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Closure Report/Decision Document SWMU K03b

March 2011

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

MAR 30 2011

Date

Kirk L. Bausman
Deputy to the Commander
Hawthorne Army Depot

State of Nevada

April 21, 2011

Date

Jim Najima
Chief, Corrective Actions Bureau
Division of Environmental Protection

FINAL

Closure Report/Decision Document for SWMU K03b: Underground Storage Tank Site Hawthorne Army Depot Hawthorne, Nevada

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March 2011

Closure Decision Document
SWMU K03b: Underground Storage Tank Sites

Hawthorne Army Depot
Hawthorne, Nevada

March 2011

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Acronyms and Abbreviations

µg/kg	microgram per kilogram
µg/L	microgram per liter
AIW	air injection well
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMW	background monitoring well
CAP	Corrective Action Plan
FID	flame ionization detector
HWAAP	Hawthorne Army Ammunition Plant
HWAD	Hawthorne Army Depot
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mg/L	milligram per liter
NAC	Nevada Administrative Code
NAPL	nonaqueous phase liquid
NDEP	Nevada Division of Environmental Protection
NFA	No Further Action
PID	photoionization detector
PMP	Project Management Plan
ppmv	part per million by volume
PVC	polyvinyl chloride
RSL	Regional Screening Level
SSTL	site-specific target level
SVOC	semivolatile organic compounds
SWMU	Solid Waste Management Unit
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons-diesel
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

1.0 Introduction

This Closure Decision Document describes the rationale for the proposed closure of Solid Waste Management Unit (SWMU) Hawthorne Army Ammunition Plant (HWAAP) K03b, Underground Storage Tanks (USTs), hereafter referred to as SWMU K03b, at Hawthorne Army Depot (HWAD), Hawthorne, Nevada (Figure 1).

A Final Corrective Action Plan (CAP) was prepared for SWMUs K03a, K03b, and K03d (CH2M HILL, 2007), and approved by the Nevada Division of Environmental Protection (NDEP) on May 7, 2007 (NDEP, 2007). The Final CAP stated that the remedy was in place for SWMU K03b. The Final CAP recommended that additional site characterization be performed at SWMU K03b to confirm that only low levels of total petroleum hydrocarbons (TPH) exist at the SWMU and that the SWMU is ready for closure. As discussed in series of letters between NDEP and Plexus Scientific during May and June 2010, several modifications were made to the *Additional Site Characterization Work Plan for SWMU K03b* that was approved as part (Appendix E) of the *Final Corrective Action Plan for K03a, b, d: Underground Storage Tank Sites* dated April 2007 (CH2M HILL, 2007). These modifications were made following changes in NDEP regulations, specifically Nevada Administrative Code (NAC) 445A.22695 to 445A.2271, which took effect on August 25, 2009. The additional site characterization activities were completed in July and August 2010, and document that SWMU K03b is ready for closure with no further action (NFA).

The following paragraphs provide a brief overview of the site history, physical setting, investigation history, additional site characterization activities, and conclusions for SWMU K03b. For additional background information, refer to the Final CAP for SWMU K03b (CH2M HILL, 2007).

2.0 Site History

SWMU K03b is a former UST site at HWAD located northwest of Building 103-6, approximately 1 mile northeast of the HWAD main gate (Figure 1). Three 21,000-gallon USTs containing #2 diesel fuel were in operation at the site from 1942 to 1992 (Figure 2).

3.0 Physical Setting

SWMU K03b currently contains two large, abandoned aboveground storage tanks (ASTs) located on the northwest corner of the site, and a propane tank located at the northwest corner of Building 103-6. Various underground utility lines and vaults, including those associated with the bioventing system that was in operation at the site from 1998 through 2004, are located within the SWMU boundary.

According to the boring logs from the recent site characterization, included in Appendix A, soils to approximately 90 feet below ground surface (bgs) are predominantly sands with layers of silty sands, silty clays, and thin gravelly sand layers. Cross sections of SWMU K03b are provided on Figures 3 and 4.

No permanent groundwater quality monitoring wells are present at the site. As discussed below in Section 5.0, two temporary wells were installed during the additional site characterization activities conducted in July 2010. Based on measurements from these

temporary wells, the average depth to groundwater at SWMU K03b is 97.6 feet bgs, and the estimated regional groundwater flow direction is to the northwest. Water supply well #7, which is used for non-potable purposes (dust suppression), is located approximately 1 mile sidegradient of SWMU K03b (Tetra Tech, 2006). No surface water bodies exist at the site (Allied Technology Group, 1998).

4.0 Investigation History

Two USTs were removed from the site in 1991, and the third UST was removed in 1993. During removal activities, soil was excavated to approximately 15 feet bgs and stockpiled onsite. The general locations of the USTs are shown on Figure 2. A portion of the excavated soil (250 cubic yards) was later transported to SWMU J03 for treatment (Tetra Tech, 1996). During excavation activities, soil samples were collected from the base of the excavation and submitted for TPH-diesel (TPH-D) analysis (Allied Technology Group, 1998), although the report of the sampling results has not been located for review.

In 1993, according to the NDEP HWAD website, TPH-D was detected at 73,000 milligrams per kilogram (mg/kg) at 17 feet bgs (Allied Technology Group, 1998).

Based on the above sampling results, an enhanced bioventing system was installed in 1998 to accelerate the petroleum degradation process. The bioventing system included installation of air injection, vapor monitoring, and soil moisture probe wells. Injection wells were screened from 65 to 83 feet bgs and 35 to 53 feet bgs, and soil vapor monitoring wells were installed to 10, 25, and 55 feet bgs (Allied Technology Group, 1998). In addition, the open excavation was backfilled with clean soil.

During installation of the bioventing system, soil boreholes were logged and screened using a photoionization detector (PID). Boring logs included in the CAP indicated that the bulk of contamination, based on elevated PID readings, petroleum odors, and stained soil, was between 15 to 80 feet bgs. The highest PID result was 647 parts per million by volume (ppmv) at 40 feet bgs in air injection well (AIW) 103-6-3. A PID result of 44 ppmv was recorded at 80 feet bgs in soil collected at AIW 103-6-1, which terminated at 83 feet bgs.

Soil respiration tests were conducted in August 2001 to determine if the bioventing system was still effective. Oxygen utilization rates indicated that significant biological activity was occurring in the upper 25 feet of the soil (Plumb, 2001). The bioventing system was operational until 2004.

5.0 Additional Site Characterization Activities

As discussed in a letter to NDEP dated June 21, 2010, several modifications were made to the *Additional Site Characterization Work Plan for SWMU K03b* that was approved as part (Appendix E) of the *Final Corrective Action Plan for K03a, b, d: Underground Storage Tank Sites* dated April 2007 (CH2M HILL, 2007). These modifications were made following changes in NDEP regulations, specifically Nevada Administrative Code (NAC) 445A.22695 to 445A.2271, which took effect on August 25, 2009. The modifications to the Work Plan included the following:

- All soil samples were submitted for analysis of TPH-D. Soil samples collected from the 0-to-10-foot bgs interval were also submitted for volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs) analyses.
- Detected concentrations of VOCs and SVOCs (including fuel-related constituents) were used to assess the potential commercial/industrial worker exposure for the 0-to-10-foot bgs depth interval.
- Detected concentrations were compared to the current (2010) U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs), which will be the Tier 1 action levels.
- The Tier 2 fuel saturation values were applied to the entire soil column.
- The two groundwater monitoring wells were gauged for free product and sampled for VOCs and SVOCs.

Additional site characterization activities were performed at SWMU K03b from July 26 through July 31, 2010, and from August 23 through August 27, 2010, to confirm that SWMU K03b is ready for closure. The following activities were performed in accordance with the above-referenced Work Plan:

- Five borings (K03b-SB1, K03b-SB2, K03b-SB3, K03b-SB4, and K03b-SB5) were advanced using a rotosonic drill rig at the locations shown on Figure 2.
- Soil cores from the borings were field screened using a PID or flame ionization detector (FID).
- Borings K03b-SB2, K03b-SB3, and K03b-SB4 were terminated at a minimum of 10 feet beyond the last occurrence of contamination (96, 87, and 67 feet bgs, respectively) based on visual evidence of soil staining, petroleum odors, and PID/FID measurements.
- Borings K03b-SB1 and K03b-SB5 were advanced to the groundwater table and completed as temporary monitoring and gauging wells, MW-SB1 and MW-SB2, respectively. These temporary wells were completed by installing 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) well risers and 10-foot, flush-threaded, 10-slot PVC well screen sections. Boring K03b-SB1 (MW-SB1) was selected as a temporary well for monitoring in the former source area and boring K03b-SB5 (MW-SB2) was selected as a temporary well to monitor for hydrocarbons downgradient of the former source area.
- Soil samples from all borings were collected at least every 10 feet (based on PID and FID measurements, visual staining, and petroleum odors) for laboratory analysis. Some of the samples from the deeper depth intervals were held by the laboratory in the event that the sample was needed. However, if the sample from the interval above contained low TPH-D concentrations, then the sample from the lower depth interval was not analyzed. This occurred with samples collected from K-03b-SB2. The sample collected from 86-87 feet bgs contained very low TPH-D concentrations; therefore, although the boring was advanced to 96 feet bgs, no other samples were analyzed.
- Soil samples were submitted to TestAmerica, Inc. (formerly Severn Trent Laboratories, Inc.) in Denver, Colorado, for TPH-D, VOC, and SVOC analyses. In addition, when

enough soil remained after sample collection for TPH-D (all samples), VOC (only samples collected from 0-10 feet bgs), and SVOC (only samples from 0-10 feet bgs) analysis, the additional soil was collected for sieve analysis to determine the particle size. Based on their TPH-D analytical results, 16 of the samples were selected for sieve analysis.

6.0 Additional Site Characterization Results

6.1 Analytical Results - Soil

Soil samples collected from the five borings K03b-SB1 through K03b-SB5 exhibited visual staining and/or petroleum odors ranging from 14 to 75 feet bgs. Soil lithology and field screening results are summarized on the boring logs included in Appendix A. The soil borings and temporary monitoring wells will be surveyed during decommissioning activities.

Analytical results from the soil sampling are summarized on Table 1 and the laboratory and data validation reports are included in Appendix B. Based on the detected concentrations of TPH-D, a sieve analysis was performed using American Society for Testing and Materials [ASTM] Method D422 [2007] on 16 of the soil samples collected from 13 to 74 feet bgs from all of the borings to determine particle size. Particle-size results were used to select appropriate site-specific target levels (SSTLs).

Tier 2 SSTLs for soil samples collected deeper than 10 feet bgs are based on conservative fuel saturation values, which vary depending on particle size from 3,000 to 20,000 mg/kg. The methods and assumptions used to derive these SSTLs are provided in the Final CAP (CH2M HILL, 2007), which was approved by NDEP on May 7, 2007 (NDEP, 2007). If sample-specific particle-size information was not collected, then the sampling results for soil samples collected deeper than 10 feet bgs are compared against the appropriate SSTL concentration based upon the observed soil type according to the soil boring logs. Notes on Table 1 indicate whether the minimum SSTL is exceeded for samples deeper than 10 feet bgs without associated particle-size measurements.

TPH-D was detected in excess of the applicable Tier 2 SSTLs in samples collected from each boring. The highest TPH-D concentration (35,000 mg/kg) was found in a sample from boring K03b-SB3 at 52 to 53.5 feet bgs. The boring log indicates that this sample was collected from a zone of silt and, therefore, the appropriate Tier 2 SSTL of 20,000 mg/kg was used for comparison. The deepest TPH-D concentration (11,000 mg/kg) above the Tier 2 SSTL was found in boring K03b-SB3 at 68 to 70 feet bgs. The appropriate Tier 2 SSTL for this sample, which was classified as fine sand according to a sieve analysis, is 10,000 mg/kg. Below 70 feet in this boring, TPH-D was not detected. The TPH-D migration is limited by the increase in silt and clay content in soils from 60-74 feet bgs. Given that fuel has not been actively managed at this site for more than 17 years, there are no continuing sources to promote vertical migration. As shown on cross sections A-A′ and B-B′ (Figures 3 and 4), TPH-D concentrations are either below the detection limit or significantly less than the minimum SSTL of 3,000 mg/kg to the depth of the boreholes (a maximum depth of 107 feet bgs was reached for borings K03b-SB1 and K03b-SB5).

TPH-D detections from the 2010 sampling event are significantly lower at depths below 60 feet bgs, which is where a zone of lower permeability material was encountered according to the soil logs. A combination of bioventing and natural attenuation has clearly decreased TPH-D levels in soil, and reduced any risk of migration to groundwater.

The remaining TPH-D in the deep soil poses no risk to groundwater based on the chemical composition of the TPH-D. Although all soil samples collected from the 0-to-10-foot bgs interval were submitted for VOC and SVOC analysis, only the sample from boring K03b-SB1 from 9 to 10 feet bgs contained detected levels of any non-fuel-related VOCs or SVOCs. None of the samples collected from the 0-to-10-foot bgs interval contained detectable concentrations of fuel-related VOCs or SVOCs. The soil sample from K03b-SB1 from 9 to 10 feet bgs contained bis(2-ethylhexyl)phthalate (70 micrograms per kilogram [µg/kg]) and phenanthrene (18 µg/kg). A duplicate sample collected from this boring at the same depth interval contained no detections of non-fuel–related VOCs or SVOCs. These non-fuel-related VOCs and SVOCs were detected at concentrations significantly below USEPA RSLs. Additional discussion of these detections is provided in the Data Validation Report in Appendix B.

In summary, as shown on cross sections A-A′ and B-B′ (Figures 3 and 4), concentrations of TPH-D are below the applicable SSTLs based on grain size or the minimum SSTL of 3,000 mg/kg from 74 feet bgs to groundwater, at approximately 98 feet bgs. Vertical migration of any remaining fuel is unlikely given that the last of the three USTs, which were the source of contamination, was removed from the site more than 17 years ago. This is supported by the fact that groundwater at the site contains no TPH and no specific fuel-related compounds of concern.

6.2 Analytical Results - Groundwater

Monitoring wells MW-SB1 and MW-SB2 were gauged and, because nonaqueous phase liquid (NAPL) was not detected in either of the wells, both wells were sampled in August 2010 in conjunction with groundwater sampling activities for SWMU B24a. Groundwater samples were submitted for VOC and SVOC analysis. Analytical results and depth-to-water measurements are summarized in Table 2 and the laboratory and Data Validation Reports are included in Appendix B. Analytes detected in groundwater samples were compared to groundwater action levels. The groundwater action levels used are either the USEPA primary maximum contaminant level (MCL) for drinking water, or, if no MCL has been established, the USEPA RSLs for tap water (residential exposure scenario).

Two VOCs were detected in the sample from MW-SB1: 2-butanone (MEK) (21 micrograms per liter [µg/L]) and chloroform (0.76 J µg/L). These detections were orders of magnitude below groundwater action levels, and one of the detections was J flagged, indicating the concentrations were estimated. Four VOCs were detected in the sample from MW-SB2: chloroform (2.0 µg/L), cis-1,2-dichloroethene (0.43 J µg/L), dibromomethane (0.3 J µg/L), and trichloroethene (0.16 J µg/L). Similar to MW-SB1, all detections are orders of magnitude below groundwater action levels, and all but one detection (chloroform) are J flagged, indicating the concentrations are estimates.

There were no SVOCs detected in the sample collected at MW-SB1. Two SVOCs were detected in the sample collected at MW-SB2: phenol (2.6 J milligrams per liter [mg/L]) and 3

& 4 methylphenol (5.9 J mg/L). All detections of SVOCs are estimated values and fall well below the groundwater action levels.

No petroleum compounds were detected in the groundwater samples collected from SWMU K03b.

7.0 Conclusions

In summary, site closure is recommended based on the sampling results and the following observations:

- As shown on cross sections A-A′ and B-B′ (Figures 3 and 4), concentrations of TPH-D are below applicable SSTLs based on grain size from 74 feet bgs to groundwater, at approximately 98 feet bgs.
- The lack of additional vertical migration is supported by the absence of VOCs, SVOCs, or TPH residuals in the groundwater.
- Vertical migration of any remaining fuel is unlikely given that the last of the three USTs, which were the source of contamination, was removed from the site more than 17 years ago.

Based on historical and additional site characterization data, closure of SWMU K03b is recommended. Accelerated approval to close SWMU K03b is requested due to the limited time the site will be accessible. The site is currently inaccessible due to a new munitions safety arc, which could be lifted temporarily for the site in order to complete the decommissioning activities. Closure is requested following NAC 459.9973(1) guidelines, under which the following issues were addressed:

a. Depth of groundwater: Average 97.6 feet bgs.

b. Distance to irrigation or drinking water wells: Water supply well #7, which is used for non-potable purposes (dust suppression), is located approximately 1 mile sidegradient from SWMU K03b.

c. Type of contaminated soil: Medium-to-fine sand, silty sand.

d. Annual precipitation: 4.6 inches (evapotranspiration potential is 45 inches per year (USAEHA, 1988).

e. Type of waste/substance released: Diesel fuel.

f. Extent of contamination: In July 2010, additional soil sampling was performed at five borings, and groundwater samples were collected from two temporary monitoring wells. Concentrations of TPH-D are below the applicable SSTLs based on grain size or the minimum SSTL of 3,000 mg/kg from 74 feet bgs to groundwater, at approximately 98 feet bgs. Vertical migration of any remaining fuel is unlikely given that the last of the three USTs, which were the source of contamination, was removed from the site more than 17 years ago. This is supported by the fact that groundwater at the site contains no TPH and no specific fuel-related compounds of concern. In addition, TPH-D detections are significantly lower at depths below 60 feet bgs, which is where a zone of lower permeability material was encountered during the recent site characterization activities

and presented in the soil boring logs. A combination of bioventing and natural attenuation has clearly decreased TPH-D levels in soil and reduced any risk of migration to groundwater.

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 the conclusions of this Closure Decision Document.

h. Preferred routes of migration: Downward migration of fuel in soil into groundwater and lateral movement in groundwater. However, given that the fuel source was removed 17 years ago, vertical migration to the groundwater table is limited. In addition, due to the drop in the groundwater table associated with the decreasing levels of Walker Lake, the depth to groundwater, and the dry conditions (4.6 inches per year precipitation and evapotranspiration potential of 45 inches per year), further migration of contamination in the soil column and in groundwater beyond the SWMU K03b boundaries is likely insignificant.

i. Structures and impediments: Abandoned ASTs are located nearby, outside of the previous excavation area. Underground utility lines and vaults are present in addition to bioventing system equipment. Building 103-6 is located nearby (southeast corner).

j. Potential fire, vapor, or explosion: None.

k. Other factors: In 1998, an enhanced bioventing system was installed at the site, but has since been shut down. No product has been observed at the water table.

An evaluation of the NAC 459 site assessment factors indicates that SWMU K03b does not require additional corrective action. Therefore, closure is recommended for this site.

8.0 Decommissioning Activities

Decommissioning activities at SWMU K03b were performed January 4-6, 2011, and included the abandonment of five air injection wells, two soil vapor monitoring probes, two soil moisture probes, two temporary groundwater monitoring wells, approximately 200 feet of subsurface horizontal air injection line, approximately 85 feet of subsurface horizontal water line, the removal of the 2-inch-diameter surface conveyance piping, and the dismantling of the treatment system components and concrete pad. Decommissioning activities were performed by WDC Exploration in accordance with the Well Decommissioning Variance Letter approved by the Division of Water Resources in September 2008 (Appendix C). Walker Lake Disposal, Inc., Mineral County, Nevada, was subcontracted to transport and dispose of all debris generated during decommissioning activities. The soil borings and temporary monitoring wells were also surveyed during decommissioning activities. The survey data are summarized in Table 3.

The grout-in-place abandonment method was used to abandon the five air injection wells (AIW-103-6-1, AIW-103-6-2, AIW-103-6-3, AIW-103-6-4, and AIW-103-6-5) and the two temporary groundwater monitoring wells (MW-SB1 and MW-SB2). 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 bentonite mixture through the tremie pipe to the bottom of the well. The tremie pipe 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, the backhoe was used to excavate/remove the concrete pads, well vaults, and well casings (to at least 5 feet bgs) on the temporary groundwater monitoring wells and (to at least 1 foot bgs) on the air injection wells, the two vapor monitoring probes, and the two soil moisture probes. Once the surface completions were removed, the top of the remaining well casings were capped with concrete and backfilled with surrounding clean soil. Photographs of SWMU K03b before and after the decommissioning activities were completed are included in Figure 5.

The grout-in-place method was used to abandon the approximately 200 feet of subsurface horizontal air injection lines connecting the air injection wells to the treatment system and the approximately 85 feet of subsurface horizontal water line connecting the treatment system to Building 103-6. The grout-in-place method was performed by using a fitting to connect the grout hose to the end of the piping and pumping a volume of bentonite grout into the line based on the approximate length and diameter of the piping. Following grout placement within the piping, the backhoe was used to excavate/remove the exposed end of the pipe and the resulting excavation was backfilled with surrounding clean soil. The concrete pad (treatment system foundation) was broken into manageable pieces using the backhoe bucket and placed into the debris roll-off. Following the completion of decommissioning activities at SWMU K03b, the backhoe was used to grade the site to match the surrounding area.

Prior to the start of treatment system dismantling activities at SWMU K03b, all electric power to the system was shut off and the electric cable was severed and capped. The treatment system was dismantled by first unbolting the blower assembly from the concrete pad and then cutting and removing the PVC conveyance piping connecting the blower to the air stripper. The backhoe was then used to remove the plastic shed housing, the treatment system, the remaining treatment system components, and the 2-inch-diameter surface conveyance piping, for placement into the debris roll-off container.

The debris generated during decommissioning activities at SWMU K03b (PVC pipe, concrete, rubber hoses, and plastic) was placed into a 20-cubic-yard roll-off container. Upon completion of the decommissioning activities at SWMU K03b, the debris roll-off container was transported by truck to the City of Fallon construction-debris landfill for disposal, where the metal debris was segregated and transported by truck to a local metal recycler.

Based on the above-described decommissioning activities conducted at SWMU K03b and in addition to the request for closure, Response Complete is requested for this site.

9.0 References

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Tables

Table 1
Additional Site Characterization Soil Sampling Results, Detected Constituents July 2010
Closure Report, SWMU K03b, Underground Storage Tank Site, Hawthorne Army Depot, Nevada

Boring	Depth (feet bgs)	Collection Date	Particle Size, D50 (mm)	Soil Type Based on Particle Size[c]	TPH-Diesel (mg/kg)	Tier 2 SSTL TPH-Diesel[a,b] (mg/kg)	TPH-Diesel Concentration > Tier 2 SSTL?	Notes for TPH-Diesel	VOC (µg/kg)	SVOC (µg/kg)
SB-1	9-10	July 30, 2010	--	*Fill*	43	3,000[b]	No	< min. SSTL	bis(2-ethylhexyl)phthalate (70 J) phenanthrene (18 J)	ND
SB-1	9-10 (Dup)	July 30, 2010	--	*Fill*	NA	3,000[b]	NA	NA	ND	ND
SB-1	14-15	July 30, 2010	--	*Silt*	**26,000**	20,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-1	25-27	July 30, 2010	--	*Silt*	3,600	20,000[a]	No	< min. SSTL	NS	NS
SB-1	33.5-35	July 30, 2010	0.26	Fine sand	**24,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-1	39-41	July 30, 2010	--	*Fine-to-coarse sand*	**9,600**	3,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-1	48-50	July 30, 2010	0.52	Medium sand	**7,400**	5,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-1	56-57	July 30, 2010	0.05	Silts/clays	8,900	20,000[a]	No	< min. SSTL	NS	NS
SB-1	61-63	July 30, 2010	--	*Sandy clay*	6,000	20,000[a]	No	< min. SSTL	NS	NS
SB-1	70-72	July 30, 2010	--	*Sandy clay*	3,800	20,000[a]	No	< min. SSTL	NS	NS
SB-1	83-85	July 30, 2010	--	*Silty fine sand*	4.6	10,000[a]	No	< min. SSTL	NS	NS
SB-1	94-95	July 30, 2010	--	*Medium sand*	0.92 J	5,000[a]	No	< min. SSTL	NS	NS
SB-2	9-10	July 26, 2010	--	*Fill*	1.6 J	3,000[b]	No	< min. SSTL	ND	ND
SB-2	14-16	July 26, 2010	0.55	Medium sand	**10,000**	5,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-2	25-27	July 27, 2010	0.12	Fine sand	**12,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-2	25-27 (Dup)	July 27, 2010	--	*Fine sand*	10,000	10,000[a]	No	< min. SSTL	NS	NS
SB-2	35-37	July 27, 2010	--	*Fine sand*	6,200	10,000[a]	No	< min. SSTL	NS	NS
SB-2	40-42	July 27, 2010	0.32	Fine sand	9,200	10,000[a]	No	< min. SSTL	NS	NS
SB-2	56-57	July 27, 2010	--	*Silty fine sand*	6,800	10,000[a]	No	< min. SSTL	NS	NS
SB-2	65-67	July 27, 2010	0.31	Fine sand	7,800	10,000[a]	No	< min. SSTL	NS	NS
SB-2	73-74	July 27, 2010	0.19	Fine sand	9,000	10,000[a]	No	< min. SSTL	NS	NS
SB-2	86-87	July 27, 2010	--	*Fine sand*	7.9	10,000[a]	No	< min. SSTL	NS	NS
SB-3	8-10	July 30, 2010	--	*Fill*	1,400	3,000[b]	No	< min. SSTL	ND	ND
SB-3	13-15	July 30, 2010	0.30	Fine sand	**31,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	25-27	July 30, 2010	--	*Fine silty sand*	7,500	10,000[a]	No	< min. SSTL	NS	NS
SB-3	30-32	July 30, 2010	0.18	Fine sand	**16,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	30-32(Dup)	July 30, 2010	--	*Fine sand*	**17,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	39-41	July 30, 2010	--	*Fine sand*	7,500	10,000[a]	No	< min. SSTL	NS	NS
SB-3	52-53.5	July 30, 2010	--	*Silt*	**35,000**	20,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	58-60	July 30, 2010	0.15	Fine sand	**18,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	68-70	July 30, 2010	0.18	Fine sand	**11,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-3	85-87	July 30, 2010		*Fine sand*	2.1 J	10,000[a]	No	< min. SSTL	NS	NS
SB-4	9-10	July 29, 2010	--	*Fill*	1.3 J	3,000[b]	No	< min. SSTL	ND	ND
SB-4	15-17	July 29, 2010	--	*Silty clay*	2,600	20,000[a]	No	< min. SSTL	NS	NS
SB-4	25.5-27	July 29, 2010	--	*Fine sand*	**11,000 J**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-4	31.5-33	July 29, 2010	0.17	Fine sand	**16,000 J**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-4	45-47	July 29, 2010	0.43	Fine sand	**20,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-4	45-47Dup	July 29, 2010	--	*Fine sand*	**20,000**	10,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-4	56.5-57	July 29, 2010	--	*Silty clay*	3,400	20,000[a]	No	< min. SSTL	NS	NS

Table 1
Additional Site Characterization Soil Sampling Results, Detected Constituents July 2010
Closure Report, SWMU K03b, Underground Storage Tank Site, Hawthorne Army Depot, Nevada

Boring	Depth (feet bgs)	Collection Date	Particle Size, D50 (mm)	Soil Type Based on Particle Size[c]	TPH-Diesel (mg/kg)	Tier 2 SSTL TPH-Diesel[a,b] (mg/kg)	TPH-Diesel Concentration > Tier 2 SSTL?	Notes for TPH-Diesel	VOC (µg/kg)	SVOC (µg/kg)
SB-4	64-66	July 29, 2010	--	*Fine-to-medium sand*	15	5,000[a]	No	< min. SSTL	NS	NS
SB-5	6-7	July 28, 2010	--	*Fill*	ND	3,000[b]	No (ND)	< min. SSTL (ND)	ND	ND
SB-5	16-17	July 28, 2010	--	*Silty clay*	1.2 J	20,000[a]	No	< min. SSTL	NS	NS
SB-5	32.5-34	July 28, 2010	--	*Sandy/silty clay*	7,800	20,000[a]	No	< min. SSTL	NS	NS
SB-5	40-42	July 28, 2010	--	*Silty sand*	1,600	10,000[a]	No	< min. SSTL	NS	NS
SB-5	54-56	July 28, 2010	0.94	Medium sand	**12,000**	5,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-5	54-56 (Dup)	July 28, 2010	--	*Medium sand*	**20,000**	5,000[a]	**Yes**	**> min. SSTL**	NS	NS
SB-5	65-67	July 28, 2010	--	*Medium sand*	95	5,000[a]	No	< min. SSTL	NS	NS
SB-5	74-76	July 28, 2010	--	*Medium sand*	26	5,000[a]	No	< min. SSTL	NS	NS
SB-5	85-87	July 28, 2010	--	*Fine-to-coarse sand*	4.9	3,000[a]	No	< min. SSTL	NS	NS
SB-5	94-95.5	July 28, 2010	--	*Fine-to-medium sand*	0.95 J	3,000[a]	No	< min. SSTL	NS	NS

Notes:

[a]SSTL: Tier 2 Site-Specific Target Level. SSTLs for soil samples collected deeper than 10 feet bgs are based on conservative fuel saturation values, which vary depending on particle size (CH2M HILL, 2007).

[b]SSTLs for soil samples collected at 10 feet bgs or shallower are compared against the minimum SSTL based on soil saturation values.
The minimum SSTLs based on soil saturation values are TPH-diesel, 3,000 mg/kg;

[c] The italicized soil types are based on soil boring logs and not particle size because sieve analysis was not performed on samples from that interval.

(Dup): duplicate sample.
D50: Median soil particle size
-- : Particle-size data are not available for this sample; therefore, the comparisons to the SSTL were not conducted.
< or ND : Not detected above the reporting limit.
J: Estimated value between the laboratory reporting limit and the method detection limit.
mm: millimeter
bgs: below ground surface
mg/kg: milligram per kilogram
µg/kg: microgram per kilogram
Bold: Detection above SSTL
min.: minimum
NS: not sampled

Table 2
Additional Site Characterization Groundwater Sampling Results, Detected Constituents, August 2010
Closure Report, SWMU K03b, Underground Storage Tank Site, Hawthorne Army Depot, Nevada

Monitoring Well	Sample Date	Northing	Easting	Top of Casing Elevation	Depth to Water[a] (ft bgs)	Depth to Free Product[a] (ft bgs)	Free Product Thickness (ft)	Groundwater Elevation (ft msl)	Adjusted Groundwater Elevationb (ft msl)	VOCs (µg/L)			SVOCs (µg/L)		
										Analyte	Concentration (µg/L)	Groundwater Action Level[b] (µg/L)	Analyte	Concentration (µg/L)	Groundwater Action Level[b] (µg/L)
MW-SB1	8/25/2010	1389509.918	490520.736	4133.55	96.84	NE	NE	4036.71	4036.71	2-Butanone (MEK)	21	6,968	no SVOCs detected		
										Chloroform	0.77 J	80			
MW-SB2	8/25/2010	1389538.662	490519.703	4133.206	98.30	NE	NE	4034.91	4034.91	Chloroform	2	80	Phenol	2.6 J	10,950
(soil boring K03b-SB5)										Cis-1,2-dichloroethene	0.43 J	70	3 & 4 Methylphenol	5.9 J	37[c]
										Dibromomethane	0.3 J	8.2			
										Trichloroethene	0.16 J	5.00			

Notes:
[a] Depths to free product and groundwater are measured with an interface probe capable of measuring to the nearest 0.01 foot.
[b]The reference used to determine Groundwater Action Levels is the U.S. Environmental Protection Agency (USEPA), 2010. "Regional Screening Levels." http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_tableGeneric_Tablespdf/composite_sl_table_run_MAY2010.pdf.
[c]3,4-dimethylphenol was used as a surrogate
NE: Not encountered
bgs: below ground surface
J: estimated value
µg/L: micrograms per liter

Table 3
Soil Boring and Temporary Monitoring Well Survey Data
Closure Report, SWMU K03b, Underground Storage Tank Site, Hawthorne Army Depot, Nevada

Boring	Northing	Easting	Elevation
K03b-SB1 (also MW01)	1389509.918	490520.736	4133.55
K03b-SB2	1389503.663	490528.58	4133.641
K03b-SB3	1389476.814	490537.252	4133.678
K03b-SB4	1389493.646	490547.22	4134.092
K03b-SB5 (also MW02)	1389538.662	490519.703	4133.206

Figures

Legend:

- Water Supply Well
- Regional Groundwater Flow Direction (Draft Annual 2005 Groundwater Monitoring Report, Tetra Tech, 2005)

FIGURE 1
SITE LOCATION
CLOSURE REPORT, SWMU K03b
HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

CH2MHILL

DEN/ES112006001/Figure1-1_K03d.ai_Rev2/4-2008

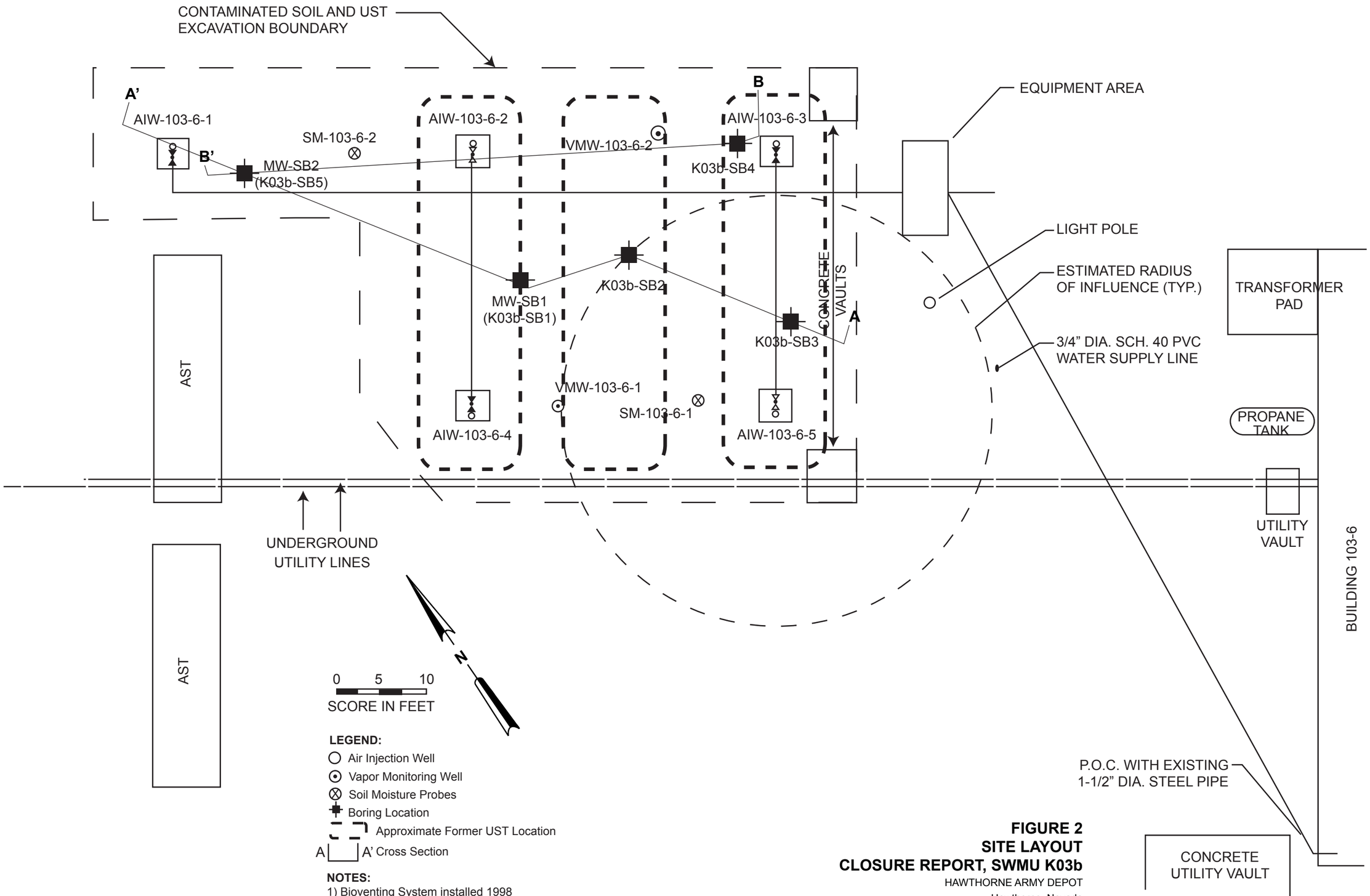
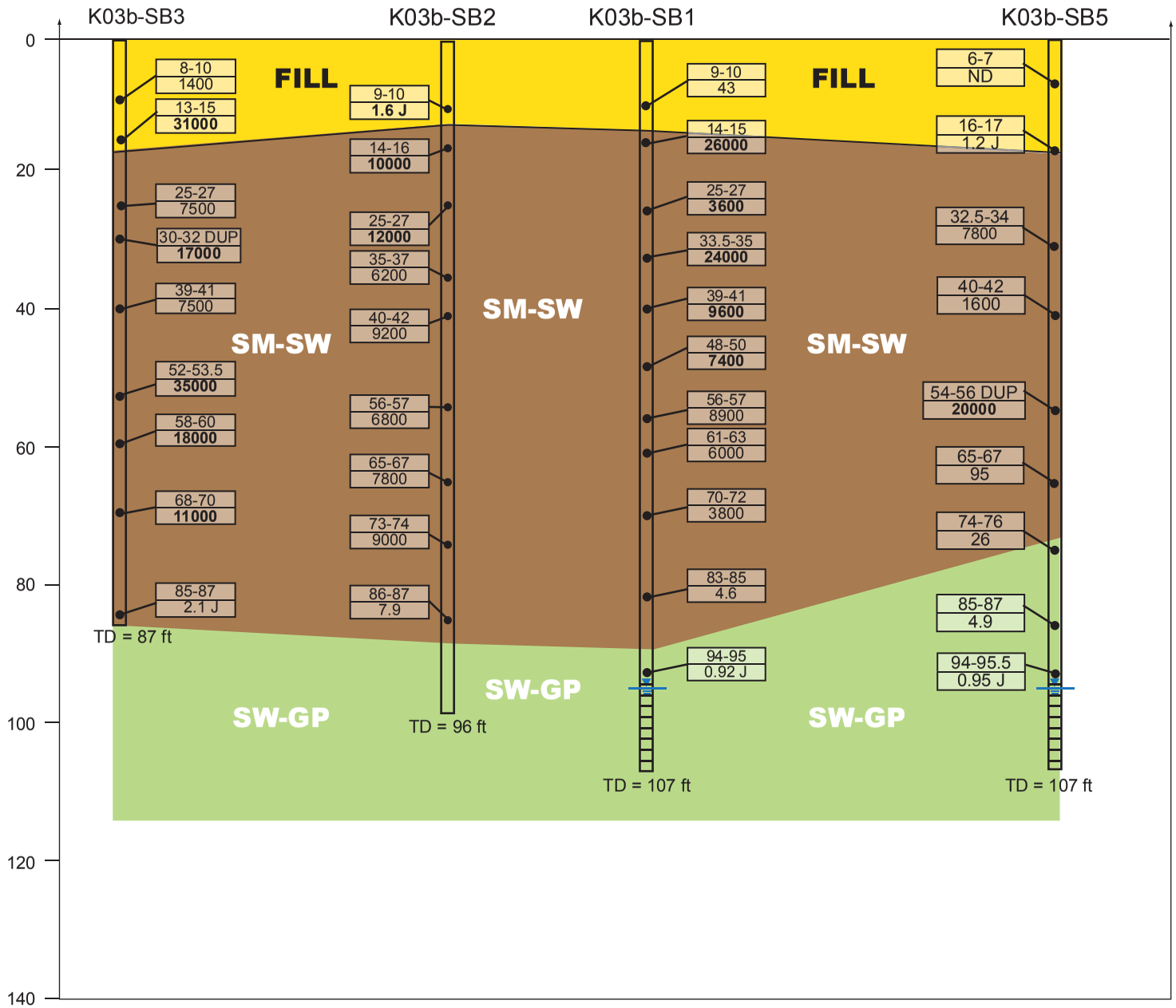


FIGURE 2
SITE LAYOUT
CLOSURE REPORT, SWMU K03b
HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

CH2MHILL

350552_Hawthorne_Figure_3-2_Sitelayout_SWMU_K03b



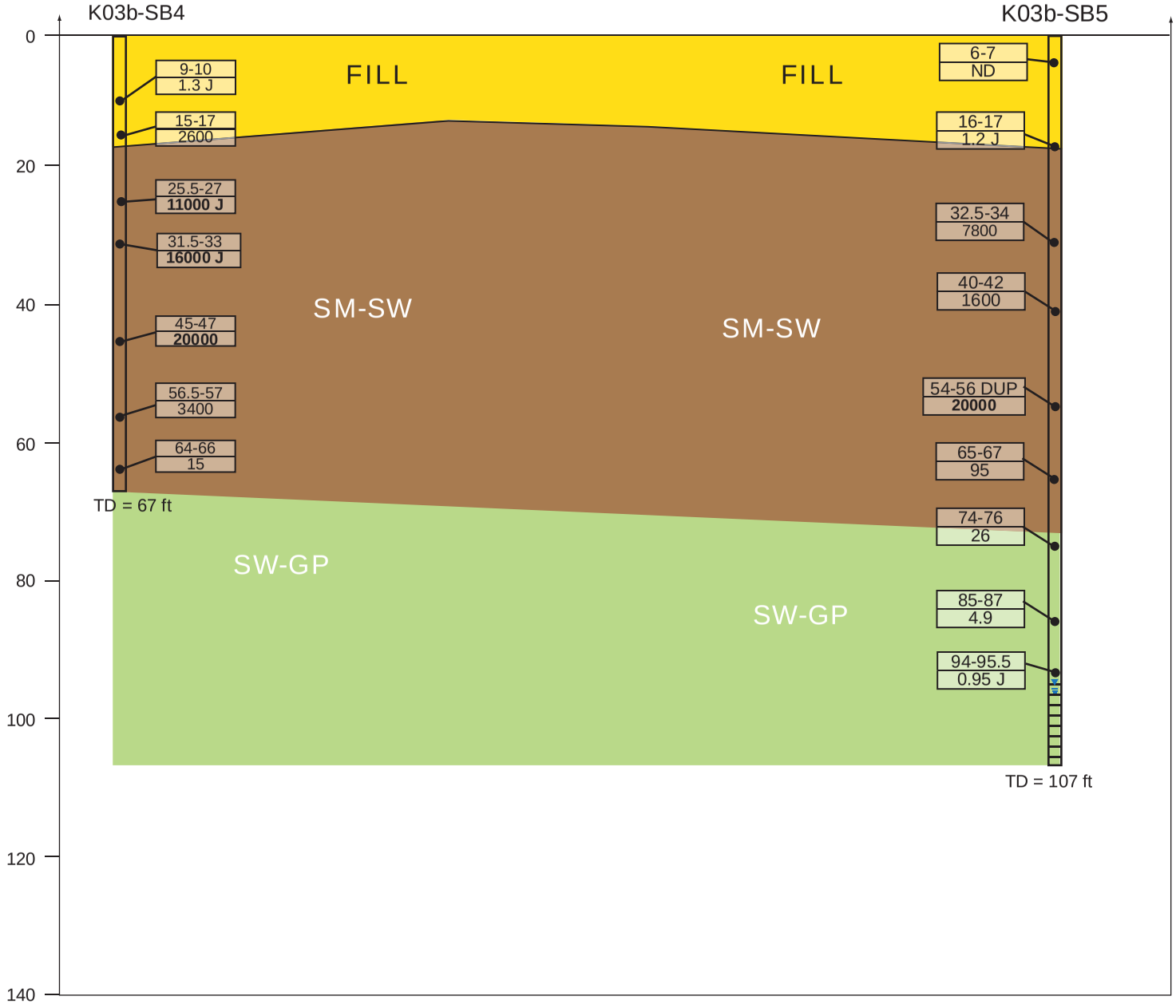
LEGEND

Depth (ft bgs.)

24-25
3000 — TPH-Diesel (mg/kg)

J	=	Estimated value
	=	Approximate water table
Fill	=	Reworked sand and gravel with construction debris
SM-GW	=	Silty sand and sand/gravel mixtures with trace interbedded silts and clays
SW-GP	=	Sand and gravel mixture
		Well screen - includes filter pack
TD	=	Total Depth
DUP	=	Duplicate
Bold	=	Exceedance of SSTL
ND	=	Not detected

FIGURE 3
CROSS SECTION A-A'
CLOSURE REPORT
SWMU K03b
Hawthorne Army Depot
Hawthorne, NV



LEGEND

Depth (ft bgs.)

24-25
3000 — TPH-Diesel (mg/kg)

J = Estimated value

= Approximate water table

Fill = Reworked sand and gravel with construction debris

SM-GW = Silty sand and sand/gravel mixtures with trace interbedded silts and clays

SW-GP = Sand and gravel mixture

Well screen - includes filter pack

TD = Total Depth

DUP = Duplicate

Bold = Exceedance of SSTL

ND = Not detected

FIGURE 4
CROSS SECTION B-B'
CLOSURE REPORT
SWMU K03b
Hawthorne Army Depot
Hawthorne, NV

FIGURE 5
Photographs of SWMU K03b before (top photograph, January 4, 2011) and after (bottom photograph, January 6, 2011) decommissioning activities were completed.

APPENDIX A

Soil Boring Logs

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB1 SHEET 1 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 13:30
END : 7/31/10 12:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
	0.0	7.0	1-D	PID = 0		Brown fine to medium sand, trace coarse sand, dry - FILL		
5								
	7.0	9.0	2-D	PID = 0				
10						Brown fine to medium sand, trace silt and gravel, dry - FILL		
				PID = 130		Brown silt, hydrocarbon odor		
15						Brownish-gray silty clay, fractured, iron oxidation in fractures		
	17.0	10.0	3-D	PID = 59		Brown fine to medium sand, trace coarse sand and fine gravel, dry		
20				PID = 63				
25								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB1 SHEET 2 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 13:30
END : 7/31/10 12:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
			3-D	PID = 111		Brown silt		
	27.0							
30				PID = 92				
		10.0				Gray-greenish silt/silty clay, fractured, staining in fractures		
						Black fine to medium sand, trace silt, moist, hydrocarbon odor		
35			4-D	PID = 150				
						Brown fine to coarse sand, trace fine gravel, dry, hydrocarbon odor		
	37.0							
				PID = 105				
40				PID = 170				
						Brown silt/clay		
		9.0				Brown fine to coarse sand, trace fine gravel, dry, hydrocarbon odor		
			5-D			Light brown fine sand, trace fine gravel, dry		
45								
	47.0			PID = 30				
						Brown clayey sand/sandy clay, black staining		
50								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB1 SHEET 3 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 13:30
END : 7/31/10 12:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
				PID = 205		Brown clayey sand/sandy clay, black staining(Soil Description Repeated)		
		10.0		PID = 111		Brown fine to coarse sand, trace silt and gravel, dry		
55			6-D			Brown fine silty sand/silt, dry		
	57.0			PID = 200		Gray sandy silt		
60						Brown fine to medium sand, trace coarse sand and fine gravel, dry		
		10.0		PID = 86		Brown sandy clay with clay lenses (1-3")		
65			7-D	PID = 28		Brown fine sand, trace silt, dry		
	67.0							
70		5.0	8-D	PID = 125		Brown fine sandy clay/clayey sand		
	72.0							
75		4.5	9-D					

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB1 SHEET 4 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 13:30
END : 7/31/10 12:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
	77.0		9-D	PID = 60		Brown fine sandy clay/clayey sand(Soil Description Repeated)		
80		9.0	10-D	PID = 1.5 PID = 2		Brown fine to medium sand with gravel, dry		
85	87.0			PID = 1		Light brown very fine sand, silty with gravel, dry		
90		10.0	11-D	PID = 0		Brown fine to medium sand, trace coarse sand and fine gravel, dry		
95	97.0					Brown fine to medium sand, trace coarse sand and fine gravel, moist to wet		
100								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB1 SHEET 5 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 13:30
END : 7/31/10 12:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
		10.0				Brown/gray sandy clay with 1-4" sand lenses (wet)		
105			12-D			Brown sandy clay, soft to medium stiff wet sand lense 105.5-106'		
	107.0						Boring terminated at 107'	
110								
115								
120								
125								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB2 SHEET 1 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/26/10 12:30
END : 7/28/10 10:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
	0.0					Light brown fine to medium sand, silty, trace fine gravel, dry - FILL		
		4.5		PID = 0				
5			1-D					
	7.0							
				PID = 0				
10								
		9.0				Brown fine to medium sand, trace silt with gravel, dry		
						Dark brown fine to medium sand, trace silt and gravel, dry, hydrocarbon odor		
15			2-D					
				PID = 115		Brown fine to coarse sand, trace silt and gravel, dry, hydrocarbon odor		
	17.0			PID = 30		Brown fine sand, trace silt and clay, dry		
				PID = 200		Brown fine to coarse sand, trace fine gravel, dry, slight hydrocarbon odor		
20								
		10.0		PID = 30				
			3-D					
25								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB2 SHEET 2 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/26/10 12:30
END : 7/28/10 10:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
	27.0		3-D	PID = 350		Dark brown fine to medium sand with clay lenses, dry, strong hydrocarbon odor		
30		9.0	4-D	PID = 45 PID = 50		Dark brown fine to medium silty sand, with clay, dry, slight hydrocarbon odor		
35	37.0					Dark brown fine to coarse sand, trace silt with some clay, slightly moist, hydrocarbon odor		
40	44.0	7.0	5-D	PID = 50 PID = 175 PID = 135				
45	47.0	3.0	6-D			Brown fine to medium sand, trace silt and coarse sand, dry, slight hydrocarbon odor		
50				PID = 45		Brown sandy clay, moist, faint hydrocarbon odor		

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB2 SHEET 3 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/26/10 12:30
END : 7/28/10 10:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
		10.0				Dark brown fine to medium sandy clay, greenish staining in fractures, hydrocabon odor		
			7-D	PID = 40		Brown fine to medium silty sand, trave gravel, dry		
55						Light brown fine silty sand, dry		
	57.0			PID = 120		Brown/black fine silty sand, dry		
						Brown fine to medium sand, trace silt and coarse sand, dry, faint hydrocarbon odor		
60				PID = 30		Brown sandy clay		
		10.0						
			8-D			Brown fine to medium silty sand, dry		
65				PID = 65				
	67.0							
70						Brown fine to medium sandy clay/interbedded with lenses of clay, dry, hydrocarbon odor		
		10.0		PID = 120				
			9-D					
75						Brown silty hard clay		

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB2 SHEET 4 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/26/10 12:30
END : 7/28/10 10:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
			9-D			Brown fine silty sand with clay lenses, dry		
	77.0			PID = 0				
80				PID = 0		Light brown fine to coarse sand, dry		
		10.0						
				PID = 0				
85			10-D					
	87.0					Light brown fine to medium sand, trace coarse sand, dry		
90				PID = 0		Light brown fine to medium sand, trace coarse sand and fine gravel, dry		
		10.0		PID = 0				
			11-D					
95						Brown fine sand, slightly moist		
	96.0						Boring terminated at 96'	
100								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB3 SHEET 1 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 08:00
END : 7/30/10 12:30
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
	0.0					Brown fine silty sand, dry - FILL		
		5.0						
5			1-D	PID = 0				
	7.0							
						Dark brown fine to medium sand, trace silt and clay, dry - FILL		
				PID = 4				
10								
						Dark brown fine to medium sandy clay/clayey sand, moist, slight hydrocarbon odor - FILL		
		10.0		PID = 55				
				PID = 130				
15			2-D					
						Dark brown fine silty clay, trace sand, (with sandy clay lenses), dry		
	17.0							
				PID = 65				
20								
		9.0						
			3-D	PID = 30				
25								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB3 SHEET 2 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 08:00
END : 7/30/10 12:30
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
			3-D	PID = 95		Brown fine silty sand, dry		
	27.0					Brown fine sand, trace coarse sand and fine gravel, dry		
				PID = 20				
30								
				PID = 72		Dark brown/black sandy clay, hydrocarbon odor		
		10.0						
				PID = 40		Brown fine to coarse sand, dry (black staining 32.5-34')		
35			4-D					
	37.0							
40				PID = 35				
		10.0						
				PID = 30				
45			5-D					
	47.0							
				PID = 100		Brown fine sand, trace silt, dry		
50								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB3 SHEET 3 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 08:00
END : 7/30/10 12:30
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
		10.0				Brown fine sand, trace silt, dry(Soil Description Repeated)		
				PID = 250		Brown silt, hydrocarbon odor		
55			6-D			Brown fine sand, trace coarse sand and fine gravel, dry, strong hydrocarbon odor at 60'		
	57.0							
				PID = 180				
60				PID = 100		Brown/gray silty and sandy clay, medium stiff		
		10.0				Brown fine to medium sand, trace silt, dry		
				PID = 100				
65			7-D					
						Brown/gray silty clay, fractured, soft to medium stiff		
	67.0			PID = 45				
						Brown fine to medium clayey sand, slightly moist		
				PID = 100				
70								
		10.0		PID = 7.5				
			8-D			Brown fine sand, trace medium sand, dry		
				PID = 4				
75								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB3 SHEET 4 OF 4

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/30/10 08:00
END : 7/30/10 12:30
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
			8-D	PID = 0		Brown fine sand, trace medium sand, dry(Soil Description Repeated)		
	77.0							
80				PID = 2		Brown fine to coarse sand, trace fine gravel, dry		
		10.0						
85			9-D	PID = 0				
	87.0						Boring terminated at 87'	
90								
95								
100								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB4 SHEET 1 OF 3

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/29/10 12:20
END : 7/29/10 15:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
	0.0					Brown fine to medium sand , trace silt and clay, dry - FILL		
		3.0						
5			1-D	PID = 0				
	7.0							
				PID = 0				
10								
		10.0						
				PID = 10		Black fine silty sand, dry		
15			2-D					
				PID = 25		Brown silty clay, fractured with iron oxidations, moist, hydrocarbon staining and odor		
	17.0							
				PID = 25		Brown fine to medium sand, trace silt and coarse sand, dry		
20								
						Brown fine to coarse sand with fine gravel, dry		
		10.0						
						Brown fine to medium sand, trace silt and coarse sand, dry		
			3-D	PID = 1.5				
25								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB4 SHEET 2 OF 3

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/29/10 12:20
END : 7/29/10 15:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
						Brown silt, hydrocarbon odor		
			3-D			Brown fine to medium sand, trace silt and coarse sand, dry		
	27.0			PID = 10				
				PID = 35				
30								
		10.0		PID = 250		Brown silty/clay, medium stiff, hydrocarbon odor		
						Brown fine to coarse sand, trace fine gravel, dry		
				PID = 80				
35			4-D					
	37.0							
40				PID = 25				
		10.0						
				PID = 28				
45			5-D					
				PID = 55				
	47.0					Greenish silty clay, fractured, soft		
						Brown fine to coarse sand, trace fine gravel, dry		
				PID = 7				
50								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB4 SHEET 3 OF 3

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/29/10 12:20
END : 7/29/10 15:00
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
		10.0	6-D	PID = 14		Brown fine to coarse sand, trace fine gravel, dry(Soil Description Repeated)		
55						Brown fine sand, trace silt, dry to slightly moist, faint hydrocarbon odor		
	57.0			PID = 58		Brown silty clay, stained, soft, hydrocarbon odor		
				PID = 0		Brown fine silty sand, trace clay, dry		
60				PID = 0		Brown fine sandy clay, moist		
		10.0	7-D	PID = 0		Brown fine to medium sand, dry		
65								
	67.0			PID = 0		Brown silty clay, fractured with iron oxidations		
							Boring terminated at 67'	
70								
75								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB5 SHEET 1 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/28/10 11:13
END : 7/29/2010
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
	0.0	5.0	1-D	PID = 0		Brown fine to coarse sand, trace fine gravel, dry - FILL		
5								
	7.0	9.0	2-D	PID = 0		Brown fine silty sand, dry - FILL		
10								
						Brown fine silty sand, trace silt, dry - Possible FILL		
15								
	17.0					Brown silty clay		
				PID = 0		Brown fine to coarse sand, trace silt and fine gravel, dry		
20								
				PID = 0		Brown fine silty sand, slightly moist		
25								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB5 SHEET 2 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/28/10 11:13
END : 7/29/2010
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
				PID = 0		Brown fine to coarse sand, trace fine gravel, dry		
	27.0							
30								
		10.0		PID = 35		Dark brown/black fine sand, dry, hydrocarbon odor		
				PID = 175		Dark brown sandy and silty clay, hydrocarbon odor		
35			3-D			Dark brown fine to coarse sand, trace fine gravel, dry		
	37.0							
				PID = 18				
40								
				PID = 59		Dark brown fine to medium silty sand, slightly moist, hydrocarbon odor		
		10.0						
						Dark brown fine to coarse sand, trace fine gravel, dry		
45			4-D					
				PID = 32				
	47.0							
				PID = 40				
50								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB5 SHEET 3 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/28/10 11:13
END : 7/29/2010
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	COMMENTS: WELL DETAILS
		9.0		PID = 100		Dark brown fine to coarse sand, trace fine gravel, dry(Soil Description Repeated)		
55			5-D	PID = 130		Brown fine silty sand, trace mica, dry, hydrocarbon odor		
						Gray silt		
	57.0					Brown fine silty sand, dry		
				PID = 50		Brown medium to coarse sand, dry		
60						Brown silty/sandy clay, hydrocarbon odor		
				PID = 60				
		10.0				Brown silty and clayey sand, slightly moist, faint hydrocarbon odor		
65			6-D	PID = 20				
	67.0					Brown silty/sandy clay, hydrocarbon odor		
						Brown silty sand, trace clay, dry		
70						Brown silty clay, stiff		
		10.0				Brown fine to medium sand, trace silt and coarse sand, dry		
			7-D	PID = 6				
75								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB5 SHEET 4 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/28/10 11:13
END : 7/29/2010
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
			7-D			Brown fine to medium sand, trace silt and coarse sand, dry(Soil Description Repeated)		
	77.0					Brown fine to coarse sand, trace fine gravel, dry		
80				PID = 1				
		10.0						
				PID = 2				
85			8-D					
	87.0							
				PID = 0				
90								
						Brown/gray silty clay, iron oxidation in fractures		
						Brown fine to medium sand, trace coarse sand, wet		
95				PID = 0				
						Brown fine silty sand, wet		
100								

PROJECT NUMBER:	BORING NUMBER:
350552	K03b-SB5 SHEET 5 OF 5

Soil Boring Log

PROJECT : Hawthorne Army Depot, Hawthorne, Nevada
LOCATION : Hawthorne, NV
ELEVATION :
DRILLING CONTRACTOR : Boart Longyear
COORDINATES :
DRILLING METHOD AND EQUIPMENT : Rotosonic Method
WATER LEVEL: ---
START : 7/28/10 11:13
END : 7/29/2010
LOGGER : B Woodard

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	ENVIRONMENTAL DATA	GRAPHIC LOG	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, & INSTRUMENTATION	WELL DETAILS
						Brown silty clay with small saturated sand lenses		
						Brown fine to medium sand, trace silt and coarse sand, wet		
105						Brown silty clay, medium stiff		
							Boring terminated at 107'	
110								
115								
120								
125								

APPENDIX B

Soil Sampling Analytical Results and Data Quality Validation Reports (Presented on CD)

APPENDIX C

Well Decommissioning Variance

JIM GIBBONS
Governor

STATE OF NEVADA

ALLEN BIAGGI
Director

TRACY TAYLOR, P.E.
State Engineer

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

CH2M HILL
9193 S. Jamaica Street
Englewood, CO 80112
Tel 720.286.0241
Fax 720.286.9230

CH2MHILL

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-feet bgs and two are located at 22-feet 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-feet 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-feet 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-feet 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-feet 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-feet 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-feet 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 Decomissioning 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 Decomissioning Activities

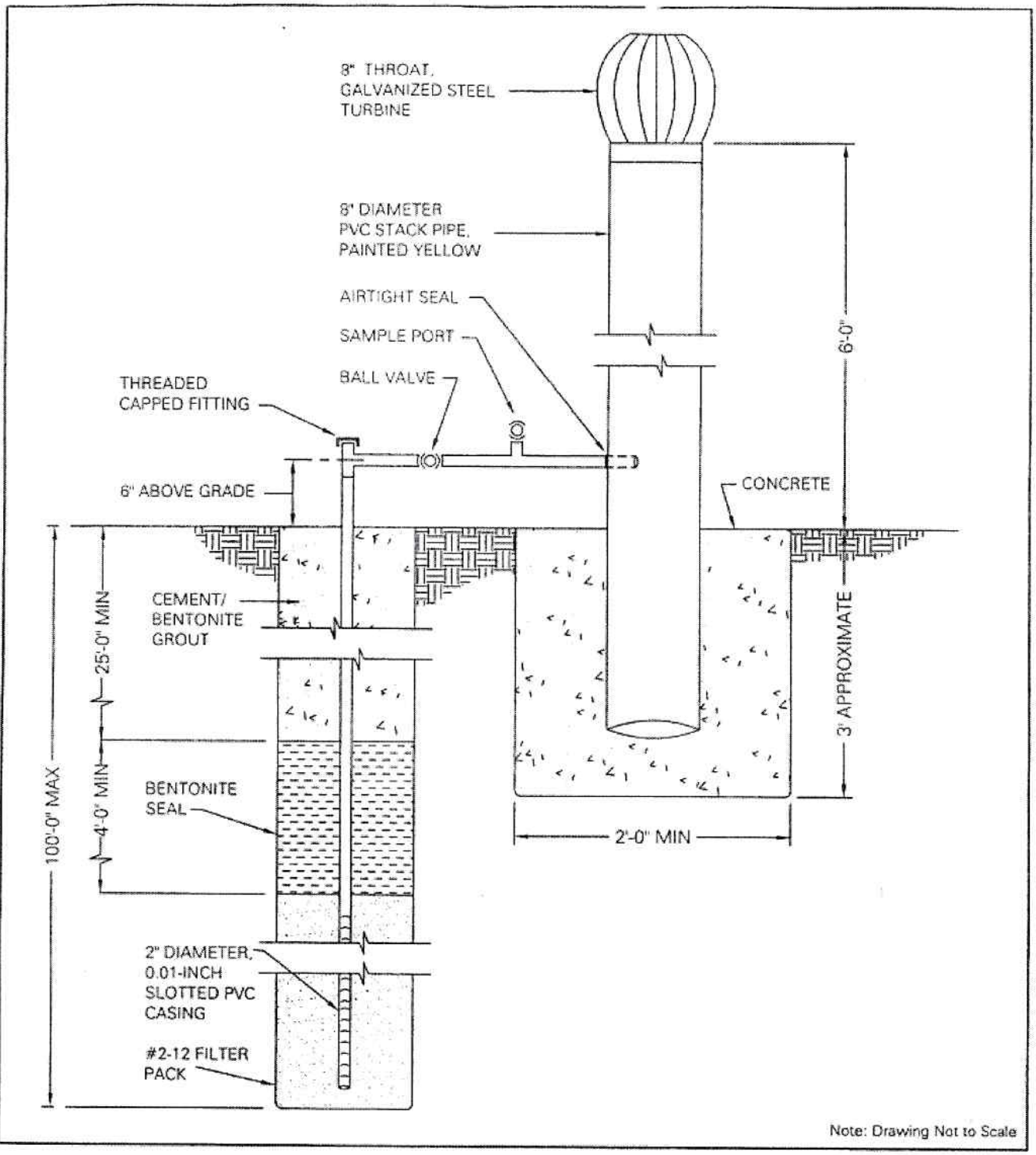
Due to the shallow depths and type of construction of the soil moisture monitoring points at SWMU J03 (lead wires buried in native-soil-filled PVC casing [Figure 6]), CH2M HILL proposes to remove the 3-foot stickup, but to leave the casing and buried wire in place.

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



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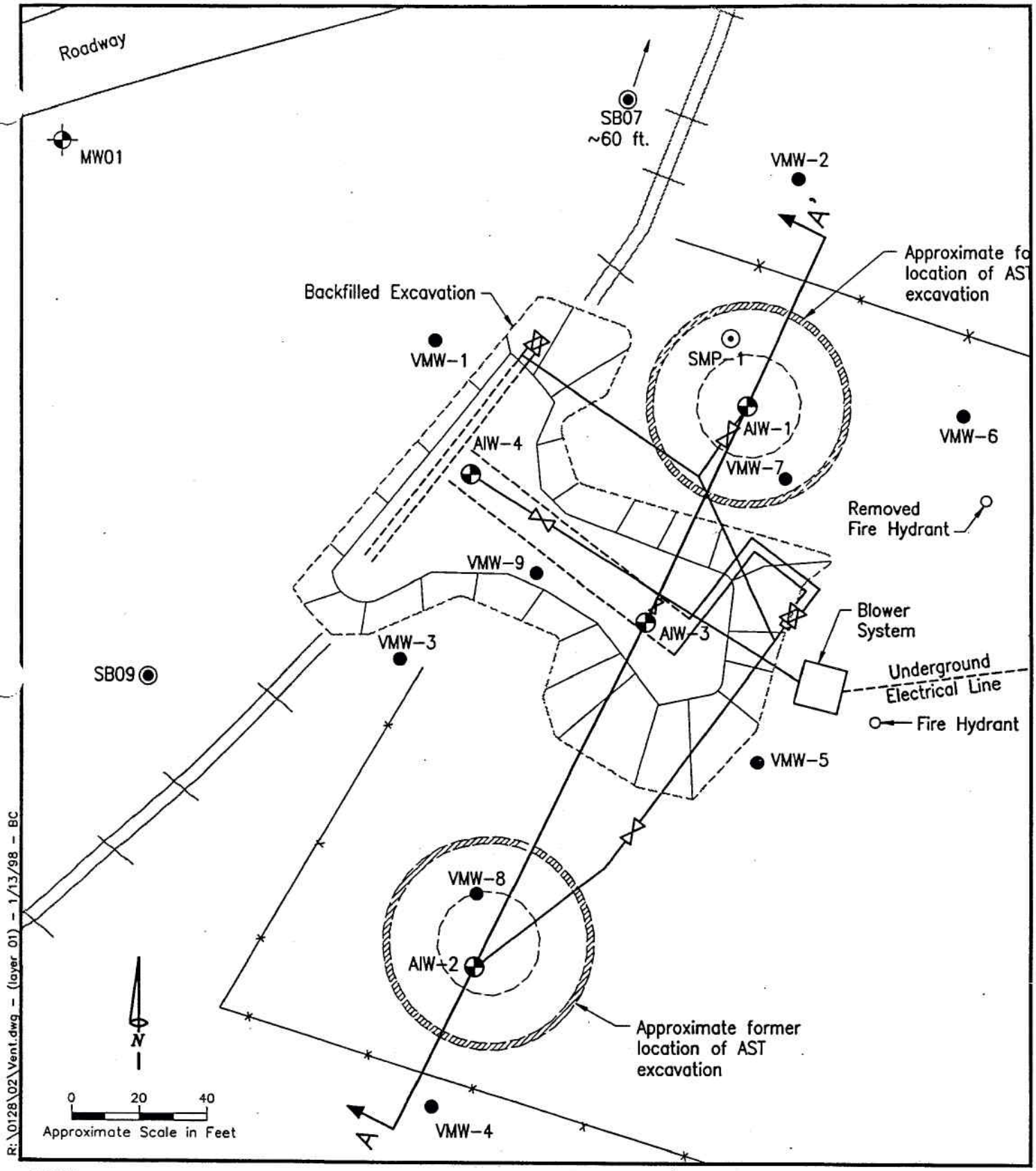
Passive Vapor Extraction Well System Design

Hawthorne Army Depot
Hawthorne, Nevada

CH2MHILL

FIGURE 1



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
- A—A' Cross Section (Figure 3-2)

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

Enhanced Bioremediation System Layout

Hawthorne Army Depot
Hawthorne, Nevada

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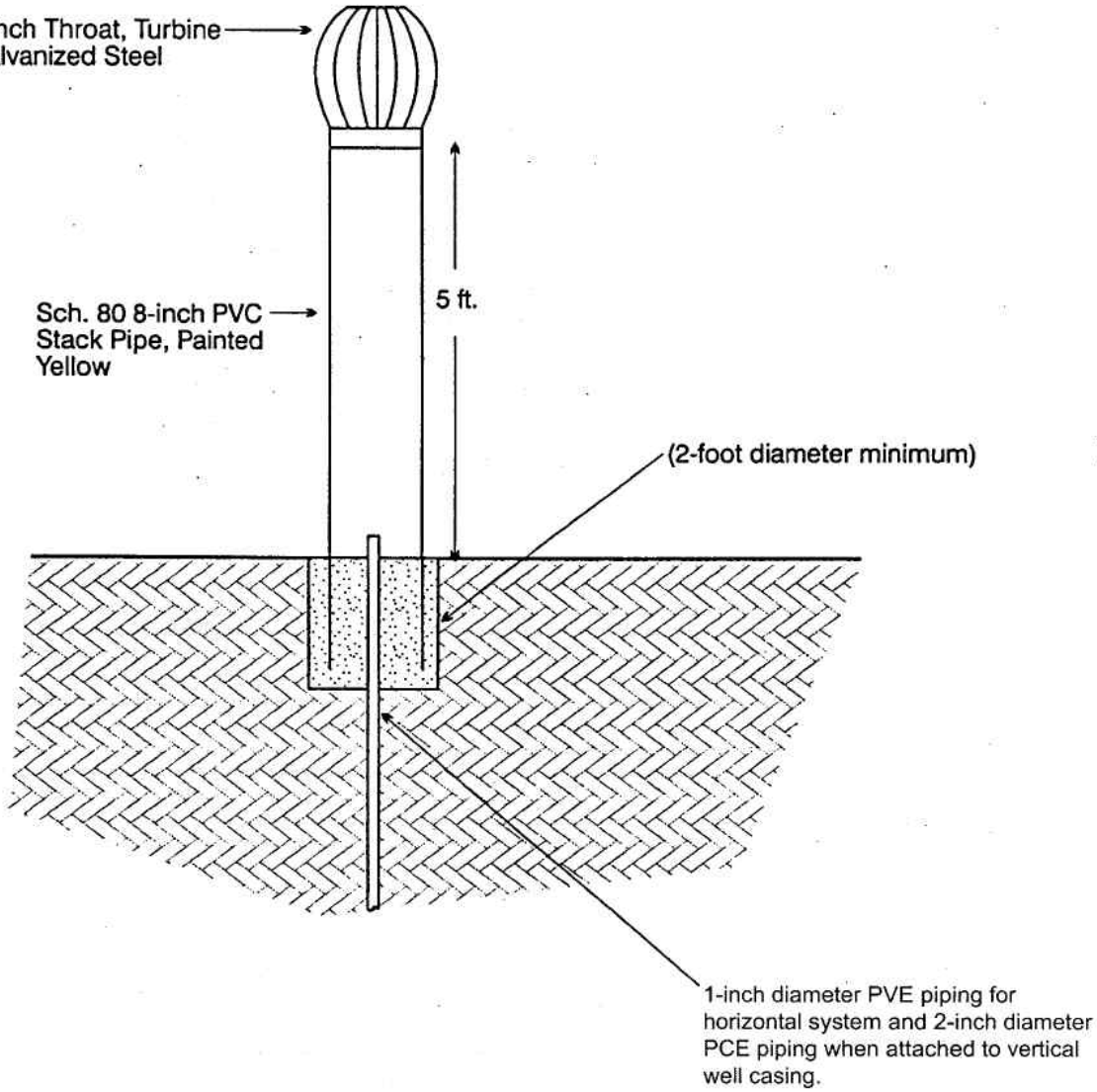
FIGURE 2



R:\0082145\Attic.cdr - 1/21/98 - BC

Attic Turbine Wind Powered Bioventing System Design

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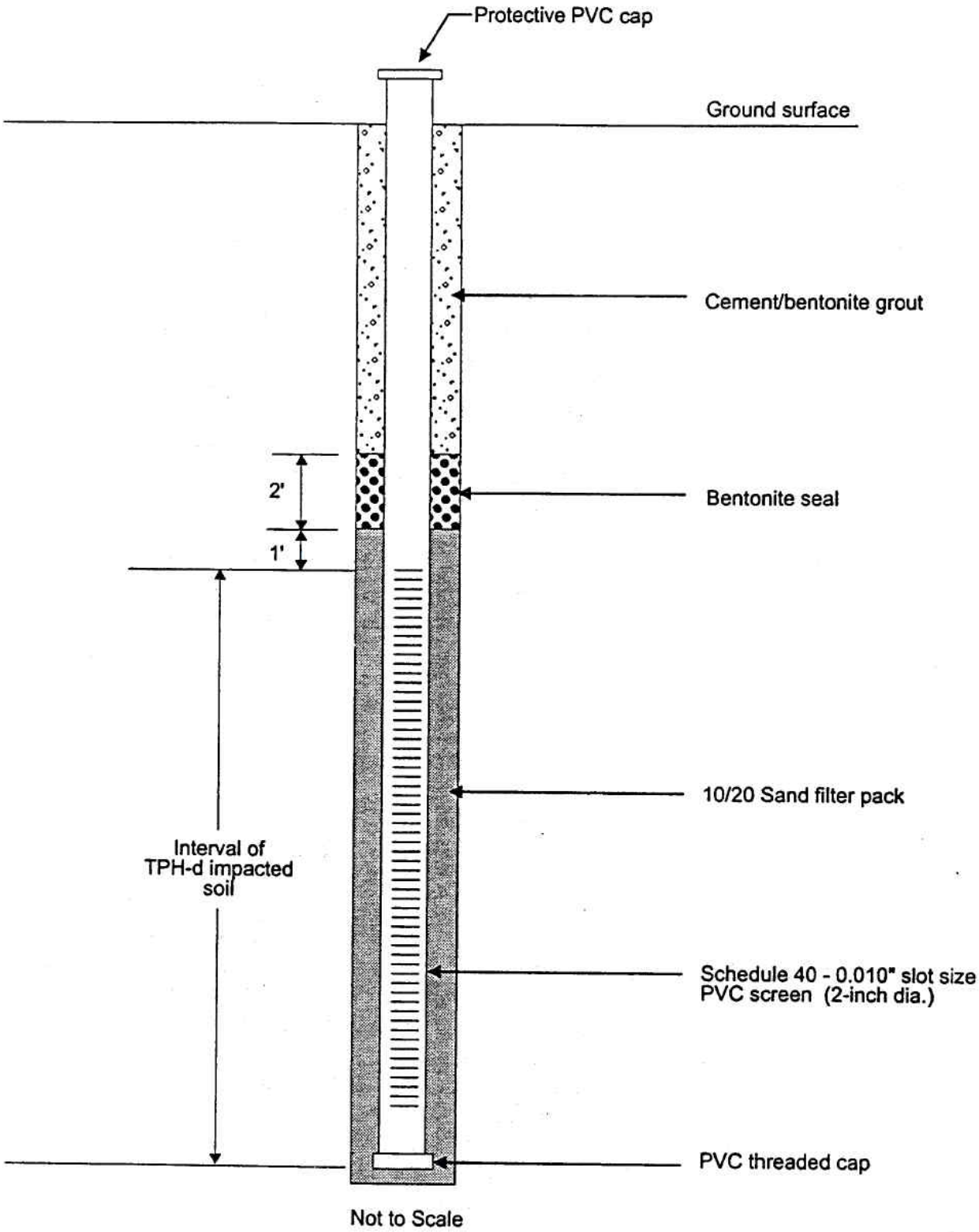
Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 3



R:\0128\02air well.cdr - 1/12/98 - kp

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

Typical Air Injection Well Construction

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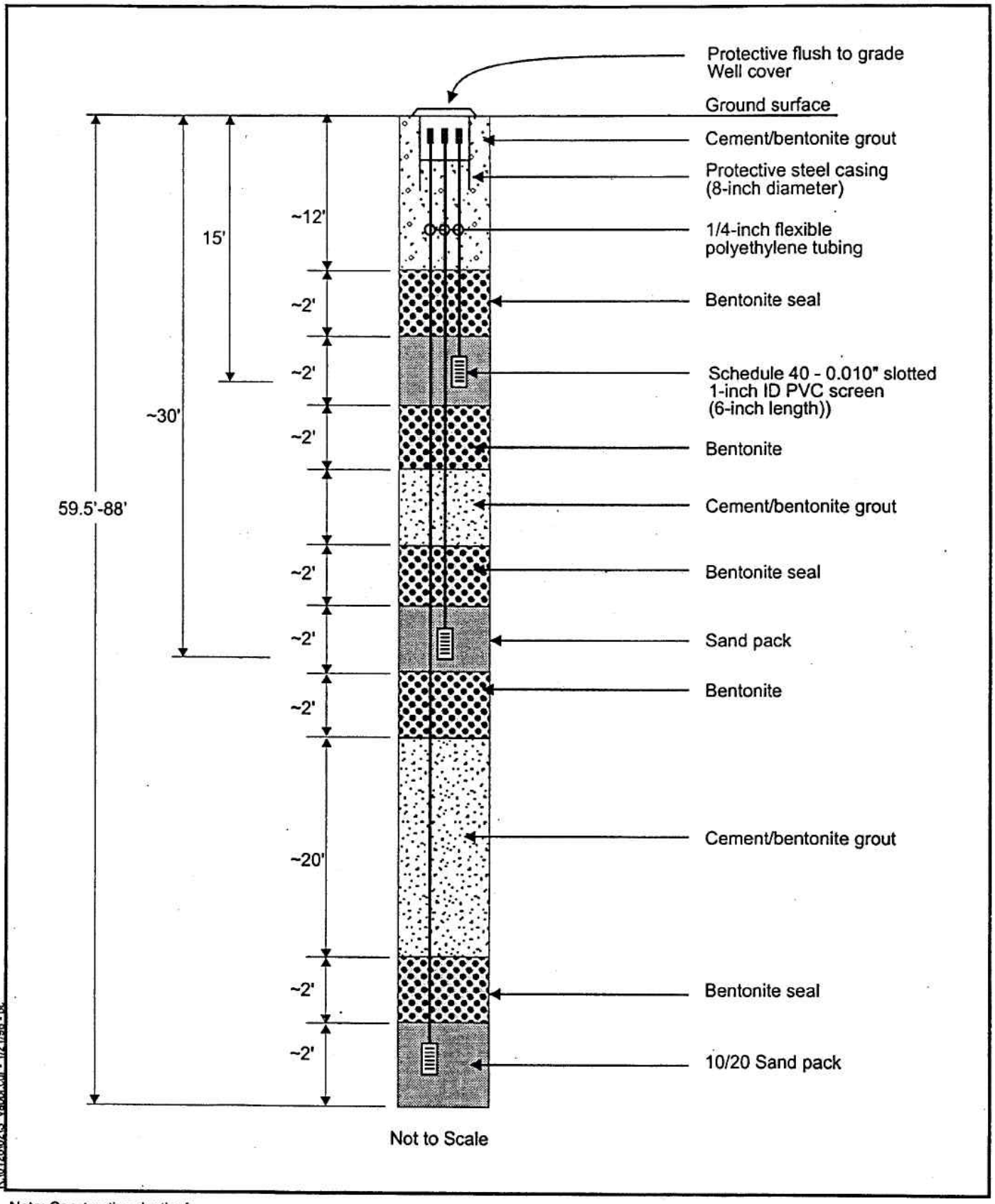
Hawthorne, Nevada

FIGURE 4



R:\0128\02\S_vapor.cdr - 1/21/98 - bc

Note: Construction depths for each of the vapor monitoring wells are approximate.

Typical Soil Vapor Monitoring Well Construction

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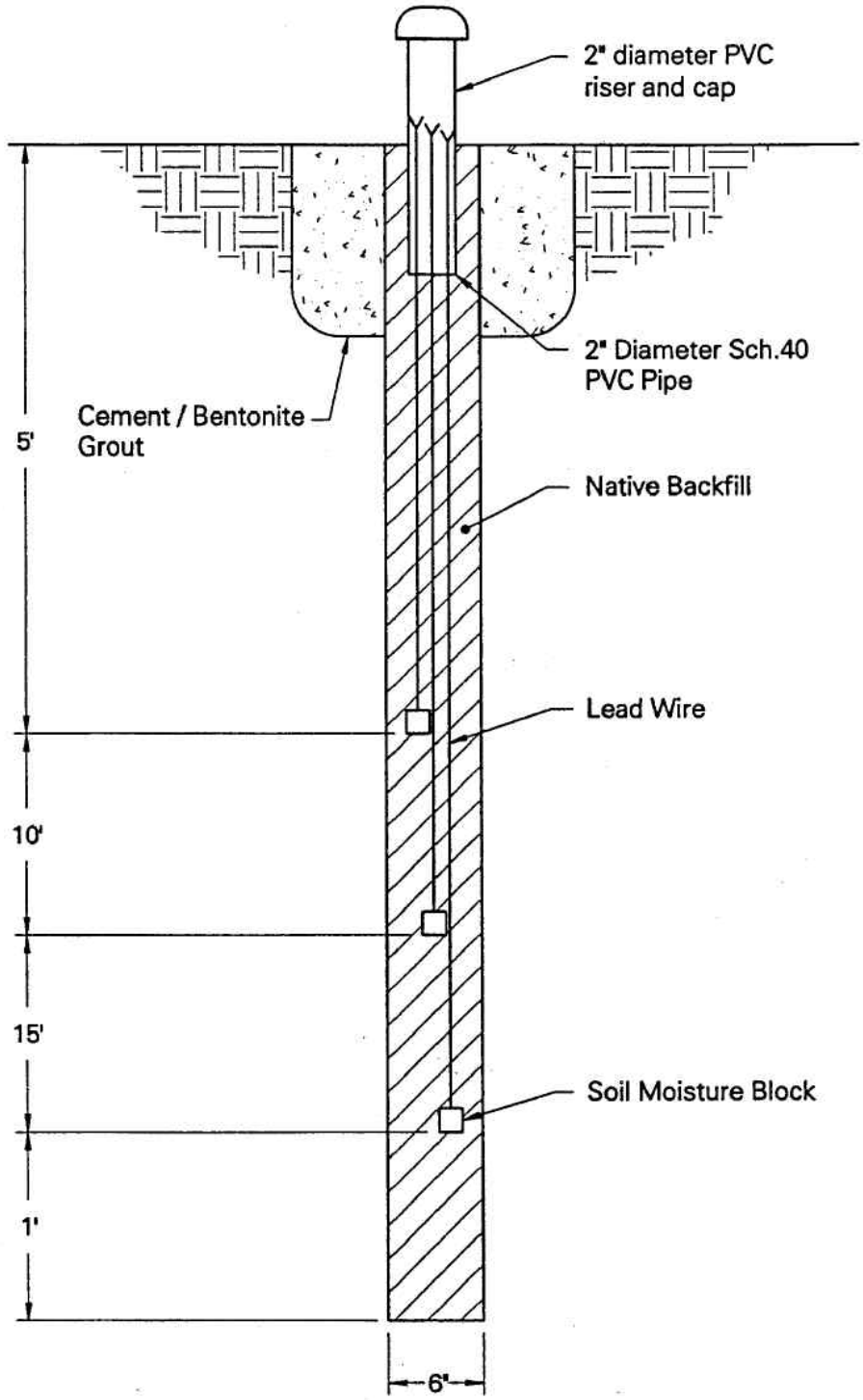
Hawthorne, Nevada

FIGURE 5



Not to Scale

r:\0128\02\Soilprob.dwg – 1/13/98 – BC

Soil Moisture Probe Construction

Hawthorne Army Depot
Hawthorne, Nevada

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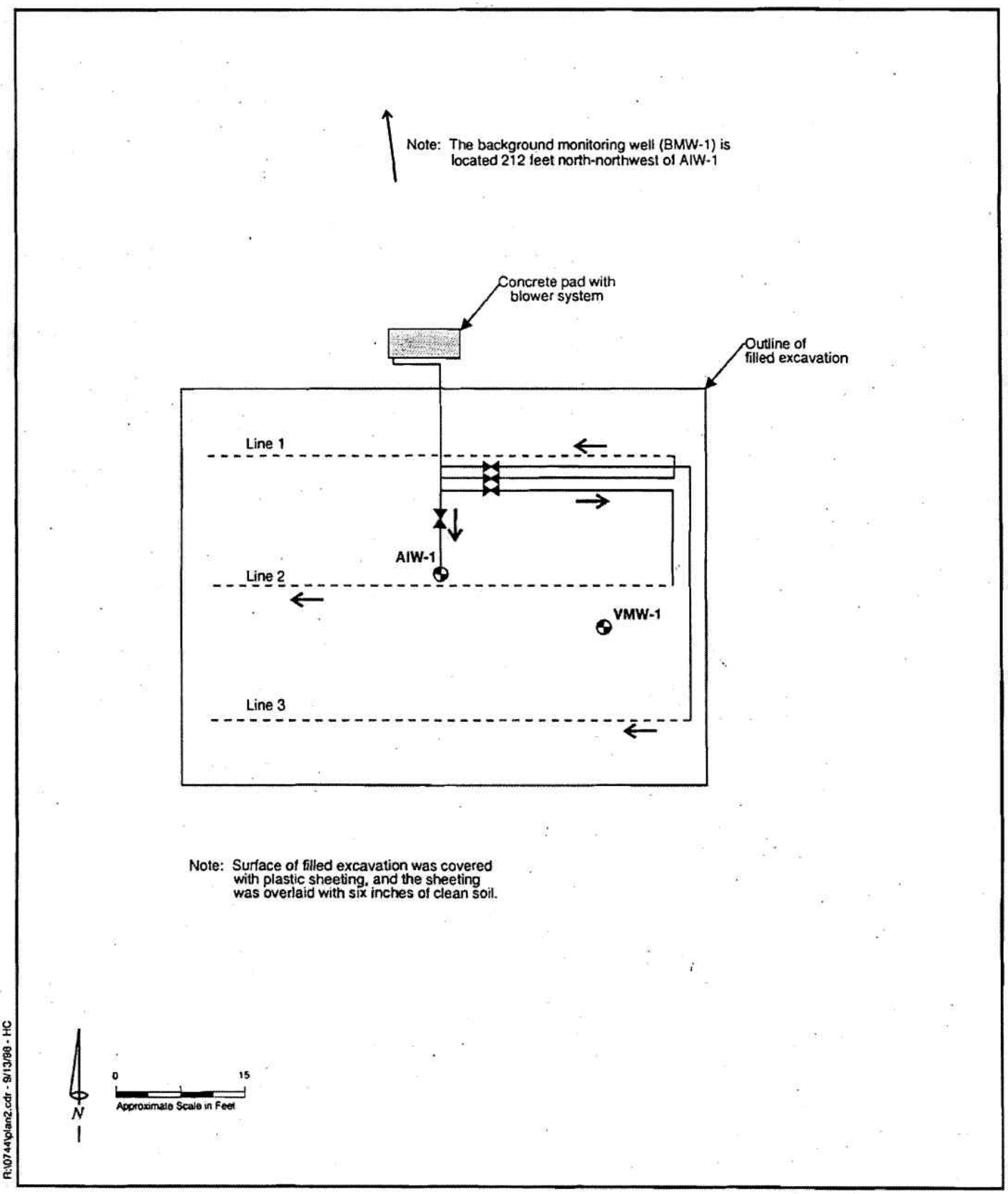
FIGURE 6



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

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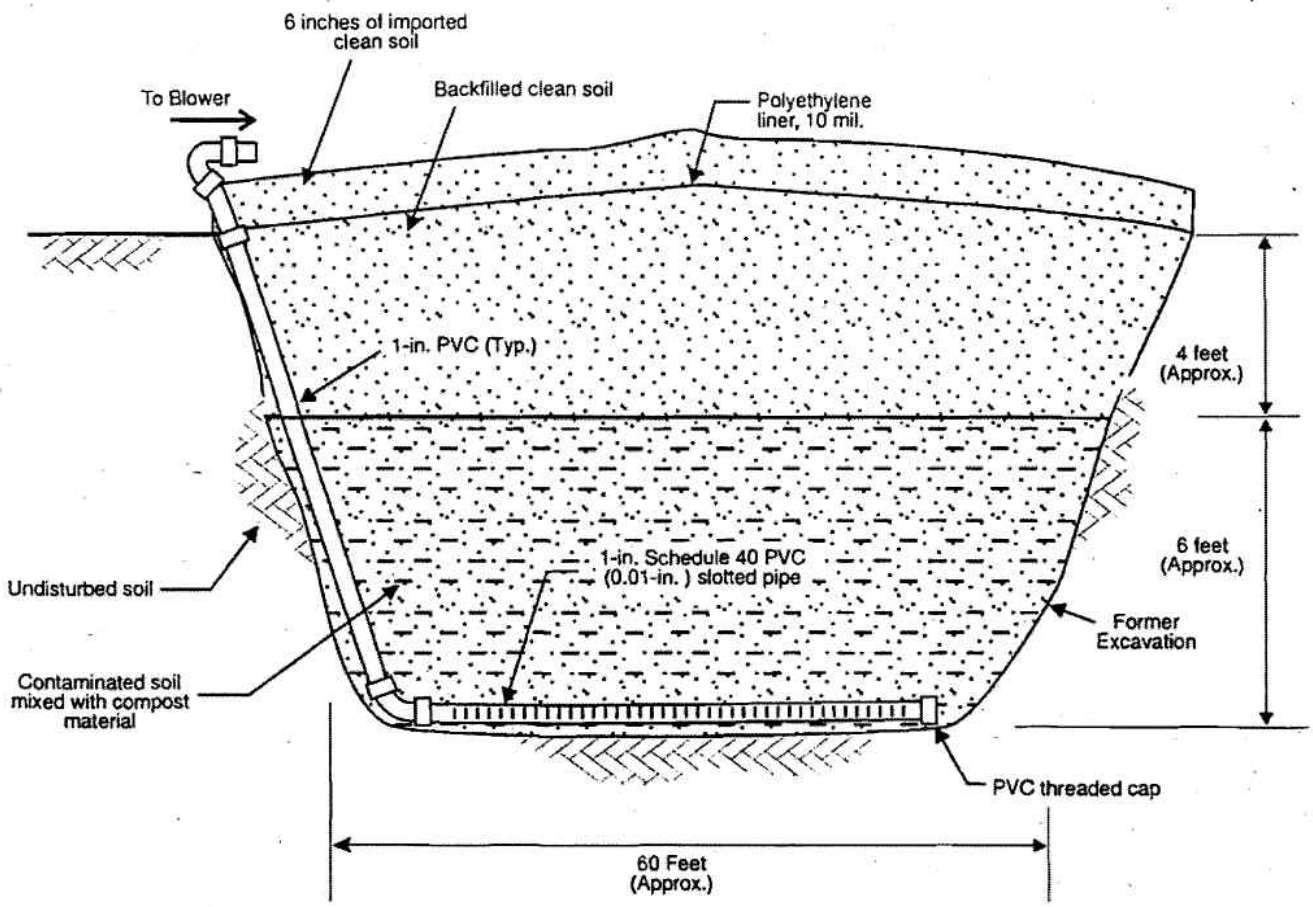
Piping Layout of Enhanced Bioremediation System

Hawthorne Army Depot
Hawthorne,Nevada

FIGURE 7



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

R:\0744\schemat.cdr - 9/12/96 - HC

Horizontal Enhanced Bioremediation System Schematic

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Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 8

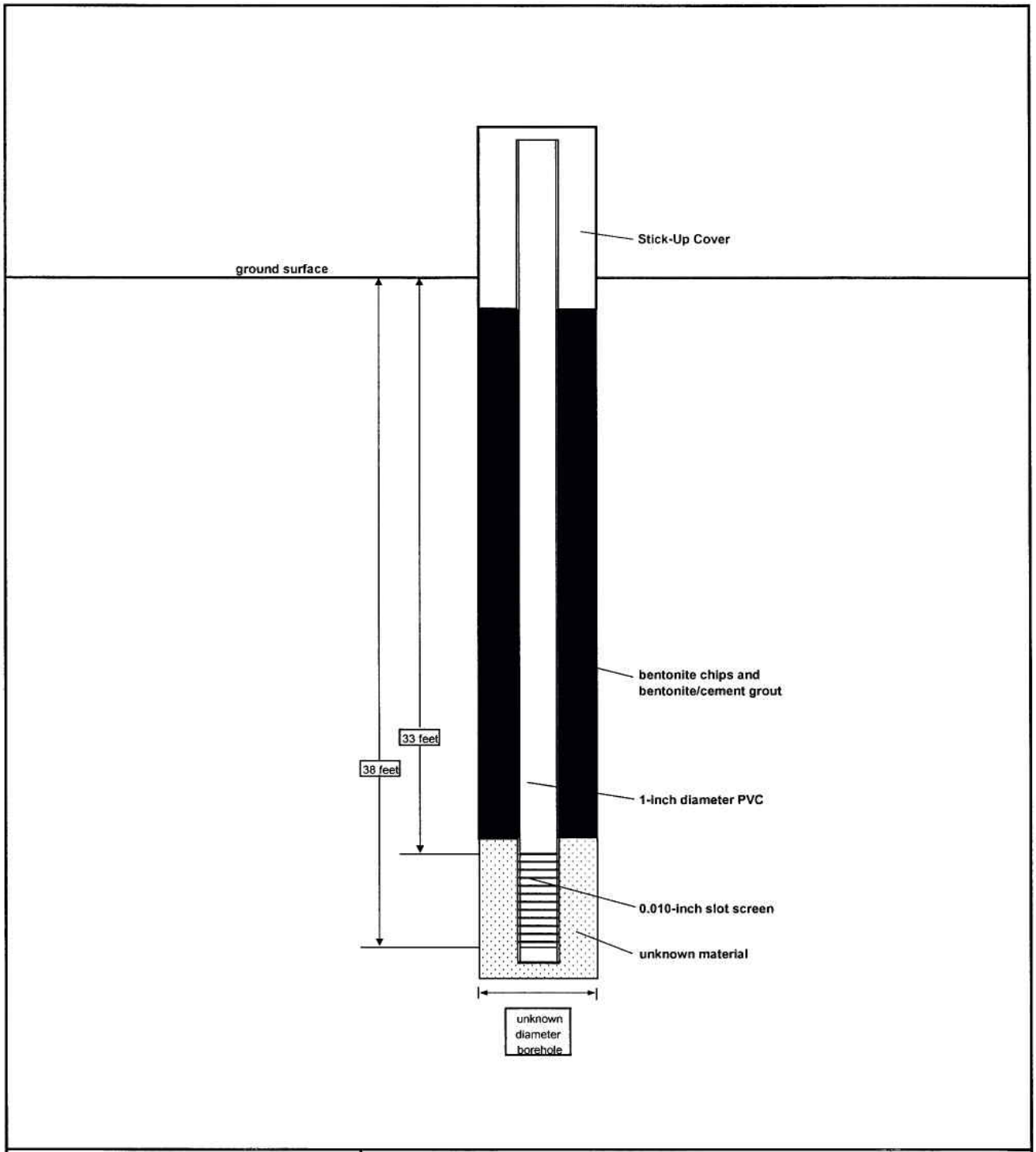

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Figure 9 - Background Vadose Zone Monitoring Well

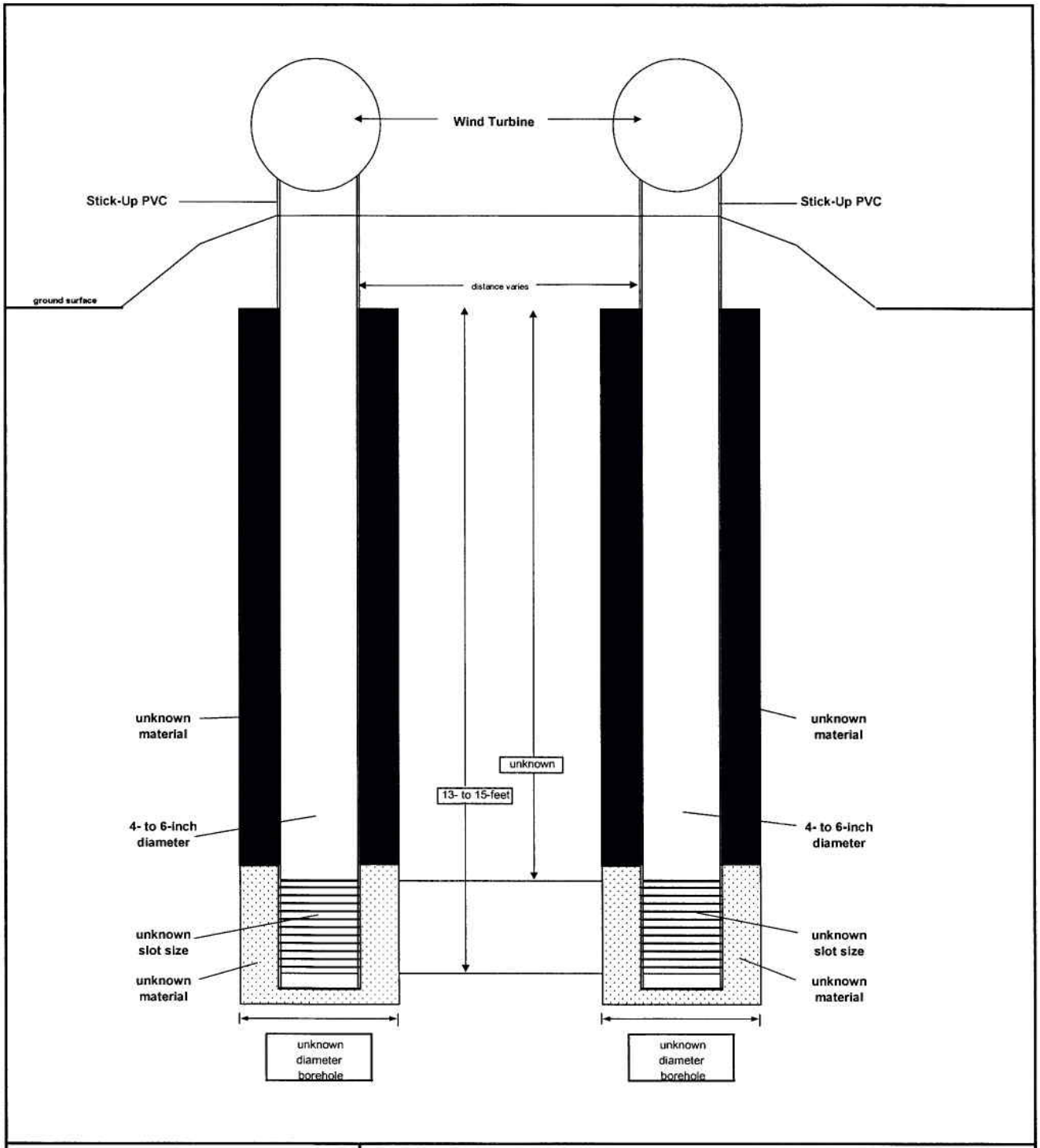

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Figure 10 - Passive Bioventing System at SWMU K05