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FINAL BASEWIDE REMEDIAL INVESTIGATION WORK PLAN ADDENDUM WITH
TRANSMITTAL LETTER KANSAS CITY MO
4/1/2000
CH2M HILL

FINAL
Basewide RI Work Plan Addendum

Richards-Gebaur AFB
Kansas City, MO

April, 2000

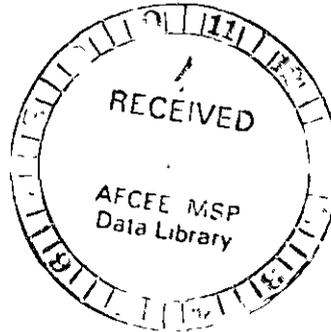


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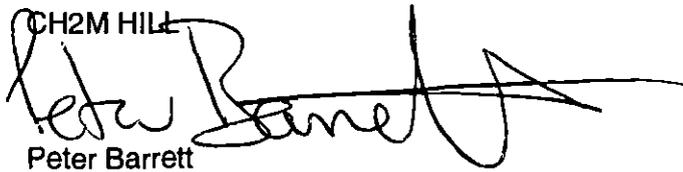
Subject Richards-Gebaur Work Plan Addendum

Dear Jim:

On behalf of the Air Force, please find attached the revised, Final RI Work Plan Addendum. The Addendum incorporates responses to the comments contained in your April 12 letter.

Regarding additional work at FT 002, the revised, Final Work Plan Addendum provides details of the additional investigation work (see Section 10). We are planning to use a geoprobe unit to sample 20 additional push-borings within the North Burn Pit compound. The geoprobe locations have been selected to delineate potential dioxin occurrence in soils beneath the concrete pad, delineate sitewide residual hydrocarbon concentrations, and also investigate soil contamination near the oil-water separator system referred to by others as Building 1033. The geoprobe holes will extend to the top of bedrock at each location, conditions permitting. Sampling of the hillside terrace has been deferred, and is not included in the Final RI Work Plan Addendum.

Sincerely,

CH2M HILL

Peter Barrett
Project Manager

STL

c: Robert Koke (USEPA)
Paul Carroll (AFBCA)
Mike Nicklow (AFBCA)
Kay Grosinske (AFCEE)
Ed Baker (Booz Allen)
George Bauml (UNITECH)
Sabina Chowdhury (WPI)

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Attachment 1

Basewide RI/FS Work Plan Addendum Richards-Gebaur Air Force Base

The Work Plan Addendum for Richards-Gebaur Air Force Base (AFB), Kansas City, Missouri, has been prepared under CH2M HILL's prime contract with the Air Force Center for Environmental Excellence (AFCEE) No F41624-97-D-8019. The additional work will be performed as a supplement to the original Remedial Investigation (RI) field work completed in November 1999. The Work Plan Addendum will be executed under Delivery Order (DO) 0090 - Modified, dated May 24, 1999, entitled, *Basewide Remedial Investigation/Feasibility Study at Richards-Gebaur AFB, Missouri*.

This document serves as a supplement to the Basewide RI/FS Work Plan for Richards-Gebaur AFB, submitted by CH2M HILL to the Air Force in October 1999. As its name implies, the Work Plan Addendum is not intended to serve as a stand-alone document. Unless stated otherwise, all field methodologies, environmental sampling procedures, sample handling, sample custody, field measurements, and record keeping will be performed in accordance with the October 1999 Basewide RI/FS Work Plan for Richards-Gebaur AFB. Additionally, all laboratory procedures and Data Quality Objectives outlined in the 1999 Work Plan will apply to the tasks described in the Work Plan Addendum.

1.0 Introduction

Between October and December 1999, CH2M HILL conducted a Basewide RI at Richards-Gebaur AFB. The RI comprised the following 16 sites

- AOC 001 Central Drainage Area
- AOC 002 North Drainage Area
- AOC 003 Firing Range
- AOC 010: Building 918 Parking Lot
- CS 001 Fuel Line – 942 Section
- CS 002: Oil / Water Separator at Building 704
- CS 004 UST 620A
- FT 002 North Burn Pit (FTA)
- SS 003: Oil Saturated Area
- SS 004: Hazardous Waste Drum Storage Area
- SS 006: Hazardous Material Storage Area
- SS 008 Test Cell Area
- SS 009: Fire Valve Area
- ST 005: Petroleum, Oil, and Lubricants (POL) Storage Yard
- ST 007 Former UST Area
- XO 001 Belton Training Complex (BTC)

Locations of the 16 sites are displayed in Figure 1.1.

Field investigations were completed at each site and consisted of one or more of the following activities:

- installing groundwater monitoring wells
- logging subsurface geological conditions
- collecting surface and subsurface soil samples
- collecting groundwater samples (in areas where groundwater was present)
- collecting surface water samples
- collecting sediment samples

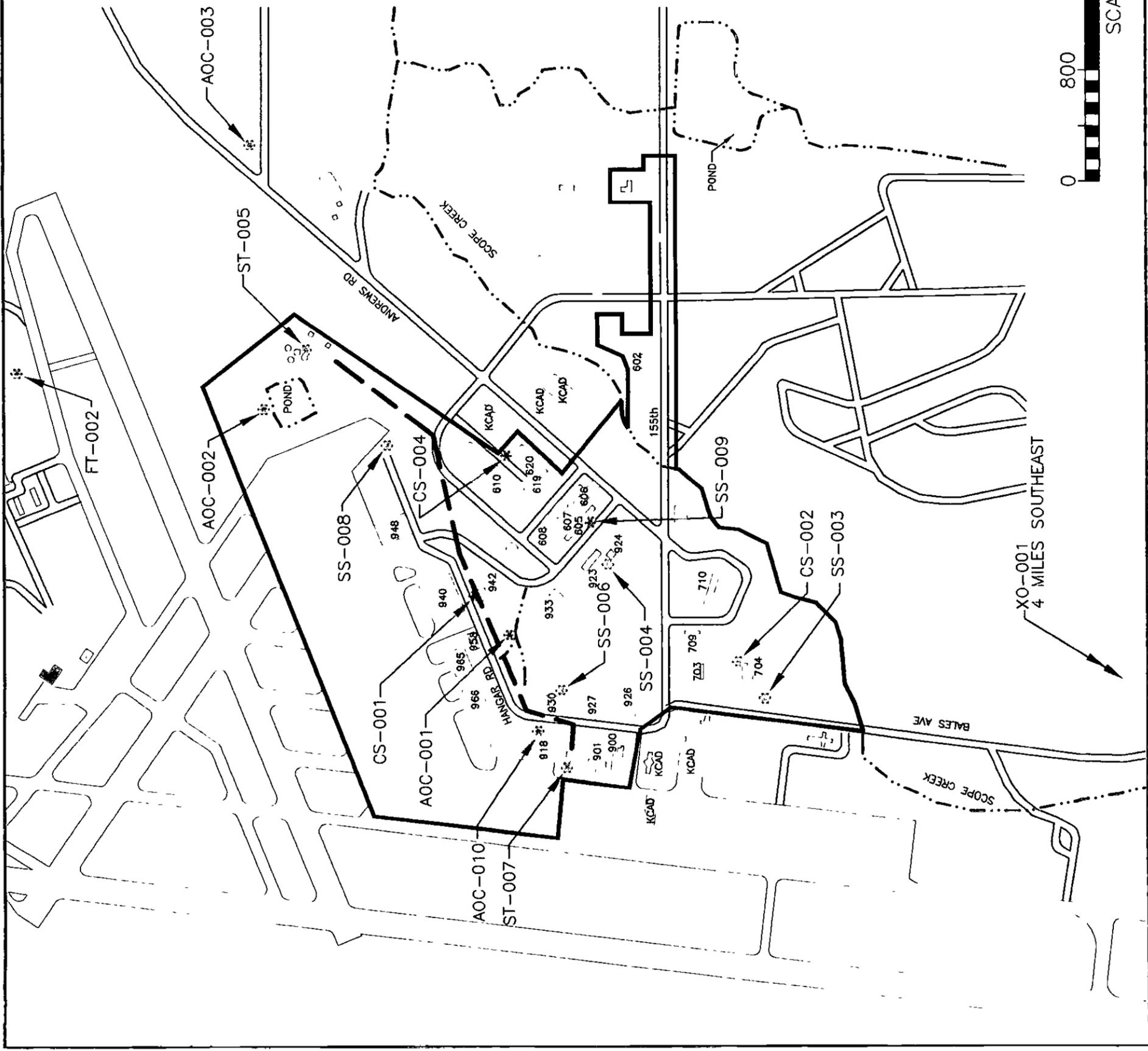
Environmental samples collected during the RI were analyzed for various Contaminants of Concern (COC) that had been identified in previous site investigations at Richards-Gebaur AFB. These previous investigations were summarized in the 1999 Evaluation and Consolidation Study (ECS) Report. In addition to investigating 16 RI/FS sites, the above field activities were also completed at select background locations agreed upon jointly by the Air Force and the Missouri Department of Natural Resources (MDNR). The purpose of the background samples was to determine representative concentrations of naturally occurring metals and anthropogenic chemicals in soil, groundwater, surface water, and sediment.

The RI field work was completed in December 1999. The samples were analyzed between November 1999 and January 2000. Data validation was completed in March 2000. Based on a preliminary assessment of analytical results, five sites were found to contain concentrations of chlorinated hydrocarbons in groundwater above applicable MDNR Groundwater Target Cleanup (GTARC) levels - which typically correspond to federal

Maximum Contaminant Levels (MCLs). In response to these data, the Air Force identified additional data needs at the five RI sites, that is, the nature and extent of the groundwater contamination required further delineation. The field work described in the Work Plan Addendum is designed to address the groundwater data needs.

In addition to the above, approximately 10 borings will be drilled at and around Site ST 007, and three background sediment and surface water samples will be collected from upper Scope Creek. The former action is an expansion of the soil investigation originally proposed in the RI/FS Work Plan; the latter sampling is recommended to provide reference background concentrations for metals and anthropogenic chemicals in onsite sediment and surface water.

The sections below describe the additional tasks, and are provided as an addendum to the original RI/FS Quality Program Work Plan (QPWP or Work Plan). The proposed work will conform to the methodologies set forth in the QPWP and associated other plans contained therein.



KEY	
SITE ID	DESCRIPTION
AOC-001	CENTRAL DRAINAGE AREA
AOC-002	NORTH DRAINAGE POND
AOC-003	FIRING RANGE
AOC-010	BUILDING 918 PARKING LOT
CS-001	FUEL LINE - 942 SECTION
CS-002	O/W SEPARATOR AT BUILDING 704
CS-004	UST 620A
FT-002	NORTH BURN PIT
SS-003	OIL SATURATED AREA
SS-004	HAZARDOUS WASTE DRUM STORAGE AREA
SS-006	HAZARDOUS MATERIAL STORAGE AREA
SS-008	TEST CELL AREA
SS-009	FIRE VALVE AREA
ST-005	POL STORAGE YARD
ST-007	FORMER UST AREA
XO-001	BELTON TRAINING COMPLEX



Figure 1.1

GENERAL SITE PLAN

Richards-Gebaur AFB
Kansas City, Missouri

CH2MHILL

2.0 Objectives and Scope

The overall objectives of the RI at Richards-Gebaur AFB are to:

- Characterize the occurrence of COC at individual sites
- Determine the underlying geology at individual sites
- Estimate the hydraulic gradient, groundwater flow direction, and groundwater flow rate at individual sites
- Evaluate the hydrogeology of the Base
- Refine the Base Conceptual Site Model (CSM) based upon new data
- Characterize the risks posed by the sites to human health and the environment

The 1999 Basewide RI was generally successful in addressing these objectives. However, after reviewing the analytical data generated from the 1999 investigation, several new data needs became apparent. This addendum to the original RI/FS Work Plan is designed to address those data needs.

The additional field work is required mainly because the RI sampling results indicated that chlorinated hydrocarbons were present in groundwater at five separate sites. The chemicals - principally trichloroethene (TCE), cis 1,2-dichloroethene (DCE), and vinyl chloride (VC) - were locally detected at concentrations exceeding applicable groundwater cleanup criteria, as set forth in the State's Cleanup Levels for Missouri (CALM) Guidance.

The elevated chemical concentrations were detected in groundwater samples collected from six monitoring wells located at five sites: CS 004, SS 003, SS 006, SS 009, and ST 005. Consequently, the primary objective of the RI/FS Work Plan Addendum is to better delineate -horizontally and vertically - the occurrence of chlorinated hydrocarbons in groundwater. Additional groundwater monitoring wells will be installed at each of these sites to better assess the extent of chlorinated hydrocarbons in the vicinity of the contaminated monitoring wells. The scope of the additional work is described further in a separate sampling plan addendum for each site.

In addition to delineating the nature and extent of chlorinated hydrocarbons in groundwater, ten soil borings will be drilled within and to the north of site ST 007 to help evaluate the extent of petroleum hydrocarbons at the former underground storage tank (UST) site. Two of the borings were part of the original RI scope of work but were not completed because of wet, unstable ground conditions. The remaining eight borings are intended to delineate further hydrocarbon contamination detected during the Air Force's investigation of the adjacent Building 903. The drilling and soil sampling will be conducted in accordance with the 1999 RI/FS Work Plan.

Furthermore, three background sediment and surface water samples will be collected from upstream stretches of Scope Creek. Sediment and surface water samples were collected from AOC 001, AOC 002, and AOC 003 as part of the RI, however no background sediment samples were collected at that time. The additional samples are needed to ensure a statistically valid comparison of background metal concentrations and anthropogenic

chemicals (such as PAHs) with site-specific results. The background sampling locations are subject to the approval of MDNR.

In summary, to address additional data needs arising from initial review of the RI analytical data, the following scope of work will be completed as an addendum to the original Basewide RI at Richards-Gebaur AFB.

- Installing 30 monitoring wells at five sites where chlorinated solvents were detected in groundwater samples at concentrations above CALM action levels
- Drilling ten soil borings and collecting approximately 30 soil samples from the vicinity of ST 007 and adjacent Building 903
- Advancing 20 geoprobe borings and collecting 60 soil samples from FT 002
- Collecting three background sediment and surface water samples from upstream stretches of Scope Creek

3.0 General Field and Laboratory Procedures

During implementation of the RI/FS Work Plan Addendum, environmental sampling will be conducted at six of the 16 RI sites (CS 004, SS 003, SS 006, SS 009, ST 005, and ST 007) and at selected background locations along upstream stretches of Scope Creek. The work will be performed in accordance with the existing Richards-Gebaur Basewide RI/FS Work Plan, including using the same drilling subcontractor (Layne-Western), analytical laboratory (Columbia Analytical Services), and Investigation-derived Waste Management Consultant (Geotechnical Services Inc). Surveying of wells and sample locations will be conducted by Wendy Lopez and Associates (WLA). General field and laboratory procedures are described below, and conform to the methodologies presented in the original RI/FS Work Plan.

3.1 General Field Procedures

The following field activities comprise the Basewide RI/FS Work Plan Addendum:

- Installing groundwater monitoring wells
- Logging soil borings
- Collecting subsurface soil samples
- Collecting groundwater samples
- Collecting sediment and surface water samples
- Surveying sample locations

Each of the Work Plan Addendum field activities will be conducted following the detailed procedures presented in the 1999 Basewide RI/FS Work Plan, with the following exceptions:

1. The procedure for installing monitoring wells will deviate slightly from the 1999 Basewide RI/FS Work Plan. During the Addendum field work, monitoring wells will be installed at each of the proposed locations described in the Work Plan Addendum, regardless of whether water is present in the borehole within 48 hours after drilling is completed. This protocol will be followed because groundwater associated with stormwater infiltration may enter "dry" monitoring wells several days or more after the monitoring wells are installed. This conservative investigation approach is confined to sites where chlorinated hydrocarbons have been detected in groundwater at concentrations above applicable CALM guidelines.
2. During execution of the Work Plan Addendum, the monitoring well termination depth will be modified from that described in the 1999 Basewide RI/FS Work Plan, which stated that the wells would be installed 6–18 inches into the upper bedrock unit. In the Work Plan Addendum, a combination of shallow and deep monitoring wells are proposed to vertically delineate potential chlorinated hydrocarbons in groundwater.

- Shallow overburden monitoring wells will be designed to screen the overburden/bedrock interval that corresponds to the screened interval of existing wells with chlorinated hydrocarbon detections.
- Deep wells will be installed to straddle the limestone/shale interface. Because chlorinated hydrocarbons are heavier than water, they will tend to sink through the groundwater column and pool at impermeable horizons. At Richards-Gebaur, the underlying shale units act as vertical barriers to groundwater flow and are therefore potential horizons where dense non-aqueous phase liquids (DNAPLs), such as trichloroethene (TCE), can collect. This approach will ensure that monitoring wells are screened across the limestone/shale interface to intercept any DNAPLs that may have accumulated on top of the impermeable shale.

Shallow and deep monitoring well pairs will be installed at two sites, ST 005 and SS 009. This allows the shallow (unconsolidated/bedrock) and deep (limestone/shale) interface zones to be screened and sampled independently. At the other sites, the uppermost bedrock unit is relatively impermeable shale, consequently DNAPLs would not be expected to migrate downward through this stratum, and drilling through it could provide an unwanted vertical pathway for groundwater. Figure 3.1 is a schematic of the proposed shallow and deep well construction.

In addition, Table 3-1 lists the construction specifications for the monitoring wells associated with this Work Plan Addendum. Recent groundwater elevations from December 1999 and January 2000 are included in the table.

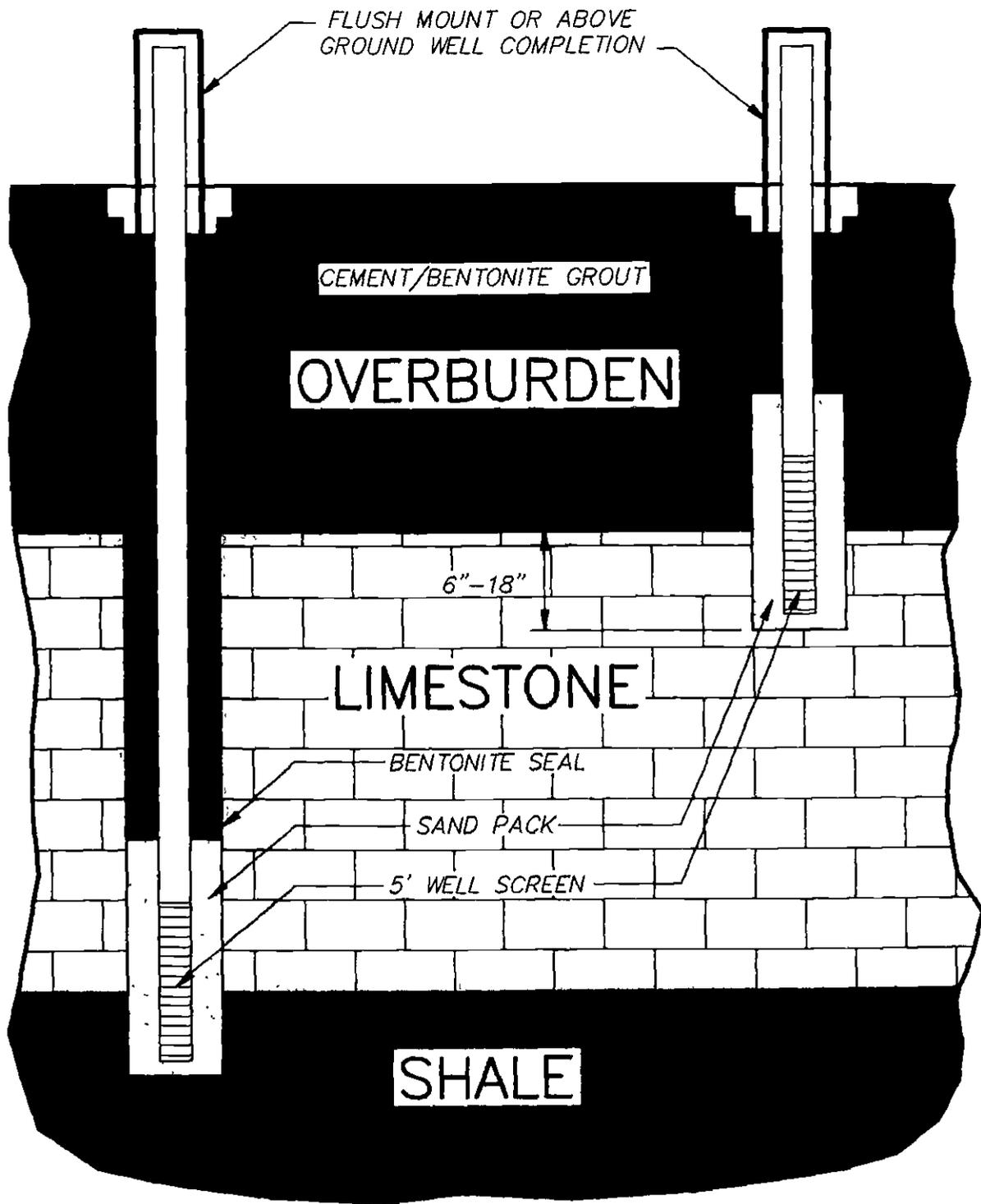
3.2 General Laboratory Procedures

Environmental samples collected during the Addendum field work will be analyzed for a suite of parameters including one or more of the following: total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile compounds (SVOCs), target analyte list (TAL) metals, and monitored natural attenuation (MNA) indicator chemicals. Analytical methods for each of these parameters are described in detail in the original 1999 Basewide RI/FS Work Plan.

During the RI Addendum, sample handling, labeling, custody, and shipment procedures will follow methodologies set forth in the October 1999 Basewide RI/FS Work Plan. Similarly, Data Quality Objectives (DQOs) - pre-established goals that help monitor and assess the progress of the project - for the Addendum field work are identical to those presented in the RI/FS Work Plan.

CH2M HILL has contracted with Columbia Analytical Services (CAS), Redding, CA, to perform the sample analyses. CAS is experienced with AFCEE QAPP requirements and can satisfy the project DQOs. CAS conducted the 1999 RI laboratory analyses.

Site-specific field procedures are described in the following individual Site Sampling Plan Addenda.



PLOT DATE 3-30-00

I:\153673\CAD\DWGS\DLV\FIGURE3.1.DWG

Figure 3.1

SCHMATIC OF NESTED MONITORING WELLS

Richards-Gebaur AFB
Kansas City, Missouri

Table 3-1 Well Construction Data Summary for Selected Sites, Richards-Gebaur AFB, Missouri

Site	Well ID	Ground Surface Elevation (ft msl)	Total Depth (ft bgs)	Screen Interval (ft bgs)	Dec 99 Water Elevation (ft msl)	Jan 2000 Water Elevation (ft msl)	Bedrock Elevation (ft msl)	Bedrock Description	Sources
CS 004	MW-1	1005 87	16 5	11 - 16	995 99	995 79	989 37	Raytown limestone	CH2M HILL (12/99)
	MW-2	1005 42	16 5	11 - 16	996 3	996 04	989 92	Raytown limestone	
	MW-3	1005 89	16 5	11 - 16	996 33	996 07	989 39	Raytown limestone	
	MW-4	TBD	TBD	TBD			TBD	TBD	
	MW-5	TBD	TBD	TBD			TBD	TBD	
	MW-6	TBD	TBD	TBD			TBD	TBD	
	MW-7	TBD	TBD	TBD			TBD	TBD	
	MW-8	TBD	TBD	TBD			TBD	TBD	
	MW-9	TBD	TBD	TBD			TBD	TBD	
	MW-10	TBD	TBD	TBD			TBD	TBD	
SS003	MW-1	1030 26	20	9 5 - 19 5	1026 2	1025 55	Unknown	Unknown	Versar (1/96) CH2M HILL (12/99)
	MW-2	1028	33 43	22 9 - 32 9	1000 22	1016 47	1012	16'-30' bgs, weathered Lane shale, >30' bgs, Raytown limestone	
	MW-3	1027 04	32	21 5 - 31 5	1019 63	1020 45	1011 04	Lane shale	
	MW-4	1030 28	24 5	14 - 24	1022 52	1022 65	1006 28	Lane shale	
	MW-5	TBD	TBD	TBD			TBD	TBD	
	MW-6	TBD	TBD	TBD			TBD	TBD	
	MW-7	TBD	TBD	TBD			TBD	TBD	
	MW-8	TBD	TBD	TBD			TBD	TBD	
	MW-9*	TBD	TBD	TBD			TBD	TBD	
	MW-9*	1055 27	16 3	5 8 - 15 8	1041 93	1040 23	1051 85	4-13 bgs, Argenville limestone, >13' bgs, Lane shale	
SS006	MW-1	TBD	TBD	TBD			TBD	TBD	Versar (1/96)
	MW-2	TBD	TBD	TBD			TBD	TBD	
	MW-3	TBD	TBD	TBD			TBD	TBD	
	MW-4	TBD	TBD	TBD			TBD	TBD	
	MW-5	TBD	TBD	TBD			TBD	TBD	
	MW-6	TBD	TBD	TBD			TBD	TBD	
	MW-7	TBD	TBD	TBD			TBD	TBD	
	MW-8	TBD	TBD	TBD			TBD	TBD	
	MW-9	TBD	TBD	TBD			TBD	TBD	
	MW-10	TBD	TBD	TBD			TBD	TBD	
SS009	MW-1	1006 3	18 59	8 59 - 18 59	1002 12	1001 28	988	Raytown limestone	CH2M HILL (12/99)
	MW-2	1006 5	14 83	7 33 - 14 83	995 29	998 64	992	Raytown limestone	
	MW-3	1005 6	12 47	4 97 - 12 47	995 37	998 47	993	Raytown limestone	
	MW-4	998	13 68	3 68 - 13 68	995 25	994 91	986 5	Raytown limestone	
	MW-5	998	12 27	8 27 - 12 27	993 05	993 88	Unknown	Unknown	
	MW-6	1001 16	15 3	5 30 - 15 30	998 17	996 49	990	Raytown limestone	
	MW-7	1019 31	22 37	12 37 - 22 37	1010 94	1011 69	1008	Lane shale	
	MW-8	1007 22	15 91	5 91 - 15 91	1001 48	1002 21	985	12.2'-14.2' bgs, Lane shale, >14.2' bgs, Raytown limestone	
	MW-9	1001 17	15 99	5 99 - 15 99	997 59	996 64	986 5	Raytown limestone	
	MW-10	994 1	15	7 5 - 15	990 12	990 15	Unknown	Unknown	
ST005	MW-1S	993 4	abandoned	N/A	N/A	N/A	978 4	15'-33.5' bgs interbedded Chanute shale and sandstone and claystone	B & M (1/92)
	MW-1D	993 4	32	22 0 - 32 0	981 37	985 16	980 1	13'-33.5' bgs interbedded Chanute shale and sandstone and claystone	
	MW-2D	997 6	35	25 0 - 35 0	984 17	984 65	980 1	17.5'-32.5' bgs interbedded Chanute shale and sandstone and claystone	
	MW-3D	997 6	19 5	9 5 - 19 5	987 61	987 18	981 6	Chanute shale	
	MW-3S	997 6	40	30 0 - 40 0	978 26	978 43	988 2	11.5'-11.65' bgs Raytown limestone, 11.65'-39' bgs interbedded Chanute shale and sandstone and claystone	
	MW-4D	999 7	40	30 0 - 40 0	978 26	978 43	988 2	11.5'-11.65' bgs Raytown limestone, 11.65'-39' bgs interbedded Chanute shale and sandstone and claystone	
	MW-5D	1005 8	39 5	24 5 - 39 5	997 82	998 32	990 3	15.5'-20' bgs Raytown limestone, 20'-34' bgs interbedded Chanute shale and sandstone and claystone	
	MW-7S	993 1	24	8 3 - 20 8	986 46	986 06	982 1	Chanute shale	
	MW-8S	995 9	15	8 0 - 13 0	987 88	987 48	981 9	Chanute shale	
	MW-10	TBD	TBD	TBD			TBD	TBD	
MW-11	TBD	TBD	TBD			TBD	TBD		
MW-12	TBD	TBD	TBD			TBD	TBD		
MW-13	TBD	TBD	TBD			TBD	TBD		
MW-14	TBD	TBD	TBD			TBD	TBD		
MW-15	TBD	TBD	TBD			TBD	TBD		
MW-16	TBD	TBD	TBD			TBD	TBD		
MW-17	TBD	TBD	TBD			TBD	TBD		
MW-18	TBD	TBD	TBD			TBD	TBD		

Note: Shaded cells are existing wells and unshaded ones are proposed wells. TBD - To be determined. MW-9* represents existing well MW-2 at CS 002

4.0 Site Sampling Plan Addendum A – CS 004

4.1 Site Description

CS 004 is the site of a former UST located at the northwest corner of Building 620. The UST was used to store waste liquids from Air Force fuel testing laboratories housed in Building 620 between 1966 and 1988. The capacity of the tank was 550 gallons. The composition of the net waste stream stored in this tank was estimated by Air Force personnel to be approximately 70% fuel, 28% water, and 2% acid (Esch, 1996). The site is about 400 square feet in area, flat, and unpaved. It is not located in a floodplain, and no surface water bodies or sediments are present onsite.

4.2 Summary of Previous Investigations

As part of a 1988 Air Force project, the UST was removed. Low levels of TPH – 39 ppm (below MDNR's action level of 50 ppm) - were measured in a single soil sample collected from the excavation during the tank removal. Additional soil samples were collected in 1993 as part of the UST closure activities for the Base at large (Burns & McDonnell, 1994b). In order to confirm that the UST had been removed, and not abandoned in place as had been reported in a previous closure report, several more soil samples were collected in 1995. The investigation verified that the tank had indeed been removed, but soil sample analytical results indicated that the former UST area contained TPH constituent concentrations in soil above the applicable MDNR UST action level of 50 ppm. In response to the indications of residual soil contamination, about 500 cubic yards of soil was excavated in 1995 (Dames & Moore, 1996b). Three post-excavation soil samples were collected at this time. Two more soil samples were collected at the site to document subsurface conditions as part of a Subsurface Assessment in 1996 (HDB, 1996).

During the 1999 Basewide RI at Richards-Gebaur AFB, CH2M HILL installed three monitoring wells, MW-1, MW-2, and MW-3, at CS 004. Groundwater samples collected from MW-1 and MW-3 contained cis-1,2 dichloroethene (cis-1,2 DCE) at concentrations of 92.6 ug/l and 211.1 ug/l, exceeding the CALM GTARC of 70 ug/L.

Existing monitoring well locations at CS 004 are shown in Figure 4.1. Boring logs from CS 004 are provided in Attachment A.

4.3 Objectives and Scope of Supplemental Field Investigation

The objective of the additional field work at CS 004 is to assess the extent of cis-1,2 DCE in the vicinity of monitoring wells MW-1 and MW-3. To meet this objective, four additional monitoring wells will be installed at CS 004. Proposed locations for the new monitoring wells are displayed in Figure 4.2. Depending on the location of underground utilities, monitoring well locations may be modified during the investigation. The monitoring wells will be installed and developed according to the procedures described below and consistent with the October 1999 Basewide RI/FS Work Plan.

Soil borings will be logged continuously with depth during the drilling of each monitoring well boring. One soil sample from each boring will be retained for laboratory analyses. The sample depth interval will be selected at the discretion of the field geologist based upon the results of field screening, as described in the 1999 Basewide RI/FS Work Plan. The soil samples will be analyzed for VOCs.

Groundwater samples will be collected from each of the new and existing monitoring wells. Water level measurements will be made before sampling. Groundwater sampling procedures will follow the methodologies described in the 1999 Basewide RI/FS Work Plan. Groundwater samples will be analyzed for VOCs and standard MNA parameters.

Table 4-1 Summary of Sample Analyses - CS 004

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	7	√				√
Soil	4	√				
QA/QC Samples¹						
Field Duplicates	2	√				√
Notes						
1 In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan, and will be collected at a frequency of 10 % of total per medium.						

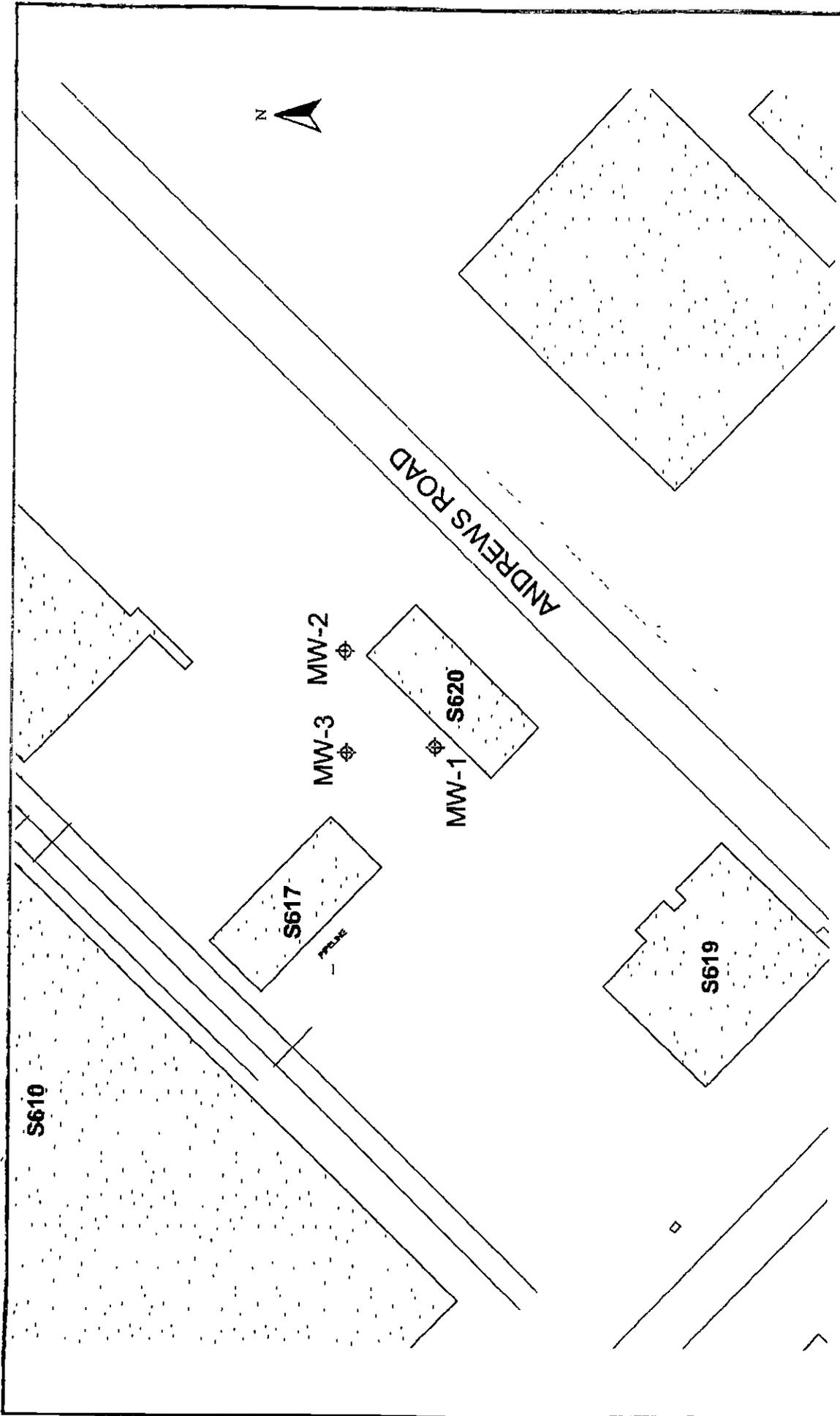


Figure 4.1

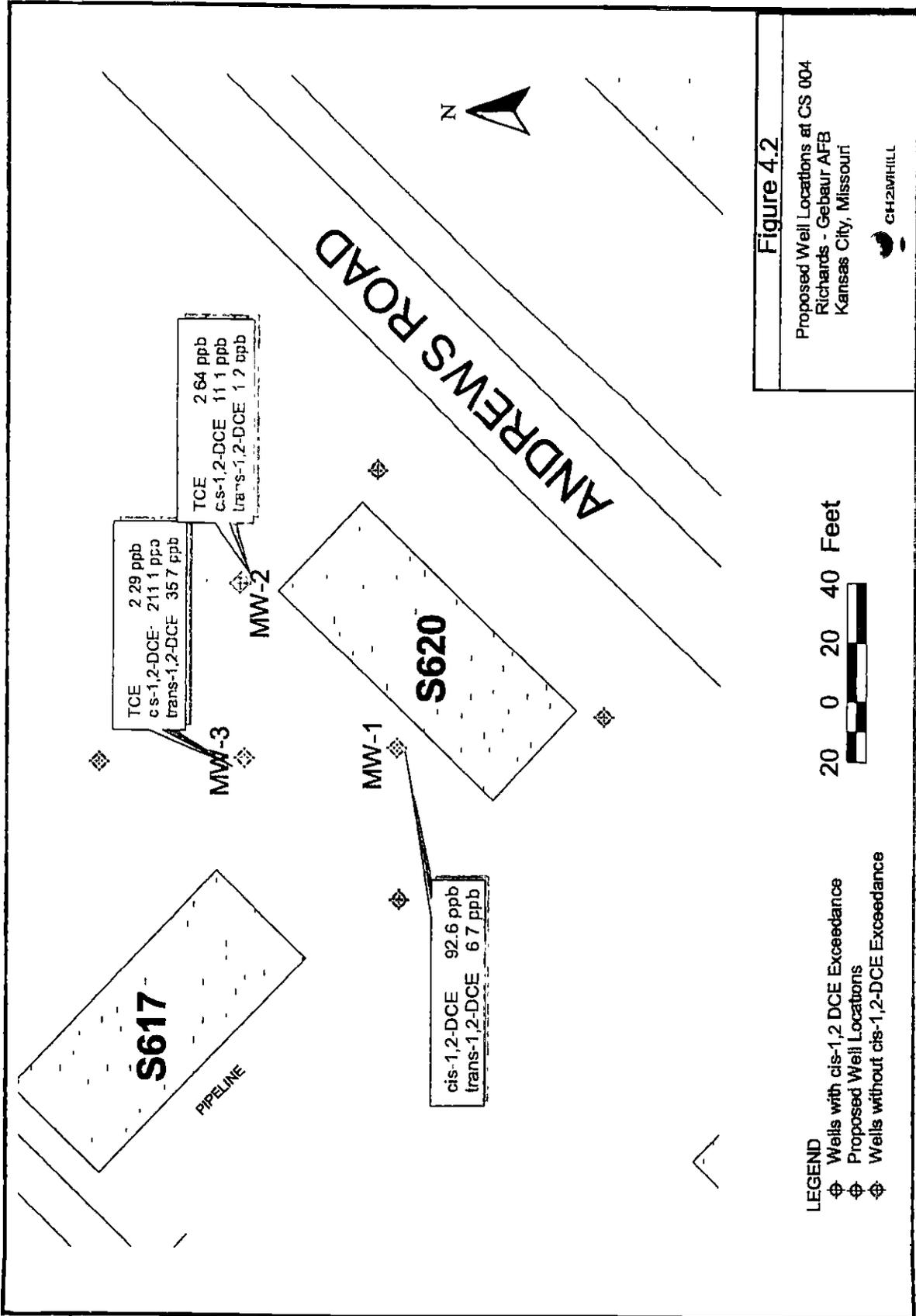
Existing Well Locations at CS 004
 Richards - Gebaur AFB
 Kansas City, Missouri

CS-2004-HILL

200 Feet

0

200



5.0 Site Sampling Plan Addendum B – SS 003

5.1 Site Description

SS 003, the Oil Saturated Area, is located south of 155th Street, southwest of Building 704. It was used to store waste oil products generated from the mid-1950s to the late 1980s by routine maintenance of the Motor Pool vehicles (USAF, 1994a). The site is part of the former waste oil storage area and originally covered approximately 1,600 square feet (Versar, 1996d). The site is paved and flat. A grassy swale runs parallel to the west and south fencelines. The site is on a small hill and is not located in or near a floodplain.

5.2 Summary of Previous Investigations

SS 003 was initially identified during a Phase I Records Search of the Air Force Base (CH2M HILL, 1983). The site was recognized at that time as being oil stained. The site was further investigated in 1986 and soil and surface water samples were collected and analyzed (Ecology and Environment, 1988). Two additional field samples were collected in 1989 as part of a Remedial Investigation (O'Brien and Gere, 1991). In 1991, approximately 42 cubic yards of contaminated soil was removed from SS 003 (Burns and McDonnell, 1992). In 1996 a groundwater assessment was conducted at the site (Versar, 1996d).

During the 1999 Basewide RI at Richards-Gebaur AFB, CH2M HILL installed four monitoring wells, MW-1 through MW-4, at SS 003. A groundwater sample collected from MW-4 contained TCE at a concentration of 71.2 ug/l, exceeding the applicable CALM Groundwater Target Concentration (GTARC) of 5 ug/L.

The locations of existing monitoring wells at SS 003 are shown in Figure 5.2. Boring logs from SS 003 are provided in Attachment A.

5.3 Objectives and Scope of Supplemental Field Investigation

The objective of the additional investigation at SS 003 is to assess the extent of TCE in the vicinity of monitoring well MW-4. MW-4 is located in the north part of SS 003, west of adjacent site CS 002 (see Figure 5.1). To meet this objective, five additional monitoring wells will be installed surrounding MW-4, one of which is a replacement well for CS 002 – MW-2, located immediately to the north of MW-4. The integrity of well CS 002 – MW-2 has been compromised because the flush-mounted well was paved over with asphalt. The well will be abandoned in place in accordance with the procedures specified in the original RI/FS Work Plan. Proposed locations for the new monitoring wells are displayed in Figure 5.2. Well locations may be modified during the investigation depending on the location of underground utilities. The monitoring wells will be installed and developed according to the procedures described below, consistent with the October 1999 Basewide RI/FS Work Plan.

Soil samples will be logged continuously with depth during the drilling of each monitoring well boring. One soil sample from each boring will be retained for laboratory analyses. The samples will be selected at the discretion of the field geologist based upon the results of

field screening, described in the 1999 Basewide RI/FS Work Plan. Soil samples will be analyzed for VOCs.

Groundwater samples will be collected from each of the new monitoring wells and also from the existing wells at site SS 003 and adjacent site CS 002. Prior to sampling, static water level measurements will be made. Groundwater sampling procedures will follow the methodologies described in the 1999 Basewide RI/FS Work Plan. Groundwater samples will be analyzed for VOCs and MNA parameters.

Table 5-1 Summary of Sample Analyses – SS 003

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	12	√				√
Soil	5	√				
QA/QC Samples¹						
Field Duplicates	3	√				√
Notes						
1. In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

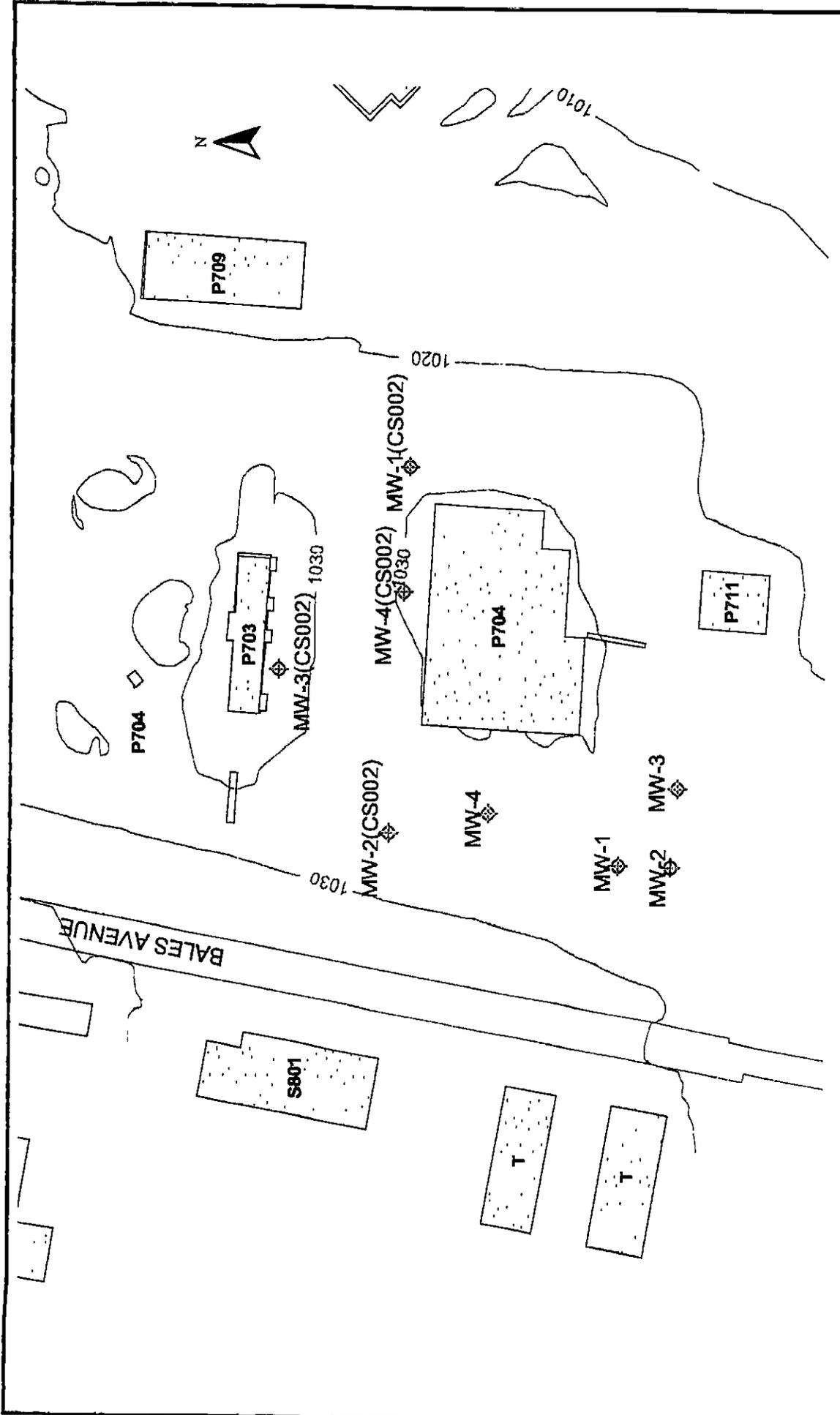


Figure 5.1

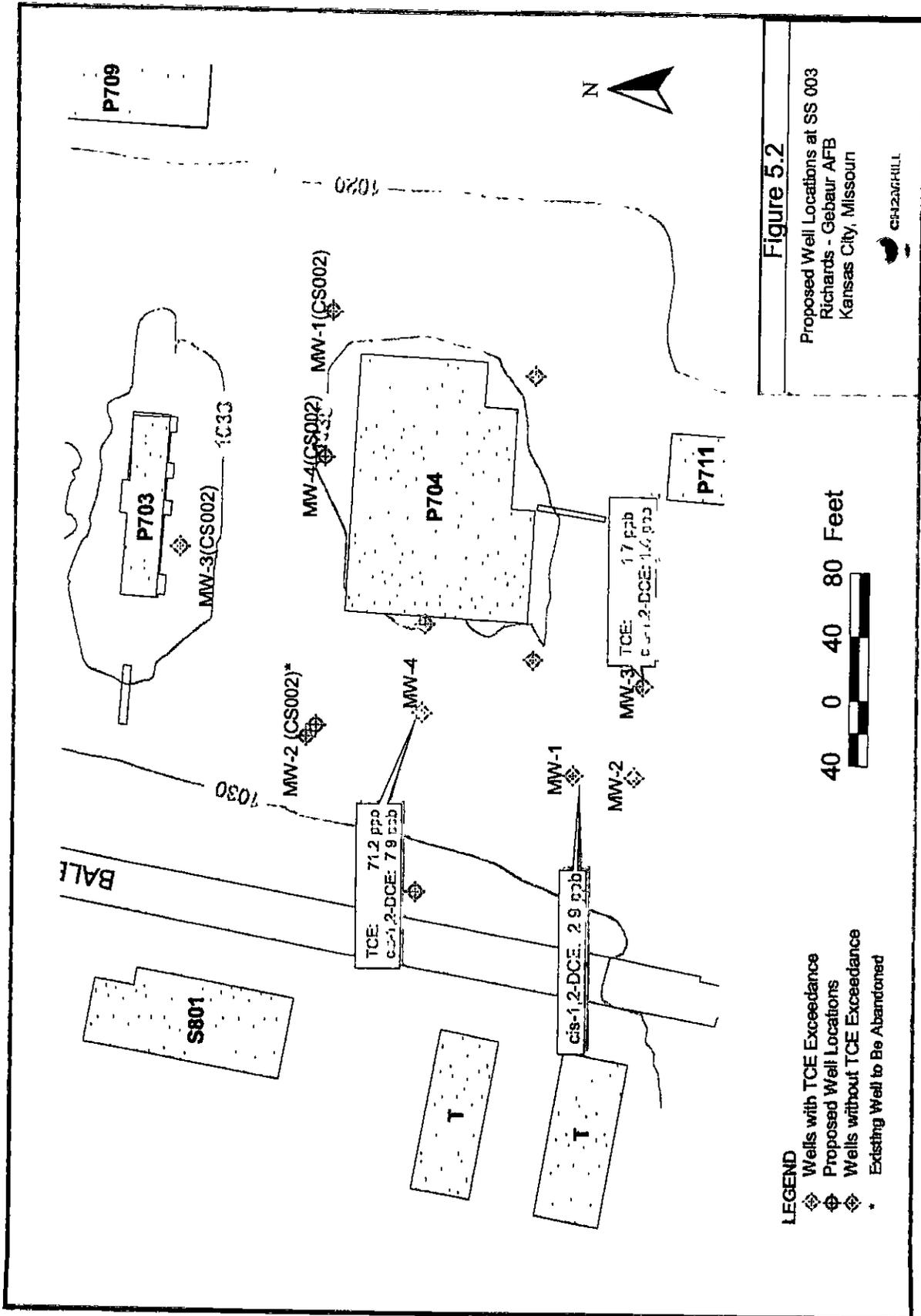
Existing Well Locations at SS 003
Richards - Gebaur AFB
Kansas City, Missouri

CH2RSHILL

200 Feet

0

200



6.0 Site Sampling Plan Addendum C – SS 006

6.1 Site Description

SS 006, the Hazardous Material Storage Area, is located east of Building 927, east of Hanger Road, north of 155th Street. Building 927 was used as an aircraft engine and propeller maintenance shop from 1957 to 1994. An area outside the rear of the building was used to keep bulk supplies of degreasers, solvents, oils and other common workshop materials. The materials were routinely stored in 55-gallon drums or other containers and placed off the ground on racks. The racks were located at the top of a grass embankment.

SS 006 is flat lying, although there is a steep downhill embankment immediately east of the storage area. The site's surface drainage is separated from the building drainage by a six-inch high curb (Versar, 1996a). The site is approximately 600 square feet in area and is situated at one of the highest parts of the Base, near the airfield. The site is not located in a floodplain, and no surface water bodies or sediments are present onsite.

6.2 Summary of Previous Investigations

The aircraft maintenance workers in Building 927 used SS 006 in the past to store common machine shop materials. Degreasers, solvents, oils, and lubricants were stored on racks outside at the rear of the building. The site was initially identified during a Site Inspection in 1990. According to records, the grass immediately behind the storage racks was discolored and showed signs of stress. In response, two surface soil samples were collected as part of a Preliminary Assessment (PA) of the site (O'Brien and Gere, 1991). Additional field samples were collected in 1991 during an IRP Site Inspection (Burns and McDonnell, 1993d and 1993e). At this time, the storage rack had been removed and signs of stressed vegetation were now absent. Subsequently, in 1993, approximately 40 cubic yards of contaminated soil was removed from SS 006 (Burns and McDonnell, 1993d). Following the soil removal, a groundwater assessment was conducted at the site (Versar, 1996a). A groundwater sample was collected from MW-1 and analyzed for metals, VOCs, SVOCs, and TPH. Metal concentrations were below applicable MDNR action levels. Three VOCs (vinyl chloride, cis-1, 2-dichloroethene, and trichloroethene) exceeded the respective State MCLs. One SVOC, bis(2-ethylhexyl)phthalate, was detected at a concentration of 10 ppb, slightly above the State MCL of 6 ppb. The constituent is a common artifact of environmental sampling, particularly in PVC-constructed wells. No TPH constituents were detected in the samples.

During the 1999 Basewide RI at Richards-Gebaur AFB, CH2M HILL attempted to install three monitoring wells at SS 006. However, each monitoring well borehole was terminated within a few feet of the ground surface because of the presence of hard limestone that would not permit continued drilling with hollow-stem augers. A groundwater sample was collected from MW-1, the only existing monitoring well at SS 006, and was found to contain TCE at a concentration of 56.2 ug/l, exceeding the applicable CALM GTARC of 5 ug/L. No SVOCs – including bis(2-ethylhexyl)phthalate – were detected.

The location of MW-1 at SS 006 is shown in Figure 6.1 Boring logs from SS 006 are provided in Attachment A.

6.3 Objectives and Scope of Supplemental Field Investigation

The objective of the supplemental work at SS 006 is to assess the extent of TCE in the vicinity of monitoring well MW-1. To meet this objective, four additional monitoring wells will be installed at SS 006. Proposed locations for the new monitoring wells are displayed in Figure 6.2. Depending on the location of underground utilities, monitoring well locations may be modified during the investigation. The monitoring wells will be installed and developed according to the procedures described below, consistent with the October 1999 Basewide RI/FS Work Plan.

Bedrock at SS 006 is very shallow, within three or four feet of the ground surface. Because of this situation, it is not possible to construct a monitoring well to screen across the overburden/bedrock interface. The existing monitoring well is drilled to a depth of 16.3 feet and penetrates about nine feet of Argentine Limestone followed by about three feet of Lane Shale. The new wells will be constructed in a similar fashion to the existing well to ensure that the same lithological interval is screened and monitored. Soil samples will be logged continuously with depth during the drilling of each monitoring well boring. One soil sample from each boring will be retained for laboratory analyses. The samples will be selected at the discretion of the field geologist based upon the results of field screening, as described in the 1999 Basewide RI/FS Work Plan. Soil samples will be analyzed for VOCs

Groundwater samples will be collected from each of the new monitoring wells and from the existing monitoring well. Water level measurements will be made before sampling. Groundwater sampling procedures will follow the methodologies described in the 1999 Basewide RI/FS Work Plan. Groundwater samples will be analyzed for VOCs and MNA parameters.

Table 6-1 Summary of Sample Analyses – SS 006

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	5	√				√
Soil	4	√				
QA/QC Samples¹						
Field Duplicates	2	√				√
Notes.						
1 In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

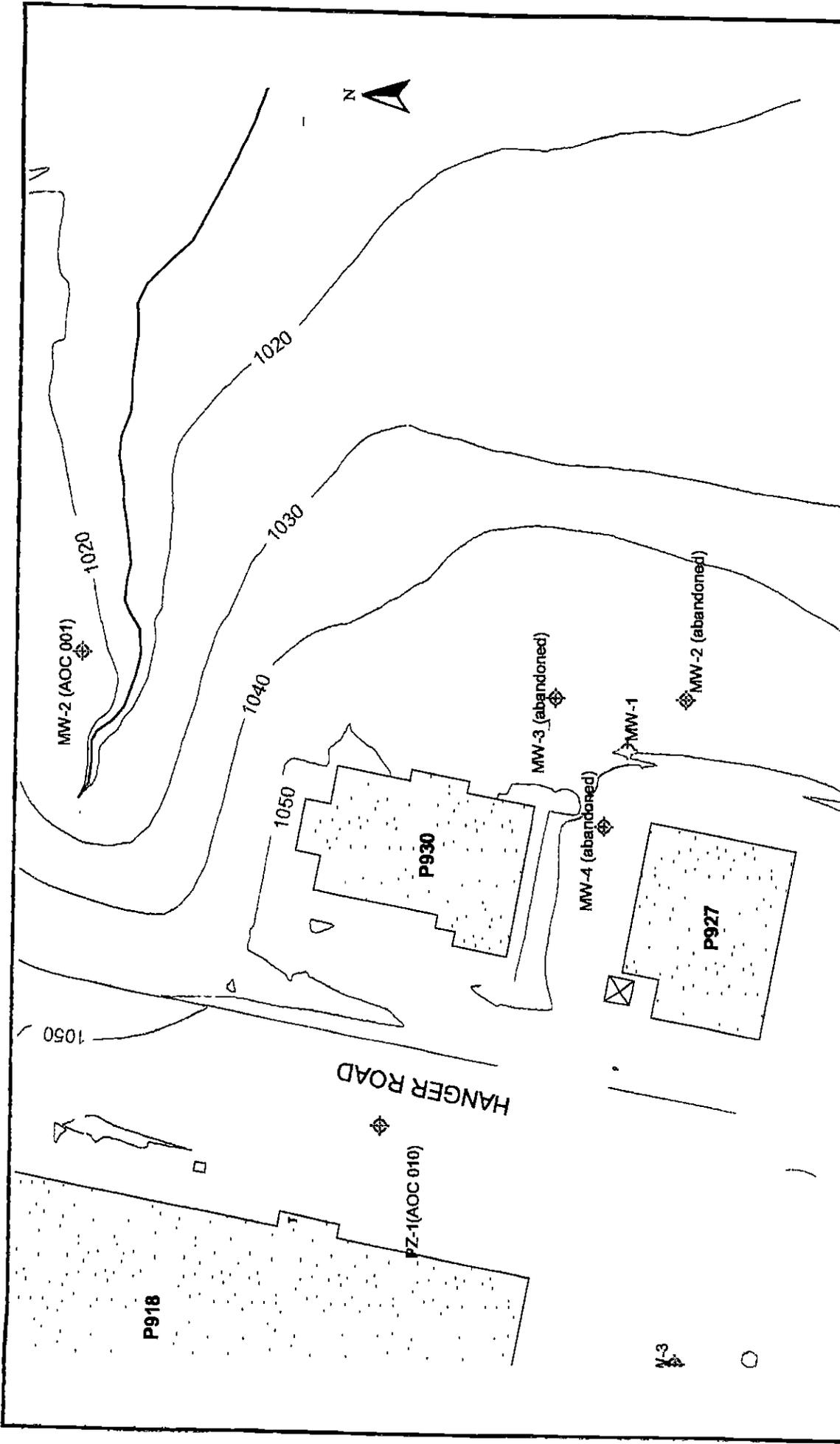
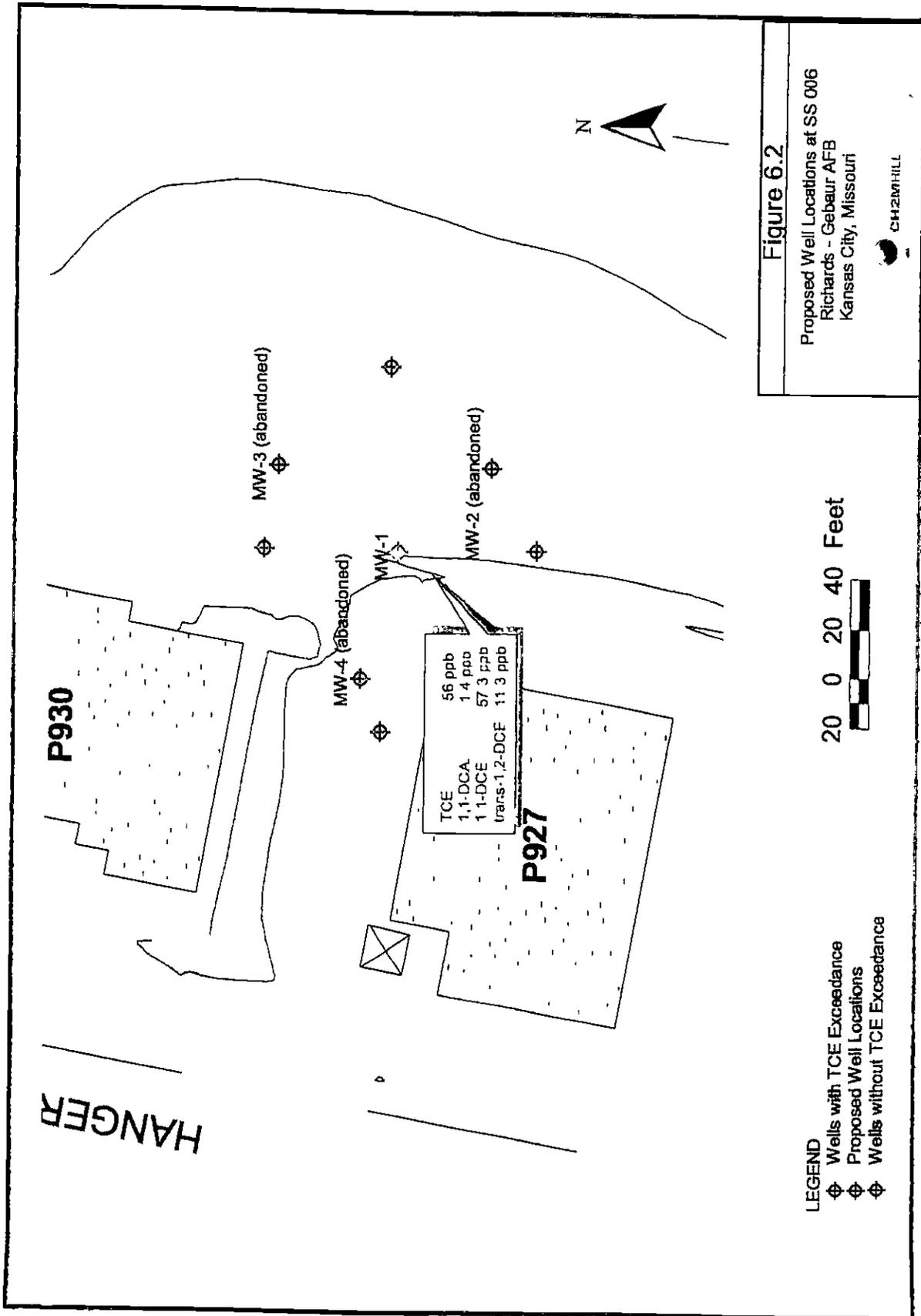


Figure 6.1

Existing Well Locations at SS 006
Richards - Gebaur AFB
Kansas City, Missouri



100 0 100 Feet



7.0 Site Sampling Plan Addendum D – SS 009

7.1 Site Description

SS 009 is located on Richards-Gebaur AFB directly on the southwest side of Building 605 on Corkill Road, southeast of the intersection of Westover and Corkill Roads. Building 605 was used by the Air Force as part of the Civil Engineering Complex from 1953 to 1996. The building was used for various purposes during this period, including a Carpenter Shop, Interior and Exterior Heat Shop, Roads and Grounds Shop, and Sanitation Shop (Tetra Tech, 1995c). Reportedly, no activities at the complex involved the storage or handling of bulk hazardous waste materials (USAF, 1993).

The site is located on the far side of a paved parking lot next to a fire valve and adjacent to a small grass drainage swale. It occupies approximately 400 square feet in area and is generally flat. The site is not located in a floodplain.

7.2 Summary of Previous Investigations

The site was initially identified in 1992 when petroleum product was reported by an Air Force contractor who was digging a ditch to repair an underground water main valve (USAF, 1993). As a consequence, 10 cubic yards of petroleum-contaminated soil was excavated from the trench to a depth of approximately five feet below ground surface in 1993.

In 1994, a total of 70 soil samples were collected from the site for possible laboratory analyses during a Preliminary Assessment /Site Investigation (PA/SI) (Tetra Tech, 1995c). A groundwater assessment was conducted at the site to evaluate the potential adverse impacts to local shallow groundwater (Versar, 1996a). No TPH constituents were detected in the samples. No SVOCs were detected above applicable MCLs. Four VOCs were detected with concentrations that exceeded their respective MCLs. The VOCs detected were 1,1-dichloroethene (17 ppb, 16 ppb), tetrachloroethene (12 ppb, 33 ppb), trichloroethene (8.8 ppb, 11 ppb), and vinyl chloride (4.6 ppb, 21 ppb).

Several metals were also detected in the total metals analysis at concentrations above their respective MCLs. The metals detected included arsenic (63.1 ppb), barium (5,240 ppb), cadmium (5.3 ppb), chromium (157 ppb, 227 ppb), and lead (56.4 ppb, 184 ppb). The dissolved metals analytical results, however, were all below the applicable MCLs. PCB results are considered inconclusive because the detection limit of 1.1 ppb was higher than the corresponding MCL of 0.5 ppb.

During the 1999 Basewide RI at Richards-Gebaur AFB, CH2M HILL attempted to install three monitoring wells at SS 009. Two of the wells were installed successfully; however, the borehole for proposed MW-1 was abandoned because it failed to produce water within 48 hours after drilling. A groundwater sample collected from MW-3 contained TCE at a concentration of 34.9 ug/l, exceeding the CALM GTARC of 5 ug/L. MW-3 also contained cis-1,2 DCE at a concentration of 241.9 ug/l, exceeding the CALM GTARC of 70 ug/l. In addition, PCBs were not detected in any soil samples collected from the three well borings.

The locations of existing monitoring wells at SS 009 are shown in Figure 7 1. Boring logs from SS 009 are provided in Attachment A.

7.3 Objectives and Scope of Supplemental Field Investigation

The objective of installing and sampling additional monitoring wells at SS 009 is to assess the extent of TCE and cis-1,2 DCE in the vicinity of monitoring well MW-3. To meet this objective, eight additional monitoring wells will be installed at SS 009. Proposed locations for the new monitoring wells are displayed in Figure 7 2. Depending on the location of underground utilities, monitoring well locations may be modified during the investigation. The monitoring wells will be installed and developed according to the procedures described below and in the October 1999 Basewide RI/FS Work Plan.

The new monitoring wells will be installed in three shallow and deep pairs, and two deep wells adjacent to the existing shallow wells. This provides five shallow/deep nested well pairs to monitor the area of interest. The shallow wells will be drilled through the unconsolidated overburden soils to the same depth as MW-3. This depth corresponds to the top of bedrock at Site SS 009. The wells will be constructed to screen across the overburden/bedrock interface. If, as expected, the Raytown Limestone is the uppermost bedrock unit, drilling will continue through the limestone (about six to eight feet thick) until two feet of the underlying Chanute Shale has been encountered. The new deep wells will then be constructed to screen the limestone/shale interface.

Soil samples will be logged continuously with depth during the drilling of each monitoring well boring. One soil sample from each shallow boring will be retained for laboratory analyses. The sample interval will be selected based upon the results of field screening, as described in the 1999 Basewide RI/FS Work Plan, and at the discretion of the field geologist. Soil samples will be analyzed for VOCs.

Groundwater samples will be collected from each of the new and existing monitoring wells. Water level measurements will be made before sampling. Groundwater sampling procedures will follow the methodologies described in the 1999 Basewide RI/FS Work Plan. Groundwater samples will be analyzed for VOCs and MNA parameters.

Table 7-1 Summary of Sample Analyses – SS 009

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	10	√				√
Soil	3	√				
QA/QC Samples¹						
Field Duplicates	2	√				√
Notes						
1 In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

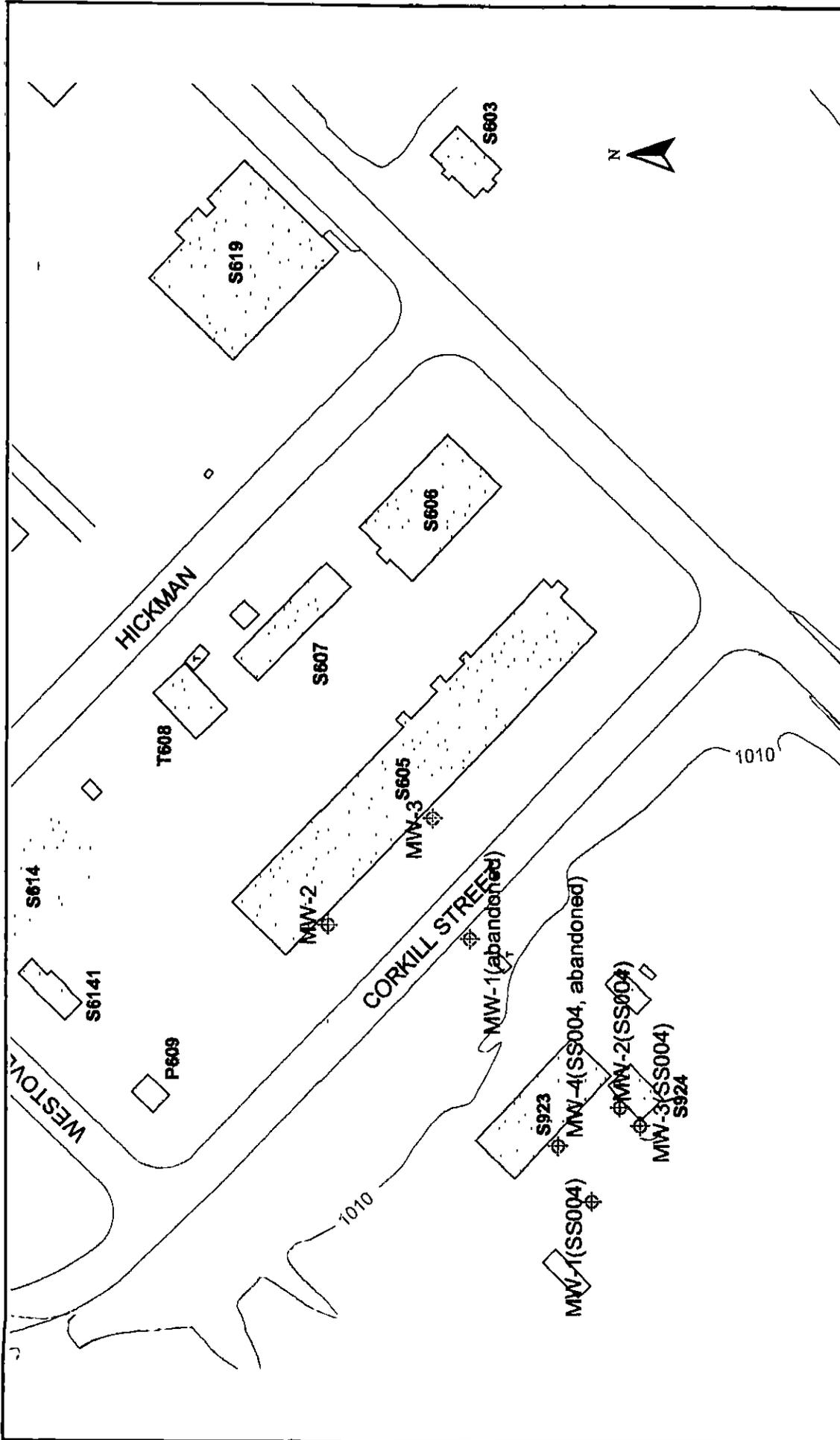


Figure 7.1

Existing Well Locations at SS 009
 Richards - Gebaur AFB
 Kansas City, Missouri



200 Feet



200

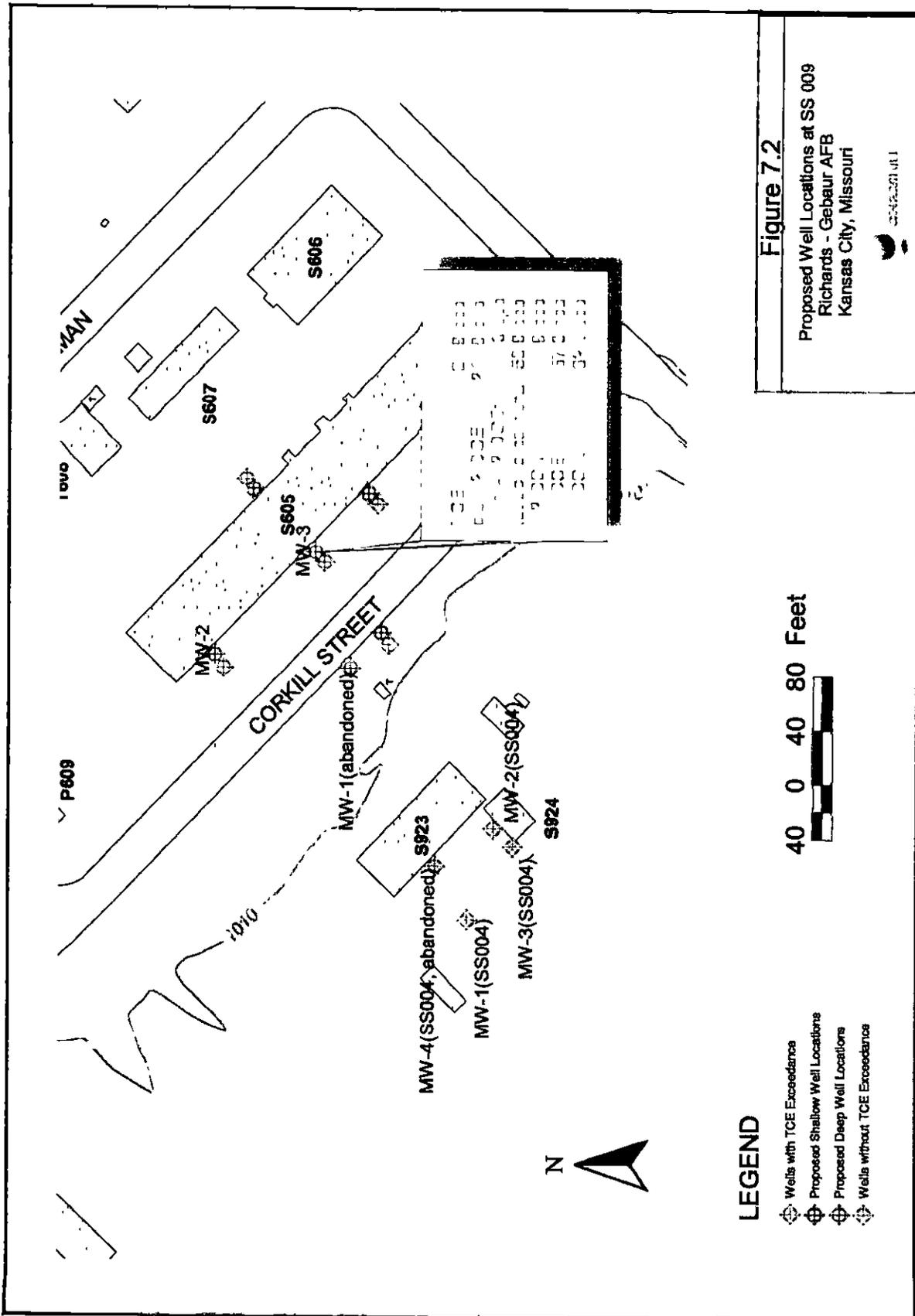
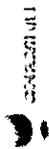


Figure 7.2
Proposed Well Locations at SS 009
Richards - Gebaur AFB
Kansas City, Missouri



LEGEND

- ⊕ Wells with TCE Exceedance
- ⊕ Proposed Shallow Well Locations
- ⊕ Proposed Deep Well Locations
- ⊕ Wells without TCE Exceedance

40 0 40 80 Feet



8.0 Site Sampling Plan Addendum E – ST 005

8.1 Site Description

ST 005, the Petroleum, Oil, and Lubricants (POL) storage yard is a former aboveground tank farm located east of the flight line and west of Andrews Road. The POL Yard is 12 acres in size and was in use from 1954 to 1988. The POL Yard was used to store and dispense jet fuel (JP-4), fuel oil and motor gasoline (MOGAS) to the Base. Most of the structures formerly at the site were removed in 1996.

8.2 Summary of Previous Investigations

The POL Yard began operations in 1954. In 1985, an aboveground storage tank (Facility 956) and a pump house (Facility 959) were sold to the City of Kansas City, and remain in place today. The POL Yard was decommissioned in 1996.

Numerous soil and groundwater investigations were performed at ST 005 prior to the 1999 RI. Results obtained from these investigations are described in the 1999 RI/FS Work Plan.

During the 1999 Basewide RI/FS at Richards-Gebaur AFB, CH2M HILL collected groundwater samples from 17 monitoring wells located throughout ST 005. A single groundwater sample, again collected from MW-3, contained TCE at a concentration of 189.1 ug/l, exceeding the CALM GTARC standard of 5 ug/L. As mentioned above, MW-3 was previously sampled in 1991 and found to contain TCE at a concentration of 44.4 ug/l. Chlorinated solvents have not been detected in any other wells at the site.

The location of existing monitoring wells at ST 005 are shown in Figure 8.1. Boring logs from ST 005 are provided in Attachment A.

8.3 Objectives and Scope of Supplemental Field Investigation

The objective of the supplemental field work at ST 005 is to assess the extent of TCE in groundwater in the vicinity of monitoring well MW-3. To meet this objective, nine additional monitoring wells will be installed at ST 005 surrounding the existing MW-3. Proposed locations for the new monitoring wells are displayed in Figure 8.2. Depending on the location of underground utilities, monitoring well locations may be modified during the investigation. The monitoring wells will be installed and developed according to the procedures described below, consistent with the October 1999 Basewide RI/FS Work Plan.

The new monitoring wells will be installed in four shallow and deep pairs, and one deep well adjacent to the existing shallow well MW-3. This provides five shallow/deep nested well pairs to monitor the area of interest. The shallow wells will be drilled through the unconsolidated overburden soils to the same depth as MW-3. This depth corresponds to the top of bedrock. If, as expected, the Raytown Limestone is the uppermost bedrock unit, drilling will continue through the limestone until two feet of the underlying Chanute Shale has been encountered. The new deep wells will then be constructed to screen the limestone/shale interface.

Soil borings will be logged continuously with depth during the drilling of each monitoring well boring. One soil sample from each shallow boring will be retained for laboratory analyses. The samples will be selected based upon the results of field screening, described in the 1999 Basewide RI/FS Work Plan, and at the discretion of the field geologist. Soil samples will be analyzed for VOCs.

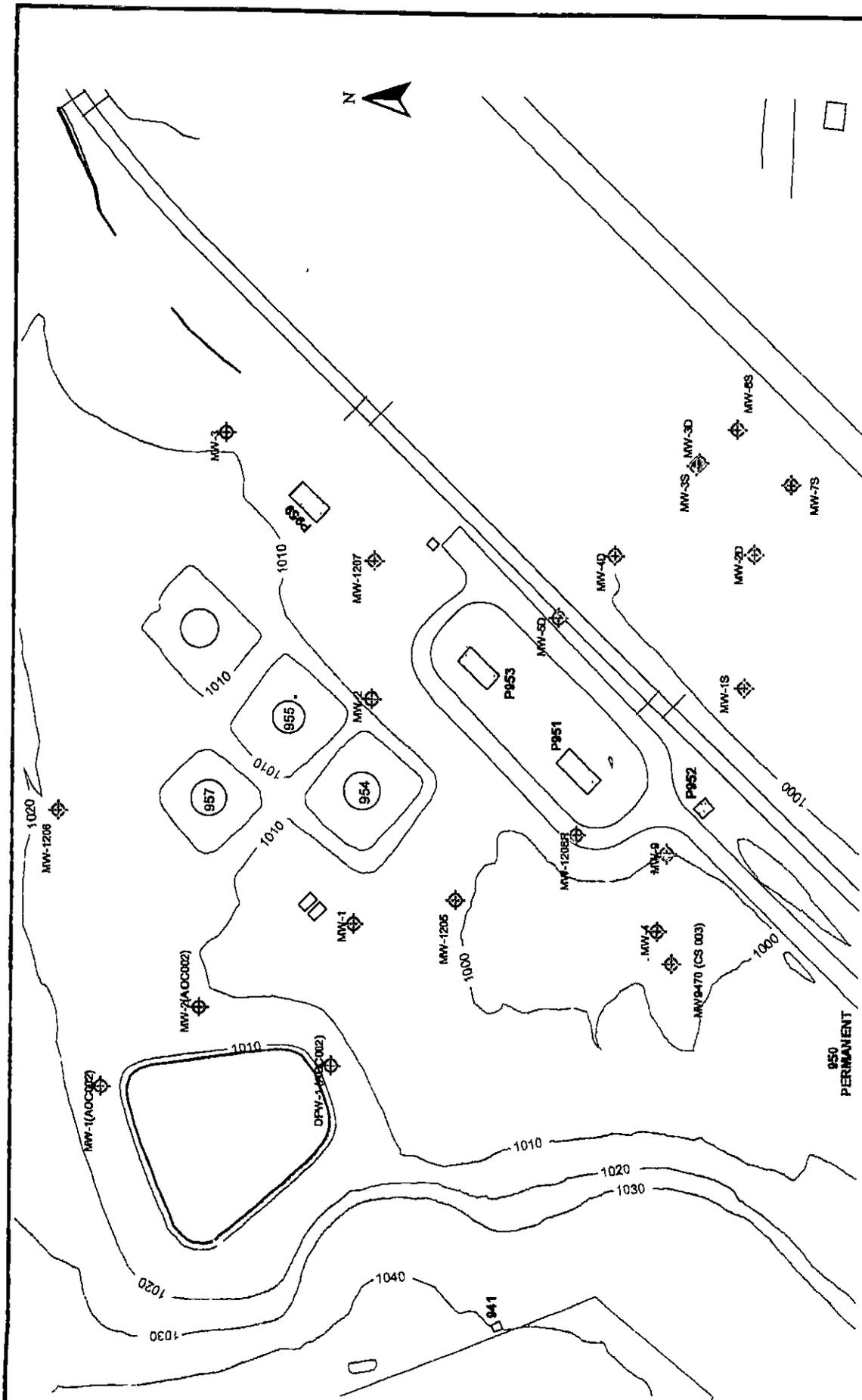
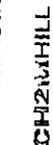
Groundwater samples will be collected from each of the new monitoring wells and from the existing monitoring well MW-3. Water level measurements will be made before sampling. Groundwater sampling procedures will follow the methodologies described in the 1999 Basewide RI/FS Work Plan. Groundwater samples will be analyzed for VOCs and MNA parameters.

Table 8-1 Summary of Sample Analyses – ST 005

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	10	√				√
Soil	4	√				
QA/QC Samples¹						
Field Duplicates	2	√				√
Notes						
1. In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

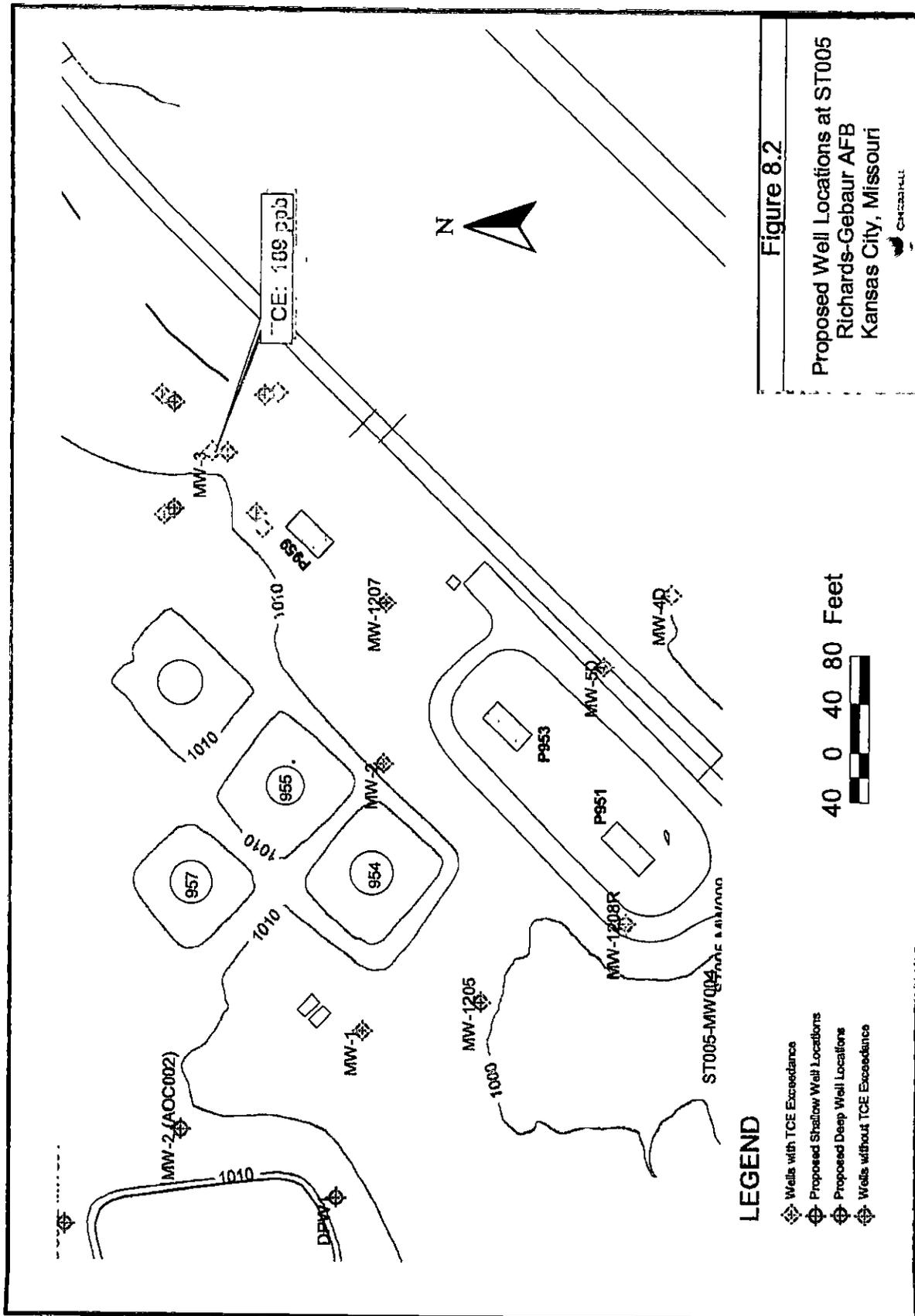
Figure 8.1

Existing Well Locations at ST005
Richards - Gebaur AFB
Kansas City, Missouri



100 0 100 Feet





9.0 Site Sampling Plan Addendum F – ST 007

9.1 Site Description

ST 007, the Former UST Area, is located at the former Building 902 site, west of Hangar Road and north of 155th Street. Building 902 was used as an aircraft refueling station (USAF, 1991). It was supplied with product from the POL Yard via the fuel hydrant line. Aviation fuel (JP-4) was stored in four 25,000-gallon steel USTs located beneath the building (Jacobs, 1995). The site is approximately 2,600 square feet in area and is covered with a variety of vegetation. The site is adjacent to the airfield runways at one of the highest points on the Base. It is also adjacent to Building 903, a former 250-gallon fuel oil UST site that has been investigated by the Air Force in 2000 as part of a separate work order.

9.2 Summary of Previous Investigations

ST 007 was used as a fuel storage depot from 1954 to 1977. In 1977, the tanks were abandoned in place using water to displace potentially explosive concentrations of organic vapors. No hazardous materials have been stored in the area since 1977. During operation of the system, no leaks were recorded during the fueling system's operational life (USAF, 1991). However, undetected spills or leaks may have occurred at the tanks and associated dispensing lines, resulting in contamination of subsurface soils.

In 1988, Building 902 and the underlying tanks, pumps, and associated piping were demolished and removed. Discolored soils and petroleum odors were noticed during the 1988 excavation and removal of the four USTs (USAF, 1993). Soil samples were collected and analyzed in 1989 to investigate the nature and extent of contamination (General Testing Laboratories, 1989).

A passive venting system was installed as an initial remediation effort (USAF, 1991). Reportedly, eighteen biovents, constructed of 4-inch PVC casing, were placed in the former UST tank pit (Dames & Moore, 1996e). Soil and groundwater samples were collected in 1991 as part of a Site Inspection (Geraghty & Miller, 1991). In 1996, additional soil and groundwater samples were collected to assess the performance of the existing passive bioventing remediation system (Dames & Moore, 1996e).

During the 1999 Basewide RI at Richards-Gebaur AFB, CH2M HILL collected soil samples at the corners of the 1988 excavation. Muddy and wet conditions in November 1999 prevented drill rig access to the center of the excavated area. The 1999 sampling locations are shown in Figure 9.1. Boring logs from ST 007 are provided in Attachment A.

In 2000, the Air Force, under a separate contract from the RI, investigated a former 250-gallon fuel oil UST at Building 903. Post-excavation soil sample results indicated residual diesel-range hydrocarbon concentrations in soil ranging between 1,400 ppm and 3,420 ppm.

9.3 Objectives and Scope of Supplemental Field Investigation

The objective of the soil boring and sampling at ST 007 is to collect subsurface soil samples from the center of the excavated former UST area and also to delineate hydrocarbon contamination detected by other Air Force investigations in soils near Building 903. To meet this objective, two soil borings will be advanced in the center of ST 007 (as originally proposed in the 1999 Basewide RI/FS Work Plan), and eight borings will be completed around the former UST excavation at Building 903. Proposed locations for the new borings are shown in Figure 9.2

The soil borings will be advanced to bedrock. Soil samples will be logged continuously with depth during the drilling of each monitoring well boring. Three soil samples from each boring will be retained for laboratory analyses. The samples will be selected at the discretion of the field geologist based upon the results of field screening and field observations, as described in the 1999 Basewide RI/FS Work Plan. Soil samples will be analyzed for VOCs, SVOCs, and TPH.

If, at the time of drilling, it is evident that the soil is significantly contaminated with petroleum hydrocarbons, up to three additional monitoring well pairs will be installed at the site to evaluate groundwater conditions. The wells will be constructed in accordance with the methodology described above in Section 3 (and similar to that described in Section 6.3 for the nearby site SS 006). A decision regarding whether to install the additional wells will be deferred until the results of the Addendum investigation are available.

Table 9-1 Summary of Sample Analyses – ST 007

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Groundwater	N/A	N/A	N/A	N/A		
Soil	30	√	√	√		
QA/QC Samples¹						
Field Duplicates	3	√	√	√		
Notes						
1 In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

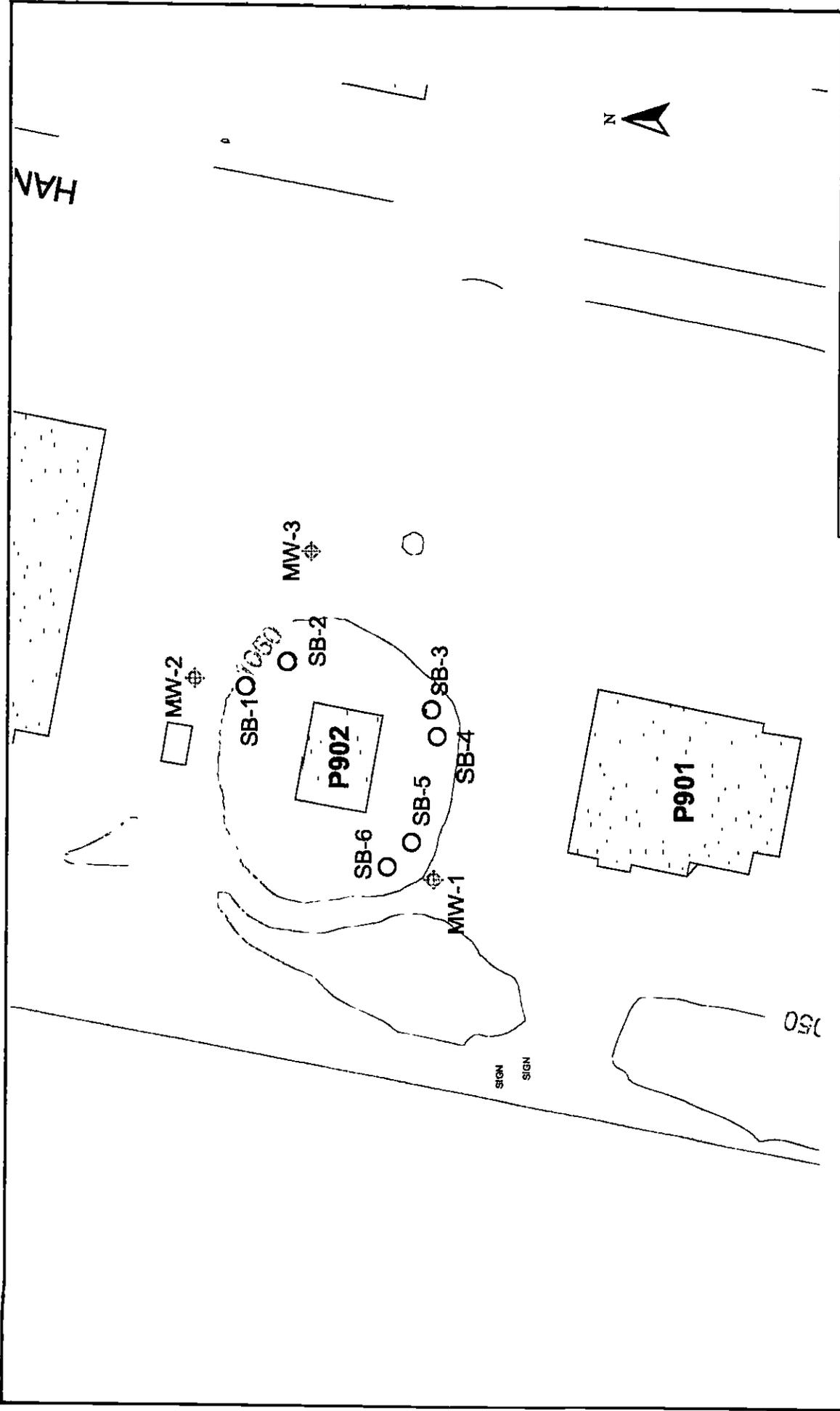
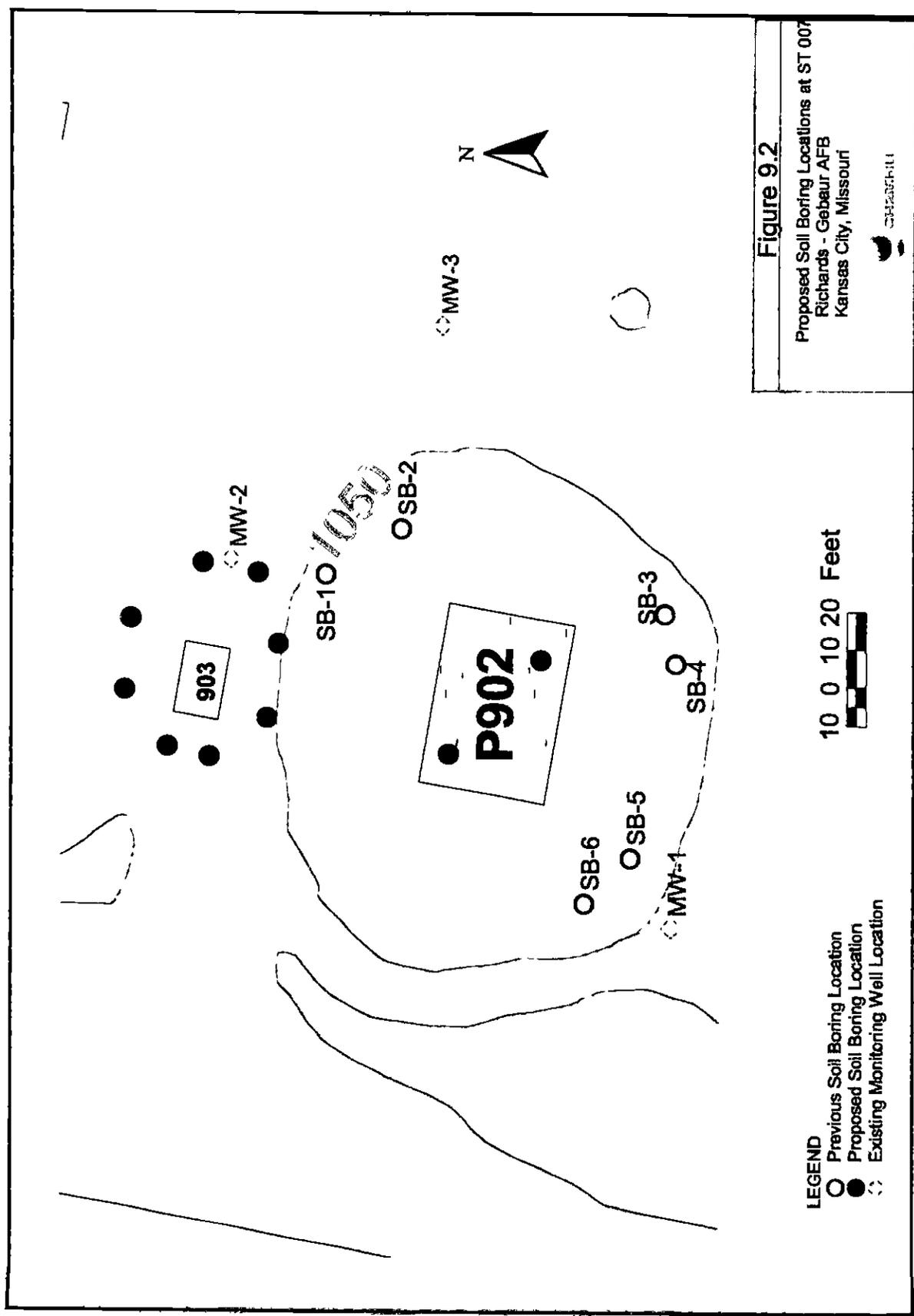


Figure 9.1

Sample Locations at ST 007
 Richards - Gebaur AFB
 Kansas City, Missouri





10.0 Site Sampling Plan Addendum G – FT 002

10.1 Site Description

FT 002, North Burn Pit Area, is located north of the flightline. The site occupies approximately 100,000 square feet of ground and is situated on a topographic high. It is not located in a flood plain. The burn pit consists of a 50-foot radius concrete pad, and is surrounded by gravel, grass and bushes. The area is bounded by a chain-link fence.

The site was first constructed in 1965 for fire department training and storage of combustible materials (Jacobs, 1995). From 1965 to 1969, waste oils, solvents, and fuels were routinely stored in 55-gallon drums and burned in the unlined pit. The facility was upgraded in 1969 with a 50-foot radius concrete slab lining, a six inch retaining curb, an oil/water separator for receiving pit runoff drainage, and a 5,000-gallon aboveground storage tank (AST) for storing waste materials prior to burning (CH2M HILL, 1983). After the pit was upgraded, JP-4 fuel was the only flammable liquid used in training exercises. The AST was removed in 1988 when training exercises were discontinued (O'Brien & Gere, 1991). The buried product and dispensing lines were cleaned, flushed with potable water, and vented in 1996 (Dames & Moore, 1996a).

10.2 Summary of Previous Investigations

In 1986, nine subsurface and six surface soil samples were collected and analyzed for TPH and VOCs (Ecology and Environment, 1988). No TPH constituents were detected above the MDNR UST action level of 50 ppm. No VOCs were detected in any of the soil samples.

Additional surface soil samples were collected in 1991 (O'Brien & Gere, 1991). The samples were analyzed for VOCs, SVOCs, and metals. No VOCs or SVOCs were detected. Lead was detected in one sample at a concentration of 440 ppm. The concentration exceeded the Any-use Soil Level of 240 ppm that was applicable as guidance in 1991; however, it is below the current CALM STARC level for commercial land use of 500 ppm.

During the 1999 RI, soil samples were collected from beneath the concrete pad and along the subsurface pipelines that fed and drained the Fire Training pad. The samples were analyzed for VOCs, SVOCs, TPH, metals, and PCBs. Four sample locations below the concrete pad were also analyzed for dioxins. High concentrations of petroleum hydrocarbons were detected below the concrete pad, including low-level detections of dioxins at concentrations below 1 ppb. Hydrocarbons at concentrations above 500 ppm were also detected near the oil-water separator, northeast of the concrete pad.

As part of the 1986 investigation, three groundwater samples were collected and analyzed for VOCs. No VOCs were detected at concentrations above their respective MCLs. Reportedly, there was only enough sample volume for VOC analysis because of insufficient groundwater recharge in two of three wells (Ecology & Environment, 1988). One surface water sample was also collected from an area of standing water inside the fence line during the 1986 site investigation. The sample was analyzed for TPH constituents and VOCs. None of the compounds were detected (Ecology & Environment, 1988).

Four additional groundwater samples were collected from newly installed monitoring wells in 1989. The samples were analyzed for VOCs, SVOCs, and metals (O'Brien & Gere, 1991). The three previously installed wells were dry and were not sampled. No VOCs or SVOCs were detected above action levels. Three out of four unfiltered samples analyzed for metals contained concentrations of chromium (0.18 ppm, 0.29 ppm, and 0.11 ppm) and lead (0.12 ppm, 0.20 ppm, and 0.11 ppm) above their applicable maximum contaminant levels (MCLs) of 0.1 ppm and 0.05 ppm, respectively. However, the clay soils in Missouri have naturally high background concentrations of these metals. Because the groundwater samples were unfiltered, concentrations may reflect this natural occurrence. Furthermore, the trace concentrations of chromium and lead are not consistent with the broad use of petroleum hydrocarbon products at the site for firefighting exercises.

In 1991, four groundwater samples were again collected from the wells installed in 1989. The samples were analyzed for VOCs, filtered metals, common anions, common cations, alkalinity, and TDS (Burns & McDonnell, 1992). The three previous monitoring wells installed in 1986 were again found to be dry. No VOCs, metals, anions, or cations were detected above applicable action levels. Alkalinity ranged from 218 ppm to 540 ppm. TDS values were below the State drinking water standard of 500 ppm.

Two monitoring wells at the site were abandoned in 1992. One of the wells was subsequently reinstalled in 1996 (Versar, 1996a) and sampled. The groundwater sample was analyzed for TPH, VOCs, SVOCs, metals, pesticides, and PCBs. None of the analytes were detected above their respective action levels.

As part of the 1999 RI, an additional monitoring well (MW-001) was installed near the center of the concrete pad. The new well and existing wells were sampled and analyzed for VOCs, SVOCs, TPH, metals, and PCBs. In addition, the sample from the new well was also analyzed for dioxins. The analytical result slightly exceeded applicable standards, however, the sample was unfiltered and the elevated analytical result is believed to be the result of suspended sediment within the unfiltered sample.

10.3 Objectives and Scope of Supplemental Field Investigation

The primary objective of the additional site investigation at FT 002 is to delineate hydrocarbon constituents present at concentrations above 200 ppm. In addition, shallow soil samples shall be collected from the subgrade soil immediately beneath the circular concrete pad and analyzed for dioxins. Figure 10.1 illustrates the existing sampling locations.

Soil samples will be collected using a geoprobe to minimize generation of potentially contaminated soil cuttings. Twenty geoprobe borings are proposed to investigate soil quality beneath the concrete pad and also around the oil/water separator system (see Figure 10.2). The geoprobe holes will be advanced to the top of bedrock. Soil samples will be collected from the following nominal depths: 0-6 inches; 12-18 inches, and at the soil/bedrock interface. The samples will be analyzed for VOCs, TPH-GRO, TPH-DRO, and dioxins. Only the shallowest soil samples will be initially analyzed for dioxins. The remaining deeper soil samples will be retained by the laboratory for future analysis, which will be based on the results of the shallow samples.

In addition to soil sampling, a filtered groundwater sample will be collected from MW-001 and analyzed for dioxins. The result will be compared with the result from the 1999 RI which was for an unfiltered groundwater sample.

Table 10-1 summarizes the proposed sampling for FT-002.

Table 10-1 Summary of Sample Analyses - FT 002

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	Dioxins
Field Samples						
Groundwater	1	√		√		√
Soil ¹	60	√		√		√
QA/QC Samples²						
Field Duplicates ^{1,3}	7	√		√		√
<p>1- Only shallow soil samples will be initially analyzed for dioxins, the remainder will be retained for potential future analysis</p> <p>2- In addition to field duplicates, other QA/QC samples may include: ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. Descriptions and frequencies of collection for QA/QC samples are described in the FSP</p> <p>3- At least one field duplicate shall be collected for each sample medium</p>						

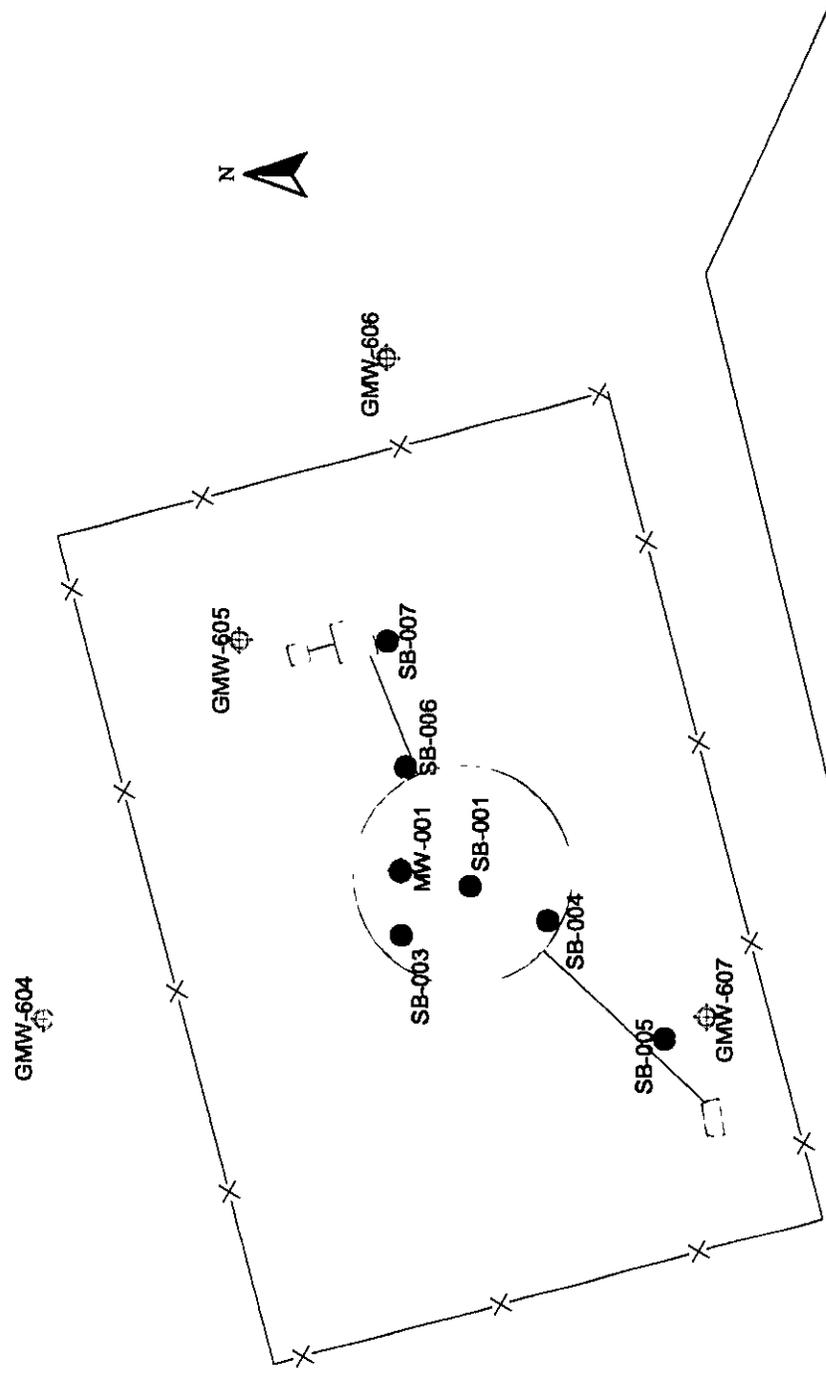


Figure 10.1

Sample Locations at FT 002
Richards-Gebaur AFB
Kansas City, Missouri



LEGEND

- ⊕ Monitoring Well Location
- Soil Boring Location

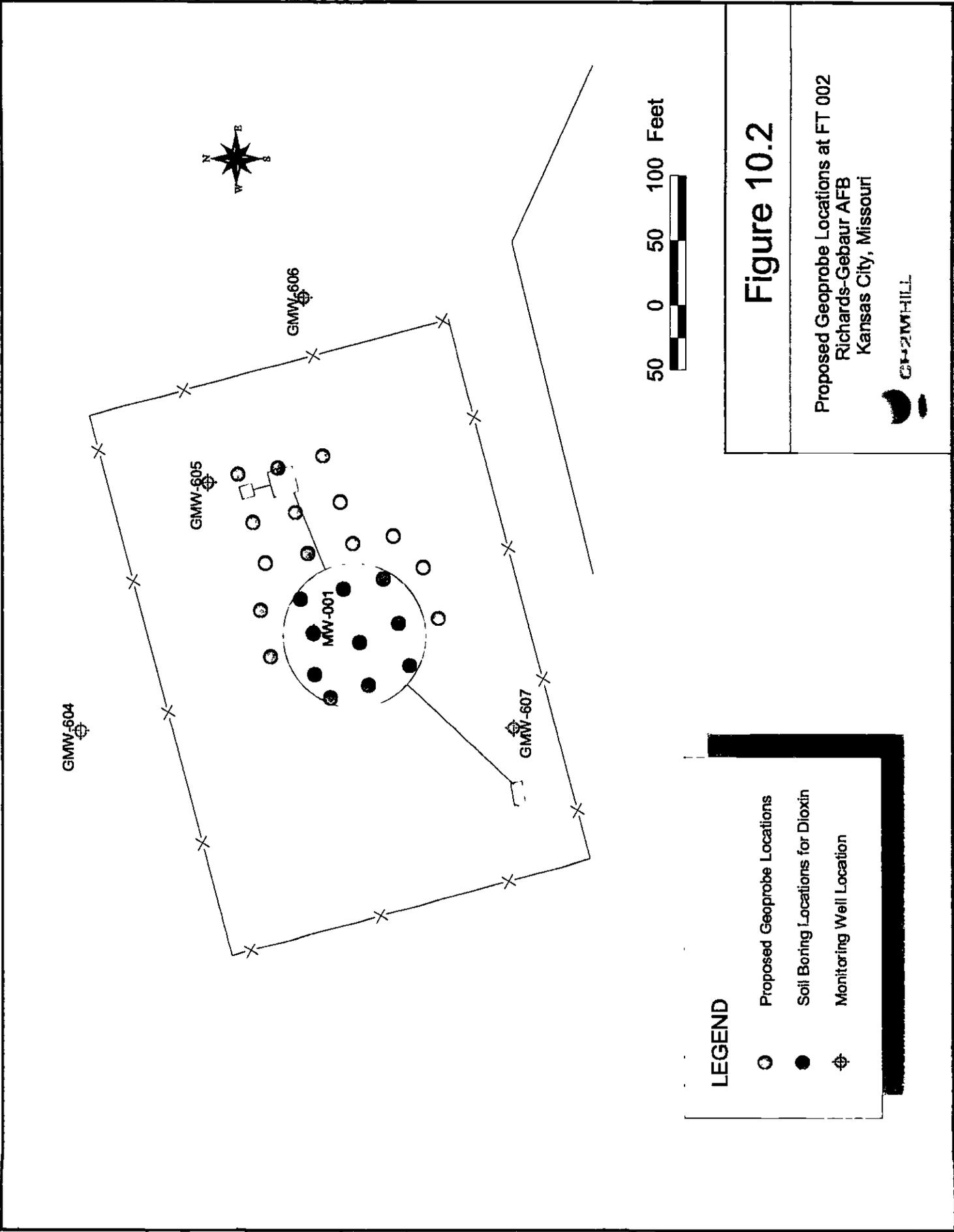


Figure 10.2

Proposed Geoprobe Locations at FT 002
 Richards-Gebaur AFB
 Kansas City, Missouri



LEGEND

- Proposed Geoprobe Locations
- Soil Boring Locations for Dioxin
- ⊕ Monitoring Well Location

11.0 Site Sampling Plan Addendum H – Additional Background Samples

11.1 Sediment and Surface Water

A total of three background sediment and surface water samples will be collected from the upstream reaches of Scope Creek, south of the main Base cantonment area. The goal is to collect samples in places before the stream becomes influenced by Air Force activities (including landfills). The precise locations of these samples will be determined in the field at the time the RI/FS Work Plan Addendum is implemented.

Sample collection methods will follow procedures outlined in the 1999 Basewide RI/FS Work Plan. Sediment will be analyzed for total metals and SVOCs, while surface water samples will be analyzed for total and dissolved metals, as well as SVOCs.

The objective of the three additional sediment/surface water sample pairs is to provide a statistically reasonable set of background data against which the other sediment and surface water samples taken from AOC 001, AOC 002, and AOC 003 may be compared. Fifteen sediment and fourteen surface water samples have been collected to date from the Base (excluding the Belton Training Complex); the three additional background sediment samples represent a conservative 18-20% of these totals.

11.2 Bedrock

In addition to the above, samples of limestone and shale will be retained from each of the deep monitoring well borings advanced as part of the Addendum investigation. Approximately 20% of the bedrock samples will be analyzed for metals to help assess the contribution of native rock mineralogy to the concentration of trace metals in soils and sediments at Richards-Gebaur AFB.

Table 11-1 Summary of Background Samples

Sample Type	Sample #	VOCs	SVOCs	TPH	Metals	MNA
Field Samples						
Sediment	3		√		√	
Surface Water	3		√		√	
Bedrock	6		√		√	
QA/QC Samples¹						
Field Duplicates	3		√		√	
Notes						
1 In addition to field duplicates, other QA/QC samples may include ambient blanks, equipment blanks, matrix spike / matrix spike duplicates (MS/MSD), and trip blanks. QA/QC samples are described in the 1999 Basewide RI/FS Work Plan and will be collected at a frequency of 10% of total per medium.						

Attachment 1



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SOIL BORING LOG

BORING NUMBER: CS004MW001

Page 1 of 1

PROJECT RICHARDS GEBEUR AFB RVFS
 ELEVATION UNKNOWN
 DRILLING METHOD MOBILE DRILL B61 4 1/4" HOLLOW STEM
 WATER LEVELS UNKNOWN

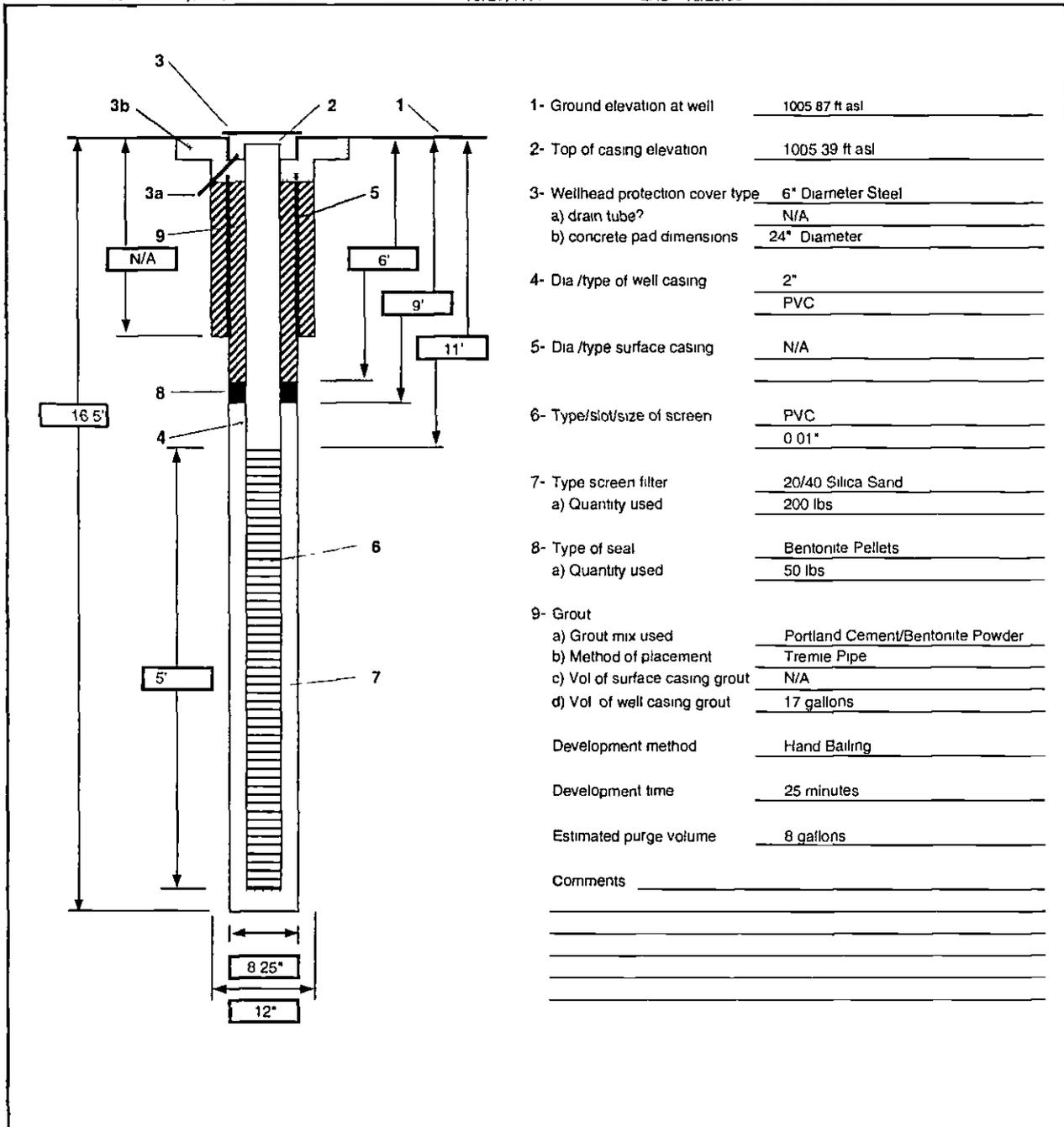
PROJECT NUMBER 153673 02 06 02
 LOCATION CS004 @ RGAFB
 DRILLING CONTRACTOR LAYNE WESTERN CO INC
 START 10/28/99 1320 FINISH 10/28/99 1415 LOGGER NL

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY	PID HEADSPACE		
0 - 5					0' - 5' GRAVELS	AMBIENT PID = 0.2 PPM STARTED DRILLING @ 1320
1					OL 0.5' - 4' ORGANIC SILT (OL) DRY, FINE ROOTS OBSERVED	
2	0.5' - 4'	SS-1	4'	N/A	CL 1' - 4' SILTY CLAY (CL) BROWN DRY, LOW PLASTICITY, DRY, MOIST	3.6 PPM
3						
4					CL 4' - 9' CLAY (CL), OLIVE - DARK GRAY, MOIST, LOW MEDIUM PLASTICITY, NO ODOR	
5						
6	4' - 9'	SS-2	3'	N/A		3.2 PPM
7						
8						
9					CL 9' - 13' SIMILAR TO 4' - 9'	
10						
11	9' - 14'	SS-3	5'	N/A		7.3 PPM
12					CL 13' - 14' BROWN MIXED WITH OLIVE GRAY, SILTY CLAY, MEDIUM PLASTICITY, MOIST	
13					CL 14' - 15' SAME AS IN 13' - 14'	
14	14' - 16.5'	SS-4	2.5'	N/A	CL 15' - 16.5' BROWN - YELLOWISH SILTY CLAY (CL), MEDIUM PLASTICITY, WET	6.0 PPM
15						
16					REFUSAL @ 16.5 BGS	ENDED BORING @ 16.5' BGS @ 1415 NOTICE LIMESTONE WAS ENCOUNTERED @ 16.5 BGS
17						
18						
19						
20						



PROJECT NUMBER 153673	WELL NUMBER CS004-MW001	SHEET 1	OF 1
WELL COMPLETION DIAGRAM			

PROJECT Richards-Gebaur AFB RI LOCATION CS004
 DRILLING CONTRACTOR Layne - Western Company, Inc
 DRILLING METHOD AND EQUIPMENT USED Mobile Drill B61, 4 1/4" ID Hollow Stem Auger
 WATER LEVELS 9' 4" bgs after 24 hours START 10/29/1999 END 10/29/99 LOGGER N L





CH2MHILL

SOIL BORING LOG

BORING NUMBER: CS004MW003

Page 1 of 1

PROJECT: RICHARDS GEBEUR AFB R1/FS

PROJECT NUMBER 153673 02 06 02

ELEVATION UNKNOWN

LOCATION CS004 @ RGAFB

DRILLING METHOD MOBILE DRILL B61 4 1/4" HOLLOW STEM

DRILLING CONTRACTOR LAYNE WESTERN CO INC

WATER LEVELS N/A

START 10/28/99 1605

FINISH 10/28/99 1645

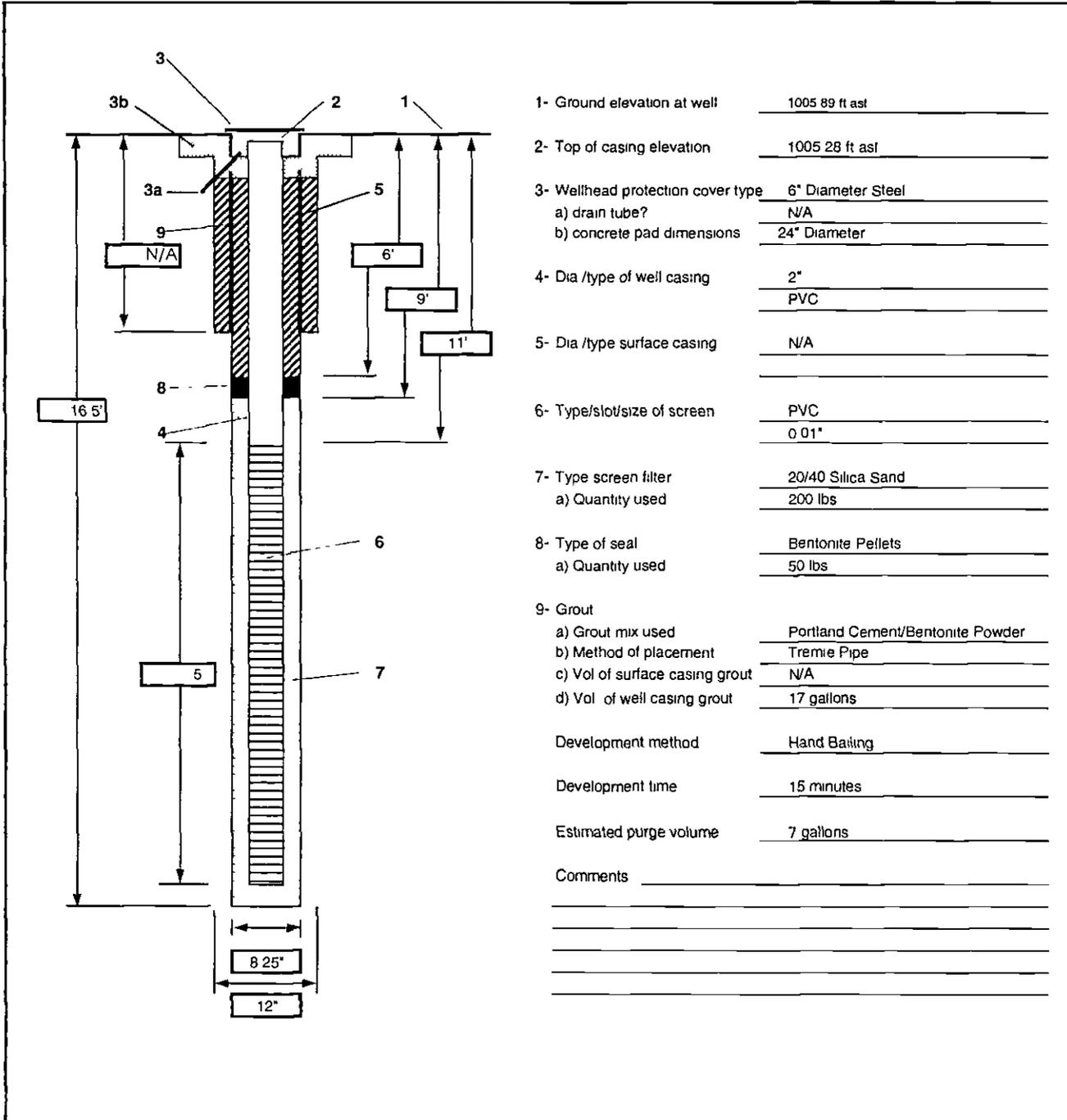
LOGGER NL

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	
	INTERVAL	NUMBER AND TYPE	RECOVERY	PIO HEADSPACE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0	0' - 0.5'			N/A		
1					0' - 1' GRANUALS	STARTED DRILLING @ 1605 AMBIENT PID = 1 PPM
2	0.5' - 4'	SS-1	3'	N/A	OL 0.5' - 1' ORGANIC SILT (OL), BLACK, LOOSE, DRY, NO ODOR 1' - 3' REDDISH - DARK BLACK ORGANIC SILTY CLAY (OL), MOIST, LOW PLASTICITY, <10% GRAVELS (1 cm - 4 cm)	40 PPM
3						
4						
5					CL 4' - 9' SILTY CLAY WITH FRAGMENTS OF (BLuish-BLUE) SHALE, COLOR CHANGED FROM OLIVE GRAY TO BLuish GRAY, MOIST, LOW - MEDIUM PLASTICITY, NO ODOR	50 PPM
6	4' - 9'	SS-2	5'	N/A		
7						
8						
9						
10					CL 9' - 14' SILTY CLAY (CL), DARK GRAY TO BROWNISH GRAY, MOIST, WET, MEDIUM PLASTICITY, SLIGHT ODOR @ 11' TO 12' BGS	WET @ 14' BGS NOTE ANGULAR SHAPE OF BLuish-BLUE SHALE WAS OBSERVED @ 12' - 13'
11	9' - 14'	SS-3	5'	N/A		31 PPM
12						
13						
14					CL 14' - 16.5' SILTY CLAY (CL), YELLOWISH, WET, MEDIUM PLASTICITY, NO ODOR	10 PPM
15	14 - 16.5'	SS-4	15'	N/A		
16						
17					REFUSAL @ 16.5' BGS	ENDED BORING @ 16.5 BGS @ 1645 NOTE ROUNDED FRAGMENTS OF LIMESTONE WAS NOTICED @ 16.5' BGS
18						
19						
20						

CH2MHILL

PROJECT NUMBER 153673	WELL NUMBER CS004-MW003	SHEET 1	OF 1
WELL COMPLETION DIAGRAM			

PROJECT Richards-Gebaur AFB RI LOCATION CS004
 DRILLING CONTRACTOR Layne - Western Company, Inc
 DRILLING METHOD AND EQUIPMENT USED Mobile Drill B61, 41/4" ID Hollow Stem Auger
 WATER LEVELS 12 8' bgs after 24 hours START 10/29/99 END 10/30/99 LOGGER N Li





CH2MHILL

SOIL BORING LOG

BORING NUMBER: SS003MW004
Page 1 of 2

PROJECT RICHARDS GEBEUR AFB RI/FS
ELEVATION UNKNOWN
DRILLING METHOD CME 75 AUGER DRILL
WATER LEVELS N/A

PROJECT NUMBER 153673 02 06 04
LOCATION SS003 @ RGAFB
DRILLING CONTRACTOR LAYNE WESTERN CO INC
START 11/2/99 FINISH 11/2/99 LOGGER BT

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS PID HEADSPACE	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY			
1					CL 1 - 4 SILTY CLAY (CL), BROWN - TAN / GRAY DAMP - SEMI-STIFF, SOME MODELING	CORE PID = 0 0 PPM HEADSPACE = 0 0 PPM
2	3' - 4'		30'	N/A		
3						
4					CL 4 - 9' SILTY CLAYS (CL), TAN / GRAY, SEMI-STIFF, DAMP	CORE PID = 0 0 PPM HEADSPACE = 0 0 PPM
5						
6	4 - 9		50'	N/A		
7						
8						
9					CL 9 - 14' SILTY CLAYS (CL), TAN / GRAY, SEMI-STIFF, DAMP	CORE PID = 0 0 PPM HEADSPACE = 0 0 PPM
10						
11	9' - 14'		50'	N/A		
12						
13						
14					CL 14 - 19 SILTY CLAYS (CL) TAN, GRAY, MARBELED, VERY STIFF, DAMP	CORE PID = 0 0 PPM HEADSPACE = 0 0 PPM
15						
16	18' - 19'		50'	N/A		
17						
18						
19					CL 19 - 24' SILTY CLAYS (CL), TAN / GRAY - STIFF - MOIST, BEDROCK FRAGMENTS, OXIDIZING LENSES, LIGNITES, GRAY SHALE - HARD	CORE PID = 0 0 PPM HEADSPACE = 0 0 PPM
20						



CH2MHILL

SOIL BORING LOG

BORING NUMBER SS003MW004

Page 2 of 2

PROJECT RICHARDS GEBEUR AFB R/WFS
 ELEVATION UNKNOWN
 DRILLING METHOD CME 75 AUGER DRILL
 WATER LEVELS N/A

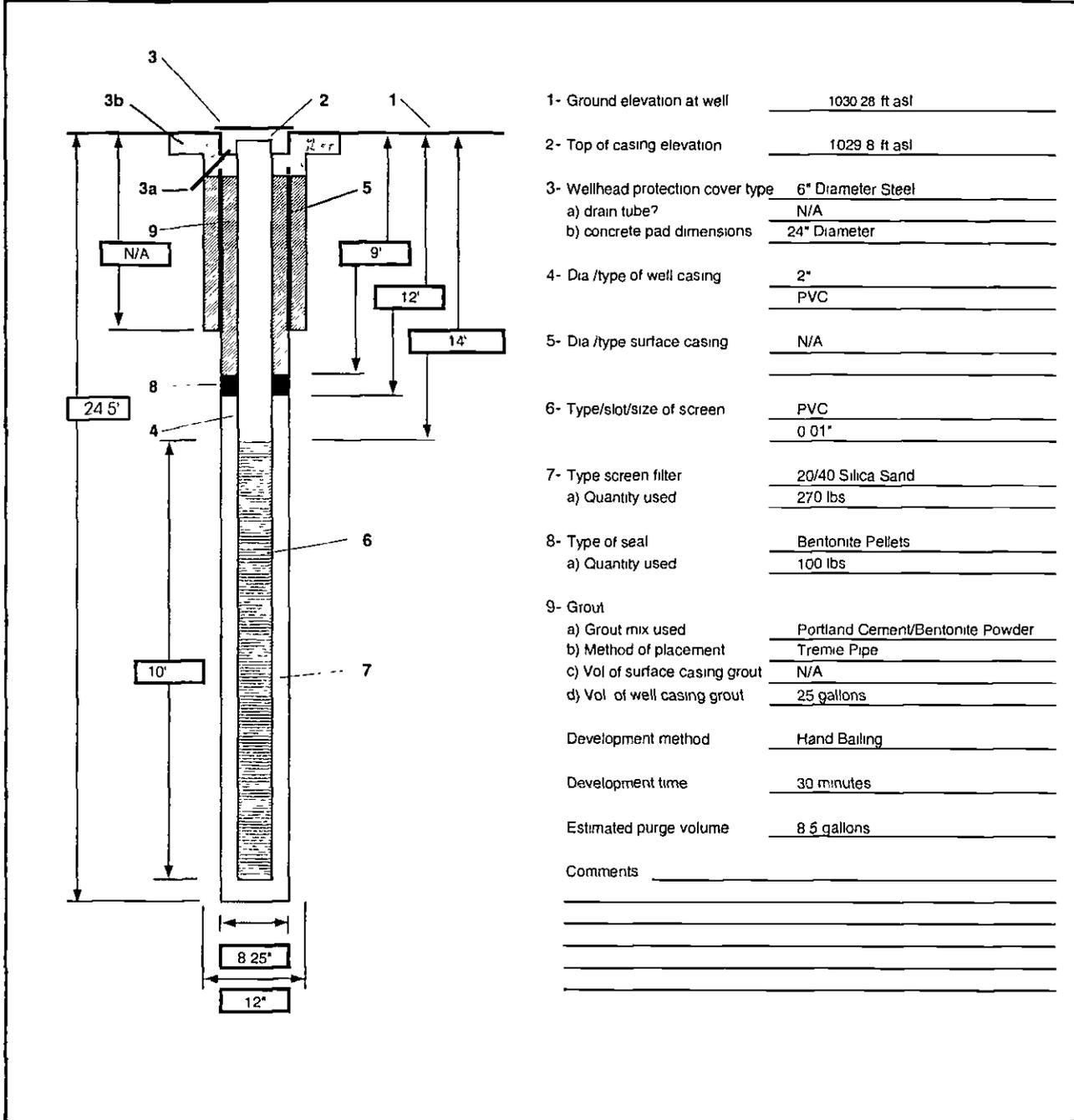
PROJECT NUMBER 153673 02 06 04
 LOCATION SS003 @ RGAFB
 DRILLING CONTRACTOR LAYNE WESTERN CO INC
 START 11/2/99 FINISH 11/2/99 LOGGER BT

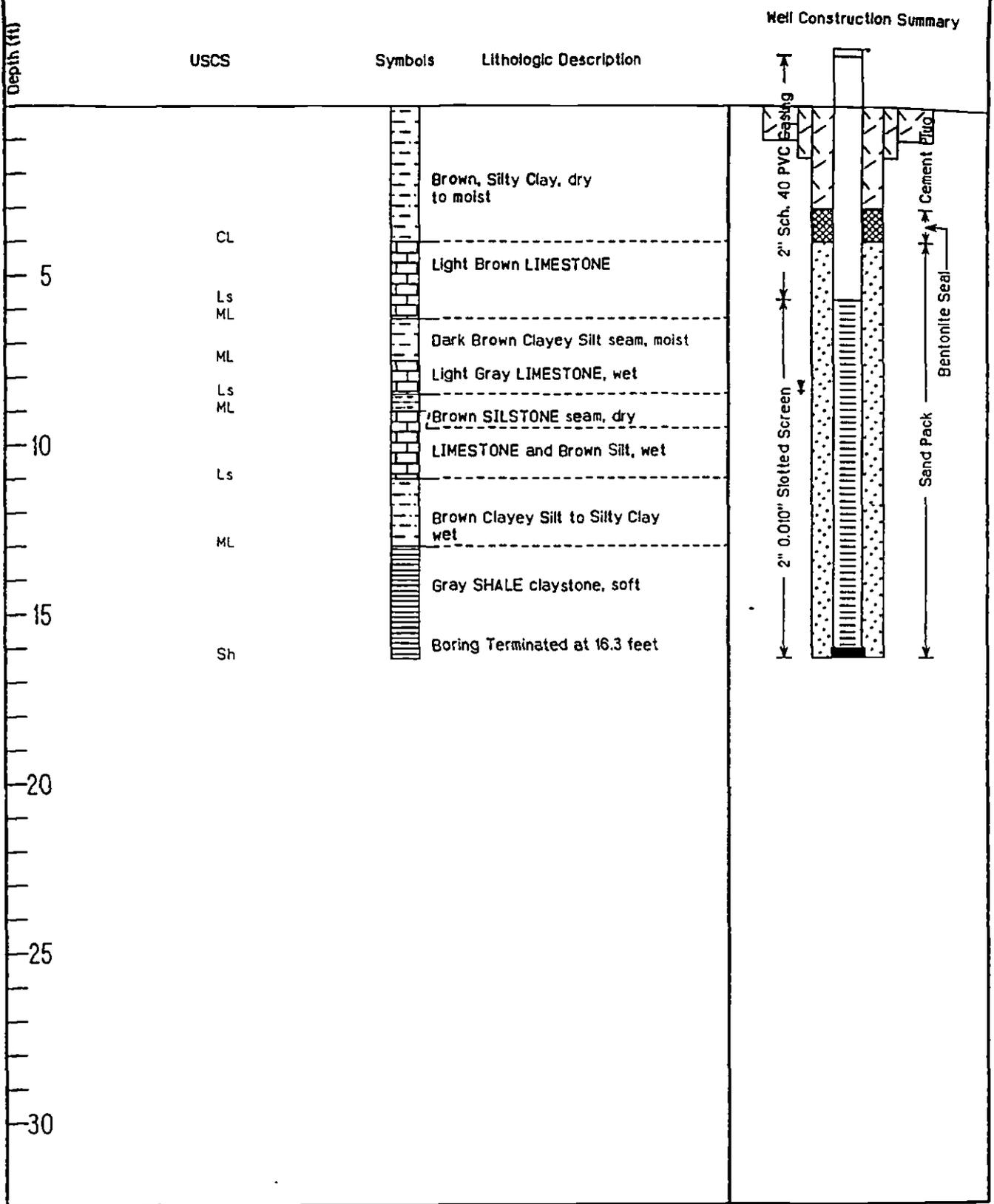
DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY	PID HEADSPACE		
21	19 - 21'		50'	N/A		
22						
23						
24					END OF BOREHOLE @ 24 0	
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

CH2MHILL

PROJECT NUMBER 153673	WELL NUMBER SS003-MW004
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT Richards-Gebaur AFB RI LOCATION SS003
 DRILLING CONTRACTOR Layne - Western Drilling Inc
 DRILLING METHOD AND EQUIPMENT USED CME 75 Auger Drill
 WATER LEVELS START 11/2/99 END 11/4/99 LOGGER B Trebble





270 53

Job Name	Richards-Gabaur	Date Started	06/26/86	Drill Method	Air Rotary
Job Number	2816.211	Date Completed	06/27/86	Casing Diameter	2"
Client Name	AFCEE	Total Depth	16.3 Feet BEG	Screen Interval	5.7 - 15.7 Feet BEG
Location	Kansas City, MO	Water Level	6.42 Feet TOC	Slot Size	0.010"
Boring Number	SS006-MW-01	Water Level Date	7/9/86	Drilling Co.	Layne Western Co.
Geologist	Alan Esko	Signature		Date	



SOIL BORING LOG

BORING NUMBER: SS009MW003

Page 1 of 1

PROJECT RICHARDS GEBEUR AFB RI/FS
 ELEVATION UNKNOWN
 DRILLING METHOD MOBILE DRILL B61 4 1/4" HOLLOW STEM
 WATER LEVELS 9.2' BGS

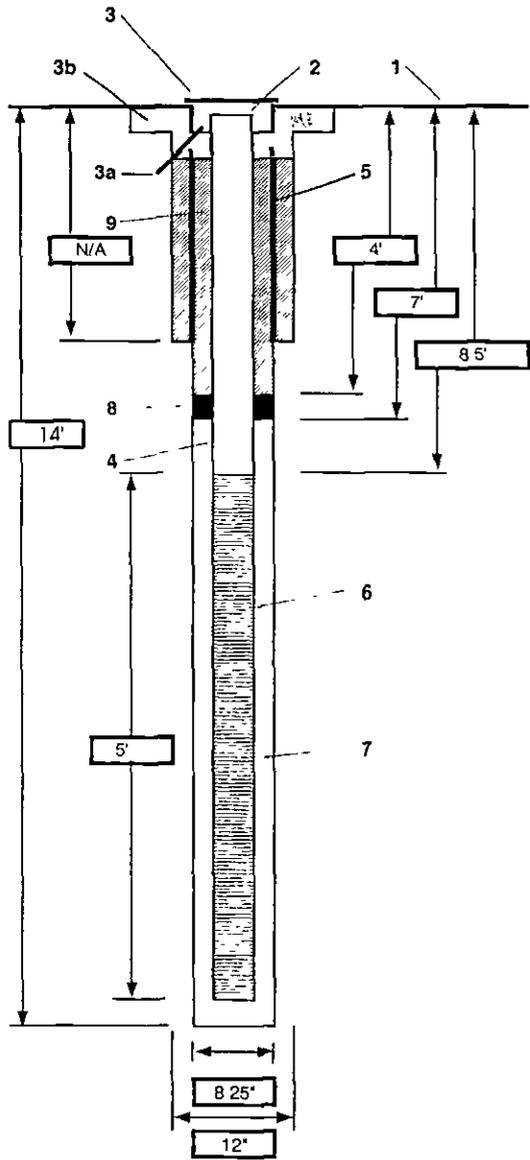
PROJECT NUMBER 153673 02 06 04
 LOCATION SS009 @ RGAFB
 DRILLING CONTRACTOR LAYNE WESTERN CO INC
 START 11/2/99 1030 FINISH 11/2/99 1130 LOGGER NL

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS TESTS AND INSTRUMENTATION
	INTERVAL	NUMBER AND TYPE	RECOVERY			
1	0' - 1'				0 - 1' GRAVELS	STARTED DRILLING @ 1030 AMBIENT PID READING = 0.0 PPM
2					CL 1' - 4' SILTY CLAY (CL), OLIVE GRAY, MOIST LOW - MEDIUM PLASTICITY, NO ODOR	
3	1' - 4'	SS-1	2'	N/A		13 PPM
4						
5					CL 4' - 9' SILTY CLAY (CL), OLIVE GRAY - DARK GRAY, WET @ 4.2', MEDIUM PLASTICITY, ODOR WAS DETECTED @ 4.5' - 5'	
6						
7	4' - 9'	SS-2	5'	N/A		18 PPM
8						
9						
10					CL 9' - 14' SILTY CLAY (CL), YELLOWISH GRAY MOIST, LOW PLASTICITY LIMESTONE FRAGMENTS OBSERVED @ A DEPTH INTERVAL OF 11.5' - 12.5'	
11						
12	9' - 14'	SS-3	5'	N/A		33 PPM
13						
14					REFUSAL @ 14' BGS	ENDED BORING @ 1121 @ 14 BGS
15						NOTE WATER WAS ENCOUNTERED @ 9.2' BGS, COLLECTED SAMPLES FROM A DEPTH INTERVAL OF 14.2' - 15.2 BGS
16						
17						
18						
19						
20						

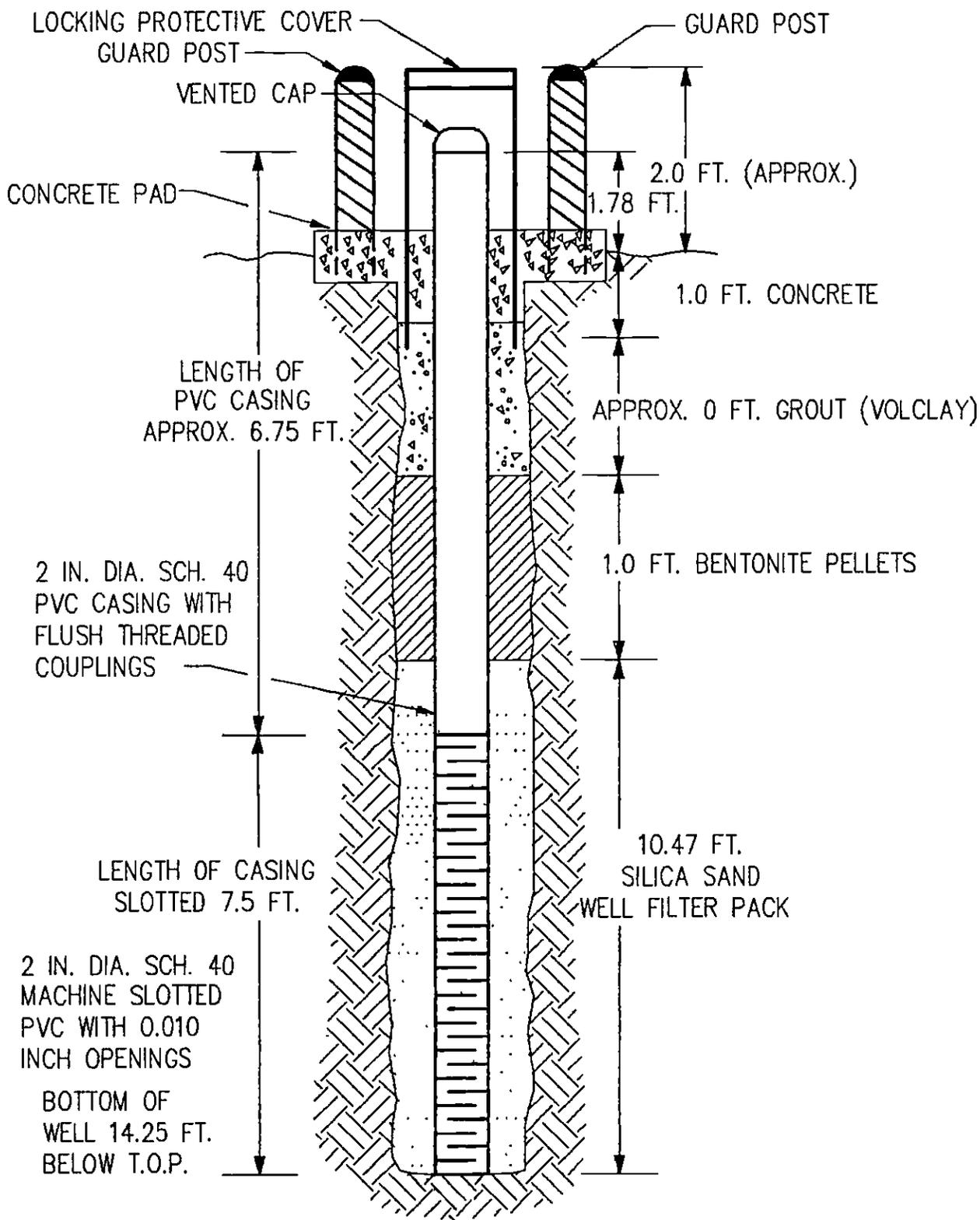


PROJECT NUMBER 153673	WELL NUMBER SS009-MW003
SHEET 1 OF 1	
WELL COMPLETION DIAGRAM	

PROJECT Richards-Gebaur AFB RI LOCATION SS009
 DRILLING CONTRACTOR Layne - Western Company, Inc
 DRILLING METHOD AND EQUIPMENT USED Mobile Drill B61, 4 1/4" ID Hollow Stem Auger
 WATER LEVELS 13' bgs after 24 hours START 11/3/99 11/4/99 LOGGER N Li



1- Ground elevation at well	1010.39 ft asl
2- Top of casing elevation	1010.1 ft asl
3- Wellhead protection cover type	6" Diameter Steel
a) drain tube?	N/A
b) concrete pad dimensions	24" Diameter
4- Dia /type of well casing	2" PVC
5- Dia /type surface casing	N/A
6- Type/slot/size of screen	PVC 0.01"
7- Type screen filter	20/40 Silica Sand
a) Quantity used	150 lbs
8- Type of seal	Bentonite Pellets
a) Quantity used	50 lbs
9- Grout	Portland Cement/Bentonite Powder
a) Grout mix used	Tremie Pipe
b) Method of placement	N/A
c) Vol of surface casing grout	11 gallons
d) Vol of well casing grout	
Development method	Hand Bailing
Development time	5 minutes
Estimated purge volume	1 gallon
Comments	



TOP OF PIPE
ELEVATION 1007.38 FT.

GROUND SURFACE
ELEVATION 1005.60 FT.

DATE INSTALLED 12-10-91

NOT TO SCALE

Barns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS
New York, New York

**POL STORAGE YARD
STO 5 GROUNDWATER
MONITORING WELL
CONSTRUCTION DIAGRAM
MONITORING WELL NO. MW-3**