

FINAL



ADDENDUM #2 TO THE SAMPLING AND ANALYSIS PLAN



3d Inf Div (Mech)

FOR

**Phase II RCRA Facility Investigations of
16 Solid Waste Management Units
at
Fort Stewart, Georgia**

Prepared for



U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

Contract No. DACA21-95-D-0022
Delivery Order 0009

September 1999


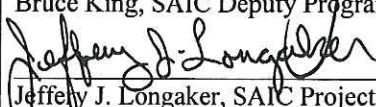
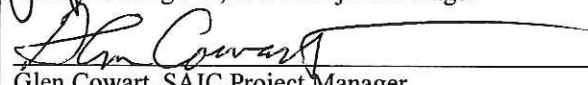


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**ADDENDUM #2 TO THE
SAMPLING AND ANALYSIS PLAN
FOR
PHASE II RCRA FACILITY INVESTIGATIONS
OF
16 SOLID WASTE MANAGEMENT UNITS
AT
FORT STEWART, GEORGIA
CONTRACT NUMBER DAC21-95-D-0022
DELIVERY ORDER NUMBER 0009**

REGULATORY AUTHORITY
RESOURCE CONSERVATION AND RECOVERY ACT
40 *CFR* 264, TITLE II, SUBPART C, SECTION 3004;
42 USC 6901 ET SEQ.

September 1999

COMMITMENT TO IMPLEMENT THE ABOVE SAMPLING AND ANALYSIS PLAN	
 Bruce King, SAIC Deputy Program Manager	10 Sep 99 Date
 Jeffrey J. Longaker, SAIC Project Manager	10 Sept 99 Date
 Glen Cowart, SAIC Project Manager	10 Sept 99 Date

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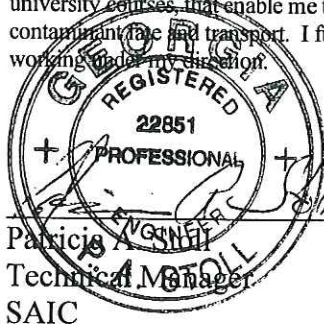
U.S. Army Corps of Engineers
Savannah District
Under Contract Number DACA21-95-D-0022
Delivery Order 0009

Prepared by:

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September 1999

The undersigned certify that I am a qualified groundwater scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering, and have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses that enable me to make sound professional judgements regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by myself or by a subordinate working under my direction.



Patricia A. Smith
Technical Manager
SAIC

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List of Abbreviations and Acronyms

BGS	below ground surface
RCRA	Resource Conservative and Recovery Act
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TOC	total organic carbon
VOC	Volatile Organic Compounds
QC	quality control

1.0 INTRODUCTION

This addendum supplements the *Sampling and Analysis Plan for Phase II RCRA Facility Investigations of 16 Solid Waste Management Units at Fort Stewart, Georgia* (SAIC 1997). It presents changes to the Sampling and Analysis Plan and the specific sampling requirements for the performance of additional Phase II RCRA Facility investigations. These investigations are required at Solid Waste Management Unit (SWMU) sites as a result of previous investigations.

Based on analytical results obtained during previous investigations seven SWMU sites were identified as requiring additional investigations.

- SWMU-24B, the Old Radiator Shop/Paint Booth.
- SWMU-27F, the 3rd Engineering Brigade.
- SWMU-27H, the DOL Maintenance Motorpool.
- SWMU-27J, Gang Mates Building 10531.
- SWMU-27L, the NGTC block 10200.
- SWMU-27S, the 103d MI BN.
- SWMU-29, Evans Army Heliport POL Storage Facility.

Table 1 identifies general site information and presents the proposed investigative activities for each site.

2.0 PROJECT ORGANIZATION

The organizational chart for this addendum is presented in Figure 1.

3.0 FIELD ACTIVITIES

Field activities for the Phase II RCRA Facility investigations will consist of geoprobe screening borings, vertical profiles, installing and sampling monitoring wells, surface soil sampling, and surface water/sediment sampling. One groundwater sample for 24-hour turnaround will be collected from each of the geoprobe screening borings. Temporary piezometers will be installed in these borings to bracket the water table to determine the presence of free product, the water table elevation, gradient, and flow direction. Vertical profile groundwater samples will be taken every 10 ft to refusal in order to determine the vertical extent. Two soil samples will be collected from the well installation borings. The wells will be developed and sampled as will any previously existing wells at each site. The site-specific investigative activities for the sites are presented in Table 1. The proposed sampling locations for the sites are presented in Appendix A, Figures A.1 through A.7.

Table 2 presents the sample numbering system that will be used for these investigations. Table 3 presents a summary of the field and quality control (QC) soil and groundwater samples to be collected during the investigations.

3.1 GEOPROBE BORINGS

Groundwater Sampling during Geoprobe Borings

Twenty-three geoprobe borings will be installed under the 16 SWMU investigations. The groundwater samples will be sent to an off-site analytical laboratory for 24-to 48-hour turn-around and analyzed for volatile organic compounds (VOCs). In addition, at SWMU 24B, the groundwater samples will be analyzed for semivolatile organic compounds (SVOCs). There are also 15 reserve geoprobe borings under the 16

SWMU investigations, which will be located based on the results of the initial 23 borings, as needed. A summary of the number of groundwater samples and quality control QC samples for the SWMU sites is presented in Table 3 and a summary of the number of reserve groundwater samples and QC samples is presented in Table 4.

Groundwater samples will be collected through the use of temporary piezometers installed using direct-push sampling techniques. These techniques will provide in situ groundwater samples without generating soil cuttings. Direct-push techniques will be used to determine the vertical extent of contamination at six of the sites. In determining the vertical extent, groundwater samples will be collected every 10 ft to refusal and analyzed for VOCs. At SWMU 24B, groundwater samples from the vertical profile boring will include SVOCs. Field measurements performed during the investigations will include pH, specific conductance, and temperature. Procedures and equipment for measuring pH, specific conductance, and temperature are presented in the Sampling and Analysis Plan (SAIC 1997).

Direct-push sampling will provide soil for lithologic descriptions without generating soil cuttings. No soil samples will be collected from the geoprobe borings for chemical analysis. Decontaminated sampling tubes measuring 2 inches outside diameter by 48 inches will be used for soil collection and temporary piezometer installation. The sampling tubes will be hydraulically pushed to the water table. Disposable, thin-walled plastic (acetate), open-ended tubes, 1.5-inches diameter by 45 inches, will be placed in the sampling tube to collect soil. Soil will be collected continuously on 4-ft centers from the ground surface to the water table. The proposed locations of the direct-push sampling for the sites are presented in Appendix A, Figures A.1 through A.7.

3.2 MONITORING WELL INSTALLATION

Up to 34 monitoring wells (i.e., 19 shallow wells and 15 deep wells) will be installed under the 16 SWMU investigations. In addition, up to 8 reserve shallow monitoring wells may be installed as necessary to determine the extent of contamination. The monitoring wells will be installed using the hollow-stem auger drilling method. The procedures and methodology for hollow-stem auger drilling are presented in the Sampling and Analysis Plan (SAIC 1997). Soil samples will be collected on 5-ft centers and split into two 2.5-ft samples. Two samples will be sent to the analytical laboratory for analysis. The proposed locations of the monitoring wells are presented in Appendix A, Figures A.1 through A.7.

Sample Selection for Monitoring Well Installation

Two soil samples will be collected from each borehole. Sample selection will be based on the criteria listed below.

- In cases where no contamination is detected by field headspace gas analysis in any of the borehole intervals, one sample will be collected from 0 to 1 ft. below ground surface (BGS) and the other will be collected from the interval prior to encountering the water table.
- In cases where contamination is detected by field headspace gas analysis in one or more of the borehole intervals, one will be collected from 0 to 1 ft BGS and the other will be collected from the 2.5-ft interval exhibiting the highest detected organic vapor concentration.

The soil will be sent to an off-site analytical laboratory and analyzed for VOCs, SVOCs, and RCRA metals. Soil samples designated for VOC analysis will be collected using Encore™ sampling devices. Three Encore™ samples will be collected from each 2.5 ft interval. In addition, analysis of grain-size distribution, Atterberg limits, and moisture content will be performed on one soil sample from each

monitoring well. One sample from each site at which fate and transport modeling is to be performed will be analyzed for total organic carbon (TOC). A summary of the number of soil and QC soil samples for the 16 SWMU sites is presented in Table 3.

Groundwater Sampling of Monitoring Wells

Groundwater field measurements performed during the 16 SWMU investigations will include pH, specific conductance, temperature, dissolved oxygen, and oxygen-reduction potential, and turbidity. Procedures and equipment for measurement of these parameters are presented in the Sampling and Analysis Plan (SAIC 1997).

The groundwater samples will be sent to an off-site analytical laboratory and analyzed for VOCs, SVOCs, and Resource Conservation and Recovery Act (RCRA) metals. Filtered RCRA metals will be collected at a frequency of 10%. A summary of the number of groundwater samples and QC samples for the 16 SWMU sites is presented in Table 3.

3.3 SURFACE WATER/SEDIMENT SAMPLING

Surface water and sediment samples will be collected at the SWMU-27H, SWMU-27J, and SWMU-27L sites where the groundwater flow could intersect a surface water drainage ditch. After groundwater flow direction has been determined, the surface water and sediment samples will be collected where the groundwater flow could intersect the surface water. One of the surface water/sediment samples at each SWMU will be collected upstream of any potential impact from surface runoff from the SWMU. Field measurements performed during the surface water sampling will include pH, specific conductance, temperature, dissolved oxygen, and oxygen-reduction potential. Procedures and equipment for measuring of these parameters are presented in the Sampling and Analysis Plan (SAIC 1997).

Surface water and sediment samples will be sent to an off-site analytical laboratory and analyzed for VOCs, SVOCs, and RCRA metals. A summary of the number of surface water/sediment samples and QC samples for the 16 SWMU sites is presented in Table 3. The surface water and sediment sample locations are presented in Appendix A, Figures A.3, A.4, and A.5.

3.4 SURFACE SOIL SAMPLING

Surface soil samples will be collected at the SWMU-24B locations recommended in the 16 SWMU Phase II report. These are presented in Appendix A, Figure A.1. The surface soil samples will be sent to an off-site laboratory and analyzed for VOCs, SVOCs, and RCRA Metals. A summary of the number of surface soil samples for the site is presented in Table 3.

3.5 WATER LEVEL MEASUREMENT

A complete set of water level measurements will be collected from all the wells at the site prior to conducting groundwater sampling. Procedures and equipment for water level measurements are presented in the Sampling and Analysis Plan (SAIC 1997).

4.0 REFERENCES

SAIC (Science Applications International Corporation) 1997. *Phase II RCRA Facility Investigations of 16 Solid Waste Management Units at Fort Stewart, Georgia.*

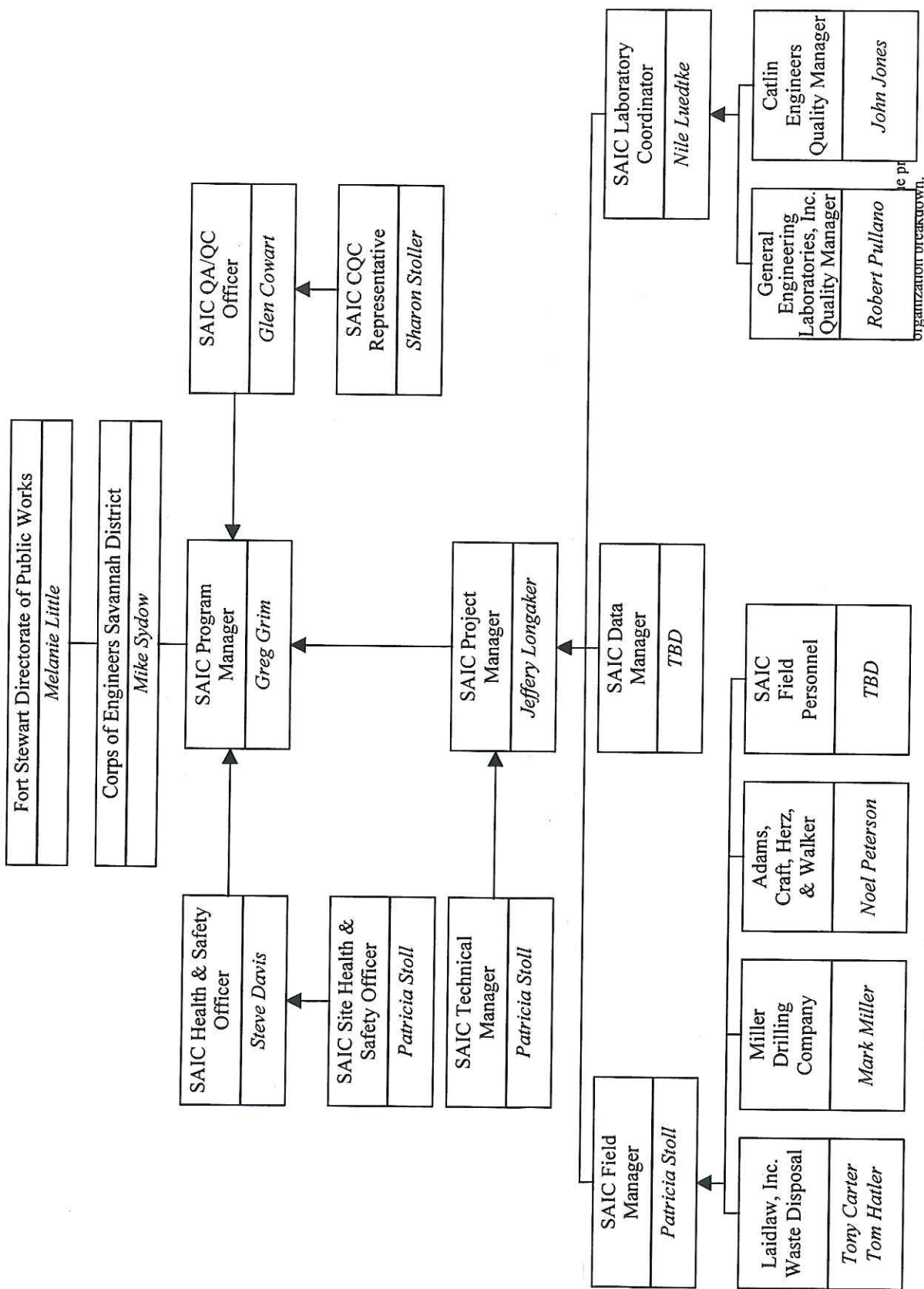


Figure 1. Revised Organization Chart for 16 SWMUs at Fort Stewart, Georgia

Table 1. Proposed 16 SWMU Investigations at Sites Requiring Additional Investigations

SWMU Number	SWMU Name	Geoprobe Borings	Vertical Profiles	Shallow Wells	Deep Wells	Surface Water/ Sediment	Surface Soil
SWMU-24B	Old Radiator/Paint Booth	4	1	4	3	–	3
SWMU-27F	3d Engineer Brigade	4	1	3	–	–	–
SWMU-27H	DOL Maintenance Motorpool	4	1	3	3	2	–
SWMU-27J	Gang Mates Bldg. 10531	4	1	3	–	3	–
SWMU-27L	NGTC Block 10200	4	1	3	3	2	–
SWMU-27S	103d MI BN	3	1	3	3	–	–
SWMU-29	Evans Heliport POL Storage Facility	–	–	–	3	–	–

Table 2. Sample Number System for Additional Activities

Sample Identification: XXMLT#	
<p>XX = Area Designator</p> <p><u>Examples</u></p> <p>24 = SWMU - 24B (Old Radiator Shop/Paint Booth) 7J = SWMU - 27F (3d Engineer Brigade) 7N = SWMU - 27H (DOL Maintenance Motorpool) 7U = SWMU - 27J (Gang Mates Building 10531) 7X = SWMU-27L (NGTC Block 10200) 8E = SWMU-27S (103d MI BN) 29 = SWMU 29 (Evans POL Storage Facility)</p>	<p>Area designators used for the project will be the SWMU number, except for SWMU 27A through 27V where there are 31 oil/water separators at 29 sites.</p>
<p>M = Sample Media</p>	<p><u>Examples</u></p> <p>1 = soil 5 = leachate 2 = sediment 6 = waste water 3 = surface water 7 = surface soil 4 = groundwater</p>
<p>L = Borehole/Sample Location</p>	<p>Sample locations will be consecutive starting from the last sample location</p> <p><u>Examples</u></p> <p>1 = Soil Borehole 1 2 = Soil Borehole 2</p>
<p>T = Sample Type</p>	<p><u>Examples</u></p> <p>1 = Environmental Sample 2 = Duplicate Sample 3 = QA Split Sample 4 = Rinsate Blank 5 = Geoprobe Screening Sample 6 = Geoprobe Screening Duplicate 7 = Monitoring Well Sample</p>
<p># = Sample Type</p>	<p>Sample number will be a sequential number</p> <p><u>Examples</u></p> <p>1 = first sample from borehole 2 = second sample from borehole</p>
<p>All trip blank samples used during the project will be consecutively identified.</p>	

Table 3. Summary of Samples to be Collected during Addendum #2 16 SWMU Investigations, Fort Stewart, Georgia

Matrix	Analysis	Analytical Procedures	No. Field Smpls	QC Dups ^a	Field Rnsts ^b	QC Trip Blks	Total Smpls	Holding Time	Preservation Requirements	Sample Containers
Groundwater	VOC	EPA 8260B	111	12	6	27	156	14 days	Cool 4°C HCl pH <2	2, 40 mL GSV
	SVOC	EPA 8270	47	5	3	0	55	7/40 days	Cool 4°C	2, 1 L AG
	RCRA Metals ^d	EPA 6010A and 7000	34	4	2	0	40	6 mo. 28 d-Hg	Cool 4°C HNO ₃ pH<2	1, 500 mL HDPE
	Filtered RCRA Metals ^d	EPA 6010A and 7000	4	1	1	0	6	6 mo. 28 d-Hg	Cool 4°C HNO ₃ pH<2	1, 500 mL HDPE
Soil	VOC	EPA 5035/8260B	68	7	4	0	79	48 hours	Cool 0°C	Encore
	SVOC	EPA 8270C	68	7	4	0	79	14/40 days	Cool 4°C	1, 8 oz. CWM
	RCRA Metals ^d	EPA 8015-Mod	68	7	4	0	79	6 mo. 28 d-Hg	Cool 4°C	None ^e
	TOC	EPA 415.1	6	1	0	0	7	28 days	Cool 4°C	None ^e
	Geotechnical ^e	Various	6	0	0	0	6	N/A	Cool 4°C	Shelby tube
	Geotechnical ^f	Various	28	0	0	0	28	N/A	Cool 4°C	Ziplock
Sediment	VOC	EPA 5035/8260B	7	1	0	0	8	48 hours	Cool 0°C	Encore
	SVOC	EPA 8270C	7	1	0	0	8	14/40 days	Cool 4°C	1, 8 oz. CWM
	RCRA Metals ^d	EPA 6010A and 7000	7	1	0	0	8	6 mo. 28 d-Hg	Cool 4°C	None ^e

- AG Amber glass
CWM Clear, widemouth glass jar
GSV Glass septa vial
HDPE High-density polyethylene
SVOC Semivolatile organic compounds
VOC Volatile organic compounds
(This table is in conformance with EM200-1-3).
- ^a The number of QC duplicate samples represent a 10% distribution between the different types of investigations to be conducted. However, the actual number of duplicates collected for each investigation type might vary slightly from the distribution presented.
- ^b The number of QC rinseate blank samples represent a 5% distribution between the different types of investigations to be conducted. However, the actual number of blanks collected for each investigation type might vary slightly from the distribution presented.
- ^c Analysis will be performed on matrix placed into the SVOC sample container.
- ^d RCRA Metals: Ag, Ba, Cd, Cr, Hg, Pb, Se, and As.
- ^e Geotechnical parameters include moisture content, Atterberg limits, grain-size distribution, permeability, specific gravity, and porosity.
- ^f Geotechnical parameters include moisture content, Atterberg limits, and grain-size distribution.

Table 3 (continued)

Matrix	Analysis	Analytical Procedures	No. Field Smpls	QC Dups ^a	Field Rnsts ^b	QC Trip Blks	Total Smpls	Holding Time	Preservation Requirements	Sample Containers
Surface Water	VOC	EPA 8260B	7	1	0	3	11	14 days	Cool 4°C HCl pH <2	2, 40 mL GSV
	SVOC	EPA 8270	7	1	0	0	11	7/40 days	Cool 4°C	2, 1 L AG
	RCRA Metals ^d	EPA 6010A and 7000	7	1	0	0	11	6 mo. 28 d-Hg	Cool 4°C HNO ₃ pH <2	1, 500 mL HDPE
Surface Soil	VOC	EPA 5035/8260B	3	0	0	0	3	48 hours	Cool 0°C	Encore
	SVOC	EPA 8270C	3	0	0	0	3	14/40 days	Cool 4°C	1, 8 oz. CWM
	RCRA Metals ^d	EPA 6010A and 7000	3	0	0	0	3	6 mo. 28 d-Hg	Cool 4°C	None ^c

AG Amber glass

CWM Clear, widemouth glass jar

GSV Glass septa vial

HDPE High-density polyethylene

SVOC Semivolatile organic compounds

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^a The number of QC duplicate samples represent a 10% distribution between the different types of investigations to be conducted. However, the actual number of duplicates collected for each investigation type might vary slightly from the distribution presented.

^b The number of QC rinse blank samples represent a 5% distribution between the different types of investigations to be conducted. However, the actual number of blanks collected for each investigation type might vary slightly from the distribution presented.

^c Analysis will be performed on matrix placed into the SVOC sample container.

^d RCRA Metals: Ag, Ba, Cd, Cr, Hg, Pb, Se, and As

**Table 4. Summary of Reserve Groundwater Samples and IDW Samples to be Collected during Addendum#2
16 SWMU Investigations, Fort Stewart, Georgia**

Matrix	Analysis	Analytical Procedures	No. Field Smpls	QC Dups ^a	Field Rnsts ^b	QC Trip Blks	Total Smpls	Holding Time	Preservation Requirements	Sample Containers
Groundwater (15 geoprobe, 8 wells)	VOC	EPA 8260B	23	3	1	5	32	14 days	Cool 4°C	2, 40 mL GSV
	SVOC	EPA 8270	8	1	0	0	9	7/40 days	HCl pH <2 Cool 4°C	2, 1 L AG
	RCRA Metals ^c	EPA 6010A and 7000	8	1	0	0	9	6 mo. 28 d-Hg	Cool 4°C HNO ₃ pH<2	1, 500 mL HDPE
	Filtered RCRA Metals ^c	EPA 6010A and 7000	1	1	0	0	9	6 mo. 28 d-Hg	Cool 4°C HNO ₃ pH<2	1, 500 mL HDPE
Soil (8 wells)	VOC	EPA 5035/8260B	16	2	1	0	19	48 hours	Cool 0°C	Encore
	SVOC	EPA 8270C	16	2	1	0	19	14/40 days	Cool 4°C	1, 8 oz. CWM
	RCRA Metals ^c	EPA 8015-Mod	16	2	1	0	19	6 mo. 28 d-Hg	Cool 4°C	None ^d
IDW Water	VOC	EPA 8260B	6	0	0	2	8	14 days	Cool 4°C HCl pH <2	2, 40 mL GSV
	Oil & Grease	EPA 413.2	6	0	0	0	6	28 days	Cool 4°C H ₂ SO ₄ pH<2	2, 1 L AG
	Total Phenols	EPA 420.1/420.2	6	0	0	0	6	28 days	Cool 4°C H ₂ SO ₄ pH<2	2, 1 L AG
	pH	EPA 150.1	6	0	0	0	6	ASAP	Cool 4°C	1, 250 mL HDPE
IDW Soil	VOC	EPA 5035/8260B	5	0	0	0	5	48 hours	Cool 0°C	Encore
	SVOC	EPA 8270C	5	0	0	0	5	14/40 days	Cool 4°C	1, 8 oz. CWM
	RCRA Metals ^c	EPA 6010A and 7000	5	0	0	0	5	6 mo. 28 d-Hg	Cool 4°C	None ^d

AG Amber glass

CWM Clear, widemouth glass jar

GSV Glass septa vial

HDPE High-density polyethylene

SVOC Semivolatile organic compounds

VOC Volatile organic compounds

(This table is in conformance with EM200-1-3).

^a The number of QC duplicate samples represent a 10% distribution between the different types of investigations to be conducted. However, the actual number of duplicates collected for each investigation type might vary slightly from the distribution presented.

^b The number of QC rinseate blank samples represent a 5% distribution between the different types of investigations to be conducted. However, the actual number of blanks collected for each investigation type might vary slightly from the distribution presented.

^c RCRA Metals: Ag, Ba, Cd, Hg, Pb, Se, and As.

^d Analysis will be performed on matrix placed into the SVOC sample container.

APPENDIX A
PROPOSED SAMPLING LOCATIONS FOR
16 SWMUs INVESTIGATIONS

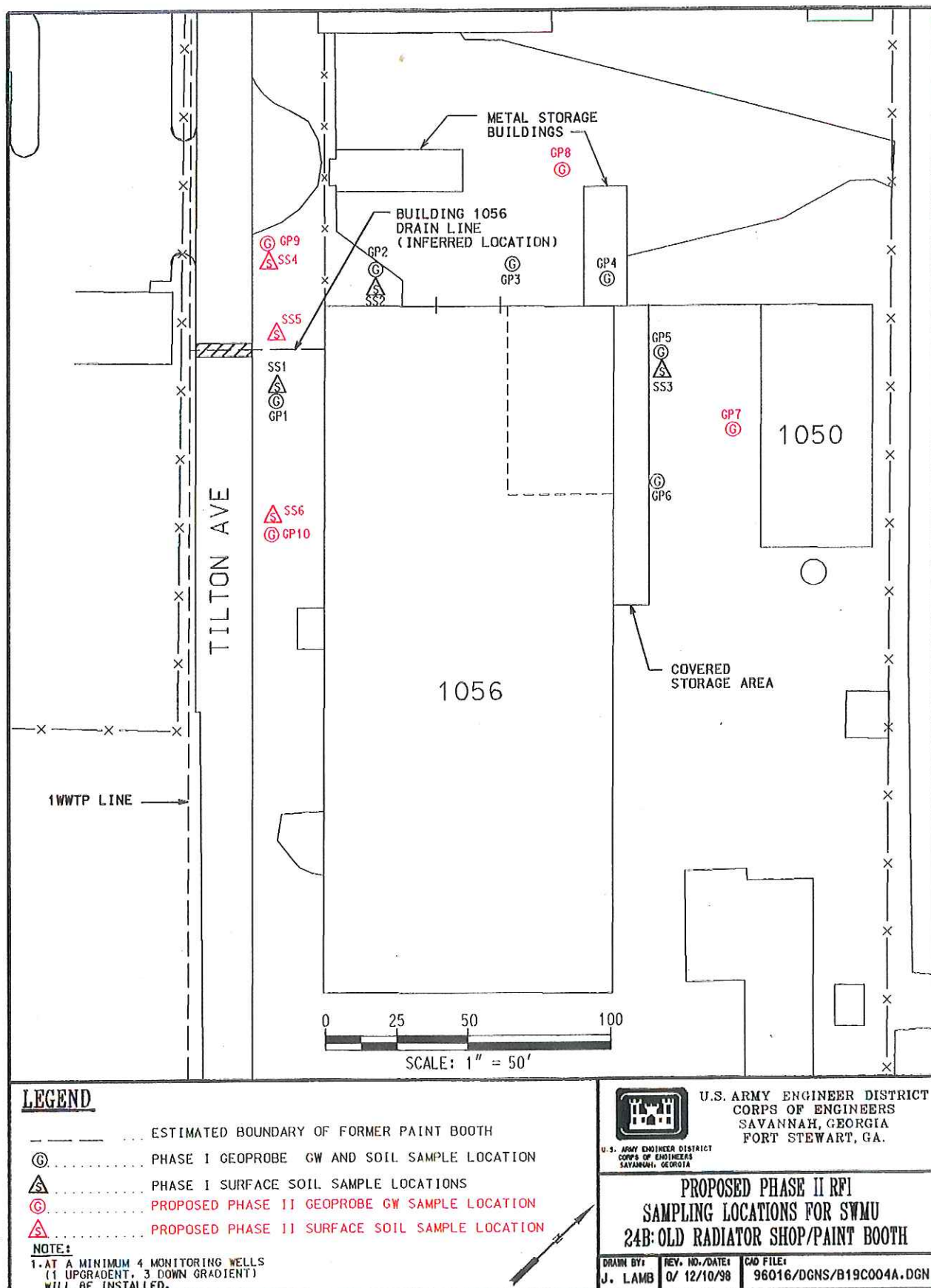


Figure A.1. Site Map for SWMU 24B: Old Radiator Shop/Paint Booth.

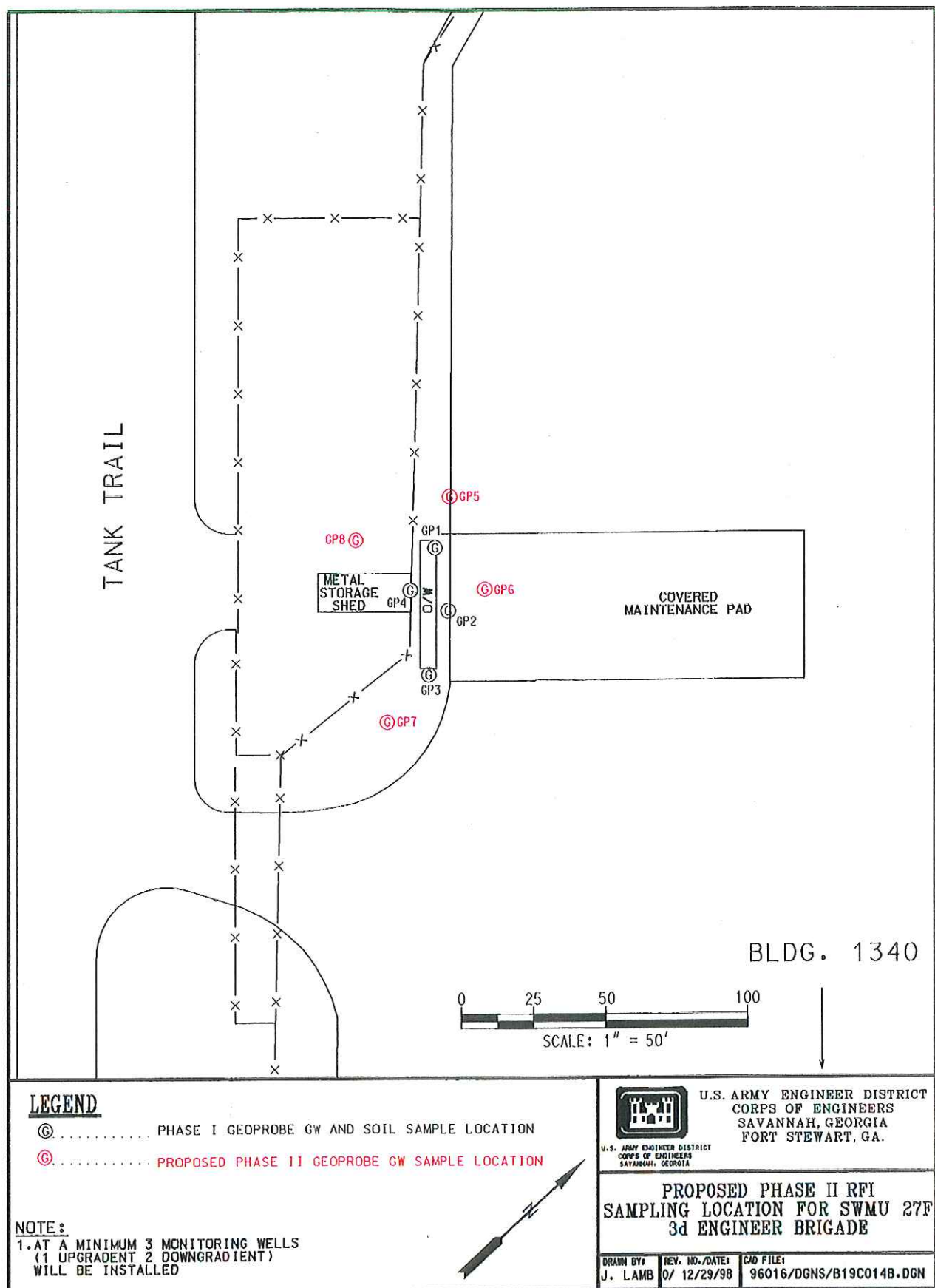


Figure A.2. Site Map for SWMU 27F: 3d Engineer Brigade.

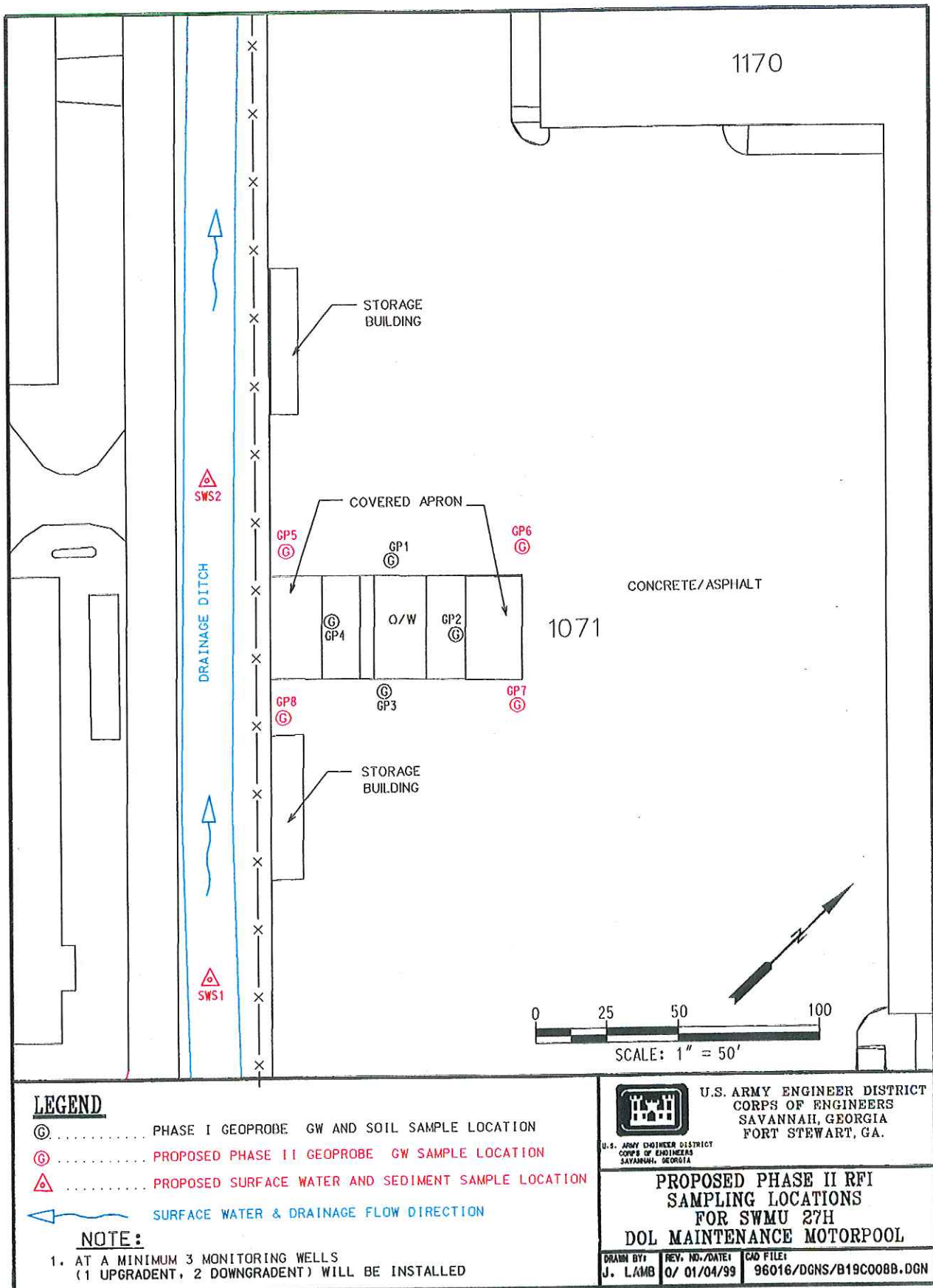


Figure A.3. Site Map for SWMU 27H: DOL Maintenance Motorpool.

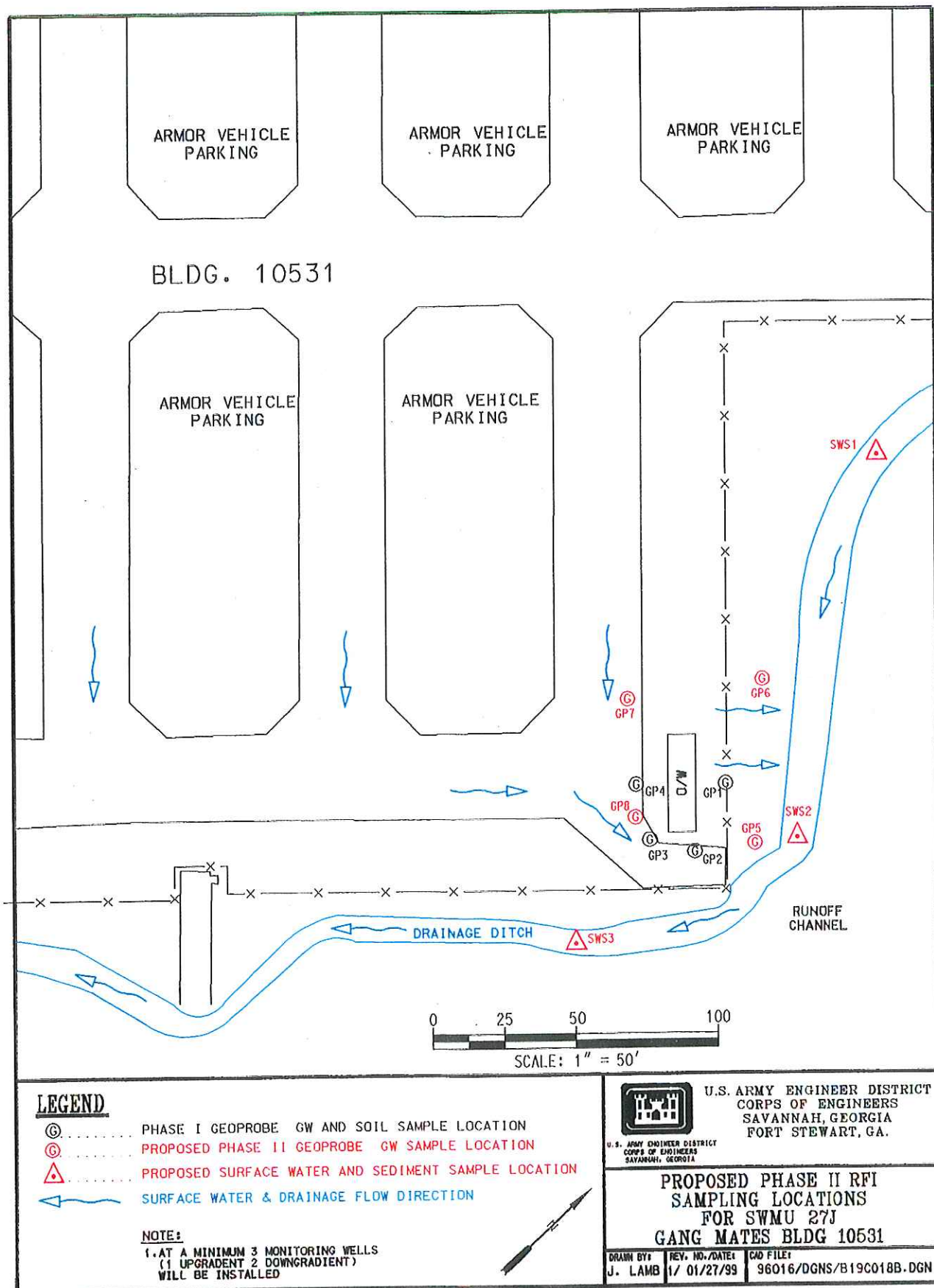


Figure A.4. Site Map for SWMU 27J: Gang Mates 10531.

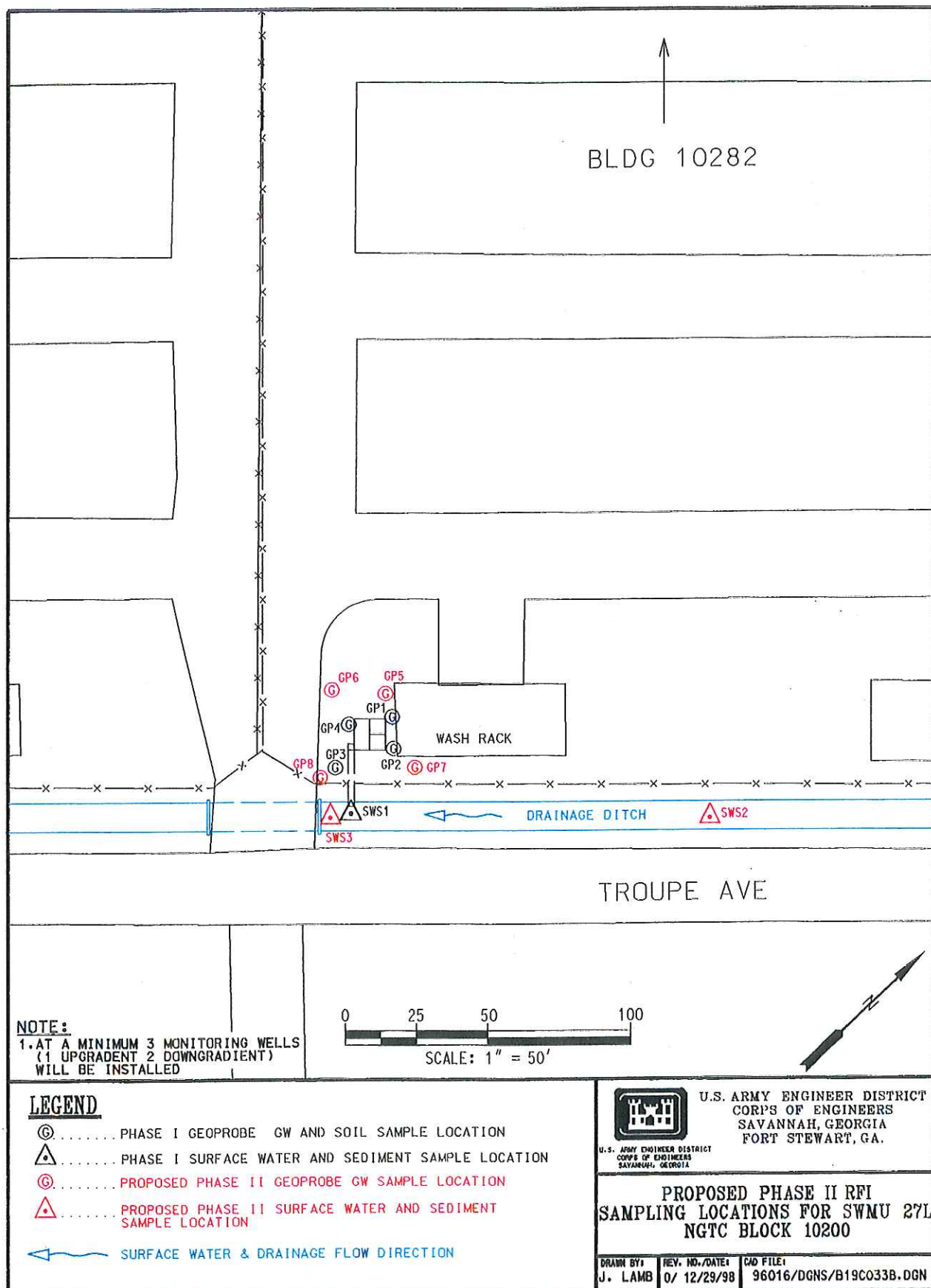


Figure A.5. Site Map for SWMU 27L: NGTC Block 10200.

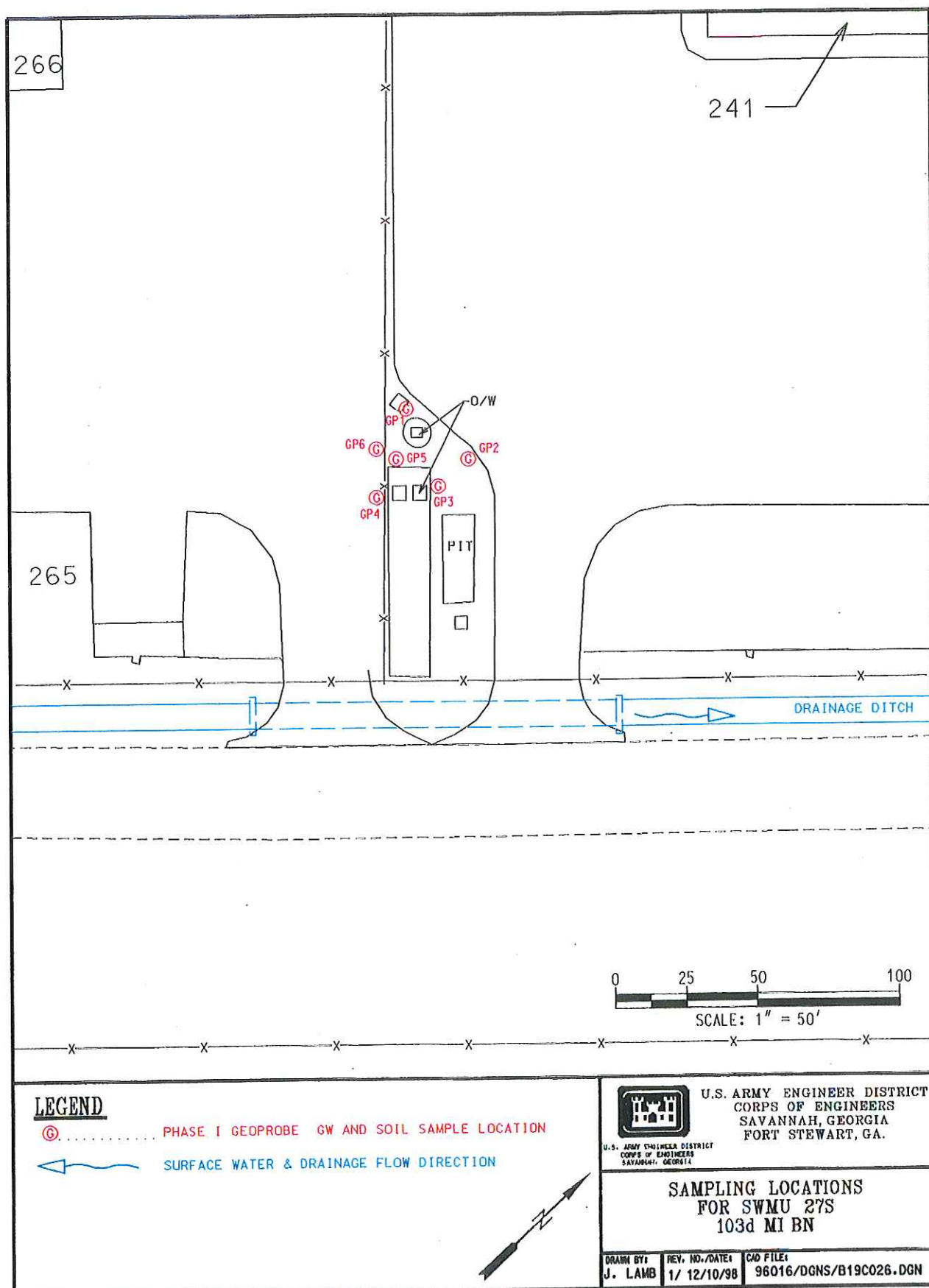


Figure A.6. Site Map for SWMU 27S: 103d MI BN.

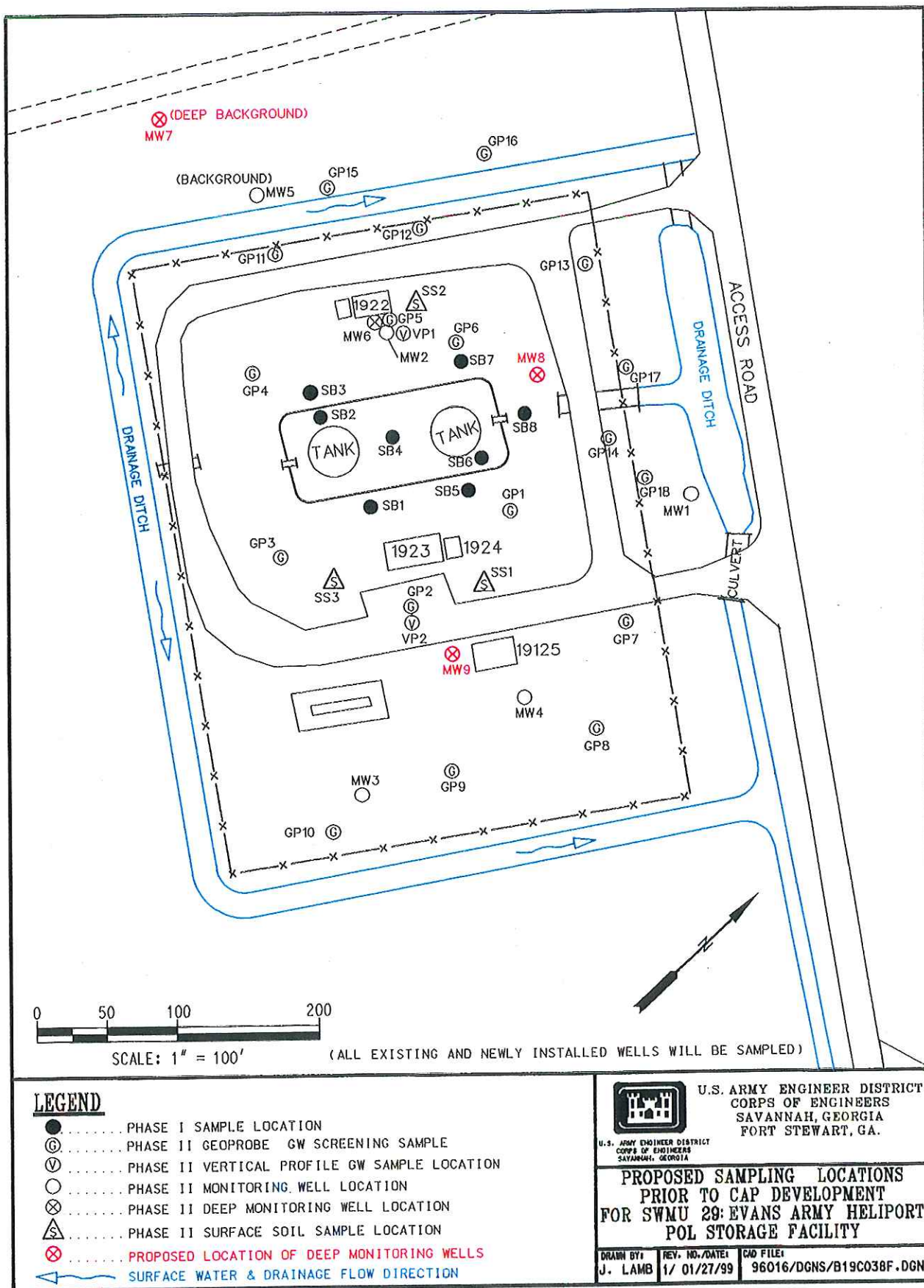


Figure A.7. Site Map for SWMU 29: Evans Army Heliport POL Storage Facility