FIRST SEMIANNUAL MONITORING ONLY REPORT
FOR
UNDERGROUND STORAGE TANK 214
FACILITY ID #9-089015
BUILDING 1503

FORT STEWART, GEORGIA

Prepared for:

U.S. Army Corps of Engineers - Savannah District
and
Fort Stewart Directorate of Public Works
Under Contract Number DACA21-95-D-0022
Delivery Order 0055

Prepared by:

Science Applications International Corporation
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37830

June 2000

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List of Abbreviations and Acronyms

ACL	alternate concentration limit
AMSL	above mean sea level
AT123D	Analytical Transient 1-, 2-, 3-Dimensional
BGS	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
DAF	dilution attenuation factor
GA EPD	Georgia Environmental Protection Division
IWQS	In-Stream Water Quality Standard
PAH	polynuclear aromatic hydrocarbon
SAIC	Science Applications International Corporation
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
USTMP	Underground Storage Tank Management Program

MONITORING ONLY REPORT

Submittal Date: June 2000 Monitoring Report Number: 1st Semiannual

For Period Covering: January 2000 to June 2000

Facility Name: UST 214 Building 1503 Street Address: W. 6th Street Southeast of McFarland Avenue

Facility ID: 9-089015 City: Fort Stewart County: Liberty Zip Code: 31314

Latitude: 31° 51′ 51″ Longitude: 81° 37′ 15″

Submitted by UST Owner/Operator:		Prepared by Consultant/Contractor:	
Name:	Thomas C. Fry/ Environmental Branch	Name:	Patricia A. Stoll
Company:	U.S. Army/HQ 3d, Inf. Div (Mech)	Company:	SAIC
Address:	Directorate of Public Works, Bldg. 1137	Address:	P.O. Box 2502
	1550 Frank Cochran Drive		
City:	Fort Stewart State: GA	City:	Oak Ridge State: TN
Zip Code:	31314-4927	Zip Code:	37831
Telephone:	(912) 767-2010	Telephone:	(865) 481-8792

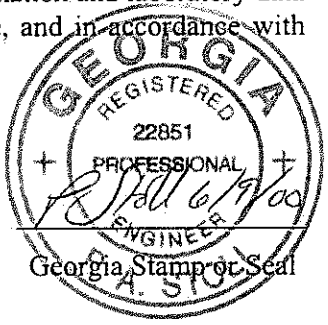
I. REGISTERED PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST CERTIFICATION

I hereby certify that I have directed and supervised the fieldwork and preparation of this plan, in accordance with State Rules and Regulations. As a registered professional geologist and/or professional engineer, I certify that I am a qualified groundwater professional, as defined by the Georgia State Board of Professional Geologists. All of the information and laboratory data in this plan and in all of the attachments are true, accurate, complete, and in accordance with applicable State Rules and Regulations.

Name: Patricia A. Stoll

Signature: Patricia A. Stoll

Date: 6/19/00



Georgia Stamp or Seal

II. PROJECT SUMMARY

(Appendix I, Figure 1: Site Location Map)

Provide a brief description or explanation of the site and a brief chronology of environmental events leading up to this report.

Former Underground Storage Tank (UST) 214, Facility ID #9-089015, was located near Building 1503 at Fort Stewart, Georgia. The tank was excavated and removed on August 1, 1996, and the associated ancillary piping was closed in-place. Science Applications International Corporation (SAIC) performed a Corrective Action Plan (CAP)-Part A investigation in 1998 to determine the extent of petroleum contamination at the site. One vertical profile boring and six temporary piezometers were installed during the investigation. The CAP-Part A Report (SAIC 1999) was submitted in August 1999 and recommended monitoring only at the site. As recommended in the Monitoring Only Plan, four shallow monitoring wells (63-08 through 63-11) were installed as part of the first semiannual sampling event in January 2000, and groundwater was sampled for benzene, toluene, ethylbenzene, and xylenes (BTEX).

The fate and transport modeling performed as part of the CAP-Part A investigation (SAIC 1999) indicated a continuous source of contamination. The results are summarized in Attachment A of this document. Upon completion of the second semiannual monitoring event in July 2000, the fate and transport modeling results will be revised, if necessary, using the results from the semiannual monitoring events to calibrate the model.

The purpose of the semiannual monitoring, summarized in this report, is to confirm the results of the fate and transport modeling and that natural attenuation is taking place at the site. If the benzene concentrations remain below the In-Stream Water Quality Standard (IWQS) during the July 2000 sampling event, then a no-further-action-required status will be recommended.

III. ACTIVITIES AND ASSESSMENT OF EXISTING CONDITIONS

A. Potentiometric Data:

(Appendix I, Figure 2: Potentiometric Surface Map)
(Appendix II, Table 1: Groundwater Elevations)

Discuss groundwater flow at this site and implications for this project.

During the first semiannual sampling event in January/February 2000, groundwater elevations were measured in all of the monitoring wells to determine the groundwater flow direction. In February 2000, the groundwater flow direction was toward the west-southwest, and the groundwater gradient was approximately 0.008 foot/foot.

B. Analytical Data:

(Appendix I, Figure 3: Groundwater Quality Map)
(Appendix I, Figure 4: Trend of Contaminant Concentrations)
(Appendix II, Table 2: Groundwater Analytical Results)
(Appendix III: Laboratory Analytical Results)

Discuss groundwater analysis results, trend of contaminant concentrations, and implications for this project.

During the first semiannual sampling event in January 2000, monitoring wells 63-08, 63-09, 63-10, and 63-11 were sampled for BTEX. Analytical results from the first sampling event showed estimated concentrations below the analytical reporting limits or no detectable BTEX concentrations in wells 63-09, 63-10, and 63-11. BTEX compounds were present in well 63-08. However, none of the constituents exceeded their respective IWQS. Benzene was detected at 6 µg/L in well 63-08, 0.24J µg/L in well 63-09, and 0.17J µg/L in well 63-11. The benzene concentrations in wells 63-08, 63-09, and 63-11 were below the IWQS of 71.28 µg/L. Figure 4 shows the variation in benzene concentrations in groundwater for all the wells.

As recommended in the CAP-Part A Report (SAIC 1999), polynuclear aromatic hydrocarbon (PAH) analysis was not recommended as part of the Monitoring Only Plan for the site.

IV. SITE RANKING (Note: re-rank site after each monitoring event)
(Appendix IV: Site Ranking Form)

Environmental Site Sensitivity Score:
(April 1999 version of the Site Ranking Form was used for January 2000 score.)

2600 (CAP-Part A Report)
350 (Jan. 2000 – First Semiannual Monitoring Event)

V. CONCLUSIONS/RECOMMENDATIONS

Provide justification of no-further-action-required recommendation or briefly discuss future monitoring plans for this site.

The Monitoring Only Plan is being conducted in accordance with Section III of the CAP-Part A Report (SAIC 1999) and as approved by the Georgia Environmental Protection Diversion (GA EPD) Underground Storage Tank Management Program (USTMP) in correspondence dated November 10, 1999 (Logan 1999). Termination conditions approved in the CAP-Part A Report (SAIC 1999) indicated that termination would be recommended if the measured benzene concentrations were less than the concentrations predicted by the fate and transport modeling.

In July 2000, semiannual monitoring will continue in wells 63-08, 63-09, 63-10, and 63-11, and groundwater samples will be collected for BTEX only. Water level measurements will also be taken during the second semiannual monitoring event in July 2000.

VI. REIMBURSEMENT

Attached _____ N/A X

(Appendix V: Reimbursement Application)

Fort Stewart is a federally owned facility and has funded the investigation for the UST 214 site, Building 1503, Facility ID #9-089015, using U.S. Department of Defense Environmental Restoration Account Funds. Application for Georgia Underground Storage Tank Trust Fund reimbursement is not being pursued at this time.

APPENDIX I

REPORT FIGURES

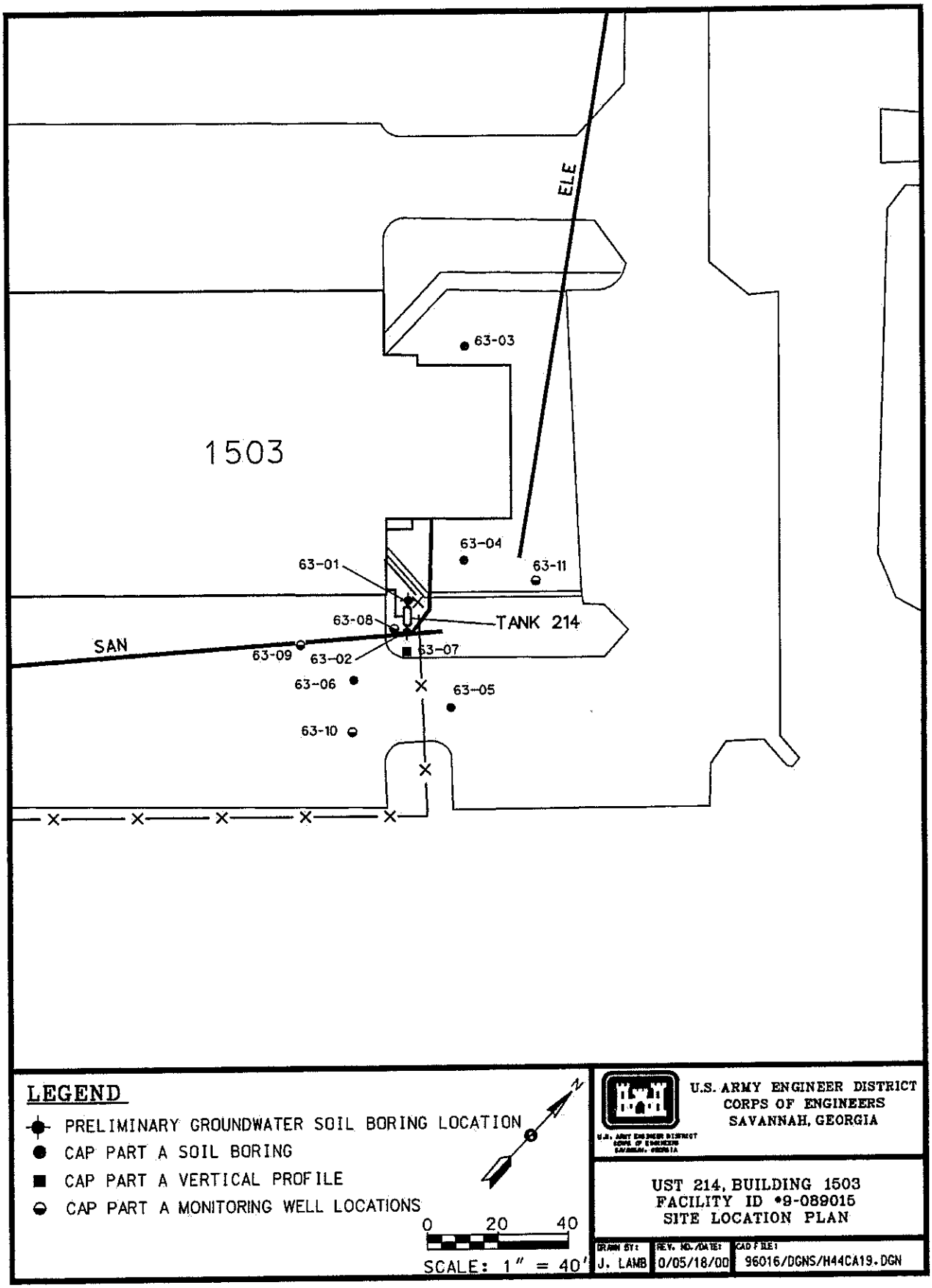


Figure 1. Location Map of UST 214 at Fort Stewart, Liberty County, Georgia

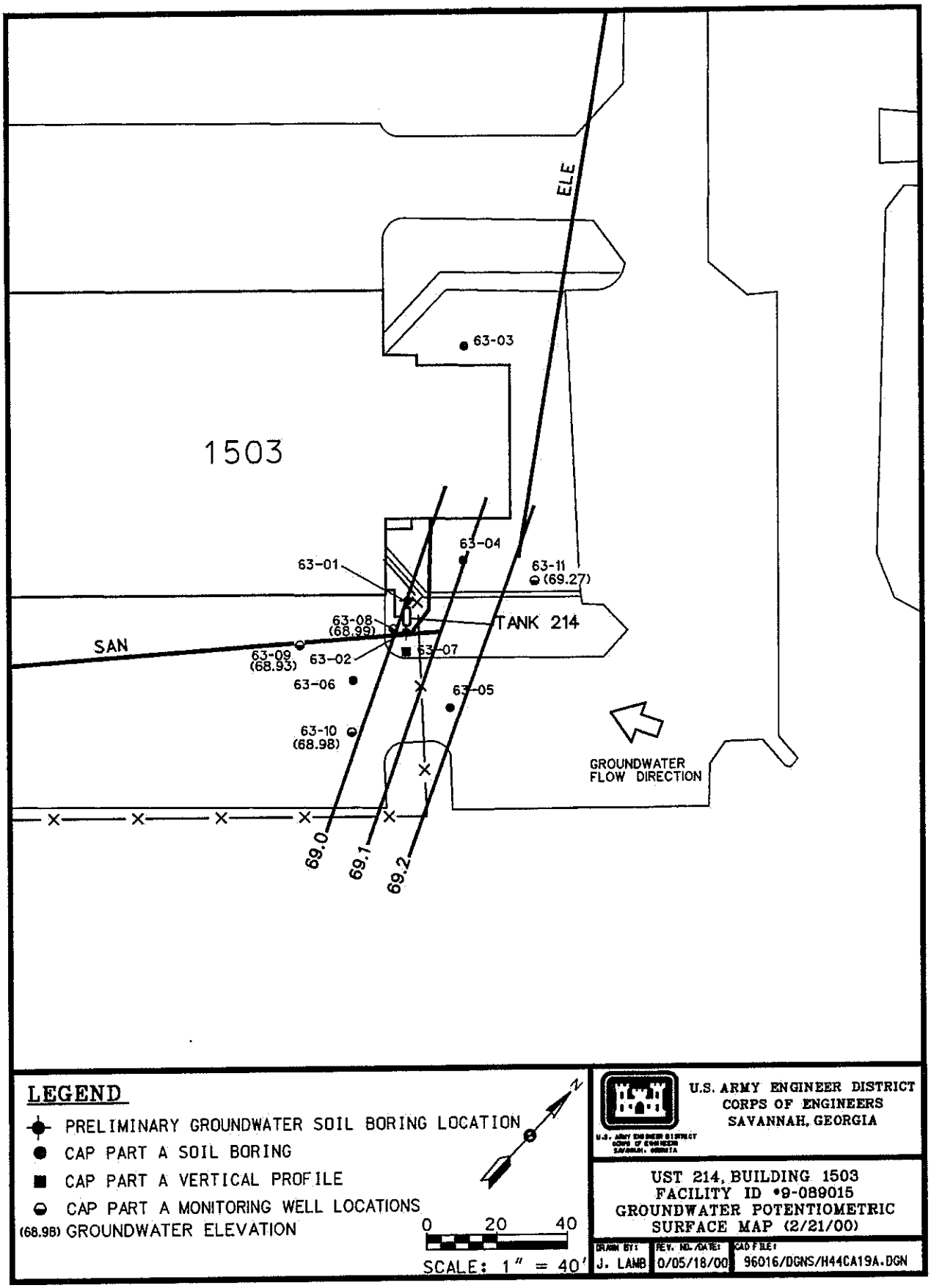


Figure 2. Potentiometric Surface Map of the UST 214 Site (February 2000)

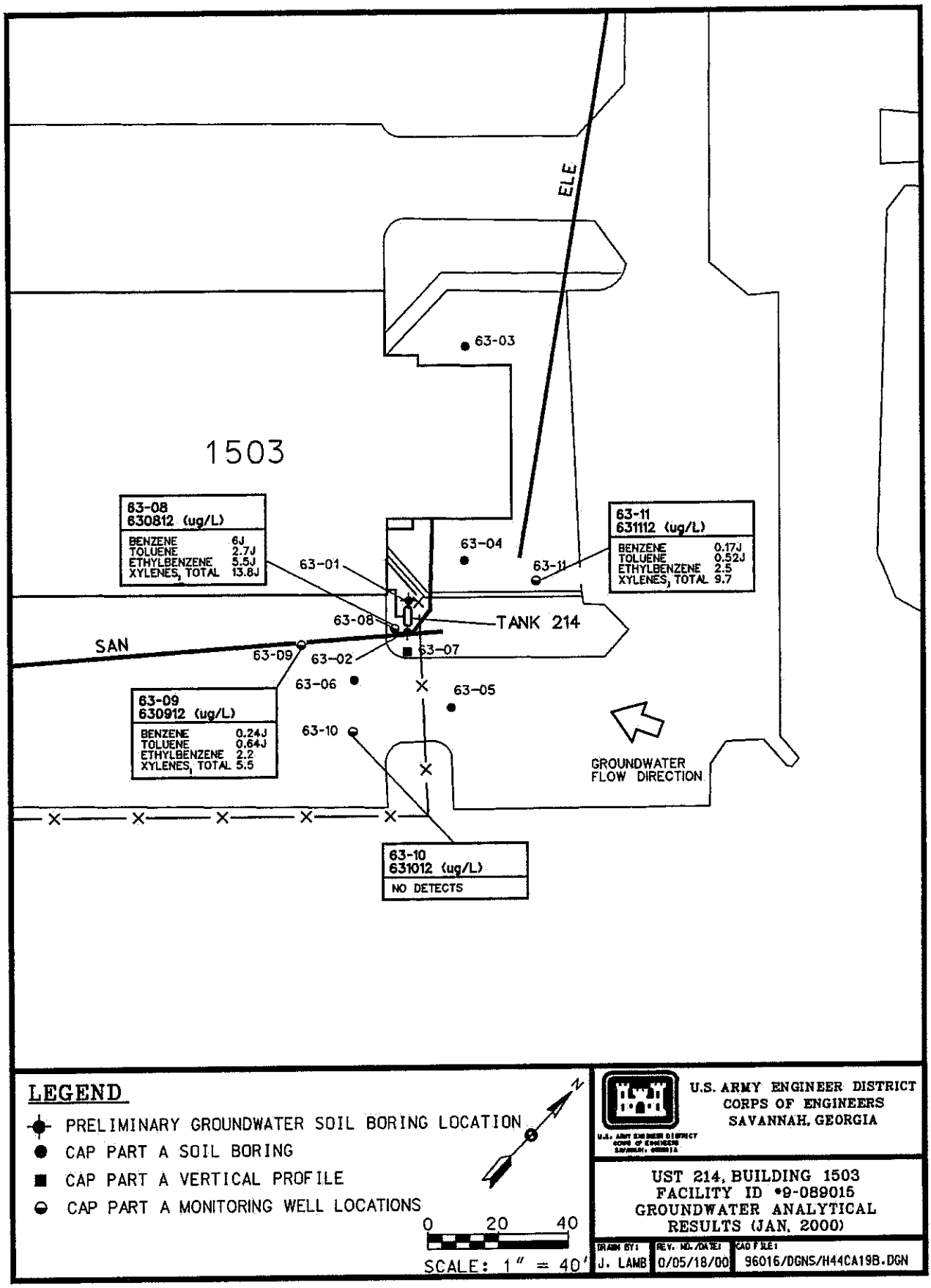


Figure 3. Groundwater Quality Map for the UST 214 Site (February 2000)

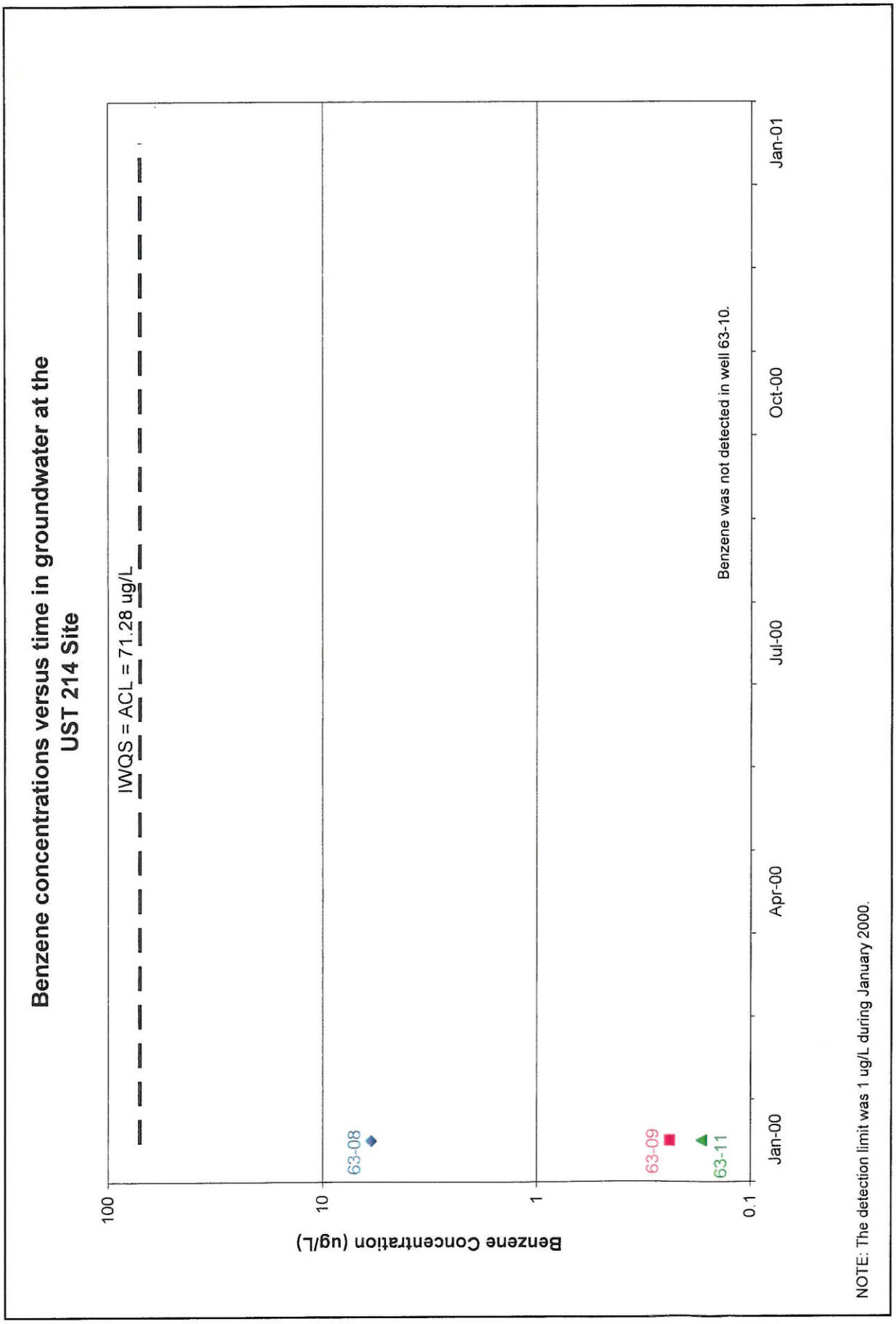


Figure 4. Trend of Contaminant Concentrations for the UST 214 Site

APPENDIX II

REPORT TABLES

Table 1. Groundwater Elevations

Well Number	Date of Measurement	Top of Casing Elevation (feet AMSL)	Screened Interval (feet BGS)	Water Depth (feet BTOC)	Groundwater Elevation (feet AMSL)
First Semiannual Monitoring Event – January/February 2000					
63-08	2/21/00	76.17	1.6 – 11.6	7.18	68.99
63-09	2/21/00	75.99	2.4 – 9.4	7.06	68.93
63-10	2/21/00	75.32	1.9 – 8.9	6.34	68.98
63-11	2/21/00	75.73	3.0 – 9.0	6.46	69.27

Table 2. Groundwater Analytical Results

Sample Location	Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	Total PAH (µg/L)
First Semiannual Monitoring Event – January/February 2000								
63-08	630812	1/15/00	6 J	2.7 J	5.5 J	13.8 J	28.0	NA
63-09	630912	1/17/00	0.24 J	0.64 J	2.2 =	5.5 =	8.58	NA
63-10	631012	1/15/00	1 U	1 U	1 U	3 U	ND	NA
63-11	631112	1/17/00	0.17 J	0.52 J	2.5 =	9.7 =	12.89	NA
In-Stream Water Quality Standard (GA EPD Chapter 391-3-6)			72.18	200,000	28,718	NRC	NRC	NRC
Alternate Concentration Limit			72.18	–	–	–	–	–

NOTE:

Bold values exceed IWQSs.

Italic values exceed alternate concentrations limits.

AMSL Above mean sea level
BGS Below ground surface
BTEX Benzene, toluene, ethylbenzene, and xylenes
BTOC Below top of casing
NA Not analyzed; PAH compounds were not required as part of the Monitoring Only Plan.
ND Not detected
NRC No regulatory criteria
PAH Polynuclear aromatic hydrocarbon

Laboratory Qualifiers

U Indicates the compound was not detected at the concentration reported.
UJ Indicates the compound was not detected above an approximated sample quantitation limit.
J Indicates the value for the compound is an estimated value.
= Indicates the compound was detected at the concentration reported.

Table 3. Well Construction Details

Boring/Well Number	Date Installed	Boring Depth (ft BGS)	Screened Interval (ft BGS)	Type of Completion	Coordinates		Ground Surface Elevation	Top of Casing Elevation
					Northing (NAD83)	Easting (NAVD88)		
First Semiannual Monitoring Event – January/February 2000								
63-08	1/15/00	11.7	1.6 – 11.6	¾" PVC	678492.9	825578.0	76.59	76.17
63-09	1/15/00	9.5	2.4 – 9.4	¾" PVC	678476.4	825559.6	76.26	75.99
63-10	1/15/00	9.0	1.9 – 8.9	¾" PVC	678463.2	825589.6	75.64	75.32
63-11	1/15/00	9.1	3.0 – 9.0	¾" PVC	678530.4	825598.1	76.00	75.73

BGS Below ground surface
PVC Polyvinyl chloride

APPENDIX III

LABORATORY ANALYTICAL RESULTS

FIRST SEMIANNUAL MONITORING EVENT

JANUARY/FEBURARY 2000

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

630812

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: FSAB005W

Matrix: (soil/water) WATER Lab Sample ID: 20661011

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5T122

Level: (low/med) LOW Date Received: 01/17/00

% Moisture: not dec. _____ Date Analyzed: 01/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
71-43-2	Benzene	6.0	J
108-88-3	Toluene	2.7	
100-41-4	Ethylbenzene	5.5	
1330-20-7	Xylenes (total)	13.8	

A03, FD4, FD8

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

630912

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: FSAB009W

Matrix: (soil/water) WATER Lab Sample ID: 20703008

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2T118

Level: (low/med) LOW Date Received: 01/18/00

% Moisture: not dec. _____ Date Analyzed: 01/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
71-43-2	Benzene	0.24	J
108-88-3	Toluene	0.64	J
100-41-4	Ethylbenzene	2.2	
107-02-8	Xylenes (total)	5.5	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

631012

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: FSAB005W

Matrix: (soil/water) WATER Lab Sample ID: 20661012

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5T123

Level: (low/med) LOW Date Received: 01/17/00

% Moisture: not dec. _____ Date Analyzed: 01/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
71-43-2	Benzene	1.0	U
108-88-3	Toluene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	Xylenes (total)	3.0	U

VS AD3

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

631112

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: FSAB009W

Matrix: (soil/water) WATER Lab Sample ID: 20703007

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2T117

Level: (low/med) LOW Date Received: 01/18/00

% Moisture: not dec. _____ Date Analyzed: 01/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
71-43-2	Benzene	0.17	J	JJ
108-88-3	Toluene	0.52	J	
100-41-4	Ethylbenzene	2.5		
107-02-8	Xylenes (total)	9.7		

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2 of 2

CHAIN OF CUSTODY RECORD

COC NO.: D05504

PROJECT NAME: Ft. Stewart USTs D.O. #55

PROJECT NUMBER: 01-1624-04-2352-200

PROJECT MANAGER: Patty Stoll

Sampler (Signature) (Printed Name)

Laura Lumley Laura Lumley

LABORATORY NAME: General Engineering Laboratory

LABORATORY ADDRESS: 2040 Savage Road Charleston, SC 29417

PHONE NO: (803) 556-8171

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	BTEX	PAH	PAH, Lead	Dissolved Iron	TPH	TCLP BTEX	TCLP Lead	No. of Bottles/ Vials:	OVA SCREENING	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
370562	1/16/00	0955	water	2							2		20606010
630812	1/15/00	1200		2							2		011
631012	1/15/00	1500		2							2		012
841712	1/16/00	1710		2							2		013
841916	1/16/00	1443		2							2		014
841912	1/16/00	1500		2							2		015
751112	1/16/00	1725		2							2		016
801212	1/16/00	1215		2							2		017
801112	1/16/00	1300		2							2		018
TB5503	1/15/00	0745		2							2		019
TB5504	1/16/00	0745		2							2		020
751011	1/16/00	1525	Soil	1		1					2		20657003

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time	TOTAL NUMBER OF CONTAINERS: 56	Cooler Temperature: 4°C
COMPANY NAME: SAIC	1/17/00 1145	COMPANY NAME: GEL	1/17/00 1525	Cooler ID: #843	FEDEX NUMBER:
RELINQUISHED BY:	Date/Time 1-17-00 1145	RECEIVED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			
RELINQUISHED BY:	Date/Time 1-17-00 1525	RECEIVED BY:	Date/Time		
COMPANY NAME: GEL		COMPANY NAME:			

III-7

CO

Science Applications International Corporation
An Employee-Owned Company

00 Oak Ridge Turnpike, Oak Ridge, TN 37831 (423) 481-4600

207

CHAIN OF CUSTODY RECORD

COC NO.: D055507

PROJECT NAME: Ft. Stewart USTs D.O. #55

PROJECT NUMBER: 01-1624-04-2352-200

PROJECT MANAGER: Patty Stoll

Sampler (Signature) (Printed Name)

Laura Lumley Laura Lumley

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	BTEX	PAH	PAH, Lead	Dissolved Iron	TPH	TCLP BTEX	TCLP Lead	VOC	No. of Bottles/ Vials:	UVA SCREENING	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
631112	1/17/00	1520	water	2								2		20703007
630912	1/17/00	1515		2								2		008
960512	1/17/00	1100									2	2		20705001
960562	1/17/00	1420									2	2		002
960572	1/17/00	1550									2	2		003
960522	1/17/00	1150									2	2		004
960532	1/17/00	1215									2	2		005
960542	1/17/00	1240									2	2		006
960552	1/17/00	1350									2	2		007
960562	1/17/00	1700									2	2		008
TB5505	1/17/00	0745	↓								2	2		009

1055 1/18/00

LABORATORY NAME: General Engineering Laboratory

LABORATORY ADDRESS: 2040 Savage Road Charleston, SC 29417

PHONE NO: (803) 556-8171

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Laura Lumley	1/18/00	[illegible]	1/18/00
COMPANY NAME: SAIC	1121	COMPANY NAME: [illegible]	1407
RECEIVED BY: [illegible]	Date/Time 1-18-00	RELINQUISHED BY:	Date/Time
COMPANY NAME: S.E.C.	1121	COMPANY NAME:	
RELINQUISHED BY: [illegible]	Date/Time 1-18-00	RECEIVED BY:	Date/Time
COMPANY NAME: S.E.C.	1407	COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 65

Cooler ID: #760

Cooler Temperature: 4 °C

FEDEX NUMBER:

8-III

6

APPENDIX IV

SITE RANKING FORM

FIRST SEMIANNUAL MONITORING EVENT

JANUARY/FEBRUARY 2000

SITE RANKING FORM

Facility Name: UST 214, Building 1503 **Ranked by:** S. Stoller

County: Liberty **Facility ID #:** 9-089015 **Date Ranked:** 5/16/2000

SOIL CONTAMINATION

A. Total PAHs –
Maximum Concentration found on the site
(Assume <0.660 mg/kg if only gasoline was stored on site)

- ☒ ≤0.660 mg/kg = 0
- ☐ >0.66 - 1 mg/kg = 10
- ☐ >1 - 10 mg/kg = 25
- ☐ >10 mg/kg = 50

B. Total Benzene -
Maximum Concentration found on the site

- ☐ ≤0.005 mg/kg = 0
- ☐ >0.005 - .05 mg/kg = 1
- * ☒ >0.05 - 1 mg/kg = 10
- ☐ >1 - 10 mg/kg = 25
- ☐ >10 - 50 mg/kg = 40
- ☐ >50 mg/kg = 50

* *Closure sample TK214-S1 (1996) elevated detection limit*

C. Depth to Groundwater
(bls = below land surface)

- ☐ >50' bls = 1
- ☐ >25' - 50' bls = 2
- ☐ >10' - 25' bls = 5
- ☒ ≤10' bls = 10

Fill in the blanks: (A. 0) + (B. 10) = (10) x (C. 10) = (D. 100)

GROUNDWATER CONTAMINATION

E. Free Product (Nonaqueous-phase liquid hydrocarbons; See Guidelines For definition of "sheen").

- ☒ No free product = 0
- ☐ Sheen - 1/8" = 250
- ☐ >1/8" - 6" = 500
- ☐ >6" - 1ft. = 1,000
- ☐ For every additional inch, add another 100 points = 1,000 +

F. Dissolved Benzene -
Maximum Concentration at the site
(One well must be located at the source of the release.)

- ☐ ≤5 µg/L = 0
- * ☒ >5 - 100 µg/L = 5
- ☐ >100 - 1,000 µg/L = 50
- ☐ >1,000 - 10,000 µg/L = 500
- ☐ >10,000 µg/L = 1500

* *LTM sample 630812 (January 2000)*

Fill in the blanks: (E. 0) + (F. 5) = (G. 5)

Facility Name: UST 214, Building 1503 **County:** Liberty **Facility ID #:** 9-089015

POTENTIAL RECEPTORS (MUST BE FIELD-VERIFIED)

Distance from nearest contaminant plume boundary to the nearest downgradient and hydraulically connected Point of Withdrawal for water supply. **If the point of withdrawal is not hydraulically connected, evidence as outlined in the CAP-A guidance document MUST be presented to substantiate this claim.**

H. Public Water Supply

☐	Impacted	= 2000
☐	≤500'	= 500
☐	>500' - ¼ mi	= 25
☐	¼ mi - 1 mi	= 10
☐	>1 mi - 2 mi	= 2
* ☒	> 2 mi	= 0

For lower susceptibility areas only:

☐	>1 mi	= 0

I. Non-Public Water Supply

☐	Impacted	= 1000
☐	≤100'	= 500
☐	>100' - 500'	= 25
☐	>500' - ¼ mi	= 5
☐	>¼ - ½ mi	= 2
☒	>½ mi	= 0

For lower susceptibility areas only:

☐	>¼ mi	= 0

Note: If site is in lower susceptibility area, do not use the shaded areas.

* For justification that withdrawal point is not hydraulically connected, see attached text.

J. Distance from nearest Contaminant Plume boundary to downgradient Surface Waters **OR UTILITY TRENCHES & VAULTS** (a utility trench may be omitted from ranking if its invert elevation is more than 5 feet above the water table)

☐	Impacted	= 500
☒	≤500'	= 50
☐	>500' - 1,000'	= 5
☐	>1,000'	= 2

K. Distance from any Free Product to basements and crawl spaces

☐	Impacted	= 500
☐	<500'	= 50
☐	>500' - 1,000'	= 5
☒	>1,000' or no free product.	= 0

Fill in the blanks: (H. 0) + (I. 0) + (J. 50) + (K. 0) = L. 50

(G. 5) x (L. 50) = M. 250

(M. 250) + (D. 100) = N. 350

P. **SUSCEPTIBILITY AREA MULTIPLIER**

☐ If site is located in a Low Ground-Water Pollution Susceptibility Area = 0.5

☒ All other sites = 1

Q. **EXPLOSION HAZARD**

Have any explosive petroleum vapors, possibly originating from this release, been detected in any subsurface structure (e.g., utility trenches, basements, vaults, crawl spaces, etc.)?

☐ Yes = 200,000

☒ No = 0

Fill in the blanks: (N. 350) x (P. 1) = (350) + (Q. 0)

= 350 (January 2000 - First Semiannual Sampling Event)

OTHER GEOLOGIC AND HYDROLOGIC DATA

The following information is presented to provide supplemental information to Item H of the Site Ranking Form and detailed information relating to the geologic and hydrogeologic conditions at Fort Stewart to support determinations of groundwater flow pathway(s) or direction(s) and contaminant transport.

1.0 REGIONAL AND LOCAL GEOLOGY

Fort Stewart is located within the coastal plain physiographic province. This province is typified by nine southeastward-dipping strata that increase in thickness from 0 feet at the fall line, located approximately 150 miles inland from the Atlantic coast, to approximately 4,200 feet at the coast. State geologic records describe a probable petroleum exploration well (the No. 1 Jelks-Rogers) located in the region as encountering crystalline basement rocks at a depth of 4,254 feet below ground surface (BGS). This well provides the most complete record for Cretaceous, Tertiary, and Quaternary sedimentary strata in the region.

The Cretaceous section was found to be approximately 1,970 feet thick and dominated by clastics. The Tertiary section was found to be approximately 2,170 feet thick and dominated by limestone, with a 175-foot-thick cap of dark green phosphatic clay. This clay is regionally extensive and is known as the Hawthorn Group. The interval from approximately 110 feet to the surface is Quaternary in age and composed primarily of sand, with interbeds of clay or silt. This section is undifferentiated into separate formations (Herrick and Vochis 1963).

State geologic records contain information regarding a well drilled in October 1942, 1.8 miles north of Flemington at Liberty Field of Camp Stewart (now known as Fort Stewart). This well is believed to be an artesian well located approximately one-quarter mile north of the runway at Wright Army Airfield within the Fort Stewart Military Reservation. The log for this well describes a 410-foot section, the lowermost 110 feet of which consisted predominantly of limestone sediments, above which 245 feet of dark green phosphatic clay typical of the Hawthorn Group were encountered. The uppermost portion of the section was found to be Quaternary-age interbedded sands and clays. The top 15 feet of these sediments were described as sandy clay (Herrick and Vochis 1963).

The surface soil located throughout the Fort Stewart garrison area consists of Stilson loamy sand. The surface layer of this soil is typically dark grayish-brown loamy sand measuring approximately 6 inches in depth. The surface layer is underlain by material consisting of pale yellow loamy sand and extends to a depth of approximately 29 inches. The subsoil is dominantly sandy clay loam and extends to a depth of 72 inches or more (Herrick and Vochis 1963).

2.0 REGIONAL AND LOCAL HYDROGEOLOGY

The hydrogeology in the vicinity of Fort Stewart is dominated by two aquifers referred to as the Principal Artesian and the surficial aquifers. The Principal Artesian aquifer is the lowermost hydrologic unit and is regionally extensive from South Carolina through Georgia, Alabama, and most of Florida. Known elsewhere as the Floridan, this aquifer is composed primarily of Tertiary-age limestone, including the Bug Island Formation, the Ocala Group, and the Suwannee Limestone. These formations are approximately 800 feet thick, and groundwater from this aquifer is used primarily for drinking water (Arora 1984).

The uppermost hydrologic unit is the surficial aquifer, which consists of widely varying amounts of sand and clay ranging from 55 feet to 150 feet in thickness. This aquifer is primarily used for domestic lawn and agricultural irrigation. The top of the water table ranges from approximately 2 feet to 10 feet BGS (Geraghty and Miller 1993). The base of the aquifer corresponds to the top of the underlying dense clay of the Hawthorn Group. The Hawthorn Group was not encountered during drilling at this site but is believed to be located at 40 feet to 50 feet BGS; thus, the effective aquifer thickness would be approximately 35 feet to 45 feet. Soil surveys for Liberty and Long counties describe the occurrence of a perched water table within the Stilson loamy sands present within Fort Stewart (Looper 1980).

The confining layer for the Principal Artesian aquifer is the phosphatic clay of the Hawthorn Group and ranges in thickness from 15 feet to 90 feet. The vertical hydraulic conductivity of this confining unit is on the order of 10^{-8} cm/sec. There are minor occurrences of aquifer material within the Hawthorn Group; however, they have limited utilization (Miller 1990). The Hawthorn Group has been divided into three formations: Coosawhatchie Formation, Markshead Formation, and Parachula Formation, which are listed from youngest to oldest.

The Coosawhatchie Formation is composed predominantly of clay but also has sandy clay, argillaceous sand, and phosphorite units. The formation is approximately 170 feet thick in the Savannah, Georgia, area. This unit disconformably overlies the Markshead Formation and is distinguished from the underlying unit by dark phosphatic clays or phosphorite in the lower part and fine-grained sand in the upper part.

The Markshead Formation is approximately 70 feet thick in the Savannah, Georgia, area and consists of light-colored phosphatic, slightly dolomitic, argillaceous sand to fine-grained sandy clay with scattered beds of dolostone and limestone.

The Parachula Formation consists of sand, clay, limestone, and dolomite and is approximately 10 feet thick in the Savannah, Georgia, area. The Parachula Formation generally overlies the Suwannee Limestone in Georgia.

Groundwater encountered at all the UST investigation sites is part of the surficial aquifer system. Based on the fact that all public and non-public water supply wells draw water from the Principal (Floridan) Artesian aquifer, and that the Hawthorn confining unit separates the Principal Artesian aquifer from the surficial aquifer, it is concluded that there is no hydraulic interconnection between the surficial aquifer (and associated groundwater plumes, if applicable) located beneath former UST sites and identified water supply withdrawal points at Fort Stewart.

APPENDIX V

REIMBURSEMENT APPLICATION

Fort Stewart is a federally owned facility and has funded the investigation for the UST 214 site, Building 1503, Facility ID #9-089015, using U.S. Department of Defense Environmental Restoration Account Funds. Application for Georgia Underground Storage Tank Trust Fund reimbursement is not being pursued at this time.

ATTACHMENT A

SUMMARY OF FATE AND TRANSPORT MODELING RESULTS

A.1 FATE AND TRANSPORT MODELING

The fate and transport modeling that was performed as part of the CAP-Part A Report (SAIC 1999) is based on the assumption of a continuous source of contamination of infinite duration at the site based on the maximum predicted benzene concentration in groundwater (i.e., 37.1 µg/L in temporary piezometer 63-01 in May 1998). In summary, the Analytical Transient 1-, 2-, 3-Dimensional (AT123D) Model was used to model contaminant migration to three potential downgradient receptors: an underground sanitary sewer line located approximately 5 feet southeast of the former tank pit, a drainage ditch located approximately 200 feet south of the site, and Mill Creek located approximately 2,000 feet southwest of the site. The modeling results indicated that, due to dilution attenuation, benzene would not reach the drainage ditch at concentrations above the IWQS or Mill Creek at detectable concentrations.

Based on modeling results, the estimated dilution attenuation factors (DAFs) for benzene were 1.0 at the sanitary sewer, 371 at the drainage ditch, and infinity at Mill Creek. Simulations of a 2-year period were not performed to predict the maximum concentrations of benzene in the downgradient wells that will be used for long-term monitoring because permanent wells did not exist at the site. This simulation will be performed when the fate and transport modeling is revised following the second semiannual sampling event.

The alternate concentration limits (ACLs) for the site were developed for each chemical of potential concern listed in the CAP-Part A Report (SAIC 1999) and were based on the maximum contaminant level. The ACLs presented in Table A-1 have been revised to reflect the use of the IWQS as the regulatory level. The IWQS is being used because the surficial aquifer is not a drinking water aquifer, and the most likely receptor for the surficial aquifer is a surface water body or preferential pathway.

Table A-1. ACLs for the UST 214 Site

Contaminant	IWQS (µg/L)	DAF[a] (sanitary sewer)	ACL[b] (µg/L)
Benzene	71.28	1	71.28

[a] DAF = Maximum observed benzene concentration ÷ predicted benzene concentration at the receptor
= 37.1 ÷ 30 = 1 at the sanitary sewer.

[b] ACL = IWQS × DAF.

A.2 FATE AND TRANSPORT MODELING CONCLUSIONS

The conclusions below are based on a fate and transport model that assumes a continuous source of contamination of infinite duration at the site based on the maximum predicted benzene concentration (i.e., 37.1 µg/L) in groundwater at the source during the CAP-Part A investigation.

- Benzene concentrations in groundwater do not exceed the IWQS and ACL of 71.28 µg/L in any of the wells at the site, indicating that the benzene concentrations at the site are not high enough to reach the sanitary sewer or drainage ditch at concentrations above the IWQS.

- Observed concentrations of benzene in groundwater indicate that the sanitary sewer is not acting as a preferential pathway.

ATTACHMENT B

REFERENCES

REFERENCES

Arora, Ram, 1984. *Hydrologic Evaluation for Underground Injection Control in the Coastal Plain of Georgia,* Department of Natural Resources, Environmental Protection Division, Georgia Geological Survey.

Geraghty and Miller 1993. *RCRA Facility Investigation Work Plan, Fort Stewart, Georgia.*

Herrick, S.M., and R.C. Vochis, 1963. *Subsurface Geology of the Georgia Coastal Plain*, Georgia Geologic Survey Information Circular 25.

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Miller, James A., 1990. *Groundwater Atlas of the United States*, U.S. Department of the Interior, U.S. Geological Survey, Hydrologic Inventory Atlas 730G.

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ATTACHMENT C

BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

HTRW DRILLING LOG

HOLE NUMBER 63-08

PROJECT: Fort Stewart USTs

INSPECTOR J. Celeste

SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0–1	Sandy ORGANIC SOIL (OL/OH), fine grained, some silt, soft to very soft, dark brown (7.5 YR 3/2)				
	1–2	Silty SAND (SM), fine grained, soft to very soft, dark brown (7.5 YR 2.5/2)				
	2–3					
	3–4	NO RECOVERY				
	4–5					▽ wet below 5.0 FT BGS
	5–6	SAND (SW), fine to medium grained, some silt, firm to hard, strong odor, wet, dark brown (7.5 YR 2.5/2)				
	6–7					
	7–8	NO RECOVERY				
	8–9					PUSHED TO 12.0 FT BGS TO SET 3/4" MONITORING POINT SCREENED FROM 1.6 TO 11.6 FT BGS
	9–10					COLLECTED GROUNDWATER SAMPLE 630812 FROM MONITORING POINT

HTRW DRILLING LOG

HOLE NUMBER 63-09

PROJECT: Fort Stewart USTs | INSPECTOR J. Celeste | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		CONCRETE				
	1	Silty SAND (SM), fine grained, gravel layer, very soft, very dark brown (7.5 YR 2.5/2)				
	2					
	3					
	4	NO RECOVERY				
	5	SAND w/SILT (SP-SM), fine grained, very soft, moist, light gray - brown (7.5 YR 5/2)				▽ wet below 5.0 ft BGS
	6	Silty SAND (SM), fine grained, moist to wet, soft to firm, black (7.5 YR 2.5/1)				
	7	SAND (SW), fine to medium grained, some silt, firm to hard, wet, dark brown (7.5 YR 3/2)				
	8					PUSHED TO 9.5 FT BGS TO SET 3/4" MONITORING POINT SCREENED FROM 2.4 TO 9.4 FT BGS
	9					COLLECTED GROUNDWATER SAMPLE 630912 FROM MONITORING POINT
	10	REFUSAL AT 9.5 FT BGS				

HTRW DRILLING LOG

HOLE NUMBER 63-10

PROJECT: Fort Stewart USTs | INSPECTOR J. Celeste | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		ASPHALT				
	1	SAND(SW), fine to coarse grained, some gravel and silt (2.5 Y 7/1)				
	2	Silty SAND (SM), fine grained, some clay, soft to firm, brown, (7.5 YR 3/2)				
	3	NO RECOVERY				
	4					
	5	Silty SAND (SM), fine grained, some clay, soft to firm, brown, (7.5 YR 3/2)				
	6					▽ Wet below 6.0 ft BGS
	7	SAND (SW), fine to coarse grained, some silt, firm, wet (7.5 YR 3/2)				
	8					PUSHED TO 9.0 FT BGS TO SET 3/4" MONITORING POINT SCREENED FROM 1.9 TO 8.9 FT BGS
	9	REFUSAL AT 9.0 FT				COLLECTED GROUNDWATER SAMPLE 631012 FROM MONITORING POINT
	10					

HTRW DRILLING LOG

HOLE NUMBER 63-11

PROJECT: Fort Stewart USTs | INSPECTOR J. Celeste | SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0–1	ORGANIC SOIL (OL/OH), fine grained, some sand and silt, very soft (7.5YR 4/2)				
	1–2	SAND (SP), fine grained, some silt, very soft (2.5Y 7/2)				
	2–3	Silty SAND (SM), fine grained, very soft, dark braon (7.5YR 3/2)				
	3–4	NO RECOVERY				
	4–8	SAND (SW), fine to coarse grained, some silt, firm to hard, moist, black (7.5YR 2.5/1)				▽ wet below 5.0 ft BGS
	8–9	REFUSAL AT 9.1 FT BGS				PUSHED TO 9.1 FT BGS TO SET 3/4" MONITORING POINT SCREENED FROM 3.0 TO 9.0 FT BGS COLLECTED GROUNDWATER SAMPLE 631112 FROM MONITORING POINT
	9–10					

MONITORING WELL

PROJECT: UST 214

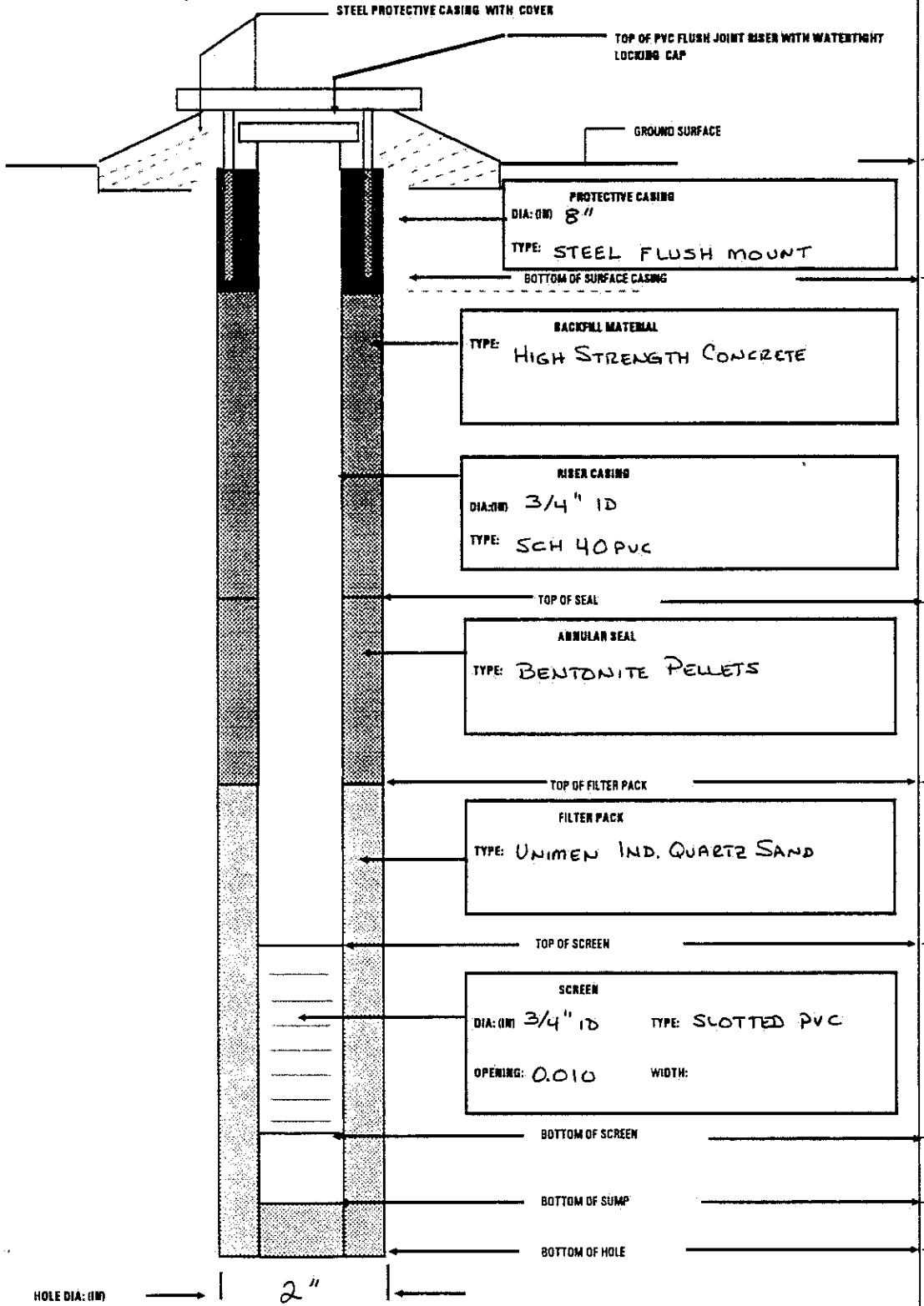
WELL NUMBER: 63-08

BEGIN: 1/15/00 **END:** 1/15/00

COORDINATES: N: 678492.9 E: 825578.6

REFERENCE POINT: TOP OF CASING **ELEVATION:** 76.17

SURVEY DATUM: NAD 83, NAVD 88



DEPTH	ELEV
0	76.59
0.3	
0.7	
1.6	
11.6	
11.7	
11.7	

MONITORING WELL

PROJECT: UST 214

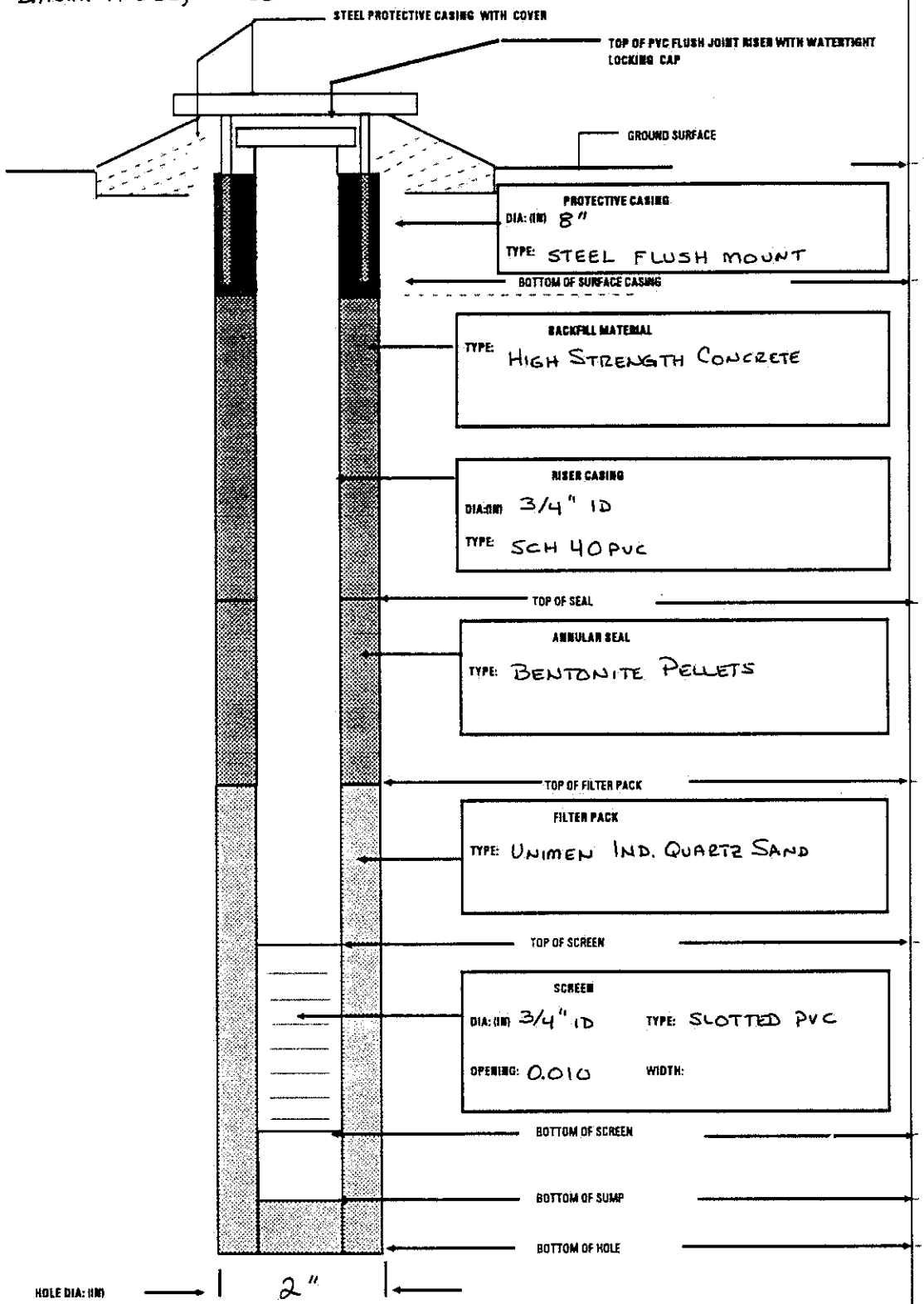
WELL NUMBER: 63-09

BEGIN: 1/15/00 **END:** 1/15/00

COORDINATES: N: 678476.4
E: 825559.6

REFERENCE POINT: TOP OF CASING **ELEVATION:** 75.99

SURVEY DATUM: NAD 83, NAVD 88



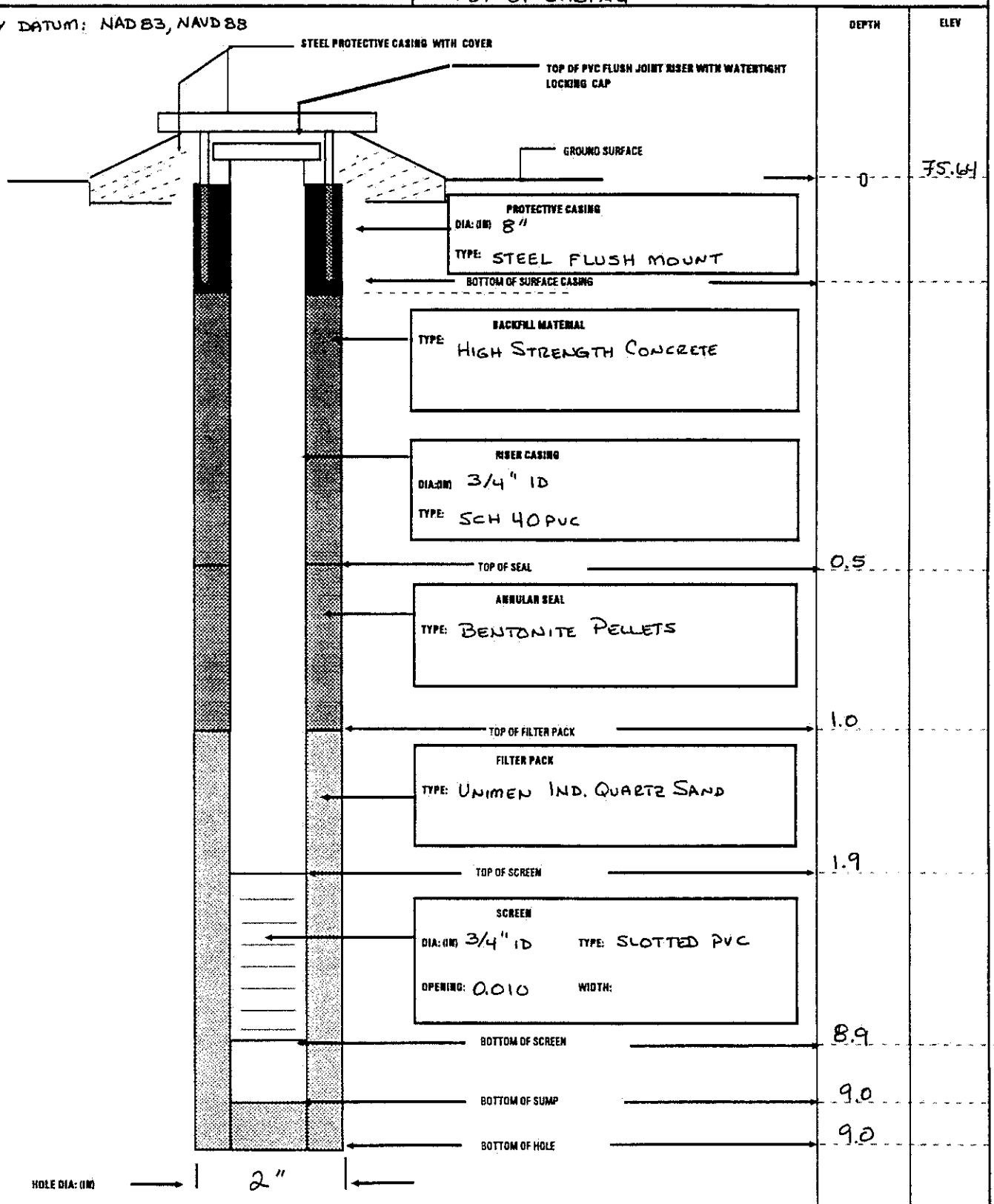
DEPTH	ELEV
0	76.26
0.5	
1.5	
2.4	
9.4	
9.5	
9.5	

MONITORING WELL

PROJECT: UST 214

WELL NUMBER: 63-10	**BEGIN:** 1/15/00	**END:** 1/15/00
COORDINATES: N: 678463.2 E: 825589.6	**REFERENCE POINT:** TOP OF CASING	**ELEVATION:** 75.32

SURVEY DATUM: NAD 83, NAVD 88



MONITORING WELL

PROJECT: UST 214

WELL NUMBER: 63-11

BEGIN: 1/15/00 **END:** 1/15/00

COORDINATES: N: 678530.4
E: 825598.1

REFERENCE POINT: TOP OF CASING **ELEVATION:** 75.73

SURVEY DATUM: NAD 83, NAVD 88