U.S. Department of Energy

Oakland Operations Office, Oakland, California

DESIGNATED-LEVEL SAMPLING AND ANALYSIS PLAN ADDENDUM FOR THE DOMESTIC SEPTIC SYSTEMS 1, 4 AND 5 AREAS

at the

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH UNIVERSITY OF CALIFORNIA, DAVIS

Prepared for:

United States Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

Prepared by:

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5801 Christie Avenue, Suite 600
Emeryville, California 94608

September 23, 2002
Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

Weiss Associates
Environmental and Geologic Services

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ACRONYMS

bgs	below ground surface
CLP	Contract Laboratory Program
COC	constituent of concern
Cr^{+6}	hexavalent chromium
DB	distribution box
DL	designated-level
DOE	United States Department of Energy
DQO	data quality objective
DSS	domestic septic system
DSSI	Domestic Septic System Investigation
DST	domestic septic tank
ft	feet
ID	identification (number)
ILM	Inorganic Laboratory Method
LEHR	Laboratory for Energy-Related Health Research
mg/kg	milligram(s) per kilogram
OAK	Oakland
pCi/g	picoCurie(s) per gram
SAP	sampling and analysis plan
SOP	standard operating procedure
SOW	statement of work
SVOC	semi-volatile organic compound
TAT	turnaround time
US EPA	United States Environmental Protection Agency
VCP	vitrified clay pipe
WA	Weiss Associates

1. SAMPLING AND ANALYSIS

This sampling and analysis plan (SAP) is an addendum to the *Final Domestic Septic Systems Investigation and Removal Action Work Plan* [Weiss Associates (WA), 2001]. This SAP presents the approach and procedures for the designated-level (DL) sampling and analysis in the Domestic Septic Systems 1, 4 and 5 areas (DSS areas) at the Laboratory for Energy-Related Health Research (LEHR), University of California, Davis. The objective of this sampling and subsequent data evaluation is to determine whether residual concentrations of specific constituents in soil could potentially impact ground water. The specific constituents were identified during the DL analyses performed for the *Draft DOE Areas Remedial Investigation Report* (WA, 2002). In addition, this SAP includes data quality objectives (DQOs) for the sampling activities and procedures for field work.

The DL evaluation identified that hexavalent chromium (Cr^{+6}) at Domestic Septic System (DSS) 1 requires additional evaluation. The DL evaluation identified five constituents of concern (COCs) at DSS 4 that require additional evaluation: Cr^{+6}, total chromium, lead, mercury and selenium. The DSS 5 DL evaluation identified Cr^{+6} and uranium-235 as DL COCs. The maximum reported concentrations of these COCs in soil in the DSSs 1, 4 and 5 areas are shown in Table 1. This SAP is designed to delineate the vertical extent of contamination of the identified DL COCs in the DSSs 1, 4 and 5 areas.

1.1 Data Quality Objectives

This SAP was developed using the DQO process described in *Guidance for the Data Quality Objectives Process* (US EPA document number QA/G-4) and *Data Quality Objectives Process for Superfund* (US EPA document number EPA540-R-93-071). The DQO process is a systematic planning tool for establishing criteria for data quality and for developing data collection designs. The following sections demonstrate how the seven steps of the DQO process were used in designing the DL SAP.

1.1.1 Statement of the Problem

Under the Federal Facility Agreement between the United States Department of Energy (DOE) and the United States Environmental Protection Agency (US EPA), DOE is the lead agency for cleanup of soil contamination associated with LEHR-related activities. DOE-Oakland (OAK) will make the final decisions on all activities associated with the DSS areas DL sampling based on recommendations from the planning team in accordance with the terms of the Federal Facility

Agreement, and all applicable orders, statutes and regulations. The planning team consists of DOE-OAK; Remedial Project Managers from US EPA Region IX, the California Department of Toxic Substances Control, the Central Valley Regional Water Quality Control Board, and the California Department of Health Services; UC Davis; the Davis South Campus Superfund Oversight Committee; and WA and its subcontractors, Shaw Environmental and Infrastructure, Inc. and Environmental Management Services.

The fundamental question to be answered by this sampling and analysis program is: "Will the residual concentrations of specific constituents in soil at the DSSs 1, 4 and 5 areas potentially impact ground water?" The sampling program described subsequently is designed to provide DOE-OAK and the planning team with the data needed to delineate the vertical extent of DL COC contamination in the DSS areas.

1.1.2 Identification of Decisions

The decision statement for the DL sampling is:

- Determine whether or not potential ground water-impacting chemicals and/or radionuclides are present in the vadose zone beneath DSSs 1, 4 and 5.

1.1.3 Identification of Decision Inputs

Existing data that will be used to resolve the decision statements include data collected during the 2001 DSSs investigation. New environmental measurement inputs will include:

- Soil sampling at appropriate locations and depths;
- Continuous soil sample description using the Unified Soil Classification System;
- Laboratory analyses for DL COCs; and,
- Laboratory data validation.

1.1.4 Definition of Study Boundaries

The geographical areas addressed in this SAP consists of the sample locations shown on Figures 1, 2 and 3. The sampling and analysis program focuses on the DL COCs identified by the DL evaluations for the DSS as shown in Table 1.

1.1.5 Development of Decision Rules

The primary decision rules for the DL sampling are:

- If the chemical or radionuclide concentrations at a DSS area will potentially impact ground water above site background thresholds, then remedial action and/or long term monitoring may be required as determined by the DOE-Areas Feasibility Study.

- Alternatively: If the chemical or radionuclide concentrations at the DSS areas will not impact ground water above site background thresholds, then no additional remedial action may be required as determined by the DOE-Areas Feasibility Study.

1.1.6 Specification of Limits on Decision Errors

The DL sampling data will not be used for statistical analyses. Therefore, this step of the DQO process does not apply.

1.1.7 Sample Design Optimization

This section describes the location and number of samples that will be collected to evaluate potential impact to ground water by the DL COCs. The output from each of the first six DQO steps described in Sections 1.1.1 through 1.1.6 was used to optimize the sampling and analysis program. In general, samples will be collected from locations with the highest concentrations of each DL COC. One boring each will be drilled at DSSs 1, 4 and 5. The DSS 1 boring will be drilled at sample location SSD1C001 (Figure 1) where the maximum Cr^{+6} concentration was reported in soil (Table 1). The DSS 4 boring will be drilled at the first point of perforation on the western leach line (Figure 2). A discrete sample from this location contained the maximum detected Cr^{+6} concentration at DSS 4. A sample composited from this location and beneath the first point of perforation on the southern leach line contained the maximum mercury, lead and selenium concentrations (Table 1). The DSS 5 boring will be drilled at sample location SSD5C001 (Figure 3), the sole soil sample collected from the DSS 5 area.

Soil samples will be collected at the original sample locations, SSD1C001, SSD4C004, and SSD5C001, and at the first five-ft interval below the original samples for the waste extraction test using deionized water for metals, semi-volatile organic compounds (SVOCs), and metals.

Soil samples will be collected from each DL boring at five-ft intervals for DL COCs, with the first sample collected approximately five ft below the depth of the original sample (Table 2). Sample collection will continue until ground water is encountered, estimated to be between 35 and 40 ft below ground surface (bgs). A grab ground water sample will be collected from each boring

when ground water is encountered if an adequate volume of ground water is reasonably obtainable. The ground water sample will be analyzed for metals, radionuclides, SVOCs, volatile organic compounds, pesticides, nitrate, and hexavalent chromium. Targeted sample depths are summarized in Table 2. Assuming ground water will be encountered between a depth of 35 and 40 ft bgs, as many as 5 soil samples for DL COCs will be collected from each location shown on Figures 1, 2 and 3.

DL borings will be located using survey coordinates and will be continuously cored using a direct-push drill rig. Soil samples will be collected in a core barrel with a butyrate liner. The soil cores will be screened by a Field Geologist for visual indications of contamination. The Field Geologist will use the Unified Soil Classification System to describe and document the lithology of the soil cores. The samples will be given unique identification numbers and placed in a cooler for transport to the laboratory under chain-of-custody procedures. In addition, one duplicate sample will be collected for every 10 samples (10%) for quality control.

All downhole drilling equipment will be steam-cleaned prior to arrival on site, and will be cleaned between each borehole using an Alconox detergent-water wash, a potable water rinse, and a final de-ionized water rinse. Investigation-derived waste, consisting of decontamination water and unused soil core, will be combined with another appropriate site waste stream as determined by the LEHR Waste Coordinator for proper disposal. Upon completion of the field work, all borings will be grouted to the surface with a cement grout containing 3-5% bentonite by weight.

Soil sampling will be conducted in accordance with applicable standard operating procedures listed in the *Final Domestic Septic Systems Investigation and Removal Action Work Plan* (WA, 2001). One soil blank will be sent with each shipment from the field. The soil quality control blank will be prepared in accordance with Section 5 of SOP 3.2, Subsurface Soil Sampling While Drilling.

Conditions that may cause deviation from this planned sampling and analysis include:

- Physical obstructions, such as buildings and underground utilities, that prevent sampling in selected locations;
- Field screening measurements indicating that the work environment, or some aspect of it, is unsafe for human or environmental health and/or welfare;
- Equipment required to perform the intended work safely is unavailable; and,
- Ground water encountered at shallower depths than anticipated.

These conditions are considered very unlikely. If one or more of these conditions occur, potential impact on achieving DQOs will be evaluated and addressed, and modifications to the sampling considered.

1.1.7.1 Sample Numbers

The sample matrix will be identified by "SS" for soil sample or "WS" for water sample. The sample collection area will be identified as follows: D1 for DSS 1, D4 for DSS 4, and D5 for DSS 5. Since these are DL samples, they will be identified by "DL." Samples will be numbered sequentially. For example, the first DL soil sample collected from DSS 1 will be identified as SSD1DL01.

1.2 Analytical Plan

The soil sample and water sample containers, laboratory and water sample analytical methods, detection limits, and holding times are specified in Tables 3 and 4. Analyses will be performed on a standard 30-day turnaround time for metals and a 45-day turnaround time for radionuclides.

The samples collected for this investigation will be analyzed by General Engineering Laboratories, Inc. in Charleston, South Carolina. Laboratory reports (hard copies and electronic files) will be forwarded from the laboratory to the Project Chemist. These results will be validated and transferred to the project database by the WA Database Manager in accordance with procedures described in the Quality Assurance Project Plan (WA, 2000).

2. REFERENCES

United States Environmental Protection Agency (US EPA) document number EPA540-R-93-071, Data Quality Objectives Process for Superfund, Interim Final Guidance.

US EPA document number QA/G-4, *Guidance for the Data Quality Objectives Process.*

Weiss Associates (WA), 2000, Final Quality Assurance Project Plan for the Laboratory for Energy-Related Health Research, University of California, Davis, June, Rev. 3.

WA, 2001, Final Domestic Septic Systems Investigation and Removal Action Work Plan for the Laboratory for Energy-Related Health Research, University of California, Davis, August, Rev. 0.

WA, 2002, Draft DOE Areas Remedial Investigation Report for the Laboratory for Energy-Related Health Research, University of California, Davis, March, Rev. C.

TABLES

Table 1. Summary of the Maximum Reported Soil Concentrations for the Designated-Level Constituents of Concern in the Domestic Septic Systems 1, 4 and 5 Areas

Constituent	Units	Maximum Concentration	Sample Identification	Depth (ft bgs)	Location
Domestic Septic Tank 1					
Hexavalent Chromium	mg/kg	0.361	SSD1C001	8.7	Beneath the DST 1 effluent line
Domestic Septic System 4					
Hexavalent Chromium	mg/kg	0.925	SSD4C004	7.75	Beneath the first point of perforation on the western leach line
Total Chromium	mg/kg	199	SSD4C004	7.75	Beneath the first point of perforation on the western leach line
Lead	mg/kg	20.1	SSD4C002A/B	4.2	Two-point composite sample beneath the first points of perforation on the southern and western leach lines
Mercury	mg/kg	3.5	SSD4C002A/B	4.2	Two-point composite sample beneath the first points of perforation on the southern and western leach lines
Selenium	mg/kg	2	SSD4C002A/B	4.2	Two-point composite sample beneath the first points of perforation on the southern and western leach lines
Domestic Septic Tank 5					
Hexavalent Chromium	mg/kg	0.339	SSD5C001	7	Below the effluent line
Uranium-235	pCi/g	0.0631	SSD5C001	7	Below the effluent line

Abbreviations
bgs below ground surface
DST domestic septic tank
ft feet
mg/kg milligrams per kilogram
pCi/g picoCuries per gram

Table 2. Summary of Designated-Level Sampling and Analysis for the Domestic Septic Systems 1, 4 and 5 Areas

DL COC	Sample ID	Sample Depth (ft bgs)	DL COC Boring ID	Sample Depths (ft bgs) [1]	Total Samples	Assumptions
Domestic Septic System 1						
Hexavalent Chromium	SSD1C001	8.7	DL-1	13.7, 18.7, 23.7, 28.7, 33.7, 38.7	5	Soil samples will be collected at five-ft intervals
DI WET for metals, SVOCs and nitrate				8.7, 13.7	2	First two samples collected at boring location
Metals, radiological, VOCs, SVOCs, pesticides, nitrate, hexavalent chromium				water table	1	Grab ground water sample at water table
Domestic Septic System 4						
Hexavalent chromium, chromium, lead, mercury, selenium	SSD4C004	7.75	DL-2	12.8, 17.8, 22.8, 27.8, 32.8, 37.8	5	Soil samples will be collected at five-ft intervals
DI WET for metals, SVOCs, and nitrate				7.8, 12.8	2	First two samples collected at boring collection
Metals, radiological, VOCs, SVOCs, pesticides, nitrate, hexavalent chromium				water table	1	Grab ground water sample at water table
Domestic Septic System 5						
Hexavalent Chromium, uranium-235	SSD5C001	7	DL-3	12, 17, 22, 27, 32, 37	5	Soil samples will be collected at five-ft intervals
DI WET for metals, SVOCs, and nitrate				7, 12	2	First two samples collected at boring collection
Metals, radiological, VOCs, SVOCs, pesticides, nitrate, and hexavalent chromium				water table	1	Grab ground water sample at water table

Notes
[1] Samples will be collected in each boring at the depths indicated.

Table 2. Summary of Designated-Level Sampling and Analysis for the Domestic Septic Systems 1, 4 and 5 Areas (continued)

Abbreviations

bgs	below ground surface
COC	constituent of concern
DI WET	waste extraction test using deionized water
DL	designated-level
ft	feet
ID	identification (number)
SVOCs	semi-volatile organic compounds
VOCs	volatile organic compounds

Table 3. Containers, Laboratory Analytical Methods, Detection Limits and Holding Times for Designated-Level Soil Sampling at the Domestic Septic Systems 4 and 5 Areas

Parameter/Container	Analytical Method	Required Detection Limit (pCi/g for radiochemicals, mg/kg for metals/general chemistry, µg/kg for organics)	Holding Time
Laboratory Analyses			
Radionuclides (2 ea. 16-oz G):			
Uranium-235	Lab SOP	0.01	6 months
Metals (2 ea. 4-oz G):	CLP SOW ILM 04.0		
Antimony		0.5	6 months
Arsenic		2	6 months
Barium		40	6 months
Beryllium		0.1	6 months
Cadmium		0.25	6 months
Chromium (total)		1	6 months
Cobalt		10	6 months
Copper		0.25	6 months
Iron		20	6 months
Lead		0.3	6 months
Manganese		3	6 months
Mercury		0.1	28 days
Molybdenum		0.1	6 months
Nickel		1	6 months
Selenium		1	6 months
Silver		0.1	6 months
Thallium		0.5	6 months
Vandium		1	6 months
Zinc		4	6 months
General Chemistry (4-oz G)			
Hexavalent Chromium	SW-846 Method 3060A/7196	0.05	24 hours
Nitrate	EPA Method 300.0	1	48 days
Organics:			
Semi-Volatile Organic Compounds (4-oz G)	CLP SOW OLM 4.2	Exhibit C of SOW OLM 4.2	14 days to extraction, 40 days to analysis of extract

Table 3. Containers, Laboratory Analytical Methods, Detection Limits and Holding Times for Designated-Level Soil Sampling at the Domestic Septic Systems 4 and 5 Areas (continued)

Notes

[1] Mercury is only a driver constituent of concern for the Domestic Septic Systems 6 removal action.

Abbreviations

(*)	Requires 30-day ingrowth-time and 1,000-minute count-time
CLP SOW	Contract Laboratory Program Statement of Work
COC	constituent of concern
ea.	Each
EPA	United States Environmental Protection Agency
G	glass
ILM 4.0	Inorganic Laboratory Method 4.0
mg/kg	milligrams per kilogram
OLM 4.2	Organic Laboratory Method 4.2
oz	ounce
pCi/g	picoCuries per gram

Table 4. Laboratory Analytical Methods, Detection Limits and Holding Times for Designated-Level Grab Ground Water Samples

Parameter/Container	Analytical Method	Required Detection Limit (pCi/l for radiochemicals, mg/l for metals/general chemistry, µg/l for organics)	Holding Time
Laboratory Analyses			
Radionuclides (4 ea. 1-l Poly and 2 ea. 2-l Poly):			
Americium-241	Lab SOP	15	6 months
Carbon-14	Lab SOP	50	6 months
Gamma Emitters	Lab SOP	50	6 months
Actinium-228	Lab SOP	50	6 months
Bismuth-212	Lab SOP	50	6 months
Bismuth-214	Lab SOP	50	6 months
Cesium-137	Lab SOP	50	6 months
Cobalt-60	Lab SOP	50	6 months
Lead-210	Lab SOP	50	6 months
Lead-212	Lab SOP	50	6 months
Lead-214	Lab SOP	50	6 months
Potassium-40	Lab SOP	50	6 months
Radium-223	Lab SOP	50	6 months
Radium-228	Lab SOP	10	6 months
Radium-226 (*)	Lab SOP	10	6 months
Thallium-208	Lab SOP	50	6 months
Thorium-228	Lab SOP	50	6 months
Thorium-230	Lab SOP	50	6 months
Thorium-232	Lab SOP	50	6 months
Thorium-234	Lab SOP	50	6 months
Gross Alpha	EPA Method 900.0	3	6 months
Gross Beta	EPA Method 900.0	10	6 months
Plutonium-241	Lab SOP	50	6 months
Strontium-90	EPA Method 905.0	2	6 months
Tritium	EPA Method 906.0	4,000	6 months
Uranium-233/234	Lab SOP	4	6 months
Uranium-235	Lab SOP	4	6 months
Uranium-238	Lab SOP	4	6 months

Table 4. Laboratory Analytical Methods, Detection Limits and Holding Times for Designated-Level Grab Ground Water Samples (continued)

Parameter/Container	Analytical Method	Required Detection Limit (pCi/l for radiochemicals, mg/l for metals/general chemistry, µg/l for organics)	Holding Time
Metals (1-l Poly):	CLP SOW ILM 04.0		
Antimony		0.001	6 months
Arsenic		0.01	6 months
Barium		0.2	6 months
Beryllium		0.001	6 months
Cadmium		0.001	6 months
Chromium (total)	CLP SOW ILM 04.0	0.01	6 months
Cobalt		1	6 months
Copper		0.2	6 months
Iron		1	6 months
Lead		0.003	6 months
Manganese		1	6 months
Mercury		0.0004	28 days
Molybdenum		1	6 months
Nickel		0.02	6 months
Selenium		0.01	6 months
Silver		0.02	6 months
Thallium		0.0004	6 months
Vandium		1	6 months
Zinc		1	6 months
General Chemistry (1L Poly)			
Hexavalent Chromium	SW-846 Method 3060A/7196	0.1	24 hours
Nitrate	EPA Method 300.0	10	48 days
Organics:			
Volatile Organic Compounds (3 ea. VOA vials)	CLP SOW OLM 4.2	Exhibit C of SOW OLM 4.2	14 days
Semi-Volatile Organic Compounds (2 ea. 1-l Amber)	CLP SOW OLM 4.2	Exhibit C of SOW OLM 4.2	7 days to extraction, 40 days to analysis of extract
Pesticides/PCBs (2 ea. 1-l Amber)	CLP SOW OLM 4.2	Exhibit C of SOW OLM 4.2	7 days to extraction, 40 days to analysis of extract

Table 4. Laboratory Analytical Methods, Detection Limits and Holding Times for Designated-Level Grab Ground Water Samples (continued)

Abbreviations

(*)	Requires 30-day ingrowth-time and 1,000-minute count-time
CLP SOW	Contract Laboratory Program Statement of Work
COC	constituent of concern
ea.	each
EPA	United States Environmental Protection Agency
G	glass
HPGe	high-purity germanium
ILM 04.0	Inorganic Laboratory Method 04.0
l	liter
mg/l	milligrams per liter
OLM 04.2	Organic Laboratory Method 04.2
oz	ounce
pCi/l	picoCuries per liter
Poly	polyethylene
SOP	Standard Operating Procedure
VOA	volatile organic analysis
µg/l	micrograms per liter

FIGURES

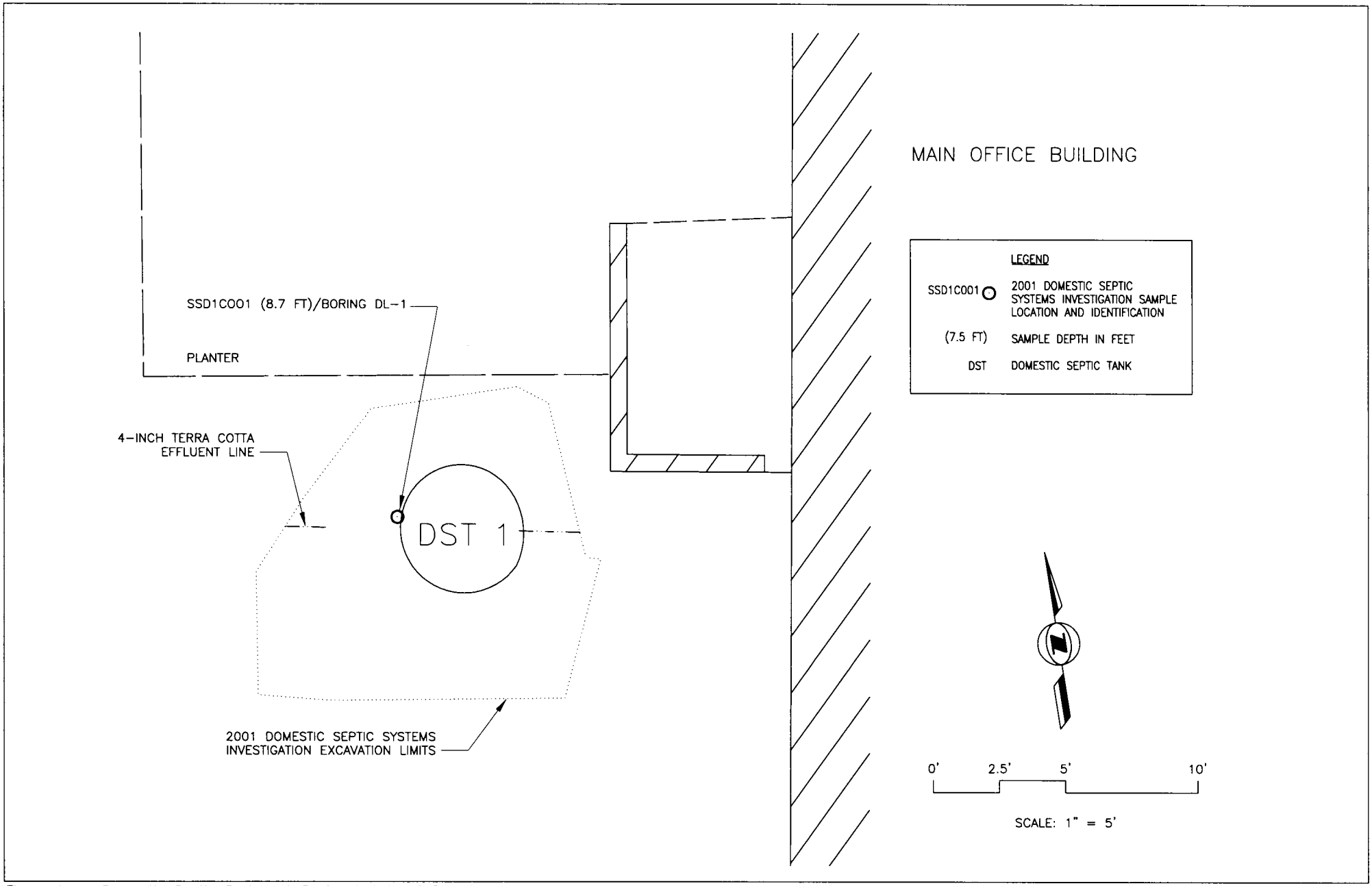

Figure 1. Domestic Septic System 1 Designated-Level Sample Location

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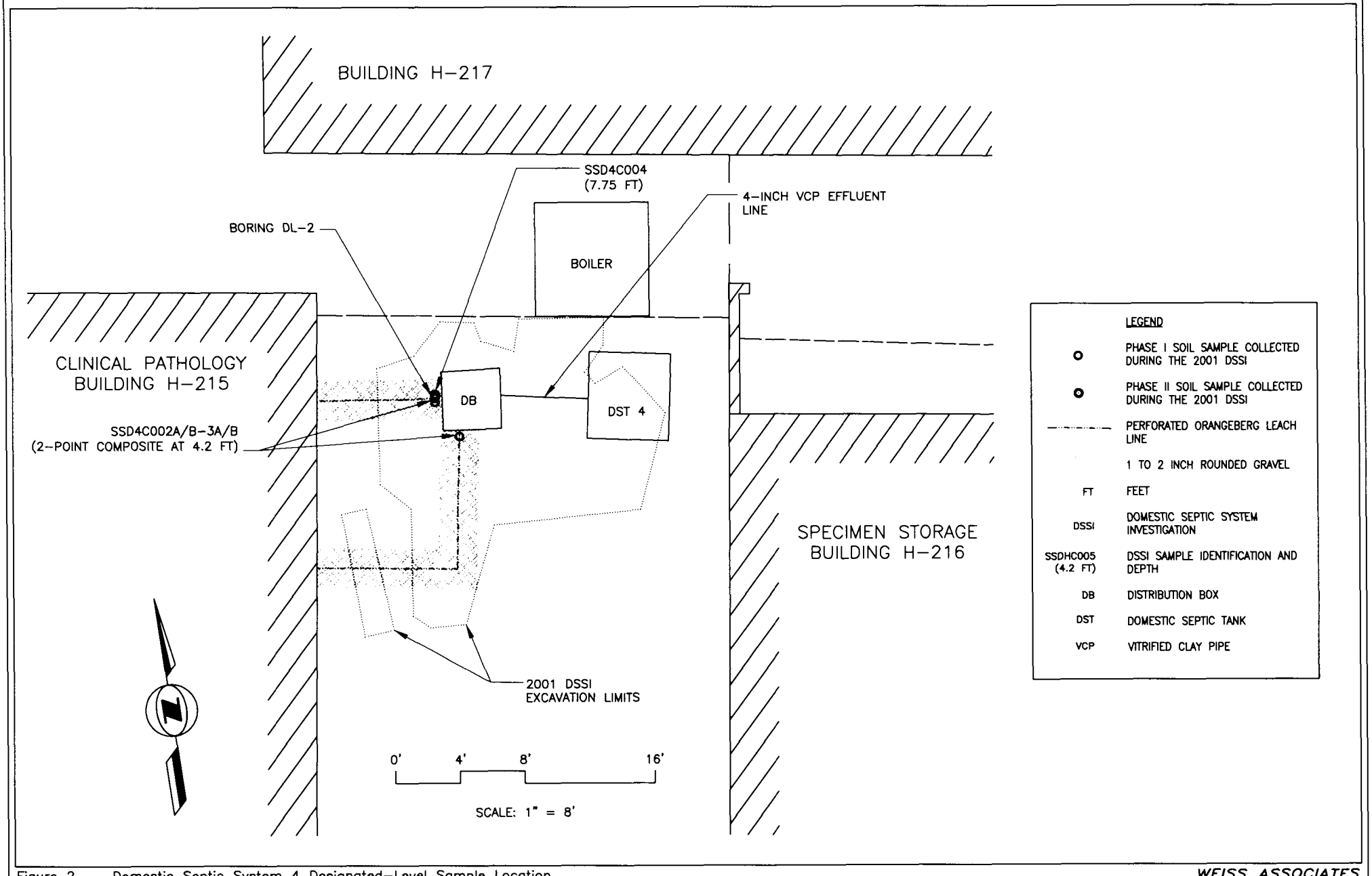

Figure 2. Domestic Septic System 4 Designated-Level Sample Location

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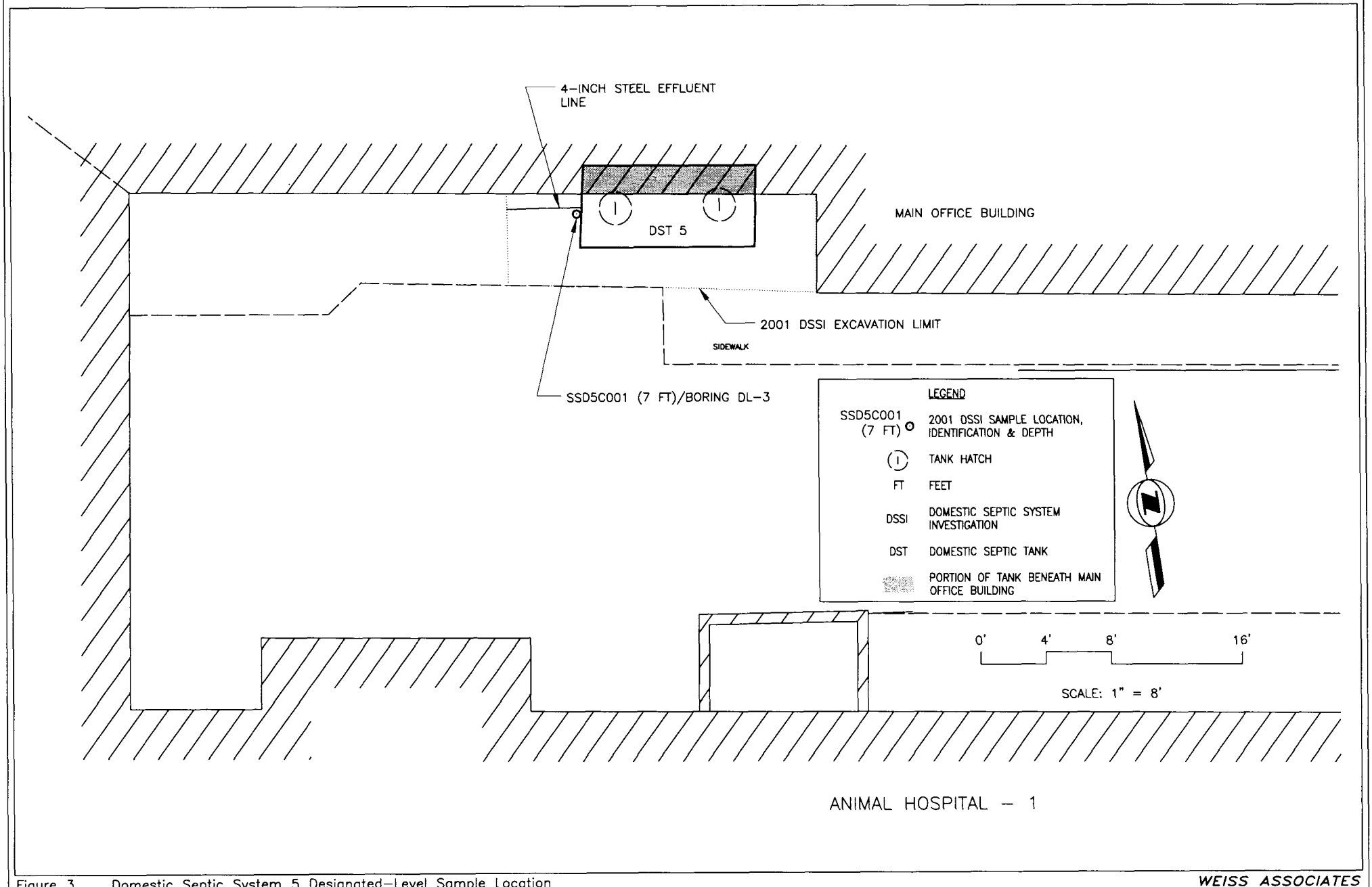

Figure 3. Domestic Septic System 5 Designated-Level Sample Location

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