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FINAL
Groundwater Investigation Report
Site 1 - Former Mixed Waste Burial Pits
United States Department of Agriculture (USDA)
National Animal Disease Center (NADC)

Ames, Iowa

United States Department of Agriculture

Prepared for:
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RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

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ACRONYMS AND ABBREVIATIONS

AFSC	Army Field Support Command
AMSL	above mean sea level
ANL	Argonne National Laboratory
bgs	below ground surface
C-14	Carbon-14
CABRERA	Cabrera Services, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COPC	chemical of potential concern
DNAPL	Dense nonaqueous phase liquid
DO	dissolved oxygen
DOT	Department of Transportation
DQOs	data quality objectives
EE/CA	engineering evaluation/cost analysis
EHC	extractable hydrocarbons
EPA	Environmental Protection Agency
ESE	Environmental Science and Engineering, Inc.
ft	feet
H-3	tritium (Hydrogen-3)
HCl	hydrochloric acid
LNAPL	light nonaqueous phase liquid
mCi	millicuries
MCL	maximum contaminant level
MDC	minimum detectable concentration
MDL	minimum detection limit
MeV	megaelectron volt
Mg/L	milligrams per liter
min	minutes
µg/L	micrograms per liter
NADC	USDA National Animal Disease Center
Ni-63	Nickel-63
NRC	Nuclear Regulatory Commission
ORD	Oxidation-reduction potential
PA	preliminary assessment
pCi	Picocuries
ppm	parts per million
PRG	preliminary remediation goal
ROPC	radionuclide of potential concern
RSO	radiation safety officer
Site 1	former mixed waster burial site (CERCLA designation)
SOP	standard operating procedure
SVOC	semi volatile organic compound
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yards
WHO	World Health Organization

EXECUTIVE SUMMARY

Cabrera Services, Inc. (CABRERA) has been contracted by the U.S. Army Field Support Command (AFSC) under Contract No. DAAA09-02-D-0024/DO17 to develop and implement a groundwater investigation for the United States Department of Agriculture (USDA) National Animal Disease Center (NADC) former mixed waste burial site (Site 1) in Ames, Iowa. This sampling effort is being conducted to supplement existing groundwater analytical data for the purpose of refining the conceptual site model and assessing the nature and extent of impacted groundwater at the site in support of regulatory closure of the former burial site.

Radioactive and organic solvent waste was disposed into unlined trenches at Site 1 from 1971 through 1980. The total volume of waste disposed was estimated to be 40 cubic yards (yd3) buried with a total radioactivity of 250 millicuries (mCi). A Supplemental Preliminary Assessment was conducted at Site 1 in 1995 by Environmental Science and Engineering, Inc. Six wells were installed and sampled and analyzed for volatile organic compounds. All analysis results were below detection limits. CABRERA conducted a removal action at Site 1 in 2002. The impacted media included soil and groundwater. Both radionuclides of potential concern (ROPCs) and chemicals of potential concern (COPCs) were identified within the former waste burial pits. A Final Closure Report for the soil removal action has been submitted (CABRERA, 2003). Evidence of solvent staining on the north wall of the trench and a review of the data from their 1996 preliminary assessment indicated that groundwater flow direction was to the northwest (at least on the measured dates), where no downgradient wells existed to assess possible groundwater contaminant migration.

This report documents the installation and development of six [6] new monitoring wells, and the initial groundwater sampling event including existing and newly installed monitoring wells. Two additional sampling events will be conducted to supplements existing groundwater analytical data for the purpose of refining the conceptual site model for USDA, evaluation groundwater flow direction and assessing the nature and extent of potentially impacted groundwater at the site. This groundwater investigation report serves as the baseline for the monitoring program approved by U.S. Environmental Protection Agency (USEPA) Region VII, and conducted in accordance with work plan (Cabrera, 2004). Additional groundwater sampling events will be reported in addenda format to this baseline report.

The groundwater flow direction was complex at the May 2004 measurement; both a southwestward and a northeastward component were calculated. Observation of soils during completion of the new borings supports previously observed conditions; soils at the site consist largely of dense sandy silt and clay with highly localized variation in sand content.

None of the previously identified COPCs or ROPCs were identified above method detection limits (or background levels for ROPCs), however, 1,4 -dioxane was reported (and confirmed). This compound was detected in ten of the eleven wells sampled at concentrations ranging from less than 2 µg/L to 1,900 µg/L. There is no federal drinking water standard for 1,4-dioxane, however, there is a USEPA advisory level for 1,4-dioxane of 3 µg/L. A standard for 1,4-dioxane has not been established by the State of Iowa.

Trace concentrations of acetone, methylene chloride and chlorobenzene were also detected in at least one well (see Table 3-1), but all concentrations were well below their respective USEPA maximum contaminant levels (MCLs). Methylene chloride was also detected in the associated lab blanks.

Further delineation of contaminant distribution is recommended in both upgradient and downgradient directions. Based on the results of the delineation, additional permanent wells could be installed and included in the current monitoring network. It is also recommended that the current groundwater monitoring program be continued, with special note to the laboratory to report 1,4-dioxane detections.

1 INTRODUCTION

Cabrera Services, Inc. (CABRERA) has been contracted by the U.S. Army Field Support Command (AFSC) under Contract No. DAAA09-02-D-0024/DO17 to implement a groundwater investigation for the United States Department of Agriculture (USDA) National Animal Disease Center (NADC) former mixed waste burial site (Site 1) in Ames, Iowa. This investigation is being conducted to supplement existing groundwater analytical data for the purpose of assessing the nature and extent of potentially impacted groundwater at the site.

1.1 Purpose

The purpose of this groundwater investigation program is to determine if radionuclides of potential concern (ROPCs) and chemicals of potential concern (COPCs) buried within the former pits at Site 1 have leached into groundwater and are adversely impacting the environment. The Data Quality Objectives for this project are provided in Appendix C for reference.

1.2 Site Background

The following sections present a site description and a historical perspective of activities and previous investigations at Site 1.

1.2.1 Site Description

The NADC is operated by the USDA and is located on the east side of Ames, Iowa, in Story County, about 33 miles north of Des Moines, Iowa. The NADC Site 1 comprises approximately 0.25 acres situated on the USDA NADC property adjacent to Road A (Figure 1-1). Site 1 is an open field located within a construction zone managed by McCarthy Building Companies. McCarthy building Companies is the prime contractor developing new buildings on the NADC property and Site 1 is surrounded by ongoing building construction activities. NADC plans to build additional structures near the Site 1 property following regulatory approval of closure.

1.2.2 Site History

The NADC began operations in 1961. The mission of the center has been to conduct basic research on animal disease of economic importance to U.S. agriculture and to apply the results to animal disease prevention and control programs.

The NADC buried waste on-site beginning in 1971 and continued through 1980, as allowed under the Code of Federal Regulations (CFR) 10 CFR 20, Subpart 304. Both chemical and radioactive constituents were included in the waste streams. The majority of the waste was made up of test tubes and vials containing liquid scintillation fluids with radioisotopes. Site 1 consisted of 16 burial pits, configured end to end, in a 300-foot long line adjacent to the south boundary fence of the NADC (Figure 1-1). Burials were conducted semiannually between 1971 and 1980. The last burial at Site 1 was completed on October 20, 1980. USDA is currently in the process of closing the waste burial site in accordance with Nuclear Regulatory Commission (NRC) requirements.

A facility-wide inventory conducted to meet the requirements of Section 3016 of the Resource Conservation and Recovery Act (RCRA) revealed the possible existence of potential hazardous waste sites at the NADC facility. As a result of USDA's RCRA 3016 report to the United States Environmental Protection Agency (USEPA), the facility was listed in the November 1988 update to the 'Federal Agency Hazardous Waste Compliance Docket'. Facilities listed were given 18 months to complete a Preliminary Assessment (PA) as required by Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 120(d). As a result, the USDA NADC developed an Environmental Action Plan in 1988 to evaluate the potential groundwater effects from radioactive and organic waste from the waste burials. The former mixed waste burial site was designated as Site 1 and a PA was conducted by AT Kearney that included Site 1.

Environmental Science and Engineering, Inc. (ESE) conducted a Supplemental Preliminary Assessment (PA) in 1995 to characterize Site 1. Six (6) soil borings were advanced to approximately 15 feet below ground surface (ft bgs) to characterize the local geology, groundwater occurrence, and enable sampling of potential volatile organic compounds in the subsurface. Two-inch diameter groundwater monitoring wells were installed in each of the borings. Monitoring well locations (designated MW-1 through MW-6, Figure 1-2) were selected based on historical information, approximated groundwater flow direction based on topographic relief, and orientation of the burial sites. ESE (1996) reported that the direction of groundwater flow was to the west and southwest. Corrected monitoring data indicates that the groundwater flow direction was to the west and northwest, meaning that at the time of original measurement and groundwater sampling, only one of the six wells was actually downgradient of Site 1.

The first round of groundwater sampling was conducted in October 1995. Samples were analyzed via EPA Method 8240 for volatile organic compounds (VOCs). The NADC has since sampled these wells periodically for volatile petroleum hydrocarbons (Iowa Methods OA-1 and OA-2) with no detectable concentrations. Historical monitoring and analysis results from all events are tabulated in Appendix A.

CABRERA conducted a removal action for buried wastes at Site 1 in the fall of 2002 in support of site closure. A Closure Report for the soil removal action has been submitted (CABRERA, 2003). The total volume of mixed waste removed was 111 cubic yards (yd^3). A review of soil sample data from the removal action indicated that no significant residual radioactive or chemical contamination remains in the soils at Site 1 above the approved cleanup goals (CABRERA, 2003). Data from nearby monitoring wells indicated that no ROPCs were present above background concentrations (see Table A-2). The NRC is holding approval of the closure report until the groundwater investigation program is complete and the results of the quarterly sampling events are available for review.

A civil survey of Site 1 was performed in July 2003 to determine the relative location and elevation of each of the existing groundwater wells and to reevaluate the groundwater flow direction. Insufficient data exist to confirm that groundwater has not been impacted by the former buried waste. The current groundwater investigation was developed to provide sufficient data to evaluate potential impacts to groundwater and complete the closure process.

1.3 Conceptual Site Model

The following section describes the current conceptual site model for Site 1. The model may be revised as additional data collection increases our understanding of the subsurface conditions, especially of the nature and extent of contamination.

1.3.1 Climate and Topography

Precipitation at Ames averages 34 inches per year, with late spring and early summer being the wettest and winter being the driest. June, the wettest month receives roughly 5 inches of water and December receiving 0.9 inches of water (or the equivalent of 9 inches as snow) on average (city-data.com, 2004). Precipitation data are provided in Appendix B, Figure B-1

The topography at Ames is generally flat to gently rolling. The slope of the ground surface at Site 1 appears to be approximately 1% to the southwest based on site survey information. Ground surface elevation is approximately 1,000 ft above mean sea level (AMSL), as shown on Figure 1-2.

1.3.2 Surface Water

No surface water bodies exist onsite. A pond at the Izaak Walton League Park lies approximately 1600 ft southwest of Site 1, as indicated in Figure 1-1. An unlined drainage swale is present along the south side of Road A, which runs across the northern side of Site 1 (Figure 1-2). The ditch is normally dry but has been observed to contain standing water in rainy weather.

1.3.3 Geology

The site lies on the glacial tills of the Wisconsin-Age Des Moines Lobe, which is a large terminal moraine (Figure B-2). The Iowa Geological Survey has grouped these deposits as the Dows Formation. The terminal moraine at Ames is typified by massive silty clays with minor sand stringers. The Dows Formation clays are estimated to be 15 m (50 ft) thick at NADC (Figure B-3). The Dow Formation is reported to overlies bedrock in the area of NADC. The Dow Formation overlies Pleistocene sands where eroded bedrock valleys exist. (Kemmis, 1981)

Soil boring/well construction log for the existing monitoring wells and ESE's 1995 hydrogeologic cross sections of Site 1 are included Appendix D-1. At least two lenses of fine-grained silty sand have been encountered during previous investigations. One lens, encountered to the east at MW-4 and MW-5, is not believed to extend to the location of the former burial trenches. The other lens, encountered to the west at MW-2 and close to the trench, was encountered from approximately 9 to 11 ft bgs. The burial trench reached a maximum depth of 6 ft bgs in the western end (Cabrera, 2003). Soil borings advanced as part of the present investigation encountered additional silty sand units to the north of the former burial trenches in the 5 ft to 10 ft bgs depth range. All six new borings encountered dense gravelly clay (glacial till).

1.3.4 Groundwater

The City of Ames water supply is pumped from wells ranging 100 to 160 ft deep. These wells draw from the extensive glacial sand and gravel deposits beneath the downtown area, the Squaw Creek valley, and the Skunk River valley (Ames, 2004).

A well-location search of the Iowa Geological Survey database was conducted in April, 2004. The nearest active wells identified are located approximately 2500 feet southeast of Site 1 and are completed in the bedrock aquifer to depths of 70 and 107 feet bgs. Well-search results are included in Appendix B.

The original round of groundwater sampling was conducted as part of the Supplemental PA in 1995. The groundwater samples were analyzed via EPA Analytical Method 8240 for VOCs. Conclusions from the Supplemental Preliminary Assessment Report indicated, "*groundwater at the sampled locations has not been affected by petroleum constituents originating from the burial areas*" (ESE 1996).

Groundwater analytical data from three separate monitoring events (June 1996, April 1998, and April 2000) yielded non-detects for extractable hydrocarbons (Iowa Method IA-OA2) and non-detects for volatile petroleum hydrocarbons (Iowa Method IA-OA1). Appendix A includes a summary of all previous monitoring results.

The depth to the surface aquifer at the site varies from approximately 5 to 8 ft bgs. Groundwater elevations were measured twice in 1995 as part of the ESE Preliminary Assessment. The inferred flow direction was to the west-northwest at both of these events, as shown in Figures B-4 and B-5. The wells were again gauged in 2003 as part of the waste removal action. The direction of groundwater flow at the time of that monitoring event was to the southwest. The groundwater elevation contour map (Figure B-6) indicates a relatively steep gradient in the east, as compared to the west. The steep gradient in the east could be the result of a number of conditions, including differences in soil texture or the addition of water to the system from the nearby drainage ditch or a leaking storm- or sanitary-sewer drain. Standing water was present in the Road A ditch during the July 2003 monitoring event, which also likely affected groundwater flow directions. Groundwater elevations were measured for existing and newly installed monitoring wells in May 2004 as part of the Groundwater Investigation in support of site closure. The direction of groundwater flow at the time of the most recent monitoring event was to the northeast and southwest, as shown on Figure 3-2.

The soil texture of the site is predominantly silty clay, which typically exhibits very low groundwater seepage velocities. The ESE report contained some hydraulic conductivity data, including a hydraulic conductivity estimate of 6×10^{-5} ft/min (or 3×10^{-7} m/s). This value is within the expected range for silty clays. The groundwater gradient was approximately 0.008 ft/ft (or 0.8%) in October 1995 and roughly 0.6% in July 2003. Assuming that the effective porosity of the soils is approximately 25%, the interpreted groundwater seepage velocity is in the range of 1 foot per year (0.3 meters per year).

1.3.5 Contaminant Source Zone

ROPCs and COPCs suspected or confirmed to have been components of waste buried at Site 1 are listed in Tables 1-1 and 1-2.

Table 1-1: NADC Site 1 Radionuclides of Potential Concern

Radionuclide	Name	Half Life	**Principal Modes of Decay**
H-3	Tritium	12.3 years	β (0.0185 mega electron volt (MeV)
C-14	Carbon-14	5730 yr	β (0.157 MeV)
Ni-63	Nickel-63	100 yr	β (0.0669 MeV)

Table 1-2: NADC Site 1 Chemicals of Potential Concern

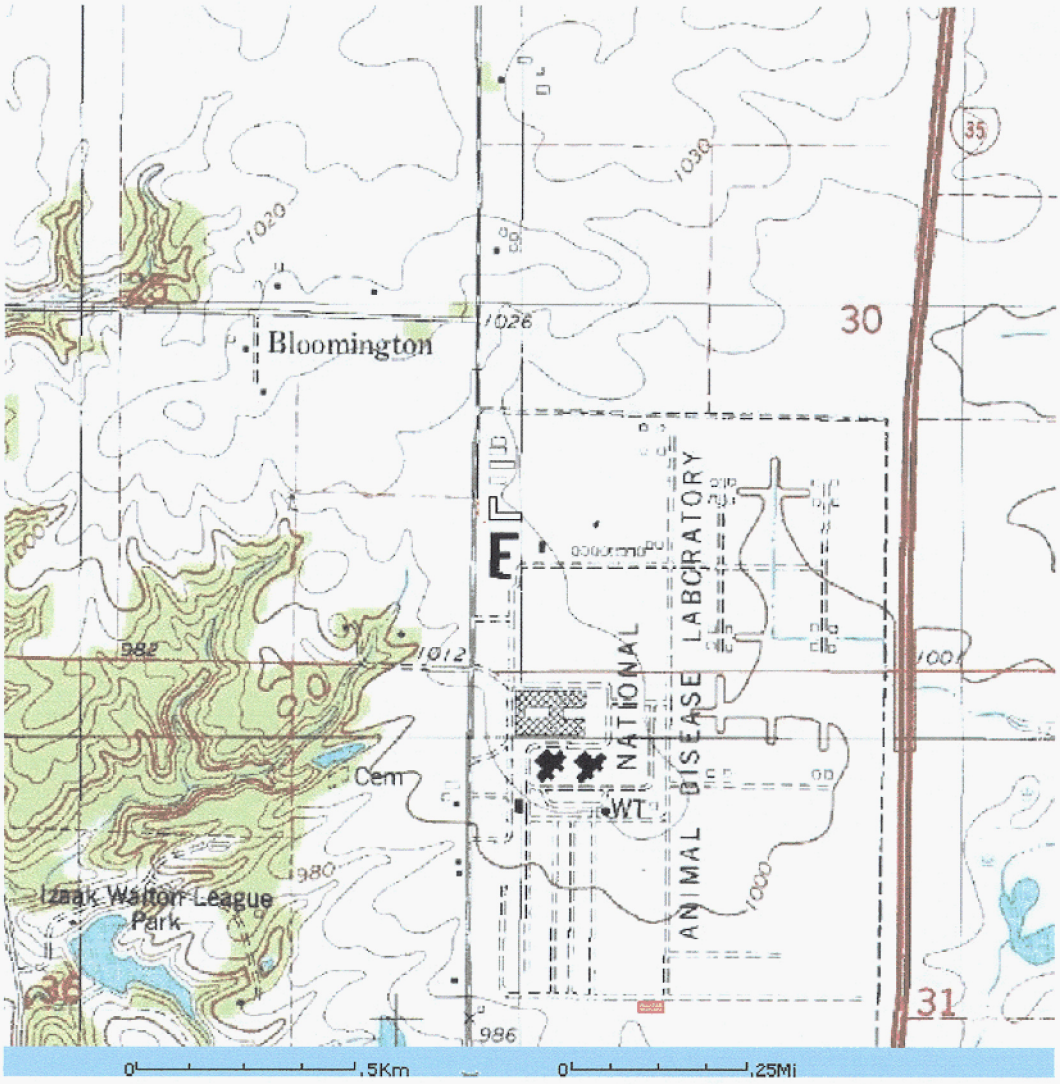
Chemical	**CASRN**	**Information**
Benzene	71-43-2	Scintillation cocktail component
Ethyl Benzene	100-41-4	Scintillation cocktail component
Toluene	108-88-3	Scintillation cocktail component
Xylene	1330-20-7	Laboratory Chemical
Lead	7439-92-1	Lead Shield Pigs
Cyanide	57-12-5	Laboratory Chemical
Formaldehyde	50-00-0	Laboratory Chemical
PPO	92-71-7	2,5- Diphenyloxazole (scintillation cocktail component)
POPOP	1806-34-4	2-(5-Phenyloxazole) Benzene (scintillation cocktail component)

Radioactive- and organic solvent- containing waste vials and bottles were disposed into unlined trenches at Site 1 from 1971 through 1981. The trenches consisted of 16 burial pits, configured end to end, in a 300-foot long line running west to east. The total volume of waste disposed was estimated to be 40yd^3 buried with a total radioactivity of 250 mCi, based on isotope purchasing and disposal logs. Soil and groundwater samples from wells and borings to the south of the trench in 1996 had non-detectable concentrations of VOCs, SVOCs and pesticides.

A removal action was conducted in 2003 in which the buried waste and backfill was excavated. Some solvent staining of native soils was observed. Approximately 72yds^3 of native soils from the northern wall of the excavation were removed, or an approximate 1-ft thickness of native soil from the northern wall of the trench. Post-excavation sampling of soils from the walls and floor of the excavation had non-detectable concentrations of COPCs and background activities of ROPCs.

During the excavation work, staining was observed on the walls of the excavation. The staining was present on the north wall of the excavation at the water line. The staining was approximately 2ft in vertical thickness and did not extend to the base of the excavation. No free-phase contamination was observed.

Groundwater that had seeped into the excavation during the removal action was removed, stored and sampled to determine disposal options. Approximately 1,000 gallons of groundwater was collected. The water was sampled for VOCs by Method 8260 and ROPCs by liquid scintillation. All VOCs were non-detectable except for toluene at 200 milligrams per liter (mg/L) and trimethylbenzene at 15 mg/L. The activities of the ROPCs were either at local background levels or nondetectable. The City of Ames permitted the disposal of the groundwater into the municipal sewer system.



USGS topographic map, July 01, 1993

Site Vicinity Map	USDA-NADC Ames, IA	CABRERA SERVICES	3/08/2004	

Figure 1-1 Site Vicinity Map

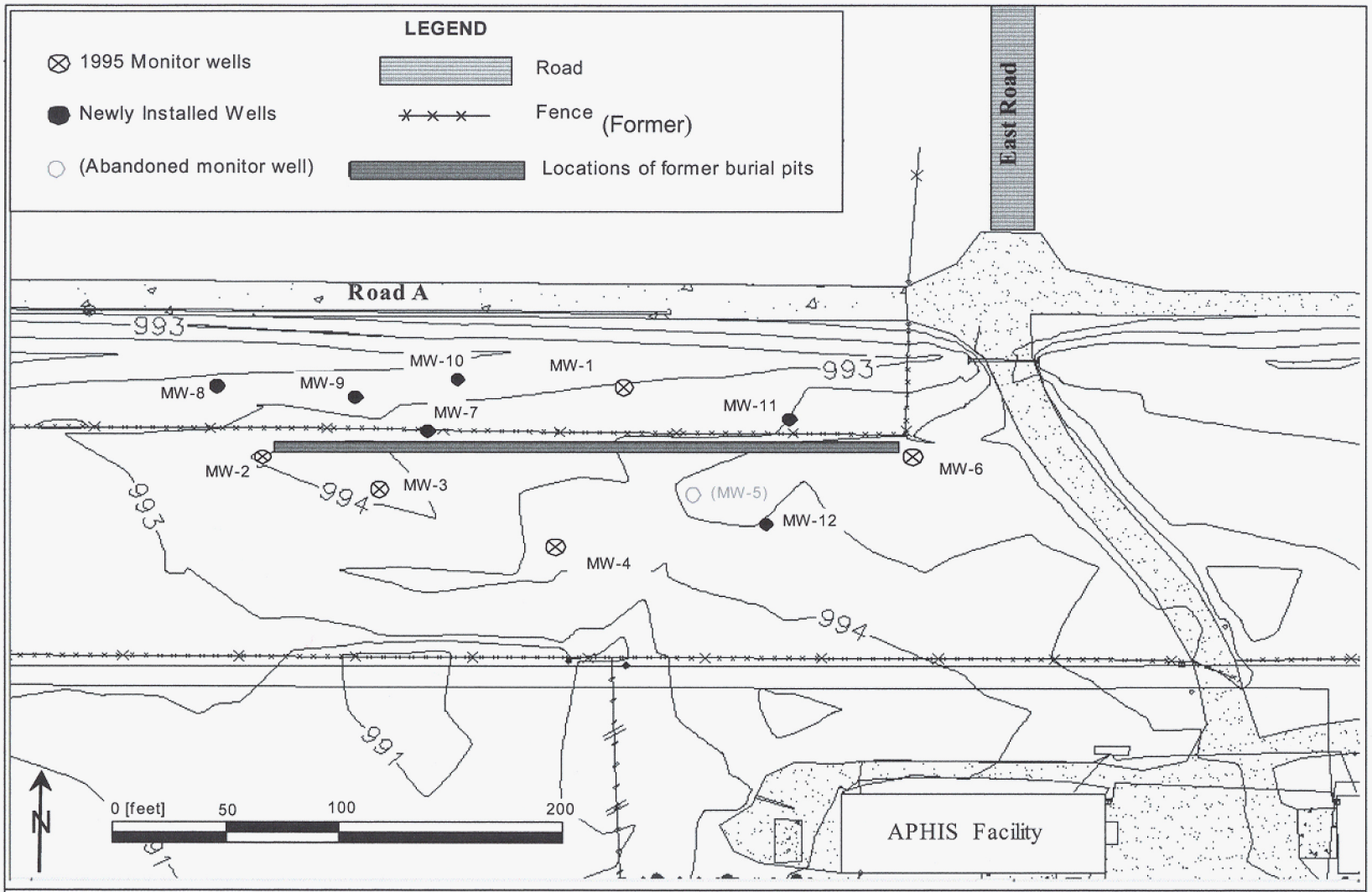


Figure 1-2 Well Locations

2 GROUNDWATER INVESTIGATION FIELD METHOD

Field activities included the installation and development of six (6) monitoring wells and groundwater sampling of all existing and newly installed monitoring wells.

2.1 Soil Boring/Monitoring Well Installation

Six (6) new monitoring wells were installed at Site 1 on May 11, 2004. All monitoring well locations are presented in Figure 2-1. Field personnel followed procedures as outlined in the project work plan (Cabrera, 2004). Monitoring Well 07 (MW-07) was located at the former excavation wall and three monitoring wells (MW-06, -08, and -09) were placed to delineate groundwater flow direction and the extent of detectable VOCs. MW-11 and MW-12 completed cross-gradient and upgradient coverage of the former excavation.

Borings were advanced for each location to approximately 15 ft bgs using hollow-stem augers. Soil samples were collected continuously using split-spoon samplers and logged in the field. Field boring logs are included in Appendix D.2. Six [6] permanent monitor wells were installed to 15 ft bgs. The monitor wells were constructed as specified in the Final Work Plan (2004). The boring diameters were 8.25 inches and the well casings were 2-in. OD. The screened intervals of the wells are from 5 ft to 15 ft bgs. The sand pack was emplaced from approximately 4 ft to 15 ft bgs and 1 foot of bentonite grout was emplaced above the sand. Wells were completed with locking guard boxes set in cement collars, approximately three feet above grade.

Drillers decontaminated all equipment using scrub brushes and a phosphate-free detergent, followed by a steam washer and a distilled water rinse. Drilling tools and other contacting equipment were decontaminated between well installations.

2.2 Well Development

Each monitoring well was developed using a surge block and bailer until the turbidity remained within a 10 nephelometric turbidity unit range for at least 30 minutes (mins). Water produced during the development process was contained in 55-gallon Department of Transportation (DOT)-approved drums. CABRERA staff monitored well development activity and recorded all pertinent information in the field logbook. The monitoring well installation and development activities were completed during the period of May 10th through May 14th, 2004.

A soil boring log and a monitoring well construction log were completed for each of the newly installed monitoring wells. Soil borings and monitoring well construction logs are included in Appendix D.2.

2.3 Groundwater Sampling Procedures

Groundwater elevations were measured in all viable monitoring wells as feet below the measuring point elevation (top of casing) to the nearest 0.01-ft. (MW-5 has been damaged and well integrity could not be confirmed, so it has been omitted from the groundwater sampling program). CABRERA also measured the total depth of the well and provided comment on whether sediment was detected in the bottom of the well as well as overall condition of the monitoring well. Wells were inspected for a phase-separate layer. Groundwater samples were obtained from the monitoring wells during the period of May 17th through May 20th, 2004. This initial round of sampling of newly installed and existing monitoring wells serves as a baseline for seasonal sampling events.

Low-flow well-purging methods were utilized to obtain ambient, representative groundwater samples. Low-flow purging was accomplished using a peristaltic pump in accordance with procedures presented in the Work Plan (2004). Purge water has been stored in drums onsite to await characterization to determine final disposition.

While each well was being purged, field parameters were monitored at the wellhead at 5- to 10-minute intervals using a flow-through cell. The water-quality stabilization parameters temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity were measured and recorded on the well sampling form after removing each well volume during purging. The purge water was pumped through an in-line flow-through cell containing measurement sensors for these four stabilization indicator parameters. Stabilization parameters were recorded for each of the monitoring wells on groundwater sample data sheets and are included in Appendix E.

Samples were collected immediately after purging, using a peristaltic pump. The samples were obtained in the following order.

- Volatile Organic Compounds
- Semivolatile Organic Compounds
- Radiological Constituents

The groundwater samples were identified using the well numbers specified in Table 2-1. Sample identification also included sampler initials, date and time of collection. All samples were appropriately preserved and shipped under chain-of-custody to the STL Laboratory facility in Arvada, Colorado.

2.4 Location/Elevation Survey

After well installation was completed, the horizontal and vertical coordinates of all wells were surveyed relative to an existing benchmark (north rim of the sewer manhole cover in Road A). The elevations of the new wells were then correlated to the elevations of the previously-existing wells and cross-checked for accuracy. Easting and northing coordinates for the new wells were

extrapolated using triangulated distances measured with an engineering tape. Coordinates and elevations of the top of casing are provided in Table 2-1.

Table 2-1: Monitor Well Coordinates

Well ID	Northing (ft)	Easting (ft)	Top-of-Casing Elevation (ft amsl)
MW-1	5130.21	6297.68	995.99
MW-2	5097.51	6141.61	996.27
MW-3	5081.53	6191.04	996.16
MW-4	5055.25	6266.67	996.46
MW-5 *	5079.15	6326.98	n/a *
MW-6	5098.16	6421.86	998.07
MW-7	5110.3	6212.1	995.39
MW-8	5133.0	6122.1	995.43
MW-9	5126.7	6180.1	994.82
MW-10	5135.5	6225.6	996.06
MW-11	5117.7	6368.6	996.65
MW-12	5068.5	6358.6	996.68

* Well MW-5 is damaged and no longer sampleable.

Note: Existing survey plan for 1-6: extrapolated date for MW-6 through -12

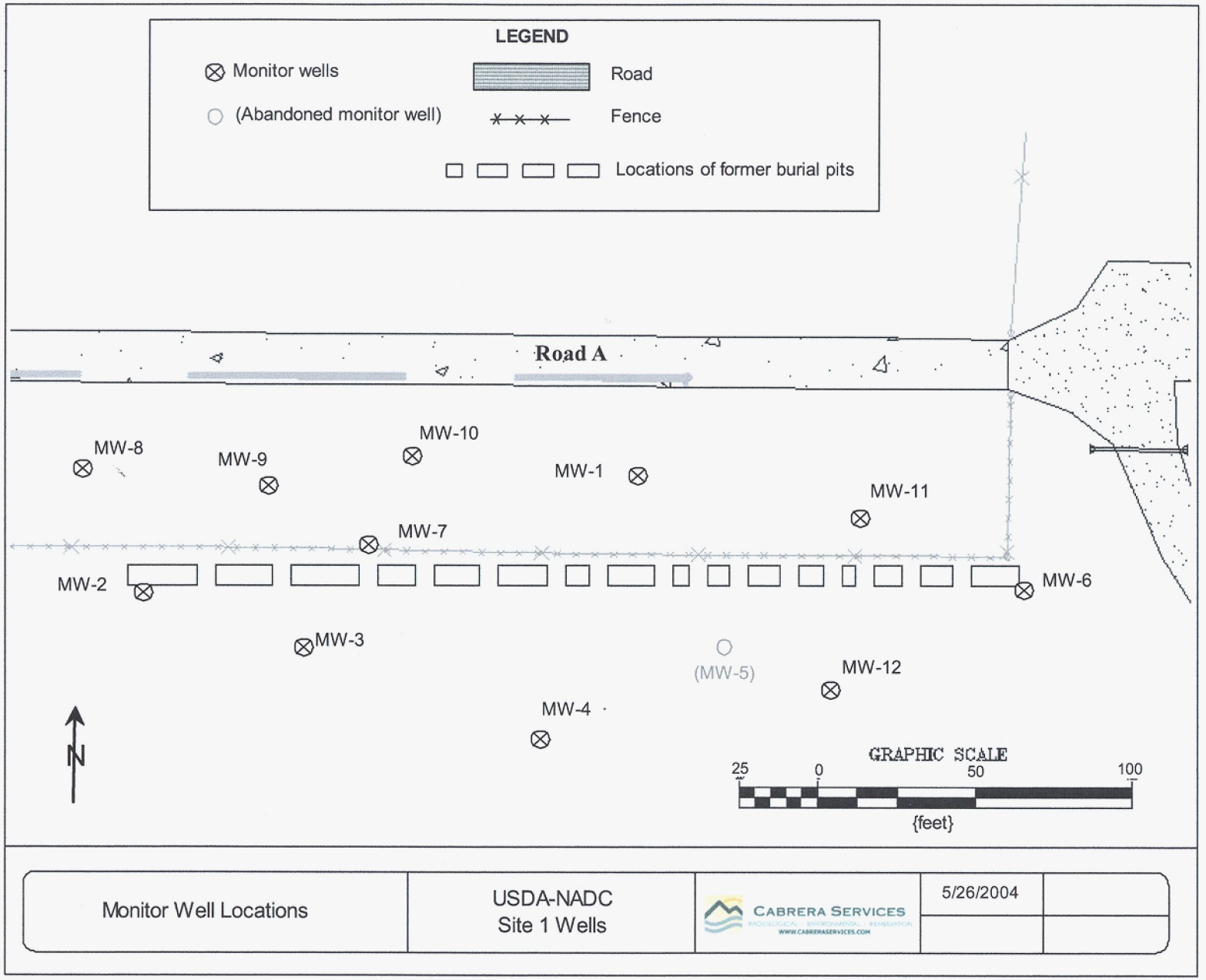


Figure 2-1: Monitoring Well Locations Including New Wells

3 GROUNDWATER MONITORING AND SAMPLING RESULTS

3.1 Soil Boring Data

The soil borings were advanced and wells were installed for the six new wells on May 11, 2004. The borings were continuously cored from ground-surface to approximately 15 ft below grade. The soil textures encountered were primarily organic-rich silty clays in the western portion of the site, while in the eastern portion, a silty sand unit was encountered from the surface to approximately 10ft bgs. Dense gravelly clays were encountered in all borings at depths of approximately 10 to 13 feet bgs. All of the borings terminated in the dense clay layer.

3.2 Groundwater Elevation Data

Groundwater elevations were gauged in all 11 existing wells on May 18, 2004, approximately one week after wells MW-07 through MW-12 were installed. An interface probe was utilized to inspect for nonaqueous phase liquid and none was detected. The depth to ground water varied from 6.43 to 8.14 ft below top-of-casing (or approximately 4 ft below ground surface). A map of the groundwater piezometric surface is included as Figure 3-1. The piezometric surface indicates two groundwater flow directions. In the eastern portion of Site 1 the flow direction was to the west-southwest and the gradient was approximately 1.7%. In the western portion of the site the groundwater flow direction was to the northwest and the gradient was approximately 0.2%.

3.3 Groundwater Quality Data

Groundwater was sampled from all of the existing wells during the period of May 18-20, 2004. The wells were developed and sampled using the USEPA low-flow sampling protocol. All of the samples were analyzed for VOCs, SVOCs, and three ROPCs; Tritium, or Hydrogen-3 (H-3), Nickel-63 (Ni-63), and Carbon-14 (C-14) by the STL Laboratory.

Activities of the three analyzed radionuclides H-3, Ni-63 and C-14 were all consistent with background levels.

Three volatile organic compounds were detected in samples; acetone, chlorobenzene, and methylene chloride. The VOC results were all near their respective detection limits. Methylene chloride was also detected in the method blanks for the analysis. A summary of the analytes that were detected is included as Table 3-1.

In order to analyze groundwater samples for the scintillation-cocktail components PPO and POPOP the Method 8270C analysis library for SVOC analytes was expanded. No Method 8270 analytes were detected, however, one volatile analyte was detected and reported as a Tentatively Identified Compound: 1,4-dioxane. The contract laboratory re-calibrated their equipment and confirmed the presence of 1,4-dioxane.

Aqueous concentrations of this analyte were present in concentrations ranging from non-detectable (at MW-08) to 1900 micrograms per liter (µg/L) at MW-07. The scintillation-cocktail tracers PPO and POPOP were not detected. An isoconcentration contour map of 1,4-dioxane concentrations is included as Figure 3-2. Complete laboratory results are included in this report as Appendix F.

1,4-Dioxane is used as a solvent and as a stabilizer in commercial solvent compounds, and as component of scintillation cocktails. It occurs in adhesives, sealants, cosmetics, pharmaceuticals, rubber chemicals and surface coatings. It is also used in automotive coolant liquid, and in shampoos and other cosmetics (WHO, 2004).

Table 3-1: Summary of Analytes Detected in Groundwater

		Acetone	Chloro-benzene	1,4-Dioxane	Methylene Chloride	Tritium	Nickel-63	Carbon-14
Analytical Method		SW846 8260B	SW846 8260B	SW846 8270C	SW846 8260B	EPA 906.0(m)	DOE STL-RC-0055	EERF C-01-1
Units		µg/L	µg/L	µg/L	µg/L	pCi/L	pCi/L	pCi/L
USEPA MCL *		n/a	100	n/a	5	20,000	50	2,000
Detection Limit		2.5	0.13	2	0.21	270	19 **	14
Well ID	**Sample Date**							
MW-01	5/18/04	ND	ND	180	0.4 J,B	ND	-0.35 U	ND
MW-02	5/19/04	ND	ND	45	ND	ND	-9 U	ND
MW-03	5/19/04	ND	ND	26	ND	ND	-10 U	ND
MW-04	5/19/04	ND	ND	58	ND	ND	-17 U	ND
MW-06	5/19/04	ND	ND	40	ND	ND	-11 U	ND
MW-07	5/19/04	ND	ND	1900	ND	290	-10 U	<16
MW-08	5/18/04	3.7 J	ND	ND	0.37 J,B	ND	-19 U	ND
MW-09	5/18/04	ND	ND	250	0.35 J,B	ND	-16 U	<15
MW-10	5/20/04	4.9 J	ND	900	0.5 J,B	370 J	-7 U	ND
MW-11	5/20/04	18	ND	790	0.47	ND	-12 U	ND
MW-12	5/19/04	15	2.3	63	ND	ND	-22 U	ND

ND – Analyte was not detected above the detection limit.
* MCLs do not exist for acetone or 1,4-dioxane, although other regulatory agencies have established limits. USEPA has established an advisory limit for 1,4-dioxane recommending a drinking water limit of 3 µg/L.
** The laboratory detection limit was above the project-specific detection limit of 5 pCi/L, so we have reported all results here. Total propagated uncertainties for Ni-63 were approximately ±18 pCi/L.

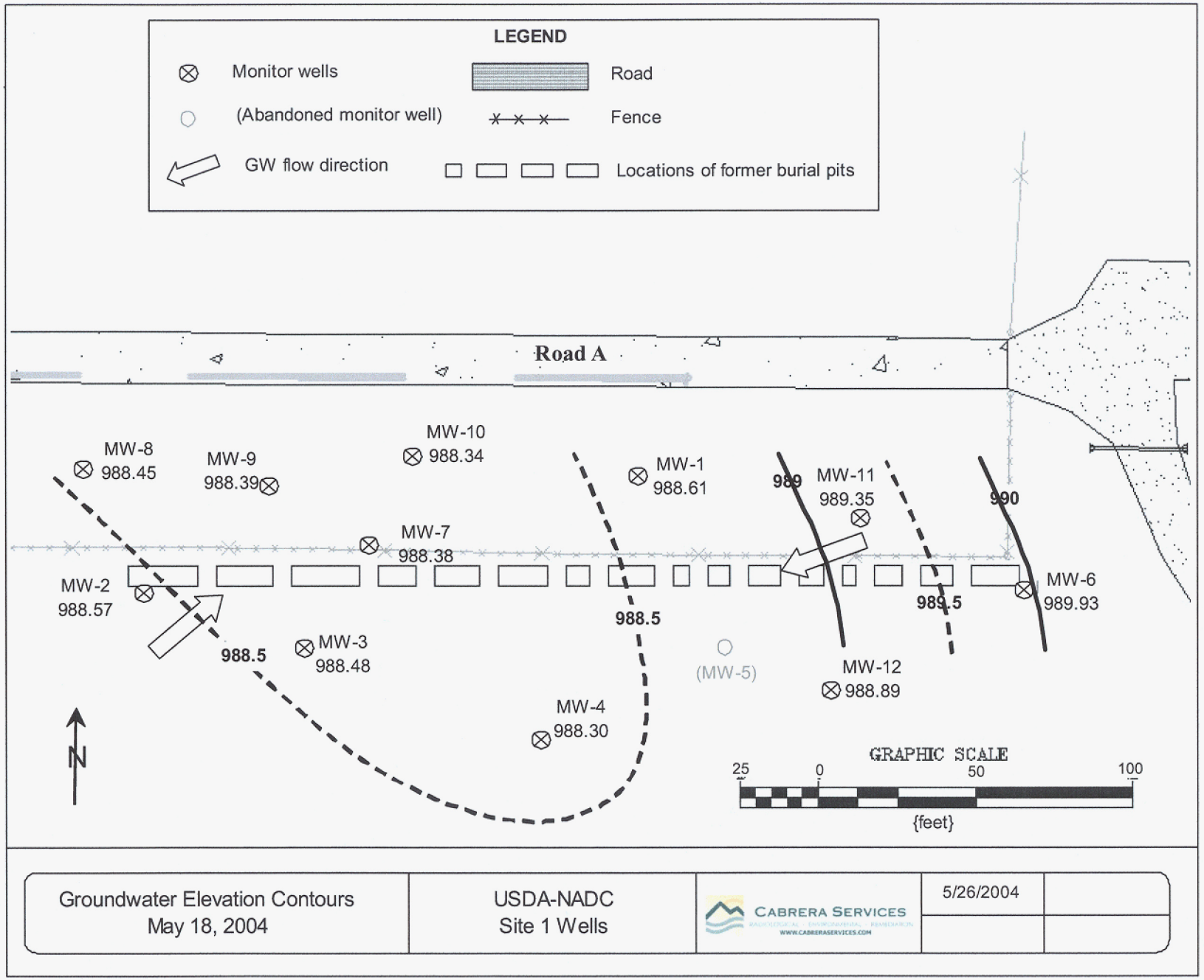


Figure 3-1: Groundwater Elevation Contours May 18, 2004

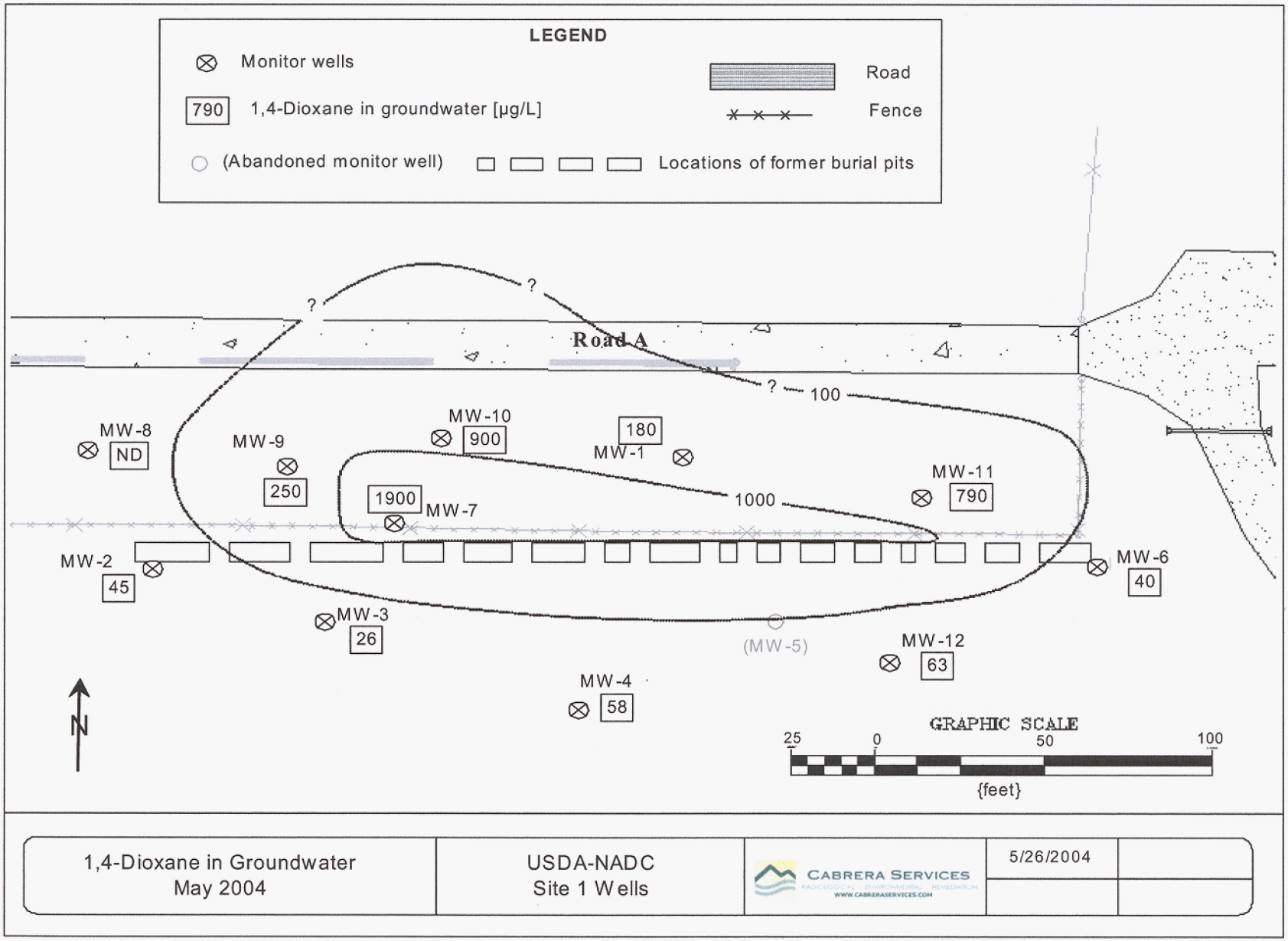


Figure 3-2: 1,4-Dioxane in Groundwater, May 2004

4 SUMMARY OF FINDINGS AND CONCLUSIONS

The following summarizes the findings of the current groundwater investigation and conclusions based on these results.

4.1 Findings

A soil removal action was completed in 2003 to remove all waste and associated soils contained in the formed mixed waste burial pits comprising Site 1. Six new monitor wells were installed in May 2004 to provide additional delineation for potential contaminant transport in support of burial site closure. None of the previously identified COPCs or ROPCs were detected above background concentrations in groundwater samples collected from the new and existing wells. However, the lab reported the presence of 1,4-dioxane as a tentatively identified compound via USEAP Method 8270C. This compound was detected in ten of the eleven wells sampled at concentrations ranging from less than 2 µg/L to 1,900 µg/L. There is no federal drinking water standard for 1,4-dioxane, however, there is a USEPA advisory level for 1,4-dioxane of 3 µg/L. A standard for 1,4-dioxane has not been established by the State of Iowa.

Trace concentrations of acetone, methylene chloride and chlorobenzene were also detected in at least one well (see Table 3-1), but all concentrations were well below their respective USEPA maximum contaminant levels (MCLs). Methylene chloride was also detected in the associated lab blanks.

The groundwater flow direction was complex at the May 2004 measurement; both a southwestward and a northeastward component were calculated (Figure 3-1). The distribution of 1,4-dioxane (Figure 3-2) implies that over time, the primary groundwater flow direction is to the northwest. Observation of soils during completion of the new borings supports previously observed conditions; soils at the site consist largely of dense sandy silt and clay with highly localized variation in sand content.

The density of 1,4-dioxane is 1.08, however, it has infinite solubility with water (i.e., it is miscible), and therefore the existence of a dense non-aqueous liquid phase (DNAPL) of 1,4-dioxane at this site is unlikely given the concentrations detected. In addition, other chlorinated solvents have been analyzed but not detected above trace concentrations at Site 1. 1,4-Dioxane also has a low soil-water partitioning coefficient, making it less likely to be retarded in groundwater-transport by soil particles. It has also been classified as relatively non-biodegradable based on chemical-oxygen-demand studies (Mohr, 2001).

4.2 Conclusions

No radionuclides or previously reported chemicals of concern were detected in any of the eleven monitor wells at Site 1. This supports previous groundwater sampling results and post soil removal analyses indicating that the source materials have been removed and there has been no

significant impact to groundwater resulting from organic compounds that may have been included in the buried materials.

The lateral extent of the aqueous 1,4-dioxane concentrations has been identified to the south at the approximate 50 µg/L contour interval and to the north the extent has been identified at the approximate 1000 µg/L contour interval. Further delineation of contaminant distribution is recommended in both upgradient and downgradient directions.

The State of California has established an Environmental Screening Level of 50 ppm for soils in non-use aquifers. Various states have established drinking water standards for 1,4-dioxane, as summarized below:

California:	3 µg/L	Massachusetts:	50 µg/L
Florida:	5 µg/L	Michigan:	85 µg/L
Maine:	70 µg/L	North Carolina:	7 µg/L

The standard laboratory practical quantitative limit for detection of 1,4-dioxane is 2 µg/L using Method 8270 (preparation by solvent-solvent extraction). It is listed as an analyte by Method 8260B, but using the standard purge-and-trap preparation method yields a fairly high practical quantitation limit of 100 -200 µg/L and other preparation methods are unreliable. Therefore, it is recommended that the current groundwater monitoring program be continued, with special note to the laboratory to report 1,4-dioxane detections.

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APPENDIX A

Summary of Previous Groundwater Monitoring Data

TABLE 5

Laboratory Results (ug/L)[a] - Ground Water
Site 1 - Radioactive Isotope Burial Site
United States Department of Agriculture/National Animal Disease Center
2300 Dayton Avenue, Ames, Iowa
Prepared For
BRIDGE ENVIRONMENTAL MANAGEMENT GROUP
Samples Collected October 5, 1995

Parameter	Sample Identification									Action Levels		
	MW-1 SB-1	MW-2 SB-2	MW-3 SB-3	MW-4 SB-4	MW-5 SB-5	MW-6 SB-6	Field Blank	Trip Blank	Equipment Blank	HA[b]	NRL	MCL
Acetone	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	NE[c]	NE	NE
Acrylonitrile	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	NE	0.06	NE
Benzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	1	5
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	0.6	100
Bromoform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	4.0	100
Bromoethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	NE	NE
Carbon Tetrachloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	0.30	5
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	100	NE	100
Chloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NE	NE	NE
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0	NE	6.0	100
Chloromethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	3.0	NE	NE
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0	NE	NE	NE
1,1-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	NE	NE
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	0.4	5
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7	NE	7

TABLE 5 (Continued)

Laboratory Results[a] (ug/L) - Ground Water
Site 1 - Radioactive Isotope Burial Site
United States Department of Agriculture/National Animal Disease Center
2360 Dayton Avenue, Ames, Iowa
Prepared For
BRIDGE ENVIRONMENTAL MANAGEMENT GROUP
Samples Collected October 5, 1995

Parameter	Sample Identification									Action Levels		
	MW-1 SB-1	MW-2 SB-2	MW-3 SB-3	MW-4 SB-4	MW-5 SB-5	MW-6 SB-6	Field Blank	Trip Blank	Equipment Blank	HA[b]	NRL	MCL
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	100	NE	100
CIS-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	70	NE	70
1,2-Dichloropropane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	6.0	5
CIS-1,3-Dichloropropene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	NE	NE
Trans-1,3-Dichloropropene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	NE	NE
Ethylbenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	700	NE	700
2-Hexanone	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NE	NE	NE
Methyl Ethyl Ketone	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NE	NE	NE
Methyl Isobutyl Ketone	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NE	NE	NE
Methylene Chloride	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NE	5	5
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	70	1.0	NE
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	0.7	5
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1,000	NE	1,000
1,1,1-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	200	NE	200
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3	NE	5

TABLE 5 (Continued)

Laboratory Results[a] (ug/L) - Ground Water
Site 1 - Radioactive Isotope Burial Site
United States Department of Agriculture/National Animal Disease Center
2300 Dayton Avenue, Ames, Iowa
Prepared for
BRIDGE ENVIRONMENTAL MANAGEMENT GROUP
Samples Collected October 5, 1995

Parameter	Sample Identification									Action Levels		
	MW-1 SB-1	MW-2 SB-2	MW-3 SB-3	MW-4 SB-4	MW-5 SB-5	MW-6 SB-6	Field Blank	Trip Blank	Equipment Blank	HA[b]	NRL	MCL
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	3	5
Trichlorofluoromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NE	NE	NE
Vinyl Chloride	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	NE	0.015	2
Xylenes, Total	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	10,000	NE	10,000

[a] One microgram per gram (ug/L) is equivalent to one part per billion. Analytical method in accordance with USEPA Method 8240 for VOC's.

[b] HA = USEPA lifetime Health Advisory; NRL = Negligible Risk Level at 10^{-6} cancer risk; MCL = Maximum Contaminant Level. Source: Drinking Water Regulation and Health Advisories; May, 1995, Office of Water, USEPA, Washington D.C. (Note: Update due out in December 1995).

[c] NE = None established.

Table A-1: Groundwater Chemical Analytical Results – April 26, 2000

Analyte	Monitoring Well Number					
	MDL [µg/L]	MW-1 [µg/L]	MW-2 [µg/L]	MW-3 [µg/L]	MW-4 [µg/L]	MW-5 [µg/L]
Extractable Hydrocarbons (EHC)						
Total EHC	380	< 380	< 380	< 380	< 380	< 380
Diesel	380	< 380	< 380	< 380	< 380	< 380
Gasoline	380	< 380	< 380	< 380	< 380	< 380
Motor Oil	380	< 380	< 380	< 380	< 380	< 380
Volatiles						
Benzene	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Toluene	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Xylenes (total)	3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

Table A-2: Groundwater Radiological Analytical Results

Sample Location		H-3			C-14			Ni-63		
		Result (pCi/L)	Uncert (2σ) (pCi/L)	MDC (pCi/L)	Result (pCi/L)	Uncert (2σ)[2] (pCi/L)	MDC[2] (pCi/L)	Result (pCi/L)	Uncert (2σ) (pCi/L)	MDC (pCi/L)
Blanks[1] (MW-5)	Baseline	-140	230	380	90	270	440	-1.0	3.5	6.0
	Post-Remed	-30	210	360	90	110	180	-6.5	4.7	7.6
MW-1	Baseline	-230	220	380	-50	270	440	-1.3	2.2	3.7
	Post-Remed	-80	210	360	80	110	180	-6.7	4.1	6.4
MW-2	Baseline	-30	220	380	130	270	440	0.1	1.5	2.5
	Post-Remed	-40	210	360	90	110	180	-3.1	4.3	7.1
MW-3	Baseline	-250	230	380	30	270	440	-1.5	2.2	3.7
	Post-Remed	-20	210	360	170	120	180	-3.8	4.6	7.7
MW-4	Baseline	-70	220	380	-100	270	440	-0.1	2.7	4.5
	Post-Remed	-10	210	360	20	110	180	-4.4	3.9	6.3
MW-6	Baseline	-160	220	380	-40	270	440	-1.6	2.7	4.5
	Post-Remed	30	210	360	180	120	180	-7.6	5.3	8.5

1 Deionized water was used in place of the MW-5 samples to serve as blanks.

The difference in sample uncertainty and MDC between the first and second rounds of sampling was due to a change of count time used by the analytical laboratory (150 mins for baseline counts versus 220 mins for post-remediation samples.

APPENDIX B

Conceptual Site Model
&
Supporting Data

Iowa Department of Natural Resources
109 Trowbridge Hall
Iowa City, IA 52242-1319
319-335-1575
319-335-2754 (fax)

To: Lisa Cundiff
Cabrera Services, Inc.
2216 Troy Road
Edwardsville, IL 62025
phone: (618) 792-2675 Fax: (618) 655-8658

From: Paul VanDorpe

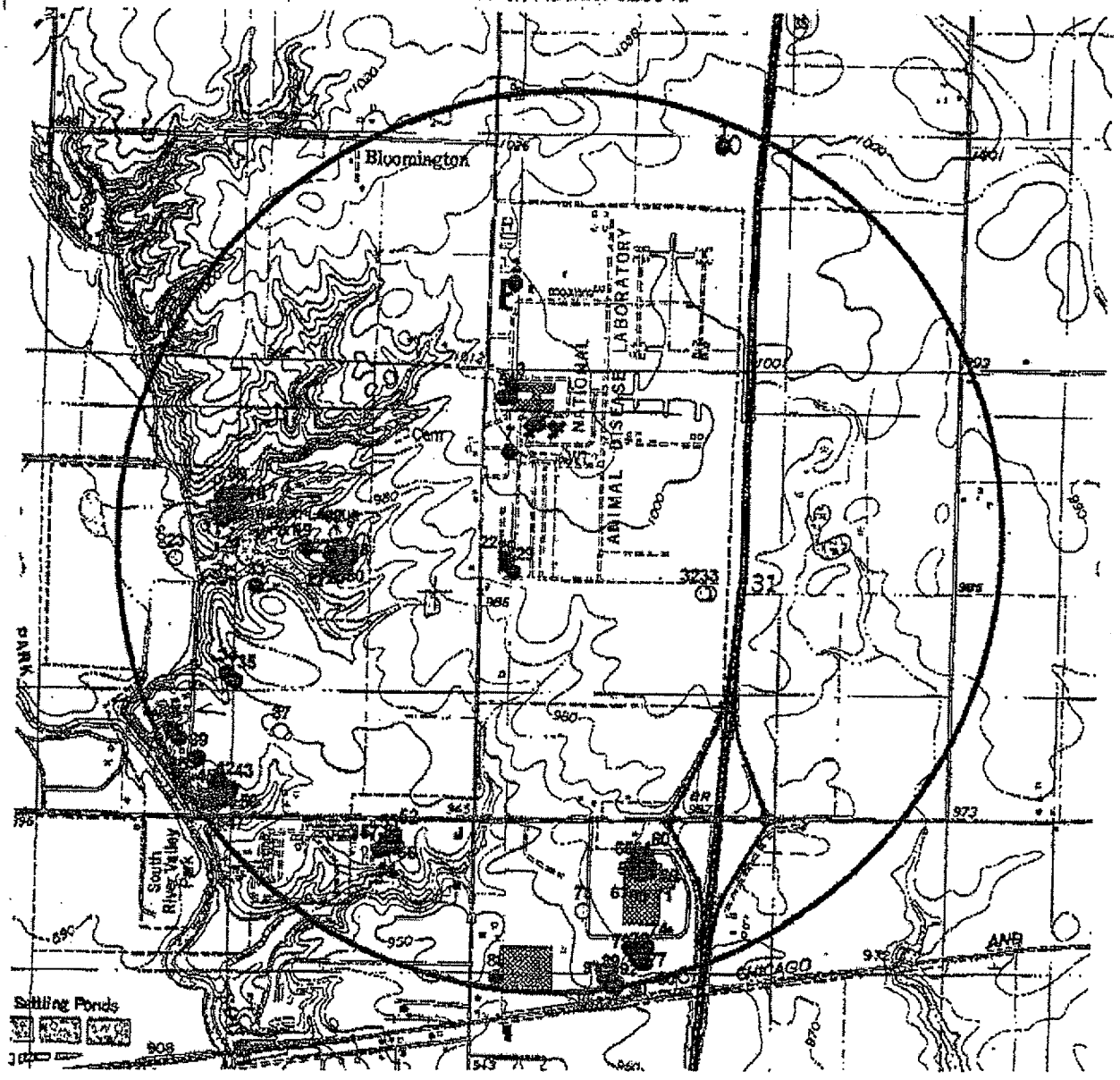
Date: 4/21/04

Subject: Well search results
Cabrera Project # 04-3040.17

Included in search	No. of wells	Database
X	5	IGS well database general well database maintained by IGS, location accuracy varies 3,730 to 25 ft., last updated 8/2003.
X	0	Public wells (municipal) municipal well database maintained by IGS, location accuracy varies 3,730 to 25 ft., under development
X	0	Public wells (non-municipal) municipal well database maintained by IGS, location accuracy varies 3,730 to 25 ft., under development
X	3	Private well tracking system IDNR database management system for Grants-to-counties-covered wells. Locational accuracy unknown, assumed to be +/-17m., Last update 9/2003.
X	30	Wells registered for testing *wells tested* under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	1	Permitted private wells *wells permitted* under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	54	Registered abandoned wells *wells abandoned* under Grant-to-Counties program. Locational accuracy varies 1150 to 150 m.; Last update 9/2001, no future updates planned.
X	0	Public water supply wells and intakes locational accuracy 220 m., last updated 8/96
X	0	Water use permit facilities facilities permitted to withdrew >25,000 gallons per day, locational accuracy is +/- 3,750 ft.; last updated 10/96
X	0	Agricultural drainage wells locational accuracy 100m., last updated 4/98

IGS Well Search Results For Client Supplied Map Location

Search Radius: 5280 ft.



Well search results
- IGS well database
- Registered abandoned wells
- Permitted private wells
- Private well tracking system wells
- Wells registered for testing

Iowa Geological Survey
109 Trowbridge Hall
Iowa City, IA 52242-1319
319-335-1575
319-335-2754 (fax)
April 11, 2001

*Note: wells with identical locations have been shifted from their original locations for the purpose of preparing this map.

Well Search Results for Client Supplied Map Location; Search Radius: 5280 ft.

IGB well database

23	4434	T. 84 N., R. 24 W., Sec. 36, NW, SE, SW	155	7/1/50	Izaak Walton League	Bedrock depth unkn; scanned log available
24	26272	T. 84 N., R. 24 W., Sec. 36, NW, SE, SE	145	12/28/87	Pattee, Peter	Bedrock depth unkn
32	26260	T. 84 N., R. 23 W., Sec 31	112	12/2/60	Sinars, R.	Bedrock depth 107 ft.; scanned log available
33	11235	T. 84 N., R. 23 W., Sec. 31	170	1/1/59	Iowa State College	Bedrock depth 79 ft.; scanned log available
73	26589	T. 83 N., R. 23 W., Sec. 5, NW	168	12/1/2000	American Modern Food Energy	Bedrock depth unkn

Private well tracking system wells

18	2079305	T. 84 N., R. 24 W., Sec. 36, NW SE NE SW SE	160	1/1/60	Johnson, Joseph	Status: Active Use: Household, Recreation Program source: Well testing
19	2079308	T. 84 N., R. 24 W., Sec. 36, NE SW SW NE SE	160	1/1/60	Unknown	Status: Active Use: Recreation Program source: Well testing
48	2076190	T. 84 N., R. 24 W., Sec. 36, SW SE SE SW NE	143	12/28/87	Meyer, Arnold	Status: Active Use: Household Program source: Well testing

Wells registered for testing

8	46497	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League, c/o Bob Miner	Drilling method: Drilled; Estimated well depth
9	36741	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
10	36747	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
11	36745	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
12	19576	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League, % Walt Motion	Drilling method: Drilled; Estimated well depth
13	36746	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	156	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
14	36743	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	156	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
15	71550	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	160	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
16	36742	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	156	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
17	36744	T. 84 N., R. 24 W., Sec. 36, NW, SE, NE	155	unkn	Izaak Walton League	Drilling method: Drilled; Estimated well depth
20	46498	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton League	Drilling method: Drilled; Well depth is uncertain
21	71549	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton Legue	Drilling method: Drilled; Well depth is uncertain
25	36748	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton League	Drilling method: Drilled;
27	36749	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton League	Drilling method: Drilled;
28	36751	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton League	Drilling method: Drilled;
30	36750	T. 84 N., R. 24 W., Sec. 36, NE, SW, SE	unkn	unkn	Izaak Walton League	Drilling method: Drilled;
34	22237	T. 84 N., R. 24 W., Sec. 36, SW, NE, SE	260	unkn	Cox, Philip C.	Drilling method: Drilled;
35	22236	T. 84 N., R. 24 W., Sec. 36, SW, NE, SE	260	unkn	Cox, Philip C.	Drilling method: Drilled;
36	22235	T. 84 N., R. 24 W., Sec. 36, SW, SE, NW	40	1968	Johnson, Leroy and Carol	Drilling method: ;
38	39510	T. 84 N., R. 24 W., Sec. 36, SW, SE, NW	70	1988	Johnson, Leroy L/Carol M.	Drilling method: Drilled; Known well depth
40	62852	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Pattee, Peter	Drilling method: Drilled; Known well depth
41	73077	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Pattee, Peter	Drilling method: Drilled; Known well depth
42	23363	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Pattee, Peter	Drilling method: Drilled;
43	35709	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Pattee, Peter	Drilling method: Drilled; Known well depth
44	73078	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Pattee, Peter	Drilling method: Drilled; Known well depth
45	23365	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	186	1969	Longfellowell, Robert T./Joan M.	Drilling method: Drilled;

46	73075	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Fattes, Peter	Drilling method: Drilled; Known well depth
47	71552	T. 84 N., R. 24 W., Sec. 26, SW, SE, SE	143	1987	Peter, Fattes	Drilling method: Drilled; Known well depth
49	73079	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	143	1987	Fattes, Peter	Drilling method: Drilled; Known well depth
50	48542	T. 84 N., R. 24 W., Sec. 36, SW, SE, SE	166	1950	Long/Nesbitt, Robert T./Joe M.	Drilling method: Drilled; Known well depth

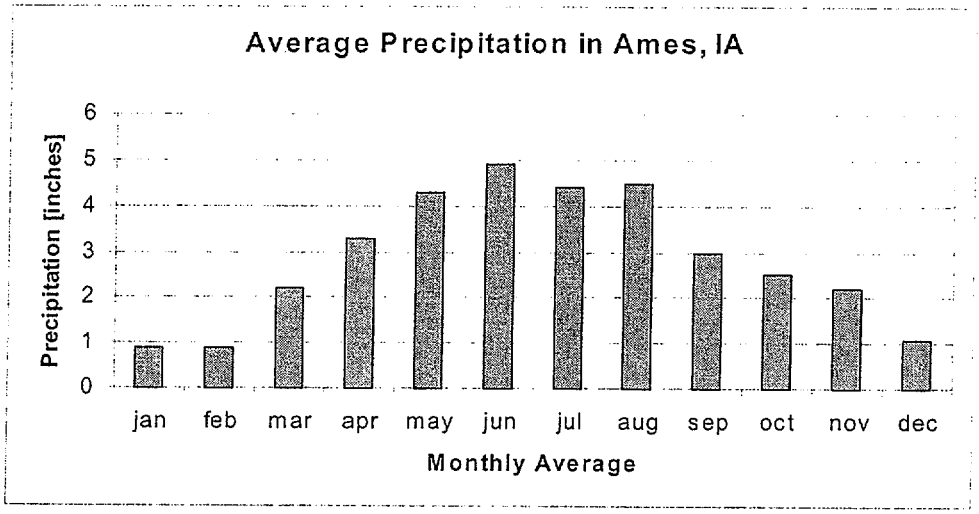
Permitted private wells

37	19005	T. 84 N., R. 24 W., Sec. 36, SE, SW, NW	825	7/30/08	Walker	Primary use: Livestock/Agricultural

Registered abandoned wells

1	13012	T. 84 N., R. 23 W., Sec. 30	75	n.a.	Cooter, Johnny	Well plugged: 11/10/1993; Well type: < 18" dia.
2	33965	T. 84 N., R. 23 W., Sec. 30, SW, SW, NW	14	n.a.	Usda	Well plugged: 8/2/1999; Well type: < 18" dia.
3	31566	T. 84 N., R. 23 W., Sec. 31, NW, NW, NW	15	n.a.	U.s.d.a- Nadc	Well plugged: 1/16/1998; Well type: < 18" dia.
4	31564	T. 84 N., R. 23 W., Sec. 31, NW, NW, NW	14	n.a.	U.s.d.a- Nadc	Well plugged: 1/16/1998; Well type: < 18" dia.
5	31565	T. 84 N., R. 23 W., Sec. 31, NW, NW, NW	13	n.a.	U.s.d.a- Nadc	Well plugged: 1/16/1998; Well type: < 18" dia.
6	19984	T. 84 N., R. 23 W., Sec. 31, NW, NW	16	n.a.	National Animal Disease, Center	Well plugged: 11/18/1993; Well type: < 18" dia.
7	8295	T. 84 N., R. 23 W., Sec. 31, NW, NW, SW	16	n.a.	Ia Light & Power, Mw#5	Well plugged: 3/13/1992; Well type: < 18" dia.
22	8298	T. 84 N., R. 23 W., Sec. 31, NW, SW, SW	16	n.a.	Ia Light & Power, Mw#8	Well plugged: 3/13/1992; Well type: < 18" dia.
26	8296	T. 84 N., R. 23 W., Sec. 31, NW, SW, SW	16	n.a.	Ia Light & Power, Mw#6	Well plugged: 3/13/1992; Well type: < 18" dia.
28	829?	T. 84 N., R. 23 W., Sec. 31, NW, SW, SW	18	n.a.	Ia Light & Power, Mw#7	Well plugged: 3/13/1992; Well type: < 18" dia.
38	18364	T. 84 N., R. 24 W., Sec. 36	125	n.a.	Johnson, Leroy L. & Carol M.	Well plugged: 8/24/1995; Well type: < 18" dia.
39	21153	T. 84 N., R. 24 W., Sec. 36, SW, SE	unkn	n.a.	Johnson, Carol M. & Le Roy L.,	Well plugged: nl; Well type: unkn
51	47562	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	6	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
52	47557	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
53	47558	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
54	47560	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
55	47561	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
56	47559	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
57	47563	T. 83 N., R. 24 W., Sec. 1, NE, NE, NW	15	n.a.	Trickle Investors, Llc, Delbert Trickle	Well plugged: nl; Well type: < 18" dia.
58	8322	T. 83 N., R. 23 W., Sec. 6, NW, NE	15	n.a.	Sever-sundstrand, Bh#14	Well plugged: 6/9/1992; Well type: < 18" dia.
59	8326	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#7	Well plugged: 6/9/1992; Well type: < 18" dia.
60	8320	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#2	Well plugged: 6/9/1992; Well type: < 18" dia.
61	8329	T. 83 N., R. 23 W., Sec. 6, NW, NE	15	n.a.	Sever-sundstrand, Bh#11	Well plugged: 6/9/1992; Well type: < 18" dia.
62	8328	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#9	Well plugged: 6/9/1992; Well type: < 18" dia.
63	8330	T. 83 N., R. 23 W., Sec. 6, NW, NE	20	n.a.	Sever-sundstrand, Bh#12	Well plugged: 6/9/1992; Well type: < 18" dia.
64	8319	T. 83 N., R. 23 W., Sec. 6, NW, NE	20	n.a.	Sever-sundstrand, Bh#1	Well plugged: 6/9/1992; Well type: < 18" dia.
65	8321	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#3	Well plugged: 6/9/1992; Well type: < 18" dia.
66	8331	T. 83 N., R. 23 W., Sec. 6, NW, NE	20	n.a.	Sever-sundstrand, Bh#13	Well plugged: 6/9/1992; Well type: < 18" dia.
67	8327	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#8	Well plugged: 6/9/1992; Well type: < 18" dia.
68	8324	T. 83 N., R. 23 W., Sec. 6, NW, NE	15	n.a.	Sever-sundstrand, Bh#5	Well plugged: 6/9/1992; Well type: < 18" dia.
69	8322	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#4	Well plugged: 6/9/1992; Well type: < 18" dia.
70	8325	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#10	Well plugged: 6/9/1992; Well type: < 18" dia.
71	8323	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#6	Well plugged: 6/9/1992; Well type: < 18" dia.
72	8333	T. 83 N., R. 23 W., Sec. 6, NW, NE	10	n.a.	Sever-sundstrand, Bh#15	Well plugged: 6/9/1992; Well type: < 18" dia.
74	18648	T. 83 N., R. 23 W., Sec. 6, NW, SE,	15	n.a.	Sever-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.

75	16454	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
76	16453	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	20	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
77	16450	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
78	16448	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
79	16449	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
80	16451	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
81	16452	T. 83 N., R. 23 W., Sec. 6, NW, SE, --	15	n.a.	Sauer-sundstrand, Company	Well plugged: 3/25/1994; Well type: < 18" dia.
82	8641	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	20	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
83	8645	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	20	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
84	8642	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	20	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
85	8643	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	20	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
86	8641	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	20	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
87	8646	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	14	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
88	8636	T. 83 N., R. 23 W., Sec. 6, NW, SW, SW	16	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
89	8634	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	80	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
90	8638	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	14	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
91	8639	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	14	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
92	8637	T. 83 N., R. 23 W., Sec. 6, NW, SE, SW	80	n.a.	Sauer-sundstrand Co., Sauer-sundst	Well plugged: 8/5/1992; Well type: < 18" dia.
93	13651	T. 76 N., R. 21 W., Sec. 30, NW, NW, SW	20	n.a.	Schmalenig, John	Well plugged: 10/1/1993; Well type: < 18" dia.



Average weather in Ames, Iowa

Based on data reported by over 4,000 weather stations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average temp. (°F)	18.1	24.4	36.7	49.3	60.9	70.1	73.8	71.5	64.0	51.9	36.2	22.9
High temperature (°F)	27.5	33.6	46.5	60.9	72.4	81.4	84.5	82.2	76.0	63.8	45.3	31.4
Low temperature (°F)	8.8	15.1	26.8	37.7	49.3	58.8	63.0	60.7	51.9	39.9	27.0	14.3
Precipitation (in)	0.9	0.9	2.2	3.3	4.3	4.9	4.4	4.5	3.0	2.5	2.2	1.1

Normal climate around Ames, Iowa

Based on data reported by main weather stations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Days with precip.	7	7	10	11	12	11	9	9	9	8	7	8
Wind speed (mph)	11.4	11.2	12.4	12.6	11.0	10.1	8.8	8.6	9.4	10.3	11.3	11.1
Morning humidity (%)	77	79	78	77	78	80	83	86	85	79	79	80
Afternoon humidity (%)	70	67	64	58	59	60	61	63	62	59	66	72
Sunshine (%)	51	54	57	56	61	68	72	70	66	62	49	46
Days clear of clouds	8	8	7	7	8	8	10	11	12	12	7	7
Partly cloudy days	7	6	7	8	8	10	11	10	8	7	7	7
Cloudy days	16	15	17	15	15	11	9	10	11	12	16	17
Snowfall (in)	8.2	7.0	6.0	1.8	0.0	0.0	0.0	0.0	0.0	0.3	3.1	6.5

Data source: city-data.com

Ames Climate Data	USDA-NADC Site 1 Wells	CABRERA SERVICES	03/08/2004	

Figure B-1 Ames Climate Data

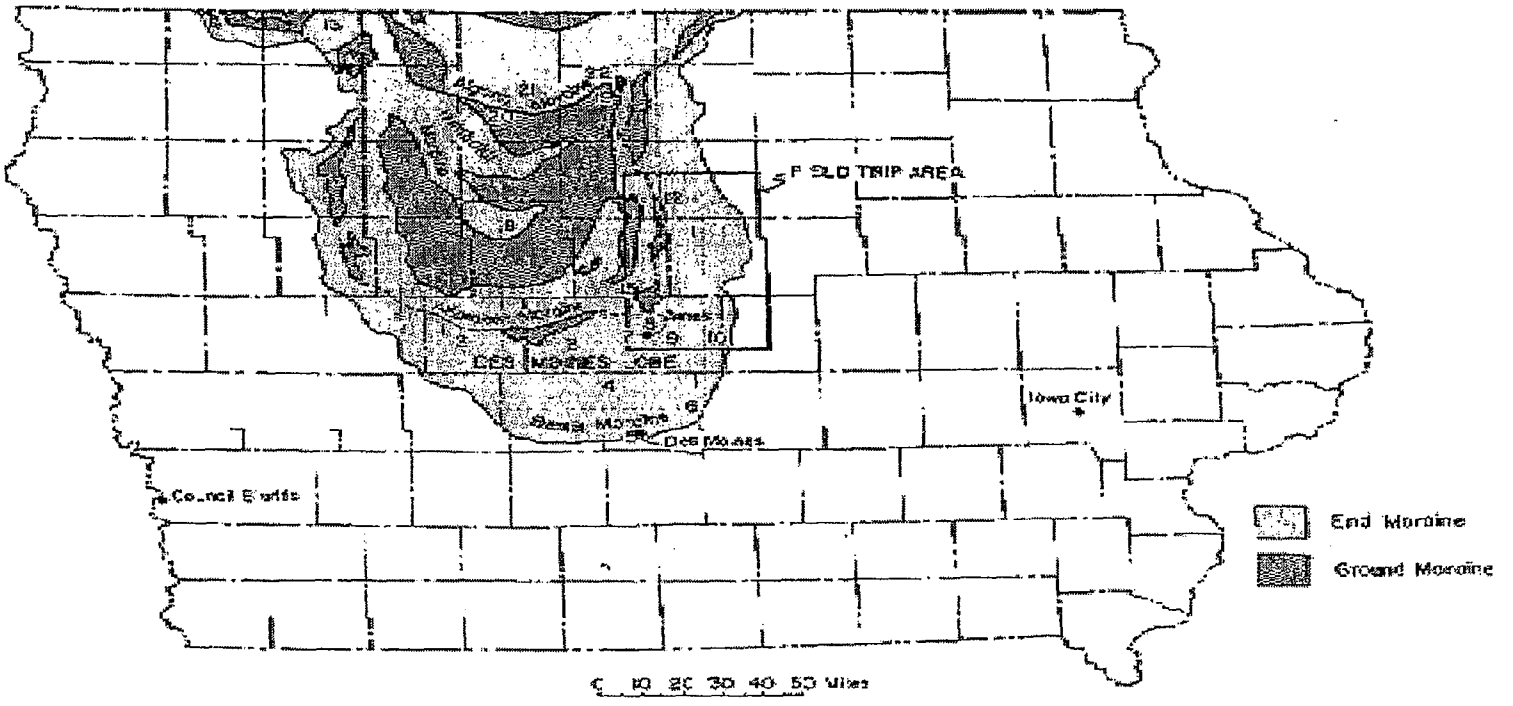


Figure 1. Map showing: 1) the location of the Des Moines Lobe in Iowa; 2) classic landform designations (after Ruhe, 1969; Prior, 1976); 3) field trip area (see figure 2); and 4) numbers show location of radiocarbon dates given in Table 1.

Source: Kemmis, 1981

Des Moines Lobe Glacial Moraine	USDA-NADC Site 1 Wells	CABRERA SERVICES	10/21/2003	

Figure B-2 Des Moines Lobe Glacial Moraine

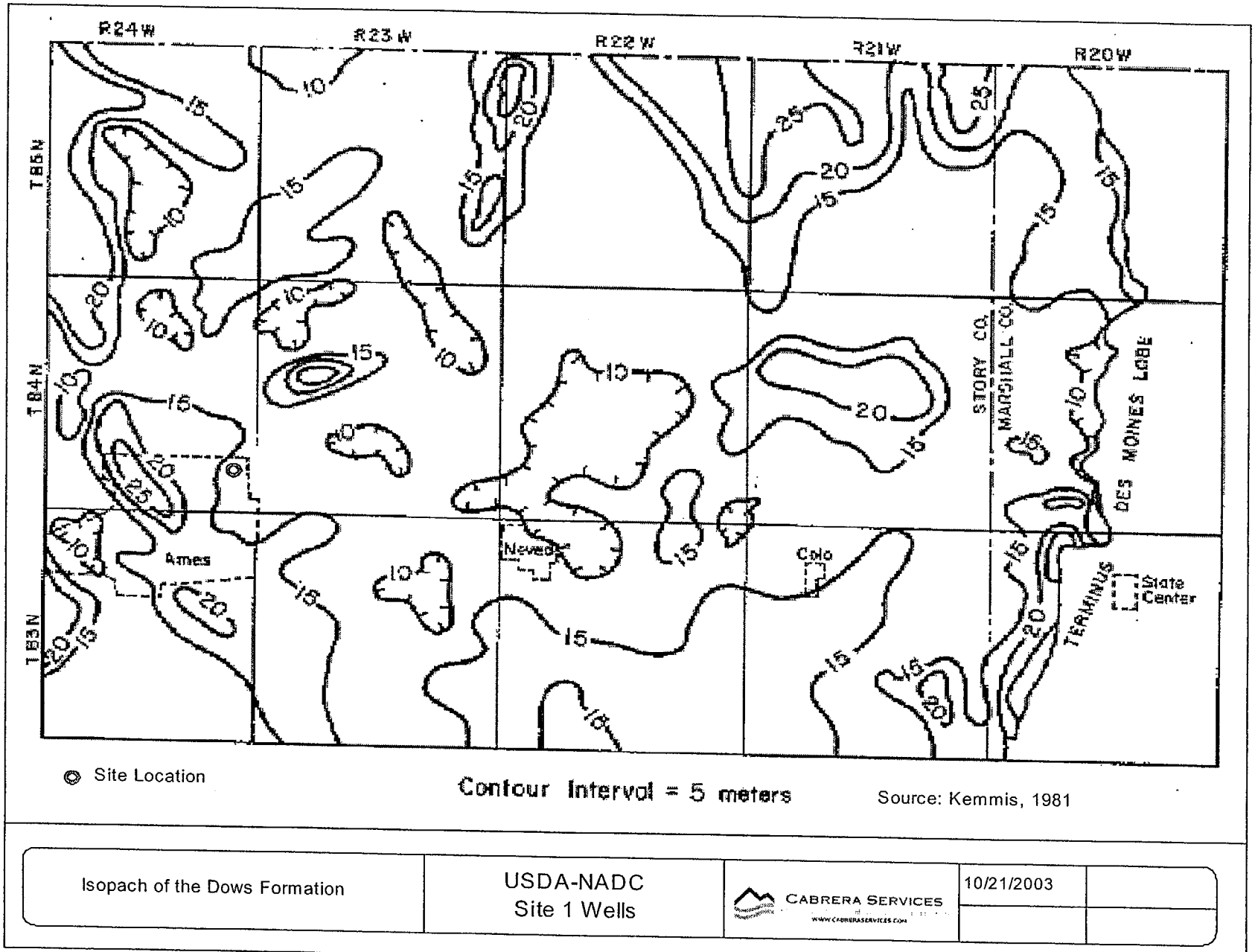


Figure B-3: Thickness of Dows Formation Tills

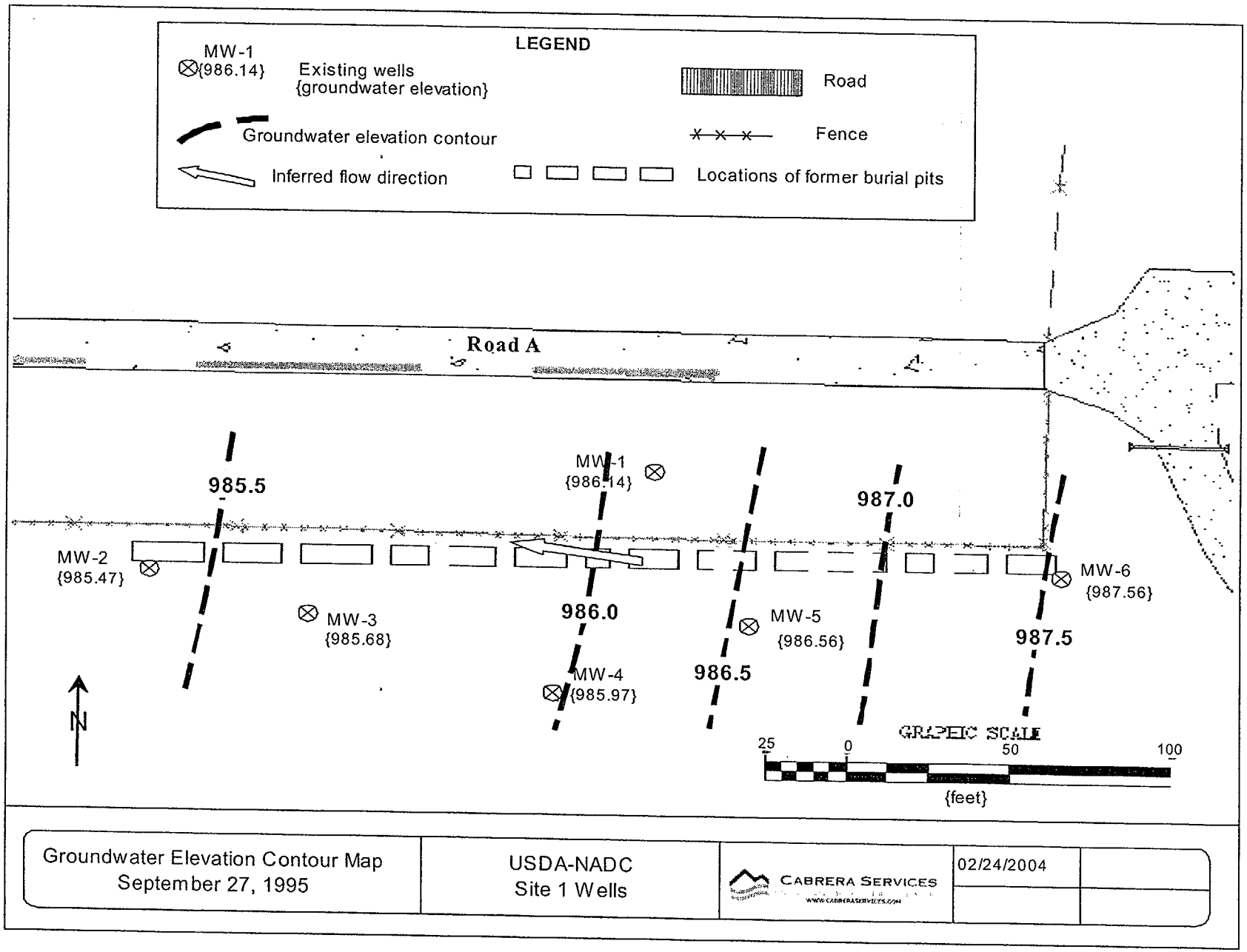


Figure B-4: Groundwater Elevation Contours on 09/27/95

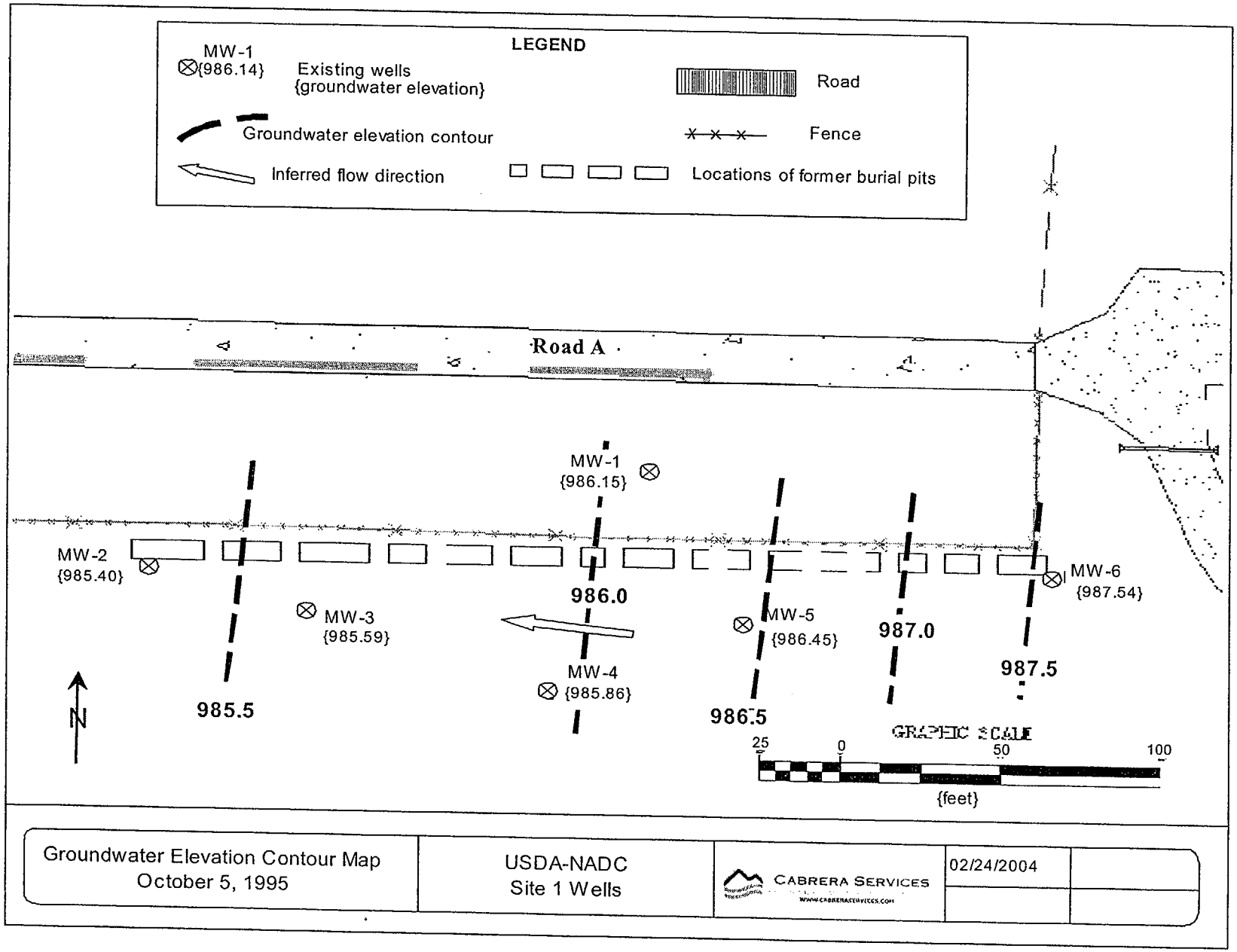


Figure B-5: Groundwater Elevation Contours on 10/05/95

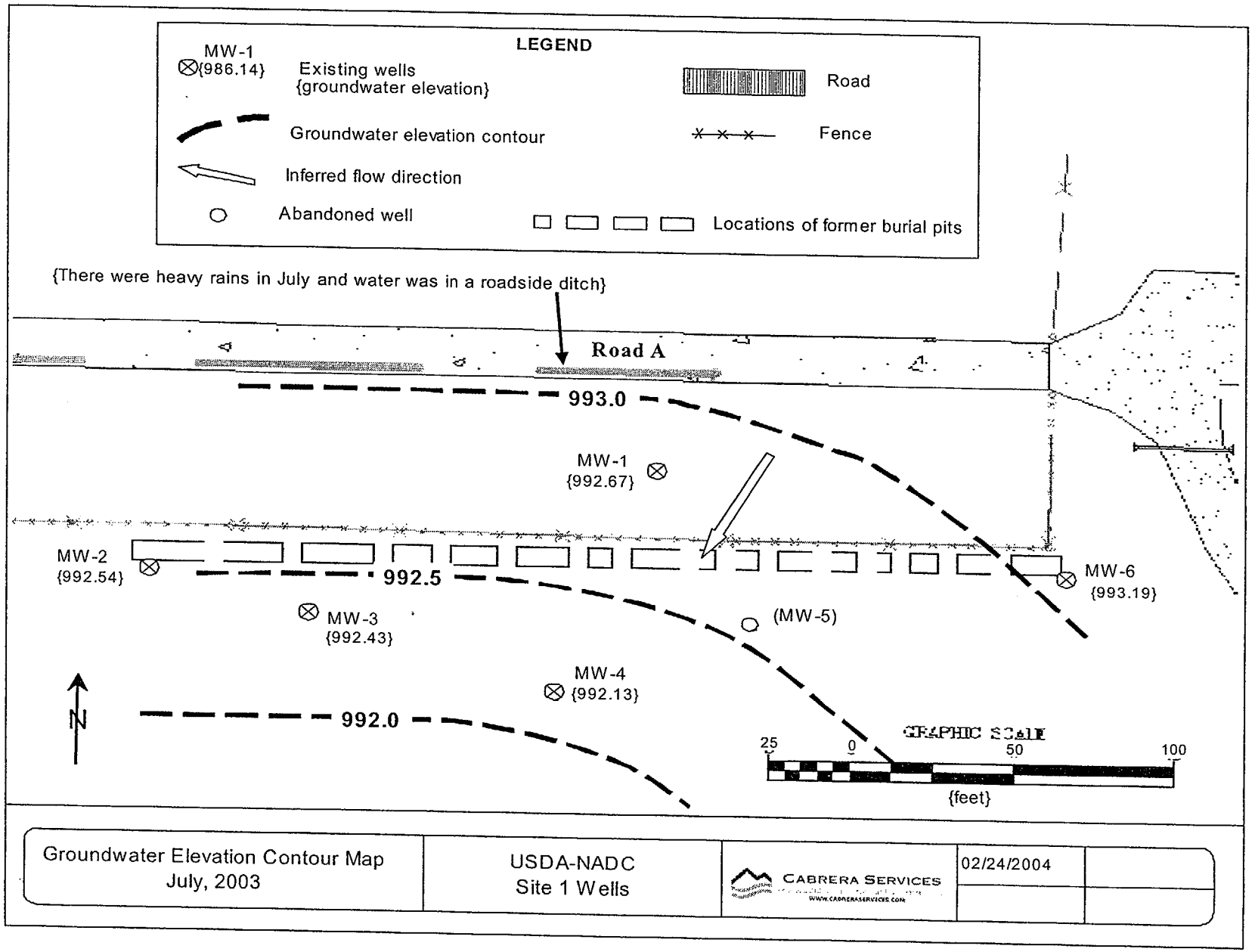


Figure B-6: Groundwater Elevation Contours on 07/16/03

APPENDIX C

Data Quality Objectives For the Groundwater Investigation Site 1 USDA NADC Ames, IA

Data Quality Objectives (DQOs) are qualitative and quantitative statements that are developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. These outputs are used to develop a data collection design that meets all performance criteria and other design requirements and constraints. The DQO process used to develop the sampling strategy described in this work plan is consistent with the guidance provided in USEPA's Guidance for the DQO Process (USEPA, 1994). The sampling and analysis plan presented in this memorandum considers the intended use of the data; the contaminants, media, and geographic areas of interest; the applicable regulatory limits; and the appropriate sampling and analytical methods.

Step 1 - State the Problem

Problem Description

Radioactive- and organic solvent- containing waste vials and bottles were disposed into unlined trenches at Site 1 from 1971 through 1981. The trenches consisted of 16 burial pits, configured end to end, in a 300-ft long line running west to east. The total volume of waste disposed was estimated to be $40yd^3$ buried with a total radioactivity of 250 mCi, based on isotope purchasing and disposal logs.

A Supplemental Preliminary Assessment (ESE, 1996) was conducted and wells were installed primarily along the southern boundary of the east-west trending trench. Soil and groundwater samples had non-detectable concentrations of VOCs, SVOCs and pesticides. A removal action of the trenches was conducted in 2003. The buried waste and backfill was excavated, but some solvent staining of native soils was observed. Approximately $72yds^3$ of native soils were over-excavated from the northern wall of the excavation, or an approximate 1-ft thickness of native soil from the northern wall of the trench. Post-excavation sampling of soils from the walls and floor of the excavation had non-detectable concentrations of COPCs and background activities of ROPCs. Groundwater pumped from the excavation contained low concentrations of toluene and trimethylbenzene (below MCLs). Evidence of solvent staining on the north wall of the trench plus a review of the data from 1996 preliminary assessment indicated that groundwater flow direction was to the northwest (at least on the measured dates) where no downgradient wells exist to delineate possible groundwater contamination.

Step 2 - Identify the Decision

Principal Study Questions

Do COPCs or ROPCs remain in the groundwater?

If so, could a contaminant plume have migrated downgradient to the northwest, away from the former trench?

If a contaminant plume exists, what is its nature and extent?

Decision Statements

Determine whether COPCs or ROPCs exist in groundwater near the former source zone

Determine whether COPCs or ROPCs have migrated in groundwater toward the northwest. If COPCs or ROPCs are encountered in groundwater, the isoconcentration contour of the MCL concentration must be completely delineated in downgradient, upgradient, and cross-gradient directions.

Step 3 - Identify Inputs to the Decision

Collect groundwater samples from locations to the northwest and north of the former trench from soil borings that have been converted to wells.

Monitor the piezometric surface in all of the wells over the course of a year in order to determine all of the natural groundwater flow directions. Accuracy of these measurements must be to within 0.01 ft as per USEPA standards. Three quarterly sampling events are currently planned.

Sample all of the existing wells on a quarterly basis over the course of a year to determine whether any trends in groundwater quality are noticeable.

The minimum detectable concentration (MDCs) will be low enough to allow for meaningful comparisons between the analytical data and the applicable threshold values. Federal MCLs have been used as guidelines to ensure sufficiently low MDCs for this project. The MDC has been set to 10% of either the MCL. Lists of PRGs and MCLs for the radionuclides and chemicals of concern are presented as Tables C-1 and C-2, respectively.

The laboratory will analyze the samples using standardized, EPA-approved procedures and will document the results in sufficient detail to support a Level III quality review.

Table C-1: MCLs and MDCs for Radioisotopes of Concern

Radioisotope of Concern[1]	MCL (pCi/L)	Analytical Laboratory Required MDC (pCi/L)
Gross Alpha	15[3]	1.5
H-3	20,000[2]	2,000
C-14	2,000[4]	200
Ni-63	50[4]	5

Notes
1. As determined by the IRA Work plan.
2. Stated in 40 CFR 141.66, effective 12/03, Table A
3. Stated in 40 CFR 141.66(c), effective 12/03, the MCL for gross alpha particle activity, including radium-226 but excluding radon and uranium
4. Stated in 40 CFR 151.66(d), effective 12/03. 4 mrem/yr limit as specified in Table IV-2A and IV-2B of EPA76 and in Table 3-3 of EPA00

Table C-2: PRGs, MCLs and MDCs for the Contaminants of Concern

Chemical of Concern[1]	PRG[2] [µg/L]	MCL[3] (µg/L)	Analytical Laboratory Required MDC (µg/L)
Benzene	0.34	5	0.2
Ethyl Benzene	2.9	700	0.29
Toluene	720	1,000	72
Total Xylenes	210	10,000	21

Chemical of Concern[1]	PRG[2] [µg/L]	MCL[3] (µg/L)	Analytical Laboratory Required MDC (µg/L)
Lead	na[4]	15	1.5
Cyanide	730	200	20
Formaldehyde	5500	na[4]	550
PPO	na[4]	na[4]	na[4]
POPOP	na[4]	na[4]	na[4]

Notes
1. As determined by the IRA Work plan.
2. *source:* EPA Region 9 PRGs Table, 10/01/02
3. *source:* National Primary Drinking Water Standards, July 2002: EPA 816-F-02-013
4. This goal or level does not exist.

Step 4 - Define the Study Boundaries

Population of Interest Defining Characteristics

The population of interest consists of the groundwater in the former source zone and downgradient of the source zone in the inferred groundwater flow direction.

Spatial Boundaries of the Decision Statement

- The upgradient spatial boundary is the former source zone.
- The downgradient spatial boundary is the distance that groundwater could be expected to travel in the 30 years since the first waste disposal, which is 30 feet (ft). This boundary is considered to be conservative because no contaminant retardation has been factored.
- The lower spatial boundary is the base of the sand lenses, which occur from 8 to 11 ft bgs. Sand lenses are potential migration pathways. The great thickness of the Dows Formation, buoyant characteristics of both the neat and aqueous phases of the COPCs, relative immobility of the ROPCs, and finally the post-excavation soil sampling results all indicate that further downward delineation is unwarranted.
- The upper spatial boundary is the top of the water table during the highest-expected recharge period; the screened intervals of the wells must be above this level in order to assure that any potential light nonaqueous phase liquid (LNAPL) could be detected.

Temporal Boundaries of the Decision Statement

Monitoring and sampling is scheduled to occur over the period of three quarters in order to capture the seasonal effects on flow direction plus all of the groundwater-elevation effects on contaminant aqueous concentrations due to contact with a potential smear zone.

Constraints on Data Collection

Unusually wet weather could raise the water table above the planned screened intervals. Monitoring wells placed in open areas are always subject to damage, in spite of traffic bollards. Any new construction activity can potentially result in damage to the surface completions of the

wells. New utility construction could add water to the geosystem and affect groundwater flow direction.

Step 5 - Develop the Decision Rules
Primary Decision Rules

1) If concentrations of COPCs and ROPCs are below MCLs after a year of monitoring and sampling, and the downgradient flow-paths are controlled by monitor wells, then the investigation warrants no further action.
2) If concentrations of COPCs or ROPCs are above MCLs in the source zone but location of the MCL isopleth can be definitively contoured with the well network, then the decision to maintain monitoring and sampling will depend on whether contaminant concentrations show increasing, decreasing, or static trends. If aqueous contaminant concentrations indicate a steady decrease toward MCLs, then the investigation may be considered for no further action.
3) If there is not a well downgradient of an aqueous plume (with aqueous concentrations above an MCL) at all times then an additional well investigation may be needed.

A decision flow diagram is included as Figure C-1, which identifies groundwater sampling outcomes and the subsequent path forward.

Step 6 - Specify Limits on Decision Errors

Decision errors occur when an incorrect action is recommended based on the decision rules. Decision errors occur primarily as a result of uncertainty in the data. However, the consequences of making a decision error are biased towards collecting additional information. Decisions based on contaminant concentrations must factor in the reporting uncertainty and method detection limits.

Step 7 - Optimize the Design for Obtaining Data

To the extent practical, the design for collecting data presented in this Work Plan has been optimized to achieve the stated DQOs. These data will be used to refine the scope of field activities, as needed, to ensure the DQOs are met. Requirements of the Work Plan will be re-evaluated upon collection and analysis of after each quarter's data, and modified to accommodate greater optimization, if necessary.

A decision flow diagram for achieving the data quality objectives is presented in Figure C-1.

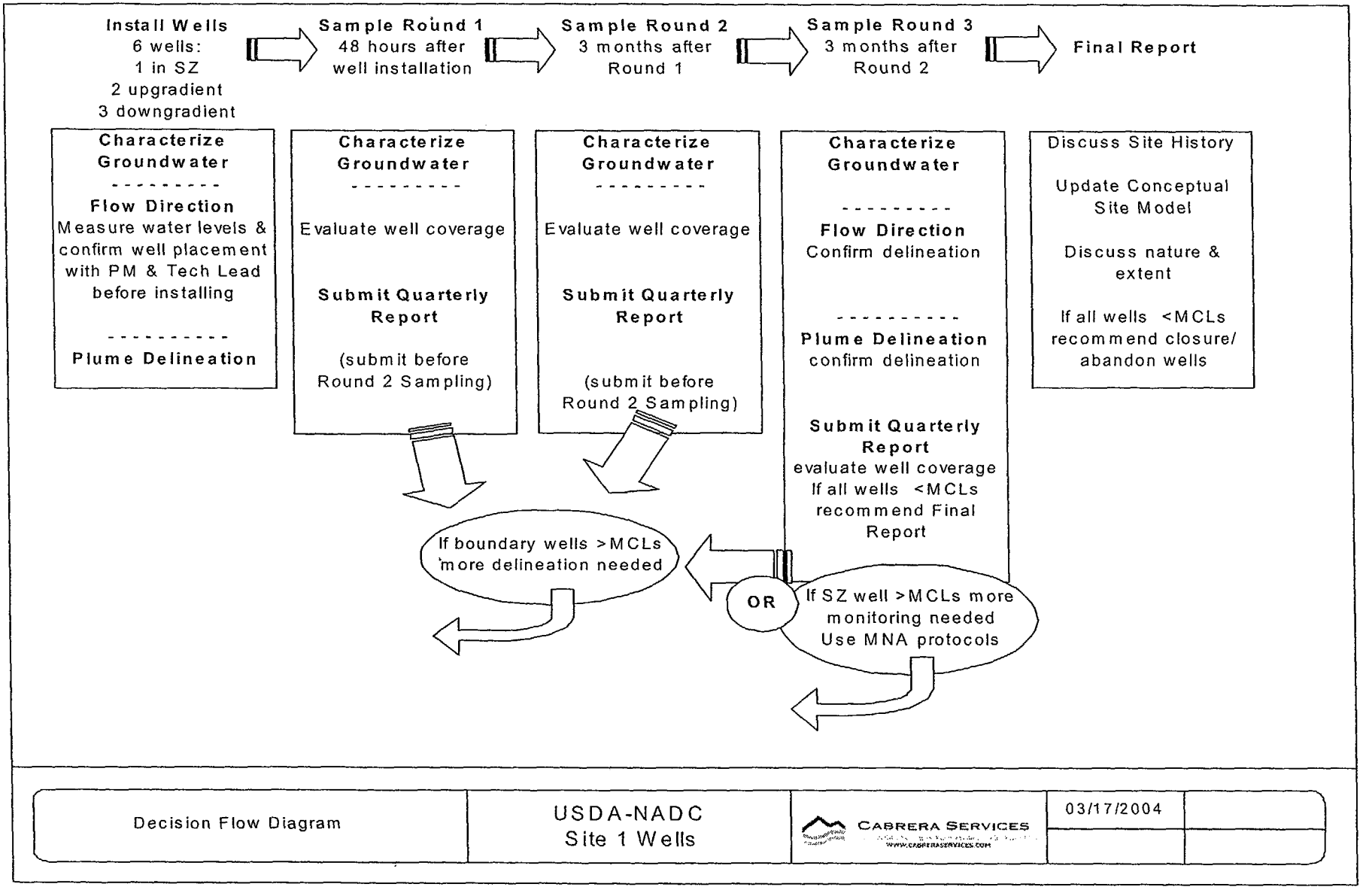


Figure C-1: Decision Flow Diagram

APPENDIX D

Soil Boring Logs and Monitoring Well Construction Sheets

D.1 - ESE 1996 (Borings/Wells 1-6)

D.2 - Cabrera 2004 (Borings/Wells 7-12)

APPENDIX D.1 - ESE 1996 (Borings/Wells 1-6)

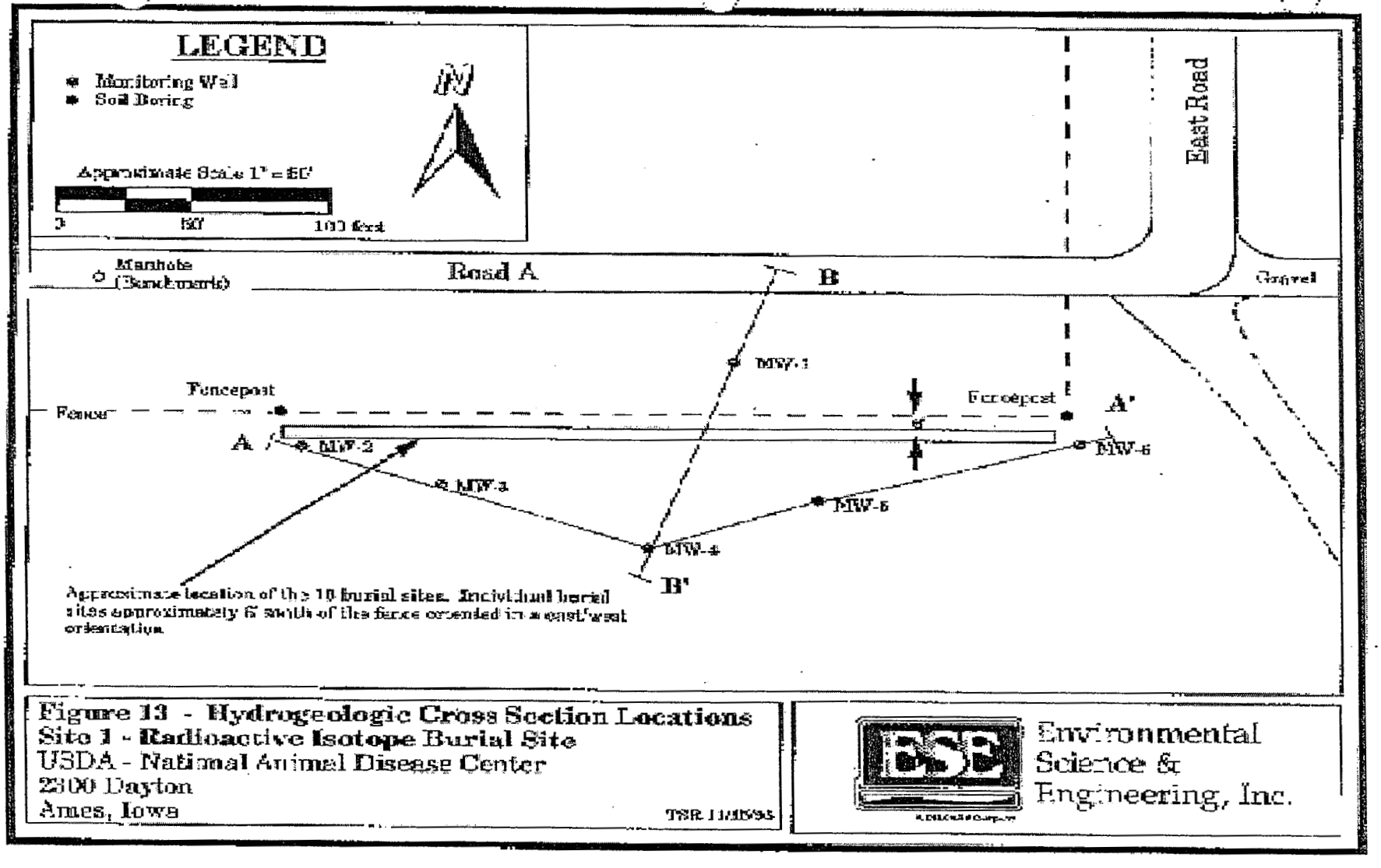


Figure 13 - Hydrogeologic Cross Section Locations
Site 1 - Radioactive Isotope Burial Site
USDA - National Animal Disease Center
2300 Dayton
Ames, Iowa

Environmental Science & Engineering, Inc.

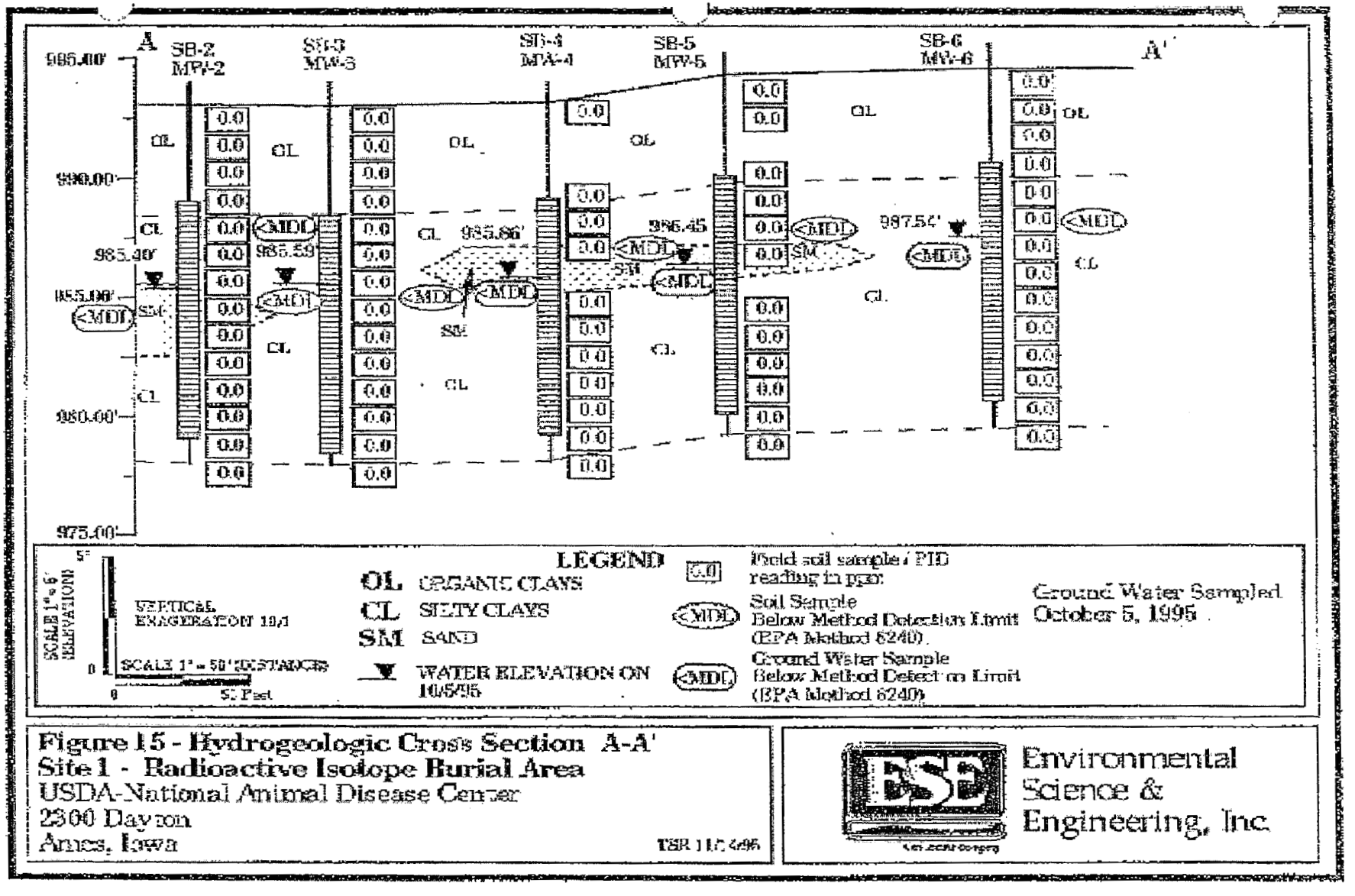


Figure 15 - Hydrogeologic Cross Section A-A'
Site 1 - Radioactive Isotope Burial Area
USDA-National Animal Disease Center
2300 Dayton
Ames, Iowa

Environmental Science & Engineering, Inc.

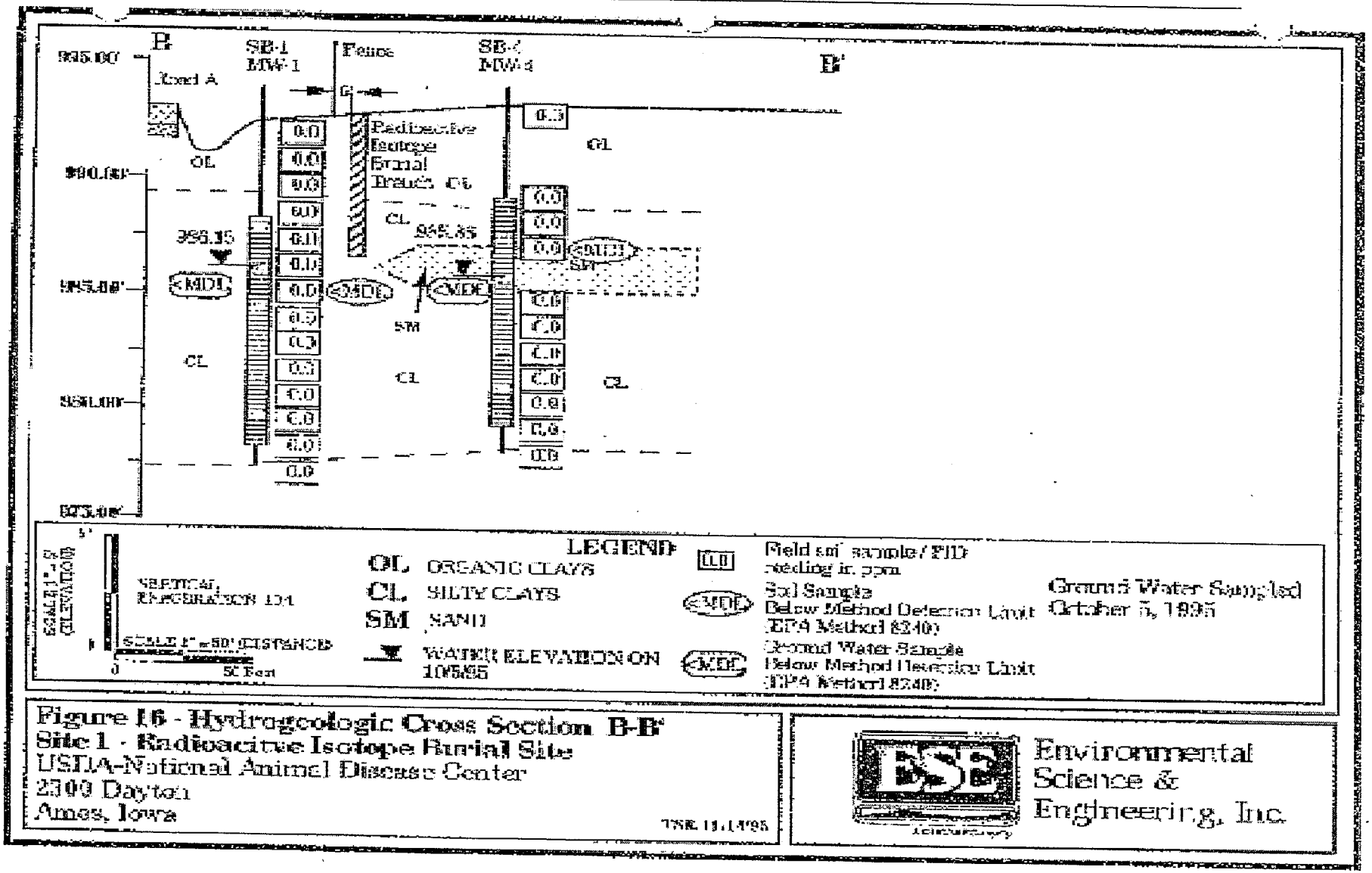
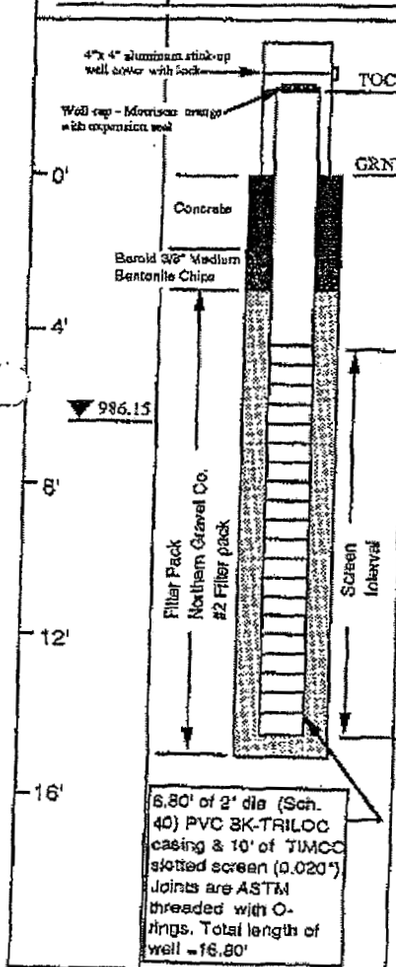


Figure 16 - Hydrogeologic Cross Section B-B'
Site 1 - Radioactive Isotope Burial Site
USDA-National Animal Disease Center
2300 Dayton
Ames, Iowa

Environmental Science & Engineering, Inc.

SOIL BORING LOG & MONITORING WELL CONSTRUCTION DIAGRAM

Boring/Well # Site #1: SB-1 / MW-1	Facility Name: USDA -National Animal Disease Center	Facility Address: 2300 Dayton, Ames, Iowa	
Boring Depth (Feet) x Diameter (inches): 15' x 8"		Drilling Method: Hollow Stem Auger, 5' Continuous Core Sampling	
Well Contractor Registration #: CD-00260-01 (AQUADRILL)		Logged by: ENVIRONMENTAL SCIENCE AND ENGINEERING: K. McFadden	
Date & Time Start: 9/19/95 0930	Date & Time End: 9/19/95 1020	Ground Surface Elevation (ASL): 992.41	EPA ID No.: IA8123490007



Depth in Feet 1" = 4'	Well Construction Details	Blow Count (if Applicable)	Sample No.	Sample Type*	PID/FID Reading (HNU PI-101)	Rock Formations, Soil, Color and Classifications, Observations (moisture, etc.)
		Continuous core recovery in feet per 5' core.	No.-DEPTH			
		TOC 995.07				
		GRNT 992.41			0'	
		4.5'/5'	1 -1'	HS	0.0 ppm	0' CLAY, with silt, topsoil horizon , low moisture content, organics, roots, blocky, black with gray tint to approximately 2.5'to 3 'BG,color grades to light brown with rust and gray mottling, becoming silty and slightly plastic with depth, moist to saturated at approximately 7' BG, trace sand at 7'BG (sand lense <1" , fine to medium grained) color grades to gray, at 8.5 to 9', moisture content decreases with depth , stiff, hard, dense, non plastic, sand and pebble content increasing with depth color grades back to dark brown with gray tint, unoxidized till at 14', lower contact not penetrated. Unified Classification- CL
			2 -2'	HS	0.0 ppm	
			3 -3'	HS	0.0 ppm	
			4 - 4'	HS	0.0 ppm	
			5 - 5'	HS	0.0 ppm	5'
			6 - 6'	HS	0.0 ppm	
		Lab soil sample - top of interval elevation 985.41	7 - 7'	LAB	0.0 ppm	
		5'/5'	8 - 8'	HS	0.0 ppm	
			9 - 9'	HS	0.0 ppm	
			10 - 10'	HS	0.0 ppm	10'
			11 - 11'	HS	0.0 ppm	
		5'/5'	12 - 12'	HS	0.0 ppm	
			13 - 13'	HS	0.0 ppm	
		978.27	14 - 14'	HS	0.0 ppm	15'

Notes:
End of boring at 15' bls, lower contact not penetrated. A well was installed within hollow stem augers; the auger sections were slowly raised while Northern Gravel #2 filter sand was placed in the annular space. Baroid Holeplug 3/8" bentonite chips were used to backfill the boring beginning at 3' BG. A 1' bentonite layer was installed. Concrete was utilized to plug the upper 2' to grade. A stick -up protective cover was installed with a brass Master lock. A Morrison blaze orange expansion plug caps the the well.

*SS (split spoon) *HS (hollow stem auger) NOTE: HS USED WITH 5' CONTINUOUS CORE - GRAB SAMPLES FROM CORE

OBSERVATIONS WATER LEVELS Static Water Level Symbol ▼	Date:	9/27/95	10/5/95				
	Level:	8.93/986.14	8.92/986.15				
	Time:	1311	1122				

SOIL BORING LOG & MONITORING WELL CONSTRUCTION DIAGRAM

Boring/Well # Site #10: SB-5	Facility Name: USDA -National Animal Disease Center	Facility Address: 2300 Dayton, Ames, Iowa	
Boring Depth (Feet) x Diameter (inches): 5' x 3.5"		Drilling Method: Direct push with Lasky, 5' Continuous Core Sampler	
Well Contractor Registration #: CD-00260-01 (AQUADRILL)		Logged by: ENVIRONMENTAL SCIENCE AND ENGINEERING: K. McFadden	
Date & Time Start: 9/21/95 1735	Date & Time End: 9/21/95 1759	Ground Surface Elevation (ASL): 996.26	EPA ID No.: IA8123490007

Depth in Feet 1" = 4'	Well Construction Details	Blow Count If Applicable	Sample No.	Sample Type*	PID/FID Reading (HNU PI-101)	Rock Formations, Soil, Color and Classifications, Observations (moisture, etc.)
		Continuous core recovery in feet per 5' core.	No.- DEPTH			
0'		GRND 996.26			0'	0'
	Baroid 3/8" Medium Bentonite Chips	5'/5'	1 - 1.5'	HS	0.2 ppm	CLAY, with silt, fill, sandy, gravelly, low moisture content, hand compacted and friable, black with gray tint to approximately 3.5ft, moisture content increasing with depth, lower contact distinct. Unified Classification- OL/CL
4'			2 - 2.5'	HS	0.2 ppm	
			3 - 3.5'	HS	0.4 ppm	3'
		992.26 Lab soil sample - top of interval elevation	4 - 4.5'	LAB	0.4 ppm	Manure, compost, clay, with silt and sand, organics, wood, some decaying organics, saturated at approximately 4', black to gray, strong manure and compost odor, spongy, non plastic, lower contact distinct, Unified Classification - OL/PT
					5'	5'
8'						
12'						
16'						

Notes:
End of boring at 5' bls, lower contact not penetrated. Baroid Holeplug 3/8" bentonite chips were used to backfill the boring to grade.

*SS (split spoon) *HS (hollow stem auger) NOTE: HS USED WITH 5' CONTINUOUS CORE - GRAB SAMPLES FROM CORE

OBSERVATIONS						
WATER LEVELS	Date:					
Static Water Level Symbol ▼	Level:					
	Time:					

DNR FORM 542-1392

APPENDIX D.2 - Cabrera 2004 (Borings/Wells 7-12)

USDA NATIONAL ANIMAL DISEASE CENTER
SITE 1 - GROUNDWATER INVESTIGATION REPORT FINAL

BORING LOG

Borehole ID: MW-7
Sheet 1 of 1

			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17		Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation	Total Drilled Depth: 15 ft.	
Drilling Equipment: SIMCO	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04 1035 hrs	Date/Time Total Depth Reached: 5/11/04 1115 hrs
Type of Sampling Device			Water Level (bgs): First / Final	
Sample Hammer: N/A Type / Driving Wt. / Drop			Hydrogeologist: K. Nelson	Checked by/Date
Location Description (include sketch in field logbook)				

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
				0-3' Topsoil Black F/M sand & silt to clay organic fibers throughout	OL		dry	PID: 0 ppm
5				3-4' Silt, clayey, plastic, black, woody fibers	CL		wet	
10				4-12' Sand, silty, w/ clay, olive grey. Multiple highly oxidized zones throughout. Trace fine gravel to coarse sand. Distributed evenly throughout. Organic fibers distributed throughout.	ML			PID: 0 ppm
15				12-15' Fine sand and silt, dark grey. Some clay. Stiff. Trace gravel throughout			dry	PID: 0 ppm
				bottom of boring 15 ft				

USDA NATIONAL ANIMAL DISEASE CENTER
SITE 1 - GROUNDWATER INVESTIGATION REPORT FINAL

BORING LOG

Borehole ID: MW-8
Sheet 1 of 1

			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17	LTCCODE (ERPIMS): n/a	Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation:	Total Drilled Depth: 15 ft.	
Drilling Equipment: simco	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04	Date/Time Total Depth Reached: 5/11/04
Type of Sampling Device:		Water Level (bgs): First	Final	
Sample Hammer Type: N/A	Driving Wt.	Drop	Hydrogeologist: K. Nelson	Checked by/Date:
Location Description (include sketch in field logbook):				

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
0				0-4' Topsoil Black F/M silt, sandy , increasing sand w/ depth. Sharp contact. 4" seam c. sand. organic fibers throughout	OL		dry	PID: 0 ppm
5					SM		wet	
10				4-11.5' Olive gray mottled sand & silt clay & F/M gravel throughout; oxidized horizons throughout but more common with depth.				PID: 0 ppm
15				11.5-15' Dark grey silty clay with trace to some F/M sand & gravel thoughout. Dense, stiff (Till)	CL		dry	PID: 0 ppm
							dry	

USDA NATIONAL ANIMAL DISEASE CENTER
SITE 1 - GROUNDWATER INVESTIGATION REPORT FINAL

BORING LOG

Borehole ID: MW-9
Sheet 1 of 1

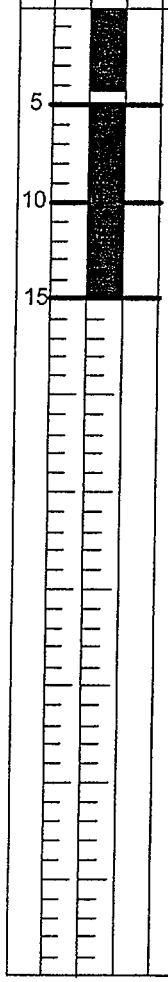
			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17	LTCCODE (ERPIMS): n/a	Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation	Total Drilled Depth: 15 ft.	
Drilling Equipment: simco	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04	Date/Time Total Depth Reached: 5/11/04
Type of Sampling Device			Water Level (bgs): First / Final	
Sample Hammer: N/A Type / Driving Wt. / Drop			Hydrogeologist: K. Nelson	Checked by/Date
Location Description (include sketch in field logbook)				

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, minerology, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
5				0-2' Topsoil Black sandy silt to clay stiff organic fibers throughout	OL		dry	PID: 0 ppm
10				2-10' Olive F/M sand & silt, tr. F/M gravel, tr. clay A+ 6' bgs - lens (4" thick) of M/C sand & F gravel (SAT). C gravel below this zone, poorly sorted.	ML		wet	PID: 0 ppm
15				10-15' (Contact unclear due to recovery) Dk grey sandy silt, clay stiff, dense. Tr. fine gravel - med. sand, poorly sorted.	CL		dry	PID: 0 ppm

BORING LOG

Borehole ID: MW-10
Sheet 1 of 1

			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17	LTCCODE (ERPIMS): n/a	Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation	Total Drilled Depth: 15 ft.	
Drilling Equipment: simco	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04	Date/Time Total Depth Reached: 5/11/04
Type of Sampling Device			Water Level (bgs): First / Final	
Sample Hammer Type: N/A	Driving Wt.	Drop	Hydrogeologist: K. Nelson	Checked by/Date
Location Description (include sketch in field logbook)				



Depth	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
0	0-2.5' Black sandy silty w/ clay; some organic tr F gravel (granitic, qtz)	OL	dry	PID: 0 ppm
5	2.5-14' grades to olive SANDY SILT; gravelly zone @ 4.5'. (completely weathered granitic); oxideized zons thoughout (sandier than other locations at this interval)	SM	wet	PID: 0 ppm
10				
15	14-15' Dk grey silt & clay w/ F sand; tr. C gravel (Till)	CL	dry	PID: 0 ppm
	bottom of boring = 15'			
	* gravels include shale clasts, qtz & granitic			

BORING LOG

Borehole ID: MW-11
Sheet 1 of 1

			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17	LTCCODE (ERPIMS): n/a	Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation:	Total Drilled Depth: 15 ft.	
Drilling Equipment: simco	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04	Date/Time Total Depth Reached: 5/11/04
Type of Sampling Device:		Water Level (bgs): First	Final	
Sample Hammer: N/A Type	Driving Wt.	Drop	Hydrogeologist: K. Nelson	Checked by/Date:
Location Description (include sketch in field logbook)				

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
5				0-1.5' Black soil organic F sand & silt. Grades to olive sandy silt, tr to some	OL		dry	PID: 0 ppm
				1.5-3' F gravel/ C. Sand - sand increases w/ depth	SP		wet	
10				3-13.5' Olive M sand & silt; tr. C. sand/F gravel (weathered granitic); tr. Organics to clay grades to	ML			PID: 0 ppm
15				13.5-15' Dk grey clay & silt; some F/M sand & F/M gravel stiff deuse (TILL)	CL		dry	PID: 0 ppm
				bottom of boring 15 ft				

BORING LOG

Borehole ID: MW-12
Sheet 1 of 1

			Location Northing: Easting:	
Project Name: Ames NADC GW Site 1	Project Number: 03-3040.17	LTCCODE (ERPIMS): n/a	Site ID: Site 1	
Drilling Company: Rewerts Well Co.	Driller: Justin Rewerts	Ground Elevation:	Total Drilled Depth: 15 ft.	
Drilling Equipment: simco	Drilling Method: HSA	Borehole Diameter: 8.25 in.	Date/Time Drilling Started: 5/11/04	Date/Time Total Depth Reached: 5/11/04
Type of Sampling Device:			Water Level (bgs): First / Final	
Sample Hammer: N/A Type / Driving Wt. / Drop			Hydrogeologist: K. Nelson	Checked by/Date:
Location Description (include sketch in field logbook)				

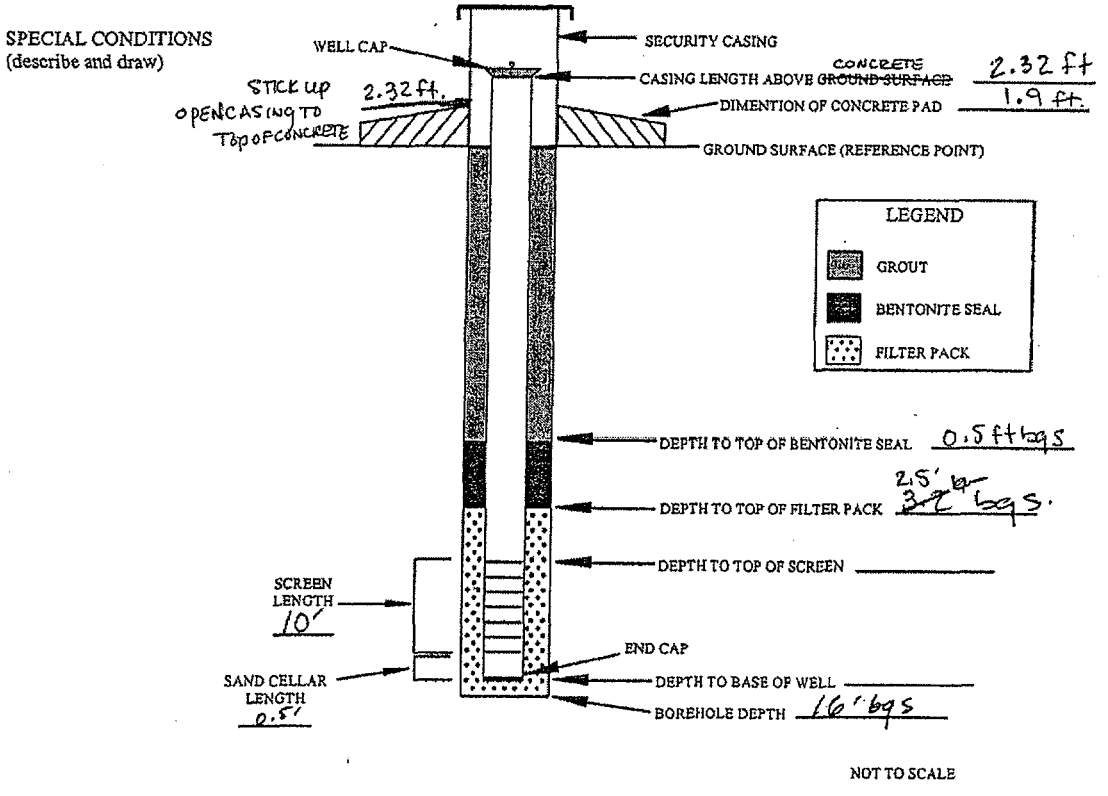
Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)
				0-3' Topsoil Black organic M sand, tr. silt	OL		dry	PID: 0 ppm
				3-4' Black organic sandy clay w/ woody fibers				
5				4-7' M grey silty sand (F-VF); some clay, slighty plastic	SM		wet	
				7-12' Olive F-M sand and silt; tr. Gravel (up to 1:, subrounded) and C. sand throughout.				PID: 0 ppm
10								
				12-15' Dk grey silty clay w/ tr. of sand & F/M gravel V. dense slight, plastic (TILL)	CL		dry	PID: 0 ppm
15				bottom of boring 15 ft				

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Rewerts Drilling
DRILLING TECHNIQUE: HSA - Simco Rig
AUGER SIZE AND TYPE: 4.25 in ID/6.25 in OD
BOREHOLE IDENTIFICATION: —
BOREHOLE DIAMETER: ~8 inches
WELL IDENTIFICATION: MW-7
WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04
SCREEN MATERIAL: sched 40 PVC
SCREEN DIAMETER: 2.0 in ID
SCREENED INTERVAL(S) (FT):
CASING MATERIAL: sched 40 PVC
CASING DIAMETER: 2.0 in ID

TYPE OF FILTER PACK: silica sand (unimin)
GRADATION: ade5-00624
AMOUNT OF FILTER PACK USED: ~250 lbs
TYPE OF BENTONITE: PureGold - med chips
AMOUNT BENTONITE USED: 1 bag.
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED:
DIMENSIONS OF SECURITY CASING: 4 inch - square
TYPE OF WELL CAP: expansion plug - no lock
TYPE OF END CAP: Flat - threaded
LOCATION: Northing: —
Easting: —
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



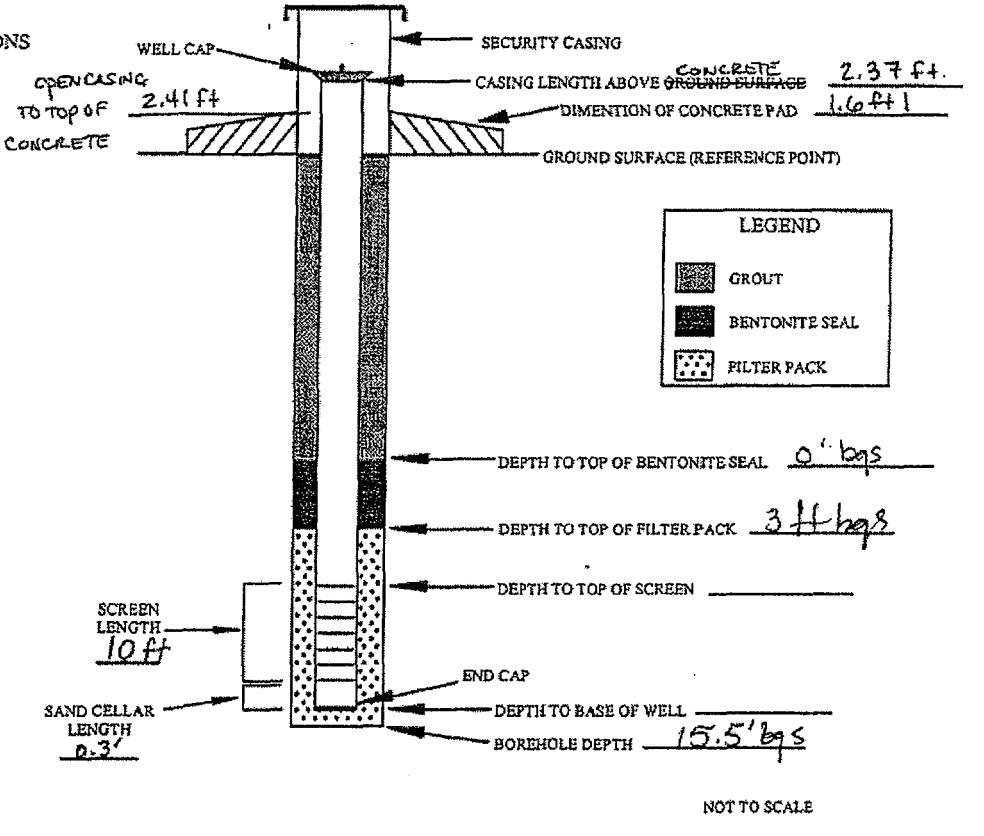
NOT TO SCALE

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Reuerts Drilling
DRILLING TECHNIQUE: HSA - Simco rig
AUGER SIZE AND TYPE: 4.25 in. ID/6.25 in. I
BOREHOLE IDENTIFICATION: -
BOREHOLE DIAMETER: ~8 inches.
WELL IDENTIFICATION: MW-8
WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04
SCREEN MATERIAL: sched 40 PVC
SCREEN DIAMETER: 2.0 in ID
SCREENED INTERVAL(S) (FT):
CASING MATERIAL: sched 40 PVC
CASING DIAMETER: 2.0 in ID

TYPE OF FILTER PACK: SILICA SAND (UNIMIN)
GRADATION: 0.65 - 00624
AMOUNT OF FILTER PACK USED:
TYPE OF BENTONITE: Pure Gold med chips
AMOUNT BENTONITE USED: 1 bag
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED: N/A
DIMENSIONS OF SECURITY CASING: 4 in Square by
TYPE OF WELL CAP: expanion plug - no lock
TYPE OF END CAP: flat - Threaded
LOCATION: Northing: -
Easting: -
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



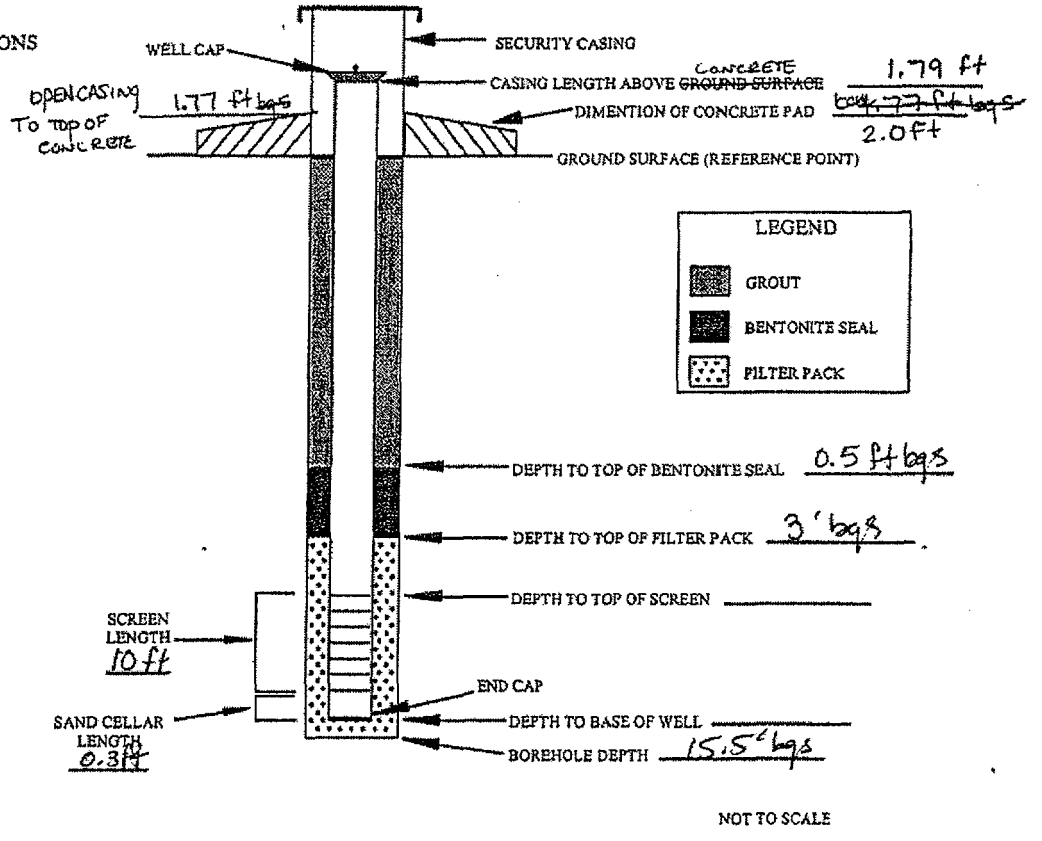
NOT TO SCALE

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Reuters Drilling
DRILLING TECHNIQUE: HSA - Simco rig
AUGER SIZE AND TYPE: 4.25" ID / 6.5 OD
BOREHOLE IDENTIFICATION: -
BOREHOLE DIAMETER: ~8 inches
WELL IDENTIFICATION: MW-9
WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04
SCREEN MATERIAL: Sched 40 PVC
SCREEN DIAMETER: 2.0 in ID
SCREENED INTERVAL(S) (FT):
CASING MATERIAL: SCHED 40 PVC
CASING DIAMETER: 2.0" ID

TYPE OF FILTER PACK: silica sand (uniniic)
GRADATION: 0.65 - 0.0024
AMOUNT OF FILTER PACK USED: ~150
TYPE OF BENTONITE: Pure Gold med chips
AMOUNT BENTONITE USED: 1 bag
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED: N/A
DIMENSIONS OF SECURITY CASING: 4.0in Square bags
TYPE OF WELL CAP: expansion plug - no lock
TYPE OF END CAP: Flat - threaded
LOCATION: Northing: -
Easting: -
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



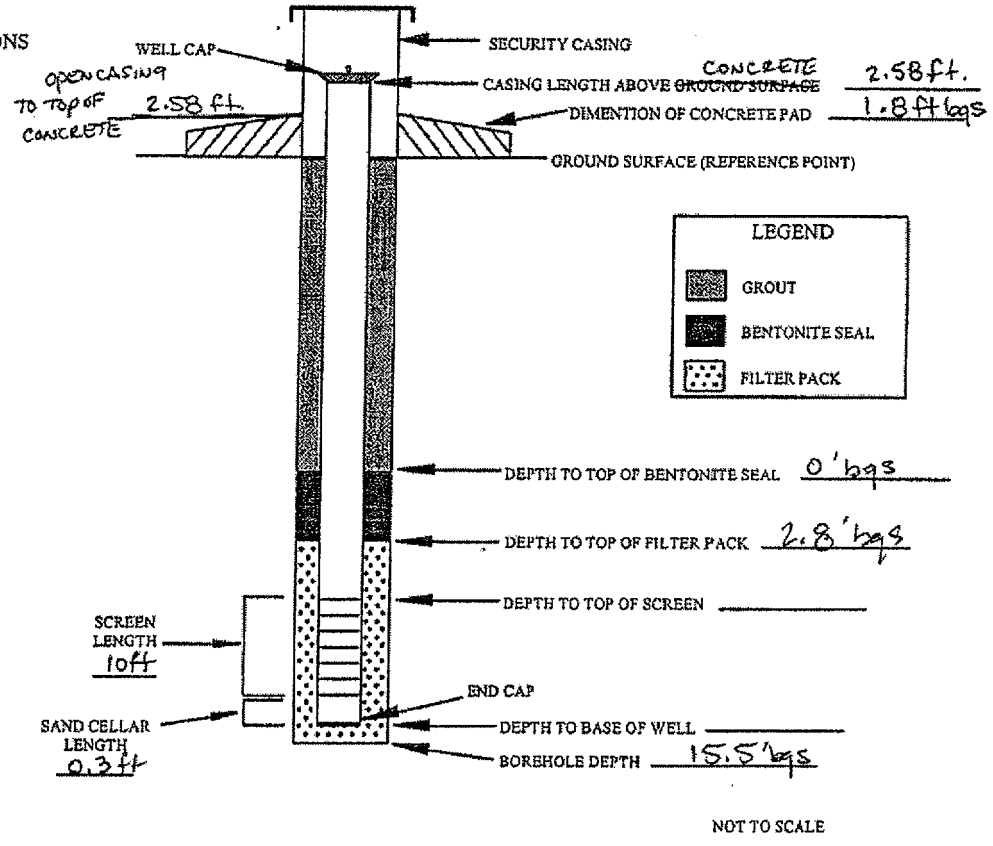
NOT TO SCALE

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Rewerts Drilling
DRILLING TECHNIQUE: HSA - Simco Rig.
AUGER SIZE AND TYPE: 4.25 ID / 6.25 OD
BOREHOLE IDENTIFICATION: —
BOREHOLE DIAMETER: ~8 inches
WELL IDENTIFICATION: MW-10
WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04
SCREEN MATERIAL: sched 40 PVC
SCREEN DIAMETER: 2.0 in ID
SCREENED INTERVAL(S) (FT):
CASING MATERIAL: sched 40 PVC
CASING DIAMETER: 2.0 in ID

TYPE OF FILTER PACK: SILICA SAND (UNIMIN)
GRADATION: 0.65 - 0.0624
AMOUNT OF FILTER PACK USED: ~150 lbs
TYPE OF BENTONITE: Pure Gold med. chips
AMOUNT BENTONITE USED: 1 bag.
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED: N/A
DIMENSIONS OF SECURITY CASING: 4 in. square box
TYPE OF WELL CAP: Expansion plug - no lock
TYPE OF END CAP: Flat - threaded
LOCATION: Northing: —
Easting: —
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



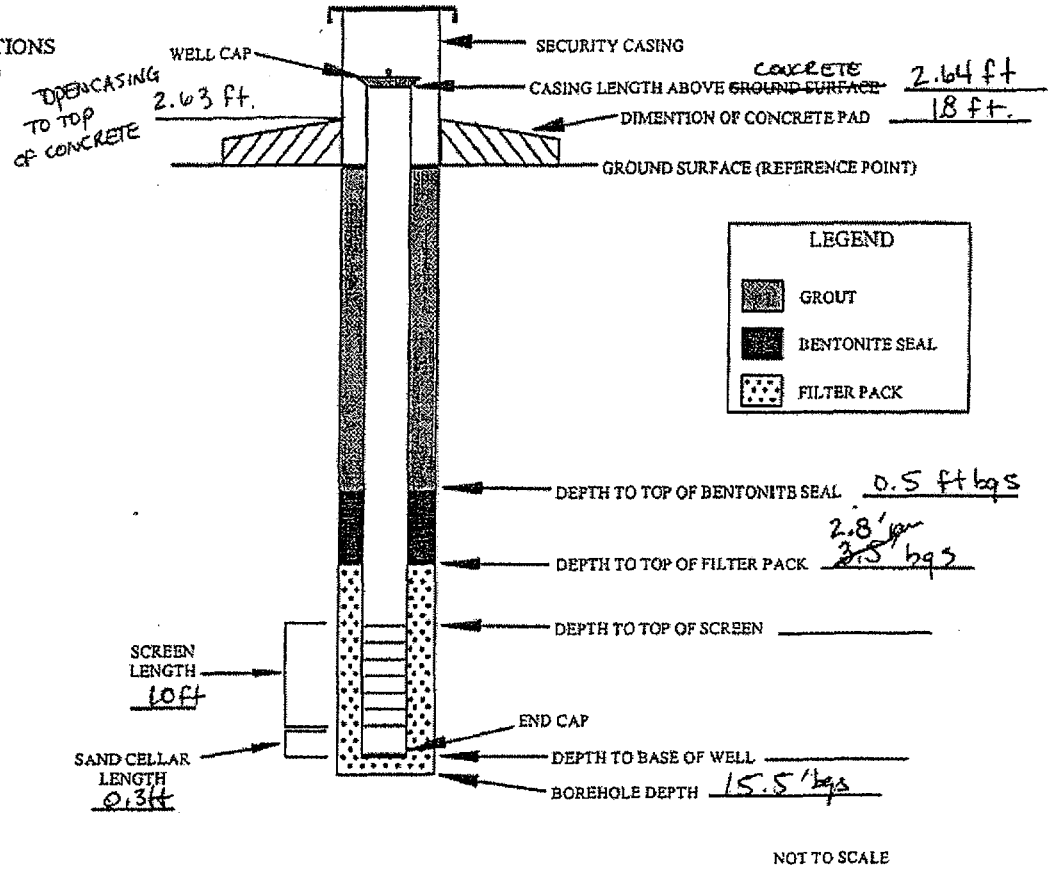
NOT TO SCALE

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Rewerts Drilling
DRILLING TECHNIQUE: HSA - Simco rig
AUGER SIZE AND TYPE: 4.25 in ID / 6.25 in OD
BOREHOLE IDENTIFICATION: -
BOREHOLE DIAMETER: ~8 inches
WELL IDENTIFICATION: MW-11
WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04
SCREEN MATERIAL: sched 40 PVC
SCREEN DIAMETER: 2.0 in ID
SCREENED INTERVAL(S) (FT):
CASING MATERIAL: sched 40 PVC
CASING DIAMETER: 2.0 in ID

TYPE OF FILTER PACK: silica sand (unimic)
GRADATION: 0.65 - 0.624
AMOUNT OF FILTER PACK USED: ~250 lbs (2.5 bags)
TYPE OF BENTONITE: PureGold med. chips
AMOUNT BENTONITE USED: 1 bag
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED: N/A
DIMENSIONS OF SECURITY CASING: 4 in - square
TYPE OF WELL CAP: expansion plug - no lock
TYPE OF END CAP: flat - threaded
LOCATION: Northing: -
Easting: -
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



NOT TO SCALE

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: Kim Nelson
DRILLING CONTRACTOR: Rewerts Drilling
DRILLING TECHNIQUE: HSA - Simco rig
AUGER SIZE AND TYPE: 4.25" ID / 6.25" OD

BOREHOLE IDENTIFICATION: -
BOREHOLE DIAMETER: ~8 inches
WELL IDENTIFICATION: MW-12

WELL CONSTRUCTION START DATE: 5/11/04
WELL CONSTRUCTION COMPLETE DATE: 5/11/04

SCREEN MATERIAL: Sched 40 PVC
SCREEN DIAMETER: 2.0" ID
SCREENED INTERVAL(S) (FT):

CASING MATERIAL: Sched 40 PVC
CASING DIAMETER: 2.0" ID

TYPE OF FILTER PACK: silica sand (unimic)
GRADATION: 0.65 - 00624
AMOUNT OF FILTER PACK USED: ~250 lbs

TYPE OF BENTONITE: Pure Gold med chips
AMOUNT BENTONITE USED: 1 bag

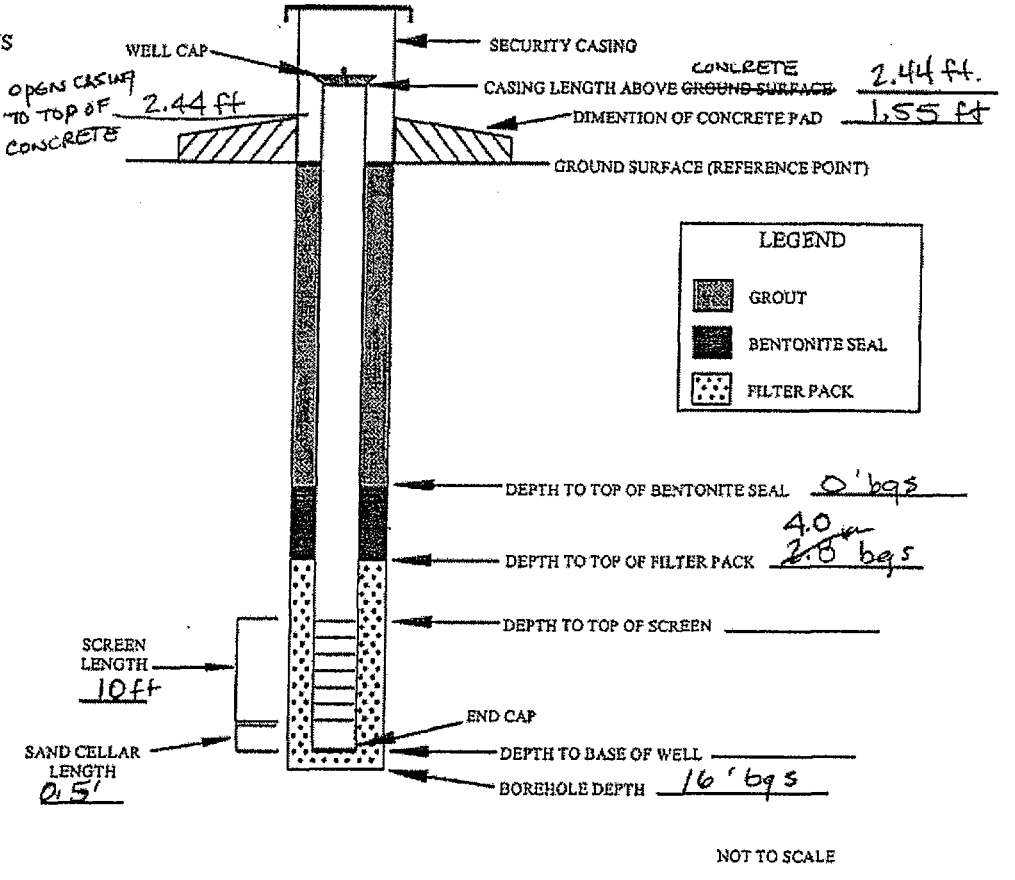
TYPE OF CEMENT:
AMOUNT CEMENT USED:
GROUT MATERIALS USED: N/A

DIMENSIONS OF SECURITY CASING: 4 in-square

TYPE OF WELL CAP: expansion plug - no lock
TYPE OF END CAP: flat - threaded

LOCATION: Northing: -
Easting: -
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



NOT TO SCALE

APPENDIX E

Well Development and Groundwater Sample Data Sheets

E.1 - May 2004 Sampling Event

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 5/18/04

MONITORING WELL ID: MW-01 | ACTIVITY TIME: START 1144 END | BOTTLE TIME: 1342

FIELD SAMPLE ID: 01-MW-01 | QC SAMPLES COLLECTED: NA | ASSOCIATED TRIP BLANK: TB1

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 16.84 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 7.38 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 9.46 FT
- VOLUME OF WATER COLUMN (V): 1.5 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.54 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 11.08 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): 3.70 FT (BGS)
- DRAWDOWN VOLUME (DV): 0.59 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.39

EQUIPMENT ID NUMBERS
- BLADDER PUMP: —
- PERISTALTIC PUMP: #2 Geopump
- SUBMERSIBLE PUMP: —
- BAILER: dedicated
- FIELD MONITORING INSTRUMENTATION: YSI 807
- FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (%) (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
			±3%	±3%	0.1 unit	±10 mV	<10			
1144	7.38									Begin Purge
1148	8.14	1½ 2.5mm	9.99	2.046	6.76	57.2%	20.46	120.3		
1153	8.167	1½ 2.4mm	10.30	2.016	6.79	37.5	7.99	111.6		
1200	9.23	1½ 2.4mm	10.25	2.013	6.80	35.7	8.64	109.3		0.42 lpm
1211	9.61	0.30	10.36	2.025	6.83	42.16	5.83	112.7		YSI shut off - reset
1224	9.85	0.30	10.27	2.031	6.86	38.4	4.28	110.2		
1232	9.98	0.30	10.39	2.032	6.87	42.2	2.71	109.6		
1239	10.16	0.30	10.64	2.028	6.88	38.7	2.06	98.1		
1247	10.29	0.30	10.62	2.034	6.88	38.5	1.96	84.5		
1257	10.52	0.30	10.67	2.035	6.89	37.6	1.49	73.2		
1303	10.60	0.30	10.82	2.031	6.90	37.3	2.26	66.0		
1310	10.77	0.30	10.66	2.041	6.92	34.9	2.89	53.4		
1317	10.89	0.30	10.47	2.050	6.92	33.9	2.92	45.6		
1325	11.08	0.30	10.52	2.055	6.90	31.1	1.97	43.5		

SAMPLE ANALYSES — BOTTLE TYPE/

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑	SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐					☐
☑	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑	NICKEL-63	LSC, EERF	HNO_3,	1 @ 500 ml plastic	☑
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES
1400 Completed sampling.

SAMPLED BY: Lisa Cundiff
RECEIVED BY: —

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 5/19/04

MONITORING WELL ID: MW-2 | ACTIVITY TIME: START 1500 END | BOTTLE TIME: 1600

FIELD SAMPLE ID: 01-MW-02 | QC SAMPLES COLLECTED: NA | ASSOCIATED TRIP BLANK: TB2

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 16.2 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): JRC 7.80 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 8.5 FT
- VOLUME OF WATER COLUMN (V): 1.36 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.08 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 8.31 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): 0.61 FT (BGS)
- DRAWDOWN VOLUME (DV): 0.10 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.07

EQUIPMENT ID NUMBERS
- BLADDER PUMP: —
- PERISTALTIC PUMP: 610
- SUBMERSIBLE PUMP: —
- BAILER: dedicated
- FIELD MONITORING INSTRUMENTATION: YSI 298
- FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
1515	7.70	—								Began Purging
1520	8.12	0.3	10.71	1.090	7.16	11.5	5.46	41.7		
1525	8.21	0.2	10.70	1.063	7.22	3.3	2.20	42.2		
1534	8.26	0.2	10.57	1.045	7.18	2.9	2.19	44.8		
1543	8.29	0.2	10.53	1.036	7.15	2.4	2.29	46.4		
1548	8.30	0.2	10.45	1.037	7.14	2.5	3.10	47.2		
1554	8.31	0.2	10.63	1.035	7.14	2.5	3.12	46.1		

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☒	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☒
☒	SVOC	8270C	4°C	2 @ 1 liter amber glass	☒
☐					☐
☒	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☒
☒	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☒
☒	NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☒
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES: Looks like an animal has burrowed under concrete leaving large hole.

SAMPLED BY: JR Cundiff

RECEIVED BY: _____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring
JOB NUMBER: 03-3040.17 Task 2
DATE: 05/19/04
MONITORING WELL ID: MW-3
ACTIVITY TIME: START 1445 END 1600
BOTTLE TIME: 16:00
FIELD SAMPLE ID: 01-MW-03
QC SAMPLES COLLECTED: NA
ASSOCIATED TRIP BLANK: TB2

WELL DATA
DIAMETER: 2 IN
DEPTH OF WELL (D): 16.68 FT (BGS)
INITIAL DEPTH TO WATER (DTW): 7.70 FT (BGS)
HEIGHT OF WATER COLUMN (D - DTW): 8.98 FT
VOLUME OF WATER COLUMN (V): 1.43 GAL
- FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
- FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.31 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
FINAL DEPTH TO WATER (FDTW): 8.11 FT (BGS)
DRAWDOWN DEPTH (FDTW - DTW): .41 FT (BGS)
DRAWDOWN VOLUME (DV): 0.0656 GAL
- FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
- FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.0656 / 1.43

EQUIPMENT ID NUMBERS
BLADDER PUMP: —
PERISTALTIC PUMP: GEOPUMP #2
SUBMERSIBLE PUMP: —
BAILER: NEW 1/2" DEDICATED TO WELL
FIELD MONITORING INSTRUMENTATION: GEOTECH #225
FIELD INSTRUMENTATION: YSI 556
CALIBRATION DATE: FACTORY CAL

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
14:45	7.70	.20	11.04	1.551	7.17	24.80	15.30	122.1	—	START
14:55	8.00	.20	10.67	1.554	7.09	13.50	9.45	97.80	—	
15:00	8.02	.20	10.49	1.545	7.06	13.00	3.71	90.80	—	
15:10	8.07	.20	10.42	1.543	7.03	22.30	1.98	129.0	—	"YSI AUTO SHUTOFF"
15:20	8.08	.20	10.57	1.536	7.03	14.05	1.00	111.6	—	
15:30	8.05	.20	10.45	1.537	7.03	13.10	0.53	98.30	—	
15:40	8.10	.20	10.50	1.535	7.05	12.10	0.55	94.0	—	
15:50	8.10	.20	10.68	1.525	7.03	12.30	0.47	93.60	—	
16:00	8.11	.20	10.69	1.525	7.03	12.20	0.46	93.41	—	Sample

MW

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑	SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐					☐
☑	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass *	☑
☑	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑	NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☐
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES

* Both in 1L Amber Bottle
Lab OK Change in Containers
on 05/19/04 @ 13:30 Hrs

SAMPLED BY: Mark Winters
RECEIVED BY:

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 05/19/04
MONITORING WELL ID: MW-4 | ACTIVITY TIME: START 1230 END 1330 | BOTTLE TIME: 13:30
FIELD SAMPLE ID: 01-MW-04 | QC SAMPLES COLLECTED: N/A | ASSOCIATED TRIP BLANK: TB2

WELL DATA
DIAMETER: 2 IN
DEPTH OF WELL (D): 16.20 FT (BGS)
INITIAL DEPTH TO WATER (DTW): 8.18 FT (BGS)
HEIGHT OF WATER COLUMN (D - DTW): 8.02 FT
VOLUME OF WATER COLUMN (V): 1.28 GAL
- FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
- FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 3.84 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
FINAL DEPTH TO WATER (FDTW): 8.41 FT (BGS)
DRAWDOWN DEPTH (FDTW - DTW): 0.23 FT (BGS)
DRAWDOWN VOLUME (DV): 0.0368 GAL
- FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
- FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.0368 / 1.28 = 0.028

EQUIPMENT ID NUMBERS
BLADDER PUMP: —
PERISTALTIC PUMP: #2
SUBMERSIBLE PUMP: —
BAILER: NOW 6" DEDICATED TO WELL
FIELD MONITORING INSTRUMENTATION: #225 YSI 556 WATER QUAL
FIELD INSTRUMENTATION CALIBRATION DATE: FACTORY CAL.

PURGE DATA TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
1230	8.18	.21	13.14	1.813	7.23	21.7	9.97	106.2	—	START
1240	8.36	.20	10.44	1.519	7.21	12.9	*	57.6	—	TURBIDITY OFFSCALE BATT?
1250	8.39	.20	10.52	1.512	7.11	10.60	1.30	48.30	—	TURB. METER CHECKED
1300	8.39	.20	10.51	1.509	7.12	11.00	.44	44.20	—	"
1310	8.39	.20	10.63	1.510	7.13	10.50	.45	37.90	—	
1320	8.39	.21	10.62	1.511	7.12	10.61	.45	37.90	—	
13:30	8.41	.20	10.61	1.511	7.12	10.52	.46	37.90	—	SAMPLE

SAMPLE ANALYSES

PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑ SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐				☐
☑ TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑ CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑ NICKEL-63	LSC, EERF	HNO_3,	1 @ 500 ml plastic	☑
☐				☐
☐				☐
☐				☐
☐				☐
☐				☐

NOTES
* NO READING. METER NOT OPERATING CORRECTLY/ SYSTEM OUT OF RANGE

SAMPLED BY: MARK L. WINTERS
RECEIVED BY:

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 05/17/04

MONITORING WELL ID: MW-6 | ACTIVITY TIME: START 0915 END 1025 | BOTTLE TIME: 10:25

FIELD SAMPLE ID: _____ | QC SAMPLES COLLECTED: MS, MSD | ASSOCIATED TRIP BLANK: TB2

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 16.35 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 8.18 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 8.17 FT
- VOLUME OF WATER COLUMN (V): 1.30 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 3.90 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 8.98 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): 0.80 FT (BGS)
- DRAWDOWN VOLUME (DV): 0.128 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.128 / 1.30 = 0.098

EQUIPMENT ID NUMBERS
- BLADDER PUMP: _____
- PERISTALTIC PUMP: #2
- SUBMERSIBLE PUMP: _____
- BAILER: 1/2" DEDICATED TOWER
- FIELD MONITORING INSTRUMENTATION: #226 YSI 556 WATERQUAL.
- FIELD INSTRUMENTATION CALIBRATION DATE: FACT. CAL.

PURGE DATA TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
0915	8.62	.20	10.54	1.257	7.01	55.30	1.10	165.6	—	START PURGE
0925	8.76	.20	10.36	1.269	6.94	57.20	1.01	157.80	—	
0935	8.89	.20	10.34	1.270	6.89	50.20	0.91	162.30	—	
0945	8.97	.18	10.11	1.287	6.87	35.00	0.80	138.70	—	
0955	8.98	.18	10.24	1.291	6.87	32.40	0.79	132.1	—	
1005	8.98	.18	10.20	1.301	6.85	28.80	0.70	124.40	—	
1015	8.98	.18	10.19	1.30	6.86	28.20	0.70	123.90	—	
1025	8.98	.18	10.18	1.29	6.86	28.19	0.69	123.78	—	Sample

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑	SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐					☐
☑	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑	NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☑
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES
34.5 mmHg @ 1946 (Barc)
MS = VOC & NICKEL
MSD = VOC & NICKEL

SAMPLED BY: MARK GENTECK
RECEIVED BY: _____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 5/19/04

MONITORING WELL ID: 07 | ACTIVITY TIME: START 1230 END 1355 | BOTTLE TIME: 1335

FIELD SAMPLE ID: 01-MW-07 | QC SAMPLES COLLECTED: NA | ASSOCIATED TRIP BLANK: TB2

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 17.59 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 6.96 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 10.63 FT
- VOLUME OF WATER COLUMN (V): 1.70 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 5.10 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 7.56 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): 0.60 FT (BGS)
- DRAWDOWN VOLUME (DV): 0.10 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.059

EQUIPMENT ID NUMBERS
- BLADDER PUMP: —
- PERISTALTIC PUMP: 610
- SUBMERSIBLE PUMP: —
- BAILER: dedicated
- FIELD MONITORING INSTRUMENTATION: YSI 298
- FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN % (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
1230	6.96									Begin Purge
1239	7.23	0.23	11.08	1.292	7.25	6.3	—	20.2		Remaining Turbidity Mtr
1251	7.45	0.23	10.71	1.257	7.08	3.5	—	29.7		not working.
1259	7.56	0.23	10.77	1.245	7.03	5.2	4.62	33.5		Mtr fixed.
1310	7.57	0.23	10.78	1.225	6.92	5.5	3.02	36.9		
1320	7.59	0.23	10.96	1.219	6.91	5.5	2.65	37.7		water very clear
1330	7.62	0.23	10.68	1.213	6.86	5.9	2.66	39.7		
1335										begin sampling

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☒	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☒
☒	SVOC	8270C	4°C	2 @ 1 liter amber glass	☒
☐					☐
☒	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☒
☒	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☒
☒	NICKEL-63	LSC, EERF	HNO_3,	1 @ 500 ml plastic	☒
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES

SAMPLED BY: LR. Cundiff

RECEIVED BY: _____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 05/18/04
MONITORING WELL ID: MW-8 | ACTIVITY TIME: START 1300 END 1580 | BOTTLE TIME: 15:30
FIELD SAMPLE ID: _____ | QC SAMPLES COLLECTED: MW-8 Equip. Blank | ASSOCIATED TRIP BLANK: TB1

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 17.46 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 6.98 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 10.47 FT
- VOLUME OF WATER COLUMN (V): 1.68 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.86 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 7.82 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): .84 FT (BGS)
- DRAWDOWN VOLUME (DV): .153 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.132 / 1.62 = 0.082

EQUIPMENT ID NUMBERS
- BLADDER PUMP: _____
- PERISTALTIC PUMP: 610
- SUBMERSIBLE PUMP: _____
- BAILER: 3/4" ± 1 M BAILER DEDICATED TO WELL
- FIELD MONITORING INSTRUMENTATION: YSI 556 #098 (WATER QUAL. METER)
- FIELD INSTRUMENTATION CALIBRATION DATE: PRE-CAL.

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l) %	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
1300	7.12	0.25	14.63	1.294	7.04	96.1%	9.99	35.40	—	START
1310	7.60	0.25	10.44	1.258	7.45*	78.50	5.96	57.20	—	
1320	7.66	0.25	10.64	1.271	6.85	64.60	1.91	56.60	—	
1330	7.72	0.24	10.81	1.262	7.02	61.30	0.0	73.80	—	
1340	7.74	0.24	10.80	1.231	7.01	61.00	0.0	71.38	—	
1350	7.75	0.24	10.68	1.252	6.79	49.00	0.0	78.40	—	
1400	7.75	0.24	10.74	1.251	6.74	55.7	0.0	48.40	—	
1410	7.70	0.24	10.62	1.25	6.26	51.8	0.0	49.90	—	
1420	7.70	0.24	10.72	1.248	6.61	54.3	0.40	72.0*	—	SYSTEM SHUT DOWN
1430	7.70	0.24	10.72	1247	6.61	54.3	0.39	89.0	—	
1440	7.69	0.25	10.71	1.248	6.62	54.2	0.39	82.20	—	* loose Probe Connection
1450	7.82	0.24	10.76	1.245	5.75	49.30	0.73	196.9	*	
1500	7.82	0.24	10.77	1.243	6.54	47.70	0.74	194.20		* ORP OFF SCALE *

SAMPLE ANALYSES

PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑ SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐				☐
☑ TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑ CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑ NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☑

TIME	DTW	PURGE	TEMP	COND	pH	DO%	TURB	ORP
15:10	7.82	0.24	10.61	1.243	6.65	47.90	0.0	89.0

NOTES
PH. @ 1310 HRS = 7.01
* EQUIP. BLANK SAMPLE

SAMPLED BY: [signature]
RECEIVED BY: _____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 5/18/04
MONITORING WELL ID: MW-09 | ACTIVITY TIME: START 1517 END 1700 | BOTTLE TIME: 17:00
FIELD SAMPLE ID: 01-MW-09 | QC SAMPLES COLLECTED: DUP | ASSOCIATED TRIP BLANK: TB1

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 17.11 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 6.66 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 10.45 FT
- VOLUME OF WATER COLUMN (V): 1.67 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 5.02 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 7.45 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): .79 FT (BGS)
- DRAWDOWN VOLUME (DV): .1264 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): .1264 / 6.34 = .0199

EQUIPMENT ID NUMBERS
- BLADDER PUMP: —
- PERISTALTIC PUMP: Geopump
- SUBMERSIBLE PUMP: —
- BAILER: —
- FIELD MONITORING INSTRUMENTATION: YSI 807 ~~Turbidity~~ Cabrera
- FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN % ~~(mg/l)~~	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
1517	6.66	0.29								Begin Purge
1526	7.04	0.29	11.04	1.787	7.05	104.0	13.2	194.2		
1533	7.11	0.22	11.41	1.788	6.99	85.9	10.6	153.7		
1540	7.15	0.20	11.41	1.791	6.94	84.8	2.84	133.7		
1546	7.20	0.20	11.32	1.792	6.91	80.8	3.33	115.7		
1556	7.25	0.20	11.35	1.793	6.90	73.5	2.51	96.9		
1603	7.29	0.20	11.38	1.786	6.89	72.1	3.86	85.1		
1613	7.33	0.20	11.27	1.785	6.84	66.6	2.67	68.20		M. WINTERS
1623	7.38	0.20	11.18	1.787	6.83	169.00	2.53	106.20	YSI	SYSTEM START DOWN M. WINTERS
1633	7.41	0.20	11.40	1.774	6.89	86.00	0.00	67.1		M. WINTERS
1643	7.45	0.20	11:61	1.773	6.91	46.50	0.0	58.2		M. WINTERS
1653	7.45	0.00	11:53	1.774	6.92	49.80	0.0	40.00		M. WINTERS

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑	SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐					☐
☑	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass,	☑
☑	NICKEL-63	LSC, EERF	HNO_3,	1 @ 500 ml plastic	☑
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES

SAMPLED BY: M. Winters
RECEIVED BY: _____

CABRERA SERVICES
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FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 2 | DATE: 05/20/04
MONITORING WELL ID: MW-10 | ACTIVITY TIME: START 0800 END 0910 | BOTTLE TIME: 0910
FIELD SAMPLE ID: 01-MW-10 | QC SAMPLES COLLECTED: NA | ASSOCIATED TRIP BLANK: TB3

WELL DATA
DIAMETER: 2" IN
DEPTH OF WELL (D): 17.89 FT (BGS)
INITIAL DEPTH TO WATER (DTW): 7.87 FT (BGS)
HEIGHT OF WATER COLUMN (D - DTW): 10.02 FT
VOLUME OF WATER COLUMN (V): 1.60 GAL
- FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
- FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.80 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
FINAL DEPTH TO WATER (FDTW): 9.29 FT (BGS)
DRAWDOWN DEPTH (FDTW - DTW): 1.42 FT (BGS)
DRAWDOWN VOLUME (DV): .227 GAL
- FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
- FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.141
.227 : 1.60 = 0.141

EQUIPMENT ID NUMBERS
BLADDER PUMP: —
GeoPump #2
PERISTALTIC PUMP: 610
GROUNDWATER CENTER
SUBMERSIBLE PUMP: —
BAILER: NEW 3" DEDICATED TEFLON
GROUNDWATER
FIELD MONITORING INSTRUMENTATION: #298
YSI 556 MPS
FIELD INSTRUMENTATION CALIBRATION DATE: FACT. CAL

PURGE DATA TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l) %	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
0800	7.87	.20	11.31	1.387	7.22	62.60	8.94	32.0	—	START
0810	8.73	.20	11.37	1.371	7.03	60.20	5.57	38.80	—	
0820	8.91	.20	11.60	1.387	6.94	60.40	2.79	41.40	—	
0830	9.04	.18	11.60	1.407	6.86	56.90	2.03	42.90	—	
0840	9.18	.18	11.72	1.417	6.76	52.10	1.14	43.70	—	
0850	9.25	.18	11.72	1.425	6.72	50.40	1.64	53.10	—	YSI SHUT OFF ERROR!
0900	9.29	.18	11.88	1.430	6.73	46.50	1.09	95.60	—	
0910	9.29	.18	12.14	1.425	6.66	44.50	1.08	99.80		Sample

SAMPLE ANALYSES

PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☑
☑ SVOC	8270C	4°C	2 @ 1 liter amber glass	☑
☐				☐
☑ TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☑
☑ CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☑
☑ NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☑
☐				☐
☐				☐
☐				☐
☐				☐
☐				☐

Baro. 773.20 mm Hg

NOTES

SAMPLED BY: [signature]
RECEIVED BY:

CABRERA SERVICES
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FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring
JOB NUMBER: 03-3040.17 Task 2
DATE: 5/20/04
MONITORING WELL ID: MW-~~12~~ 11
ACTIVITY TIME: START 0755 END
BOTTLE TIME: 0800
FIELD SAMPLE ID: ~~MW-12~~ 01-MW-11 LRC
QC SAMPLES COLLECTED: NA
ASSOCIATED TRIP BLANK: TB 3

WELL DATA
DIAMETER: 2 IN
DEPTH OF WELL (D): 16.35 FT (BGS)
INITIAL DEPTH TO WATER (DTW): 8.76 FT (BGS)
HEIGHT OF WATER COLUMN (D - DTW): 7.59 FT
VOLUME OF WATER COLUMN (V): 1.21 GAL
- FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
- FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 3.64 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
FINAL DEPTH TO WATER (FDTW): 10.86 FT (BGS)
DRAWDOWN DEPTH (FDTW - DTW): 2.10 FT (BGS)
DRAWDOWN VOLUME (DV): 0.34 GAL
- FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
- FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.28

EQUIPMENT ID NUMBERS
BLADDER PUMP: —
PERISTALTIC PUMP: Cabrera Pump
Geo Pump 2
SUBMERSIBLE PUMP: —
BAILER: dedicated
FIELD MONITORING INSTRUMENTATION: —
FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA

TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
0755	8.76						648			
0800		0.2								begin sampling
0830	10.86	0.2								complete sampling

Surged the well after sampling to try to develop white water remained in well. Approximately 1 gallon of water was pumped with peristaltic after surge/block before the well went dry again.

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☒	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☒
☒	SVOC	8270C	4°C	2 @ 1 liter amber glass	☒
☐					☐
☒	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☒
☒	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☒
☒	NICKEL-63	LSC, EERF	HNO3,	1 @ 500 ml plastic	☒
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES
Due to inability to develop properly (poor recharge) sampling w/o purging.

SAMPLED BY: L.R. Cundiff
RECEIVED BY:

CABRERA SERVICES
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FIELD DATA RECORD
GROUNDWATER SAMPLING

PROJECT: USDA NADC Groundwater Monitoring | JOB NUMBER: 03-3040.17 Task 17 | DATE: 5/19/04

MONITORING WELL ID: MW-12 | ACTIVITY TIME: START 0915 END | BOTTLE TIME: 1030

FIELD SAMPLE ID: 01-MW-12 | QC SAMPLES COLLECTED: ~~MS/MSD~~ Lee | ASSOCIATED TRIP BLANK: 13

WELL DATA
- DIAMETER: 2 IN
- DEPTH OF WELL (D): 17.59 FT (BGS)
- INITIAL DEPTH TO WATER (DTW): 7.92 FT (BGS)
- HEIGHT OF WATER COLUMN (D - DTW): 9.67 FT
- VOLUME OF WATER COLUMN (V): 1.55 GAL
  - FOR 2-IN. DIAM., V = 0.16 x (D - DTW)
  - FOR 4-IN. DIAM., V = 0.65 x (D - DTW)
- MINIMUM VOLUME OF WATER TO BE PURGED (PV = 3 x V): 4.64 GAL

WATER LEVEL DATA (POST SAMPLE COLLECTION)
- FINAL DEPTH TO WATER (FDTW): 17.09 FT (BGS)
- DRAWDOWN DEPTH (FDTW - DTW): 9.17 FT (BGS)
- DRAWDOWN VOLUME (DV): 1.47 GAL
  - FOR 2-IN. DIAM., DV = 0.16 (FDTW - DTW)
  - FOR 4-IN. DIAM., DV = 0.65 (FDTW - DTW)
- RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME (DV / V): 0.95

EQUIPMENT ID NUMBERS
- BLADDER PUMP: ~~1~~
- PERISTALTIC PUMP: 610
- SUBMERSIBLE PUMP: —
- BAILER: dedicated
- FIELD MONITORING INSTRUMENTATION: YSI 298
- FIELD INSTRUMENTATION CALIBRATION DATE: —

PURGE DATA TIME	DTW (ft)	PURGE RATE (lpm)	TEMP (deg C)	CONDUCTIVITY (mS/cm)	pH	DISSOLVED OXYGEN (mg/l)	TURBIDITY (NTU)	OX-RED POTENT (mV)	SALINITY (PSS)	COMMENTS
0915	7.92	—								Began purge
0921	8.83	0.24	9.70	3.410	6.63	51.3	7.99	72.0		
0928	8.54	0.24	9.66	3.298	6.61	49.2	8.33	74.7		
0934	10.22	0.24	9.59	3.351	6.62	49.3	6.107	76.9		
0943	11.22	0.24	9.49	3.468	6.68	52.8	7.04	78.7		
0958	12.58	0.24	9.58	3.637	6.71	49.7	7.17	80.2		
1007	12.54	0.24	9.73	3.557	6.68	47.4	4.40	79.2		
1017	14.50	0.24	9.79	3.460	6.68	48.3	4.50	79.8		
1025	14.92	—							→	Began sampling
1040	16.42	—							→	Could obtain more sample
										See note.
1107	completed sampling									

SAMPLE ANALYSES

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	BOTTLE TYPE/ VOLUME REQUIRED	SAMPLE COLLECTED
☒	VOC	8260B	HCl, 4°C	3 @ 40 ml glass vials	☒
☒	SVOC	8270C	4°C	2 @ 1 liter amber glass	☒
☐					☐
☒	TRITIUM	LSC, EPA 906.0	4°C	1 @ 250 ml amber glass	☒
☒	CARBON-14	LSC, C-01	H_2SO_4, 4°C	1 @ 250 ml amber glass	☒
☒	NICKEL-63	LSC, EERF	HNO_3,	1 @ 500 ml plastic	☒
☐					☐
☐					☐
☐					☐
☐					☐
☐					☐

NOTES
@ 10:40 - could not pump sample due to depth of water and hose tube extended tube to deepest depth by lifting pump to sit on well casing.

SAMPLED BY: L R Cundiff
RECEIVED BY: —

Had to turn off pump for ≈ 5 minutes to obtain enough recharge for final sample bottle (Ni-63)
Note; Farm cat visiting site as can be seen by paw prints above.

APPENDIX F

Laboratory Analytical Reports

F.1 - May 2004 Sampling Event

Quarter 1 analyses are contained in two sample delivery groups (SDGs).

SDG 1 contains results from MW-1, MW-8 and MW-9. SDG 1 begins on the next page.

SDG 2 contains results from MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-10, MW-11 and MW-12. This SDG begins on page 720 of the pdf document.

(Enclosed on CD)