

FINAL SWMU H01 DECISION DOCUMENT

SWMU H01: Former Fire Training Pit



July 2011
Version 01

Hawthorne Army Depot
Hawthorne, Nevada

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ENVIRONMENTAL PROTECTION

U.S. Army Corps of Engineers - Sacramento District
Contract W91238-06-D-0019
Task Order 0004



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FINAL

**DECISION DOCUMENT
SWMU H01: Former Fire Training Pit**

Hawthorne Army Depot, Nevada

Contract No. W91238-06-D-0019

July 2011

Prepared for:



US Army Environmental
Command



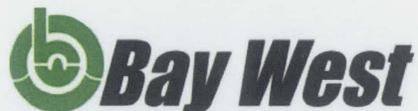
Hawthorne Army Depot
Hawthorne, Nevada

Prepared by:



US Army Corps of Engineers
Sacramento District

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ACRONYMS

Army.....	United States Army Environmental Command
ARFI.....	Additional RCRA Facility Investigation
bgs.....	below ground surface
CESPK.....	U.S. Army Corps of Engineers, Sacramento District
COPC.....	Chemicals of Potential Concern
E & E.....	Ecology and Environment
HSSM.....	Hydrocarbon Spill Screening Model
HWAAP.....	Hawthorne Army Ammunition Plant
HWAD.....	Hawthorne Army Depot
mg/kg.....	milligrams per kilogram
NDEP.....	Nevada Division of Environmental Protection
NFA.....	No Further Action
PCB.....	Polychlorinated Biphenyl
Plexus.....	Plexus Scientific Corporation
POL.....	Petroleum, Oil, and Lubricants
PRG.....	Preliminary Remediation Goal
RCRA.....	Resource Conservation & Recovery Act
RFA.....	RCRA Facility Assessment
RFI.....	RCRA Facility Investigation
SWMU.....	Solid Waste Management Unit
SVOCs.....	Semi-Volatile Organic Compounds
TPH.....	Total Petroleum Hydrocarbons
USACE.....	United State Army Corps of Engineers
USAEHA.....	United States Army Environmental Hygiene Agency
USEPA.....	United States Environmental Protection Agency
VOCs.....	Volatile Organic Compounds

1.0 DECLARATION

1.1 Site Name and Location

Facility Name: Hawthorne Army Depot

Site Location: Hawthorne, Nevada

Operable Unit/Site: Solid Waste Management Unit (SWMU) H01

1.2 Statement of Basis and Purpose

This Decision Document describes the rationale for the selected remedy of No Further Action (NFA) at SWMU H01 at Hawthorne Army Ammunition Plant (HWAAP), hereafter referred to as SWMU H01, at Hawthorne Army Depot (HWAD), Hawthorne, Nevada (Figure 1).

This document is issued by the United States Army Environmental Command (Army), as the lead agency. The Army is managing remediation of contamination at SWMU H01 in accordance with Nevada Division of Environmental Protection (NDEP) guidance.

As the lead agency, the Army has selected the remedy. NDEP concurs with the selected remedy. The United States Environmental Protection Agency (USEPA) defers to NDEP for regulatory oversight of the Environmental Restoration Program at HWAD.

1.3 Description of Selected Remedy

It has been determined that no remedial action is necessary at SWMU H01 in HWAD. Based on investigative results the Army, with concurrence from NDEP, has determined that no significant risks or threats to human health or the environment exist at this time.

1.4 Regulatory Setting

Remedial investigations of hazardous substances, pollutants, or contaminants at SWMU H01 have been demonstrated to meet the following regulatory criteria:

- Chemicals of Potential Concern (COPCs) below USEPA industrial soil screening levels (formerly Preliminary Remediation Goals [PRGs]);
- Fate and Transport Modeling of residual Total Petroleum Hydrocarbons (TPH) contamination does not pose a significant risks to human health or the environment; and,
- Detected metals concentrations are statistically within HWAD-established background screening levels.

1.5 Authorizing Signatures

This signature sheet documents the Army approval and NDEP concurrence of the remedy selected in the Decision Document for SWMU H01 in HWAD.

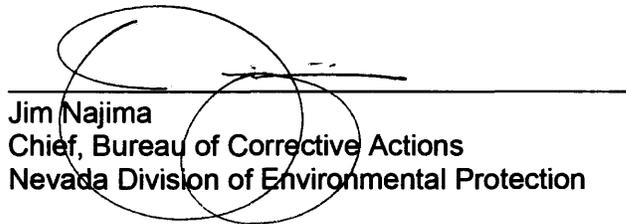
This remedy decision may be reviewed and modified in the future if information becomes available that indicates the presence of contamination may cause unacceptable risk to human health or the environment.



Kirk L. Bausman
Deputy to the Commander
Hawthorne Army Depot



Date



Jim Najima
Chief, Bureau of Corrective Actions
Nevada Division of Environmental Protection



Date

2.0 DECISION SUMMARY

The Decision Summary identifies the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the Administrative Record file that supports the remedy selection decision.

2.1 Site Name, Location, and Description

SWMU H01 (**Figure 2**) is a concrete slab foundation of a former movie theater located 1,000 feet northwest of the intersection of US Highway 95 and Thorne Road. The slab slopes toward the east, measures 60 feet wide by 120 feet long, and is divided into four equal sections. After the theater was torn down, it was used for fire training where waste petroleum, oil, and lubricants (POL) were ignited and extinguished at this site. The quantity of these ignitable products used is unknown and the fire training was in operation for an undetermined period. The three-foot high foundation wall on the east end of the foundation and the earthen berms in the doorways contained the fuel within the building structure. The last fire-training permit, No. 87-41, expired in October 1987. The concrete slab remains in place at the site (CESPK, 2003).

2.2 Physical Setting

HWAD is located on the southern shore of Walker Lake, 140 miles southeast of Reno, Nevada. It occupies approximately 150,000 acres of semi-arid land surrounding the Hawthorne community. The town has a resident population of about 5,000 (CESPK, 2003).

Soil at SWMU H01 is characterized as ranging from silty sand to sand. The maximum boring depth advanced was 40 feet below ground surface (bgs). Groundwater was not encountered during the investigations performed at H01. The average depth to groundwater is approximately 110 feet bgs and the estimated regional groundwater flow direction is to the northwest. The nearest irrigation or drinking water well NAD06 is approximately 7,200 feet from SWMU H01 (CESPK, 2003).

2.3 Site History

A total of five site assessments, including inspections and investigations, have been completed at SWMU H01. **Table 2-1** below provides a brief summary of these investigations. Copies of analytical tables and applicable figures for the RCRA Facility Assessment (RFA), RCRA Facility Investigation (RFI), and Additional RCRA Facility Investigation (AFRI) are included in **Attachment 1**. Copies of boring logs from the RFI investigation are included in **Attachment 2**. Boring logs from the other investigations are not available.

**Table 2-1
Summary of Actions at SWMU H01**

Date	Area and Purpose of Investigation	Company	Summary of Actions	Major Findings	Recommendations
1988	SWMU H01 Survey	U.S. Army Environmental Hygiene Agency (USAEHA)	H01 (Former movie theater)	Identified visible evidence of possible petroleum staining on surrounding soils and the concrete slab.	Recommended evaluation of the stained soils near the concrete slab.
1994	RCRA Facility Assessment (RFA)	Ecology and Environment, Inc. (E & E)	Four subsurface soil samples, 10 to 33 feet bgs, were collected adjacent to the impoundment and on its down-gradient side. Surface and near-surface soil samples, 0.5 to 5.5 feet bgs, were collected from locations where overflow or leakage of liquids may have occurred. All samples were analyzed for semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyl (PCB), TPH, nitrate, ammonium picrate, metals, explosives, and pH. Subsurface samples were also analyzed for volatile organic compounds (VOCs). One surface sample was analyzed for dioxins.	Beryllium was detected at a concentration exceeding the soil remediation criteria in one soil sample; however, the concentration was within the HWAD background range. Arsenic was detected at a concentration exceeding the soil remediation criteria and the background range in one soil sample.	Recommended additional subsurface soil samples from directly beneath the concrete slab to determine if joints in the slab allowed contaminants to migrate into the underlying soils.
1997	Human Health Risk Evaluation	Tetra Tech, Inc.	H01	Determined the estimated cancer risk and hazard index are within the U.S. Environmental Protection Agency (USEPA) acceptable criteria.	
1997	RCRA Facility Investigation (RFI)	(E & E)	Subsurface samples were collected from four soil borings, range 10 to 40 feet bgs, and analyzed for VOCs, SVOCs, TPH, and dioxins. Three borings were	Above-background organic vapor measurements and saturated soil were observed to a depth of 7.5 feet bgs. Analytical results did not	Complete additional assessment beneath the southern portion of the concrete slab.

**Table 2-1
Summary of Actions at SWMU H01**

Date	Area and Purpose of Investigation	Company	Summary of Actions	Major Findings	Recommendations
			drilled through the concrete slab. The fourth boring was drilled at the southeast corner outside of the foundation.	identify any sample concentrations exceeding the soil remediation criteria.	
2002	Additional RCRA Facility Investigation (ARFI)	U.S. Army Corps of Engineers, Sacramento District (CESPK)	Three subsurface samples were collected at 5 feet bgs and analyzed for metals, VOCs, SVOCs, and TPH. A fate and transport study using the Hydrocarbon Spill Screen Model was prepared.	TPH was detected at a concentration above the HWAD action level in one soil sample. TPH is stable and will not migrate downward significantly. The residual TPH contamination is unlikely to impact groundwater.	Recommended no further action.

2.4 Nature and Extent of Contamination

Based on previous investigations that were performed at H01, the following conclusions were determined and documented in the *Draft Final Closure Report Additional RCRA Facility Investigation Solid Waste Management Unit H01, April 2003*, prepared by the United States Army Corps of Engineers (USACE). The report was approved by NDEP on August 17, 2007. A copy of the NDEP report approval letter is included in **Attachment 3**. The following is a summary of conclusions from the report referenced above;

- With exception to arsenic and TPH, the COPCs either were not detected or their maximum detected concentrations were less than their respective PRGs for industrial soil.
- Seven of the 11 field samples exceeded the arsenic industrial PRG but were within the natural background range. One sample (HA-1-000) with arsenic concentration of 14 milligrams per kilogram (mg/kg) at 0.5 to 1.0 foot exceeded the PRG (1.6 mg/kg) and was slightly above the upper background range of 11.6 mg/kg. This single exceedance suggests the localized effects of arsenic and naturally occurring condition at the site.
- One of the twenty-nine field samples (SB1-7-5) with TPH-motor oil concentration of 270 mg/kg at 5.0 to 5.5 feet exceeded the proposed TPH cleanup level of 100 mg/kg. TPH was not detected in the adjacent samples (SB1-2-010, SB1-2-020, SB1-2-030 and SB1-040), which were located within a two-foot radius and at 10, 20, 30, and 40 feet bgs, respectively. This single exceedance suggests the localized effects of TPH, and should be considered not to pose an exposure risk to full-time on-site worker for an industrial site scenario. Furthermore, the fate and transport study using USEPA Hydrocarbon Spill Screening Model (HSSM) indicated that TPH in place was stable, and would not migrate downward significantly. Thus, the residual TPH contamination is unlikely to impact groundwater.

The USEPA HSSM was used to model the movement of TPH-motor oil through the unsaturated zone to determine potential impact to groundwater at SWMU H01. The model was calibrated using the following, as well as other, parameters:

- Soil types present at SWMU H01: silty sand to sand
- Hydrocarbon phase parameters for the TPH fraction detected at the highest concentration and greatest depth: TPH-motor oil.
- Source area based on reported concrete and soil staining: 3-m²
- Conservative hydrocarbon release time: one year
- Most recent potential release date (year the last fire-training permit expired): 1987
- Greatest depth of contamination detected: 5.5 feet bgs
- Time between release and detection (contamination detected at 5.5 feet bgs in 2002): 15 years

Results of running the HSSM for 100 years predicted TPH-motor oil would reach a maximum depth of 6.3 feet which is significantly above the groundwater depth of

approximately 110 feet bgs. Additionally, the total percent liquid saturation at 6.3 feet bgs is approximately equal to the percent liquid saturation for the residual source, indicating that the contamination is stable, and will not migrate downward significantly (CESPK, 2003). A copy of the Fate and Transport Study is included in **Attachment 4**.

2.5 Decommissioning Activities

Soil borings completed during the RFA and RFI were grouted from the bottom of the boring to the ground surface. Grout emplaced within the boring was a cement-bentonite (5%) mixture. A tremie pipe was used to feed grout into the base of the open boring to prevent bridging and help ensure a good seal. After 24 hours the abandoned borehole was checked for grout settling and additional grout added as necessary (E & E, 1997). Soil borings completed during the ARFI were backfilled to the ground surface using the original excavated soil. The final level of the sealing material was filled and made flush with the original concrete slab with Portland cement. The concrete slab remains in place (CESPK, 2003).

3.0 CONCLUSIONS

Sampling, analysis and modeling indicate that no present or future receptors are likely to be adversely impacted by site contamination at SWMU H01. NFA is requested following NAC 445A.227 guidelines, under which the following issues were addressed:

**Table 3-1
Site Evaluation for SWMU H01**

A	Depth of any groundwater	The average depth to groundwater is approximately 110 bgs based on October 2009 groundwater surface data collected from proximity wells IRPMW45, IRPMW46, IRPMW47, and IRPMW48.
B	Distance to irrigation or drinking water wells	The nearest irrigation or drinking water well NAD06 is approximately 7,200 feet from SWMU H01.
C	The type of soil that is contaminated	Soil at SWMU H01 is characterized as ranging from silty sand to sand.
D	The annual precipitation	Annual precipitation for Hawthorne Nevada is 4.6 inches.
E	The type of waste or substance released	Petroleum hydrocarbons, non-regulated wastes, were released at SWMU H01 following fire training activities.
F	The extent of the contamination	The hydrocarbon contamination is limited to depths between 0 to 5.5 feet bgs directly below the former theater foundation
G	The present and potential use for the land	The site is presently used for industrial purposes. Future land use is also expected to be industrial.
H	The preferred routes of migration	Given the low annual precipitation at HWAD, the preferred route of migration for the hydrocarbon contamination will be downward vertically, due to gravity.
I	The location of structures and impediments	Structure location is shown in Figure 2 , a figure has been included in Attachment 1 .
J	The potential for a hazard related to fire, vapor, or explosion	There are no such identified hazards at SWMU H01.
K	Other site-specific factors	Not other site-specific factors have been noted.

4.0 REFERENCES

CESPK, 2003. U.S. Army Corps of Engineers Environmental Chemistry Section, Sacramento District, 2003. *Draft Final Closure Report, Additional RCRA Facility Investigation, Solid Waste Management Unit (SWMU) H01, Hawthorne Army Depot, Hawthorne, Nevada, April 2003*

Ecology and Environment, Inc., 1997. *RCRA Facility Investigation Report for Group A Solid Waste Management Units A04, B16, B21, B26 and H01, Hawthorne Army Depot, Contract DACA05-93-D-006, DO # 0012 and 0013, prepared for the US Army Corps of Engineers. May 1997.*

Plexus Scientific Corporation, 2010. *Base-Wide Groundwater Monitoring Annual Report 2009 Hawthorne Army Depot, Hawthorne, Nevada, March 2010*

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FIGURES

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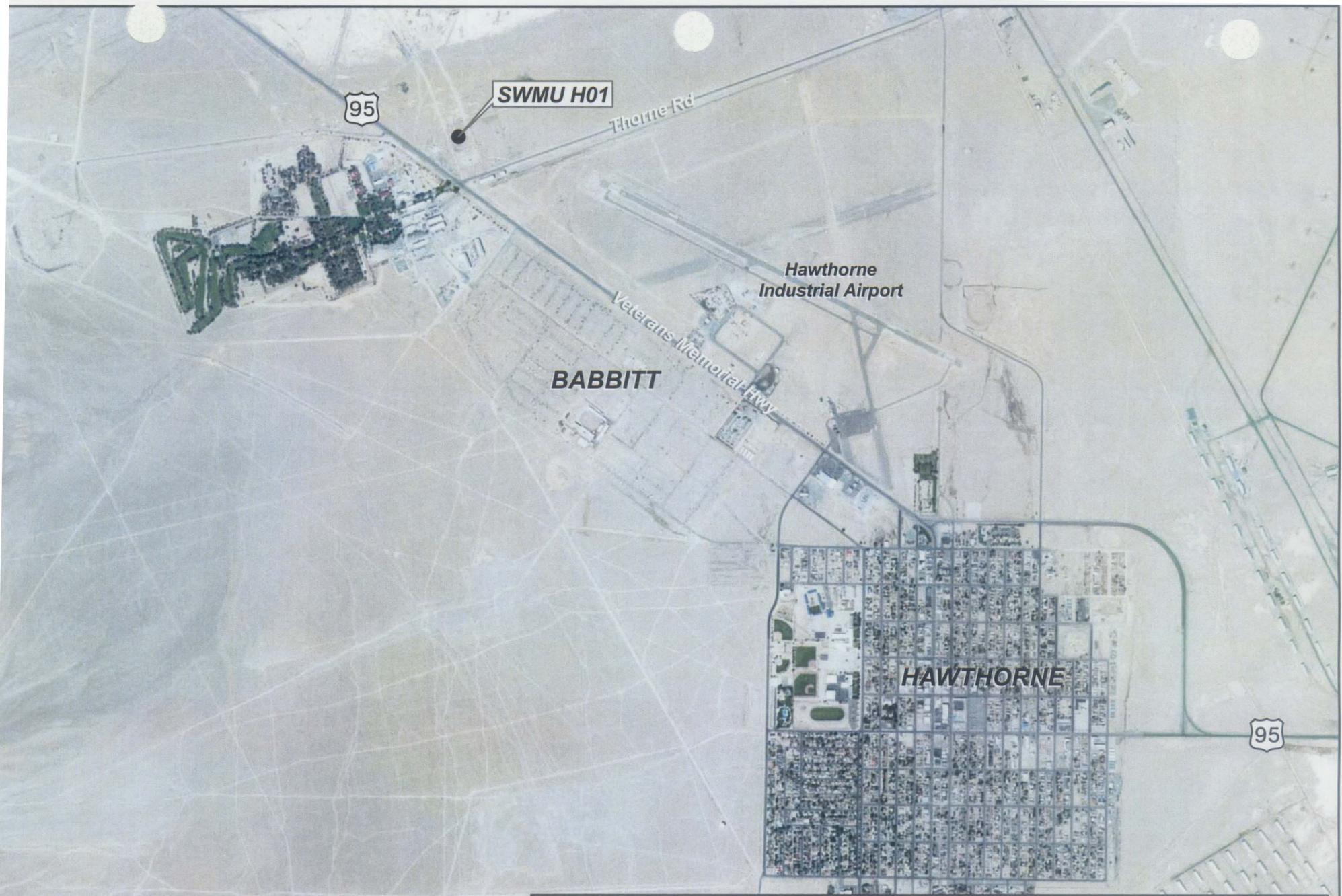
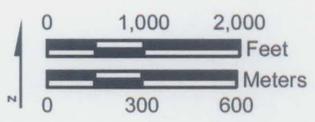


FIGURE 1
SWMU H01
Site Location



Legend
 SWMU H01
 Data is Projected in the NAD83 UTM Zone 11N
 Aerial Photo: Bing Image Server
 Figure Create Using ArcMap 9.3.1





SWMU H01

FIGURE 2
SWMU H01
Site Map

NEVADA
 Hawthorne Army Depot

Legend
 SWMU H01

Date is Provided in the NAD83 UTM Zone 11N
 Aerial Photo: Bing Image Server
 Figure Create Using ArcMap 9.3.1

0 100 200 Feet
 0 30 60 Meters

North Arrow



Attachment 1

RFA (Resource Conservation and Recovery Act (RCRA) Facility Assessment), RFI (RCRA Facility Investigation), and ARFI (Additional RCRA Facility Investigation) Analytical Results

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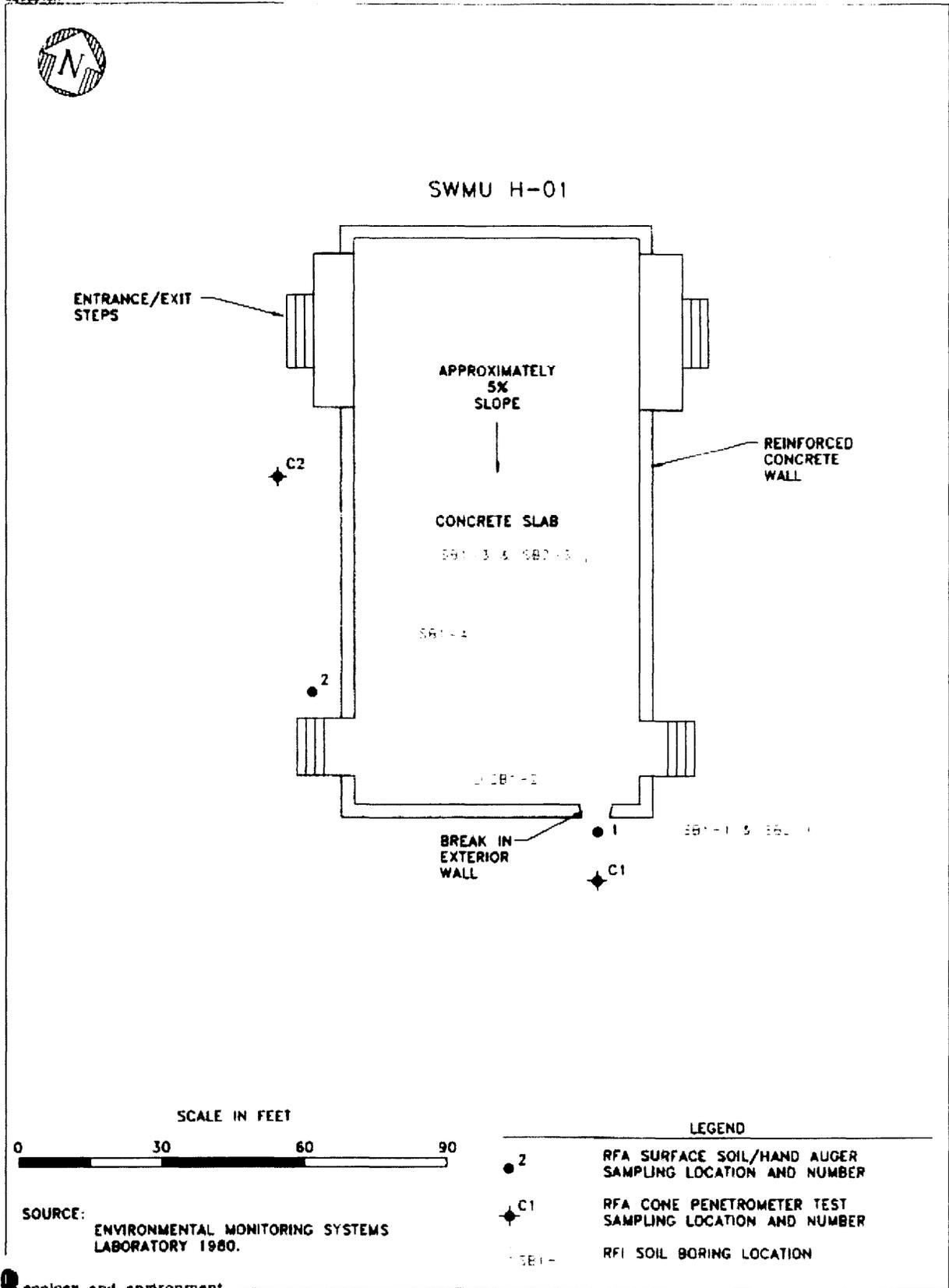


Figure 3-5 SAMPLE LOCATIONS AT SWMU H-01
FIRE TRAINING PIT
HAWTHORNE ARMY DEPOT

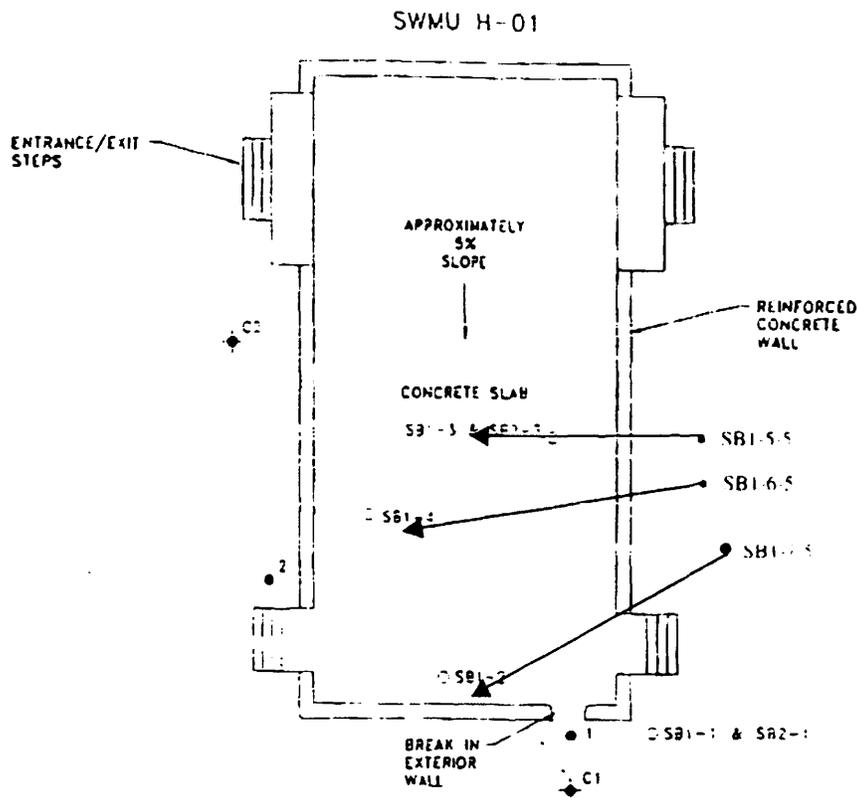
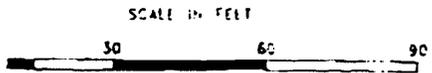


Figure 2:
 Sample Locations at SWMU H-01
 Hawthorne Army Depot
 Hawthorne, Nevada



ENVIRONMENTAL MONITORING SYSTEMS
 LABORATORY 1980

LEGEND	
● 2	RFA SURFACE SOIL/HAND AUGER SAMPLING LOCATION AND NUMBER
◆ C1	RFA CONE PENETROMETER TEST SAMPLING LOCATION AND NUMBER
○ SBI-1	RF SOIL BORING LOCATION

Red Dot ARFI Sampling Location

Table 3-1: RFA ANALYTICAL RESULTS (mg/kg) (source: Ecology and Environment, Inc., May 1997. *RCRA Facility Investigation (RFI) Report for Group A SWMUs A-04, B-16, B-21, B-24, B-26, and H01, Hawthorne Army Depot, Final*).

Sample No./ Parameter	PRG Industrial Soil	H-01 HA1-1-000	H-01 HA1-1-005	H-01 HA1-2-000	H-01 HA1-2-005	H-01 CPS1-1-012	H-01 CPS1-1-024	H-01 CPS1-2-010	H-01 CPS1-2-032	
Sample Depth (feet)		0.5 - 1.0	4.5 - 5.0	0.5 - 1.0	5.0 - 5.5	11.5 - 12.5	24.0 - 25.0	10.0 - 11.0	32.0 - 33.0	
Inorganic (Method 352.1)										
Nitrate-nitrogen	NE	ND	3.8	7.5	3.8	ND	ND	1.1 J	ND	
Metals (Methods 6010/7000)										
Background Metals Range at HWAD ⁽¹⁾										
Arsenic	0 to 11.6	1.6	14	3.0	4.9	1.7	0.74	1.1	0.84	1.0
Barium	0 to 0.77	67,000	47	33	56	84	38	47	46	43
Beryllium	0 to 277	1,900	ND	ND	ND	0.53	ND	ND	ND	ND
Chromium	0.4 to 9.3	450	3.2 J	2.8 J	2.9 J	5.7 J	5.1	3.7	1.8	8.0
Lead	0 to 10.9	750	4.6	14	2.2	4.5	1.5	2.8	1.6	1.8
Mercury	0 to 0.067	310	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	NA	3,100	ND	ND	ND	ND	ND	ND	ND	ND
Silver	NA	3,000	ND UJ	ND UJ	ND UJ	ND UJ	ND	ND	ND	ND
Semi-volatile Organic Compounds (Method 8270)										
Bis (2-ethylhexyl) phthalate	120	0.076 J	0.050 J	ND	ND	ND	ND	ND	ND	ND
Benzo (k)fluoranthene	21	ND	ND	0.038 J	ND	ND	ND	ND	ND	ND

Table 3-1: RFA ANALYTICAL RESULTS (mg/kg) (source: Ecology and Environment, Inc., May 1997. RCRA Facility Investigation (RFI) Report for Group A SWMUs A-04, B-16, B-21, B-24, B-26, and H01, Hawthorne Army Depot, Final).

Sample No./ Parameter	PRG Industrial Soil	H-01 HA1-1-000	H-01 HA1-1-005	H-01 HA1-2-000	H-01 HA1-2-005	H-01 CPS1-1-012	H-01 CPS1-1-024	H-01 CPS1-2-010	H-01 CPS1-2-032
Sample Depth (feet)		0.5 - 1.0	4.5 - 5.0	0.5 - 1.0	5.0 - 5.5	11.5 - 12.5	24.0 - 25.0	10.0 - 11.0	32.0 - 33.0
Pesticides (Method 8080)									
4-4'-DDD	10	ND	ND	0.059	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (Method 8015m)									
THP as gasoline	HWAD TPH Level 100	ND	ND	ND	ND	ND	ND	ND	ND
TPH as diesel		59C	24C	ND	ND	ND	ND	ND	ND
Explosives and Picric Acid (Method 8330 and 8330M)									
Explosives and ammonium picrate	Various	ND	ND	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyl (Method 8080)									
Polychlorinated Biphenyl	Various	ND	ND	ND	ND	ND	ND	ND	ND

⁽¹⁾ Tetra Tech 1997, Technical Memorandum Background Soil Sampling Hawthorne Army Depot, Hawthorne, Nevada. Comparison of Metal Concentration in Background Soil Samples from HWAD. Table 4. (Range @ 1 standard deviation.)

Key: C = Quantitated in the range of diesel but does not appear to be diesel.

J = Estimated value, due to poor QC results or presence below laboratory quantitation limit. ND = Not detected.

NE = Not Established. Bold Font = Values exceed PRG (EPA Region 9, October 2002 update) and/or background range.

Table 5-1: ARFI ANALYTICAL RESULTS (mg/kg)						
Sample No./ Parameter		PRG Industrial Soil	SBI-5-5	SBI-6-5	SBI-7-5	SBI-DUP-5
Sample Depth (feet)			5.0 - 5.5	5.0 - 5.5	5.0 - 5.5	5.0 - 5.5
Background Metals Range at HWAD ⁽¹⁾	Metals (Method 6010B)					
Arsenic	0 to 11.6	1.6	3.0	3.5	2.5	3.3
Barium	0 to 277	1,900	38.6 J	47.8 J	37.1 J	47.1 J
Cadmium	0 to 0.77	67,000	ND (<0.21)	ND (<0.21)	ND (<0.21)	ND (<0.21)
Chromium	0.4 to 9.3	450	3.3	3.6	3.9	4.4
Lead	0 to 10.9	750	3.1 J	3.9 J	2.5 J	4.0 J
Mercury	0 to 0.067	310	0.016 J	0.019 J	0.016 J	0.025 J
Selenium	NA	3,100	0.30 J	0.28 J	0.57	0.51 J
Silver	NA	3,000	ND (<0.53)	ND (<0.53)	ND (<0.53)	ND (<0.53)
Volatile Organic Compounds (Method 8260B)						
Toluene		520	ND (<6.9)	2 J	ND (<5.1)	2 J
Semi-volatile Organic Compounds (Method 8270C)						
Bis (2-ethylhexyl) phthalate		120	ND (<0.35)	ND (<0.35)	ND (<0.35)	ND (<0.35)
Benzo (k)fluoranthene		21	ND (<0.35)	ND (<0.35)	ND (<0.35)	ND (<0.35)
Total Petroleum Hydrocarbons (Method 8015B)						
TPH as gasoline (C5-C12)		HWAD Level 100	0.01 J	ND (<0.99)	ND (<1.1)	ND (<11)
THP as diesel (C10-C24)			ND (<11)	ND (<11)	78	ND (<11)
THP as Motor oil (C20- C36)			ND (<11)	3 J	270	3 J
SBI-DUP-5 is the duplicate of SBI-6-5.						
J = Estimated value, due to poor QC results or presence below laboratory quantitation limit. ND = Not detected. Bold Font = Values exceed PRG (EPA Region 9, October 2002 update), background ranges, and/or TPH level.						

⁽¹⁾ Tetra Tech 1997, Technical Memorandum Background Soil Sampling Hawthorne Army Depot, Hawthorne, Nevada. Comparison of Metal Concentration in Background Soil Samples from HWAD, Table 4. (Range @ 1 standard deviation.)

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Attachment 2
RFI Boring Logs

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Hole No. H01-SB1-1

DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 1 OF 2 SHEETS
1. PROJECT RFI Group A SWMUs		10. SIZE AND TYPE OF BIT 8" Fingered Bit w/ 4.25" ID HSA		
2. LOCATION (Coordinates or Station) Hawthorne, Nevada		11. DATUM FOR ELEVATION (TBM or MSL) MSL		
3. DRILLING AGENCY Stewart Bros. Drilling Co.		12. MANUFACTURER'S DESIGNATION OF DRILL CME 750 ATV		
4. HOLE NO. (As shown on drawing title and file number) H01-SB1-1		13. TOTAL NO OF OVER-BURDEN SAMPLES TAKEN : 0		
5. NAME OF DRILLER Stanley Johnson		14. TOTAL NUMBER OF CORE BOXES NA		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERTICAL		15. ELEVATION GROUND WATER NA		
7. THICKNESS OF OVERBURDEN Unknown		16. DATE HOLE : STARTED 08/19/96 COMPLETED 08/19/96		
8. DEPTH DRILLED INTO ROCK No rock encountered		17. ELEVATION TOP OF HOLE NA (gs)		
9. TOTAL DEPTH OF HOLE 40.0 ft BGS		18. TOTAL CORE RECOVERY FOR BORING 88 %		
		19. INSPECTOR Sherril Johnson		

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	1		SILTY SAND (SM); fine sand, little to some fine gravel, med. loose. Color: 10YR-6/3 (Pale Brn)	52		
	2					
	3		SAND (SW); fine to med. sand and fine gravel, tr silt, loose. 10YR-5/3 (Brn)	100		
	4					
	5		loose to med. with some silt from 5' to 6.3'.	72		
	6					
	7					
	8		loose to med. with little silt from 7.5' to 10'.	100		
	9					
	10			80		Analytical sample collected @ 10 feet, ID= 2-H01-SB1-1-010.
	11					Duplicate sample collected @ 10 feet, ID= 2-H01-SB2-1-010. Split sample collected @ 10 feet, ID= 2-H01-SB3-1-010.
	12		SILT (ML); some fine sand, tr fine gravel, med. loose. 10YR-5/3	80		
	13		SAND (SW); fine to med. sand and fine gravel, tr silt, with 1/2" to 2" silt seams, loose to med. 10YR-5/3			
	14					
	15		SAND (SW); fine to med. sand, tr coarse sand, some fine gravel, little silt, loose. 10YR-5/4 (Yllw-Brn)	100		
	16					
	17					
	18		SAND (SM); fine to med. sand, tr coarse sand, some fine gravel, loose to med, some silt and occasional 1" to 3" fine sandy silt	100		
	19					

DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 2 OF 2 SHEETS		
PROJECT RFI Group A SWMUs			LOCATION Hawthorne, Nevada			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	20		seams with tr gravel. 10YR-5/4	100		Analytical sample collected @ 20 feet. ID= 2-H01-SB1-1-020.
	21		SAND (SW); fine to med. sand, tr coarse sand, little silt, some fine gravel, loose. 10YR-5/3	100		
	22					
	23		with fine gravel and tr silt from 22.5' to 25'.	100		
	24					
	25		with little coarse sand from 25' to 27.5'.	64		
	26					
	27					
	28		SAND (SW); fine to coarse sand and fine gravel, tr coarse gravel, loose. 10YR-5/4	100		
	29					
	30			84		Analytical sample collected @ 30 feet. ID= 2-H01-SB1-1-030.
	31					
	32					
	33			100		
	34					
	35			100		
	36		loose to med., with some silt and tr to little clay from 36" to 36.8".			
	37					
	38		SAND (SW); med. to coarse sand and fine gravel, little fine sand, loose. 10YR-5/3	80		
	39					
	40		Total depth of boring, 40.0 feet			Analytical sample collected @ 40 feet. ID= 2-H01-SB1-1-040.
	41					
	42					
	43					
	44					

DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 1 OF 2 SHEETS
1. PROJECT RFI Group A SWMUs		10. SIZE AND TYPE OF BIT 8" Fingered Bit w/ 4.25" ID HSA		
2. LOCATION (Coordinates or Station) Hawthorne, Nevada		11. DATUM FOR ELEVATION (TBM or MSL) MSL		
3. DRILLING AGENCY Stewart Bros. Drilling Co.		12. MANUFACTURER'S DESIGNATION OF DRILL CME 750 ATV		
4. HOLE NO. (As shown on drawing title and file number) H01-SBI-2		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		
		DISTURBED	UNDISTURBED	
5. NAME OF DRILLER Stanley Johnson		14. TOTAL NUMBER OF CORE BOXES NA		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERTICAL		15. ELEVATION GROUND WATER NA		
7. THICKNESS OF OVERBURDEN Unknown		16. DATE HOLE	STARTED	COMPLETED
8. DEPTH DRILLED INTO ROCK No rock encountered		08/20/96	08/20/96	
9. TOTAL DEPTH OF HOLE 40.0 ft BGS		17. ELEVATION TOP OF HOLE NA (Gs)		
		18. TOTAL CORE RECOVERY FOR BORING 81 %		
		19. INSPECTOR Sherril Johnson		

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	1		SAND (SW); med. to coarse sand and fine gravel, tr fine sand and silt, loose. Color: 10YR-4/2 (dk Gry-Brn)	88		
	2					
	3			72		
	4		micaceous, with little silt and color change to 10YR-5/3 from 3.3' to 6'.			
	5			56		
	6		SILTY SAND (SM); med. to coarse sand, little fine gravel, loose to med. 10YR-5/3 (Brn)			
	7			80		
	8					
	9		SAND (SW); fine to med. sand, some fine gravel, no silt, loose. Color: 10YR-5/3			
	10			80		
	11		dk yllw-brn (10YR-4/4) silt seam with little clay and fine sand from 10.8' to 11.4', loose to med.			
	12					
	13		occasional 1/2" to 1" silt seams from 12.5' to 15'.	100		
	14					
	15		SAND (SW-SM); fine to med. sand, little fine gravel, little to some silt, med. loose. 10YR-5/4 (Yllw-Brn)	64		
	16					
	17					
	18		SAND (SW); fine to med. sand, tr coarse sand, little to some fine gravel, loose. 10YR-5/3	100		
	19					

Analytical sample collected @ 10 feet, ID= 2-H01-SBI-2-010.

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Hole No. H01-SB1-2

DRILLING LOG		DIVISION Southwest		INSTALLATION Hawthorne Ammunition Depot		SHEET 2 OF 2 SHEETS	
PROJECT RFI Group A SWMUS				LOCATION Hawthorne, Nevada			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
a	b	c	d	e	f	g	
	20			100		Analytical sample collected @ 20 feet, ID= 2-H01-SB1-2-020.	
	21			76			
	22			100			
	23		SAND (SM); v.fine to fine sand, some silt, little fine gravel, micaceous, loose to med. 10YR-4/4 (dk Yllw-Brn)				
	24			80			
	25		SAND (SW); v.fine to fine sand, tr silt, some fine gravel, micaceous, loose. 10YR-5/3				
	26			92			
	27		SAND (SW); fine to med. sand, tr coarse sand and silt, little to some fine gravel, loose. 10YR-5/4				
	28			80			
	29		with tr coarse gravel from 27.5' to 30'.				
	30			100			
	31		loose to med., with tr silt and clay from 30' to 30.7'.				
	32			60			
	33		SILTY SAND (SM); fine to med. sand, tr fine gravel and clay, loose to med. 10YR-5/3				
	34			60			
	35		SAND (SW); med. to coarse sand, tr fine sand, some fine gravel, loose. 10YR-6/3 (Pale Brn)				
	36			60			
	37		with tr coarse gravel and tr to little silt from 37.5' to 40'.				
	38						
	39						
	40		Total depth of boring, 40.0 feet			Analytical sample collected @ 40 feet, ID= 2-H01-SB1-2-040.	
	41						
	42						
	43						
	44						

DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 2 OF 2 SHEETS		
PROJECT RFI Group A SWMUs			LOCATION Hawthorne, Nevada			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		<u>SILTY SAND (SM)</u> ; fine to med. sand, little fine gravel, micaceous, loose. 10YR-5/3	60		Analytical sample collected @ 20 feet, ID= 2-H01-SB1-3-020. Duplicate sample collected @ 20 feet, ID= 2-H01-SB2-3-020.
	21		<u>SAND (SW)</u> ; fine to med. sand, tr coarse sand and silt, some fine gravel, loose. 10YR-5/4	80		
	22		loose to med., with tr coarse gravel from 25' to 27.5'.	84		Analytical sample collected @ 30 feet, ID= 2-H01-SB1-3-030.
	23					
	24					
	25					
	26					
	27					
	28		<u>SAND (SW)</u> ; fine to med. sand and fine gravel, tr coarse sand, coarse gravel and silt, loose. 10YR-6/3	76		
	29		with tr cobbles from 35' to 37.5'.	100		
	30					
	31					
	32		with tr cobbles from 35' to 37.5'.	40		
	33					
	34		with tr cobbles from 35' to 37.5'.	60		
	35					
	36		<u>SAND (SW)</u> ; med. to coarse sand, some fine gravel and fine sand, tr silt, loose. 10YR-5/3	100		
	37					
	38		Total depth of boring, 40.0 feet			Analytical sample collected @ 40 feet, ID= 2-H01-SB1-3-040.
	39					
	40		Total depth of boring, 40.0 feet			
	41					
	42					
	43					
	44		Total depth of boring, 40.0 feet			

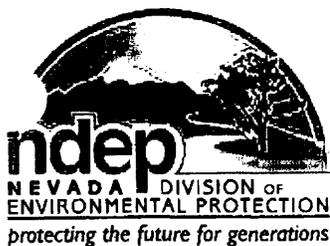
DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 1 OF 2 SHEETS
1. PROJECT RFI Group A SWMUs		10. SIZE AND TYPE OF BIT 8" Fingered Bit w/ 4.25" ID HSA		
2. LOCATION (Coordinates or Station) Hawthorne, Nevada		11. DATUM FOR ELEVATION (TBM or MSL) MSL		
3. DRILLING AGENCY Stewart Bros. Drilling Co.		12. MANUFACTURER'S DESIGNATION OF DRILL CME 750 ATV		
4. HOLE NO. (As shown on drawing title and file number) H01-SBI-4		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED 0 UNDISTURBED 16
5. NAME OF DRILLER Stanley Johnson		14. TOTAL NUMBER OF CORE BOXES NA		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERTICAL		15. ELEVATION GROUND WATER NA		
7. THICKNESS OF OVERBURDEN Unknown		16. DATE HOLE		STARTED 08/20/96 COMPLETED 08/20/96
8. DEPTH DRILLED INTO ROCK No rock encountered		17. ELEVATION TOP OF HOLE NA (gs)		
9. TOTAL DEPTH OF HOLE 40.0 ft BGS		18. TOTAL CORE RECOVERY FOR BORING		93 %
		19. INSPECTOR Sherrri Johnson		

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
	1		SAND (SM); fine to med sand, some silt, little fine gravel, micaceous, loose to med. Color: 10YR-4/4 (dk Yllw-Brn)	100		
	2					
	3		SAND (SW); fine to coarse sand and fine gravel, loose. 10YR-6/2 (lt Brn-Gry)	72		
	4		SAND (SP); v. fine to fine, tr fine gravel, loose. 10YR-5/3 (Brn)			
	5					
	6		SAND (SW); fine to coarse sand and fine gravel loose. 10YR-6/2	100		
	7					
	8		SANDY SILT (ML); fine sand, tr fine gravel, micaceous, med. loose. 10YR-4/3 (Brn)	100		
	9		SAND (SM); fine to med. sand, tr coarse sand, some fine gravel, loose. 10YR-5/3			
	10		loose to med, with some silt at 11.5'.	80		Analytical sample collected @ 10 feet. ID= 2-H01-SBI-4-010.
	11					
	12					
	13		micaceous, with occasional 2" to 3" silty, v. fine to fine, sand seams from 12.5' to 15'.	100		
	14					
	15		SAND (SW); fine to med. sand, tr coarse sand, some fine gravel, loose, little silt from 15' to 15.6'. 10YR-5/3	100		
	16					
	17					
	18		with tr silt and coarse gravel from 17.5' to 20'.	100		
	19					

DRILLING LOG		DIVISION Southwest	INSTALLATION Hawthorne Ammunition Depot	SHEET 2 OF 2 SHEETS		
PROJECT RFI Group A SWMUS			LOCATION Hawthorne, Nevada			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20			100		Analytical sample collected @ 20 feet, ID= 2-H01-SB1-4-020.
	21			100		
	22		3", silty, v. fine to fine, sand seam at 21.5'.			
	23		SAND (SW); fine to med. sand, some fine gravel, tr silt loose. 10YR-6/3	80		
	24					
	25			100		
	26		3" silty seam at 26.3'.			
	27					
	28		with tr coarse gravel and no silt from 27.5' to 30'.	100		
	29					
	30		with little coarse sand from 30' to 32.5'.	100		Analytical sample collected @ 30 feet, ID= 2-H01-SB1-4-030.
	31					
	32					
	33		SAND (SM); fine to med. sand, some silt, tr fine gravel, 2.5" silt seam at 32.9', med. loose. 10YR-5/3	100		
	34					
	35			84		
	36		SAND (SW); med. to coarse sand, tr fine sand, tr to little fine gravel, loose. 10YR-5/3			
	37					
	38		with little to some fine gravel and tr coarse gravel from 37.5' to 40'.	72		
	39					
	40		Total depth of boring, 40.0 feet			Analytical sample collected @ 40 feet, ID= 2-H01-SB1-4-040.
	41					
	42					
	43					
	44					

Attachment 3
NDEP Approval Letter

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STATE OF NEVADA

Department of Conservation & Natural Resources

DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF CORRECTIVE ACTIONS

P: 775.687.9368 F: 775.687.8335

Jim Gibbons, Governor

Allen Biaggi, Director

Leo M. Drozdoff, P.E., Administrator

August 17, 2007

Mr. Kevin Shannon
Hawthorne Army Depot
1 South Maine Street
Hawthorne, NV 89415-9404

RE: Approval of Draft Final Closure Report, Additional RCRA Facility Investigation, Solid Waste Management Unit H-01, Hawthorne Army Depot, Hawthorne, Nevada, April 2003

Dear Mr. Shannon:

The Nevada Division of Environmental Protection, Bureau of Corrective Actions (NDEP) has reviewed Hawthorne Army Depot's *Draft Final Closure Report, Additional RCRA Facility Investigation, Solid Waste Management Unit H-01, April 2003*. Solid Waste Management Unit (SWMU) H01 is a concrete slab of a former movie theater. After the theater was torn down, the slab was used for fire training. Waste petroleum, oil, and lubricants (POL) were ignited and extinguished at the site for fire training. The quantity of POL used at the site is unknown, as is the duration of fire training at the site. Visible evidence of POL staining has been noted on the surrounding soil and concrete slab.

This closure report documents the results of the RCRA Facility Assessment (RFA) completed in 1994, the RCRA Facility Investigation completed in 1997, and the sampling results obtained from field work completed for this investigation. The report indicated that one of the twenty-nine field samples collected during the three investigations exceeded the Total Petroleum Hydrocarbon (TPH) action level of 100 mg/kg, with a value of TPH-motor oil of 270 mg/kg. Seven of eleven field samples exceeded the arsenic industrial Preliminary Remediation Goal (PRG) but were within the natural background range for the Hawthorne Army Depot. One sample exceeded the PRG and was slightly above background range. The report recommends closure of SWMU H01.

The NDEP approves the *Draft Final Closure Report, Additional RCRA Facility Investigation, Solid Waste Management Unit H-01*. If you should have any questions or wish to discuss any of these items, please feel free to contact me at (775) 687-9443 or rkutsch@ndep.nv.gov.

Sincerely,

Raquel M. Kutsch
Department of Defense Branch
Bureau of Corrective Actions

cc: Scott Smale, Supervisor, Department of Defense Branch, Bureau of Corrective Actions, NDEP
Lt. Col. Hardee Green, Hawthorne Army Depot, Hawthorne, NV 89415
Herman Millsap, Hawthorne Army Depot, Hawthorne, NV 89415
Jeff Armstrong, U.S. Army Environmental Center, Technical Assistance Project Manager, 5179 Hoadley Road, APG, MD 21010-5401
Sophie Ngu, USACE Sacramento District, 1325 J Street, Sacramento, CA 95814
Guy Romine, IMAE-CDS, 19932 SE Foster Road, Boring, OR 97089
Patrick Reilley, Plexus Scientific, Project Manager, 9104 Guilford Road, Suite 1010, Columbia, MD 21046
Amy L. Lange, CH2M Hill Project Manager, 9191 South Jamaica Street, Englewood, CO 80112-5946
Kee Chan, USACE Sacramento District, 1325 J Street, Sacramento, CA 95814

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Attachment 4
Fate and Transport Study

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FATE and TRANSPORT STUDY

Modeling Impact To Groundwater Using Hydrocarbon Spill Screening Model SWMU H-01 Hawthorne Army Depot Hawthorne, Nevada

1.0 Rationale

The U.S. Environmental Protection Agency Hydrocarbon Spill Screening Model (HSSM; USEPA, 1995) was used to model the movement of motor oil contamination (TPH-m) through the unsaturated zone to determine potential impact to groundwater at SWMU H-01. This model was designed to simulate the behavior of water-immiscible contaminants, such as motor oil. The HSSM model is appropriate for use at Hawthorne Army Depot (HWAD), which is an arid desert environment, because it allows the user to define percent saturation in soil.

2.0 General Assumptions and Calibration

The HSSM model was calibrated using both default and site specific information. Default model hydrologic parameters were used, and an average arid climate percent saturation value of 0.19 (Flint *et al.*, 1996) was input into the model. Porous medium parameters used were based on the soil types present at SWMU H-01, silty sand to sand. Hydrocarbon phase parameters used such as density, viscosity, solubility and surface tension were obtained from the Oil Properties Database (Environment Canada, 2002). The hydrocarbon phase parameters used were for motor oil (diesel), as that was the TPH fraction detected at the highest concentration and greatest depth. Hydrocarbon release time was estimated at one year, a conservative estimate, based upon the last fire-training permit (No. 87-41), which expired in October 1987. Previous records regarding the ignition of waste petroleum, oil and lubricants are unavailable. Therefore, one year was used as the hydrocarbon release duration. The source area was estimated at 3-m², based on previous reported staining of the concrete slab and the surrounding soil.

Calibration was accomplished by running the model, with the above parameters, from 1987 to 2002 (15 years). The flux was then varied so that the resulting saturation curves indicated contamination would reach 5.5 feet (1.52 meters) bgs, the lowest depth with detected TPH-m in the 2002 ARFI sampling round (SB1-7-5). The final flux used was 0.00023 m/d, which corresponds to a release of approximately 66 gallons of unburned hydrocarbons over the 3-m² assumed source area. The model was then run for 100 years to estimate the extent of downward migration through the unsaturated zone.

3.0 Results and Conclusions

Results after running the model for 100 years indicated that the TPH-motor oil impacted soils would reach a maximum depth of approximately 6.3 feet bgs (1.9 meters; Figure 1).

Closure Report: ADDITIONAL RCRA FACILITY INVESTIGATION
Solid Waste Management Unit H-01, Hawthorne Army Depot, Hawthorne, Nevada

This depth is well above the average groundwater depth of approximately 112 feet based on the proximity wells (IRPMW41, IRPMW46, IRPMW47, and IRPMW48). Further, the total percent liquid saturation at 6.3 feet bgs is approximately equal to the percent liquid saturation for the residual source, indicating that the contamination is stable, and will not migrate downward significantly. Based upon these results, the residual TPH contamination at SWMU H-01 is unlikely to impact groundwater.

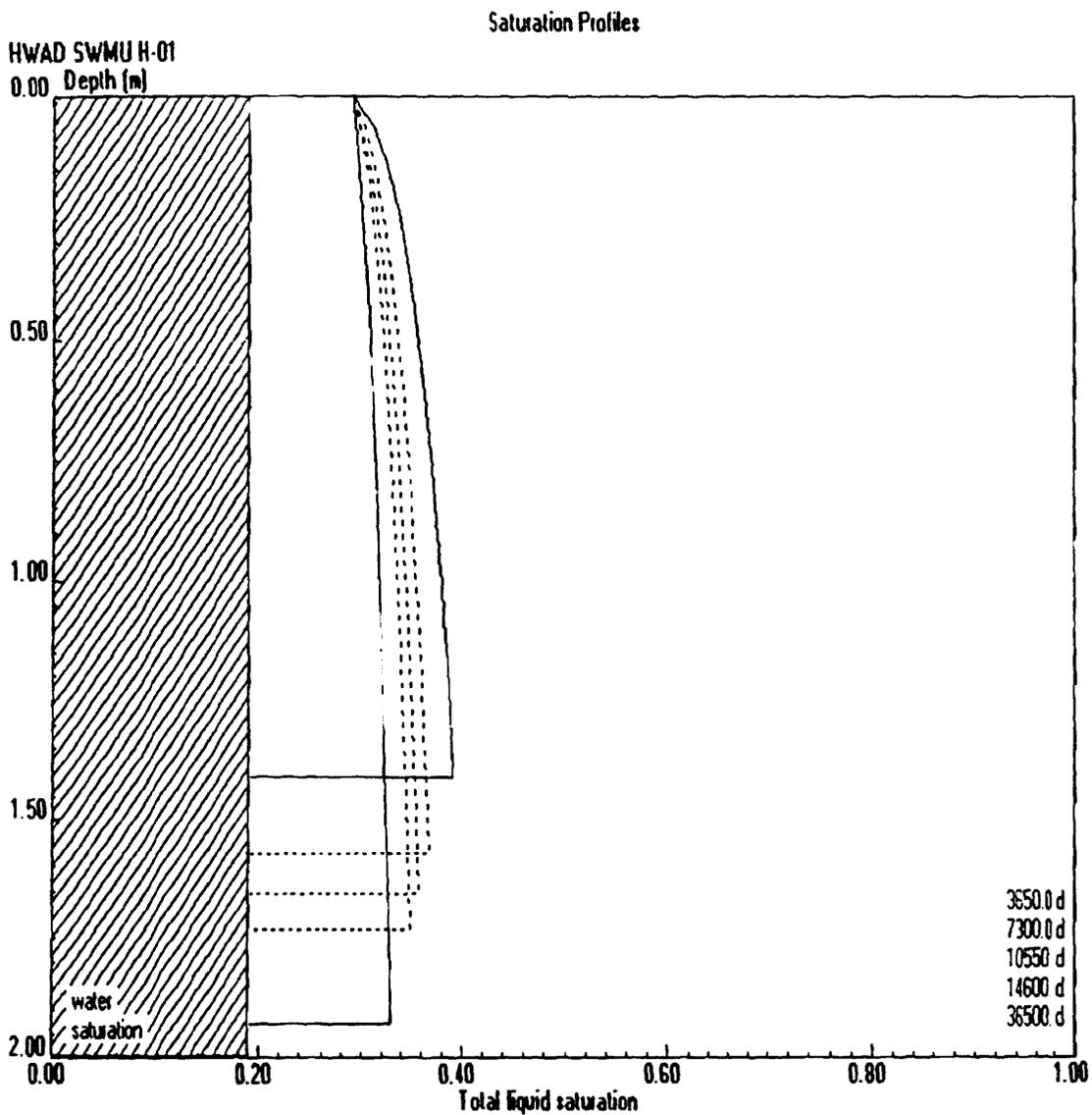
4.0 References

Environnement Canada Website. 2002. http://www.etc-cte.ec.gc.ca/databases/spills_e.html

Flint Alan L., Hevesi Joseph A., Flint Lorraine E. 1996. Conceptual and Numerical Model of Infiltration for the Yucca Mountain Area, Nevada. U.S. Geological Survey, Denver, Colorado.

USEPA. 1995. The Hydrocarbon Spill Screening Model (HSSM) Users Guide, Volume 1, Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, Ada, Oklahoma.

Figure 1



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