

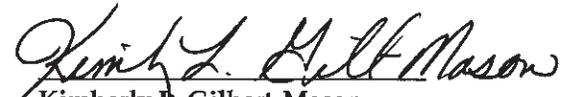
Closure Decision Document SWMU B20

June 2009

The selected remedy is protective of human health and the environment. It has been shown that a complete pathway to human health and the environment does not exist, and there is no potential for an exposure pathway to be completed in the future.

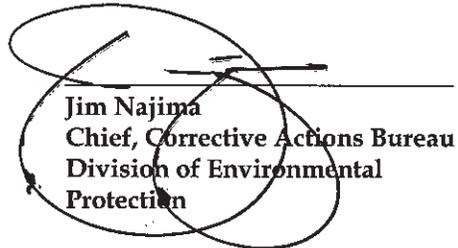
U.S. Army

16 June 2009
Date


Kimberly L. Gilbert-Mason
Lieutenant Colonel, U.S. Army
Commanding

State of Nevada

July 16, 2009
Date


Jim Najima
Chief, Corrective Actions Bureau
Division of Environmental
Protection

FINAL

**Closure Decision Document for
SWMU B20: 101-41 Catchment Pit
Hawthorne Army Depot
Hawthorne, Nevada**

Facility I.D. Number 9-000031
Contract No. W91ZLK-05-D-0011
Delivery Order 0002

Prepared for:
U.S. Army Environmental Command



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for
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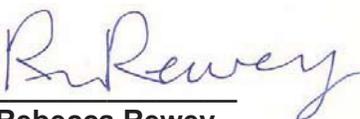
4501 Ford Avenue, Suite 1200
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June 2009

**Closure Decision Document
SWMU B20: 101-41 Catchment Pit**

**Hawthorne Army Depot
Hawthorne, Nevada**

June 2009

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Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
bgs	below ground surface
CAP	Corrective Action Plan
COC	contaminant of concern
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HWAAP	Hawthorne Army Ammunition Plant
HWAD	Hawthorne Army Depot
IRP	Installation Restoration Program
MCL	maximum contaminant level
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
PCE	tetrachloroethene
ppbv	pars per billion by volume
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TNT	trinitrotoluene
VEW	vapor extraction well
VOC	volatile organic compound

1.0 Introduction

This Closure Decision Document describes the rationale for the proposed closure with long-term monitoring as part of the basewide groundwater monitoring of Solid Waste Management Unit (SWMU) Hawthorne Army Ammunition Plant (HWAAP) B20, 101-41 Catchment Pit, hereafter referred to as SWMU B20, at Hawthorne Army Depot (HWAD), Hawthorne, Nevada (Figure 1).

A Final Corrective Action Plan (CAP) was prepared for SWMU B20 (CH2M HILL, 2007), and approved by the Nevada Division of Environmental Protection (NDEP) in a letter dated May 7, 2007 (NDEP, 2007). Objectives of the CAP included additional site characterization to confirm the limited extent of TCE in subsurface soil, and confirmation of site closure.

Results of the quarterly groundwater monitoring efforts and additional site characterization results support the closure of SWMU B20. As described in a letter from NDEP addressed to Kevin Shannon on August 7, 2008, SWMU I15, Building 101-42 Catchment Pit, located upgradient of SWMU B20, will be reopened for investigation of contamination in groundwater (NDEP, 2008a). Because the source of the groundwater contamination most likely originated from the buildings within SWMU I15, groundwater investigation and cleanup activities will be handled under SWMU I15 (NDEP, 2008a).

The following paragraphs provide a brief overview of the site history, physical setting, investigation history, summary of the additional site characterization activities, conclusions, and completed decommissioning activities for SWMU B20. Additional background information is provided in the Final CAP for SWMU B20 (CH2M HILL, 2007).

2.0 Site History

SWMU B20, located south of Buildings 101-41 and 101-42 (Figure 2), consists of a wastewater disposal system that received wastewater from Building 101-41 containing dilute levels of the explosives trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and the solvent TCE during its operation from 1940 to the early 1970s.

3.0 Physical Setting

SWMU B20 is in a relatively remote area of the HWAD, with the exception of the paved road located just to the west and northwest. The wastewater disposal system consisted of two steel settling tanks, three unlined surface impoundments (pits), and one trench located southwest of Building 101-41. The impoundments were interconnected and ranged in size from 1,300 to 2,700 square feet in area and between 6 and 10 feet deep. According to boring logs, soil at this site consists of interbedded layers of sand, silt, and clay.

Three groundwater quality monitoring wells are associated with SWMU B20, two of which are located along the northern boundary of the unit and one of which is located approximately 600 feet northeast of SWMU B20 (Figure 2). Depth to groundwater at the site is estimated to be 135 feet below ground surface (bgs), and the estimated regional groundwater flow direction is to the northwest.

Water supply well #7, which is used for non-potable purposes, is located approximately 2.4 miles to the north, sidegradient to groundwater flow. Water supply well #1, which is infrequently used as a potable water source, is 4.9 miles to the northwest, sidegradient to groundwater flow. No surface water is located near SWMU B20 (CH2M HILL, 2007).

4.0 Investigation History

In 1988 and 1992, TNT-stained soils were noted during site inspections at SWMU B20. In 1994, surface and near-surface soil samples were collected and analyzed for explosive compounds, metals, and nitrogen compounds. Elevated concentrations of explosives-affected soils were found in the trench and in the surface impoundment nearest the trench. Metals and nitrogen compounds were not detected (CH2M HILL, 2007).

In 1997, the explosive-contaminated soils were remediated during a pilot study using windrow composting technology. As part of the Installation Restoration Program (IRP) in 1996, two groundwater wells were installed downgradient of the SWMU B20 site. Well IRPMW37 is located approximately 150 feet downgradient, while well IRPMW36 is located approximately 60 feet southwest of IRPMW37 (Figure 2). Basewide groundwater sampling was conducted at IRPMW36 and IRPMW37 from January 1997 through February 2002, again in December 2005, and during quarterly sampling from December 2006 to January 2008. In 2002, an additional monitoring well, IRPMW37A, was installed 400 feet downgradient of SWMU B20 (Figure 2) for the purpose of monitoring for volatile organic compounds (VOCs). TCE was the only analyte detected above the associated groundwater action level (5 micrograms per liter [$\mu\text{g}/\text{L}$]) in these monitoring efforts, and it was identified as the only contaminant of concern (COC) for site groundwater. The maximum historical concentration of TCE in well IRPMW37, 177 $\mu\text{g}/\text{L}$, was measured in November 1999 (Table 1). TCE was detected only once in well IRPMW36, in 1999, at a concentration of 6.9 $\mu\text{g}/\text{L}$. TCE was never detected in IRPMW37A (CH2M HILL, 2007).

In 1998 and 1999, two Gore soil gas surveys were conducted to identify the areal extent of VOC contamination at the site. Three primary analytes were identified as a potential concern: TCE, tetrachloroethene (PCE), and chloroform. The highest concentrations of these analytes were found at the ends of drain lines from Building 101-41 leading to the trench and surface impoundments. Eight soil borings were drilled in the area of highest TCE concentrations, as indicated by the soil gas surveys (Figure 3). These borings were advanced to 100 feet bgs to delineate the vertical extent of the contamination. Soil sample analyses indicated TCE was the primary COC. Out of 172 soils samples, there were 90 detects for TCE, only five of which exceeded the current 110 microgram-per-kilogram ($\mu\text{g}/\text{kg}$) soil action level for TCE (CH2M HILL, 2007).

In 2000, passive wind-driven turbine vapor extraction wells (VEWs) were installed in four of the eight soil borings (Figure 3) in order to remediate the mass of VOCs in soil. In 2004, soil gas sampling indicated that maximum TCE concentrations had declined from 42,600 parts per billion by volume (ppbv) to 8.5 ppbv. Concentrations of TCE in IRPMW37 have significantly decreased since the installation of the VEWs as presented in Table 1 (CH2M HILL, 2007).

5.0 Quarterly Groundwater Monitoring

Quarterly groundwater monitoring activities, as described in the CAP (CH2M HILL, 2007), were conducted from April 2007 through January 2008 at SWMU B20, and consisted of sampling wells IRPMW36, IRPMW37, and IRPMW37A. As presented in the *Draft/Final Quarterly Groundwater Monitoring Report, First Quarter 2008, SWMU B20: 101-41 Catchment Pit, Hawthorne Army Depot, Hawthorne, Nevada*, March 2008 (CH2M HILL, 2008a), approved by NDEP in a letter dated April 24, 2008 (NDEP, 2008b), TCE concentrations in site groundwater at IRPMW37 have approached an asymptotic level (Figure 4) and quarterly monitoring efforts were ceased. There were no detections of TCE in IRPMW36 and IRPMW37A.

6.0 Additional Site Characterization

Additional site characterization activities were performed at SWMU B20 in December 2007 to confirm that the site is ready for closure. Four borings (B20-SB1, B20-SB2, B20-SB3, and B20-SB4) were advanced to the groundwater table using a rotasonic drilling rig at the locations show on Figure 3. At each boring, a soil sample was collected at 20-foot intervals to 100 feet bgs and at 5-foot intervals from 100 feet bgs to the water table. Each soil sample was submitted to TestAmerica, Inc. (formerly Severn Trent Laboratories, Inc.) in Denver, Colorado, for analysis of VOCs, including TCE, using U.S. Environmental Protection Agency (EPA) Method 8260B. Soil lithology and field screening results are summarized on the boring logs included in Appendix A.

All four borings were converted to temporary groundwater quality monitoring wells. Groundwater samples were collected from a temporary well screen at each boring location and submitted for VOC analysis by EPA Method 8260B. The temporary stainless steel well screens were placed in the cased boreholes and exposed to the formation. All temporary wells were abandoned after sample collection activities in accordance with Section 5.3.3 of the Field Sampling Plan (FSP) and Section 5.9 of the Standard Operating Procedures (SOPs).

Results from the soil samples taken from each of the four borings are summarized on Table 2. The highest detected concentration of TCE (7.2 µg/kg) was found between 46 and 47 feet bgs, significantly lower than the soil action level of 110 µg/kg for TCE. As shown on cross-sections A-A' and B-B' (Figures 5 and 6), TCE concentrations in the four borings are generally non-detect or detected at low concentrations at all depths from zero to 145 feet bgs. Groundwater samples taken from the four borings reported TCE concentrations above the 5-µg/L action level (Table 3). The highest level of TCE (510 µg/L) was found in boring B20-SB3, which was installed near the northeastern corner of SWMU B20 (Figure 3). Also reported in the groundwater were low-level detections of acetone, toluene, chloroform, and 2-butanone (Table 3). Because it is known that the groundwater gradient at the site is to the northwest, the discovery of elevated TCE in the northwest portion of SWMU B20 indicates a source of TCE located upgradient of SWMU B20. In addition and in support of these observations, the history of operations for Buildings 101-41 and 101-42 indicated that solvents were used as a cleaning fluid near SWMU I15, (NDEP, 2008a).

7.0 Conclusions

Based on historical and additional site characterization data, closure of SWMU B20 is recommended and has been documented at the site. Closure is requested following NAC 445A.227 guidelines, under which the following issues were addressed:

- a. Depth of groundwater: 135 feet bgs.
- b. Distance to irrigation or drinking water wells: Water supply well #7 (currently used as non-potable water source because the water quality is inadequate for use as a potable water source) is 2.4 miles to the north (sidegradient to groundwater flow) and water supply well #1 (infrequently used as a potable water source) is 4.9 miles to the northwest (sidegradient to groundwater flow).
- c. Type of contaminated soil: The lithology from the ground surface to approximately 145 feet bgs is well-graded sand to sandy silt with interbedded beds of clay and volcanic ash. The clay beds vary in thickness from approximately 0.5 to 17 feet. The thickest clay beds generally occur between 24 and 52 feet bgs.
- d. Annual precipitation: 4.6 inches (evapotranspiration potential is 48 inches per year [USAEHA, 1988]).
- e. Type of waste/substance released: Wastewater containing dilute levels of TNT, RDX, and TCE disposed to surface impoundments and a trench (TCE is the only identified COC).
- f. Extent of contamination: Groundwater samples from monitoring wells IRPMW36, IRPMW37, and IRPMW37A collected in January 2008 showed detection of TCE only in IRPMW37 at a reported 5.5 µg/L, concentrations slightly higher than the 5-µg/L groundwater action level. Soil samples were taken from B20-SB1, B20-SB2, B20-SB3, and B20-SB4 with a maximum TCE concentration of 7.2 µg/kg, significantly lower than the 110-µg/kg soil action level. Groundwater samples taken from the four borings reported concentrations of TCE higher than the groundwater action level. As a result, and due to the historical use of solvents in buildings within SWMU I15, groundwater contamination within SWMU B20 will be investigated as part of SWMU I15 (NDEP, 2008a).
- g. Present and potential use of the land: Industrial (present and future). Significant changes in land use (e.g., residential use) in the future may require a reassessment of the results and conclusions of this closure report.
- h. Preferred routes of migration: Downward migration of TCE in soil into groundwater and lateral movement in groundwater. Soil samples collected from SWMU B20 do not show high levels of TCE contamination. The maximum TCE concentration of 7.2 µg/kg is significantly lower than the 110-µg/kg soil action level. Groundwater samples taken from the four borings reported concentrations of TCE higher than the groundwater action level. As a result, and due to the historical use of solvents in buildings within SWMU I15, groundwater contamination within SWMU B20 will be investigated as part of SWMU I15 (NDEP, 2008a).

- i. Structures and impediments: With the exception of the VEWs, no structures exist onsite. Buildings 101-42 and 101-41 are located to the northeast, outside of the boundary of SWMU B20.
- j. Potential fire, vapor, or explosion: None.
- k. Other factors: Upgradient to SWMU B20 are Buildings 101-41 and 101-42 in SWMU I15, which are buildings where solvents were previously used as cleaning fluids. This is the suspected source of TCE in groundwater at SWMU B20 (NDEP, 2008a). As indicated in NDEP's letter to HWAD (NDEP, 2008a), groundwater investigation and cleanup activities in the area will be conducted under SWMU I15.

As the result of an evaluation of the NAC 445A site assessment factors and the conclusions drawn here, SWMU B20 is prepared for closure.

8.0 Decommissioning Activities

Decommissioning activities at SWMU B20 were performed on March 11 and March 14, 2009, and included the abandonment of four passive vapor extraction wells. Three groundwater monitoring wells located at the site (IRPMW36, IRPMW37, and IRPMW37A) were retained and will continue to be monitored for TCE as part of the basewide groundwater monitoring program. Decommissioning activities were performed by WDC Exploration and Wells, Zamora, California, in accordance with the Well Decommissioning Variance approved by the Division of Water Resources (DWR) in September 2008 (Appendix C) (DWR, 2008). Walker Lake Disposal, Inc., Mineral County, Nevada, was subcontracted to transport and dispose of all debris generated during decommissioning activities.

The grout-in-place abandonment method was used to abandon the four passive vapor extraction wells (VEW-1 through VEW-4) at SWMU B20. The grout-in-place method was performed by placing a tremie pipe (1.5-inch-diameter) inside the well casing and pumping grout composed of a cement/bentonite mixture through the tremie pipe to the bottom of the well. The tremie hose was slowly withdrawn keeping the bottom of the pipe below the level of the grout until the well casing was filled to ground surface. Following grout placement within the casing, a John Deere 310E backhoe was used to excavate/remove the concrete pads, well casings (to at least 1 foot bgs), passive vent stack pipes, and associated surface conveyance piping. Once the surface completions were removed, the tops of the remaining well casings were capped with concrete and backfilled with surrounding clean soil. Photographs of SWMU B20 before and after the decommissioning activities were completed are included in Figure 7.

The debris generated during decommissioning activities at SWMU B20 (PVC pipe and concrete) was placed into one of two 20-cubic-yard roll-off containers with similar debris generated during decommissioning activities conducted at four other HWAD sites (J03, K03a, K03d, and K05). Upon completion of the decommissioning activities at all of the sites, the debris roll-off containers were transported by truck to the HWAD construction-debris landfill for disposal, while the roll-off container with the metal debris was transported by truck to a local metal recycler.

Prior to CH2M HILL demobilizing from the facility, HWAD conducted a site inspection of SWMU B20 and found no outstanding issues at that time. Therefore, based on the above-described decommissioning activities conducted at SWMU B20 in addition to the request for closure, Response Complete is requested for this site.

9.0 References

CH2M HILL, 2008a. *Draft/Final Quarterly Groundwater Monitoring Report, First Quarter 2008, SWMU B20: 101-41 Catchment Pit, Hawthorne Army Depot, Hawthorne, Nevada*. Facility I.D. Number 9-000031. March.

CH2M HILL, 2008b. *Well Decommissioning Variance Request*. September.

CH2M HILL, 2007. *Final Corrective Action Plan for B20: Building 101-41 Catchment Pit, Hawthorne Army Depot, Hawthorne, Nevada*. April.

Division of Water Resources (DWR), 2008. *Vadose Zone Well Plugging, Hawthorne Army Depot*. September.

Nevada Division of Environmental Protection (NDEP), 2008a. "Re: Reopening of Solid Waste Management Unit I15 at the Hawthorne Army Depot for Groundwater Investigation." Letter dated August 7, 2008.

Nevada Division of Environmental Protection (NDEP), 2008b. *Approval of Final Quarterly Groundwater Monitoring Report, First Quarter 2008, SWMU B20: 101-41 Catchment Pit, Hawthorne Army Depot, Hawthorne, Nevada*. Letter to Kevin Shannon, April 24, 2008.

Nevada Division of Environmental Protection (NDEP), 2007. *Approval of Final Report, Corrective Action Plan for SWMU B20: 101-41 Catchment Pit, Hawthorne Army Depot, Hawthorne, Nevada*. Letter to Kevin Shannon, April 24, 2008.

U.S. Army Environmental Health Agency (USAEHA), 1988. *Evaluation of Solid Waste Management Units. HWAAP, Hawthorne, Nevada*. Final Report. Ground Water Contamination Survey No. 38-26-0850-88. May 12-19 and August 1-5.

Tables

Table 1

Trichloroethene Groundwater Concentrations in IRPMW37

Closure Report/Decision Document for SWMU B20, 101-41 Catchment Pit, Hawthorne Army Depot, Nevada

Sample Date	Sample ID	Trichloroethene (µg/L)
PRIOR TO INSTALLATION OF SOIL VAPOR EXTRACTION WELLS		
January 29, 1997	IRPMW37-012997-W	11
April 24, 1997	IRPMW37A-042497-W	57.3
April 24, 1997	IRPMW37B-042497-W	61
July 24, 1997	IRPMW37-072497-W	51.2
October 16, 1997	IRPMW37-101697-W	120
March 7, 1998	IRPMW37A-030798-W	57
March 7, 1998	IRPMW37B-030798-W	51
June 3, 1998	IRPMW37-060398-W	80
September 2, 1998	IRPMW37-090298-W	61
December 2, 1998	IRPMW37-120298-W	37
February 17, 1999	IRPMW37-021799-W	23
May 19, 1999	IRPMW37-051999-W	54
August 11, 1999	IRPMW37-081199-W	47
November 17, 1999	IRPMW37-111799-W	177
AFTER INSTALLATION OF SOIL VAPOR EXTRACTION WELLS		
February 17, 2000	IRPMW37-021700-W	103
May 18, 2000	IRPMW37-051800-W	60
August 17, 2000	IRPMW37-081700-W	77
November 15, 2000	IRPMW37-111500-W	116
May 16, 2001	IRPMW37-051601-W	7.6
August 14, 2001	IRPMW37-081401-W	25
November 28, 2001	IRPMW37-112801-W	31
February 12, 2002	IRPMW37-021202-W	93
December 1, 2005	IRPMW37-120805-W	6.6
December 12, 2006	IRPMW37-121206-W	4.8
April 24, 2007	IRPMW37 042407 W	4
July 9, 2007	IRPMW37-070907-W	2.6
November 9, 2007	IRPMW37-110907-W	5.4
January 15, 2008	IRPMW37-011508-W	5.5

Table 2**Trichloroethene Concentrations in Soil - December 2007**

Closure Report/Decision Document for SWMU B20, 101-41 Catchment Pit, Hawthorne Army Depot, Nevada

Depth	Unit	B20-SB1	B20-SB2	B20-SB3	B20-SB4
		Trichloroethene Concentration			
19-20	µg/kg	5.7 U	6.6 U	5.1 U	5.6 U
25.5-26	µg/kg				5.2 U
26-26.5	µg/kg		5.1 U		
33-34	µg/kg			5.7 U	
35-36	µg/kg			7.5 U	
39-40	µg/kg	5.7 U			
46-47	µg/kg		7.2		
59-60	µg/kg	7.4 U		5.5 U	7.5 U
69-70	µg/kg		6 U		
75-76	µg/kg			6.9 U	
79-80	µg/kg	5.3 U			6.8 U
87-88	µg/kg		6 U		
99-100	µg/kg	6.4 U		6.1 U	0.77 J
104-105	µg/kg	6 U	5.5 U	6.6 U	0.29 J
107-108	µg/kg			5.6 U	
109-110	µg/kg	6.2 U	7.7 U		3.2 J
114-115	µg/kg	0.41 J	7 U	0.92 J	2.7 J
119-120	µg/kg	5.8 U	6 U	6 U	6 U
124-125	µg/kg	6.6 U	6.5 U	5.8 U	6.1 U
129-130	µg/kg	7 U	0.39 J	6.4 U	6 U
134-135	µg/kg	6.1 U	6 U	0.4 J	6.4 U
136-137	µg/kg			5.8 U	
139-140	µg/kg	6.7 U	6 U		6.1 U
142-143	µg/kg		5.5 U		
144-145	µg/kg	5.8 U			

Notes:

U flagged results are non-detected at the reported concentration.

J flagged results are estimated concentrations.

Bold results exceed the associated action level (110 µg/kg)

Table 3**Additional Site Characterization Groundwater Data - December 2007***Closure Report/Decision Document for SWMU B20, 101-41 Catchment Pit, Hawthorne Army Depot, Nevada*

Depth	Unit	Groundwater Action Level	B20-SB1	B20-SB2	B20-SB3	B20-SB4
2-Butanone (MEK)	µg/L	6,968	47	30 U	120 U	6 U
Acetone	µg/L	5,475	12	50 U	200 U	10 U
Chloroform	µg/L	100	0.24 J	5 U	2 U	1 U
Trichloroethene	µg/L	5	37	210	510	11
Toluene	µg/L	1,000	2.7	0.31 J	20 U	1.7

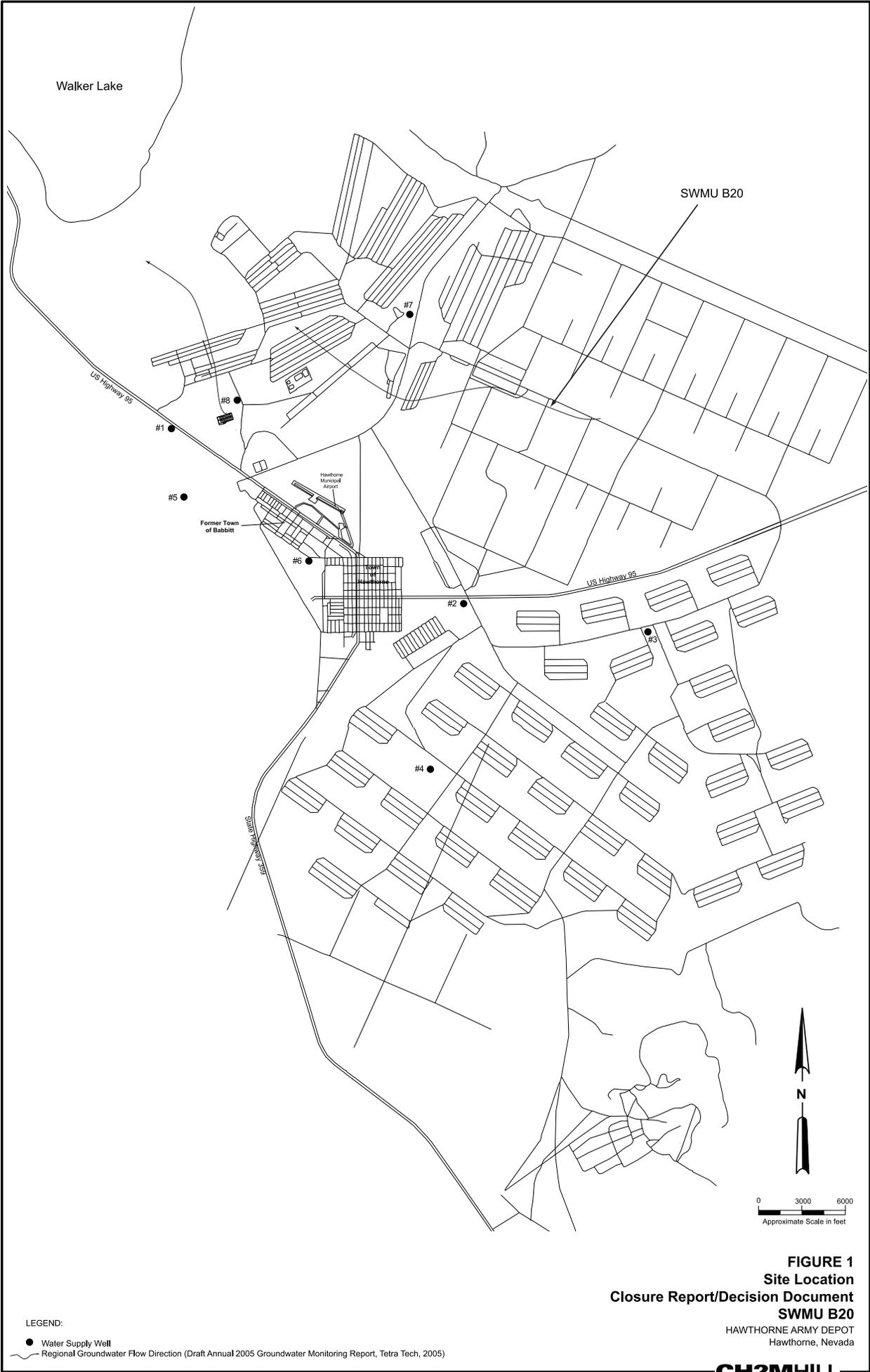
Notes:

U flagged results are non-detected at the reported concentration.

J flagged results are estimated concentrations.

Bold results exceed the associated action level

Figures



LEGEND:
 ● Water Supply Well
 → Regional Groundwater Flow Direction (Draft Annual 2005 Groundwater Monitoring Report, Tetra Tech, 2005)

FIGURE 1
Site Location
Closure Report/Decision Document
SWMU B20
 HAWTHORNE ARMY DEPOT
 Hawthorne, Nevada

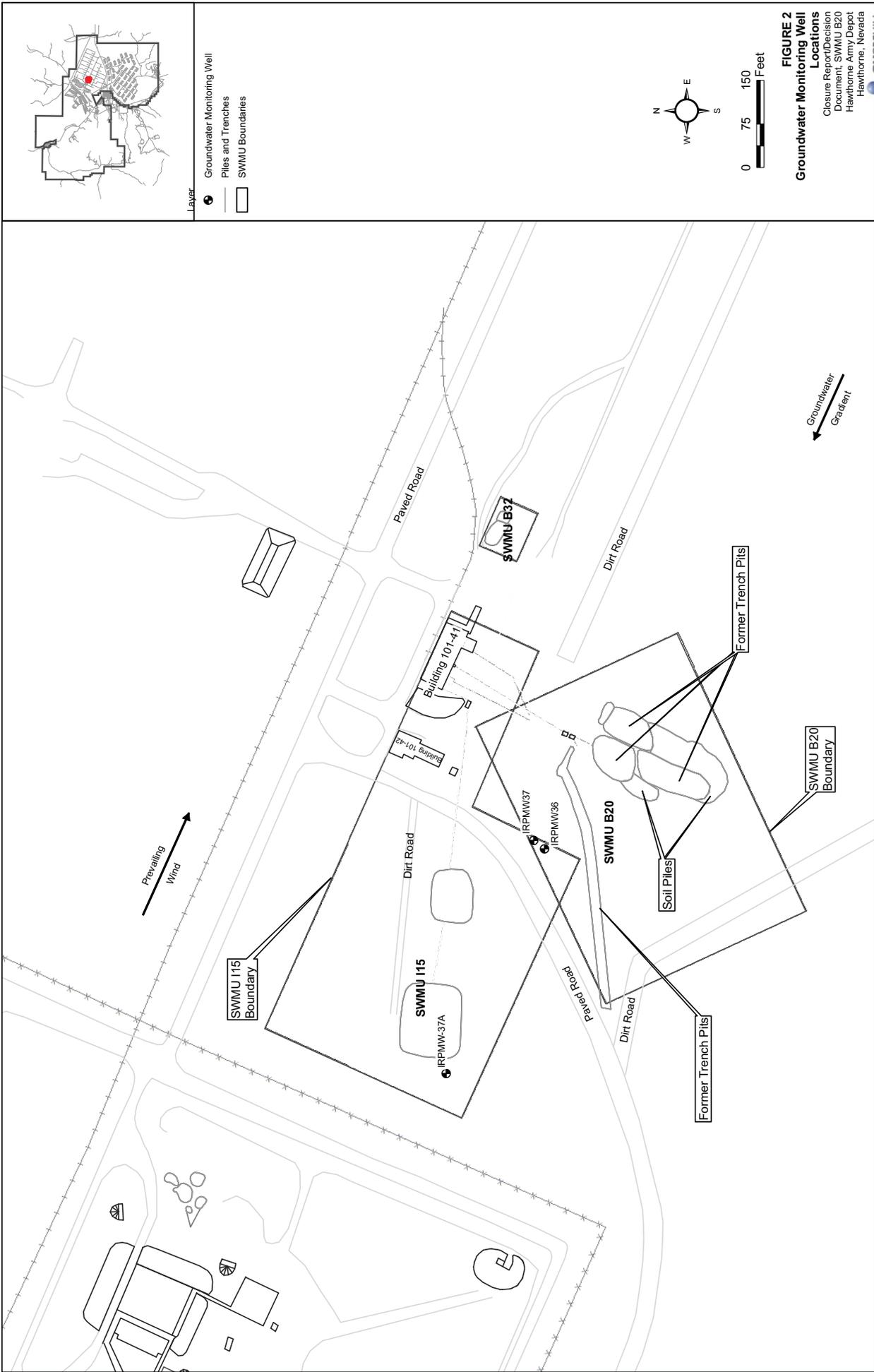
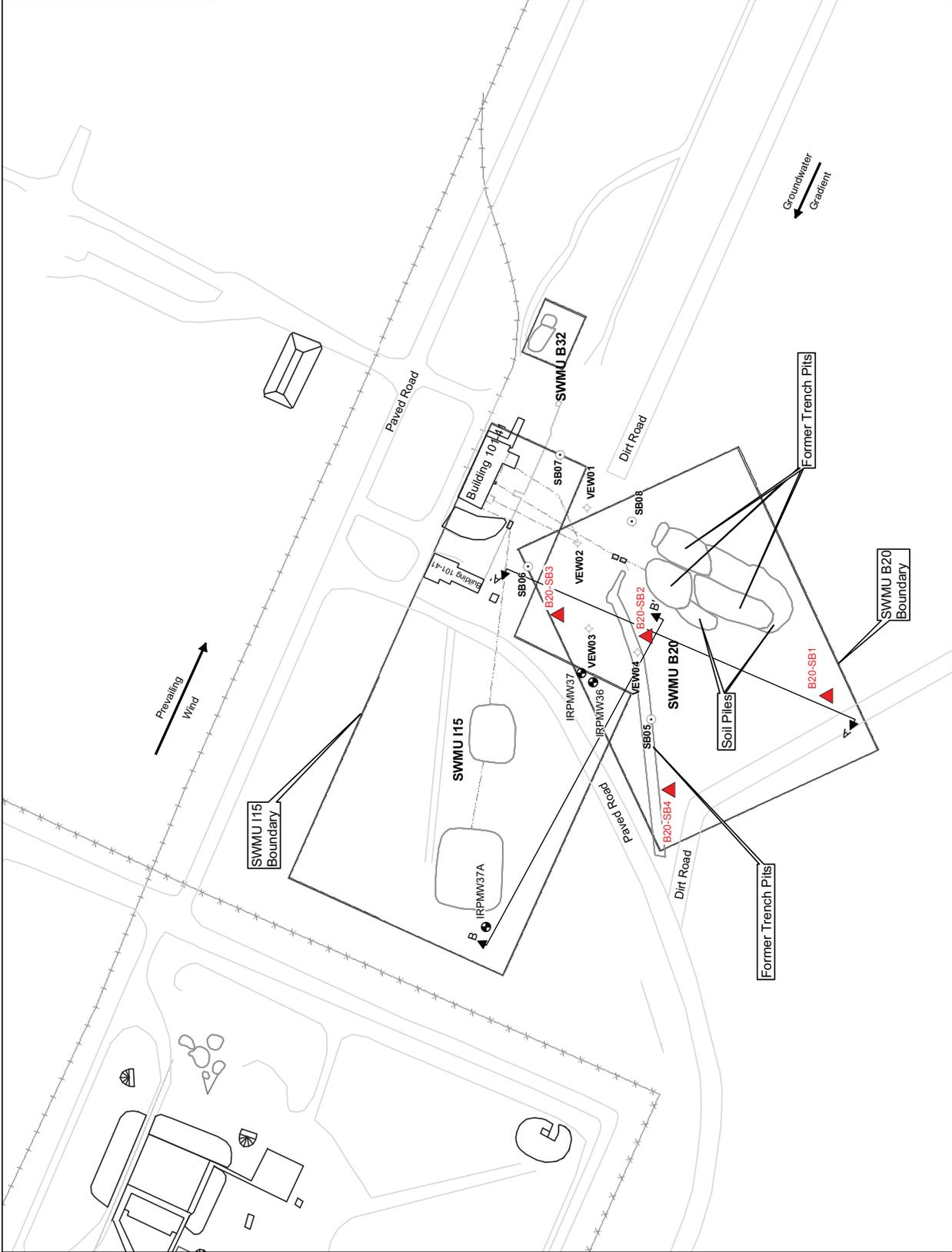


FIGURE 2
Groundwater Monitoring Well
Locations

Closure Report/Decision
 Document, SWMU B20
 Hawthorne Army Depot
 Hawthorne, Nevada





- Passive Vapor Extraction Wells
- Soil Borings
- Boring/Temporary Well Locations from Additional Site Characterization
- Groundwater Monitoring Well
- Cross Sections
- Piles and Trenches
- SWMU Boundaries

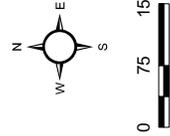
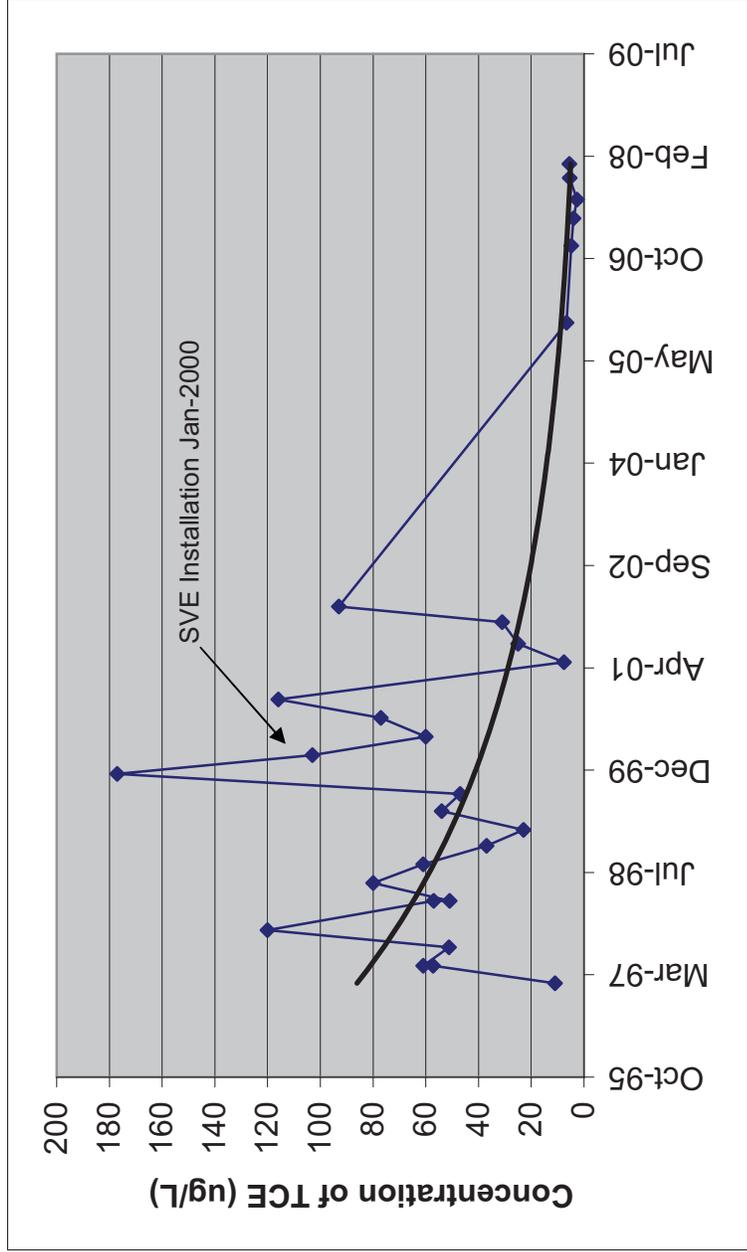


FIGURE 3
Soil Boring Locations
 Closure Report/Decision Document, SWMU B20
 Hawthorne Army Depot
 Hawthorne, Nevada

Figure 4
Trichloroethene Groundwater Concentrations in IRPMW37 over Time
Closure Report/Decision Document for SWMU E20, 101-41 Catchment Pit, Hawthorne Army Depot, Nevada



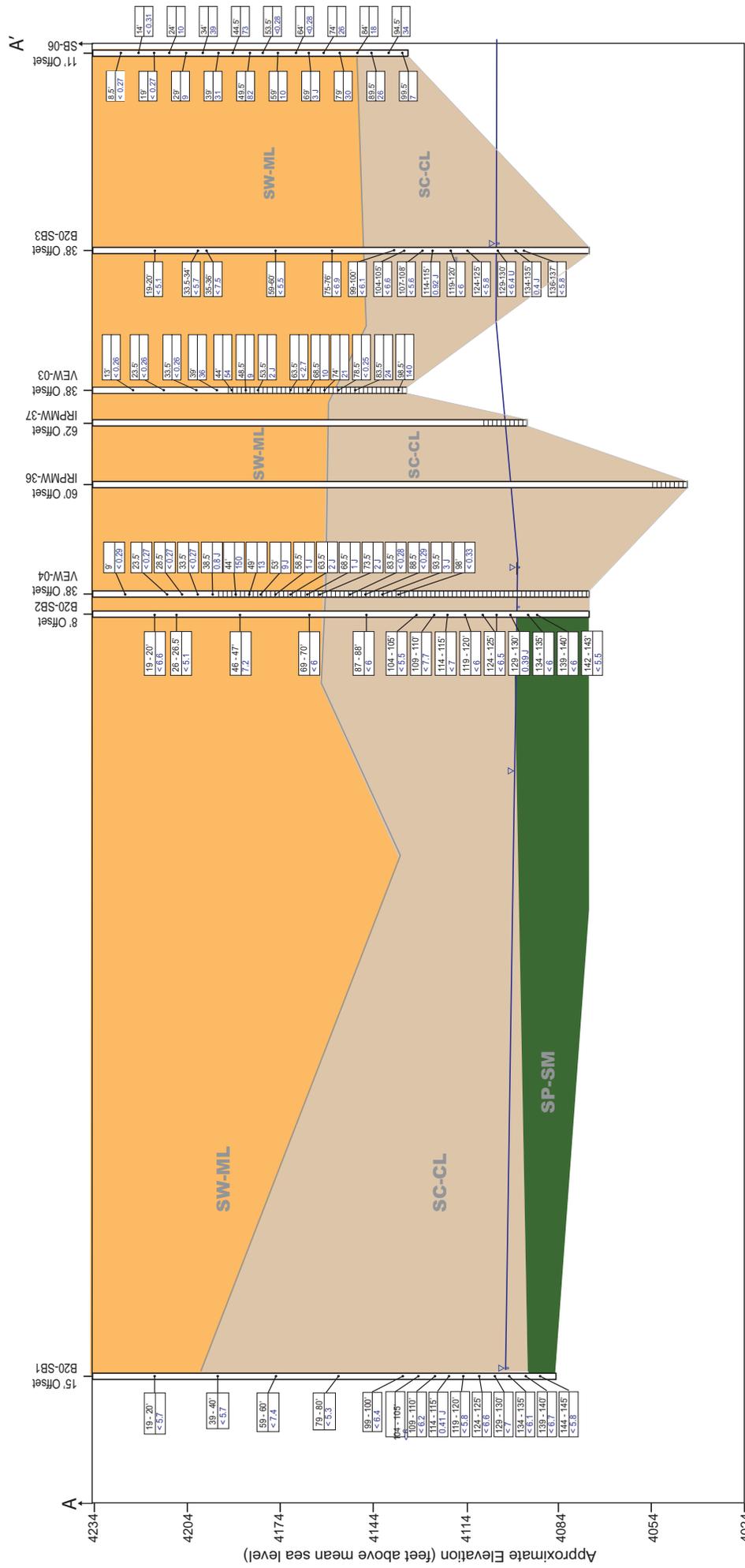
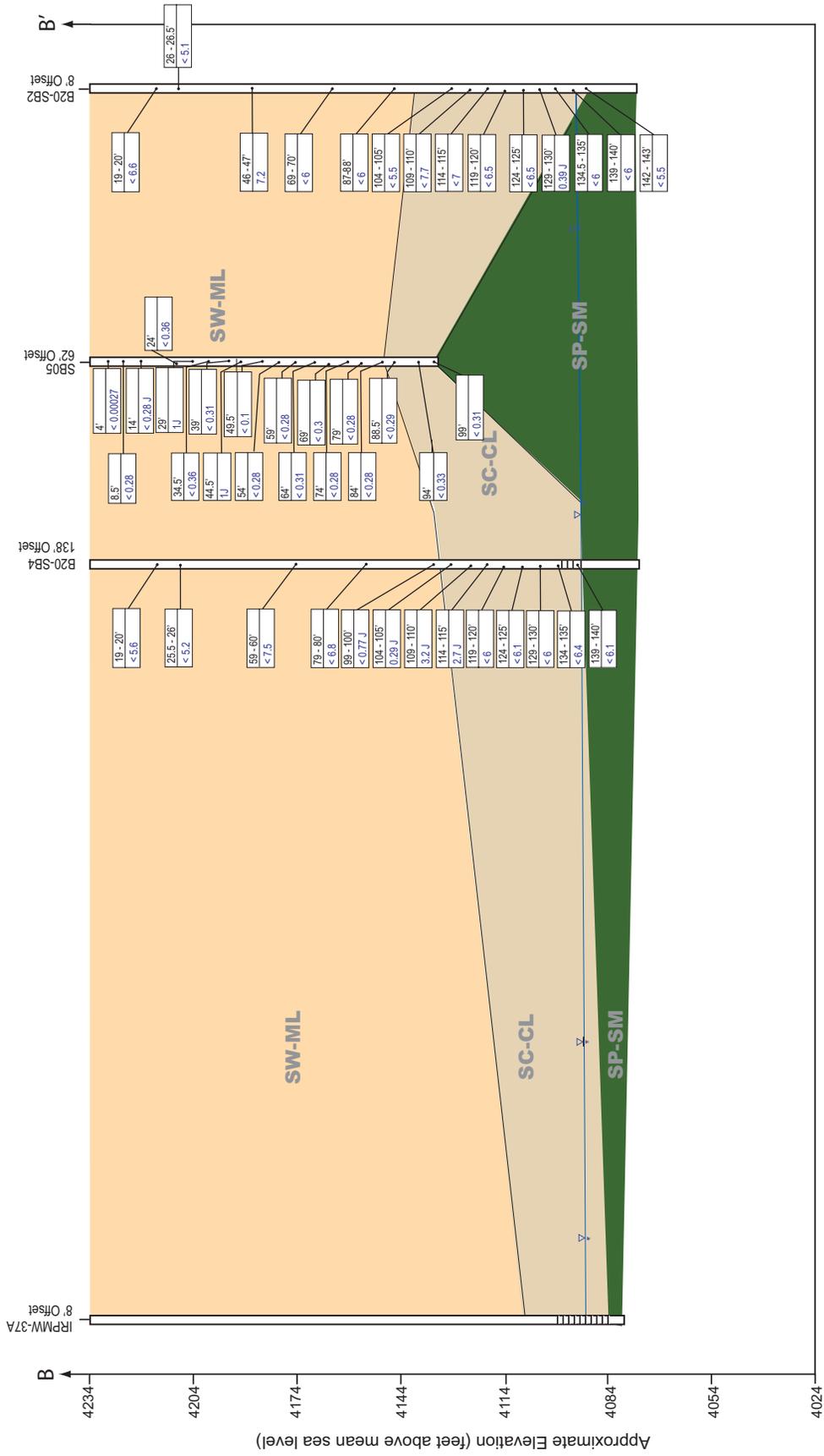


Figure 5
 Cross Section A-A'
 SWMU B20
 Closure Report/Decision Document
 HAWTHORNE ARMY DEPOT
 Hawthorne, Nevada



LEGEND

Depth (ft (g.s.))

24 - 25

1,400

TCE (µg/kg)

Approximate water table

Scale: H: 1" = 45'

V: 1" = 30'

SW-ML - Sand and sandy silts with trace interbedded clays and silts units

SC-CL - Clayey sand and clay with trace interbedded sand units

SP-SM - Sand and silty sand

< = Non-detect at reported concentration

J = Estimated concentration

▽ = Approximate water table

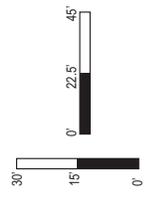


Figure 6
 Cross Section B-B'
 SWMU B20
 Closure Report/Decision Document
 HAWTHORNE ARMY DEPOT
 Hawthorne, Nevada

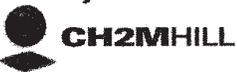
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Figure 7: Photographs of SWMU B20 before (top photograph) and after (bottom photograph) decommissioning activities were completed.

APPENDIX A

Soil Boring Logs



PROJECT NUMBER: 350552

BORING NUMBER: B20-SB1

SHEET 1 OF 1

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Gerardo / Burt

DRILLING METHOD AND EQUIPMENT USED: Sonic-Track - 4x6

DATE: 12/11/07 - 12/12/07

WATER LEVELS:

START: 1230

END:

LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)		RECOVERY (IN)		SOIL DESCRIPTION	COMMENTS
INTERVAL (FT)		#	TYPE		
		0.5		SW - fine to med sand & silt SM - very fine sand and silt, loose	FID = 0.0 ppm FID = 0.0 ppm
		5		SAA SAA - very fine sand & silt, loose	
		13		GP - very fine sand & silt, to gravel	FID = 0.0 ppm
		13.5		ML - silt, tr. very fine sand, dry cemented	FID = 0.0 ppm
		15		SAA - loose	
		16		SM - very fine sand & silt, loose, dry	FID = 0.0 ppm
		19		SAA - some very cemented cobble size pieces	SAMPLE: B20-SB1-19-20
		25		ML - silt, cemented, dry, tr. sand	0.0 ppm
		27		SM - very fine sand & silt, some large cemented pieces, loose	
		29		SAA - very fine sand, & silt, white	



PROJECT NUMBER
350552

BORING NUMBER
B20-SB1

SHEET OF
2

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

PS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)		RECOVERY (IN)		SOIL DESCRIPTION	COMMENTS
INTERVAL (FT)		#	TYPE		
				ML - silt to sand, cemented, dry, cohesive, - brittle	0.0 ppm
35		39		SM - very fine sand & silt, cemented, SM brittle, dry	0.0 ppm
40		39		SC - sand & silt, to clay	0.0 ppm
		40		SM - very fine sand & silt	SAMPLE B20-SB1-39-40 0.0 ppm
					0.0 ppm
45		45.5		SC - sand & silt, to clay	0.0 ppm
		46		SM - fine sand & silt, some cemented pieces	0.0 ppm
		47		SAA - loose, white, very fine sand & silt	0.0 ppm
		47.5		SAA - very fine sand & silt, cemented, dry	0.0 ppm
50					
		53		SC - sand & silt to clay, cohesive	0.0 ppm
55		54		SM - very fine sand & silt	0.0 ppm
60					SAMPLE B20-SB1-59-60



PROJECT NUMBER
350552

BORING NUMBER
B20-SB1

SHEET OF
3

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)		RECOVERY (IN)		SOIL DESCRIPTION	COMMENTS
INTERVAL (FT)		#	TYPE	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
65				SAA - very fine sand & silt	0.0 ppm
		66		white	
		67		white	
70		70		SC - Fine sand & silt, tr clay, cohesive	0.0 ppm
		72		SM - Fine sand & silt, loose	0.0 ppm
		73.5		SC - silt, some coarse sand, tr clay cohesive, Firm	0.0 ppm
75		75		SM - very fine sand & silt loose	0.0 ppm
		78.5		SC - silt, tr sand, tr clay	0.0 ppm
		79		SM - Fine to med sand	0.0 ppm
80		80		CL - clay, tr sand & silt, very firm	0.0 ppm SAMPLE B20-SB1-79-80
					0.0 ppm
85		84.5		SM - Fine sand & silt, loose, some cemented pieces	0.0 ppm
		86		MH - silt, some clay, soft, cohesive	0.0 ppm
		88			0.0 ppm
		89		SM - Fine to med sand & silt	
		89.5		SC - Fine sand & silt, tr clay	
90				SP - med sand	



PROJECT NUMBER
350552

BORING NUMBER
B20-SB1

SHEET 4 OF 4

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)		SOIL DESCRIPTION	COMMENTS
	RECOVERY (IN)	#/TYPE		
			SC - med sand, some silt, cohesive	0.0 PPM
		91	SW - fine to coarse sand	0.0 PPM
		92	SC - silt, tr clay, tr very fine sand, hard brittle	0.0 PPM
95		94	MH - silt, some clay, soft, cohesive, moist	0.0 PPM
		96	GP - well graded sand, some sm gravel, tr cobbles	0.0 PPM
		98	SC - med to coarse sand & silt, tr clay, moist, soft	0.0 PPM
100		100	SM - very fine sand, white, & silt	0.0 PPM SAMPLE B20-SB1-99-100
		101	SC - fine to med sand & silt, firm	0.0 PPM
105		104	SP - coarse sand, tr silt, moist	0.0 PPM SAMPLE B20-SB1-104-105
		108	CL - very firm clay w/ silt & sand	0.0 PPM
110		109	SC - coarse sand & clay, cohesive, moist to med some silt	0.0 PPM SAMPLE B20-SB1-109-110
		110	SAA - fine sand & silt, some clay cohesive, moist firm	
115		114	SAA - med to coarse sand & clay, some silt firm	0.0 PPM SAMPLE B20-SB1-114-115
		116	SAA - fine sand & silt, some clay, firm	0.0 PPM
		118	SW - well graded fine to coarse, sand	0.0 PPM
120		119	SC - well graded sand, some clay	0.0 PPM

SAMPLE B20-SB1-119-120
dragged tube = 0



PROJECT NUMBER
350552

BORING NUMBER
B20-SB1

SHEET 5 OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SAA Fine to med sand, some clay and silt	0.0ppm
			122 CL - very fine clay, for sand & silt, moist	0.0ppm
125			124 SC - silt & sand, some clay, cohesive, firm	0.0ppm SAMPLE B20-SB1-124-125
			128 CL - silty clay, soft, some very firm	0.0ppm SAMPLE B20-SB1-129-130
			131.5 1/2" Fine sand, some clay, CL - silty clay, soft	0.0ppm
			133 SAA - very firm	
135			134 SC - fine to med sand & silt, some clay, cohesive, moist	0.0ppm
			135 CL - clay, trace silt, very firm	0.0ppm SAMPLE B20-SB1-134-135
			137 SC - fine sand & silt, some clay, SAA - soft, moist	0.0ppm
140			140 SP - med sand, moist	0.0ppm SAMPLE B20-SB1-139-140
			142 SM - fine silt & sand, moist, red	0.0ppm
145			144 SP - med sand, moist	0.0ppm SAMPLE B20-SB1-144-145
			146 SAA - fine sand, some clay	0.0ppm
			146.5 SP - med sand, moist	0.0ppm
			147 SM - very fine sand & silt	0.0ppm
150			148	



PROJECT NUMBER
350552

BORING NUMBER
B20-SB2

SHEET 1 OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

PS Coordinates:

DRILLING CONTRACTOR: Bort - Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE: 12-14-07

WATER LEVELS:

START: 1220

END:

LOGGER: R. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION	COMMENTS
				FID
			FILL - wood pieces, fine to med sand, dark brown, loose	0.0 ppm
		2	SW - fine to coarse sand, loose, dry	0.0 ppm
		4	SM - very fine sand & silt, loose, dry	0.0 ppm
5				0.0 ppm
10		10	SAA - cohesive pieces	0.0 ppm
15				
		18	SW - fine to med sand	0.0 ppm
		19	SAA - fine to coarse sand	collect sample B20-SB2-19-20 DUPI-121407
20				
		21	SAA - fine to med sand	0.0 ppm
		22	SAA - trace silt	0.0 ppm
25				
		25.5	SM - silt & fine sand, some cohesive pieces	4 ppm 8 ppm @ 26' SAMPLE B20-SB2 26-26.5 4.5 ppm @ 28'
30				



PROJECT NUMBER
350552

BORING NUMBER
B20-SB2

SHEET 2

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Bost - Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START: 1350

END:

LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SAA - loose, dry	1.0 ppm @ 30.5
35		33 -	SAA - cohesive pieces	
		34 -	SAA - loose, dry	0.0 ppm @ 35'
		38 -	ML - silt & sand, some clay	0.0 ppm @ 38'
40		39 -	SM - silt & fine sand, cohesive, hard	0.0 ppm
		40 -	ML - silt & sand, some clay, cohesive	3.3 ppm
		41 -	SW - fine to med sand	0.0 ppm
		41.5 -	ML - silt & sand, some clay, cohesive, hard	0.0 ppm
		42 -	SM - silt & sand (fine to med)	0.0 ppm
		42.5 -	ML - silt & sand, some clay, cohesive	0.0 ppm
45		43 -	SM - silt & sand (fine to med), cemented pieces	6.0 ppm
		46 -	ML - silt & sand, fine, cohesive, some clay	2.9 ppm SAMPLE B20-SB2-46-47
		47 -	SW - fine to coarse sand	0.0 ppm
		48 -	SC - well graded sand, some clay, cohesive, some silt	1.6 ppm
50		50 -	SW - fine to med sand	
		51 -	SM - very fine sand & silt, loose	0.0 ppm
55				0.0 ppm
60				



PROJECT NUMBER
350552

BORING NUMBER
B20-SB2

SHEET 3 OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Boart + Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
70			SW - well graded sand SM - very fine sand + silt	19 ppm @ 72 73
75			74 SW - well graded sand + silt 75 SM - sand + silt	20 ppm @ 75 10 ppm
80			77 SW - well graded sand, + cobbles	4 ppm
			80 MH - silt, some clay, soft	10 ppm @ 78, 9 ppm @ 79 15 ppm
			81 SM - very fine sand, and silt, loose	9 ppm
			82 CL - clay and silt, firm	0 ppm
85			84 SM - very fine sand + silt	0 ppm
				7 ppm @ 86 24 ppm @ 88 SAMPLE B20-SB2-87-88 B20-SB2-87-88 HAND
90				10 ppm

PROJECT NUMBER
350552BORING NUMBER
B20-SB2

SHEET 4 OF 4

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Best - Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION 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
			MH - silt, some clay, soft	0.0 ppm
		92	SM - fine to med sand & silt, loose	0.0 ppm
		93	SW - well graded sand, cemented	0.0 ppm
95		94	SM - fine to med sand & silt	1 ppm
		96	SA - very fine sand & silt	2 ppm
		98	SC - well graded sand w/ clay, moist, some cobbles (or cemented sand) (can't bust open) - looks like coral	0.0 ppm
100		105	MH - silt some clay cohesive	0.0 ppm
		105	SW - well graded sand	0.0 ppm
105		105	ML - silt & sandy clay, hard	0.0 ppm
		108	SC - fine to med sand, some clay	0.0 ppm
110		109	SA - fine sand & silt, some clay, hard	0.0 ppm
		110	SW - well graded sand, loose	0.0 ppm
		112	CL - clay, some silt, very firm	0.0 ppm
115		116	SC - fine sand & silt, some clay	0.0 ppm
		117	MH - silt w/ clay, hard, brittle	0.0 ppm
		118	SM - fine to med sand & silt, cohesive, moist	0.0 ppm
120				0.0 ppm

SAMPLE B20-SB2-104-105

SAMPLE B20-SB2-109-110

SAMPLE B20-SB2-114-115

SAMPLE B20-SB2-119-120



PROJECT NUMBER
350552

BORING NUMBER
B20-SB2

SHEET OF
5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Bort - Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE: 1

WATER LEVELS: START: END: LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
123				SAA - well graded sand & silt, cohesive, moist	0.0 ppm SAMPLE B20-SB2-124-125
125				SAA - well graded sand & silt, cohesive SC - well graded sand & clay, firm, cohesive	0.0 ppm
128				CL - silty clay, soft, + sand (wet)	SAMPLE 0.0 ppm B20-SB2-129-130
130				130 - SAA - Firm	
133				133 - SAA - silty clay very firm, + fine sand	
134				134 - Mx. silt, some sand, + clay, hard, cohesive	0.0 ppm
134.5				134.5 - Sd sand, some clay, soft, cohesive	0.0 ppm SAMPLE B20-SB2-134.5-135
135				135 - SW - well graded sand, + gravel, wet	0.0 ppm
137				137 - CL - some silt & sand	0.0 ppm
138				138 - SM fine sand, loose, some silt, cohesive, wet	SAMPLE B20-SB2-139-140
140				140 - SW - well graded sand, some silt	
146				146 - SM - Fine sand & silt	SAMPLE B20-SB2-142-143

13.5

EOB = 158

PROJECT NUMBER
350552BORING NUMBER
B20-SB3SHEET OF
1/5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Best Longyear - Gerardo

DRILLING METHOD AND EQUIPMENT USED: Sonic 4x6

DATE: 12-19-07

WATER LEVELS:

START: 0630

END:

LOGGER: B. Rewey

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SW - Fine to med sand, loose, dry	FID 0 ppm
			3 SP - fine sand	0 ppm
5			4 SM - very fine sand & silt, loose, dry	0 ppm
			6 SW - Fine sand to med sand	0 ppm
10			10 SP - fine sand	0 ppm
			11 SM - very fine sand & silt, loose	0 ppm
			12 ML - silt, some fine sand, cohesive	0 ppm
			13.5 SW - fine to med sand, loose, gray	0 ppm
15			14 SM - sand with silt, cohesive (sami)	0 ppm
			15 ML - silt, fr very fine sand, cohesive	0 ppm
			16.5 SW - med to coarse sand, loose, dry	0 ppm
20			19 SAA - fine to coarse sand loose dry	SAMPLE B20-SB3-19-20
25			23 GP - fine to med sand w/ gravel & cobbles	0 ppm
30				

PROJECT NUMBER
350552BORING NUMBER
B20-SB3

SHEET 2/5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS: START: END: LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SW - well graded sand, to gravel	Dragger = 0 SAMPLE B20-SB3-33.5-34
35		33.5	SM - Fine sand & silt	40ppm odor of some sort
		35	SP - Fine sand cemented	0ppm
		35	SM - Fine sand & silt, cemented	34ppm 200ppm, no odor SAMPLE B20-SB3-35-36
		37	SAA - white	0ppm Dragger = 0
		38	ML - silt, some fine sand cohesive	0ppm
40		40	SM - Fine to med sand & silt	
		42	SAR - fine sand & silt	0ppm
45				
		48	SP - fine sand	
50		50	SAA oxidation	0ppm
		51	ML - silt, trace fine sand, cohesive hard, oxidation, moist	0ppm
		52	SM - Fine sand, some silt	0ppm
55				
		58	ML - silt, & some very fine sand loose	0ppm SAMPLE B20-SB3-59-60
60				



PROJECT NUMBER
350552

BORING NUMBER
B20-SB3

SHEET 3/5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)

SOIL DESCRIPTION

COMMENTS

INTERVAL (FT)

RECOVERY (IN)

#/TYPE

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

65

66

SAA - cohesive, hard

Open

70

69.5

SP - Fine sand

Open

70

ML - silt, fr sand hard, cohesive

Open

70.5

SP - Fine sand

Open

72.5

SM - silt fr sand cohesive fine sand
Some silt

~~2.5 ppm~~ ~~2.5 ppm~~

75

ML - silt Sand cohesive

2.5 ppm

80

80.5

SP - med sand

0.0 ppm

81.5

ML - silt, fr sand cohesive

0 ppm

85

84

SP - Fine sand loose

0 ppm

86

SM - med sand & silt, cohesive

0 ppm

86.5

ML - silt, cemented gray

0 ppm

87

SP - med sand 100%

0 ppm

88

SP - Fine sand 100%

0 ppm

89

ML - silt, some fine sand, cohesive

0 ppm

90

silt, some sand

SAMPLE B20-SB3-75-76



PROJECT NUMBER
350552

BORING NUMBER
B20-SB3

SHEET 4/5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)		INTERVAL (FT)		RECOVERY (IN)	SOIL DESCRIPTION	COMMENTS
				#/TYPE	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
				91	SM - very fine sand, some silt	0.0 ppm
				93	SM - very fine sand, some silt, loose	
95				94	SW - fine to med sand to gravel	
				96	SAA - cobble	0 ppm
				97	SM - coarse sand & silt, cohesive, moist	0 ppm
				98	ML - silt very hard SAA - white	
100				100	SP - fine sand loose	SAMPLE B20-SB3-99-100 DUP1-121907
				101	ML - silt some sand loose	0 ppm
				102	SAA - hard	
						SAMPLE B20-SB3-104-105
				107	SM - fine sand some silt, loose	2.5 ppm
				108	SAA - fine sand w/ silt, cohesive, soft	SAMPLE B20-SB3-107-108
100				111	SP - med sand some gravel	0 ppm
				115	SM - med to coarse sand & gravel - cohesive	0 ppm
				114	ML - silt some fine sand	SAMPLE B20-SB3-114-115
115				116.5	SM - med sand & silt	0 ppm
				118	SAA - very fine sand & silt, cohesive, firm	0 ppm SAMPLE B20-SB3-118-120

B20-SB3-118-120



PROJECT NUMBER
350552

BORING NUMBER
B20-SB3

SHEET 5/5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)		INTERVAL (FT)		RECOVERY (IN)		SOIL DESCRIPTION	COMMENTS
				#	TYPE		
						SAA	0 ppm
	122					ML-silt, some very fine sand	0 ppm
	123					SM-fine to med sand & silt	0 ppm SAMPLE B20-SB3-124-125
125							
	126.5					ML-silt, tr fine sand, very firm	0 ppm
	128					SM-silt & very fine sand, wet moist	SAMPLE B20-SB3-129-130 0 ppm
130							
	133					MC-silt, tr very fine sand, oxidized, very firm	0 ppm SAMPLE B20-SB3-134-135
135							
	136					SPK fine to med sand & gravel	0 ppm SAMPLE B20-SB3-136-137
136.5							
	138						
140						Blind	
145							
150						EOB=148	



PROJECT NUMBER
350552

BORING NUMBER
B20-SB4

SHEET / OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Beart Longyear - Gerardo

DRILLING METHOD AND EQUIPMENT USED:

DATE: 12-15-07

WATER LEVELS: ~ 140.5

START:

END:

LOGGER: B. Rewey / Den

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)		SOIL DESCRIPTION	COMMENTS
		#	TYPE		
				SM - very fine sand, fr. silt, loose, dry	FID 0.0 ppm
10				ML - silt, fr. fine sand, white loose ML	0.0 ppm
10.5				SP - very fine sand, loose	0.0 ppm
12				SM - very fine sand, fr. silt loose	0.0 ppm
16				SP - very fine sand, loose, some cemented pieces	0.0 ppm
17				SAA - loose	
18				SAA - loose	0.0 ppm
19				SAA - cemented	SAMPLE B20-SB4-19-20
20				SM - very fine sand & silt, loose	0.0 ppm
26				ML - silt, some clay, cohesive	2 ppm - 25.5' - 26'
27.5				SM - very fine sand & silt, loose	0.0 ppm
28				ML - silt, some clay, soft, cohesive moist	0.0 ppm

SAMPLE B20-SB4-25.5-26



PROJECT NUMBER
350552

BORING NUMBER
B20-SB4

SHEET OF
2

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SAA	0.0 ppm
35		34	SM - very fine sand & silt	0.0 ppm
40				
45		45.5	ML - silt & some clay, cohesive,	0.0 ppm
		46	hard SM - fine sand & silt, cohesive	0.0 ppm
		49	SP - very fine sand & silt, loose	0.0 ppm
50		50	SM - very fine sand & silt loose	0.0 ppm
55				
60				12 ppm Sample B20- SB4-59-60



PROJECT NUMBER
350552

BORING NUMBER
B20-SB4

SHEET 3 OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS
				SA-SM	5ppm @ 61
			61	ML-silt, some fine sand, cohesive	0.0ppm
65			67	ML-silt, some fine sand & silt, loose	0.0ppm
			68	ML-silt, some sand, cohesive	0.0ppm
			69	SM-fine sand & silt	0.0ppm
70			72	ML-silt, some fine sand, cohesive, firm	0.0ppm
			74	SM-fine sand & silt, loose	0.0ppm
75			78	ML-silt some sand, moist, cohesive, soft	0.0ppm
			79	SP-fine sand & silt, loose	0.0ppm
80			81	ML-silt, some sand, cohesive	0.0ppm
			82	SP-fine sand loose	0.0ppm
			82.5	SM-fine sand & silt loose	0.0ppm
			83.5	SP-fine sand loose	0.0ppm
85			84	ML-silt, cohesive, moist, clay, firm	0.0ppm
			86	SA-silt, some fine sand, cohesive	0.0ppm
			87.5	SP-fine sand	0.0ppm
			88	SM-med to coarse sand, loose	0.0ppm
			88.5	ML-silt & sand, cohesive	0.0ppm
90					0.0ppm

SAMPLE
B20-SB4-79-80



PROJECT NUMBER
350552

BORING NUMBER
B20-SB4

SHEET **4**

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS:

START:

END:

LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	
			sm - very fine sand & silt	0 ppm
		92	ML - silt some fine sand, cohesive firm	0 ppm
95		95	SW - fine to coarse sand & silt loose, moist	0 ppm
		97	SM - med to coarse sand w/ silt, moist, cohesive	
		98	SM - med to coarse sand w/ silt, moist, cohesive	0 ppm
		100	ML - silt w/ fine sand, hard	0.0 ppm SAMPLE B20-SB4-99-100
		101	SAA - silt w/ fine sand, white, hard	0 ppm
		102	SAA - silt w/ med sand, cohesive, lots of silt	
		103	SM - med to coarse sand w/ silt, lots of cohesive	0 ppm
105		104	SAA - moist silt	
		106	SM - silt w/ fine sand, cohesive, moist, firm, + clay	0.0 ppm SAMPLE B20-SB4-104-106
				SAMPLE B20-SB4-109-110
115		114	SM - fine to med sand w/ silt, cohesive, soft	0.0 ppm SAMPLE B20-SB4-114-115
		117	SW - med to coarse sand, some silt	0.0 ppm
		118.5	SM - silt, very firm, tr sand	0.0 ppm
120		119	SM - very fine sand & silt cohesive, firm	0.0 ppm SAMPLE B20-SB4-119-120



PROJECT NUMBER
350552

BORING NUMBER
B20-SB4

SHEET **5**

SOIL BORING LOG

PROJECT: Hawthorne Depot

LOCATION: Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED:

DATE:

WATER LEVELS: START: END: LOGGER:

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN) #/TYPE	SOIL DESCRIPTION	COMMENTS
			ML - silt some fine sand, firm ML - silt some fine sand, firm	0 ppm
123			SM - med to coarse sand & silt, cohesive, soft	0 ppm
124			SAA - fine sand & silt	SAMPLE B20-SB4-124-125
125			SAA - med to coarse sand & silt	
128			ML - silt silt & fine sand, firm	0 ppm SAMPLE B20-SB4-129-130
130			SAA - very fine sand & silt hard w/ very fine sand cohesive	0 ppm
134			SM - fine sand & silt, cohesive, moist	SAMPLE B20-SB4-134-135
137			SW - fine to med sand, wet	0 ppm
138			SM - fine to med sand, with silt wet	0 ppm
139				SAMPLE B20-SB4-139-140
140				
148			BLIND TO 158'	

EOB = 158

APPENDIX B

**Additional Site Characterization
Soil Sampling Analytical Results
and Data Quality Validation Reports
(Presented on CD)**

APPENDIX C

Well Decommissioning Variance



**DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES**

901 S. Stewart Street, Suite 2002
Carson City, Nevada 89701
(775) 684-2800 • Fax (775) 684-2811
water.nv.gov

Waiver Correspondence 2008

September 19, 2008

CH2MHILL
Attn: Oscar Sorensen
9193 So. Jamaica Street
Englewood, CO 80112

RE: Vadose Zone Well Plugging, Hawthorne Army Depot

Dear Mr. Sorensen:

This will acknowledge your waiver request, dated September 8, 2008, received by this office September 15, 2008

Division of Water Resources Staff have reviewed your proposal and, as Provided in Section 534.450 of the Regulation for Water Well and Related Drilling as adopted under Chapter 534 of the Nevada Administrative Code, and for good cause shown, authorization is herewith **granted** to complete the subject well plugging and abandonment as described in your September 8, 2008 letter.

It is expressly understood this authorization does not relieve the operator of the permitting requirements of other state, federal and local agencies.

If you have any questions, please contact this office, (775) 684-2800.

Sincerely,

Wm Hamilton Reed, RPG, PE
Staff Engineer

WHR/sg



CH2MHILL

CH2M HILL

9193 S. Jamaica Street

Englewood, CO 80112

Tel 720.286.0241

Fax 720.286.9230

September 8, 2008

Division of Water Resources
Attn: Hamilton Reed
901 S. Stewart Street, Suite 2002
Carson City Nevada 89701

Subject: Well Decommissioning Variance Request
Hawthorne Army Depot
Hawthorne, Nevada

Dear Mr. Reed:

This well-abandonment variance request has been prepared based on discussions between Rebecca Rewey (CH2M HILL) and yourself on June 4, 2008 regarding required well abandonment procedures for a project at the Hawthorne Army Depot (HWAD) in Hawthorne, Nevada. During the phone call, well abandonment options for passive vent wells at Solid Waste Management Unit (SWMU) K05 were discussed. This letter expands the request for a variance to Nevada Administrative Code (NAC) 534.420 to include wells associated with remediation systems in SWMUs B20, J03, K03d in addition to SWMU K05, which was specifically discussed on the June 4 phone call.

The remediation systems consist of passive vent wells, vapor monitoring wells, air injection wells, horizontal injection lines, background vadose zone monitoring wells, and soil moisture probes. The remediation system wells either (1) do not meet the definition of a "well" as defined in Nevada Administrative Code (NAC) 534.220 as they were not used for "measuring, testing or sampling the underground strata or producing groundwater" or (2) do not pose a threat to groundwater. This letter presents well-construction details for the various remediation systems and proposes alternate decommissioning activities to those described in NAC 534.420.

Remediation System Design Summary

SWMU B20 Passive Vapor Extraction Well System Design

The passive vapor extraction well system at SWMU B20 consists of four vertical passive vent wells constructed of 2-inch-diameter PVC casing and 0.010-inch slotted screen to a maximum depth of 100-feet below grade (Figure 1). Aboveground, each passive vent well is connected to a ball valve, a sample port, and an 8-inch-diameter PVC stack pipe with a wind-driven turbine. The groundwater at this site ranges from approximately 129-feet to 134-feet below ground surface (bgs).

SWMU J03 Enhanced Bioremediation System Design

The enhanced bioremediation system at SWMU J03 consists of horizontal and vertical air injection lines, vapor monitoring wells, and soil moisture probes. The groundwater at this site is approximately 104-feet bgs.

Horizontal injection lines (Figure 2), each approximately 80 feet in length, consist of 1-inch diameter schedule-40 PVC screen with 0.010-inch-diameter slots; two lines are located at 10-foot bgs and two are located at 22-foot bgs. Vertical air-injection wells (Figures 3 and 4) at SWMU J03 are constructed of 2-inch diameter, schedule-40 PVC casing with 0.010-inch slot screen; screens are set at various target depths.

Each vapor monitoring well (Figure 5) consists of three ¼-inch diameter polyethylene piping with a 6-inch long schedule-40, 0.010-inch slotted, 1-inch diameter PVC screen, set at 59.5-, 30-, and 15-foot bgs.

Soil-moisture probes (Figure 6) consist of wire leads attached to 7/8-inch diameter gypsum soil-moisture blocks. The soil-moisture probes were installed in 8-inch diameter boreholes at depths of 5-, 15-, and 30-foot bgs. The boreholes were backfilled with native material, finished with a 3-foot tall, two-inch-diameter PVC pipe and cemented in place.

SWMU K03d Enhanced Bioremediation System Design

The enhanced bioremediation system at SWMU K03d consists of horizontal manifold lines, an air-injection well, a background vadose zone monitoring well, and a vapor-monitoring well. The groundwater at this site is approximately 121-feet bgs.

The horizontal manifold lines (Figure 7) are constructed of 1-inch diameter schedule-40 PVC screened pipe with 0.010-inch slots at approximately 10 feet below grade. Each screened horizontal manifold is connected to a 1-inch-diameter solid PVC riser pipe (Figure 8). Each riser pipe is connected to the main air injection well via above ground piping.

The main air injection well (similar to Figure 4) is constructed of 2-inch-diameter schedule-40 PVC casing with 0.010-inch slot screen from 15-to 60-foot bgs. The well was sealed with bentonite chips and bentonite/cement grout and finished with a flush-mount steel cover.

The background vadose zone monitoring well (Figure 9) was constructed of 1-inch diameter schedule-40 PVC and 0.010-inch slot screen from 33-to 38-foot bgs. The well was sealed with bentonite chips and bentonite/cement grout and finished with a stickup steel cover.

The vapor monitoring well (similar to Figure 5) consists of three ¼-inch diameter polyethylene tubes with a 6-inch long schedule-40, 0.010-inch slot, 1-inch-diameter PVC screen, set at 16-, 31-, and 46-foot bgs.

SWMU K05 Passive Bioventing System Design

The passive bioventing system at SWMU K05 consists of pairs of vertical passive vent wells which may be connected by horizontal perforated pipe. Each vent well is constructed of 4- to 6-inch diameter PVC casing and screen. The depths of the wells range from 13- to 15-foot bgs; the screen interval and slot size are not known (Figure 10). The groundwater at this site is approximately 19-feet bgs.

Decommissioning Activities

Passive Vent Wells, Horizontal Injection Lines, Air Injection Wells, and Background Vadose Zone Monitoring Wells

Due to the distance between the bottom of the perforated PVC casing and groundwater table at each of the SWMUs, CH2M HILL proposes to abandon the passive vent wells (including horizontal conveyance pipe if present at SWMU K05), horizontal injection lines, air injection wells, and background vadose zone monitoring wells by:

1. Injecting bentonite grout or concrete into the PVC casing,
2. Removing the above ground conveyance piping (if any), removing the flush mount or stick up protective cover, and removing the PVC casing to at least 1 foot below grade, and
3. Placing a concrete cap/seal over the vertical opening.

Vapor Monitoring Well Decommissioning Activities

Due to the narrow diameter (¼-inch diameter flexible tubing) and shallow depths of the vapor monitoring wells at SWMUs J03 and K03d, CH2M HILL proposes to abandon these wells by removing the flush mount cover and piping to 1-foot bgs and placing a concrete seal/cap over the vertical openings.

Soil Moisture Probe Decommissioning Activities

Due to the shallow depths and type of construction of the soil moisture monitoring points at SWMU J03 (lead wires buried in native-soil-filled PVC casing [Figure 6]), CH2M HILL proposes to remove the 3-foot stickup, but to leave the casing and buried wire in place.

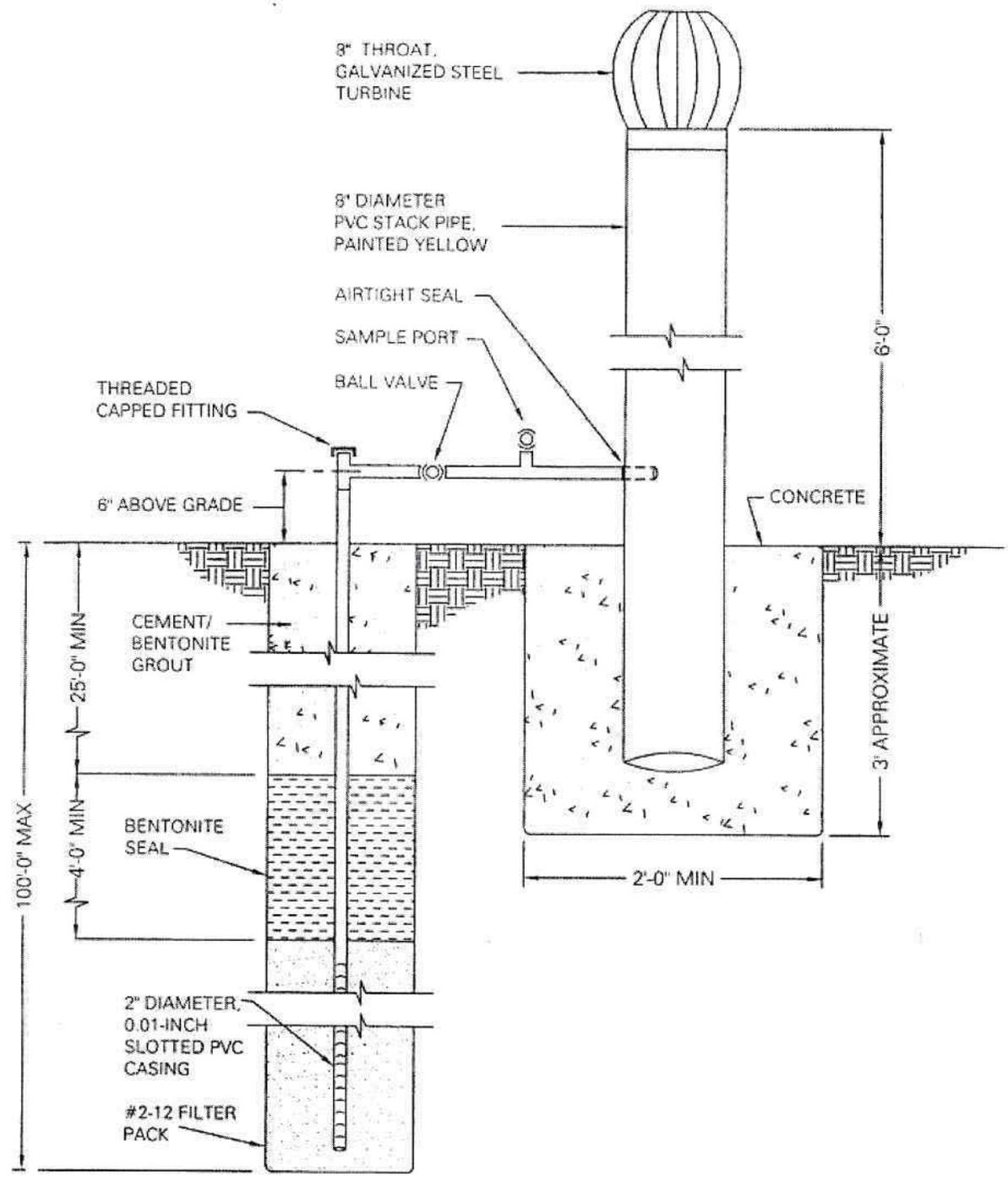
Please contact me at 720-286-0241 or via email (oscar.sorensen@ch2m.com) with approval of this plan or if you have any questions or comments.

Sincerely,

CH2M HILL

Project Manager
Oscar Sorensen

r:\New\10324\VaporREV4.dwg - 02/12/01 - MNM



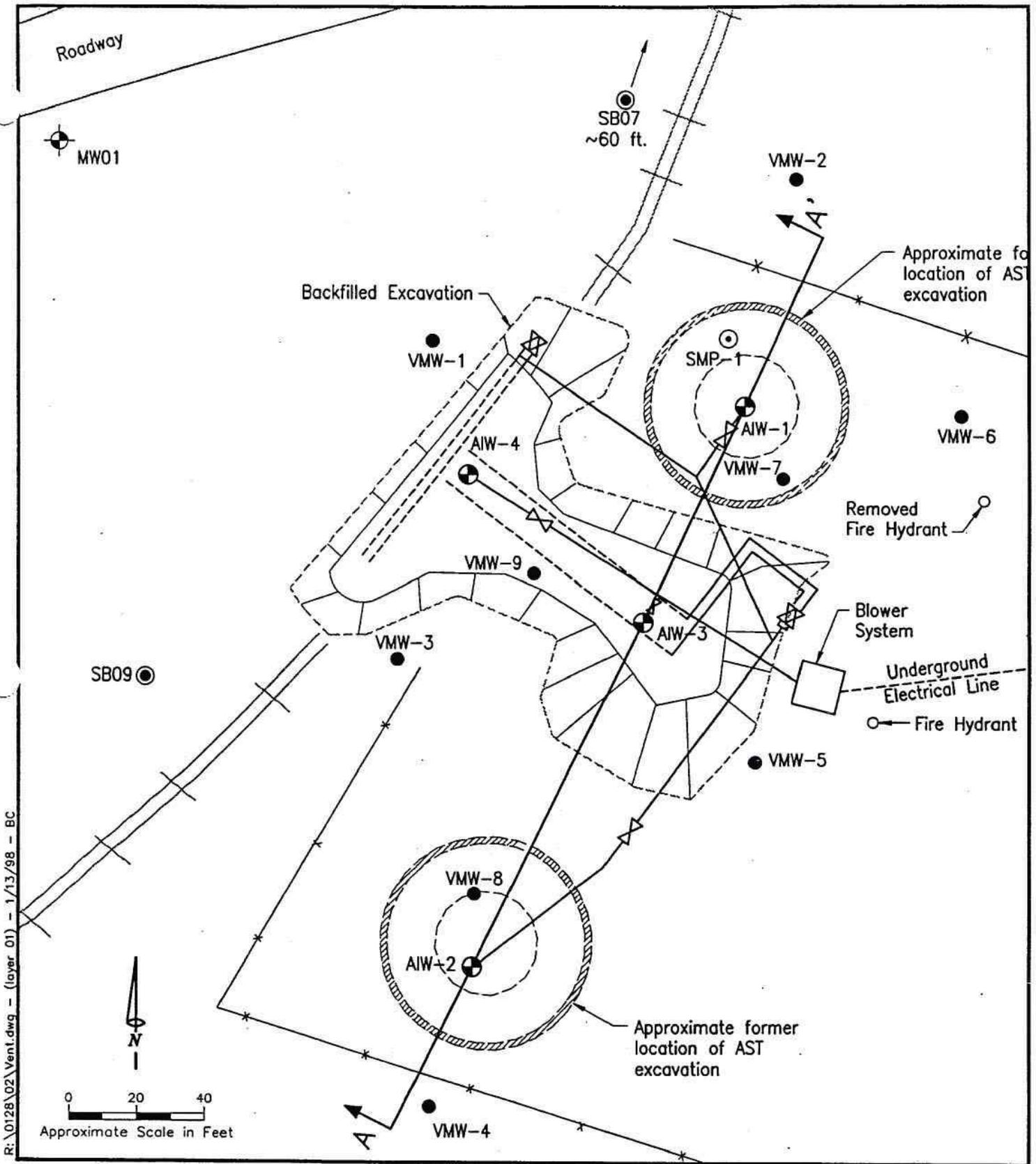
Note: Drawing Not to Scale

Passive Vapor Extraction Well System Design

Hawthorne Army Depot
Hawthorne, Nevada



FIGURE 1



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LEGEND	
	R.R. tracks
	Fence
	Underground PVC Line (slotted, 0.01 inch slots)
	Aboveground PVC Line
	Air Flow Control Valve
	Vapor Monitoring Well
	Air Injection Well
	Soil Moisture Monitoring Probe
	Monitoring Well
	Soil Boring Installed in 1994
	Cross Section (Figure 3-2)

Enhanced Bioremediation System Layout

**Hawthorne Army Depot
Hawthorne, Nevada**

Note: Only four of the eight total horizontal lines are shown.



FIGURE 2

8 inch Throat, Turbine
Galvanized Steel

Sch. 80 8-inch PVC
Stack Pipe, Painted
Yellow

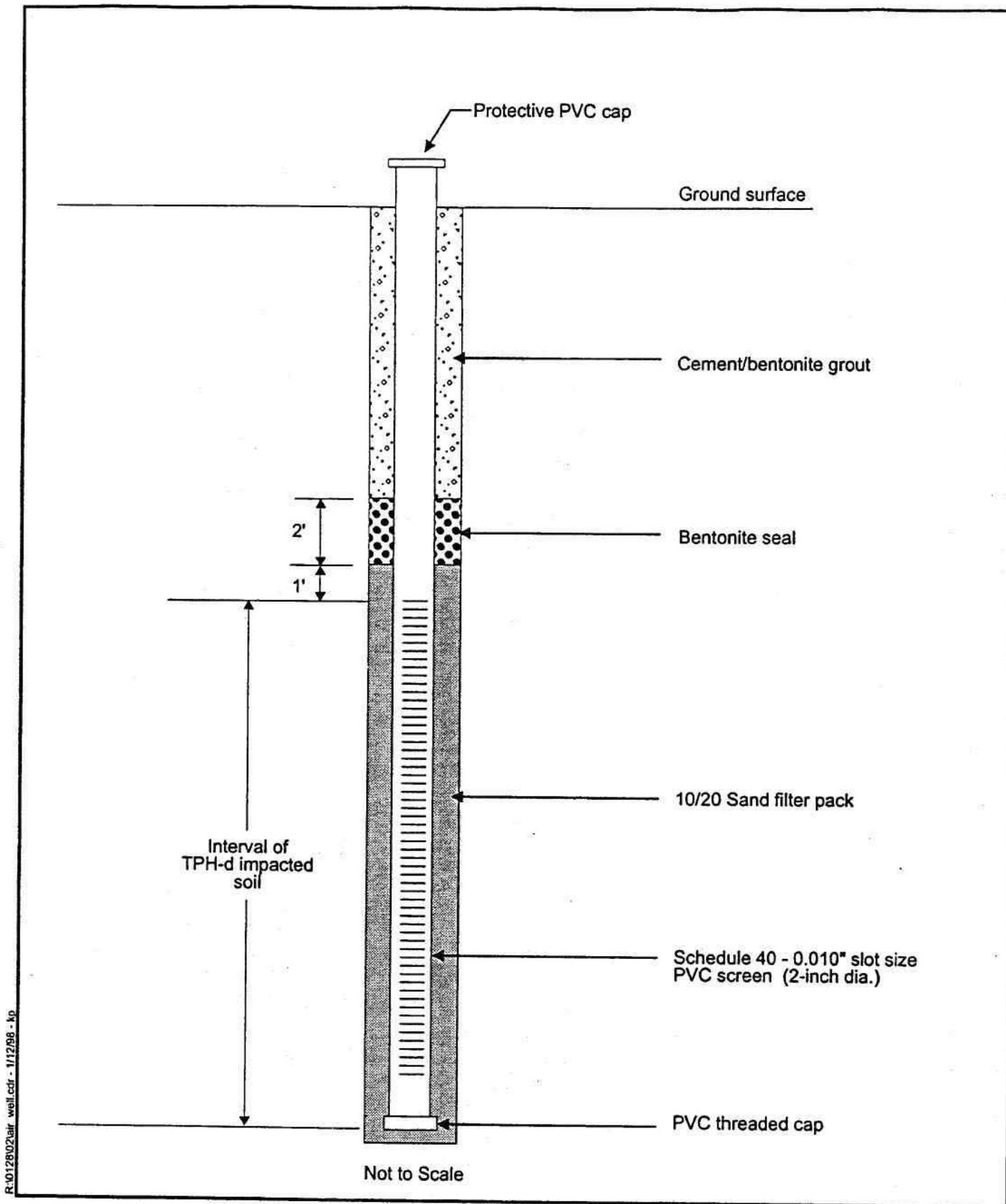
5 ft.

(2-foot diameter minimum)

1-inch diameter PVE piping for
horizontal system and 2-inch diameter
PCE piping when attached to vertical
well casing.

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Attic Turbine Wind Powered Bioventing System Design



R:012802air_well.cdr - 1/12/98 - kp

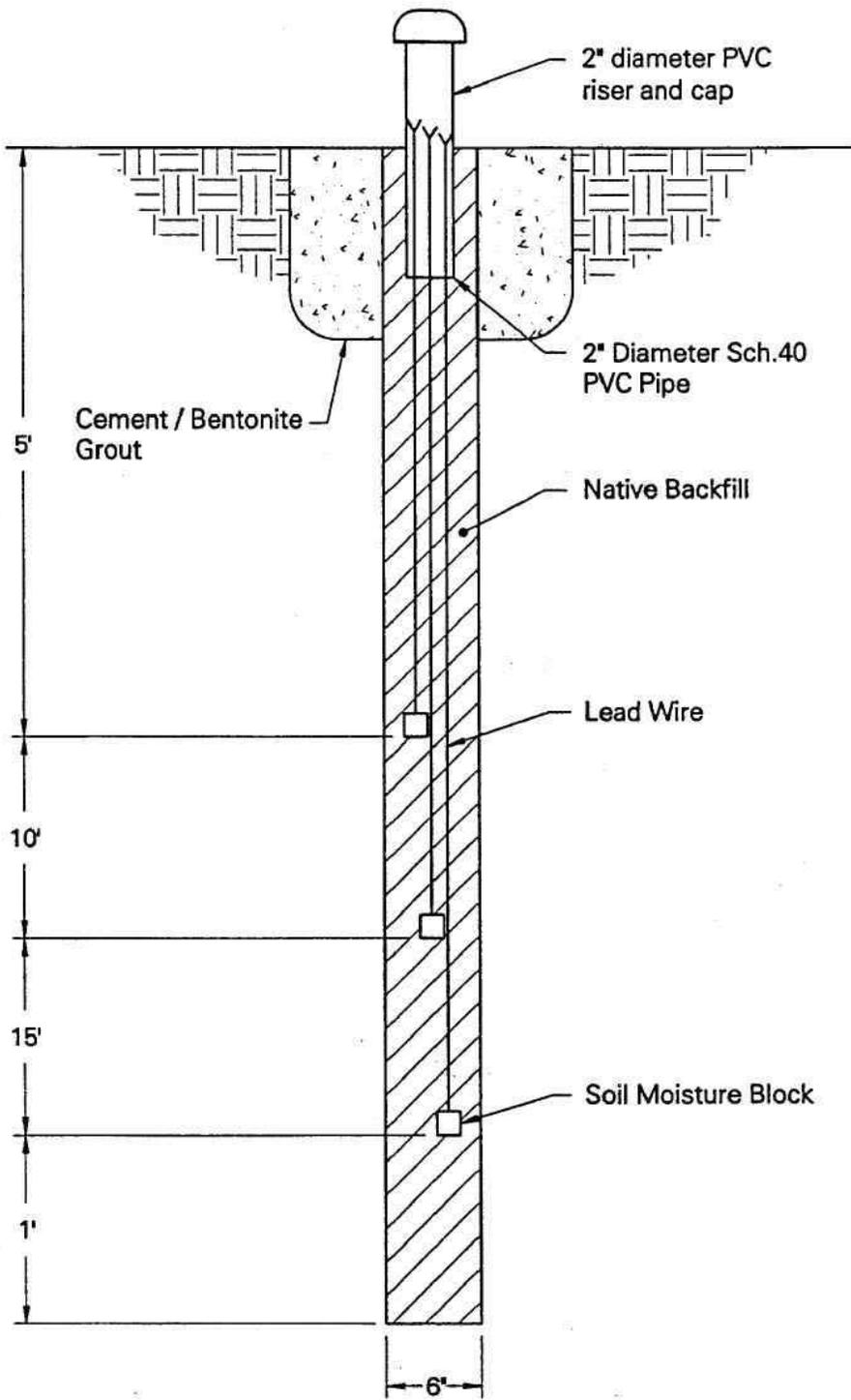
Note: Construction depths for each of the air injection wells vary.

Typical Air Injection Well Construction



Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 4



Not to Scale

Soil Moisture Probe Construction

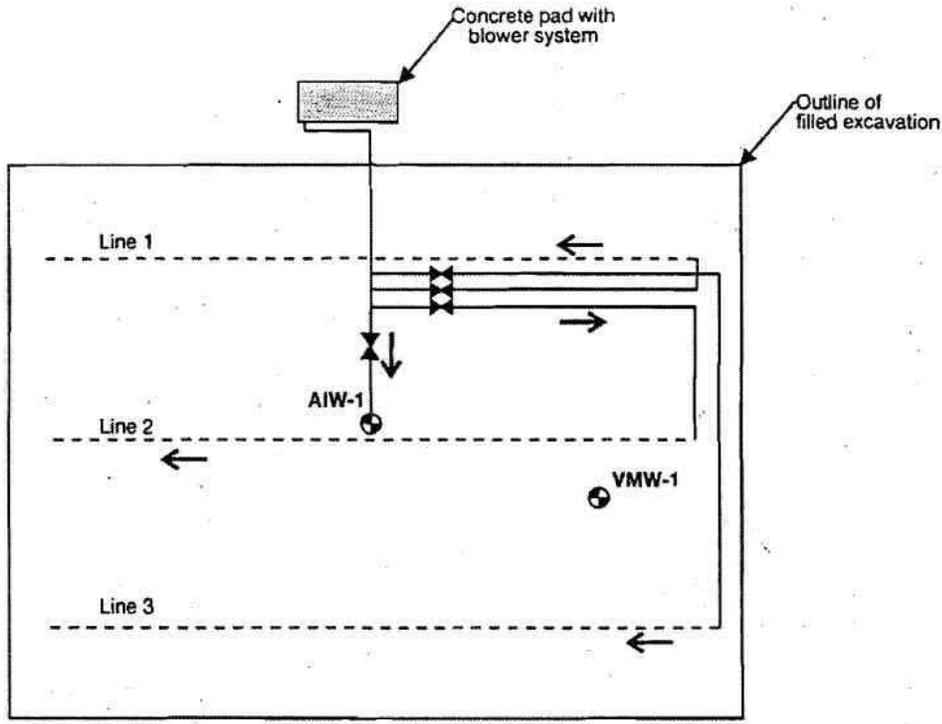
Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 6

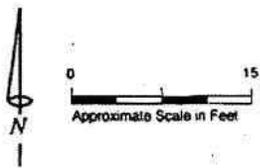
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Note: The background monitoring well (BMW-1) is located 212 feet north-northwest of AIW-1



Note: Surface of filled excavation was covered with plastic sheeting, and the sheeting was overlaid with six inches of clean soil.



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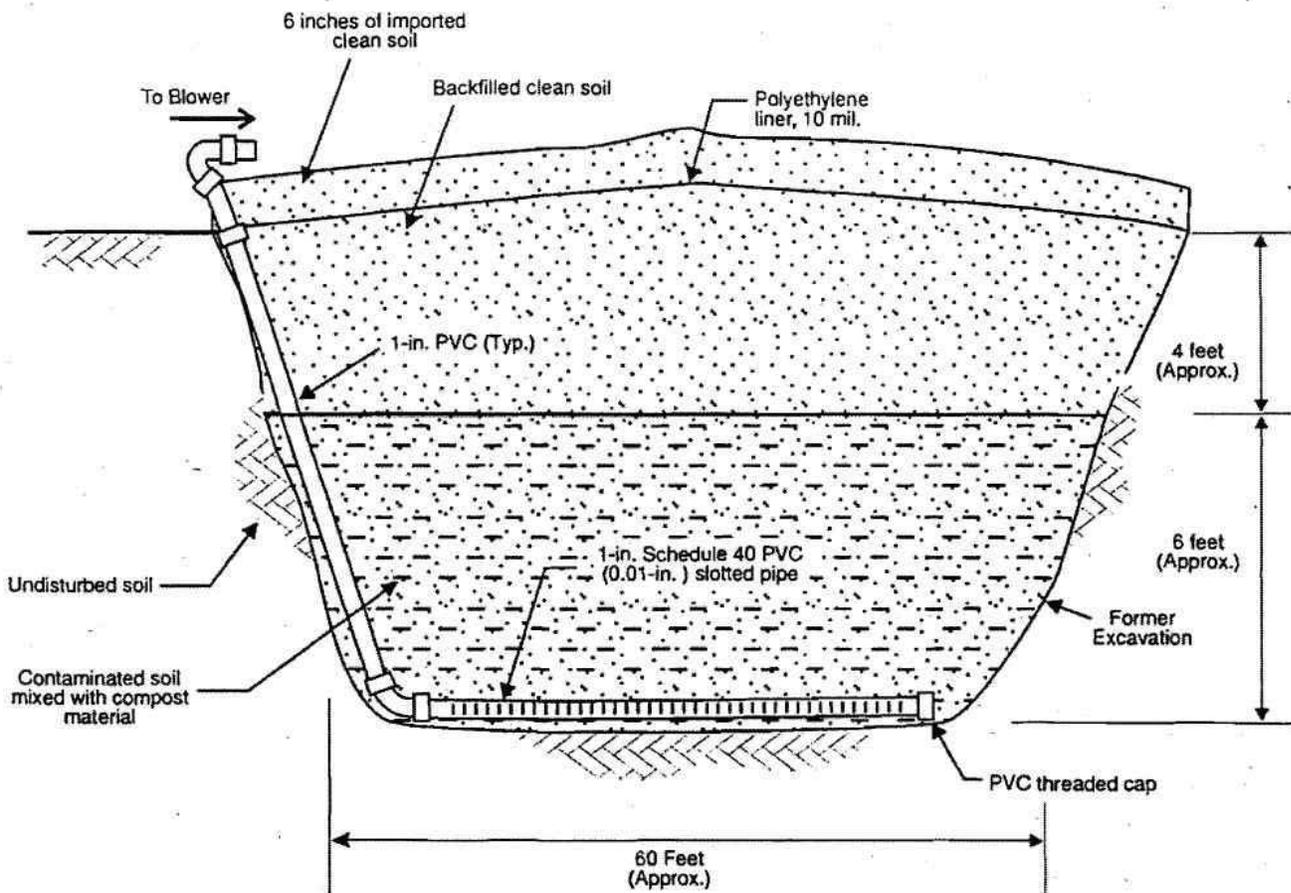
- Legend:**
- ⊕ AIW-1 Air injection well
 - ⊕ VMW-1 Vapor monitoring well
 - Air flow direction
 - - - - - Underground PVC line
 - Above ground PVC line
 - ⊘ Air flow control valve

Piping Layout of Enhanced Bioremediation System

Hawthorne Army Depot
Hawthorne, Nevada



FIGURE 7



Note: View is looking to the south.
Not to scale.

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Horizontal Enhanced Bioremediation System Schematic



Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 8

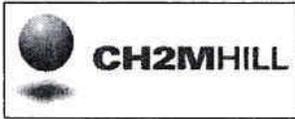
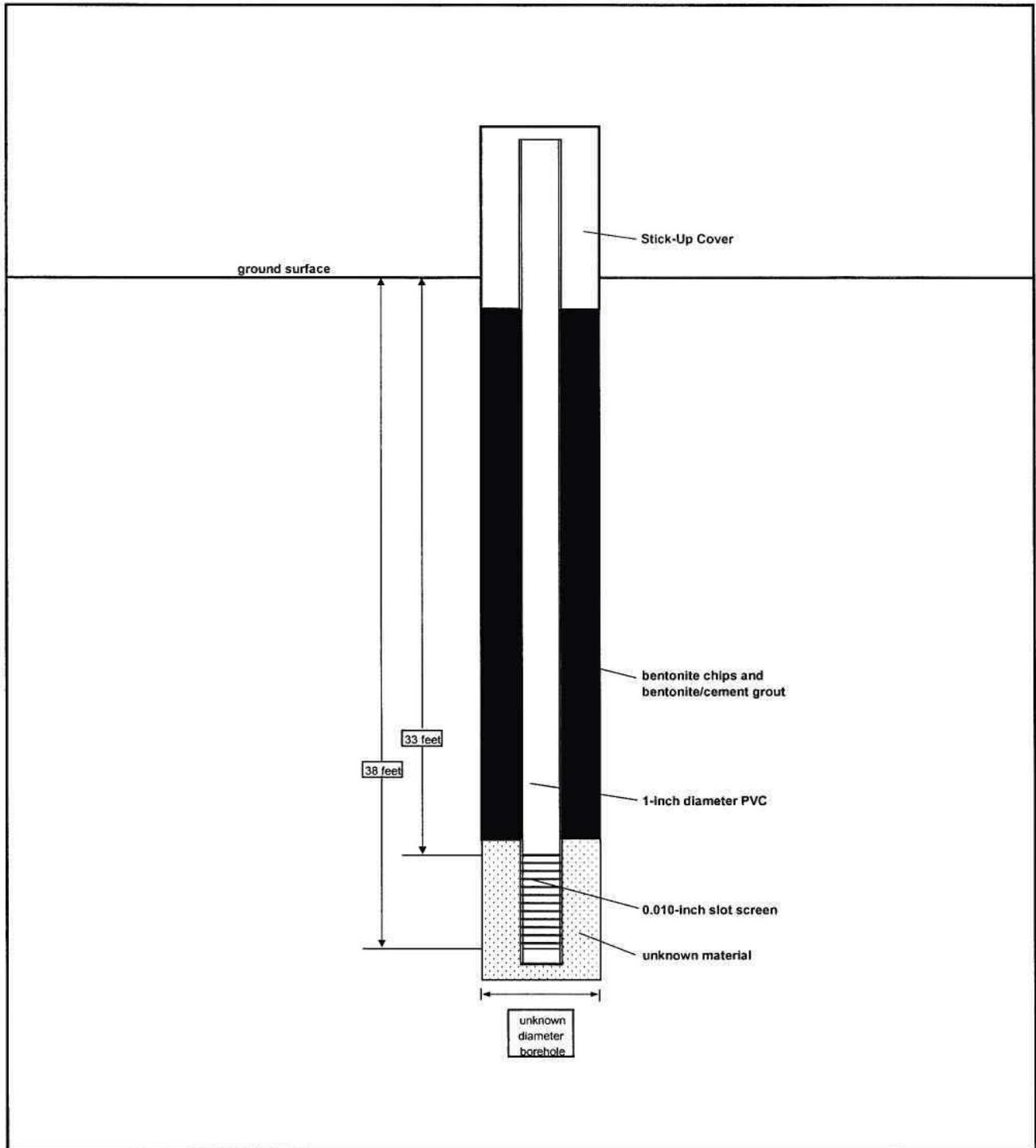


Figure 9 - Background Vadose Zone Monitoring Well

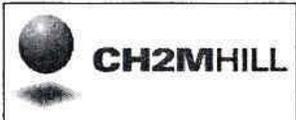
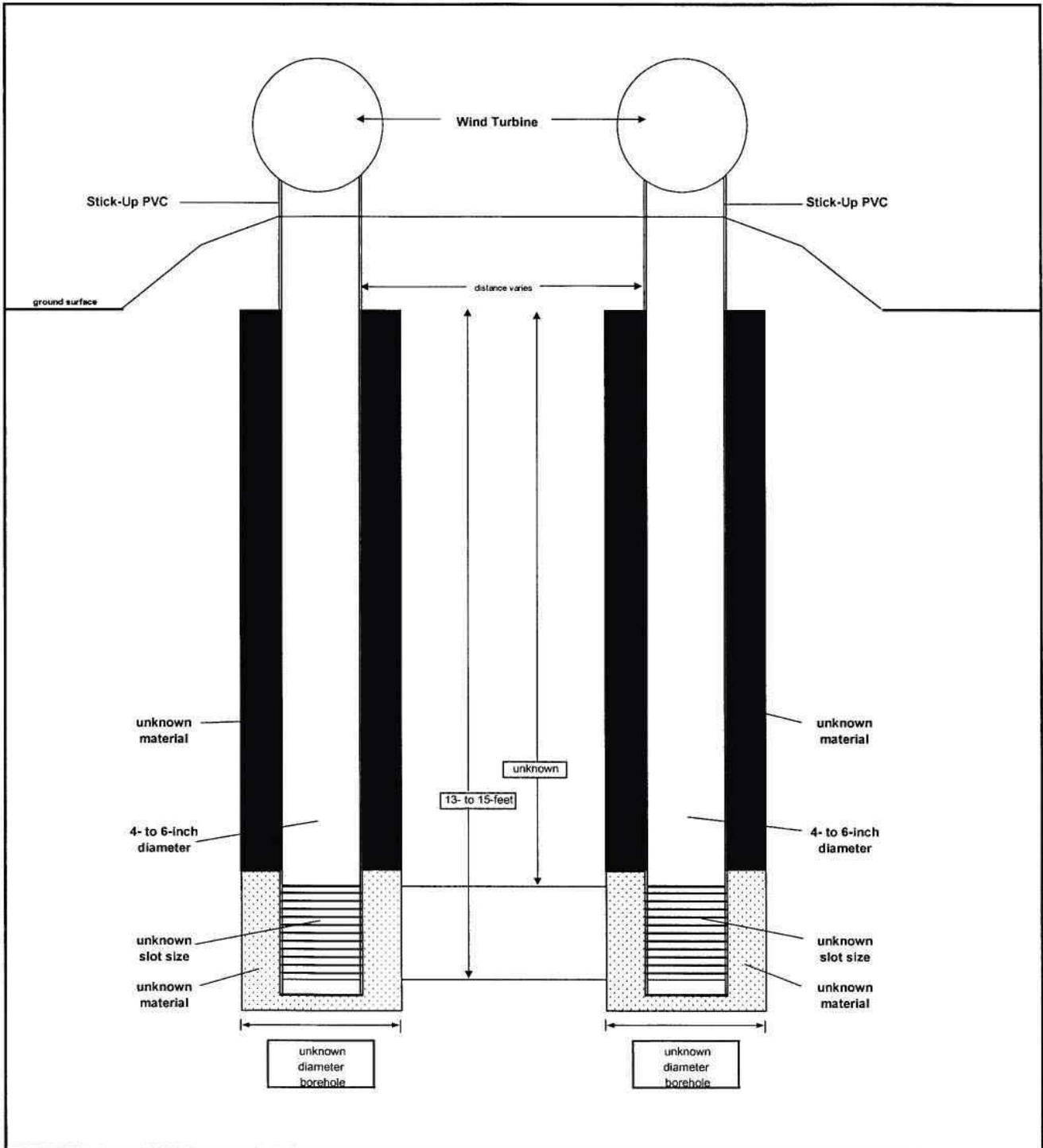


Figure 10 - Passive Bioventing System at SWMU K05