Closure Decision Document SWMU J03

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
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

REVISED FINAL

Closure Decision Document for SWMU J03: Building 70 Diesel Fuel Leak 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

5179 Hoadley Road
Aberdeen Proving Ground, Maryland

Prepared by:

CH2MHILL

for

Plexus Scientific Corporation

PLEXUS scientific

9104 Guilford Road, Suite 1010
Columbia, MD 21046

June 2009

Closure Decision Document
SWMU J03: Building 70 Diesel Fuel Leak

Hawthorne Army Depot
Hawthorne, Nevada

June 2009

Prepared By: _____
Rebecca Rewey
Task Manager

Reviewed By: _____
Oscar Sorensen
Project Manager

Contents

Section **Page**

Acronyms and Abbreviations ..... **iii**
1.0 Introduction **1**
2.0 Site History **1**
3.0 Physical Setting **1**
4.0 Investigation History **2**
5.0 Additional Site Characterization Activities **2**
6.0 Additional Site Characterization Results **4**
7.0 Conclusions **5**
8.0 Decommissioning Activities **7**
9.0 References **8**

Appendixes

A Soil Boring Logs

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

C Well Decommissioning Variance

Tables

1 Groundwater Gauging Data, December 2006 – April 2008

2 Additional Site Characterization Soil Sampling Results, September – December 2007

Figures

1 Site Location

2 Site Layout and Sample Locations

3 Cross Section A – A′

4 Cross Section B – B′

5 Decommissioning Photographs

Acronyms and Abbreviations

µg/L	microgram per liter
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
CAP	Corrective Action Plan
FID	flame ionization detector
HWAAP	Hawthorne Army Ammunition Plant
HWAD	Hawthorne Army Depot
LUST	leaking underground storage tank
mg/kg	milligrams per kilogram
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
PCE	tetrachloroethene
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
SSTL	Site-Specific Target Level
SWMU	Solid Waste Management Unit
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
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) J03, Building 70 Diesel Fuel Leak, hereafter referred to as SWMU J03, at Hawthorne Army Depot (HWAD), Hawthorne, Nevada (Figure 1).

A Final Corrective Action Plan (CAP) was prepared for SWMU J03 (CH2M HILL, 2007) and approved by the Nevada Division of Environmental Protection (NDEP) on October 12, 2007 (NDEP, 2007). The Final CAP stated that the remedy is in place for SWMU J03, and recommended additional site characterization be performed to confirm that only low levels of total petroleum hydrocarbons (TPH) exist at the site and that the site is ready for closure. The additional site characterization activities have been completed, the presence of free product remains at less than 0.5 inches in all wells, and the site is ready for closure. The following paragraphs provide a brief overview of the site history, physical setting, investigation history, summary of the additional site characterization activities, conclusions, and decommissioning activities completed at the site. Additional background information is provided in the Final CAP for SWMU J03 (CH2M HILL, 2007).

2.0 Site History

SWMU J03 is located near the west corner of the central magazine area of HWAD, approximately 2 miles east of the U.S. 95 gate near Building 70 (Figure 2). In the early 1940s, two 100,000-gallon aboveground storage tanks (ASTs) were installed at SWMU J03 to provide diesel fuel to boilers at Building 70 (USAEHA, 1988). Releases of fuel from the piping connecting the two ASTs, or related piping, were reported in 1991 during an inspection.

3.0 Physical Setting

The site is presented in detail on Figure 2. With the exception of its proximity to the paved road just to the west and northwest, the site is in a relatively remote area of HWAD. A bioventing system and one downgradient groundwater quality monitoring well still operate onsite, but no other structures remain. The site is covered with sparsely vegetated earth.

In July 1997, the depth to groundwater in the downgradient monitoring well was measured at 200 feet below ground surface (bgs), but no other instances of this depth were noted. Depth to groundwater at the site has consistently ranged from approximately 104 to 128 feet bgs. The most recent groundwater levels, measured in February 2009, indicate that groundwater at the site is between 103.99 and 105.00 feet bgs. Given the basewide groundwater flow pattern, the groundwater flow at the site is estimated to be toward the northwest (Secor, 2005).

Soil beneath the backfilled excavations consists of sands, silts, and sandy silts.

Water supply well #7 (currently used as a non-potable water source because the water quality is inadequate for use as a potable water source) is 1.2 miles to the north

(sidegradient to groundwater flow) and water supply well #1 (infrequently used as a potable water source for HWAD) is 2.9 miles to the northwest (sidegradient to groundwater flow) (Figure 1).

4.0 Investigation History

During an inspection conducted in 1991, a diesel release was discovered and reported at J03 from piping connecting the two ASTs (Secor, 2005). For an undetermined period of time from the 1940s to 1991, an unknown quantity of diesel fuel was released at this site. In 1991, the piping and approximately 34,000 cubic yards of soil between the two ASTs were removed to 35 feet bgs. Approximately 250 cubic yards of the impacted excavated soil were stockpiled onsite and later used for backfill; however, the disposition of the remaining 33,750 cubic yards of impacted excavated soil is not known. The ASTs were removed from the site along with surrounding soil in 1997. Approximately 500 cubic yards of soil from the AST excavation were used to backfill the main excavation, but disposition of the remaining excavated soil is unknown.

By 1994, erosion and sloughing reduced the depth of the pit to 25 feet bgs, prohibiting collection of soil samples at the floor of the excavation. However, after removing exposed and weathered soils from near the sidewalls of the excavation, sidewall soil samples (SS01 through SS08) were collected at approximately 15 to 25 feet bgs. Two additional sidewall samples (BG70-SS01-2-S and BG70-SS02-2-S) were collected from an observed stained area at approximately 15 feet bgs. To define the vertical extent of soil contamination, subsurface soil samples were collected from hollow-stem auger soil borings SB01 through SB09. To investigate the potential for groundwater contamination, hydropunch groundwater samples were collected from SB07, SB08, and SB09; SB08 was completed as groundwater monitoring well BLDG70MW01.

The excavation was backfilled with a mixture of woodchips and stockpiled contaminated soils from 12 leaking underground storage tank (LUST) sites (Tetra Tech, 1998). Vertical air injection wells were installed to passively remediate the impacted soil beneath the excavation. The active bioremediation system was converted to a passive system after the 2-month pilot test. Results from the pilot test were used to estimate the time necessary to complete remediation in the shallow and deep soils. Remediation in the shallow soils was calculated to be 0.4 years, while remediation in the deep soils was estimated at 7.5 years (Tetra Tech, 1998). The passive bioremediation system was decommissioned in March 2009 at the direction of NDEP as stated in the Final Closure Report/Decision Document approval letter dated December 12, 2008.

5.0 Additional Site Characterization Activities

Additional site characterization activities were performed at SWMU J03 from September 20 through December 5, 2007. Geoprobe push sampling was performed at boring J03-SB1 in September to a depth of 46 feet bgs where refusal was encountered. Sample collection at boring J03-SB1 was resumed and completed in November using a rotosonic drilling rig. Nine borings (J03-SB1, J03-SB2, J03-SB3, J03-SB4, J03-SB5, J03-SB6, J03-SB7, J03-SB8, and J03-SB9) were advanced using rotosonic drilling technology at the locations shown on Figure 2.

Continuous soil cores were collected at each location from ground surface to the total depth of the boring. Each soil core was observed for visual staining and field-screened using a photoionization detector (PID) and flame ionization detector (FID). At least one soil sample was collected at every 10-foot interval and directly above groundwater (if groundwater was reached) based upon PID and FID measurements and visual observations. Each soil sample was submitted to TestAmerica, Inc. (formerly Severn Trent Laboratories, Inc.) in Denver, Colorado, for TPH-diesel, TPH-gasoline, and TPH-motor oil analyses.

Borings J03-SB1 through J03-SB3 and J03-SB5 were completed as temporary groundwater gauging wells. All of the temporary gauging wells were designed to intersect groundwater and were installed using 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) well risers and 10-foot, flush-threaded, 10-slot PVC well screen sections. Annular materials such as a filter pack and a bentonite seal were not installed. Depth to water was measured 12 hours following installation using an interface probe. Product was not detected in any of the temporary gauging wells. All temporary wells were abandoned according to Nevada regulations following soil sampling and/or groundwater gauging activities.

On November 27-28, 2007, borings J03-SB4 and J03-SB6 were advanced and completed as permanent gauging wells. Boring J03-SB4 was selected as a monitoring well to represent the most downgradient extent of contamination at J03. Boring J03-SB6 was selected as a monitoring well to represent a well within the former source area for SWMU J03. Both borings were observed for visual staining and field screened from ground surface to groundwater using PID and FID instruments. Both borings were completed by installing 2-inch-diameter Schedule 40 PVC well risers and 10-foot, flush-threaded, 10-slot PVC well screen sections. Following installation, water level measurements were collected at each boring using an interface probe.

Borings J03-SB7 through J03-SB9 were advanced to the base of a former excavation or 10 feet past evidence of contamination. Boring J03-SB9 was advanced to 76 feet bgs, 16 feet past the last evidence of contamination. Boring J03-SB7 had no evidence of contamination throughout the entire boring but was advanced to 75 feet bgs for verification. J03-SB8 was advanced to 107 feet bgs, 12 feet past the last evidence of contamination. All borings were abandoned following sampling activities.

In December 2006, free product was measured at 3.8 inches in BLDG70MW01, but remained under 0.5 inches from February 2007 to April 2008. At the request of NDEP, wells BLDG70MW01, J03-SB4, and J03-SB6 were gauged for the presence of free product on February 4, 2009. Well BLDG70MW01 observed 0.04 feet (0.48 inches) of free product during the February 2009 gauging event; although this product was at a thickness of less than 0.50 inches, it was removed on April 7, 2009, during a subsequent site visit to HWAD when the product was measured at a thickness of 0.44 inches. Wells J03-SB4 and J03-SB6 were monitored for free product in January, February, March, and April 2008, and none was detected. In addition, no free product was observed in these two wells during the gauging event completed on February 4, 2009. As a result, groundwater samples were collected and submitted for volatile organic compound (VOC) analysis by U.S. Environmental Protection Agency (USEPA) Method 8260B as directed by NDEP.

6.0 Additional Site Characterization Results

Soil lithology and field screening results are summarized on the boring logs (Appendix A) and cross sections (Figures 3 and 4). The soil samples collected at SWMU J03 exhibited visual staining and petroleum odors. The two highest FID readings at SWMU J03 were 1,804 parts per million (ppm) from boring J03-SB2 at 66.5 to 68 feet bgs, and 1,063 ppm from J03-SB8 at 44 to 45 feet bgs. Elevated FID readings were not detected at the groundwater table. Visual staining was only noted in boring J03-SB1 at 36 to 38 feet bgs.

Temporary wells J03-SB1 through J03-SB3 and J03-SB5 were gauged following installation activities and allowed to stabilize before abandoning. Soil samples were collected throughout the depth of each borehole and at the water table. Free product was not detected in any of the temporary gauging wells. Groundwater levels in the temporary gauging wells ranged from 102.93 to 104.99 feet bgs.

Permanent gauging wells J03-SB4 and J03-SB6 were gauged following installation activities, allowed to stabilize, and gauged monthly since January 2008. Free product has never been detected in either permanent well. Groundwater levels ranged from 103.72 to 104.94 feet bgs. Depth-to-water measurements for these wells are summarized on Table 1. Depth-to-water measurements were not taken for borings J03-SB7 through J03-SB9 because they were not drilled to groundwater.

Analytical soil sample results are summarized in Table 2 and the laboratory and data validation reports are included in Appendix B.

Tier 2 Site-Specific Target Levels (SSTLs) for soil samples collected deeper than 10 feet bgs are based on conservative fuel saturation values, which vary depending on particle size. The methods and assumptions used to derive these SSTLs are provided in the Final CAP for J03 (CH2M HILL, 2007), which was approved by NDEP on October 12, 2007 (NDEP, 2007). If sample-specific particle size information is not collected, then the sampling results for soil samples collected deeper than 10 feet bgs are compared against the minimum SSTL concentration (i.e., 2,000 milligrams per kilogram [mg/kg] for TPH-gasoline; 3,000 mg/kg for TPH-diesel; and 5,000 mg/kg for TPH-motor oil). Notes on Table 2 indicate whether the minimum SSTL is exceeded for samples deeper than 10 feet bgs without associated particle-size measurements.

Eight soil samples were collected from 44 to 71 feet bgs from borings J03-SB1, J03-SB2, J03-SB5, J03-SB6, J03-SB8, and J03-SB9 from a range of soil types and analyzed for particle size (American Society for Testing and Materials [ASTM] Method D422 [2007]). The particle sizes were used to select the appropriate SSTL. In addition to the eight soil samples where SSTLs were developed, a total of 96 samples were collected from all nine boring locations.

TPH-gasoline and TPH-motor oil were not detected above their respective SSTLs or minimum SSTLs in any of the soil samples collected at SWMU J03. The maximum TPH-gasoline result of 510 mg/kg was collected from J03-SB5 from 70 to 71 feet bgs, significantly below the SSTL for gasoline. The maximum TPH-motor oil result of 2,500 mg/kg was collected from J03-SB1 at a depth from 46 to 47 feet bgs, significantly below the 5,000-mg/kg SSTL for motor oil.

TPH-diesel was detected above the minimum SSTL of 3,000 mg/kg in borings J03-SB1, J03-SB6, J03-SB7, and J03-SB9. The highest TPH-diesel concentration was 38,000 mg/kg detected at J03-SB9 from 53.5 to 54 feet bgs. The deepest occurrence of TPH-diesel above the minimum SSTL was detected at 3,600 mg/kg in boring J03-SB6 at 55 to 56 bgs. Although these TPH-diesel concentrations are above the minimum SSTL for TPH-diesel, as shown on Cross Sections A-A′ and B-B′ (Figures 3 and 4), the concentrations drop to below the minimum SSTL for the remainder of the borehole depth. There are no exceedances of the minimum SSTL within 10 feet of groundwater.

Groundwater samples collected from wells J03-SB4 and J03-SB6 reported estimated concentrations of tetrachloroethene (PCE) below the 5-micrograms-per-liter (µg/L) action level. The highest level of PCE (0.91J µg/L) was detected in the sample collected from well J03-SB4 (the estimated PCE concentration of the field duplicate collected at this location was 0. 81J µg/L). PCE was detected in the sample collected from well J03-SB6 at an estimated concentration of 0.29J µg/L. No other analytes were detected in the samples collected from these two wells (Appendix B).

Seven of the 10 samples collected from 0 to 10 feet bgs were below the Tier 1 action level of 100 mg/kg. No TPH-gasoline results exceeded 100 mg/kg. Borings with TPH concentrations above 100 mg/kg were J03-SB1 (TPH-diesel of 810 J mg/kg and TPH-motor oil of 960 J mg/kg), J03-SB5 (TPH-diesel of 430 J mg/kg and TPH-motor oil of 340 J mg/kg), and J03-SB8 (TPH-diesel of 220 J mg/kg and TPH-motor oil of 170 J mg/kg). However, none of samples collected from the 0 to 10-foot bgs depth interval exceeds the minimum Tier 2 SSTL value samples (2,000 mg/kg for TPH-gasoline; 3,000 mg/kg for TPH-diesel; and 5,000 mg/kg for TPH-motor oil; see Table 2). The maximum concentrations in the 0 to 10-foot bgs depth interval were collected from J03-SB1: TPH-gasoline of 3.5 mg/kg; TPH-diesel of 810 J mg/kg; and TPH-motor oil/Bunker C of 960 J mg/kg (Table 2).

7.0 Conclusions

Based on historical and additional site characterization data, closure criteria have been satisfied for SWMU J03. Closure of SWMU J03 is requested following Nevada Administrative Code (NAC) 445A.227 guidelines, under which the following issues were addressed:

a. Depth of groundwater: 103.99 to 105.00 feet bgs (February 2009).

b. Distance to irrigation or drinking water wells: Water supply well #7 (currently used as a non-potable water source because the water quality is inadequate for use as a potable water source) is 1.2 miles to the north (sidegradient to groundwater flow) and water supply well #1 (infrequently used as a potable water source for HWAD) is 2.9 miles to the northwest (sidegradient to groundwater flow).

c. Type of contaminated soil: Sands and silty sands.

d. Annual precipitation: 4.6 inches (evapotranspiration potential is 48 inches per year [USAEHA, 1988]).

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

f. Extent of contamination: In December 2006, 0.32 feet of product was detected in monitoring well BLDG70MW01. Monthly gauging has been performed at the well from January 2007 through April 2008. Product measurements have been less than 0.5 inches during those months. Well BLDG70MW01 was gauged for the presence of free product on February 4, 2009; the well observed 0.04 feet (0.48 inches) of free product at that time. Although not removed at the time of gauging, this product was removed on April 7, 2009, during a subsequent site visit to HWAD; 0.44 inches of product was observed at that time.

   In September and December 2007, additional soil sampling was performed at nine borings. The soil sampling confirms that there are only isolated detections of TPH-diesel above the Tier 2 SSTL. There are no exceedances of the TPH-diesel SSTL within 50 feet of groundwater. From the results, the extent of contamination primarily appears in the soils located above the groundwater table with minimum contamination located from 0 to 10 feet bgs at J03-SB1 (TPH-diesel of 810 J mg/kg and TPH-motor oil of 960 J mg/kg), J03-SB5 (TPH-diesel of 430 J mg/kg and TPH-motor oil of 340 J mg/kg), and J03-SB8 (TPH-diesel of 220 J mg/kg and TPH-motor oil of 170 J mg/kg). There are no exceedances of the TPH-diesel SSTL within the 0 to 10-foot bgs depth interval. No product was observed at the two borings advanced to the water table, and no product was observed at the water table during the first 4 months of 2008. Groundwater samples from monitoring wells J03-SB4 and J03-SB6 collected in February 2009 reported estimated detections of PCE at 0.91J µg/L and 0.29J µg/L, respectively. These estimated PCE concentrations are below the groundwater action level. No other analytes were detected in the samples collected from these two wells.

g. Present and potential use of the land: Industrial (present and future).

h. Preferred routes of migration: Downward migration of fuel in soil into groundwater and lateral movement in groundwater.

i. Structures and impediments: With the exception of the vapor extraction wells and associated equipment, no structures exist onsite. Railroad tracks run along the western edge of the site.

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

k. Other factors: Since 1998, a passive and active bioremediation system has been remediating soil at this site. Oxygen utilization data collected in 2001 indicated that bioremediation was still occurring. Due to the relatively flat gradient and low groundwater velocity at the site, a thin layer of free product appears to have slowly moved from the tank area to the northwest until it was discovered in well BLDG70MW01 in December 2006. Slightly elevated levels of dissolved TPH in late 2001 and early 2002 may have provided some indication that product was approaching this well, which is located approximately 140 feet from the tank area. The lack of product thickness and free product recovery from this well from January 2007 through April 2008 monthly free product sampling events indicates that the extent and magnitude of free product are limited and appear to be below the 0.5-inch action level.

An evaluation of the NAC 445A site assessment factors indicates that SWMU J03 does not require additional corrective action. Free product levels continue to be below 0.5 inches in

well BLDG70MW01 and no product has ever been observed in wells J03-SB4 and J03-SB6. Closure at SWMU J03 is, therefore, recommended. It is further recommended that wells J03-SB4 and J03-SB6 be abandoned in accordance with State of Nevada Division of Water Resources regulations.

8.0 Decommissioning Activities

Decommissioning activities at SWMU J03 were performed on March 10, 11, 16, and 17, 2009, and included the abandonment of four air injection wells, seven vapor monitoring wells, one soil moisture probe, approximately 384 feet of subsurface horizontal air injection line, the removal of eight aboveground passive vent stack pipes, 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 and Wells, Zamora, California, in accordance with the Well Decommissioning Variance 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 grout-in-place abandonment method was used to abandon the four air injection wells (AIW-1, AIW-2, AIW-3, and AIW-4) and the 384 feet of subsurface horizontal air injection line at SWMU J03. 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, a backhoe was used to excavate/remove the concrete pads, well vaults, and well casings (to at least 1 foot bgs) on the air injection wells, the seven vapor monitoring wells, and the soil moisture probe. 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 J03 before and after the decommissioning activities were completed are presented in Figure 5.

The grout-in-place method was used to abandon the subsurface horizontal air injection lines connecting the passive vent stack pipes to the treatment system. 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, a 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 J03, the backhoe was used to grade the site to match the surrounding area.

Prior to the start of treatment system dismantling activities at SWMU J03, 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 blower assembly was removed intact and placed into bunker 101-129 for storage. The backhoe was then used to remove the plastic shed housing, the treatment

system, the remaining treatment system components, the 2-inch-diameter surface conveyance piping, and the eight passive vent stack pipes for placement into the debris roll-off container.

The debris generated during decommissioning activities at SWMU J03 (PVC pipe, concrete, rubber hoses, and plastic) was placed into one of two 20-cubic-yard roll-off containers with similar debris generated during decommissioning activities conducted at four other sites at HWAD (B20, 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 J03 and found no outstanding issues at that time. Therefore, based on the above-described decommissioning activities conducted at SWMU J03 in addition to the request for closure, Response Complete is requested for this site.

9.0 References

ASTM International, 2007. *ASTM D422-63(2007) Standard Test Method for Particle-Size Analysis of Soils.*

CH2M HILL, 2007. *Final Corrective Action Plan for J03: Building 70 Diesel Fuel Leak*. September.

Nevada Division of Environmental Protection (NDEP), 2007. "Approval of Final Corrective Action Plan for SWMU J03: Building 70 Diesel Fuel Leak, Hawthorne Army Depot, Hawthorne, Nevada, September 2007." Letter dated October 12, 2007.

SECOR, International Inc., 2005. *Final Work Plan Additional Site Investigation at SWMU J03, Hawthorne Army Depot, Hawthorne, Nevada.* August.

Tetra Tech, Inc., 1998. *Final Report Enhanced Bioremediation Pilot Test Building 70 Diesel Spill Site, Hawthorne Army Depot, Hawthorne, Nevada.* April.

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.

Guidance for Dermal Risk Assessment). Final. USEPA/540/R/99/005. NTIS No. PB99-963312. Office of Emergency and Remedial Response, Washington, D.C. July.

Tables

Table 1

Groundwater Gauging Data, December 2006 - February 2009

Closure Report/Decision Document for SWMU J03, Underground Storage Tank Site, Hawthorne Army Depot, Nevada

Monitoring Schedule	Monitoring Well	Sample Date	Top of Casing (ft msl)	Depth to Free Product[a] (ft btoc)	Free Product Thickness (ft)	Depth to Water[a] (ft btoc)	Groundwater Elevation (ft msl)	Adjusted Groundwater Elevation[b] (ft msl)	Quantity of Product Recovered (gal)	PID Reading (Breathing Zone)[c] (ppm)	LEL Reading (Breathing Zone)[d] (%)	Comments
Monthly	MW-01	12/20/2006	Unknown	104.40	0.32	104.72	Unknown	Unknown		ND	ND	
Monthly	MW-01	1/23/2007	Unknown	NM	--	104.61	Unknown	Unknown	1/2 cup	ND	ND	Bailed 1/2 cup of product from well. Ran bailer down five times.
Monthly	MW-01	2/13/2007	Unknown	104.53	0.01	104.54	Unknown	Unknown	0.25	ND	ND	Old, weathered diesel, coagulated. Bailed 0.25 gallons.
Monthly	MW-01	3/27/2007	Unknown	104.51	0.01	104.52	Unknown	Unknown		NM	NM	Breathing zone LEL/PID not measured due to malfunctioning multi-rae. Very windy.
Monthly	MW-01	4/24/2007	Unknown	104.55	0.01	104.56	Unknown	Unknown		NM	NM	Breathing zone LEL/PID not measured due to malfunctioning multi-rae. Oxygen sensor malfunctioning.
Monthly	MW-01	5/23/2007	Unknown	104.58	0.01	104.59	Unknown	Unknown		NM	NM	
Monthly	MW-01	6/26/2007	Unknown	104.53	0.02	104.55	Unknown	Unknown		NM	NM	
Monthly	MW-01	7/24/2007	Unknown	104.49	0.01	104.50	Unknown	Unknown		NM	NM	
Monthly	MW-01	8/28/2007	Unknown	104.60	0.02	104.62	Unknown	Unknown		1.8	NM	
Monthly	MW-01	10/23/2007	Unknown	104.44	0.02	104.46	Unknown	Unknown		0.5	NM	
Monthly	MW-01	11/15/2007	Unknown	104.47	0.02	104.49	Unknown	Unknown		0.5	NM	
Monthly	MW-01	12/5/2007	Unknown	104.45	0.01	104.46	Unknown	Unknown		0.4	NM	
Monthly	MW-01	1/23/2008	Unknown	104.53	0.02	104.55	Unknown	Unknown		1.0	NM	
Monthly	MW-01	2/27/2008	Unknown	104.51	0.03	104.54	Unknown	Unknown		0.0	NM	
Monthly	MW-01	3/26/2008	Unknown	104.57	0.02	104.59	Unknown	Unknown		0.3	NM	
Monthly	MW-01	4/17/2008	Unknown	104.70	0.03	104.73	Unknown	Unknown		0.0	NM	
Closure	MW-01	2/4/2009	Unknown	104.75	0.04	104.79	Unknown	Unknown		NM	NM	
Monthly	J03-6	1/23/2008	Unknown	NE	NE	103.89	Unknown	Unknown	NE	1.0	NM	
Monthly	J03-6	2/27/2008	Unknown	NE	NE	103.83	Unknown	Unknown	NE	0.0	NM	
Monthly	J03-6	3/26/2008	Unknown	NE	NE	103.72	Unknown	Unknown	NE	0.0	NM	
Monthly	J03-6	4/17/2008	Unknown	NE	NE	103.78	Unknown	Unknown	NE	0.0	NM	
Closure	J03-6	2/4/2009	Unknown	NE	NE	105.00	Unknown	Unknown	NE	NM	NM	
Monthly	J03-4	1/23/2008	Unknown	NE	NE	104.86	Unknown	Unknown	NE	0.9	NM	
Monthly	J03-4	2/27/2008	Unknown	NE	NE	104.71	Unknown	Unknown	NE	0.0	NM	
Monthly	J03-4	3/26/2008	Unknown	NE	NE	104.81	Unknown	Unknown	NE	0.0	NM	
Monthly	J03-4	4/17/2008	Unknown	NE	NE	104.94	Unknown	Unknown	NE	0.0	NM	
Closure	J03-4	2/4/2009	Unknown	NE	NE	103.99	Unknown	Unknown	NE	NM	NM	

Notes:

[a] Depth to free product and groundwater are measured with an interface probe capable of measuring to the nearest 0.01 foot.

[b] Adjusted groundwater elevations are obtained by multiplying the thickness of the free product by the product density 0.08. The adjustment is only made when free product is detected

[c] Peak PID readings in breathing zone are measured with multi-rae that can detect volatile organic compounds (VOCs) above zero parts per million. Respirators with an organic cartridge are worn during bailing activities

[d] LEL readings are obtained with a multi-rae capable of detecting lower gasoline explosive limit above 0.134 percent

ft msl: feet above mean sea level

ft btoc: feet below top of casing

gal: gallons

ppm: parts per million

PID: Photoionization detector

LEL: Lower explosive limit

ND: Not detected in breathing zone

NM: Not measured

NE: Not encountered

Table 2
Additional Site Characterization Soil Sampling Results, September - December 2007
Closure Report/Decision Document for SWMU J03, Building 70 Diesel Fuel Leak, Hawthorne Army Depot, Nevada

Boring	Depth (feet bgs)	Collection Date	Particle Size, D50 (mm)	TPH-Gasoline (mg/kg)	Tier 2 SSTL TPH-Gasoline[a,b] (mg/kg)	TPH-Gasoline Concentration > Tier 2 SSTL?	Notes for TPH-Gasoline	TPH-Diesel (mg/kg)	Tier 2 SSTL TPH-Diesel[a,b] (mg/kg)	TPH-Diesel Concentration > Tier 2 SSTL?	Notes for TPH-Diesel	TPH-Motor Oil (mg/kg)	Tier 2 SSTL TPH-Motor Oil[a,b] (mg/kg)	TPH-Motor Oil Concentration > Tier 2 SSTL?	Notes for TPH-Motor Oil
SB-1	6-10	September 20, 2007	–	<1.3	2,000[b]	No (ND)		51	3,000[b]	No		38 J	5,000[b]	No	
SB-1	20-24	September 20, 2007	–	31	2,000[a]	No	< min. SSTL	2,800	3,000[a]	No	< min. SSTL	370 J	5,000[a]	No	< min. SSTL
SB-1	24-28	September 20, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	550	3,000[a]	No	< min. SSTL	96 J	5,000[a]	No	< min. SSTL
SB-1	28-30	September 20, 2007	–	<2.5	2,000[a]	No (ND)	< min. SSTL (ND)	5,300	3,000[a]	**Yes**	**> min. SSTL**	920 J	5,000[a]	No	< min. SSTL
SB-1	36-38	September 21, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	1,100	3,000[a]	No	< min. SSTL	180 J	5,000[a]	No	< min. SSTL
SB-1	44-46*	September 21, 2007	--	25	2,000[a]	No	< min. SSTL (ND)	9,500	3,000[a]	**Yes**	**> min. SSTL**	1,000 J	5,000[a]	No	< min. SSTL
SB-1	6-7	November 19, 2007	–	3.5	2,000[b]	No	No	810 J	3,000[b]	No		960 J	5,000[b]	No	
SB-1	13-14	November 19, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	480 J	3,000[a]	No	< min. SSTL	230 J	5,000[a]	No	< min. SSTL
SB-1	29-30	November 19, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	110	3,000[a]	No	< min. SSTL	43	5,000[a]	No	< min. SSTL
SB-1	39-40	November 19, 2007	–	55	2,000[a]	No	< min. SSTL	27,000	3,000[a]	**Yes**	**> min. SSTL**	2,300	5,000[a]	No	< min. SSTL
SB-1	46-47	November 19, 2007	–	250	2,000[a]	No	< min. SSTL	33,000	3,000[a]	**Yes**	**> min. SSTL**	2,500	5,000[a]	No	< min. SSTL
SB-1	56-57	November 19, 2007	<0.05 (silts/clays)	12	10,000[a]	No		3,700	20,000[a]	No		150	50,000[a]	No	
SB-1	69-70	November 19, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	2.6 J	3,000[a]	No	< min. SSTL	<4.8	5,000[a]	No (ND)	< min. SSTL (ND)
SB-1	79-80	November 19, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	3.7 J	3,000[a]	No	< min. SSTL	<4.7	5,000[a]	No (ND)	< min. SSTL (ND)
SB-1	89-90	November 19, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	1.5 J	3,000[a]	No	< min. SSTL	<4.5	5,000[a]	No (ND)	< min. SSTL (ND)
SB-1	99-100	November 19, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-1	104-105	November 19, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<4.9	3,000[a]	No (ND)	< min. SSTL (ND)	<4.9	5,000[a]	No (ND)	< min. SSTL (ND)
SB-2	9-10	December 4, 2007	–	<1.2	2,000[b]	No (ND)		<4.1	3,000[b]	No (ND)		<4.1	5,000[b]	No (ND)	
SB-2	19-20	December 4, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4	3,000[a]	No (ND)	< min. SSTL (ND)	<4	5,000[a]	No (ND)	< min. SSTL (ND)
SB-2	23-24	December 4, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	1.8 J	3,000[a]	No	< min. SSTL	5.2	5,000[a]	No	< min. SSTL
SB-2	38-39	December 4, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	1.9 J	3,000[a]	No	< min. SSTL	5.6	5,000[a]	No	< min. SSTL
SB-2	49-50	December 4, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	<4.2	5,000[a]	No (ND)	< min. SSTL (ND)
SB-2	59-60	December 4, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-2	67-68	December 4, 2007	0.375 (fine sand)	17	5,000[a]	No	No	4,400	10,000[a]	No		160	30,000[a]	No	
SB-2	70-71	December 4, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<5.1	3,000[a]	No (ND)	< min. SSTL (ND)	1.5 J	5,000[a]	No	< min. SSTL
SB-2	81-82	December 4, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	4.8	3,000[a]	No	< min. SSTL	1.4 J	5,000[a]	No	< min. SSTL
SB-2	100-101	December 5, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	<4.7 J	3,000[a]	No (ND)	< min. SSTL (ND)	<4.7 J	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	9-10	November 19, 2007	–	<1.2	2,000[b]	No (ND)		<4.1	3,000[b]	No (ND)		<4.1	5,000[b]	No	
SB-3	19-20	November 19, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	29-30	November 19, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	<4.8	3,000[a]	No (ND)	< min. SSTL (ND)	<4.8	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	39-40	November 19, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	<4.2	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	49-50	November 19, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	3.4 J	3,000[a]	No	< min. SSTL (ND)	<5.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	57-58	November 19, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	10	3,000[a]	No	< min. SSTL	8	5,000[a]	No	< min. SSTL
SB-3	68-69	November 19, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	1.9 J	3,000[a]	No	< min. SSTL (ND)	<4.9	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	72-73	November 19, 2007	–	<1.8	2,000[a]	No (ND)	< min. SSTL (ND)	<4.4	3,000[a]	No (ND)	< min. SSTL (ND)	<4.4	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	86-87	November 19, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<4.9	3,000[a]	No (ND)	< min. SSTL (ND)	<4.9	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	94-95	November 19, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.3	3,000[a]	No (ND)	< min. SSTL (ND)	<4.3	5,000[a]	No (ND)	< min. SSTL (ND)
SB-3	103-104	November 20, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	<4.6	3,000[a]	No (ND)	< min. SSTL (ND)	<4.6	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	8-10	November 27, 2007	–	3	2,000[b]	No		<4.1	3,000[b]	No (ND)		<4.1	5,000[b]	No	
SB-4	19-20	November 27, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<4.9	3,000[a]	No (ND)	< min. SSTL (ND)	<4.9	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	21-22.5	November 27, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<4.9	3,000[a]	No (ND)	< min. SSTL (ND)	<4.9	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	39-40	November 27, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.3	3,000[a]	No (ND)	< min. SSTL (ND)	<4.3	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	49-50	November 27, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	59-60	November 27, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	1.7 J	5,000[a]	No	< min. SSTL
SB-4	69-70	November 27, 2007	–	2	2,000[a]	No	< min. SSTL	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	79-80	November 27, 2007	–	<2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	<4.2	5,000[a]	No (ND)	< min. SSTL (ND)
SB-4	89-90	November 27, 2007	–	<2	2,000[a]	No (ND)	< min. SSTL (ND)	<5.2 J	3,000[a]	No (ND)	< min. SSTL	<5.2 J	5,000[a]	No (ND)	< min. SSTL
SB-4	99-100	November 27, 2007	–	<1.7	2,000[a]	No (ND)	< min. SSTL (ND)	<4.7	3,000[a]	No (ND)	< min. SSTL (ND)	2.6 J	5,000[a]	No	< min. SSTL
SB-4	106-107	November 27, 2007	–	<1.9	2,000[a]	No (ND)	< min. SSTL (ND)	<4.8	3,000[a]	No (ND)	< min. SSTL (ND)	<4.8	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	9-10	November 14, 2007	–	<1.3	2,000[b]	No (ND)		430 J	3,000[b]	No		340 J	5,000[b]	No	
SB-5	19-20	November 14, 2007	–	<1.8	2,000[a]	No (ND)	< min. SSTL (ND)	17	3,000[a]	No	< min. SSTL	<6.6	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	29-30	November 14, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	<4.2	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	39-40	November 14, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	49-50	November 14, 2007	–	<1.5	2,000[a]	No (ND)	< min. SSTL (ND)	<4.8	3,000[a]	No (ND)	< min. SSTL (ND)	<4.8	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	59-60	November 14, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	66.5-67	November 14, 2007	0.065 (silty sand)	230	7,500[a]	No	No	14,000	15,000[a]	No		660	40,000[a]	No	
SB-5	70-71	November 14, 2007	0.12 (fine sand)	510	5,000[a]	No	No	9,900	10,000[a]	No		520	30,000[a]	No	
SB-5	80-80.5	November 15, 2007	–	18	2,000[a]	No	< min. SSTL	180	3,000[a]	No	< min. SSTL	9.2	5,000[a]	No	< min. SSTL

Table 2
Additional Site Characterization Soil Sampling Results, September - December 2007
Closure Report/Decision Document for SWMU J03, Building 70 Diesel Fuel Leak, Hawthorne Army Depot, Nevada

Boring	Depth (feet bgs)	Collection Date	Particle Size, D50 (mm)	TPH-Gasoline (mg/kg)	Tier 2 SSTL TPH-Gasoline[a,b] (mg/kg)	TPH-Gasoline Concentration > Tier 2 SSTL?	Notes for TPH-Gasoline	TPH-Diesel (mg/kg)	Tier 2 SSTL TPH-Diesel[a,b] (mg/kg)	TPH-Diesel Concentration > Tier 2 SSTL?	Notes for TPH-Diesel	TPH-Motor Oil (mg/kg)	Tier 2 SSTL TPH-Motor Oil[a,b] (mg/kg)	TPH-Motor Oil Concentration > Tier 2 SSTL?	Notes for TPH-Motor Oil
SB-5	99-100	November 15, 2007	–	19	2,000[a]	No	< min. SSTL	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	109-110	November 15, 2007	–	<1.6	2,000[a]	No (ND)	< min. SSTL (ND)	<5.3	3,000[a]	No (ND)	< min. SSTL (ND)	<5.3	5,000[a]	No (ND)	< min. SSTL (ND)
SB-5	DUP1-11/14/07	November 14, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	<4.8	3,000[a]	No (ND)	< min. SSTL (ND)	<4.8	5,000[a]	No (ND)	< min. SSTL (ND)
SB-6	9-10	November 28, 2007	–	2.3	2,000[b]	No		21	3,000[b]	No		28	5,000[b]	No	
SB-6	13.5-14	November 28, 2007	–	3.2	2,000[a]	No	< min. SSTL	180 J	3,000[a]	--	< min. SSTL	510 J	5,000[a]	No	< min. SSTL
SB-6	26.5-27	November 28, 2007	–	13	2,000[a]	No	< min. SSTL	6,400	3,000[a]	**Yes**	**> min. SSTL**	340	5,000[a]	No	< min. SSTL
SB-6	38-38.5	November 28, 2007	–	42	2,000[a]	No	< min. SSTL	15,000	3,000[a]	**Yes**	**> min. SSTL**	830	5,000[a]	No	< min. SSTL
SB-6	48.5-49	November 28, 2007	0.3 (fine sand)	160	5,000[a]	No	No	8,400	10,000[a]	No		410	30,000[a]	No	
SB-6	55-56	November 28, 2007	–	24	2,000[a]	No	< min. SSTL	3,600	3,000[a]	**Yes**	**> min. SSTL**	180	5,000[a]	No	< min. SSTL
SB-6	68-68.5	November 28, 2007	0.62 (med. sand)	57	3,000[a]	No	No	4,200	5,000[a]	No		180	20,000[a]	No	
SB-6	72.5-73	November 28, 2007	–	9.4	2,000[a]	No	< min. SSTL	530 J	3,000[a]	No	< min. SSTL	24 J	5,000[a]	No	< min. SSTL
SB-6	89-90	November 28, 2007	–	<2.1	2,000[a]	No (ND)	< min. SSTL (ND)	5.6	3,000[a]	No	< min. SSTL	1.6 J	5,000[a]	No	< min. SSTL
SB-6	99-100	November 28, 2007	–	<2	2,000[a]	No (ND)	< min. SSTL (ND)	1.6 J	3,000[a]	No	< min. SSTL	1.2 J	5,000[a]	No	< min. SSTL
SB-6	104-105	November 28, 2007	–	<1.7	2,000[a]	No (ND)	< min. SSTL (ND)	<5.7	3,000[a]	No (ND)	< min. SSTL (ND)	<5.7	5,000[a]	No (ND)	< min. SSTL (ND)
SB-7	9-10	November 15, 2007	–	<1.3	2,000[b]	No (ND)		<4.3	3,000[b]	No (ND)		<4.3	5,000[b]	No (ND)	
SB-7	19-20	November 15, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	2.1 J	3,000[a]	No	< min. SSTL	1.7 J	5,000[a]	No	< min. SSTL
SB-7	29-30	November 15, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	<4.5	3,000[a]	No (ND)	< min. SSTL (ND)	<4.5	5,000[a]	No (ND)	< min. SSTL (ND)
SB-7	39-40	November 15, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-7	49-50	November 15, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.3	3,000[a]	No (ND)	< min. SSTL (ND)	<4.3	5,000[a]	No (ND)	< min. SSTL (ND)
SB-7	59-60	November 15, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.2	3,000[a]	No (ND)	< min. SSTL (ND)	<4.2	5,000[a]	No (ND)	< min. SSTL (ND)
SB-7	74-75	November 15, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	<4.4	3,000[a]	No (ND)	< min. SSTL (ND)	<4.4	5,000[a]	No (ND)	< min. SSTL (ND)
SB-8	9-10	December 4, 2007	–	<1.2	2,000[b]	No (ND)		220	3,000[b]	No		170	5,000[b]	No	
SB-8	19.5-20.5	December 4, 2007	–	66	2,000[a]	No	< min. SSTL	11,000	3,000[a]	**Yes**	**> min. SSTL**	450	5,000[a]	No	< min. SSTL
SB-8	29-30	December 4, 2007	–	4.7	2,000[a]	No	< min. SSTL	1,400	3,000[a]	No	< min. SSTL	75	5,000[a]	No	< min. SSTL
SB-8	38-39	December 4, 2007	–	210	2,000[a]	No	< min. SSTL	7,300	3,000[a]	**Yes**	**> min. SSTL**	220	5,000[a]	No	< min. SSTL
SB-8	44-45	December 4, 2007	0.2 (fine sand)	160	5,000[a]	No	No	5,600	10,000[a]	No		180	30,000[a]	No	
SB-8	59-60	December 4, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	26	3,000[a]	No	< min. SSTL	3.5 J	5,000[a]	No	< min. SSTL
SB-8	69-70	December 4, 2007	–	<1.3	2,000[a]	No (ND)	< min. SSTL (ND)	11	3,000[a]	No	< min. SSTL	2 J	5,000[a]	No	< min. SSTL
SB-8	72-73	December 4, 2007	–	2.5	2,000[a]	No	< min. SSTL	360 J	3,000[a]	No	< min. SSTL	23 J	5,000[a]	No	< min. SSTL
SB-8	85-86	December 4, 2007	–	1.6	2,000[a]	No	< min. SSTL	2.7 J	3,000[a]	No	< min. SSTL	<4.4	5,000[a]	No (ND)	< min. SSTL (ND)
SB-8	99-100	December 4, 2007	–	<1.2	2,000[a]	No (ND)	< min. SSTL (ND)	<4.1	3,000[a]	No (ND)	< min. SSTL (ND)	<4.1	5,000[a]	No (ND)	< min. SSTL (ND)
SB-9	9-10	November 14, 2007		<1.3	2,000[b]	No (ND)		<4.5	3,000[b]	No (ND)		<4.5	5,000[b]	No	
SB-9	19-20	November 14, 2007	–	<1.4	2,000[a]	No (ND)	< min. SSTL (ND)	14	3,000[a]	No	< min. SSTL	<6.3	5,000[a]	No (ND)	< min. SSTL (ND)
SB-9	21-21.5	November 14, 2007	–	210	2,000[a]	No	< min. SSTL	10,000	3,000[a]	**Yes**	**> min. SSTL**	700	5,000[a]	No	< min. SSTL
SB-9	34.5-35	November 14, 2007	–	22	2,000[a]	No	< min. SSTL	30,000	3,000[a]	**Yes**	**> min. SSTL**	1,900	5,000[a]	No	< min. SSTL
SB-9	49-50	November 14, 2007	–	90	2,000[a]	No	< min. SSTL	14,000	3,000[a]	**Yes**	**> min. SSTL**	580	5,000[a]	No	< min. SSTL
SB-9	53.5-54	November 14, 2007	–	55	2,000[a]	No	< min. SSTL	38,000	3,000[a]	**Yes**	**> min. SSTL**	1,400	5,000[a]	No	< min. SSTL
SB-9	60-60.5	November 14, 2007	0.25 (fine sand)	18	5,000[a]	No	No	6,200	10,000[a]	No		430	30,000[a]	No	
SB-9	75-76	November 14, 2007	–	34	2,000[a]	No	< min. SSTL	25	3,000[a]	No	< min. SSTL	<10	5,000[a]	No (ND)	< min. SSTL (ND)
						No. > SSTL (with Particle Size):	0 of 18			No. > SSTL (with Particle Size):	0 of 18			No. > SSTL (with Particle Size):	0 of 18
						No. > min. SSTL:	0 of 79			No. > min. SSTL:	13 of 79			No. > min. SSTL:	0 of 79

Notes:

* September drilling and sampling activities at SB-1 were discontinued at 46 feet bgs and then resumed in November.

[a]SSTL: Tier 2 Site-Specific Target Level. SSTLs for soil samples collected greater than 10 feet bgs are based on conservative fuel saturation values, which vary depending on particle size (CH2M HILL, 2007).
Minimum SSTLs are applied for soil deeper than 10 feet bgs without associated particle-size measurements.

[b]SSTLs for soil samples collected 10 feet bgs or less are compared against the minimum SSTL based on soil saturation values.
The minimum SSTLs based on soil saturation values are TPH-gasoline, 2,000 mg/kg; TPH-diesel, 3,000 mg/kg;
and TPH-Bunker C, 5,000 mg/kg.

DUP1-11/19/07: Duplicate sample collected at J03-SB5-49-50.

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

Bold: Detection above SSTL

min.: minimum

Figures

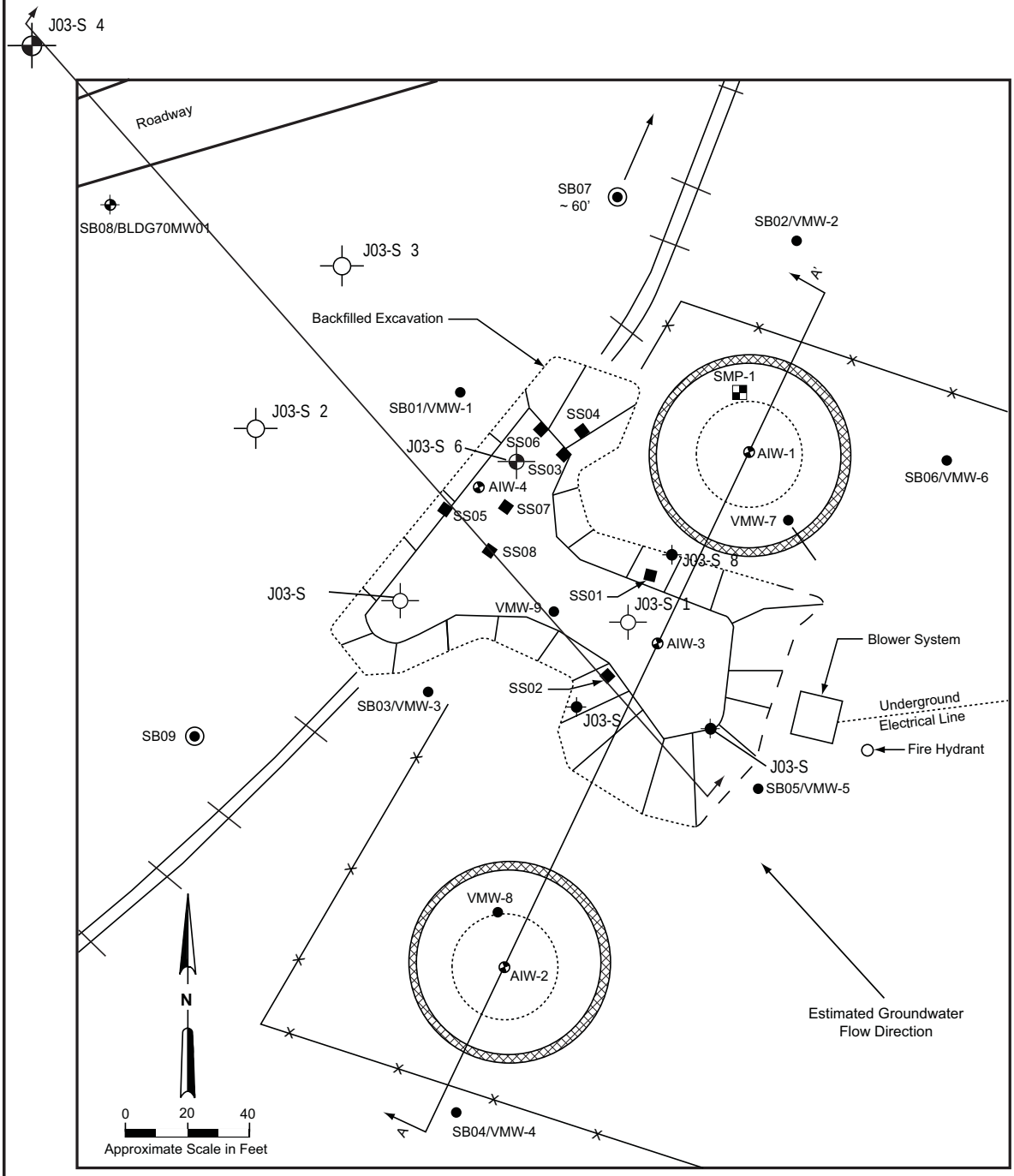
Legend:

- 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 J03
HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

CH2MHILL

DEN/ES112006001/Figure1-1_SWMU_J03_rev2.ai/4-2008



LEGEND

- R.R. Tracks
- Fence
- Approximate Soil Boring (SB)/Vapor Monitoring Well (VMW) Location
- Air Injection Monitoring Well (AIW) Location
- Groundwater Monitoring Well Location
- Groundwater Sample Location (Hydropunch)
- Soil Moisture Probe (SMP) Location
- Former Aboveground Storage Tank (AST)
- Approximate Location of Former AST Excavation
- Approximate Soil Sample Location
- A' A Cross Section
- Soil Boring Location to base of excavation or 10 feet beyond deepest observed contamination
- Boring Location to Groundwater

FIGURE 2
SITE LAYOUT AND SAMPLE LOCATIONS
CLOSURE REPORT/DECISION DOCUMENT, SWMU J03

HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

CH2MHILL

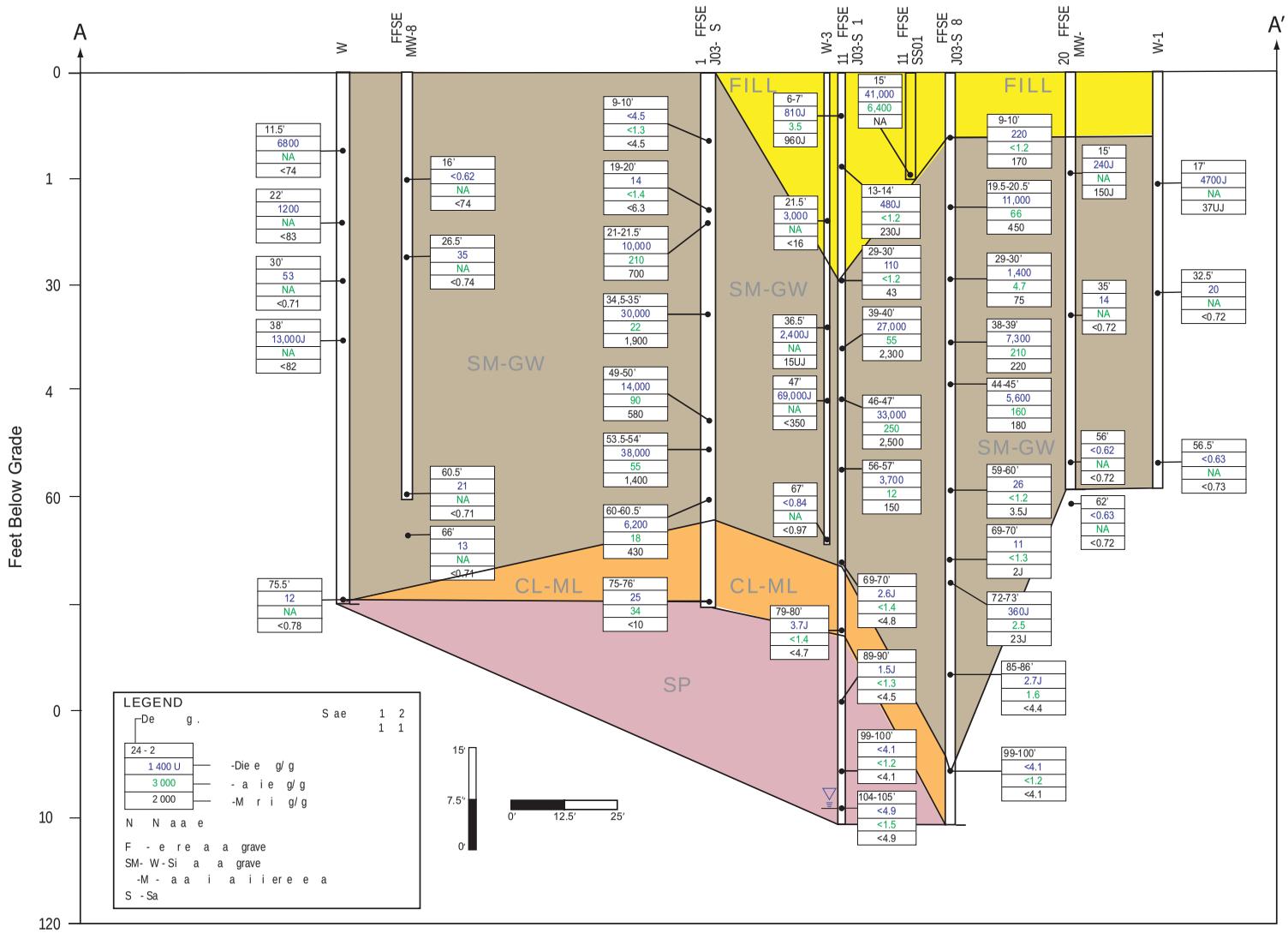


FIGURE 3
CROSS SECTION A-A'
ADDITIONAL SITE CHARACTERIZATION
SWMU J03

HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

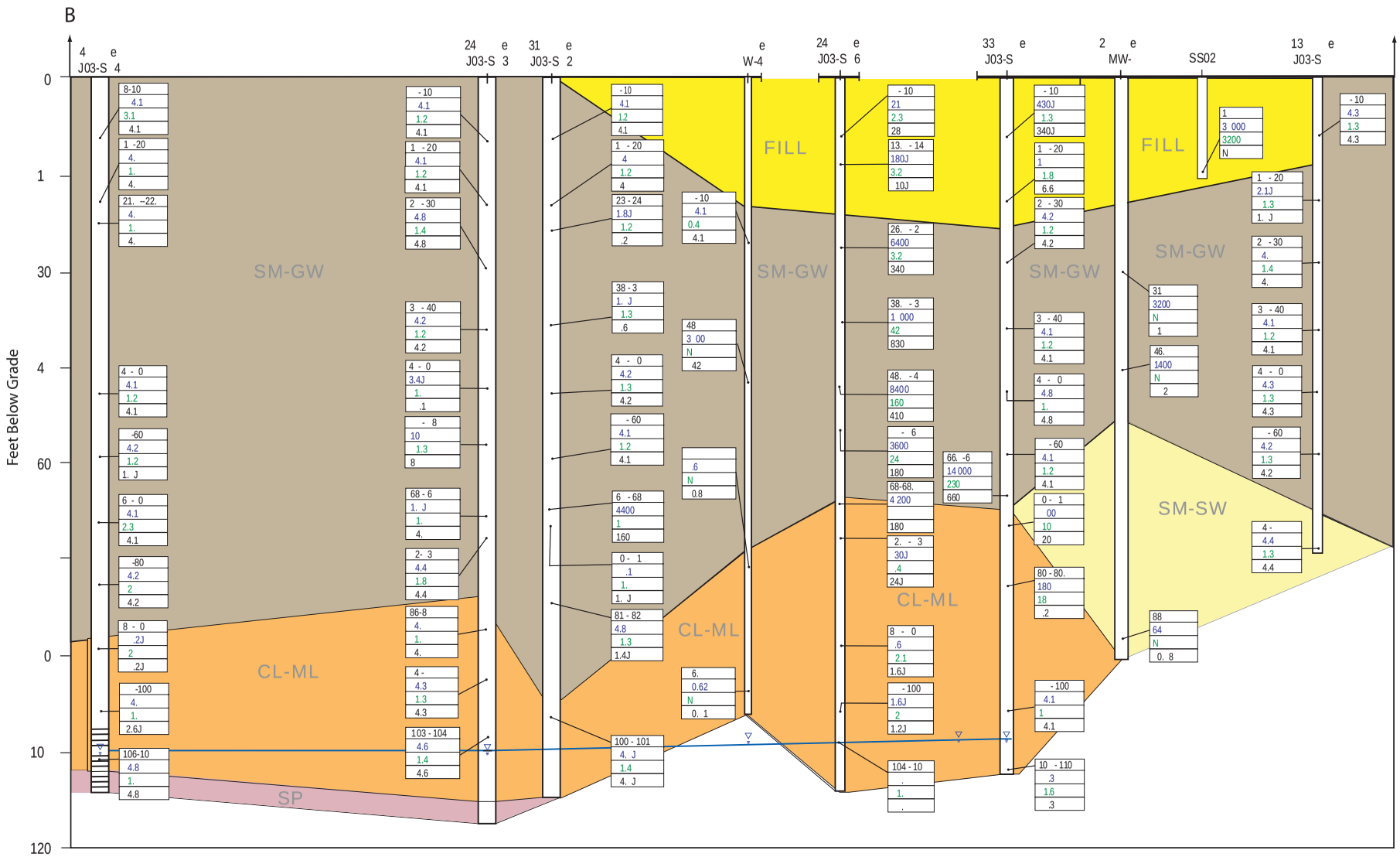


FIGURE 4
CROSS SECTION B-B'
ADDITIONAL SITE CHARACTERIZATION
SWMU J03

HAWTHORNE ARMY DEPOT
Hawthorne, Nevada

Figure 5: Photographs of SWMU J03 before (top photograph) and after (bottom photograph) decommissioning activities were completed.

APPENDIX A

Soil Boring Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	J03-SB1	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot | LOCATION:

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
			0-7	fill- sand, gravel, wood fragments Asphalt, Dry, Reworked look unconsolidated	
5			6-7	[Black substance]	12 ppm, Sl odor J03-SB1-6-7
				fill - SAA, NO Asphalt	
10			7-16		J03-SB1-13-14 25 ppm / NO odor
15					
			16-28	FILL SAA	No odor 0.0 ppm
20					
25					
			28-30	SP Poorly graded sand w/ silt (fine grains) + gravel (medium to fine) Trace cobbles	0.0 ppm J03-SB1-29-30
30					

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB1

SHEET OF

SOIL BORING LOG

PROJECT : Hawthorne Army Depot

LOCATION:

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
35			30-36	SAD Dry loose, unconsolidated Angular to subangular gravel + cobbles (2-3"), v.fine to fine sand w/silt	6 ppm 25 ppm No odor or stain
40			36-39 39-41	SP poorly sorted, fine sand w/ silt + gravel (medium to coarse) trace cobbles (2-3") Dry SAA moist	26 ppm Strong odor 104 ppm some staining J03-SB1-39-40
45			42-46	SW well graded fine to very fine sand w/ little silt	60-80 ppm FID
50			46-50 50-56	SM silty sand w/ trace (fine) gravel (med → coarse) + cobbles (2-3"	J03-SB1 46-47 300 ppm v. strong odor 100 ppm
55					300 ppm v. strong odor
60				SM silty sand w/ trace clay - (fine) - no gravel or cobbles moist, semi consolidated	J03-SB1-56-57

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB1

SHEET OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION:

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
			60-61	SP Poorly graded sand w/ gravel, loose, Dry (fine to medium)	25 PPM FID No odor
			61-64	SAA	23 PPM FID No odor
65			64-66	SAA	~~0 ppm~~ 22 PPM
			66-70	CL sandy clay w/ fine silt, fine grained, weak plasticity moist, soft	20 ppm - No odor or stain odor J03-SB1-69-70 70 ppm
70			70-73	SW Silty sand (fine to med grained) w/ Trace clay, moist, firm,	< 10 PPM No odor FID
			73-76	SAA w/ cobbles	< 10 PPM No odor FID
75			76-79	SW well sorted sand w/ Trace silt, loose, moist, unconsolidated	< 10 PPM No odor FID
80			79-87	SAA w/ Trace Silty Clay lenses (1-2" Thick) moist, loose (fine)	J03-SB1-79-80 < 30 PPM > 10 PPM FID No strong odor
85			87-109	SW well sorted ~~sandy~~ Silty sand w/ lenses of sandy clay, loose, moist	< 40 PPM > 15 PPM J03-SB1-99-100
90					

107 EOB

J03-SB1-104-105

CH2MHILL

PROJECT NUMBER 350552 | BORING NUMBER | SHEET OF

SOIL BORING LOG J03-SB2

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
			0-7	SP poorly sorted sand (fine) w/ gravel (fine) + silt, Dry, loose unconsolidated	0.0 ppm FID no odor or sheen
5					
			7-8	SM U. fine silty sand, semi compact, Dry	0.0 ppm
			8-11	SP - poorly sorted fine sand w/ silt + coarse gravel, Dry	0.0 ppm J03-SB2-9-10
10					
			11-12	SM U. fine silty sand, U. fine + compact, Dry	0.0 ppm
			12-14	SP - poorly sorted fine sand w/ fine to medium gravel, some silt, Dry, loose, unconsolidated	0.0 ppm
15					
			18-20	SAA	0.0 ppm J03-SB2-19-20
20					
			20-21	SAA w/ 2-3" cobbles	
			21-28	SP poorly graded sand (fine) to gravel (medium to fine) Dry loose, unconsolidated	40-60 ppm J03-SB2-23-24
25					
				SAA	
30					

CH2MHILL

PROJECT NUMBER 350552 | BORING NUMBER | SHEET OF

SOIL BORING LOG J03-SB2

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
			30-34	SP SAA	10-15 PPM
			34-35	SW V. fin silty sand compact + fim, Dry	10-15 PPM
35			35-38	SP Poorly sorted sand w fin gravel + silt, Dry loose unconsolidated	10-15 ppm
	38.0'-39.0'			poorly graded sand (SP) w/ trace gravel	* wet due to addition of H_2O by drillers FID 21.90 PPM
40	39.0-41.0			NO RECOVERY! Core Lost	LOST!
	41.0-42.0			poorly graded sand w/ silt, Moderately compact (SW-SM) Moist	FID 20.70 PPM
45	42.0-43.5			42.0-42.5 - poorly graded sand with silt (SW-SM) trace gravel. Very Dry 42.5-43.5 - Well graded sand with gravel (SW) Moist	FID 21.55 PPM
50	43.5-45.5			Well graded sand w/ gravel (SW) Up to 3". Moist	FID 19.60 PPM
	45.5-48.0			Well graded sand w/ gravel (SW) Moist	FID 21.73 PPM
55	48.50.5			same as above (SW) Moist	FID ≈ 87.5-112 ppm
	50.5-52.5			same as above (SW) DRY	FID 53.9 ppm
	52.5-54.0			Same as above (SW) Moist	FID 37.66 PPM
60	54.0-56.0			Same as above (SW) Moist to Dry	FID 47.97

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB2

SHEET 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
56.0	58.0			Same as above (SW) except increase in silt w/depth. MOIST	FID 31.64 ppm
58.0	59.0			Same as above (SW) Moist to Dry	FID 39.42 ppm
59	61.5			Silt with sand (ML) trace gravel. DRY	FID 70.81 ppm * Collect sample 15:15
61.5	64.5			well graded sand with silt (SW-SM) trace gravel DRY	FID 83.72 ppm
64.5	66.5			same as above (SW-SM)	FID ≈836 ppm
66.5	68.0			Same as above. Silt content and gravel content decreasing with depth. @67.7' - well graded sand (SW) (MOIST)	FID ≈1,804 ppm * collect sample 15:25
68.0	70.5			Well graded sand (SW) Moist	FID 207 ppm
70.5	72.0			70.5-71.0 - well graded sand (SW) Moist 71.0-72.0 - well graded sand with silt. Highly compact. not broken apart easily.	FID 238 ppm
72.0	74.0			poorly graded sand (SP) Moist	FID 114 ppm
74.0	76.0			Same as above (SP)	FID 125 ppm
76.0	78.0			76.0-77.0 - same as above (SP) Moist 77.0-78.0 - Same as above (SP) w/ increase in silt & compaction w/ depth	FID 222 ppm

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB2

SHEET OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: J03 SB2 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
78-80'				78-79'- Poorly graded sand (SP) Moist 79'-79.2 - Thin layer compact poorly graded sand with silt. (SP-SM) Moist 79.2-80.0 - Well graded sand (SW). Moist	FID 86.65 ppm
80'-82'				Well graded sand. Trace gravel (SW). Moist.	FID 97.71 ppm * collect sample 15:55
82'-84'				Well graded sand (SW). Moist	FID 42.96 ppm
84-86'				same as above (SW). Moist	FID 33.79 ppm
86'-88'				86'-87' - Same as above (SW). Moist 87'-88' - poorly graded sand (SP) Moist	FID 38.94 ppm
88'-90'				88-89.5 - Well graded sand w/ silt (SW-SM) trace gravel. Moist 89.5-90.0 - Highly compact well graded sand w/ silt Moist	* Begin drilling @ 6:50 am 12/5/07 Silt content increase w/ depth. FID < 20 ppm
90'-92'				90-91'- Well graded sand w/ silt. Compact. (SW-SM) Moist 91-92'- Well graded sand w/ silt and Gravel (Pea) DRY	FID 38 ppm
92'-94'				Well graded sand w/ silt and gravel. (PEA) SW-SM. DRY	FID < 20 ppm
94'-96'				LOST core - unrecovered. broken bag	

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB2

SHEET 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
96'-98'-				Well graded sand w/ silt & gravel (SW-SM). DRY to Moist	FID 10 ppm
5	98-100'			98'-99'- Well graded sand w/ gravel (SW). Moist 99'-99.5- poorly graded sand (SP) Moist 99.5-100'- Well graded sand w/ clay. (SW-SC). Trace gravel up to 3/4". Moist	FID < 20ppm
100'-102' 10				100'-100.5'- Well graded sand. (SW) Moist 100.5'-102'- Lean clay (CL). Moist	FID <20 ppm
102'-104' 15				Lean clay. Trace sand (CL) Moist	FID <20 ppm
104'-106'				same as above (CL)	FID <20 ppm
106'-108'				same as above (CL)	FID <20 ppm
108' 20 -111'				same as above (CL) except no sand	FID <20 ppm
111'-113'				same as above (CL) except no sand	FID <20 ppm
25				Install Temporary Well 20' screen	end 8:55 am
30					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	J03-SB3	

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: HWAD - J03

Coordinates:

DRILLING CONTRACTOR: BOART LONGYEAR - TRACK - GERARDO

DRILLING METHOD AND EQUIPMENT USED: SONIC - TRACK - 4"/6"

DATE: 11-19-07

WATER LEVELS:

START: 1050 END:

LOGGER: B. Lewey

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
	0-3			GW - well graded sand, fine gravel, loose, dry, tr. silt	0.0 ppm FID/PID NO ODOR NO STAINING
	3-4			SAA - cohesive	
5	4-15			GW - well graded sand, fine gravel, loose, dry, tr silt	
10					SAMPLE J03-SB3-9-10 0.0 ppm PID / FID NO ODOR NO STAINING
15	15-18			SW - very fine sand & silt, dry, loose	0.0 ppm PID/FID
	18-21			GW - med to coarse sand & gravel, moist SAA - well graded sand & gravel, loose	0.0 ppm PID/FID NO ODOR NO STAINS SAMPLE J03-SB3-19-21
20	21-24			SW - well graded sand, loose, dry	
25			24-24.25	SP - med sand, tan/rust lens (2")	
			24.25-24.5	SW - fine sand & silt lens (2")	
			24.5-25	SAA - well graded sand	
			25-26	SP - fine sand, loose	
			26-26.5	SW - fine sand & silt, cohesive	
			26.7-27	SAA - fine to med sand	
			27-28	SAA - fine silt & sand well graded - gray, loose, dry	0.0 ppm P/D/FID
30			28-29	GW - well graded sand & gravel	
			29-31	SW - cohesive, fine silt & sand, dry	SAMPLE J03-SB3-29-30

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB3

SHEET OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION:

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
	31-32			SW - well graded sand, loose, dry	0.0 ppm PID/FID
35	32-37			GW - well graded sand with gravel	
	37-38			SP - very fine silt & sand	FID = 220
40	38-44			SW - well graded sand loose	FID = 318 FID = 75 FID = 590 SAMPLE J03-SB3-39-40 FID = 190
				SAA - cohesive	
45	44-45			SP - fine silt & sand	FID = 55
	44-47			SW - well graded sand & silt, cohesive, dry.	
	47-49			SP. very fine sand & silt	0.0 ppm PID/FID
50	49-50			SW - well graded sand & gravel, cohesive,	FID = 31 SAMPLE J03-SB3-49-50
	50-51			ML - clayey silt	
	51-55			SW - well graded sand & gravel, loose	FID = 44 FID = 90
55	55-58			GW - sand & gravel w/ cobbles	
					FID = 256 SAMPLE J03-SB3-57-58
60	58-66			GW - med-coarse sand & gravel	

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB3

SHEET OF

SOIL BORING LOG

PROJECT : Hawthorne Army Depot

LOCATION:

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
					PID/FID = 0.0 PPM
65					
	66-67			CH - very firm, Fat clay	
	67-71			SP - very fine sand & silt, moist with fine lens of cemented sand	FID=40 SAMPLE J03-SB3-68-69 ~~FID=40~~
70				SAA, cohesive	
	71-72			MH - silt & sand, trace clay, dry	
	72-73			SW - very fine sand, trace gravel	FID=32 SAMPLE J03-SB3-72-73
	73-75		MH	~~SM~~ - sandy silt, tr clay, moist	
75	75-78			SP - very fine sand & silt	
				SP - ~~sandy silty~~ sandy sand & silt	
	78-80			MH - sand & silt, tr clay, cohesive	
80					
	80-81			SW - well graded sand	
	81-82			MH - silt & sand, tr clay, ~~cemented~~ cohesive	
				SP - very fine silt & sand, loose	
				MH - silt & sand, some clay, cohesive	
85				SW - well graded sand	FID=32
				MH - silt & sand, tr clay, cohesive	FID@ 87-90 SAMPLE J03-SB3-86-87
				SW - well graded sand, moist, cohesive	
90				SP - very fine silt & sand, loose, dry	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	1 J03-SB3	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot

LOCATION:

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
	90-93			SW - well graded sand	
	93-94			MH - silt & sand tr clay, cohesive	FID@95 = 80
95	94-99			SW - well graded sand	SAMPLE J03-SB3-94-95
					0.0 ppm - FID/PID
	99-100			MH - silt & sand, tr clay	
100	100-101			SW - silt & well graded sand	
	101-			CL - silty clay, moist, firm	
			MH-	SW - well graded sand tr cl	SAMPLE J03-SB3-103-104
105				CL - silty clay	
110				1" fine sand lens	0.0 ppm
115				SP - very fine sand & silt, loose wet	0.0 ppm
120				EOB 117'	

CH2MHILL

PROJECT NUMBER	BORING NUMBER
350552	

SHEET 1 OF

SOIL BORING LOG J03-SB04

PROJECT : Hawthorne Army Depot
LOCATION:
Coordinates:
DRILLING CONTRACTOR :
DRILLING METHOD AND EQUIPMENT USED :
DATE: 11/27/07
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
			0-6	SP Poorly sorted sand w/ medium to fine gravel (fine), Dry, loose unconsolidated	0.0ppm No odor FID or stain
5			6-7	DAA	
			7-9	SP Poorly graded sand with gravel (medium gravel) loose, Dry, unconsolidated	FID 0.0ppm
10			7-15	SP poorly sorted sand (fine) w/ gravel (fine), loose, Dry, unconsolidated	J03-SB4-8-10 + MS/MSD FID 0.0ppm
15			15-18	SP Poorly sorted sand (medium to coarse), with gravel (medium to coarse, moist, loose	0.0ppm No odor
20			18-21	SW well sorted sand w/ trace (fine to very fine) fine gravel, loose, unconsolidated	J03-SB4-18-20 0.0ppm
			21-21.5	SM - fine silty sand, moist non plastic	0.0ppm
			21.5-23	SP - poorly graded sand w gravel (medium to fine	0.0ppm
25			23-25	SW well sorted fine to very fine sand loose, trace silt + few oxidation layers (1-2")	0.0ppm
			25-29	GP poorly sorted fine to medium gravel w/ coarse sand	0.0ppm No odor
30			30-38	SP - poorly graded fine to medium sand w/ medium to fine gravel, loose unconsolidated	0.0ppm

CH2MHILL

PROJECT NUMBER	BORING NUMBER
350552	SHEET OF

SOIL BORING LOG J03-SB-04

PROJECT : Hawthorne Army Depot | LOCATION:

S 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
35				SAA	0.0 ppm No odor or stain
40			38-51	SP- poorly graded sand (fine to medium) w/ gravel (medium) w/ trace cobbles (2-3") trace oxidized layers (2-3" thick) Dry, loose, unconsolidated	J03-SB-04 39-40 0.0 ppm No odor or stain
45					
50					J03-SB-04-49-50 0.0 ppm
			51-52	SAA	
			52-53	SP- poorly graded gravel w/ sand (coarse) + cobbles (2-3") loose, Dry	
55			53-60	SP poorly sorted fine sand w/ trace gravel (fine grained) loose, Dry unconsolidated	0.0 ppm No odor
60			60		J03-SB4-59-60

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	J03 - SB4 -	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot | LOCATION:

S 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
			60-61	SC Clayey sand - fine grained dense, consolidated, mod hard Dry	0.0 ppm No odor
			61-66	SP Poorly graded sand (fine) w/ gravel + silt, Dry, loose unconsolidated	0.0 ppm
65					
			66-68	SM fine silt, ~~clay~~ sand w trace clay moist, non plastic	No odor 0.0 ppm
			68-76	SP Poorly graded (fine to med) sand w/ gravel (med-coarse) loose, Dry unconsolidated	J03-SB4-69-70 0.0 ppm
70					
75					
			76-80	SAA	0.0 ppm No odor J03-SB4-79-80
80					
			80-88	SAA	
85					
			88-93	CL lean sandy clay, mod plasticity, moist, hard (75-80% clay)	J03-B4 8990 0.0 ppm No odor
90					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	J03-SB4	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot
LOCATION:
Coordinates:
DRILLING CONTRACTOR :
DRILLING METHOD AND EQUIPMENT USED :
DATE: 11/27/07
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
			93	CL SAA	0.0ppm
95			93-96	SW well sorted fin sand w/ Rd oxidized layers Trace silt moist, loose	0.0 ppm
			96-98	CL Sandy clay - lean moist	0.0ppm
			96-98	SW well sorted fin sand w/ little silt, moist, well graded	NO odor 0.0ppm
100			99-106	SC clayey sand (v. fin → fin) Trained moist → saturated some silt, little plasticity	J03-SB4 99-100
					102 TOS
105			106-108	SW well sorted sand (fine), saturated loose, w/ silt	▽
			108-109	CL Sandy clay - compact semi-plasticity - wet, thick	
110			109-112	SW well sorted sand w Trace clay + silt - fine grained	no odor or staining
				112' BOS	
				EOB	
115					
30					

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB5 SHEET 1 OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: HWAD - J03

Coordinates:

DRILLING CONTRACTOR: BOART - DALE

DRILLING METHOD AND EQUIPMENT USED: Sonic - 4"/6"

DATE: 11-14-07

WATER LEVELS: START: 1300 END:

LOGGER: Rewey / De

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
				FILL, sand and gravel, dry, loose	NO ODOR, STAINING OR PID/FID HITS
2			2'	FILL, reworked sand & silt, moist, cobbles, chunks of asphalt	
5					
7			7'	FILL, reworked sand & silt, coarse gravel	SAMPLE J03-SB5-9-10 - NO SIEVE
10			10'	FILL, wood, mulched	
12			12'	FILL - sand & silt, coarse gravel	
15			15	FILL, wood mulch	
17			17'	FILL SW - well graded sand, dry, loose	
			18	SP - coarse sand	
			19	SW - very fine sand and silt	
20				SP - coarse sand, coarse gravel	SAMPLE J03-SB5-19-20
				GM - sand & silt, tr. gravel	
			21	FILL - sand & gravel, w/wood chips, reworked	
			23	GW - well graded fine gravel w/sand	
			24	GW - well graded med sand trace fine gravel, trace silt, oxidized	
25			25	SM From 24-24.5, moist sand and silt, cohesive, tr. clay	
			26	SP - med ~~to coarse~~ sand, dry, loose well sorted	
			28	SC - oxidized silt & sand, tr. clay, moist	
30					SAMPLE J03-SB5-29-30

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 2 OF
350552	J03-SB5	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot
LOCATION: HWAD - J03
S Coordinates:
DRILLING CONTRACTOR : Boart - Dale
DRILLING METHOD AND EQUIPMENT USED : Sonic - 4/6"
DATE: 11-14-07
WATER LEVELS :
START: 1300 END:
LOGGER : Rewey IDe

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
				GW - very fine sand & silt, gravel - med to coarse, trace cobbels	
35					
			36	GW - silt & med to coarse gravel	
			37.5	GW - well graded sand, coarse gravel	SAMPLE J03-SB5-39-40
40			40	SP - very fine sand & silt	
			43	GW - well graded sand, med gravel	
45			46'	~~[illegible]~~	
			47		
			48'	CL ~~lean clay~~ silty clay, soft	~~DUP I II~~ DUP1-11/14/07
				MH clayey silt, soft	SAMPLE J03-SB5-49-50
50			50	GW - well graded sand & gravel, ~~some co~~ tr. cobbels	
55			56		
60					SAMPLE J03-SB5-59-60

MS
J03-SB5-59-60-MS/MSD

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 3 OF
350552	J03-SB5	

SOIL BORING LOG

PROJECT: Hawthorne Army Depot — LOCATION:

Coordinates: — DRILLING CONTRACTOR:

DRILLING METHOD AND EQUIPMENT USED: — DATE: 11-15-07

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
			63	GW - coarse sand & gravel	
			64	SW - silt & sand (fine to med)	
65			66	SW - ~~fine to med~~ med to coarse sand, moist, pet odor	
			66.5	CH - stained, fat clay, pet. odor	PID@66.5 = 330
			67	SW - silt & sand (fine to med)	
			68	CH - fat clay	PID = 30 @68 pet. odor PID = 100 @69
70			70	SC - fine sand & silt, tr clay	PID = 402 @70.5 SAMPLE J03-SB5 70-71
			71	SC - fine sand & silt, tr clay, tr gravel	PID = 45@71.5
			72	clayey silt, cemented	
			73	SP - very fine sand ~~very fine sand~~	
			74	CL - silty clay & sand	
75				~~SW well graded sand & gravel~~ ~~very fine sand~~	PID = 10-25
				CL silty clay & sand	
			76	SW very fine sand & silt	
80			80-81	GW silt & well graded sand, tr gravel	FID = 9.3 @ 80.5
			81-82	SW well graded sand & silt	SAMPLE
			82-83	GW well graded sand & vine gravel	J03-SB5-80-80.5
			83-88	SW med to fine sand & silt	
85					FID@ 87' = 3.2
				GW - well graded sand & gravel (fine) tr silt, cemented	
90					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 4 OF
350552	J03 - SB5	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot | LOCATION:

S Coordinates: | DRILLING CONTRACTOR :

RILLING 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, loose, dry	
9.5			95	CL Lean Clay, 80%, tr gravel	
			96	GW med to coarse sand, and gravel, loose, moist	0.0ppm - FID
			98	SAA	J03-SB5 - 99-100 No odor/Staining
10.0			100	SW med to coarse sand, well sorted moist, loose	
			102	SAA w/ Trace cobbles & gravel	0.0 FID/PID
			103	CL Sandy Clay w/Silt - v. firm moist (lean clay) - 90% clay	▽ 104'
10.5				~~SAA~~ CL ~~w/~~ Clay w/ sand + gravel (fine to coarse) - poorly (sorted), firm + moist, 80% clay lean	No odor/staining
			107		
11.0			110	CL SAA w/ few sand lenses saturated	No odor/Staining 0.0 FID/PID J03-SB5 - 109-110 last sample
				EOB	
11.5					
12.0					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 1 OF 4
350552	J03-SB6	

SOIL BORING LOG

PROJECT: Hawthorne Army Depot
LOCATION: SWMU J03
Coordinates:
DRILLING CONTRACTOR: Boart - Dale
DRILLING METHOD AND EQUIPMENT USED: Sonic 4x6 (Truck)
DATE: 11/28/07
WATER LEVELS: START: END:
LOGGER: 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
				FILL - well graded sand & gravel, moist	
5					
			9	SAA - dry	SAMPLE J03-SB6-9-11
10			10		
				SAA - moist w/wood pieces	
			12	SAA - dry	13.5-14 → FID = 113 SAMPLE J03-SB6-13.5-14
15					
			19	FILL - wood pieces 1"-2"	
20			19.5	FILL - well graded sand, tr clay	
			20	SW - well graded sand	
			22	SP - med sand	FID = 100 @ 23-23.5 pet odor
			23	SP - very fine sand & silt	
			23.5	SW - well graded sand, moist	FID = 90 @ 24
25			25	SP - very fine sand & silt	
			26	SW - fine to med sand & silt	FID = 330 @ 26.5-27' pet odor, staining SAMPLE J03-SB6-26.5-27
			27	SW - well graded sand & gravel	FID = 70
			28.5		FID = 110
30			29	SW - silt & sand tr gravel	FID = 270 @ 30' pet odor

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 2 OF 4
350552	J03-SB6	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot
LOCATION:
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
				GW - well graded sand & gravel, tr. cobbels	FID = 123 FID = 150 FID = 125
			33	SW - well graded sand & silt	
			34	SP - coarse sand	
35			35	SP - very fine sand & silt	FID = 80
			36	SW - well graded sand	FID = 145
			37	ML - clayey silt	FID@37 = 180, strong pet. odor
			37.5	SW - very fine silt & sand	FID = 285, strong pet odor
			38.5	SW - well graded sand & silt	SAMPLE J03-SB6-38-38.5
40			40	SW - med to coarse sand, moist	FID = 60 @ 40, pet odor
			41	GW - coarse sand tr gravel	
			42	SW - ~~med sand~~ well graded sand & silt	FID = 105 @ 42
					FID = 90 @ 44
45					
			47	GW - well graded sand & gravel	
			48	CL - silty clay, pet odor	FID = 106
			48.5	GW - well graded sand, tr cobbels	FID = 244 SAMPLE J03-SB6-48.5-49
50					
					FID = 80 @ 52'
			53	SW - well graded sand	
			53.5	GW - well graded sand & gravel	FID = 110 @ 54
			54	ML - silt, tr sand	
55			54.5	SP - very fine sand & silt	SAMPLE J03-SB6 55-56
			55	SP - med sand, ~~tr gravel~~	FID = 190 @ 56
			55.5	GW - well graded sand & gravel	FID = 112 @ 57'
			57	SM - very fine silt & sand	
			58	SW - well graded sand	
60					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 3 OF 4
350552	J03-SB6	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot | LOCATION:

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
			61	SW - Fine to med sand, dry	FID = 57
			64	SW - well graded sand & gravel, moist	FID = 110
65			65	ML - sandy silt	FID = 280 @ 65-65.5
			65.5	MH - clayey silt, gray/green	FID @ 66 = 175
			66	CL - lean clay, tr silt	& pet. odor
			67	SW - well graded sand, tr gravel	FID @ 68-68.5 = 355
			68	SC - med to coarse sand, trace clay	pet. odor SAMPLE J03-SB6-68-68.5
			68.5	CL - lean clay, some sand & gravel	
			69.5	SC - very fine silt & sand, tr clay	
70			70	SW - very fine silt & sand, some cemented sand	chunks
			70.5	SP - silt and fine sand, tr clay	FID = 86 @ 70.5, pet odor
			71	SP - very fine sand & silt	
			71.5	SC - clayey silt & sand, oxidation, brittle	
			72	SP - fine sand & silt	FID = 145 @ 73 SAMPLE J03-SB6-72.5-73
			73.5	SC - very fine sand & silt, tr clay	
75			76	SW - well graded sand & clay	FID = 50
			78	SP - very fine sand & silt	FID = 0.0
80			80	ML - clayey silt	
			80.5	SP - very fine sand & silt	
			81	SP - coarse sand	FID = 0.0
			82	SW - well graded sand, some silt	
			83	SC - very fine sand & silt tr clay	
			83.5	SW - fine to med sand & silt	
85					FID = 0.0
			86.5	CL - silty clay	
			87	SW - well graded sand	SAMPLE J03-SB6-89-90
			89	SP - very fine sand	
90					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 4 OF 4
350552	J03-SB6	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot | LOCATION:

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, loose	
			92	ML - silt, tr sand	
			93	SW - fine to med sand	
			94	SP - fine sand & silt	
			95		FID = 0.0
95				SW - well graded sand	
					FID = 25 @ 99' SAMPLE J03 SB6-99-100
			99	SP - very fine sand & silt	
100			99.5	SW	
			100	GW - well graded sand & gravel	
			101	CL - clay - some silt & sand, moist	
			102	ML - silt, trace clay & sand	
105					
			107	ML - silt & sand, some clay	
110					▽ 11/28/07
			112	EOB	
115					
30					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	J03-SB7	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot
LOCATION:
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
5				0-10 fill - Angular / subangular fill w/ sand (coarse to fine), silt, cobbles gravel some wood shavings	0.0 ppm FID/PID No odor / stained J03-SB7-9-10
10				10-13 SAA	0.0ppm FID/PID
15				13-17 GP Poorly sorted/graded gravel w/ sand (medium to fine coarse) loose unconsolidated, semi-moist w/ Trace silt subangular to sub round clasts	
20				17-24- SW well graded fine sand w/ Trace gravel (coarse) + silt, moist to Dry unconsolidated, loose light Brown to light gray	0.0ppm FID/PID J03-SB7-19-20
25				24-26 ~~GP~~ SP poorly graded gravel w/ coarse to medium sand loose, moist	0.0ppm FID/PID
30				26-30 SAA w/ Trace cobbles	0.0 ppm FID/PID J03-SB7-29-30

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB7

SHEET OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION:

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
				31-35 SP - Poorly graded gravel w/ sand (medium to coarse), loose, moist, unconsolidated	0.0 ppm PID/FID No odor/Stained
35				35-37 - SAA w/ cobbles (2-3")	0.0 ppm FID/PID
				37-38 SAA - moist 38-41 SAA w/ cobbles 2-3' - Dry	0.0 ppm FID/PID J03-SB7-39-40
40					
				41-46 SM well graded sand with silt U-moist, semi-un consolidated. Trace gravel (med to coarse)	0.0 ppm FID/PID
45					
			46-47	SC clayey sand w/ some silt - Semi Compact + firm	0.0 ppm
			47-57	SP - medium to coarse sand with gravel (medium to fine). loose, moist unconsolidated. Trace cobbles + silt, Trace lenses of fine sand	0.0 ppm J03-SB7-49-50 FID/PID
50					
			57		
55					
				57-60 SP SAA - moist	0.0 ppm No odor/Stained J03-SB7-59-60
60					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET OF
350552	T03-SB57	

SOIL BORING LOG

PROJECT : Hawthorne Army Depot
LOCATION:
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
65				60-66 - SP. Poorly graded sand w/ gravel - loose, moist, unconsolidated, trace silt + cobbles - sand / gravel - medium to coarse light gray	0.0ppm FID/PID No odor or stain
			66-70	SAA w trace silt + clay moist / semi consolidated	
70			70-75	SW - well graded sand w trace silt + clay, trace clay lenses (<1" thick) moist, semi consolidated	0.0ppm FID/PID No odor or stain
75				EOB	T03-SB57-74-75
80					
85					
90					

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB8

SHEET OF

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: J03-8 Hawthorne, NV

GPS Coordinates:

DRILLING CONTRACTOR: Boart-Longyear Prosonic

DRILLING METHOD AND EQUIPMENT USED:

DATE: 12/5/07

WATER LEVELS: 104 ft. START: END:

LOGGER: JN

	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
RUN 1	0-6'				0'-3.0' - Silty-sand (SM) with trace gravel. Trace organics. Top 1/4" moist. Below surface dry.	FID 7.23
	5				3.0'-6.0' - Well graded sand (SW) with few gravel.	FID 9.56
RUN 2	6-12'				6.0-9.5' - (SM) silty sand with trace gravel. DRY	
	10				9.5'-12.0' - (SM) silty sand with concentrated organics (wood chips)	* Sample 9.0'-10.0' 7:55am
3	12'-14.3'				12.0-13.7' - (SM) silty sand w/ trace gravel. DRY 13.7-14.3' - well graded sand with silt & trace gravel	
	15					
4	14.3'-17'				14.3-15.5' - well graded sand w/ trace cobble (4.0") (SW) 15.5-16.0' - Poorly graded sand (SP) ~~16.0'-16.5' - poorly graded sand w/ silt (SP-SM)~~ 16.5'-17.0' - well graded sand w/ some gravel (SW)	
RUN 5	17.0-19.5'				17.0-18.0 - well graded sand w/gravel (SW) moist to dry 18.0-18.5' - well graded gravel w/sand (GW) dry 18.5-19.5' - well graded sand w/ gravel (SW) moist to dry	
	20					
RUN 6	19.5-22.0'				19.5-19.8 - poorly graded sand (SP) moist to dry	* Note intense color change (abrupt) to charcol
	25				19.8-20.4' - (very dark) silt to lean clay [CL/ML] Moist	SAMPLE → PID 32.49 PPM FID 123.0 PPM
					20.4-21.4' - poorly graded sand (SP) moist to dry - Ash colored 21.4-22.0' - (very dark) silt to lean clay [CL/ML] Moist	* Sample 8:25am 19.5-20.5'
	30					

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB8

SHEET 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
RUN 7 22.0 - 24.0'				22.0-22.6' - well graded gravel w/ sand (GW) Dry ? 22.6-24.0' - well graded sand w/ some gravel (SW) 22.6'-22.8' - Moist 22.8'-23.0' - Dry 23.0'-24.0' - Moist	
RUN 8 24.0 - 27.0'				24.0-25.0' - Well graded sand w/ some gravel. Moist 25.0-25.5 - Poorly graded sand (SP) Moist 25.5-27.0 - Well graded sand w/ some gravel. Moist to dry	
RUN 9 27.0 - 28.7				Well graded sand w/ trace gravel. (SW) Moist 27.0-28.0 - Darker 28.0-28.7 - Ligher (less gravel)	
28.7 - 31.2				Same as above (SW) Moist	* Sample 29.0'-30.0' 9:00 am
31.2 - 34.0				Same as above (SW) Moist	
34.0 - 37.0				34.0-35.5 - poorly graded sand (SP) moist 35.5-35.8 - Compact Layer (discolored) has odor 35.8-37.0 - Poorly graded sand (SP) Moist to dry	* PID 9.19 PPM FID 39.36 PPM
37.0 - 39.0				Poorly graded sand with silt (SP-SM) has odor. Moist. Discolored	* PID 120 PPM Sample 38'-39' 9:25 FID 551 PPM
39.0 - 42.0'				Poorly graded sand (SP) Moist	
42.0' - 44.0'				Poorly graded sand (SP) Dry	

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB8

SHEET 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
44.0 - 47.0				44.0-46.0' - Poorly graded sand. strong/abrupt discoloration Moist. 46.0-47.0' - Poorly graded sand with silt (SP-SM)	* PID - 262.7 PPM FID - 1063.0 PPM *Sample 44.0'-45.0'
47.0 - 49.0				Same as above (SP-SM) Moist	
49.0 - 51.5				49.0-51.0' - same as above (SP-SM) Moist to Dry 51.0 - 51.5 - Well graded sand (SW) w/ trace pea gravel	
51.5 - 53.5				51.5-53.0 - Well graded sand (SW) w/ trace gravel same as above 53.0-53.5 - Poorly graded sand (SP) Moist	
53.0 - 55.0				53.5-54.0 - Poorly graded sand (SP) Moist 54.0 - 55. - Well graded sand (SW) with gravel up to 1" Moist to Dry.	
55.0 - 57.0				Well graded sand (SW) w/ some gravel. Moist to dry	
57.0 - 59.0				Same as above (SW) Moist	
59.0 - 62.0				Same as above (SW) moist	
62.0 - 63.0				same as above (SW) moist	

@ 73' - FID 152 PPM
continue drilling

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB8

SHEET 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
63.0 - 65.0				63.0-63.5 - Same as above (SW) Moist 63.5-64.0 - well graded gravel w/ sand (GW) Moist to wet. 64.0-65.0 - Lean Clay (LC). low plasticity. Some silt	— Very compact. core intact!
65.0 - 67.0				65.0-66.5 - Lean Clay (LC) Very compact. Moist 66.5-67.0 - poorly graded sand (SP) Moist	
67.0 - 69.0				67.0-68.- Poorly graded sand (SP). Moist 68.0-69.0- Lean clay (LC) very compact Moist	
69.0 - 71.0				Poorly graded sand (SP) Moist.	
71.0 - 73.0				Poorly graded sand (SP) w/ some gravel. Moist	#FID - 152 PPM sample 72'-73' 10:40
73.0 - 76.0			73-74.5	well graded sand w/ silt and gravel. (SW-SM) Moist 74.5-76.0'- poorly graded sand (SP) Moist	
76.0 - 80.0				Poorly graded sand (SP) Moist	
80.0 - 83.0				same as above (SP) Moist	

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB8

SHEET 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
83.0 - 84.0				Same as above (SP) Moist	
84.0 - 86.0				84.0-85.6 Same as above (SP) Moist 85.6-86.0 ≈4" compact well graded sand w/ clay (SW-SC) Moist	*FID ≈97.0 collect sample 11:15am
86.0 - 88.5				Supersaturated Layer. (Wet) Poorly graded sand. (SP)	
88.5 - 90.5				poorly graded sand (SP) Moist	
90.5 - 91.5				90.5-90.8 - poorly graded sand (SP) Moist 90.8-91 - well graded sand (SW) with gravel up to 1.0" DRY 91.0-91.5 - poorly graded sand (SP) Moist	
91.5 - 93.0				91.5-92.0 - poorly graded sand (SP) Moist 92.0-93.0' - well graded sand w/ gravel (SW)	*FID Below 25 PPM
93.0 - 95.0				well graded sand w/ trace pea gravel (.5"). Moist (GW)	
95.0 - 97.0				Same as above except increase in gravel content. Moist to Dry	*FID Below 50 PPM ≈38.65
97.0 - 99.0				97.0-97.5 - Poorly graded sand with silt (SP-SM) Moist 97.5-97.9 Well graded sand with gravel 97.9-98.5 Poorly graded sand (SP) compact Moist 98.5-99.0 Well graded sand with gravel (SP) up to 1.0". DRY	

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-SB8

SHEET 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
99.0	102.5			99.0 – 101.0 - well graded sand with gravel DRY 101.0 - 101.5 – poorly graded sand w/ trace gravel 101.5 - 102.5 - Lean clay with sand and trace gravel. Highly compact.	
102.5	105.0			Lean clay. Highly compact. Moist	
105.0	107.0			105.0 - 106.5 - Lean clay Highly compact. Moist 106.5 - 107 - poorly graded sand (SP) Moist	* Final FID < 20 PPM 12:20 PM Abandoned borehole by backfilling to surface with cement.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET / OF
350552	J03-SB9	1 / 5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot
LOCATION: J03-SB9 HWAD-J03
Coordinates:
DRILLING CONTRACTOR: BOART - DALE
DRILLING METHOD AND EQUIPMENT USED: SONIC - 6"/4"
DATE: 11-14-07
WATER LEVELS: NA
START: 0730 END: 1030
LOGGER: Rewey / De

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 — FID	PID
	0-7	7/7		0-3' fill loose, 1" cobbles, wood, sand	0.0 ppm	Multi Rae
				3-7' GP - sand with gravel (fine to coarse), loose	0.0 ppm	Mini Rae
					No staining or odor	
7						
	7-17	10/10		7-9 - sand w/ fine gravel GW with some silt, dry	0.0 ppm	
				9-10 ~~clay~~ sand w/ silty clay GC	9-10 = sample (J03-SB9-9-10)	
				10-10.5 - GW sand w/ fine grave some silt, moist	0.0 ppm	0.0
				10.5-11 - sand w/ silty clay GC		
				11-11.5 = sandy gravel GP		
				11.5-12 - well sorted sand, semi moist SW (fine to med)	0.0 ppm	0.0
				12-13 - sand w/ fine to med gravel, loose, dry GW		
				13-15 - well sorted sand, semi moist SW	0.0	0.0
				15-15.5 - well sorted medium gravel w/ fine sand GP	0.0	
				15.5-18' - well sorted sand, semi moist SW		0.0
17				18.5 oxidation		
				18-19 well sorted fine sand w trace silt, moist loose SW		
				19-20 fine sand w/ trace silt & clay SC	(J03-SB9-19-20) PID of 20	
				2" intr clayey silt, gray/green		

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 2 OF 5
350552	J03-SB9	

SOIL BORING LOG

PROJECT: Hawthorne Army Depot
LOCATION: HWAD-J03
Coordinates:
DRILLING CONTRACTOR: BOART - DALE
DRILLING METHOD AND EQUIPMENT USED: Sonic 6"/4"
DATE: 11-14-07
WATER LEVELS: NA
START: 0730 END: 1030
LOGGER: 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
				20-21 loose very fine sand, SW tr. silt, dry, well sorted	FID = 50 @ 21'
				3" clay layer @ 21', stained, pet. odor MH	(J03-SB9 21-21.5) sample
5				21-22 sand w fine gravel, dry, loose GW	
				22-23 sand w/ fine to coarse gravel, semi moist, loose, poorly sorted GW	
10				23-24 med sand w/ fine to med gravel, moist, poorly sorted loose, trace cobbles GW	
15				26' trace oxidation	
				27' - slight odor	27' = PID = 10 FID = 7
20				27-27.7 - med sand w fine to med gravel GW	
				27.7-28.3 coarse sand w med gravel to cobbles, darker GW	
25				28.3-29 moist fine sand, tr. silt, fine gravel, loose GW	
				29-31 fine to med sand ptr SC silt & clay fine to med gravel, a little cobbles, wet FH,	
30					

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET 3 OF 5
350552	J03-SB9	

SOIL BORING LOG

PROJECT: Hawthorne Army Depot
LOCATION: HWAD-J03
Coordinates:
DRILLING CONTRACTOR: BOARS - DALE
DRILLING METHOD AND EQUIPMENT USED: Sonic 6"/4"
DATE: 11-14-07
WATER LEVELS: N.A.
START: 0730 END: 1030
LOGGER: 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
					background FID = 7 PID = 5
				31-31.5 very fine sand, tr silt SP	
				31.5-35 fine to med sand, dry loose w/gravel (med to coarse) GM	
				34 oxidation	
				34.5-35 silty sand tr. clay, staining, odor SC	sample (J03-SB9-34.5-35) FID=93, PID=78
				35-35.5 - very fine sand, tr silt, dry SP	
				35-36 - very fine sand, moist, tr silt SP	
				36-37 - dry very fine sand, tr silt light gray SP	
				37-37.5 - dry very fine sand light brown, tr silt SP	
				37.5-38.5 very fine sand tr silt, tr gravel GM	
				38.5-39 very fine sand, tr. clay & silt moist SC	
				39-42 very fine sand, trace silt and cobbles @ 40 GP	
				poorly sort sand & fine to med gravel	
				42-43 very fine sand tr. silt some med to coarse gravel GW	
				43-45 very fine sand, tr GM coarse gravel & cobbles (3" dia) (med to coarse) SM	FID @ 46' = 27
				45-47 dry cemented sand fine	

CH2MHILL

PROJECT NUMBER: 350552

BORING NUMBER: J03-SB9

SHEET 4 OF 5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: HWAD-J03

Coordinates:

DRILLING CONTRACTOR: BOART - ~~[illegible]~~ DACE

DRILLING METHOD AND EQUIPMENT USED: Sonic 6"/4"

DATE: 11-14-07

WATER LEVELS: NA

START: 0730 END: 1030

LOGGER: 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
				47-50 - strong pet. odor moist, very fine sand, ~~lean~~ tr. silt brown, tr coarse gravel	FID=474 @ 50 GM
				50-50.5 med to coarse gravel, tr cobbles, moist	
5				50.5 - ~~[illegible]~~ ~~well graded sand & gravel, some cobbles, dry loose~~	
				~~[illegible]~~ -53 med to coarse sand, ~~coarse~~ fine to med gravel, loose dry, trace cobbles @ 53'	GM
10				53-53.5 moist, dark brown, pet. odor very fine sand, trace silt & clay SC	FID @ 54 = 175 (J03-SB9-53.5-54) Sample
				53.5-54 med to coarse sand ~~med~~ + gravel (coarse) moist, loose, pet. odor SW	
15				54'-54.5' med to coarse sand, loose, dry, lt. br. tr silt SW	
				54.5-55 - fine ~~sandy silt~~ sand + trace silt, light gray stain, pet. odor, trace coarse gravel SW	
20				55-56.5 med to coarse sand & gravel, trace cobbles, loose, dry GM	
				~~56-56.5~~	
25				56.5-59 very fine sand & silt, trace ~~med~~ coarse gravel GW	
30					

CH2MHILL

PROJECT NUMBER 350552

BORING NUMBER J03-S89

SHEET 4 OF 5

SOIL BORING LOG

PROJECT: Hawthorne Army Depot

LOCATION: HWAD - J03

GPS Coordinates:

DRILLING CONTRACTOR: Boart - Dale

DRILLING METHOD AND EQUIPMENT USED: Sonic 6/4

DATE: 11-14-07

WATER LEVELS: NA

START: 0730 END: 1030

LOGGER: 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
				59-60 med to coarse sand and gravel, moist GW	tough drilling @ 58' FID = 3 @ 58' FID = 36 @ 60' FID: 94 @ 60.5
				60-61 med to coarse sand & gravel, moist, loose, tr	
5				61-62 very fine sand & silt, gray SW trace med sand	
				62-64.5 med to coarse sand and gravel GW	
10				64.5-65 lean (80%) clay, some coarse gravel, CL oxidation @ 64'	
				66.0-66.5 silty clay MH	
15				66.5-67 med sand, tr gravel, moist GW	
				67-68 silty clay, moist, tr gravel MH	
				68-68.5 very firm lean clay, tr gravel, oxidation MH	
20				68.5-69 very fine sand & silt SW	
				69-71 very fine sand to med sand + tr silt, moist	SW
				71-72 very firm lean clay, trace gravel MH	
25				72- sandy clay, CL trace silt	
				74.5 very compacted sand, SC trace clay & silt	
30					

EOB = 76'

100% recovery

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

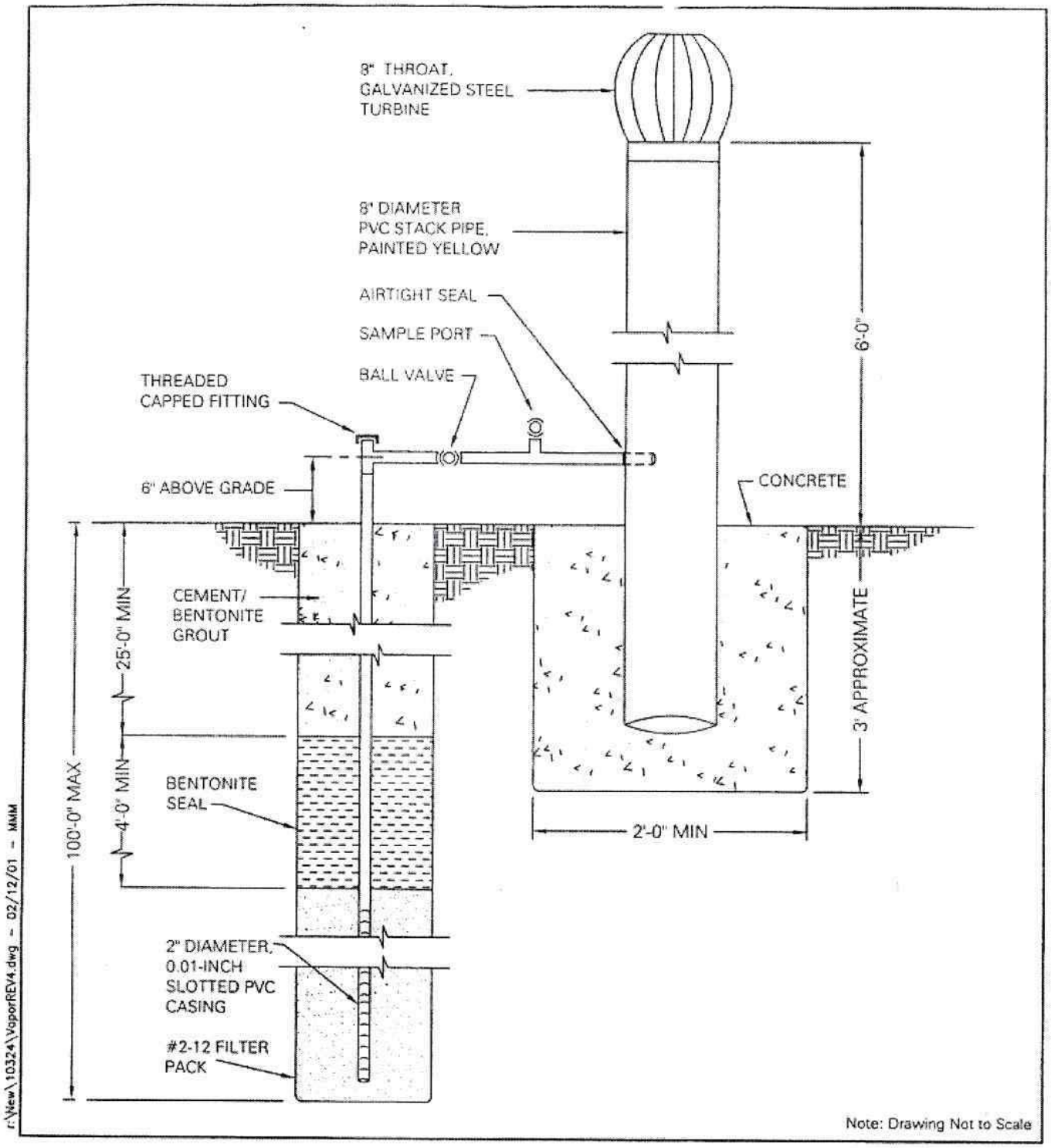
Due to the shallow depths and type of construction of the soil moisture monitoring points at SWMU J03 (lead wires buried in native-soil-filled PVC casing [Figure 6]), CH2M HILL proposes to remove the 3-foot stickup, but to leave the casing and buried wire in place.

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



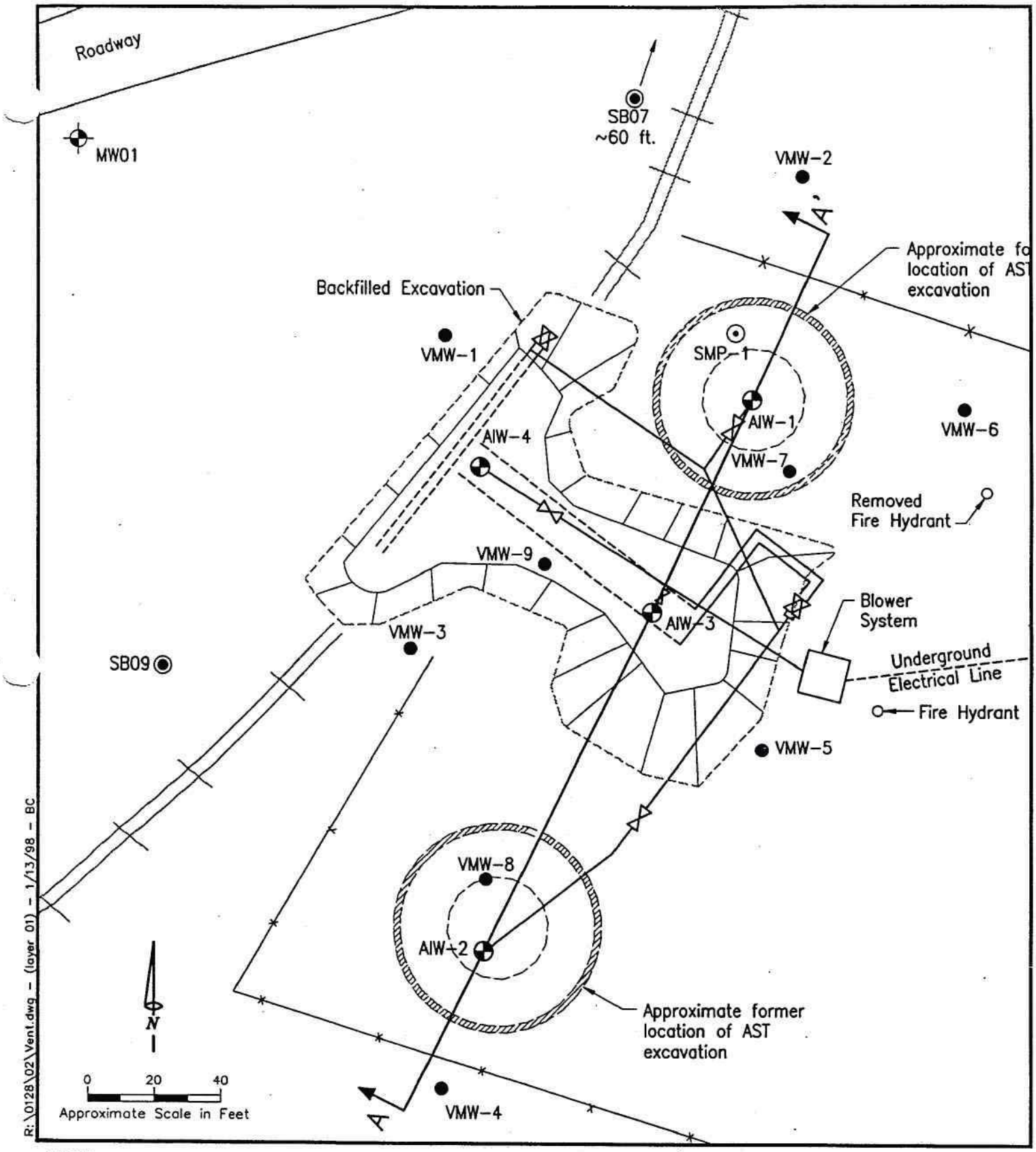
r:\New\10324\VaporREV4.dwg - 02/12/01 - MMM

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)

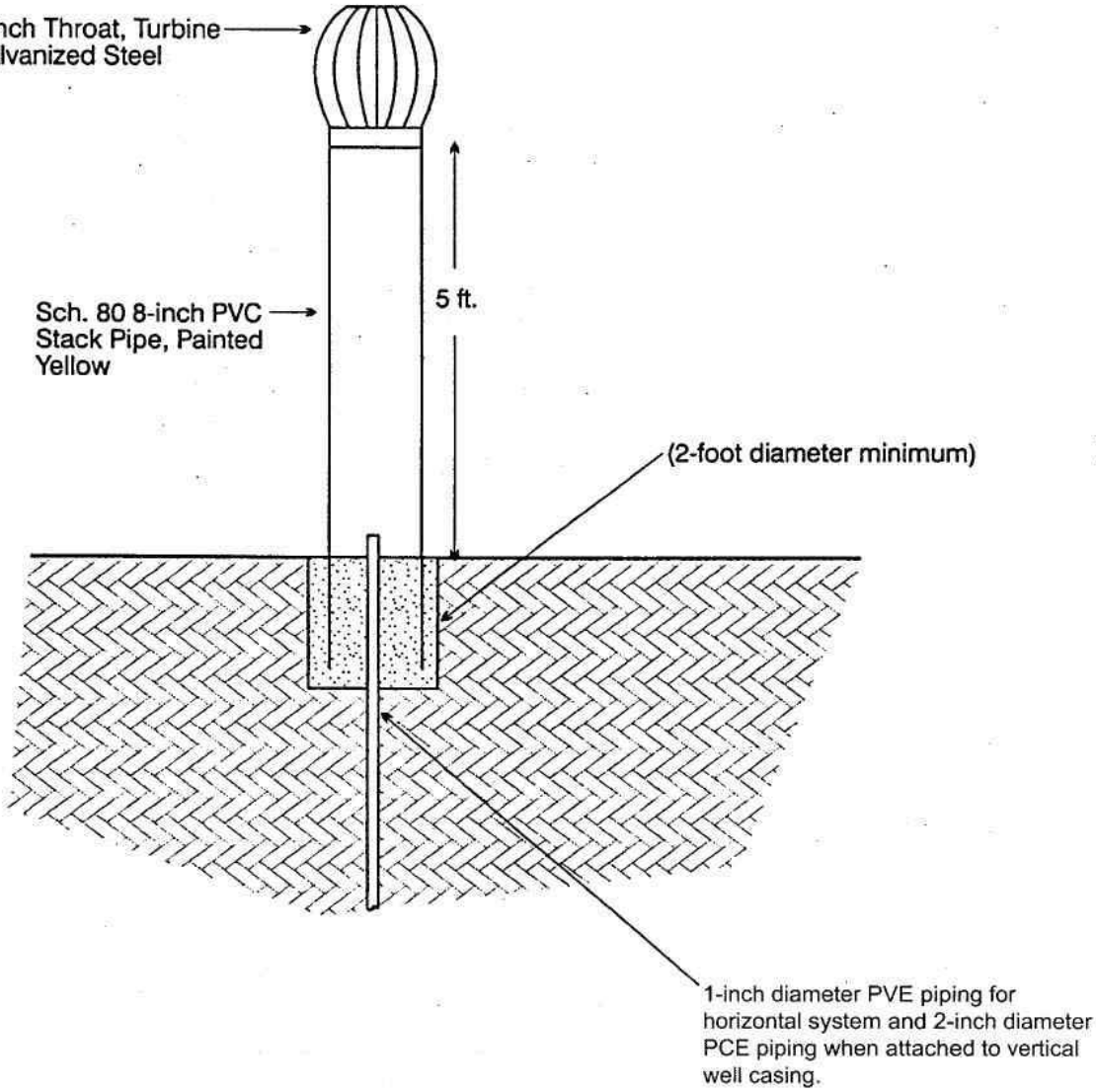
Enhanced Bioremediation System Layout

Hawthorne Army Depot
Hawthorne, Nevada

CH2MHILL

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

FIGURE 2



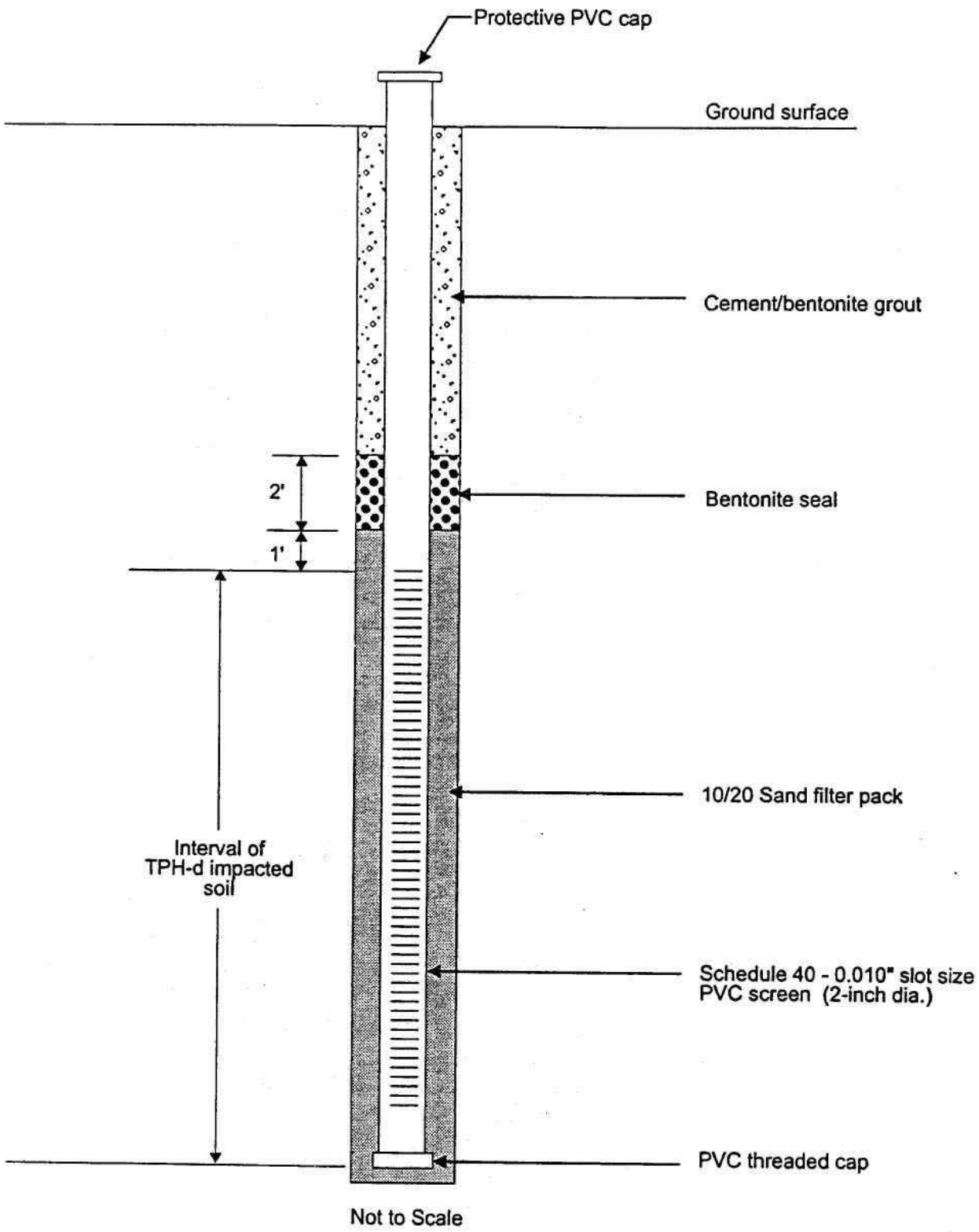
R:\0082\45\Attic.cdr - 1/21/98 - BC

Attic Turbine Wind Powered Bioventing System Design

CH2MHILL

Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 3



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

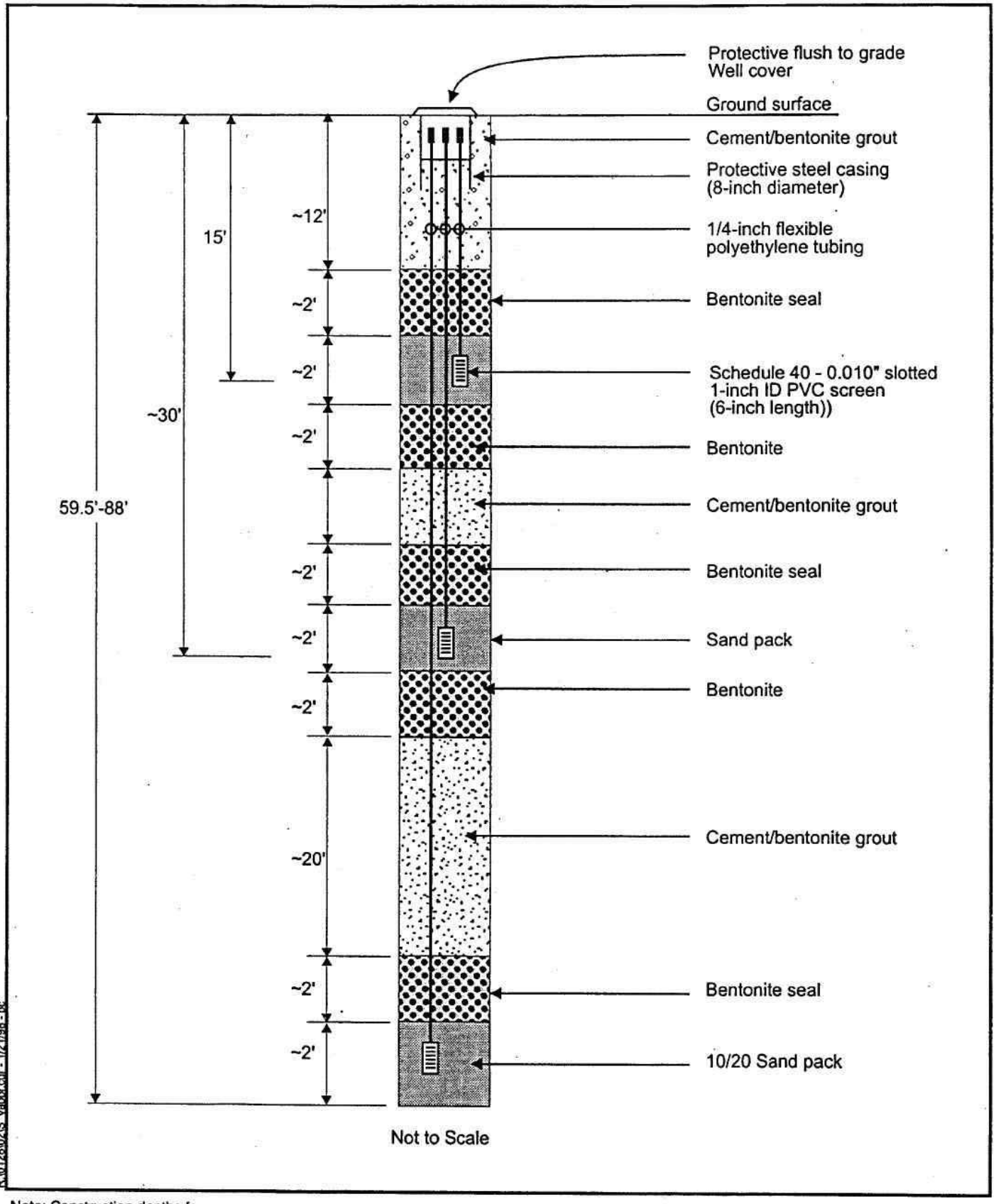
Note: Construction depths for each of the air iniection wells vary.

Typical Air Injection Well Construction

CH2MHILL

Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 4



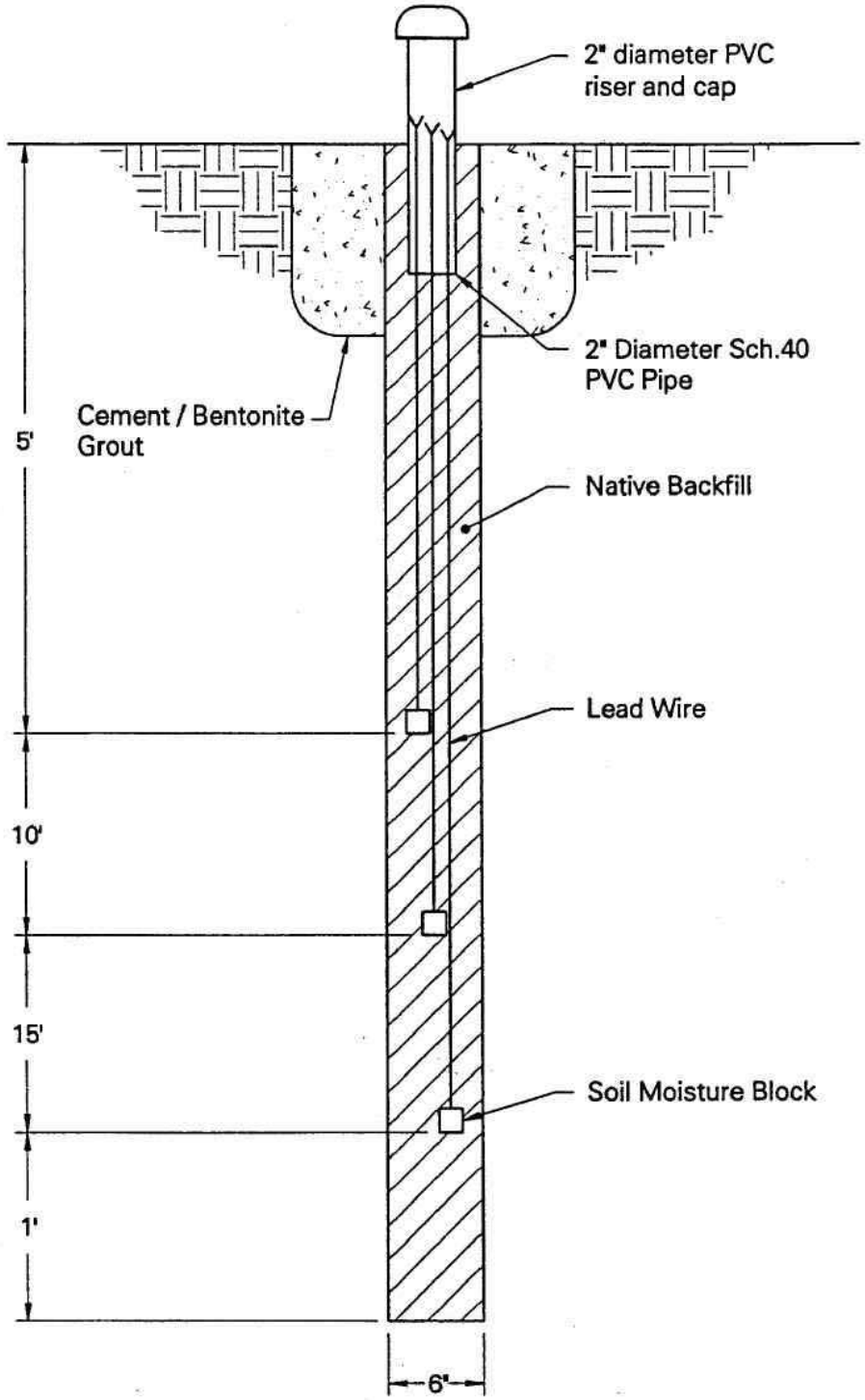
Note: Construction depths for each of the vapor monitoring wells are approximate.

Typical Soil Vapor Monitoring Well Construction

CH2MHILL

Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 5



Not to Scale

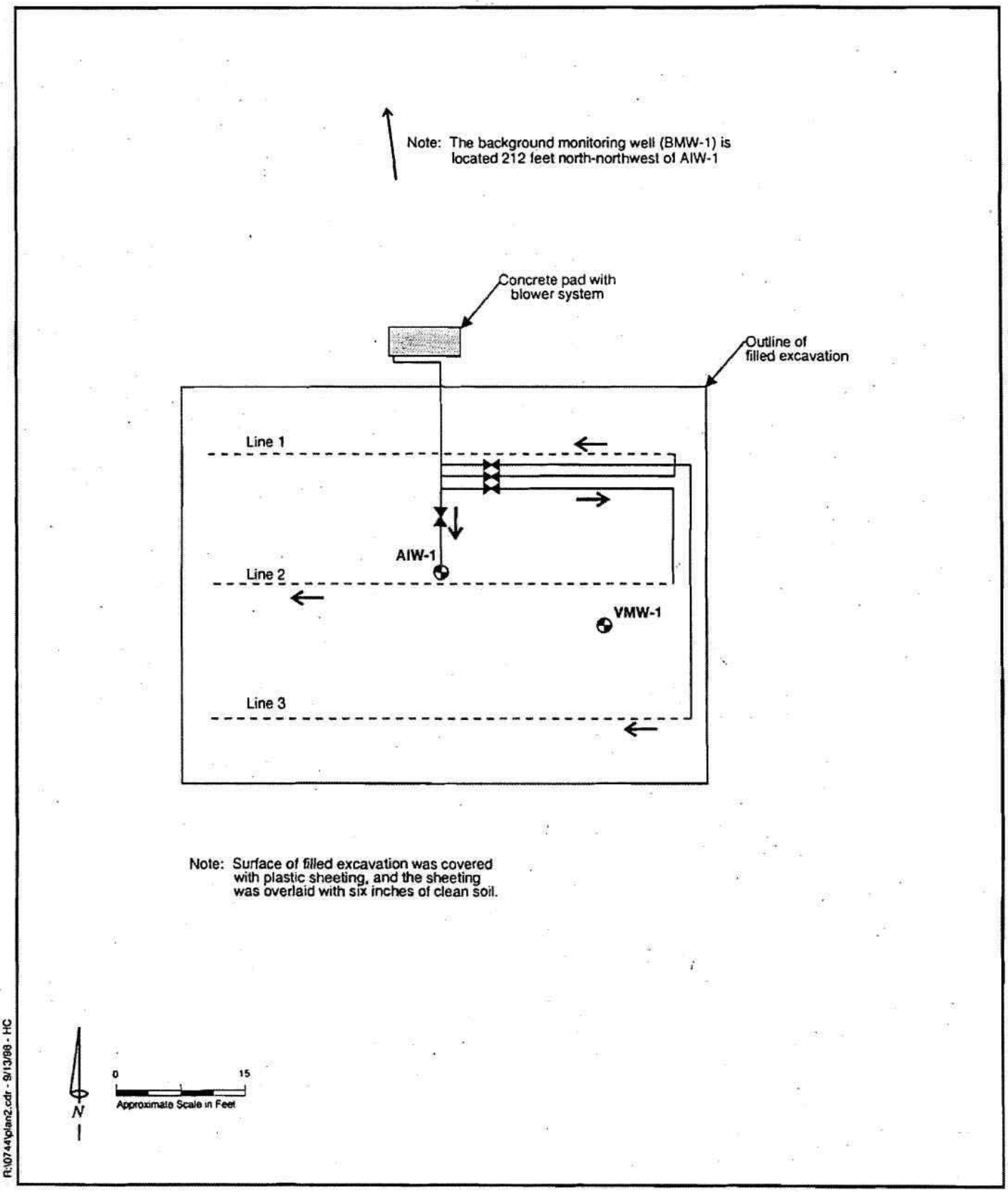
r:\0128\02\Soilprob.dwg – 1/13/98 – BC

Soil Moisture Probe Construction

Hawthorne Army Depot
Hawthorne, Nevada

CH2MHILL

FIGURE 6



Legend:

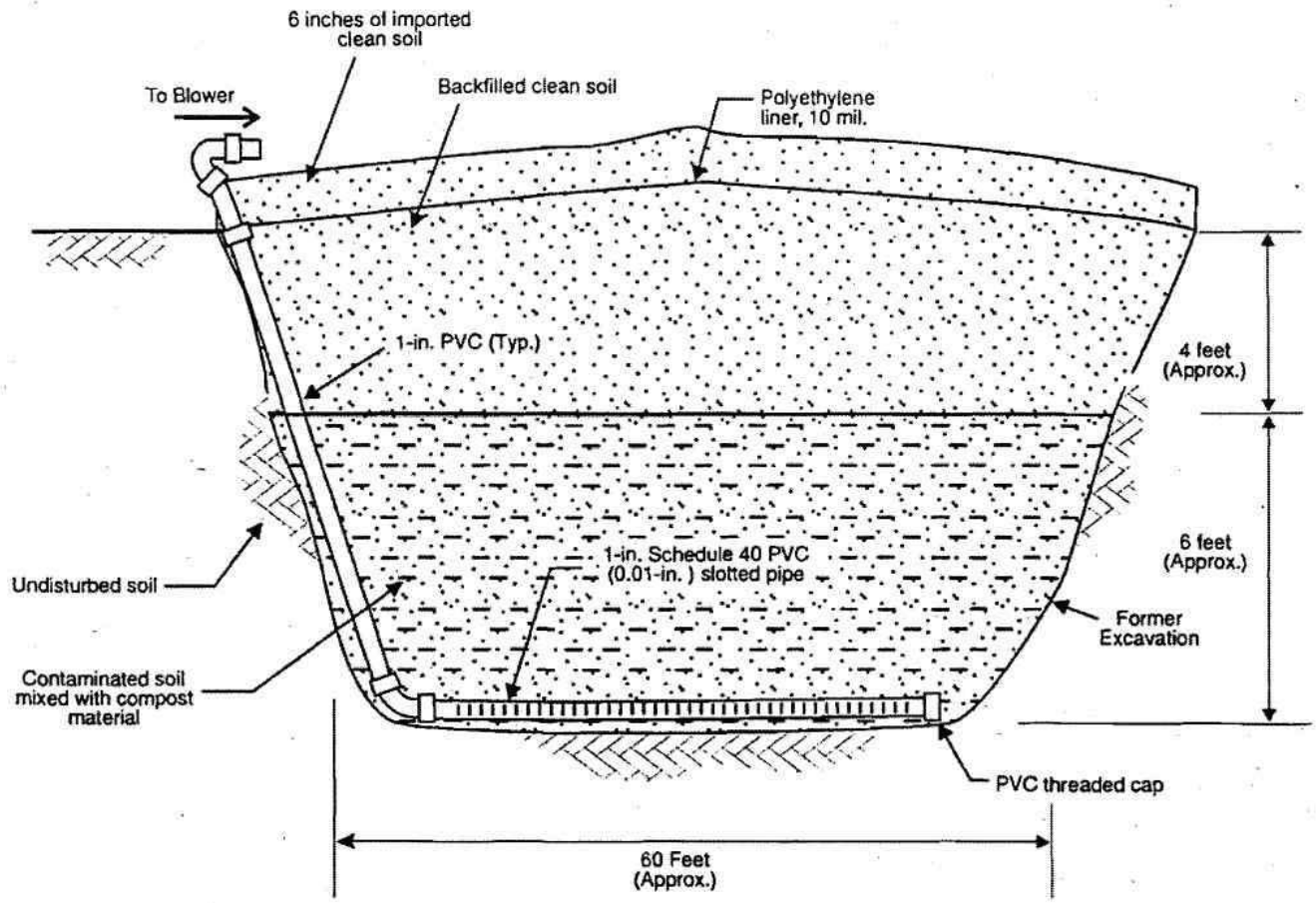
- AIW-1 — Air injection well
- VMW-1 — Vapor monitoring well
- Air flow direction
- Underground PVC line
- Above ground PVC line
- Air flow control valve

CH2MHILL

Piping Layout of Enhanced Bioremediation System

Hawthorne Army Depot
Hawthorne,Nevada

FIGURE 7



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

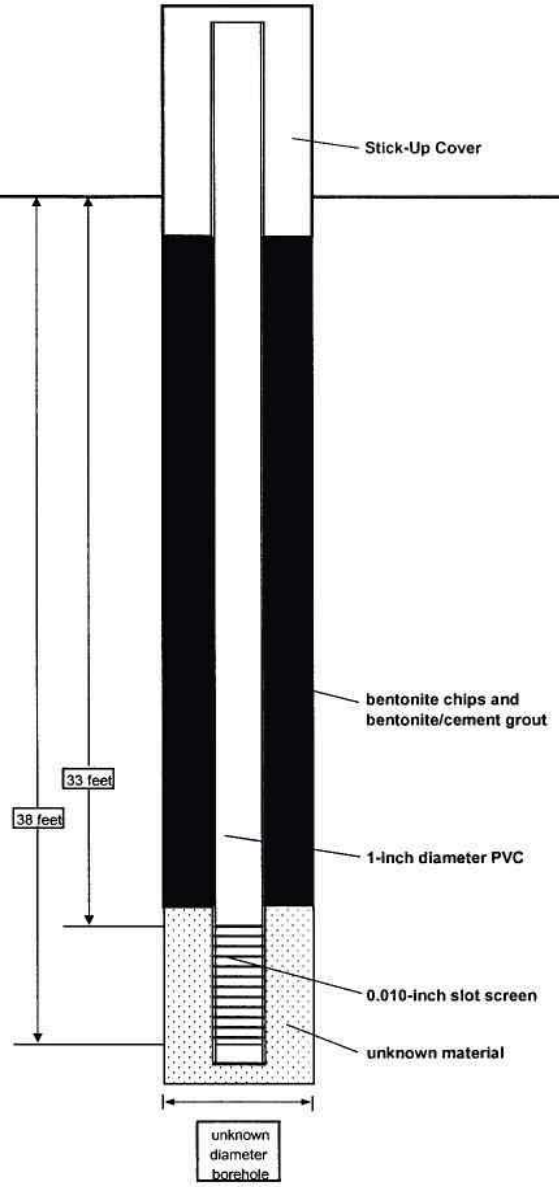
R:\0744\schemat.cdr - 9/12/96 - HC

Horizontal Enhanced Bioremediation System Schematic

CH2MHILL

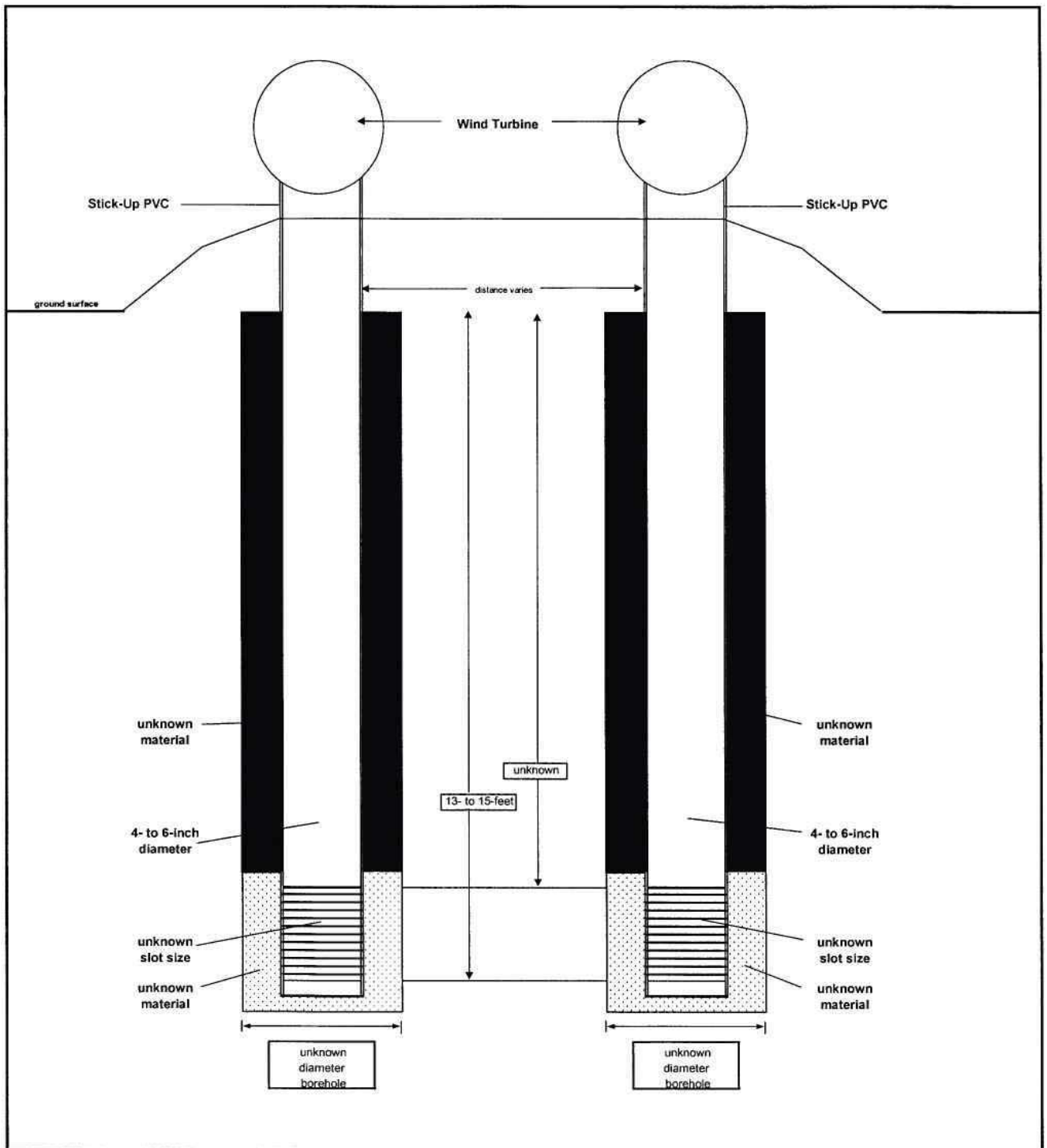
Hawthorne Army Depot
Hawthorne, Nevada

FIGURE 8



CH2MHILL

Figure 9 - Background Vadose Zone Monitoring Well



CH2MHILL

Figure 10 - Passive Bioventing System at SWMU K05