ↓

4:30p Meet w/ Driller - Discuss plans for pumping test

5:00 p Measure and mark all transducer cables And install transducers in MW-9-S, MW-9-I, MW-9-D, Ex-2-S and Ex-2-I

10psi Transducer = max depth [illegible] water 23 ft

Well	Transducer Depth	Ref Datum = TOC Transducer S/N
MW-9-S	120'	5052
MW-9-I	134'	[illegible]072
MW-9-D	136'	6959
Ex-2-S	125'	5416
Ex-2-I	133'	6963

5:00p Start Recorder to monitor Water table [illegible] [illegible] [illegible] = Measurements 1 min intervals
Recorder - Hermit [illegible]
S/N 45419

Well	Input Port
MW-9-S	#1
MW-9-I	#2
MW-9-D	#3
Ex-2-S	#4
Ex-2-I	#5
Ex-2-D	#6

10:00p Finish preliminary setup

Appears from static water levels that there is a slight [illegible] Difference in water [illegible] Intermediate-shallow and Deep wells (<2')

D. Marlow

Transducer S/N	Range	Scale	Linearity	Offset
3082	10psi	9.9661	0.0297	0.0519
5092	10psi	9.9179	0.0222	0.00[illegible]
6959	[illegible]	10.0011	0.0197	0.179
5416	10[illegible]	9.9456	0.0232	[illegible]
[illegible]	10[illegible]	10.0335	0.0[illegible]	0.0107
[illegible]7	[illegible]	21.3116	0.25	0.0[illegible]

[illegible]

Values

[illegible] 11, 2002

[illegible] | [illegible] @ S[illegible]C

[illegible]

Well	Transducer	Range	Scale	Linearity	Offset
[illegible]-1-S	[illegible]	10[illegible]	[illegible]	0.0[illegible]3	[illegible]
[illegible]-1-I	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]-1-D	5415	10psi	[illegible]	0.0242	0.1109
[illegible]	5497	10[illegible]	[illegible]	[illegible]	[illegible]
[illegible]-2-I	[illegible]	10[illegible]	[illegible]	[illegible]	[illegible]
[illegible]-2-D	[illegible]	10[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

Well	[illegible]
[illegible]	111.42
[illegible]-9-I	111.29
[illegible]	111.13
[illegible]-2-S	111.12
[illegible]-2-I	110.36

[illegible] ± [illegible]

[illegible] 40A

[illegible] 45418

Hermit 4545[illegible] S/N [illegible]

INPUT

#1 OB-1-S

#2 OB-1-I [illegible]

[illegible] OB-1-D

#4 OB-2-[illegible]

[illegible] OB-[illegible]

[illegible] OB-[illegible]-D

D. Marlow

RATE	DRAWDOWN
70	48.6 - 20.4'
100 gpm	39.8 - 29.2'
120 gpm	29.7 - 29.3'
100 gpm	20.4 - 14.6'

DEW
14.6
13.7
22.2
22.17

5:30p
Check Flow Rate = 100 gpm.

D. Mallon

Ex-2-1

10:20	-1.805					46.5	2.9	2.1	
	14.4	0.08	1.3	21.0	29.7	48.6	3.2	2.2	
	14.6	0.31	1.3	21.0	29.9	48.1	3.2	2.2	
	13.7	0.2	1.2	21.0	29.1	47.4	3.0	2.2	
	11.4	0.1	1.2	21.0	30.0	47.3	3.0	2.1	
	[illegible]	0.0	1.2	21.0	30.1	47.5	2.9	2.1	
	[illegible]	1.0	1.2	21.1	29.8	41.4	2.8	2.1	
	[illegible]	1.2	1.2	21.0	30.1	49.5	2.8	2.1	
	[illegible]	[illegible]	1.2	21.1	29.7	49.8	2.7		
	6.6	[illegible]	1.2	21.1	36.0	49.5	2.7	2.1	
	6.7	1.3	1.2	21.2	38.6	49.5	2.6	2.0	
11:01	12.8	1.3	1.2	21.2	37.3	49.5	2.6	2.0	
	15.2	1.3	1.2	21.2	29.6	49.4	2.6	2.0	
	16.5	1.3	[illegible]	21.2	29.7	49.4	2.5	2.0	
	16.7	1.3	(12:01)	21.1	29.8	49.5	2.5	2.0	
	17.3	1.3	1.21	21.2	29.9	49.3	2.4	2.0	
	17.2	1.3	1.19	21.1	29.6	49.3	2.4	2.0	
	16.9	1.3	1.18	21.1	29.8	49.5 (12:13)	2.4	2.0	
	17.0	1.3	[illegible]	21.2	40.1	49.9	2.4	2.0	
	16.9	1.3	19.4	21.5	40.2	49.9	2.3	2.0	
	16.8	1.3	20.1	21.0	40.0	49.9	2.3	2.0	
	17.1	1.3	20.8	29.9	40.0	49.5	2.3	1.9	
	17.2	1.3	20.8	29.5	40.1	49.6	2.3	1.9	
	17.2	1.3	20.9	29.5	40.6	49.7	2.2	1.9 (14:07)	
11:14	0.5	1.3	20.9		42.7				

D. Marlow

8:30p Flowrate 105 gpm

10:00p [illegible] 105 gpm

10:40p [illegible] 23.6'

[illegible]

11:[illegible]

17:05

August 2, 2000
Call Chad

[illegible] 312 560 [illegible] Cell phone
312 [illegible]

[illegible] Plot [illegible]

11:00p [illegible]

[illegible]

[illegible]

[illegible]

[illegible]	1.8	1.71	
	1.8	(14:32) 35.72	44.18
	1.8	42.27	44.2[illegible]
	1.8	45.0[illegible]	44.[illegible]
	1.8	4[illegible]	44.[illegible]
	1.8	4[illegible]	44.4[illegible]
	1.77	42.9	44.[illegible]
	1.78	43.0	44.4[illegible]
	1.77	[illegible]	44.4[illegible]
	1.7[illegible]	4[illegible]	44.4[illegible]
	1.79	43.4	44.5
	1.79	4[illegible]	44.[illegible]
	1.8	43.5	44.[illegible]
	1.8	43.6	44.5[illegible]
	1.8	43.6	44.[illegible]
	1.77	43.83	44.6[illegible]
[illegible]	1.77	43.85	44.6
	1.75	43.[illegible]	44.[illegible]
	[illegible]	43.95	44.66
	[illegible]	44.1	44.72
	1.7[illegible]	(15:12) 44.[illegible]	44.7[illegible]
	[illegible]	44.[illegible]	44.[illegible]
	[illegible]	44.[illegible]	44.7[illegible]
[illegible])	1.7	44.[illegible]	44.84
			([illegible]) 44.91

D. Marlow

44.88	46.41	46.5	[illegible]	47.[illegible]		47.7	1145 - 46.3
44.78	46.47	46.48	[illegible]	47.71		[illegible]	1245 46.2
44.97	46.35	46.5	[illegible]	47.77		[illegible]	1332 46.1
[illegible]	46.45	[illegible]	[illegible]	47.71		[illegible]	1416 - 46.4
[illegible]	[illegible]	[illegible]	[illegible]	47.74		47.7	1491 - 46.5
[illegible]	[illegible]	[illegible]	[illegible]	47.7		47.7	1:30 [illegible]
[illegible]	1	[illegible]	[illegible]	47.7		47.7	1:[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	47.8		47.7	
[illegible]	[illegible]	[illegible]	[illegible]	47.7		47.7	
[illegible]	[illegible]	[illegible]	[illegible]	47.7		[illegible]	
[illegible]	[illegible]	[illegible]	7.[illegible]	47.7			
[illegible]	[illegible]	46.[illegible]	7.72	47.74			
[illegible]	[illegible]	[illegible]	47.74	47.74		55 47.7	
[illegible]	[illegible]	46.41	47.74	47.75			
[illegible]	[illegible]	[illegible]	[illegible]	47.75		1605 46.65	
[illegible]	[illegible]	46.[illegible]	[illegible]	47.76			
[illegible]	[illegible]	46.5	[illegible]	47.76		[illegible] 46.3	
[illegible]	[illegible]	[illegible]	[illegible]	47.79		2032 46.3	
[illegible]	[illegible]	[illegible]	47.78	47.78			
[illegible]	[illegible]	[illegible]	47.53	47.75		916 46.3	
[illegible]	46.63	[illegible]	47.74	47.78			
[illegible]	46.53	[illegible]	47.61	47.75		749 46.4	
[illegible]	46.5	[illegible]	[illegible]	47.65			
[illegible]	46.47	[illegible]	[illegible]	47.65		1032 46.3	
46.41	46.47	[illegible]	47.82	47.65	(505)		

3:00p-5:00p Plot Data for Constant ~~Rate~~ Test

5:30 - 11:00p
at Site monitoring pump test

Test #1 Background MW9-D
7-31-00

20:49	0.0	-0.001
	0.0	-0.001
	0.0	-0.001
	0.0	-0.001
	-0.003	0.00
	-0.001	0.0
	-0.001	0.0
	-0.003	0.001
	-0.003	0.003
	-0.001	0.004

D. Marlow

0.003	0.030	0.064	0.097	0.129	0.158	23:38	0.184	.206	.232	.255	.329			
0.006	0.032	0.065	0.098	0.130	0.156		.184	.207	.230	.255	4A	.327		
0.006	0.033	0.067	0.1	0.132	0.158		.185	.207	.232	.255		.329		
0.006	0.035	0.068	0.101	0.133	0.159		.185	.208	.234	.256		.326		
0.007	0.036	0.069	0.103	0.135	0.161		.187	.208	.239	.255		.321		
0.009	0.038	0.071	0.104	0.136	0.162		.188	.21	.236	.256		.314		
0.009	0.039	0.072	0.106	0.137	0.162		.190	.211	.236	.258		.304		
0.010	0.041	0.073	0.106	0.137	0.164		.190	.211	.237	.259	5A	.291		
0.012	0.042	0.075	0.107	0.139	0.165		.192	.213	.237	12:00A	.261		.276	
0.012	0.042	0.077	0.109	0.140	0.165		.192	.214	.239	10min	.266		.261	
0.013	0.043	0.078	0.110	0.142	0.166		.194	.214	.240	↓	.274		.246	
0.014	0.045	0.078	0.111	0.143	0.168		.144	.216	.242		.281		.23	
0.014	0.046	0.081	0.113	0.145	0.168		.195	.217	.242		.287		.22	
0.016	0.048	0.082	0.114	0.145	0.169		.195	.219	.242		.292	6A	.198	
0.017	0.049	0.084	0.116	0.146	0.171		.197	.219	.243	2:00A	.297		.184	
0.019	0.051	0.084	0.119	0.146	0.171		.198	.220	.243		.302		.17	
0.020	0.052	0.084	0.119	0.148	0.172		.198	.220	.247		.310		.15	
0.022	0.054	0.085	0.120	0.149	0.174		.200	.224	.246		513		.14	
0.022	0.055	0.087	0.122	0.151	0.175		.201	.224	.246		.317		.13	
0.022	0.056	0.088	0.122	0.151	.178		.201	.226	.249	3:00A	.320	7A	.114	
0.025	0.058	0.090	0.124	0.152	.178		.201	.226	.247	↓	.323		.101	
0.026	0.059	0.090	0.124	0.153	.179		.203	.227	.250		.324		.093	
0.027	0.061	0.093	0.126	0.155	.181		.203	.229	.252		.326		.084	
0.027	0.062	0.094	0.126	0.155	.181	8/11/00 12:01A	.204	.229	.252		.327		.78	
0.029	0.064	0.096	0.127	0.156	.182		.204	.229	.253		.329		.78	

D. Marlow

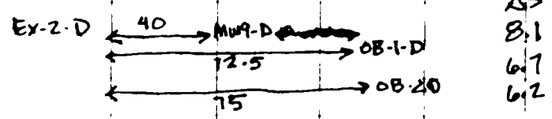
93

BA

0.084
0.088
0.094
0.106
.111
.113

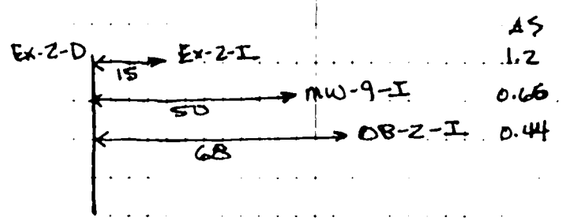
8000 #2100

			est. Dist. FT
MW 9-S	~~8954~~	0.161	65
MW 9-I	~~22109~~	0.656	50
MW 9-D	~~44147~~	8.118	40
Ex-2-S	~~13455~~	0.201	30
Ex-2 I		1.119	15
Ex-2-D		~~46.445~~	0
OB-1-S		0.272	75
OB-1-D		6.692	72.5
OB-2-S		0.186	62.5
OB-2-I		0.436	68
OB-2-D		6.188	75

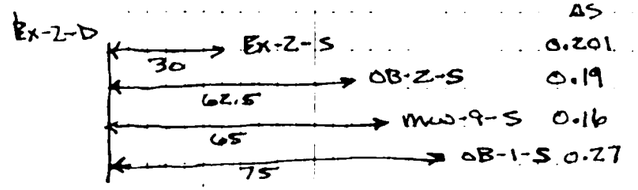


ΔS
8.1
6.7
6.2

9



ΔS
1.2
0.66
0.44

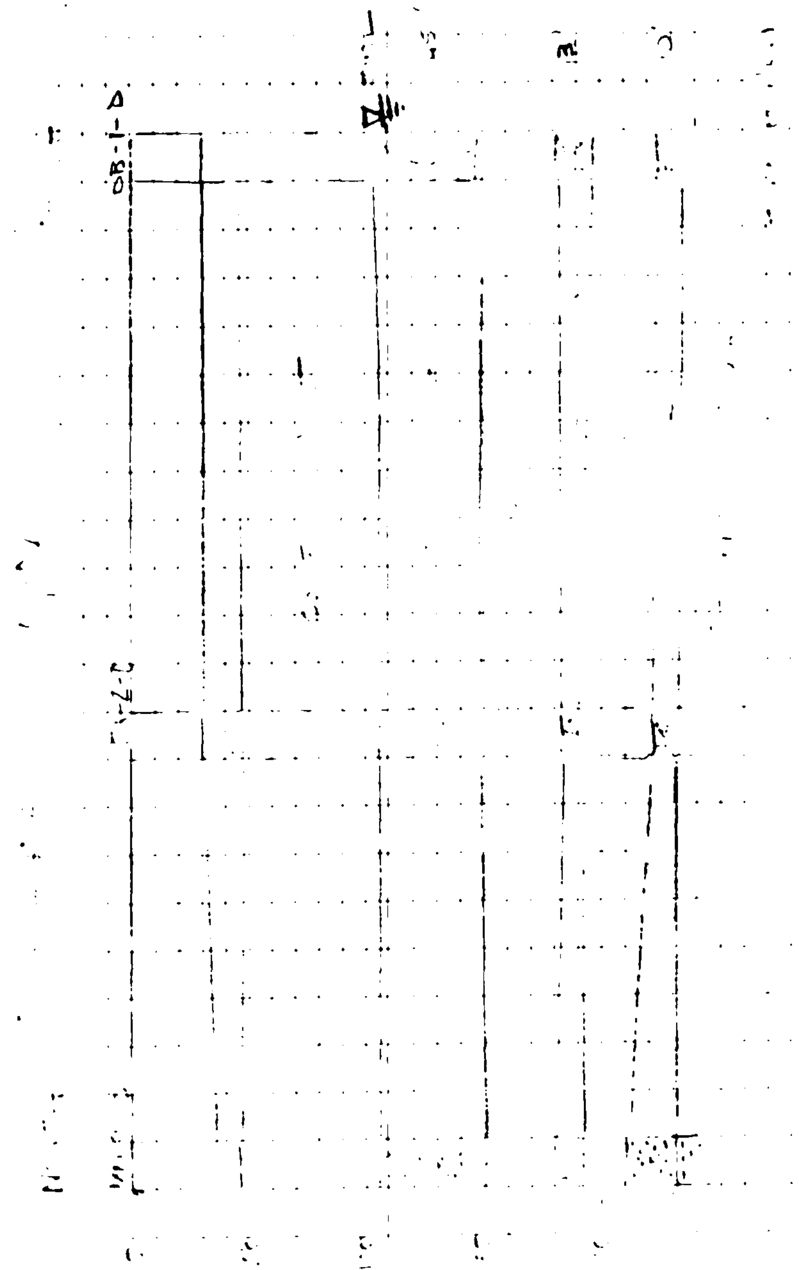


ΔS
0.201
0.19
0.16
0.27

ishes

45.6
116.75

D. Marlow



D. Marlow

10hrs = 600 min 16hrs 40min = 1000 min

5hrs = 300 min

1 hr = 60 min

will try to use Log scale on

Ex-2-I pump test Longest interval @ 1000 min

Need to switch Transducers
in Ex-2-D & Ex-2-I

SWL	SWL
110.0	110.33

RATE 106 gpm

12hrs

Sunny and Hot

10:45A Arrive at site

pumping Rate 106 gpm

7:00A Ex-2-D 46.7 ft below MP

7:48A Take water samples for analysis

8:00A pump turned off

let Recover till 12:00p

Move pump to Ex-2-I

2:00p in hole Ex-2-I w/ pump

Probe 5 - Ex-2-D
Probe 6 - Ex-2-I

Start Hermit [illegible]

Ex-2-5 13.7'

4584(18 gal) Start pump @ 2:25p
50 gal/min

D. Mallow

2:25p 50 gal/min D 69 S 13.7

2:40p 100 gal/min 60.2 13.5

2:55p 150 13.8 11

Ex-1-I 0.5

Ex-3-I 6.0

Ex-3-D 0.4

Ex-2-S 0.77

Ex-2-D 1.90

Ex-2-I 55.2

4:00p

5:15p 186

11:00A Q=186gpm

D. Marlow

3:30p leave site

3:30p - 6:30p Plot up Time
Download Data

6:30 ~~-8:30~~ 8:30 at site Review ~~Data~~ 14 Hrs
August 6, 2000

or.
6:45a Arrive at site
Q = 186 gpm

11:57a [illegible] Ex-2-I
will plot [illegible]

leave site @ 4:30p

4:30 - 7:30p
Plot Data for Ex-2-I
New Plots for Deep Aquifer
13 Hrs

Aug 7, 2000
~~Arrived~~ Site @ 6:30a

Q = 184 gpm

11:[illegible]
11:[illegible]

Gauge [illegible]

[illegible]

1:30p [illegible]

1:45p [illegible]

2:00p pull pump [illegible]

3:[illegible] [illegible] Set up

D. Mellow

4:00 - 4:25p [illegible]

[illegible]

[illegible]

5:00p [illegible]

5:30p [illegible]

6:00 - 7:00 [illegible]

12 HRS

[illegible]

6:15 [illegible]

[illegible]

9:15A All well locations Survey Complete

[illegible]

[illegible]

[illegible]

Sample Depth [illegible]

[illegible] 3-I [illegible]

[illegible] 7-I [illegible]

[illegible] 5

[illegible]

[illegible]

5:00p [illegible] 3'

5:30p [illegible]

6:[illegible] 10:40p Plot [illegible]

14 Hrs

D. Marlow

Aug 9, 2000

Q = 20 gpm

7 457

Preliminary [illegible]

[illegible]

20 gpm

Used Hand [illegible]

Pine [illegible] kk-2-I [illegible]

13 hrs

y = [illegible] x = .000045 BR-1-I

y [illegible] + 0.[illegible] x = .178 OB-2-I

y [illegible] x = .00475 MW-7-I

[illegible] 1.07 ft

T [illegible] = 45,891 Not correct [illegible]

$= \frac{T_{to}}{770\, r^2} = 0.0002$ [illegible]

Aug 10, 2000

D. Marlow

10:15p [illegible]

[illegible] 15418 [illegible]

15457 [illegible]

11:30A [illegible]

[illegible]

100p [illegible]

8:00 [illegible]

13 HRS

D. Marlow

Calibrated Ph to 7.0 Solution
Calibrated conductivity to 1000 µS/cm Solution

0730 on site at well site MW-12
08:20 MW12-I depth 143.42
0900 MW12-S depth 143.07

1012 Started pumping
1019 water rate ≅ 1 L/min
1054 W-MW-12-S-091800-P collected for total Cr and Cr VI
1105 15 gal collected and placed into large collection vessel for treatability
1125 - arrived at well MW-7-I depth to water = 116.65
1134 Started pumping water - rate adjusted to 1.1 L/min
1218 collected water samples
W-MW-7-I-091800-P
W-MW-7-I-091800-MS
W-MW-7-I-091800-MSD
(1 bottle = Cr6; 1 bottle = total Cr)
12:20 - 1248 - collected 30 gallons placed in large collection vessel for treatability study
Well # MW-5-I @ 1350
1400 measured well at 100.56 feet
1407 Started pumping - adjusted to 1.0 L/min
1416 - Starting monitoring water depth was 100.56

K. Madden

1433 - ~1440 Lost prime on pump
restarted & adjusted to 1 L/min
1503 collected 2 (Cr6 & total Cr) Samples
labeled W-MW-5-I-091800-P
1505 -1516 collected 30 gallons for
Treatability Study
1600 - MW2-I - tested
for depth of water @102.80
1606 - Started pumping, adjusted
to ~1.0 L/min
1614 - Started to take readings
1646 - collected 2 water Samples
W-MW-2-I-091800-P - 1 Cr total, 1 Cr6
1740 preparation of log / Shipping
1750 - to Shipping / UPS

end of day
[illegible] 09/18/00

0815 Calibrated ph probe with ph 7 Solution
Calibrated conductivity probe with 1000µs/cm solution

09-19-00 0800 on Site - waiting for crew
0830 - crew got distilled water ... [illegible]
0845 on Site at wells MW-1-S, D
0900 - Depth to water at 106.56
0910 - pumping Started - flow adjusted
to 1.0 L/min
0918 readings Started
0953 collected 1 water Sample
W-MW-1-D-091900-P (total Cr)
1030 Set up on Well MW-1-S
depth to water = 107.00 feet
1040 - Started pumping - adjusted to ~1.0 L/min
1051 - Started monitoring
1129 collected 1 water Sample
W-MW-1-S-091900-P (total Cr)
1140 - Measured Depth to water at 107.07 for
Well MW-1-I
1147 - Pumping Started - flow rate adjusted to ~1.0 L/min
1151 monitoring Started
1234 Water Sample collected W-MW-1-I-091900-P
(total Cr)
1240 - 30 gallons collected for treatability Study
1312 - lunch - also got DI water from [illegible]
1350 - At site/well MW-4-D
1359 - initial depth to water 98.68'
1420 - Started pumping - adjusted flow to 1.0 L/min

K. Madden
[illegible]

1426 - Started monitoring

1516 Collected 1 Sample W-MW-4-D-091900-P (total Cr)

deconed equipment

1526 Well MW-4-I - depth to water = 96.50 feet

1537 - Started pumping - Flow adjusted to 1.0 L/min

1617 Collected 1 water Sample W-MW-4-I-091900-P (Total Cr)

1632 Well MW-4-S - Initial depth to water = 96.02

1644 - left well to dump wastewater

1656 - Started pumping - flow adjusted to ~1.0 L/min

1702 Started monitoring

1730 Collected 1 total Cr Sample # W-MW-4-S-091900-P

decond ~1745

1800 - Shipping Samples

End of day 091900 [signature]

Note: Calibrated both meters at ~0830 (pH = 7) (cond = 1 mS/cm) KEM 09-21-00

09-20-00

0800 - on meeting site

0820 - at Culligan getting water for decon

0840 At well site MW-6-I

0848 - took initial measurement of depth to water = 105.00'

~~08~~ 0900 Starting pumping - some problems with pumping - Flow achieved and adjusted to 1.0 L/min at ~0939

0949 - Started monitoring

1028 1 Sample collected W-MW-6-I-092000-P

1042 - initial ~~Sample~~ measurement of depth to water = 106.17 For well MW-6-D

1050: Started pumping - adjusted flow rate to 1.0 L/min

1108 - Started monitoring

1141 - collected 1 water sample W-MW-6-D-092000-P

1222 - initial measurement of depth to water Well MW-6-S

~~1257~~ 1245 pumping started - flow rate adjusted to 1.0 L/min

1335 - conductivity OK - turbidity high - lots of PVC shavings coming up and in monitoring chamber - used "T" button to clean turbidity probe - probe tested at ~1300 in Culligan drinking water and turbidity was ~0.8

K. Madden

1340 Sample collected - total Cr -
W-MW-6-S-092000-P

1415 Lunch after decon - also emptied waste water and did water depth on well behind Ace Site - no water in well at bottom of ~ 32 feet

1525 - measured initial depth to water (?) of ACE-R-S,I,D well, at 104.03 from ground level (west side of casing)

1530 pumping started - adjusted flow rate to ~1.0 L/min

1541 - Started monitoring of ACE-R-I - pump set to depth of 167' (Screen depth 161-171) from ground level.

1631 - collected W-ACE-R-I-092000-P (total Cr)

1645 - after decon - measured depth to water @ 103.99 (?) from ground level - Set pump at 130' from ground level for shallow screen

1652 - started pumping - flow rate set to ~1.0 L/min

1715 - noticed air bubbles flowing into monitor possible pump cavitation? - bubbles periodic

1730 - collected sample W-ACE-R-S-092000-P

1815 - all decon completed - Samples logged and sent to UPS

end of Day
[signature]
092000

09-21-00

0800 - met crew on worksite

0835 - arrived at well ACE-R-D and calibrated meter - 2 pt ph calibration (pH4, pH7) and 1000µ/cm for conductivity

0849 - at site for well ACE-R-D
Depth meter appears to be malfunctioning - got other meter - probably correct at

0900 - depth to water measured at 84.00' (probably not correct)
note: much higher water level than yesterday

0910 - pumping started water level adjusted to 1.0 L/min

0920 - Fixed other water meter

0938 Started monitoring

1022 - collected 1 total Cr sample - W-ACE-R-D-092100-P

1024 - began decon - also dumped waste water

1104 arrived at OB-1 cluster - started OB-1-I

1112 initial depth to water at 112.17'

1120 pumping started - flow adjusted to 1.0 L/min

1131 started monitoring

1220 - collected W-OB-1-I-092100-P (total chrome)

1225 - decon

1235 move to OB-1-S

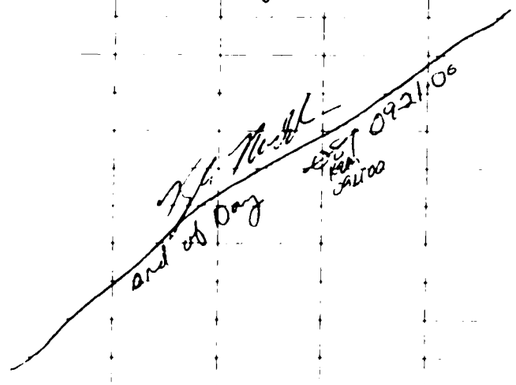
1240 Initial depth of OB-1-S at 112.08

1300 Started Pumping - adjusted flow to 1.0 L/min

1355 collected W-OB-1S-092100-P (total Cr)

K. Madden

1430 Initial measure - depth to water at 109.56 for OB-2-D
1440 - started pumping - flow rate adjusted to ~1.0 L/min
1506 started monitoring
1554 collected total Cr sample w-10B 2 0-092.00-T
1612 well OB-2-I ginitial Depth to water measured 108.15'
1622 - pumping - flow set at 1.0 L/min
1635 - Sample / monitor
1717 - W-OB-2-I-092100-P collected
1800 - Samples & treatability water left at UPS
1810 end of day



09-22-00

0800 - at job site
0825 - Calibration of monitoring probes
pH = 2 point - soln for pH 4 & pH 7
conductivity = soln 1000 µs/cm
0830 - power problem with monitoring module - tested - AC converter faulty - switched to car AC supply
0851 - at well OB-2-S - well initially measured to water at 109.30 feet
- micropurge pump lowered to 120 feet
0910 - started pumping
0917 - flow rate adjusted to ~1.0 L/min
0921 - monitoring started
1016 - sample W-OB-2-S-092200-P collected
1022 - Rinsate sample collected
1046 at side of well MW-2-S
1051 - depth to water 102.49 feet
1102 flow rate set at 1.0 L/min
1107 - started monitoring
1202 took sample W-MW-2-S-092200-P
1204 decon - final
1240 - lunch
1310 - met to prepare for simultaneous reading of well depths

K. Madden

well	dtw	time reading
Depth readings:		
MW-8-S	108.25	1340
MW-8-I	107.80	1337
MW-8-D	107.89 / 107.89	1332
	Gary F's meter.	K Madden meter
MW-9-S	112.95	1349
MW-9-I	111.81	1352
MW-9-D	113.29	1354
MW-11-S	119.81	1402
MW-11-I	120.16	1404
MW-11-D	122.49	1406
MW-12-S	143.24	1419
MW-12-I	143.57	1416
MW-12-D	144.65	1414

Personal well monitoring

1445 arrived 1940 E 4th (Metzler house) RW-06
1450 - Started monitoring
1510 - took last monitoring reading and collected 1 total Cr sample, W-RW-06-092200-P
1516 - arrived at 1650 E. 4th (Havel Residence) well RW-05
1516 - started tap through hose
1521 - started monitoring
1537 - took 3 total Cr samples W-RW-05-092200-P, W-RW-05-092200-MS and W-RW-05-092200-MSD

1541 - arrived at 175 Thompson Dr. at Leopold Residence - RW-01 well.
1546 - Started monitoring
1601 - last monitoring.
1603 - collected 1 total Cr. W-RW-01-092200-P
1630 - Arrived at Smith residence RW-08 started well water running through garden hose
1641 - Started monitoring
1702 - collected sample W-RW-08-092200-P
1720 - dewatering equipment, getting materials ready to ship

K. Madden

Appendix E
Chain-of-Custody Records

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.™
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER
Blackl Veatch	Gary Felkner	(815) 810-5859

P O or PROPOSAL NUMBER	PROJECT NAME
#6118.124	Air Services

SAMPLER (Signature): [signature]

ANALYTICAL TESTS REQUESTED: TCL Lead

SAMPLE NO	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	TCL Lead								REMARKS
	7-12-00	1400	X		S-IDWEX2-071200	S	1									24 hr Turn Around Time
																FAX to
																(785) 462-2344
																c/o Gary Felkner

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
[signature]	7-12-00	1730	UPS 120E810W2210000674

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY (Signature)

REMARKS

[SR012-1192-03]

WASTE SCIENCE AND TECHNOLOGY CORP.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CON-TAINERS	TRI C… [illegible]						REMARKS
[illegible]	[illegible]								

SAMPLERS: (Signature) [illegible]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	TRI C…						REMARKS
	[illegible]	[illegible]	x		[illegible] 081-[illegible]	1	X						[illegible] TA[illegible]
													[illegible]
													[illegible] 462-2344
													[illegible]
													[illegible]

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[illegible]	[illegible]	UPS [illegible]			
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: White and Yellow Accompanies Shipment; Pink copy to Field Files

BASIC SCIENCE AND TECHNOLOGY CORP.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CONTAINERS								REMARKS
SAMPLERS: (Signature)										
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION					
			X			1	1			

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: White and Yellow Accompanies Shipment; Pink copy to Field Files

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

TM

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER
Black & Veatch	Craig Falkner	(713) 459 6585

P.O. or PROPOSAL NUMBER	PROJECT NAME
46118.124	Area Services

SAMPLER (Signature)

SAMPLE NO	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	ANALYTICAL TESTS REQUESTED: Total U	ANALYTICAL TESTS REQUESTED: Hex U	REMARKS
	9-18-00	1010		X	W-MW-12-I-091800-P	W	2	1	1	
	9-18-00	1054		X	W-MW-12-S-091800-P	W	2	1	1	
	9-18-00	1151		X	W-MW-11-I-091800-P	W	2	1	1	
	9-18-00	1151		X	W-MW-11-I-091800-D	W	2	1	1	Duplicate (D)
	9-18-00	1210		X	W-MW-7-I-091800-P	W	6	3	3	Include ms/msd volume
	9-18-00	1255		X	W-MW-11-S-091800-R	W	2	1	1	Rinsate (R)
	9-18-00	1355		X	W-MW-11-S-091800-P	W	2	1	1	
	9-18-00	1503		X	W-MW-5-S-091800-P	W	2	1	1	
	9-18-00	1540		X	W-MW-2-D-091800-P	W	2	1	1	
	9-18-00	1646		X	W-MW-2-I-091800-P	W	2	1	1	
	9-18-00	1745		X	W-EX-2-D-091800-P	W	2	1	1	

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
	9-18-00	1800	UPS 1Z0F310W0390022 9

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY (Signature)

REMARKS

[SR012-1192-03]

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER
[illegible] & Veatch	[illegible]	[illegible] 6583

P O or PROPOSAL NUMBER	PROJECT NAME
40118.124	A[illegible] Services

SAMPLER (Signature): [signature]

ANALYTICAL TESTS REQUESTED

SAMPLE NO	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	Total Cr	Hex Cr	①	②	TOC	Ammonia	Sulfide		REMARKS
	9-19-00	0955		X	W-FX-2-I-091900-P	W	2	1	1							
	9-19-00	1111		X	W-PWS-8-091900-P	W	2	1	1							
	9-19-00	1315		X	W-FX-2-S-091900-P	W	1	1								
	9-19-00	1430		X	W-MW-9-S-091900-P	W	1	1								
	9-19-00	1450		X	W-MW-9-S-091900-D	W	1	1								[illegible]
	9-19-00	1600	[illegible]	X	W-IX-TS-1-091900-P	W	6	1	1	1	1	1	1			① Alk, Cl, F, NO_3, NO_2, SO_4, TDS,
	9-19-00	1655		X	W-MW-9-I-091900-P	W	1									TSS, TC, silica, orthophosphate, bicarbonate,
	[illegible]	[illegible]		X	[illegible]-D-[illegible]-P	W	1	1								carbonate
	[illegible]	[illegible]		X	W-MW-1-S-091900-P	W	1	1								② Al, Ca, Fe, Mg, Mn, K, Na,
	09-19-00	1239		X	W-MW-1-I-091900-P	W	1	1								Sr, Ba
	09-19-00	1516		X	W-MW-4-D-091900-P	W	1	1								
	09-19-00	1617		X	W-MW-4-I-091900-P	W	1	1								
	09-19-00	1730		X	W-MW-4-S-091900-P	W	1	1								

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
[signature]	9-19-00	1900	UPS 1Z0E810W2110000069				

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY (Signature)

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	REMARKS

(SR012-1192-07)

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER
[illegible]	[illegible]	[illegible]

P.O. or PROPOSAL NUMBER	PROJECT NAME
48-H.124	[illegible]

SAMPLER (Signature): [illegible]

ANALYTICAL TESTS REQUESTED

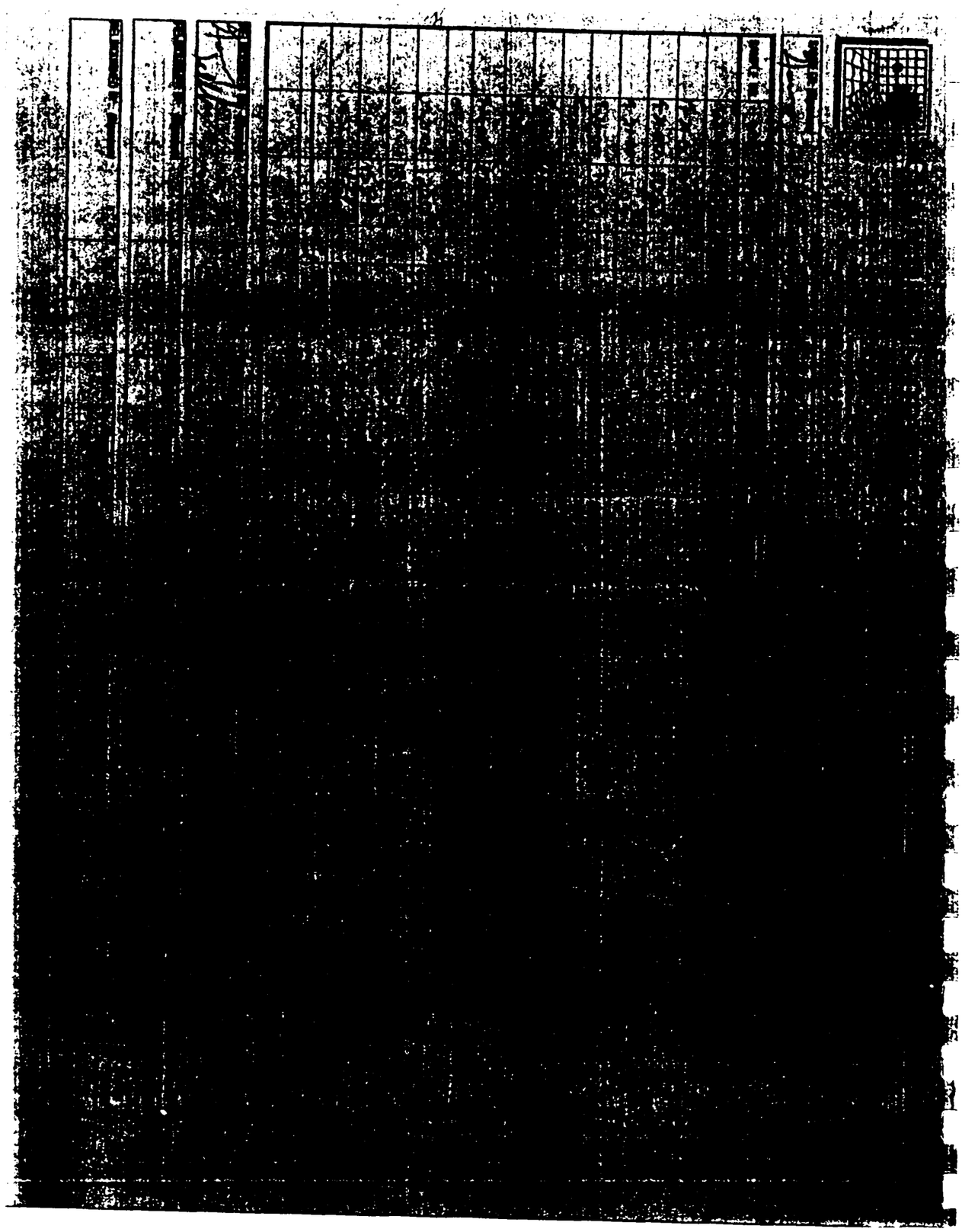
SAMPLE NO	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	[illegible]	[illegible]	REMARKS
	[illegible]	0940		X	W-MW-9-D-092000-P	W	1	1		
	[illegible]	1045		X	W-MW-12-D-092000-P	W	1	1		
	[illegible]	1045		X	W-MW-12-D-092000-D	W	1	1		Duplicate
	[illegible]	1225		X	W-HPMW-6-S-092000-P	W	3	3		mw/mwD volumes
	[illegible]	1405		X	W-HPMW-9-S-092000-P	W	1	1		
	[illegible]	1505		X	W-ACE-R-I-092000-R	W	1	1		Rinsate
	[illegible]	1540		X	W-MW-8-S-092000-P	W	1	1		
	[illegible]	1655		X	W-MW-8-I-092000-P	W	1	1		
	[illegible]	1028		X	W-MW-6-I-092000-P	W	1	1		
	[illegible]	1740		X	W-MW-6-S-092000-P	W	1	1		
	[illegible]	1141		X	W-MW-6-D-092000-P	W	1	1		
	[illegible]	1631		X	W-ACE-R-I-092000-P	W	1	1		
	[illegible]	1528		X	W-ACE-R-S-092000-P	W	1	1		
			EQD							

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
[illegible]	9-20-00	1800	UPS [illegible]
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)

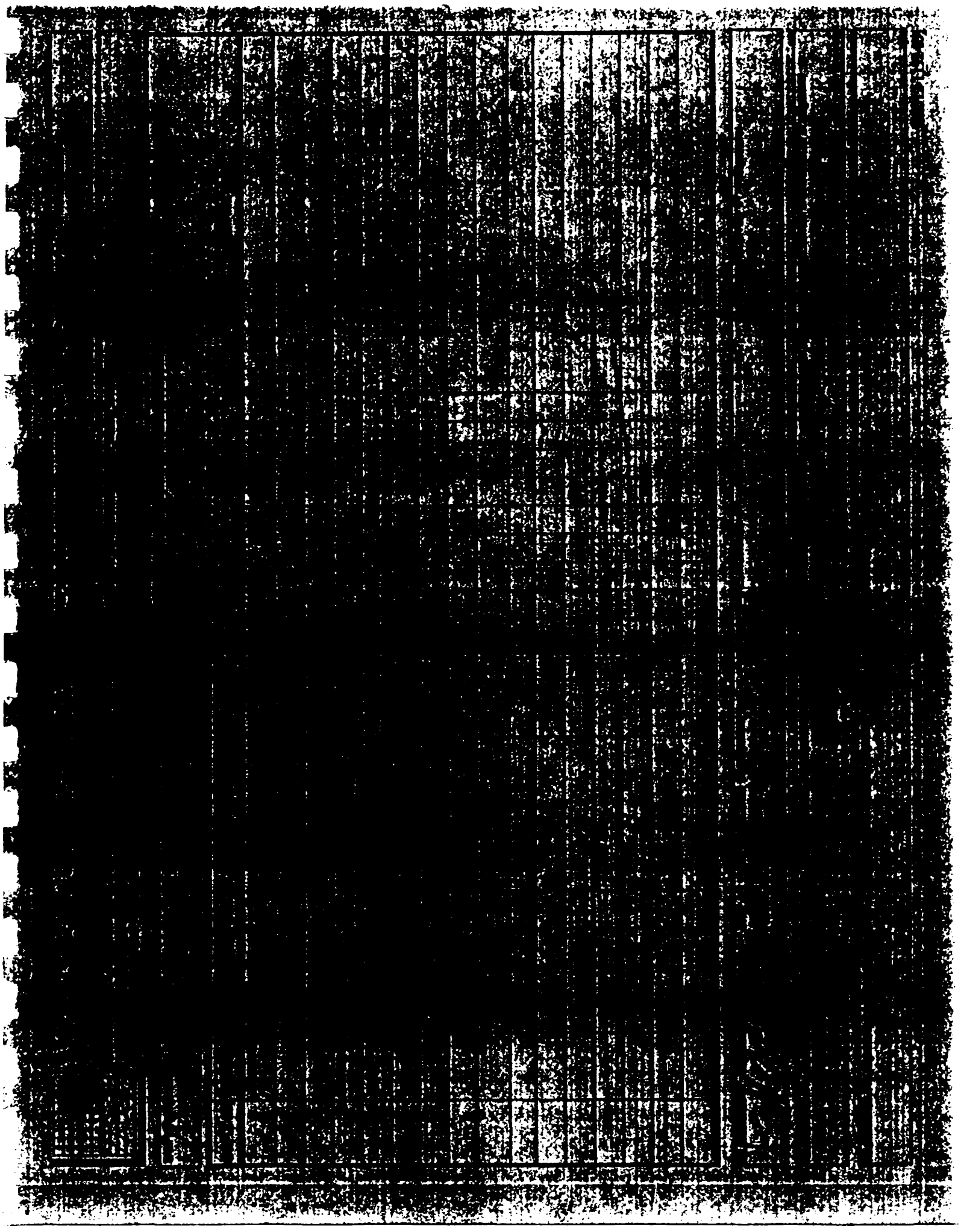
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY (Signature)

REMARKS

[SR012-1192-03]



[redacted]



Appendix F
Airbills

UPS Next Day Air
UPS Worldwide Express
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER: 1Z 0E8 10W 22 1000 067 4

1 SHIPMENT FROM

SHIPPER'S UPS ACCOUNT NO: UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felkner — TELEPHONE: 913-458-2000

COMPANY: BLACK & VEATCH SPEC PROJ CORP

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK KS — ZIP CODE: 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Dave LeMaster — TELEPHONE: (918)251-2858

COMPANY: SW Labs

STREET ADDRESS: 1700 W. Albany — DEPT./FLOOR:

CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL): Broken Arrow, OK — ZIP CODE: 74012

3 WEIGHT: WEIGHT (ENTER LTR IF LETTER): 2 lbs — DIMENSIONAL WEIGHT (If Applicable):

SHIPPER'S COPY

4 TYPE OF SERVICE: [X] NEXT DAY AIR [ ] WORLDWIDE EXPRESS (INTERNATIONAL) — CHARGES

FOR WORLDWIDE EXPRESS SHIPMENTS: Mark an "X" in this box if shipment only contains documents of no commercial value [ ] DOCUMENTS ONLY — $

5 OPTIONAL SERVICES: [ ] SATURDAY PICKUP (See instructions) [ ] SATURDAY DELIVERY (See instructions) — $

[ ] DECLARED VALUE. Contents are automatically protected up to $100. For declared value over $100, see instructions. $ _____ AMOUNT — $

[ ] C.O.D. If C.O.D. enter amount to be collected and attach completed UPS C.O.D. tag to package. $ _____ AMOUNT — $

6 ADDITIONAL HANDLING CHARGE: [ ] An Additional Handling Charge applies for certain items. See instructions — $

TOTAL CHARGES — $

7 METHOD OF PAYMENT: [X] BILL SHIPPER [ ] BILL RECEIVER [ ] BILL THIRD PARTY (Next Day Air Only) [ ] CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) [ ] CHECK

8 RECEIVER'S / THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO. — EXPIRATION DATE /

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes. This shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

9 SHIPPER'S SIGNATURE: X Gary Felkner — DATE OF SHIPMENT: 7/12/00

0101911202609 2/99 M

UPS Next Day Air
UPS Worldwide Express
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER: 1Z 0E8 10W 22 1000 073 6

1 SHIPMENT FROM

SHIPPER'S UPS ACCOUNT NO: UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felkner — TELEPHONE: 913-458-2000

COMPANY: BLACK & VEATCH SPEC PROJ CORP

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK KS — ZIP CODE: 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Randy Stagg — TELEPHONE: (918) 251-2858

COMPANY: SW Laboratory

STREET ADDRESS: 1700 W. Albany — DEPT./FLOOR:

CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL): Broken Arrow, OK — ZIP CODE: 74012

3 WEIGHT: WEIGHT (ENTER LTR IF LETTER): 2 lbs — DIMENSIONAL WEIGHT (If Applicable):

SHIPPER'S COPY

4 TYPE OF SERVICE: [X] NEXT DAY AIR [ ] WORLDWIDE EXPRESS (INTERNATIONAL) — CHARGES

FOR WORLDWIDE EXPRESS SHIPMENTS: Mark an "X" in this box if shipment only contains documents of no commercial value [ ] DOCUMENTS ONLY — $

5 OPTIONAL SERVICES: [ ] SATURDAY PICKUP (See instructions) [ ] SATURDAY DELIVERY (See instructions) — $

[ ] DECLARED VALUE. Contents are automatically protected up to $100. For declared value over $100, see instructions. $ _____ AMOUNT — $

[ ] C.O.D. If C.O.D. enter amount to be collected and attach completed UPS C.O.D. tag to package. $ _____ AMOUNT — $

6 ADDITIONAL HANDLING CHARGE: [ ] An Additional Handling Charge applies for certain items. See instructions — $

TOTAL CHARGES — $

7 METHOD OF PAYMENT: [X] BILL SHIPPER [ ] BILL RECEIVER [ ] BILL THIRD PARTY (Next Day Air Only) [ ] CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) [ ] CHECK

8 RECEIVER'S / THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO. — EXPIRATION DATE /

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes. This shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

9 SHIPPER'S SIGNATURE: X Gary Felkner — DATE OF SHIPMENT: 7/12/00

UPS Next Day Air
UPS Worldwide Express
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER: 1Z 0E8 10W 22 1000 072 7

1 SHIPMENT FROM

SHIPPER'S UPS ACCOUNT NO: UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felknor — TELEPHONE: 913-458-2000

COMPANY: BLACK & VEATCH SPEC PROJ CORP

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK KS — ZIP CODE: 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Randy Staggs — TELEPHONE: (918) 251-2858

COMPANY: SW Labs

STREET ADDRESS: 1700 W. Albany — DEPT./FLOOR:

CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL): Broken Arrow, OK — ZIP CODE: 74012

3 WEIGHT: WEIGHT ENTER LTR IF LETTER: 1 — DIMENSIONAL WEIGHT if Applicable:

SHIPPER'S COPY

4 TYPE OF SERVICE: [X] NEXT DAY AIR [ ] WORLDWIDE EXPRESS (INTERNATIONAL)

FOR WORLDWIDE EXPRESS SHIPMENTS: Mark an "X" in this box if shipment only contains documents of no commercial value. [ ] DOCUMENTS ONLY

CHARGES

5 OPTIONAL SERVICES:
- [ ] SATURDAY PICKUP — [ ] SATURDAY DELIVERY
- [ ] DECLARED VALUE — $ _____ AMOUNT
- [ ] C.O.D. — $ _____ AMOUNT

6 ADDITIONAL HANDLING CHARGE: [ ] An Additional Handling Charge applies for certain items. See instructions

TOTAL CHARGES

7 METHOD OF PAYMENT: [X] BILL SHIPPER — [ ] BILL RECEIVER — [ ] BILL THIRD PARTY — [ ] CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) — [ ] CHECK

8 RECEIVER'S THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO. — EXPIRATION DATE

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

9 SHIPPER'S SIGNATURE: X Gary Felknor — DATE OF SHIPMENT: 7/14/00

0101911202609 2/99 M

UPS Next Day Air Early A.M.
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER: 1Z 0E8 10W 21 1000 022 9

1 SHIPMENT FROM

UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felkner — TELEPHONE: 913-458-2171

COMPANY: BLACK & VEATCH

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK — ZIP CODE: KS 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Randy Staggs — TELEPHONE: (918) 251-2858

COMPANY: SW Lab of OK

STREET ADDRESS: 1700 West Albany — DEPT./FLR

CITY AND STATE: Broken Arrow, OK — ZIP CODE: 74012

3 EARLIEST DELIVERY TIME: 7:00

WEIGHT: 42 lbs. — DIMENSIONAL WEIGHT if Applicable:

SHIPPER'S COPY

CHARGES

- [ ] SATURDAY PICKUP — [ ] SATURDAY DELIVERY
- [ ] DECLARED VALUE — $ _____ AMOUNT
- [ ] C.O.D. — $ _____ AMOUNT
- [ ] VERBAL CONFIRMATION OF DELIVERY
- [ ] An Additional Handling Charge applies for certain items. See instructions

[X] BILL SHIPPER — [ ] BILL RECEIVER — [ ] BILL THIRD PARTY — [ ] CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) — [ ] CHECK

RECEIVER'S THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO. — EXPIRATION DATE

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

SHIPPER'S SIGNATURE: X Gary Felknor — DATE OF SHIPMENT: 9/18/00

ups Next Day Air Early A.M.
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER 1Z 0E8 10W 21 1000 006 9

1 SHIPMENT FROM
SHIPPER'S UPS ACCOUNT NO — UPS ACCOUNT NO 0E810W
REFERENCE NUMBER 046118Q123
NAME Gary Felkner TELEPHONE 913-458-2171
COMPANY BLACK & VEATCH
STREET ADDRESS 6601 COLLEGE BLVD
CITY AND STATE OVERLAND PARK ZIP CODE KS 66211 1504

2 EXTREMELY URGENT DELIVERY TO
NAME Randy Staggs TELEPHONE (918) 251-2858
COMPANY SW Lab of OK
STREET ADDRESS 1700 W. Albany DEPT/FLR
CITY AND STATE Broken Arrow OK ZIP CODE 74012

3 EARLIEST DELIVERY TIME
If the receiver is not available for delivery prior to 8:00 a.m. (9:00 a.m. Saturday), record the earliest time that delivery should be attempted. 7:00

0201011288808 8/98 W

4 WEIGHT 39.5 | DIMENSIONAL WEIGHT If Applicable

SHIPPER'S COPY
CHARGES

5 NEXT DAY AIR EARLY A.M. CHARGE $
6 OPTIONAL SERVICES
☐ SATURDAY PICKUP See instructions ☐ SATURDAY DELIVERY See instructions $
☐ DECLARED VALUE Contents are automatically protected up to $100. For declared value over $100, see instructions. $ AMOUNT $
☐ C.O.D. If C.O.D., enter amount to be collected and attach completed UPS C.O.D. tag to package. $ AMOUNT $
☐ VERBAL CONFIRMATION OF DELIVERY See instructions $
7 ADDITIONAL HANDLING CHARGE ☐ An Additional Handling Charge applies for certain items. See instructions. $
TOTAL CHARGES $

8 METHOD OF PAYMENT
☒ BILL SHIPPER ☐ BILL RECEIVER ☐ BILL THIRD PARTY ☐ CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) — Record Account No. in Section 9 — ☐ CHECK

9 RECEIVER'S / THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO — EXPIRATION DATE /
THIRD PARTY'S COMPANY NAME
STREET ADDRESS
CITY AND STATE ZIP CODE

10 SHIPPER'S SIGNATURE X [signature] DATE OF SHIPMENT 9/19/00

---

ups UPS Next Day Air UPS Worldwide Express℠
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER 1Z 0E8 10W 22 1001 149 3

1 SHIPMENT FROM
SHIPPER'S UPS ACCOUNT NO — UPS ACCOUNT NO 0 E 8 1 0 W
REFERENCE NUMBER 0461180123
NAME GARY FELKNER TELEPHONE 913-458-6583
COMPANY BLACK & VEATCH SPEC PROJ CORP
STREET ADDRESS 6601 COLLEGE BLVD
CITY AND STATE OVERLAND PARK ZIP CODE KS 66211

2 EXTREMELY URGENT DELIVERY TO
NAME Randy Staggs TELEPHONE (918) 251-2858
COMPANY SW Lab of OK
STREET ADDRESS 1700 West Albany DEPT/FLR
CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL) Broken Arrow OK ZIP CODE 74012

3 WEIGHT ENTER LTR IF LETTER 30 | DIMENSIONAL WEIGHT If Applicable 104

SHIPPER'S COPY
CHARGES

4 TYPE OF SERVICE ☐ NEXT DAY AIR ☐ EXPRESS (INT'L)
FOR WORLDWIDE EXPRESS SHIPMENTS Mark an "X" in this box if shipment only contains documents of no commercial value ☐ DOCUMENTS ONLY $
5 OPTIONAL SERVICES
☐ SATURDAY PICKUP See instructions ☐ SATURDAY DELIVERY See instructions $
☐ INSURED VALUE Contents are automatically protected up to $100. For insured value over $100, see instructions. $ AMOUNT $
☐ C.O.D. If C.O.D., enter amount to be collected and attach completed UPS C.O.D. tag to package. $ AMOUNT $
6 ADDITIONAL HANDLING CHARGE ☐ An Additional Handling Charge applies for certain items. See instructions. $
TOTAL CHARGES $

7 METHOD OF PAYMENT
☒ BILL SHIPPER ☐ BILL RECEIVER ☐ BILL THIRD PARTY (Next Day Air Only) ☐ CREDIT CARD (American Express, Diner's Club, MasterCard, Visa) — Record Account No. in Section 8 — ☐ CHECK

8 RECEIVER'S / THIRD PARTY'S UPS ACCT NO. OR MAJOR CREDIT CARD NO — EXPIRATION DATE /
THIRD PARTY'S COMPANY NAME
STREET ADDRESS
CITY AND STATE ZIP CODE

9 SHIPPER'S SIGNATURE X [signature]
DATE OF SHIPMENT 9/20/00

UPS Next Day Air
UPS Worldwide Express
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER 1Z 0E8 10W 22 1000 096 9

1 SHIPMENT FROM

SHIPPER'S UPS ACCOUNT NO — UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felkner — TELEPHONE: 913-458-2000

COMPANY: BLACK & VEATCH SPEC PROJ CORP

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK KS — ZIP CODE: 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Randy Staggs — TELEPHONE: (918)251-2858

COMPANY: SW Lab of Ok

STREET ADDRESS: 1700 W. Albany — DEPT/FLOOR

CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL): Broken Arrow, OK — ZIP CODE: 74012

3 WEIGHT — WEIGHT (ENTER LTR IF LETTER): ~~[illegible]~~ 29 lbs — DIMENSIONAL WEIGHT (If Applicable) — 104

SHIPPER'S COPY

4 TYPE OF SERVICE — [X] NEXT DAY AIR [ ] WORLDWIDE EXPRESS (INTERNATIONAL)

FOR WORLDWIDE EXPRESS SHIPMENTS Mark an "X" in this box if shipment only contains documents of no commercial value [ ] DOCUMENTS ONLY

5 OPTIONAL SERVICES — [ ] SATURDAY PICKUP See instructions [ ] SATURDAY DELIVERY See instructions

[ ] DECLARED VALUE Contents are automatically protected up to $100. For declared value over $100, see instructions. $ ____ AMOUNT

[ ] COD If C.O.D., enter amount to be collected and attach completed UPS C.O.D. tag to package. $ ____ AMOUNT

6 ADDITIONAL HANDLING CHARGE — [ ] An Additional Handling Charge applies for certain items. See instructions.

TOTAL CHARGES

CHARGES
$
$
$
$
$
$

7 METHOD OF PAYMENT — [X] Bill Shipper [ ] Bill Receiver [ ] Bill Third Party (Next Day Air Only; Record Account No. in Section 8) [ ] Credit Card (American Express, Diner's Club, MasterCard, Visa) [ ] Check

8 RECEIVER'S / THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO — EXPIRATION DATE /

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

9 SHIPPER'S SIGNATURE X [signature]

DATE OF SHIPMENT 9/21/00

0101911202609 2/99 M

UPS Next Day Air
UPS Worldwide Express
Shipping Document

See instructions on back. Call 1-800-PICK-UPS (800-742-5877) for additional information.

TRACKING NUMBER 1Z 0E8 10W 22 1000 097 8

1 SHIPMENT FROM

SHIPPER'S UPS ACCOUNT NO — UPS ACCOUNT NO: 0 E 8 1 0 W

REFERENCE NUMBER: 0461180123

NAME: Gary Felkner — TELEPHONE: 913-458-2000

COMPANY: BLACK & VEATCH SPEC PROJ CORP

STREET ADDRESS: 6601 COLLEGE BLVD

CITY AND STATE: OVERLAND PARK KS — ZIP CODE: 66211 1504

2 EXTREMELY URGENT DELIVERY TO

NAME: Randy Staggs — TELEPHONE: (918)251-2858

COMPANY: SW Lab of Ok

STREET ADDRESS: 1700 W. Albany — DEPT/FLOOR

CITY AND STATE (INCLUDE COUNTRY IF INTERNATIONAL): Broken Arrow OK — ZIP CODE: 74012

3 WEIGHT — WEIGHT (ENTER LTR IF LETTER): 28 — DIMENSIONAL WEIGHT (If Applicable) — 104

SHIPPER'S COPY

4 TYPE OF SERVICE — [X] NEXT DAY AIR [ ] WORLDWIDE EXPRESS (INTERNATIONAL)

FOR WORLDWIDE EXPRESS SHIPMENTS Mark an "X" in this box if shipment only contains documents of no commercial value [ ] DOCUMENTS ONLY

5 OPTIONAL SERVICES — [ ] SATURDAY PICKUP See instructions [ ] SATURDAY DELIVERY See instructions

[ ] DECLARED VALUE Contents are automatically protected up to $100. For declared value over $100, see instructions. $ ____ AMOUNT

[ ] C.O.D. If C.O.D., enter amount to be collected and attach completed UPS C.O.D. tag to package. $ ____ AMOUNT

6 ADDITIONAL HANDLING CHARGE — [ ] An Additional Handling Charge applies for certain items. See instructions.

TOTAL CHARGES

CHARGES
$
$
$
$
$
$

7 METHOD OF PAYMENT — [X] Bill Shipper [ ] Bill Receiver [ ] Bill Third Party (Next Day Air Only; Record Account No. in Section 8) [ ] Credit Card (American Express, Diner's Club, MasterCard, Visa) [ ] Check

8 RECEIVER'S / THIRD PARTY'S UPS ACCT NO OR MAJOR CREDIT CARD NO — EXPIRATION DATE /

THIRD PARTY'S COMPANY NAME

STREET ADDRESS

CITY AND STATE — ZIP CODE

9 SHIPPER'S SIGNATURE X [signature]

DATE OF SHIPMENT 9/22/00

Appendix G
Survey Data

File I.S

4611?

Zerr Engineering
Date: 08-08-2000
Project No. 99-126

ACE SERVICES
Colby, Kansas

Well Designation	Coordinates * North	Coordinates * East	Elevation Top of Casing	Elevation Top of North Side of Flush Mount Ring
OB 1S	9380.08607	10308.46867	3142.71	3143.05
OB 1I	9378.57019	10328.25223	3142.31	3142.66
OB 1D	9362.49239	10332.46531	3141.98	3142.29
OB 2S	9377.06295	10392.88955	3139.59	3139.86
OB 2I	9377.94194	10402.35013	3138.63	3138.91
OB 2D	9377.88098	10412.45754	3138.11	3138.47
EX 2S	9449.78932	10336.29564	3142.13	3142.42
EX 2I	9441.91718	10347.99760	3141.30	3141.57
EX 2D	9434.31623	10358.43995	3140.50	3140.89

* Assumes the Coordinates of the SW Corner of 32-07-33 to be N = 9079.96000, E = 10000.00000

ACE SERVICES
Colby, Kansas

Well Designation	Distance From SW Corner of 32-07-33 North	East	2.5 Acre Tract Location
OB 1S	300	308	SW SW SW SW
OB 1I	299	328	SW SW SW SW
OB 1D	283	332	SW SW SW SW
OB 2S	297	393	SW SW SW SW
OB 2I	298	402	SW SW SW SW
OB 2D	298	412	SW SW SW SW
EX 2S	370	336	NE SW SW SW
EX 2I	362	348	NE SW SW SW
EX 2D	354	358	NE SW SW SW

ELMER G. ZERR LICENSED LS-1001 KANSAS SURVEYOR

Elmer G. Zerr
Kansas License LS-1001

Appendix H
Pump Test Results

File D.3
46118

TECHNICAL MEMORANDUM

USEPA
Ace Services Site
Pump Test Results

BVSPC Project 46118.126
BVSPC File D.3
November 13, 2000

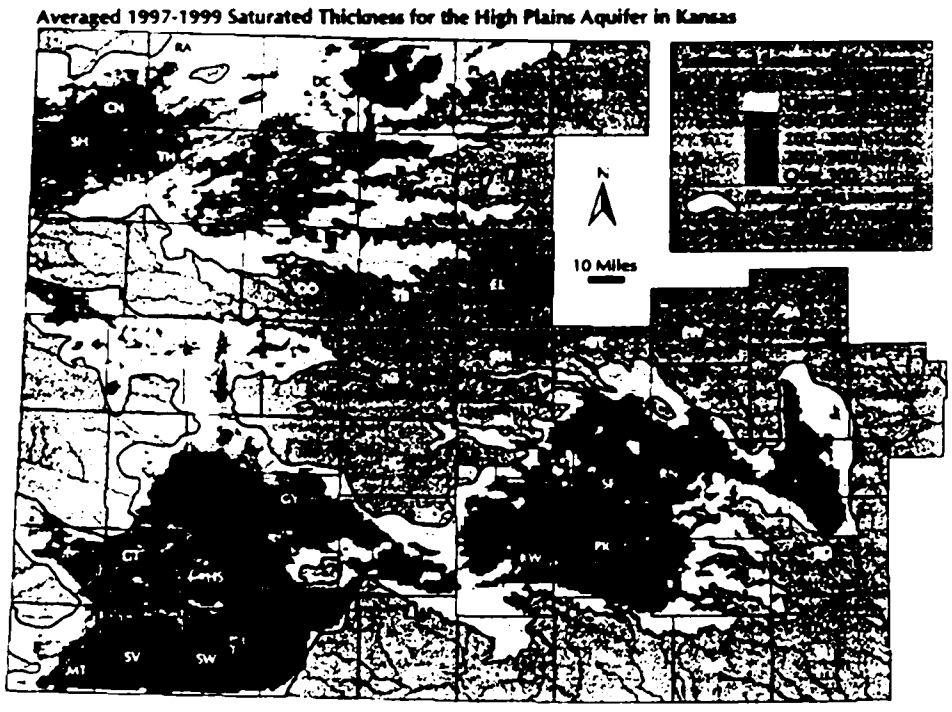
INTRODUCTION

In August 2000, a pump test was conducted at the Ace Services site in Colby, Kansas. The purpose of the pump test was to characterize the High Plains aquifer in the vicinity of the Ace Services site. Results of the pumping test will be used to model the hydraulic properties of the aquifer and to develop a design for a pump and treat remedial alternative for the Ace Services site. Three 72-hour pumping tests were conducted at three separate hydrologic zones within the aquifer to determine the transmissivity and hydraulic conductivity of the aquifer.

The City of Colby, Kansas relies upon the High Plains aquifer for its source of potable water (Figure 1). The High Plains aquifer is the principal source of water for the High Plains region. The High Plains aquifer consists primarily of sediments within the Ogallala Formation of Miocene age. The Ogallala consists of unconsolidated gravel, sand, silt, and clay. Locally , it also includes caliche, which is deposited as thin, discontinuous, layers within the upper portions of the formation. The Ogallala Formation was deposited by an extensive eastward flowing system of braided streams that drained the eastern slopes of the Rocky Mountains during the late Tertiary Period.

Unconsolidated deposits of Quaternary age overlie the Ogallala Formation. These deposits consist of gravel, sand, silt, and clay, much of which is reworked material that was derived from the Ogallala Formation. Deposits of loess overlie the Ogallala Formation or the unconsolidated Quaternary sediments at some locations.

FIGURE 1



Modified from U.S.G.S., 1997

SITE GEOLOGIC CONDITIONS:

The lithology of the unconsolidated sediments, determined from soil samples collected during the drilling of the extraction and observation wells, indicates a highly stratified aquifer consisting of sand, gravelly sand, silt, and clay. The thickness of the unconsolidated sediments (Ogallala Formation) was approximately 230 feet thick. Multicolored shale of the Pierre Shale Formation underlies the unconsolidated sediments at 230 feet. The site subsurface stratigraphy is generalized by the following:

Depth (ft)	Lithology	Remarks
0 – 30	Silt, Sandy Silt (Loess)	Dry
30 - 57	Sand and Silty Clay	Dry
57 - 105	Silt, Clay, and Sand	Dry to moist
105 - 135	Sand, some gravel w/ Silty Clay layers	Shallow Aquifer Zone
135 - 145	Sand and Clay (w/ interbedded caliche)	Shallow Aquifer Zone
145 - 190	Gravelly Sand w/ thin clay lenses	Intermediate Aquifer Zone
190 - 207	Clay and Silty Clay	Semi-Confining Unit
207 - 230	Gravelly Sand w/ thin clay lenses	Deep Aquifer Zone
230 +	230 +	Bedrock (Pierre Shale)

REGIONAL HYDROGEOLOGY

The average saturated thickness of the High Plains aquifer in Kansas is approximately 90 feet. Water in the High Plains aquifer generally is under unconfined conditions. However, in some locations, water levels in wells completed in portions of the aquifer may rise or fall slightly in relation to the regional water table because of artesian pressure created by local confining beds. Generally the ground water gradient within the aquifer is from west to east. Water moves in response to the slope of the water table, which typically averages between 10 to 15 feet per mile. On the basis of these average gradients and aquifer hydraulic properties, the regional velocity of water that moves through the aquifer is estimated to average about 1 foot per day. Regional transmissivity values typically range from 40,000 to 60,000 gallons per day/ft with storage coefficients ranging from 0.14 to 0.27 (Miller and Appel, U.S.G.S. Ground Water Atlas, 1997).

SITE HYDROGEOLOGY

Water levels measured during the remedial investigation indicate a slightly downward gradient within the aquifer surrounding the Ace Services site. Locally ground water flows to the east-southeast at horizontal gradients ranging from 0.0022 – 0.0032 ft/ft. Continuous water level monitoring prior to the pump test activities indicated that the shallow and intermediate zones within the aquifer function as a typical unconfined aquifer. However, monitoring data from the deep zone, collected prior to the pumping activities suggest that this lower zone acts as a semi-confined unit. Diurnal fluctuations in hydraulic head prior to the pump test occurred only in observation wells screened in the deep zone. These fluctuations suggest significant lateral influence by water supply wells pumping from the deep zone portion of the aquifer.

PUMPING TESTS

Pumping tests were conducted at the Ace Services site within the Ogallala aquifer in Colby, Kansas from July 31 to August 10, 2000. Three 72-hour pump tests were conducted within each hydrologic interval. Changes in water levels within the three extraction wells and nine observation wells were measured during pumping tests using pressure transducers attached to a Hermit 3000 data recording device. An atmospheric transducer was also installed near the surface in one of the wells (MW-6) to monitor atmospheric pressure changes during the test. The data recorders were programmed to take readings at 1-minute intervals during the duration of the tests.

The extraction wells were screened at three different intervals: shallow, intermediate, and deep zones within the aquifer. The observation wells consisted of three well nests of three wells per nest. Each nest of wells contained a well screened in the shallow, intermediate, and deep zones of the aquifer. A plan of the extraction wells and observation wells is shown in Figure 2. The following table gives well numbers, locations, elevation of top of casing, depth to static water level, and the screened interval.

Table 1

Well Number	Northing	Easting	Elevation TOC Ft.	Static W.L. Depth in Ft. bgs	Screen Interval Ft. bgs
Extraction Wells:					
EX-2-S	9449.79	10336.29	3142.13	111.10	110-130
EX-2-I	9441.92	10348.0	3141.30	110.33	145-195
EX-2-D	9434.32	10358.44	3140.50	110.0	195-235
Observation Wells:					
MW-9-S	9495.90	10336.04	3142.47	111.40	112-132
MW-9-I	9480.50	10335.85	3142.35	111.25	170-190
MW-9-D	9464.69	10336.19	3142.13	113.09	216-236
OB-1-S	9380.09	10308.47	3142.71	111.75	110-130
OB-1-I	9378.57	10328.25	3142.31	111.37	175-195
OB-1-D	9362.49	10332.46	3141.98	113.11	215-235
OB-2-S	9377.06	10392.89	3139.59	108.75	110-130
OB-2-I	9377.94	10402.35	3138.63	107.91	172-192
OB-2-D	9377.88	10412.46	3138.11	109.43	215-235

A 1.5-horsepower submersible pump was used to conduct the shallow zone pump test while a 20-horse power pump was used to conduct the pump tests in the intermediate and deep zones. A flow meter was installed at the well head to monitor the discharge rate. The discharge water was piped approximately 50 feet to a sanitary sewer manhole for disposal, as per permission by the City of Colby public works department.

TEST ACTIVITIES

The deep zone pump test was conducted from August 1 to August 4, 2000 at a pumping rate of 105 gallons per minute (gpm). The test lasted for 68 hours and drawdown data from the deep zone monitoring wells initially indicated that this zone behaved like a semi-confined aquifer (larger drawdowns over time). However, some drawdown was measured in the shallow extraction well EX-2-S (0.25 ft) and the intermediate extraction well EX-2I, (1.1 ft) immediately adjacent to the deep zone extraction well indicating significant vertical leakage from the overlying intervals.

The intermediate zone pump test was conducted from August 4 to August 7, 2000 at a pumping rate of 187 gpm. The test was conducted for 69 hours and up to 6.6 feet of drawdown was measured in the observation wells within the intermediate zone. Lesser amounts of drawdown were measured in EX-2S (2.2 ft) and EX-2D (2.4 ft), immediately adjacent to the intermediate pumping well. Negligible drawdowns were measured in the shallow observation wells and were not used in the pump test analysis because of the difficulty of filtering out the background aquifer fluctuations and atmospheric effects.

The shallow zone pump test was conducted from August 7 to August 10, 2000 at a rate of 30 gpm for 63 hours. Due to the limited zone of saturation within the upper portion of the aquifer, little to no drawdown was measurable in the observation and non-pumping extraction wells.

TEST LIMITATIONS

The tests were limited by several factors; the pumping rate for each test could not exceed 150-200 gpm, the pumping tests were limited to a maximum of 72 hours, and the wells were constructed in the three distinct zones (partial penetration) because of analytical/treatment considerations. Also, difficulties occurred at the beginning of each test with relation to establishing a constant pumping rate that would yield sufficient drawdowns in the adjacent observation wells. As a result, the intermediate and deep zones may not have been stressed sufficiently and/or may not have been pumped long enough to generate a cone of depression that would yield precise estimates of transmissivity and specific yield. To compensate for uncertainties in early time data, the late time data was used to perform curve matching. Overall, late time data is considered more accurate in unconfined aquifers for estimating transmissivities and storage coefficients.

ANALYSES

Several methods of analysis were used to determine solutions that most closely matched the conditions within the aquifer at the Ace Services site. The aquifer is generally considered to be under unconfined flow conditions. As a result, the Neuman (1975) method is thought to best analyze pumping test data within unconfined aquifers. The Neuman method was implemented during analysis of the intermediate pump test data. The Neuman method assumes that:

- The aquifer is unconfined and has an "apparent infinite extent"
- The aquifer is homogeneous, isotropic, and of uniform thickness
- The well is pumped at a constant rate
- Well diameter is small, so well storage is negligible
- Flow is unsteady to the pumping well
- The well penetrates the entire aquifer

Several factors involved with the pump tests at the Ace Services site could cause significant variations with relation to evaluation of the data by the Neuman method. The biggest factor is that the pumping wells did not fully penetrate the aquifer. There are also large portions of the aquifer that are not homogeneous and isotropic.

The Moench method, derived from Neuman's solution, may be better suited to the testing conditions that occurred at the Ace Services site. The Moench method is an analysis used when partially penetrating conditions occur. The Moench method was also implemented during analysis of the data and assumes that:

- The aquifer is unconfined and has an "apparent infinite extent"
- The aquifer in homogeneous and isotropic
- The well is pumped at a constant rate
- Well diameter is small, so well storage is negligible
- Drawdown is small relative to saturated thickness

This method appeared to best suit the conditions of the pump test within the intermediate and deep zones.

However, due to the geologic conditions, mainly the presence of a clay layer that separated the intermediate and deep zones, the deep zone data was also analyzed by traditional methods typically applicable to confined or leaky confined aquifers (Cooper-Jacob method and the Hantush-Jacob method).

The traditional methods of time vs. drawdown and distance vs. drawdown assume:

- The aquifer is confined and has an "apparent" infinite extent
- The aquifer is homogeneous, isotropic, and of uniform thickness
- The well is pumped at a constant rate
- The well is fully penetrating
- Water removed from storage is discharged instantaneously with decline in head

- Well diameter is small, so well storage is negligible
- The values of u are small (rule of thumb $u < 0.01$)

TEST RESULTS

The deep zone pump test data were analyzed by the Cooper & Jacob time/drawdown, the Hantush & Jacob, and Moench methods. Results from the Cooper & Jacob method (Figure 3) yielded a transmissivity of 1,900 Ft^2/day, the Hantush & Jacob method (Figure 4) yielded a transmissivity of 1,310 Ft^2/day, and the Moench method (Figure 5) yielded a transmissivity of 1,610 Ft^2/day. Horizontal hydraulic conductivities ranged from 10.4 to 15.4 ft/day.

The Intermediate zone pump test data was analyzed by the Moench and Newman methods. Intermediate zone pump test data from shallow and intermediate observation wells, analyzed by the Moench method yielded transmissivities of 4,520 – 6,090 Ft^2/day with storage coefficients of 0.11 to 0.20. Horizontal hydraulic conductivities ranged from 53.1 to 71.7 ft/day. Late time drawdown data from the shallow extraction well EX-2-S were used in the Moench analysis plots as illustrated in Figures 6, 7, and 8. This well was selected because it showed evidence of the delayed yield effects that were expected within the shallow zone during the test. The intermediate observation wells did not show any significant effects of delayed yield. Analysis of the late time data for the intermediate observation wells using the Neuman method, Figures 9 and 10, resulted in values of transmissivity and specific yield that were significantly lower than expected and much lower than published values for the aquifer.

The Neuman method of analysis was used for the intermediate zone pump test using shallow well drawdown data from EX –2S and MW-9S. The late-time data were graphically matched to the type curves and yielded a transmissivity of 2,940 Ft^2/day. Horizontal hydraulic conductivities ranged from 17.9 to 34.6 ft/day. Neuman analysis of the intermediate observation well data yielded transmissivities of only 1,520 Ft^2/day, significantly lower than expected. The values for the storage coefficient were not considered because the wells were partially penetrating.

Table 2
Transmissivity Summary Table

Aquifer Zone	Solution Method (Transmissivity, Ft^2/day)				Hydraulic Conductivity (Ft/day)	Combined Transmissivity
	Neuman	Cooper Jacob	Hantush Jacob	Moench		
Intermediate	2,940 1,520			4,520 – 6,090	53.1 - 71.7	6,682
Deep		1,900	1,310	1,610	10.4 - 15.4	

The aquifer pump tests were conducted at the Ace Services site under the assumption that there existed three distinct zones within the aquifer. However, results of the pump test analyses indicate that the High Plains aquifer at the Ace Services site may function as two distinct hydrologic zones, an upper zone (shallow and intermediate) and a lower (deep) zone. The fine grained clay-silty clay unit that separates the intermediate and deep zones appears to function as a leaky aquitard. Combining the average transmissivities of the upper (from Moench analysis) and lower zones arithmetically yields a value of approximately 6,682 Ft^2/day (50,000 gpd/ft). This is consistent with published transmissivity values for this region of the High Plains Aquifer. The combined transmissivity and hydraulic conductivity values

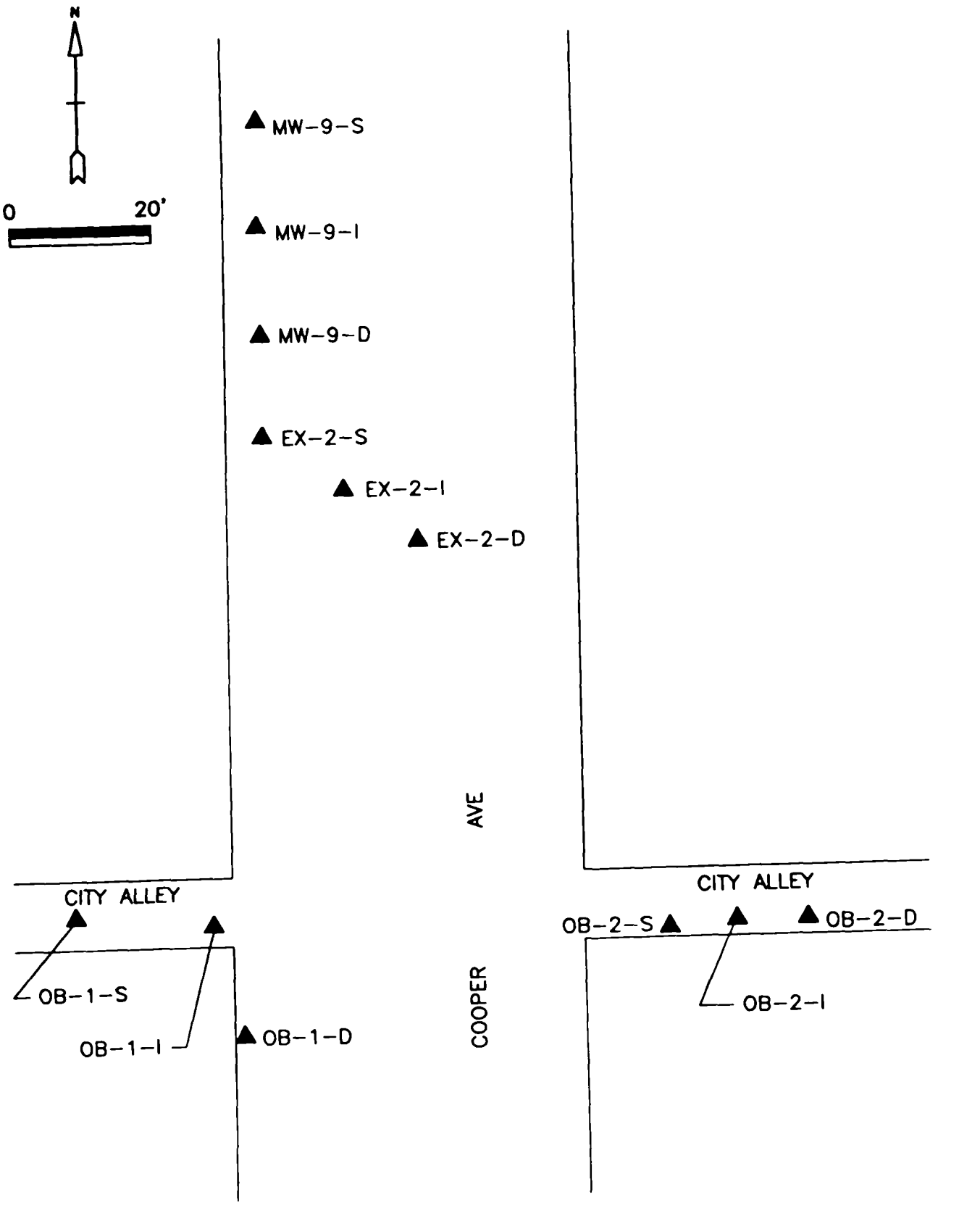
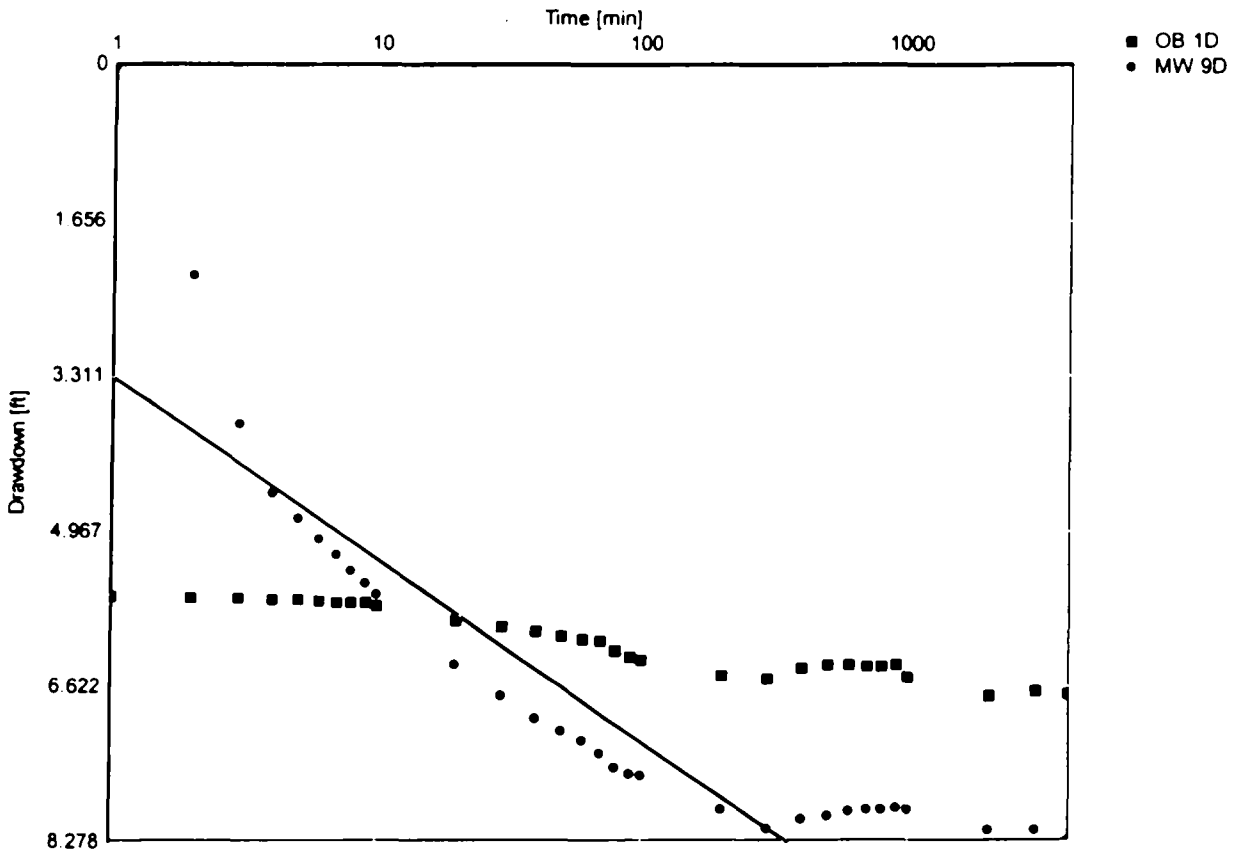


FIGURE 2
WELL LOCATIONS FOR
MW-9, EX-2, OB-1
AND OB-2
ACE SERVICES SITE

Black & Veatch Special Projects 6601 College Blvd Overland Park KS Phone (913) 458-2000	**Pumping test analysis**	
	No:	46118.126
	Project:	Ace Services
	Client:	USEPA

Location:	Colby, KS	Pumping test:	Deep ZoneTest	Pumping well:	EX 2D
Test performed by:	Dustin Marlow	Evaluated by:	Brian Smith		
Test date:	8/30/00	Evaluation date:	9/11/00		
Analysis method:	COOPER & JACOB Time-Drawdown	Aquifer thickness:	123		
		Discharge rate:	105 [U.S. gal/min]		



Transmissivity: 1.90×10^+3 [ft²/d]

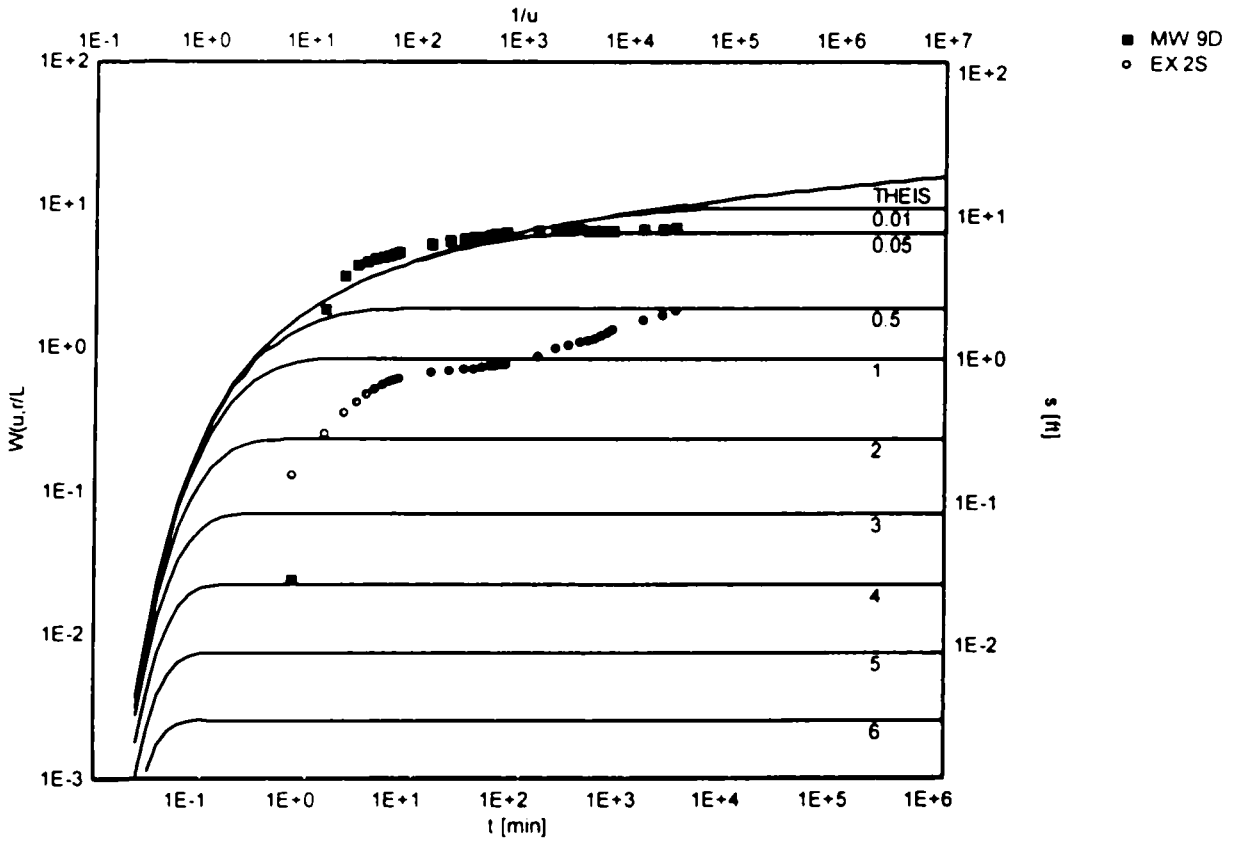
Conductivity: 1.55×10^+1 [ft/d]

** Graphically Matched Curve

FIGURE 3

BLACK & VEATCH SPECIAL PROJECTS CORP	**Black & Veatch Special Projects** 6601 College Blvd Overland Park KS Phone (913) 458-2000	**Pumping test analysis** No: 46118.126 Project: Ace Services Client: USEPA	

Location: Colby, KS		Pumping test: Deep ZoneTest	Pumping well: EX 2D
Test performed by:	Dustin Marlow	Evaluated by:	Brian Smith
Test date:	8/30/00	Evaluation date:	9/1/00
Analysis method:	Hantush and Jacob	Aquifer thickness:	123
		Discharge rate:	105 [U.S. gal/min]



Transmissivity: 1.31×10^+3 [ft²/d]

Conductivity: 1.07×10^+1 [ft/d]

Storativity: 3.56×10^-4

c : 1.55×10^+7 [min]

** Graphicall Matched Curve

FIGURE 4

Black & Veatch Special Projects
6601 College Blvd
Overland Park KS
Phone (913) 458-2000

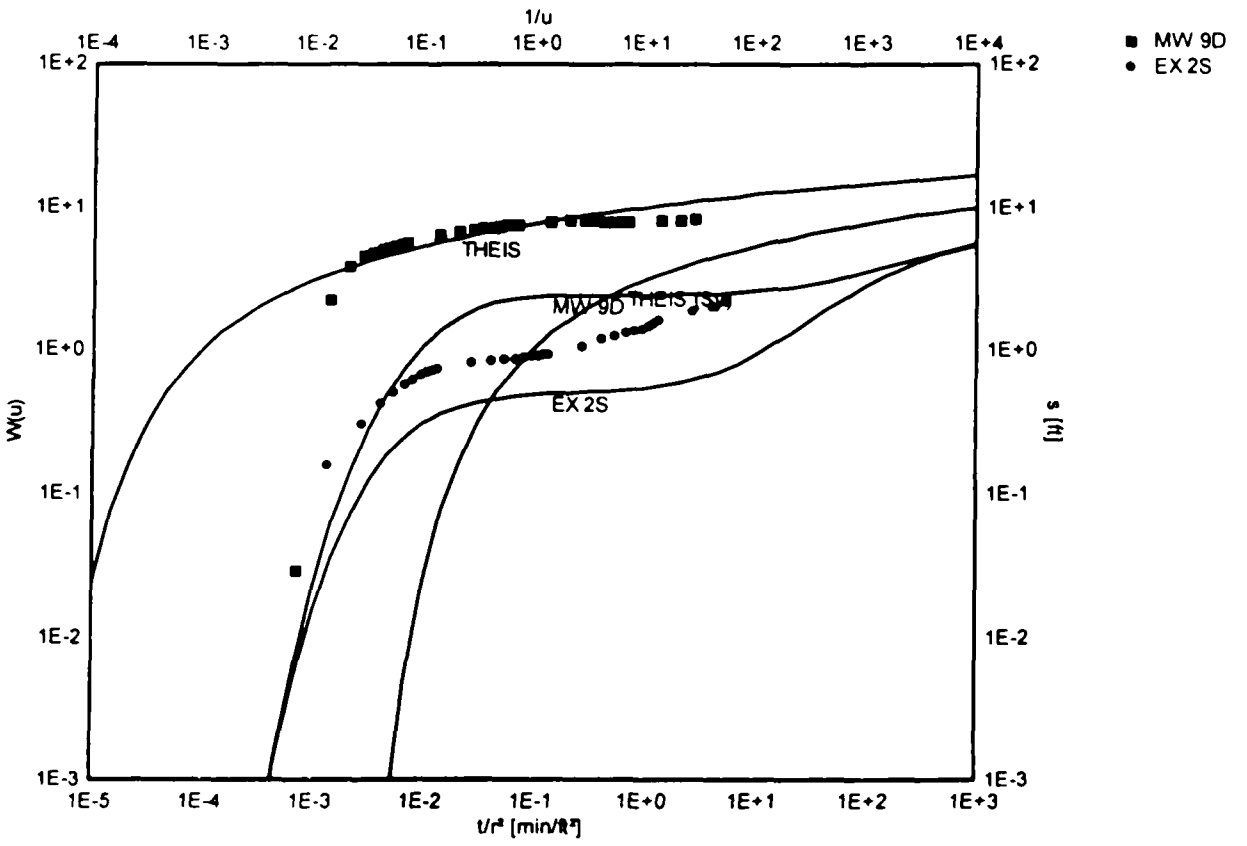
BLACK & VEATCH
SPECIAL PROJECTS CORP

Pumping test analysis

No:	46118.126
Project:	Ace Services
Client:	USEPA

Location: Colby, KS Pumping test: Deep ZoneTest Pumping well: EX 2D

Test performed by:	Dustin Marlow	Evaluated by:	Brian Smith
Test date:	8/30/00	Evaluation date:	8/31/00
Analysis method:	MOENCH	Aquifer thickness:	123
		Discharge rate:	105 [U.S. gal/min]



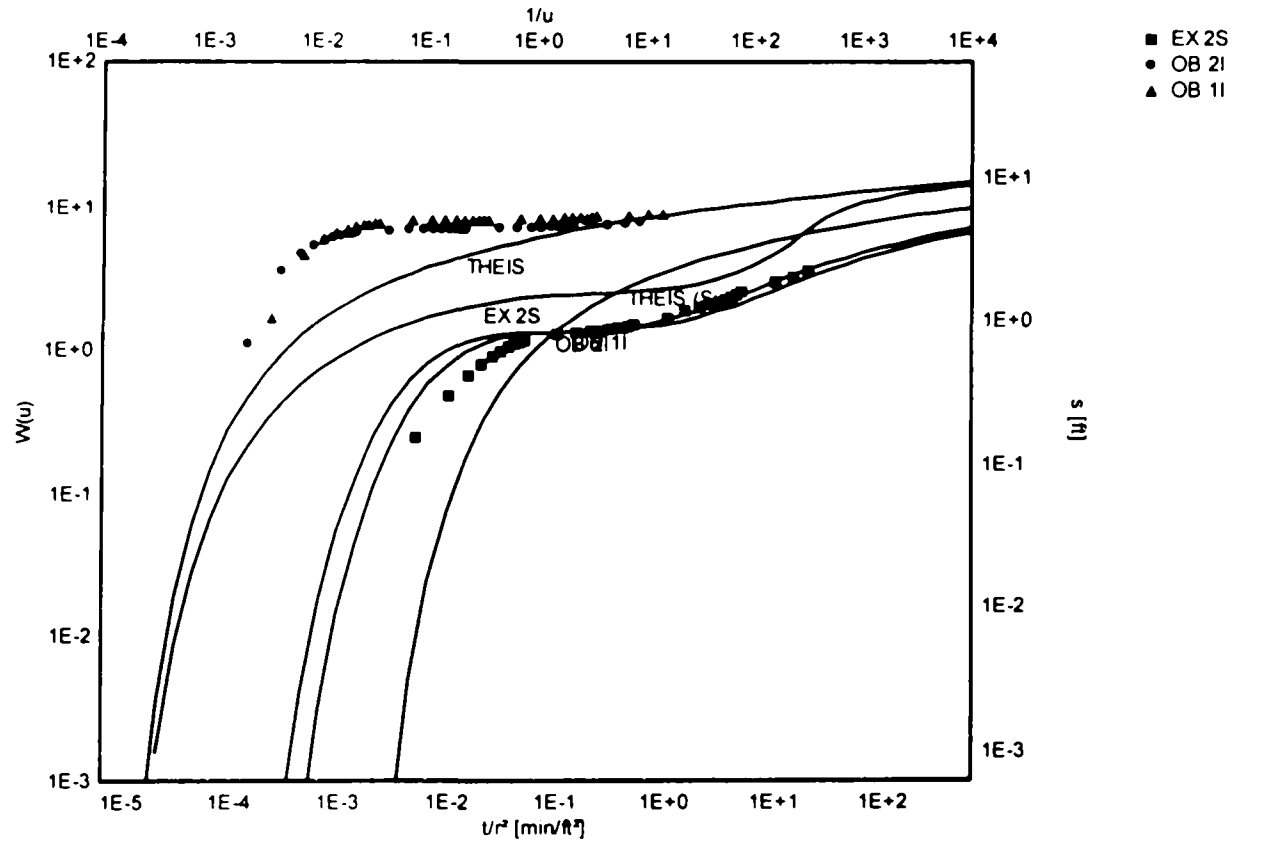
Transmissivity:	1.61×10^+3 [ft²/d]
Conductivity:	1.31×10^+1 [ft/d]
Storativity:	1.12×10^-1
Conductivity vertical:	1.31×10^-1 [ft/d]

** Computer Matched with "automatic fit"

FIGURE 5

Black & Veatch Special Projects		**Pumping test analysis**	
6601 College Blvd		No:	46118.126
Overland Park KS		Project:	Ace Services
Phone (913) 458-2000		Client:	USEPA

Location:	Colby, KS	Pumping test:	Intermediate Zone	Pumping well:	EX 2I
Test performed by:	G Felkner	Evaluated by:	Brian Smith		
Test date:	8/7/00	Evaluation date:	8/30/00		
Analysis method:	MOENCH	Aquifer thickness:	85 [ft]		
		Discharge rate:	186 [U.S. gal/min]		



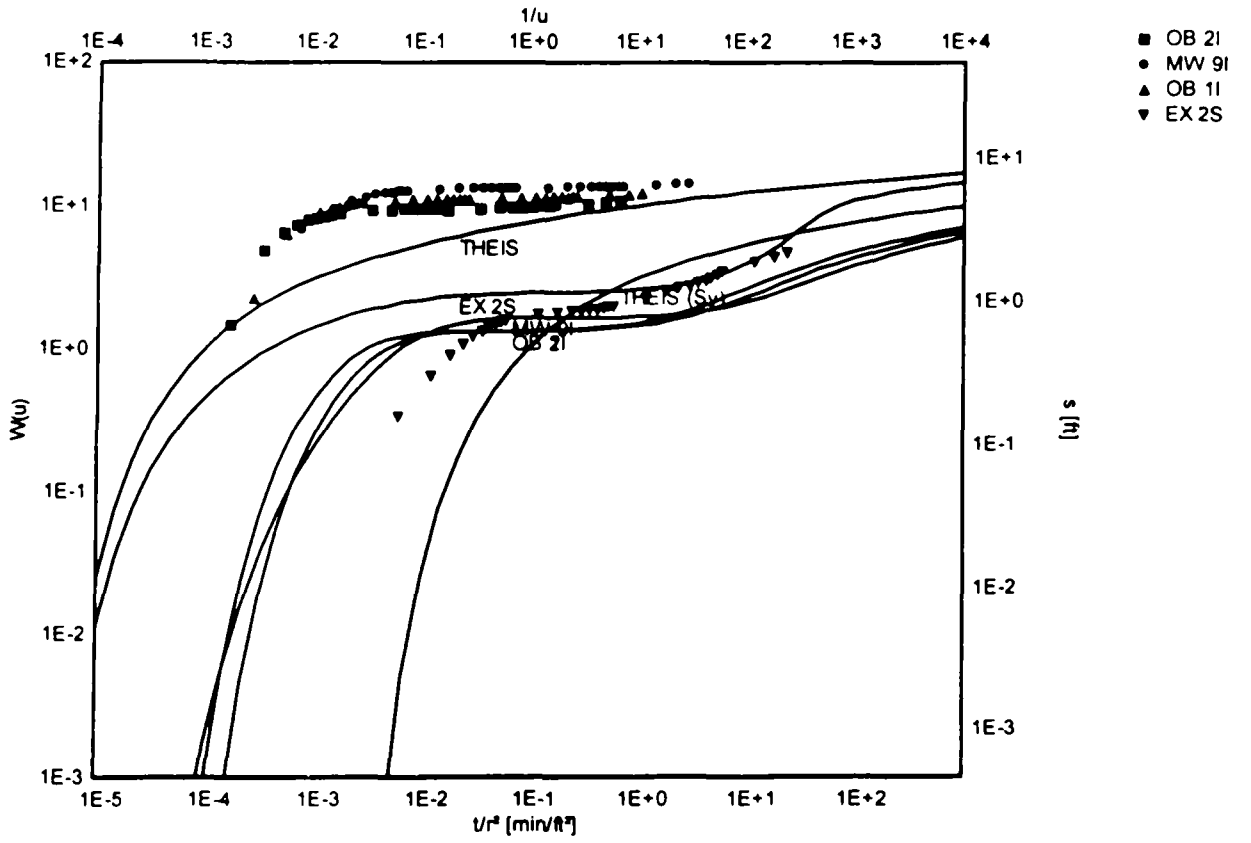
Transmissivity:	4.52×10^+3 [ft²/d]
Conductivity:	5.31×10^+1 [ft/d]
Storativity:	2.02×10^-1
Conductivity vertical:	5.31×10^-1 [ft/d]

** Graphically Matched Curve Using Late-time Data

FIGURE 6

BLACK & VEATCH SPECIAL PROJECTS CORP	**Black & Veatch Special Projects** 6601 College Blvd Overland Park KS Phone (913) 458-2000	**Pumping test analysis** No: 46118.126 Project: Ace Services Client: USEPA	

Location: Colby, KS		Pumping test: Intermediate Zone	Pumping well: EX 2I
Test performed by:	G Felkner	Evaluated by:	Brian Smith
Test date:	8/7/00	Evaluation date:	8/29/00
Analysis method:	MOENCH	Aquifer thickness:	85 [ft]
		Discharge rate:	186 [U.S. gal/min]



Transmissivity: 6.09×10^+3 [ft²/d]

Conductivity: 7.17×10^+1 [ft/d]

Storativity: 3.52×10^-1

Conductivity vertical 7.17×10^-1 [ft/d]

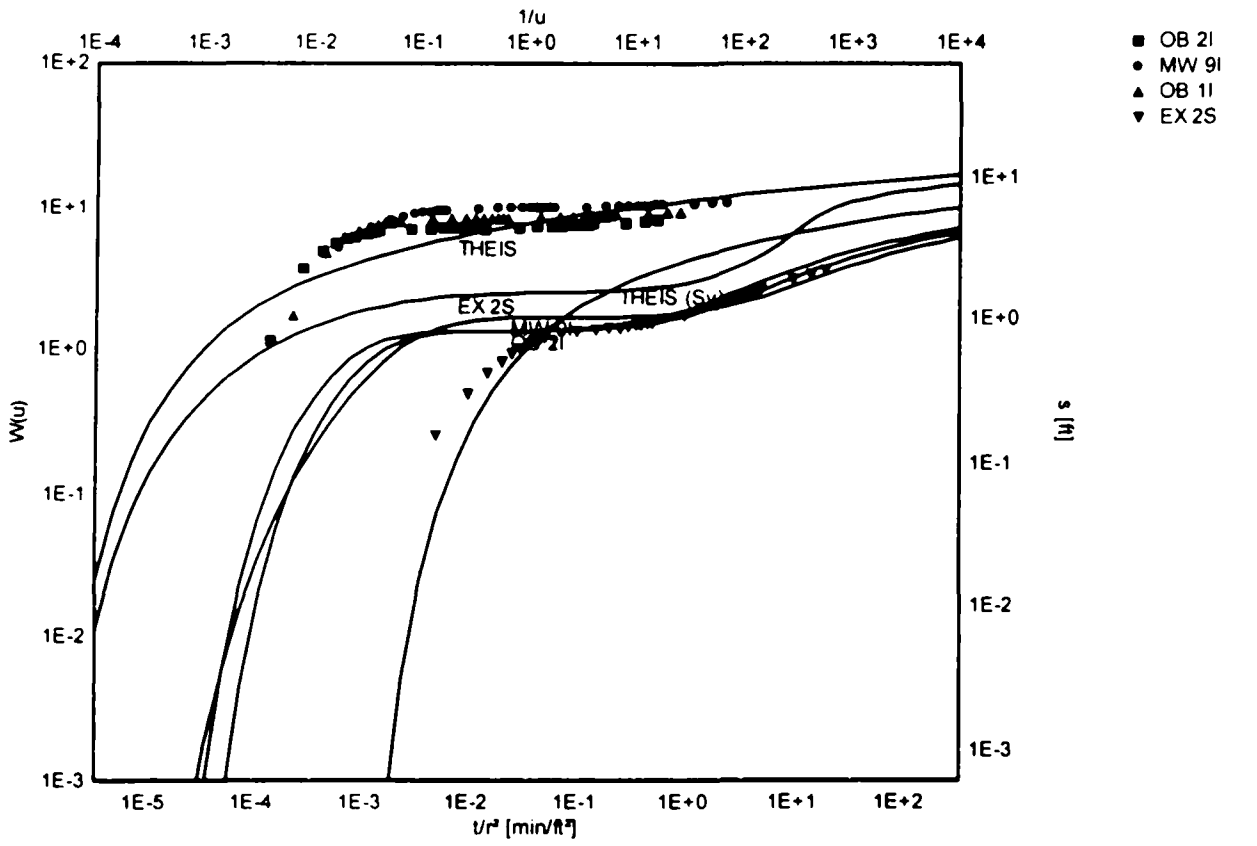
** Graphically Matched Curve Using Late-time Data

FIGURE 7

BLACK & VEATCH SPECIAL PROJECTS CORP	**Black & Veatch Special Projects** 6601 College Blvd Overland Park KS Phone (913) 458-2000	**Pumping test analysis** No: 46118.126 Project: Ace Services Client: USEPA	

Location:	Colby, KS	Pumping test:	Intermediate Zone	Pumping well:	EX 2I

Test performed by:	G Felkner	Evaluated by:	Brian Smith
Test date:	8/7/00	Evaluation date:	8/29/00
Analysis method:	MOENCH	Aquifer thickness:	85 [ft]
		Discharge rate:	186 [U.S. gal/min]



Transmissivity: 4.62×10^+3 [ft²/d]

Conductivity: 5.44×10^+1 [ft/d]

Storativity: 1.14×10^-1

Conductivity vertical: 5.44×10^-1 [ft/d]

** Graphically Matched Curve Using Late-time Data

FIGURE 8

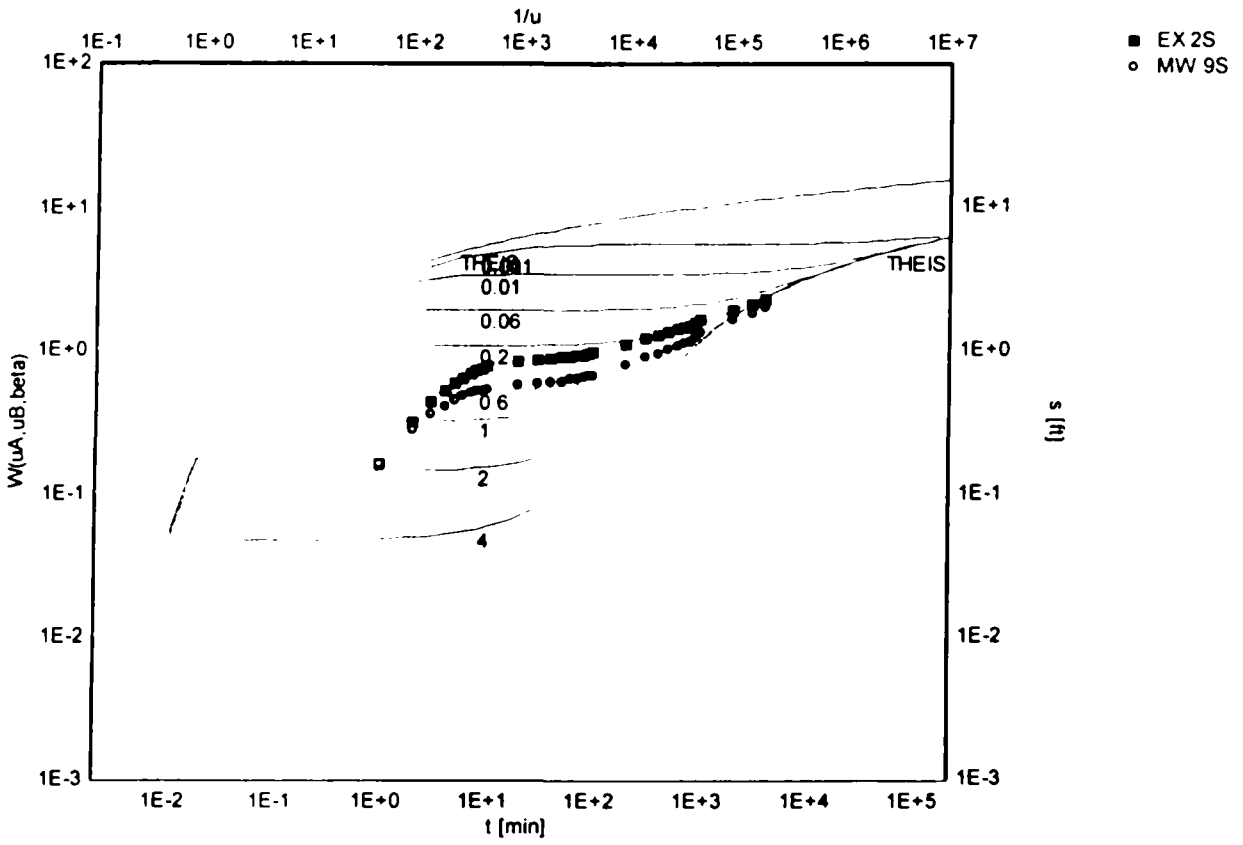
Black & Veatch Special Projects
6601 College Blvd
Overland Park KS
Phone (913) 458-2000

BLACK & VEATCH
SPECIAL PROJECTS CORP

Pumping test analysis
No: 46118.126
Project: Ace Services
Client: USEPA

Location: Colby, KS | Pumping test: Intermediate Zone | Pumping well: EX 2I

Test performed by:	G. Felkner	Evaluated by:	Brian Smith
Test date:	8/7/00	Evaluation date:	8/30/00
Analysis method:	NEUMAN	Aquifer thickness:	85 [ft]
		Discharge rate:	186 [U.S. gal/min]



Transmissivity: 2.94×10^+3 [ft²/d]

Conductivity: 3.46×10^+1 [ft/d]

Storativity: 5.64×10^-5

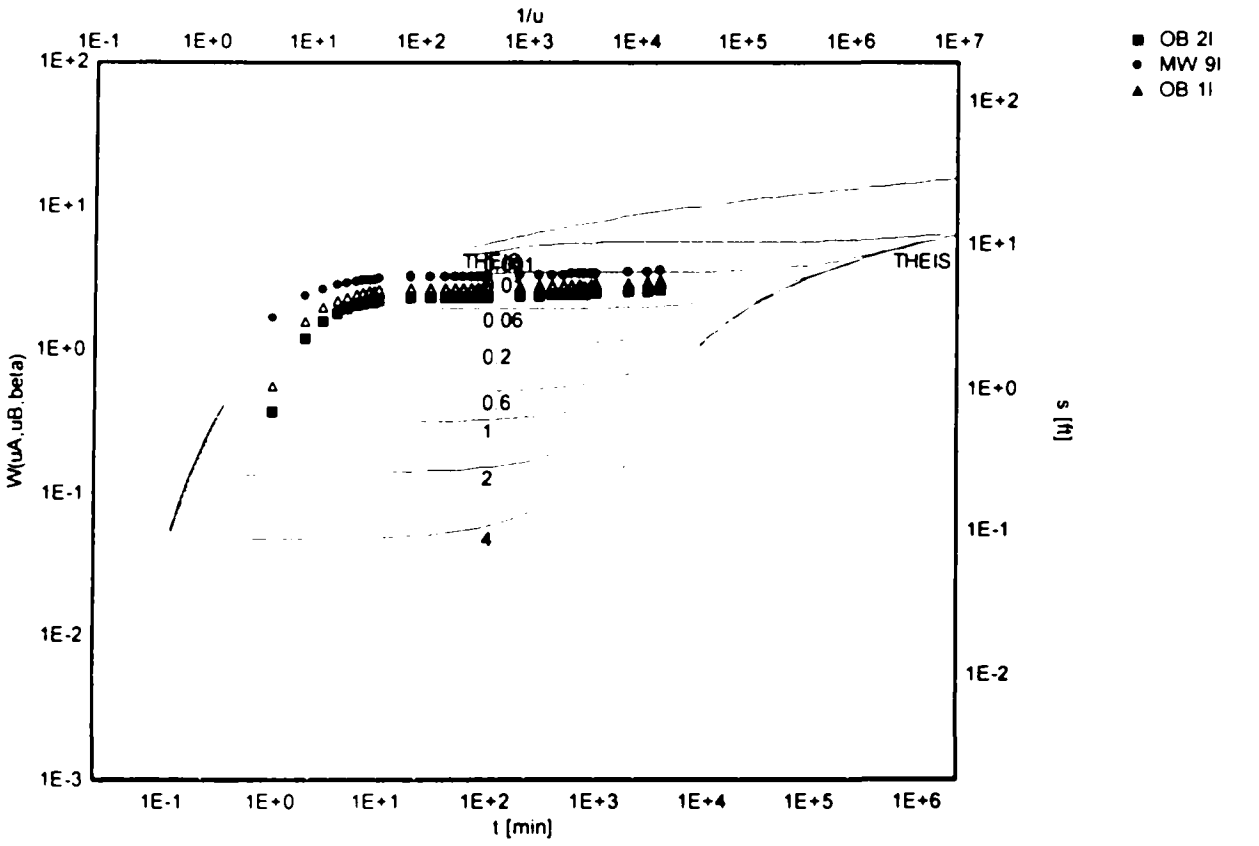
Specific yield: 5.64×10^-1

** Graphically Matched Curve Using Late-time Data

FIGURE 9

BLACK & VEATCH SPECIAL PROJECTS CORP	**Black & Veatch Special Projects** 6601 College Blvd Overland Park KS Phone (913) 458-2000	**Pumping test analysis** No: 46118.126 Project: Ace Services Client: USEPA	

Location:	Colby, KS	Pumping test:	Intermediate Zone	Pumping well:	EX 2I
Test performed by:	G Felkner	Evaluated by:	Brian Smith		
Test date:	8/7/00	Evaluation date:	8/29/00		
Analysis method:	NEUMAN	Aquifer thickness:	85 [ft]		
		Discharge rate:	186 [U.S. gal/min]		



Transmissivity: 1.52×10^+3 [ft²/d]

Conductivity: 1.79×10^+1 [ft/d]

Storativity: 1.37×10^-4

Specific yield: 1.37×10^+0

** Computer Matched using "Automatic Fit"

FIGURE 10

from this analysis will be implemented into a finite difference ground water model to aid in the design of an optimum active remediation pump and treat system for the Ace Services site.

REFERENCES

Cooper, H.H. and C.E. Jacob, 1946, A Generalized Graphical Method for Evaluation Formation Constants and Summarizing Well Field History, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

Hantush, M.S. and C.E. Jacob, 1955, Non-steady Radial Flow in an Infinite Leaky Aquifer, Am. Geophys. Union Trans., vol. 36, pp. 95-100.

Miller, J.A., and Appel, C.L., 1997, Ground Water Atlas of the United States, Kansas, Missouri, Nebraska, U.S. Geological Survey Hydrologic Atlas 730-D.

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Appendix I
Groundwater Modeling Results

Original
File D.3
46118

TECHNICAL MEMORANDUM

USEPA
Ace Services
Ground Water Modeling Activities

BVSPC Project 46118.126
BVSPC File D.3
December 14, 2000

INTRODUCTION

A record of decision (ROD) for the Ace Services site was signed on May 5, 1999 stipulating an active remediation pump and treat system be installed based on a ground water model developed in 1998. Following completion of this ROD, an additional phase of investigation work was conducted in late 1999 and this new data indicates that a larger and more vertically complex plume of chromium contamination is present at the Ace Services site. To investigate this new information and provide a more accurate design basis for the pump and treat remediation system, vertically stratified pumping tests within the observed contaminated water column were performed in August 2000. These pumping tests confirm that the aquifer system exhibits a large amount of vertical heterogeneity and that the ground water contamination at the Ace Services site is vertically distributed. Therefore as part of the required modifications to the original ROD, a new ground water model was constructed to more accurately simulate the vertical flow component within the aquifer system at the site and provide input for evaluating potential remedial designs for capturing and remediating the chromium plume. The primary objectives of this new modeling effort were the following:

- Develop a ground water flow model capable of simulating the observed vertically stratified flow within the aquifer.
- Incorporate the recently collected pumping test data into the ground water flow model and calibrate this model using the pumping test results.
- Determine an effective extraction well configuration to capture the observed chromium plume.
- Determine an effective pumping rate for the selected extraction well configuration.
- Estimate the potential duration of the pump and treat remediation effort.

To accomplish these objectives, MODFLOW, a three-dimensional finite difference ground water flow model was used to simulate ground water flow and estimate the aquifer response to various ground water remediation strategies. MODPATH, a three dimensional advective particle transport program was used in combination with MODFLOW to more accurately estimate extraction well capture zones by tracking individual particles within the simulated flow field. GMS, Ground Water Modeling Software, originally developed by the Department of Defense, was utilized as a pre- and post-processor to expedite model runs and to generate ground water contour maps showing modeling results and well field configurations.

REGIONAL HYDROGEOLOGY

The average saturated thickness of the High Plains aquifer in Kansas is approximately 90 feet. Water in the High Plains aquifer generally is under unconfined conditions. However, in some locations, water levels in wells completed in portions of the aquifer may rise or fall slightly in relation to the regional water table because of artesian pressure created by local confining beds. Generally the ground water gradient within the aquifer is from west to east. Water moves in response to the gradient of the water table, which typically averages between 10 to 15 feet per mile. On the basis of these average gradients and aquifer hydraulic properties, the regional velocity at which water moves through the aquifer is estimated to average about 1 foot per day. Transmissivity values within the High Plains aquifer typically range from 40,000 to 60,000 gallons per day/ft with storage coefficients ranging from 0.14 to 0.27 (Miller and Appel, U.S.G.S Ground Water Atlas, 1997).

SITE HYDROGEOLOGY

Aquifer testing was conducted at the Ace Services site under the assumption that three distinct water bearing zones were present. However, based on the results of the pumping tests performed at the site

(Pumping Test Technical Memorandum, BVSPC, October 2000), the High Plains aquifer at the Ace Services site appears to function as two distinct hydrologic zones, an upper zone consisting of shallow and intermediate ground water and a lower zone consisting of deep ground water. A fine grained clay/silty clay unit that separates the upper and lower zones and appears to function as a leaky aquitard. Water levels recorded during the remedial investigation indicate a slightly downward vertical gradient within the aquifer surrounding the Ace Services site. Locally, ground water flows to the east-southeast at horizontal gradients ranging from 0.0022 – 0.0032 ft/ft. Continuous water level monitoring conducted prior to the pumping test activities indicates that the upper zone within the aquifer follows typical unconfined aquifer behavior. However, continuous ground water monitoring data collected from the lower zone suggests that this zone behaves as a semi-confined aquifer. This is demonstrated by observed diurnal fluctuations in hydraulic head in the deep zone wells due to the hydraulic influence of water supply wells in the vicinity of the Ace Services site. Diurnal fluctuations in hydraulic head were not observed in nested shallow and intermediate wells.

MODEL ASSUMPTIONS

Ground water modeling requires a set of assumptions to simplify the modeling effort in order to approximate the complexities associated with ground water flow. Simplifying some of the uncertainties of the system allows for the model to come to an accurate solution. The following assumptions were used to develop the Ace Services site ground water flow model:

- Water level data collected from nested monitoring wells at the site indicate ground water flow to the east-southeast. The data also indicate that a downward vertical gradient exists across the site. The geology within the saturated and contaminated portion of the aquifer consists of interbedded zones of sands, silty sands, gravels and a realitively consistent silty clay layer that separates the intermediate and deep water bearing zones. These hydrogeologic conditions were approximated by four model layers. Layer 1 represented the shallow zone. Layer 2 represented the intermediate zone. Layer 3 represented the silty clay leaky confining layer. Layer 4 represented the deep zone. Representing the site hydrogeology with four model layers allowed for the simulation of a vertical gradient and the stratification of aquifer properties and ground water extraction.
- Hydraulic conductivities used in the model were based on the pumping test data conducted in August, 2000. However the hydrologic data calculated from the shallow zone pumping test was determined to be unrepresentative of site conditions and was not used in the model. The small magnitudes of drawdown observed during the shallow zone test did not allow for accurate curve matching to derive an accurate solution for transmissivity. Also, the analytical solutions derived from data collected from the deep zone pump test appeared low in relation to published values. As a result, the horizontal hydraulic conductivity value from the intermediate test was used as a starting value and the values for the upper and lower layers were estimated as a percentage thereof based on lithology and well yields from the shallow and deep extraction wells. Hydraulic conductivity values of 37 ft/day (layer 1), 62 ft/day (layer 2), and 43 ft/day (layer 4) were used to simulate flow within the shallow, intermediate, and deep zones respectively . Vertical hydraulic conductivity values were estimated as $K_h/10$. Layer 3 was simulated as a leaky-confining unit and the hydraulic conductivities of this layer were determined during model calibration. The leaky-confining unit was modeled over the entire domain of the model but may only be present in the vicinity of the site. To test the validity of these model assumptions, the model was calibrated in both steady-state and transient mode.
- The aerial and vertical extent of the contamination was assumed to be that which is defined in the technical memorandum for remedial design activities, (BVSPC, March 29, 2000). However, the actual downgradient extent of the plume and the extent of the 100 ug/L contour line representing the MCL for chromium has not been completely defined along the southern plume boundary or at the downgradient edge of the plume due to property access constraints.
- It has been assumed that proposed new nested monitoring wells installed along the southern plume boundary and at the downgradient plume edge will not show high (>500 ppb Cr) levels of contamination.
- It has been assumed that no additional source areas exist downgradient of the site.

MODEL DOMAIN AND BOUNDARY CONDITIONS

The model domain is approximately 5 miles by 4 miles with the long axis (parallel to ground water flow direction) oriented approximately 104 degrees from north. The model boundaries were extended far from the site to ensure that the boundary conditions had negligible impact on the model simulations. Figure 1 shows the model domain in relation to the Ace Services site. The model grid consists of 110 columns and 85 rows with 4 layers. Grid spacing near extraction well locations was set at 10 ft by 10 ft and expanded outward in increments of 1.5 to a maximum of 1000 feet in the x-direction and to a maximum of 500 feet in the y-direction. Constant head values were assigned at the northwest and southeast boundaries to simulate ground water entering and discharging from the model domain. No-flow boundaries were assigned to the northern and southern boundaries because ground water flow is essentially parallel to these boundaries. Ground water recharge from leakage through the overlying strata was input to the top of layer 1. A value of 0.05 in/year was assigned to the model based on published recharge data for the High Plains aquifer.

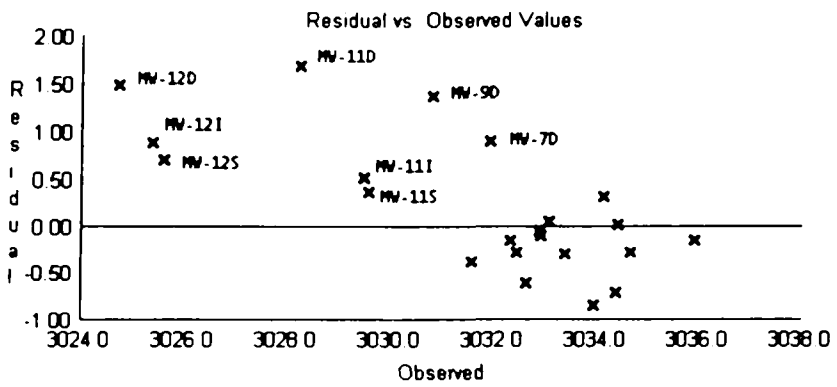
MODEL CALIBRATION

The model was calibrated in two steps through both steady-state and transient simulation. In the first step, appropriate head values were input for each constant head boundary and the model was run under steady-state conditions. The modeled heads were then compared to the observed head values collected from monitoring wells at the site prior to the pump test in August 2000. Figure 2 shows the modeled simulated ground water contours with no wells pumping. Hydrogeologic parameters (constant head, recharge, horizontal and vertical hydraulic conductivity) were adjusted until the calibration error was minimal. Table 1 shows the results of the steady-state model calibration. This first part of the calibration resulted in a ground water gradient of 0.0023. Figure 3 shows a comparison between observed heads and modeled residual values (the difference between the measured heads and the modeled heads). The residual head values show that the recharge and hydraulic conductivity values (calculated from the pumping test data) used in the calibration process are representative of site conditions and did not have to be adjusted during calibration.

A trend was observed during the steady-state calibration: the modeled heads on the north and western sides of the site were lower than the observed heads and the modeled heads on the far downgradient side of the site (the labeled wells) and were significantly higher than the observed heads. The magnitude of the error appeared to be skewed by the differences in head within the deep wells (layer 4) along the eastern end of the site. One explanation might be changes in lithology, which might influence the hydraulic conductivity within and between the intermediate (layer 2) and deep (layer 4) zones of the aquifer. However, subsurface geological data does not indicate significant changes in aquifer material across the site. Another possible explanation is the position of the well screens of the monitoring wells on the western side of the site. The intermediate and deep monitoring wells at well nests at MW-2 are screened very close together and have the smallest vertical hydraulic gradient. The intermediate and deep wells at well nest MW-1 are screened at higher elevations so the wells may in fact be screened in the same hydrologic zone (intermediate). These differences in head do not significantly impact the flow model.

The second part of the calibration involved inputting calibrated steady-state head values into a transient simulation identical to the 72-hour pumping tests that were conducted within the intermediate and deep water bearing zones in August 2000. During this part of the calibration, the coefficient of storage and specific yield values were adjusted within those layers to best match the observed aquifer response during each pumping test. The transient calibration data confirm that the hydraulic conductivity and recharge values used in the model accurately simulated flow within the aquifer. Table 2 shows the results of the transient calibrations.

Figure 3



Error Summary

Solution / Data set: briantun2c4 /

Observed parameter: head

Mean error: 0.20

Mean abs. error: 0.55

Root mean sq. error: 0.73

Table 1
MODFLOW Calibration Results

WELL	MODEL HEAD	OBSERVED HEAD	RESIDUAL HEAD	RESIDUAL SQUARED
MW-1S	3035.8	3035.9	-0.10	0.01
MW-2S	3034.4	3034.7	-0.3	0.09
MW-2I	3034.4	3034.41	0.01	0.0001
MW-2D	3034.4	3034.1	0.3	0.09
MW-4S	3032.0	3032.6	-0.6	0.36
MW-6S	3033.7	3034.4	-0.7	0.49
MW-7S	3032.8	3032.9	-0.1	0.01
MW-7I	3032.8	3032.9	-0.1	0.01
MW-7D	3032.8	3031.9	0.9	0.81
MW-8S	3033.1	3033.9	-0.8	0.64
MW-8I	3033.1	3033.4	-0.3	0.09
MW-8D	3033.1	3033.14	0.04	0.0016
MW-9S	3032.2	3032.3	-.01	0.01
MW9I	3032.1	3032.4	-.03	0.09
MW-9D	3032.1	3030.8	1.3	1.69
MW-11S	3030.0	3029.5	0.5	0.25
MW-11I	3029.9	3029.6	0.3	0.09
MW-11D	3029.9	3028.2	1.7	2.89
MW-12S	3026.3	3025.6	0.7	0.49
MW-12I	3026.2	3025.4	0.8	0.64
MW-12D	3026.2	3024.7	1.5	2.25

Table 2
Transient Calibration Results

WELL	MODEL HEAD	OBSERVED HEAD	RESIDUAL HEAD	RESIDUAL SQUARED
OB-2I	3027.19	3026.96	0.231	0.053
OB-1I	3027.36	3026.36	1.0	1.0
MW-9I	3024.73	3025.46	-0.72	0.518
OB-1D	3025.98	3025.37	0.617	0.38
OB-2D	3025.65	3025.56	0.098	0.0096
MW-9D	3023.67	3023.77	0.10	0.01

SENSITIVITY ANALYSIS

After the model was calibrated, a sensitivity analysis was conducted to evaluate the model uncertainty. Hydraulic conductivity and aquifer recharge were both increased and decreased by factors of 25 and 50 percent, and the residual sum of squares (difference or residual between the measured and the modeled head values squared) was calculated. The results of the sensitivity analysis are shown on Table 3. These results indicate that the calibrated model has the best match. The sensitivity results also indicate that the model is most sensitive to changes in hydraulic conductivity.

Table 3
Model Sensitivity Analysis

	RESIDUAL SUM OF SQUARES (FT^2)
Calibrated Model	0.69
Hydraulic Conductivity +/- 25%	0.88
Hydraulic Conductivity +/- 50%	1.18
Recharge +/- 25%	0.78
Recharge +/- 50%	0.80

EXTRACTION WELLFIELD DESIGN EVALUATION

Following calibration of the MODFLOW model, an active ground water extraction scheme was developed for containment and remediation of the contamination at and down gradient from the Ace Services site. Well locations were selected by incorporating property access considerations, position within the known extent of contamination, and pumping rate required to actively remediate the contamination. Property access was a major factor in extraction well location selection to minimize cost and property agreement delays.

Both MODFLOW and MODPATH programs were used to optimize extraction well locations and pumping rates. Ground water pumping rates were simulated at different locations within the different model layers using the calibrated steady-state heads to generate ground water contour plots for each layer. A set of optimal pumping scenarios were developed and used by the MODPATH particle tracking program to

further define extraction well positions and pumping rates. Particle travel times of 3 years were used as a benchmark when considering the well locations for active contaminant removal. The three year time period was used because most of the extraction well locations simulate capture of the edges of the 100 ug/L plume in less than 2 years. However, certain well locations require a minimum of 3 years to capture ground water from the edges of the 100 ug/L contour, indicating that it will require approximately 3 years to remove one pore volume within the area encompassed by the plume.

As outlined in the Technical Memorandum for Remedial Design (BVSPC, March, 2000), three distinct zones of contamination were identified through the sampling activities. The largest aerial extent of chromium contamination occurs within the intermediate zone of the aquifer. This zone will also require the greatest number of extraction wells to capture the contamination. The shallow zone and the deep zone will require a fewer number of extraction wells. The proposed total combined pumping rate and the proposed number of extraction wells differs significantly from the original FS modeling study due primarily to the large increase in the vertical and lateral extent of the plume.

Simulations within the shallow zone (layer 1) resulted in three optimal pumping scenarios that would sufficiently capture the maximum extent of contamination in an acceptable time frame. One limitation within the upper most portion of the aquifer is saturated thickness. Within the upper zone (layer 1) there exists only 30-35 feet of saturation. As a result, ground water extraction rates are limited to the 20 to 30 gpm range in order to maintain a steady pumping rate. These lower extraction rates limit the cone of influence generated by the extraction wells. Figures 4, 5, and 6 show the optimum well configurations and pumping rates predicted within the shallow zone of the aquifer. It should be noted however that these scenarios, simulated by extracting water from the shallow zone (layer 1), will be accomplished in the field by extraction wells screened within both the shallow and intermediate zones. The total pumping rate expected to capture and contain the shallow zone contamination is expected to be 65 – 85 gpm. It should be noted that the 25 gpm that is simulated at the PWS-8 well location may vary because the actual discharge from the upper zone during pumping at PWS-8 has not been determined.

Four optimal pumping scenarios were developed for the intermediate zone (layer 2) remediation. The intermediate zone is the most transmissive interval within the aquifer in the vicinity of the site. Figures 7, 8, 9, and 10 show the well configurations and pumping rates that most efficiently capture the contamination within the intermediate zone. A series of 5 or 6 extraction wells was used to maximize the area of capture and minimize the time required for treatment of the entire plume. The extraction well east of the plume, as shown in Figures 7, 8, and 9, is not located within the 100 ug/L contour. This additional well was simulated because of data from the residential wells indicates the presence of contamination, but the vertical distribution of the contamination in this area is not known because the residential wells are screened within multiple zones. Extraction well discharge rates vary from 35 gpm to 100 gpm depending upon the zone of capture. The predicted total discharge from the intermediate zone scenarios ranges from 285- 335 gpm. It also should be noted that the discharge of 50 gpm that is simulated from the intermediate zone of PWS-8 may vary due to the lack of information on that multi-screened well. The majority of the contaminant load for the treatment plant will come from the intermediate zone.

The simulated extent of capture within the deep zone (layer 4) is illustrated in Figures 11 and 12. Pumping rates vary from 35 to 100 gpm depending upon the position within the plume. Cones of influence are much larger within this zone because it behaves as a semi-confined zone within the aquifer. Estimated total discharge expected to actively remediate the deep zone range from 185 to 300 gpm. The discharge from the lower screen zone within PWS-8 was estimated and contributes to the uncertainty of the actual pumping rates that will be required within the deep zone.

EXTRACTION WELLFIELD DESIGN RECOMMENDATIONS

The well configuration shown on Figure 13 illustrates the optimal shallow zone pumping scheme. Extraction wells EX-2S and PWS-8 have already been installed, therefore shallow wells EX-3S and EX-4S will need to be installed.

The optimal extraction well scheme for the intermediate zone is shown on Figure 14. This scheme incorporates 6 wells pumping at a combined total of 335 gpm. Wells EX-2I and PWS-8 were installed during the remedial design investigation and pumping test activities. Wells EX-1I, EX-3I, EX-4I, and EX-5I will need to be installed in the intermediate zone with an option for a seventh well. This optional well may be installed east of EX-5I if additional analytical data indicate that the extent of the plume is further east than presently indicated.

Figure 15 shows wells EX-1D, PWS-8, EX-2D, and EX-3D pumping a total of 260 gpm for complete capture of the deep zone contamination. Well EX-1D and EX-3D will need to be installed. Wells EX-2D and PWS-8 are already installed.

The proposed configuration for all of the extraction wells is illustrated on Figure 16, assuming property access is granted for each location. Proposed extraction well design specifications are presented in Table 4. This report estimates a total extraction rate of approximately 690 gpm. At this pumping rate it is expected that one pore volume of the aquifer will be removed approximately every 3 years. However, it is common to require flushing several (3 to 5) pore volumes through contaminated media to reduce contaminant concentrations to cleanup goals. The total time to actively remediate the chromium contamination to acceptable levels is estimated to be approximately 12 years. Due to the variability within the multi-layered aquifer with respect to both the horizontal and vertical distribution of contaminants, it is recommended that the final plant design influent rate incorporate some flexibility to allow for a 15% to 20% increase in flow. Should the results of this modeling study be incorporated into a final design, 8 additional extraction wells at four different locations (2 shallow, 4 intermediate, and 2 deep) will be needed to satisfy the active remediation goals. Additional nested monitoring wells will also be needed to be installed to ensure that contaminant capture is occurring and to monitor contamination reduction. The total number and final pumping rates of the extraction wells required to meet the site remediation objectives may differ from the predictions presented in this report.

REFERENCES

Black & Veatch, October, 2000, Pumping Test Memorandum, Ace Services, Colby, Kansas, USEPA Technical Memorandum.

Black & Veatch, March 29, 2000, Remedial Design Sampling Activities, Ace Services, Colby, Kansas, USEPA Technical Memorandum.

Miller, J.A., and Appel, C.L., 1997, Ground Water Atlas of the United States, Kansas, Missouri, Nebraska, U.S. Geological Survey Hydrologic Atlas 730-D.

Table 4
Proposed Extraction Well Design Specifications

Extraction Well	Screened Interval (bgs) (aquifer zone)	Pumping Rate (gpm)	Well Diameter (inches)
EX-1I	165' – 195' intermediate	35 gpm	8"
EX-1D	210' – 235' deep	35 gpm	8"
PWS-8	128' – 138' shallow 145' – 150' intermediate 190' – 200' intermediate 215' – 240' deep	145 gpm	12"
EX-2S	100' – 130' shallow	25 gpm	6"
EX-2I	145' – 195' intermediate	100 gpm	8"
EX-2D	195' – 235' deep	100 gpm	8"
EX-3S	120' – 140' shallow	25 gpm	6"
EX-3I	150' – 200' intermediate	50 gpm	8"
EX-3D	210' – 230' Deep	50 gpm	8"
EX-4S	110' – 140' shallow	25 gpm	6"
EX-4I	180' – 200' intermediate	50 gpm	8"
EX-5I	170' – 200' intermediate	50 gpm	8"
Total Well Field Pumping Rate		690 gpm	

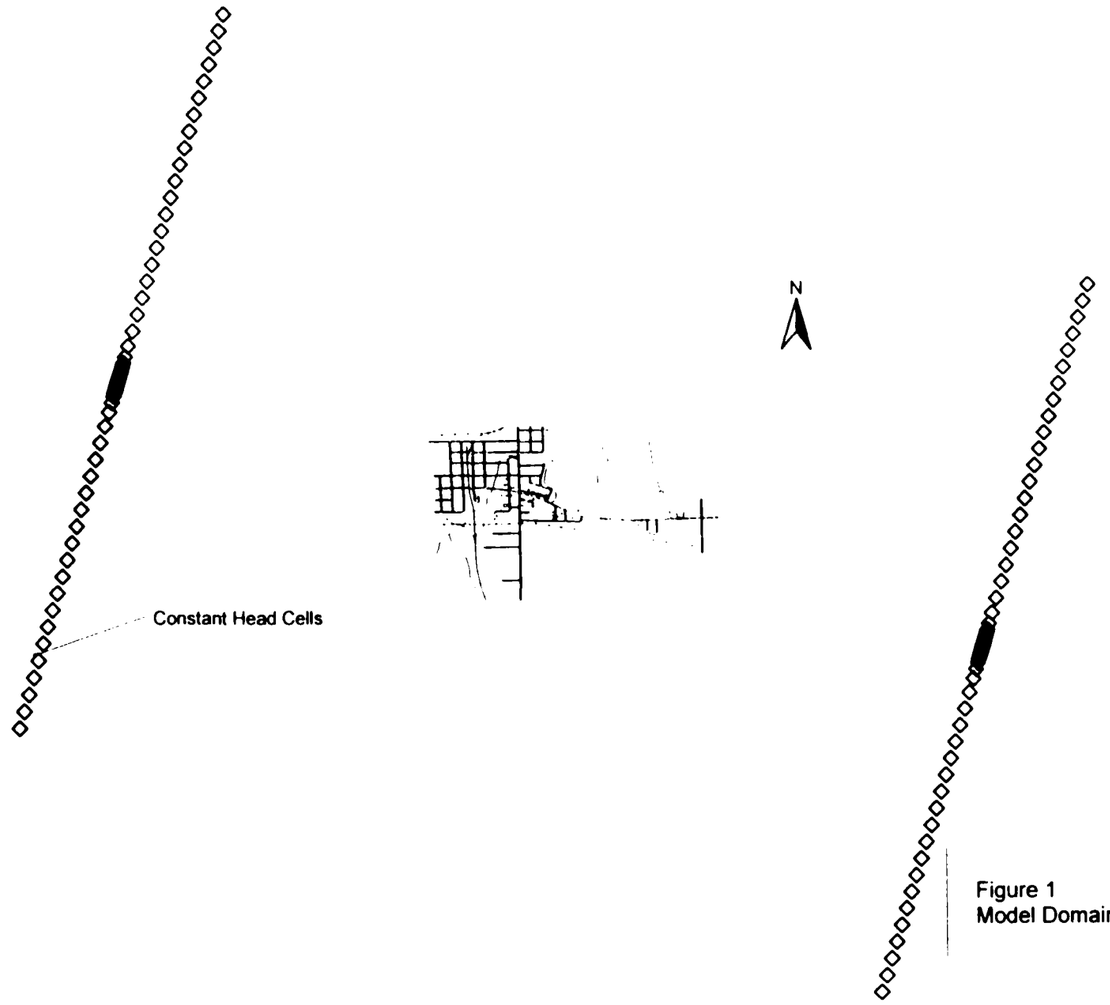


Figure 1
Model Domain

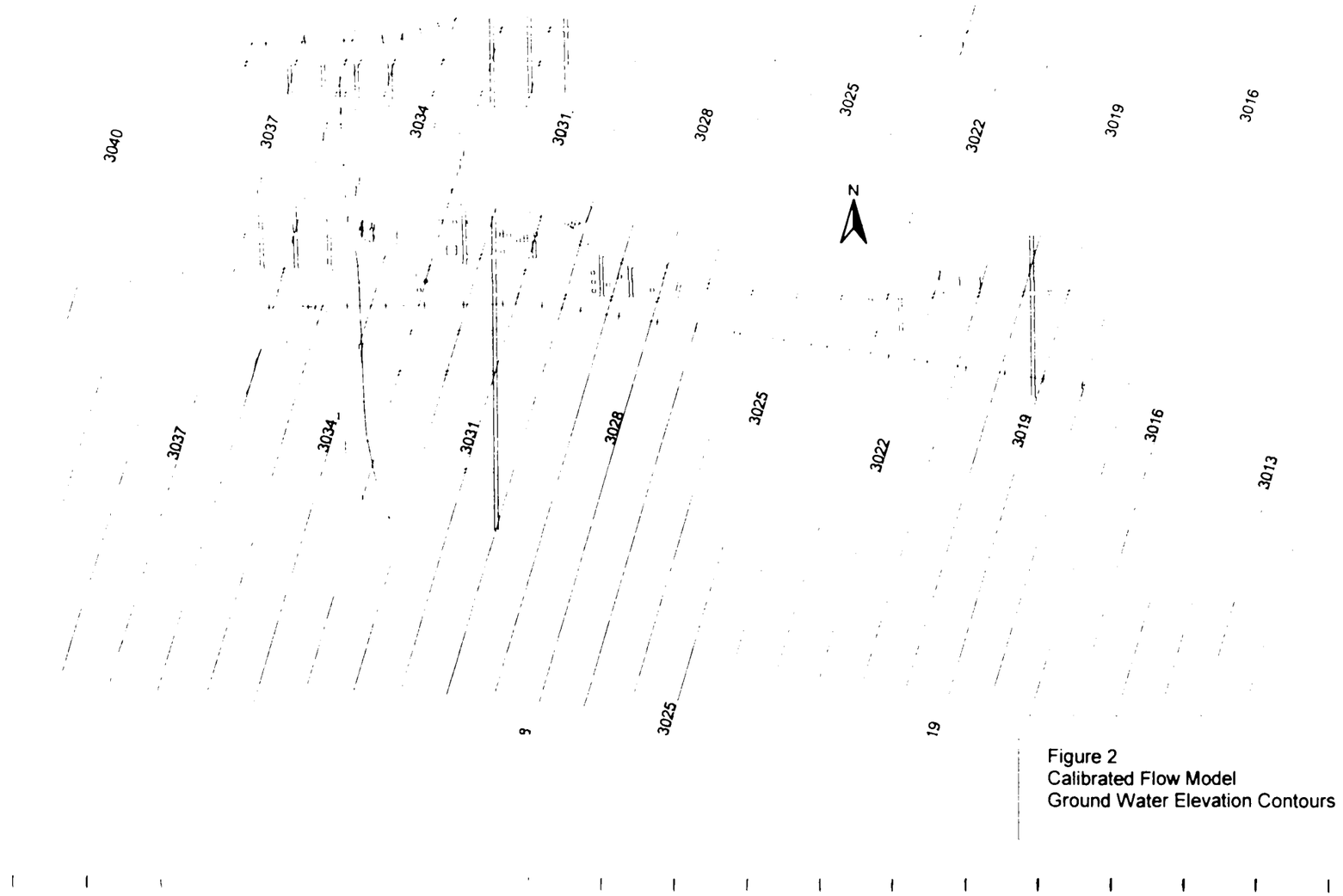


Figure 2
Calibrated Flow Model
Ground Water Elevation Contours

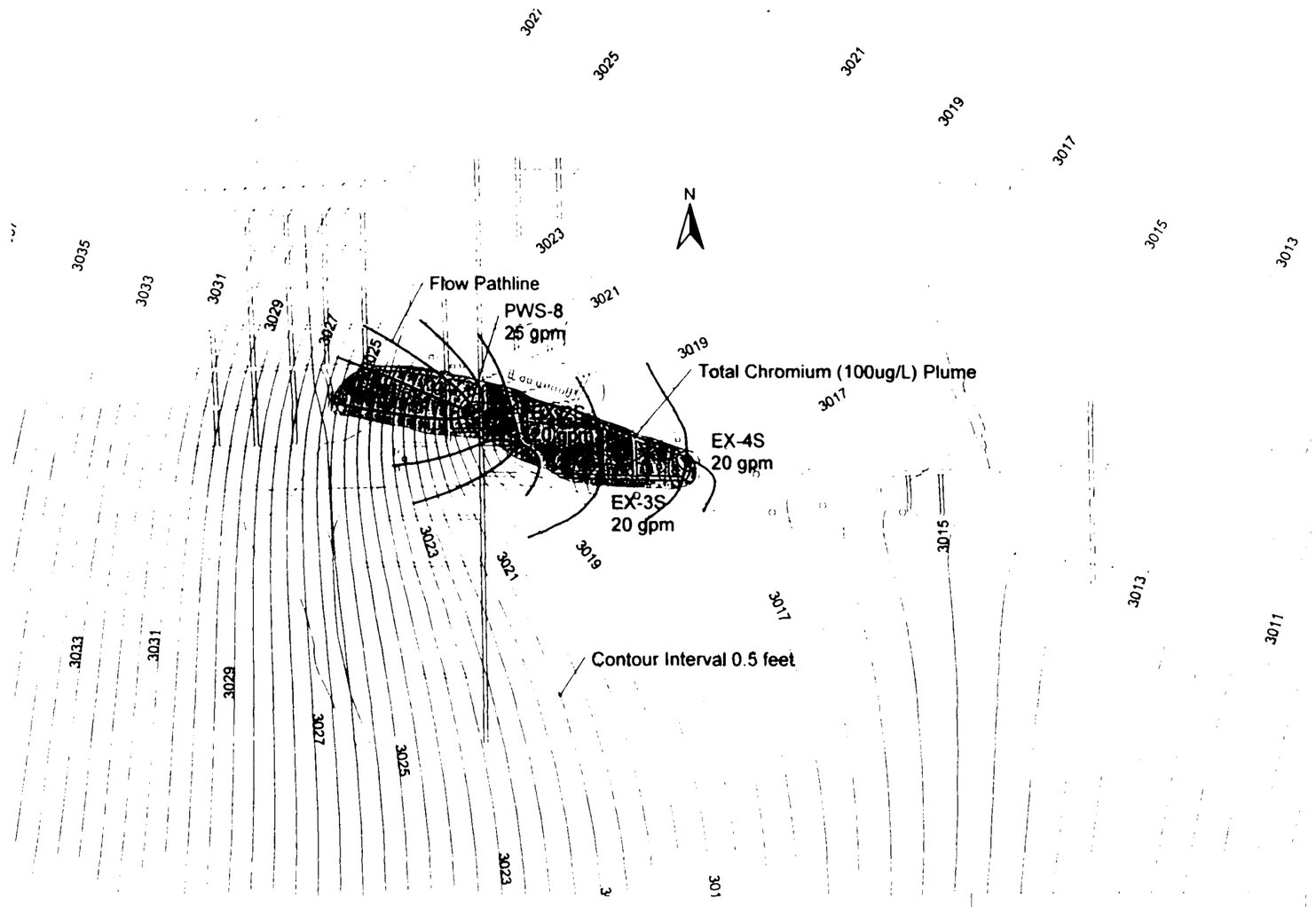


Figure 4
Shallow Zone
Total Discharge 85 gpm
3-yr Contaminant Capture Zone

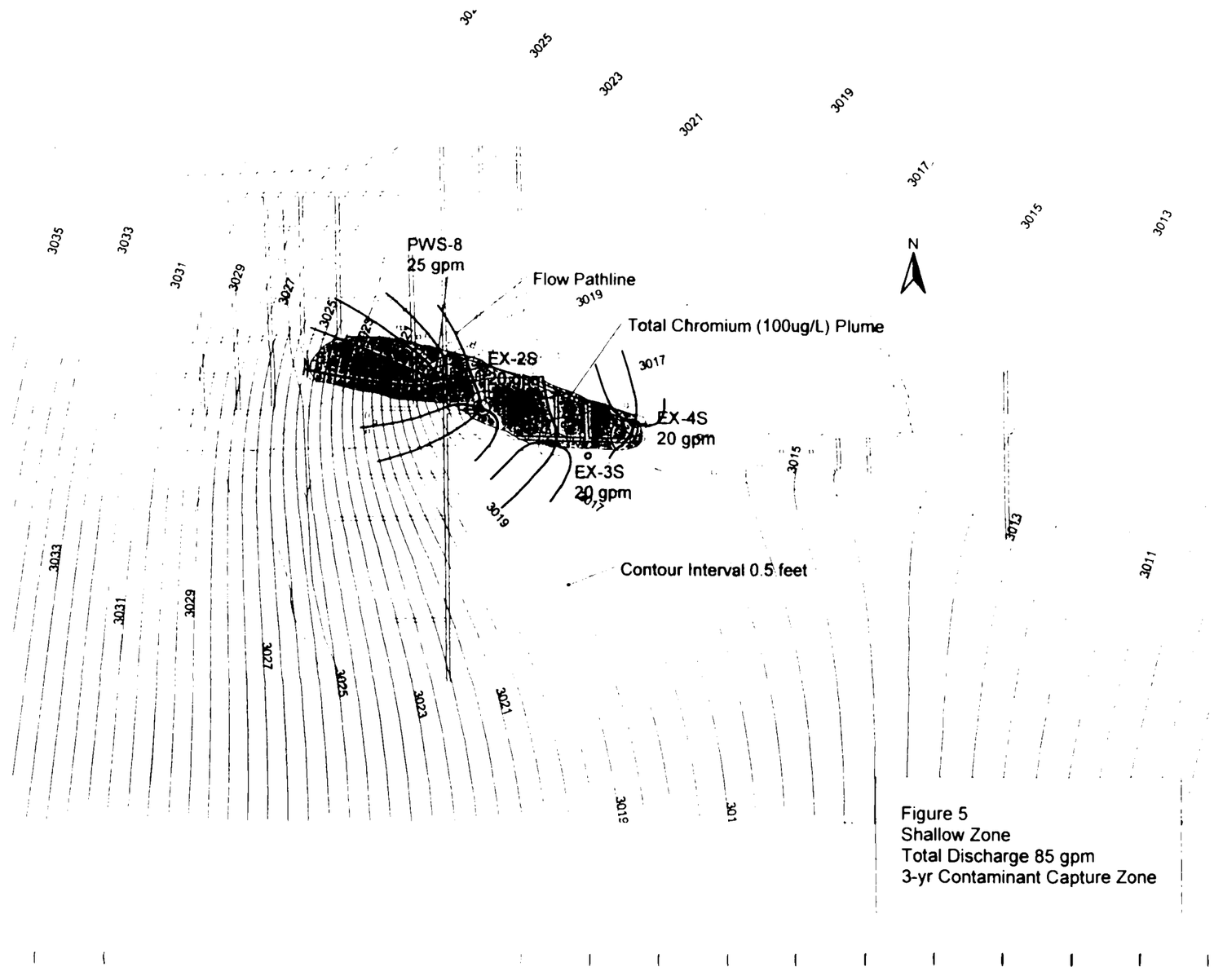


Figure 5
Shallow Zone
Total Discharge 85 gpm
3-yr Contaminant Capture Zone

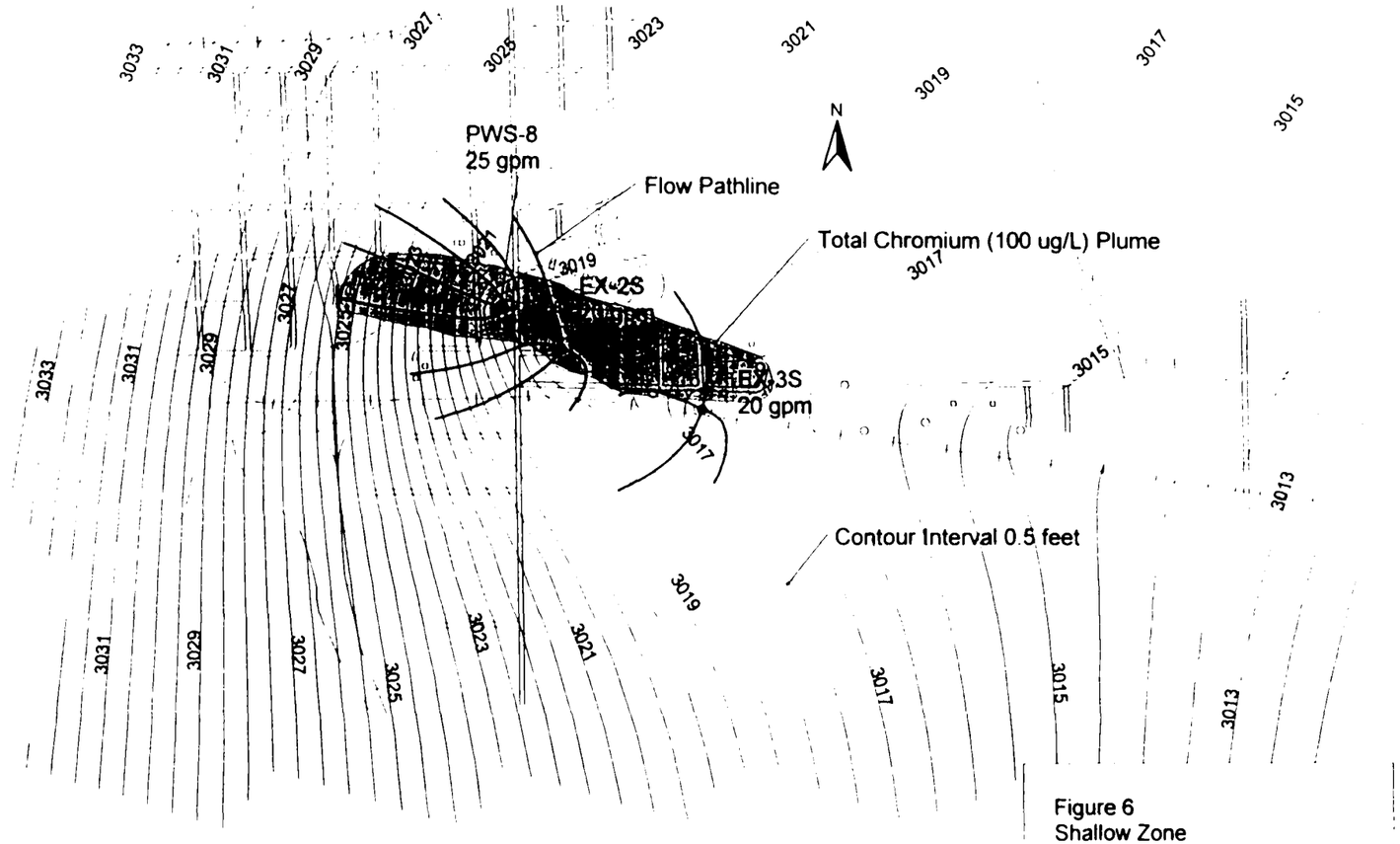


Figure 6
Shallow Zone
Total Discharge 65 gpm
3-yr Contaminant Capture Zone

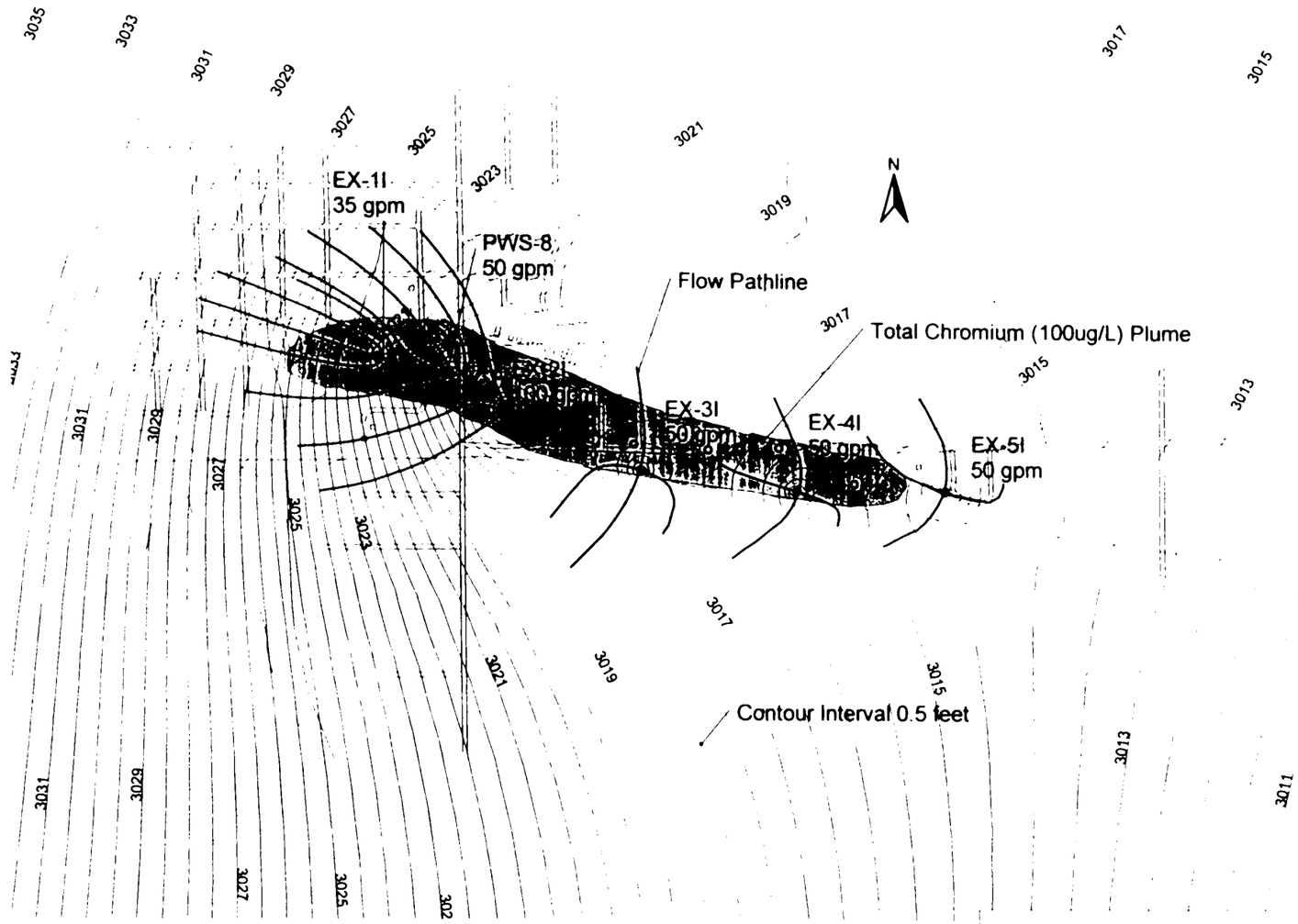


Figure 7
Intermediate Zone
Total Discharge 335 gpm
3-yr Contaminant Capture Zone

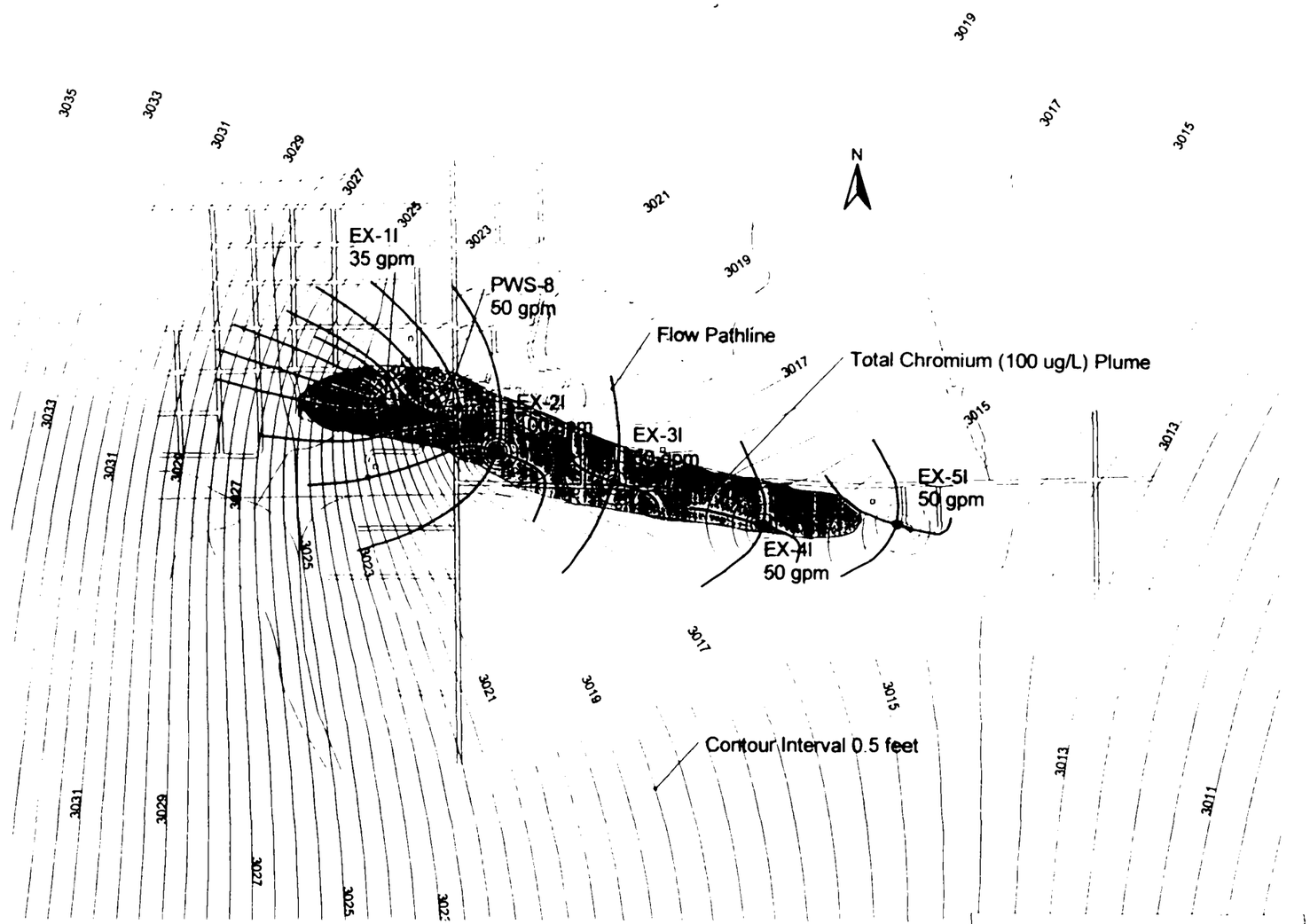


Figure 8
Intermediate Zone
Total Discharge 335 gpm
3-yr Contaminant Capture Zone

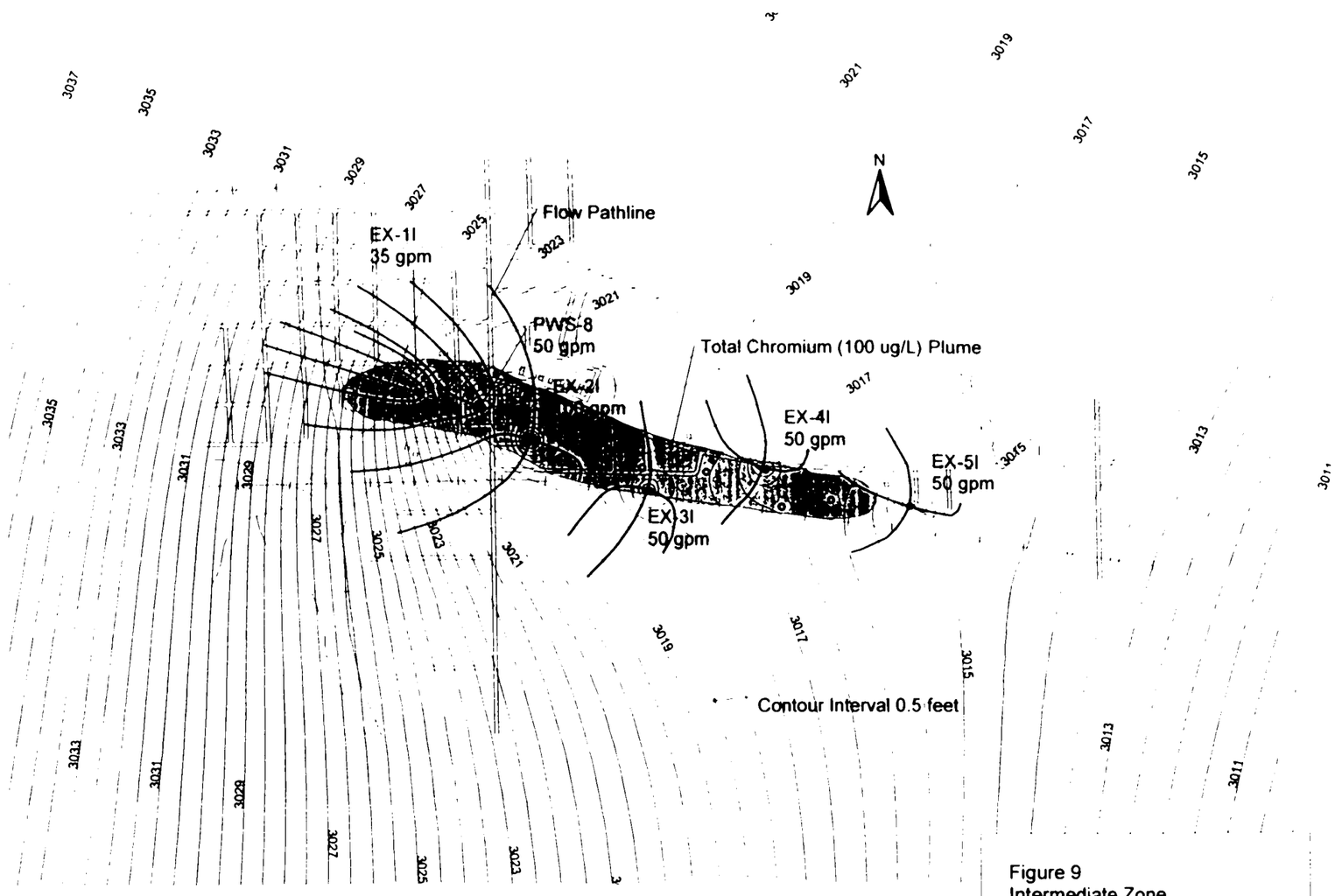


Figure 9
Intermediate Zone
Total Discharge 335 gpm
3-yr Contaminant Capture Zone

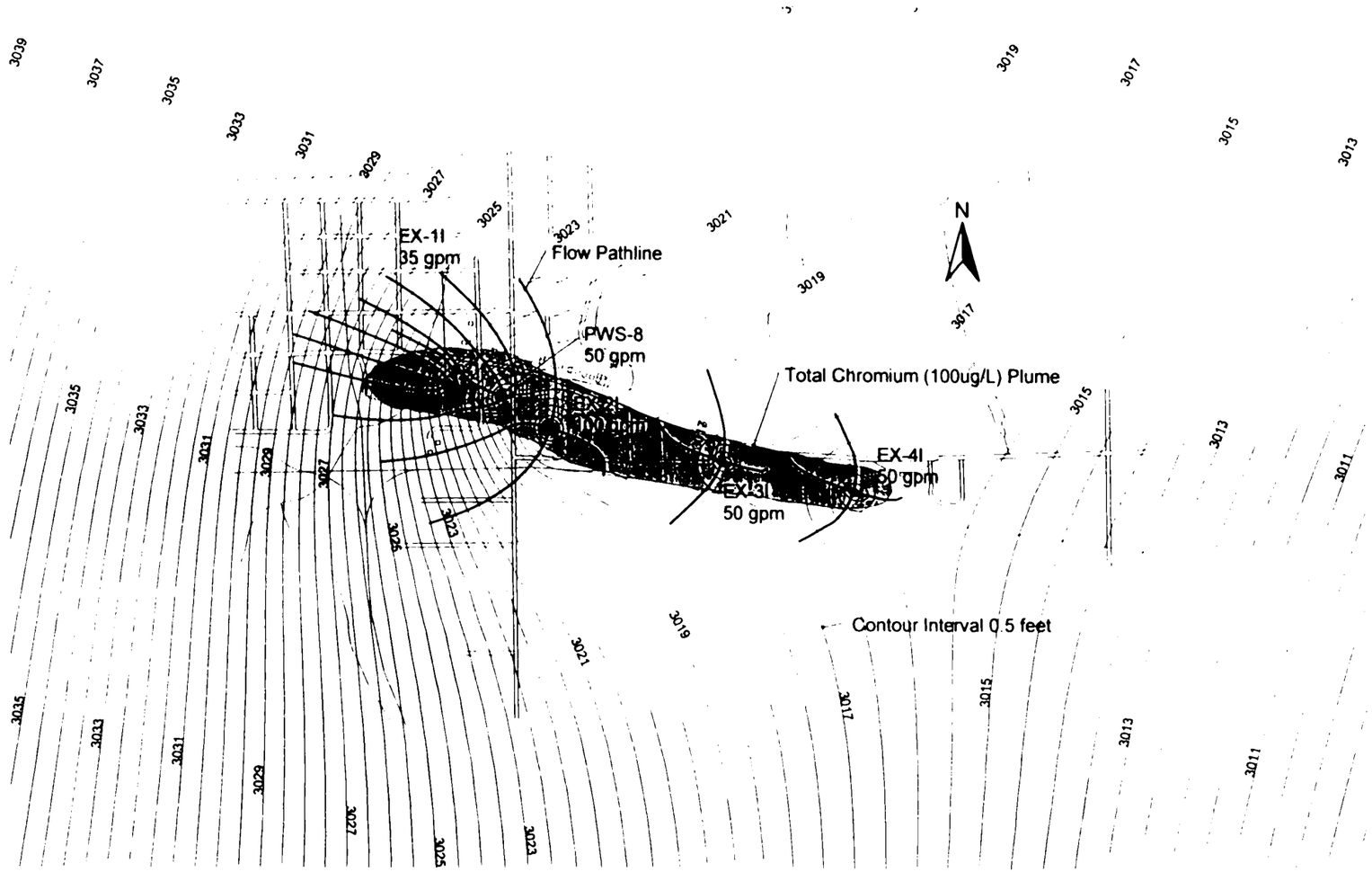


Figure 10
Intermediate Zone
Total Discharge 285 gpm
3-yr Contaminant Capture Zone

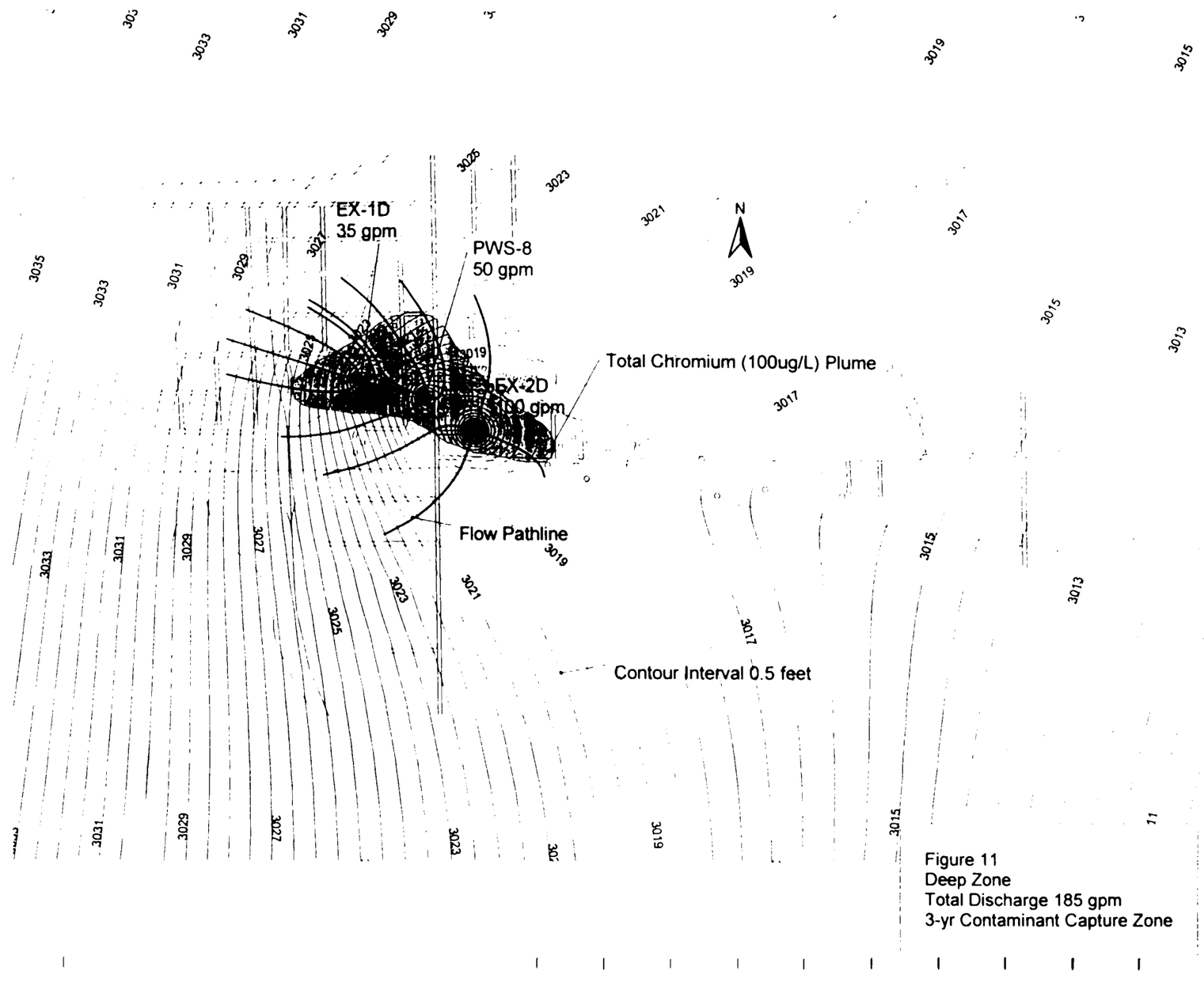


Figure 11
Deep Zone
Total Discharge 185 gpm
3-yr Contaminant Capture Zone

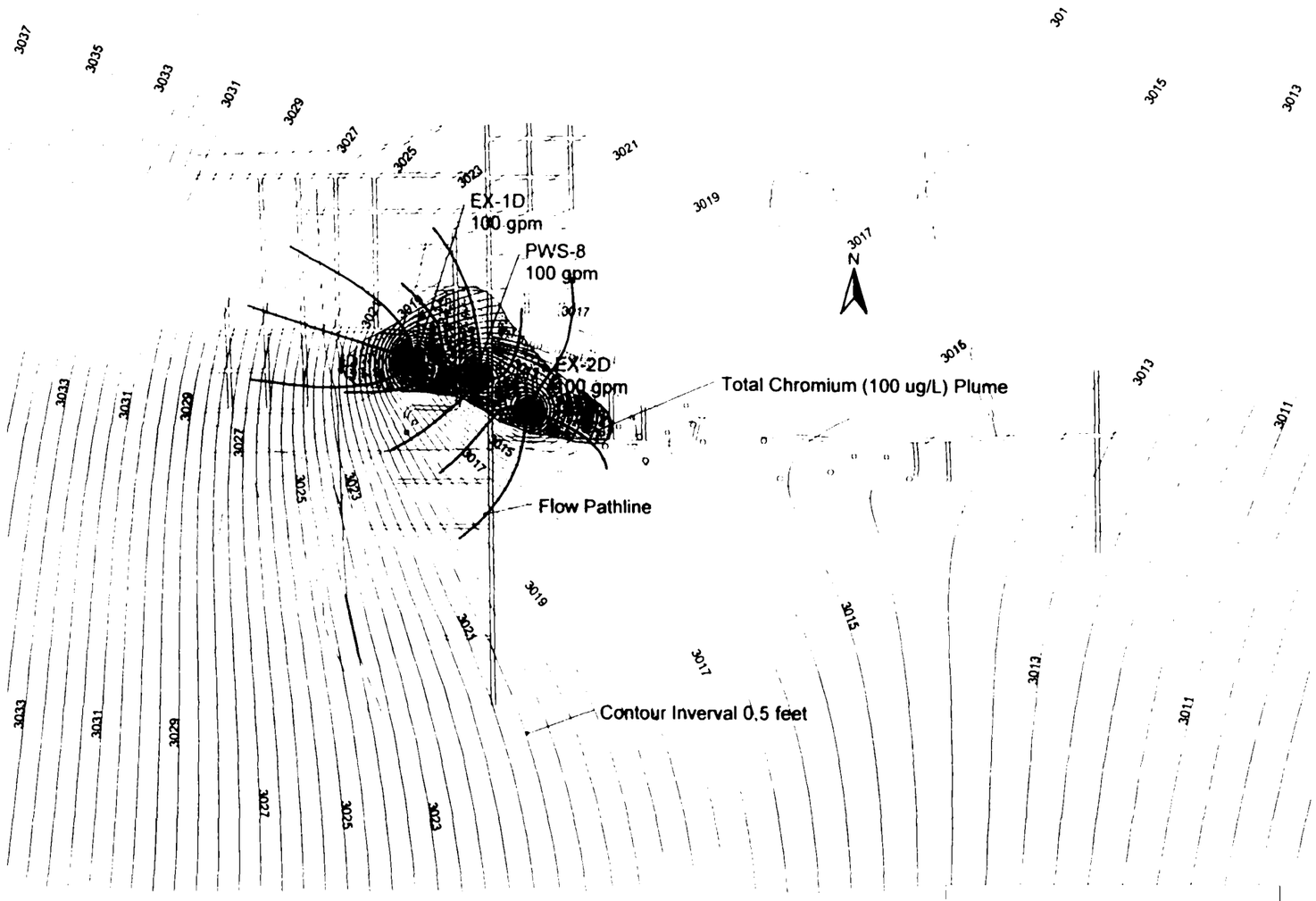


Figure 12
Deep Zone
Total Discharge 300 gpm
3-yr Contaminant Capture Zone

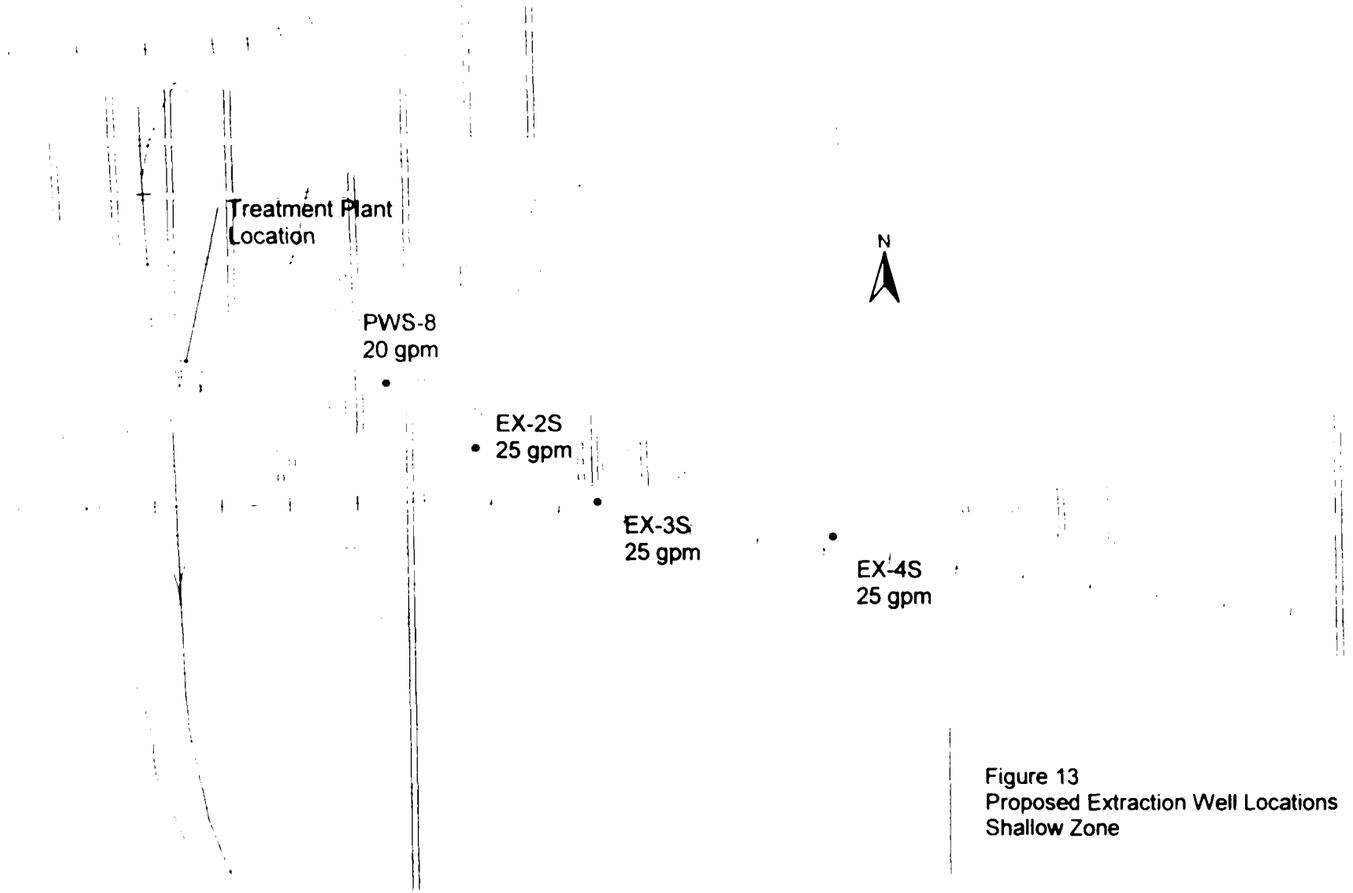


Figure 13
Proposed Extraction Well Locations
Shallow Zone

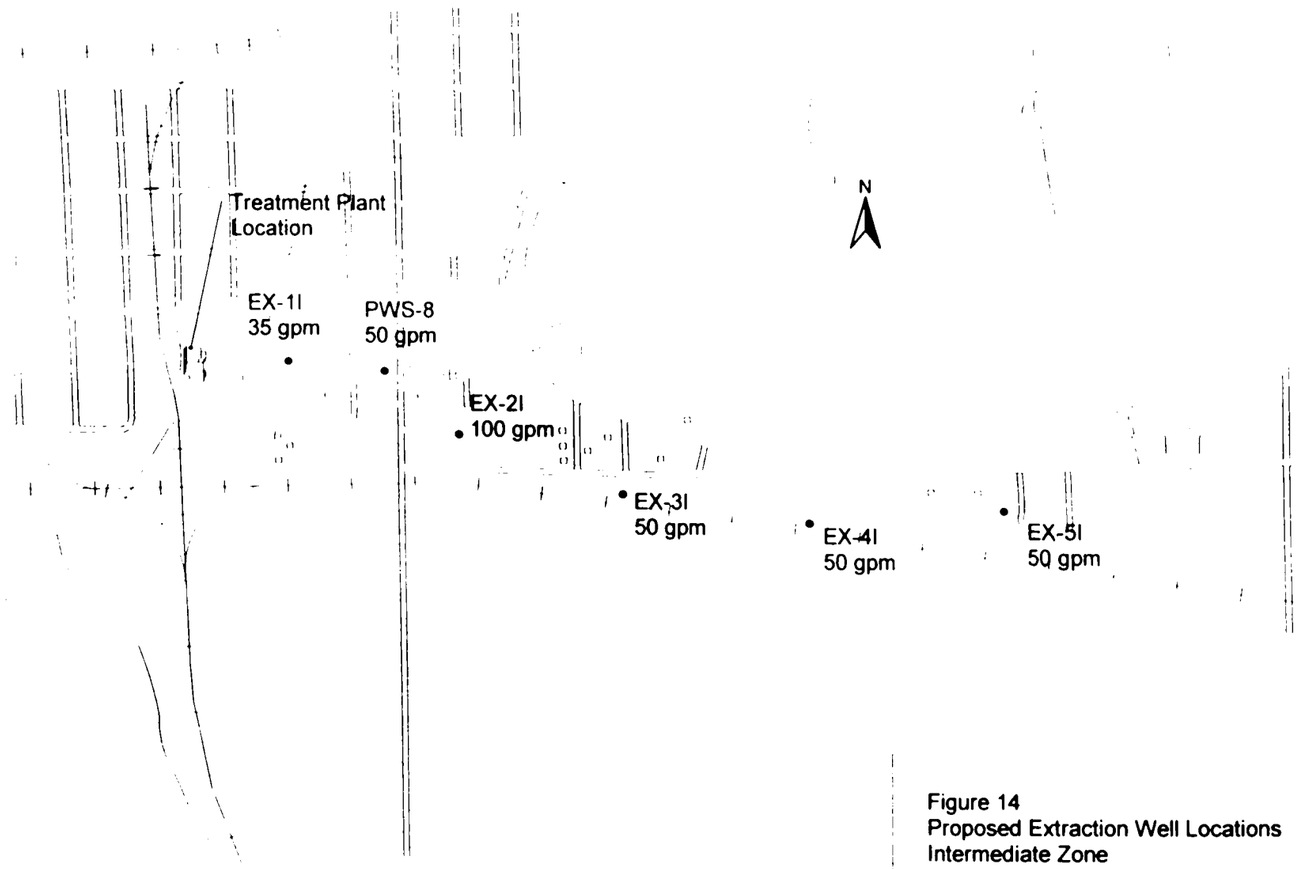


Figure 14
Proposed Extraction Well Locations
Intermediate Zone

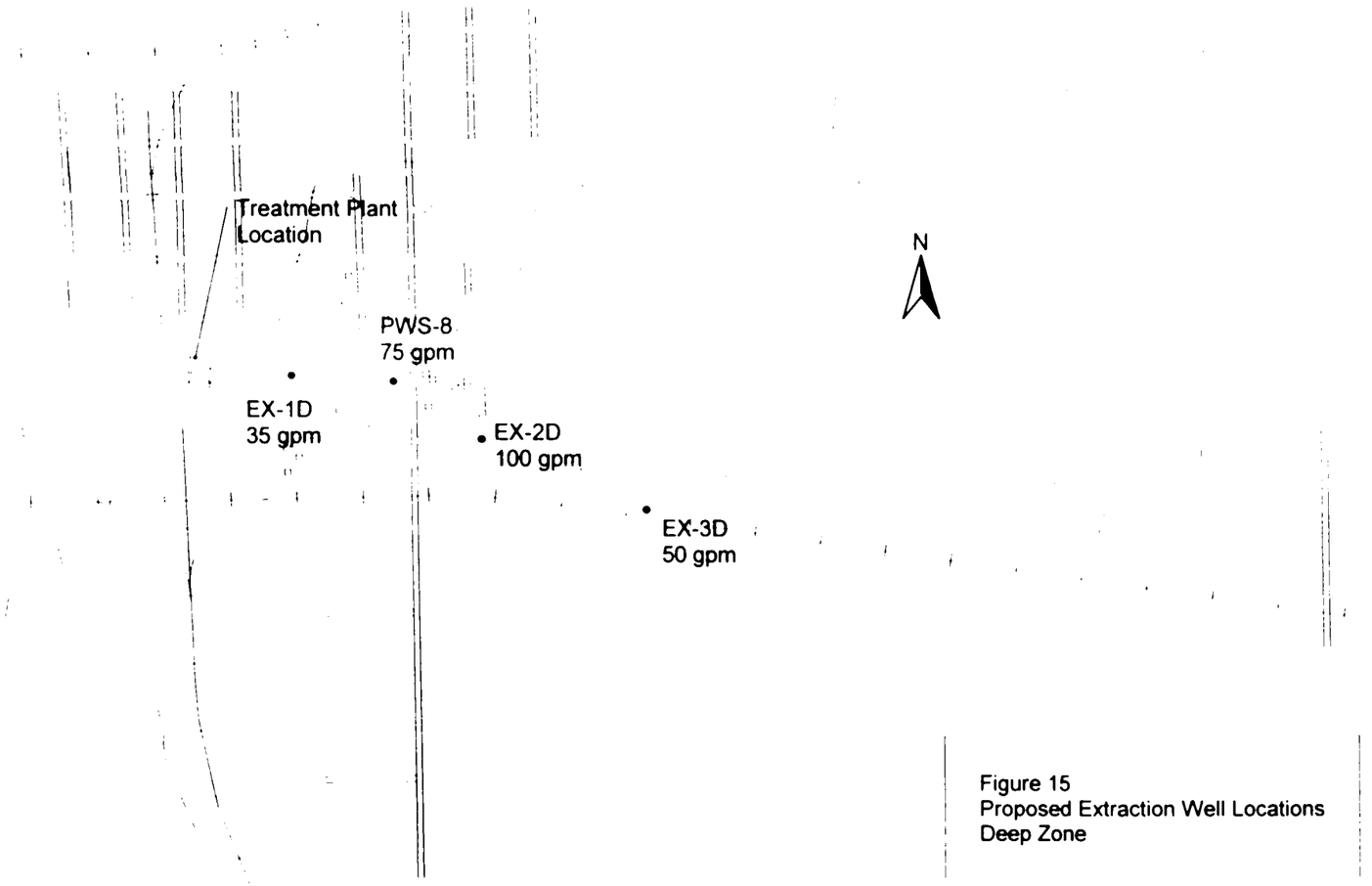


Figure 15
Proposed Extraction Well Locations
Deep Zone

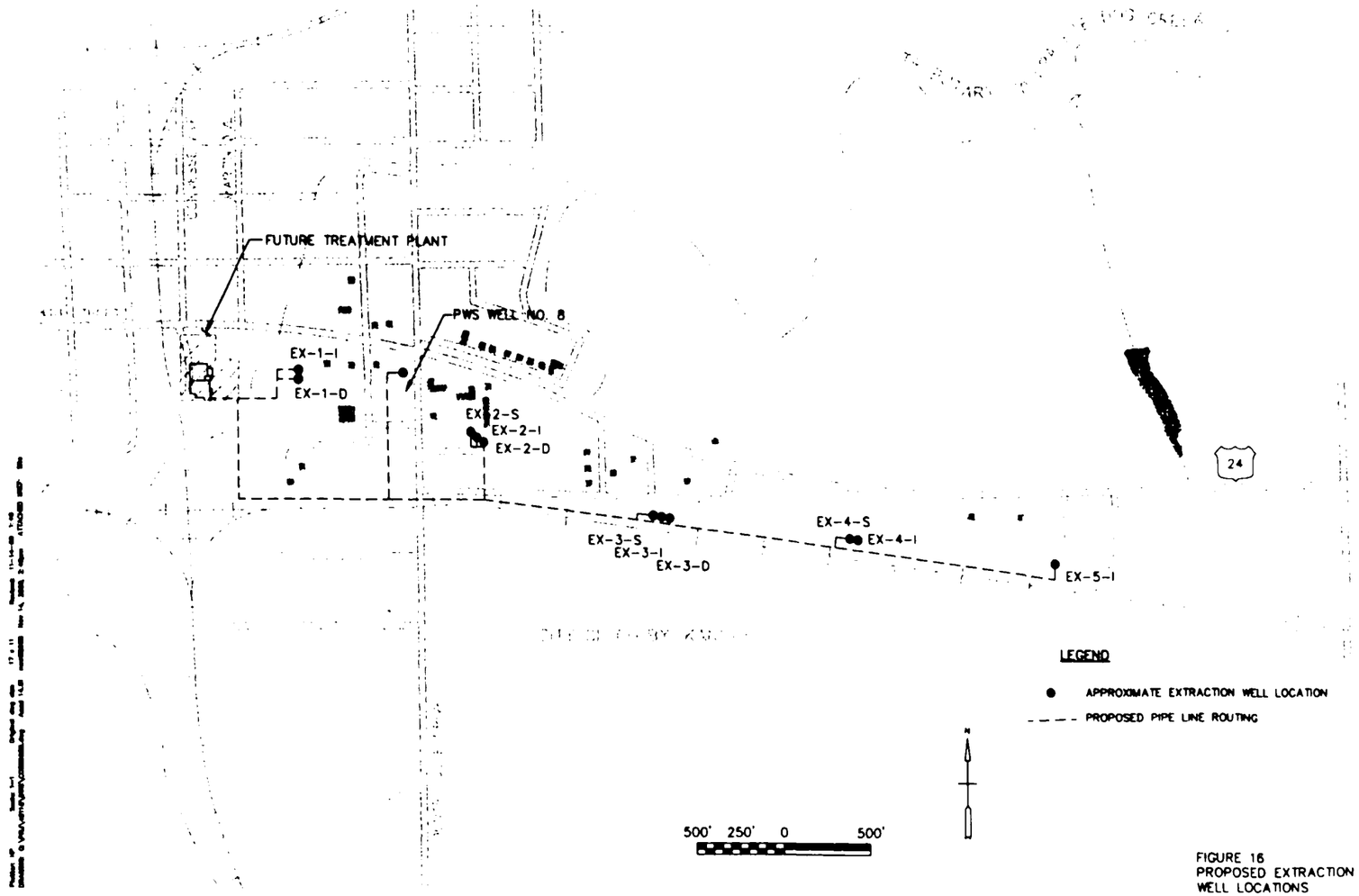


FIGURE 16
PROPOSED EXTRACTION
WELL LOCATIONS
ACE SERVICES SITE

Appendix J

EPA and KDHE Comments and Responses on *Technical Memorandum Remedial Design* ***Sampling Activities, Ace Services*** *Site, Colby, Kansas, March 29, 2000.*

File C.7
46118

BLACK & VEATCH

6601 College Boulevard
Overland Park, Kansas 66211 USA

Tel (913) 458-2900

Black & Veatch Special Projects Corp.

USEPA Region VII
Ace Services Site

BVSPC Project 46118.126
BVSPC File
May 12, 2000

Mr. Bob Stewart
USEPA Region VII
901 N. 5th Street
Kansas City, Kansas 66101

Subject: EPA Contract No. 68-W5-0004
W.A. No. 034-RDRD-07GE
Responses to KDHE
Review Comments for *Technical Memorandum Remedial Design Sampling Activities, Ace Services Site, Colby, Kansas*

Dear Mr. Stewart:

The following are responses to review comments for the *Technical Memorandum Remedial Design Sampling Activities, Ace Services Site, Colby, Kansas (March 29, 2000).* The comments were provided by the Kansas Department of Health and Environment (KDHE), April 18, 2000. The review comments are restated in italics, followed by responses from Black & Veatch Special Projects Corp. (BVSPC).

1. *KDHE/BER requests an electronic copy of the site map when it is completed.*

   An electronic copy of the site map will be forwarded to KDHE when the survey is final.

2. *Pages 3-5 and 3-9, Sections 3.1.5 and 3.3.2. Newly installed wells were sampled immediately after the wells were developed. The well development procedure, however, only removed "at least half as much water as was introduced during drilling". From the discussion in the report, there appears to be the potential that samples from the new wells may not be representative of aquifer conditions. Is data from the new wells consistent with the old wells? For example, consider the results from MW-8-D (89 mg/L total Cr) compared to PWS well No. 8 (1930 mg/L total Cr) which is immediately adjacent. The report should discuss the implications of the well development procedure relative to any theoretical effects on the quality of the samples.*

   Well development consisted of surging and pumping the well using an electric

submersible pump. The temperature, pH, specific conductivity, turbidity, dissolved oxygen (DO), and oxidation reduction potential (ORP) was monitored during pumping. Pumping continued until the field parameters stabilized and the water was clear and free of fines at which time the samples were collected.

Additional water was also removed during well construction. Approximately 400 gallons of water was displaced and collected from each boring during installation of the well casing, filter packs, bentonite seal, and bentonite grout. This information will be included in the report.

This same development/sampling method was used for all newly installed wells. Analytical results of total chromium in groundwater samples ranged from non-detect to 2740 ug/L, indicating dilution of groundwater by introducing drilling fluid (potable water) was not significant and that the samples are representative of groundwater quality.

All wells will be sampled again during the final stages of the remedial design. Analytical results of the two rounds of sampling will be compared and, if necessary, extraction well locations could be relocated to accommodate changes in concentrations and limits of the plume.

3. *Page 5-1, Section 5-2, last sentence. Conclusive evidence has not been gathered to show that leaching of residual chromium from the unsaturated zone to groundwater is no longer occurring. Showing that chromium concentrations in the unsaturated zone decrease with depth only shows the depths of chromium contamination in the unsaturated zone. Migration of chromium to groundwater does not occur through movement of the mass of chromium downward through the unsaturated zone, but rather by dissolution of chromium as water percolates downward to the water table. Chromium concentrations in groundwater 200 to 500 feet downgradient of Ace Services still range from 500 to 1130 mg/L. During the removal of chromium sludge in 1994, it was recognized that the bottom of the soil contamination had not been reached even after digging 20 feet below the floor of the Ace Services building (EPA Site Progress Report, July 13, 1994). If the source has been significantly reduced, then with time chromium concentrations in groundwater near the source area should diminish while higher concentrations continue to exist downgradient. Enough time may not have passed to see such a trend, however, since remediation of groundwater will not be successful without significant source reduction, further analysis should be conducted to assess whether or not the source area continues to be active.*

Ceasing discharge of wastewater and the excavation of contaminated sludge and soils has removed the primary sources of groundwater contamination. It is not evident that the remaining contaminants will migrate significantly to the groundwater.

Elevated chromium levels in the surface soil of the lagoon area was addressed when the surface soil was remediated to cleanup levels (1500 mg/kg total chromium and 500 mg/kg lead) during the 1994 removal action. A monitoring well (MW-10-P) was installed near the former lagoon and screened at a depth of 30 feet (BVSPC 1999) to evaluate the possibility of a contaminated perched groundwater zone. Well MW-10-P has been dry on every water level measurement event indicating the perched groundwater zone is no longer present.

As described in comment #6 of the Responsiveness Summary of the ROD, EPA will conduct further investigation of the subsurface soil. Initial efforts including subsurface soil sampling and installation of well MW-10-P has been performed. Additional efforts will continue up to and after the groundwater extraction program has begun. This will allow EPA to judge the effectiveness of the extraction and then determine if the soils have a continuing source impact on the groundwater quality. A decision concerning further remedial action of the soil will be made before or during the 5-year review

Further evaluation of significant leaching of contaminants from the lagoon area soils will be made by sampling groundwater from each of the three screened intervals of the Ace Recovery well. The groundwater sampling will be performed quarterly for the first year as part of the remedial action as described in the ROD or more frequently as necessary to evaluate contaminant trends in the groundwater. Analytical results from groundwater samples collected from the Ace Recovery well will identify any trends in contaminant leaching. It is estimated that the contaminant concentrations will decrease with time. In addition, well MW-10-P will be monitored to verify that the perched groundwater condition is still no longer present.

4. *Figures 5-7 and 5-8. The extent of chromium contamination above the Maximum Contaminant Level (MCL) within shallow and intermediate depths of the groundwater aquifer has not been defined. The extent needs to be known to determine if the plume can be captured by the proposed extraction wells and to determine if additional receptors, such as wells R-7 and R-8, might be at risk. KDHE/BER recommends installation of additional wells*

east of MW-12 to define the downgradient extent of chromium contamination. KDHE/BER also recommends installation of additional wells south of the railroad line because the direction of groundwater flow indicates that the chromium plume should be oriented in a more southeasterly direction from the source area. Most receptors to the plume are located along either side of Highway 24, which led us to position monitor wells along the same east-west directional trend. This has resulted in a picture of the plume that follows the highway, rather than the groundwater gradient. To determine if the plume will be captured by the extraction wells, the spatial distribution of the plume needs to be known. See enclosures 1 and 2 for the areas where additional wells should be located.

Current data have delineated the plume extent and concentration for the purposes of remedial design. However, to further ensure optimization of the placement of extraction wells additional monitoring wells will be installed as KDHE requests. It is proposed that two additional groundwater monitoring well nests consisting of shallow and intermediate depth wells be installed south of the railroad tracks. Proposed locations for the two well nests are illustrated on the attached figure. Final locations of the wells will be limited to property access restrictions.

If you have any questions or require any additional information, please call me at (913) 458-6583.

Sincerely,

BLACK & VEATCH SPECIAL PROJECTS CORP.

Gary L. Felkner
Site Manager

cc: Randy Carlson, KDHE
File

Enclosure 1

proposed area of additional well

● MW-13(S-I)
Proposed Well Location

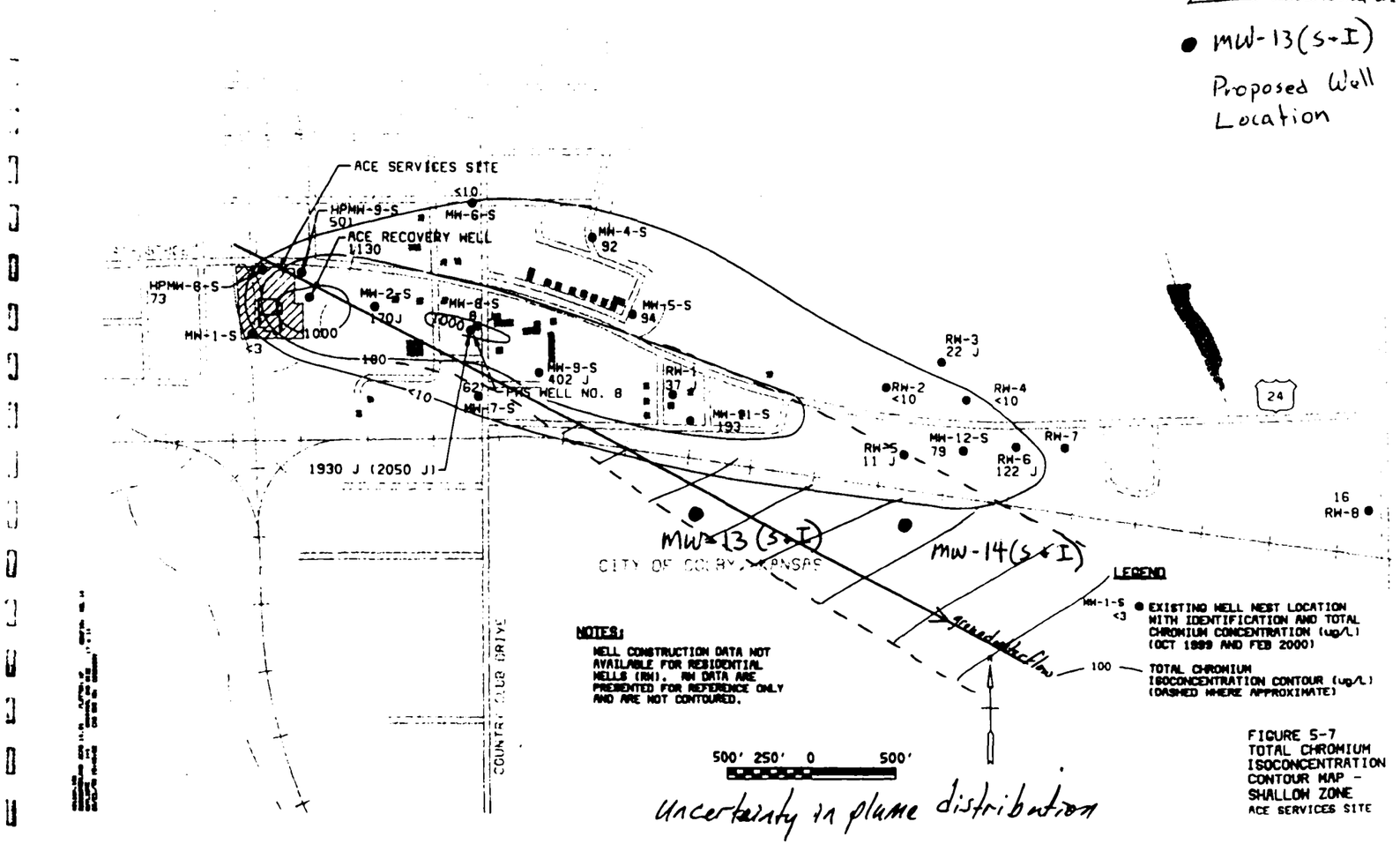


FIGURE 5-7
TOTAL CHROMIUM ISOCONCENTRATION CONTOUR MAP - SHALLOW ZONE
ACE SERVICES SITE

uncertainty in plume distribution