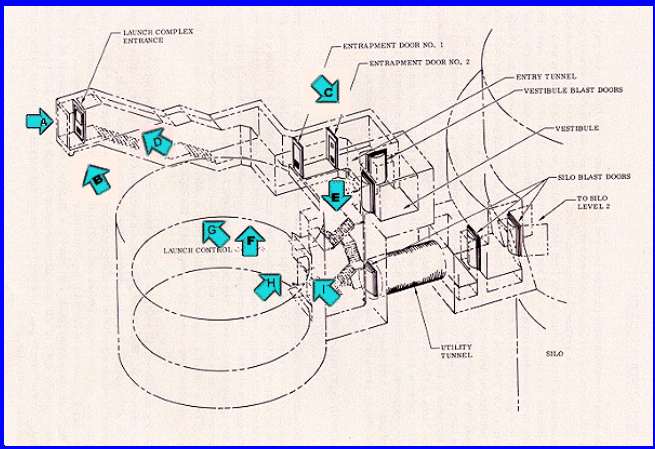
Former Atlas Missile Site No. 7, Vernon, Texas



Expanded Site Investigation Report

Report, Appendixes A through J)

January 2001

Total Environmental Restoration Contract
Contract No. DACA56-94-D-0021
Task Order No. 22

Prepared by:
Morrison Knudsen Corporation
Littleton, Colorado

Prepared for:
U.S. Army Corps of Engineers
Tulsa District
Tulsa, Oklahoma

MORRISON KNUDSEN CORPORATION

FINAL REPORT
FOR
EXPANDED SITE INVESTIGATION

FORMER ATLAS MISSILE SITE NO. 7
Vernon, Texas

Prepared For:

U.S. Army Corps of Engineers,
Tulsa District
Tulsa, Oklahoma

Prepared By:

Littleton, Colorado

Under Contract to:

U.S. Army Corps of Engineers
Tulsa District
Tulsa, Oklahoma

TOTAL ENVIRONMENTAL RESTORATION CONTRACT
CONTRACT NO. DACA56-94-D-0021

January 16, 2001
Revision 0

FINAL REPORT

FOR

EXPANDED SITE INVESTIGATION

FORMER ATLAS MISSILE SITE NO. 7
Vernon, Texas

Revision 0

REVIEWS AND APPROVALS

_____	_____
Steve Roe, MK Program Manager	Date
_____	_____
Lacy Key, MK Project Manager	Date

Acceptance:

_____	_____
Carol Wies U.S. Army Corps of Engineers Tulsa District	Date

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ACRONYM LIST

AF	Artificial Fill
AMS	Atlas Missile Site
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Above-ground Storage Tank
ASTM	American Society of Testing and Materials
bgs	below ground surface
CFR	Code of Federal Regulations
DI	Deionized
DOD	Department of Defense
DNAPL	Dense Non-aqueous Phase Liquid
EB	Equipment Blank
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Investigation
FFA	Future Farmers of America
FUDS	Formerly Used Defense Site
gpm	gallons per minute
HSA	Hollow-stem auger
ID	Inside Diameter
IDW	Investigative Derived Waste
LCC	Launch Control Center
LNAPL	Light Non-aqueous Phase Liquid
MDL	method detection limit
MEK	Methyl Ethyl Ketone
MK	Morrison Knudsen Corporation
MSC	Medium Specific Concentration
msl	Mean Sea Level
NTU	Nephelometric Turbidity Units
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
PID	Photo Ionization Detector
PQL	Practical Quantitative Limit
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RRS	Risk Reduction Standards
SI	Site Investigation
SOPs	Standard Operating Procedure
SOW	Scope of Work

SVOC	Semi-volatile Organic Compound
TAL	Total Analyte List
TCE	Trichloroethene or Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TERC	Total Environmental Restoration Contract
THM	Trihalomethanes
TIC	Tentatively Identified Compound
TNRCC	Texas Natural Resources Conservation Commission
TRPH	Total Recoverable Petroleum Hydrocarbons
USACE	United States Army Corp of Engineers
USCS	Unified Soil Classification System
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WP	Work Plan

EXECUTIVE SUMMARY

This Expanded Site Investigation (ESI) was conducted to determine if any releases of hazardous substances occurred at the former Atlas Missile Site (AMS) No. 7 when the Department of Defense occupied the site during 1960 to 1967. The ESI consisted of a

- literature research,
- site inspection
- data collection,
- results and findings presentation, and
- recommendations for site closure and remediation.

Site closure and remediation will adhere to Texas Natural Resources Conservation Commission (TNRCC) Chapter 335, Subchapter S Risk Reduction Standards (RRS). All data was collected closely following TNRCC and U.S. Environmental Protection Agency protocol.

AMS No. 7 is currently owned by a local government (Northside Independent School District No. 905 of Vernon, Texas), and the school district currently uses this facility for livestock shows several times each year. Therefore, non-residential or industrial risk reduction cleanup levels will apply to this site. Exposure pathways identified for this site are groundwater ingestion, soil inhalation/ingestion and groundwater protection with the nearest farm residence located approximately one-quarter mile.

The site investigation focused on three areas that were suspected to have had the greatest potential for contaminant release(s) based on historical or former site activities. These areas were:

1. Incinerator area,
2. Cooling tower area, and
3. Underground diesel fuel storage tank area.

The structures in these areas have been removed; therefore, the investigation was limited to assessing existing soil and groundwater site conditions. Specific field data collected included:

- surface soil samples

- subsurface soil samples from three boreholes, and
- groundwater samples from three shallow wells and one deep well

Surface soil lead and zinc concentrations exceeded Texas-specific background concentrations near the former incinerator and former cooling tower areas and will require localized remediation for compliance with RRS1 or RRS2 cleanup levels described in Appendices J.1 and J.2. Additionally, petroleum vapors, elevated photoionization readings and the detection of trichloroethylene (TCE) near or in monitoring well number 8 indicates a potential contaminant release and should be further evaluated to confirm the TCE concentration. Other metals, VOCs, and SVOCs were detected in surface soils, subsurface soils, and groundwater; however, their concentrations did not exceed RRS2 closure requirements.

In summary, a preliminary comparison of existing ESI data to the TNRCC Risk Reduction Standards indicates that closure to RRS1 and RRS2 does not appear to be achievable without localized soil remediation and groundwater monitoring. Localized remediation would include removal of localized surface soil contamination near the former incinerator and former cooling towers. All groundwater monitoring wells would be monitored for TCE to determine the viability of attenuation of TCE or the need for localized groundwater treatment. Closure to RRS2 may be required if low levels of TCE persist in groundwater around the cooling towers. Therefore, regulatory input is encouraged to ensure site closure and remediation efforts are consistent with TNRCC closure and remediation requirements.

1.0 INTRODUCTION

1.1 Site Location and History

The entire Formerly Used Defense Site (FUDS) property covers approximately 8 acres in an area of farmland; however, the missile silo and its support buildings were located in a secured and fenced area comprising less than 5 acres, located approximately five miles south of the Texas-Oklahoma border, shown in Figure 1-1. The site is accessed by State Highway 91, as shown in Figure 1-2. The nearest residential community is Odell, Texas, located approximately 6 miles west of the project site.

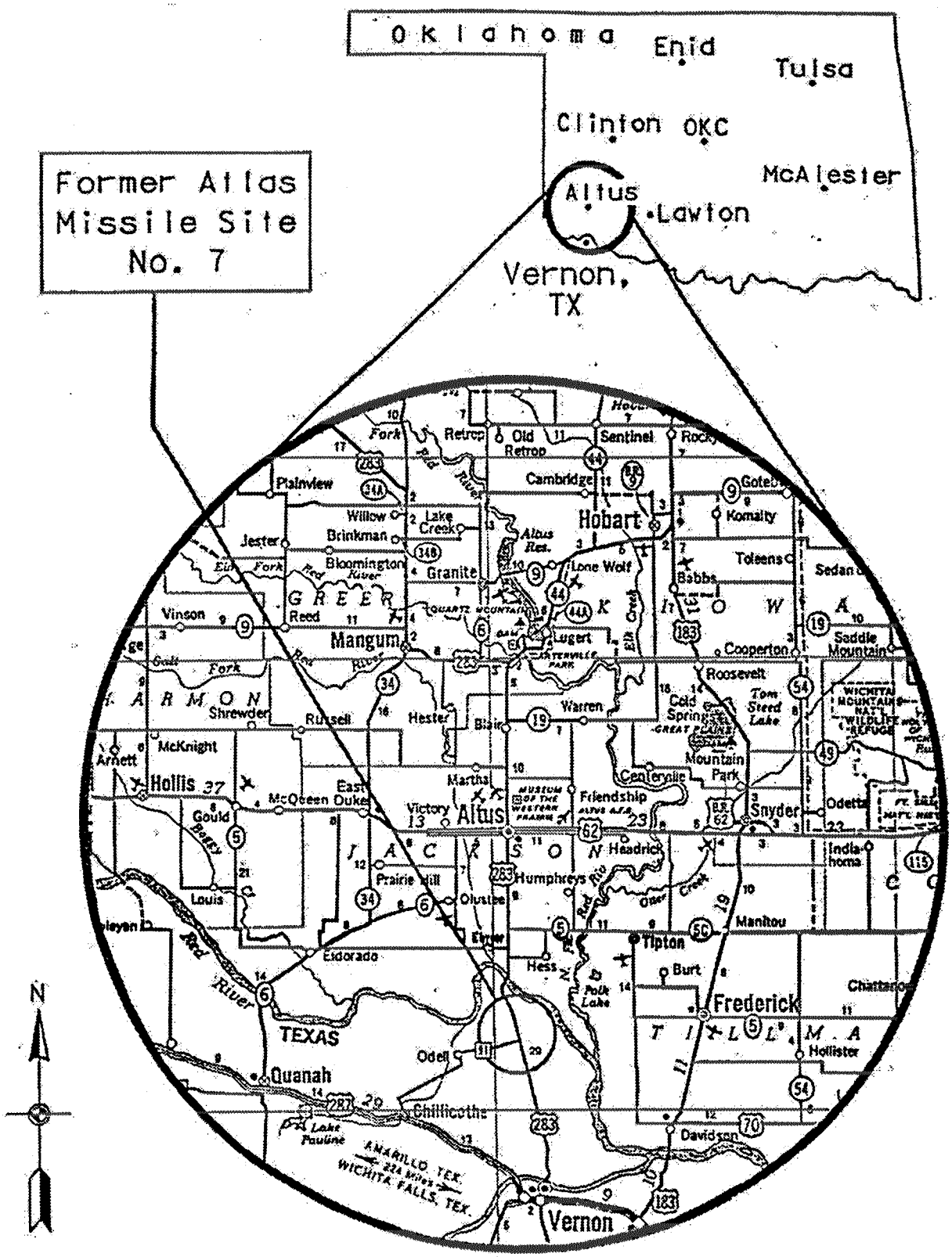
Prior to construction of the missile launch facility, the site was used primarily for cattle grazing and cattle operations. The site was selected by the Department of Defense (DOD) because of its isolation in an unpopulated, rural area of the state, and acquired in March 1960. The site was attached to the Altus Air Force Base. Construction of the facility was completed shortly thereafter. Site improvements made by the DOD included a Quonset hut, an underground Launch Control Center (LCC), an underground missile silo, septic systems, underground storage tank (UST), water supply well with pump house, helicopter pad, and various utility vaults/manholes (Figure 1-3).

The missile site was active for only a short period of time while housing liquid rocket propelled missiles with single nuclear warheads before being taken out of service in 1964. The site was later identified as excess, and the property was conveyed by deed to the Northside Independent School District No. 905, Vernon, Texas, in 1967. The DOD removed all USTs prior to conveyance of the property to the school district. The school district has since used the facility for Future Farmers of America (FFA) exhibitions and other livestock shows.

1.2 General Physiography

The AMS No. 7 is located in gently rolling topography of northwestern Wilbarger County known as the Odell Sand Hills (Willis and Knowles, 1953). The site has as an average elevation of 1365 feet above mean sea level (msl). The area is predominantly sandy soils with the primary groundwater aquifer located approximately 20 feet below ground surface.

More detailed discussion of the physiography, geology, and underlying aquifers are found in Section 4.0.



TULSA TERC ESI REPORT FORMER AMS NO. 7			
Figure 1-1 **REGIONAL LOCATION MAP**			
USACE TULSA DISTRICT			
MORRISON KNUDSEN CORPORATION			
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WORK ORDER 4423	TASK 0220	DRAWING NUMBER 2201018	REV. A

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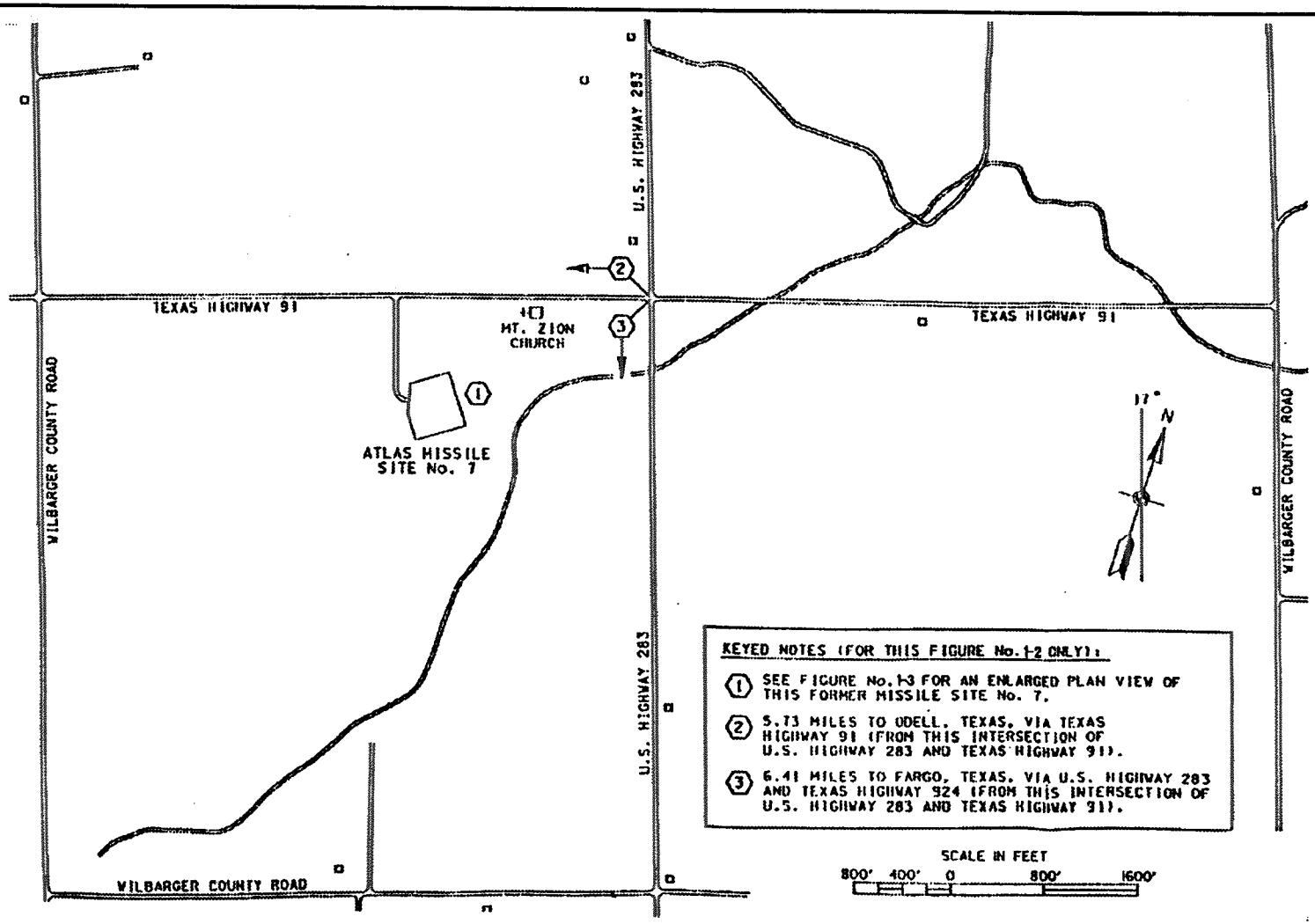

Source: USACE, 1998

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TULSA TERC
ESI REPORT
FORMER AMS NO. 7

Figure 1-2

AREA LOCATION MAP

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201019.dwg		DATE: 05/02/00	
WORK ORDER	TASK	DRAWING NUMBER	REV. / DRIVE
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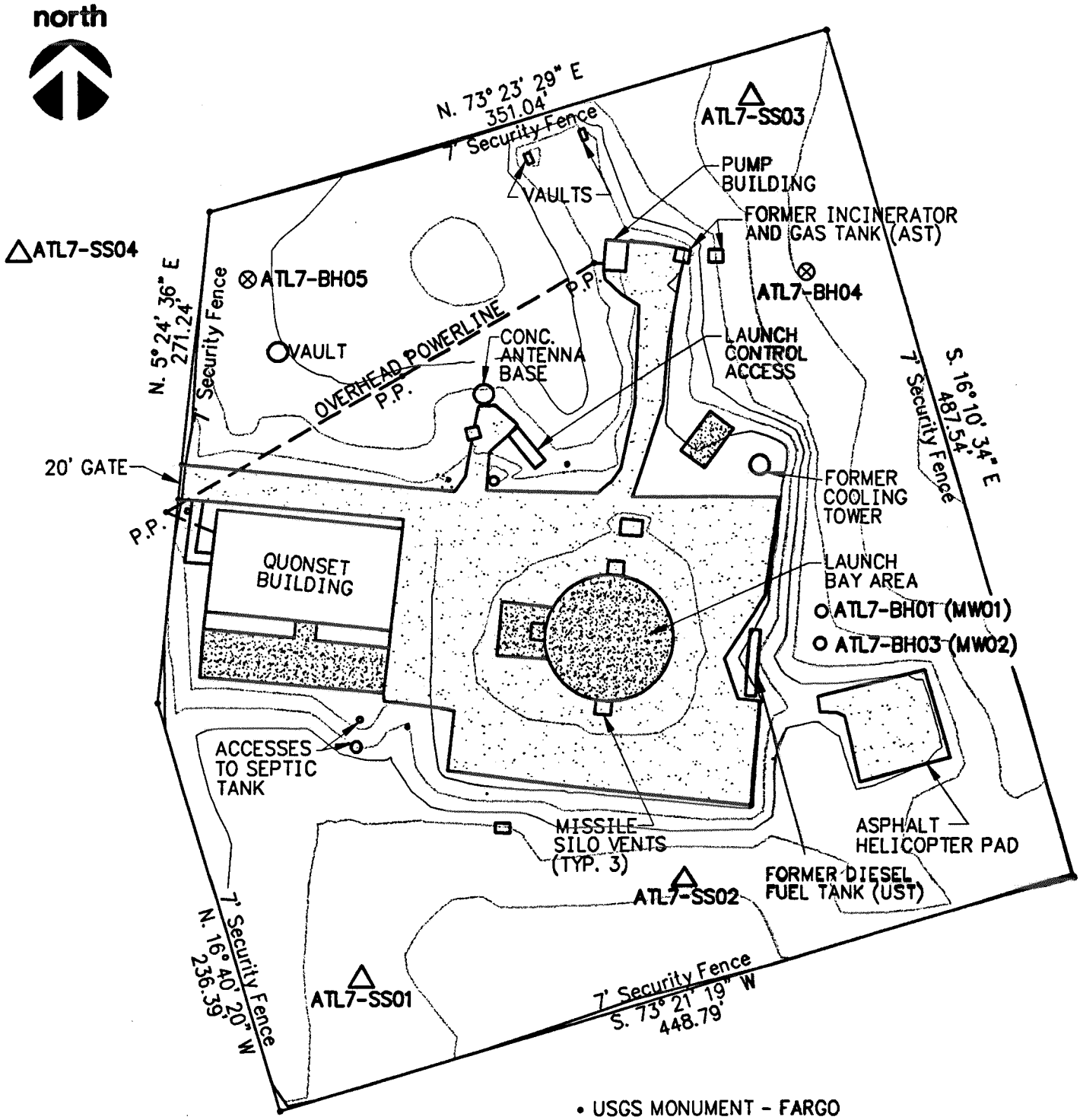

• USGS MONUMENT - FARGO
X = 1719712.871
Y = 7543120.831

LEGEND

△ SURFACE SAMPLE

⊗ BOREHOLE

○ BOREHOLE/MONITORING WELL

CONCRETE

ASPHALT

NOTE: ALL BEARINGS AND DISTANCES ARE STATE PLANE GRID VALUES.

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TULSA TERC
ESI REPORT
FORMER AMS NO. 7

Figure 1-3

SITE MAP SHOWING ON-SITE STRUCTURES AND FORMER SI SAMPLING LOCATIONS

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201020.dwg		DATE: 05/02/00	
WORK ORDER	TASK	DRAWING NUMBER	REV.
4423	0220	2201020	A

1.3 Previous Environmental Investigations and Closures

Previous work at this site consisted of a Preliminary Assessment and Site Inspection (PA/SI) conducted during 1995, and closure of various DOD structures onsite during 1999.

1.3.1 Investigations

The PA/SI for the AMS No.7 was conducted in 1995 by the USACE as part of the DOD Environmental Restoration Program (USACE, 1998). The primary objectives of the PA/SI were to determine if there was a potential for release of hazardous substances due to DOD activities at the site.

The PA was accomplished by gathering and reviewing existing information from:

- site interviews,
- DOD files,
- published geological and hydrogeological reports, and
- aerial photography.

The PA identified sources for potential releases as:

1. on-site fuel tanks used to fuel electrical generators and incinerators,
2. fuels and oils used for equipment maintenance, and
3. the hydraulic system used to operate the launch bay doors.

The purpose of the SI that followed the PA was to investigate if contamination of site soils or groundwater had occurred as a result of past DOD activities and what present threat exists to human health and/or the environment, if a release had occurred. SI activities consisted of the following:

- Collection of surface soil samples.
- Installation of three shallow boreholes for surface and subsurface soils data collection.
- Installation of a shallow and a deep well to assess ground water quality.
- Collection of water samples from the flooded missile silo and from an on-site water well via a water spigot.

Surface soils, subsurface soils and water were analyzed for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), total recoverable petroleum hydrocarbons (TRPH), and the eight Resource Conservation and Recovery Act (RCRA) metals. SI sampling locations are shown on Figure 1-3.

SI Findings and Recommendations

No VOCs were detected in soil or groundwater and all metals detected were stated as within acceptable background ranges. TRPH and several SVOCs were detected in soils and groundwater and are summarized below in Table 1-1.

Table 1-1 Summary of Detectable Contaminant Concentrations as Reported in the Site Investigation

Compound	Surface Soil		Subsurface Soil		Groundwater	
	Detected	Conc (µg/kg)	Detected	Conc. (µg/kg)	Detected	Conc. (µg/l)
Total Recoverable Petroleum Hydrocarbon	1 in 7 samples	4180	None		2 of 2	0.55 and 1.56
Bis(2-ethylhexyl) phthalate	5 of 7 samples	390 to 807	11 of 13	416 to 7,870	2 of 2	28.9 and 93.3
Benzoic Acid	None		None		1 of 2	>176
Di-n-octylphthalate	None		None		1 of 2	16.2
Phenol	None		None		1 of 2	13.2

Source: Site Inspection Final Report, Atlas Missile Site No. 7, Wilbarger County, Texas, Project No. K06TX006302, February 1998, US Army Corps of Engineers, Tulsa District

Bis(2-ethylhexyl)phthalate was the only SVOC detected in soils. It was detected at all three boreholes and occurred at depths ranging from the surface to 25 feet below ground surface (bgs). SVOCs detected in groundwater included bis(2-ethylhexyl)phthalate, benzoic acid, di-n-octylphthalate, and phenol.

Bis(2-ethylhexyl)phthalate is commonly added to plastics to enhance flexibility, therefore the SI report concluded that the presence of this compound in site soils and groundwater was probably due to leaching of the compound from sampling equipment and rubber gloves used in sampling, rather than a result of former DOD activities onsite. The report also stated that the other SVOCs detected in groundwater were known laboratory contaminants and were thought to be probably introduced during laboratory procedures. Based on these conclusions, the SI report recommended no further action

at the site. In May of 1998, the monitoring wells at the site were plugged and abandoned.

In March of 1999, the Texas Natural Resource Conservation Commission (TNRCC) completed its review of the SI Report and responded with a Notice of Deficiency, disagreeing that the presence of SVOC contaminants were not field sampling or laboratory artifact and that potential impacts to the upper and lower aquifers had not been properly evaluated.

1.3.2 Closures

In late 1999, the USACE (Tulsa District) completed the following site closure activities (MK, 2000a):

- The underground silo and LCC were backfilled with flowable fill,
- The above ground portion of the LCC stairwell entrance and other utility risers and vents were demolished below grade and then covered with clean fill to prohibit future access,
- The silo launch bay doors were welded shut, and
- The site was graded and reseeded.

1.4 ESI Study Objective

The main objective of the Expanded Site Investigation (ESI) was to collect information that was not obtained and reported during a previous investigation report and to provide sufficient information to substantiate compliance with one of three risk reduction standards (RRS) as it relates to site closure and remediation.

The TNRCC in their Notice of Deficiency dated March 5, 1999 outlined the following issues, concerns, and comments that were considered in developing specific study objectives for completing this ESI:

1. Removal or decontamination of all contaminated media or operating system components to background concentrations is necessary to attain RRS 1 site closure. Contaminants exceeding background concentrations may be allowed for RRS 2 and RRS 3; however, deed certification or deed recordation in Wilbarger County deed records is necessary.

2. Present and interpret all collected data, to the extent possible.

3. Conduct all sampling in accordance with proper TNRCC and U.S. Environmental Protection Agency (EPA) procedures.

4. Metals analyzes should include all metals listed in 40 CFR, Part 264, Appendix IX and not just the eight RCRA metals noted in 40 CFR Part 261.23.

5. Use the lowest possible limits of quantitation in laboratory analyses.

6. Designate and substantiate whether residential or nonresidential cleanup standards apply.

7. Test the groundwater to the full depth of the missile silo.

8. Test for dense non-aqueous phase liquids (DNAPL) at the sediment-bedrock interface.

9. Test for light non-aqueous phase liquids (LNAPL) across the top of the water table encountered at 14 to 16 feet below ground surface.

10. Determine if uppermost aquifer is continuous to the entire depth of the silo.

11. Identify the distinct saturated zones to the depth of the silo.

12. Discuss whether the missile silo is the only potential ground water source or if other potential contaminant sources should be evaluated, such as the underground storage tank.

13. Determine local groundwater flow direction by measuring the water table at a minimum of three locations.

14. Consider all data collected regardless if the contaminant(s) is regulated.

15. Provide a thorough description of the water wells to include their present status, location, static water elevations, construction, production interval, and any sampling results.

The USACE required specific objectives be addressed while completing this comprehensive ESI Report as well as address TNRCC concerns noted above. Specific investigation objectives included:

1. Characterize the contamination at the site
2. Gather field data to evaluate the level of concentrations and their associated risks/threat
3. Identify potential pathways of exposure
4. Identify applicable regulatory requirements
5. Establish which Texas RRS is achievable
6. Determine if additional work is required
7. Identify additional work requirements
8. Identify costs associated with the additional work.

2.0 ESI FIELD INVESTIGATION

This section describes the activities and general procedures performed during the field investigation. The field investigation was performed by MK and its subcontractors from July 12 to August 14, 2000. A detailed description of procedures and specifications are contained within the final ESI Work Plan (WP) and included standard operating procedures (SOPs) (MK, 2000b).

Supporting documentation is presented in the following appendices:

- Sample collection logs and borehole logs are presented in Appendix A and B, respectively.
- Monitoring well construction diagrams and state well registration forms are presented in Appendix C.
- Monitoring well development logs are presented in Appendix D.
- Field notes, waste records, and location survey data are presented in Appendices E through G, respectively.

2.1 Field Investigation Overview

The ESI field investigation program consisted of the following activities as stipulated in the Scope of Work Expanded Site Investigation Former Atlas Missile Site No. 7, Vernon, Texas, Contract No. DACA56-94-D-0021, Modification 2211, hereafter known as the Scope of Work (SOW):

- Collection of ten (10) surface soil samples (seven on-site and three off-site) for chemical analysis.
- Drilling and continuous coring of three shallow boreholes. Boreholes were drilled to the top of the alluvial/bedrock contact and soils were lithologically described. Soil samples were collected for chemical analysis at 5-foot intervals within the vadose zone at each borehole and at the underlying alluvial/bedrock contact.

- Drilling and continuous coring of one deep borehole. The deep borehole was drilled to 210 feet bgs and soils were lithologically described. No soil samples were collected for chemical analysis as directed in the SOW.

- Subsequent installation of monitoring wells at each borehole location. Shallow wells were screened across the water table within the Seymour Aquifer to test for dissolved phase contaminants and light non-aqueous phase liquid (LNAPL). The deep bedrock well was screened at the bottom of the borehole to test for dissolved phase contaminants in the San Angelos Aquifer below the former missile silo base. Well installation was followed by well development and groundwater sampling at each well.

- Location surveying of all sampling locations and monitoring wells.

2.2 Sample Analysis Summary

All soil samples collected were analyzed for VOCs, SVOCs, pesticides/herbicides, polychlorinated biphenyls (PCBs), TRPH, and total analyte list (TAL) of metals as listed in 40 CFR, Part 264, Appendix IX. Soil sample analyses were performed by Test America, Inc., Nashville, Tennessee.

Groundwater samples were analyzed for TNRCC Drinking Water Standard parameters and TRPH. TNRCC Drinking Water Standards include VOCs, trihalomethanes (THM), SVOCs, insecticides/herbicides, carbamate insecticides, organohalide pesticides, PCBs, endothall, glyphosate, diquate, metals, fluoride, cyanide, and nitrate/nitrite. Groundwater sample analyses were performed by Environmental Health Laboratories, Southbend, Indiana.

Quality Control and Quality Assurance (QA/QC) samples were collected for soil and groundwater samples at a frequency of one per ten samples (10 percent). Equipment blank (EB) samples were collected at a frequency of one per twenty samples (5 percent) for both soil and groundwater. QA/QC and EB samples are listed in Table 2-1 and Table 2-2. Laboratory prepared trip blanks were included and analyzed for each cooler containing aqueous samples for VOC analysis. QA sample analyses were performed by the USACE contract laboratories.

Table 2-1

Sample ID, Depth Interval, Quality Control and Chemical Analysis Performed for Surface and Subsurface Soil Samples
AMS No. 7 ESI

Sample ID (AMS7-)	Depth Interval (ft)	Quality Control	VOCs (EPA 5035/8260)	SVOCs (EPA 8270)	Pesticides (EPA 8081)	PCBs (EPA 8082)	Herbicides (EPA 8151)	TPH (TNRCC 1005)	Total Metals [1] (EPA 6000/7000)
Surface Soil Samples									
SS-05	0.0 - 0.5		X	X	X	X	X	X	X
SS-06	0.0 - 0.5	EB	X	X	X	X	X	X	X
SS-07	0.0 - 0.5		X	X	X	X	X	X	X
SS-08	0.0 - 0.5	QA/QC	X	X	X	X	X	X	X
SS-09	0.0 - 0.5		X	X	X	X	X	X	X
SS-10	0.0 - 0.5		X	X	X	X	X	X	X
SS-11	0.0 - 0.5		X	X	X	X	X	X	X
SS-12	0.0 - 0.5		X	X	X	X	X	X	X
SS-13	0.0 - 0.5		X	X	X	X	X	X	X
SS-14	0.0 - 0.5		X	X	X	X	X	X	X
Borehole Soil Samples									
BH06									
S-00	0.0 - 0.5		X	X	X	X	X	X	X
S-05	5.0 - 6.0		X	X	X	X	X	X	X
S-10	10.0 -11.0		X	X	X	X	X	X	X
S-18	16.0 - 18.0	QA/QC	X	X	X	X	X	X	X
S-76	75.5 - 76.5		X	X	X	X	X	X	X
BH07									
S-00	0.0 - 0.5		X	X	X	X	X	X	X
S-05	5.0 - 6.0		X	X	X	X	X	X	X
S-10	10.0 - 11.0		X	X	X	X	X	X	X
S-85	84.5 - 85.5		X	X	X	X	X	X	X
BH08									
S-00	0.0 - 0.5		X	X	X	X	X	X	X
S-05	5.0 - 6.0		X	X	X	X	X	X	X
S-10	10.0 - 11.0		X	X	X	X	X	X	X
S-15	15.0 - 16.0		X	X	X	X	X	X	X
S-18	16.5 - 18.5	QA/QC	X	X	X	X	X	X	X
S-80	80.1 - 80.5	EB	X	X	X	X	X	X	X

1 - Metals include: Aluminum, Antimony, Arsenic, Barium Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, Zinc, Mercury.

Table 2-2

Sample ID, Quality Control and Chemical Analysis Performed for Ground Water Samples AMS No. 7 ESI

Sample ID (AMS7-)	Field Quality Control	VOCs/ THMs (EPA 524.2/ 504.1)	SVOCs/ Insecticides/ Herbicides (EPA 525.2/ 515.1)	Carbamate Insecticides (EPA 531.1)	Organohalide Pesticides/ PCBs (EPA 505)	Endothall (EPA 548.1)	Glyphosate (EPA 547)	Diquate (EPA 549.1)	TPH (TNRCC 1005)	Metals[1] (EPA 200.8)	Inorganics[2]
MW06-GW	QA/QC	X	X	X	X	X	X	X	X	X	X
MW07- GW	EB	X	X	X	X	X	X	X	X	X	X
MW08-GW		X	X	X	X	X	X	X	X	X	X
MW09-GW		X	X	X	X	X	X	X	X	X	X

[1]Metals include Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Mercury, Nickel, Selenium, Thallium, Copper, and Lead.
[2]Inorganics include fluoride by Technicon 380-75WE, cyanide by EPA 335.4, nitrate by EPA 300.0, and nitrite by EPA 353.2.

2.3 Surface Soil Samples

Ten surface soil samples (SS05 through SS14) were collected for chemical analysis. Three surface soil samples (SS05, 06, and 07) were collected outside the perimeter fence or offsite and seven surface soil samples (SS08 through SS14) were collected within the sites perimeter fence or onsite of the AMS No. 7. The three off-site surface soil samples were intended as background samples for comparison purposes with onsite samples. Sample identifications, depth intervals and chemical analyses are summarized in Table 2-1.

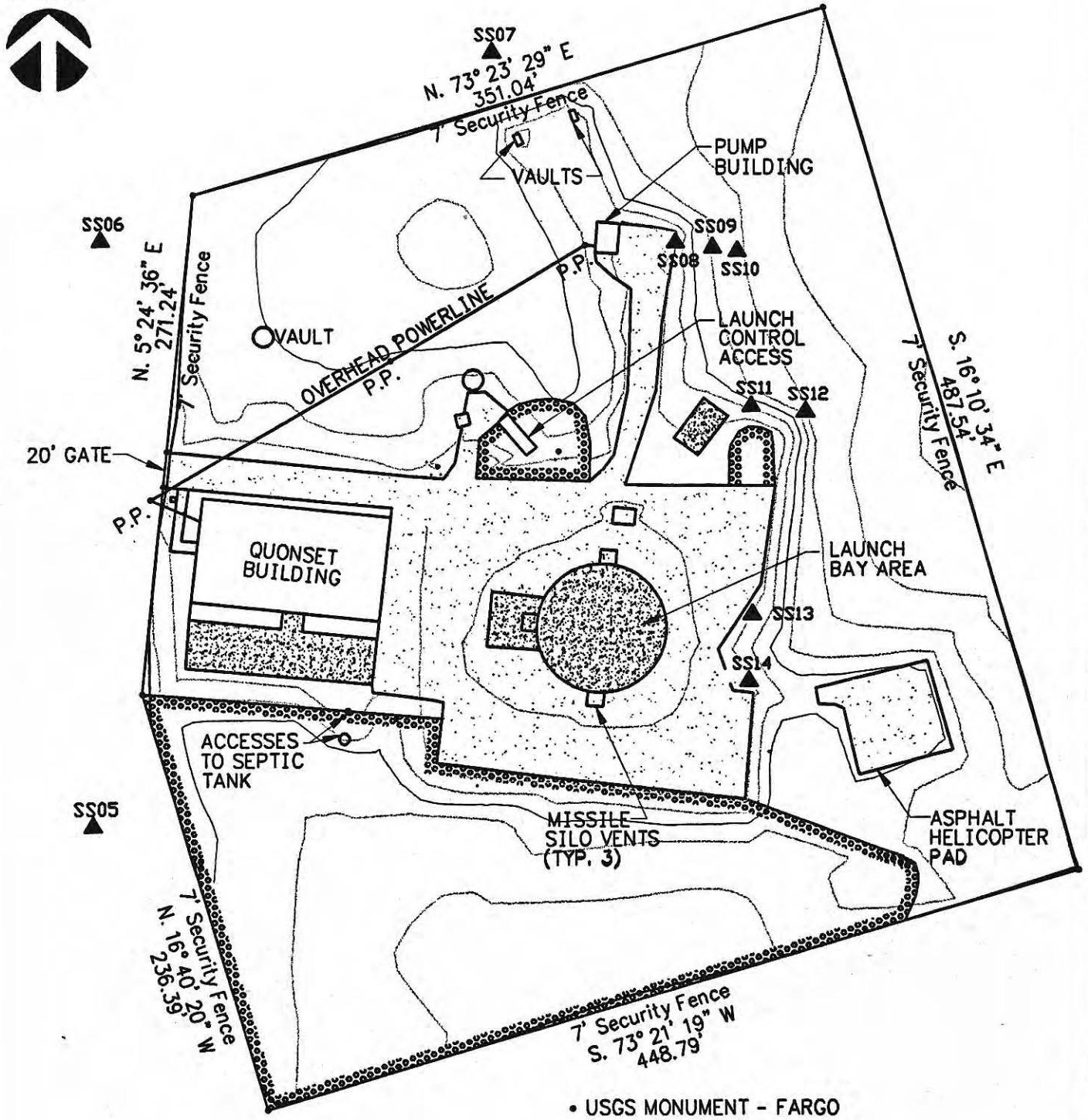
2.3.1 Sample Locations

During earlier closure activities in 1999 (MK, 2000a), various sectors of the site were covered with clean imported fill from a local quarry. The fill was used for backfilling structures that were demolished or plugged below grade and was also used as aggregate in the flowable fill. On April 14, 2000, the USACE and MK jointly inspected the site in order to assess site conditions and determine sample locations for the ESI. During the site visit, the areas covered by clean fill were located and are shown on Figure 2-1. Since the near surface soils in these areas consist of clean imported fill, no contamination is expected. A surface soil sample collected from BH-06 confirms this condition.

No evidence of surface spills such as stressed vegetation or discolored soils were identified during the site visit and no surface contaminant releases were found recorded or documented for the site (USACE 1998). Therefore, on-site surface soil locations were located near three former site structures or operations that may have had a potential for contaminants release. The three former site structures or operational areas included:

- Incinerator (surface soil samples SS08, SS09, and SS10)
- Cooling tower (surface soil samples SS11 and SS12)
- Underground diesel storage tank (surface soils samples S13 and SS14)

Sample locations are shown on Figure 2-1 and Plate 1.



LEGEND

▲ ESI SURFACE SOIL SAMPLE (AMS7-)

PERIMETER OF CLEAN FILL

CONCRETE

ASPHALT

NOTE: ALL BEARINGS AND DISTANCES ARE STATE PLANE GRID VALUES.

<CPD: 09/11/00 [TIME: 4:44 PM]>

TULSA TERC
ESI REPORT
FORMER AMS NO. 7

Figure 2-1

ESI SURFACE SOIL SAMPLE LOCATIONS

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201021.dwg		DATE: 05/02/00	
WORK ORDER 4423	TASK 0220	DRAWING NUMBER 2201021	REV. B

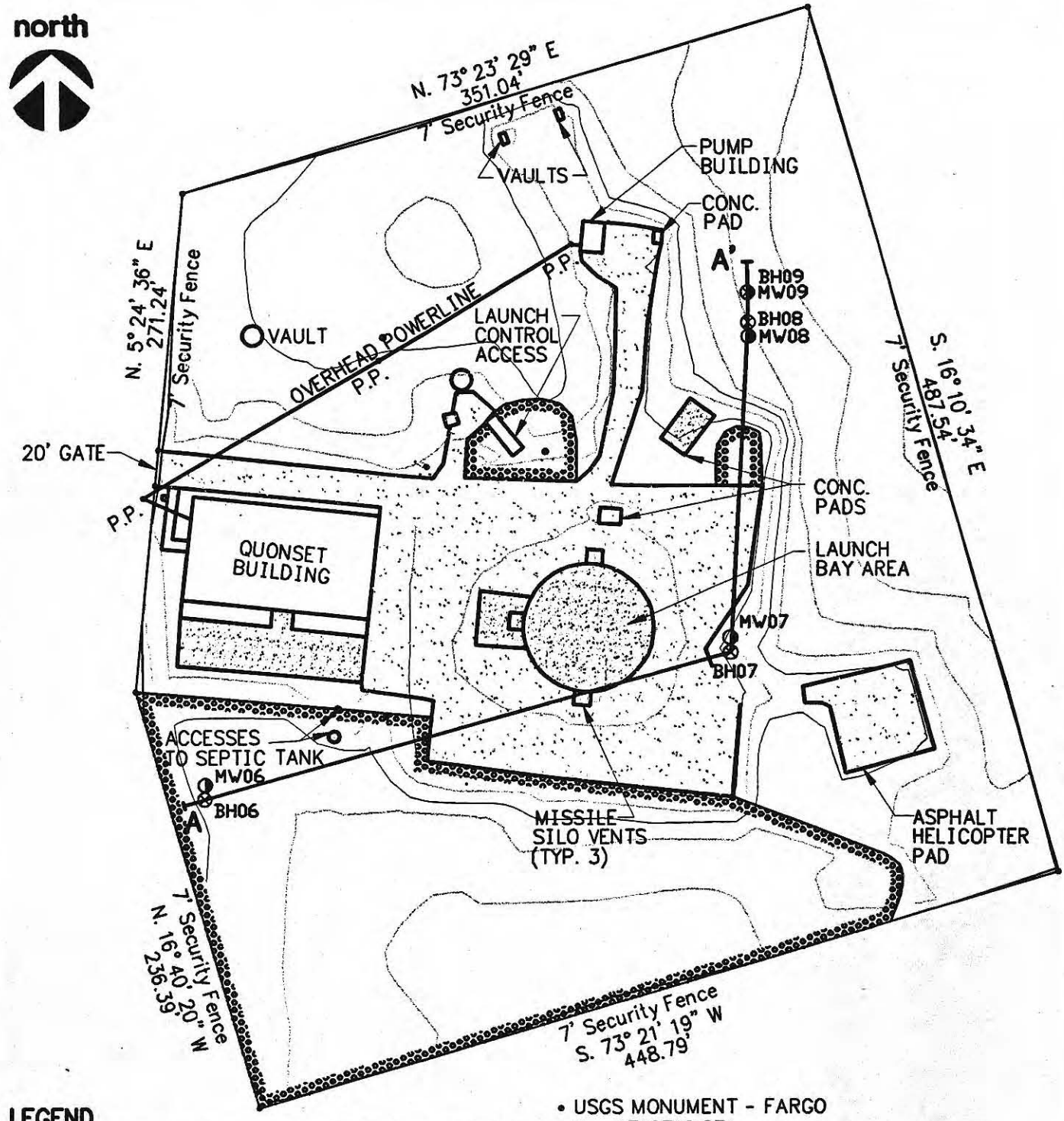
2.3.2 Sample Collection Methods

Prior to sampling at each surface soil location, the immediate area was cleared of debris, rocks and vegetation. Five (5) gram soil volumes for VOC analysis were collected using EnCore™ samplers. EnCore™ samplers were pushed directly into surface soils and then soils were transferred immediately into laboratory-preserved sample vials in accordance with EPA Method 5035. Sample volumes for the other analytical parameters were then collected from the upper 6 inches of soil using a stainless steel trowel and placed directly into sample containers without compositing. Sampling information was documented on soil sample collection logs (see Appendix A.1). For QA/QC samples, soil for non-VOC analysis were placed into a stainless steel bowl and homogenized prior to splitting into sample containers.

2.4 Boreholes

Three shallow boreholes (BH06 - BH08) were drilled to investigate the lithologies and potential contamination within the alluvial Seymour Formation or shallow aquifer. The boreholes were drilled and soils continuously cored to the underlying alluvial/bedrock contact. This contact was approximately 80 feet bgs at all three locations. One deep borehole (BH09) was drilled to investigate the lithologies of the underlying San Angelos Formation (bedrock) or deep aquifer. This borehole was drilled to a depth of 210 feet bgs. Monitoring wells were subsequently installed at all four borehole locations.

Borehole (and the subsequent monitoring well) locations were chosen based on areas of potential releases and the presumed groundwater gradient beneath the site. Since the previous SI did not determine the groundwater gradient beneath the site, the gradient was estimated from regional maps for years 1951 through 1971 for the Odell Sand Hills (Price 1979). Based on these maps, groundwater flow may vary from slightly east of north to eastward in the vicinity of the site. BH06 was placed along the southwestern boundary of the site and was assumed to be in an upgradient position. BH07 was placed at the former location of the diesel fuel UST and BH08 was placed down-gradient of the missile silo and former cooling tower location to investigate for potential contaminant releases. BH09 was placed adjacent to BH08 to compare hydrogeologic conditions between the shallow aquifer and the deep aquifer. Borehole locations are shown in Figure 2-2 and Plate 1.



LEGEND

- ⊗ ESI SHALLOW BOREHOLE (AMS7-)
- ◑ ESI SHALLOW MONITORING WELL (AMS7-)
- ⊗ ESI DEEP BOREHOLE/ MONITORING WELL (AMS7-)
- A — A' LOCATION OF GEOLOGIC X-SECTION A-A' (SEE FIGURE 3-1)
- PERIMETER OF CLEAN FILL
- CONCRETE
- ASPHALT

NOTE: ALL BEARINGS AND DISTANCES ARE STATE PLANE GRID VALUES.

• USGS MONUMENT - FARGO
X = 1719712.871
Y = 7543120.831

<CPD: 09/20/00 [TIME: 4:59 PM]>

TULSA TERC
ESI REPORT
FORMER AMS NO. 7

Figure 2-2

ESI BOREHOLE AND MONITORING WELL LOCATIONS

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201021a.dwg			DATE: 05/02/00	
WORK ORDER 4423	TASK 0220	DRAWING NUMBER 2201021A	REV. B	DRIVE

2.4.1 Drilling Methods

Shallow boreholes were drilled with conventional hollow-stem auger (HSA) methods in combination with a 5-foot-long split sampling barrel that is advanced with the auger string during drilling to obtain continuous samples. At BH07, drive sampling with a two-foot split-spoon was also used in the lower portion of the borehole. Shallow boreholes were drilled with a Longyear BK-81 drill rig.

At each shallow borehole, loose flowing sands were encountered at a depth of about 40 feet bgs. Sand inflow into the augers caused problems in auger drilling and sample barrel retrieval. At borehole BH07, sand flowing into the augers locked the sample barrel in the augers on two separate occasions, requiring the augers and rods to be removed from borehole to retrieve the sample barrel. In attempts to control the inflow of sand at BH07, a water head was added to the augers and circulated through a mud pit. At about 65 feet bgs, a mud additive (Insta-Vis) was added in attempts to remove sand and fines from the augers and stabilize the borehole walls. Insta-Vis (a CETCO product) is a liquid polymer consisting of a surfactant dispersed in a mineral oil base. Therefore, soil samples collected for total petroleum hydrocarbons (TPH) or other organics after the use of Insta-Vis may likely be compromised and were not analyzed for petroleum hydrocarbons. Insta-Vis was not used in the other two shallow boreholes (BH06 and BH08); but pure bentonite mud was added to the inside of the augers during drilling to control the inflow of sand. After completion of each borehole, the augers were removed and borehole abandoned in accordance with state regulatory requirements using a bentonite cement grout.

At the deep borehole (BH-09), an 8-inch-diameter steel isolation casing was cemented in place across the Seymour aquifer prior to drilling ahead into the underlying San Angelos aquifer. Bentonite based mud was used for casing installation and for bedrock coring. The base of the casing was set at 91 feet bgs (7 feet into unweathered bedrock). The casing was set with a Garner-Denver 1500 drill rig using bentonite mud rotary techniques. The San Angelos formation (bedrock) was then continuously cored with a Longyear BK-81 drill rig using conventional air rotary and bentonite mud rotary methods. Rock cores were retrieved with a 10-foot-long inner core barrel attached to a wire-line.

Lithologic Logging

At all borehole locations, alluvium and bedrock was lithologically described by the field geologist. Unconsolidated material (alluvium) was classified in accordance with the American Standard for Testing and Materials (ASTM) Standard D2488-90, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. This procedure is a modification of the Unified Soil Classification System (USCS). Lithologic descriptions, field observations, sample information, and drilling methods were recorded on borehole log forms and are presented as Appendix B.

2.4.2 Subsurface Soil Sample Collection

Fifteen (15) soil samples were collected for chemical analysis from the three shallow boreholes located within 10 feet of the monitoring wells. Samples were collected to investigate potential contamination within the vadose zone of the Seymour Aquifer and at the underlying alluvial/bedrock contact. Samples for chemical analysis were not collected from the deep borehole. Sample identifications, depth intervals and chemical analysis summaries are presented in Table 2-1. The boreholes were later abandoned in accordance with state regulatory requirements using a bentonite cement grout.

Soil Sample Depths

Samples were collected within the vadose zone from the three shallow boreholes at approximately 5-foot intervals beginning at the land surface and every five foot thereafter until the water table was encountered. The borehole was then advanced (with continuous coring and lithologic logging) until the underlying San Angelos bedrock was encountered. At all three shallow borehole locations, the alluvial/bedrock contact was sharp and distinct, with light brown soft clean sand (SP) overlying reddish brown hard sandstone. The alluvial sand directly above the bedrock contact was then sampled in each borehole to determine the presence or absence of DNAPL constituents.

Soil Sample Collection Methods

Once the sample barrel or spoon was retrieved and opened, the soil cores were monitored by a photoionization detector (PID) and observed for the presence of contamination (see Appendix B for PID readings and observations). The surface layer of the core in contact with the sample barrel was cut away using a stainless steel knife at the appropriate depth to be sampled. EnCore™ samplers were pushed into the core

and the soil was immediately transferred into laboratory prepared preservation vials in accordance with EPA Method 5035. All VOC samples were collected and preserved for both high and low concentrations; therefore, allowing the analytical laboratory to determine the appropriate sample for data reporting. The remaining sample volumes needed for other analytical suites were then collected with a stainless steel spoon and placed directly into sample containers without compositing. Sampling information was documented on soil sample collection forms (see Appendix A).

2.5 Monitoring Wells

Borehole/monitoring well locations were chosen based on areas of potential releases and the presumed groundwater gradient beneath the site; however, the boreholes were not used for water monitoring because the boreholes were installed with a bentonite mud rotary technique and not air rotary. Therefore, monitoring wells were installed within 10 feet of each borehole location once soil and bedrock sampling was complete. Monitoring well locations are shown in Figure 2-2 and Plate 1. A summary of well constructions is presented in Table 2-3. Detailed diagrams of construction and associated Texas well registration reports are presented as Appendix C.

2.5.1 Well Installation

At the three shallow borehole locations, two-inch diameter polyvinyl chloride (PVC) monitoring wells were installed adjacent to the abandoned boreholes. Monitoring wells were installed with 4¼-inch interior diameter (ID) HSAs. Fifteen (15) feet of well screen was placed in each well and screens were placed across the water table within the unconfined Seymour Aquifer.

Prior to installation of the deep monitoring well (MW09), the pilot borehole was reamed with a Driltech D40K airlift drill rig using a 7O-inch tricone bit. A 4-inch-diameter PVC well casing was installed with twenty five (25) feet of well screen placed at the bottom of the reamed hole. Stainless steel centralizers were placed every 20 feet along the well casing.

Table 2-3

Monitoring Well Construction Summary

Well Construction	MW06	MW07	MW08	MW09
Steel Isolation Casing Depth (ft, bgs)	NI	NI	NI	91.0
Well Casing/Screen Material	2 inch diameter schedule 40 PVC	2 inch diameter schedule 40 PVC	2 inch diameter schedule 40 PVC	4 inch diameter schedule 80 PVC
Bottom of Well (ft, bgs)	31.5	23.5	25.5	211.5
Screen Length (ft)	15	15	15	25
Screen Interval Depths (ft, bgs)	16 - 31	8 - 23	10 - 25	186 - 211
Stablilizers (stainless steel)	NI	NI	NI	Every 20' from top of screen
Filter Pack	20-40 gradation silica sand	20-40 gradation silica sand	20-40 gradation silica sand	20-40 gradation silica sand
Seal Type (thickness)	Bentonite pellets (3')	Bentonite pellets (3')	Bentonite pellets (3')	Bentonite slurry (36')
Water Level encountered during drilling (ft, bgs)	21.5	11.3	15.0	Approx. 20
Static Water Level Measured in Well (ft, bgs) after Installation	21.68	11.83	20.30	NR
Top of Casing Elevation (ft, msl)	1367.73	1370.88	1365.94	1366.22
Static Water Level Measured in Well (ft, btoc) on 8/14/00	24.37	15.07	23.65	42.46
Static Water Level Measured in Well (ft, msl) on 8/14/00	1343.36	1355.81	1342.29	1323.76

Notes:
NI - not installed
bgs - below ground surface
btoc - below top of casing

2.5.2 Well Development

All installed wells were developed in order to restore the aquifers hydraulic conductivity and remove any fluids, cuttings and mobile particulates introduced during well drilling and installation. Monitoring well development logs are presented as Appendix D.

Well development of shallow monitoring wells (MW06-MW08) was accomplished using a surge block and submersible pump. Turbidity, specific conductance, temperature and pH were monitored during development. All parameters stabilized at each well, but turbidity could not be lowered below 990 nephelometric turbidity units (NTU) during development. A minimum of 11 casing volumes were removed at each well (see Appendix D). The deep monitoring well, MW09, was developed with a surge block and weighted bottom discharge bailer (sand bailer). The well was bailed dry twice during development. A total of 240 gallons was removed during development.

2.5.3 Groundwater Sampling

Groundwater sampling using the low-flow (minimal drawdown) purging and sampling technique (Environmental Protection Agency (EPA), 1996) was attempted at each monitoring well. This technique has the advantage of producing samples which are more representative of aquifer conditions since the technique produces:

1. less entrainment of sediment and colloids normally not carried by groundwater flow
2. less mixing of stagnant casing water and formation water
3. minimal loss of VOCs, and
4. greater sample consistency

Low-flow sampling was successful at MW06 and MW07, but could not be achieved at MW08 and MW09. These later wells were therefore sampled with disposable teflon bailers with VOC tips. Monitoring well sample collection logs are presented in Appendix A.2.

Sampling Procedures

Low-flow ground water sampling was performed using a Grundfos Redi-Flo2 submersible pump with teflon tubing. The pump intake was set within the lower portion of the screen interval of each well. Pumping rates during purging and sampling were kept below 0.5 L/min by adjusting the voltage regulator. Flow rates were measured every five minutes using a graduated cylinder.

Ground water quality parameters were also measured every five minutes during pumping, by use of a flow-through cell and a Horiba U-22 water quality meter. Water quality field parameters used to indicate stabilization included temperature, pH, specific conductivity, turbidity, dissolved oxygen and total dissolved solids (TDS). Based on EPA's low-flow ground water sampling procedures (EPA, 1996) stabilization was demonstrated with three successive field readings of temperature within 0.5 degrees Celsius, pH within 0.1, specific conductivity within 3 percent, and turbidity and dissolved oxygen within 10 percent. After water quality field parameters had stabilized, sample bottles were filled while maintaining the low flow pumping rate.

The pump and tubing were decontaminated prior to reuse in each well in accordance with Section 2.6 below; except MW09 required new tubing because of well depth.

At MW08, low flow pumping rates could not be sustained, apparently due to insufficient water head in the well. In accordance with the ESI WP (MK, 2000b), the pump was then lowered to the bottom of the well, and the well was pumped dry. The next day, after water level in the well had recovered, groundwater was sampled with a disposable teflon bailer. Due to high turbidity of bailed water (660 NTU), water for metal analysis was filtered through a 10-micron filter.

At MW09, groundwater could not be pumped to the surface with the Grundfos Redi-flo2 without consistently tripping the voltage regulator. Groundwater was therefore sampled with a disposable teflon bailer, after the groundwater level had recovered from development. The bailer was lowered to 200 feet bgs in order to collect water from the screened interval of the well.

2.5.4 Water Level Measurements

In order to construct a site specific potentiometric map for the site, water levels in all wells were measured on August 14, 2000, approximately 1 to 2 weeks following sampling. Water levels are listed in Table 2-3.

2.6 Equipment Decontamination

Drill rigs and drilling equipment such as augers, drill rods and bits, were decontaminated between boreholes and monitoring wells. Decontamination was performed at an on-site temporary decontamination pad using a high-pressure steam washer. Downhole sampling equipment (sample barrels, split spoons, and downhole submersible pump) and surface soil sampling tools were decontaminated at each sampling location between each sampling event or use. Decontamination procedures consisted of:

1. Wash and scrub with a solution of potable water and Alconox
2. Rinse with deionized (DI) water
3. Rinse with Reagent Grade II water

Equipment blank (EB) samples were collected by pouring Reagent Grade II water over deconned downhole and surface soil sampling equipment directly into sample containers.

2.7 Investigative Derived Wastes (IDW)

Excess soils, decontamination fluids, development and purge waters were containerized onsite during ESI field activities. Approximately 25 cubic yards of soils were generated during borehole and monitoring well installation and were placed in two lined roll-off bins. Approximately 8,800 gallons of fluids and waters were generated with the majority coming from the drilling, reaming and development of MW09. These fluids and waters were placed in three lined roll-off bins.

Composite waste samples were collected from the roll-off bins and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, SVOCs, pesticides, herbicides and metals. Samples were also analyzed for RCRA hazardous characteristics of ignitability, corrosivity and reactivity. Results of analyses are presented in Appendix H.4. No TCLP analytes were detected in the waste samples; therefore, the wastes were characterized as RCRA non-hazardous.

Waste soils and water were removed from the site by January Environmental Services, Inc., Oklahoma City, Oklahoma. Soils were disposed of in the Waste Management Industrial Landfill, Oklahoma City, Oklahoma and wastewaters were treated by January Environmental's onsite permitted industrial wastewater treatment facility. Disposal manifests are presented in Appendix F.2.

2.8 Location Survey

Upon completion of ESI field activities, boreholes, monitor wells and surface soil sample locations were surveyed by a licensed surveyor in the state of Texas. Horizontal coordinates were recorded to the nearest 0.01 foot and established relative to the Texas State Plane coordinate system.

Ground surface elevations were measured at each borehole and soil sample locations to the nearest 0.1 foot. Top of well casing elevations were also measured on the casing's north side and recorded to the nearest 0.01 foot. Survey data are tabularized in Appendix G.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

3.1 Local Physiography, Geology and Underlying Aquifers

This section describes the site-specific geology and hydrogeology based on information and data gathered during literature research and data obtained from lithologic logs and water level data acquired from borehole drilling and monitoring well installation. Lithologic logs are presented as Appendix B and water level data is listed in Table 2-3.

The near surface stratigraphic units of concern for this study consist of Quaternary age surficial deposits and underlying Permian age redbeds (see Table 3-1). The local surficial deposits consist of a thin mantle of Recent age wind-blown sands and silts and the underlying Pleistocene age Seymour Formation (Willis and Knowles, 1953). The Seymour Formation is fluvial in origin and is comprised of fine to medium grained sands with interbedded silts and clays. The lower sands in the formation generally contains well rounded pebbles of chert, quartz and igneous rocks and may contain lenses of gravel (Price, 1979). Previous investigations at AMS No. 7 report a thickness for surficial deposits ranging from 42 to 80 feet beneath the site. The Seymour Formation rests on an erosional surface developed on the underlying Permian age bedrock. Relief of 135 feet occurs on this surface regionally beneath the Odell Sand Hills (Willis and Knowles, 1953).

The Seymour Formation is the major groundwater aquifer in Wilbarger County. The aquifer is unconfined (i.e., under water-table conditions). The quality of water ranges from fresh to slightly saline and well yields range from 30 to 400 gallons per minute (gpm) (Price, 1979). Thirty-two (32) wells are registered with the state of Texas in a three mile radius of AMS No. 7. All wells produce from the Seymour aquifer. Based on water-table elevation maps from 1951 through 1971 for the Odell Sand Hills (Price 1979), groundwater flow directions in the vicinity of the site may vary from slightly east of north to eastward.

The redbeds beneath the Seymour Formation belong to the Permian age San Angelos Formation of the Peace River Group (Table 3-1). The San Angelos Formation consists of red medium-grained deltaic sandstone (near the top of the formation) underlain by

Table 3-1 Stratigraphy in the Vicinity of the Former AMS No. 7

System	Series	Formation	Maximum Thickness	Lithology	Water-Bearing Characteristics
Quaternary	Recent	Wind-blown deposits	Several feet	Fine sands and clayey silts (loess)	Predominantly above water table
	Pleistocene	Seymour	112 feet	Contains while to red fine sands with interstratified lenses of silt and reddish-orange to gray clay. Caliche nodules in upper part. Lower portion of formation generally contains well rounded pebbles of chert, quartz and igneous rocks. Locally contains gravel lenses. Fluvial in origin. Buried erosional topography at base on top of underlying bedrock formations.	Yields mostly fresh to slightly saline water in small to moderate quantities. Main water supply for Wilbrarger County.
Permian	Guadalupe	San Angelo	210 feet	Red to greenish-gray medium sandstone, deltaic in origin, near top of formation. Lower portion contains interbedded sandstone (as above) with cherty conglomerate, and red and green shale. Contains gypsum nodules and streaks of “satin spar” gypsum.	

interbedded sandstone and shale (Price, 1979). The formation obtains a maximum thickness of 210 feet in Wilbarger County.

The San Angelos Formation is a minor aquifer in Wilbarger County. Water quality ranges from fresh to slightly saline and yields are generally less than 50 gpm. Hydraulic connection between the San Angelos Aquifer and the overlying Seymour aquifer is unknown.

3.2 Geology

As mentioned above the local geology in the vicinity of AMS No. 7 consists of the unconsolidated fluvial Seymour Formation (Pleistocene age) which uniformly overlies the redbeds of the San Angelos Formation (Permian age). A generalized geologic cross-section across the site is shown in Figure 3-1. Location of the cross-section is shown on Figure 2-2.

3.2.1 Seymour Formation

The Seymour formation is divided into three informal units (for discussion purposes) based on lithology and thickness that are recognizable across the site. Unit 1 is an upper sandy unit, Unit 2 is a middle clayey unit and Unit 3 is a lower flowing sand unit. Each unit is discussed in the following text.

Unit 1 (Upper Unit)

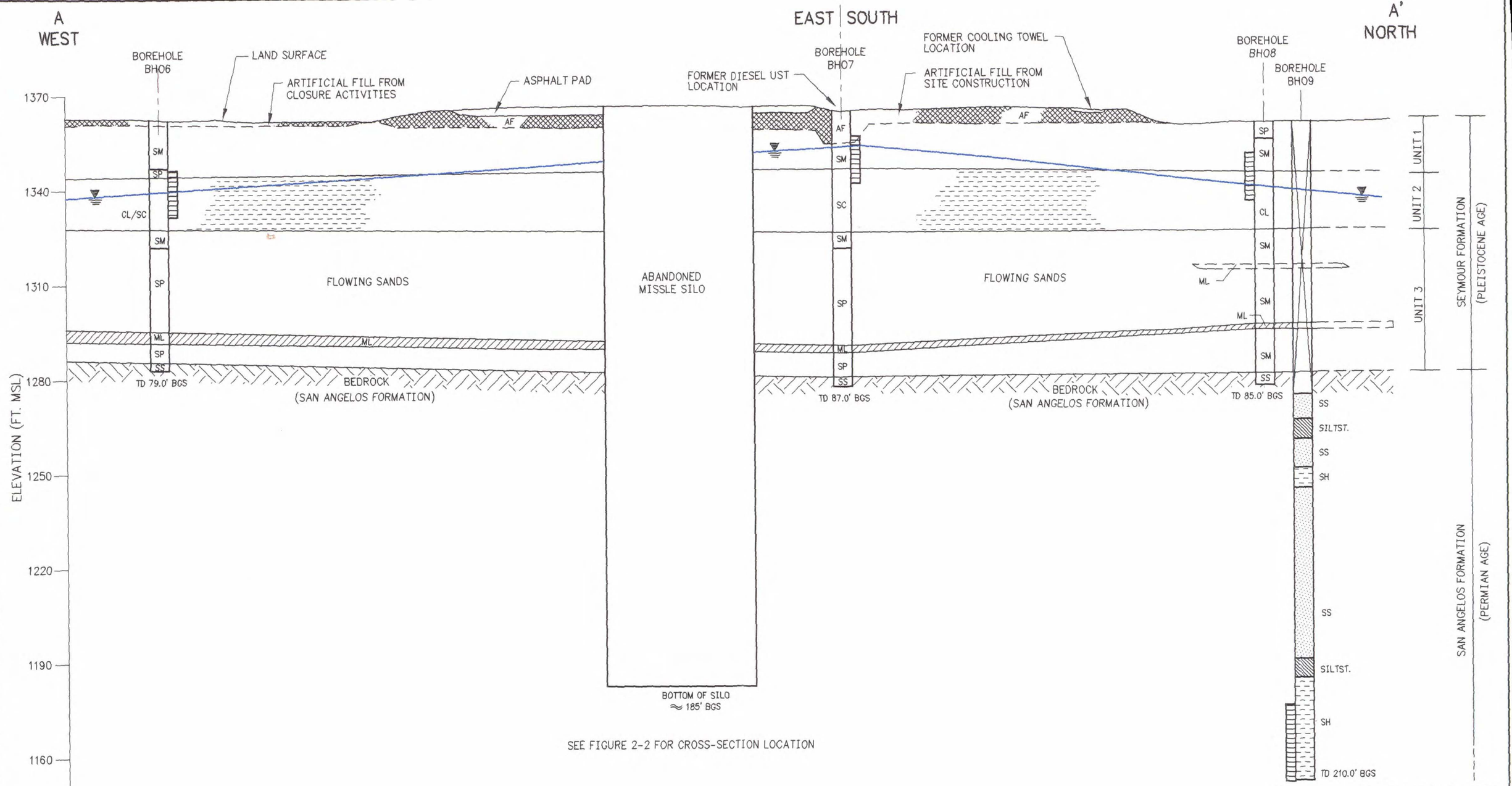
Unit 1 consists of silty sands (SM) and clean sands (SP). The unit ranges from 14 to 18 feet in thickness. Sands of this unit are characteristically very fine grained and colors range form moderate reddish brown to pale orange. Lighter colors are probably due to the presence of caliche in the sand matrix. Sands also contain caliche nodules in areas. Silty sands have slit fractions estimated at 15 percent.

Artificial fill (AF) has been placed on top of this unit in some locations, thereby raising the local land surface. The majority of this AF was placed during silo construction and lesser amounts during silo closure (see Figure 3-1).

A
WEST

EAST | SOUTH

A'
NORTH



SEE FIGURE 2-2 FOR CROSS-SECTION LOCATION

SCALE
0 40 80
HORIZONTAL SCALE 1" = 40'
VERTICAL SCALE 1" = 30' (1.3X)

LEGEND

AF - ARTIFICIAL FILL
CL - SANDY CLAY (20-35% SAND)
ML - SILT AND SANDY SILT (0-40% SAND)
SC - CLAYEY SAND (20-40% CLAY)
SM - SILTY SAND AND SAND WITH SOME SILT (10-20% SILT)
SP - SAND

SH - SHALE
SILTST. -SILTSTONE
SS - SANDSTONE

SCREEN INTERVAL IN ADJACENT M.WELL

GROUNDWATER LEVEL 8/14/00

<CPD: 09/18/00 [TIME: 3:50 PM] >

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Figure 3-1

GENERALIZED SITE GEOLOGIC CROSS SECTION A-A'

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201025.dwg		DATE: 09/12/00		
WORK ORDER	TASK	DRAWING NUMBER	REV.	DRIVE
4423-0220		Figure 4-1	A	

Unit 2 (Middle Unit)

Unit 2 consists of sandy clay (CL) and clayey sand (SC). The unit ranges from 17 to 20 feet in thickness. Sandy clays (CL) exhibit low plasticity and have sand content ranging from 20 to 35 percent. Clay colors range from pale orange to light or yellowish brown. Clayey sands (SC) are characteristically very fine to fine-grained and contain clay content ranging from 20 to 40 percent. Colors are typically light or yellowish brown and pale olive. Scattered pebbles up to 1.5 inch in diameter occur in some of the clayey sands. Unit 2 contains small caliche nodules in areas.

Unit 3 (Lower Unit)

Unit 3 consists predominantly of silty sands (SM) and clean sands (SP) with a few thin interbeds of silt (ML). The unit ranges from 42 to 46 feet in thickness. Silty and clean sands are characteristically very fine grained and colors are typically light brown. Silty sands contain silt fractions estimated at 10 to 20 percent. During auger drilling, flowing sand conditions were encountered throughout this unit. Adding mud to the HSAs was necessary to control the inflow of sand when sample barrels were removed. Sands of the lower Seymour Formation did not contain significant amounts of pebbles or any gravel lenses as reported in other studies (see Price, 1979).

One thin silt/sandy silt (ML) bed within Unit 3 appears to be traceable across the site. The bed ranges from 1 to 20 feet in thickness and was found from 8 to 14 feet above the base of the Seymour Formation (see Figure 3-1).

Basal Contact (Top of Bedrock)

The base of the Seymour Formation is an erosional unconformity on top of the underlying San Angelos Formation. The contact encountered in the ESI boreholes was quite sharp and distinct consisting of light brown soft clean sand (SP) of Unit 3 overlying reddish brown hard sandstone of the San Angelos Formation. No gravel or slag were noticeable at the contact. Between the three shallow boreholes drilled at AMS No. 7, 8 feet of erosional relief exists on the basal contact.

3.2.2 San Angelos Formation

Underlying the Seymour Formation are the red beds of the San Angelos Formation. The formation is Permian in age and constitutes the shallow bedrock beneath the site. The three shallow boreholes were drilled only several feet into the top of the formation

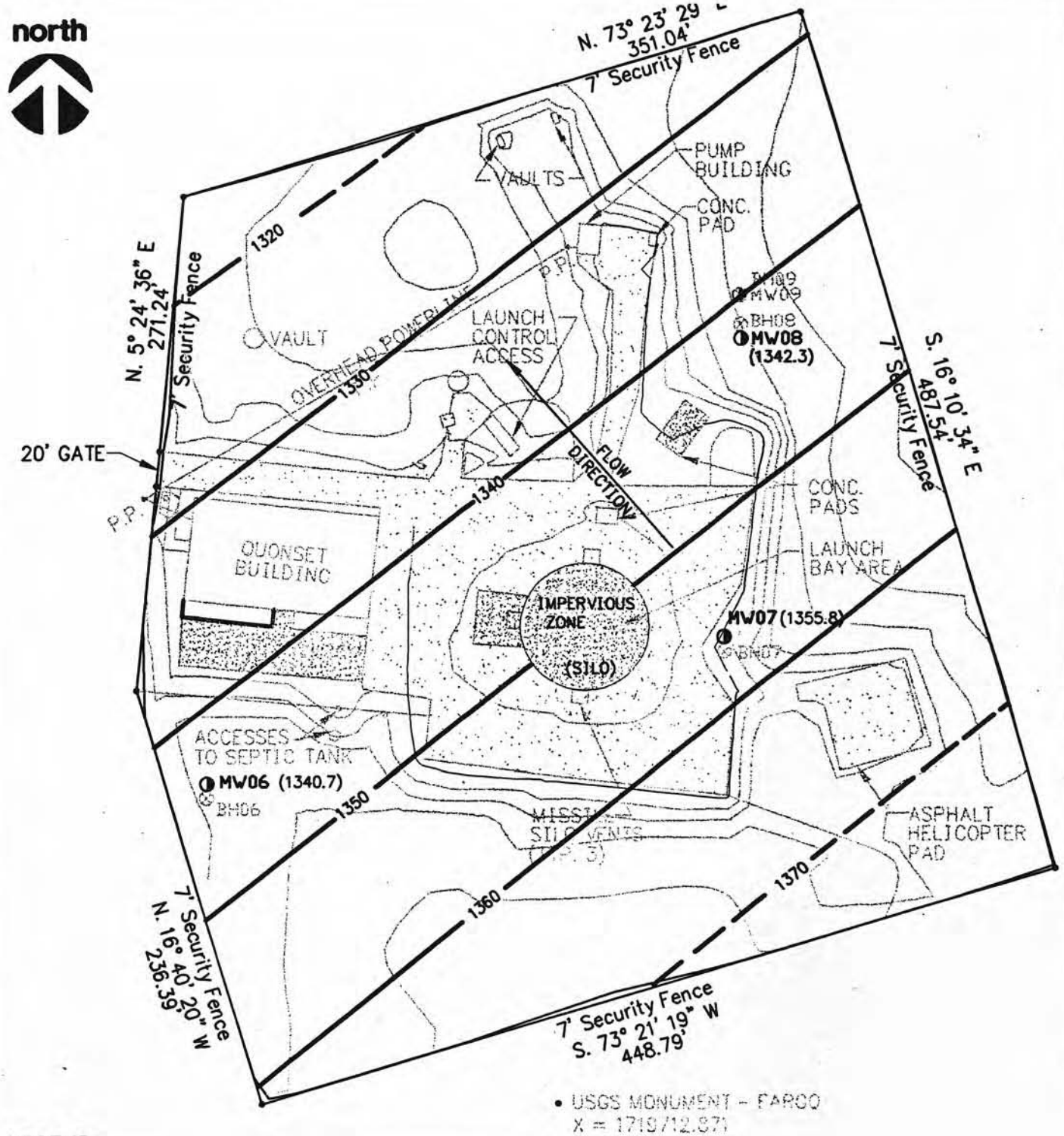
to verify the base of the overlying Seymour Formation. Borehole (BH09) was the only borehole drilled deeper to investigate the lithologies of the underlying San Angelos prior to placement of the deep monitoring well (MW09).

Approximately 130 feet of the San Angelos Formation was drilled at BH09. The San Angelos Formation in the borehole consists of an upper sandstone and a lower shale unit. The sandstone unit is approximately 91 feet in thickness and extends from the top of bedrock to about 172 feet bgs. The sandstone is characteristically very fined grained and quartzose in composition. Colors are pale to moderate reddish brown with pale olive mottling in zones. Low-angle cross bedding is noticeable throughout most of the section and flattened shale clasts are common. The sandstone is weakly to moderately cemented. Siltstone and sandy shale beds occur in the upper portion of the sandstone (see Figure 3-1).

The underlying shale unit consists predominantly of a very hard, dense non-fissile shale. The shale is moderate reddish brown in color with greenish gray occurring in spots and thin bands. Fractures in the shale are common and are distinguished by soft, wet zones separating the hard dense shale. The shale unit is separated from the overlying sandstone unit by a thin greenish gray siltstone unit. Approximately 38 feet of the shale was drilled at BH09. The base was not encountered.

3.3 Hydrogeology

The Seymour Aquifer, which underlies the AMS No. 7, is the major groundwater aquifer for Wilbarger County. The aquifer is used locally for public and private water supply and irrigation. The aquifer is unconfined (i.e., under water-table conditions). Water levels in the shallow monitoring wells (MW06, MW07, and MW08) were measured on August 14th, 2000 and a site specific potentiometric map for the Seymour Aquifer was contoured. The regional groundwater flow direction is from slightly east of north to eastward (Price, 1979), but local groundwater flow beneath the site is to the northwest (see Figure 3.2). No hydraulic conductivity measurements for the Seymour Aquifer were gathered during this investigation.



LEGEND

- ESI SHALLOW BOREHOLE (AMS7-)
- ESI SHALLOW MONITORING WELL (AMS7-) SHOWING ELEVATION (ft, msl) OF POTENTIOMETRIC SURFACE WITHIN SEYMOUR AUIFER
- ESI DEEP BOREHOLE/ MONITORING WELL (AMS7-)
- 1360 COUNTOUR INTERVAL (ft, msl)
- CONCRETE
- ASPHALT

NOTE: CONTOURED SURFACE ASSUMES PLANAR NATURE

<CPD: 09/20/00 [TIME: 4:43 PM] >

TULSA TERC
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FORMER AMS NO. 7

Figure 3-2

CONTOURED POTENTIOMETRIC SURFACE (WATER TABLE) WITHIN SEYMOUR AQUIFER (Aug. 14, 2000)

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201023.dwg		DATE: 05/02/00	
WORK ORDER 4423	TASK 0220	DRAWING NUMBER 2201023	REV. A

The underlying San Angelos (bedrock) Formation is a minor aquifer in Wilbarger County. Within a three-mile radius of AMS No. 7, no wells are registered in this aquifer. The deep monitoring well MW09 was screened across a fractured shale within this aquifer. Since only one well penetrated the aquifer, the groundwater flow direction is unknown. On August 14, 2000, the water level in MW09 was approximately 20 feet below the water level in the overlying Seymour Aquifer (MW08). Since this water level measurement was taken only three days after development of this deep well, equilibrium may not yet have been achieved. Whether the San Angelos aquifer is under confined conditions or in connection with the overlying Seymour aquifer is currently unknown, and will require further water level measurements to determine.

4.0 REGULATORY COMPLIANCE

Closure and remediation must comply with TNRCC Chapter 335, Subchapter S, Risk Reduction Standards (RRS) for Industrial Solid Waste and Municipal Hazardous Waste sites. The requirements of TNRCC Chapter 335, Subchapter S will, when adequately carried out, assure adequate protection of human health and the environment from potential exposure to contaminants associated with releases from solid waste management facilities or other areas. Cleanup levels are specified in the regulation for different types of contaminated media such as groundwater and soil, and for cross-media contamination pathways such as soil to groundwater and soil to air. General procedures based on scientific principles are provided or referenced by the regulations so that specific numeric cleanup levels can be generated in accordance with the risk reduction standards.

Specific cleanup levels are developed after a property use can be designated as residential or non-residential (industrial). Non-residential property is any real property or portion of a property not currently being used for human habitation or for other purposes with a similar potential for human exposure, at which activities have been or are being conducted. Industrial is defined as any non-residential property

All facilities are subject to the residential soil requirements unless:

- the property is located within the jurisdictional area of a zoning authority and the property is zoned for commercial or industrial use,
- the property is not located within the jurisdictional area of a zoning authority and documentation is provided that the activities being conducted on the property satisfy the definition for non-residential property, or
- for government-owned (local, state or federal) property which does not satisfy either of the above conditions and does have non-residential activities occurring on all or portions of the property. Documentation may be provided that access will be restricted such that the exposure assumptions remain valid for the duration of government control.

Additionally, in accordance with TNRCC Subchapter 335.556, an analysis of the probable point of exposure is necessary to determine the location where human or environmental receptors can come into contact with contaminants.

Risk Reduction Standard 1 (RRS1)

This standard requires closure/remediation to concentrations equivalent to background concentrations of the environment adjacent to the site. If the Practical Quantitation Limit (PQL) for chemical analysis is greater than background, then the PQL rather than background shall be used as the cleanup level.

To meet this standard the site is required to remove all hazardous waste and hazardous waste residues and contaminated design and operating system components such as liners, leachate collection systems and dikes. Associated contaminated media, such as soils and groundwater, must be removed or remediated to background or PQL levels.

Risk Reduction Standard 2 (RRS2)

For closure of hazardous waste management units and response to unauthorized discharges of hazardous waste, all hazardous waste and hazardous waste residues must be removed from the unit or area of the unauthorized discharge. Contaminated design and operating system components such as liners, leachate collection systems and dikes must be removed from the unit or area of the unauthorized discharge. Phase-separated non-aqueous liquids released from the unit that is undergoing closure or remediation must be removed or decontaminated to the extent practicable. For remediation of media that have become contaminated by releases from a hazardous waste management unit or by other unauthorized discharge of hazardous waste, the contaminated media must be removed or decontaminated to RRS2 cleanup levels specified in TNRCC Chapter 335 or such other lower levels necessary to be in conformance with current hazardous waste regulations.

The concentration of a contaminant in contaminated media of concern such as groundwater or soil cannot exceed RRS2 cleanup levels as determined using the process in TNRCC Chapter 335. RRS2 cleanup levels for individual contaminants are established by Texas or federal promulgated health-based standards, or, when these are not available or do not provide appropriate protection for human health or the environment, the site must develop RRS2 cleanup levels based on procedures specified or referenced in TNRCC Chapter 335 for determining other numeric criteria, referred to

as Medium Specific Concentrations (MSCs). Necessary adjustments to these numeric criteria may also be required based on site exposure scenarios and pathways.

Risk Reduction Standard 3 (RRS3)

If the site is unable to meet the requirements of RRS 1 or RRS 2 through closure or remediation, then it must meet the requirements of RRS 3.

This condition requires a remedial investigation report, which contains sufficient documentation such as, but not limited to, descriptions of procedures and conclusions of the investigation to characterize the nature, extent, direction, rate of movement, volume, composition and concentration of contaminants in environmental media of concern, including summaries of sampling methodology and analytical results. Information obtained from attempts to attain RRS 1 or RRS 2 may be submitted for this purpose.

5.0 INVESTIGATION RESULTS

This section summarizes and compares the analytical results to site closure criteria. Sample data are summarized in tabular form in Appendices H and I. Site closure criteria are presented in Appendix J.

AMS No. 7 is currently owned by the Northside Independent School District No. 905 (local government) of Vernon, Texas. The school district uses this facility for Future Farmers of America (FFA) exhibitions and livestock shows several times each year, whereby access is controlled by a gated fence. Therefore the project site is considered non-residential, and all data comparisons are based on TNRCC risk reduction standards and medium specific concentrations (MSCs) applicable to non-residential or industrial activities and Texas-Specific Background Concentrations (see Appendix J). MSC values presented in this report were taken from the July 14, 1999 TNRCC Updated Examples of Standard No.2, Appendix II Medium-Specific Concentrations, Subchapter S: Risk Reduction Standards (see Appendix J.1). The most recently published Texas-Specific Background Concentrations are reported in a TNRCC Interoffice Memorandum, dated June 28 (see Appendix J.2).

In accordance with TNRCC Subchapter 335.556, an analysis of probable point of exposure was completed that defines the point of exposure as the location where human or environmental receptors can come into contact with contaminants. The analysis determined the potential exposure pathways for AMS No. 7 are:

1. ground water ingestion,
2. soil inhalation, ingestion, and dermal contact, and
3. groundwater protection.

No surface water exists on site; therefore, surface water ingestion is not an exposure pathway.

For non-residential scenarios, the concentration of a contaminant in near-surface soils (i.e., within two feet of the land surface) shall not exceed the lower of the Non-Residential Soil MSC (SAI-Ind) based upon worker ingestion of soil and inhalation of particulates and volatiles, and the Non-Residential Soil-to-Ground Water Cross-Media Protection Concentration (GWP-Ind). The concentration of a contaminant in subsurface soils (i.e., greater than two feet in depth from the land surface) shall not exceed the GWP-Ind.

The analytical results for each surface soil, subsurface soil, and groundwater samples collected during this study are presented in Appendix H with associated lab and validation qualifiers. All soil samples were analyzed for VOCs, SVOCs, pesticides/herbicides, PCBs, TRPH, and heavy metals. Additionally, tentatively identified compounds (TICs) were also reported from the VOC and SVOC analyses. Groundwater samples were analyzed for the parameters listed in the TNRCC Drinking Water Standards, and TRPH. TNRCC Drinking Water Standards include VOCs, trihalomethanes (THMs), SVOCs, insecticides/herbicides, carbamate insecticides, organohalide pesticides, PCBs, endothall, glyphosate, diquate, metals, fluoride, cyanide, and nitrate/nitrite.

For target analytes not detected above the method detection limit (MDL), the sample MDL is shown. MDLs vary slightly from sample to sample based on moisture content and dilution factors. All TICs are reported as estimated concentration and MDLs are not determined for these compounds. A precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) summary for ESI data is presented in Appendix K and the complete lab reports and validation reports for samples are presented in Appendix L (both under a separate cover).

Results of sampling and analyses are discussed in the following sections by media sampled (surface soils, subsurface soils and groundwater).

5.1 Surface Soils

A total of thirteen (13) surface soil samples were collected and analyzed. These consist of three off-site samples (SS05-07), seven on-site samples (SS08 - SS14) and the surface interval from three boreholes (BH06 - BH08) (see Plate 1 for locations) located onsite. All surface soil samples were collected from the upper 6 inches of soil. On-site samples were placed discretely at or near areas of potential releases based on known past site activities that include the incinerator, cooling towers, and underground diesel fuel storage tank.

Various VOCs and SVOCs were detected from both offsite and onsite surface soil samples. Notable contaminants found onsite that may be indicative of a contaminant release include:

- benzene, toluene, 1,2,4-trimethylbenzene, 1-3-5-trimethylbenzene and xylenes near the incinerator.

- trichlorethene (TCE), toluene, and xylenes near the cooling tower.
- benzene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and xylenes near the UST.

However, all VOCs and SVOCs were reported below MSC for (1) inhalation, ingestion, and dermal contact; and (2) groundwater protection for industrial use (Appendix J.1).

Low levels of PCBs were detected from onsite samples near the incinerator, cooling tower, and USTs and not from offsite samples; therefore this may be indicative of a contaminant release. The concentrations do not exceed the MSC for inhalation, ingestion, and dermal contact; but, do exceed the MSC for groundwater protection. However, subsurface PCBs concentrations reported in Section 5.2 below were not detected; therefore, groundwater protection criteria is met.

No pesticides, herbicides or TRPH were detected in the surface soil samples.

Bis(2-ethylhexyl)phthalate detected in most of the soil samples in the previous SI (see Table 1-1) was not detected in surface or subsurface soils during this investigation. The MDL for bis(2-ethylhexyl)phthalate during this ESI was approximately four times lower than the SI (70 µg/kg versus 330 µg/kg). Therefore the absence of detectable levels of this compound at a lower MDL suggests that the presence of this SVOC in SI samples was an artifact of sampling or lab procedures and not an onsite contaminant.

Lead and zinc were the notable metals reported for surface soil samples at the incinerator, cooling tower, and USTs that also exceeded background metal concentrations reported from offsite samples. Additionally, all metals were found less than TNRCC established background levels, with the exception of low levels of lead and zinc noted near the incinerator, cooling tower, and USTs. The Texas-specific background concentration for lead and zinc is 15 mg/kg and 30 mg/kg respectively, as reported in a TNRCC Interoffice Memorandum, dated June 28, 2000 (see Appendix J.2).

Lead concentrations reported in onsite surface soils were:

- incinerator : 152 mg/kg, 19.3 mg/kg, and 10.4 mg/kg
- cooling tower: 18.4 mg/kg and 6.6 mg/kg,
- USTs: 22.2 mg/kg and 14.5 mg/kg

Zinc concentrations reported in onsite surface soils were:

- Incinerator: 102 mg/kg, 45.6 mg/kg, and 18.8 mg/kg
- Cooling tower: 181 mg/kg and 32.2 mg/kg
- USTs: 44.3 mg/kg and 11 mg/kg

5.2 Subsurface Soils

A total of twelve (12) subsurface soil samples from three boreholes were collected and analyzed. Samples were collected at 5-foot intervals within the vadose zone at each borehole and directly above the underlying alluvial/bedrock contact. Sample depth intervals for each subsurface sample are shown in Table 2-1.

Borehole BH06 was drilled along the southwestern boundary of the site in an area believed to be unaffected by site activities. Borehole BH07 was placed at the former location of the on-site diesel UST. Borehole BH-08 was placed north of former cooling tower and south of the incinerator (see Plate 1).

Borehole BH06

Subsurface soil samples were collected at depths of 5, 10, 18 and 76 feet bgs at borehole BH06. No organic compounds were detected in subsurface soils at this borehole, except methylene chloride and acetone contaminants were detected near background concentrations; refer to SS05, SS06, and SS07. All metal concentrations were less than the Texas-specific background concentrations (Appendix J.2).

Borehole BH07

Subsurface soil samples were collected at depths of 5,10, and 85 feet bgs at borehole BH07. Four VOCs (toluene, 1,2,4-trimethylbenzene, xylenes and pentane) were detected in the 5-foot depth sample at low concentrations less than MSC values for inhalation, ingestion, dermal contact, and groundwater protection (Appendix J.1). No VOCs were detected in the underlying 10-foot depth sample directly above groundwater except methylene chloride was detected near background concentrations, refer to SS05, SS06, and SS07; therefore, VOC contamination appears to be confined to the surface and near surface at this former UST location. One SVOC, 1,1,2,2-tetrachloro-ethane, was detected at the 10-foot depth sample at a concentration below the MSC values for inhalation, ingestion, dermal contact, and groundwater protection (Appendix J.1).

No pesticides/herbicides, PCBs, or TRPH were detected in the subsurface at borehole BH07.

As discussed earlier, a liquid drilling additive (Insta-Vis) was added to borehole BH07 at about a depth of 65 feet bgs. Insta-Vis is a liquid polymer consisting of a surfactant dispersed in a mineral oil base. The additive was added by the drillers in attempts to remove sand and fines from the augers and stabilize the borehole walls. This additive was noticeable in the 85-foot depth interval sample; therefore no sample was collected because of the petroleum contaminants introduced from the Insta-Vis.

All metal concentrations were less than the Texas-specific background concentrations (Appendix J.2).

Borehole BH08

Subsurface soil samples were collected at depth of 5,10,15,18 and 80 feet bgs at borehole BH08.

No organic compounds were detected in soils at the 5-,10-, and 15-foot depth intervals, although from 5 to 15 feet bgs there was a slight oil odor and field PID readings were greater than 2000 units. No visible staining or discoloration was noticeable. Noticeable odor and high PID readings, with a lack of soil discoloration and detected compounds suggests the occurrence of contamination in a soil gas phase rather than adhered to the soil matrix.

One notable organic contaminant, trichloroethene (TCE), was detected at a concentration of 36.7 µg/kg in the 18-foot depth sample, below this soil gas zone. PID readings at this depth were 50 units. Though this TCE value is below the MSC concentration for ground water protection, its presence indicates a possible contaminant release. No organic compounds were detected in the underlying sample (S-80) collected at the alluvial/bedrock contact.

All metal concentrations were less than the Texas-specific background concentrations (Appendix J.2).

5.3 Groundwater

Four groundwater samples were collected and analyzed. These consist of three samples from the Seymour Aquifer (MW06, 07, 08) and one from the underlying San

Angelos Aquifer (MW09). After well installation and prior to development of each well, a disposable bailer was lowered into the well across the water table to check for any free-phase product. No product or sheen was found in any of the wells.

Monitoring Well MW06

Monitoring Well MW06 was placed in an area believed to be unaffected by DOD activities as a background well. As noted above, no organic compounds were detected in soil samples collected at this location and no organic compounds were detected in the groundwater at this location. All metals and other inorganic contaminants met TNRCC drinking water standards (Appendix J.1).

Monitoring Well MW07

Monitoring Well MW07 was placed at the former diesel UST location. One SVOC TIC, designated as hydrocarbon oil, was detected in groundwater at this location with an estimated concentration of 21 µg/l; however, no oily sheens were observed. No other organic compounds were detected. All metals and other inorganic contaminants met TNRCC drinking water standards (Appendix J.1).

Monitoring Well MW08

Monitoring well MW08 was placed near the former cooling tower location. Low concentrations of VOCs and SVOCs were detected below MSC groundwater values; the only exception was a TCE concentration of 140 µg/l, which exceeded the groundwater standard of 5 µg/l (Appendix J.1).

As discussed earlier, TCE was detected in subsurface soils from the adjacent borehole BH08 and the other VOCs detected — 1,1-dichloroethylene, cis-1,2-dichloroethylene and trans-1,2-dichloroethylene — are known biodegradation products of TCE, which are all indicators of a contaminant release.

All metals and other inorganic contaminants met TNRCC drinking water standards (Appendix J.1).

Monitoring Well MW09

Monitoring Well MW09 was screened across a fractured shale of the San Angelos aquifer to investigate any potential releases from the base of the on-site silo.

Bis(2-ethylhexyl)phthalate was the only organic compound detected at MW09; however, the concentration was below TNRCC drinking water standards. All metals and other inorganic contaminants also met TNRCC drinking water standards (Appendix J.1).

5.4 Preliminary Comparison of ESI Data to RRS1 and RRS2 Cleanup Levels

A preliminary comparison of contaminant concentrations in soils and groundwater is made to RRS1 and RRS2 cleanup levels. A summary of the comparison is shown in Table 5-1 and a summary of detects in presented in Appendix I.

RRS1 cleanup levels for organics are established as the average MDL achieved by the laboratories. It should be noted that sample MDLs vary depending upon soil moisture content and dilution factors (required for analysis). TICs reported in the VOC and SVOC analyses are estimated concentrations and do not have established MDLs by the laboratories, therefore RRS1 cleanup levels are not determined for these compounds. RRS1 cleanup levels for metals are statistically determined background values and have not been performed in this study. Table 5-1 merely lists the laboratory MDL for metals.

RRS2 cleanup levels (MSCs) are for an industrial scenario and values shown in Table 5-1 are those calculated by TNRCC and contained in Appendix II of TNRCC Chapter 335. Maximum concentrations of compounds and metal reported for ESI sampling are shown in Table 5-1 for comparison.

Direct comparisons of the ESI organic and metals data to RRS1 and RRS2 cleanup levels are discussed below. The TNRCC risk reduction standard guidance allows for direct comparison of the results of analysis of discrete samples of the medium of concern with the cleanup level.

Table 5-1

Summary of Contaminant Maximum Concentrations and Known Clean Up Levels for RRS1 and RRS2 (Industrial Scenario) AMS No. 7

Matrix/ Analytical Suite/ Analyte	CAS No.	ESI Maximum Concentration	RRS1 (Avg. MDL)	RRS2 MSCs		
				GW-Ind	GWP-Ind	SAI-Ind
SOILS						
VOCs (ug/kg)						
Acetone	67-64-1	190	7.59	NA	1,020,000	4,160,000
Benzene	71-43-2	2.42	0.67	NA	500	162,000
2-Butanone (MEK)	78-93-3	9.14J	2.81	NA	511,000	14,000,000
Carbon disulfide	75-15-0	3.37	0.78	NA	1,020,000	23,400
Methylene chloride	75-09-2	44.0	5.35	NA	500	13,800
Toluene	108-88-3	10.8	0.72	NA	100,000	3,630,000
Trichloroethene (TCE)	79-01-6	36.7	0.64	NA	500	2,850
1,2,4-Trimethylbenzene	120-82-1	5.37	1.26	NA	---	---
1,3,5-Trimethylbenzene	108-67-8	2.74	0.89	NA	---	---
Xylene (total)	1330-20-7	17.8	1.39	NA	1,000,000	5,800,000
VOC tics (ug/kg)						
Acetaldehyde	75-07-0	5J	ND	NA	---	---
Acetic acid, methyl ester	79-20-9	56J	ND	NA	---	---
Arsenous acid, tris(trimethylsilyl)	NF	3J	ND	NA	---	---
Benzaldehyde	100-52-7	7J	ND	NA	---	---
Butanal	123-72-8	10J	ND	NA	---	---
Butanal, 3-methyl-	590-86-3	5J	ND	NA	---	---
Butane, 2-methyl-	78-78-4	35J	ND	NA	---	---
Cyclohexane	110-82-7	10J	ND	NA	---	---
Cyclohexane, methyl-	108-87-2	14J	ND	NA	---	---
Cyclotetrasiloxane, octamethyl	556-67-2	11J	ND	NA	---	---
Cyclotrisiloxane, hexamethyl	541-05-9	4J	ND	NA	---	---
2-Furancarboxaldehyde	98-01-1	28J	ND	NA	---	---
Heptanal	111-71-7	3J	ND	NA	---	---
Hexanal	66-25-1	190J	ND	NA	---	---
Hexane	110-54-3	23J	ND	NA	---	---
Pentanal	110-62-3	42J	ND	NA	---	---
Pentane	109-66-0	59J	ND	NA	---	---
Pentane, 2-methyl-	107-83-5	19J	ND	NA	---	---
SVOCs (ug/kg)						
Benzo(a)anthracene	56-55-3	145J	50	NA	---	---
Benzo(a)pyrene	50-32-8	76J	60	NA	---	---
Benzo(b)fluoranthene	205-99-2	126J	50	NA	---	---
Chrysene	218-01-9	142J	50	NA	---	---
Fluoranthene	206-44-0	426	60	NA	409,000	81,800,000
Phenanthrene	85-01-8	191J	60	NA	---	---
Pyrene	129-00-0	329J	50	NA	310,000	61,000,000
SVOCs tics (ug/kg)						
1,1,2,2-Tetrachloroethane	79-34-5	15J	ND	NA	1,430	11,700
PCBs (ug/kg)						
Aroclor 1260	11096-82-5	166	3.6	NA	50	10,000

Table 5-1 (cont.)

Summary of Contaminant Maximum Concentrations and Known Clean Up Levels for RRS1 and RRS2 (Industrial Scenario) AMS No. 7

Matrix/ Analytical Suite/ Analyte	CAS No.	ESI Maximum Concentration	RRS1 (Avg. MDL)	RRS2 MSCs		
				GW-Ind	GWP-Ind	SAI-Ind
Metals (mg/kg)						
Aluminum	7429-90-5	15,900	2.06	NA	---	---
Arsenic	7440-38-2	2.9	0.67	NA	5	3.27
Barium	7440-39-3	131	0.05	NA	200	137,000
Calcium	7440-70-2	53,600	1.14	NA	---	---
Chromium	7440-47-3	17.9 (9/25)	0.22	NA	10	5,110
Copper	7440-50-8	16	0.21	NA	---	---
Iron	7439-89-6	16,000	1.13	NA	---	---
Lead	7439-92-1	152 (25/25)	0.48	NA	1.5	1,000
Magnesium	7439-95-4	8,250	1.11	NA	---	---
Manganese	7439-96-5	342	0.04	NA	---	---
Nickel	7440-02-0	13.1 (2/25)	0.32	NA	10	20,400
Potassium	7440-09-7	4,370	5.93	NA	---	---
Sodium	7440-23-5	123	11.3	NA	---	---
Vanadium	7440-62-2	22.2	0.18	NA	---	---
Zinc	7440-66-6	181	0.21	NA	---	---
Groundwater						
VOCs (ug/l)						
1,1-Dichloroethylene	75-35-4	0.3	0.2	7	NA	NA
cis-1,2-Dichloroethylene	156-59-2	30	0.1	70	NA	NA
trans-1,2-Dichloroethylene	156-60-5	2.8	0.1	100	NA	NA
VOC tics (ug/l)						
Acetone	67-64-1	8.7	ND	10,220	NA	NA
Chloroform	67-66-3	0.5	ND	336	NA	NA
4-Isopropyltoluene	99-87-6	0.1	ND	---	NA	NA
SVOCs (ug/l)						
Bis(2-ethylhexl)phthalate	117-81-7	1.3J	0.6	20.4	NA	NA
SVOC tics (ug/l)						
Camphorsulfonic Acid	NF	3.8J	ND	---	NA	NA
Tetradecanoic acid	544-63-8	17J	ND	---	NA	NA
Metals (ug/l)						
Antimony	7440-36-0	1.0	0.2	6.0	NA	NA
Barium	7440-39-3	410	0.2	2000	NA	NA
Chromium	7440-47-3	15	0.2	100	NA	NA
Copper	7440-50-8	10	0.5	1,300	NA	NA
Lead	7439-92-1	14	0.5	15	NA	NA
Nickel	7440-02-0	100	0.5	100	NA	NA
Inorganics mg/l						
Flouride	7782-41-4	0.9	0.1	4.0	NA	NA
Nitrate	14797-65-0	9.5 (1/4)	0.5	1.0	NA	NA
Nitrite	14797-55-8	0.01	0.01	10	NA	NA

Notes:

NA - Not Applicable, ND - Not Determined, NF - Not Found
--- MSC not calculated
Concentrations exceeding a MSC are highlighted with the exceedance frequency shown in parenthesis.

5.4.1 Comparison to RRS1

If closure to RRS1 is achieved, no deed recordation or post-closure care would be required for the site, upon approval from the state executive director. However, based on existing ESI data, AMS No.7 cannot be closed to RRS1 by a direct comparison method without remediation of soils and groundwater. Direct comparison of site concentrations to MDLs for organics more than likely will not allow closure for all compounds without remediation. To achieve closure (with or without remediation) to RRS1, MDLs or practical quantitation limits (PQLs) for VOC and SVOC TICs may be required.

5.4.2 Comparison to RRS2

For organic compounds with calculated RRS2 MSCs (see Table 5-1), current known concentrations in on-site soils and groundwaters are below the MSCs except for TCE in MW08. TCE exceeds the groundwater MSC for industrial use and must be confirmed through additional sampling. For metals with calculated MSCs, three have on-site concentrations in soils above the associated MSCs. Chromium concentrations are above the MSC in 9 out of 25 soil samples. Lead concentrations are above the MSC in all 25 soil samples. Nickel concentrations are above the MSC in 2 out of 25 soil samples. This high frequency of MSC exceedance is probably due to natural metal content in the soils rather than on-site DOD activities. Additionally, zinc and lead surface soil samples were found to exceed the Texas-specific background concentrations shown in Appendix J.2, 50 percent and 40 percent, respectively. Therefore, additional testing may be required to establish background to avoid surface soil removal.

If RRS2 is achieved, with or without remediation, deed recordation is required but post-closure care is not, upon approval of the state executive director.

If the site cannot meet RRS1 or RRS2 closure requirements, it must comply with the process required for RRS3. This process involves developing a remedial investigation report, a baseline risk assessment report; and performing a corrective measure study, deed recordation, and post closure care requirements as specified in TNRCC Chapter 335.

6.0 SUMMARY

This section summarizes the results and findings of the ESI field investigation and regulatory compliance review. It should be understood that AMS 7 operations ceased more than 30 years ago; therefore, natural attenuation of biodegradable products should be expected if aerobic soil and groundwater conditions prevail.

6.1 Geology/Hydrogeology

The site geology consists of approximately 80 feet of unconsolidated alluvium of the Pleistocene age Seymour Formation which overly sandstone and shale (bedrock) of the Permian age San Angelos Formation. Alluvium consists of three informal units recognized across the site which include an upper sand unit (14 to 18 feet thick), a middle clayey unit (17 to 20 feet thick) and a lower sand unit (42 to 46 feet thick). The contact with the underlying bedrock is sharp and distinct. The underlying bedrock consists of an upper sandstone unit (91 feet thick) underlain by a dense but fractured shale (38+ feet thick).

The groundwater flow in the Seymour Aquifer, beneath the site, is to the northwest based on three monitoring wells screened across the water table within the aquifer. On a regional basis, flow is slightly east of north to eastward (Price, 1979). Since only one monitoring well was screened in the underlying San Angelos Formation, the groundwater flow direction in that aquifer is unknown. No hydraulic connection between the two aquifers is currently known; however, it appears the missile silo could have penetrated both aquifers during construction, as noted in Figure 3-1.

6.2 Field Sampling Program

Thirteen surface soil samples and 12 subsurface soil samples from three boreholes were collected and analyzed. Three shallow wells and one deep well were installed, sampled, and analyzed. ESI soil samples were analyzed for VOCs, SVOCs, pesticides/herbicides, PCBs, TRPH, and total metals as listed in 40 CFR, Part 264, Appendix IX. This list of parameters was more comprehensive than used during the 1995 SI; specifically, this list included pesticides/PCBs, herbicides, and 21 additional metals. ESI groundwater samples were analyzed for parameters identified in the TNRCC drinking water standards. Also, tentatively identified compounds were reported in addition to target analytes in the VOC and SVOC range. ESI analyses were also performed at MDLs significantly lower than the previous SI.

6.3 Nature and Extent of Contamination

Based on direct comparison of existing data, AMS No. 7 cannot be closed in accordance with RRS1 or RRS2 cleanup levels without remediation of soils and groundwater.

Surface soil sampling around the incinerator and cooling towers detected VOCs, SVOCs, and PCB concentrations above offsite surface soil conditions. Though these concentrations are very low, the contaminant concentrations are above background levels; therefore, removal and disposal is necessary to achieve RRS 1 cleanup standards. Existing VOCs, SVOCs, and PCBs are below MSC industrial exposures for inhalation, ingestion, and dermal contact and may satisfy RRS2 cleanup levels; however, lead and zinc were found above Texas-Specific Background Concentrations and must be removed to achieve RRS1 and RRS2 cleanup levels. The horizontal extent of contamination has not been thoroughly defined with this study; therefore, site cleanup measures should utilize site process knowledge combined with field screening measures during surface soil removal to identify the horizontal perimeter of contaminant removal.

VOCs and SVOCs were detected below RRS2 cleanup levels in all subsurface soil samples from the three boreholes. However, petroleum vapors and high field PID readings were noted in BH08, suggesting that VOC contamination may be in a soil gas vapor phase and is not adhering to the soil matrix.

Groundwater monitoring conducted from the three shallow monitoring wells and one deep well noted water quality in both aquifers that met groundwater MSC for industrial use criteria. However, two contaminants were noted, one each in MW07 and MW08, that will require additional evaluation:

1. One SVOC TIC, designated as hydrocarbon oil, was detected at a low concentration in MW07. No oily sheen was observed during sampling and subsurface soil samples taken from BH07 did not show any signs of a petroleum release. Therefore, additional water sampling should be conducted to confirm this condition; however, no additional cleanup measure is warranted if groundwater aerobic conditions prevail.

2. TCE was detected in MW08 above the groundwater MSC for industrial use. The subsurface soil samples taken from BH08 did show evidence of a petroleum

product release as noted above; therefore, additional sampling should also be conducted to confirm the contaminant concentration and to assist in determining whether natural attenuation will be sufficient to permit site closure.

The deep monitoring well was screened across a fractured shale of the underlying San Angelos aquifer to investigate any potential releases from the base of the on-site silo. Bis(2-ethylhexyl)phthalate was the only organic compound detected and the concentration was well below the groundwater MSC for residential use; therefore, there are no signs of a contaminant release from the silo base to the deep aquifer.

7.0 RECOMMENDATIONS

Based on the data, findings, and regulatory compliance review, the following recommendations for AMS No. 7 are presented below. However, regulatory input is encouraged to ensure site closure and remediation efforts are consistent with TNRCC requirements.

1. Remove and properly dispose of local surface contaminants near the incinerator and cooling tower, using field screening and site process knowledge in determining horizontal excavation boundaries. Localized surface contaminant removal near the incinerator and cooling tower will ensure that background standards can be attained without a complex confirmation sampling program. Estimated labor, material, and equipment costs to surface remediate a 10,000 square foot area (100 ft x 100 ft) without demolition debris removal is $18,000. Therefore, approximately $46,000 will be required to remediate surface soils near the incinerator and the cooling tower to include confirmation testing and report preparation.

2. Resample all groundwater monitoring wells to confirm contaminant levels. It is essential that low concentrations of trichlorethene (TCE) in MW08 near the cooling tower are confirmed to determine if localized groundwater treatment is required or whether natural attenuation of TCE can be used to satisfactorily attain TNRCC cleanup and risk reduction standard requirements. Aerobic soil and groundwater conditions are essential if natural attenuation is utilized; however, natural groundwater attenuation will likely require property deed restrictions for regulatory site closure. Estimated groundwater resampling labor and direct costs are $9,500, to include sample analysis, data validation, and report preparation.

3. The previous SI boreholes and monitoring well locations (now abandoned) were not surveyed during the SI. These locations are still observable on-site by the surface grout; therefore, these locations should be surveyed in order that the SI soil and groundwater data can be incorporated into the analytical data collected during the ESI. This should be accomplished before any additional shallow wells are considered following regulatory review of this report. Estimated labor and material costs to complete this task are $1,000.

8.0 REFERENCES

American Society for Testing and Materials (ASTM), 1990. *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. ASTM D-2488-90.

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Willis, G. W., and Knowles, 1953. *Ground-Water Resources of the Odell Sand Hills, Wilbarger County, Texas*, published by Texas Board of Water Engineers (January).

MONITOR WELL TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
MW06	7543299.76	1719524.64	1367.73
MW07	7543379.73	1719805.65	1370.88
MW08	7543542.98	1719815.49	1365.94
MW09	7543566.68	1719814.85	1366.22

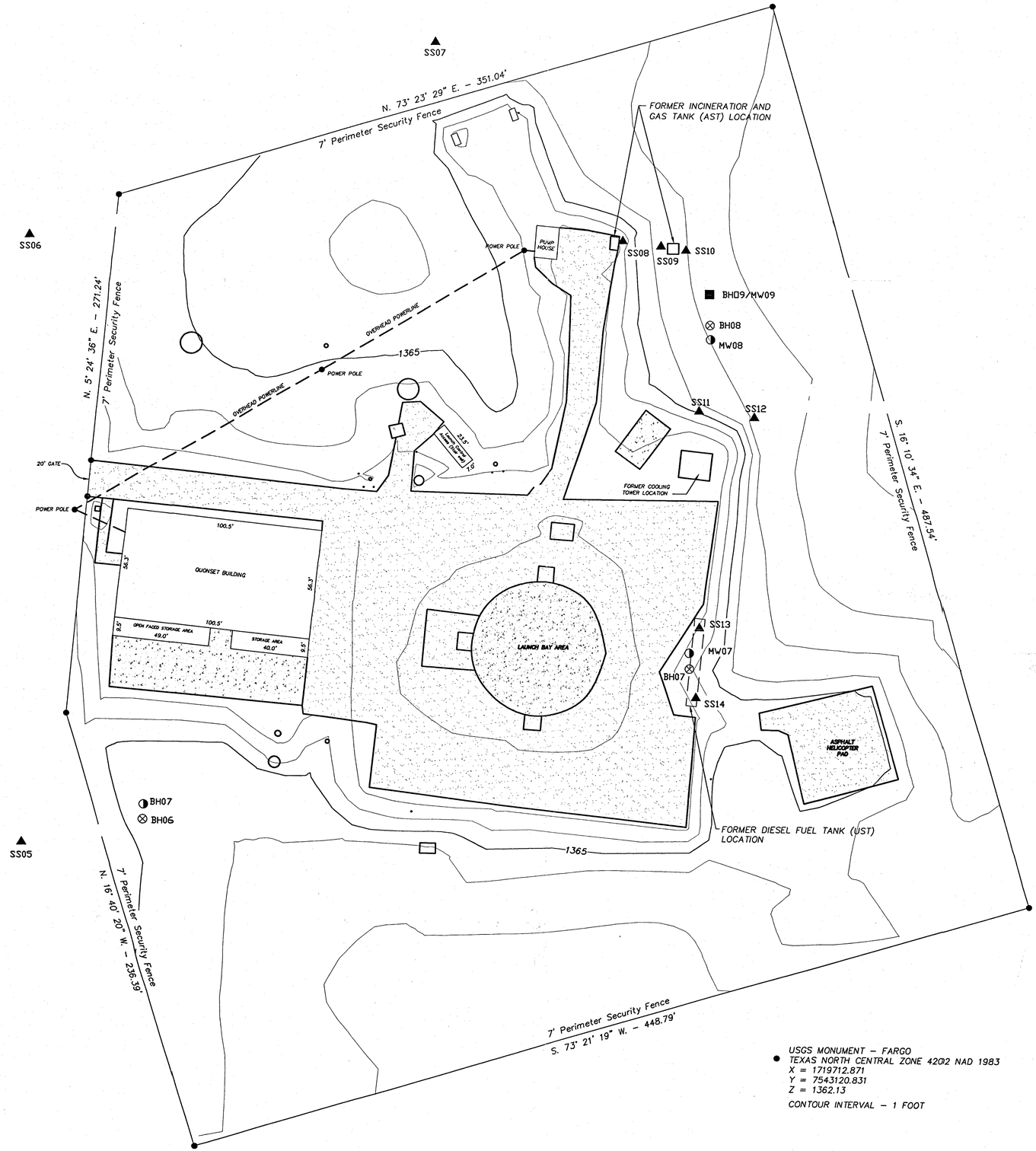
NOTE: ELEVATIONS WERE TAKEN AT THE NORTH END OF THE INTERIOR PVC CASING.

BORE HOLE TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
BH06	7543291.90	1719524.29	1365.0
BH07	7543371.68	1719805.76	1367.0
BH08	7543550.53	1719815.19	1362.5

SOIL SAMPLE TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
SS05	7543279.80	1719460.31	1366.7
SS06	7543596.67	1719463.11	1365.6
SS07	7543697.65	1719671.36	1363.7
SS08	7543594.58	1719769.25	1366.4
SS09	7543591.92	1719789.20	1363.8
SS10	7543589.83	1719802.20	1363.2
SS11	7543505.56	1719809.86	1364.3
SS12	7543502.42	1719838.56	1362.9
SS13	7543392.98	1719810.79	1367.1
SS14	7543356.83	1719809.09	1366.8



USGS MONUMENT – FARGO
TEXAS NORTH CENTRAL ZONE 4202 NAD 1983
X = 1719712.871
Y = 7543120.831
Z = 1362.13

CONTOUR INTERVAL – 1 FOOT

LEGEND

- ESI SURFACE SOIL SAMPLE LOCATION (ID)
- ESI SHALLOW BOREHOLE LOCATION (ID)
- ESI SHALLOW MONITORING WELL LOCATION (ID)
- ESI DEEP BOREHOLE/MONITORING WELL LOCATION (ID)
- 1365 — TOPOGRPHIC CONOUR INTERVAL (MSL)
- CONCRETE
- ASPHALT

NOTE:
ALL BEARINGS AND DISTANCES ARE STATE PLANE GRID VALUES.

STATE OF TEXAS : KNOW ALL MEN BY THESE PRESENTS, that I, Richard E. Johnson, Registered
COUNTY OF COLLINGSWORTH : Professional Land Surveyor, do hereby certify that I did cause to be surveyed on the ground the tract of land shown on this plat, and to the best of my knowledge and belief, the said description is true and correct.

IN WITNESS THEREOF, my hand and seal, this the 15th day of August, A.D., 2000.

STATE OF TEXAS · REGISTERED · RICHARD E. JOHNSON · 4263 · PROFESSIONAL LAND SURVEYOR

Richard E. Johnson
Registered Professional
Land Surveyor #4263

north

80' 0 80'
SCALE

TULSA TERC
ESI REPORT
FORMER AMS NO. 7

PLATE 1

ESI SAMPLING LOCATIONS

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201027.dwg			DATE: 09/18/00	
WORK ORDER	TASK	DRAWING NUMBER	REV.	DRIVE
4423	220	Figure XXX		

<CPD: 09/21/00 [TIME: 4:41 PM] >

APPENDIX A.1

ESI Soil Sample Collection Logs

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-05

Date (YYMMDD): 07/17/00

Time (HHMMSS): 0850

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Partly Cloudy, 85°F, slight breeze

Prepared by: Phil Hammons

Checked by: DJA

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
~~Glass~~ Vial	40mL x 3	TPH	~~2~~ 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-06

Date (YYMMDD): 07/17/00

Time (HHMMSS): 0910

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC (FD) / CS

Sample Type: (GRAB) COMP. / NA

Sampler: RODNEY HICKMON

Witness: PHIL HAMMONS

Contractor: Morrison Knudsen

Remarks:

Weather: Partly Cloudy, 90°F, Sky NE Breeze

Prepared by: Phil Hammons

Checked by: RG AG

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Soil Glass	16oz	Pesticides, PCBs Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	40mL 203	TPH	2 1
Vial	40mL	VOCs	3
Rinsate Blank			

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 EST

Site: AMS No.7

Sample I.D.: AMS7-SS-06-EB

Date (YYMMDD): 7/17/00

Time (HHMMSS): 9:10AM 0920

Top Depth: NA 0.0'

Bottom Depth: 0.0'

Matrix: Sed / Soil / (Water)

Sample Qualifier: QA / QC / (EB) / CS

Sample Type: GRAB / COMP. / NA

Sampler: Rodney Hackman

Witness: Phil Hammonds

Contractor: Morrison Knudsen

Remarks:

Weather:

Prepared by: Phil Hammonds

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Amber glass	1 liter	Pesticides	2
Amber glass	1 liter	Herbicides	2
Amber glass	1 liter	PCB	2
Amber glass	1 liter	SVOCs	2
VOA vials	40 ml	TPH	3
VOA vials	40ml	VOCs	3
Poly	250ml	Metals	1

Field Screening Results

PID	Bkgd 0.0	Reading NA
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-07

Date (YYMMDD): 07/17/00

Time (HHMMSS): 10:15

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Hot, Dry, Windy 88°F

Prepared by: Phil Hammons

Checked by: [signature]

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Vial Glass	40mL 2oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-08

Date (YYMMDD): 07/14/00

Time (HHMMSS): 11:55

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: (QA) (QC) / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 100°F, Clear, Slight Breeze

Prepared by: Phil Hammons

Checked by: DSH

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	3 ea
Poly	4oz	Moisture	3 ea
Glass	2oz	Metals	3 ea
~~Glass~~ Vial	40mL x3	TPH	3 ea
Vial	40mL	VOCs	9 ea

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-09

Date (YYMMDD): 07/14/00

Time (HHMMSS): 12:15

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 102°F, Clear, calm

Prepared by: Phil Hammons

Checked by: DS

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCB, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	40mL 2oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-10

Date (YYMMDD): 07/17/00

Time (HHMMSS): 0830

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) COMP. / NA

Sampler: RODNEY HICKMON

Witness: PHIL HAMMONS

Contractor: Morrison Knudsen

Remarks:

Weather: Partly Cloudy, 85°F, Light breeze

Prepared by: Phil Hammons

Checked by: DSH

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Perform w/ TCLP Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	40mL 2oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220	Project: AMS No.7 ESI Site: AMS No.7

Sample I.D.: AMS7-SS-11
Date (YYMMDD): 07/14/00
Time (HHMMSS): 0945
Top Depth: 0.0'
Bottom Depth: 0.5'
Matrix: Sed / (Soil) / Water
Sample Qualifier: QA / QC / RB / CS
Sample Type: (GRAB) / COMP. / NA
Sampler: Rodney Hickmon
Witness: Phil Hammons
Contractor: Morrison Knudsen
Remarks:

Weather: Clear, 90°F, Calm

Prepared by: Phil Hammons
Checked by:

Analytical Request			
Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs/ Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	40mL	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results		
PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-12

Date (YYMMDD): 07/14/00

Time (HHMMSS): 0935

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Clear, 90°F, Calm

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	~~4oz~~ 2oz	TPH	≥1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-13

Date (YYMMDD): 07/14/00

Time (HHMMSS): 10:15

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Clear, 95°F, Calm

Prepared by: Phil Hammons

Checked by: DWH

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	40mL 2oz	TPH	2-1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-14

Date (YYMMDD): 07/14/00

Time (HHMMSS): 10:30

Top Depth: 0.0

Bottom Depth: 0.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Clear, 95°F, Calm

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
~~Glass~~ Jar	~~40mL~~ 2oz	TPH	21
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH06-S-00

Date (YYMMDD): 07/18/00

Time (HHMMSS): 1200

Top Depth: 0.0

Bottom Depth: 0.5'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Partly Cloudy, 85°F, breezy

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs Herb SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
~~Glass~~ Poly	~~4oz~~ 40z	TPH	1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

TULSA TERC	DOCUMENT NUMBER: 10-SS-01	EFFECTIVE DATE: 02/25/98
	REVISION: 0	PAGE: 11 of 11

TITLE: SOIL SAMPLING

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH06-S-05

Date (YYMMDD): 07/19/00

Time (HHMMSS): 1405

Top Depth: 5.0'

Bottom Depth: 6.0'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 103°F, Clear, Slight breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	4oz	TPH	2
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

f:\white\tercldoc#18.ppt\procedur\ss01

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH06-S-10

Date (YYMMDD): 07/19/00

Time (HHMMSS): 1415

Top Depth: 10.0'

Bottom Depth: 11.0'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 105°F, Clear Slight Breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	4oz	TPH	2
Vial	40mL	VOC's	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH06-S-18

Date (YYMMDD): 07/19/00

Time (HHMMSS): 1425

Top Depth: 16.0'

Bottom Depth: 18.0'

Matrix: Sed / (Soil) / Water

Sample Qualifier: (DA) (QC) / RB / CS

Sample Type: GRAB / (COMP.) / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 105°F, Clear, slight breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Total Pb, TCLP Pb, Herb, SVOCs	X3
Poly	4oz	Moisture	X3
Glass	2oz	Metals	X3
Glass Vial	4oz 2.03	TPH	X3
Vial	40mL	VOCs	X9

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH06-S-76

Date (YYMMDD): 07/19/00

Time (HHMMSS): 1815

Top Depth: 75.5

Bottom Depth: 76.5

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: 102°F, Clear, Calm

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs Herb SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Vial Glass	4 40mL 2oz	TPH	2 1
Vial	40mL	VOC's	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-SS-0 BH07-S-00

Date (YYMMDD): 07/14/00

Time (HHMMSS): 1510

Top Depth: 0.0'

Bottom Depth: 0.5'

Matrix: Sed / (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Clear, 101°F, Muggy

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Vial Glass	40mL 2oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH07-S-05

Date (YYMMDD): 07/17/00

Time (HHMMSS): 1520

Top Depth: 5.0'

Bottom Depth: 6.0'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Clear, 101°F, breezy

Prepared by:

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
~~Glass~~ Vial	~~40mL~~ 4oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220	Project: AMS No.7 ESI Site: AMS No.7
Sample I.D.:	AMS7-BH07-S-10
Date (YYMMDD):	07/17/00
Time (HHMMSS):	15:25
Top Depth:	10.0'
Bottom Depth:	11.0'
Matrix:	Sed / (Soil) / Water
Sample Qualifier:	QA / QC / RB / CS
Sample Type:	GRAB / COMP. / NA
Sampler:	Rodney Hickmon
Witness:	Phil Hammons
Contractor:	Morrison Knudsen
Remarks:	
Weather:	Clear, 101°F, breezy
Prepared by:	Phil Hammons
Checked by:	

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass	4oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH07-S-85

Date (YYMMDD): 07/18/00

Time (HHMMSS): 1740

Top Depth: 84.5'

Bottom Depth: 85.5'

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks: Insta-Vis (CETCO) a liquid polymer added to mud pit at 65' bgs. Sample collected at 84.5-85.5' had polymer present based on characteristic "slimy" feel to sample.

Weather: Partly Cloudy, 95°F, Slight breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb, SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz.	Metals	1
Vial Glass	4oz 2oz	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH08-~~00~~ 0.5-00

Date (YYMMDD): 07/18/00

Time (HHMMSS): 1205

Top Depth: 0.0

Bottom Depth: 0.5

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Rodney Hickmon

Witness: Phil Hammons

Contractor: Morrison Knudsen

Remarks:

Weather: Partly Cloudy, 95°F, Breezy

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pesticides, PCBs, Herb. SVOCs	1
Poly	4oz	Moisture	1
Glass	2oz	Metals	1
Glass Vial	4oz 40mL	TPH	2 1
Vial	40mL	VOCs	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No. 7

Sample I.D.: AMS7-BH08-S-05

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1250

Top Depth: 5.0'

Bottom Depth: 6.0'

Matrix: Sed (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Phil Hammans

Witness: Rodney Hickman

Contractor: Morrison Knudsen

Remarks:

Weather: 103°F, Hazy, Slight breeze

Prepared by: Phil Hammans

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pest./PCB Herb. SVOCs	1
Glass	2oz	Metals	1
Glass	4oz	TPH	1
Poly	4oz	Moisture	1
Vials	40ml	VOC's	3

Field Screening Results

PID	Bkgd 0.0	Reading >2000 ppm
RAD Frisk	Bkgd	Reading
pH		

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ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No. 7

Sample I.D.: AMS7-BH08-S-10

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1300

Top Depth: 10.0'

Bottom Depth: 11.0'

Matrix: Sed (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Phil Hammons

Witness: Rodney Heckman

Contractor: Morrison Knudsen

Remarks:

Weather: 103°F, Hazy, slight breeze

Prepared by: Phil Hammons

Checked by: BB HS

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Rest./Acb Herb. SVOCs	1
Glass	2oz	Metals	1
Glass	4oz	TPH	1
Poly	4oz	Moisture	1
Vials	40ml	VOC's	3

Field Screening Results

PID	Bkgd 0.0	>2000 PPM Reading 0.0 ppm
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH08-S-15

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1325

Top Depth: 15.0'

Bottom Depth: 16.0'

Matrix: Sed (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Phil Hammons

Witness: Rodney Heckman

Contractor: Morrison Knudsen

Remarks:

Weather: 109°F, clear, calm

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pest./PCB Herb. SVOCs	1
Glass	2oz	Metals	1
Glass	4oz	TPH	1
Poly	4oz	Moisture	1
Vials	40ml	VOC's	3

Field Screening Results

PID	Bkgd 0.0	Reading 56.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 Est

Site: AMS No.7

Sample I.D.: AMS7-BH08-S-18.0

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1340

Top Depth: 16.5

Bottom Depth: 18.5

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB (COMP) / NA

Sampler: Phil Hammons

Witness: Rodney Heckman

Contractor: Morrison Knudsen

Remarks:

Weather: 103°F, Clear, calm

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16 oz	Pest./Herb SVOCs/PCBs	3
Glass	2 oz	metals	3
Glass	4 oz	TPH	3
Poly	4 oz	Moisture	3
Viols	40 ml	VOC's	9

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No. 7

Sample I.D.: AMS7-BH08-S-80

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1730

Top Depth: 80.1

Bottom Depth: 80.5

Matrix: Sed (Soil) Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: (GRAB) / COMP. / NA

Sampler: Phil Hammonds

Witness: Rodney Hickman

Contractor: Morrison Knudsen

Remarks:

Weather: 105°F, Clear, Slight breeze

Prepared by: Phil Hammonds

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Glass	16oz	Pest./PCB Herb. SVOCs	1
Glass	2oz	Metals	1
Glass	4oz	TPH	1
Poly	4oz	Moisture	1
Vials	40ml	VOC's	3

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-BH08-S-80 EB

Date (YYMMDD): 7/20/00

Time (HHMMSS): 1730

Top Depth: NA

Bottom Depth: NA

Matrix: Sed / Soil / (Water)

Sample Qualifier: QA / QC / (RB) / CS

Sample Type: GRAB / COMP. / (NA)

Sampler: PHIL Hammons

Witness: Rodney Heckman

Contractor: Morrison Knudsen

Remarks:

Weather: 105°F, Clear, Slight breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
Amber Glass	1 liter	PCBs	2
Amber Glass	1 liter	SVOCs	2
Amber Glass	1 liter	Pest.	2
Amber Glass	1 liter	Herb.	2
VOA Vials	40ml	TPH	3
VOA Vials	40ml	VOCs	3
Poly	250ml	Metals	1

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

APPENDIX A.2

ESI Groundwater Sample Collection Logs

TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No. 7	LocID: MW06	Date: 7/26/00 and 8/08/00
	Project Name: Atlas Missile Silo No.7 ESI	Project #: 4423-0220	Recorded By: P. Hammons Checked By:
EQUIPMENT	Water Quality Meter Type/ID #: Horiba U-22 Hach Co #0102	Water Level Indicator Type/ID #: Solinst M.101/26268	PID Type/ID #: Photovac 2020/Hnu 13896
		Sampling Equipment: Grundfos Redi-flo2/300'	Equipment Decon.: Wash/double rinse
WELL INFO	Casing I.D. (in) [a]: 2"	Unit Casing Volume (gal/lin ft) [b]: 0.16 gal/ft	Initial Depth to Water (ft) [c]: 24.21'
	Total Well Depth (ft) [d]: 33.79'	Water Column Thickness (ft) [d-c]: 9.58	Well Volume (gal) ([d-c] x b): 1.53 gal.
	Ambient PID (ppm): 0.0	Well Mouth PID (ppm): 140 ppm	Ground Condition of Well: Dry
	Ambient Explosimeter (%LEL): NA	Well Mouth Explosimeter (%LEL): NA	Remarks: Pump intake set at 30.0' btoc

CASING INFO										
Casing I.D. (in) [a]:	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (gal/lin ft) [b]:	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Date	Time (24 hr)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	Radiation (TDS / g/L)	Remarks (odor, clarity, etc.)
7/26/00	1055	24.21	~~0.50.3~~	0.40	22.4	7.01	0.435	6.7	130		Clear
	1100	24.35	0.6	0.40	22.6	6.85	0.434	6.7	130	0.28	↓
	1105	24.35	1.2	0.40	22.9	6.82	0.434	6.6	120	0.28	↓
	1110	24.35	2.0	0.35	23.3	6.81	0.433	6.6	73	0.28	Generator went down from 1132 to 1136
~~GW~~	~~1120~~	~~24.35~~	~~2.~~			pmm					Generator went down again 11:18-11:25
	1130	24.35	2.8	0.40	24.6	6.77	0.431	6.3	62	0.28	Clear
	1135	24.35	3.4	0.40	24.3	6.73	0.429	6.2	42	0.28	↓
	1140	24.35	4.2	0.40	24.3	6.71	0.428	6.2	36	0.28	↓

Pump Rate: <=0.5 L/min Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH, +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

Sample ID #(s)/Time(s)/Ferrous Iron Result(s)	No. Containers/Volume/Type	Preserv.	Filter (Y/N)	Pump OR Bailer	Parameter(s)
AMS7-MW06-GW/1215/7-26-00 →	~~VOA~~ 20 (7/26/00)		No	Pump	as above
GW-QA/1215/7-26-00 →	20 ↓		No	↓	
GW-QC/1215/7-26-00 →	20 ↓		No	↓	
AMS7-MW06-GW/1225/8/08/00 →	2 (8/08/00)		No	Pump	
GW-QC/1225/8-08-00 →	2 ↓		No	↓	
GW-QA/1226/8-08-00 →	6 ↓		No	↓	MS/MSD
On 8/08/00 Collected additional volume for PCB/Tox analysis, MS/MSD for QA sample					

TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No. 7	LocID: MW06
	Project Name: Atlas Missile Silo No. 7 ESI	Project #: 4423-0220

Date	Time (24 hr)	Method (pump, bail)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	Sed. (mg/L)	TDS ~~Red.~~ (g/L)	Remarks (odor, clarity, etc.)
7/26/00	1145	Pump	24.35	4.9	0.40	24.2	6.69	0.427	6.1	30		0.28	Clear
	1150		24.35	5.5	0.40	24.2	6.68	0.427	6.1	28		0.28	
	1155		24.30	5.8	0.25	24.6	6.69	0.426	6.1	24		0.28	
↓	1200	↓	24.30	6.2	0.30	24.9	6.70	0.427	6.1	22		0.28	↓ parameters stable
Sample collected (1215) AMS7-mw06-GW/QA/QC													
8/08/00	1105	Start purging well 3 casing volumes prior to parameter measurements at 0.34m											
	1135		24.40	~~2.3~~ 3.8	0.30	23.2	6.90	0.424	7.9	14		0.28	
	~~1140~~												~~pump stable~~
	1145		24.45	~~4.0~~ 3.8	0.50	22.9	6.90	0.419	7.4	150		0.27	
	1150		24.40	4.4	0.30	23.4	6.89	0.416	7.4	140		0.27	
	1155		24.42	4.8	0.30	23.7	6.88	0.416	7.8	120		0.27	
	1200		24.37	5.2	0.20	24.1	6.89	0.417	7.4	92		0.27	
	1205		24.40	5.5	0.30	24.6	6.90	0.418	7.7	50		0.27	
	1210		24.39	5.7	0.075	25.1	6.92	0.421	7.2	50		0.27	
	1215		24.40	6.4	0.16	24.9	6.90	0.422	7.3	78		0.27	
	1220		24.40	6.8	0.35	24.0	6.91	0.420	7.4	41		0.27	
↓	1225		Sample collected at 1225 for PCB/TOX Analysis										
			Turbidity not stable and Temp ±0.9c										

Pump Rate: <=0.5 ' Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

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TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No.7	LocID: MW07	Date: 7/28/00 and 7/31/00
	Project Name: Atlas Missile Silo No.7 ESI	Project #: 4423-0220	Recorded By: P. HAMMONDS Checked By:
EQUIPMENT	Water Quality Meter Type/ID #: Horiba U-22 / HazCo # 0102	Water Level Indicator Type/ID #: Solinst M. 101/26268	PID Type/ID #: Photovac 2020/Hz36 #13896
		Sampling Equipment: Redi flo2/300'/Teflon tubing	Equipment Decon.: Wash/double rinse
WELL INFO	Casing I.D. (in) [a]: 2"	Unit Casing Volume (gal/lin ft) [b]: 0.16 gal/ft	Initial Depth to Water (ft) [c]: 14.52
	Total Well Depth (ft) [d]: 26.75 ~~20~~ pmo	Water Column Thickness (ft) [d-c]: 11.68	Well Volume (gal) [(d-c) x b]: 1.87
	Ambient PID (ppm): 0.0	Well Mouth PID (ppm): 0.0 ppm	Ground Condition of Well: dry
	Ambient Explosimeter (%LEL): N/A	Well Mouth Explosimeter (%LEL): N/A	Remarks: Pump intake set at 20 ~~20~~ 22.0' btoc

CASING INFO	Casing I.D. (in) [a]: 2"	1.5	(2.0)	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
	Unit Casing Volume (gal/lin ft) [b]:	0.09	(0.16)	0.20	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Date	Time (24 hr)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	TDS Radiation (g/L)	Remarks (odor, clarity, etc.)
7/28/00	0845	16.93	0.5	.350	22.5	6.51	0.885	6.6	120	0.57	Cloudy
	0850	16.90	0.75	.250	22.6	6.52	0.886	5.7	96	0.57	Cloudy
	0855	16.79	1.30	.300	22.7	6.51	0.884	5.4	94	0.57	Slightly Cloudy
	0900	16.71	2.00	.300	22.8	6.52	0.885	4.7	91	0.57	Clear
	0905	16.75	2.60	.300	22.9	6.53	0.893	4.4	91	0.57	
	0910	16.76	3.10	.300	23.1	6.53	0.898	4.3	83	0.58	
	0915	16.79	3.60	.300	23.2	6.54	0.907	4.3	61	0.58	
	0920	16.76	4.10	.300	23.4	6.56	0.909	4.3	60	0.58	

Pump Rate: <=0.5 L/min Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH, +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

Sample ID #(s)/Time(s)/Ferrous Iron Result(s)	No. Containers/Volume/Type	Preserv.	Filter (Y/N)	Pump OR Bailer	Parameter(s)
AMS7-MW07-GW/0935/7-28-00	~~Hg15~~ 19 2 19		Y 10u	Pump	as above
AMS7-MW07-GW/0830/7-31-00	/		N	Pump	
AMS7-MW07-GW/0950/8-01-00	19		N	Pump	
AMS7-MW07-GW-EB/1400/7-31-00	20		N	Pump	

TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No. 7	LocID: MW07
	Project Name: Atlas Missile Silo No. 7 ESI	Project #: 4423-0220

Date	Time (24 hr)	Method (pump, bail)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	Sed. (mg/L)	TDS Red. (g/L)	Remarks (odor, clarity, etc.)
7/28 00	0925	Pump	16.81	4.7	0.30	23.6	6.57	0.913	4.4	56		0.58	Parameters stable
↓	Collected sample at 0930 AMS7-MW07-GW (Fl Nitrite/Nitrate not collected)												
7/31 00	0810	Begin repurging MW07 to collect Fl/Nitrate/Nitrate sample											
		Purged 2.5 gallons at 0.300 l/m rate before starting purge measurements											
	0820	Pump	17.80	2.6	0.30	21.3	6.83	0.865	7.2	28		0.55	Clear
	0825	↓	17.87	3.3	0.30	21.4	6.86	0.866	7.2	26		0.55	↓
↓	0830	↓	17.86	3.8	0.30	21.6	6.89	0.870	7.2	25		0.56	↓
			Collect AMS7-MW07-GW @ 0830 for Fl/NO_2/NO_3.										
8/01 00	0830	Begin repurging MW07 to collect sample. Purged 2.5 gallons at 0.300 l/m rate before starting purge measurements											
	0850	Pump	16.72	2.5	0.30	21.7	6.38	0.892	5.5	15		0.57	
	0855		16.74	2.9	0.30	21.9	6.40	0.895	5.0	13		0.57	
	0900		16.78	3.4	0.30	22.1	6.43	0.899	4.7	17		0.58	
	0905		16.79	3.8	0.30	22.3	6.48	0.902	4.5	16		0.58	
	0910		16.75	4.3	0.30	22.7	6.54	0.907	4.5	12		0.58	
	0915		16.80	4.8	0.30	22.9	6.62	0.910	4.6	8		0.58	
	0920		16.81	5.2	0.30	23.2	6.67	0.913	4.6	3		0.58	
	0925		16.80	5.6	0.30	23.6	6.70	0.916	4.6	~~20~~		0.59	
	0930		16.79	5.8	0.30	23.9	6.73	0.918	4.5	0		0.59	
	0935		16.80	6.2	0.30	24.3	6.74	0.921	4.6	0		0.59	
	0940		16.80	6.6	0.20	24.7	6.76	0.924	4.5	0		0.59	Parameters stable
	Sample collected at 0950 AMS7-MW07-GW												

Pump Rate: <=0.5 Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

hibit 1

TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No.7	LocID: MW08	Date: 7/31/00
	Project Name: Atlas Missile Silo No.7 ESI	Project #: 4423-0220	Recorded By: P.Hammons Checked By:
EQUIPMENT	Water Quality Meter Type/ID #: Horiba U-22 Hazco #0102	Water Level Indicator Type/ID #: Solinst M. 101/26268	PID Type/ID #: Photovac 2020/Hazco #13896
		Sampling Equipment: Redi flo 2/300'/Teflon tubing	Equipment Decon.: Wash/double rinse
WELL INFO	Casing I.D. (in) [a]: 2"	Unit Casing Volume (gal/lin ft) [b]: 0.16 gal/ft	Initial Depth to Water (ft) [c]: 23.42
	Total Well Depth (ft) [d]: 28.02'	Water Column Thickness (ft) [d-c]: 4.6'	Well Volume (gal) ([d-c] x b): 0.736
	Ambient PID (ppm): 0.0	Well Mouth PID (ppm): 218 ppm	Ground Condition of Well: Dry
	Ambient Explosimeter (%LEL): NA	Well Mouth Explosimeter (%LEL): NA	Remarks: Set Pump Intake at 27.0' btoc

CASING INFO											
Casing I.D. (in) [a]:	1.5	(2.0)	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (gal/lin ft) [b]:	0.09	(0.16)	0.20	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Date	Time (24 hr)	Water Level (FTOC)	Volume Removed (gal)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	TDS Radiation (g/L)	Remarks (odor, clarity, etc.)
7/31/00	0915	23.90	0.20	0.20	22.2	7.12	0.606	1.2	990	0.39	Turbid
	0920	23.85	~~0.45~~ 0.4	0.15	22.4	7.08	0.610	0.9	990	0.39	↓
	0950	24.12	3.4	0.15	—	—	—	—	—	—	Let pump run at 0.10 Lpm for 30 min to clean up turbidity, removed 3.0 gallons
	0950	— Pump stops - or flow stops - Pull pump to check									
	1000	Pump restarted									
	1020	Flow stops again due to insufficient head above pump intake (6.4 gallons removed)									
	1045	Pump Well Dry with high flow and pump on bottom. In accordance w/ SOP will sample well w/ bailer tomorrow morning									

Pump Rate: <=0.5 L/min Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH, +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU Ideal) for 3 consecutive readings

Sample ID #(s)/Time(s)/Ferrous Iron Result(s)	No. Containers/Volume/Type	Preserv.	Filter (Y/N)	Pump OR Bailer	Parameter(s)
AMS7-MW08-GW/0800/08-01-00	4x40		N	Bailer pump	as above
			Nitrate filters w/ 10 um (660 NTU) turbidity		filter due to high

Exhibit 1

TULSA TERC

MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No. 7	LocID: MW08
	Project Name: Atlas Missile Silo No. 7 ESI	Project #: 4423-0220

Date	Time (24 hr)	Method (pump, bail)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	Sed. (mg/L)	TDS ~~Red.~~ (g/L)	Remarks (odor, clarity, etc.)
08/01/00	0750	Begin	Filling	bottles	w/	Teflon	bailer	at	MW08				
	0800	bailer	—	—	—	20.6	6.53	0.608	~~4.2~~	670 660		0.39	
	Sample collected		AMS7-MW08-GW at 0800										

Pump Rate: <= [illegible] Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

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MONITORING WELL SAMPLE COLLECTION FORM

LOCATION	Site: AMS No.7	LocID: MW09	Date: 8/14/00
	Project Name: Atlas Missile Silo No.7 ESI	Project #: 4423-0220	Recorded By: P. Hammons Checked By:
EQUIPMENT	Water Quality Meter Type/ID #: Horiba U-22 Haz Co # 0102	Water Level Indicator Type/ID #: Solinst M. 101/20248	PID Type/ID #: Photovac 2020/Haz Co # 13896
		Sampling Equipment: Grundfos Redi-flo2/300'	Equipment Decon.: Wash/double rinse
WELL INFO	Casing I.D. (in) [a]: 4"	Unit Casing Volume (gal/lin ft) [b]: 0.65	Initial Depth to Water (ft) [c]: 42.65'
	Total Well Depth (ft) [d]: ~~215'~~ 215'	Water Column Thickness (ft) [d-c]: 172.35	Well Volume (gal) [(d-c) x b]: 112.03'
	Ambient PID (ppm): 0.0	Well Mouth PID (ppm): 0.0	Ground Condition of Well: Dry
	Ambient Explosimeter (%LEL): NR	Well Mouth Explosimeter (%LEL): ~~0.0~~ NR	Remarks:

CASING INFO											
Casing I.D. (in) [a]:	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (gal/lin ft) [b]:	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Date	Time (24 hr)	Water Level (FTOC)	Volume Removed (L)	Pumping Rate (Lpm)	Temp. (C)	pH	Conductivity (mS/cm)	DO (mg/L)	Turb. (NTU)	TDS Reading (g/L)	Remarks (odor, clarity, etc.)
8/14/00	0800	42.46'	Well	sampled w/ bailer after				Recovered for	~~development~~		from dry status at end
				of Development on 8/11/00							
	0830	—	NA	NA	21.7	10.04	7.39	7.0	220	4.7	Slightly cloudy

Pump Rate: <=0.5 L/min Drawdown: < 0.33 ft Measurements: 3-5 min Stabilization: +/- 0.5 C, +/- 0.1 pH, +/- 3% conductivity, +/- 10% DO, +/- 10% turb (<= 10 NTU ideal) for 3 consecutive readings

Sample ID #(s)/Time(s)/Ferrous Iron Result(s)	No. Containers/Volume/Type	Preserv.	Filter (Y/N)	Pump OR Bailer	Parameter(s)
AMS7-MW09-GW/0800/08-14-00	21			Bailer Teflon	

APPENDIX B

ESI Borehole Logs

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 3

Project Number: 4423-0220

Hole Number: BH06

Project: AMS No. 7 ESI

Location: AMS No. 7, Vernon Texas

Coordinates: (N) 7543291.90 (E) 1719524.29

Drilling Contractor: Horizon Drilling

Drill Make and Model / Drilling Method: Longyear BK-81 / HSA

Depth Top of Rock: 76.7

Depth Casing & Size: NA

Hole Size: 8"

Elevation: 1365.0 (MSL)

Angle from Vert. and Bearing: N/A

Depth Bottom of Hole: 79.0'

Water Level: 21.5' 18.3' (in core) (in open hole)

Fluid & Additives: Mud (100% bentonite)

Date Start: 7/19/00

Date Finish: 7/19/00

Logger: Phil Hammons

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (Time)	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
	0	(0-0.5') 1200	AMS7-BH06-S-00 PID=0.0 chemical	5.0/5.0			SAND WITH SOME SILT (SM), moderate brown (5YR 4/4), v. fine grained, quartoze, 15% silt, dry (Upper several ft probable AF due to closure activities). PID=0.0
	5	15.0-6.0 1405	-05 PID=0.0 chemical	5.0/5.0			grades to grayish orange (10YR 7/4) PID=0.0
	10	10.0-11.0' 1415	-10 chemical PID=0.0	5.0/5.0			- laminated moderate reddish brown (10R 4/6) and very pale orange (10YR 8/2) PID=0.0 gradational
	15	(16.0-18.0) 1425	-18 (QA/QC) chemical PID=0.0	5.0/5.0			SAND (SP), moderate reddish brown (10R 3/4, 4/6), v. fine grained, quartoze, no silt PID=0.0
18.3' W (in core)	20			5.0/5.0			Very silty sand (SM), moderate reddish brown (10R 4/6), very fine grained, quartoze, 30% silt, saturated - 20.5' grades to silty Sand (SM), light brown (5YR 5/6), 15-20% silt PID=0.0
	25			3.0/5.0			SANDY CLAY (CL), pale yellowish brown (10YR 6/2), 20% v. fine grained sand, low plasticity, saturated

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 3
Project Number: 4423-0220
Hole Number: BH 06

Project: AMS No.7 ESI
Location: AMS No.7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
				5.0/5.0			CL (as above) gradational CLAYEY SAND (SC), light brown (5YR 5/6), v. fine grained, quartoze, 35-40% clay, soft, saturated. PID = 0.0
	30			4.8/5.0			SANDY CLAY (CL), very pale orange (10YR 8/2), 25-30% v. fine grained sand, stiff, abundant calcine nodules (2-3 mm diam.) PID = 0.0
	35			4.0/5.0			Silty SAND (SM), mottled light brown (5YR 5/6) and very pale orange (10YR 8/2), v. fine grained, quartoze, 10-20% silt, soft flowing sand PID = 0.0
	40			2.1/5.0			SAND (SP), light brown (5YR 5/6), v. fine grained, subrounded to subangular, soft, flowing sand PID 0.0
	45			1.0/5.0			PID = 0.0
	50			1.3/5.0			- grades to rounded grains PID = 0.0
	55						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 3
Project Number: 4423-0220
Hole Number: BH06

Project: AMS No.7 ESI
Location: AMS No.7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (TIME)	SAMPLE TYPE & NUMBER	% RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
							SAND (SP) as above
				1.7/5.0			PID = 0.0
	60						
				1.6/5.0			PID = 0.0
	65						
							PID = 0.0
				3.0/5.0			SILT (ML), light brown (5YR 6/4), hard
	70						
				2.6/5.0			SAND (SP) as above
							PID = 0.0
	75	15.5-76.5 (10LS)	AMS7-BH06-5-76 chemical PID = 0.0				
				3.2/5.0	50/4.0 push		Top of Bedrock at 76.7'
							SANDSTONE, moderate reddish brown (10R 4/6), very fine grained, trace silt, faint low angle x-bedding, highly weathered.
							T.D. at 79.0'
	80						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS NO. 7 ESI
Location: AMS No. 7/Vernon Texas
Coordinates: (N) 7543371.68 (E) 1719805.76
Drilling Contractor: Horizon Drilling
Drill Make and Model / Drilling Method: Longyear BK-81
Depth Top of Rock: 85.5'
Depth Casing & Size: NA
Hole Size: 8"
Elevation: 1367.0 (MSL)
Angle from Vert. and Bearing: NA
Depth Bottom of Hole: 87.0'
Water Level: 11.3 (in open hole) 10' (in core)
Fluid & Additives: Inhibit Plus Polymer
Date Start: 7/17/00
Date Finish: 7/18/00
Logger: Phil Hammons

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (Time)	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
	0	0-1.5' (1510)	AMST-BH07-S-00 (Chemical) PID=0	3.3/5.0			SAND (SM), moderate reddish brown (10R 4/6), very fine to medium grained, 10% silt, 5% gravel, trace caliche nodules, Artificial Fill, soft
							PID = 0.0'
	5	5-6' (1520)	-05 (Chemical) PID=0	1.8/5.0			(as above)
							approximate
	10	(10-11') (1525)	-10 (Chemical) PID=0	2.0/5.0			SAND (SP), grayish orange (10YR 7/4), medium to coarse grained, subrounded to rounded grains, quartz Saturated at 10.0' in core, soft (AF?)
							SAND with some silt (SM), mottled moderate reddish brown (10R 4/6) and light brown (5YR 5/6), very fine grained, trace medium grained, quartz, 15% silt, soft
	15			2.5/5.0			PID = 0.0
							approximate
	20			5.0/5.0			CLAYEY SAND (SC), laminated light brown (5YR 5/6) and moderate yellowish brown (10YR 5/4), fine grained, quartz, 35% fines, trace caliche nodules stiff
							PID = 0.0
	25						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
				5.0/5.0			(as above) PID = 0.0
	30			5.0/5.0			trace gravel (up to 1" diameter), some caliche nodules and layers PID = 0.0
	35			3.8/5.0			SAND with some gravel (SW), moderate yellowish brown (10YR 5/4), fine grained, gravel up to 1.5" diameter, soft (36.0-36.8')
							CLAYEY SAND (SC), laminated pale olive (10Y 6/2) and moderate yellowish brown (10YR 5/4), fine grained, 20% clay, stiff
	40			4.0/5.0			approximate SAND with some SILT (SM), mottled light brown (5YR 5/6) and grayish orange (10YR 7/4), V. fine grained, trace clay, flowing sands PID = 0.0
	45			3.8/5.0			approximate SAND (SP), light brown (5YR 6/4), fine grained, poorly graded, trace silt, quartoze, flowing sands PID = 0.0
	50			4.0/5.0			(as above) Core barrel stuck in augers due to flowing sand on 50-55' run. Could not dislodge. Had to pull augers and rods out of hole to dislodge and go back in.
	55						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
	60						Drilled ahead without sampling from 55-65' AT 65' added Insta-Vis liquid Polymer to mud pit to bring up cuttings and flush out HSA. (ACETCO product)
	65			0.9/2.0'			From 65'-86', switched from continuous sampling to drive sampling with downhole hammer and 2' spoons (2" diameter) SAND (SP) as above, flowing sands
				0.7/2.0'			PID = 0.0
	70			0.4/2.0			
				1.0/2.0			PID = 0.0
				2.0/2.0			
	75			1.3/2.0			SANDY SILT (ML), light brown (5YR 5/6), sand is v. fine grained (30%), trace clay.
				1.0/2.0			SAND (SP) as above PID = 0.0
	80						Drilled ahead without sampling from 79'-83', push
							SAND (SP) as above
	85	845' (1740) 85'. AMS7-BH07-S-85 (chemical) PID = 0.0		3.0/4.0			

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 4 of 4
Project Number: 4423-0221
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
				3/4			SAND (SP) as above — TOP OF BEDROCK at 85.5'
							SANDSTONE, moderate reddish brown (10R 4/6), silty, hard
							T.D. @ 87.0'
	90						
	95						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 3
Project Number: 4423-0220
Hole Number: BH-08

Project: AMS No. 7 EST
Location: AMS No. 7, Vernon Texas
Coordinates: (N) 7543550.53 (E) 1719815.19
Drilling Contractor: Horizon Drilling
Drill Make and Model / Drilling Method: Long Year BK 81 / HSA
Depth Top of Rock: 80.5'
Depth Casing & Size: NA
Hole Size: 8"
Elevation: 1362.5 (msl)
Angle from Vert. and Bearing: N/A
Depth Bottom of Hole: 85.0'
Water Level: 15.0' in 18.5' in core open hole
Fluid & Additives: Mud / Bentonite (100%)
Date Start: 7/20/00
Date Finish: 7/20/00
Logger: PHN Hammonds

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (TIME)	SAMPLE TYPE & NUMBER / PID	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
	0	0.0-0.5' (1205)	AMS7-BH08-S-00 chemical PID=0.0	3.0/5.0			SAND (SP), light brown (5YR 5/6), v. fine grained, trace silt, dry.
	5	5.0-6.0' (1250)	S-05 chemical	5.0/5.0			approximate SILTY SAND, (SM), mod. reddish brown (10R 4/6), v. fine grained, 15% silt, trace gravel (rounded, <1" diameter), abundant caliche nodules (2-4" diam.). from 5'-15' slight oil odor
	10	10.0-11.0' (1300)	S-10 chemical	5.0/5.0			grades to light brown (5YR 5/6) with some very pale orange (10YR 8/2) mottling
		15.0-16.0' (1325)	S-15 chemical (15-17') PID=2000 ppm (5-15')	5.0/5.0			trace caliche nodules (2-4 mm)
	15						silt content increases to 30%
		16.5-18.5' (1340)	S-18 QNAC chemical	5.0/5.0			
	20	incore 18.5'					SANDY CLAY (CL), light brown (5YR 5/6), v. fine grained sand (35%), some caliche nodules, low plasticity.
			PID=0.0	3.5/5.0			
	25						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 3
Project Number: 4423-0220
Hole Number: BH-08

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon TX.

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
			PID ϕ.ϕ	5.0/5.0			SANDY CLAY (CL) as above 25-27' - grayish orange (10YR 7/4) with abundant caliche nodules (3-7mm dia.). - grades to light brown (5YR 5/6) without caliche
30			PID ϕ.ϕ	5.0/5.0			30.0-32.2 grayish orange (10YR 7/4), abundant caliche nodules (3-7mm) - grades to l. brown (5YR 5/6) gradational
35			PID ϕ.ϕ	4.0/5.0			SILTY SAND (SM), light brown (5YR 5/6), v. fine grained, quartzose, well rounded, 20% silt, trace clay, soft, flowing sand
40			PID ϕ.ϕ	1.3/5.0			
45			PID ϕ.ϕ	1.0/5.0			SANDY SILT (ML), mod. orange pink (5YR 8/4), 15% v. fine sand, hard SAND WITH SOME SILT (SM), l. brown (5YR 5/6), v. fine grained, quartzose, well rounded, 10% silt, flowing sand, soft
50			PID ϕ.ϕ	4.1/5.0			
55							

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 3
Project Number: 4423-0220
Hole Number: BH-08

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon Tx

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
	60		PID ϕ.ϕ	1.0/5.0			SAND WITH SOME SILT (SM) as above
			PID ϕ.6	0.6/5.0			
	65		PID ϕ.6	2.2/5.0			VERY SANDY SILT, l. brown (5YR 6/4), 40% v. fine gr. sand, stiff.
							SAND (SP), light brown (5YR 6/4), v. fine grained, quartzose, rounded flowing sand.
	70		PID ϕ.6	1.2/5.0			
	75						
	80	(80.1-80.5') 1730	S-80 (ES) chemical PID=ϕ.ϕ	1.0/5.0			Top of Bedrock at 80.5'
				2.8/5.0			SANDSTONE, Mod. reddish brown, v. fine grained; faint low angle x-bedding; highly weathered
	85						T.D. at 85' bgs

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 4
Project Number: 4423-0220
Hole Number: BH-09

Project: AMS NO.7 ESI
Location: AMS No.7, Veron Texas
Coordinates: (N) 7543566.68 (E) 1719814.85
Drilling Contractor: Horizon Drilling / Peterson Drilling
Drill Make and Model / Drilling Method: Gardner-Denver 1500/Mud Rotary
Longyear BK-81/Air Rotary/Mud Rotary
Depth Top of Rock: ~~84'~~ 80.5'
Depth Casing & Size: Isolation Casing 91'/8 5/8" (steel)
Hole Size: 0-95' (12 1/4"); 95'-210' (7 7/8") 3
Elevation: NR-1362.82 (MSL)
168'-210' Bentonite mud
Angle from Vert. and Bearing: Borehole Reamed w/ D8 Keck D40K
Depth Bottom of Hole: 210'
Water Level:
Fluid & Additives: 0-95'-Bentonite Mud; 95-168'-None
Date Start: 7/12/00
Date Finish: 8/03/00
Logger: PHIL HAMMONS

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
	10	N/A	N/A		N/A		Drilled from 0.0' to 88' bgs with 4.25" tricone; logged cuttings (see log of adjacent Borehole BH08 for lithologies)
	20						▼ approximate depth to groundwater
	30						
	40						
	50						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 4
Project Number: 4423-022C
Hole Number: BH-09

Project: AMS No.7 ESI
Location: AMS No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE: INTERVAL	SAMPLE: TYPE & NUMBER	SAMPLE: % RECOVERY	STANDARD PENETRATION TEST RESULTS: 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
							see log of adjacent Borehole BH08 for lithologies
	60						
	70						
	80						Top of Bedrock at 80.5' (based on contact encountered in adjacent BH08)
							weathered bedrock
							unweathered bedrock at 84.0' based on drilling change
	90	Boring isolation casing		5.0/5.0	N/A		SANDSTONE, moderate reddish brown (10R 4/6), v. fine grained, quartzose, prominent low angle cross-bedding, hard dry
		91.0'					Reamed pilot (4.25") borehole with 12.25" tricone bit from 0.0' to 98' bgs. Set 8 5/8" steel casing to 91' bgs and grouted in place.
							Begin Air Coring at 98.0' on 7/19/00
	100						SILTSTONE w/ some sand, moderate reddish brown (10R 4/6), sand is v. fine, rounded (10%), dry, possible water bearing fractures
			4.4	6.5/10	NA		SILTY SANDSTONE, moderate reddish brown (10R 4/6), sand is fine grained, quartzose, 25-30% silt, ~~dense~~ friable, low angle x-l
							approximate
	110			5.1/10	NA		SANDSTONE, pale reddish brown (10R 5/4) with pale olive (10Y 6/2) mottling, v. fine grained, quartz and rk fragments, abundant elongate shale clasts mm-cm, prominent low angle x-bedding, small (2-10 mm) solution cavities, some filled w/ crystals.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 4
Project Number: 4423-0220
Hole Number: BH-09

Project: Ams No. 7 ESI
Location: Ams No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER PID	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
							as above
			ϕ.ϕ	5.7/10	NA		SANDY SHALE, pale reddish brown (10R 5/4) with pale olive (10Y 6/2) mottling. Sand is vf fine grained (20-30%)
							approximate
							SANDSTONE, Pale reddish brown (10R 5/4), vf fine grained, quartzose, low angle x-bedding, moderately cemented.
120			ϕ.ϕ	6.8/10	NA		122'-128' - clayey
							131.5-134.0 mottled pale olive (10Y 6/2) with abundant shale clasts
130			ϕ.ϕ	8.7/10	NA		(from 116-138' - loss g ≈ 100 gallons to Fm.)
							138.5'-140.2' mottled pale olive (10Y 6/2) with abundant shale clasts
							140.2'-142.9' - weakly cemented
140			ϕ.ϕ	4.9/10	NA		
							weakly cemented, no noticeable x-bedding
150			ϕ.ϕ	3.0/10	NA		
							159.2'-160.7' - mottled pale olive (10Y 6/2) with abundant shale clasts
							160.7'-164.0' - weakly cemented
160			ϕ.ϕ	6.0/10	NA		(from 138-168' loss g ≈ 160 gallons to Fm.) Drillers added InstaVis 2g and Polymer at 168' (Flushed out pit prior to coring)
				6.9/10	NA		168.0'-170.6' well cemented, abundant solution cavities (1-4 mm) prominent x-bedding (low angle)
170							

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 4 of 4
Project Number: 4423-022C
Hole Number: BH-09

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
							170.5-171.5 - weakly cemented
			0.7	6.0/10	NA		SILTSTONE, greenish gray (5G 6/1), shaley in areas, sand content (5%) weakly cemented
							approximate SHALE, moderate reddish brown (10R 4/6) with thin bands of greenish gray (5G 4/1)
180							178'-180' - soft, wet 180'-181.8' very hard, dry 181.8-184' - alternating soft and hard, dry
			2.6	6.1/10	NA		
190			~2000	4.8/5			moderate reddish brown (10R 4/6) with occassional greenish gray (5G 4/1) spots, very hard, dry, fractures in areas (possible water bearing).
			~2000	5.0/5.0			
200			~2000	3.7/5.0			
			NR	2.1/5.0			low battery on PID, lamp will not light
			NR	1.4/2.0			T.D. at 210' bgs
210							
220							
230							

Exhibit 1: **Monitoring Well Development Log**

Date: 7/24/00

Well No. MW06

Depth from top of well casing: 21.84 ppm 22.12 bgs

Top of water (ft.) 24.22 - 2.38 (SW)

Bottom of well (ft.) 33.75 ΔH = 9.53

Well diameter (in.) 2"

Top, sampling interval 16.0'

Bottom, sampling interval 31.0'

V = 0.0408 x ΔH(ft) x D(in)² 1.56 (gal.)

5 x V = 4.67 ppm 7.8 (gal.)

Well Development Technique:

- ☑ ~~Redi-Flo 2 submersible pump~~ Blue Whale submersible Pump 12v DC
- ☑ Surge Block PVC
- ☐ Bailer
- ☐

Ground Water Parameters:

		±10% ↓	±3% ↓	±1°C ↓	±0.2 ↓	
Volume 0	Time 12:05	Turb 990	SC .659	Temp 29.0c	pH 7.35	OVA 0
Volume 1.5gal	Time 12:06	Turb 990	SC .519	Temp 21.3c	pH 7.52	OVA 0
Volume 3gal	Time 12:07	Turb 990	SC .487	Temp 20.4c	pH 7.48	OVA 0
Volume 5gal	Time 12:08	Turb 990	SC .467	Temp 20.1c	pH 7.43	OVA 0
Volume 6gal	Time 12:10	Turb 990	SC .466	Temp 20.3c	pH 7.62	OVA 0
Volume 8gal	Time 12:11	Turb 990	SC .460	Temp 20.0c	pH 7.50	OVA
Volume 11gal	Time 12:15	Turb 990	SC .479	Temp 20.8c	pH 7.44	OVA

Notes (i.e., weather, equipment status, other) Clear, 85°F, breezy (5-10 mph out of south) Parameters stable after 8gallon (total) removed. Continued removal of gw in attempts to lower turbidity. 35 gallons finally removed with slight lowering of turbidity.

Development Oversight Rick Hammon

Exhibit 1: **Monitoring Well Development Log**

Well No. MW06

Date: 7/24/00

Depth from top of well casing:

Top of water (ft.) _____
Bottom of well (ft.) _____
Well diameter (in.) _____

Top, sampling interval _____
Bottom, sampling interval _____
$V = 0.0408 \times \Delta H(ft) \times D(in)^2$ _____ (gal.)
$3 \times V =$ _____ (gal.)

Well Development Technique:

- ☑ ~~Redi-Flo 2 submersible pump~~ Blue Work Submersible Pump 12V DC
- ☑ Surge Block PVC
- ☐ Bailer
- ☐ _____

Ground Water Parameters:

Volume 13gal	Time 12:17	Turb 990	SC .482	Temp 20.3c	pH 7.34	OVA
Volume 16gal	Time 12:20	Turb 990	SC .465	Temp 20.5c	pH 7.43	OVA
Volume 19gal	Time 12:22	Turb 990	SC .451	Temp 20.0c	pH 7.34	OVA 31x
Volume 21gal	Time 12:25	Turb 950	SC .446	Temp 20.4c	pH 7.25	OVA
Volume 24gal	Time 12:27	Turb 640	SC .457	Temp 19.9c	pH 7.15	OVA
Volume 26gal	Time 12:30	Turb 990	SC .449	Temp 21.2c	pH 7.19	OVA
Volume 30gal 35gal	Time 12:33 12:37	Turb 440 960 740	SC .456 .450	Temp 20.4c 20.8c	pH 7.18 6.97	OVA

Notes (i.e., weather, equipment status, other) Clear, 85°c Breezy (5-10mph out of South)

Development Oversight: Rick Hammons

Exhibit 1: **Monitoring Well Development Log**

Well No. MW07

Date: 7/24/00
7/25/00

Depth from top of well casing: 11.88 bgs

Top of water (ft.) 14.38 -2.5(SD)

Bottom of well (ft.) 26.24 ΔH 11.86

Well diameter (in.) 2"

Top, sampling interval 8.0'

Bottom, sampling interval 28.0'

V = 0.0408 x ΔH(ft) x D(in)^2 1.94 (gal.)

5 x V = 9.68 (gal.)

Well Development Technique:

- ☑ ~~Redi-Flo 2~~ submersible pump Blue Whale 12V DC
- ☑ Surge Block PVC
- ☑ Bailer Weighted
- ☐ _____

Ground Water Parameters:

		±10%	±3%	±1°C	±0.2	
Volume 2gal	Time 1300	Turb 990	SC .881	Temp 25.0	pH 7.21	OVA /
Volume 4gal	Time 1304	Turb 990	SC .818	Temp 22.5	pH 7.28	OVA
Volume 5gal	Time 1410	Turb 990	SC .919	Temp 25.2	pH 6.88	OVA
Volume 6gal	Time 1412	Turb 990	SC .900	Temp 23.1	pH 6.42	OVA
Volume 7gal	Time 1416	Turb 990	SC .833	Temp 21.9	pH 6.65	OVA
Volume 8gal	Time 1417	Turb 990	SC .794	Temp 21.6	pH 6.61	OVA
Volume 9gal	Time 1419	Turb 990	SC .797	Temp 21.4	pH 6.49	OVA
10gal	1423	990	.805	22.2	6.65	

Pumped dry at 4gal.

Notes (i.e., weather, equipment status, other) Clear, 85°F, breezy (5-10 mph out of south) Well pumped dry after 4 gallons removed. Let well recover and continued development with weighted bailer. Bailed dry after 10.5 total gallons removed. Parameters stable after 10 gallons removed. 7/25/00 removed another 10 gallons w/ bailer in attempt to clean up well and remove sediment.

Development Oversight: Phil Hammond

Exhibit 1: **Monitoring Well Development Log**

Well No. MW07

Date: 7/24/00
7/25/00

Depth from top of well casing:

Top of water (ft.)_____
Bottom of well (ft.)_____
Well diameter (in.)_____

Top, sampling interval_____
Bottom, sampling interval_____
$V = 0.0408 \times \Delta H(ft) \times D(in)^2$_____(gal.)
$3 \times V =$_____(gal.)

Well Development Technique:

- ☑ ~~Redi-Flo~~2 submersible pump Blue Whale 12 V DC
- ☑ Surge Block PVC
- ☑ Bailer Weighted
- ☐ _____

Ground Water Parameters:

Bailed Dry

Volume 105	Time 1426	Turb 990	SC .800	Temp 21.8	pH ~~7.05~~ 6.96	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA

Notes (i.e., weather, equipment status, other) Clear, 85°F, breezy (5-10mph out of south)

Development Oversight: Rhel Hammons

Exhibit 1:

Monitoring Well Development Log

Well No. MW08

Date: 7/24/00
7/25/00

Depth from top of well casing: 20.52 bgs

Top of water (ft.) 23.28 - 2.76(SU)
Bottom of well (ft.) 28.00 ΔH 4.72
Well diameter (in.) 2"

Top, sampling interval 10.0'
Bottom, sampling interval 25.0'
V = 0.0408 x ΔH(ft) x D(in)² 0.77 (gal.)
SJ x V = 3.85 (gal.)

Well Development Technique:

- ☑ Redi-Flo 2 submersible pump Blue Whale, 12V DC
- ☑ Surge Block PVC
- ☐ Bailer
- ☐

Ground Water Parameters:

	Time	±10% Turb	±3% SC	±1°C Temp	±0.2 pH	
Volume 1gal	Time 1340	Turb 990	SC .6737	Temp 22.5	pH 7.68	OVA
Volume 2gal	Time 1342	Turb 990	SC .686	Temp 22.0	pH 7.61	OVA
Volume 3gal	Time 1344	Turb 990	SC .665	Temp 22.4	pH 7.57	OVA
Volume 4.5gal	Time 1355	Turb 990	SC .663	Temp 25.6	pH 7.77 7.50	OVA
Volume 5gal	Time 1366	Turb 990	SC .668	Temp 22.3	pH 7.25	OVA
Volume 5.5gal	Time 1234	Turb 990	SC .649	Temp 20.4	pH 6.40	OVA
Volume 6.5gal	Time 1237	Turb 990	SC .637	Temp 19.4	pH 7.15	OVA
7.5	1239	990	.627	19.2	7.09	
8.5	1242	990	.622	19.0	7.06	

well pumped dry at 5gals. 7/25/00 ↓

Notes (i.e., weather, equipment status, other) Clear, 90°F, breezy (10-20 mph out of south) Parameters Stabilized not stable after 5 gallon removed. Well Pumped dry after 5 gallons removed. Left well recover overnight. Bailed more water out of well on 7/25/00 until parameter stabilized 8.5 gallons removed (total)

Development Oversight: Chuck Hammons

Exhibit 1: **Monitoring Well Development Log**

Well No. MW09

Date: 8/10/00

Depth from top of well casing:

Top of water (ft.) 28.5'
Bottom of well (ft.) ~~215.8~~ 215.2'
Well diameter (in.) 4"

ΔH 186.9'
Top, sampling interval _____
Bottom, sampling interval _____
V = 0.0408 x ΔH(ft) x D(in)² 122 (gal.)
3 x V = _____ (gal.)

Well Development Technique:

☑ ~~Redi-Flo~~ 2 submersible pump Redi-flo 2 submeisible pump
☑ Surge Block PVC on 1" PVC pipe
☑ Bailer metal sand bailer and PVC weighted bailer (2 gal) bailer pump
☐ _____

Ground Water Parameters:

Volume 130	Time 1555	Turb 990	SC 7.74	Temp 22.5	pH 8.47	OVA ____
Volume 134	Time 1605	Turb 990	SC 7.17	Temp 21.7	pH 8.38	OVA ____
Volume 138	Time 1610	Turb 990	SC 7.17	Temp 22.0	pH 7.87	OVA ____
Volume 142	Time 1615	Turb 990	SC 6.92	Temp 23.4	pH 7.91	OVA ____
Volume 146	Time 1620	Turb 990	SC 5.52	Temp 20.9	pH 8.49	OVA ____
Volume 148	Time 1628	Turb 990	SC 5.00	Temp 24.4	pH 8.42	OVA ____
Volume well is dry	____	Turb ____	SC ____	Temp ____	pH ____	OVA ____

Notes (i.e., weather, equipment status, other) Clear, 100°F breezy (5-10mph out of south)
16:45 add 20 gallons potable water to well to assist in sand removal
Surge screen interval of surge block. Bail out 52 more gallons until well
is dry.

Development Oversight: Rhel Hammons

Exhibit 1: **Monitoring Well Development Log**

Date: 8/11/00 8/11/00 pmh

Well No. MW09

Depth from top of well casing:

Top of water (ft.) 146.0'
Bottom of well (ft.) 215.2'
Well diameter (in.) 4"

ΔH = 69.2'

Top, sampling interval _____
Bottom, sampling interval _____
V = 0.0408 x ΔH(ft) x D(in)² 45 (gal.)
3 x V = _____ (gal.)

water in well came up to 146.0' b+oc overnight

Well Development Technique:

- ☑ ~~Redi-Flo-2 submersible pump~~ Redi-flo
- ☑ Surge Block PVC on 1" PVC pipe.
- ☑ Bailer PVC weighted bailer (2 gal volume), Metal Sand bailer (2 1/4 gal)
- ☐ _____

Ground Water Parameters:

Volume 200-210 pmh	Time 0858	Turb 990	SC 11.9	Temp 22.3	pH 9.77	OVA
Volume 210-220 pmh	Time 0915	Turb 540	SC 12.5	Temp 21.3	pH 9.20	OVA
Volume 220-230 pmh	Time 0925	Turb 990	SC 12.4	Temp 21.5	pH 8.60	OVA
Volume 230-240 pmh	Time 0933	Turb 990	SC 11.2	Temp pmh 21.3	pH 8.75	OVA
Volume 11.18 drop at 240 gals removed	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA
Volume	Time	Turb	SC	Temp	pH	OVA

Notes (i.e., weather, equipment status, other) Clear, 98°F, breezy (5-10mph out of south) Second pH not calibrated. Bottom at 240 gallons removed well to dry again development complete. SC probably too high due to bad calibration.

Development Oversight: Phil Hammons

APPENDIX E.1

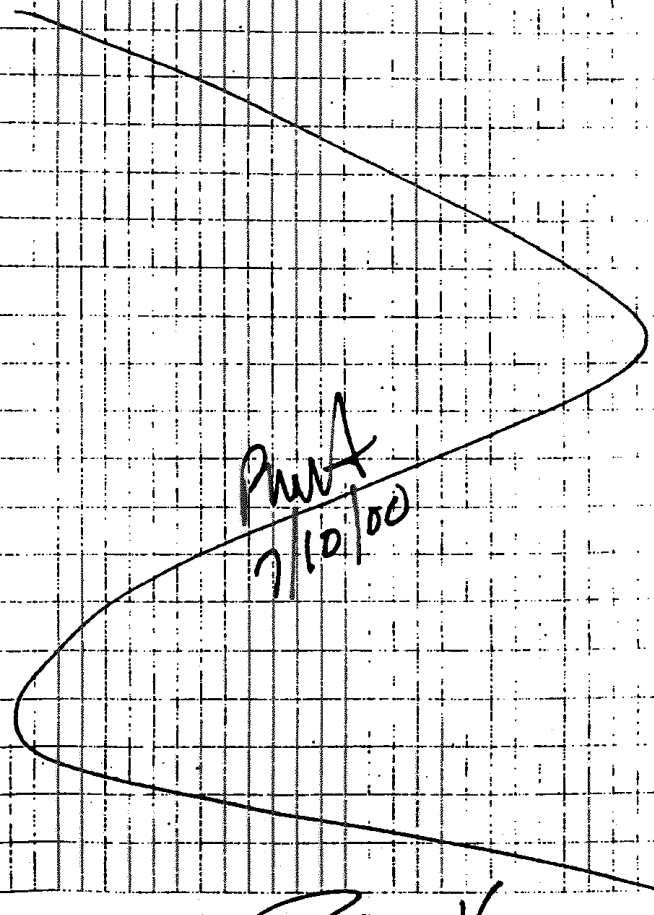
Geologist Field Notes

CONTENTS

PAGE NO.	REFERENCE	DATE

7/10/00 Monday

15:30 Arrive at OK City Airport
15:30 Arrive in Altus OK.
16:00 Meet with Rodney for site orientation and equipment Check



7/11/00 Tuesday

0800 Meet w/ Rodney Hickmon for Bottle count and supply organization.

09:45 Go to Ace to buy field supplies
11:00 Arrive on-site at AMS No. 7
11:15 Baker Tank arrives with two roll offs, tarp covered

11:50 Completed loading bins
12:15 Ayon Chemical Ramamos w/ portable toilet.

12:30 Ayon leaves

12:50 Finish Recon'g site
13:00 Leave for Altus
13:30 Arrive back at Altus for more shopping

15:40 Meet w/ Rodney to discuss sampling protocols.

7/12/00 Wednesday

0800 Met Rodney to Pre fill out COCs, Sample Collection logs and sample labels.

0900 Lining truck tailgates w/ Plastic Sheeting
10:10 Run to Wal Mart for ice
10:30 Leave for site
11:00 Arrive at AMS No. 7
11:05 Prime Equipment Rental arrives w/ Bobcat for Driller
11:20 Prime E. leaves site
11:45 Houzon driller shows up
Mike Seiger, Superintendent
Richard Reherman, Driller
Harry ~~Gerbetta~~ Beeman, helper
two support vehicles w/ Haulers

12:10 Begin Decon Pad construction
12:30 Roy Wedell Sup.
Gabe Perez driller
Tommy Jordon helper
Peter Bill Lucas helper
Joe Rodriguez hel.

Peterson Drilling, Amarillo, TX.

1315 H&S Briefing and Tailgate Mtg

1350 Begin initial hole to set mud pit Driller "Gabe Perez"

0-2' Sand w/ some silt, light brown 5YR 5/6, fine grained, poorly graded 15% silt, trace soft caliche nodules, SM

20' Sand w/ some silt as above

30' as above

36-40' as above w/ Caliche layers

60' - Sand medium grained w/ clay clasts and caliche nodules

80' - as above

84' - TOB
Sandstone, mod reddish brown 10R 4/6, fine grained.

~~pm~~ 15:31 Finish coring 5' into bedrock 88'-93'

88'-93' 5/5"
Sandstone, mod reddish brown 10R 4/6, v. fine gr. Prominent low angle crossbedding, hard fractures at 6" spacing.

~~pm~~ 16:10 lay mast down on rig, for the day will ream and set casing tomorrow Morning

16:40 Leave site for the day

17:15 at Hotel

Rec'd
7/12/00

6 7/13/00 AMS No. 7

0704 Arrive on site

Peterson Rig to set Casing to isolate Seymour Aquifer is a Gardner-Denver 1500, Driller - Gabe Perez

07:30 begin reaming pilot hole w/ 12" tricone bit. Original pilot hole drilled w/ 4 1/4" tricone

0800 Reamed to 55'
0825 Reamed to 80'
0835 Carol Weis arrived onsite
0843 Carol decided that 230' is max depth to coax on BH-09
Carol 918 669-7519 direct
0910 T.D. at 98' reaming
0920 ~~pmk~~ 7/13/00
0930 finish Cleaning out borehole w/ fresh water
0945 Welding wings on casing as centralizers
10:00 finish Welding wings on casing
0955 Water downed grass beneath welding to prevent fire

Paul Hammond

7/13/00 7

11:30 45' of casing in the ground and the casing ~~is stuck~~ has hit a hard spot. The hole appears to have sluffed in to about 45' bgs.
11:45 Drillers advance casing to about 50' bgs but will go no further, will have to come out of hole w/ casing and ream hole again. This time Drillers will mud up.
12:00 Break for lunch
13:00 Back at site
13:40 Drill Crew shows up. Bill ~~from~~ pmk takes water truck to refill. We are still awaiting Roy who is looking for supplies including a lanyard.
14:15 Roy back onsite
14:30 begin coming out of hole w/ casing
14:50 All casing out of hole
16:10 Hole has been mudded up sufficiently and now topping out of hole

Paul Hammond

8 7/13/00

16:50 Tripping into hole w/ Casing. Bottom of casing at Head at 91' bgs (7' into bedrock).

17:30 All casing in the hole

17:40 Shut down due to thunderstorms

18:10 Resume work, placing tremie pipe in hole.

19:00 Leave site for the day

AMA

7/13/00

7/14/00 AMS No. 7 EST 9

0700 Arrive at Site

Weather

Temp high 102

low 70

Wind 5-10 mph

0710 Safety Mtg

0720 Going down hole w/ tremie pipe took casing off pipe to allow better access down annulus

0810 95' of tremie down hole, bottom at 89' bgs

0815 Placed 3 bags of bentonite chips in casing to prevent cement from coming up the casing

0830 Grout mixture (45g hopper)

25 gallon Water

3 bags Portland

6% bentonite

0920 5 batches of grout in hole.

10:30 Grout to surface 36 bags of grout 12 batches.

10:50 Isolation casing cut at surface

11:45 Return and Horizon Remove Site Cleaned up

11:50 Sampling SS-08
12:20 Finish sampling SS-09
12:30 Leave site to process samples
13:10 Packing samples at Hotel
14:00 Drop off samples at Fedex Drop.
14:15 Doing paper work and Reports
15:15 Finish for the day

Paul H
7/17/00

Paul Hammerons

7/17/00 Monday
0700 Meet Rodney H. to collect bottles / ice for Rinsate and surface soil samples.
0800 at AMS No. 7. start sampling surface soils at SS10
1030 completed surface soils sampling SS10, 05, 06, 07, 08 EB
11:00 Jerry Pioneer shows up w/ Reagent grade water and coolers
11:35 Bullers show up - Richard Peterson
12:00 Support truck shows up w/ Alan Brantley (supervisor) Wes Dawson (helper)
12:30 Deion Backing Rig
12:40 Setting up on BH 09.
11:50 Rodney leaves to shuttle samples to Fedex and fax COCs to Elton
13:25 Allan called Pump Rental and Pump will not be in until tommorrow so we will start on shallow holes BH-07
13:50 Setting up at BH-07
14:50 Rodney shows up w/ bottles
15:00 Start bulley w/ HSA at BH-07

Paul Hammerons

12 7/17/00

16:00

17:40 at 50-55' run, core barrell gets stuck in augers.

18:10 Can not get core barrel unstuck. Start Pulling all augers and rods

19:00 Leave site for the day All Augers out of hole

7/17/00

13

7/18/00

0700 Onsite at AMS No. 7

0705 Measure Water level in open hole 11.3' bgs.

Jim Watkins - new hand for Horizon

725 Tailgate Mtg

735 Going down hole w/ augers Lithologic logging

Name (USCS code), color, grain size sorting, silt/clay %, gravel %, other

0845 Cable jumped winch, have to lay derrick down to fix.

0745 Pulled from 55 to 65' w/o sampling. from 65' to TD will sample with 2' spoons (2" Diam) thru auger catcher. Rig uses down hole hammer on wire line:

0937 Up and running sampling from 65-67'

0955 Sampled from 67-69' then augered ahead to 69' bgs

7/18/00

69-71' Sampler in augers

73-75' Struck sampler in augers

11:45 Allan's down up w/ new cables for winch - Dallas putting it on

12:00 Sampling surface soil at BH06 and BH08.

12:15 Break for lunch

12:45 Back to Work

13:00 Tripping in hole w/ truck and rod to drill out sand in augers

13:20 Weigh daily out sand.

14:10 Sampled from 75-79' at 2' intervals

14:15 Sand in augers again

14:30 Ran Augers down to bedrock at 85.5' hrs and then washed augers out.

7/18/00

1550 Make run w/ 5' barrel from 83-87' to collect last sample of sand above bedrock

16:00 Core barrel is locked in sand so will pull augers and rods together

16:25 20' of auger out of hole

16:50 45' of augers out of hole

17:20 All augers out of hole

17:40 Collected sample of SS at 85'

Thul Hammes

7/18/00

17:50 Drillers set up on next hole BH-09

18:00 Flushing mud out of casing

18:15 100 gallons of mud flushed out of hole

18:30 Leave site for the day

7573

PMH

7/18/00

Thul Hammes

7/19/00

06:30 Onsite at AMS No. 7

06:50 H&S Mtg

07:00 Getting ready to pump mud out of hole

0740 Pipe down to 91' bgs and start to core.

0805 Drill thru grouted casing to 98' Bottoming rammed hole

0830 Core from 98'-108'

Excess water is coming out of hole while coring - looks like isolation casing did not seal off upper saturated aquifer.

0840 Coring barrel - silty sandstone and sandy siltstone. dry.

Water in hole is coming from upper aquifer

0850 Shut down to discuss problem

0930 decide to abandon hole and reset isolation casing.

0940 Coming out of hole w/ pipe

Mike was called by Allan and informed of casing problem. Mike will call Allan and Peterson Drilling.

7/19/00

10:30 mobbed and set up at BH07 to install well, well install well in new hole 7' feet north of borehole since BH caved in to 10' below g.s.

1050 begin augering to install MW07 in new hole

11:25 begin setting MW07

11:30 Sanding hole

12:00 leave for Altus to fax Lithologic log to Mike Sever

12:40 On way back to site, phone call w/ Mike Sever. Mike proposes we Cement bond log the casing at BH-09 to determine seal. If seal is bad there is no cost to MK. If seal is good MK pays for it $650. 350 logging 300 mob

13:10 back onsite

15:50 Start drilling at BH06

16:10 T.D into weathered bedrock at 80' bgs 79'

16:15 Collect last sample S-76

16:35 Auger out of hole and at decon pad.

16:45 Leave site for the day

Paul Hammons

7/19/00

1310 Called Jerry Prowse to inform on Mike Sewells Proposal. Jerry concurs with proposal and instructed to go ahead w/ scheduled logger.

18:00 Logger is scheduled to arrive Thursday (7/20) at about 9:00am

pmt
7/20/00 pmt
7/19/00

Paul Hammons

7/20/00

0600 Packing Samples for Fedex Drop off

0715 Arrive onsite

0730 H&S Mtg

0740 move about 7' north to install MW04

0830 Logger out of Wichita Falls shows up (Mastin Wireline Services, Inc.)

10:00 Start running cement bond log at BH09

11:00 Break for lunch

11:35 Setting up at BH-08 to drill

12:00 Start augering at BH-08

~~1610:20~~ pmt 7/20/00

10:30 Logging complete and Logger printing copies. Bond log shows good cement bond from surface to ±55' from 55' to 88' partial bond a bad seal. Tool bottomed in hole at 95' bgs but detector is 7' off bottoming tool

11:00 Call Karl Sewell and inform him of results, accuracy, Petersons decision

11:20 Jerry drives to Altus to fax ~~pmt~~ Fedex 3 copies of log to Peterson

11:342:00 Alan leaves site for the day

Paul Hammons

7/20/00

12:00 (cont) pmh 7/20/00

11:30 (cont.) Alan will fax copy of log to Peterson before leaving Altus.

16:30 Dulley at BH-08 at 70' bgs.

15:00 Jerry Ponessa called and informed me that Mike and Hem had discussed Change Order for coring by Peterson. They decided on 500 w/ no markup for coring.

17:30 T.D. at 85' bgs at BH08 Collect sample directly above bedrock

EB on spoon of tri decon

18:10 Packing up supplies

18:30 Leave site for the day

PMW
7/20/00

Phil Hammond

7/21/00

0730 Arrive on site

0740 Tailgate Mtg.

0815 Moving rig 7 feet south to install MW08

0845 Augers down to 25' bgs Well set screen from 10-25'

0820 Water level in open hole is 15' bgs

0830 Measure sound of auger rig down augers UF2 to 86.6 behind rig and at Cullers Stand. Marin UF1

95-99.9 at engine

0945 MW08 installed and seal set

1000 Start Pad installation and soil clean up at MW-08

1200 Pad and bollards at MW08 Complete

12:40 Bollards painted at MW08

1240 Start Pad construction at MW07

14:10 Surface Completion at MW07 complete

1330 Grouting BH-06 and constructing frame for pad

Phil Hammond

22 7/21/00

15:45 Surface completion at MW06 complete

15:50 Drillers demobing

16:30 Leave site for the day

7/21/00
PDMA

Chad Hamm

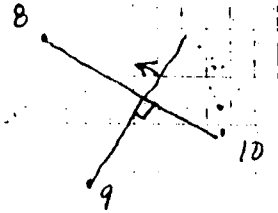
7/24/00.

23

0900 on site

0800 Fedex packages, make copies and get supplies

0915 Measure water levels and calculate purge volumes for MW06, 07, 08



0955 Finish calculating purge volumes on all three shallow wells

1046 Drillers show up
Richard, Wes, Tim

11:50 Begin development at MW06

12:40 Well Development complete at MW06

12:50 begin development at MW07

13:10 pumped MW06 dry, waiting for recharge

13:20 Let MW07 set to recharge

13:30 start development on MW08

1345 pumped well dry

Chad Hamm

24 7/24/00

13:50 Set up on MW07 to bail
Bailed dry at 14:15 w/ 10.5 gals removed
14:00 Richard left Jim go to get more water for tommarrow
15:00 Leave site for the day
17:00 Steve Roe calls to know Rodney's availability
17:15 Unpicking Pump delivered from Geotech.
17:45 Done for the day

MWA
7/24/00

Bud Hammons

25

7/25/00

0840 Arrive onsite
0850 Start Development on MW-07 to remove more sediment from well.
0920 Ray and Tony of Peterson Show up
0920 Allan of Horizon shows up.
0930 begin welding casing at BH07 to pressure grout
1015 remove another 10 gallons from MW07 to lower turbidity
1025 Cement truck and Compressor truck arrive onsite to pressure grout Peterson has subcontracted pressure grout to FCI out of Electra, Tx.
11:25 finish grouting casing grout returned to surface. Seal was not good even in upper part of formation
11:30 Cleaning pump out w/ water
11:45 Peterson and FCI service
13:00 leave site for the day
13:30 back at Hotel. Inventory supplies for GW Sampling

Bud Hammons

7/26/00

0720 at site forgot Key have to go back to Hotel
0820 Redrive at site
0830 Tadgale H&S Mtg
0840 Setting up to sample MW06
0950 Tubing Coco not fit connectors, Rodney goes to town to get new fittings.
1005 108.6 on control box is 0.5 L/min
107.8 " " .5 x 134/60 - 0.224 l/m
.5L / 134 sec = .00373 L/sec x 60 sec/1 m. = .224 l/m
1055 Begin Pumping at MW06
For 30 sec measurement L x 2 = L/min
0330 Finish sampling MW06 QA/QC
1350 Leave site to pack samples
01420 at Walmart getting ice
1435 at Hotel packing Samples
1530 finish packing samples, Rodney shuttles samples to Fedex
1540 Filling out paperwork
1730 Paper work complete.

Paul
7/26/00

Paul Hammon

7/27/00 Thursday

0700 Arrive at site
0705 take pressure ripple off well head
0710 1st rod w/ bit that core barrel sets in is 13' long.
0715 Measuring SU at MW06
2.38 above pad + 1.5" to ground
2.53
0725 Casing cut off at BH09
0735 Drill bit (roller cone) is 1.35' long
0751 Wesard Richard arrive on site
0805 Drill bit on top of grout
65.0 + 1.4 = 66.4 - 1.7 (SU) 64.7'
approximately 26' ft of grout in casing
91 - 65 = 26
0820 Begin reaming out grout in casing
0825 75' of pipe in hole
0835 80' of pipe in hole
0845 85' " " "
0900 90' " " "
0905 95' " " "
0915 at 91.0 hrs hole began to make water bit is at casing casing

Paul Hammon

7/27/00

0920 100' of pipe in hole
0922 96.5' bgs w/ manned hole
T.D. hole making cuts & water.
0925 Awaiting logging truck to run Cement bond log.
1035 Logging truck arrives on site.
1100 Logging complete, downhole tool/cable pass
1130 Loggers demob site
1200 Leave site for lunch and to fax logs to Lee Peterson
1315 Back at site
1320 call Jerry Pioneer and inform on logging results
Jerry decides that a conference call w/ USACE/MK/Horizon is needed on Monday 7/31/00, before we procede.
1430 Dallas demobing from site
1500 leave site for the day
1545 preparing faxes to Carol Wesnal Joel Siegel and Jerry Pioneer and Daily Paperwork
1730 Paperwork finished

PMA
7/27/00

7/28/00

0754 ~~0850~~ Arrive onsite
0845 Begin sampling MW07
0925 Parameter Stable
0935 Collect sample AMS7-MW07-GW
10:30 Leave site to pack and ship samples
11:05 at Hotel packing samples
11:20 Rodney leaves to await pickup on bobcat and compressor by Rental company and close gate
final stainless steel funnel
12:15 Finish packing samples
12:20 Rodney leaves to await pickup on bobcat and compressor by Rental company and close gate
1330 drop off samples at fedex and make copies of Daily Reports
1400 Labels Rinsate Sample labels
1515 talk to Jerry about Casey Resolution.

PMA
7/28/00

7/31/00

0630 Complete info for Joel

0645 Fax to Joel

0745 Arrive on site setting up on MW07

0810 Begin purging MW07 - low flow

0830 Parameters stable and sample collected for Fl/NO_2/NO_3 - 1 bottle.

0900 Set up at MW08 - preparing to low flow purge.

0915 Begin purging

0920 Water very turbid - will allow the well to low flow purge for 20-30 min w/o measuring parameters to clean up well.

0950 3.4 gallon removal - pump is acting up. appears there is not enough head above the pump intake to allow it to pump.

0955 Pull pump out of well and clean

10:05 Back in hole and restarting pumping

10:20 Flow stops again - not enough head.

Phil Hammons

7/31/00

10:45 Pump well dry w/ pump on bottom w/ high flow rate

11:15 Supplies and equipment packed up and leave site

11:45 at Hotel

11:50 Talk to Clyde Murray of USACE Tulsa district about BH09 casing.

~~12:30 Stainless steel funnel arrives~~ ~~pmh~~

13:00 Stainless steel funnel arrives

14:00 Collect EB on pump cleaned from MW07

1515 Drop samples off at Fedex

7/31/00

Phil Hammons

32

8/01/00

0730 Arrive on site

0735 Prepare to sample MW08 w/ bailer

0800 Sample collected

0830 Repurge MW07 to resample
Purge 2.5 gal at 0.30 L/m prior to parameter measurements

0860 Begin parameter measurements

0940 Parameter stable

0950 Collect sample at MW07

10:15 Site cleaned up.

10:30 leave site to pack samples

11:00 back at Hotel

11:30 Drop off samples at Fedex

Supplies Needed
Gatorade
3 paper towels
bottles for MW06 PCB/Tox
trash bags

Hours
14 | 16+ | 45 + 48 | 74+
14 9 | 11+ | 90 + 48 | 79+
+500 comp
? +700 logging

Phil Hummon

33

8/01/00 6hrs

Supplies: Bread, cheese, meat
Yogurt (6), juice, bananas
mayonnaise, TV dinners 3

1210 Jerry Pioneer shows up for lunch

1300 Monthly update GDMS No. 7 w/ Jerry and Rodney

1400 Jerry leaves for Fredrick

1635 Karl w/ Horizon calls about additional costs for pumping water out of casing

1652 Additional cost faxed to Hotel

1700 Call Jerry Pioneer about costs prior
Houzer suggest buying a pump to remove stagnant water in isolation casing that probably has some crude oil from logging tool and cable. Proposal seems unacceptable since rental of 4" groundfos is far cheaper than purchasing pump.
On second logging run on 7/27/00 down hole cement bond tool and cable had crude oil on it from former job in the oil field. Decision was made to allow tool down hole since hole is cased off by isolation casing and

Phil Hummon

08/01/00

Casing and location purged by air or water pump. Any Crude oil contamination can be removed by purging and water replaced by clean aquifer water coming from bottom of casing at 91.0' bgs.

1030 Jerry informs drillers will have 4" groundhog on site tomorrow to purge casing.

Estimated casing volume on 8 5/8" casing is 3.0 gal/ft x 70' = 210 gallons

8/01/00

Phil Hammons

08/02/00 11½ 24½ W

0700 Rodney onsite, Baker tank delivers another 25 yd roll off w/ liner

0730 Phil shows up on site

0745 Drillers, Mike, Wes, Allen show up on site.

0800 Preparing to go down hole w/ 4" pump to evacuate casing

0835 Generator arrives on site to run pump

0900 Set Pump intake at 40' bgs

0910 Begin pumping casing

0915 Water drawn down to pump intake lowering pump another 20'

0935 Avg water drawn down to pump intake at 60'

0950 Water drawn down to 80' bgs

1010 Water drawn down to 91' bgs - base of casing 635 gallon removed

1015 Flow rate into well casing is ≈ 9 gal/min

1100 4" PVC placed in isolation casing to decrease mud necessary for base of casing bedrock. PVC base at 92.8' bgs

Phil Hammons

08/02/00

1125 Going down hole w/ core pipe bit (13') 11/1111

Placed 2 buckets and 2 bags of bentonite chips (200 lbs) around PVC casing to get water seal

1140 break for lunch

1220 begin coring at 92.5'

1310 at 101' bgs

1314 another 5' add'l 108'

1326 at 103' bgs add 5' pipe 113'

1348 at 108' bgs add 5' " 118'

1407 at 113' bgs add 5' " 123'

1423 at 118' bgs add 5' " 128'

1423 at 123 bgs add 5' " 133'

1453 at 128 bgs add 5' " 138'

1507 at 133 bgs " " 143'

1515 at 138 bgs " " 148'

1540 at 143 bgs " " 153'

1547 at 148 bgs " " 158

1520 have lost about 100 gallons of mud into porous sandstone above 138'

1601 at 153 bgs " " " 163'

1619 at 158 bgs " " " 168'

1702 stop to refuel rig

Phil Hammers

08/02/00

1644 at 163' bgs " " " 173'

1653 at 168' bgs add 5' pipe 178'

1655 Mike Saver adds Insta Vis to well pit to increase viscosity. Stop briefly to inform drillers that liquid polymer is not allowed

17:00 Shut down for the day.

17:20 Drillers will have to flush Casing / hole and mud pit of liquid polymer in morning prior to further coring.

17:35 leave site for the day

18:05 at Hotel doing paperwork

19:30 finish paperwork

Phil Schlecker

Phil Hammers

08/03/00

0700 arrive on site

0710 Preparing to pump used mud out of mud pit into new rolloff

0815 Trouble pumping and cleaning out mud pit

0820 Waiting on Wess to return w/ more water

0827 beginning at 168' bgs 178' pipe

0835 at 173' bgs add 5' pipe 183' pipe

0843 at 178' bgs " " " 188' pipe

0923 at 183' bgs " " " 193' pipe

10 00 at 188 bgs " " " 198' pipe

0925 lost about 150 gallons of water to Fm above 183' bgs
lost another 100 gallons of water to Fm between 183-188' bgs

1108 at 193' bgs " " " 203'
~~at 198' bgs " " " 208' pms~~

1115 Break for lunch

11:45 Back to Drilly at 193' bgs

11:55 Shut down, PVC casing dropped and broke joint at surface have to repair

11:56 PID reads 1500 ppm off outlet to mud pit

Jerel Hammons

8/03/00

Gas bubbles diffusing from mud in pit.
Gas is coming out of solution in mud probably or possibly natural gas in fractured shale is giving high PID readings

1209 back to drilling

1217 at 198' bgs add one five' to 208'
Broke pipe 690 ppm at pipe head.

1236 back to drilly at 198' bgs 208' pipe

1304 at 203' bgs add 5' to 213'

1305 Chain on water pump breaks so shut down to fix

1340 Chain fixed

1419 at 208' bgs add 5' to 218'

15 at 210' bgs TD.

1600 all pipe out and pulling PVC (4") Isolation casing

1630 Rig moved off site to next borehole and driller staking augers on it.

1645 Allan leaves w/ drill rig

1700 leave site for the day

1730 back at Hotel long Paperwork

MWH
8/3/00

Jerel Hammons

08/4/00

0630 Get supplies for sampling at Walmart.

0709 arrive at site to sample Bin 1 for waste characterizations

0720 Bin sampled

0745 Sampled packed for Saturday Delivery

0800 leave site

0830 at Hotel organizing field supplies and doing paperwork

11:30 Go to fedex to make copies and drop off packages

13:00 Done for the day

DMH
8/4/00

08/07/00

0700 Supplies to get
Generator
3 Solium vials crystals
2 Env Health tubes
Call Ellen

Rental A&L 2200 Falconhd
Rent City 1025 N. Main

0750 Arrive on site after picking up generator for sampling

0815 Set up at MW06 to test pump and generator

0845 Generator works and does not trip converter

0950 Still waiting on Dull Rig to ream BH09 for well installation

1100 Dull Rig delayed will be on by 1200-1300

1138 Measure PID reading on open Isolation area >2000 ppm

1200 Break for lunch

1300 Venture Drilling shows up - Placing drill pipe in borehole and putting bit. Dull Rig is a Gilbert 540K percussion Hammer rig

DMH

8/07/00

1420 set up on cleared tripod pipe to hole
We are using tricone bit instead of downhole hammer so not to introduce oil into airstream that hammer rig technique requires

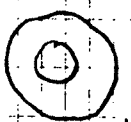
1430 80' in hole
1625 Reamed to 200' bgs
1645 last 20' reamed T.D. at 220' bgs
1646 cleaning up hole w/ bit off bottom
1710 Tripping out of hole
1735 leave site for the day
1800 at ~~Hotel~~ Hotel doing paperwork

Mat
08/07/00

Phil Hammon

8/08/00

0700 Arrive on site
0720 Preparing rig to retrip truck in hole to clean bottom of hole up.
0750 tripping out of hole w/ pipe
0820 out of hole w/ pipe
0845 leave site to get Houlo U-22 at Hotel
0945 back on site, 75' of casing in hole, centalizers every 20' 25' of screen.
1045 25' of screen and pipe in hole Rig getting off hole.
12:25 Collect sample at MW06 resample for PCB/Tox analysis
1340 Begin pumping MW09 to place sand filter pack. Pump set at about 210' bgs.
1400 Begin placing filter pack



8" $\pi r^2 \times h$ 221 − 183 = 17 + 21 = 38'

1700 Filter pack at 199' bgs
Will place sand to 183' bgs

Phil Hammon

8/08/00

1800 15 bags of sand in hole
Weighted tape got stuck on
bottom centralizer
1830 1815 unstick tape
1835 leave site for the day
1905 Back at Hotel

8/09/00

8/02/00

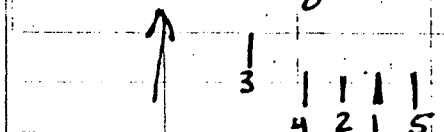
0700 Arrive on site
0710 Tailgate Safety Mtg
0715 Drillers cutting weight on weighted tape.
0750 Pumped well for 10 min in attempts to lower sand
0800 No drop on sand pack top at 182.0' bgs
0815 Preparing to grout hole
Will place bentonite slurry from 182 to 120' bgs and cement from 120' - ground surface.
0830 leave site to make copies at Altus
1015 Back on site, bentonite seal set to 146' bgs, and place cement to surface
1113 1st batch of cement set in well
1117 mixing 2nd batch
1215 Grout Returned to surface
1217 Cleaning out grout pump on rig.
1230 Remove pipe out of hole
1250 Coming out of hole w/ 4" pump
1305 pumping out of hole

8/09/00

1310 Break for lunch
1340 Back to Work.
1350 T.D. at base of well 215.5
- 4.0
211.5'.

1355 Grout in steel casing has dropped 15'. Have to add more.
300 gallons used so far
110 gallons of Bentonite slurry

1425 Roll off bins



1425 Begin transfering water from Bin 2 to Bin 4
1535 Stop transfering in order to mix grout to top of hole
1605 Back to transfering water from Bin 1 to Bin 5
1635 stop to help move dirt
1805 leave site for the day

Phil
8/10/00

Phil Hummel

8/10/00

0655 Arrive onsite
0720 Drillers arrive onsite
Mike is getting a welder
0745 Grading site around MW09 and settling pit
0830 Time est. lost due to casing caps 1 1/2, 1/2, 1/2, 1 1/2, 1, 1
Time est. lost due to deep bedrock at shallow wells 1 1/2
Time est due to sloughing sands 1
0845 Mike arrives on site, preparing to develop MW09.
0915 Development pump set at 200' bgs.
0945 begin pumping well at 4.5 gal/min If well is dry will take ~7 mins
1002 4 gal min
1005 Pump cuts off ~~not enough~~, not getting power, rewiring lead to generator
1025 Pump back up and running 4 gal/min
1045 Pump converter blew up, hung other converter - did not work
1100 Decide to bail well w/ sand bailer

Phil Hummel

8/10/00

11:10 Water level at 97'
77 gallons left in casing
1130 Start sand bailing
1158 25 gallons removed
1205 water level at 143',
1234 water level at 175'. 55 total gallons removed
Need to get Daily footage from Mike
1310 water level at 205' 75 gal removed
1325 well bailed dry ≈95 gal removed
1339:30 measuring time taken to raise a ft in well
1346:20 raised one' at 211.9
1355:10 at 210.9
1401:46 at 209.9
1409:10 208.9
8/10/00 203.9 pmh
1510 Closed all drums and cleanup upside.
1554 water level at 200' bgs begin bailing again
1630 additional well is dry
1645 add 40 gallons to well to assist in cleanup of sediment

Paul Hammond

pmh 8/10/00
1445 water out of well is very turbid
1645 and sediment laden
1755 Begin surging w/ PVC surgeblock w/ 220' of 1" pvc in hole.
Surge 3' sections at a time
1815 Begin bailing water out of hole after surging
1928 Shut down for the day
Bailed 52 gallons out of hole
Will continue development tomorrow
1935 leave site for the day

3.5
3.75
2.25

Paul 8/10/00

Paul Hammond

8/11/00

0710 Arrive onsite

0725 tag water in MW09 at 146 b toc

0740 opening down hole w/ surge block

~~0815 Surge block out of hole/run~~

~~0805 Rodney arr~~ pmh

0830 Rodney arrives onsite

0835 Surge block out of hole

0845 open in hole w/ PVC bailer

0850 PVC bailer breaks off

0855 open downhole w/ metal sand bailer

0950 Surging and Bailing complete. Well is dry again.

Hougens Costs dtd 7/28/00

Per diem	9 day	195/day
Waste handling	11 days	150/day
Other activities	0.5	90/hr
Decon	2 hr	115/hr
Development	3.5 hr	115/hr
Surface Completions	3	425/ea
Shallow Wells	79'	20/ft
Steel Casing	91'	68/ft
Auger Drilling	250'	20/ft
Mob/demob		2000
coring at BH09		

8/11/00

1000 Surveyors from OSD arrive onsite, They are setting up to survey

1055 Mixing concrete for pad at MW09

1150 Pad complete

1055 to 1230 welding top on gate

1230 take lunch

1300 back to ~~daddy~~ work

1440 bollards placed and painted

1450 drillers demobing

1550 leave site for motel

pmh 8/11/00

TOTALS	
1755	
1650	
45	
230	
402.5	
1275	
1580	
6188	
5000	
2000	
580	

Total 20,706
320
21,026

850
425

Air Comp 10' × 32 ft³ = 320

pmh 8/11/00

8/11/00

Hourgous Cost as of 7/28 - 8/11:

	Amount	rate	TOTAL
Air Rotary Coring	102'	32/ft	3264
MW installation	211.5 ft	33/ft	6980
Decon	0.5 hr	115/hr	57.5
Other Activities	8 hr	90/hr	765
Perdiem	6 dy	195/dy	1170
Washchange	84	150/dy	~~450~~ 600
Surface Completion		425/ea	425
well development	9.75	115/hr	1,121
Rental		160	110
Supplies			34
			21
			40
			205

1830 Arrive back at site to set pump in MW09. Set pump at 200' below top, 196' bgs. Water level at 150' bgs

1900 Started pump. Cannot get Mhz past 170' w/o tripping ground fault interrupter. Can not get flow to surface w/o tripping control box.

1930 leave site for the day

Shel Hammons

8/14/00

0800 Arrive onsite to sample MW09 w/ Layne

Water levels

42.46'	BTOC	MW09
23.65'	BTOC	MW08
15.07'		MW07
24.37		MW06

Start bailing MW09 at 0820

Screen interval 186-211 bgs

Went to bail from 200' bgs 3.5' SU

203.5' of rope.

0930 Finished sampling MW09

0940 Pulled protective casing at MW09

1000 Leave Dele for Ada

1030 at Hotel Removed equipment to office and Rental Supply store

1530 Finish packing and shipping supplies.

1730 Washing vehicle

1900 done for the day. Leave tomorrow morning at 9:10 out of OKC.

8/14/00

Shel Hammons

APPENDIX E.2

Sample Technician Field Notes

Job Code # 4423 0220.44.00.000043.0.20

Paul Hickman 7/10/00 7022

7:00AM - Drive to Atoka, OK
- W/Jerry Pidcock to Missile Site. Spoke to Jerry about details
- Spoke to Phil Harmon about project. review equipment
5:30PM - Off

PH

Pool Hickman 7/11/00

8:00AM - Inventory Equip. Make list of equipment that we may need more of
- TO the Hardware, Collect supplies
- TO Missik Site, Stake out BH 9, 8, 7, & 6, Heat Baker Tank Rig, & Port-A-Potty was delivered
- Read over Site Safety Plan
- Review how to Fill out COC & Labels for various containers
- Review how to pack sample coolers for shipping
- Review EnCore Sampling techniques

6:30PM - OFF

PH

Rod Hickman 7022 7/12/00 5

8:00AM - Work on paperwork - Samples - Index - QA, QC, etc
- TO Missile Site
- Bobcat was Delivered. Wait on Drillers to arrive & make sure They can clear the gate (overhead)

12:00PM - Horizon Drilling Arrives
- Peterson Drilling Arrives
- Horizon Stages Equipment
- Peterson Prepares to Drill BH09

2:00PM - Start Drilling @ BH09
Check properties of soil 0-2ft at BH09 Soil is SM type
- Surface 0-2ft fine sands
- 20' fine sands
- 30' " "
- 40' " " W/caliche
- 60' " " W/more Caliche
- 80' " " W/more Silts & some Caliche
- 84' Hit Bedrock
- Drilled 4' coal/stone
- 88' Total Depth to install Casing

Rod Hickson 7000 7/12/00

Cont.

- Drilled Core at 88' Hardrock Level to 93' - Sandstone Core
- Recovered Core - Simply Sandstone
- Drove Car to Hotel Casino Tomorrow
- Back to Room
- Shop for Supplies

6:00PM - OFF

8

9

Rod Hacker 7/13/00 7022

6:30Am - TO Missile Site
7:00Am - Safety Meeting
7:20Am - Drillers Start Reaming Hole & Cut & weld casing
- Spoke w/ Carol Weis She said 230ft Max. Depth on BH09
- Drillers stopped Reaming at 95' Prepare to install Casing
12:00PM - Casing Sticks at about 50'
- Drillers will have to pull casing back out hole & ream the hole
- Drillers Looking for Safety Harness so they can climb the tower (Peterson)
- Drillers start pulling Casing back out of hole
4:30PM - Mud Hole, Start pulling Bit back out to install Casing
- Install Casing. Prepare to ground. Stopped work due to lightning/weather

Rod Hickman 7/13/00 7022

Attempt to get trace in hole. No luck
7:00 PM - left site

PBD

Rod Hickson 7/14/00 7022

6:30AM - Go to site
- Peterson Drilling works w/Tremie Pipe to Grout hole
9:00AM - Prepare to Sample Soils Start w/SS12
- Sample Surface Soils at SS10 & SS11
Peterson Drilling finishes w/hole abandonment
11:30AM - H/p Peterson Crew
- Start Sampling SP508(QA,QC)
- Take Soil Samples at SS08 & SS09
- Take Soil Samples SS11 & SS12 SS13 & SS14 Soil Samples
- Packed in Ice & took to FedEx for Shipping
4:30PM - OFF Work

RH

Rod Hickman 7/17/00 TO22

6:30AM - Sort bottles for samples to be taken today
- Get Ice at Wal-Mart
- Drive to Site
- Take Soil Samples from SS05, SS06, SS07, & SS10 & Rinsate on SS06
- Pack Soil & Rinsate in Ice for Shipping

10:15PM - Took Soil & Water samples to Fedex
- Get Sample Jars & tools to take to field

10AM - Start taking Core samples at TH07

0.0' (PID) - 0-1½ ft, 15:10 PID=0
05' (PID) - 5-6 ft, 15:20 PID=0
10' - 10-11 ft, 15:25 PID=0
- Hit Groundwater at 11' stopped Sampling
- Continue drilling to refusal,
- Drillers Get Spoon Stuck at 55'

5:00PM - Fill out COC for AMS-TH07-00 05 10

Rock Hotrod- 7022 7/17/00

Cont..

6:00PM - Drillers start pulling augers out of hole to get spoon.

7:00PM - Exit Site

PJH

10 3/4
11. 3/4
12
12 1/4
10 1/4
58 ft

Rod Hickson 7/18/00 70's

6:30AM - Leave Room to go to site
7:00AM - Arrive at Site
- Check water in BH07, Water standing at about 11'
- Reduce Coc to BH07
- Calibrate PID Meter to 100ppm using isobutylene
- Drillers continue down BH07 (Hole caved in at 18' overnight)
- Drillers change to 2" spoon
8:45AM - Drillers break cable for spoon Repair Cable
- Start Coring at 3' intervals from 65' on
65'-67' - Sandy (core)
67-69 - Sandy from water (core)
10:00AM - Drilled on down to 69'
69-71' - Sandy (mostly water) Core
71-73' - Sandy (less water) Core Driller to 73'
73-75' - Sand comes into hole. Drillers have trouble getting next core
73-75' Sandy (less water) Core
11:00AM - Drill to 75'

Pool Hickman 7/18/00 7022

cont...

- Drillers Change cable so they can use hammer or spoon

12:00PM - Start Surface Soil Sampling
- BH06
- BH08

1:00PM - Drillers Continue to Clean Sand out of auger at about 75'
- Drillers retrieve core sample at 75-77' - Sandy

3:00PM - Repack samples for Shipping Via FedEx

3:00PM - Drillers reach backout @ 85'

3:30PM - Took Samples into FedEx

5:00PM - Back at Site
- BH08 caved into 11'
- Drillers Clean up

5:40PM - Take soil samples at 85' of BH08

6:45PM - Exit Site

PBH

Rod Hickmon 7/19/00 7022

6:20AM - Arrive at Site
- Drillers set up on BH09
- Flush Mud out of BH09

7:00AM - TO Post Western, Athens OK
To need Jelly Pioneer
to take water samples

- TO AIRS#11 Take water
Samples at 95' & 135' in
Silo & in Nitrogen Vault

12:00PM - Back at AIRS#7

1:30PM - Horizon Drilling starts Decon
& Setting up at BH06

2:00PM - Drillers start on BH06

2:15PM - Take soil samples at
5' & 10' & 18' at BH06

3:15PM - Take Samples to Fedex
Get more water, Fuel Pick-up

4:45PM - Back to AIRS#7
- Drillers drilling to bedrock

6:15PM - Take Soil samples at BH06 at 26'

6:45PM - Exit Site

Rodney Hickner 7/20/00 TOD

05:45AM - To Wal-Mart to get ice, Repack samples for shipping (Fedex)

~~0800~~

07:30 - Back to Wal-Mart - Get Bags, Distilled water & Ice

08:00 - TO Fedex ship samples

08:30 - Arrive at Site
- Loggers arrive at site
- Drillers set BH09 Well

09:45 - Drillers set up on BH09 for Logging 10:00AM - Log BH09

10:45 - Meeting with Jerry Powers, Phil Harmons & Alan Brantley about Palmer's Work

11:45AM - Lunch

11:45AM - Drillers continue set up on BH08
- Rodied sample equipment

12:20 - Drillers pulled first Core out of BH08

1250 * - Took Sample at 5' soil Placed in Sealed Bag for
* PID Meter >1000 ppm

Rodney Hickman 7/20/10 7000

Cont

1300 - Took soil Sample at 10'
Soil Fissed Slightly in Sample
Bisulfate
* PID Meter >2000
- Took soil sample at 15'
PID Meter 500ppm
1315 - Took soil Sample at 15'
PID Meter 0ppm
1340 - Took Soil sample at 18'
QA, & QC Samples also.
- Drillers continue to core down hole
14:00 - Prepare for Next Sample above Bedrock (Rinsate, Sample.)
- Temperature is 111°F
- Drillers continue downward
1650 - Take Last Sample above bedrock at BH08. Not Full recovery, only about 3" Filled VOA, TPH, Metals only
17:30 - Drillers Clean up
18:30 - Exit Site

Rodney Hickman 7/21/00 7022

5:45 - TO Wal-Mart. Get Ice & Freezer Bags for sampling
- Pack Samples in Ice (3 coolers)

8:00 - TO Fedex, send samples
- TO Wal-Mart Get 2 more bags of ice
- TO Site

8:45 - Drillers Down to 25' at ~~BH08~~ MW08
- Start setting well at MW08

9:45 - Well complete
Start setting pool

11:30 - Grout ~~BH07~~ & MW07.

12:00 - Finish setting pool at MW08
- Start setting pool at MW07

2:00PM - Finish setting pool at MW07
- Start setting pool at MW06

~~4:00PM~~ - Finish MW06
- Drilled Pump water out of trailer into tank

4:30PM - Exit Site

RH

588 hours

Rod Hickson 7/24/00 70°F

8:00AM - To Wal-Mart & other Supplier for the day.
- TO Site (MW#7)
- Prepare to test MW's for water Level & Bottom
- MW06 = 29.22 to water from top of MW06 Case. Bottom of Well 25'
2.1' Stickup on casing
27.12 to water from bgs
MW07 - 14.38 to water from top of (MW07
26.24 to bottom of well
.25 Stickup of casing
11.88 bgs to water
- MW05 - 23.28 to water from ~~bgs~~ top of casing
28.00 TO bgs Water
2.76 Stickup of Casing
20.52 to water bgs
10:00 Finish with water levels
Start Water Quality testing at MW07. PH was 6.61 (OK)
11:00 Safety Meeting
- Horizon Arrives on Site
Prepares to develop wells
12:00 - Horizon Surges MW06
- Pumps well

Rod Hickman 7/24/00 T022

CONT..

- Filled out Pantorius well abandonment Log on well
- 12:45 - Start Surging MW07
- Start Pumping MW07 & Filling out MW Development sheet
- Pumped well dry
- 13:20 - Started MW08 while MW07 recharges - Surging
- 13:40 - Start filling out well Development Log on MW08
- Pump well dry. Needs to recharge
- 14:00 - Finish MW08
- Back to MW07 to bail
- 14:10 - Start Bailing MW07
- 14:30 - Finish bailing MW07
- 15:30 - Arrive back at Holiday Inn

RG

Rod Hickox 7/28/00 7022

7:30 - To Wal-Mart, Gather supplies
9:30 - Leave for Site
10:00 - Arrive at Site
- Pump 10 gallons from MW07
- Paterson Drilling & Sub. FCI
Prepare to pressure grout BH09
- FCI Grouts BH09 (Grout comes out at surface)
12:00 - FCI & Patersons Leave site
Horizon sets up to drill/Mo BH09 Thurs.
12:30 - Start Developing MW08 again
- Pump 5 gallons from MW08 until (hole is dry)
- To Wal-Mart - Get Pickup Serviced
3:00PM (15:00) - Back to Room

DJH

Brad Hickman 7/26/00 7222

6:45AM - TO Wal-Mart, Gather supplies
- TO Site
- Prepare to take water samples from MW06
- Check PID on MW06, Received reading of 1100 PPM but meter won't clear possibly due to moisture - Good Reading is 140 PPM
10:00AM - TO Athens OK to get Connectors for holding tank
10:50 - Start taking readings from MW06
12:00 Water stabalizes
12:05 Start collecting samples
14:00 - Finish Collecting Samples. Clean up equipment (otherside)
15:00 - Pack Samples in Ice for Shipping
16:00 - Take Samples to FedEx
16:30 - Back to room, Clean up
17:00 - OFF

BHickman

Rod Hickman 7/20/00 7022

6:30 - TO Well Yard Gather supplies for day
- Fax Enclosure
- TO Site
- Drillers set up to Air Core BHC9
8:15 - Drillers start Air Coring hole (BHC9)
- Air Core out connect grade
9:15 - Drillers at 91' water coming up hole Rings not sealed well
- Drillers drill on down to 96'
9:45 - Drillers pull equipment out of hole in preparation for the Loggers
10:30 - Logger engineer setting on hole Log hole concrete bottom seal then backfill gravel backside from 82' down
12:00 - Cline Services exits site (Get Copies of Log)
- Allen From Horizon wants to Fax Log from to Peterson Drillers
- Horizon MSE Peterson talk about what to do about BHC9

Rodney Hickson 7/27/06 702 J.

3:30 - Exhibit S.T.

RSA

Rodney Hickson 7/28/00 7002

6:30 - To Wal-Mart. Gather supplies
7:00 - To Site
7:30 - Prepare to sample water at MW07
- Fill out logs on MW07
9:15 - Start taking water samples from MW07
10:15 - Finished taking Groundwater Samples from MW07
- TO Atlas OK, Pack Samples in Ice to go to Fedex
12:00 - Back to Site. Pick Forklift packing up equipment for Horizon Drilling
- Back to room, prepare equip for next sample
14:30 - OFF Duty

Rod Hickman 7/31/00 TQL

6:30 - TO Wal-Mart to get supplies
- TO Site
7:30 - Set up water testing equipment on MW07
8:00 - Start pumping MW07
8:30 - Take Samples for F, NO_2, NO_3
- Drop Equip
8:45 - Set up on MW08
9:10 - Start pumping
- Sand clogs Pump. Clear pump
- Start pumping again
- Sand clogs pump.
10:45 - Pumped well dry
- Decide to let well sit & bale it tomorrow
11:30 - IN to Altus.
- Wait for Stainless Steel Funnel to come in Via FedEx
2:00 - Do Rinsate on MW07
- Pack Samples in Ice & Prepare for FedEx
3:20 - Phil takes Samples to FedEx
- OFF

Rod Hicks or 8/1/00 TO22

6:30 - TO Wal-Mart - get supplies for Day
- TO Site
8:00 - Start taking samples from MW08 (Baling) Take all bad 1 sample, Waiting on call from Elka McEdar
8:30 - Set up on MW07. Start pumping well
- Check parameters on well, wait for them to stabilize
9:50 - Start sampling water at MW07
10:30 - Back to MW08, Resample 1 bottle of water
11:30 - To Red Ex, Send Samples
12:00 - Meet w/ Jerry Pierson at Chuck talk about schedule / costs etc
2:30 - OFF

Paul Hickman 8/2/00 TO22

6:30 - Leave to go to site
7:00 - January waiting at Gate to deliver 3rd Rolloff
7:40 - Horizon Drilling arrives at site
- Safety Meeting w/ Phil Hammins
- Horizon prepares to pump well
8:40 - Compressor arrives for drillers
Drillers wire pump & put down hole
9:30 - Horizon pumps well
10:15 - Horizon finishes pumping well, starts pulling pipe out of hole
- Sets up to start coring hole (sets PVC pipe in hole)
12:30 - Horizon starts drilling
13:05 - First Core Cards up
14:30 - Ran PID Meter on Core at 118' (0)
15:00 - Ran PID meter on Core at 128' (0)
15:30 - Ran PID Meter on Core at 138' (0)
16:00 - Ran PID Meter on Core at 148' (0)
16:30 - Ran PID Meter on Core at 158' (0)
17:00 - PID on Core at 168' (0)
17:30 - Drillers stop for evening
18:00 - Arrive at Camp

Rod Hickman 8/3/00 T022

6:15 - Leave for Site
7:00 - Horizon Arrives on site, prepares to drill
- Horizon pumps water into rolloff
8:15 - Starts drilling at 168'
9:15 - Run PID Meter on Core at 178' (Small reading of, 1 ppm but conductivity Verify again)
10:00 - Horizon pulls barrel at 188'
Run PID meter on Core
Received reading of 25 PPM
- Jerry Tidwell & Lacy Key visit Site
11:15 - Horizon hits 198'
Run PID meter on Core
12:00 >2000ppm!!!
12:30 Run PID meter on Core at 198' <2000ppm!!!
1:15 - Horizon hits 203'
Run PID on Core
- Horizon breaks down. Fixes
Continues Drilling
2:30 - Horizon Hits 208' PID Read (0)
3:10 - Horizon Hits 210'
PID Meter reads (0)

Rod Hickman 8/3/00 7020

CONT...

- Horizons starts observabilities

5:00PM - Leave site, Horizon leaves

5:30PM - Arrive at Pam

8/4/00 Pool Hrlkmor TQW

6:30 - To Wal-Mart, Retrieve Supplies

- To S2
- Take soil samples from Rolloff bin
- Pack Samples in ice
- Take samples to Fedex

~~8:00 - Hon~~

9:00 - ~~E~~

[signature]

8/7/00 Rod Hickson 7022

7:00 - Leave for Site

8:00 - Horizon prepares site for Venture

9:00 - Set equipment up on MW06 to be sure generator doesn't trip breaker when we resample MW06 for the Corps lab

10:00 - Horizon continues to setup for Venture, Wait on Venture
- Venture calls, says they are running late, it will be 1-2 hours before they arrive

11:30 - Check Headspace on BH07 with PID Meter ≥ 2000ppm !!! (Natural Gas?)

12:00 - Lunch

12:30 - Wait on Venture

1:00 - Venture Drilling arrives at site
- Prepares equipment

2:15 - Venture starts ~~down~~ the hole (BH07)

5:00 - Venture hits Depth (Total) 220
- Venture pulls ~~[illegible]~~ [illegible] of pipe out of hole

6:15 - Arrive back at room

[signature]

8/8/00 Rod Horizon 7000

6:15 - Leave for site
7:00 - Horizon Drilling arrives
7:15 - Venture Drilling arrives
7:30 - Venture starts Down RH09 - to clean out Sediment
7:45 - Venture reaches bottom of hole
- Horizon prepares to install casing
- Venture pulls pipe from hole
8:45 - Venture gets pipe out of hole
9:00 - Horizon & Venture start installing casing
10:45 - Horizon & Venture get casing to bottom of hole.
11:05 - Set up on MW06 - to resample Start purging it.
11:35 - Start taking readings at MW06
12:25 - Start to take samples
1350 - Horizon gets pump from Sampling MW06
1330 - Horizon gets pump down RH09
- Starts pumping RH09
- Stops pumping. Starts on Filter Pack
18:00 - Horizon stops with Filter Pack
- Sticks tape measure in hole.
18:30 - Horizon retrieves tape from hole
- Prepares to Leave Site

8/18/00 Tool Selection TEDD

19:00 Normal Run

PJO

8/9/00 Rod Hickman 7022

6:15 - To Wal-Mart pick up ice & water
- Pack Samples in ice
8:00 - Take Samples to Fedex for Shipping
- TO Site
- Horizon prepares "draw down" well
- draws well down - it did not Settle at all. (BH09)
- Horizon prepares to pump bentonite Slurry down hole (BH09)
9:10 - Horizon pumps slurry down hole
11:00 - Bentonite slurry stops at 146' (BH09)
- Horizon Mixes grout
12:15 - Horizon Flushes Grouting (BH09)
- Pulls pipe & pump from hole
13:45 - Horizon starts cleaning up area
14:30 - Horizon starts pumping water from Frac tank to Frac Tank
16:00 - Horizon starts grouting top of Casing (BH09)
- Continues to clean up Site
18:00 - Leave Site
18:30 - Arrive at Room

RSH

8/10/00 Rod Hickman TO22 65

6:15 - TO Wal-Mart, get supplies for day
- TO site
7:00 - Arrive at site
- Turn PID Meter on BH09 (0 PPM)
- Check Water Level at BH09 28.30'
7:30 - Horizon shows up - Picks up site
Smooths dirt out around BH09
- Horizon Prepares to pump (Colorado) BH09
9:54 Horizon Starts purging well at 4,856 PM
- Pump stops purging, water level is Approx 75'
11:00 - Horizon decides to take lunch out
13:40 - Horizon states hole dry
- Recharge is 1 ft per 7 min Starts then it changed to 1 ft per 8 min
14:45 - Horizon clears and prepares to Set BH09 Pad.
15:15 - Take Soil Sample from Roll off
- Take Water Sample from Roll off
15:50 - Checked water level it is at -200'
1585 - Started taking readings on BH09 with Water Quality tester

8/10/00 Rathbun 7002

17:00 - Horizon decants to surge BW99
Put 40 gallons of water down hole.
- Water level at 163'
- Horizon starts to surge hole. Sees that surge block is too large. Pulls out surge block cuts it smaller, then surges hole

19:30 - Horizon gets water pumped (bailed) out of BW09
- Prepares to leave site
- Leave site

20:00 - Arrive at Base

8/11/00 Rod Hickman 7000

6:15 - TO Wal-Mart, Retrieve Supplies
- Pack Sampler in ice
8:00 - TO Fed Ex, Send samples
8:30 - Arrive at site. Horizon is setting up well
8:45 - Horizon starts boring well
9:00 - Start taking readings from boring
9:40 - Take water level, water at 200 bgs
Horizon took 40 gal out of well to reach this level
- Horizon working on welding up gate (Lifting gate 3' so high clearance vehicles may clear)
10:00 - Surveyors Arrive
- Start Surveying
12:00 - Surveyors equipment does not make good connection - Have work on equip
12:30 - Surveyors finish up
~~1:15 - Horizon welds~~
1:15 - Horizon drills holes for Bollards on MW09
14:30 - Horizon finishes bollards & painting bollards on MW09

8/11/00 Back Home 7200

16:00 - Leave site
16:30 - Arrive at Base
18:20 - Back to Site
- Tried to pump MW08 (Test)
- the Generator failed
20:00 - Left Site

DJ

APPENDIX F.1

ESI Waste Sample Collection Logs

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220	Project: AMS No. 7 EST
	Site: AMS NO. 7

Sample I.D.: AMS7-Bin 1-S
Date (YYMMDD): 08/04/00
Time (HHMMSS): 0715
Top Depth: NA
Bottom Depth: NA
Matrix: Sed / (Soil) / Water
Sample Qualifier: QA / QC / RB / CS
Sample Type: GRAB / (COMP.) / NA
Sampler: Phil Hammons
Witness: Rodney Heckman
Contractor: Morrison Knudsen
Remarks: Composite sample from Bin 1 for waste characterization

Weather: Clear, 82°F, Calm

Prepared by: Phil Hammons
Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
glass	16 oz		1
glass	4 oz		1

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220

Project: AMS No.7 ESI

Site: AMS No.7

Sample I.D.: AMS7-Bin 3-S

Date (YYMMDD): 08/10/00

Time (HHMMSS): 1500

Top Depth: NA

Bottom Depth: NA

Matrix: Sed / (Soil) / Water

Sample Qualifier: QA / QC / RB / CS

Sample Type: GRAB / (COMP.) / NA

Sampler: Phil Hammons

Witness: Rodney Heckman

Contractor: Morrison Knudsen

Remarks: Composite sample from Bin 3 for waste characterization

Weather: Partly Cloudy, 100°F, slight breeze

Prepared by: Phil Hammons

Checked by:

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
glass	16 oz		1
glass	4 oz		1

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

ATTACHMENT 3

SOIL SAMPLE COLLECTION LOG

Delivery Order No: 4423-0220	Project: Ams No. 7 EST Site: Ams No. 7
Sample I.D.:	AMS7-BIN245-W
Date (YYMMDD):	08/10/00
Time (HHMMSS):	1515
Top Depth:	NA
Bottom Depth:	NA
Matrix:	Sed / Soil / (Water)
Sample Qualifier:	QA / QC / RB / CS
Sample Type:	GRAB / (COMP.) / NA
Sampler:	PHIL Hammonds
Witness:	Rodney Hackman
Contractor:	Morrison Knudsen
Remarks:	Composite sample from Bins 2,4,5 for Waste Characterization. All water in Bins came from Drilling, Installation and Development of MW09
Weather:	Partly Cloudy, 100°F, Slight breeze
Prepared by:	
Checked by:	

Analytical Request

Container Type	Sample Volume	Parameter	No. of Cont.
glass	1 liter		1
plastic	1 liter		2

Field Screening Results

PID	Bkgd 0.0	Reading 0.0
RAD Frisk	Bkgd	Reading
pH		

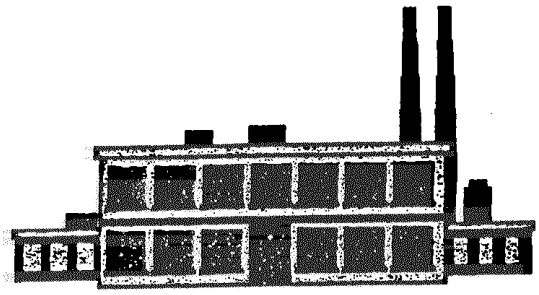
APPENDIX F.2

ESI Waste Disposal Manifests

Waste Manifest

№ 16704

January Environmental Services, Inc.



2701 South Prospect
Oklahoma City, OK 73129
(405) 670-2030
FAX: (405) 670-6747

Invoice No. _____

GENERATOR INFORMATION

Business Name: Washington Group Int'l.

Address: Atlas missle silo #7 Odell Tx.

Telephone: _____

Waste Description: waste sludge

Waste Volume: 25 yd. Cost $ _____

Date Removed: 10-4-00

Generator: X LACY C KEY (PRINT) X Lacy C Key (SIGN)

TRANSPORTATION INFORMATION

Business Name: January Transport, Inc. Truck 22320

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Waste Volume: 25yds.

Driver's name: Tim Reavis (PRINT) _____ (SIGN)

DISPOSAL INFORMATION

Business Name: January Environmental Services, Inc.

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Date _____

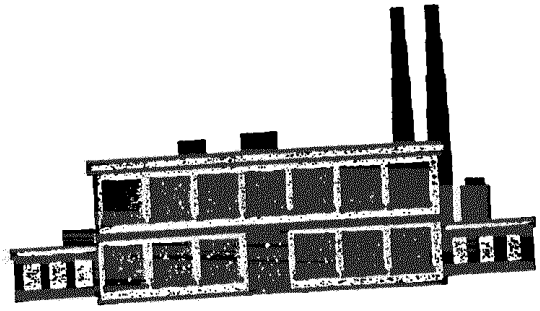
Operator Name: _____ (PRINT) _____ (SIGN)

WHITE—REPORTER PINK—RETURN COPY GOLDENROD—GENERATOR

Waste Manifest

No 15705

January Environmental Services, Inc.



2701 South Prospect
Oklahoma City, OK 73129
(405) 670-2030
FAX: (405) 670-6747

Invoice No.

GENERATOR INFORMATION

Business Name: Washington Group Intl. Odell TX.
Address: Atlas missle silo
Telephone:
Waste Description: waste sludge
Cost $
Waste Volume: 12yds.
Date Removed: 10-3-00
Generator: X Lilcy C. Key (PRINT) X (SIGN)

TRANSPORTATION INFORMATION

Business Name: January Transport, Inc.
Address: 2701 South Prospect Oklahoma City, OK
Telephone: (405) 670-2030
Waste Volume: 12yds.
Driver's name: Tim Reavis (PRINT) (SIGN)

DISPOSAL INFORMATION

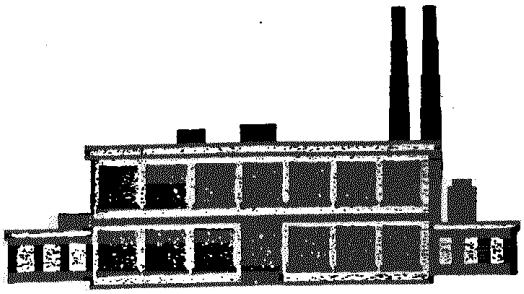
Business Name: January Environmental Services, Inc.
Address: 2701 South Prospect Oklahoma City, OK
Telephone: (405) 670-2030
Date
Operator Name: (PRINT) (SIGN)

GOLDENROD—GENERATOR

Waste Manifest

№ 16534

January Environmental Services, Inc.



2701 South Prospect
Oklahoma City, OK 73129
(405) 670-2030
FAX: (405) 670-6747

Invoice No. _____

GENERATOR INFORMATION

Business Name: WASHINGTON FIN. & INS.

Address: BOX 87 OKLA CITY

Telephone: 405-840-3333

Waste Description: WASTE WATER

Waste Volume: 4,000 GAL Cost $ _____

Date Removed: 10-4-00

Generator: CALY C KEY (PRINT) (SIGN)

TRANSPORTATION INFORMATION

Business Name: January Transport, Inc. TRUCK 2220

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Waste Volume: 4,000 GAL

Driver's name: (PRINT) (SIGN)

DISPOSAL INFORMATION

Business Name: January Environmental Services, Inc.

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Date _____

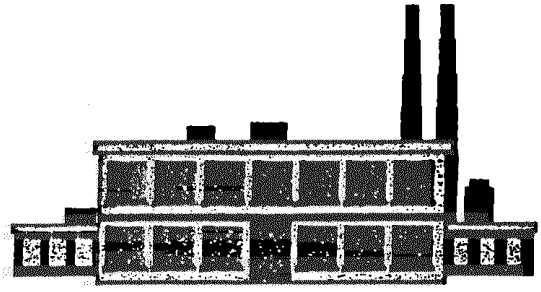
Operator Name: (PRINT) (SIGN)

GOLDENROD - GENERATOR

Waste Manifest

№ 16533

January Environmental Services, Inc.



2701 South Prospect
Oklahoma City, OK 73129
(405) 670-2030
FAX: (405) 670-6747

Invoice No. _____

GENERATOR INFORMATION

Business Name: [illegible]

Address: [illegible] OKC OK

Telephone: 405-[illegible]-7737

Waste Description: [illegible]

Waste Volume: [illegible] Cost $ _____

Date Removed: 12-3-20

Generator: LACY C. KEY (PRINT) [signature] (SIGN)

TRANSPORTATION INFORMATION

Business Name: January Transport, Inc.

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Waste Volume: [illegible]

Driver's name: [illegible] (PRINT) [signature] (SIGN)

DISPOSAL INFORMATION

Business Name: January Environmental Services, Inc.

Address: 2701 South Prospect Oklahoma City, OK

Telephone: (405) 670-2030

Date _____

Operator Name: _____ (PRINT) _____ (SIGN)

SURVEY DATA TABLE FOR MONITOR WELL, SOIL SAMPLE, AND BORE HOLE LOCATIONS, AMS NO. 7[illegible]			
NAME	NORTHING	EASTING	ELEVATION
BH06	7543291.90	1719524.29	1365.0
BH07	7543371.68	1719805.76	1367.0
BH08	7543550.53	1719815.19	1362.5
MW06	7543299.76	1719524.64	1367.73*
MW07	7543379.73	1719805.65	1370.88*
MW08	7543542.98	1719815.49	1365.94*
MW09	7543566.68	1719814.85	1366.22*
SS05	7543279.80	1719460.31	1366.7
SS06	7543596.67	1719463.11	1365.6
SS07	7543697.65	1719671.36	1363.7
SS08	7543594.58	1719769.25	1366.4
SS09	7543591.92	1719789.20	1363.8
SS10	7543589.83	1719802.20	1363.2
SS11	7543505.56	1719809.86	1364.3
SS12	7543502.42	1719838.55	1362.9
SS13	7543392.98	1719810.79	1367.1
SS14	7543356.83	1719809.08	1366.8
FARGO	7543120.83	1719712.87	1362.13
BASED ON THE TEXAS NORTH CENTRAL ZONE 4202 STATE PLANE GRID COORDINATE SYSTEM OF 1983			

Note:

* - Top of PVC well casing (north side)

APPENDIX H.1
DETECTION TABLES FOR
SURFACE SOIL LOCATIONS
AMS NO. 7 ESI

Analyte	ATLAS#7-AMS-7-SS-05	ATLAS#7-AMS-7-SS-06	ATLAS#7-AMS-7-SS-07	ATLAS#7-AMS-7-SS-08	ATLAS#7-AMS-7-SS-09
SW 8260B (µg/Kg)					
VOCs					
Acetone	**97.4**	**184**	**155**	9.46 U	9.12 U
Benzene	1.84 U	1.77 U	1.53 U	**2.37**	1.87 U
2-Butanone	9.08 U	8.65 U	7.76 U	**7.10 J**	**7.69 J**
Carbon disulfide	1.84 U	1.77 U	1.53 U	2.47	1.87 U
Methylene chloride	**6.22**	**31.1**	**4.29**	**43.4**	**34.7**
Toluene	1.84 U	1.77 U	1.53 U	**10.8**	1.87 U
Trichloroethene	1.84 U	1.77 U	1.53 U	1.94 U	1.87 U
1,2,4-Trimethylbenzene	1.84 U	1.77 U	1.53 U	**4.19**	1.87 U
1,3,5-Triinethylbenzene	1.84 U	1.77 U	1.53 U	**2.26**	1.87 U
Xylenes, Total	1.84 U	1.77 U	1.53 U	**16.5**	1.87 U
VOC TICs					
Acetic acid, methyl ester	ND	ND	ND	ND	ND
Butane, 2-methyl-	ND	ND	ND	**33 JN**	ND
Pentane	ND	ND	ND	**59 JN**	ND
Pentane, 2-methyl-	ND	ND	ND	**17 JN**	ND
Hexane	ND	ND	ND	**23 JN**	ND
Cyclohexane	ND	ND	ND	**10 JN**	ND
Cyclohexane, methyl-	ND	ND	ND	**13 JN**	ND
Hexanal	**22 JN**	**52 JN**	**56 JN**	**190 JN**	**160 JN**
Pentanal	ND	**15 JN**	**13 JN**	ND	**26 JN**
Benzaldehyde	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	**3 JN**	**28 JN**	**17 JN**	ND	ND
Carbon dioxide	**75 JN**	**210 JN**	**160 JN**	ND	ND
Butanal, 3-methyl-	**5 JN**	ND	ND	ND	ND
Cyclotrisiloxane, hexamethyl	**3 JN**	**4 JN**	**4 JN**	ND	ND
Cyclotetrasiloxane,octarnethyl	**8 JN**	**11 JN**	**7 JN**	ND	ND
Acetaldehyde	ND	**5 JN**	**5 JN**	ND	ND
Butanal	ND	**6 JN**	**4 JN**	ND	ND
Heptanal	ND	**3 JN**	ND	ND	ND
Arsenous acid, tris(timethylsilyl)	ND	ND	ND	ND	ND
SW8082 (µg/Kg)					
PCBs					
Aroclor 1260	20.4 U	20.8 U	20.4 U	**28**	22 U
TX 1005 (µg/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25500 U	2~0600 U	25500 U	26900 U	27500
C6 - C28 Hydrocarbons	51000 U	52100 U	5 1000 U	53800 U	54900 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**4360**	**10600**	**8390**	**8600**	**7840**
Arsenic	I U	I U	**1.2**	1.1 U	1.1 U
Barium	**30.3**	**63.9**	**74.5**	**96.9**	**61.4**
Calcium	**570**	**1230**	**1590**	**53600**	**6390**
Chromium	**5.4**	**9.9**	**9.4**	**124**	**8.2**
Copper	**1.8**	**3.4**	**2.9**	**16**	**4.2**
Iron	**3660**	**7000**	**6720**	**6760**	**6810**
Lead	**3**	**5**	**4.9**	**152**	**19.3**
Magnesium	**781**	**1660**	**1540**	**3580**	**2840**

Note: Detected analyte concentrations are reported in **bold** font.

Analyte	ATLAS#7-AMS-7-SS-05	ATLAS#7-AMS-7-SS-06	ATLAS#7-AMS-7-SS-07	ATLAS#7-AMS-7-SS-08	ATLAS#7-AMS-7-SS-09
Manganese	**68.7**	**106**	**122**	**149**	**129**
Nickel	**2.8**	**5.4**	**4.7**	**5.8**	**4.6**
Potassium	**858**	**2060**	**1770**	**2330**	**1740**
Sodium	**21.1**	**54.2**	**38.3**	**86.2**	**30.3**
Vanadium	10 U	**16.9**	**16**	**15.4**	**13.2**
Zinc	10 U	**13.9**	**14.9**	**102**	**45.6**

Analyte	ATLAS#7-AMS-7-SS-10	ATLAS#7-AMS-7-SS-11	ATLAS#7-AMS-7-SS-12	ATLAS#7-AMS-7-SS-13	ATLAS#7-AMS-7-SS-14
SW 8026B (µg/Kg)					
VOCs					
Acetone	**109**	10.0 U	8.62 U	9.57 U	10.1 U
Benzene	1.94 U	2.02 U	1.70 U	1.94 U	**2.42**
2-Butanone	9.59 U	**7.87 J**	**4.57 J**	**9.14 J**	**4.11 J**
Carbon disulfide	1.94 U	2.02 U	1.70 U	1.94 U	3.37
Methylene chloride	**31.7**	**9.21 U**	**7.45 U**	**6.67 U**	**6.32 U**
Toluene	1.94 U	**2.92**	1.70 U	**3.44**	**10.7**
Trichloroethene	1.94 U	**2.25 J**	1.70 U	1.94 U	2.00 U
1,2,4-Triinethylbenzene	1.94 U	2.02 U	1.70 U	1.94 U	**5.37**
1,3,5-Trimethylbenzene	1.94 U	2.02 U	1.71 U	1.94 U	**2.74**
Xylenes, Total	1.94 U	2.47 U	1.70 U	**3.23**	**17.8**
VOC TICs					
Acetic Acid, methyl ester	ND	**56 JN**	ND	ND	ND
Butane, 2-methyl-	ND	ND	ND	**11 JN**	**35 JN**
Pentane	ND	ND	ND	ND	ND
Pentane, 2-methyl-	ND	ND	ND	ND	**19 JN**
Hexane	ND	ND	ND	ND	**25 JN**
Cyclohexane	ND	ND	ND	ND	ND
Cyclohexane, methyl-	ND	ND	ND	ND	**14 JN**
Hexanal	**29 JN**	**130 JN**	**55 JN**	**200 JN**	**58 JN**
Pentanal	**6 JN**	**26 JN**	**ND**	**42 JN**	ND
Benzaldehyde	ND	7 JN	ND	ND	ND
2-Fuiancarboxaldehyde	**6 JN**	ND	ND	ND	ND
Carbon dioxide	**360 JN**	ND	ND	ND	ND
Butanal, 3-methyl-	ND	ND	ND	ND	ND
Cyclotrisiloxane, hexamethyl	ND	ND	ND	ND	ND
Cyclotetrasiloxane,octarnethyl	**8 JN**	ND	ND	ND	ND
Acetaldehyde	ND	ND	ND	ND	ND
Butanal	ND	ND	ND	**10 JN**	ND
Heptanal	ND	ND	ND	ND	ND
Arsenous acid, tris(timethylsilyl)	**3 JN**	ND	ND	ND	ND
SW 8082 (µg/Kg)					
PCBs					
Aroclor 1260	20.4 U	**166 J**	21.3 U	**106 J**	**142 J**
TX 1005 (µg/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25500 U	28100 U	26600 U	26900 U	26300 U
C6 - C28 Hydrocarbons	51000 U	56200 U	53200 U	53800 U	52600 U

Note: Detected analyte concentrations are reported in **bold** font.

Analyte	ATLAS#7-AMS-7-SS-10	ATLAS#7-AMS-7-SS-11	ATLAS#7-AMS-7-SS-12	ATLAS#7-AMS-7-SS-13	ATLAS#7-AMS-7-SS-14
SW 6010B (mg/Kg)					
Metals					
Aluminum	**10500**	**8710**	**7380**	**7850**	**3100**
Arsenic	I U	**1.5**	1.1 U	1.1 U	1.0 U
Barium	**72**	**84.1**	**47**	**79.8**	**42.4**
Calcium	**5650**	**11200**	**2620**	**31600**	**28300**
Chromium	**9.8**	**9.8**	**7.5**	**12.3**	**4.5**
Copper	**4.1**	**9.2**	**3.2**	**5.6**	**2.9**
Iron	**7180**	**6530**	10.7 U	**7550**	**3080**
Lead	**10.4**	**18.4**	**6.6**	**22.2**	**14.5**
Magnesium	**1890**	**2380**	**5320**	**3510**	**2360**
Manganese	**139**	**129**	**83.9**	**153**	**51.9**
Nickel	**5.5**	**5.6**	**4.1**	**7.5**	**2.7**
Potassium	**2180**	**1880**	**1520**	**1970**	**569**
Sodium	**39.8**	**41.9**	**41.8**	**77.6**	**41.6**
Vanadium	**16.3**	**14.1**	**12**	**13.8**	10.3 U
Zinc	**18.8**	**181**	**32.2**	**44.3**	**11**

Qualifiers applied by data validator

J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect to practical quantitation limit
ND: Not detected
JN: Estimated value, compound not included in calibration

Note: Detected analyte concentrations are reported in **bold** font.

APPENDIX H.2
DETECTION TABLES FOR

BORE HOLES
AMS NO. 7 ESI

Analyte	ATLAS#7-AMS7-BH06-S-00	ATLAS#7-AMS7-BH06-S-05	ATLAS#7-AMS7-BH06-S-10	ATLAS#7-AMS7-BH06-S-18	ATLAS#7-AMS7-BH06-S-76
SW 8260B (ug/Kg)					
VOCs					
Acetone	**86.0**	**41.2**	11.9 U	**16.1**	**34.6**
Methylene chloride	**21.2**	**44.0**	**51.0**	**32.7**	37.8 U
Toluene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
Trichloroethene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
1,2,4-trimethylbenzene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
Xylenes, Total	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
VOCs TICs					
Pentane	ND	ND	ND	ND	ND
Hexanal	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	ND	ND	ND	ND	ND
SW 8270 C (ug/Kg)					
SVOCs					
Benzo (a) anthracene	333 U	340 U	371 U	347 U	407 U
Benzo (a) pyrene	333 U	340 U	371 U	347 U	407 U
Benzo (b) fluoranthene	333 U	340 U	371 U	347 U	407 U
Chrysene	333 U	340 U	371 U	347 U	407 U
Fluoranthene	333 U	340 U	371 U	347 U	407 U
Phenanthrene	333 U	340 U	371 U	347 U	407 U
Pyrene	333 U	340 U	371 U	347 U	407 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
TX1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25300 U	25800 U	28100 U	26300 U	30900 U
C6 - C28 Hydrocarbons	50500 U	51500 U	56200 U	52600 U	61700 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**8200**	**5520**	**13400**	**8000**	**6120**
Arsenic	**1.4**	1.0 U	1.1 U	1.1 U	**2.2**
Barium	**54.1**	**39.7**	**69.5**	**38.9**	**35.9**
Calcium	**794**	**507**	**822**	**693**	**13300**
Chromium	**7.9**	**5.7**	**10.1**	**7.2**	**8.7**
Copper	**2.2**	**2.0**	**2.7**	**2.3**	**4.0**
Iron	**5800**	**3440**	**7100**	**5260**	**7390**
Lead	**3.2**	**2.2**	**3.4**	**2.5**	**3.0**
Magnesium	**1310**	**778**	**1680**	**1090**	**3590**
Manganese	**92.9**	**49.1**	**74.4**	**58.7**	**191**
Nickel	**4.2**	**4.5**	**5.4**	**4.2**	**6.9**
Potassium	**1390**	**811**	**2550**	**1530**	**1410**
Sodium	**38.6**	**24**	**94.7**	**60.2**	**99.2**
Vanadium	**14.9**	9.8 U	**12.7**	10.5 U	**15.9**
Zinc	**11.1**	**15.7**	**17.2**	**11.2**	**13.9**

Note: Detected analyte concentrations are reported in **bold** font.

Analytes	ATLAS#7-AMS7-BH07-S-00	ATLAS#7-AMS7-BH07-S-05	ATLAS#7-AMS7-BH07-S-10		ATLAS#7-AMS7-BH08-S-00
SW 8260B (ug/Kg)					
VOCs					
Acetone	7.74 U	9.48 U	12.5 U		**190**
Methylene chloride	**16.5**	**21.1**	**25.2**		**5.27**
Toluene	**2.15**	**3.96**	2.47 U		1.94 U
Trichloroethene	1.51 U	1.88 U	2.47 U		1.94 U
1,2,4-Trimethylbenzene	1.51 U	**2.08**	2.47 U		1.94 U
Xylenes, Total	**1.94**	**4.48**	2.47 U		1.94 U
VOC TICs					
Pentane	ND	**12.5J**	ND		ND
Hexanal	**25.8 J**	ND	ND		**37.6 J**
2-Furancarboxaldehyde	ND	ND	ND		**19.4 J**
SW 8270C (ug/KG)					
SVOCs					
Benzo (a) anthracene	**145 J**	344 U	371 U		355 U
Benzo (a) pyrene	**76 J**	344 U	371 U		355 U
Benzo (b) fluoranthene	**126 J**	344 U	371 U		355 U
Chrysene	**142 J**	344 U	371 U		355 U
Fluoranthene	**426**	344 U	371 U		355 U
Phenanthrene	**191 J**	344 U	371 U		355 U
Pyrene	**329 J**	344 U	371 U		355 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	**15 J**		ND
TX 1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	26900 U	26000 U	28100 U		26900 U
C6 - C28 Hydrocarbons	53800 U	52100 U	56200 U		53800 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**10800**	**11100**	**1390**		**9870**
Arsenic	**1.3**	**1.8**	1.1 U		1.1 U
Barium	**79.1**	**83.9**	**131**		**64.5**
Calcium	**16700**	**46600**	**40500**		**4540**
Chromium	**10.6**	**10.4**	**1.8**		**9.9**
Copper	**3.2**	**3.9**	1.1 U		**4.7**
Iron	**7610**	**8740**	**2090**		**7270**
Lead	**3.7**	**4.7**	**3.2**		**8.8**
Magnesium	**2670**	**4900**	**1240**		**2030**
Manganese	**132**	**186**	**169**		**132**
Nickel	**6.2**	**6.7**	1.1 U		**5.8**
Potassium	**2480**	**3020**	**348**		**2340**
Sodium	**70.2**	**121**	**59**		**69.7**
Vanadium	**16.6**	**17**	11.3 U		**15.3**
Zinc	**13.6**	**16.7**	11.3 U		**28.2**

Note: Detected analyte concentrations are reported in **bold** font.

Analytes	ATLAS#7-AMS7-BH08-S-05	ATLAS#7-AMS7-BH08-S-10	ATLAS#7-AMS7-BH08-S-15	ATLAS#7-AMS7-BH08-S-18	ATLAS#7-AMS7-BH08-S-80
SW 8260B (ug/Kg)					
VOCs					
Acetone	**52.2**	**26.4**	**62.5**	**27.8**	**26.7**
Methylene chloride	**26.7**	**30.5**	**35.8**	**34.6**	**20.5**
Toluene	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
Trichloroethene	1.63 U	2.29 U	2.00 U	**36.7**	1.79 U
1,2,4-Trimethylbenzene	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
Xylenes, Total	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
VOC TICs					
Pentane	ND	ND	ND	ND	ND
Hexanal	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	ND	ND	ND	ND	ND
SW 8270C (ug/Kg)					
SVOCs					
Benzo (a) anthracene	359 U	398 U	388 U	402 U	393 U
Benzo (a) pyrene	359 U	398 U	388 U	402 U	393 U
Benzo (b) fluoranthene	359 U	398 U	388 U	402 U	393 U
Chrysene	359 U	398 U	388 U	402 U	393 U
Fluoranthene	359 U	398 U	388 U	402 U	393 U
Phenanthrene	359 U	398 U	388 U	402 U	393 U
Pyrene	359 U	398 U	388 U	402 U	393 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
TX 1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	27200 U	30100 U	29400 U	30500 U	29800 U
C6 - C28 Hydrocarbons	54300 U	60200 U	58800 U	61000 U	59500 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**11800**	**7930**	**17700**	**15900**	**1670**
Arsenic	**1.9**	**1.4**	**2.9**	**2.5**	1.1 U
Barium	**70.8**	**54.8**	**95.2**	**122**	**13.6**
Calcium	**4950**	**13000**	**3050**	**2670**	**9340**
Chromium	**13.1**	**10.9**	**17.9**	**17**	**3.4**
Copper	**3.2**	**1.7**	**5.9**	**7.6**	1.1 U
Iron	**9370**	**10800**	**13800**	**16000**	**2400**
Lead	**4.6**	**3.8**	**7.2**	**7.4**	**1.6**
Magnesium	**2780**	**8250**	**3760**	**4240**	**916**
Mamganese	**163**	**294**	**134**	**342**	**58**
Nickel	**7.4**	**8.5**	**10.4**	**13.1**	**1.8**
Potassium	**2590**	**2870**	**4370**	**3740**	**336**
Sodium	**15.8**	**123**	11.3 U	12.3 U	**45.6**
Vanadium	**17.7**	**14.5**	**22.2**	**21.9**	11.3 U
Zinc	**19.6**	**19.7**	**29**	**36.5**	11.3 U

Qualifiers applied by data validator
J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect tp practical quantitation limit
ND: Non-detect
R: Data rejected by data validator
JN: Estimated value, compound not included in calibration

Note: Detected analyte concentrations are reported in **bold** font.

APPENDIX H.3

GROUND WATER
AMS NO. 7 ESI

ANALYTE	ATLAS#7-AMS7-MW06-GW	ATLAS#7-AMS7-MW07-GW	ATLAS#7-AMS7-MW08-GW	ATLAS#7-AMS7-MW09-GW
EPA 200.8 (ug/L)				
Metals				
Antimony	<0.2	<0.2	1.0	<1.0
Barium	**200**	**410**	**320**	**260**
Chromium	**12**	**15**	**8.3**	**1.3**
Copper	**7.9**	**10**	**4.1**	**4.3**
Lead	**14**	**6.8**	<0.5	<2.5
Nickel	**12**	**18**	**8.7**	**100**
EPA 300.0 (mg/L)				
Nitrate				
Nitrate	**9.5**	<0.5	**0.5**	**0.7**
EPA 353.2 (mg/L)				
Nitrite				
Nitrite	**0.01**	<0.01	<0.01	<0.01
EPA 380-75WE (mg/L)				
Fluoride				
Fluoride	**0.9**	**0.6**	**0.6**	<0.1
EPA 524.2 (ug/L)				
VOCs				
Chloroform	<0.1	<0.1	**0.5**	<0.1
1,1-Dichloroethylene	<0.2	<0.2	**0.3**	<0.2
cis-1,2-Dichloroethylene	<0.1	<0.1	**30**	<0.1
trans-1,2-Dichloroethylene	<0.1	<0.1	**2.8**	<0.1
4-Isopropyltoluene	<0.1	<0.1	**0.1**	<0.1
Trichloroethylene	<0.1	<0.1	**140**	<0.1
Vinyl chloride	<0.2	<0.2	**0.2**	<0.2
Acetone	ND	ND	**8.7**	ND
EPA 525.2 (ug/L)				
SVOCs				
Di(2-ethylhexyl)phthalate	<0.6	<0.6 J	**1.0 J**	**1.3 J**
Camphorosulfonic Acid	ND	ND	**3.8**	ND
Hydrocarbon oil	ND	**21**	ND	ND
Tetradecanoic acid	ND	ND	**17**	ND
Unknown compound	ND	ND	**3.3**	ND
Dodecanoic acid	ND	ND	**27**	ND

Qualifiers applied by data validator

J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect to practical quantitation limit.
ND: Non-detect
R: Data was rejected by the data validator
JN: Estimated value, compound not included in calibration (~)

Note: Detected analyte concentrations are reported in **bold** font.

APPENDIX H.4

WASTE BIN
AMS NO. 7 ESI

PARAMETERS	ATLAS#7-AMS7-BIN1-S	ATLAS#7-AMS7-BIN245-W	ATLAS#7-AMS7-BIN3-S
RCRA			
Reactive Cyanide, mg/Kg	ND	ND	ND
Reactive Sulfide, mg/Kg	ND	ND	ND
Corrosivity	Not Corrosive	Not Corrosive	Not Corrosive
Ignitability, Deg F	Not Ignitable to 200 °F	Not Ignitable to 200°F	Not Ignitable to 200°F
TCLP			
SW846/8260B/1311,mg/L	ND	ND	ND
SW846/8270C/1311,mg/L	ND	ND	ND
SW846/8081A/1311,mg/L	ND	ND	ND
SW846/8151A/1311,mg/L	ND	ND	ND
SW846/6010B/1311,mg/L	ND	ND	ND
SW846/7470A/1311,mg/L	ND	ND	ND

Qualifiers applied by data validator

J: Estimated value.
UJ: Detection limit above the practical quantitation limit (PQL)
U: Non-detect to practical quantitation limit (PQL)
ND: Non-detect
R: Data was rejected by the data validator
JN: Estimated value, compound not included in calibration

Note: Detected analyte concentrations are reported in **bold** font.

APPENDIX H.5

REAGENT GRADE II RINSE WATER
AMS NO. 7 ESI

PARAMETERS	ATLAS#7-AMS7-RINSE WATER
8260B	
Methylene Chloride (ug/L)	1.8 J
6010B	
	ND

Qualifiers applied by laboratory
J: Estimated value.
ND: Non-detect

Note: Detected analyte concentrations are reported in **bold** font.

APPENDIX I-1

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SURFACE SOILS

Table I-1
Summary of Organic Compounds Detected in Surface Soils
AMS No. 7

Suite/Compound	Detection Frequency	Max. Conc. (ug/kg)	BH06-S-00	Off-Site			Incinerator			Cooling Tower			Diesel UST			Potential Sources*
				SS-05	SS-06	SS-07	SS-08	SS-09	SS-10	SS-11	SS-12	BH08-S-00	SS-13	SS-14	BH07-S-00	
Pentane, 2-methyl-	2	19J	---	---	---	---	17J	---	---	---	---	---	---	19J	---	unknown
SVOCs (ug/kg)																
Benzo(a)anthracene	1	145J	---	---	---	---	---	---	---	---	---	---	---	---	145J	incomplete combustion of fuels
Benzo(a)pyrene	1	76J	---	---	---	---	---	---	---	---	---	---	---	---	76J	incomplete combustion of fuels
Benzo (b)flouranthene	1	126J	---	---	---	---	---	---	---	---	---	---	---	---	126J	incomplete combustion of fuels
Chyrsene	1	142J	---	---	---	---	---	---	---	---	---	---	---	---	142J	incomplete combustion of fuels
Flouranthrene	1	426	---	---	---	---	---	---	---	---	---	---	---	---	426	incomplete combustion of fuels
Phenanthrene	1	191J	---	---	---	---	---	---	---	---	---	---	---	---	191J	incomplete combustion of fuels
Pyrene	1	329J	---	---	---	---	---	---	---	---	---	---	---	---	329J	incomplete combustion of fuels
PCBs (ug/kg)																
Aroclor 1260	4	166	---	---	---	---	28	---	---	166	---	---	106	142	---	heat transfer fluids, pesticide extender

--- Compound not detected above MDL (see Appendix H for associated MDLs)
J - Estimated concentration
Note: * Sources:
National Toxicity Profile (NTP) database
Risk Assessment Information System (RAIS) database
USEPA Pesticide Product Information System

Table I-1
Summary of Organic Compounds Detected in Surface Soils
AMS No. 7

Suite/Compound	Detection Frequency	Max. Conc. (ug/kg)	BH06-S-00	Off-Site			Incinerator			Cooling Tower			Diesel UST			Potential Sources*
				SS-05	SS-06	SS-07	SS-08	SS-09	SS-10	SS-11	SS-12	BH08-S-00	SS-13	SS-14	BH07-S-00	
VOCs (ug/kg)																
Acetone	6	190	86	97.4	184	155	---	---	109	---	---	190	---	---	---	solvents, laboratory contaminant
Benzene	2	2.42	---	---	---	---	2.37	---	---	---	---	---	---	2.42	---	fuels, solvents, pesticides (impurity)
2-Butanone (MEK)	6	9.14J	---	---	---	---	7.10J	7.69J	---	7.87J	4.57J	---	9.14J	4.11J	---	solvents, laboratory contaminant
Carbon Disulfide	2	3.37	---	---	---	---	2.47	---	---	---	---	---	---	3.37	---	resin solvents, insecticides
Methylene Chloride	13	34.7	21.2	6.22	31.1	4.29	4.43	34.7	31.7	9.21	7.45	5.27	6.67	6.32	16.5	solvents, laboratory contaminant
Toluene	5	10.8	---	---	---	---	10.8	---	---	2.92	---	---	3.44	10.7	2.15	fuels, solvents
Trichloroethene (TCE)	1	2.25	---	---	---	---	---	---	---	2.25	---	---	---	---	---	grease solvents, heat exchange fluid
1,2,4 Trimethylbenzene	2	5.37	---	---	---	---	4.19	---	---	---	---	---	---	5.37	---	high octane fuels, paint solvents
1,3,5 Trimethylbenzene	2	2.74	---	---	---	---	2.26	---	---	---	---	---	---	2.74	---	paint solvents
Xylenes (total)	4	17.8	---	---	---	---	16.5	---	---	---	---	---	3.23	17.8	1.94	fuels, solvents, pesticides (impurity)
VOC tics (ug/kg)																
Acetaldehyde	2	5J	---	---	5J	5J	---	---	---	---	---	---	---	---	---	degredation of toluene
Acetic Acid, methyl ester	1	56J	---	---	---	---	---	---	---	56J	---	---	---	---	---	paint solvents
Arsenous acid, tris(trimethylsilyl)	1	3J	---	---	---	---	---	---	3J	---	---	---	---	---	---	pesticides
Benzaldehyde	1	7J	---	---	---	---	---	---	---	7J	---	---	---	---	---	oil and resin solvents, degredation of toluene, pesticides
Butanal	3	10J	---	---	6J	4J	---	---	---	---	---	---	10J	---	---	solvents
Butanal, 3-methyl-	1	5J	---	5J	---	---	---	---	---	---	---	---	---	---	---	unknown
Butane, 2-methyl-	3	35J	---	---	---	---	33J	---	---	---	---	---	11J	35J	---	solvents
Cyclohexane	1	10J	---	---	---	---	10J	---	---	---	---	---	---	---	---	paint and oil solvents, pesticides
Cyclohexane, methyl-	2	14J	---	---	---	---	13J	---	---	---	---	---	---	14J	---	solvents
Cyclotetrasiloxane, octamethyl	4	11J	---	8J	11J	7J	---	---	8J	---	---	---	---	---	---	unknown
Cyclotrisiloxane, hexamethyl	3	4J	---	3J	4J	4J	---	---	---	---	---	---	---	---	---	unknown
2-Furancarboxaldehyde	5	28J	---	3J	28J	17J	---	---	6J	---	---	19.4J	---	---	---	oil solvents, insecticides, herbicides
Heptanal	1	3J	---		3J	---	---	---	---	---	---	---	---	---	---	unknown
Hexanal	12	190J	---	22J	52J	56J	190J	160J	29J	130J	55J	37.6J	200J	58J	25.8J	unknown
Hexane	1	23J	---	---	---	---	23J	---	---	---	---	---	---	25J	---	high octane fuels, glue solvents
Pentanal	6	42J	---	---	15J	13J	---	26J	6J	26J	---	---	42J	---	---	unknown
Pentane	1	59J	---	---	---	---	59J	---	---	---	---	---	---	---	---	fuels, solvents, pesticides

APPENDIX I-2

COMPOUNDS DETECTED IN SURFACE SOILS POTENTIALLY ASSOCIATED WITH PESTICIDES/HERBICIDE SPRAYING

Table I-2

Compounds Detected in Surface Soils Potentially Assocciated with Pesticide/Herbicide Spraying
AMS No. 7

Suite	Compound	Detection Frequency (x/13)	Maximum Concentration (ug/kg)
VOCs	Benzene	2	2.42
	Carbon Disulfide	2	3.37
	Xylenes (total)	4	17.8
VOC tics	Arsenous acid, tris(trimethylsilyl)	1	17.22J
	Benzaldehyde	1	7J
	Cyclohexane	1	10J
	2-Furancarboxaldehyde	3	28J
	Pentane	1	59J
PCBs	Aroclor 1260	5	166

Note:
Compounds are inert components of some current and discontinued pesticides, occurring as impurities, carriers or extenders.

APPENDIX I-3

SUMMARY OF METALS DETECTED IN SURFACE SOILS

Table I-3

Summary of Metals Detected in Surface Soils
AMS No. 7

Metal	Detection Frequency (x/13)	Maximum Concentration (mg/kg)
Aluminum	13	10800
Arsenic	4	1.5
Barium	13	96.9
Calcium	13	53600
Chromium	13	12.4
Copper	13	16
Iron	12	7610
Lead	13	152
Magnesium	13	5320
Manganese	13	153
Nickel	13	7.5
Potassium	13	2480
Sodium	13	86.2
Vanadium	11	16.9
Zinc	12	181

APPENDIX I-4

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOILS AT SHALLOW BOREHOLES

Table I-4
Summary of Organic Compounds Detected in Subsurface Soils at Shallow Boreholes
AMS No. 7

Suite/Compound	Detection Frequency (x/12)	Borehole BH06				Borehole BH07			Borehole BH08				
		S-05	S-10	S-18	S-76	S-05	S-10	S-85*	S-05	S-10	S-15	S-18	S-80
VOCs (ug/kg)													
Acetone [1]	8	41.2	---	16.1	34.6	---	---	---	52.2	26.4	62.5	27.8	26.7
Methylene Chloride [1]	11	44.0	51.0	32.7	---	21.1	25.2	30.0	26.7	30.5	35.8	34.6	20.5
Toluene	1	---	---	---	---	3.96	---	---	---	---	---	---	---
Trichloroethene (TCE)	1	---	---	---	---	---	---	---	---	---	---	36.7	---
1,2,4-Trimethylbenzene	1	---	---	---	---	2.08	---	---	---	---	---	---	---
Xylenes (total)	1	---	---	---	---	4.48	---	---	---	---	---	---	---
VOC tics (ug/kg)													
Pentane	1	---	---	---	---	12.5J	---	---	---	---	---	---	---
SVOC tics (ug/kg)													
1,1,2,2-Tetrachloroethane	1	---	---	---	---	---	15J	---	---	---	---	---	---

S-05 - sample ID denoting depth (in ft.bgs)
--- Compound not detected above MDL (see Appendix H for assoicated MDLs)
J - estimated value
* - compounds attributed to drilling additive (see Table 4-5) are omitted
1 - possible laboratory artifact

APPENDIX I-5

SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS AT SHALLOW BOREHOLES

Table I-5

Summary of Metals Detected in Subsurface Soils at Shallow Boreholes
AMS No. 7

Metal	Detection Frequency (x/12)	Maximum Concentration (mg/kg)
Aluminum	12	15,900
Arsenic	6	2.9
Barium	12	131
Calcium	12	46,600
Chromium	12	17.9
Copper	10	7.6
Iron	12	16,000
Lead	12	7.4
Magnesium	12	8,250
Manganese	12	342
Nickel	11	13.1
Potassium	12	4,370
Sodium	10	123
Vanadium	7	22.2
Zinc	9	36.5

APPENDIX I-6

ORGANIC COMPOUNDS, METALS AND INORGANICS DETECTED IN GROUNDWATER

Table I-6

Organic Compounds, Metals and Inorganics Detected in Groundwater
AMS No. 7

Suite/Compound	Detection Frequency (x/4)	Seymour Aquifer			San Angelos Aquifer
		MW06	MW07	MW08	MW09
VOCs (ug/l)					
1,1-Dichloroethylene	1	---	---	0.3	---
cis-1,2-Dichloroethylene	1	---	---	30	---
trans-1,2-Dichloroethylene	1	---	---	2.8	---
trichloroethylene	1	--	--	140	--
VOC tics (ug/l)					
Acetone [1]	1	---	---	8.7	---
Chloroform	1	---	---	0.5	---
4-Isopropyltoluene	1	---	---	0.1	---
SVOCs (ug/l)					
Bis(2-ethylhexyl)phthalate	2	---	---	1.0	1.3J
SVOC tics (ug/l)					
Camphorsufonic Acid	1	---	---	3.8J	---
Tetradecanoic Acid	1	---	---	17J	---
Hydrocarbon Oil	1	---	21J	---	---
Metals (ug/l)					
Antimony	1	---	---	1.0	---
Barium	4	200	410	320	260
Chromium	4	12	15	8.3	1.3
Copper	4	7.9	10	4.1	4.3
Lead	2	14	6.8	---	---
Nickel	4	12	18	8.7	100
Inorganics (mg/l)					
Flouride	3	0.9	0.6	0.6	---
Nitrate	3	9.5	---	0.5	0.7
Nitrite	1	0.01	---	---	---

--- Compound not detected above MDL

J - estimated value

[1] - possible laboratory contaminant

APPENDIX J-1

TNRCC RISK REDUCTION STANDARDS

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

Background Information:

Section 335.558(d) of the existing Risk Reduction Rules indicates that the Commission will periodically revise the example unadjusted Standard No. 2 MSCs presented in the Appendix II table to reflect newly promulgated standards and to provide MSCs based on current toxicological data. Additionally, §335.556(b) requires consideration of other exposure pathways by which human populations are likely to be exposed (e.g., dermal absorption and vegetable uptake) when setting MSCs.

However, because no specific equations or parameters were provided in the rule, consideration of the dermal absorption pathway has not been addressed in a consistent manner. Therefore, in order to facilitate implementation of Standard No. 2, the MSC values have been updated to reflect current standards (e.g., MCLs), toxicological factors, the soil dermal absorption exposure pathway where appropriate (see Section VII of the memo entitled Implementation of the Existing Risk Reduction Rule for more detail), and to identify contaminants where exposure through vegetable consumption is of particular concern (i.e., cadmium). The updated Standard No. 2 MSCs are provided below for your convenience.

The updated Standard No. 2 Soil MSCs have been calculated using the Risk Reduction Standard No. 2 equations, with the addition of the dermal pathway, updated toxicity factors, and updated chemical/physical properties. In calculating the updated Standard No. 2 Soil MSCs, a risk level of 10^{-6} was used for Class A and B carcingens and a risk level of 10^{-5} was used for Class C carcinogens, and a hazard quotient of 1 was used for all noncarcinogens. In cases where contaminants had both carcinogenic and noncarcinogenic toxicity factors, both types of MSCs (carcinogenic and noncarcinogenic) were calculated and the lowest value (i.e., most conservative) was selected as the updated Standard No. 2 Soil MSC.

The updated Standard No. 2 Groundwater MSCs have been calculated using the MCL (when available) or Risk Reduction Standard No. 2 equations with updated toxicity factors when MCLs were not available. In calculating the updated Standard No. 2 Groundwater MSCs, a risk level of 10^{-6} was used for Class A and B carcingens and a risk level of 10^{-5} was used for Class C carcinogens, and a hazard quotient of 1 was used for all noncarcinogens. In cases where contaminants had both carcinogenic and noncarcinogenic toxicity factors, both types of MSCs (carcinogenic and noncarcinogenic) were calculated and the lowest value (i.e., most conservative) was selected as the updated Standard No. 2 Groundwater MSC.

Abbreviations:

CAS # - Chemical Abstracts Service number
GW-Res - Groundwater MSC for Residential Use
GW-Ind - Groundwater MSC for Industrial Use
GWP-Res - Soil MSC for Resiential Use Based on Groundwater Protection
GWP-Ind - Soil MSC for Industrial Use Based on Groundwater Protection
SAI-Res - Soil MSC for Residential Use Based on Inhalation, Ingestion, and Dermal Contact
SAI-Ind - Soil MSC for Industrial Use Based on Inhalation, Ingestion, and Dermal Contact

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Acenaphthene	83-32-9	2.2E+00	6.1E+00	2.2E+02	6.1E+02	8.2E+03	5.3E+04
Acenaphthylene	208-96-8	2.2E+00	6.1E+00	2.2E+02	6.1E+02	8.2E+03	5.3E+04
Acetaldehyde	75-07-0	---	---	---	---	5.2E+00	8.8E+00
Acetone	67-64-1	3.7E+00	1.0E+01	3.7E+02	1.0E+03	1.6E+03	2.4E+03
Acetone cyanohydrin	75-86-5	2.9E-02	8.2E-02	2.9E+00	8.2E+00	1.2E+02	8.2E+02
Acetonitrile	75-05-8	---	---	---	---	1.8E+02	2.6E+02
Acetophenone	98-86-2	3.7E+00	1.0E+01	3.7E+02	1.0E+03	2.7E+03	4.3E+03
Acifluorfen, sodium	62476-59-9	4.7E-01	1.3E+00	4.7E+01	1.3E+02	2.0E+03	1.3E+04

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Acrolein	107-02-8	7.3E-01	2.0E+00	7.3E+01	2.0E+02	5.5E+03	4.1E+04
Acrylamide	79-06-1	1.9E-05	6.4E-05	1.9E-03	6.4E-03	1.1E-01	6.4E-01
Acrylic acid	79-10-7	1.8E+01	5.1E+01	1.8E+03	5.1E+03	1.4E+05	1.0E+06
Acrylonitrile	107-13-1	1.6E-04	5.3E-04	1.6E-02	5.3E-02	7.9E-02	1.4E-01
Alachlor	15972-60-8	2.0E-03	2.0E-03	2.0E-01	2.0E-01	6.1E+00	3.6E+01
Aldicarb	116-06-3	7.0E-03	7.0E-03	7.0E-01	7.0E-01	1.5E+02	1.0E+03
Aldicarb sulfone	1646-88-4	7.0E-03	7.0E-03	7.0E-01	7.0E-01	1.5E+02	1.0E+03
Aldrin	309-00-2	5.0E-06	1.7E-05	5.0E-04	1.7E-03	2.7E-02	1.4E-01
Allyl alcohol	107-18-6	1.8E-01	5.1E-01	1.8E+01	5.1E+01	1.4E+03	1.0E+04
Allyl chloride	107-05-1	---	---	---	---	1.3E+00	1.8E+00
Aluminum	7429-90-5	3.7E+01	1.0E+02	3.7E+03	1.0E+04	1.5E+05	9.9E+05
Aminopyridine, 4-	504-24-5	7.3E-04	2.0E-03	7.3E-02	2.0E-01	3.1E+00	2.0E+01
Ammonia	7664-41-7	---	---	---	---	1.6E+02	2.3E+02
Aniline	62-53-3	1.5E-02	5.0E-02	1.5E+00	5.0E+00	8.6E+01	5.0E+02
Anthracene	120-12-7	1.1E+01	3.1E+01	1.1E+03	3.1E+03	4.1E+04	2.7E+05
Antimony	7440-36-0	6.0E-03	6.0E-03	6.0E-01	6.0E-01	7.2E+01	4.9E+02
Aramite	140-57-8	3.4E-03	1.1E-02	3.4E-01	1.1E+00	2.0E+01	1.1E+02
Arsenic	7440-38-2	5.0E-02	5.0E-02	5.0E+00	5.0E+00	2.0E+01[b]	2.0E+02[b]
Arsine	7784-42-1	---	---	---	---	---	---
Asbestos	1332-21-4	---	---	---	---	1.5E+03	2.5E+03
Atrazine	1912-24-9	3.0E-03	3.0E-03	3.0E-01	3.0E-01	2.2E+01	1.3E+02
Barium	7440-39-3	2.0E+00	2.0E+00	2.0E+02	2.0E+02	9.1E+03	5.8E+04
Benzene	71-43-2	5.0E-03	5.0E-03	5.0E-01	5.0E-01	9.2E-01	1.6E+00
Benzenethiol	108-98-5	3.7E-04	1.0E-03	3.7E-02	1.0E-01	1.5E+00	3.9E+00
Benzidine	92-87-5	3.7E-07	1.2E-06	3.7E-05	1.2E-04	2.1E-03	1.2E-02
Benz-a-anthracene	56-55-3	2.0E-04	3.9E-04	2.0E-02	3.9E-02	6.3E-01	3.4E+00
Benzo-a-pyrene	50-32-8	2.0E-04	2.0E-04	2.0E-02	2.0E-02	6.3E-02	3.4E-01
Benzo-b-fluoranthene	205-99-2	2.0E-04	3.9E-04	2.0E-02	3.9E-02	6.3E-01	3.4E+00
Benzo-k-fluoranthene	207-08-9	1.2E-03	3.9E-03	1.2E-01	3.9E-01	6.3E+00	3.4E+01
Benzo-g,h,i-perylene	191-24-2	1.1E+00	3.1E+00	1.1E+02	3.1E+02	4.1E+03	2.7E+04
Benzoic acid	65-85-0	1.5E+02	4.1E+02	1.5E+04	4.1E+04	6.2E+05	4.1E+06
Benzotrichloride	98-07-7	6.6E-06	2.2E-05	6.6E-04	2.2E-03	3.8E-02	2.2E-01
Benzyl alcohol	100-51-6	1.1E+01	3.1E+01	1.1E+03	3.1E+03	4.6E+04	3.1E+05
Benzyl chloride	100-44-7	5.0E-04	1.7E-03	5.0E-02	1.7E-01	3.8E+00	3.4E+01
Beryllium	7440-41-7	4.0E-03	4.0E-03	4.0E-01	4.0E-01	4.6E+01	2.7E+02
Biphenyl, 1,1-	92-52-4	1.8E+00	5.1E+00	1.8E+02	5.1E+02	1.9E+02	2.7E+02
Bis (2-chloro-ethyl) ether	111-44-4	7.7E-05	2.6E-04	7.7E-03	2.6E-02	1.5E-01	3.2E-01
Bis (2-chloroisopropyl) ether	108-60-1	1.5E+00	4.1E+00	1.5E+02	4.1E+02	6.2E+03	4.1E+04
Bis (2-chloromethyl) ether	542-88-1	3.9E-07	1.3E-06	3.9E-05	1.3E-04	1.1E-04	1.9E-04
Bis (2-ethyl-hexyl) phthalate	117-81-7	6.0E-03	6.0E-03	6.0E-01	6.0E-01	1.7E+01	6.5E+01
Bromodichloromethane	75-27-4	1.0E-01	1.0E-01	1.0E+01	1.0E+01	1.0E+01	9.2E+01
Bromoform	75-25-2	1.0E-01	1.0E-01	1.0E+01	1.0E+01	3.4E+01	8.5E+01
Bromomethane	74-83-9	5.1E-02	1.4E-01	5.1E+00	1.4E+01	3.5E+00	4.9E+00
Butadiene, 1,3-	106-99-0	---	---	---	---	1.8E-02	3.0E-02

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Butanol, n-	71-36-3	3.7E+00	1.0E+01	3.7E+02	1.0E+03	2.7E+04	2.0E+05
Butylate	2008-41-5	1.8E+00	5.1E+00	1.8E+02	5.1E+02	7.7E+03	5.1E+04
Butyl benzyl phthalate	85-68-7	7.3E+00	2.0E+01	7.3E+02	2.0E+03	3.1E+04	2.0E+05
Cacodylic acid	75-60-5	1.1E-01	3.1E-01	1.1E+01	3.1E+01	4.6E+02	3.1E+03
Cadmium	7440-43-9	5.0E-03	5.0E-03	5.0E-01	5.0E-01	1.2E+02[c]	4.1E+02
Captan	133-06-2	2.4E-02	8.2E-02	2.4E+00	8.2E+00	1.4E+02	8.2E+02
Carbaryl	63-25-2	3.7E+00	1.0E+01	3.7E+02	1.0E+03	1.5E+04	1.0E+05
Carbazole	86-74-8	4.3E-03	1.4E-02	4.3E-01	1.4E+00	2.4E+01	1.4E+02
Carbofuran	1563-66-2	4.0E-02	4.0E-02	4.0E+00	4.0E+00	7.7E+02	5.1E+03
Carbon disulfide	75-15-0	3.7E+00	1.0E+01	3.7E+02	1.0E+03	1.0E+03	1.5E+03
Carbon tetrachloride	56-23-5	5.0E-03	5.0E-03	5.0E-01	5.0E-01	3.5E-01	6.3E-01
Carbosulfan	55285-14-8	3.7E-01	1.0E+00	3.7E+01	1.0E+02	1.5E+03	1.0E+04
Chloral	75-87-6	7.3E-02	2.0E-01	7.3E+00	2.0E+01	5.5E+02	4.1E+03
Chlordane	57-74-9	2.0E-03	2.0E-03	2.0E-01	2.0E-01	1.6E+00	1.1E+01
Chlorine	7782-50-5	4.0E+00	4.0E+00	4.0E+02	4.0E+02	2.0E+04	1.4E+05
Chloroaniline, p-	106-47-8	1.5E-01	4.1E-01	1.5E+01	4.1E+01	6.2E+02	4.1E+03
Chlorobenzene	108-90-7	1.0E-01	1.0E-01	1.0E+01	1.0E+01	3.1E+02	4.5E+02
Chlorobenzilate	510-15-6	3.2E-04	1.1E-03	3.2E-02	1.1E-01	1.8E+00	1.1E+01
Chloro-1,3-butadiene, 2-	126-99-8	---	---	---	---	1.0E+01	1.4E+01
Chlorodifluoromethane	75-45-6	---	---	---	---	1.1E+04	1.5E+04
Chloroethane	75-00-3	1.5E+01	4.1E+01	1.5E+03	4.1E+03	1.1E+04	1.7E+04
Chloroform	67-66-3	1.0E-01	1.0E-01	1.0E+01	1.0E+01	3.1E-01	5.1E-01
Chloromethane	74-87-3	6.6E-02	2.2E-01	6.6E+00	2.2E+01	2.3E+00	3.8E+00
Chloronaphthalene, 2-	91-58-7	2.9E+00	8.2E+00	2.9E+02	8.2E+02	1.1E+04	7.1E+04
Chlorophenol, 2-	95-57-8	1.8E-01	5.1E-01	1.8E+01	5.1E+01	1.1E+03	4.0E+03
Chlorotoluene, o-	95-49-8	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.0E+03	7.7E+03
Chlorpyrifos	2921-88-2	1.1E-01	3.1E-01	1.1E+01	3.1E+01	4.6E+02	3.1E+03
Chromium (III) (total chromium)	16065-83-1/ 7440-47-3	1.0E-01	1.0E-01	1.0E+01	1.0E+01	5.3E+04	2.3E+05
Chromium (VI)	18540-29-9	1.0E-01	1.0E-01	1.0E+01	1.0E+01	2.0E+02	1.2E+03
Chrysene	218-01-9	1.2E-02	3.9E-02	1.2E+00	3.9E+00	6.3E+01	3.4E+02
Cobalt	7440-48-4	2.2E+00	6.1E+00	2.2E+02	6.1E+02	1.3E+04	6.1E+04
Copper	7440-50-8	1.3E+00	1.3E+00	1.3E+02	1.3E+02	1.0E+04	7.4E+04
Cresol, m-	108-39-4	1.8E+00	5.1E+00	1.8E+02	5.1E+02	7.7E+03	5.1E+04
Cresol, o-	95-48-7	1.8E+00	5.1E+00	1.8E+02	5.1E+02	7.7E+03	5.1E+04
Cresol, p-	106-44-5	1.8E-01	5.1E-01	1.8E+01	5.1E+01	7.7E+02	5.1E+03
Crotonaldehyde	123-73-9	4.5E-04	1.5E-03	4.5E-02	1.5E-01	3.4E+00	3.0E+01
Cumene	98-82-8	3.7E+00	1.0E+01	3.7E+02	1.0E+03	5.4E+03	9.0E+03
Cyanide	57-12-5	2.0E-01	2.0E-01	2.0E+01	2.0E+01	5.1E+03	3.7E+04
Cyanogen	460-19-5	1.5E+00	4.1E+00	1.5E+02	4.1E+02	4.3E+00	6.0E+00
Cyclohexanone	108-94-1	1.8E+02	5.1E+02	1.8E+04	5.1E+04	2.1E+03	3.0E+03
Cyclotrimethylenetrinitramine	121-82-4	7.7E-03	2.6E-02	7.7E-01	2.6E+00	3.6E+01	5.4E+01
DDD	72-54-8	3.5E-04	1.2E-03	3.5E-02	1.2E-01	2.4E+00	1.8E+01
DDE	72-55-9	2.5E-04	8.4E-04	2.5E-02	8.4E-02	1.7E+00	1.3E+01

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
DDT	50-29-3	2.5E-04	8.4E-04	2.5E-02	8.4E-02	1.7E+00	1.2E+01
Di-n-butyl phthalate	84-74-2	3.7E+00	1.0E+01	3.7E+02	1.0E+03	1.5E+04	1.0E+05
Di-n-octyl phthalate	117-84-0	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.1E+03	2.0E+04
Diallate	2303-16-4	1.4E-03	4.7E-03	1.4E-01	4.7E-01	8.0E+00	4.7E+01
Diazinon	333-41-5	3.3E-02	9.2E-02	3.3E+00	9.2E+00	1.4E+02	9.2E+02
Dibenz-a,h-anthracene	53-70-3	2.0E-04	2.0E-04	2.0E-02	2.0E-02	6.3E-02	3.4E-01
Dibromo-3-chloropropane, 1,2-	96-12-8	2.0E-04	2.0E-04	2.0E-02	2.0E-02	3.5E-01	2.0E+00
Dibromochloromethane	124-48-1	1.0E-01	1.0E-01	1.0E+01	1.0E+01	7.6E+01	6.8E+02
Dicamba	1918-00-9	1.1E+00	3.1E+00	1.1E+02	3.1E+02	4.6E+03	3.1E+04
Dichlorobenzene, 1,2-	95-50-1	6.0E-01	6.0E-01	6.0E+01	6.0E+01	2.6E+03	3.9E+03
Dichlorobenzene, 1,4-	106-46-7	7.5E-02	7.5E-02	7.5E+00	7.5E+00	2.7E+02	2.4E+03
Dichlorobenzidine, 3,3-	91-94-1	1.9E-04	6.4E-04	1.9E-02	6.4E-02	1.1E+00	6.4E+00
Dichloro-2-butene, 1,4-	764-41-0	—	—	—	—	2.3E-02	3.8E-02
Dichlorodifluoromethane	75-71-8	7.3E+00	2.0E+01	7.3E+02	2.0E+03	2.2E+03	3.1E+03
Dichloroethane, 1,1-	75-34-3	3.7E+00	1.0E+01	3.7E+02	1.0E+03	8.9E+02	1.3E+03
Dichloroethane, 1,2-	107-06-2	5.0E-03	5.0E-03	5.0E-01	5.0E-01	2.7E-01	4.7E-01
Dichloroethylene, 1,1-	75-35-4	7.0E-03	7.0E-03	7.0E-01	7.0E-01	6.0E-01	1.1E+00
Dichloroethylene, cis-1,2-	156-59-2	7.0E-02	7.0E-02	7.0E+00	7.0E+00	1.2E+03	2.5E+03
Dichloroethylene, trans-1,2	156-60-5	1.0E-01	1.0E-01	1.0E+01	1.0E+01	1.4E+03	2.4E+03
Dichlorophenol, 2,4-	120-83-2	1.1E-01	3.1E-01	1.1E+01	3.1E+01	4.6E+02	3.1E+03
Dichlorophenoxyacetic acid, 2,4-	94-75-7	7.0E-02	7.0E-02	7.0E+00	7.0E+00	2.0E+03	1.4E+04
Dichloropropane, 1,2-	78-87-5	5.0E-03	5.0E-03	5.0E-01	5.0E-01	9.4E+00	2.5E+01
Dichloropropanol, 2,3-	616-23-9	1.1E-01	3.1E-01	1.1E+01	3.1E+01	4.6E+02	3.1E+03
Dichloropropene, 1,3-	542-75-6	4.7E-04	1.6E-03	4.7E-02	1.6E-01	2.7E-01	4.8E-01
Dichlorvos	62-73-7	2.9E-04	9.9E-04	2.9E-02	9.9E-02	1.7E+00	9.9E+00
Dieldrin	60-57-1	5.3E-06	1.8E-05	5.3E-04	1.8E-03	3.1E-02	1.8E-01
Diethylhexyl adipate	103-23-1	7.1E-01	2.4E+00	7.1E+01	2.4E+02	4.1E+03	2.4E+04
Diethyl phthalate	84-66-2	2.9E+01	8.2E+01	2.9E+03	8.2E+03	1.2E+05	8.2E+05
Diethylstilbestrol	56-53-1	1.8E-08	6.1E-08	1.8E-06	6.1E-06	1.0E-04	6.1E-04
Dimethoate	60-51-5	7.3E-03	2.0E-02	7.3E-01	2.0E+00	3.1E+01	2.0E+02
Dimethoxybenzidine, 3,3'-	119-90-4	6.1E-03	2.0E-02	6.1E-01	2.0E+00	3.5E+01	2.0E+02
Dimethylbenzidine, 3,3'-	119-93-7	9.3E-06	3.1E-05	9.3E-04	3.1E-03	5.3E-02	3.1E-01
Dimethyl phenol, 2,4-	105-67-9	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.1E+03	2.0E+04
Dinitrobenzene, 1,3-	99-65-0	3.7E-03	1.0E-02	3.7E-01	1.0E+00	1.5E+01	1.0E+02
Dinitrobenzene, 1,4-	100-25-4	1.5E-02	4.1E-02	1.5E+00	4.1E+00	6.2E+01	4.1E+02
Dinitrophenol, 2,4-	51-28-5	7.3E-02	2.0E-01	7.3E+00	2.0E+01	3.1E+02	2.0E+03
Dinitrotoluene, 2,4-	121-14-2	1.3E-04	4.2E-04	1.3E-02	4.2E-02	7.2E-01	4.2E+00
Dinitrotoluene, 2,6-	606-20-2	1.3E-04	4.2E-04	1.3E-02	4.2E-02	7.2E-01	4.2E+00
Dinoseb	88-85-7	7.0E-03	7.0E-03	7.0E-01	7.0E-01	1.5E+02	1.0E+03
Dioxane 1,4-	123-91-1	7.7E-03	2.6E-02	7.7E-01	2.6E+00	5.8E+01	5.2E+02
Diphenylamine	122-39-4	9.1E-01	2.6E+00	9.1E+01	2.6E+02	3.9E+03	2.6E+04
Diphenylhydrazine, 1,2-	122-66-7	1.1E-04	3.6E-04	1.1E-02	3.6E-02	6.1E-01	3.6E+00
Diquat	85-00-7	2.0E-02	2.0E-02	2.0E+00	2.0E+00	3.4E+02	2.2E+03
Disulfoton	298-04-4	1.5E-03	4.1E-03	1.5E-01	4.1E-01	6.2E+00	4.1E+01

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Diuron	330-54-1	7.3E-02	2.0E-01	7.3E+00	2.0E+01	3.1E+02	2.0E+03
Endosulfan	115-29-7	2.2E-01	6.1E-01	2.2E+01	6.1E+01	6.2E+01	9.2E+01
Endothall	145-73-3	1.0E-01	1.0E-01	1.0E+01	1.0E+01	3.1E+03	2.0E+04
Endrin	72-20-8	2.0E-03	2.0E-03	2.0E-01	2.0E-01	4.6E+01	3.1E+02
Epichlorohydrin	106-89-8	8.6E-03	2.9E-02	8.6E-01	2.9E+00	7.2E+00	1.0E+01
Ethion	563-12-2	1.8E-02	5.1E-02	1.8E+00	5.1E+00	7.7E+01	5.1E+02
Ethoxy ethanol, 2-	110-80-5	1.5E+01	4.1E+01	1.5E+03	4.1E+03	4.3E+00	6.0E+00
Ethyl acetate	141-78-6	3.3E+01	9.2E+01	3.3E+03	9.2E+03	8.9E+03	1.3E+04
Ethyl acrylate	140-88-5	1.8E-03	6.0E-03	1.8E-01	6.0E-01	1.3E+01	1.2E+02
Ethyl benzene	100-41-4	7.0E-01	7.0E-01	7.0E+01	7.0E+01	4.3E+03	6.9E+03
Ethyl dipropylthiocarbamate, S-	759-94-4	9.1E-01	2.6E+00	9.1E+01	2.6E+02	3.9E+03	2.6E+04
Ethyl ether	60-29-7	7.3E+00	2.0E+01	7.3E+02	2.0E+03	3.8E+03	5.7E+03
Ethyl methacrylate	97-63-2	3.3E+00	9.2E+00	3.3E+02	9.2E+02	5.7E+03	9.9E+03
Ethyl-2-methyl benzene, 1-	611-14-3	1.0E+00	1.0E+00	1.0E+02	1.0E+02	5.5E+03	8.4E+03
Ethyl-4-methyl benzene, 1-	622-96-8	1.0E+00	1.0E+00	1.0E+02	1.0E+02	4.8E+03	7.2E+03
Ethylenediamine	107-15-3	7.3E-01	2.0E+00	7.3E+01	2.0E+02	5.5E+03	4.1E+04
Ethylene dibromide	106-93-4	5.0E-05	5.0E-05	5.0E-03	5.0E-03	7.2E-03	5.5E-02
Ethylene glycol	107-21-1	7.3E+01	2.0E+02	7.3E+03	2.0E+04	3.1E+05	2.0E+06
Ethylene oxide	75-21-8	8.3E-05	2.8E-04	8.3E-03	2.8E-02	7.5E-02	1.4E-01
Ethylene thiourea	96-45-7	7.7E-04	2.6E-03	7.7E-02	2.6E-01	4.4E+00	2.6E+01
Fluoranthene	206-44-0	1.5E+00	4.1E+00	1.5E+02	4.1E+02	5.5E+03	3.6E+04
Fluorene	86-73-7	1.5E+00	4.1E+00	1.5E+02	4.1E+02	5.5E+03	3.6E+04
Fluorine (soluble fluoride)	7782-41-4	4.0E+00	4.0E+00	4.0E+02	4.0E+02	1.5E+04	1.1E+05
Formaldehyde	50-00-0	7.3E+00	2.0E+01	7.3E+02	2.0E+03	5.5E+04	4.1E+05
Formic acid	64-18-6	7.3E+01	2.0E+02	7.3E+03	2.0E+04	5.5E+05	4.1E+06
Furan	110-00-9	3.7E-02	1.0E-01	3.7E+00	1.0E+01	3.9E+01	6.1E+01
Furfural	98-01-1	1.1E-01	3.1E-01	1.1E+01	3.1E+01	8.2E+02	6.1E+03
Glycidylaldehyde	765-34-4	1.5E-02	4.1E-02	1.5E+00	4.1E+00	1.1E+02	8.2E+02
Heptachlor	76-44-8	4.0E-04	4.0E-04	4.0E-02	4.0E-02	9.3E-02	4.1E-01
Heptachlor epoxide	1024-57-3	2.0E-04	2.0E-04	2.0E-02	2.0E-02	5.4E-02	3.1E-01
Hexachlorobenzene	118-74-1	1.0E-03	1.0E-03	1.0E-01	1.0E-01	2.5E-01	1.0E+00
Hexachlorobutadiene	87-68-3	7.3E-03	2.0E-02	7.3E-01	2.0E+00	1.6E+01	3.2E+01
Hexachlorocyclohexane, alpha	319-84-6	1.4E-05	4.5E-05	1.4E-03	4.5E-03	9.0E-02	6.5E-01
Hexachlorocyclohexane, beta	319-85-7	4.7E-04	1.6E-03	4.7E-02	1.6E-01	3.2E+00	2.3E+01
Hexachlorocyclohexane, gamma	58-89-9	2.0E-04	2.0E-04	2.0E-02	2.0E-02	4.4E-01	3.1E+00
Hexachlorocyclohexane, techn	608-73-1	4.7E-05	1.6E-04	4.7E-03	1.6E-02	3.2E-01	2.3E+00
Hexachlorocyclopentadiene	77-47-4	5.0E-02	5.0E-02	5.0E+00	5.0E+00	3.6E+00	5.0E+00
Hexachloroethane	67-72-1	3.7E-02	1.0E-01	3.7E+00	1.0E+01	1.5E+02	7.5E+02
Hexachlorophene	70-30-4	1.1E-02	3.1E-02	1.1E+00	3.1E+00	4.6E+01	3.1E+02
Hexane, n-	110-54-3	2.2E+00	6.1E+00	2.2E+02	6.1E+02	5.7E+01	8.1E+01
Hexazinone	51235-04-2	1.2E+00	3.4E+00	1.2E+02	3.4E+02	5.1E+03	3.4E+04
Hydrazine	302-01-2	2.8E-05	9.5E-05	2.8E-03	9.5E-03	2.1E-01	1.9E+00
Indeno-1,2,3-cd-pyrene	193-39-5	2.0E-04	3.9E-04	2.0E-02	3.9E-02	6.3E-01	3.4E+00
Isobutyl alcohol	78-83-1	1.1E+01	3.1E+01	1.1E+03	3.1E+03	3.0E+03	4.3E+03

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Isophorone	78-59-1	9.0E-01	3.0E+00	9.0E+01	3.0E+02	5.2E+03	3.0E+04
Kepone	143-50-0	1.8E-02	5.1E-02	1.8E+00	5.1E+00	7.7E+01	5.1E+02
Lead (inorganic)	7439-92-1	1.5E-02	1.5E-02	1.5E+00	1.5E+00	5.0E+02[d]	1.0E+03[d]
Malathion	121-75-5	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.1E+03	2.0E+04
Maleic anhydride	108-31-6	3.7E+00	1.0E+01	3.7E+02	1.0E+03	1.5E+04	1.0E+05
Maleic hydrazide	123-33-1	1.8E+01	5.1E+01	1.8E+03	5.1E+03	7.7E+04	5.1E+05
Malononitrile	109-77-3	7.3E-04	2.0E-03	7.3E-02	2.0E-01	3.1E+00	2.0E+01
Manganese	7439-96-5	1.7E+00	1.4E+01	1.7E+02	1.4E+03	1.6E+04	8.1E+04
Mercury	7439-97-6	2.0E-03	2.0E-03	2.0E-01	2.0E-01	6.1E+00	9.6E+00
Methacrylonitrile	126-98-7	3.7E-03	1.0E-02	3.7E-01	1.0E+00	1.1E+01	2.2E+01
Methanol	67-56-1	1.8E+01	5.1E+01	1.8E+03	5.1E+03	1.4E+05	1.0E+06
Methomyl	16752-77-5	9.1E-01	2.6E+00	9.1E+01	2.6E+02	3.9E+03	2.6E+04
Methoxychlor	72-43-5	4.0E-02	4.0E-02	4.0E+00	4.0E+00	7.5E+02	4.4E+03
Methoxyethanol, 2-	109-86-4	---	---	---	---	6.1E+00	8.5E+00
Methyl ethyl ketone	78-93-3	2.2E+01	6.1E+01	2.2E+03	6.1E+03	6.0E+03	8.6E+03
Methyl isobutyl ketone	108-10-1	2.9E+00	8.2E+00	2.9E+02	8.2E+02	2.0E+03	2.9E+03
Methyl mercury	22967-92-6	3.7E-03	1.0E-02	3.7E-01	1.0E+00	2.5E+01	1.9E+02
Methyl methacrylate	80-62-6	5.1E+01	1.4E+02	5.1E+03	1.4E+04	5.8E+03	8.2E+03
Methylnaphthalene, 2-	91-57-6	1.5E+00	4.1E+00	1.5E+02	4.1E+02	5.5E+03	3.6E+04
Methyl parathion	298-00-0	9.1E-03	2.6E-02	9.1E-01	2.6E+00	3.9E+01	2.6E+02
Methylene-bis (2-chloroaniline) 4,4'-	101-14-4	6.6E-04	2.2E-03	6.6E-02	2.2E-01	3.8E+00	2.2E+01
Methylene chloride	75-09-2	5.0E-03	5.0E-03	5.0E-01	5.0E-01	8.7E+00	1.6E+01
Molinate	2212-67-1	7.3E-02	2.0E-01	7.3E+00	2.0E+01	3.1E+02	2.0E+03
Molybdenum	7439-98-7	1.8E-01	5.1E-01	1.8E+01	5.1E+01	1.1E+03	8.1E+03
MTBE	1634-04-4	3.7E-01/ 1.5E-02[e]	1.0E+00/ 1.5E-02[e]	3.7E+01	1.0E+02	1.5E+03	3.7E+03
Naled	300-76-5	7.3E-02	2.0E-01	7.3E+00	2.0E+01	3.1E+02	2.0E+03
Naphthalene	91-20-3	7.3E-01	2.0E+00	7.3E+01	2.0E+02	1.8E+02	2.7E+02
Nickel and compounds	7440-02-0	7.3E-01	2.0E+00	7.3E+01	2.0E+02	1.9E+03	1.2E+04
Nitrate	14797-55-8	1.0E+01	1.0E+01	1.0E+03	1.0E+03	4.1E+05	3.0E+06
Nitrite	14797-65-0	1.0E+00	1.0E+00	1.0E+02	1.0E+02	2.5E+04	1.9E+05
Nitroaniline, 2-	88-74-4	1.1E-02	3.1E-02	1.1E+00	3.1E+00	4.6E+01	3.1E+02
Nitrobenzene	98-95-3	1.8E-02	5.1E-02	1.8E+00	5.1E+00	6.5E+01	2.7E+02
Nitropropane, 2-	79-46-9	---	---	---	---	4.2E-03	7.0E-03
Nitroso-n-ethylurea, n-	759-73-9	6.1E-07	2.0E-06	6.1E-05	2.0E-04	3.5E-03	2.0E-02
Nitroso-methyl-ethyl-amine, n-	10595-95-6	3.9E-06	1.3E-05	3.9E-04	1.3E-03	2.9E-02	2.6E-01
Nitrosodi-n-butylamine, n-	924-16-3	1.6E-05	5.3E-05	1.6E-03	5.3E-03	4.1E-02	1.0E-01
Nitrosodi-n-propylamine, n-	621-64-7	1.2E-05	4.1E-05	1.2E-03	4.1E-03	4.1E-02	1.6E-01
Nitrosodiethanolamine	1116-54-7	3.0E-05	1.0E-04	3.0E-03	1.0E-02	1.7E-01	1.0E+00
Nitrosodiethylamine, n-	55-18-5	5.7E-07	1.9E-06	5.7E-05	1.9E-04	4.3E-03	3.8E-02
Nitrosodimethylamine, n-	62-75-9	1.7E-06	5.6E-06	1.7E-04	5.6E-04	1.3E-02	1.1E-01
Nitrosodiphenylamine	86-30-6	1.7E-02	5.8E-02	1.7E+00	5.8E+00	5.9E+01	2.3E+02
Nitrosopyrrolidine, n-	930-55-2	4.1E-05	1.4E-04	4.1E-03	1.4E-02	2.3E-01	1.4E+00
Nitrotoluene, m-	99-08-1	3.7E-01	1.0E+00	3.7E+01	1.0E+02	4.4E+02	7.9E+02

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
Nitrotoluene, o-	88-72-2	3.7E-01	1.0E+00	3.7E+01	1.0E+02	4.7E+02	8.6E+02
Nitrotoluene, p-	99-99-0	3.7E-01	1.0E+00	3.7E+01	1.0E+02	4.4E+02	7.9E+02
Octamethylpyrophosphoramide	152-16-9	7.3E-02	2.0E-01	7.3E+00	2.0E+01	3.1E+02	2.0E+03
Oxamyl	23135-22-0	2.0E-01	2.0E-01	2.0E+01	2.0E+01	3.9E+03	2.6E+04
Parathion	56-38-2	2.2E-01	6.1E-01	2.2E+01	6.1E+01	9.3E+02	6.1E+03
Pebulate	1114-71-2	1.8E+00	5.1E+00	1.8E+02	5.1E+02	7.7E+03	5.1E+04
Pentachlorobenzene	608-93-5	2.9E-02	8.2E-02	2.9E+00	8.2E+00	1.2E+02	8.0E+02
Pentachloronitrobenzene	82-68-8	3.3E-03	1.1E-02	3.3E-01	1.1E+00	1.9E+01	1.1E+02
Pentachlorophenol	87-86-5	1.0E-03	1.0E-03	1.0E-01	1.0E-01	3.0E+00	1.4E+01
Perchlorate	NA	2.2E-02[f]	9.2E-02	2.2E+00[f]	9.2E+00	6.6E+01[f]	1.2E+03
Phenanthrene	85-01-8	1.1E+00	3.1E+00	1.1E+02	3.1E+02	4.1E+03	2.7E+04
Phenol	108-95-2	2.2E+01	6.1E+01	2.2E+03	6.1E+03	9.3E+04	6.1E+05
Phenyl mercuric acetate	62-38-4	2.9E-03	8.2E-03	2.9E-01	8.2E-01	1.2E+01	8.2E+01
Phenylene diamine, m-	108-45-2	2.2E-01	6.1E-01	2.2E+01	6.1E+01	9.3E+02	6.1E+03
Phenylene diamine, p-	106-50-3	6.9E+00	1.9E+01	6.9E+02	1.9E+03	2.9E+04	1.9E+05
Phorate	298-02-2	7.3E-03	2.0E-02	7.3E-01	2.0E+00	1.6E+01	3.8E+01
Phosphine	7803-51-2	1.1E-02	3.1E-02	1.1E+00	3.1E+00	5.9E+01	4.1E+02
Phosphorus, white	7723-14-0	7.3E-04	2.0E-03	7.3E-02	2.0E-01	4.0E+00	2.7E+01
Phthalic anhydride	85-44-9	7.3E+01	2.0E+02	7.3E+03	2.0E+04	3.1E+05	2.0E+06
Polybrominated biphenyls	67774-32-7	9.6E-06	3.2E-05	9.6E-04	3.2E-03	5.5E-02	3.2E-01
Polychlorinated biphenyls	1336-36-3	5.0E-04	5.0E-04	5.0E-02	5.0E-02	1.0E+01[g]	1.0E+01[g]
Pronamide	23950-58-5	2.7E+00	7.7E+00	2.7E+02	7.7E+02	1.2E+04	7.7E+04
Propargite	2312-35-8	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.1E+03	2.0E+04
Propargyl alcohol	107-19-7	7.3E-02	2.0E-01	7.3E+00	2.0E+01	5.5E+02	4.1E+03
Propham	122-42-9	7.3E-01	2.0E+00	7.3E+01	2.0E+02	3.1E+03	2.0E+04
Propylene oxide	75-56-9	3.5E-04	1.2E-03	3.5E-02	1.2E-01	1.2E+00	3.1E+00
Pyrene	129-00-0	1.1E+00	3.1E+00	1.1E+02	3.1E+02	4.1E+03	2.7E+04
Pyridine	110-86-1	3.7E-02	1.0E-01	3.7E+00	1.0E+01	8.2E+00	1.2E+01
Quinoline	91-22-5	7.1E-05	2.4E-04	7.1E-03	2.4E-02	4.1E-01	2.4E+00
Selenium	7782-49-2	5.0E-02	5.0E-02	5.0E+00	5.0E+00	1.3E+03	9.2E+03
Selenourea	630-10-4	1.8E-01	5.1E-01	1.8E+01	5.1E+01	1.4E+03	1.0E+04
Silver	7440-22-4	1.8E-01	5.1E-01	1.8E+01	5.1E+01	4.6E+02	2.8E+03
Sodium diethyldithiocarbamate	148-18-5	3.2E-03	1.1E-02	3.2E-01	1.1E+00	2.4E+01	2.1E+02
Strychnine	57-24-9	1.1E-02	3.1E-02	1.1E+00	3.1E+00	4.6E+01	3.1E+02
Styrene	100-42-5	1.0E-01	1.0E-01	1.0E+01	1.0E+01	1.3E+04	2.3E+04
Tetrachlorobenzene, 1,2,4,5-	95-94-3	1.1E-02	3.1E-02	1.1E+00	3.1E+00	4.6E+01	3.0E+02
Tetrachloroethane, 1,1,1,2-	630-20-6	3.3E-02	1.1E-01	3.3E+00	1.1E+01	5.2E+01	1.0E+02
Tetrachloroethane, 1,1,2,2-	79-34-5	4.3E-03	1.4E-02	4.3E-01	1.4E+00	5.1E+00	9.8E+00
Tetrachloroethylene	127-18-4	5.0E-03	5.0E-03	5.0E-01	5.0E-01	6.0E+00	1.7E+01
Tetrachlorophenol, 2,3,4,6-	58-90-2	1.1E+00	3.1E+00	1.1E+02	3.1E+02	4.6E+03	3.1E+04
Tetraethyl dithiopyrophosphate	3689-24-5	1.8E-02	5.1E-02	1.8E+00	5.1E+00	7.7E+01	5.1E+02
Tetraethyl lead	78-00-2	3.7E-06	1.0E-05	3.7E-04	1.0E-03	1.5E-02	9.7E-02
Thallium and compounds (as thallium chloride)	7791-12-0	2.0E-03	2.0E-03	2.0E-01	2.0E-01	2.0E+01	1.5E+02
Thiofanox	39196-18-4	1.1E-02	3.1E-02	1.1E+00	3.1E+00	4.6E+01	3.1E+02

Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs)

(Last update: July 14, 1999)

Contaminant	CAS #	GW-Res (mg/l)	GW-Ind (mg/l)	GWP-Res (mg/kg)	GWP-Ind (mg/kg)	SAI-Res[a] (mg/kg)	SAI-Ind[a] (mg/kg)
The SAI-Res (20 mg/kg) and SAI-Ind (200 mg/kg) values for arsenic are based on the cleanup levels established by the Executive irector (interoffice memos entitled "Arsenic Soil Cleanup Standards" from Dan Pearson on May 19, 1995 and "Arsenic Soil leanup Standards for Commercial/Industrial Areas" from Jeff Saitas on September 11, 1998, respectively).							
The SAI-Res MSC value for cadmium does NOT account for vegetable ingestion. Please include this pathway when warranted ue to site-specific conditions.							
The SAI-Res and SAI-Ind values for lead were calculated using the USEPA Lead Uptake/Biokinetic Model and the USEPA odel for Assessing Risks Associated with Adult Exposures to Lead in Soil, respectively.							
The first value for MTBE represents the health-based value; the second value for MTBE is based on odor and taste.							
The GW-Res, GWP-Res, and SAI-res values for perchlorate are specifically set to address a childhood exposure scenario, due to he potential for the unique toxicity of perchlorate to children.							
The SAI-Res and SAI-Ind value for PCBs (10 mg/kg) is based on the TSCA limit defined in 40 CFR 761.125. An alternate leanup level of 25 mg/kg may be appropriate for certain industrial sites, provided the site meets the requirements for a restricted ccess site (i.e., > 0.1 km from a residential/commercial area limited by man-made barriers) as defined in TSCA 40 CFR 761.123.							

APPENDIX J-2

TEXAS-SPECIFIC BACKGROUND CONCENTRATIONS

Texas Natural Resource Conservation Commission

INTEROFFICE MEMORANDUM

To: Remediation Division Project Managers **Date:** June 28, 2000

Thru: Jacqueline S. Hardee, P.E., Director *(Initialed JSH)*
Remediation Division

From: Chet Clarke, Manager *(Initialed WDC)*
Technical Support Section

Subject: Using non-site specific background assumptions under the 30 TAC 335 Risk Reduction Rules.

As stated in Section VI.3 of the TNRCC Interoffice Memorandum dated July 23, 1998, regarding Implementation of the Existing Risk Reduction Rule, commonly referred to as the "Consistency Document," background concentrations established under the Risk Reduction Rule (30 TAC 335) must be established site-specifically and that Soil Conservation Survey or U.S. Geological Survey reports should not be used to characterize site-specific background for soils. The general policy regarding background as stated in the Consistency Document stands but is now modified to address situations when background cannot be established site-specifically. These situations are limited to sites without appropriate locations being available, due to the extent of contamination from releases or presence of physical barriers, to collect natural background concentration data which are reasonably proximal or within the same environmental media as the affected media of interest. In situations where there are no appropriate locations to collect natural background concentration data, persons may use the following table to determine background concentrations. Otherwise, the person must set background site-specifically. Quantification of anthropogenic background likely will not be influenced by these location constraints and should continue to be based on sample locations beyond the release site.

Texas-Specific Background Concentration	
Metal	Median Background Concentration (mg/kg)
Aluminum	30,000
Antimony	1
Arsenic	5.9
Barium	300
Beryllium	1.5

Boron	30
Total Chromium	30
Cobalt	7
Copper	15
Fluorine	190
Iron	15,000
Lead	15
Manganese	300
Mercury	0.04
Nickel	10
Selenium	0.3
Strontium	100
Tin	0.9
Titanium	2,000
Thallium	9.3
Vanadium	50
Zinc	30

Additional constituents may be added to this table as information becomes available.

MONITOR WELL TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
MW06	7543299.76	1719524.64	1367.73
MW07	7543379.73	1719805.65	1370.88
MW08	7543542.98	1719815.49	1365.94
MW09	7543566.68	1719814.85	1366.22

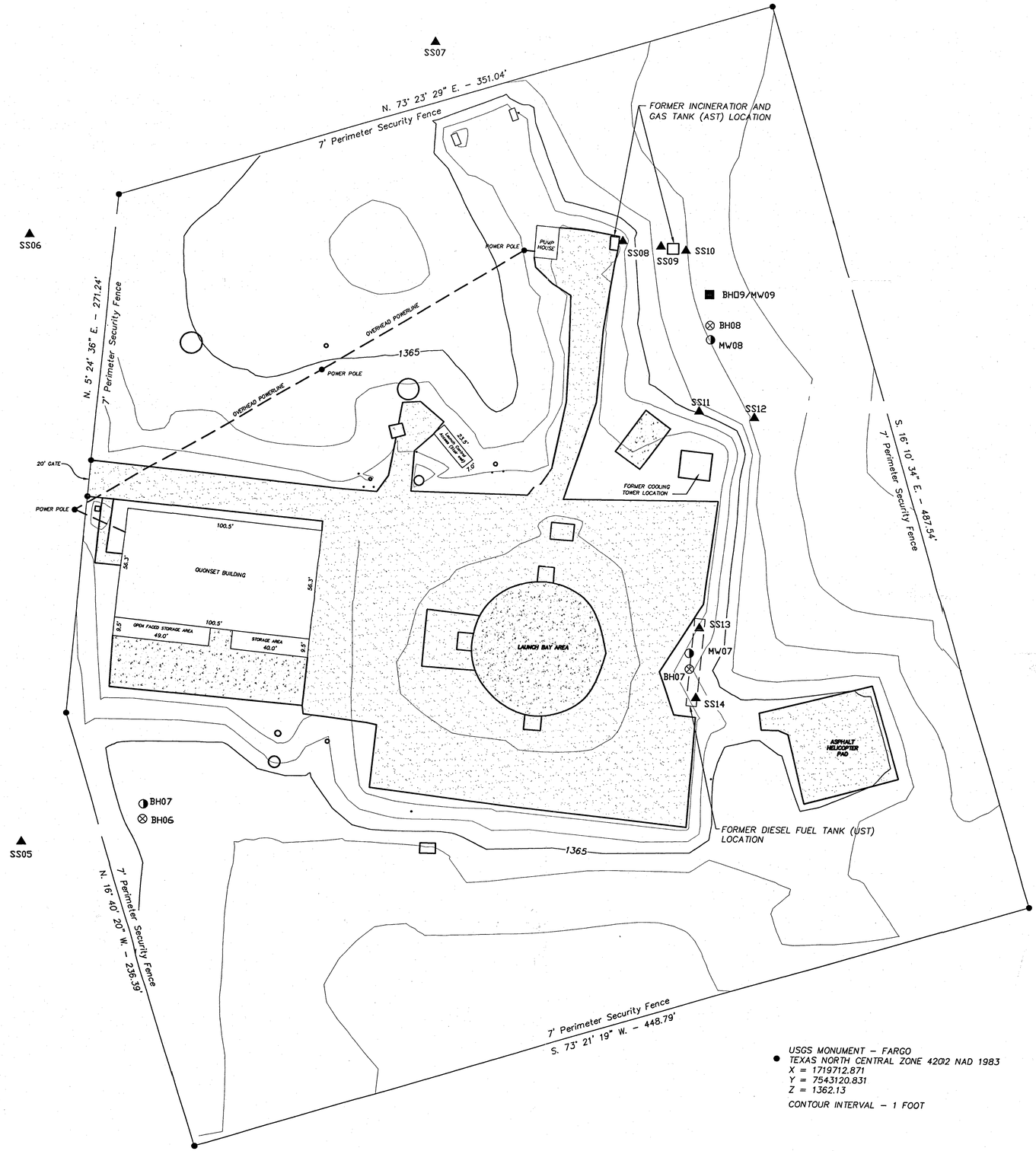
NOTE: ELEVATIONS WERE TAKEN AT THE NORTH END OF THE INTERIOR PVC CASING.

BORE HOLE TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
BH06	7543291.90	1719524.29	1365.0
BH07	7543371.68	1719805.76	1367.0
BH08	7543550.53	1719815.19	1362.5

SOIL SAMPLE TABLE

NAME	NORTHING	EASTING	ELEVATION
	STATE PLANE GRID COORDINATES		FEET
SS05	7543279.80	1719460.31	1366.7
SS06	7543596.67	1719463.11	1365.6
SS07	7543697.65	1719671.36	1363.7
SS08	7543594.58	1719769.25	1366.4
SS09	7543591.92	1719789.20	1363.8
SS10	7543589.83	1719802.20	1363.2
SS11	7543505.56	1719809.86	1364.3
SS12	7543502.42	1719838.56	1362.9
SS13	7543392.98	1719810.79	1367.1
SS14	7543356.83	1719809.09	1366.8



USGS MONUMENT – FARGO
TEXAS NORTH CENTRAL ZONE 4202 NAD 1983
X = 1719712.871
Y = 7543120.831
Z = 1362.13

CONTOUR INTERVAL – 1 FOOT

LEGEND

- ESI SURFACE SOIL SAMPLE LOCATION (ID)
- ESI SHALLOW BOREHOLE LOCATION (ID)
- ESI SHALLOW MONITORING WELL LOCATION (ID)
- ESI DEEP BOREHOLE/MONITORING WELL LOCATION (ID)
- 1365 — TOPOGRPHIC CONOUR INTERVAL (MSL)
- CONCRETE
- ASPHALT

NOTE:
ALL BEARINGS AND DISTANCES ARE STATE PLANE GRID VALUES.

STATE OF TEXAS : KNOW ALL MEN BY THESE PRESENTS, that I, Richard E. Johnson, Registered
COUNTY OF COLLINGSWORTH : Professional Land Surveyor, do hereby certify that I did cause to be surveyed on the ground the tract of land shown on this plat, and to the best of my knowledge and belief, the said description is true and correct.

IN WITNESS THEREOF, my hand and seal, this the 15th day of August, A.D., 2000.

STATE OF TEXAS · REGISTERED · RICHARD E. JOHNSON · 4263 · PROFESSIONAL LAND SURVEYOR

Richard E. Johnson
Registered Professional
Land Surveyor #4263

north

80' 0 80'
SCALE

TULSA TERC
ESI REPORT
FORMER AMS NO. 7

PLATE 1

ESI SAMPLING LOCATIONS

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 2201027.dwg			DATE: 09/18/00	
WORK ORDER	TASK	DRAWING NUMBER	REV.	DRIVE
4423	220	Figure XXX		

<CPD: 09/21/00 [TIME: 4:41 PM] >