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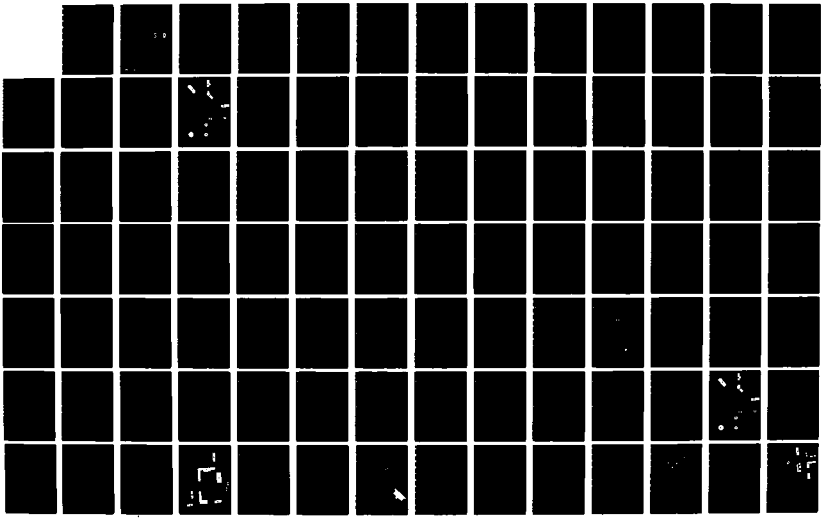

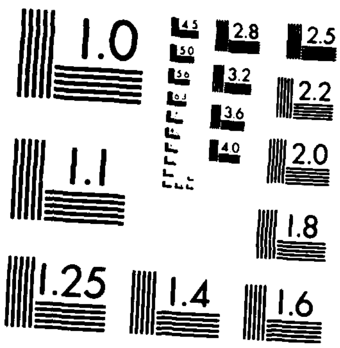
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AD-A171 579

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Installation Restoration Program
Phase II — Confirmation/Quantification
Stage 1

Homestead Air Force Base
Homestead Air Force Base, Florida 33039-5300

Science Applications International Corporation
8400 Westpark Drive, McLean, VA 22102

March 1986

Final Report 8/84 to 3/86

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Bioenvironmental Engineering Division
Langley Air Force Base, Virginia 23665-5001

United States Air Force
Occupational and Environmental Health Laboratory (USAFOEHL)
Brooks Air Force Base, TX 78235-5501

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT

FOR

HOMESTEAD AIR FORCE BASE
HOMESTEAD AIR FORCE BASE, FLORIDA 33039-5300

HEADQUARTERS TACTICAL AIR COMMAND
COMMAND SURGEON'S OFFICE (HQ TAC, SGPB)
BIOENVIRONMENTAL ENGINEERING DIVISION
LANGLEY AIR FORCE BASE, VIRGINIA 23665-5001

MARCH 1986

PREPARED BY

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MARIA R. LAMAGNA, 1 LT., USAF

USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

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ABSTRACT

Ten sites at Homestead Air Force Base were investigated during the Installation Restoration Program (IRP) Phase II, Stage 1 Study. These included five fuel-related leaks or spills (SP-2, SP-4, SP-5, SP-6, and SP-7), two fire protection training areas (FPTA-2 and FPTA-3), two pesticide-related sites (P-2 and P-3), and one electroplating waste disposal site (SP-1).

During Stage 1, 19 groundwater monitoring wells were installed and 22 wells were sampled. Fourteen soil samples and four sediment samples were also collected. Four surface water samples, planned to correspond to the four sediment samples, could not be collected due to the Stage 1 field activities being conducted during the dry season when many minor drainage canals held no water. Samples from the fuel-related sites and fire protection training areas were analyzed for total organic carbon (TOC), total organic halogens (TOX), and oil and grease. The two pesticide-related sites were sampled and analyzed for 17 specific pesticides. Samples from the electroplating waste disposal site were analyzed for seven metals and cyanide.

Of the ten sites investigated during Stage 1, contamination was found at nine. Only the Entomology Storage Area (P-2) was found to be free of contamination in the media investigated. Groundwater contamination was found at seven of the nine sites where it was investigated (SP-1, SP-4, SP-5, SP-6, SP-7, FPTA-2, and FPTA-3). Soils and/or sediments were found to be contaminated at three sites (SP-1, SP-2, and P-3).

The Stage 1 effort confirmed the presence or absence of contamination at the sites investigated, but did not quantify the extent of contamination nor identify all soruces of contamination. Consequently, Stage 2 monitoring is recommended for nine of the ten Stage 1 sites.

PREFACE

Ten potentially contaminated sites at Homestead Air Force Base, Florida were investigated by collecting and analyzing samples from groundwater, soils, and sediments. The objectives of the Phase II Stage 1 study were to confirm or deny the existence of contamination at the sites investigated, provide estimates of the magnitude and extent of contamination if present, and identify future monitoring efforts. This report presents the activities, findings, and recommendations generated from the IRP Phase II Stage 1 study at Homestead AFB. This study was accomplished between August 1984 and March 1986.

SAIC personnel were responsible for the project management and technical performance of the study. Mr. Philip Spooner was Project Manager, and field personnel included Mr. Brian Vickers and Mr. Douglas Sarno. Dr. Edward Repa and Dr. Zubair Saleem provided senior technical review.

The assistance of Capt. Jesse D. Humberd and his staff in the Base Bioenvironmental Engineering Office is acknowledged and appreciated.

1LT. Maria R. LaMagna, Technical Services Division, United States Air Force Occupational Environmental Health Laboratory (USAFOEHL) was the technical monitor.

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FIGURES

FIGURES (continued)

TABLES

TABLES (continued)

SUMMARY

A total of 13 sites at Homestead Air Force Base (AFB) were identified by the Phase I Installation Assessment as having a potential for environmental contamination. These 13 sites were ranked using the Hazardous Assessment Rating Methodology (HARM) and the top eight ranked sites were recommended for monitoring under Phase II. Two additional sites, from the original 13 sites, the leak at Pump Station No. 9 (SP-5) and the Residual Pesticide Disposal Area (P-3), were added by USAFOEHL to the Phase I recommendations for monitoring, making a total of 10 sites which received Phase II confirmation investigation (Figure ES-1). Two sites (SP-4 and SP-6), located near the west gate, in close proximity to one another ~~(Figure ES-2)~~, are indistinguishable from each other based on the groundwater analysis results. These are combined into a single zone for Phase II, Stage 2 recommendations.

Nineteen 2-inch groundwater monitoring wells were installed into the upper Biscayne aquifer during Phase II, Stage 1 ~~(Table ES-1)~~. These, along with three existing wells, were sampled, with samples being shipped to both OEHL and SAIC laboratories. Soil samples were collected at three sites, and sediment samples at two (Table ES-2). Surface water sampling, planned for two sites, could not be collected because Stage 1 was conducted during the dry season (late fall, early winter). Three main suites of analyses were conducted and keyed to the known or suspected contaminants at each site. These were:

- Seven metals plus cyanide - one site
- Seventeen specific pesticides - two sites
- Total organic halogens (TOX), total organic carbon (TOC), and oil and grease - seven sites.

Two sites of the last category also received total lead analyses related to gasoline and used motor oil associated with those sites. At the time of sampling, water from each well was also measured for pH, temperature, and specific conductance.

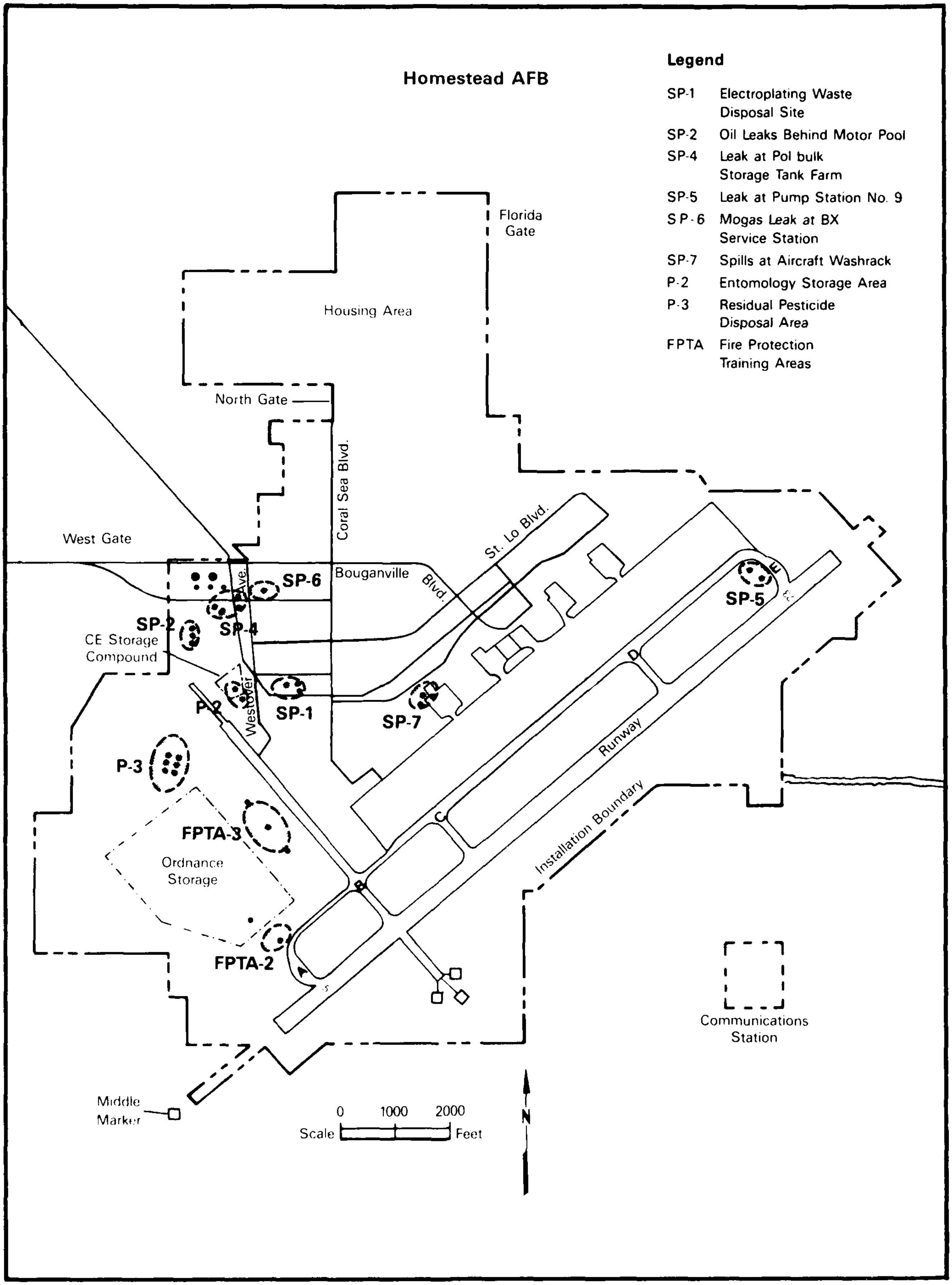

Figure ES-1. Location of Sites Investigated

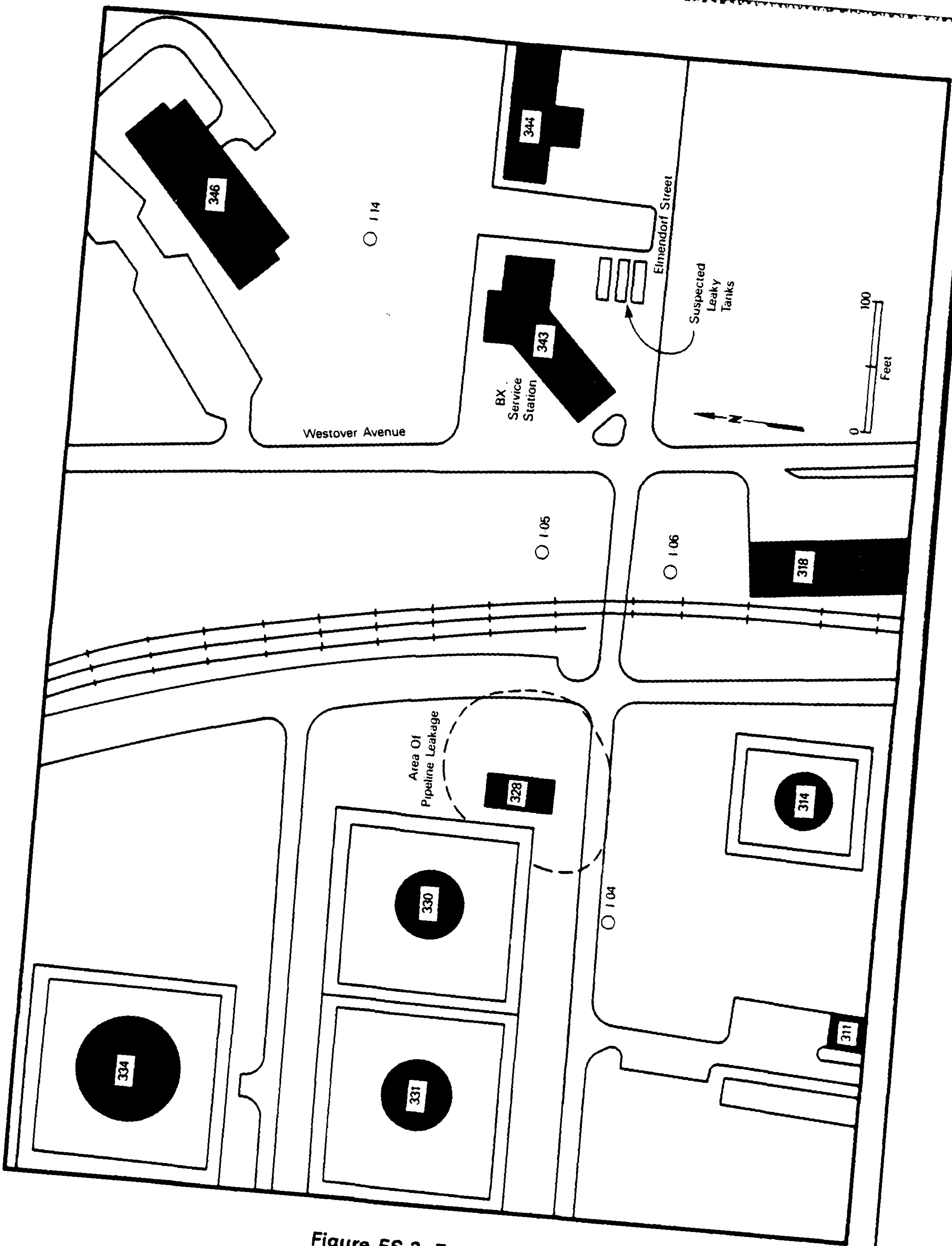

Figure ES-2. Zone 1

TABLE ES-1: SUMMARY OF CONTAMINANTS IN GROUNDWATER

				ZONE I									
				SP-1			SP-4			SP-6	SP-7		
Analyte	AFLC[1]	SDWA[2]	AWQC[3]	I-01	I-02	I-03	I-04	I-05	I-06	I-14	I-07	I-08	I-09
Trace Metals (ppb)													
Cadmium	10.0	10.0	9.0	0.2	0.2	0.4	-	-	-	-	-	-	-
Total Chromium	50.0	50.0	20.0	19.7	<0.5	<0.5	-	-	-	-	-	-	-
Hexavalent Chromium	50.0	NS[4]	50.0	0.30	<0.1	<1.7	-	-	-	-	-	-	-
Copper	20.0	1000.0	2.0	4.22	5.3	7.0	-	-	-	-	-	-	-
Lead	20.0	50.0	10.0	7.79	6.8	5.7	13.3	9.5	2.2	15.9	-	-	-
Nickel	100.0	NS	22.0	10.6	10.8	16.9	-	-	-	-	-	-	-
Zinc	50.0	5000.0	60.0	15.1	16.3	16.3	-	-	-	-	-	-	-
Other Inorganics (ppb)													
Cyanide	10.0	NS	10.0	<5.0	<5.0	<5.0	-	-	-	-	-	-	-
Organics (ppm)													
Oil & Grease	0.10	NS	1.00	-	-	-	5.19	4.29	0.47	0.83	0.15	0.51	6.49[5]
Total Organic Halogens	0.01	NS	0.10	-	-	-	0.04	0.10	0.05	0.04	0.01	0.02	0.03
Total Organic Carbon	1.00	NS	10.00	-	-	-	37.	19.	10.	47.	93.	170.	62.

1. Air Force Level of Concern
2. Safe Drinking Water Act 1974 (Also Florida State Drinking Water Standards)
3. Ambient Water Quality Criteria (Pitt, 1975; Waller, 1983)
4. No Standard
5. Partial diluted oil phase residing over aqueous phase was found to contain 732000 ppm of oil and grease.

TABLE ES-1: SUMMARY OF CONTAMINANTS IN GROUNDWATER
(continued)

Analyte	AFLC[1]	SDWA[2]	AWQC[3]	FPTA-3			FPTA-2		SP-2	SP-5		WF1	WF2
				I-10	I-11	I-12	I-13	248	I-17	I-18	I-19		
Trace Metals (ppb)													
Cadmium	10.0	10.0	9.0	-	-	-	-	-	-	-	-	<0.2	<0.2
Total Chromium	50.0	50.0	20.0	-	-	-	-	-	-	-	-	0.7	<0.5
Hexavalent Chromium	50.0	NS[4]	50.	-	-	-	-	-	-	-	-	0.3	<0.1
Copper	20.0	1000.0	2.0	-	-	-	-	-	-	-	-	1.9	4.3
Lead	20.0	50.0	10.0	-	-	-	-	-	7.7	-	-	2.3	2.7
Nickel	100.0	NS	22.0	-	-	-	-	-	-	-	-	<5.0	<5.0
Zinc	50.0	5000.0	60.0	-	-	-	-	-	-	-	-	18.8	32.5
Other Inorganics (ppb)													
Cyanide	10.	NS	10.0	-	-	-	-	-	-	-	-	12.0	7.0
Organics (ppm)													
Oil & Grease	0.1	NS	1.0	0.16	0.18	2.59	0.18	<0.10	<0.10	-[5]	0.11	-	<0.10
Total Organic Halogens	0.001	NS	0.1	<0.01	0.02	0.02	2.2	0.03	-	0.05	0.003	-	0.04
Total Organic Carbon	1.0	NS	10.0	98.	64.	90.	5.6	2.2	-	22.	7.0	-	5.4

1. Air Force Level of Concern
2. Safe Drinking Water Act 1974 (Also Florida State Drinking Water Standards)
3. Ambient Water Quality Criteria (Pitt, 1975; Waller, 1983)
4. No Standard
5. Fuel observed to be floating on top of water.

TABLE ES-1: SUMMARY OF CONTAMINANTS IN GROUNDWATER
(continued)

Analyte	AFLC[1]	SDWA[2]	AWQC[3]	P-2 I-15	P-2 I-16	WF1	WF2
Pesticides (ppb)							
Aldrin	0.02	NS[4]	0.02	<0.02	<0.02	<0.02	<0.02
DDD	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
DDT	0.02	NS	0.02	<0.02	<0.0	<0.02	<0.02
Dieldrin	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
Endrin	0.02	0.2	0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
Hepachlor Epoxide	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
Lindane	0.01	4.0	0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor	0.20	100.	0.20	<0.20	<0.20	<0.20	<0.20
Toxaphene	1.00	5.0	1.00	<1.00	<1.00	<1.00	<1.00
Diazinon	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
Malathion	0.10	NS	0.10	<0.10	<0.10	<0.10	<0.10
Parathion	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02
2,4-D	0.06	100.	0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-T	0.06	NS	0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-TP (silvex)	0.06	10.	0.06	<0.06	<0.06	<0.06	<0.06
Sevin	1.0	NS	1.0	<1.0	<1.0	<1.0	<1.0

1. Air Force Level of Concern
2. Safe Drinking Water Act 1974 (Also Florida State Drinking Water Standards)
3. Ambient Water Quality Criteria (Pitt, 1975; Waller, 1983)
4. No Standard

TABLE ES-2: SUMMARY OF CONTAMINANTS IN SOILS AND SEDIMENTS

Analyte	AFLC[1]	ASQC[2]	NLS[3]	SP-1						SP-2					
				SL-1	SL-2	SL-3	SL-4	SD-1	SD-2	SL-5	SL-6	SL-7	SL-8	SD-3	SD-4
<u>Trace Metals (ppb)</u>															
Cadmium	-	0.02	3.50	0.00	0.00	0.00	0.00	0.00	0.01	-	-	-	-	-	-
Total Chromium	5.00	0.10	25.00	0.07	0.02	0.03	0.04	0.02	0.09	-	-	-	-		-
Copper	-	0.23	50.00	0.08	0.02	0.03	0.11	0.01	0.04	-	-	-	-	-	-
Lead	2.00	0.37	100.0	0.17	0.09	0.11	0.21	0.11	1.18	0.62	0.23	0.72	0.19	0.93	1.07
Nickel	-	0.02	500.0	0.02	0.01	0.04	0.05	0.00	-	-	-	-	-	-	-
Lead	2.00	0.37	100.0	0.17	0.09	0.11	0.21	0.11	1.18	0.62	0.23	0.72	0.19	0.93	1.07
Nickel	-	0.02	500.0	0.02	0.01	0.04	0.05	0.00	0.01	-	-	-	-	-	-
Zinc	-	0.18	150.00	0.72	0.12	0.15	0.28	0.13	0.92	-	-	-	-	-	-
<u>Other Inorganics (ppm)</u>															
Cyanide	-	1.0	-	1.30	0.60	0.70	0.80	0.60	3.0	-	-	-	-	-	-
<u>Organics (ppm)</u>															
Oil & Grease	100.0	10.	-	-	-	-	-	-	-	21900	1540	586	983	749	822

1. Air Force Level of Concern
2. Ambient Soil Quality Criteria (Waller, 1983)
3. Normal Levels in Soil

TABLE ES-2: SUMMARY OF CONTAMINANTS IN SOILS AND SEDIMENTS (continued)

Analyte	AFLC[1]	ASQC[2]	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14
Pesticides (ppm)								
Aldrin	0.02	0.02	<0.02	<0.02	<0.02	0.07	<0.02	<0.02
DDD	0.02	0.02	<0.02	0.08/ 0.08[3]	<0.02	<0.02	<0.02	<0.02
DDT	0.02	0.02	0.09	0.67/ 0.62	0.26	0.37	<0.02	0.03
Dieldrin	0.02	0.02	<0.02	<0.02	0.04	0.03	<0.02	<0.02
Endrin	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor Epoxide	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lindane	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor	0.20	0.20	<0.02	0.09/ 0.12	<0.20	0.09	<0.20	<0.20
Toxaphene	1.00	1.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Diazinon	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Malathion	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Parathion	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-D	0.06	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-T	0.06	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-TP (silvex)	0.06	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Sevin	1.00	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

1. Air Force Level of Concern
2. Ambient Soil Quality Criteria (Waller, 1983)
3. Normal Levels in Soil

An attempt at conducting an aquifer pump test, using Well No. 10 in Well Field 2, was not successful. The base's water treatment plant had limited storage capacity because one tank was down for repairs, so a long duration pump test was not possible. Consequently, no site-specific hydrologic data, beyond static water levels, were obtained. However, the Biscayne aquifer is among the most studied aquifers in the nation, and so a wealth of local hydrologic and water quality data is available in the literature. These references are cited throughout the text, and listed in Appendix G.

Contamination was found at 9 of the 10 investigated sites. Groundwater contamination was found at seven of the nine sites where it was investigated. Soil and sediment contamination was found at all three sites where these media were sampled. Only one site was without contamination in the media investigated.

No standards have been set for general scan analyses for contaminants like oil and grease, TOX, and TOC. For analytes and media to which no standards apply, the range of background values published for the area is used to set levels of significance. Where these were lacking, levels of significance were chosen based on levels found in Well Field 2 and on past experience.

The Stage 1 results fulfill the Phase II goal of confirming or denying the existence of contamination at the sites investigated. They do not, however, satisfy the Phase II goals of determining the specific contaminants involved at most sites, nor do they provide sufficient data on the extent of contaminant migration from the sites. Particularly lacking are surface water quality data which was unobtainable during the dry season.. Consequently, additional monitoring is recommended at all but 1 of the 10 Stage 1 sites.

Table ES-3 presents a brief description of the additional Stage 2 monitoring recommended. These are discussed in greater detail in Section 6 of this report.

TABLE ES-3

SUMMARY OF RECOMMENDATIONS

Site	Recommendations	Rationale
Entomology Storage Area (P-2)	None	No contamination found in either of 2 monitoring wells.
Leak at Pump Station No. 9 (SP-5)	Install 5 additional wells, sample and analyze for volatile organic priority pollutants using EPA method 624.	To determine the areal extent of contaminated groundwater and its flow patterns.
	Resample I-19 and analyze as for additional wells.	
	Resample groundwater below fuel in I-18 and analyze for all priority pollutants.	To determine the specific contaminants in groundwater.
	Sample surface water and sediments at 4 locations during wet season and analyze for volatile organics priority pollutants using EPA method 624.	To determine the role of surface water drainage as a contaminant sink and pathway.
Oil Spills at Aircraft Washrack (SP-7)	Resample I-9 below floating contaminant layer and analyze for all organic priority pollutants.	To determine the specific contaminants in groundwater.
	Install 4 additional wells, sample and analyze for target compounds identified in I-9 (or for volatile organics using EPA method 624 if no specific targets have been identified).	To determine the areal extent of groundwater contamination.
	Resample I-7 and I-8 and analyze as for the additional wells.	See above
	Sample surface water and sediments at 4 locations during wet season, and analyze as for the additional wells.	To determine the role of surface water as a contaminant sink and pathway.

TABLE ES-3

SUMMARY OF RECOMMENDATIONS (continued)

Site	Recommendations	Rationale
Zone 1: Leak at POL Bulk Storage Tank Farm (SP-4) and MOGAS Leak at BX Service Station (SP-6)	Resample I-4 and I-14 and analyze for all organic priority pollutants.	To determine specific groundwater contaminants and distinguish between contaminant sources.
	Install 6 additional monitoring wells, sample and analyze for target compound identified in I-4 and I-14 (or for volatile organics using EPA method 624 and for tetraethyl lead).	To determine the extent of groundwater contamination and better define ground-water flow in the area.
Residual Pesticide Disposal Area (P-3)	Install 1 monitoring well, sample and analyze for priority pollutant pesticides.	To confirm or deny pesticide contamination in groundwater.
	Collect 10 soil samples and analyze using the stage 1 17-analyte pesticide scan.	To delineate the areal extent of soil contamination.
Fire Protection Training Area No. 3 (FPTA-3)	Resample I-12 and analyze for all organic priority pollutants.	To determine specific groundwater contaminants.
	Install 5 monitoring wells, sample and analyze for volatile organics using EPA method 624.	To delineate the extent of contaminant migration.
Fire Protection Training Area No. 2 (FPTA-2)	Resample I-13 and analyze for the halogenated priority pollutants.	To identify the compound(s) responsible for the elevated TOX values.
	Install 3 monitoring wells, sample and analyze for specific contaminant(s) identified by the priority pollutant analysis (or analyze for TOX if no priority pollutant analysis is performed).	To delineate the contamination plume.

TABLE ES-3

SUMMARY OF RECOMMENDATIONS (continued)

Site	Recommendations	Rationale
Oil Leakage Behind Motor Pool (SP-2)	Install 2 monitoring wells, sample and analyze for lead and volatile organic priority pollutants. If volatile organics are detected, more detailed analysis will be required.	To confirm or deny contamination of groundwater by targeted pollutants.
	Sample surface water and sediments in 4 locations during wet season, and analyze for lead and volatile organic priority pollutants. If volatile organics are detected, more detailed analysis will be required.	To determine specific contaminants in the sediments and to determine the role of surface water as a contaminant sink and pathway.
Electroplating Waste Disposal Site (SP-1)	Sample surface water and sediments at 2 locations during the wet season, and analyze for the Stage I parameter.	To determine the role of surface water as a contaminant pathway.
	Resample I-1, I-2, and I-3 and analyze for the Stage I parameters.	For comparison with Stage 1 results to determine the statistical significance of the elevated inorganics indicated by Stage 1 analyses.

1. INTRODUCTION

In support of its mission to defend the United States through aircraft operation and maintenance, the United States Air Force has been engaged in a wide variety of operations requiring the handling of hazardous materials. Federal, State, and local governments have implemented regulations requiring that disposers of toxic and hazardous wastes identify the locations and contents of past disposal sites and take actions to eliminate any hazards to the public health or environment.

The Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), were passed by the Federal government to control hazardous waste disposal and to identify and clean up sites where environmental contamination is occurring. To comply with these hazardous waste regulations, the Department of Defense (DOD) issued the Environmental Quality Program Policy Memorandum 81-5 which directs the evaluation, identification, and control of hazardous materials disposal on DOD property. The program developed by the United States Air Force (USAF), in response to the DOD issued Defense Environmental Quality Program Policy Memorandum 81-5 is called the Installation Restoration Program (IRP). The IRP serves as a framework for response actions at Air Force installations under the provisions of CERCLA and involves the following four-phased approach:

- Phase I - Installation Assessment (Record Search)
- Phase II - Confirmation/Quantification
- Phase III - Technology Base Development (if needed)
- Phase IV - Operations/Remedial Actions.

Phases I, III, and IV are administered through the Air Force Engineering and Services Center (AFESC), Tyndall AFB, Florida. Phase II is administered through the U.S. Air Force Occupational and Environmental Health Laboratory (USAFOEHL), Brooks AFB, Texas.

Phase I of the IRP was completed at Homestead AFB in August 1983, by Engineering Science. This phase identified and prioritized sites posing a potential threat to public health or the environment through contaminant migration. Phase II was initiated at Homestead AFB in May 1984. Phase II Stage 1 focused on the confirmation of the presence or absence of contaminants and the quantification of the level and extent of contamination (see Appendix C). This report, prepared by SAIC, details the Phase II Stage 1 activities together with a presentation of the results from the analysis of groundwater, soil, and sediment samples. The presentation and discussion of results is followed by recommendations for further action.

Phase II activities began with a preliminary meeting with base personnel in May 1984 to survey the base and to sample existing base wells. Monitoring wells were drilled in November, and Phase II sampling took place in December 1984.

1.1 BASE HISTORY

Homestead AFB is located in Dade County, Florida, approximately 25 miles southwest of Miami, and 7 miles east of Homestead (Figure 1-1). The main installation measures 2,916 acres in area (Figure 1-2); easements constitute an additional 429 acres.

The Homestead Army Airfield was activated in September 1942, when the Caribbean Wing Headquarters acquired a commercial airfield just east of Homestead, Florida. Initially operated by the Army Air Transport Command, the field mission was changed to pilot and crew training in 1943, when the Second Operational Training Unit was activated. Following extensive hurricane damage, the field was placed on inactive status in 1945, and the property was turned over to Dade County. During the next 8 years the base was used lightly by crop dusters and housed a few small commercial and industrial operations. The base was reacquired by the Air Force in 1953 and rebuilt, becoming a Strategic Air Command (SAC) base in 1955. B-52's were flown out of the base at this time. The command of the base was changed in 1968 to the Tactical Air Command, and the 4531st Tactical Fighter Wing (TFW) became the new host unit, flying mainly F-100 C's and D's. In 1970, this wing's designation was changed to the 31st TFW, and again in 1981, it was redesignated the 31st Tactical Training Wing (TTW). The 31st TTW now files mainly F-4's. There have been no major changes in organization or mission at the base since that time.

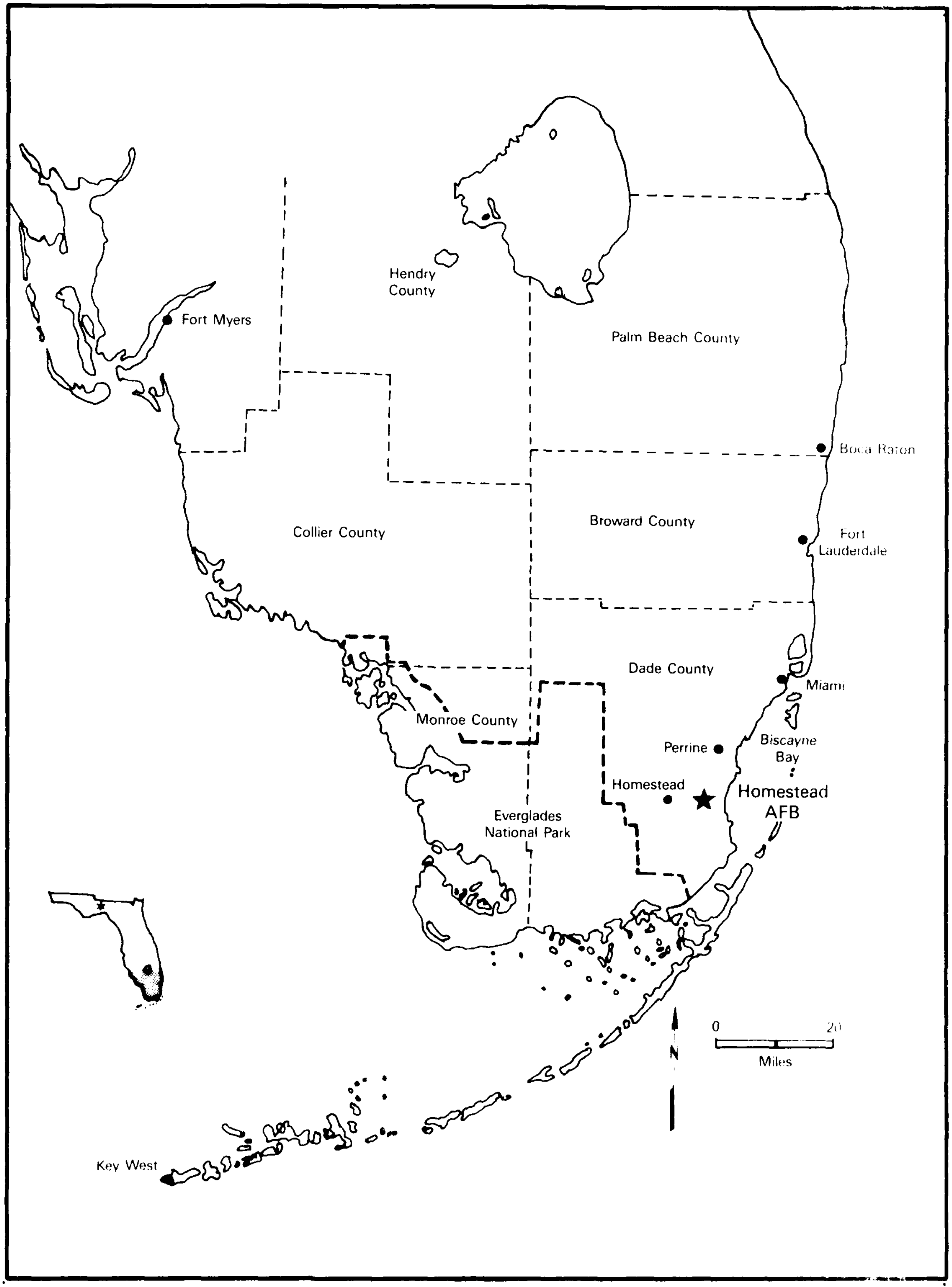

Figure 1-1. Homestead AFB Location

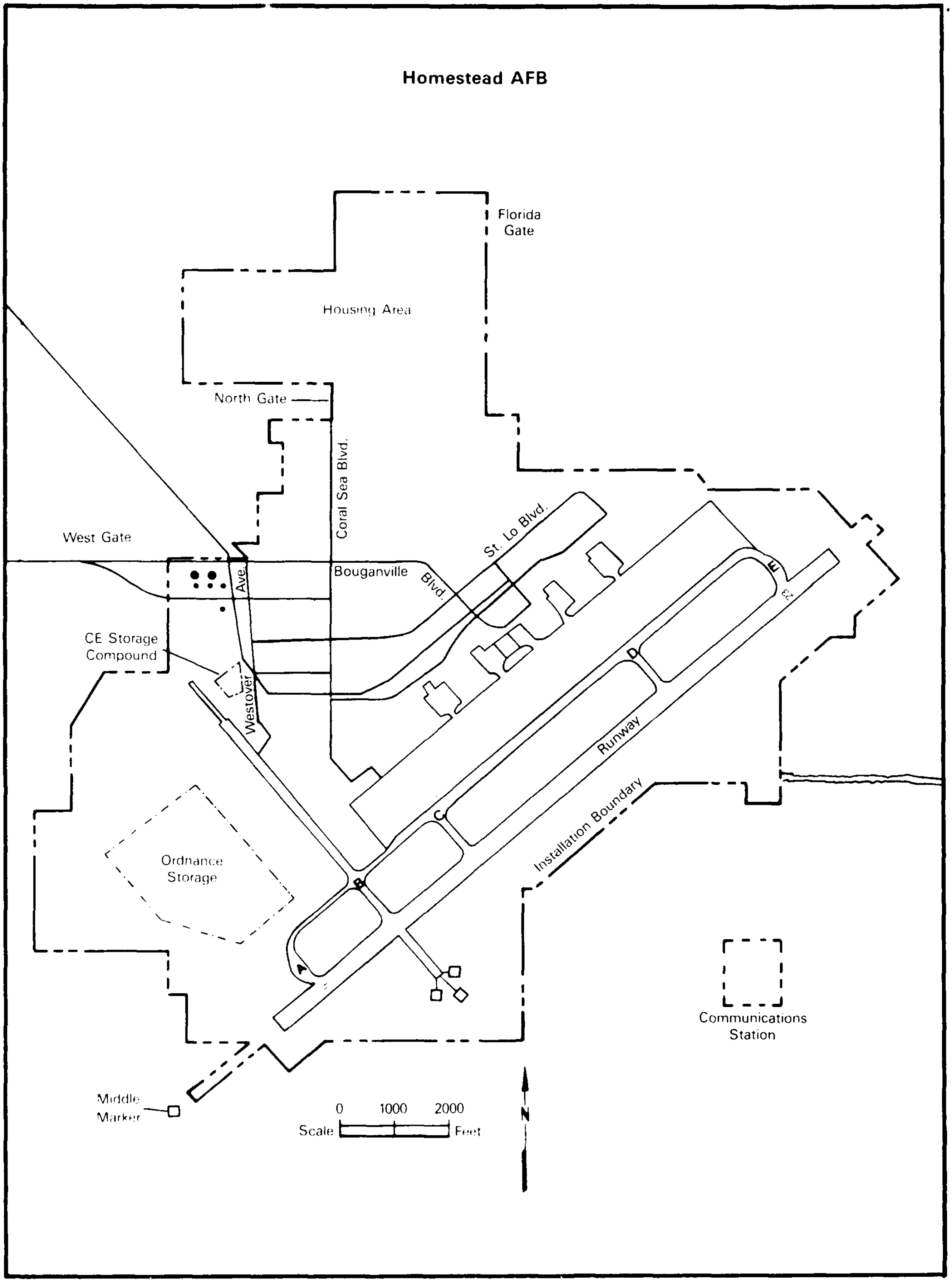

Figure 1-2. Homestead AFB Plan

Homestead AFB overlies the Biscayne aquifer, designated under the Federal Safe Drinking Water Act (1974) as the sole source of water supplies for southeastern Florida. The base water supply is drawn directly from the Biscayne aquifer.

1.2 SITE HISTORY

The sites identified in the Phase I report as having a potential for environmental contamination are ranked in Table 1-1. The top eight ranked sites were recommended by Engineering Science, for further monitoring under Phase II. Two additional sites from the original 13 sites, the Leak at Pump Station No. 9 (SP-5) and the Residual Pesticide Disposal Area (P-3), were added by USAFOEHL to Engineering Science's recommendations for monitoring, making a total of 10 sites which received Phase II confirmation investigation (Appendix C). The Fire Protection Training Area No. 1 (FPTA-1) and the Old Landfill (L-1) were not included in the recommendations because the two sites were graded out of existence during the extension of the present runway in 1960. The site of the PCB spill in the Civil Engineering Storage Compound (SP-3) was not recommended for further monitoring because the contaminated soil was removed and disposed of at an off base site.

1.3 SITE DESCRIPTION

The sites investigated in the Phase II investigation are shown in Figure 1-3. The site numbering system developed in the Phase I study is maintained for continuity.

Detailed site-scale maps are shown in Figures 1-4 through 1-7. The approximate locations of spills and disposal areas are taken from Phase I findings. The locations of FPTA-2 and P-3 are estimates because no visible evidence of the sites remains.

1.4 POLLUTANTS ANALYZED

The sample numbering system together with the pollutants sampled is shown in Table 1-2. The Phase I report states that the industrial operation previously located near SP-1 was a chromium electroplating plant. Because of the possibility of other types of electroplating having been employed, a wider

TABLE 1-1

SITES ASSESSED USING THE HARM METHODOLOGY
HOMESTEAD AFB

Rank	Site Name and Number	Date of Operation or Occurrence	Overall Total Score
1	Electroplating Waste Disposal Site (SP-1)	1946-1953	72
2	Leak at POL Bulk Storage Tank Farm (SP-4)	1958	69
3	Oil Spills at Aircraft Washrack (SP-7)	Early 1970's-1981	69
4	Fire Protection Training Area No. 3 (FPTA-3)	1972-present	66
5	Fire Protection Training Area No. 2 (FPTA-2)	1955-1972	66
6	MOGAS Leak at BX Service Station (SP-6)	1980	64
7	Entomology Storage Area (P-2)	1960's-present	63
8	Oil Leakage Behind Motor Pool (SP-2)	1960's-present	59
9	Fire Protection Training Area No. 1 (FPTA-1)	Early 1940's	59
10	Leak at Pump Station No. 9 on Flight Apron (SP-5)	1982	58
11	Residual Pesticide Disposal Area (P-3)	1977-1982	58
12	Landfill (L-1)	Early 1940's	50
13	PCB Spill in Civil Engineering Storage Compound (SP-3)	1981	7

Source: Phase I Report, Engineering Science, 1983

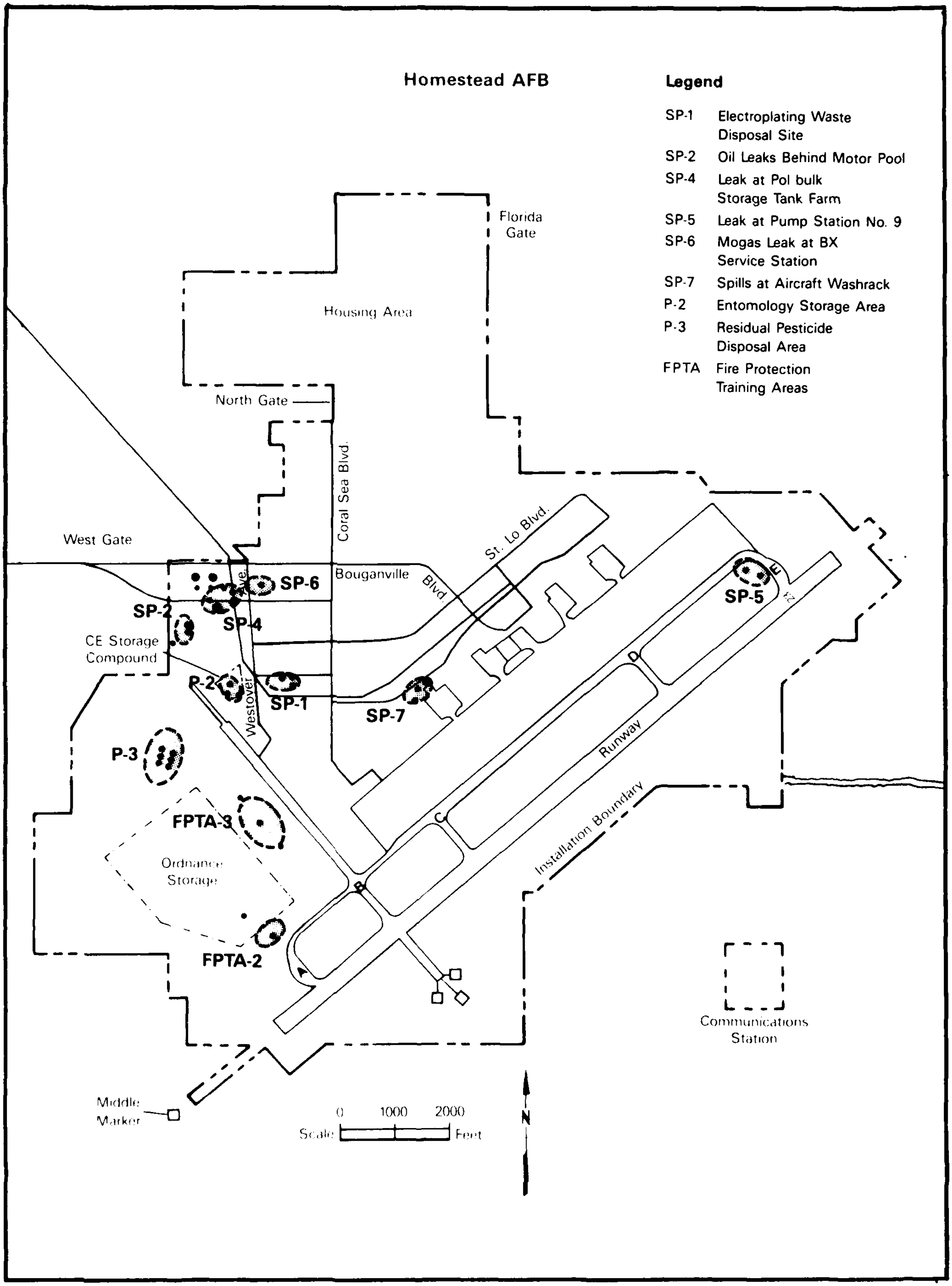

Figure 1-3. Location of Sites Investigated

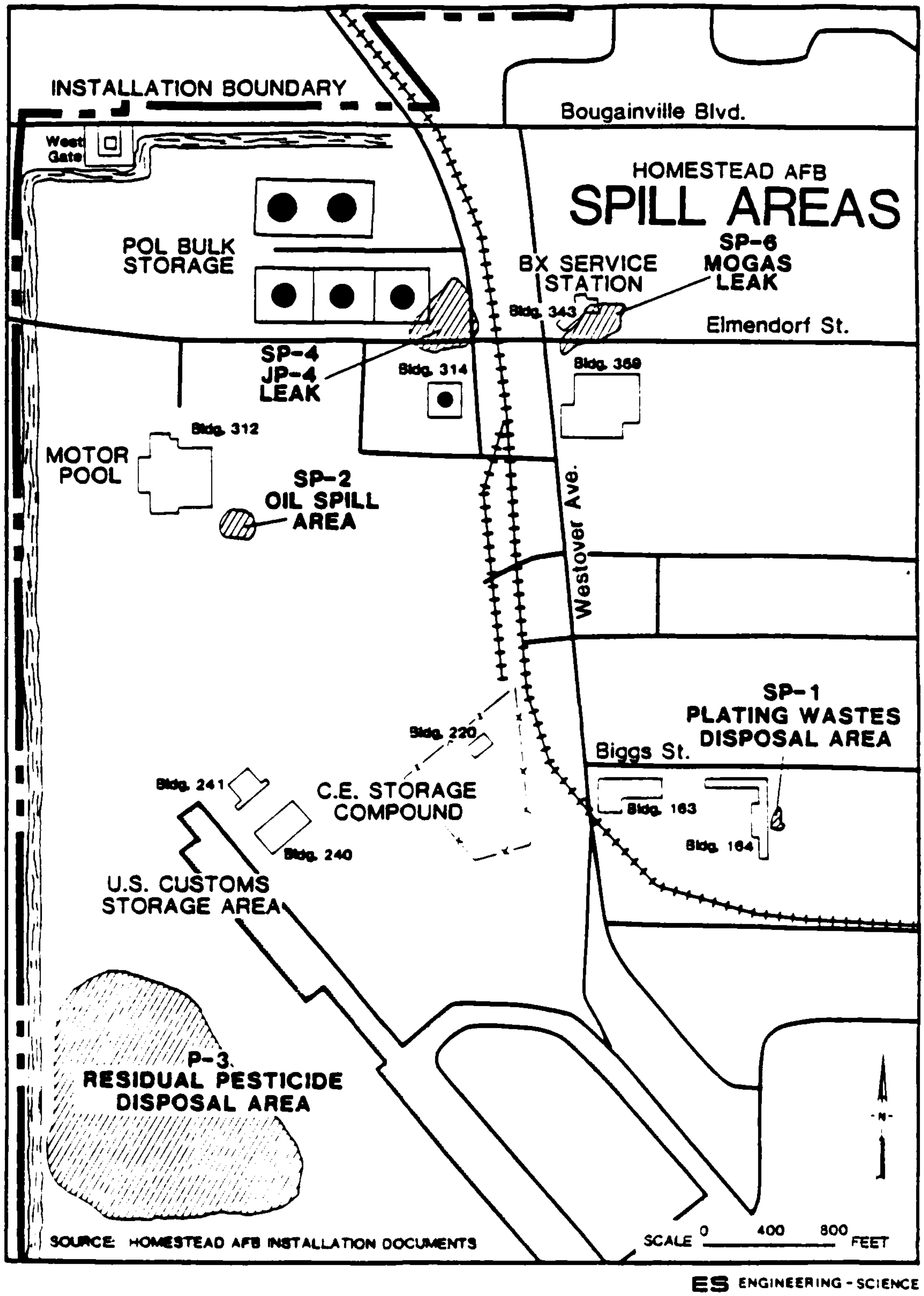

Figure 1-4. Spill, Plating Waste Disposal, and Pesticide Areas

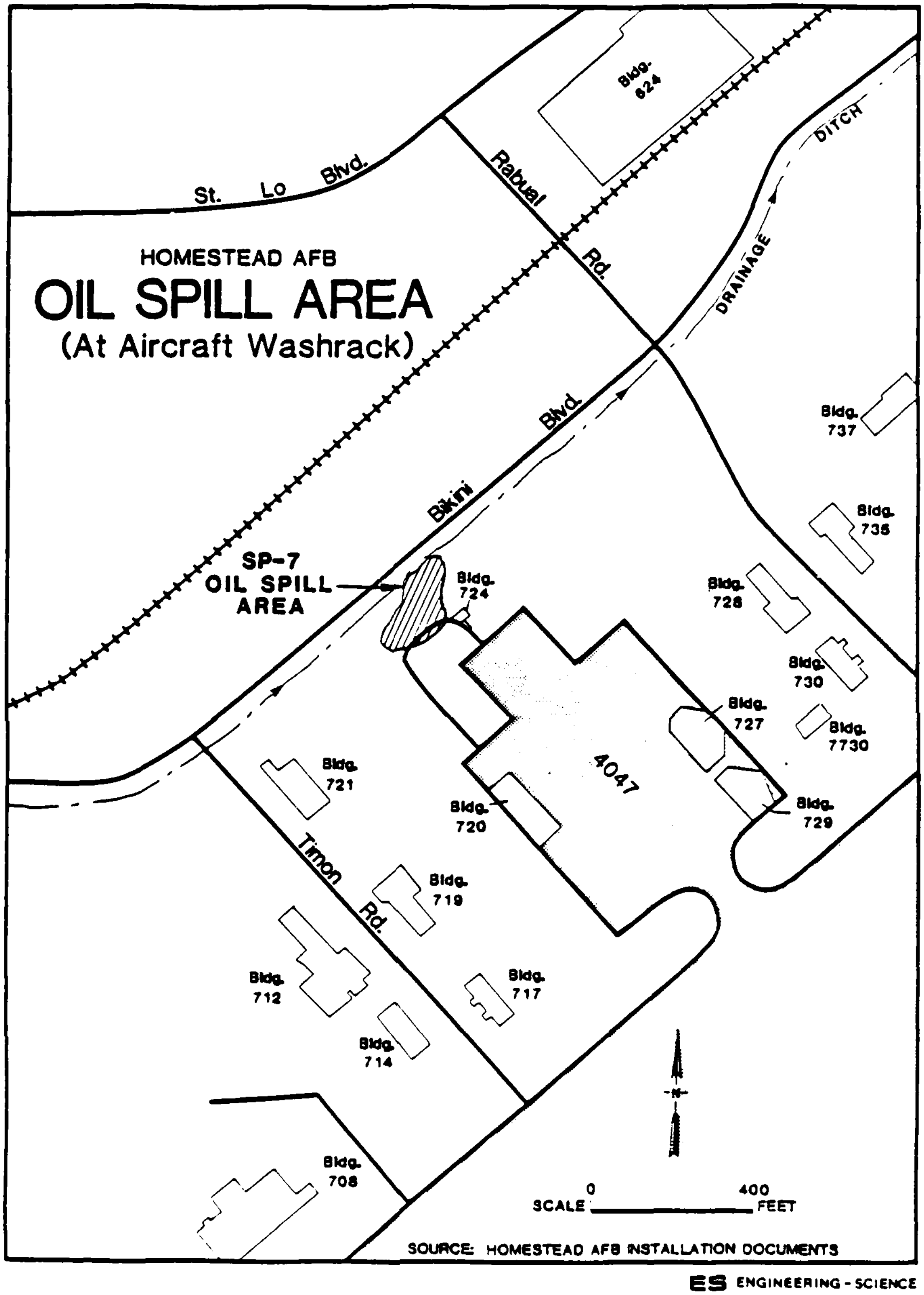

Figure 1-5. Oil Spill Area (at Aircraft Washrack)

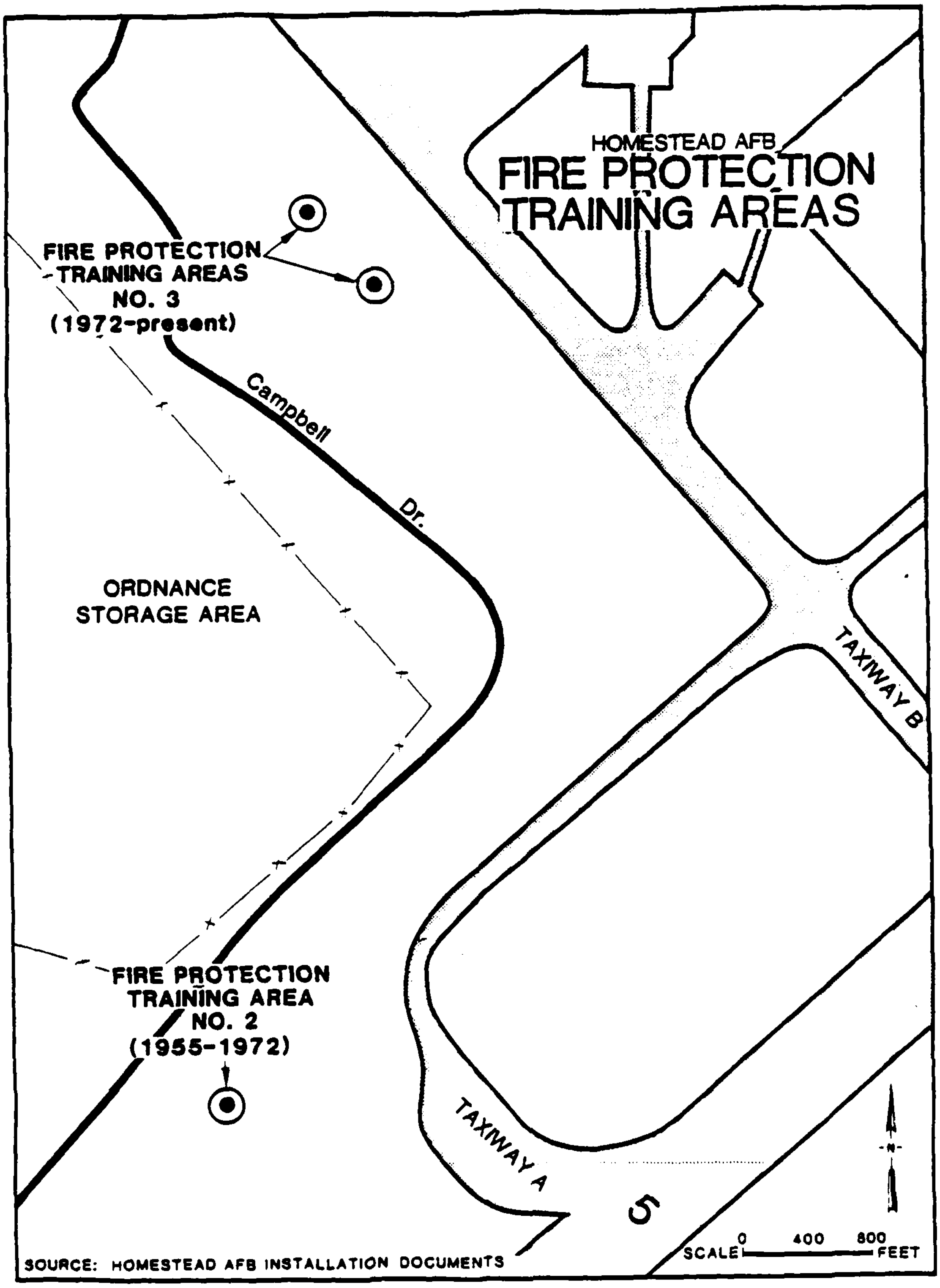

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Figure 1-6. Fire Protection Training Areas

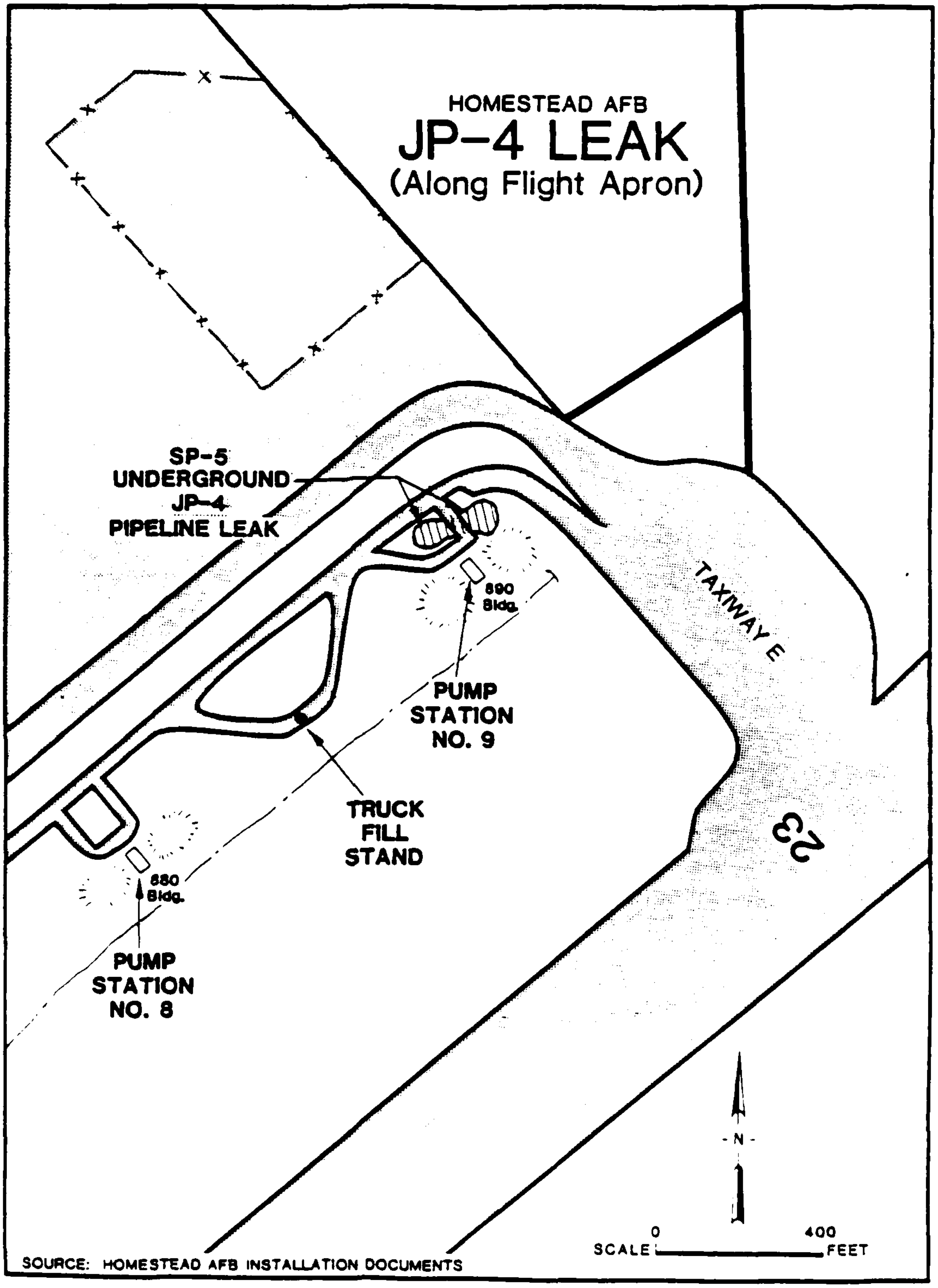

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Figure 1-7. JP-4 Leak (Pump Station No. 9)

TABLE 1-2

SAMPLE NUMBERING SYSTEM WITH POLLUTANTS SAMPLED
HOMESTEAD AFB

Site Number	Analytes	Well Number	Soil Sample Number	Sediment Sample Number
SP-1	Trace Metals[1],	I-01		
	CN[2]	I-02		
		I-03		
			SL-01	
			SL-02	
			SL-03	
			SL-04	
				SD-01
				SD-02
SP-4	O&G[3], TOC[4],	I-04		
	TOX[5], Pb[1]	I-05		
		I-06		
SP-7	O&G, TOC,	I-07		
	TOX	I-08		
		I-09		
FPTA-3	O&G, TOC,	I-10		
	TOX	I-11		
		I-12		
FPTA-2	O&G, TOC,	I-13		
	TOX	248[7]		
SP-6	O&G, TOC,	I-14		
	TOX, Pb			
P-2	Pesticides[6]	I-15		
		I-16		
SP-2	O&G, Pb	I-17		
			SL-05	
			SL-06	
			SL-07	
			SL-08	
				SD-03
				SD-04

1. Trace Metals: Cadmium (Cd), Total Chromium (Cr), Hexavalent Chromium (CR^{+6}), Copper (Cu), Lead (Pb), Nickel (Ni), and Zinc (Zn)
2. Cyanide
3. Oil and Grease
4. Total Organic Carbon
5. Total Organic Halogens
6. Pesticides: Aldrin, DDT Isomer, Dieldrin, Endrin, Heptachlor, Heptachlor Epoxide, Lindane, Methoxychlor, Diazinon, Malathion, Parathion, Toxaphene; 2,4-D; 2,4,5-T; 2,4,5-TP (Silvex), Sevin
7. Fire Plug well near Building 248
8. U.S. Geological Survey well near Well Field 1 pump house.

TABLE 1-2

SAMPLE NUMBERING SYSTEM WITH POLLUTANTS SAMPLED
HOMESTEAD AFB (Continued)

Site Number	Analytes	Well Number	Soil Sample Number	Sediment Sample Number
SP-5	O&G, TOC, TOX	I-18 I-19		
P-3	Pesticides		SL-09 SL-10 SL-11 SL-12 SL-13 SL-14	
Well Field 1	Trace Metals, CN, Pesticides	S-530[8]		
Well Field 2	Trace Metals, CN, O&G, TOC, TOX, Pesticides	No. 10		

1. Trace Metals: Cadmium (Cd), Total Chromium (Cr), Hexavalent Chromium (CR^{+6}), Copper (Cu), Lead (Pb), Nickel (Ni), and Zinc (Zn)
2. Cyanide
3. Oil and Grease
4. Total Organic Carbon
5. Total Organic Halogens
6. Pesticides: Aldrin, DDT Isomer, Dieldrin, Endrin, Heptachlor, Heptachlor Epoxide, Lindane, Methoxychlor, Diazinon, Malathion, Parathion, Toxaphene; 2,4-D; 2,4,5-T; 2,4,5-TP (Silvex), Sevin
7. Fire Plug well near Building 248
8. U.S. Geological Survey well near Well Field 1 pump house.

analysis of trace metals was employed. Soil and sediment samples (the latter in nearby drainages) were collected to determine if any residual pollutants from oil spills or land disposal of electroplating wastes or pesticides were evident. Oil and grease (O&G), total organic carbon (TOC), and total organic halogens (TOX) were chosen as indicator parameters for oils and fuels. Total lead was sampled for at SP-2, SP-4, and SP-6 to determine if tetraethyl lead (associated with MOGAS spills at the BX Service Station or at the Motor Pool) was evident. The list of pesticides (a general term for insecticides, herbicides, and rodenticides) was established from conversations with base personnel at the Entomology Shop during Phase I investigations. This pesticide scan includes chlorinated hydrocarbons, phenoxy-acid herbicides, and organophosphates.

1.5 FIELD TEAM

The field program was coordinated and implemented by SAIC personnel (Appendix H). Borehole drilling and well installation was contracted to Wingerter Laboratories of Miami, Florida, and supervised by SAIC personnel. Samples collected by SAIC personnel were split, one set sent for analysis to the SAIC laboratory in La Jolla, California, and a duplicate set sent to USAFOEHL in San Antonio, Texas.

2. ENVIRONMENTAL SETTING

2.1 PHYSICAL GEOGRAPHY

Homestead Air Force Base lies at the southern end of the Atlantic Coastal Ridge, a surface slightly elevated above the shoreline to the east and the Everglades to the west (Figure 2-1). Extending from near Palm Beach southwestward to Perrine, the Atlantic Coastal Ridge (comprising the Gold Coast Area) decreases in prominence to the south (Lane, 1981). The land on which the base is located was reclaimed from seasonal wetlands by the construction of drainage canals. Rainfall runoff from the base is drained via the diversion canals into the base Boundary Canal, which empties into Military Canal. This in turn discharges eastward to Biscayne Bay.

The topography of Homestead AFB is generally level, with local relief usually the result of installation development activities. Installation land surface elevations range from 5 feet above mean sea level (MSL) along the base's southern boundary, to almost 10 feet above MSL to the north in the housing area. The surrounding area is semirural, and for most of its perimeter, the base borders on agricultural land.

2.2 REGIONAL GEOLOGY AND HYDROLOGY

Homestead AFB is underlain by a sequence of Tertiary and Quaternary, near-shore marine and freshwater deposits. Table 2-1 summarizes the subsurface geology underlying the base (Parker, 1955) and Figure 2-2 shows a log of USGS Well No. G-518, which depicts the Miami Oolite, the Fort Thompson Formation and the top of the Tamiami Formation. The soil cover throughout the installation was generally insignificant, with bedrock visible in many locations. The Miami Oolite, present within 2 feet of ground surface, is approximately 20 feet thick in the study area. The product of deposition in a shallow marine environment on a shoal or bar (Parker, 1955), the Miami Oolite is typified by small spherical or ellipsoidal accretions (i.e., ooliths) in a massive limestone matrix. Dissolution cavities are prevalent throughout the formation and are partially soil-filled near the land surface.

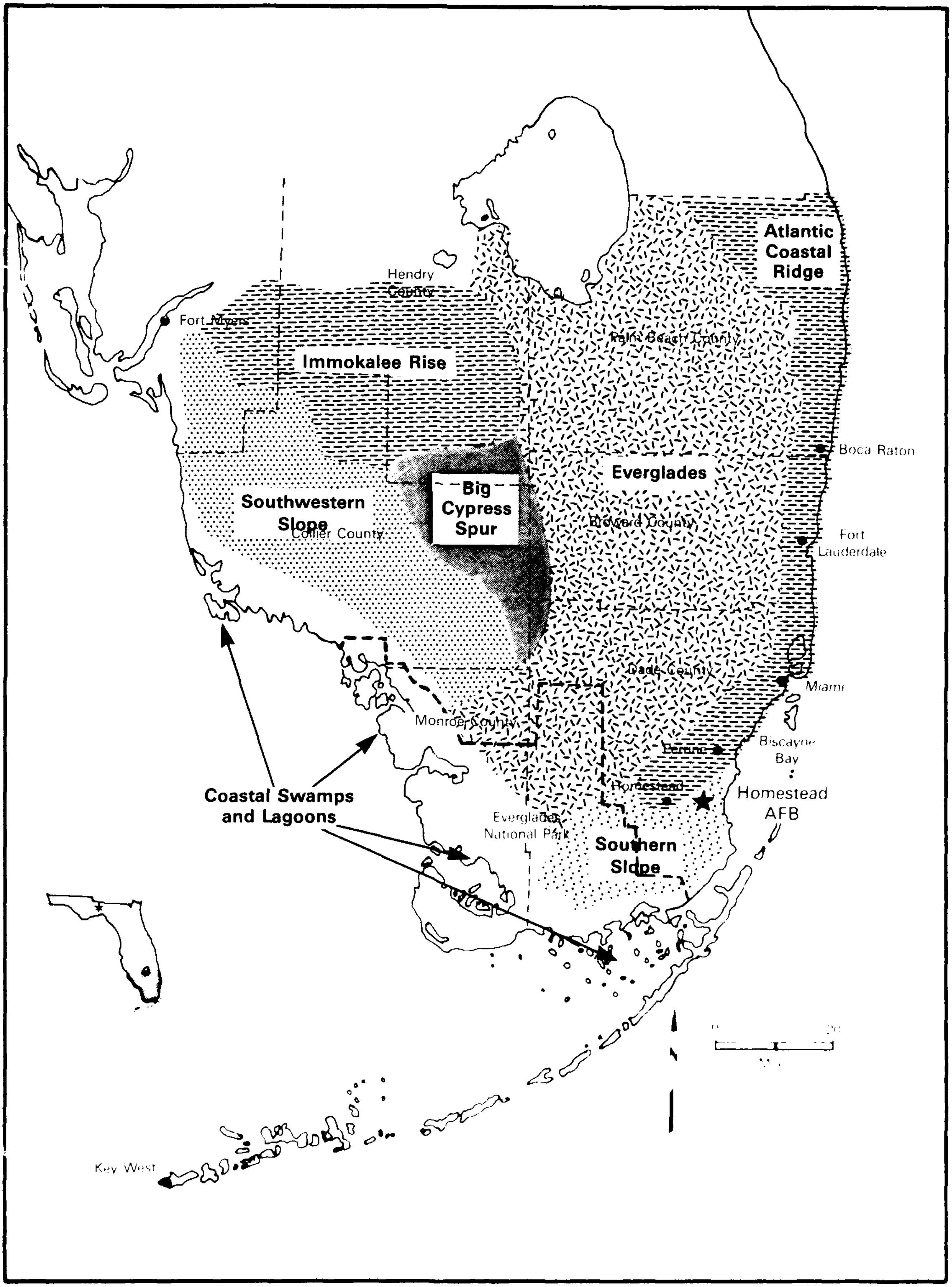


Figure 2-1. South Florida Physiographic Map

TABLE 2-1

GEOLOGIC UNITS OF SOUTHEASTERN FLORIDA

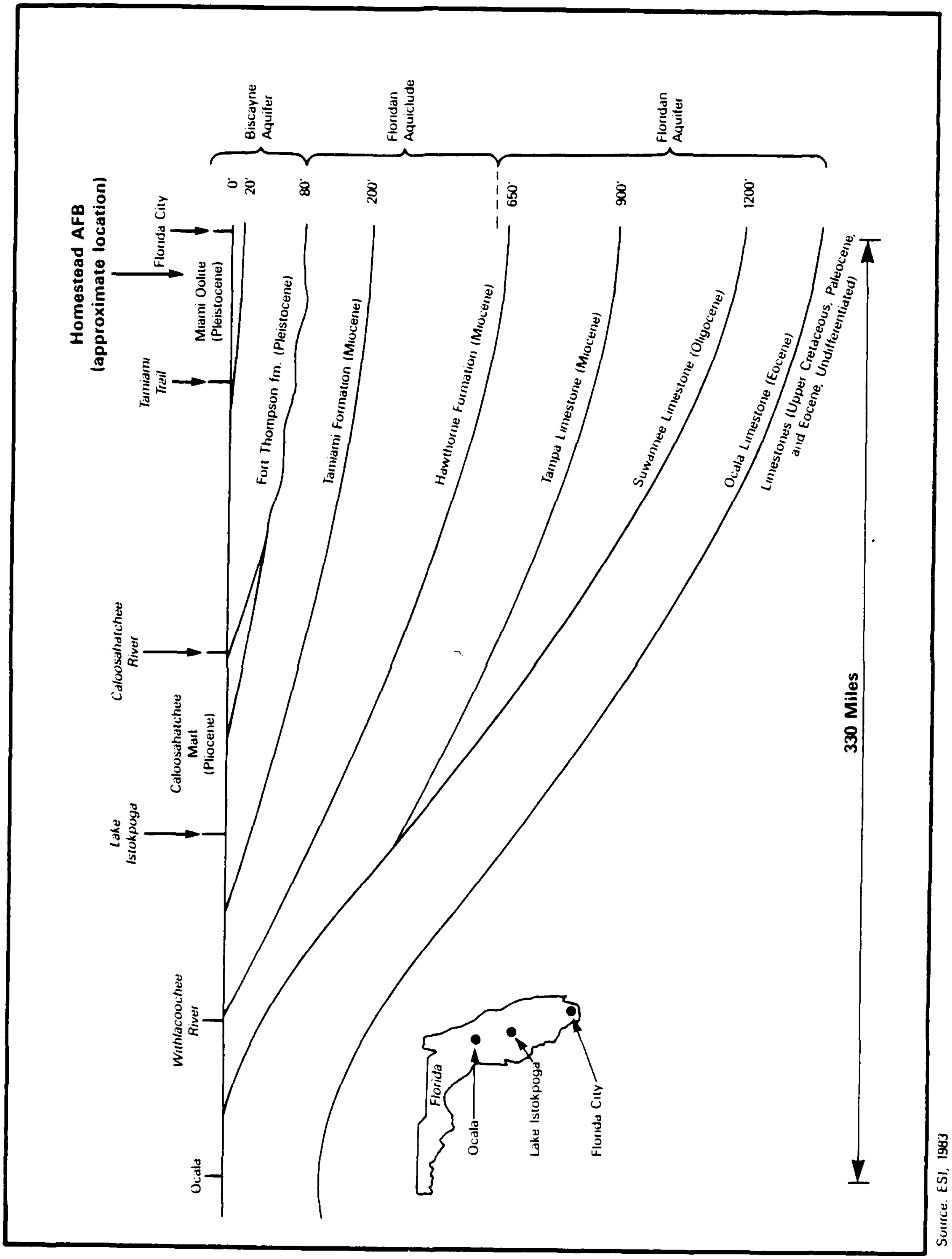
Period (Epoch)	Formation	Characteristics	Thickness (feet)
Quaternary (Recent and Pleistocene)	Modern soils	Peat and muck, all Recent in age; laterite	0-12
	Lake Flint Marl	White to gray calcareous and rich with shells of Helisoma sp., a freshwater gastropod. In places case-hardened to a dense limestone. Relatively impermeable.	0-6
(Pleistocene)	Miami Oolite	Limestone, soft, white to yellowish, containing streaks or thin layers of calcite, massive to crossbedded and stratified; generally perforated with vertical solution holes. Fair to very high permeability.	0-40
	Fort Thompson Formation	Alternating marine, brackish, and freshwater marls, limestones, and sandstones. Very low permeability in the upper Everglades-Lake Okeechobee area, but it is the major component of the highly permeable Biscayne aquifer of coastal Dade, Broward, and Palm Beach Counties, which yields copious supplies of ground water.	0-200
Tertiary (Pliocene)	Caloosahatchee Marl	Sandy marl, clay silt, sand, and shell beds. Yields some water, in places under low artesian head, but is little used because of low permeability and generally poor quality of water, especially in the Everglades-Lake Okeechobee area. Not nearly so widely spread as was once believed but occurs chiefly as erosion remnants.	0-50
(Miocene)	Tamiami Formation	Creamy-white limestone, and greenish-gray clayey and calcareous marl locally hardened to limestone, silty and shelly sands, and shell marl. Upper part, where permeability is high, is only a few feet thick, and forms the lower part of Biscayne aquifer. Lower, and major part of the formation, is of low to very low permeability and forms the upper part of the Floridan aquiclude.	0-150

TABLE 2-1

GEOLOGIC UNITS OF SOUTHEASTERN FLORIDA
(Continued)

Period (Epoch)	Formation	Characteristics	Thickness (feet)
	Hawthorne Formation	Sandy, phosphatic marl, interbedded with clay, formation shell marl, silt, and sand. Greenish colors predominate. Contains beds of flattened, well-worn quartzite and phosphate pebbles up to half an inch in greatest diameter. Water is generally scarce, of poor quality, and in the permeable beds is confined under low pressure head. Comprises the major part of the Floridan aquiclude.	50-100
	Tampa Limestone	White to tan, soft to hard, often partially recrystallized limestone. Yields artesian water but not so freely as lower parts of the Floridan aquifer.	150-250
(Oligocene)	Suwanee Limestone	Creamy, soft to hard limestone, similar lithologically to underlying Ocala Limestone and often included with it in some earlier reports. With the Ocala is part of the Florida aquifer.	0-450
(Eocene)	Ocala Limestone	White to cream, porous and cavernous to dense, in part cherty, in part highly foraminiferal, limestone. An excellent water-bearing formation, although the water is saline in large areas, especially south of Lake Okeechobee and along the Atlantic and Gulf coasts some distance northward. Principal component of the Floridan aquifer.	100-350

Source: Modified from Parker, et al., (1955).



Source: ESI, 1983

Figure 2-2. Hydrogeologic Cross Section, Southern Florida

The Miami Oolite is underlain by the Fort Thompson Formation, which is approximately 50 feet thick in the study area (Parker, 1955). This wedge of alternating marine, brackish, and freshwater marl, limestones, and sandstones is in hydrologic contact with the Miami Oolite. Together, the Fort Thompson Formation and the Miami Oolite compose the Biscayne aquifer. The Biscayne aquifer has been designated as a sole source aquifer for southeastern Florida (see Section 2.7).

The Biscayne aquifer is underlain by the Floridan aquiclude, which in turn is underlain by the Floridan aquifer (Figure 2-3). The Floridan aquiclude, which comprises the Tamiami and Hawthorne Formations, is approximately 600 feet thick beneath the site (Parker, 1955). The Floridan aquifer comprises the Tampa, Suwanee, and Ocala Limestones. The Flor ian aquifer is less desirable than the Biscayne aquifer due to natural mineralization and to the greater well depths required to obtain water.

2.3 GENERAL HYDROGEOLOGY

The Biscayne aquifer underlies most of southeastern Florida (Figure 2-4). In the Biscayne aquifer, groundwater occurs under water table (unconfined) conditions in the numerous interconnecting pores, slots, channels, and dissolution cavities present in the limestones, sandstones, and sands that form the Biscayne. Klein and Hull (1978) report that the Biscayne is capable of producing large quantities of water due to high horizontal and vertical transmissivities. In the study area, transmissivities range from 4 to 8 million gallons per day per foot (MGD/ft) (Figure 2-5). The aquifer is recharged by precipitation falling on its entire areal extent. During the dry season, recharge can be furnished by canals flowing through the aquifer's exposure.

Homestead AFB lies within the recharge zone of the Biscayne aquifer. Of the approximately 60 inches of annual rainfall, about 20 inches are lost to evaporation prior to infiltration, about 20 inches are lost to evapotranspiration after infiltration, 16 to 18 inches are discharged by canals and by coastal seepage, and the remainder is utilized by humans. The large percentage of total infiltration discharged by canals and by coastal seepage (almost 50%) reflects the effectiveness of the canals as a drainage network and the impact of canal drainage on groundwater levels (Klein, 1978; Parker, 1955).

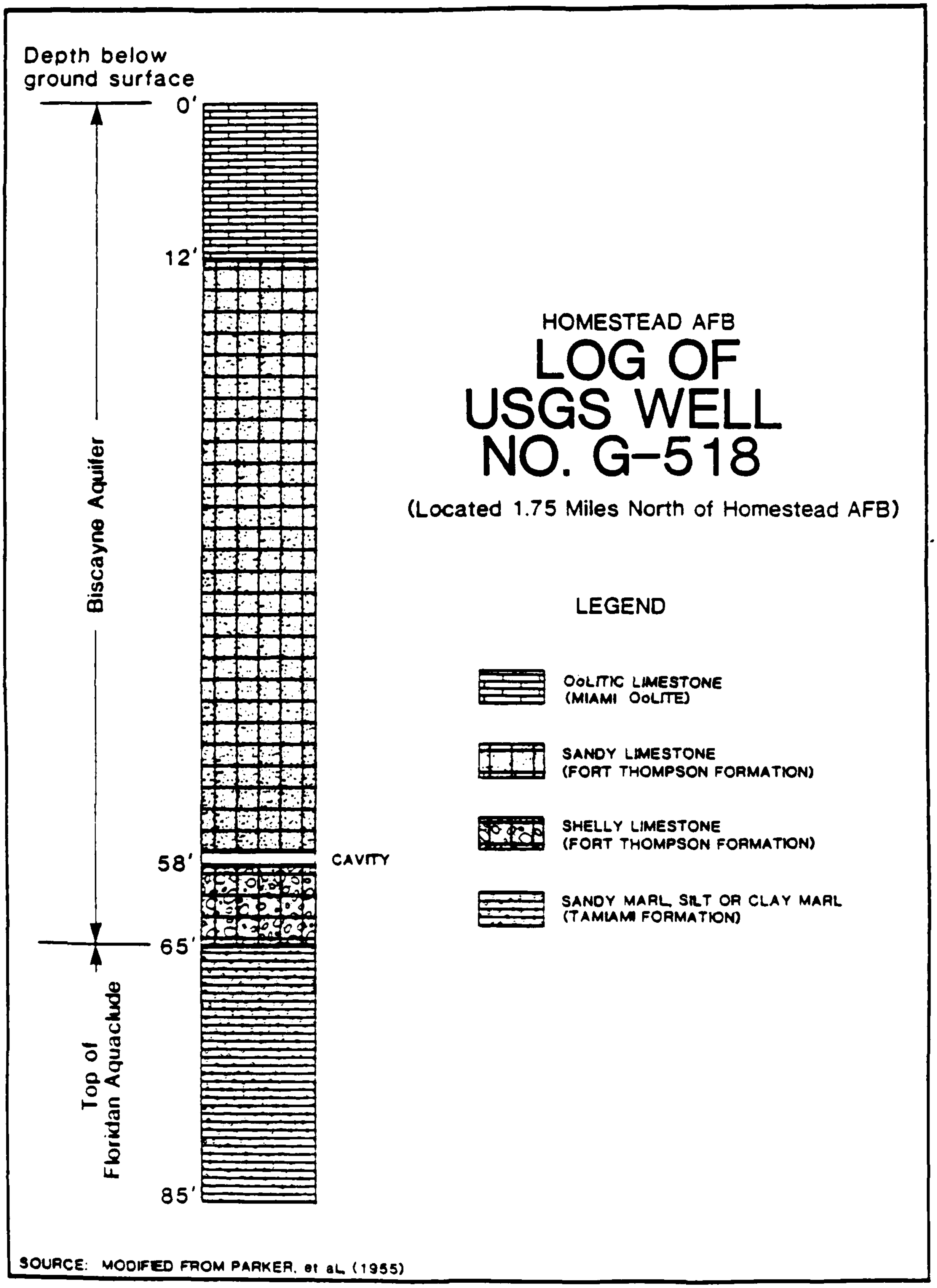


Figure 2-3. Geologic Column

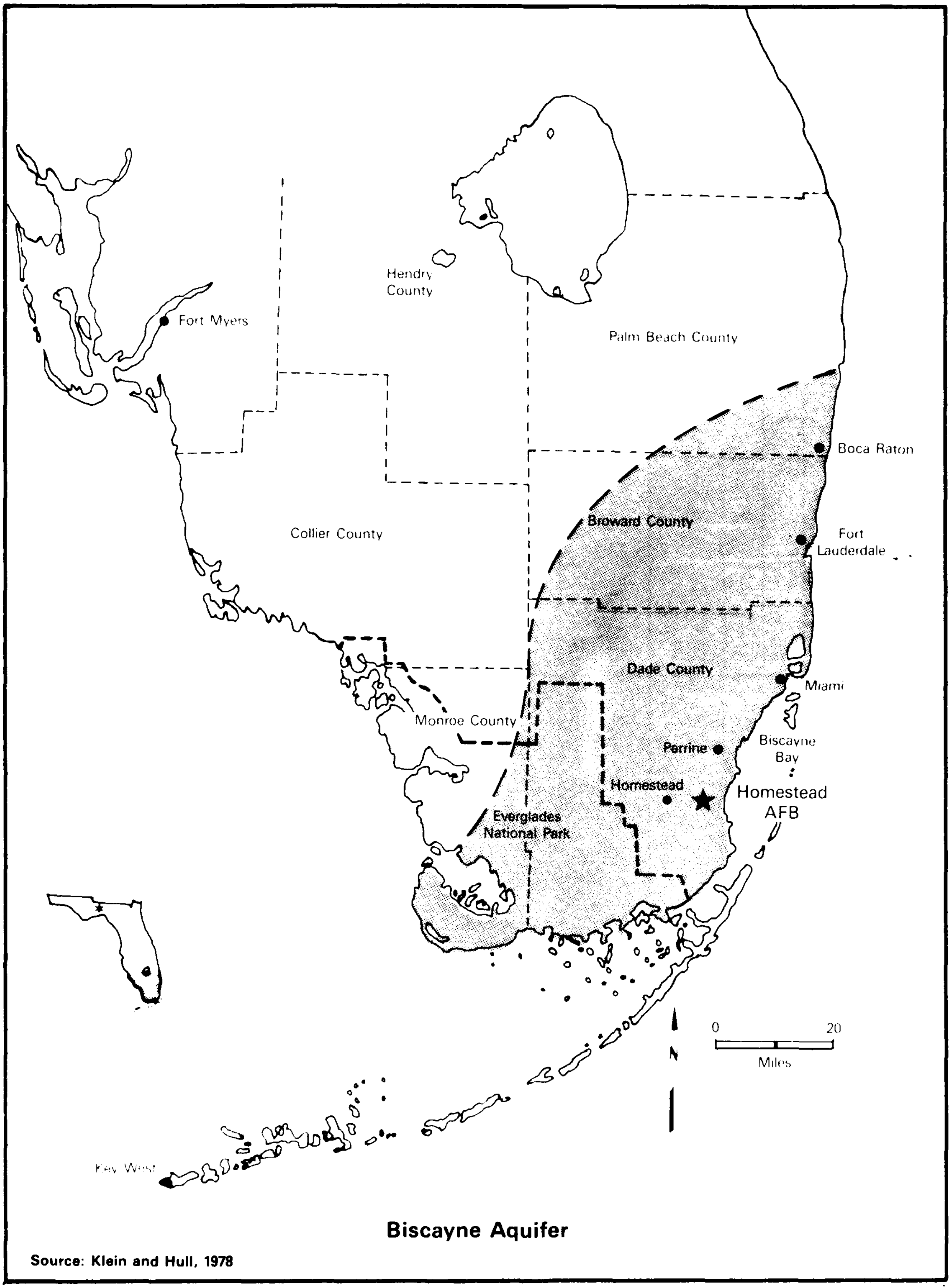


Figure 2-4. Extent of Biscayne Aquifer

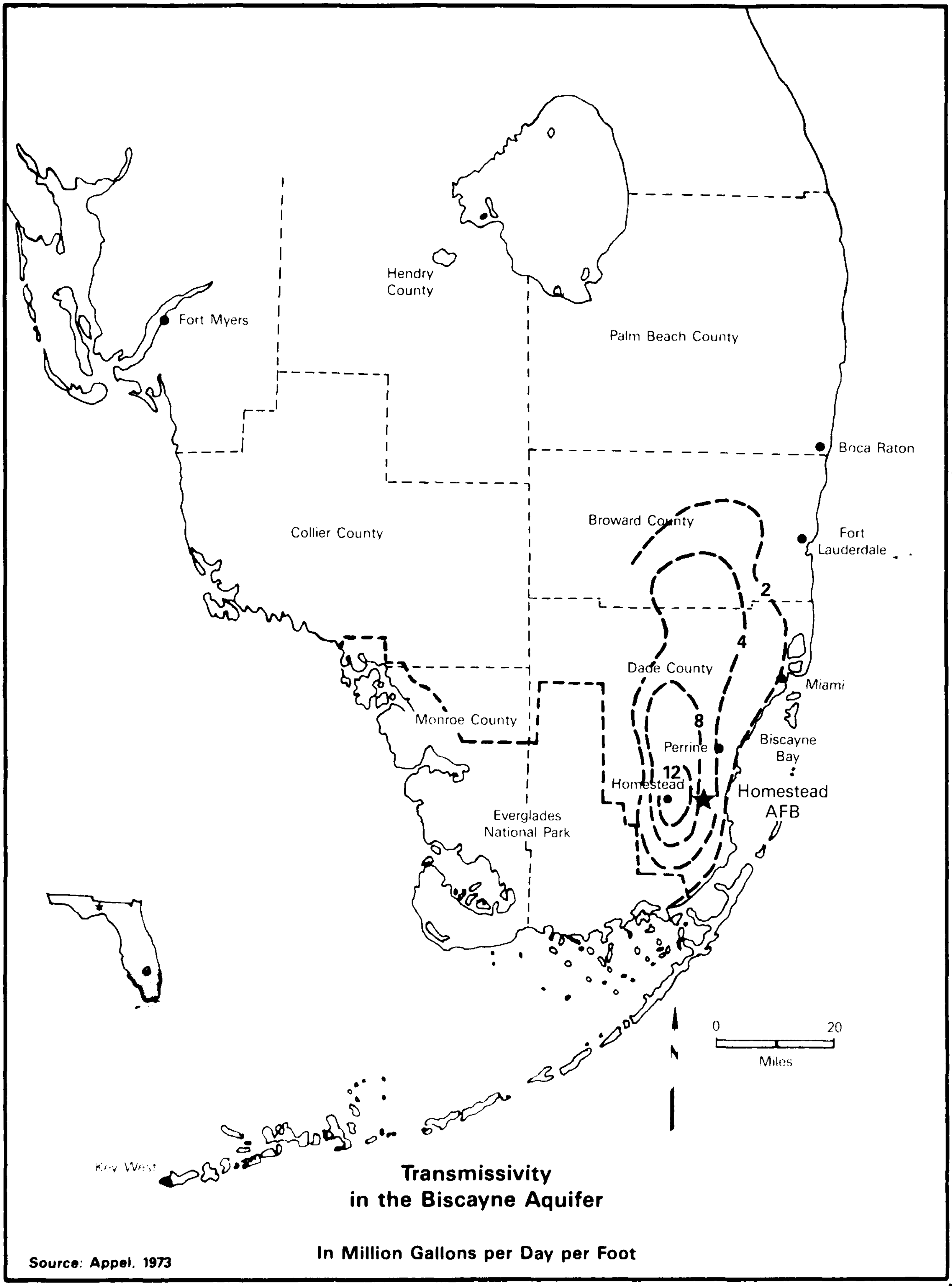


Figure 2-5. Lines of Equal Transmissivity of the Biscayne Aquifer

The control of groundwater levels for land use purposes, however, is moderated by a need to maintain sufficient levels to stabilize the salt water intrusion line (see Section 2.7).

Groundwater levels within the Biscayne system are usually high, in other words, close to ground surface. According to data recorded at USGS Monitoring Well G-1183 (located just east of Building 701, Homestead AFB), groundwater levels have ranged from 1 foot below ground surface (9 June 1966), after above normal recharge, to 6 feet deep (12 May 1971), during a year of unusual drought. The ground surface elevation at Observation Well G-1183 is 5 feet above MSL.

In the vicinity of Homestead AFB, regional groundwater flow directions tend to change slightly on a seasonal basis. During the wet season (May to October) when groundwater recharge is highest, flow in the Biscayne is generally east to Biscayne Bay. During the dry season (November to April), low water levels result in southeasterly flow in the Biscayne which also terminates at Biscayne Bay. However, since the groundwater surface gradient is normally very low (only an average of 3 feet of vertical drop over 10 miles during the dry season), the groundwater flows at a low velocity (approximately 0.4-0.9 ft^2/day, based on Darcy's Law for the given gradient and transmissivities and an assumed aquifer thickness of 70 ft). A relatively horizontal groundwater surface is subject to localized fluctuations in the groundwater surface gradient caused by unevenly distributed rainfall recharge, canal drainage, or well pumpage. These localized fluctuations can cause contaminant migration pathways to deviate from the regional flow gradient. In addition, the low flow velocities associated with the minimal groundwater surface gradient imply that the contaminants will have time to spread and diffuse while being transported. Therefore, in areas where fluctuations in the groundwater surface gradient are common, (e.g., near canals, drainages, or well fields), the upgradient and downgradient direction from a site can vary.

2.4 SITE-SPECIFIC GEOLOGY

Core samples of the Miami Oolite collected during the well installation program were analyzed for macroscopic (see Appendix D) and microscopic properties. The objective of these analyses was to determine the process of formation of the Miami Oolite, in order to characterize its permeability. The process of formation of the Miami Oolite determined the degree of interconnectedness of its pores which is directly proportional to its ability to transmit groundwater (and contaminants).

The core samples can generally be described as fossiliferous oolitic limestone riddled with vugs (cavities). The prevalence of vugs made core recovery difficult. Near the surface and decreasing with depth, the vugs are filled with soil- and sand-sized particles. Throughout the core samples there is evidence of secondary calcite replacement in the vugs. The fossil fragments evident in the sample are coelenterates (corals), bryozoans, brachiopods, and mollusks (gastropods and other fragments). The sample matrix is generally greater than 90 percent calcium carbonate ($CaCO_3$) and can be described as a lime mud (micrite).

Well-cemented zones are evident in some of the cores. These nonhomogeneities could have contributed to the difficulty encountered in coring. If the cemented zones are continuous over significant areas, they could constitute subsurface barriers and perch or isolate bodies of water.

Based on thin section analysis of one core sample, the rock is described as a sandy peloidal packstone. The peloids show evidence of being altered ooids, as ghost rim structures of ooids are included within some peloids. The abundance of skeletal debris elicits the packstone designation. The prevalence of quartz sand particles in the micrite matrix explains why the rock is described as sandy.

The fossil assemblage evident in the core samples and the micritic matrix indicate that the Miami Oolite originated in a shallow water carbonate environment, possibly on an open shelf (Sellwood, 1978). The diagenesis of the Miami Oolite, according to thin section interpretations, was accomplished by a change in sea level and the resulting exposure to freshwater. After Pleistocene sea level drops exposed the shoal upon which the mixture of peloids, skeletal debris, and lime mud reposed, a freshwater table became established. As a consequence of freshwater alteration, the originally aragonitic constituents were equilibrated to calcite; many of the peloids dissolved to form molds; calcium carbonate ($CaCO_3$) was released by dissolution as a source for cementation (and secondary calcite replacement); and vugs were formed as enlargements of joints, planes of weakness, or worm burrows. The process of lithification, therefore, was associated with a single geological event--exposure to freshwater.

The porosity of the Miami Oolite can be divided into three levels: macroscopic, intermediate, and microscopic porosity. Macroscopic dissolution pores (vugs) contain the majority of the groundwater. The horizontal and vertical permeabilities of these pores depend on the extent to which they are interconnected. The intermediate, or "moldic," porosity is a summation of the pores that have formed where solids or skeletal debris have dissolved. These pores have a large storage capacity but a poor permeability. The microporosity is evident as minute spaces in the micritic matrix. Fluids in such pore systems, however, tend to have a very high affinity for the pore walls, making them nearly immovable. Consequently, the permeability of the Miami Oolite is primarily a function of the extent of the macroscopic dissolution pores (vugs).

The interconnected vugs provide the easiest path for horizontal and vertical contaminant migration. The rate of contaminant migration through interconnected vugs, however, is dependent on the continuities of the vug connections, the groundwater flow velocities, the absorption properties of the Miami Oolite, and the chemical interactions of the contaminants with groundwater and formation materials. In addition, well-cemented zones in the Miami Oolite may retard contaminant migration. Moldic porosity and microporosity are less significant than vuggy porosity in relation to contaminant migration, but may play a significant role in temporarily storing absorbed contaminants.

2.5 SITE HYDROLOGY

Water level data collected at the end of the sampling program along with ground surface and monitoring well cap elevations, as surveyed by base personnel, are shown in Table 2-2. Water level measurements were taken with a fiberglass tape and referenced to the top of the protective casing. The water levels elevations are consistent with average dry season measurements. Water level elevations below sea level are consistent with historic groundwater level fluctuations (Klein, 1978).

TABLE 2-2

SURVEY ELEVATIONS AND WATER LEVEL DATA, DECEMBER 1984
HOMESTEAD AFB

Well Number	Protective Casing Elevation (ft ASL)[1]	Ground Surface(GS) Elevation (ft ASL)	Height of Protective Casing (feet)	Measured[2] Water Level (feet)	Water Level Depth Below GS (feet)	Water Level Elevation (feet)
I-01	9.64	8.20	1.44	9.25	7.81	0.39
I-02	9.00	7.21	1.79	7.61	5.82	1.39
I-03	8.76	7.59	1.17	7.37	6.20	1.39
I-04	6.21	4.68	1.53	6.61	5.08	-0.40[3]
I-05	7.06	5.21	1.85	7.43	5.58	-0.37
I-06	6.96	5.01	1.95	7.34	5.39	-0.38
I-07	9.51	7.25	2.26	7.91	5.65	1.60
I-08	9.44	7.74	1.70	7.82	6.12	1.62
I-09	10.38	7.07	3.31	8.71	5.40	1.67
I-10	7.34	5.43	1.91	5.85	3.94	1.49
I-11	7.38	5.41	1.97	5.98	4.01	1.40
I-12	7.35	5.90	1.45	5.89	4.44	1.46
I-13	6.25	4.48	1.77	4.76	2.99	1.49
I-14	6.25	4.62	1.63	6.64	5.01	-0.39
I-15	9.00	7.49	1.51	7.61	6.10	1.39
I-16	9.18	7.37	1.81	7.79	5.98	1.39
I-17	7.92	5.27	2.65	5.89	3.24	2.03
I-18	6.98	4.81	2.17	5.33	3.16	1.65
I-19	4.73	2.82	1.91	3.33	1.42	1.40

1. Feet above sea level
2. Measured from top of protective casing
3. Negative elevations indicate values below sea level

To characterize the groundwater surface, a water level elevation contour map was constructed (Figure 2-6). The contour map was drawn using computer-generated plots as references. The computer-generated contour map is a non-linear interpolation of the available data points. The minimal number of data points and the lack of a uniform distribution made it impractical to try to refine the computer plot to be more representative of the base hydrology. In addition, with the exception of Wells I-04, I-05, I-06, I-14, and I-17, all of the water level elevations fall in the narrow range of 1.39 to 1.67 feet above sea level. From Figure 2-6, it is evident that the water level gradients in the study area are insignificant.

The apparent groundwater surface gradient towards the northwest, which is a localized contradiction of the reported regional groundwater surface gradient to the southeast (Klein, 1978), indicates the impact of local conditions on groundwater elevations and gradients. Groundwater level elevations can be influenced by both subsurface and surface conditions. Subsurface, well-cemented zones could create perched water tables. Surface structures (e.g., paved areas and drainage ditches) can affect groundwater levels by diverting or channeling recharge. Groundwater levels are also affected by pumping water from supply wells. In this instance, however, the effects of pumping from Well Field 2 could not be discerned.

A short duration aquifer test was conducted at the end of the sampling period to confirm transmissivity values obtained from the literature (Appel, 1973) and to ascertain the impacts on the surrounding water level gradients. The test was conducted by pumping Well No. 10 in Well Field 2 at a discharge rate (Q) of 900 gallons per minute (gpm) for 2 hours. Groundwater levels were monitored in Wells I-17 and I-04 to detect any test related drawdowns. The short duration of the test was fixed by the storage limitations of the base water supply system (i.e., the pump installed in Well No. 10 feeds directly into a supply line).

No data was obtained from this test from either the pumping well or the observation wells. Well No. 10 was sealed at the surface for pumping, but the pressure gauge which reflects drawdowns in the well was inoperable; hence, no water level data was obtained. Due to the shortness of the test and the high

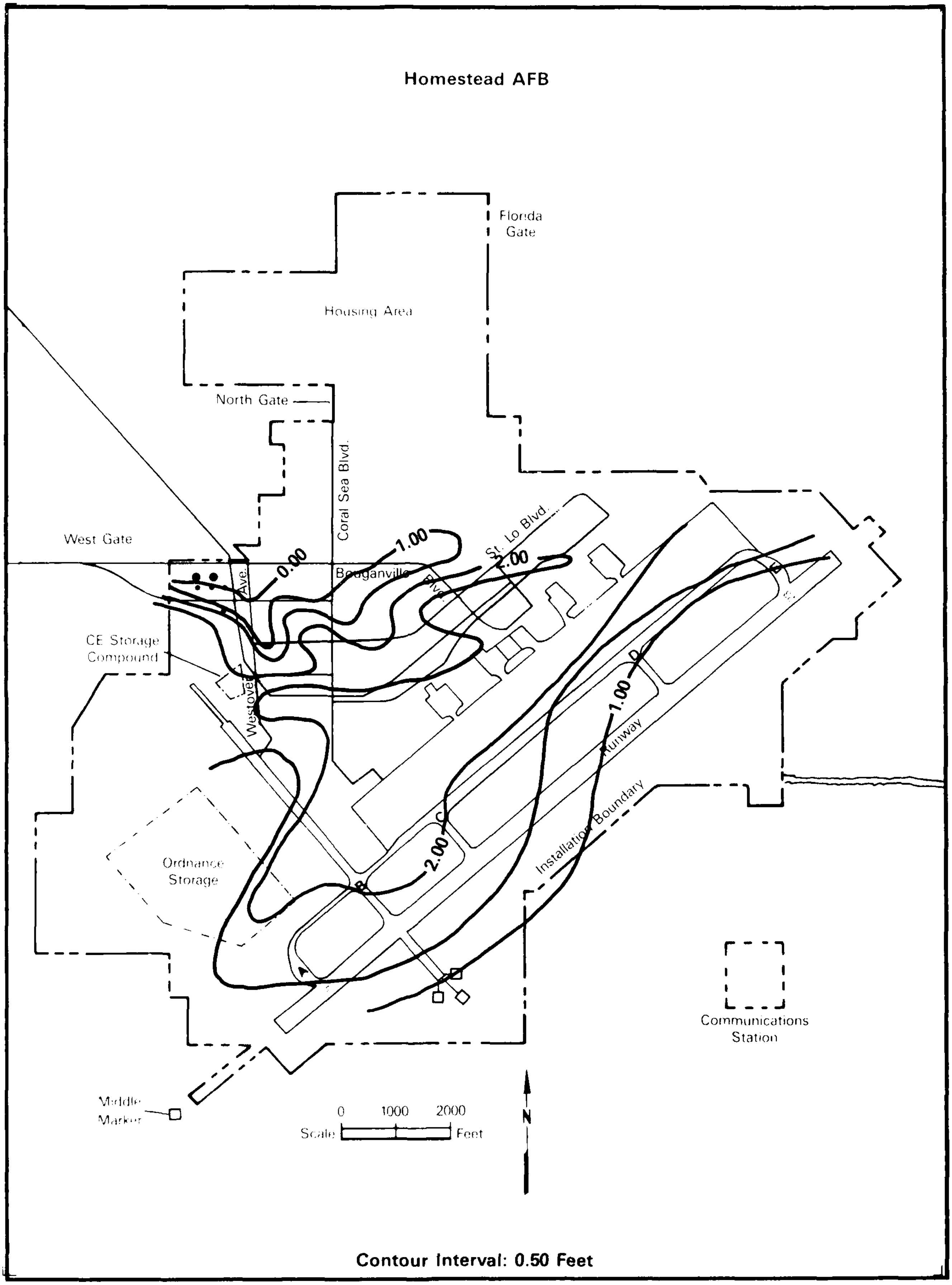


Figure 2-6. Water Table Elevation Contour Map

specific yield of the Biscayne aquifer, no effects of pumping were observed on the water levels in Wells I-17 and I-04. To obtain representative values of transmissivity, a larger pumping test (2 to 3 days in duration) or a higher pumping rate (3,000-3,500 gpm) would need to be implemented (Parker, 1955). Conducting tests of this magnitude are outside the current scope of work. The values for transmissivity put forward in the literature will suffice for the purposes of this investigation (Figure 2-5).

2.6 HISTORIC DISPOSAL, STORAGE, AND SPILL AREAS

The following is a brief description (summarized from the Phase I report) of past practices for handling potentially hazardous materials and a list of incidents for each of the sites investigated. Incidents are presented in order of decreasing HARM scores.

1. ELECTROPLATING WASTE DISPOSAL AREA (SP-1)

   While the base was inactive between 1946 and 1953, a small electroplating shop was operated in Building 164. Spent plating baths and rinses were poured on the ground in an area just east of Building 164. The wastes were generated at a rate of about 250 gallons per month for 2 years.

2. LEAK AT POL BULK STORAGE TANK FARM (SP-4)

   Around 1958, it was discovered that a leak in an underground pipeline at the POL Bulk Storage Tank Farm had bled a significant, but unknown, quantity of JP-4 jet fuel into the ground. Heavy rains raised the water table annually, causing fuel to appear in the surrounding drainage ditches.

3. OIL SPILLS AT AIRCRAFT WASHRACK (SP-7)

   Between about 1970 and 1980, contaminated oils, hydraulic fluids, solvents, and other liquid wastes generated in shops on the flight line were, prior to disposal, routinely transported to two storage tanks located near the aircraft washrack on Flight Apron 4047. These tanks frequently overflowed onto the ground and possibly into a nearby drainage ditch. In addition, numerous spills and occasional dumping of wastes also occurred at the site. Since these tanks were taken out of service in 1980, the site has been disturbed and the contaminated surface soil was either removed or covered.

4. FIRE PROTECTION TRAINING AREA NO. 3 (FPTA-3)

   Since 1972, all fire training activities have been conducted in the present Fire Protection Training Area (FPTA), which is located just northeast of the Ordnance Storage Area. The FPTA, which is actually composed of two burning areas, does not contain a liner system. Preapplication of water to inhibit percolation into the soil became a routine practice at the base in the early 70's.

A wide variety of materials, including JP-4, AVGAS, MOGAS, and liquid wastes from the shops, has been burned during fire training. In addition, sludges from fuel tanks and other wastes were occasionally discarded at the site. Typically, water and AFFF were used to extinguish fires.

5. FIRE PROTECTION TRAINING AREA NO. 2 (FPTA-2)

From the time the base was reactivated in 1955 until 1972, the FPTA was located south of the Ordnance Storage Area, just north of the approach zone to Runway 05. Materials burned at the site were the same as those burned at FPTA No. 3 and probably included a variety of wastes other than contaminated fuels and oils.

6. MOGAS LEAK AT BX SERVICE STATION (SP-6)

During 1980 a discrepancy was recorded in the regular leaded gasoline inventory which was presumed to have been the result of a leak from an underground storage tank. Two tanks were subsequently lined with fiberglass.

7. ENTOMOLOGY STORAGE AREA (P-2)

Since the 1960's, the Entomology Shop has stored its more toxic chemicals in a fenced and sheltered area within the Civil Engineering Storage Compound. Other chemicals which they used in bulk have been stored there as well. The area is a raised concrete pad surrounded by earth and open at the sides. There is visual evidence of spills at the base of the pad.

8. OIL LEAKAGE BEHIND MOTOR POOL (SP-2)

Prior to disposal, waste oils from the Motor Pool are collected in two 500-gallon tanks behind Building 312; this practice has been followed since the 1960's. Over the years, leaks have occurred which resulted in oil being spilled onto the ground. Evidence of these spills is visible at the site today. In addition to waste oils, a number of used batteries are also stored at the site.

9. LEAK AT PUMP STATION NO. 9 ON THE FLIGHT APRON (SP-5)

In May 1982, a leak in an underground pipeline that resulted in the loss of an unknown quantity of JP-4 was discovered. Fuel appeared in nearby drainage ditches and other low-lying areas. Attempts were made to clean up the spill, and floating fuel was recovered from nearby surface waters.

10. RESIDUAL PESTICIDE DISPOSAL AREA (P-3)

Between 1977 and 1982 waste pesticides used by the Entomology Shop were disposed of in an open area between the Ordnance Storage and U.S. Customs Storage Areas. The disposal practice involved pouring and spraying the wastes on the ground over a 20-acre area, followed by applying chlorine bleach and ammonia to help break down the chemicals.

2.7 HISTORIC GROUND WATER PROBLEMS

Saltwater intrusion has long been recognized as a major threat to groundwater quality in South Florida. However, with the growing concern about the impacts of development, attention has broadened to include nonpoint and point sources of groundwater contamination (Klein, 1978). Saltwater intrusion remains a concern because of the increasing water supply demands on the Biscayne aquifer and the continued operation of flood control channels which lower aquifer recharge. Nonpoint sources of groundwater pollution include runoff from buildings, yards, and paved areas, plus runoff from and infiltration in agricultural areas (Klein 1978). Point sources of groundwater contamination include infiltration from septic tanks (Pitt, 1975), canals, and landfills (McKenzie, 1983), and accidental leaks or spills.

The saltwater intrusion line is not a static interface between the Biscayne aquifer and the seawater (Kohout, 1960). It is a salt concentration gradient that at any one time is defined as 1000 mg/l (ppm) of salt (the level at which salt becomes a taste problem in drinking water). Seawater flows in a cycle from the floor of the sea into the zone of diffusion between the Biscayne aquifer and the seawater and back to the sea. This cycle acts to lessen the extent to which the saltwater intrudes on the aquifer. The extent of saltwater intrusion is directly influenced by rainfall recharge, regressing seaward during the rainy season.

The rapid advancement of the saltwater intrusion line beneath Homestead AFB in the early 70's (Figure 2-7) prompted the installation of Well Field 2, as Well Field 1 was expected to become totally unserviceable. Only one well in Well Field 1, however, has been abandoned to this date due to saltwater contamination. Expecting a possible problem with further saltwater intrusion in the future, Homestead AFB constructed Well Field 3 1.5 miles west of the

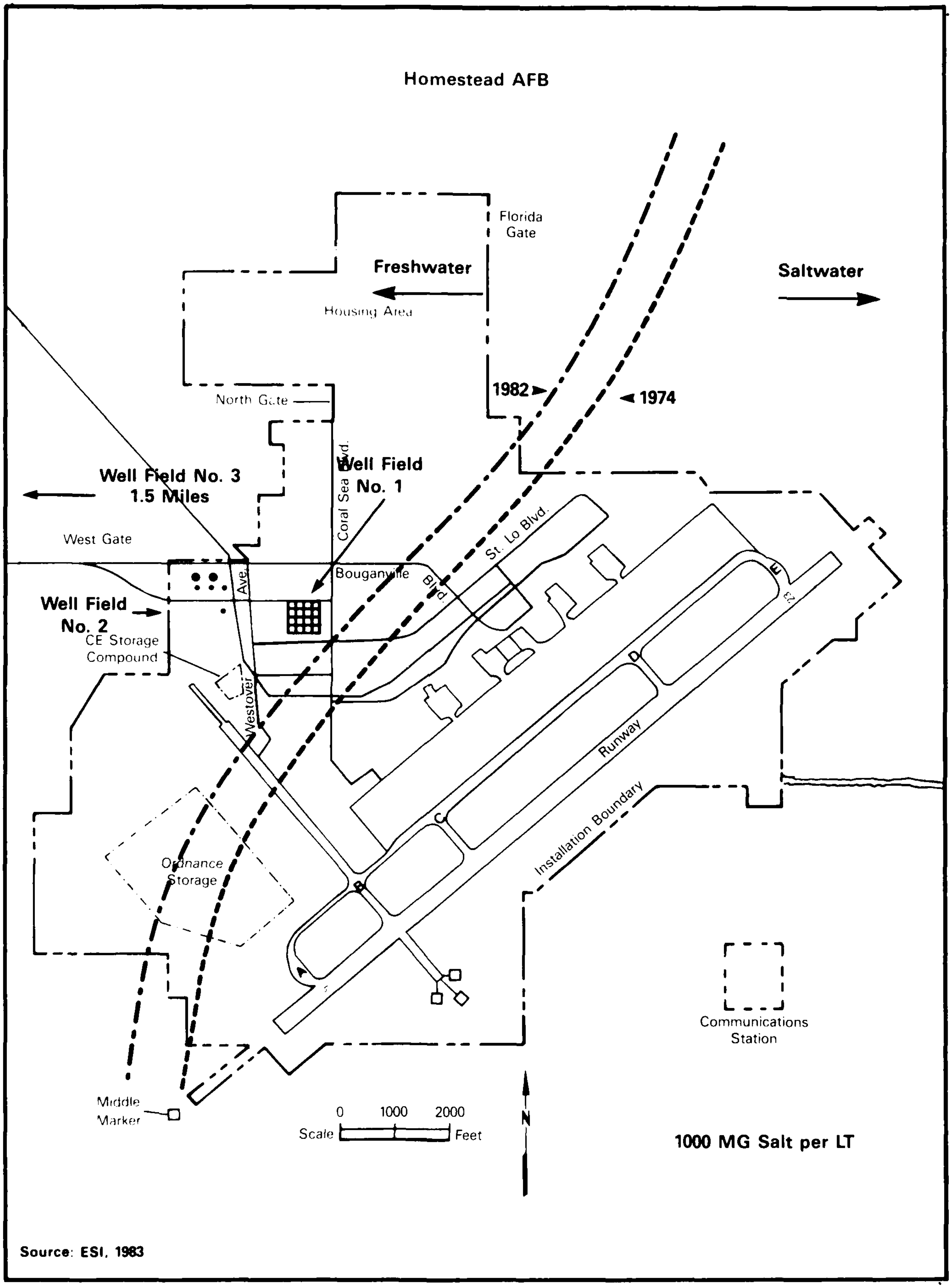


Figure 2-7. Limit of Salt Water Intrusion (1000 mg/l)

base (refer to Section 2.8 for more detail on well field construction and operation).

County and State efforts to impede saltwater intrusion have included maintaining constant water levels in the drainage canals and constructing a freshwater barrier canal parallel to the coast. Maintaining water levels at or above groundwater levels in the canals, which are connected hydrologically with the Biscayne aquifer, stabilizes groundwater levels in the Biscayne which in turn impedes saltwater intrusion.

Nonpoint and point sources of groundwater pollution have been monitored in several studies (Pitt, 1975; Waller, 1983; McKenzie, 1983), and recommendations have been made for regulating development and improving waste disposal practices in all areas overlying the Biscayne aquifer. Additional impetus has been given by designation of the Biscayne aquifer as a "sole source" aquifer for southeastern Florida under the Federal Safe Drinking Water Act (1974). Contaminants which have infiltrated from any overlying area into the Biscayne aquifer migrate toward the ocean in the direction of the groundwater flow gradient, unless they are diverted by pumping wells, utilized by vegetation, absorbed into subsurface materials (i.e., limestone, sandstone, or marl), or chemically precipitated to form insoluble compounds. The rate of dispersion of these contaminants is greater during the rainy season. The continued growth of population and industry in southern Florida will affect groundwater quality in the future if protection strategies are not implemented.

2.8 INSTALLATION WELLS

Homestead Air Force Base obtains its water resources from wells constructed on the installation and from three supply wells recently drilled immediately west of Homestead AFB. All installation water supply wells have been screened in the Biscayne aquifer. According to base documents, installation wells have been constructed as follows:

a. Well Field No. 1 - six wells, 8-inch diameter, 72 feet deep, 29 gpm total capacity (five wells available for backup use and one well no longer in use)

b. Well Field No. 2 - two wells, 8-inch diameter, 70 feet deep
- two wells, 16-inch diameter, 70 feet deep
- capacity: 8 in: 300 gpm; 16 in: 1000 gpm (backup use)

c. Well Field No. 3 - three wells, 20-inch diameter, 45 feet deep
capacity: 1600 gpm per well.

Well Field 2 was completed as an immediate response to the advance of the saltwater intrusion line in the early 70's (Section 2.7), as Well Field 1 was expected to become totally unserviceable. Only one well in Well Field 1, however, has been abandoned to this date due to saltwater contamination. Well Field 3 was completed in expectation of potential saltwater intrusion problems in the future. After Well Field 2 was constructed and before Well Field 3 became operational, Well Field 2 provided most of the base water supply with about 10% coming from Well Field 1 (routinely from either of two wells, although five of the wells are serviceable). Five wells in Well Field 1 and all of Well Field 2 are still totally functional and are operated about once per month to keep them serviceable. Well Field 3 is used today as the primary source, relying on a remote switching device.

In addition to the wells listed above, seven nonpotable local service wells are known to exist at Homestead Air Force Base. Construction information describing these wells is not on file. The locations of all base water supply wells and USGS observation wells are shown on Figure 2-8. The USGS wells were drilled as part of a continuing program to monitor saltwater intrusion.

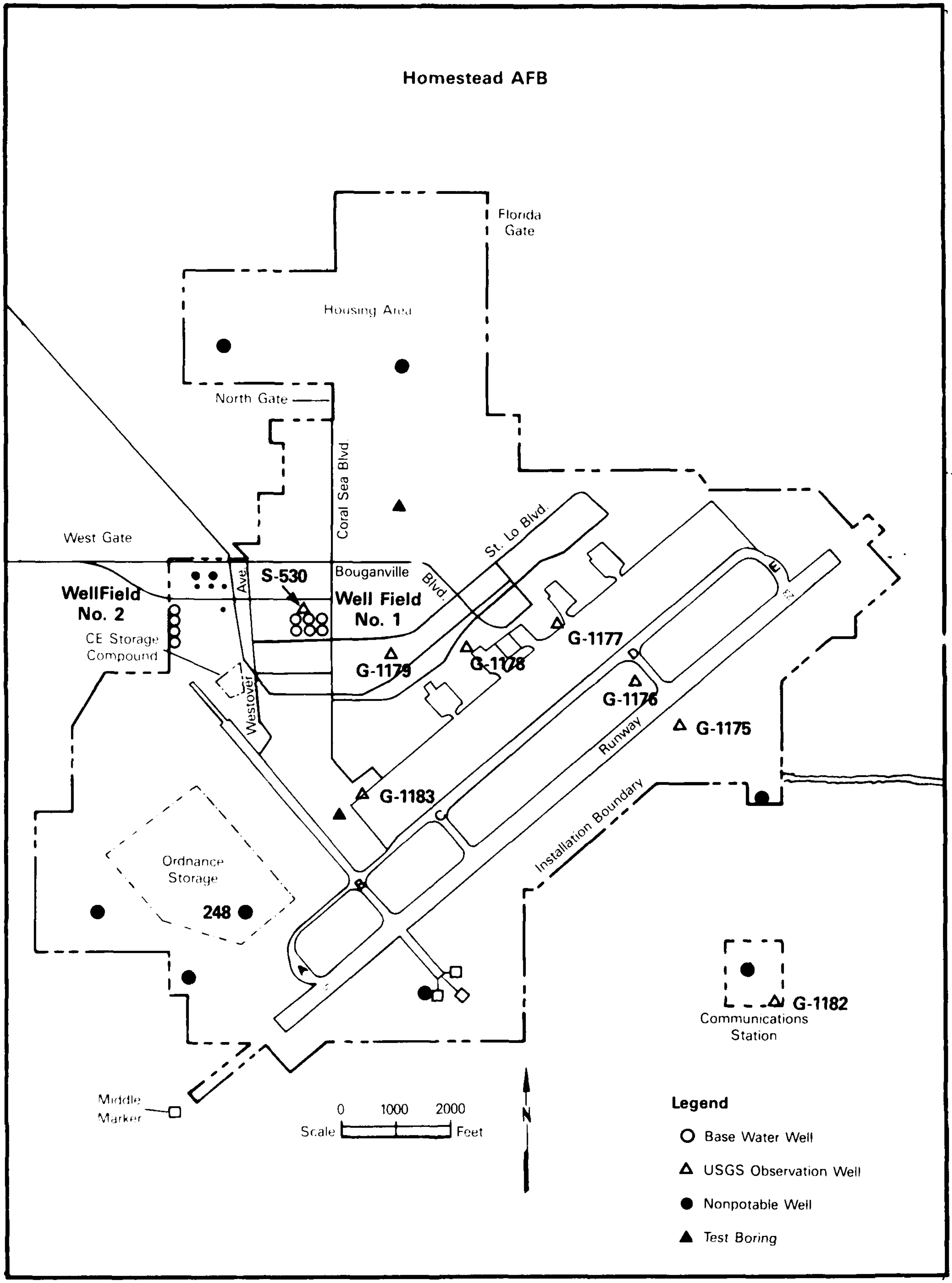


Figure 2-8. Base Well Locations

3. FIELD PROGRAM

The field program was developed to confirm the absence or presence of contaminants at the designated sites and to quantify the concentration of observed contamination. The list of sites to be investigated was adopted from Phase I findings with modifications worked out through conversations with USAFOEHL and base personnel. The sites investigated are shown in Figure 3-1.

Monitoring well and soil and sediment sampling locations were selected to maximize data acquisition while minimizing cost. Monitoring wells were located to provide both upgradient and downgradient sampling points (i.e., in relation to the groundwater flow direction identified in the Phase I investigation). Soil and sediment sampling points (the latter in adjacent drainages) were chosen to determine if residual contamination from spills or land disposal of wastes is evident at Sites SP-1, SP-2, or P-3.

The sampling program was developed to provide representative samples for shipping to USAFOEHL and SAIC laboratories within the allowable holding times for the analytes. The wells were completed according to predetermined specifications and purged prior to sampling to yield representative results. Quality assurance/quality control (QA/QC) provisions were included in the sampling procedures to ensure the integrity of the samples.

3.1 DRILLING AND WELL COMPLETION

The monitoring wells were drilled at staked locations using a trailer mounted Acker AD-2 auger drill rig. Boreholes were drilled to approximately 20 feet below land surface (BLS) using 4-inch (ID) hollow stem augers. The description of subsurface formations from cuttings was precluded by the dispersal of most of the cuttings into solution cavities. The boreholes were redrilled if the hole was not open to at least 18 feet BLS. Core holes were opened to approximately 20 feet below land surface using a 4-inch (OD) core barrel. Core recovery was minimal because of solution cavity collapses and nonhomogeneous cemented zones in the Miami Oolite. The core barrel was lubricated with water during coring.

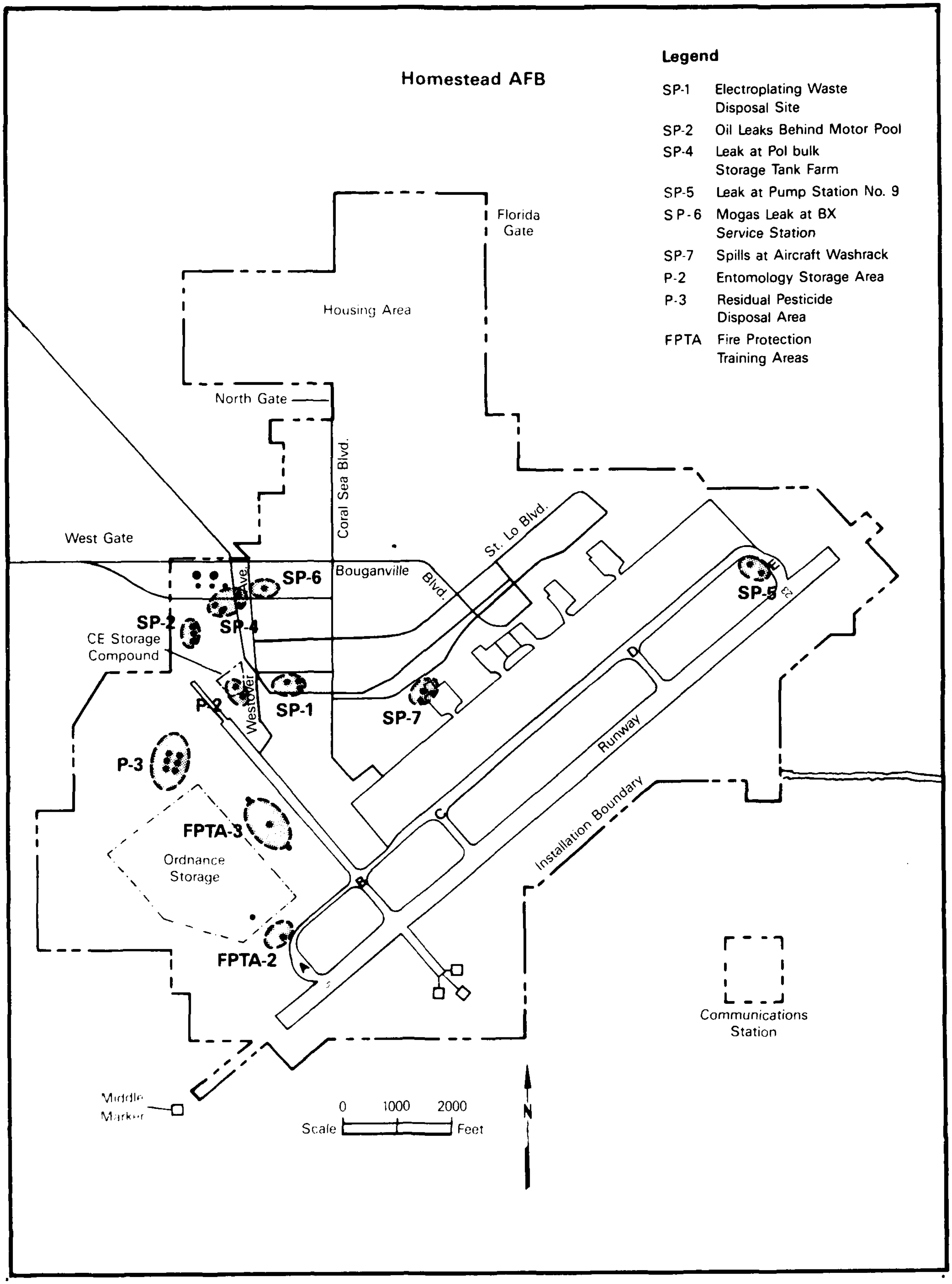


Figure 3-1. Location of Sites Investigated

The monitoring wells were installed according to the following procedure (see Figure 3-2): 15 feet of 2-inch (ID), 0.010 slot PVC, flush-joint screen and 5 feet of 2-inch (ID) schedule 40 casing were assembled at threaded ends, fitted with a plug at the base, and installed plug end first into the open borehole, retaining 2 feet of casing above ground surface to facilitate sampling. Sand of uniform size was then added to the annulus until the top of the sand pack was one-half of a foot to a foot above the top of the screen. A 1/2-foot layer of bentonite pellets was then added on top of the sand pack and wetted to promote swelling. The bentonite-pellet layer, which isolates the sand pack from the overlying bentonite grout, was reduced from the original specifications of one foot to 1/2 foot to increase the thickness of the bentonite grout layer to ensure an adequate seal. A 6-inch steel protective casing was then installed over the well casing. Finally, a cement/clay grout was added to the annulus from the top of the bentonite to the ground surface and around the base of the protective casing to seal the well from surface contamination. Well construction summaries for each of the monitoring wells are included in Appendix D.

Before drilling the first borehole, and following each borehole, all drilling equipment that came in contact with the borehole cuttings was steam cleaned, washed with a low residue detergent (Alconox®), and rinsed. This procedure prevented cross-contamination between boreholes. A kerosene-burning steam generator was used to clean the equipment on the washrack behind the base firehouse.

During the drilling program, a photoionization analyzer was kept near the drilling rig to measure the concentration of trace gases. Readings taken with the photoionization analyzer (hnu®) are included in Table 3-1. Because of equipment malfunctions, measurements were not taken at all boreholes.

The wells were developed utilizing a 3-horsepower centrifugal pump connected to a noncollapsible hose. The wells were pumped until the specific conductance values of the pumped groundwater stabilized. Prior to pumping Wells I-14, I-15, and I-17, an air compressor was used to surge the wells in order to loosen the fines which were impeding development. These three wells were completed in more well-cemented limestone than the others.

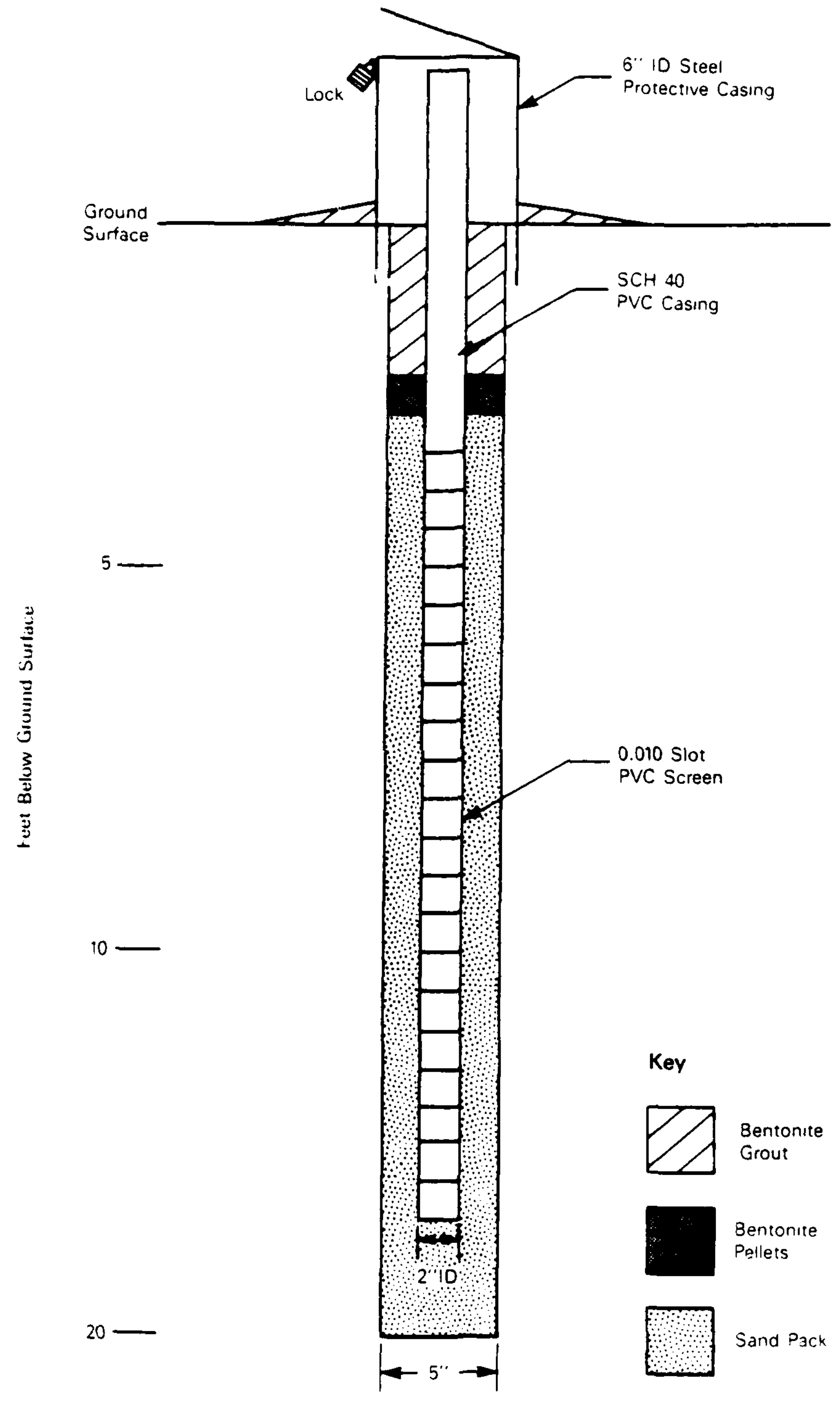


Figure 3-2. Typical Well Construction Diagram

TABLE 3-1

BOREHOLE
hnu® READINGS

Site	Well Number	(Highest) hnu Reading ppm	Date
SP-1	I-01	---[2]	11/20
	I-02	---	11/20
	I-03	---	11/20
SP-4	I-04	105	11/19
	I-05	BDL[1]	11/17
	I-06	120	11/17
SP-7	I-07	---	11/14
	I-08	20	11/14
	I-09	22	11/14
FPTA-3	I-10	---	11/19
	I-11	BDL	11/19
	I-12	---	11/19
FPTA-3	I-13	---	11/15
SP-6	I-14	BDL	11/20
P-2	I-15	BDL	11/16
	I-16	---	11/15
SP-2	I-17	BDL	11/16, 11/26
SP-5	I-18	150	11/17
	I-19	BDL	11/17

[1]Below Detection Limit

[2]No reading (equipment malfunction)

3.2 SAMPLING

Groundwater samples were collected with a Teflon® bailer after the monitoring wells were purged with a submersible pump. Samples collected in the bailer were transferred to the appropriate prepared sample containers, packed into coolers with blue ice, and shipped via overnight courier to the SAIC and USAFOEHL laboratories. Sampling equipment was decontaminated before sampling each well to prevent cross-contamination between wells.

Soil and sediment samples were collected at staked locations using a stainless steel trowel. Samples from Site P-3 were sifted to exclude rock fragments. The soil and sediment samples were packed in glass jars which were then packed in coolers for shipment. All soil and sediment sampling equipment was thoroughly decontaminated prior to sampling to prevent cross-contamination of samples.

3.3 DETAILS OF INSTRUMENTATION

Field instruments used to retrieve representative samples included a submersible Keck® Pump (Model SP-81) for purging the wells; a Teflon® point-source bailer assembly for grabbing samples; and a conductivity meter for field determination of specific conductance and temperature. The pH probe was damaged during shipping, hence pH measurements were made using standard pH Litmus paper. The submersible Keck® Pump, which evacuates the groundwater through a Teflon® hose, was decontaminated by first pumping low residue detergent (Alconox®) solution, then fresh water, through the pump. The bailer assembly, except for the metal clip and the nylon cord used to suspend the bailer, is comprised of Teflon® parts. To prevent cross-contamination, the nylon cord was replaced before sampling each well. The conductivity meter probe was rinsed with distilled water prior to each measurement.

3.4 PRESERVATION AND SAMPLING PROCEDURES

Before sampling the ground water, SAIC personnel added preservatives to the sample containers in the base bioenvironmental laboratory. Preservatives were added according to standard methods as outlined in Table 3-2. The sample containers were then filled according to the procedures specified in the last column of Table 3-2.

TABLE 3-2

SAMPLING AND PRESERVATION SPECIFICATIONS

Analyte	Bottle	Preservative	Approx. Percent of Bottle Filled with Sample
Metals (other than Chromium)	1 l-plastic	2 ml HNO_3	75%
Chromium	1 l-plastic	--[1]	75%
Cyanide	1 l-plastic	4 ml 6N NaOH	> 75%
Oil & Grease	1 l-glass	1-2 ml HCL	90%
TOC	120 ml-glass	1 ml H_2SO_4 (or HCL)	100% (no head space)
TOX	120 mg-glass	1 ml $NaSO_4$ + 1 ml HNO_3[3]	100% (no head space)
Pesticides	1 gal-glass		90%[2]
Soil/Sediments	32 oz-glass		100%

HNO_3 = Nitric Acid
NaOH = Sodium Hydroxide
HCL = Hydrochloric Acid
$NaSO_4$ = Sodium Sulfate

[1]Lab cleaned chromium bottles in HCL

[2]Bottle rinsed with approximately 50 ml of sample and rinse discarded prior to sampling

[3]EPA Method 9020 (SW-846, 1982)

After preparing sample containers and purging the wells, the following sampling procedure took place:

1) Decontaminate sampling equipment
2) Measure static water level in well
3) Retrieve samples
4) Fill sample containers
5) Seal containers and transfer to coolers containing blue ice
6) Retrieve a sample for determination of pH, temperature, and specific conductance.

The depth to the static water level was measured with a fiberglass tape with a metal bell attached (cleaned prior to measurements). When an oil and grease sample was included in the sampling suite, it was collected first to ensure collection of floating liquids.

Duplicate samples were collected for shipping to both USAFOEHL and SAIC laboratories. The sample containers were packed into coolers with padding and blue ice and shipped in three separate lots to the respective labs. Each container was recorded on a chain of custody form which was shipped with the samples for tracking purposes (Appendix E).

3.5 QUALITY ASSURANCE/QUALITY CONTROL

To ensure the integrity of the samples, the following quality assurance/ quality control (QA/QC) steps were implemented in the field:

1. Wells were purged of at least five well volumes, less than 24 hours prior to sampling
2. All sampling equipment was decontaminated prior to sampling
3. QA/QC samples were collected each day of groundwater sampling and for every 10 soil or sediment samples, for shipment to the SAIC laboratory.

The QA/QC samples for groundwater included a field blank, a bailer wash, and a replicate sample, whereas the QA/QC samples for soils and sediments were simply replicates. The field blank (distilled water in the appropriately preserved bottles) was included to monitor any contamination of the samples which might occur during handling or shipping. The bailer wash (distilled water poured through the cleaned bailer assembly into the appropriately preserved bottles) was included as a check on the effectiveness of the decontamination procedures. The replicate sample was included to provide a check on laboratory analytical accuracy.

Analytical results from the Field QA/QC program are discussed in Section 4.1. These results indicate that the overall field sampling effort succeeded in maintaining the integrity of the samples from sampling through analysis. The reliability of the bailer in collecting representative samples after decontamination, of the handling and shipping procedures in isolating and preserving the samples, and of the analytical procedures in generating reproducible analyses are confirmed by these results.

4. DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

Eight sites were recommended for further monitoring by the Phase I report (Engineering Science, 1983). Two additional sites, from the original 13 sites investigated in the Phase I records search, the leak at Pump Station No. 9 (SP-5) and the Residual Pesticide Disposal Area (P-3), were added by USAFOEHL to the Phase I report recommendations for monitoring. A total of 10 sites, therefore, were investigated during the Phase II, Stage 1 field effort to confirm or deny the presence of contaminants and to determine the extent of contaminant migration. Samples of groundwater, soils, and sediments were collected during this effort and submitted for laboratory analysis. This section summarizes the results of the sampling program and discusses the significance of the findings with respect to the sites under study.

4.1 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

All field sampling and laboratory analysis was accompanied by quality assurance/quality control (QA/QC) checks to assess the validity of the effort. Data validity, as assessed by internal laboratory QA/QC, field QA/QC, and duplicate analyses, is discussed in this section.

Table 4-1 presents the results of the internal laboratory QA/QC checks. These are standard surrogate spike samples used to assess the accuracy of the analytical instruments. Surrogate compounds, or spikes, of known concentrations are added to previously analyzed samples. Values for spike recovery for total organic carbon (TOC), oil and grease, phenols, and cyanide all average over 95 percent, indicating good accuracy. Spike recovery for metals was excellent, averaging over 99 percent. The spike recovery for total organic halogens (TOX) ranged from 14 to 62 percent, both because of the low TOX concentration in the sample prior to spike addition and the method itself. No acceptable range for spike recovery in TOX analysis has been established by EPA.

TABLE 4-1

INTERNAL LABORATORY QUALITY CONTROL REPORT

Parameter	Replicate		Spike Value	Spike Level	Recovery %
TOC	3.0/2.9		6.3	17	107
TOX	0.115/0.105		0.01	0.016	14
			0.01	0.045	62
Phenol	0.050/0.050		<0.005	0.051	102
	2.6/1.6		0.2	1.6	78
Cn-	0.056/0.055		<0.005	0.055	100
Oil and Grease	insufficient sample to do		linear curve	see attached	
Metals Cr	(SL-1/SP-1)	47.1/82/2/72.2			
	(SL-2/SP-1)	8.40/7.72/7.48	7.87	171	98
Cd	(SL-1/SP-1)	4.04/4.85/6.04			
	SL-2/SP-1	0.427/0.400/0.447	0.425	10	109
Cu	(SL-1/SP-1)	70.3/85.7/86.6			
	(SL-2/SP-1)	9.29/6.92/9.93	8.71	102	73
Pb	(SL-1/SP-1)	143/186/187			
	(SL-2/SP-1	48.8/45.3/58.6	50.9	243	101
Ni	(SL-1/SP-1)	14.2/16.4/18.5			
	(SL-2/SP-1	6.50/5.89/7.97	6.79	43	103
Zn	(SL-1/SP-1)	626/755/772			
	(SL-2/SP-1)	55.1/48.7/54.2	54.2	391	114
Pesticide/Herbicide			P,P' DDT Spike		
SL 10					43
SL 10-2					44
SL 11					55
SL 11-Rep					43
SL 12					45
SL 13					36
SL 14					27

Internal laboratory QA/QC procedures for pesticides are different from those discussed above. All samples are spiked prior to extraction with dibutyl chlorendate (DBC), a pesticide surrogate (U.S. EPA, 1985). Thus the recovery data shown is an assessment of both extraction efficiency and analytical instrument accuracy. Because this adds more potential variation, the target range for recovery is very wide: from 17 to 180 percent. Consequently, the average DBC recovery of 42 percent (range of 27 to 55 percent) found here is considered good. No suitable surrogate compounds are available for the organophosphate pesticides or the insecticide carbaryl (Sevin) .

Field QA/QC samples are of three sorts: field blanks, sampler (bailer) washes, and replicate samples. Field blanks consist of commercially available distilled water poured directly into the sample containers, and then handled, transported, and analyzed along with the normal samples. These serve principally as a check of packaging, handling, and transport procedures. Bailer washes consist of pouring distilled water into the decontaminated bailer and then into the sample containers. These serve as a check of the decontamination procedures. Replicate analyses consist of double sampling at one or more points, and serve as a check of the precision of the combined sampling and analysis procedures.

Analytical results from the field QA/QC program are shown in Table 4-2. These show that the overall field sampling effort and the analytical precision were quite good. The most notable exceptions are the heavy metals (lead and zinc) found in both field blanks and bailer washes collected on 10 and 12 December 1984, and the relatively high oil and grease values in the field blank and bailer wash from 13 December 1984. The relatively high lead and zinc levels are attributable to the off-the-shelf, commercially available distilled water used for blanks, washes, and final decon rinses.

The levels for oil and grease found in the field blank and bailer wash (1.20 and 0.19 mg/l [ppm]) from 13 December are higher than in either the normal sample (I-19) (0.11 ug/l [ppb]) or replicate (I-19R) (0.13 ug/l [ppb]) collected at the same time. This discrepancy is caused by the fact that Well I-19 is at the north edge of the runway, adjacent to Taxiway E, where several

TABLE 4-2

FIELD QA/QC RESULTS PER DAY[1] OF SAMPLING
HOMESTEAD AFB

ANALYTES	12/7 FB[2]	12/7 BW[3]	12/10 FB	12/10 BW	12/11 FB	12/11 BW	12/12 FB	12/12 BW	12/13 FB	12/13 BW
<u>Organics</u> (ppm)										
Oil and Grease	<0.10	<0.10					<0.10	<0.10	1.20	0.19
Total Organic Halogens (TOX)	0.01	0.01					0.04	0.04	0.02	0.02
Total Organic Carbon (TOC)	1.6	1.1					0.4	0.4	1.2	0.6
<u>Trace Metals</u> (ppb)										
Cadmium (Cd)			<0.20	<0.20			<0.20	<0.20		
Total Chromium (Cr)			<0.50	<0.50			<0.50	<0.50		
Hexavalent Chromium (Cr^{+6})			<0.05	<0.05			<0.05	<0.05		
Copper (Cu)			0.84	1.17			0.97	1.29		
Lead (Pb)			1.22	1.07			1.97	2.93		
Nickel (Ni)			<5.00	<5.00			<5.00	<5.00		
Zinc (Zn)			8.72	6.55			12.2	17.0		
<u>Other Inorganics</u> (ppb)										
Cyanide (CN)			<5.	<5.			7.	7.		
Pesticides (ppb)					ND[4]	ND	ND	ND		

[1]Samples collected on the following days were: 12/17 = I-7, I-8, I-9, I-10, I-11, I-12, SL-9, SL-10, SL-11, SL-12, SL-13, SL-14; 12/10 = I-1, I-2, I-3, SL-1, SL-2, SL-3, SL-4; 12/11 = I-15, I-16, SL-5, SL-6, SL-7, SL-8, SD-3, SD-4; 12/12 = I-14, I-4, I-5, I-6, I-17, S-530 (WFI), Well #10 (WF2), SD-1, SD-2; 12/13 = 248, I-13, I-18, I-19

[2]Field Blank

[3]Bailer Wash

[4]No Detection

jet aircraft were landing and detaching their drag chutes within close proximity during sample collection. This is documented in the project field log. Examination of the results of replicate analyses indicates good precision for the combined sampling and analysis.

Overall, the QA/QC program analytical results, both for the field and for the laboratory work, are well within the normal limits, and may be used with a high degree of confidence. Any discrepancies of note can be explained and are not indicative of flaws in the program.

4.2 ANALYTICAL RESULTS

This section presents a discussion of the analytical results as reported by the laboratory. Reference values for groundwater and soils, used to determine the significance of the findings, are shown in Tables 4-3 and 4-4, respectively. The Air Force Levels of Concern (AFLC) are the levels of detection specified in Attachment 1 to the Statement of Work (Appendix C). Background values are taken from published studies on other sites in Dade County, Florida (Appendix G). The normal ranges of trace metals in soils are taken from standard soil science texts, and represent national averages. The normal levels in soils, used in the following discussion are the approximate medians of these ranges. The one to two order-of-magnitude difference between the published background values and the national averages for the normal ranges in soils, can be attributed to the low mineral content of the carbonate bedrock from which the soil is partially derived.

4.2.1 Interpretation of Contaminant Levels

The first step in interpreting analytical results was to evaluate the QA/QC data to determine if any undue bias was introduced by the field sampling techniques or in the laboratory. Based on this evaluation (Section 4.1), we have concluded that the analytical results are valid and amenable to more or less straightforward interpretation.

The second step in data interpretation was to compare the analytical results with the given reference values for groundwater and soil for the subject contaminants (Tables 4-3 and 4-4). No published background levels were

TABLE 4-3. REFERENCE VALUES FOR GROUNDWATER
HOMESTEAD AFB

Analyte	AFLC[1]	SDWA[2]	Background: Pitt, 1975	Background: McKenzie, 1983	Background: Waller, 1983
Field Parameters:					
pH (units)		6.5-8.5			6.7-8.0
Temperature (C)		NS[3]			24.4
Specific Conductance (umhos/cm)		NS			435.0
Trace Metals (ppb):					
Cadmium	10.0	10.0		0-4	1-9
Total Chromium	50.0	50.0		10-20	10-20
Hexavalent Chromium	50.0	NS			
Copper	20.0	1000.0			0-2
Lead	20.0	50.0		4-21	0-10
Nickel	100.0	NS			2-22
Zinc	50.0	5000.0			0-60
Other Inorganics (ppb):					
Cyanide	10.0	NS			
Organics (ppm):					
Oil & Grease	0.10	NS			
Total Organic Halogens	0.01	NS			
Total Organic Carbon	1.0	NS	0-10		
Pesticides (ppb):					
Aldrin	0.02	NS			
DDD	0.02	NS			
DDT	0.02	NS			
Dieldrin	0.02	NS			
Endrin	0.02	0.2			
Heptachlor	0.02	NS			
Heptachlor Epoxide	0.02	NS			
Lindane	0.01	4.0			
Methoxychlor	0.20	100.0			
Toxaphene	2.00	5.0			
Diazinon	0.02	NS			
Malathion	0.10	NS			
Parathion	0.02	NS			
2,4-D	0.06	100.0			
2,4,5-T	0.06	NS			
2.4.5-TP (Silvex)	0.06	10.0			
Sevin	1.00	NS			

[1] Air Force Levels of Concern

[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Wat : Standards)

[3] No Standard

TABLE 4-4. REFERENCE VALUES FOR SOILS
HOMESTEAD AFB

	Background	NORMAL RANGES IN SOILS			
Analyte	AFLC[1]	Waller, 1983	Rose, 1979	Fairbridge, 1979	Brady, 1974
Trace Metals (ppm):					
Cadmium		0.01	0.06	<1	0.1-7
Total Chromium	5.00		10-50		
Hexavalent Chromium		0.01-0.09			
Copper		0.02-0.23		20.00	2-100
Lead	2.00	0.02-0.37	2-20		2-200
Nickel		0.01-0.02		5-500	10-1000
Zinc		0.01-0.18		10-300	10-300
Other Inorganics (ppm):					
Cyanide					
Organics (ppm):					
Oil & Grease	100.00				
Total Organic Halogens	5.00				
Total Organic Carbon					
Pesticides (ppm):					
Aldrin	0.02				
DDD	0.02				
DDT	0.02				
Dieldrin	0.02				
Endrin	0.02				
Heptachlor	0.02				
Heptachlor Epoxide	0.02				
Lindane	0.01				
Methoxychlor	0.20				
Toxaphene	1.00				
Diazinon	0.02				
Malathion	0.10				
Parathion	0.02				
2,4-D	0.06				
2,4,5-T	0.06				
2,4,5-TP (Silvex)	0.06				
Sevin	1.00				

[1] Air Force Levels of Concern

obtained for groundwater for hexavalent chromium, cyanide, oil and grease, total organic halogens (TOX), and pesticides or for soils for total chromium, cyanide, oil and grease, total organic halogens (TOX), total organic carbon (TOC), and pesticides.

Because Homestead AFB proper is more industrialized than most of the surrounding area, the maximum background values taken from the literature are used as the ambient water and soil quality criteria for each parameter for which they were available. For those parameters for which no background levels were obtained from the literature, the ambient water and soil quality criteria were was chosen based on the levels encountered in the study, and our best professional judgment. These are as follows:

- Total chromium: 0.1 ug/g (ppm) soil
- Hexavalent chromium: 50 ug/l (ppb) water
- Cyanide: 10 ug/l (ppb) water
1.0 ug/g (ppm) soil
- Oil and grease: 1 mg/l (ppm) water
10 ug/g (ppm) soil
- TOX: 0.10 mg/l (ppm) water
- Pesticides: AFLC for groundwater and soil.

These criteria, above which analytical results are considered significant, apply throughout the following discussions (no soil samples were analyzed for TOC or TOX, hence no criteria were required).

The final step in data interpretation was to compare upgradient and downgradient values between sites. This is difficult to do for Homestead AFB due to the extremely flat gradient across the base. Localized fluctuations in the direction of this slight gradient; due to uneven distribution of rainfall recharge, canal drainage or well pumpage; can cause contaminant migration pathways to deviate from the regional flow gradient (see Section 2.3). The groundwater quality analysis results indicate that contaminants have migrated in different directions than originally estimated based on an assumed easterly to southeasterly flow gradient. Many of the designated upgradient wells, therefore, did not succeed in providing a reference point for background water quality outside the area of influence of the contaminant plume.

4.2.2 Field Measurements

During the sampling of both new and existing wells, field measurements of pH, temperature, and specific conductance were taken. These are summarized in Table 4-5. The values measured for pH and temperature do not reveal much of significance except that the temperature probe used (attached to the conductivity meter) was not reliable. The specific conductance values are considered reliable (instrument calibration checked daily) and are indicative of groundwater salinity. The highest values, recorded at Wells I-05 and I-06, correspond to a groundwater low in that vicinity. This is discussed further in Section 4.2.4.

4.2.3 Site Specific Results/Significance of Findings

The following sections discuss the analytical results for each of the 10 sites and present the conclusions drawn based on those results.

4.2.3.1 Electroplating Waste Disposal Site (SP-1)

Three new groundwater monitoring wells (I-01, I-02, and I-03) were installed and sampled at this site. Four soil and two sediment samples were also collected. Their locations are shown in Figure 4-1, and the analytical results are shown in Tables 4-6 and 4-7, respectively.

Contamination concentrated mainly in soils and sediments rather than groundwater is evident at this site. The groundwater results can be summarized as follows:

- Cadmium: very low levels, all below AWQC and drinking water standard
- Total chromium: one value (19.7 ppb at I-01) close to AWQC but below drinking water standard
- Hexavalent chromium: all values well below AWQC. There is no drinking water standard
- Copper: all but one value (1.9 ppb at WF-1) above AWQC but below drinking water standard

TABLE 4-5

FIELD MEASUREMENTS

Well Number	pH	Temperature (°C)	Specific Conductance (umhos/cm)
I-01	6.8	29	420
I-02	6.8	24	420
I-03	6.7	29	430
I-04	6.7	24	840
I-05	6.6	24	1,170
I-06	6.8	23	1,120
I-07	6.4	16	320
I-08	6.4	16	340
I-09	6.6	15	380
I-10	6.6	17	200
I-11	6.8	22	320
I-12	6.8	23	370
I-13	6.6	24	590
248	6.7	24.5	550
I-14	6.7	23	420
I-15	6.5	15	460
I-16	6.7	22	360
I-17	6.8	23	360
I-18	6.8	26	830
I-19	6.8	24	780
WF1	6.8	24.5	690
WF2	6.7	24	460

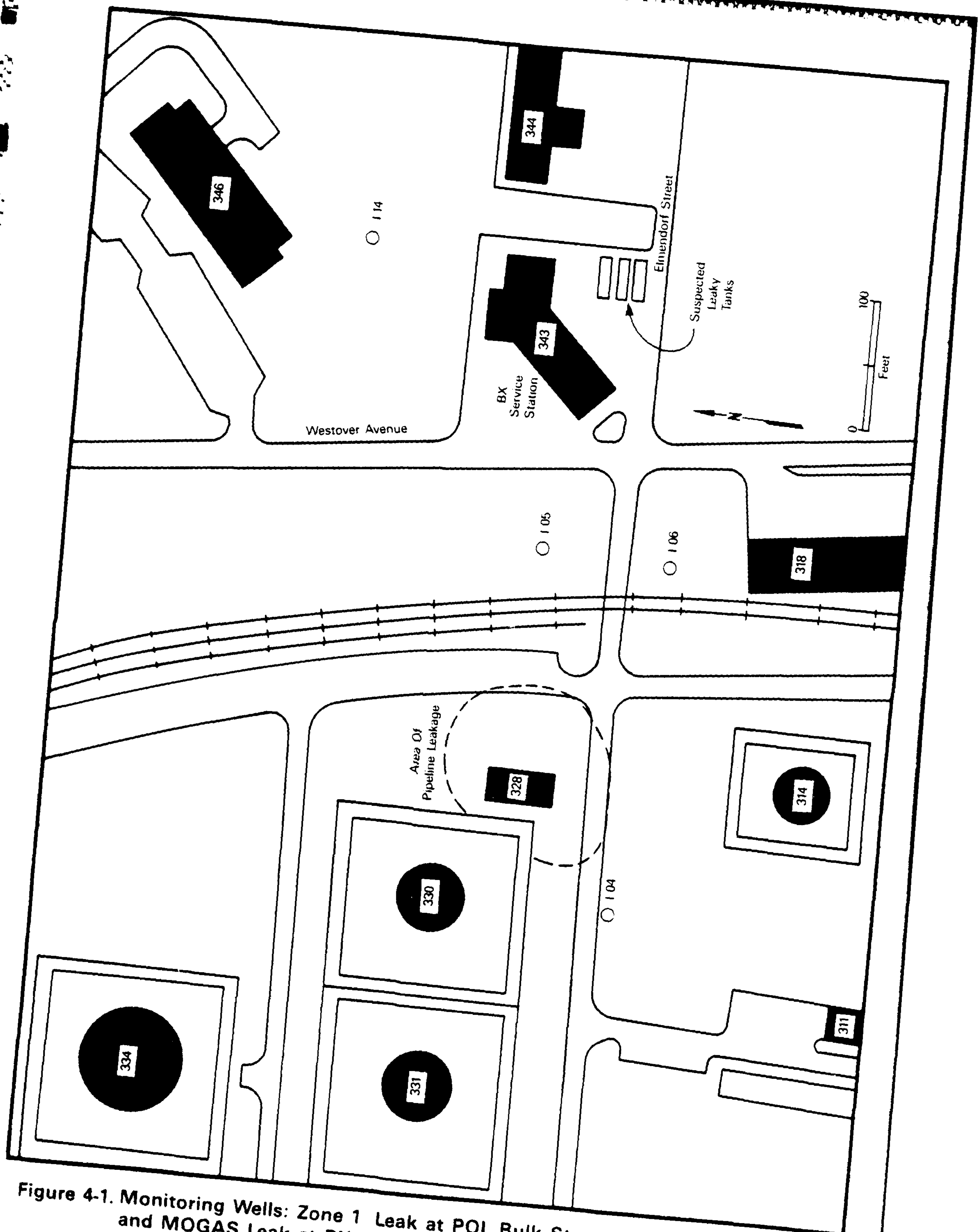


Figure 4-1. Monitoring Wells: Zone 1 Leak at POL Bulk Storage Tank Farm (SP-4) and MOGAS Leak at BX Service Station (SP-6)

TABLE 4-6

ANALYTICAL RESULTS FOR GROUNDWATER
ELECTROPLATING WASTE DISPOSAL SITE (SP-1)
HOMESTEAD AFB

All Results in Parts per Billion (ppb)
Unless Otherwise Noted

ANALYTE	REFERENCE VALUES			GROUNDWATER						
	AFLC[1]	SDWA[2]	AWQC[3]	I-01	I-02	Replicate I-02	I-03	WF1	Replicate WF1	WF2
PH (Field)	--	--	6.7-8.0	6.8	6.8	6.8	-	6.8	6.8	6.7
Temp (°C) (Field)	--	--	24.4	29	24	24	29	245	24.5	24
Specific Conductance umhos/cm (Field)	--	--	435	420	420	420	430	690	690	460
Cadmium	10.	10.	9.	0.2	0.2	<0.2	0.4	<0.2	<0.2	<0.2
Total Chromium	50.	50.	20.	19.7	<0.5	<0.5	<0.5	0.7	0.8	<0.5
Hexavalent Chromium	50.	NS[4]	50	0.3	<0.1	<0.1	1.7	0.3	0.2	<0.1
Copper	20.	1000.	2.	4.2	5.3	4.8	7.0	1.9	1.8	4.1
Lead	20.	50.	21.	7.8	6.8	9.0	5.7	2.3	3.7	2.7
Nickel	100.	NS	22.	10.6	10.8	9.2	16.9	<5.0	<5.0	<5.0
Zinc	50.	5000.	60.	15.1	16.3	15.7	16.3	18.8	16.7	32.5
Cyanide	10.	NS	10.	<5.0	<5.0	<5.0	<5.0	12.0	9.	7.0

[1] Air Force Levels of Concern

[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)

[3] Ambient Water Quality Criteria

[4] No Standard

TABLE 4-7

ANALYTICAL RESULTS FOR SOILS AND SEDIMENTS
ELECTROPLATING WASTE DISPOSAL SITE (SP-10)
HOMESTEAD AFB

All Results in Parts per Million (ppm)
Unless Otherwise Noted

	REFERENCE VALUES			SOIL					SEDIMENTS		
ANALYTE	AFLC[1]	ASQC[2]	NLS[3]	SL-1	SL-2	SL-3	SL-4	Replicate SL-4	SD-1	SD-2	Replicate SD-21
Cadmium		0.01	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Total Chromium	5.00	0.10	25.00	0.07	0.02	0.03	0.04	0.04	0.02	0.09	0.07
Copper		0.23	50.00	0.08	0.02	0.03	0.11	0.12	0.01	0.04	0.05
Lead	2.00	0.3 7	100.00	0.17	0.09	0.11	0.21	0.20	0.11	1.18	1.17
Nickel		0.02	500.00	0.02	0.01	0.04	0.05	0.04	0.00	0.01	0.01
Zinc		0.18	150.00	0.72	0.12	0.15	0.28	0.24	0.13	0.92	0.80
Cyanide		1.00		1.30	0.60	0.70	0.80	0.80	0.60	3.00	3.90

[1] Air Force Level of Concern

[2] Ambient Soil Quality Criteria

[3] Normal Level in Soils

- Lead: All below AWQC and drinking water standard
- Nickel: all values below AWQC. There is no drinking water standard
- Zinc: all values below AWQC and drinking water standard
- Cyanide: All values were below AWQC except one value (12.0 ppm at WF1). There is no drinking water standard.

The soils and sediment results for site SP-1 can be summarized as follows:

- Cadmium: all values below ASQC
- Total chromium: all values below ASQC
- Copper: all values below ASQC (SL-1, SL-4)
- Lead: one value (1.18 ppm at SD-2) well above ASQC, but below AFLC
- Nickel: two values (0.04 ppm at SL-3 and 0.05 ppm at SL-4) above ASQC, but below NLS
- Zinc: three values (0,72 ppm at SL-1, 0.28 ppm at SL-4, and 0.92 ppm at SD-2) above ASQC, but below NLS
- Cyanide: two values (1.3 ppm at SL-1 and 3.0 ppm at SD-2) above ASQC.

The pattern of contamination found at this site is about as expected from a 30-year-old electroplating waste disposal site. Measurable levels of heavy metals were found in the groundwater, but the drinking water standards were not exceeded. The majority of the contamination is concentrated in the soils and sediments, with one or more of the following: lead, nickel, zinc, and cyanide exceeding ASQC at four locations (SL-1, SL-3, SL-4, and SD-2). The measured values for lead, nickel, zinc, and cyanide which exceed ASQC are well below the normal levels in soils (NLS), however, which signifies that the present concentrations of these heavy metals in the soils and sediments do not pose a threat to human health. These results show that the contaminants are strongly sorbed to the soils and sediments, and not entering groundwater to a great degree. The more soluble components of the wastes have either been degraded or flushed from the area via groundwater or surface drainage. The cyanides present are likely in the form of cyanide-metal compounds or complexes that resist degradation. This site does not appear to be the source of the elevated level of cyanide found at Well Field 1 (12.0 ppm). This value is not explainable by the data generated by this study.

4.2.3.2 Zone 1: Leak at POL Bulk Storage Tank Farm (SP-4) and MOGAS Leak at BX Service Station (SP-6)

These two sites, shown in Figure 4-2, are combined into a single zone for this discussion because they are close to one another and the contaminants (JP-4 and leaded gasoline) involved are similar. Also, the lead analysis, chosen to differentiate between the two contaminants, was incapable of doing so. Groundwater samples were collected from four new monitoring wells (I-04, I-05, I-06, I-14) and from production Well No. 10 in Well Field 2. These were analyzed for oil and grease, TOX, TOC, and total lead. The results, shown in Table 4-8, can be summarized as follows:

- Oil and Grease: significant levels [i.e. >1 mg/l (ppm)] found in two wells (I-04 and I-05); no background levels available
- TOX: no significant levels [i.e. >.10 mg/l (ppm)] found in any well
- TOC: significant levels [i.e. >10 mg/l (ppm) which is the AWQC] found in two wells (I-04 and I-05)
- Total Lead: significant levels [i.e. >10 ug/l (ppb) which is the AWQC] found in two wells (I-04 and I-14); levels found in I-05 approach 10 ug/l (ppb); drinking water standard not exceeded.

Specific conductance values over twice the AWQC were found in Wells I-05 and I-06. These correspond to low points in the water table and are indicative of saltwater intrusion. The mechanism by which this is possible, however, is not evident based on currently available data. Wells I-04 and I-14 both have water levels below sea level, as do I-05 and I-06, but do not show their high specific conductance values.

The significance of these data is difficult to determine, both because all wells are contaminated (i.e., no site-specific background data available), and because the contamination and groundwater flow have variable patterns. As shown in Table 4-8, Wells I-04 and I-05 are the most contaminated with oil and grease. Wells I-14 and I-04 are the most contaminated with TOC and total lead. These data indicate that we are seeing evidence of two separate sources; one near I-04 and one near I-14. However, the total lead levels in I-04 and I-14 are very close to one another, and do not identify one source as being related to leaded gasoline and one to JP-4. Consequently, it is not

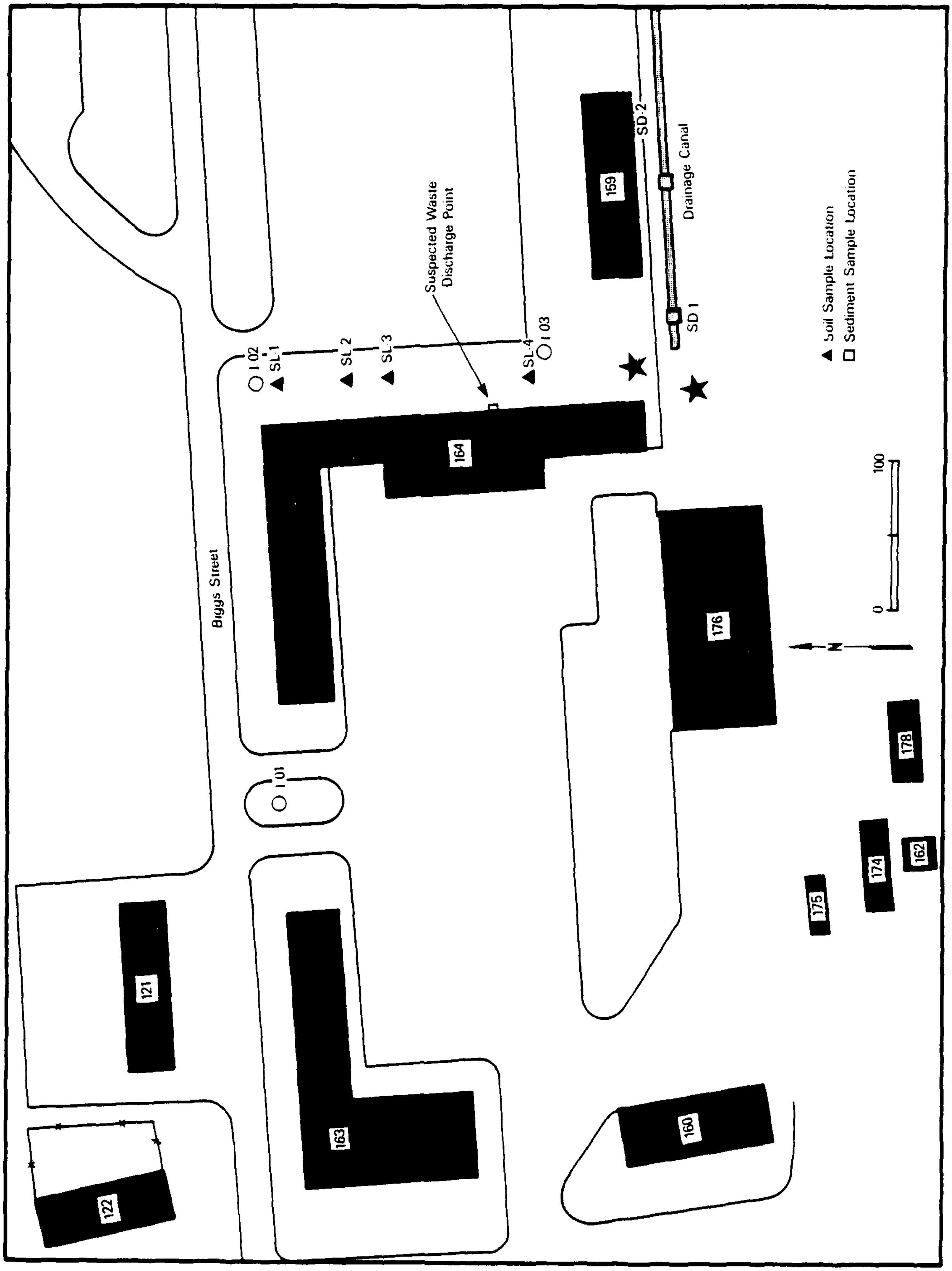


Figure 4-2. Sampling Locations: Electroplating Waste Disposal Site (SP-1)

TABLE 4-8

ANALYTICAL RESULTS:
LEAK AT POL BULK STORAGE TANK FARM (SP-4)
AND MOGAS LEAK AT BX SERVICE STATION (SP-6)
HOMESTEAD AFB

Analyte	Reference Values			Groundwater					
	AFLC[1]	SDWA[2]	AWQC[4]	I-04	I-05	I-06	Replicate I-06	I-14	WF2
pH (Field)		6.5-8.5	6.7-8.0	6.7	6.6	6.8	6.8	6.7	6.7
Temp °C (Field)		NS[3]	24.4	24	24	23	23	23	24
Specific Conductance umhos/cm (Field)		NS	435.0	840	1170	1120	1120	420	460
Oil & Grease (ppm)	0.10	NS	1.00	5.19	4.29	0.47	<0.10	0.83	<0.10
Total Organic Halogens (ppm)	0.01	NS	0.10	0.044	0.10	0.049	0.052	0.036	0.039
Total Organic Carbon (ppm)	1.00	NS	10.00	37	19	10	12	47	5.4
Total Lead (ppb)				13.3	9.47	2.22	No Analysis	15.9	2.66

[1] Air Force Levels of Concern
[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)
[3] No Standard
[4] Ambient Water Quality Criteria

possible at this stage to determine if the contamination found is attributable to the confirmed JP-4 leak alone or to both it and the unconfirmed leak of leaded gasoline.

4.2.3.3 Oil Spills at Aircraft Washrack (SP-7)

Three new groundwater monitoring wells (I-07, I-08, and I-09) were installed around this site, as shown in Figure 4-3. The results of the oil and grease, TOX, and TOC analyses are shown in Table 4-9. These results can be summarized as follows:

- Oil and Grease: significant levels (>1 mg/l [ppm]) found in only one well (I-09), but this well is so contaminated that the sample separated into two fractions. The partially diluted, floating fraction had 732,000 mg/l (ppm) (73.2 percent) oil and grease, while the water fraction had 6.49 mg/l (ppm)
- TOX: no significant contamination found
- TOC: significant contamination found in all three wells, with I-08 having the highest.

These data show gross contamination in all three wells, so the boundaries of the contamination plume are unknown. A body of floating contaminants exists in the vicinity of Well I-09. This contamination appears to be primarily oil and fuel related, with no significant evidence of chlorinated organic solvents, as indicated by the insignificant TOX levels.

4.2.3.4 Fire Protection Training Area No. 3 (FPTA-3)

Three new groundwater monitoring wells (I-10, I-11, and I-12) were installed to assess contamination at this site. These are shown in Figure 4-4. Results of the oil and grease, TOX and TOC analyses are shown in Table 4-10. These can be summarized as follows:

- Oil and Grease: significant levels (>1 mg/l [ppm]) found in one well (I-12)
- TOX: no significant levels found
- TOC: significant levels (>10 mg/l [ppm]) found in all three wells.

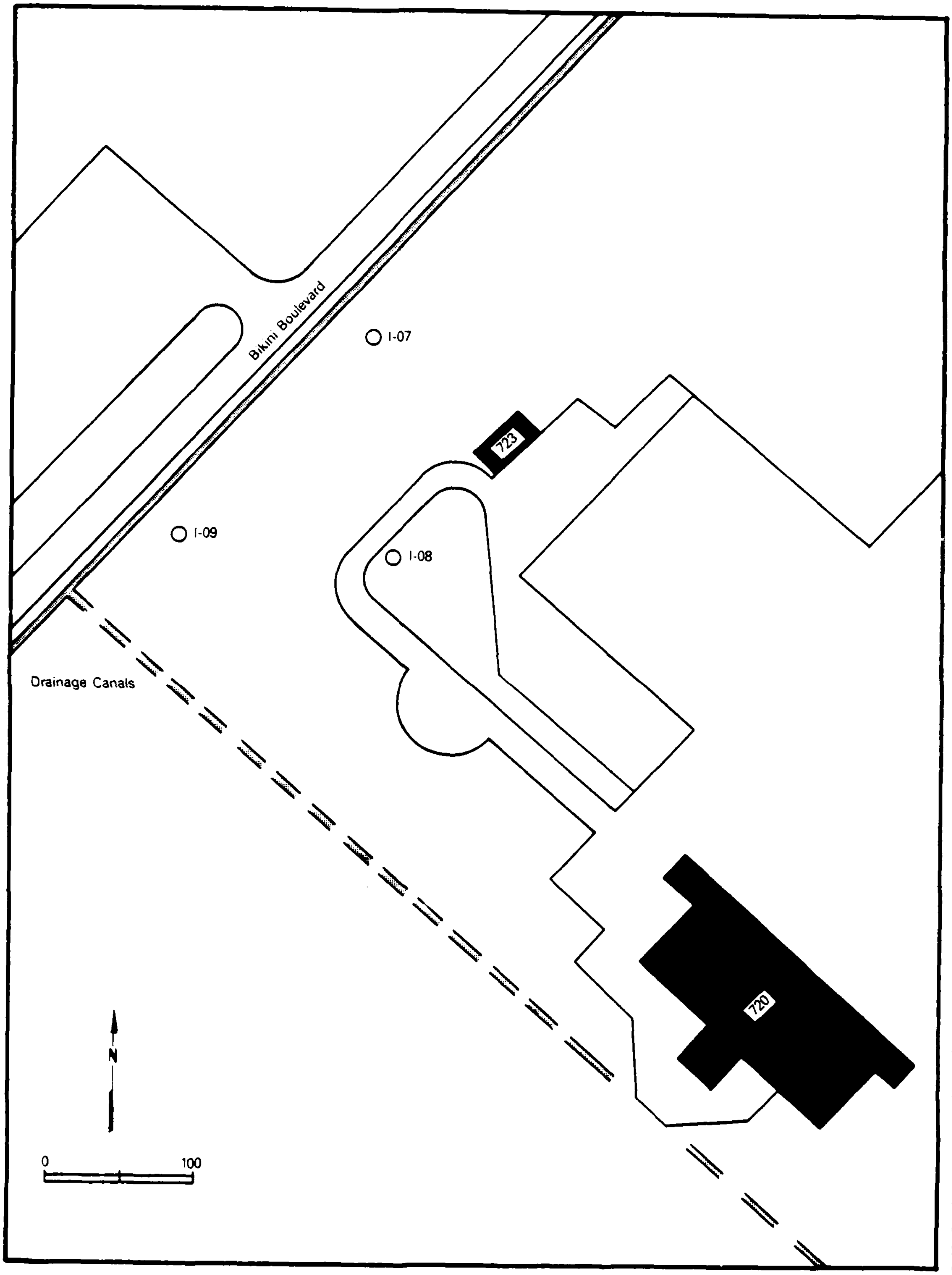


Figure 4-3. Monitoring Wells: Oil Spills at Aircraft Washrack (SP-7)

TABLE 4-9

ANALYTICAL RESULTS:
OIL SPILL AT AIRCRAFT WASHRACK (SP-7)
HOMESTEAD AFB

Analyte	Reference Values			Groundwater			
	AFLC[1]	SDWA[2]	AWQC[4]	I-07	I-08	I-09	I-09[5]
pH (Field)		6.5-8.5	6.7-8.0	6.4	6.4	6.6	
Temp (°C) (Field)		NS[3]	24.4	16	16	15	
Specific Conductance umhos/cm (Field)		NS	435.0	320	340	380	
Oil & Grease (ppm)	0.10	NS	1.00	0.15	0.51	6.49	732000
Total Organic Halogens (ppm)	0.01	NS	0.10	0.01	0.02	0.03	
Total Organic Carbon (ppm)	1.00	NS	10.00	93	170	62	

[1] Air Force Levels of Concern
[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)
[3] No Standard
[4] Ambient Water Quality Criteria
[5] Partially diluted on phase over aqueous phase of Sample I-09 was analyzed as a separate sample

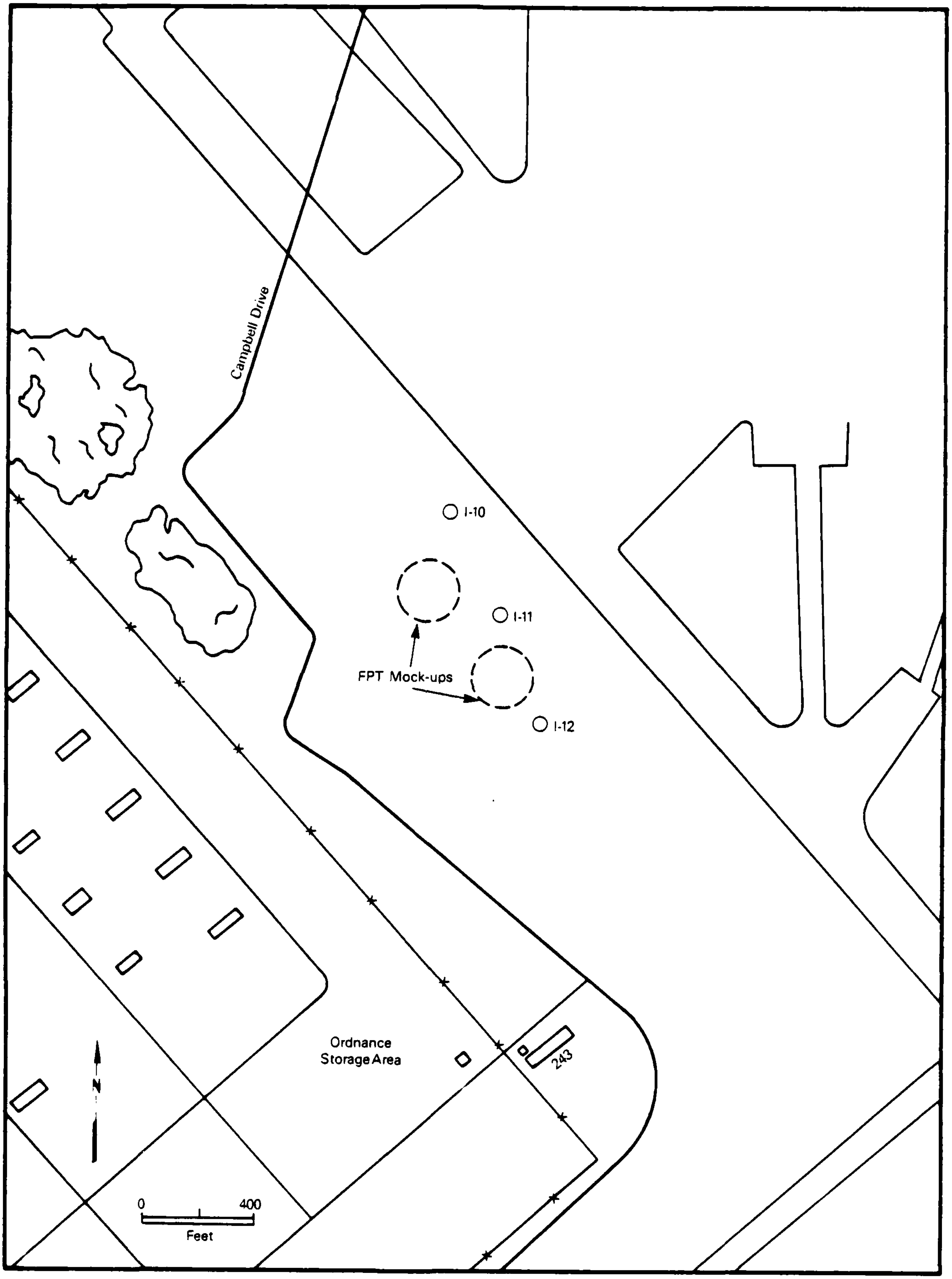


Figure 4-4. Monitoring Wells: Fire Protection Training Area No. 3 (FPTA-3)

TABLE 4-10

ANALYTICAL RESULTS:
FIRE PROTECTION TRAINING AREA NO. 3 (FPTA-3)
HOMESTEAD AFB

Analyte	Reference Levels			Groundwater			
	AFLC[1]	SDWA[2]	AWQC[4]	I-10	I-11	I-11	I-12
pH (Field)		6.5-8.5	6.7-8.0	6.6	6.8	6.8	
Temp (°C) (Field)		NS[3]	24.4	17	22	22	23
Specific Conductance umhos/cm (Field)		NS	435.0	200	320	320	370
Oil & Grease (ppm)	0.10	NS	1.00	0.16	0.18	<0.10	2.59
Total Organic Halogens (ppm)	0.01	NS	0.10	<0.01	0.02	0.02	0.02
Total Organic Carbon (ppm)	1.00	NS	10.00	98	64	58	90

[1] Air Force Levels of Concern
[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)
[3] No Standard
[4] Ambient Water Quality Criteria

These data show that the site is quite contaminated with fuel (in the vicinity of I-12), non-specified organic carbons, and fire fighting foam, the presence of the latter based on visual evidence of foaming seen during well development and purging and on TOC levels. Because all of the wells show contamination, the plume boundaries are not definable at this stage.

4.2.3.5 Fire Protection Training Area No. 2 (FPTA-2)

One new groundwater monitoring well (I-13) was installed to the southeast (downgradient) of the suspected location of this site. This well, and a fire fighting supply well (termed Well 248) located just northwest of Building 248 within the Ordnance Storage Area, were sampled for oil and grease, TOX, and TOC. These wells and the suspected site location are shown in Figure 4-5. The analytical results are shown in Table 4-11. These results can be summarized as follows:

- Oil and Grease: no significant levels found
- TOX: significant levels found only in the downgradient well (I-13)
- TOC: levels found in the downgradient well (I-13) are elevated over the upgradient well (248) but are below AWQC; not considered significant.

Contamination is confirmed in the vicinity of this site by the presence of significant TOX values in I-13. This data point indicates contamination by some chlorinated organic compound, quite possibly a solvent that was contained in wastes used for fire fighting training. It is also possible that it results from organochlorine pesticides used on the base. More detailed analyses are needed to fully explain this data point.

4.2.3.6 Entomology Storage Area (P-2)

Two new groundwater monitoring wells (I-15 and I-16) were installed at this site, one upgradient and one downgradient. These are shown in Figure 4-6. A total of 17 specific pesticides, both insecticides and herbicides, were analyzed as shown in Table 4-12. None of these pesticides were detected at this site.

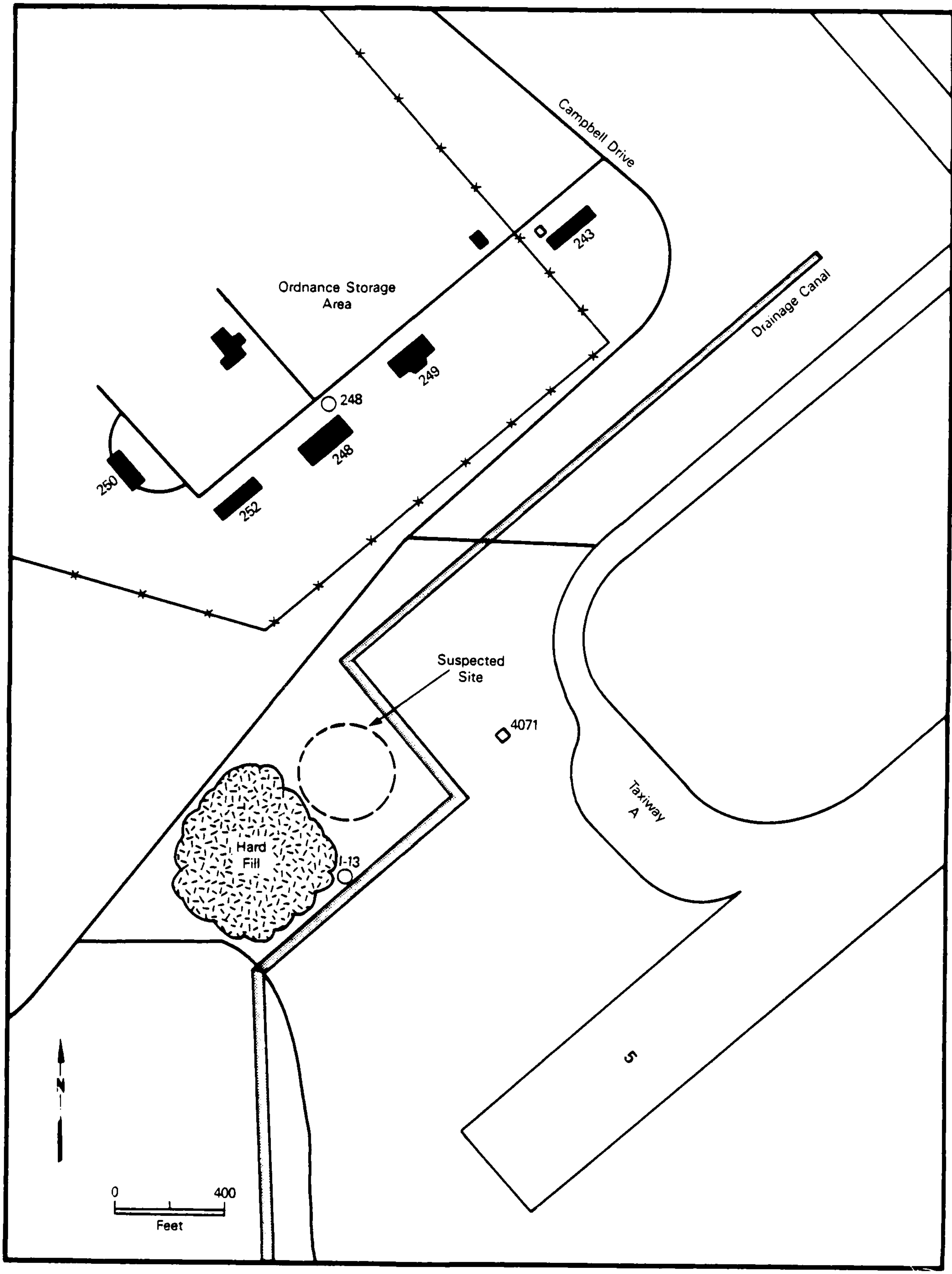


Figure 4-5. Monitoring Wells: Fire Protection Training Area No. 2 (FPTA-2)

TABLE 4-11

ANALYTICAL RESULTS:
FIRE PROTECTION TRAINING AREA NO. 2 (FPTA-2)
HOMESTEAD AFB

Analyte	Reference Values			Groundwater	
	AFLC[1]	SDWA[2]	AWQC[4]	I-13	248
pH (Field)		6.5-8.5	6.7-8.0	6.6	6.7
Temp ('C) (Field)		NS[3]	24.4	24	24.5
Specific Conductance umhos/cm (Field)		NS	435.0	590	550
Oil & Grease (ppm)	0.10	NS	1.0	0.18	<0.10
Total Organic Halogens (ppm)	0.01	NS	0.10	2.2	0.03
Total Organic Carbon (ppm)	1.00	NS	10.00	5.6	2.2

[1]Air Force Levels of Concern

[2]Safe Drinking Water Act, 1974 (Also Florida State Water Standards)

[3]No Standard

[4]Ambient Water Quality Criteria

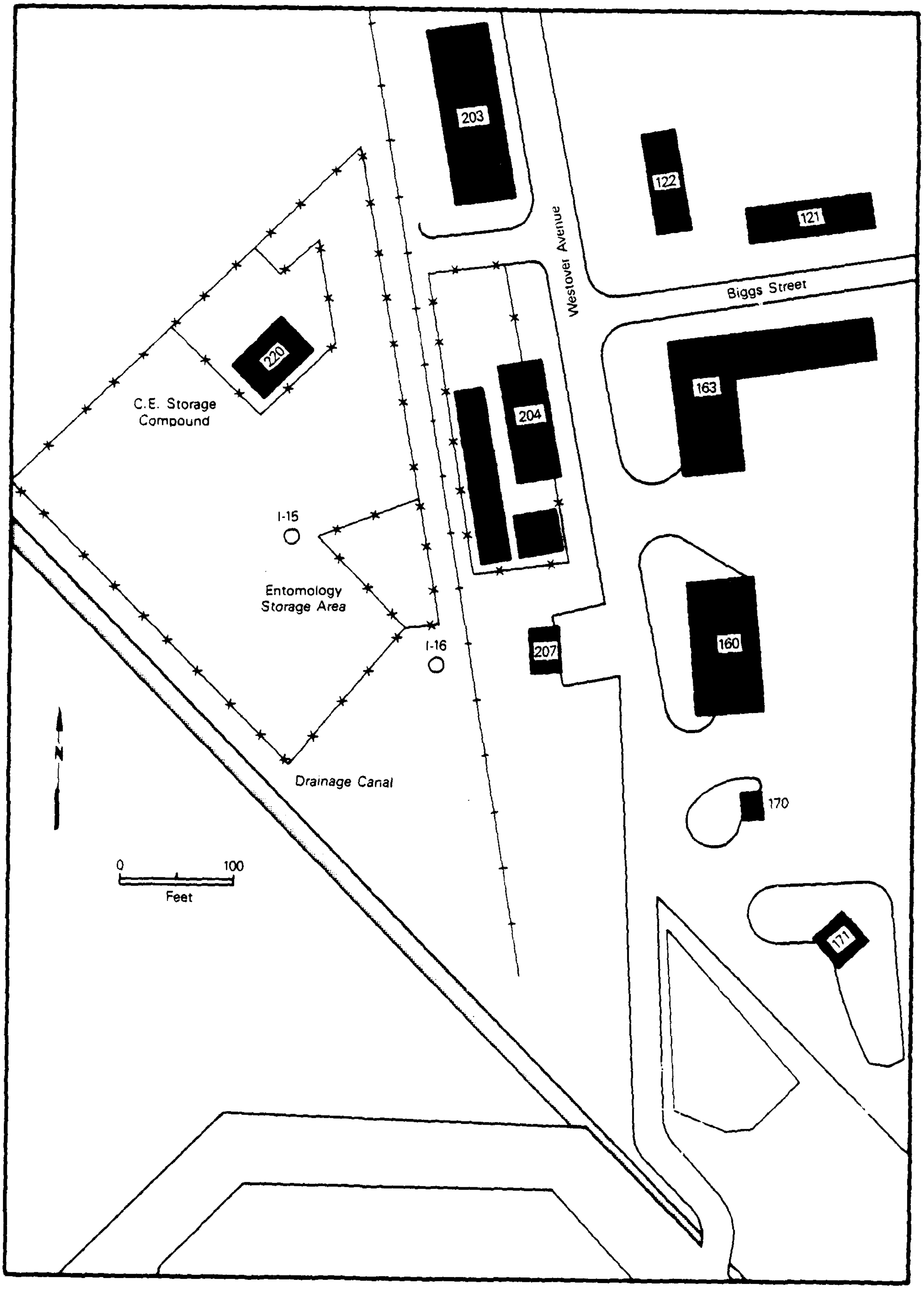


Figure 4-6. Monitoring Wells: Entomology Storage Area (P-2)

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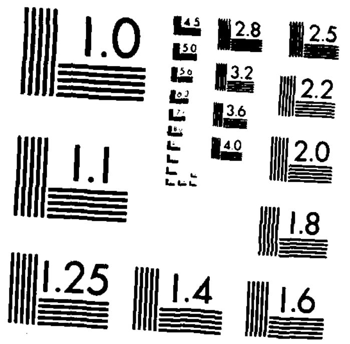


MICROCOPY RESOLUTION TEST

NATIONAL BUREAU OF STANDARDS

TABLE 4-12

ANALYTICAL RESULTS:
ENTOMOLOGY STORAGE AREA (P-2)
HOMESTEAD AFB

Analyte	Reference Values			Groundwater Levels					
	AFLC[1]	SDWA[2]	AWQC[4]	I-15	I-16	Replicate I-16	WFI	Replicate WFI	WF2
pH (Field)		6.5-8.5	6.7-8.0	6.5	6.7	6.7	6.8	6.8	6.7
Temp °C (Field)		NS[3]	24.4	15	22	22	24.5	24.5	24
Specific Conductance umhos/cm (Field)		NS	435.0	460	360	360	690	690	460
Pesticides (ppb)									
Aldrin	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
DDD	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
DDT	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dieldrin	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Endrin	0.02	0.2	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor Epoxide	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lindane	0.01	4.0	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor	0.20	100.0	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toxaphene	1.00	5.0	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Diazinon	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Malathion	0.10	NS	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Parathion	0.02	NS	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-D	0.06	100.0	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-T	0.06	NS	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-TP (Silvex)	0.06	10.0	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Sevin	1.00	NS	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

[1]Air Force Levels of Concern

[2]Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)

[3]No Standard

[4]Ambient Water Quality Criteria

Based on these data, no groundwater contamination has occurred at this site.

4.2.3.7 Oil Leakage Behind Motor Pool (SP-2)

As shown in Figure 4-7, one new groundwater monitoring well (I-17), located just south of the Motor Pool (Building 312), was installed at this site. It was sampled for oil and grease and total lead, as shown in Table 4-13. The oil and grease level was below the detection limit. The total lead value was below the ASQC. Four soil and two sediment samples were collected immediately east of the motor pool fence line, in an area with visible patches of oil contamination. These were also analyzed for oil and grease and total lead as shown in Table 4-14. Soil samples SL-5 and SL-6 were collected from points where contamination was visibly evident. At the other two soil sampling points, no contamination was visible.

Although no significant groundwater contamination was found, all soil and sediment samples were found to be contaminated by oil and grease. Two of the soil samples (SL-5 and SL-6) and both of the sediment samples had lead values which exceeded ASQC, but were well below the normal level in soils (NLS). Consequently, these lead concentrations in the soils do not pose a threat to human health. Oil and grease and lead can be expected to be sorbed to the soil and sediment particles, and relatively immobilized. The relative magnitude of these contaminants migrating from the site via surface water (canals) could not be assessed because the nearby drainages were dry.

4.2.3.8 Leak at Pump Station No. 9 (SP-5)

Two new groundwater monitoring wells (I-18 and I-19) were installed at this site, as shown in Figure 4-8. Both wells were sampled for TOX and TOC, and only Well I-19 was sampled for oil and grease. Well I-18 was not sampled for oil and grease because six-tenths of a foot of fuel was found floating on the groundwater at this location. A sample of this fuel was collected by the base Bioenvironmental Engineer and sent to the Energy Management Laboratory at MacDill AFB, Florida, for analysis. The results of the groundwater analyses are shown in Table 4-15. The fuel analysis is summarized in Table 4-16. The USAF Energy Management Laboratory report

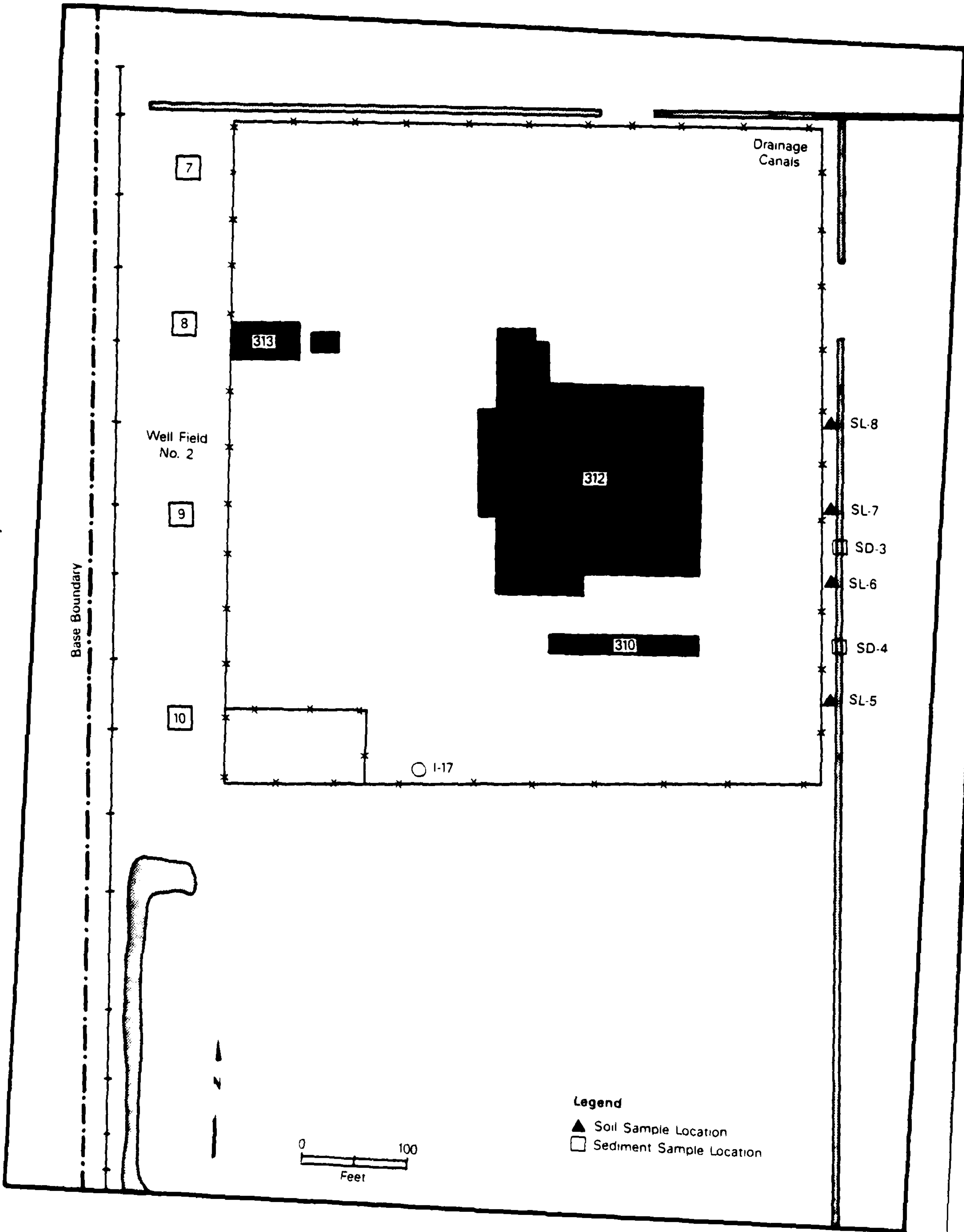


Figure 4-7. Sampling Locations: Oil Leakage Behind Motor Pool (SP-2)

TABLE 4-13

ANALYTICAL RESULTS FOR GROUNDWATER
OIL LEAKAGE BEHIND MOTOR POOL (SP-2)
HOMESTEAD AFB

	Reference Values			Groundwater
Analyte	AFLC[1]	SDWA[2]	AWQC[4]	I-17
pH Field		6.5-8.5	6.7-8.0	6.8
Temp °C (Field)		NS[3]	24.4	23.
Specific Conductance umhos/cm (Field)		NS	435.0	360.
Oil & Grease (ppm)	0.10	NS	1.00	<0.10
Total Lead (ppb)	20.0	50.0	21.0	7.74

[1] Air Force Levels of Concern

[2] Safe Drinking Water Act, 1974 (Also Florida State Drinking Water Standards)

[3] No Standards

[4] Ambient Water Quality Criteria

TABLE 4-14

ANALYTICAL RESULTS FOR SOILS AND SEDIMENTS
OIL LEAKAGE BEHIND MOTOR POOL (SP-2)
HOMESTEAD AFB

	Reference Values			Soils					Sediments	
Analyte	AFLC[1]	ASQC[2]	NLS[3]	SL-5	Replicate SL-5	SL-6	SL-7	SL-8	SD-3	SD-4
Oil & Grease (ppm)	100.00	10.0		21900	26600	1540	586	983	749	822
Total Lead (ppm)	2.00	0.37	100.00	0.62	0.23	0.23	0.72	0/19	0.19	1.07

[1]Air Force Level of Concern

[2]Ambient Soil Quality Criteria

[3]Normal Level in Soils

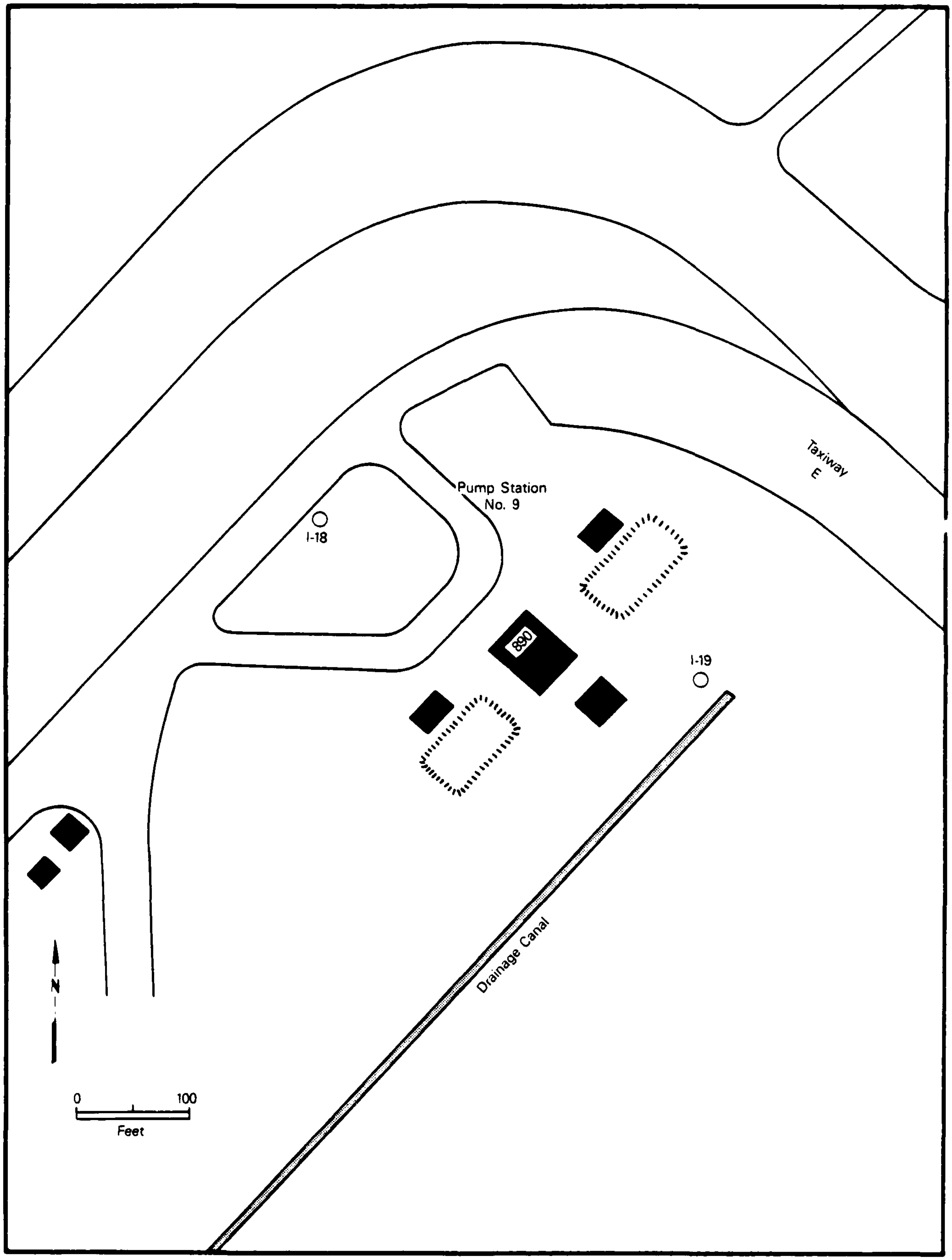


Figure 4-8. Monitoring Wells: Leak at Pump Station No. 9 (SP-5)

TABLE 4-15

ANALYTICAL RESULTS:
LEAK AT PUMP STATION NO. 9 (SP-5)

Analyte	Reference Values			Groundwater		
	AFLC[1]	SDWA[2]	AWQC[4]	I-18	I-19	Replicate I-19
pH (Field)		6.5-8.5	6.7-8.0	6.8	6.8	6.8
Temp (°C) (Field)		NS[3]	24.4	26	24	24
Specific Conductance umhos/cm (Field)		NS	435.0	830	780	780
Oil & Grease (ppm)	0.10	NS	1.00	No Analysis	0.11	0.13
Total Organic Halogens (ppm)	0.01	NS	0.10	0.05	0.03	0.03
Total Organic Carbon (ppm)	1.00	NS	10.00	22	7.0	9.4

[1] Air Force Levels of Concern
[2] Safe Drinking Water Act, 1974 (Also Florida State Water Standards)
[3] No Standard
[4] Ambient Water Quality Criteria

TABLE 4-16

ANALYSIS OF FUEL (JP-4) SAMPLED FROM WELL I-18

Appearance	Clear
Color	Dark Straw
Odor	Usual
Visible Free Water (Ml/Gal.)	0.0
Existent Gum, MG/100 ml	19.2
Fuel System Icing Inhibitor, Vol. %	0.00
Lead MG/l	16.00

NOTE: Gas chromatograph shows typical pattern of unweathered JP-4 with respect to early-boiling hydrocarbons.

identified the fuel as unweathered JP-4. Since JP-4 contains no lead, the source of the 26.0 ppm of lead in this sample is unknown.

Contamination was confirmed at this site before the first well was completed. The TOC values were twice the AWQC in Well I-18, but below AWQC in I-19. Oil and grease and TOX values for I-19 and the TOX value for I-18 exceeded AFLC, but were below AWQC. These data suggest the contamination exists in the vicinity of Well I-18 as a pool of fuel of unknown size.

4.2.3.9 Residual Pesticide Disposal Area (P-3)

Six soil grab samples were collected from within and near this site, at the locations shown in Figure 4-9. These received the 17 pesticide analysis shown in Table 4-17.

Five of the 17 pesticide analytes were detected in these samples. Only one, SL-13, had no pesticides detected. The compounds detected are all organochlorine insecticides of extremely low solubility in water. Consequently, all have great affinity for soil (high adsorption coefficients), reducing their potential for percolating down into the groundwater. These insecticides are all persistent compounds, degraded only after many years in the soil. If they are allowed to enter the groundwater, where degradation is far slower than in soil, they may persist indefinitely. According to Entomology Shop personnel (conversation, 11/84) pesticides were poured on the ground at this site (not just sprayed as indicated in the Phase I Report), therefore, there is a strong possibility that the more mobile compounds have entered the groundwater. Even the low solubility compounds found in soils here could have contaminated the groundwater if applied (poured) in sufficient amounts, given the thin soil and the shallow groundwater in the area.

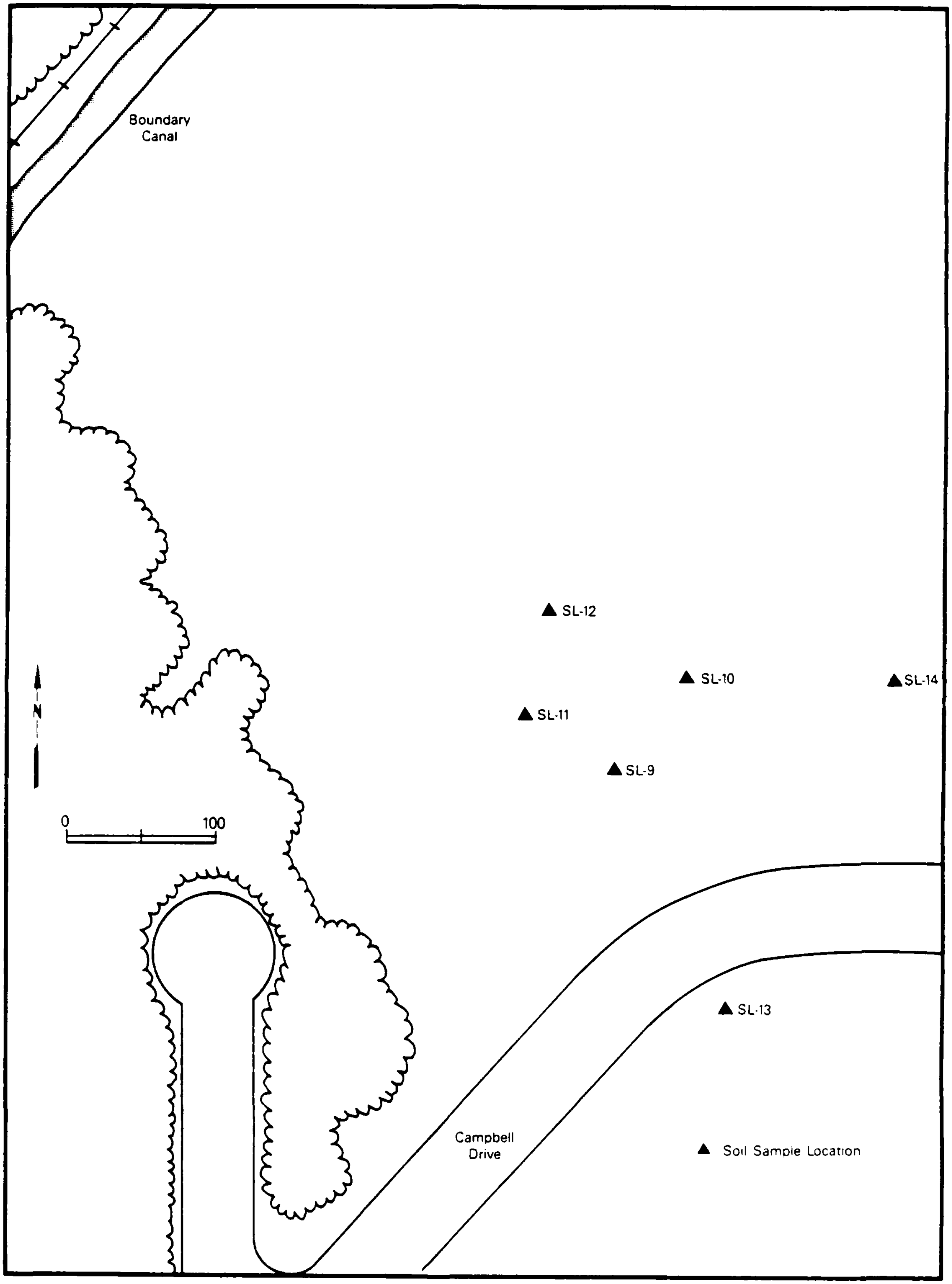


Figure 4-9. Sampling Locations: Residual Pesticide Disposal Area (P-3)

TABLE 4-17

ANALYTICAL RESULTS FOR SOILS
RESIDUAL PESTICIDE DISPOSAL AREA (P-3)
HOMESTEAD AFB

Analytes (ppm)	Reference Values AFLC[1]	ASQC[2]	SL-9	SL-10	SL-11	Replicate SL-11	SL-12	SL-13	SL-14
Aldrin	0.02	0.02	<0.02	<0.02	<0.02	0.04	0.07	<0.02	<0.02
DDD	0.02	0.02	<0.02	0.08/0.08[3]	<0.02	<0.02	<0.02	<0.02	<0.02
DDT	0.02	0.02	0.09	0.67/0.62	0.26	0.20	0.37	<0.02	0.03
Dieldrin	0.02	0.02	<0.02	<0.02	0.04	0.03	0.03	<0.02	<0.02
Endrin	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptachlor Epoxide	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lindane	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor	0.20	0.20	<0.20	0.09/0.12	<0.20	<0.20	0.09	<0.20	<0.20
Toxaphene	1.00	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Diazinon	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Malathion	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Parathion	0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-D	0.06	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
2,4,5-T (Silvex)	0.06	0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Sevin	1.00	1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

[1] Air Force Level of Concern

[2] Ambient Soil Quality Criteria

[3] Analysis Duplicated

5. ALTERNATIVE MEASURES

This section presents the major monitoring alternatives, by site, for Phase II, Stage 2, activities at Homestead AFB. These are alternatives selected to meet the goals of the IRP Phase II by identifying specific contaminants and their sources, where unknown; by assessing the magnitude and extent of contaminant migration from each site, and by assessing the environmental and health risks associated with each site.

5.1 ELECTROPLATING WASTE DISPOSAL SITE (SP-1)

Stage 1 results show that the soils and sediments at this site are contaminated with heavy metals and cyanide. Groundwater is also contaminated with heavy metals but all values are below drinking water standards (for hexavalent chromium, nickel and zinc, which have no drinking water standards, the measured values are close to or below ambient water quality criteria).

There are no data showing uncontaminated groundwater downgradient of the site, therefore the extent of heavy metal contamination in groundwater is unknown. This is further complicated by the fact that values for lead and chromium are higher in the upgradient well than in the two downgradient wells. Also, because surface water samples were unobtainable during Stage 1, this pathway, and the partitioning of contaminants between surface water and sediments could not be evaluated.

5.1.1 <u>Alternative 1 - Resample Existing Wells</u>

Stage 1 sampling revealed a somewhat complicated pattern of groundwater contamination. Well I-03, directly downgradient from the site, is clearly the most contaminated, but I-01, directly upgradient, shows higher levels of lead and chromium. All of these contaminants are present in relatively low concentrations, and an additional sampling round, or preferably a periodic sampling, would help to determine if these values are statistically significant. There is no evidence to indicate that a wider range of analysis, beyond the inorganics used in Stage 1, is required.

5.1.2 Alternative 2 - Install Additional Monitoring Wells

The magnitude of groundwater contamination downgradient of this site is reasonably well known. The extent, however, is not. An additional monitoring well, located southeast of Building 159, would enable us to determine if contaminants are in significant concentrations some 400 feet downgradient of the site or are being attenuated in the groundwater system.

5.1.3 Alternative 3 - Surface Water Sampling

Because Stage 1 was conducted during the driest season, most small base drainage canals, including the one closest to this site, were dry. Sediment samples from this canal show significant levels of chromium, lead, zinc, and cyanide. This canal, however, receives runoff from the site and other areas, including an electrician's storage yard. Additional sampling of canal water (and sediments) and runoff from the contributing drainage areas would determine the contaminant contribution of the site area and whether significant levels of inorganics are migrating from the site via surface water.

5.1.4 Alternative 4 - Additional Soil Sampling

All of the soil samples collected from the swale just east of Building 164 show significant levels of chromium, lead, nickel, zinc, and cyanide. No clean or background soil levels were found. Consequently, the extent of soil contamination is not known. Additional soil samples, collected at greater distances from the site, would help determine this extent. This effort would be hampered by the large areal extent of parking lots in the area, limiting soil-sampling locations, and providing metal-laden runoff to the entire study area.

5.1.5 Alternatives Analysis

The contamination at this site is not of high magnitude and appears to pose no immediate environmental threat. Most contamination is contained in the soils and sediments and not in groundwater. The magnitude of contamination migrating from the site via surface water is not known. At this stage, the most appropriate measures appear to be a combination of alternatives 1 and 3 above. These would determine if the groundwater contamination is statistically significant, and if it is all migrating with the regional gradient. They would also determine if surface water drainage is a migration pathway of concern.

5.2 ZONE 1: LEAK AT POL BULK STORAGE TANK FARM (SP-4) AND MOGAS LEAK AT BX SERVICE STATION (SP-6)

Stage 1 results show significant fuel-related groundwater contamination throughout the area of these two sites. Data were insufficient to determine if the contamination in the zone results from both sites or just from SP-4. Groundwater flow patterns and the exact nature (i.e., specific compounds) of the contamination remain unknown.

5.2.1 Alternative 1 - Resample Existing Wells

Resampling of the existing wells and analyzing for organic Priority Pollutants would identify the specific compounds responsible for the high oil and grease and TOC values found here. These analyses, coupled with analysis for tetraethyl lead, would serve to distinguish between JP-4 contamination and leaded MOGAS contamination. This alternative would not, however, delineate the extent of groundwater contamination in this zone.

5.2.2 Alternative 2 - Conduct Soil Gas Mapping and Install Additional Monitoring Wells

Installation and sampling of additional monitoring wells will be needed to better define the extent of contamination. To site new wells most effectively, a soil gas survey could be conducted. This technique involves establishing a grid on fifty foot centers over the site area and collecting a soil gas sample at each grid node. Analysis of these samples, either by portable gas chromatography or quick turn-around laboratory, has been shown to provide an excellent indication of the areal extent of groundwater contamination by volatile organic fuel components. These data would then be used to site new groundwater monitoring wells. It is estimated that at least six additional wells would be required, given the areal extent of contamination confirmed during Stage 1. These, and the Stage 1 wells, should be sampled and analyzed for volatile organics, using the modified EPA method 624 plus tetraethyl lead to identify the exact contaminants and to distinguish JP-4 related contamination from the leaded MOGAS contamination.

5.2.3 Alternatives Analysis

Given the severity and areal extent of contamination at these sites and their relatively close proximity to Well Field No. 2, additional monitoring of these sites is essential. Stage 1 efforts confirmed contamination but did not provide a complete understanding of the specific contaminants, or of ground-water flow. The extent to which contaminants have migrated from the sites is also unknown. Consequently, alternative 2 above seems most appropriate.

5.3 OIL SPILLS AT AIRCRAFT WASHRACK (SP-7)

Severe contamination was found in all three wells installed during Stage 1. All three were found to be contaminated with oil and grease and TOC; however, all were low in TOX. The oil and grease sample from Well I-09 separated into nearly equal fractions, the upper of which was over 70 percent oil and grease. The exact compounds responsible for this contamination are believed to be fuel-related but are not definitely known. Since all wells are contaminated, the extent of contamination was not determined by the Stage 1 effort.

5.3.1 Alternative 1 - Resample Existing Wells

A resampling of the Stage 1 wells, and analysis for all organic compounds on the Priority Pollutant list, would serve to identify specific compounds present. Although the low TOX values found would indicate that chlorinated organic solvents are not present, the location of this site near paint stripping and painting operations, and its past history, would indicate that other than fuel-related contaminants are present. This alternative would not serve to delineate the extent of contamination at this site.

5.3.2 Alternative 2 - Install Additional Monitoring Wells

The most certain method of delineating the extent of contamination at this site is to install and sample additional monitoring wells. Again, soil gas mapping on a fifty-foot grid should be conducted at this site to delineate the extent of volatile compounds in soil and rock above the water table. This will make for the best possible use of new monitoring wells. Analysis for the organic Priority Pollutants in these and the Stage 1 wells would identify specific contaminants, and serve to better define the contamination plume. It is estimated that a minimum of four additional wells would be required.

5.3.3 Alternative 3 - Sample Surface Water and Sediments

The Stage 1 results indicate that contamination from this site is almost certain to be migrating into the canal that runs between the site and Bikini Drive. This is likely to be a seasonal phenomenon, occurring only during the wetter months. During the spring and early summer, groundwater levels rise and floating contaminants are released into canals. Sampling of the canal running adjacent to the site during the wet season, coupled with sediment sampling, would be required to determine the degree of surface water contaminant migration.

5.3.4 Alternatives Assessment

Based on the goals of the IRP Phase II, and the severe contamination found during Stage 1, additional monitoring of this site is necessary. Therefore, a combination of alternatives 2 and 3 above seem most appropriate. These efforts would determine the specific contaminants involved, help define their areal extent in groundwater, and determine the role played by surface water as a contaminant migration route. This site should be reinvestigated during the wetter season. These data are essential to a complete assessment of the environmental impact of this site.

5.4 FIRE PROTECTION TRAINING AREA NO. 3 (FPTA-3)

TOC contamination was found in all three new wells installed to monitor this site. The farthest downgradient well (I-12) also had significant oil and grease contamination. The oil and grease contamination is likely fuel-related, while the TOC contamination appears to be related to the use of Aqueous Film Forming Foam (AFFF) in fire fighting training. Because none of these three wells is uncontaminated, none of the boundaries of the contaminated area is known. The specific fuel- and AFFF-related contaminants also are not known.

5.4.1 Alternative 1 - Resample Existing Wells

An additional round of sampling of Stage 1 wells, with analysis for all organic Priority Pollutants, would identify the specific contaminants in groundwater at this site. Many of the more serious contaminants, such as benzene, toluene, and xylene, suspected of being present would be detected by the organics analysis. This alternative would serve to better characterize the nature of the contaminant plume, but would not provide additional delineation of its boundaries.

5.4.2 Alternative 2 - Install Additional Monitoring Wells

Additional monitoring wells would be required to further delineate the contaminant plume at this site. Because this site is so large, soil gas mapping should be used to site a minimum of five additional wells at this site. Sampling of these and the Stage 1 wells, with analysis for the volatile organic Priority Pollutants, would serve to both delineate and characterize the plume of contamination at this site. The new wells should be sited to avoid interfering with construction of the new fire training facility planned for the area northeast of Well I-10.

5.4.3 Alternatives Analysis

The goals of the IRP Phase II have not been completely met by the Stage 1 investigation at this site. Contamination in groundwater is confirmed but its exact nature and extent are unknown. Soil contamination is a given at this site because, in the past, fire fighters poured fuel directly on the ground before igniting and extinguishing it. Nonetheless, groundwater contamination is the primary concern here, and more data are needed to fully assess it. Consequently, alternative 2 above seems most appropriate for Stage 2.

5.5 FIRE PROTECTION TRAINING AREA NO. 2 (FPTA-2)

Contamination by TOX was found in the one well installed at this site. The specific compound(s) responsible for this TOX value are not known but are probably to be related to chlorinated solvents contained in wastes once used for training fire fighters or to chlorinated pesticides used in the area. The exact location of this site has not been determined, and it is probably obscured by a large rubble fill west of Well I-13.

5.5.1 Alternative 1 - Resample Existing Wells

Resampling of Well I-13 to analyze for halogenated organics would serve to identify the specific compounds involved in this contamination. Resampling of Well 248 would be unnecessary because no significant contamination was found there. This alternative would not provide further data on the size of the contaminant plume, or on the exact location of the former Fire Protection Training Area.

5.5.2 Alternative 2 - Install Additional Monitoring Wells

The installation and sampling of additional monitoring wells would be needed to delineate the extent of the contaminated groundwater at this site. Analysis for the halogenated Priority Pollutants would identify the compounds responsible for the elevated TOX values. Because the exact location of the site is unknown, a minimum of four additional wells would be required to further define the contaminated area. Siting new wells in this area is complicated by the large rubble fill just west of Well I-13. In some cases, heavy equipment would be required to gain access to well drilling locations.

5.5.3 Alternative 3 - Surface Water and Sediment Sampling

Prior to Stage 1, no need was seen to sample the canal that runs just east of this site. Now that contamination has been confirmed in groundwater adjacent to this canal, sampling of it to define its role as a contaminant pathway is needed. Surface water and associated sediment samples, collected from a minimum of four locations along this canal and analyzed for the halogenated Priority Pollutants, would serve to assess this pathway.

5.5.4 Alternatives Analysis

Chlorinated and other halogenated organic compounds are serious contaminants. Many are resistant to degradation and so persist in the environment. Many are also toxic, thus of considerable concern in a sole-source aquifer like the Biscayne. Consequently, a combination of alternatives 2 and 3 above, which would identify specific contaminants, better define the plume, and characterize the surface water pathway, seems best suited to meeting the IRP Phase II goals.

5.6 ENTOMOLOGY STORAGE AREA (P-2)

No pesticide contamination was found in the two wells installed to monitor this site. Consequently, no Stage 2 monitoring is recommended. None the less, due to the potential for contamination, periodic monitoring of these wells is an alternative worth considering. Also, Well I-16 can be used as an upgradient well to monitor the underground fuel storage tanks located west of Building 207, should this be required.

5.7 OIL LEAKAGE BEHIND MOTOR POOL (SP-2)

No groundwater contamination, but significant soil and sediment contamination, was found at this site. The Stage 1 results reveal, however, that Well I-17 is not placed to intercept groundwater contaminated by this site. This is due to Well Field No. 2 having less influence on groundwater flow than originally estimated, and due to the unexplained groundwater flow east of the Motor Pool, near the BX Service Station. Resampling of Stage 1 Well I-17 is not, therefore, considered an appropriate alternative for this site.

5.7.1 Alternative 1 - Install Additional Monitoring Wells

The installation and sampling of additional monitoring wells southeast and east of this site would be required to confirm or deny groundwater contamination at this site. A minimum of two would be required. These would have to be sited fairly close to the Motor Pool compound to avoid detection of only contamination from the POL Tank Farm Area (SP-4). These new wells could be analyzed for the Stage 1 scan parameters, followed by more complete analysis if contamination is confirmed.

5.7.2 Alternative 2 - Surface Water Sampling

Sediment samples collected from the canal just east of the Motor Pool compound indicate significant oil and grease and lead contamination. Conditions are such that this canal carries water only during the wetter seasons, and no water samples could be collected during Stage 1. Thus, no full evaluation of surface water as a contaminant pathway was possible. Doubtless, some surface water contamination is occurring, given the high contaminant concentrations in soils adjacent to, and sediments within the canal. A minimum of four surface water and four sediment samples would be required.

5.7.3 Alternatives Analysis

Of the 10 sites investigated during Stage 1, this is the closest to Well Field No. 2, which supplies a portion of the Homestead AFB drinking water. Although Well Field 2 is no longer a primary source for the base's drinking water supply (see Section 2.8), a more thorough characterization of the local groundwater quality is advisable, to accurately characterize the potential for contamination reaching Well Field 2. Because of the close relationship between groundwater and surface water in this region, surface water sampling should also take place. Thus, both alternatives 1 and 2 above seem appropriate.

5.8 LEAK AT PUMP STATION NO. 9 (SP-5)

The Stage 1 investigation has confirmed gross JP-4 contamination at this site, apparently existing as a pool or pools of fuel floating on the groundwater in the vicinity of Well I-18. The groundwater beneath this fuel is certain to be contaminated with the more soluble components of JP-4, such as benzene and toluene. The extent of the fuel contamination here is not known, but given a thickness of 0.6 feet of floating fuel at Well I-18, a fairly large area is likely to be contaminated. Given that Well I-19 showed no significant contamination, and I-18 is proven to be contaminated with JP-4, additional sampling of these wells is considered an option only as part of a larger scale monitoring program.

5.8.1 Alternative 1 - Install Additional Monitoring Wells

Additional groundwater monitoring at this site appears necessary. Well installation should be preceded by soil gas mapping in this area to first delineate the contaminated area. These data would then be used to site an additional five monitoring wells. These wells and the two Stage 1 wells would then be sampled and analyzed for volatile organic priority pollutants.

5.8.2 Alternative 2 - Surface Water and Sediment Sampling

The canal that runs just southeast of Pump Station No. 9 is a potential contaminant pathway. No visible contamination was evident in this canal during either the Presurvey or Stage 1. Nonetheless, soluble components of JP-4 could easily be migrating to and through this canal without leaving visible evidence. A minimum of four canal water samples and associated sediment samples would be required. These should be analyzed for the volatile organic Priority Pollutants which would detect the more soluble JP-4 components like benzene, toluene, and xylene.

5.8.3 Alternatives Analysis

The JP-4 found in Well I-18 is at an elevation slightly higher (0.25 feet) than the water level in I-19, which is approximately the same as the elevation of surface water in the canal. Contamination should be moving in that direction, though its direction is not possible to determine based on only two elevations. Additional monitoring of both surface water and groundwater is needed to determine the extent of groundwater contamination by both JP-4 and its component compounds, and to determine if these contaminants are entering and migrating via surface water. Alternatives 1 and 2 above appear appropriate for meeting these IRP Phase II goals.

5.9 RESIDUAL PESTICIDE DISPOSAL AREA (P-3)

Five of the six soil pesticides samples collected from this site were found to be contaminated with organochlorine pesticides. The one uncontaminated sample (SL-13) was collected outside the actual disposal area. These are very persistent compounds in soils, and extremely persistent in groundwater. The banned insecticide DDT was found in concentrations over 600 ug/l (PPB) at least 2 years after disposal activities ceased. This indicates a serious and persistent soil contamination problem in the area, and suggests that groundwater is also contaminated.

5.9.1 Alternative 1 - Install Monitoring Wells

The installation and sampling of groundwater monitoring wells in and around this site would be required to confirm or deny the existence of groundwater contamination. This site has extremely thin soil cover, as does most of Homestead AFB, and thus affords little attenuation capacity even for compounds with a high absorption coefficient. A minimum of four monitoring wells, one upgradient and three downgradient, would be required because of the size of the site and the degree of diffusion encountered elsewhere during Stage 1. Samples from these wells should be analyzed for all pesticides on the Priority Pollutants List.

5.9.2 Alternative 2 - Additional Soil Sampling

Only one of the six soil samples collected during Stage 1 was found to be uncontaminated. Therefore, the extent of the pesticide contamination in soil is not well defined. Additional samples, collected outside the grid of locations sampled during Stage 1 and analyzed for Priority Pollutant pesticides, would be needed to better define the areal extent of soil contamination. An estimated 10 additional samples would be required.

5.9.3 Alternatives Analysis

Stage 1 results have confirmed soil contamination at this site and strongly suggest that groundwater, too, is contaminated. The confirmation or denial of groundwater contamination is extremely important here, as is determination of the extent of soil contamination. Therefore, alternatives 1 and 2 above seem most appropriate for meeting the Phase II goals for this site.

6. RECOMMENDATIONS

This section presents recommendations for Stage 2 work, based on the results of Stage 1. These recommendations are presented by category, with Category I including sites that require no further IRP-related action. Only one site, the Entomology Storage Area (P-2), is assigned to Category I. Category II sites include those that are recommended for Phase II, Stage 2, work and are presented in order of recommended priority. This category includes all of the remaining sites. None of these sites has been sufficiently characterized by Stage 1 to be ready for Phase IV; thus, there are no true Category III sites. Nonetheless, the two sites in Category II having the highest priority are recommended for immediate waste removal actions to halt further environmental impairment while Stage 2 is being conducted and to reduce the clean-up effort under Phase IV. Because none of the sites is ready for Phase IV, the recommendations made below are for the most part a reiteration of the alternatives assessments in Section 5.

6.1 CATEGORY I SITES

This category contains the one site for which the Stage 1 results reveal no further monitoring is required and no further IRP work is anticipated.

6.1.1 Entomology Storage Area (P-2)

No contamination was found in either of the two wells installed at this site. The wells are properly situated hydrologically to represent both upgradient (I-15) and downgradient (I-16) groundwater quality. Any groundwater contamination caused by this site is almost certain to have been detected by this Stage 1 monitoring. Consequently, no further IRP-related monitoring is recommended for this site.

Nevertheless, this site is not without the potential for environmental impairment. During both the presurvey visit and the Stage 1 field work, it was noted that the concrete berm surrounding the pesticide storage area, constructed with the intention of capturing and containing any accidental pesticide spills, had a drain hole through it. Consequentally, its main purpose was defeated. It is recommended, therefore, that the spill containment capability of the site be reviewed as soon as possible, and periodically thereafter. Should any pesticide spills occur in the area, the closest monitoring well(s) should be sampled for the contaminant(s) of concern as soon as the spill is cleaned up. Due to the geologic conditions at Homestead AFB, contaminants can enter groundwater within minutes or hours of a spill.

6.2 CATEGORY II SITES

The remainder of the Homestead AFB sites are assigned to Category II. These are sites for which additional Phase II work is recommended to determine the need for subsequent IRP Phases. These are presented in order of priority according to the severity of contamination the Stage 1 results revealed.

6.2.1 Leak at Pump Station No. 9 (SP-5)

A pool of relatively unweathered JP-4 was encountered in the vicinity of Well I-18 at this site. Fuel transfer lines ruptured near this well in 1982 and again in 1983. The amount of JP-4 lost is not known, but at that time JP-4 had been observed in the drainage canal southeast of the pump station (Building 890). The areal extent of the pool of JP-4 floating on groundwater is not known, nor have specific groundwater contaminants been identified. Also, the drainage canal has not been evaluated as a contaminant sink or migration pathway.

An unknown but considerable amount of JP-4 is floating on groundwater at this site. It is recommended that recovery and removal operations begin here as soon as possible. This measure is needed to prevent further spread of contamination via groundwater or surface water while Stage 2 monitoring is conducted.

Recommended Stage 2 monitoring for this site is directed toward determining the following:

- The areal extent of contaminated groundwater and its flow patterns
- The specific contaminants in groundwater

- The role of surface water drainage as a contaminant sink and pathway.

The first goal can be met by conducting a soil gas survey and installing and sampling five additional groundwater monitoring wells based on the soil gas results (Figure 6-1). Samples from these wells and existing Well I-18 should undergo analysis for volatile organic Priority Pollutants using EPA Method 624. This method will detect the most soluble and mobile components of JP-4.

The second goal can be met by sampling the groundwater below the fuel in Well I-18 and analyzing for all Priority Pollutants. This strategy will allow for a determination of all contaminants in groundwater at the site, whether or not they are directly related to the JP-4 leaks.

The third goal can be met by sampling both surface water and sediments at four locations along the drainage canal as shown in Figure 6.1. These would undergo analysis, using EPA Method 624, to detect the concentrations of volatile organics in canal water and sediments. An assessment of the contaminant load sorbed to the sediments can then be made.

6.2.2 Oil Spills at Aircraft Washrack (SP-7)

Groundwater in all three Stage 1 wells was found to be contaminated, and a floating layer several inches thick of a fuel-like substance was found in Well I-09. This layer was analyzed as over 70 percent oil and grease. TOC values were high in all three wells. Although contamination is confirmed, the specific contaminants involved and their areal extent are not known.

Although not strictly a Phase II related activity, recovery and removal of floating contaminants, as soon as possible, is recommended. The close proximity of this body of contamination to a drainage canal indicates that during the wetter seasons, contaminants are likely to be entering surface water. Recovery and removal of this floating layer would reduce the amount of further contamination that would occur before Phase II is complete.

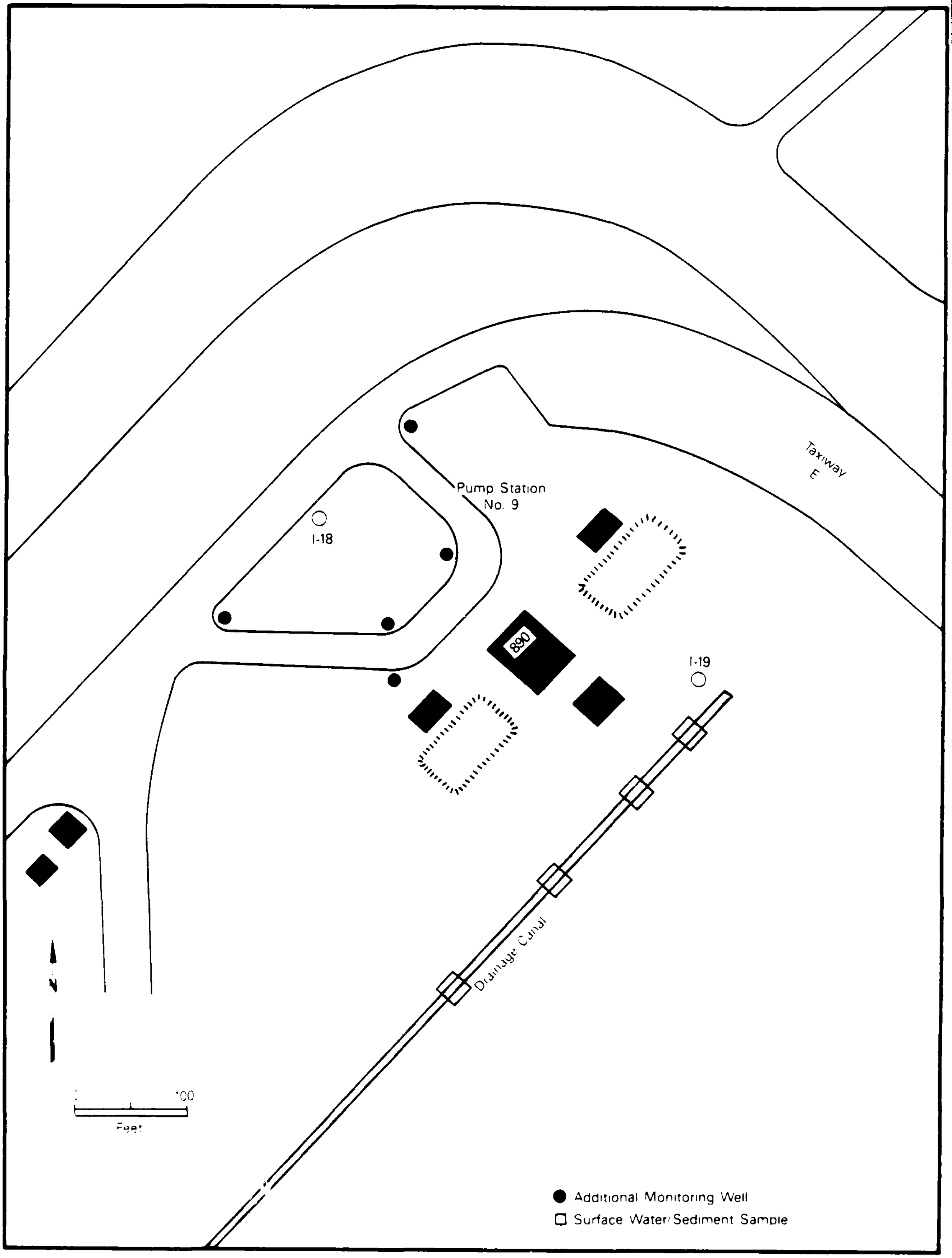


Figure 6-1. Recommended Monitoring: SP-5

The measures recommended for Stage 2 monitoring at this site are intended to determine:

- The specific contaminants in groundwater
- The areal extent of groundwater contamination
- The role of surface water as a contaminant sink and pathway.

The first goal can be met by sampling each of the three existing wells below the floating contaminant layer and conducting analysis for all organic Priority Pollutants. This measure will allow for identification of the specific contaminants of concern at the site, and allow selection of target parameters for use in subsequent monitoring and cleanup efforts.

The second goal, determining the extent of groundwater contamination, will require the installation of additional monitoring wells. It is recommended that a soil gas survey be conducted to delineate the extent of contamination and that four additional wells, as illustrated in Figure 6-2, be installed and sampled along with the Stage 1 wells. Analysis of these samples for volatile organics should be accomplished by EPA method 624. Based on our current understanding of the contaminants and the site setting, this approach should be suitable for determining the nature and extent of contamination.

The third goal, assessing surface water contamination, can be met by collecting water and associated sediment samples from the canal that runs between the site and Bikini Blvd. It is recommended that samples be collected at four locations, as shown in Figure 6-2. These samples of both water and sediments should be analyzed for volatile organics by EPA Method 624. These resulting data will allow for an assessment of this pathway by determining if significant contamination is present and determining the partitioning of contaminants between the water and sediments.

6.2.3 ZONE 1: Leak at POL Bulk Storage Tank Farm (SP-4) and MOGAS Leak at BX Service Station (SP-6)

Stage 1 results for the two sites in this zone show significant, apparently fuel-related, groundwater contamination throughout this area. All four Stage 1 wells were found to be contaminated, but both the pattern of

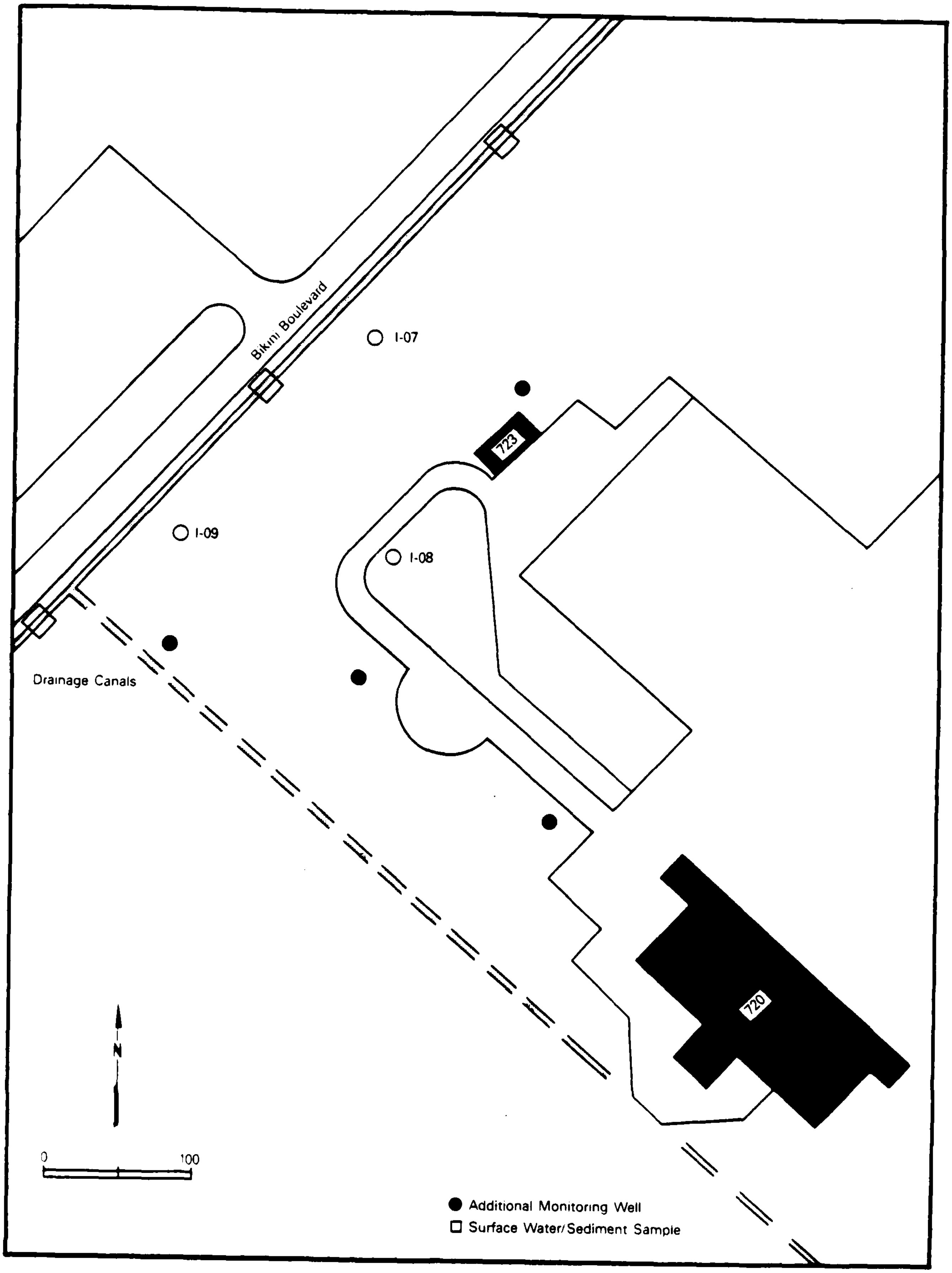


Figure 6-2. Recommended Monitoring: SP-7

contamination and the nature of groundwater flow in this area are not clear (see Section 4.2.3.2). The Stage 1 data were insufficient to determine if the confirmed contamination results from just the JP-4 leak or both it and a MOGAS leak. For these reasons, and because specific contaminants have not been identified, additional monitoring of this zone is recommended.

The goals of the recommended Stage 2 monitoring effort are threefold:

- Determine specific groundwater contaminants
- Determine if both sites are contaminant sources
- Determine the extent of groundwater contamination and better understand groundwater flow in the area.

The first two goals can be met by resampling the four Stage 1 wells and conducting full organic Priority Pollutant analyses on them. This would serve to identify the specific contaminants of concern for the entire zone, and determine if the contamination results from just the confirmed leak of JP-4 from the POL Tank Farm, or from it and the suspected leaded MOGAS leak from the BX Service Station. Results of these analyses could also be used to identify target contaminants for the zone. These would be used as analytes in subsequent efforts, thereby reducing analytical costs.

Meeting of the third goal will require soil gas mapping of the entire zone and the installation of at least six additional monitoring wells approximately as illustrated in Figure 6-3. This monitoring network (including Stage 1 wells) will be more capable of determining the extent of groundwater contamination, and will provide a much better characterization and perhaps an explanation for the groundwater low and corresponding high specific conductance in the zone. If no specific target analyses are identified beforehand, these groundwater samples should undergo analysis for volatile organics using EPA Method 624 and tetraethyl lead. This last analyte is needed to distinguish leaded MOGAS contamination.

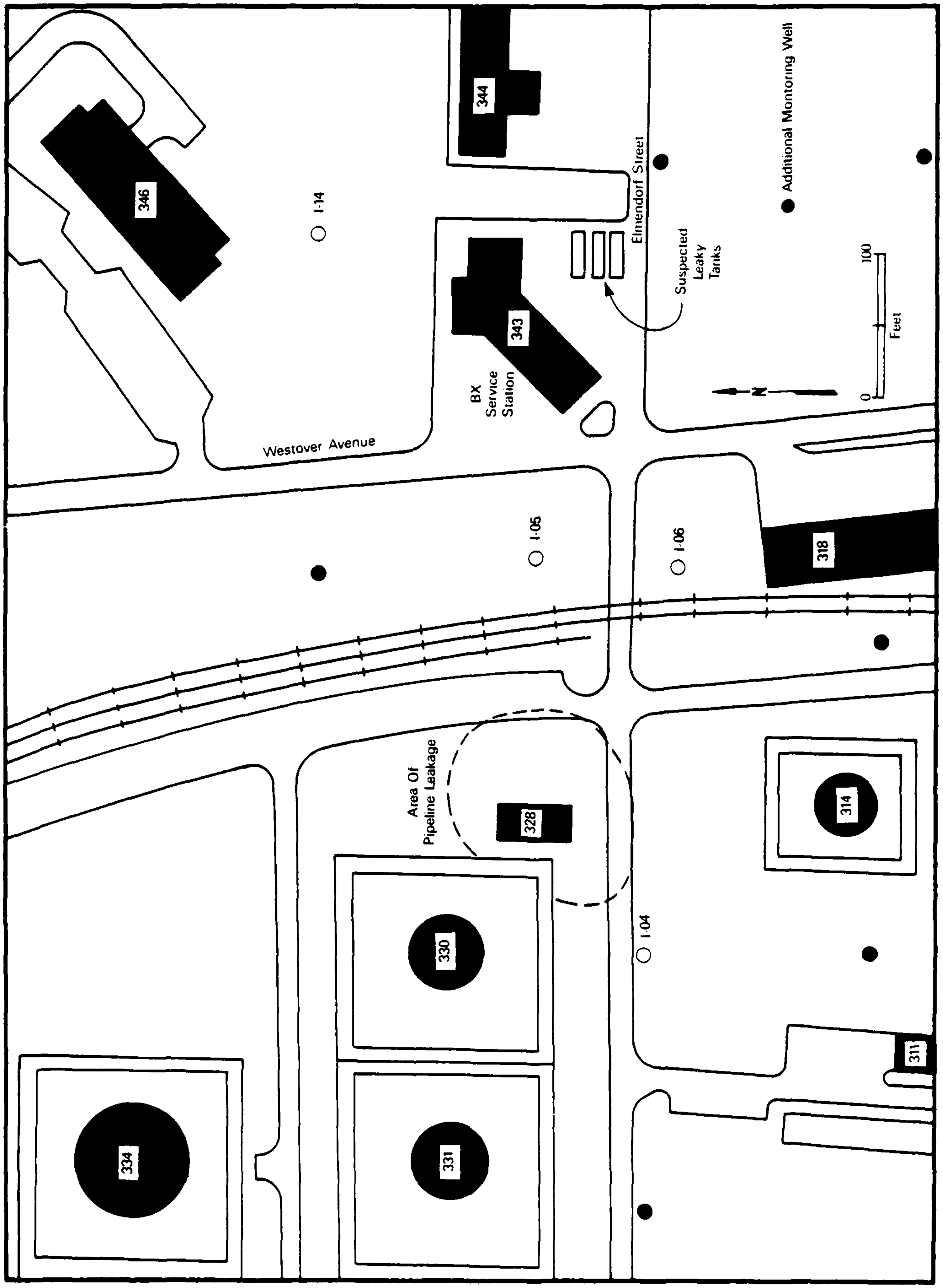


Figure 6-3. Recommended Monitoring: Zone 1

6.2.4 Residual Pesticide Disposal Area (P3)

Stage 1 sampling and analysis revealed significant pesticide contamination in the thin soils at this site. Five of the six samples collected contained significant levels of organochlorine insecticides, and groundwater contamination, though not confirmed, is strongly suspected. Because one of the samples from outside the area reportedly used for disposal was contaminated with DDT, the boundaries of the contaminated area were not established by Stage 1.

The Stage 2 goals for this site include:

- Confirmation or denial of pesticide contamination in groundwater
- Delineation of the areal extent of soil contamination.

Confirmation or denial of pesticide contamination in groundwater at this site will require the installation of at least two groundwater monitoring wells here, as shown in Figure 6-4. The characterization of the groundwater flow in the area and extent of contamination, should any be found, would require additional wells. Samples from these wells should be analyzed for all of the pesticides on the Priority Pollutants list. Delineation of the extent of pesticide contamination in soils at this site will require additional soil sampling. Ten samples collected from the locations shown in Figure 6-4, and analyzed for the 17 analyte pesticide scan used in Stage 1, should allow this delineation to be made.

6.2.5 Fire Protection Training Area No. 3 (FPTA-3)

Three wells were installed parallel to groundwater flow at this site. All three wells were found to be contaminated with TOC and the farthest downgradient, I-12, with oil and grease as well. The site-specific contaminants and the areal extent of contamination are not yet known.

The IRP Phase II goals, to be fulfilled by Stage 2 at this site, are to determine the specific groundwater contaminants and to delineate the extent of contaminant migration. Sampling of Well I-12, with analysis for all of the organic Priority Pollutants, would identify the specific compounds responsible

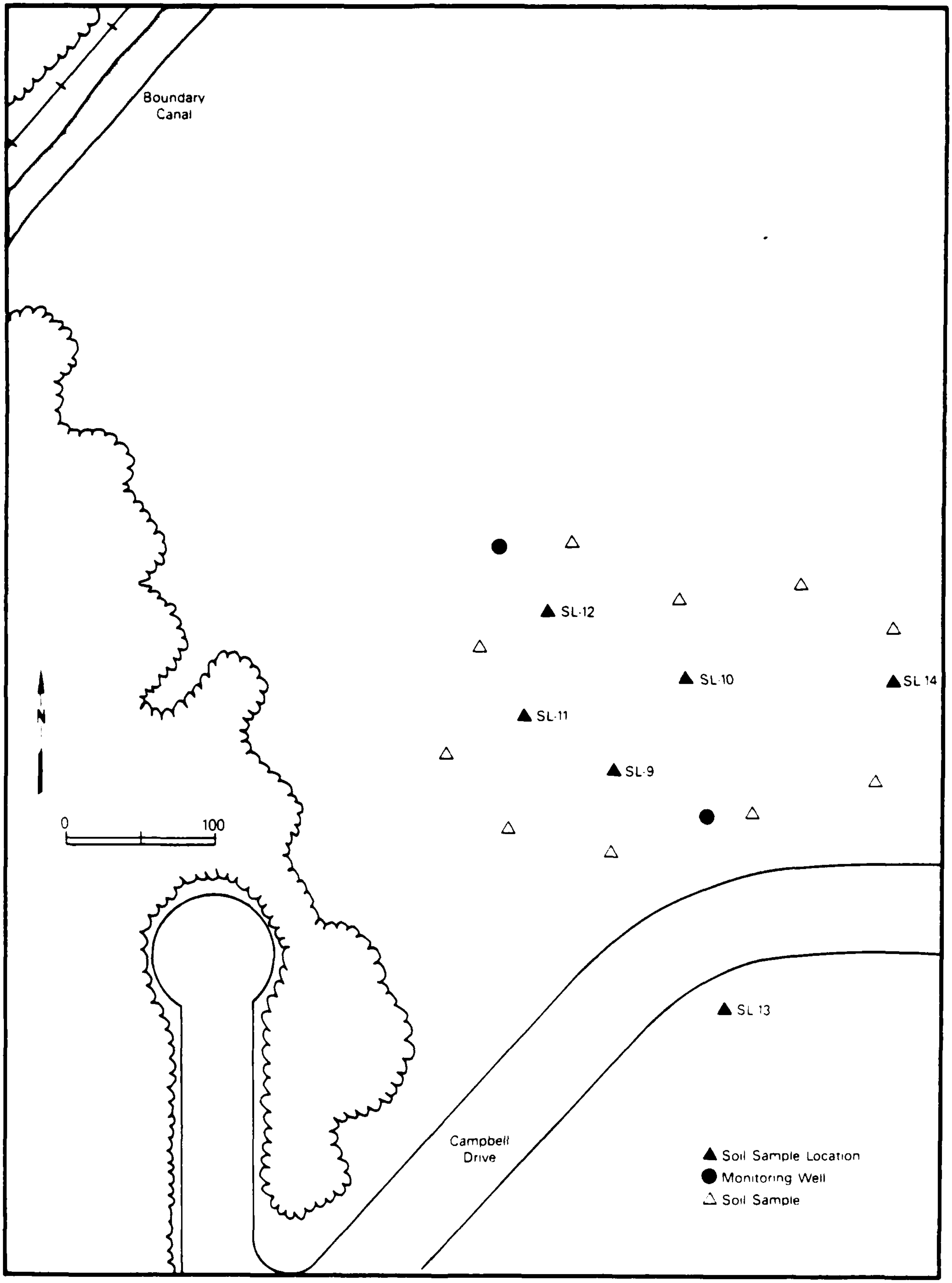


Figure 6-4. Recommended Monitoring: P-3

for the TOC and oil and grease values found. A soil gas survey and five additional monitoring wells, installed approximately as shown in Figure 6-5, will be required to help delineate the contamination boundaries. Samples from these should be analyzed for volatile organics by EPA Method 624.

6.2.6 Fire Protection Training Area No. 2 (FPTA-2)

Well I-13, installed downgradient of the suspected location of this site, registered the highest TOX values found during Stage 1. The upgradient well, a hydrant well immediately northwest of Building 248, registered just above the detection limit. The most likely explanation for this TOX value is the presence of residual halogenated compounds that were once part of wastes burned for fire fighting training. It is also possible that they result from other activities, such as using organochlorine pesticides in the vicinity. Based on this one sampling point, and general scan analyses, it is not possible to determine the exact contaminants or the extent of contamination at this site.

To meet the goals of Phase II, additional sampling and additional installation of monitoring wells should take place at this site. Sampling of Well I-13, with analysis for the halogenated Priority Pollutants, should identify the compound(s) responsible for the elevated TOX values. To delineate the contamination plume, three additional monitoring wells drilled at the locations shown in Figure 6-6 are recommended. These would be sampled for TOX and organic priority pollutants which should suffice for defining the areal extent of contamination.

6.2.7 Oil Leakage Behind Motor Pool (SP-2)

All of the soil and sediment samples collected just outside the east fence of the Motor Pool compound were contaminated with significant amounts of oil and grease and lead. Well I-17, drilled south-southwest of Building 312, was not contaminated. However, based on the Stage 1 data, there appears to be no measurable component of groundwater flow in the direction of Well Field No. 2. Because groundwater flow is in an easterly direction, Well I-17 is not in a location to intercept groundwater contamination resulting from spills or leaks within the compound. Moreover, the extremely high oil and grease values

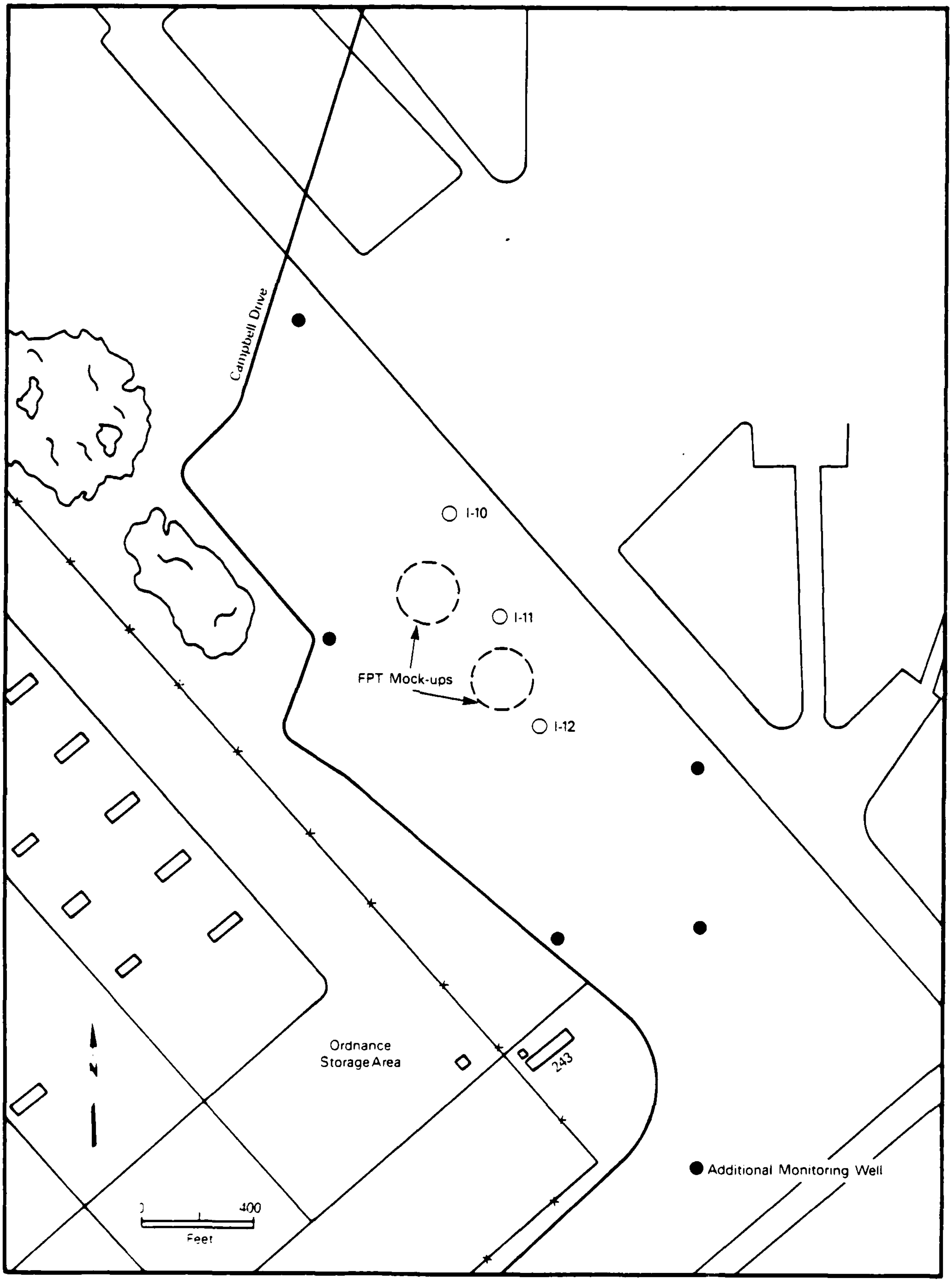


Figure 6-5. Recommended Monitoring: FPTA-3

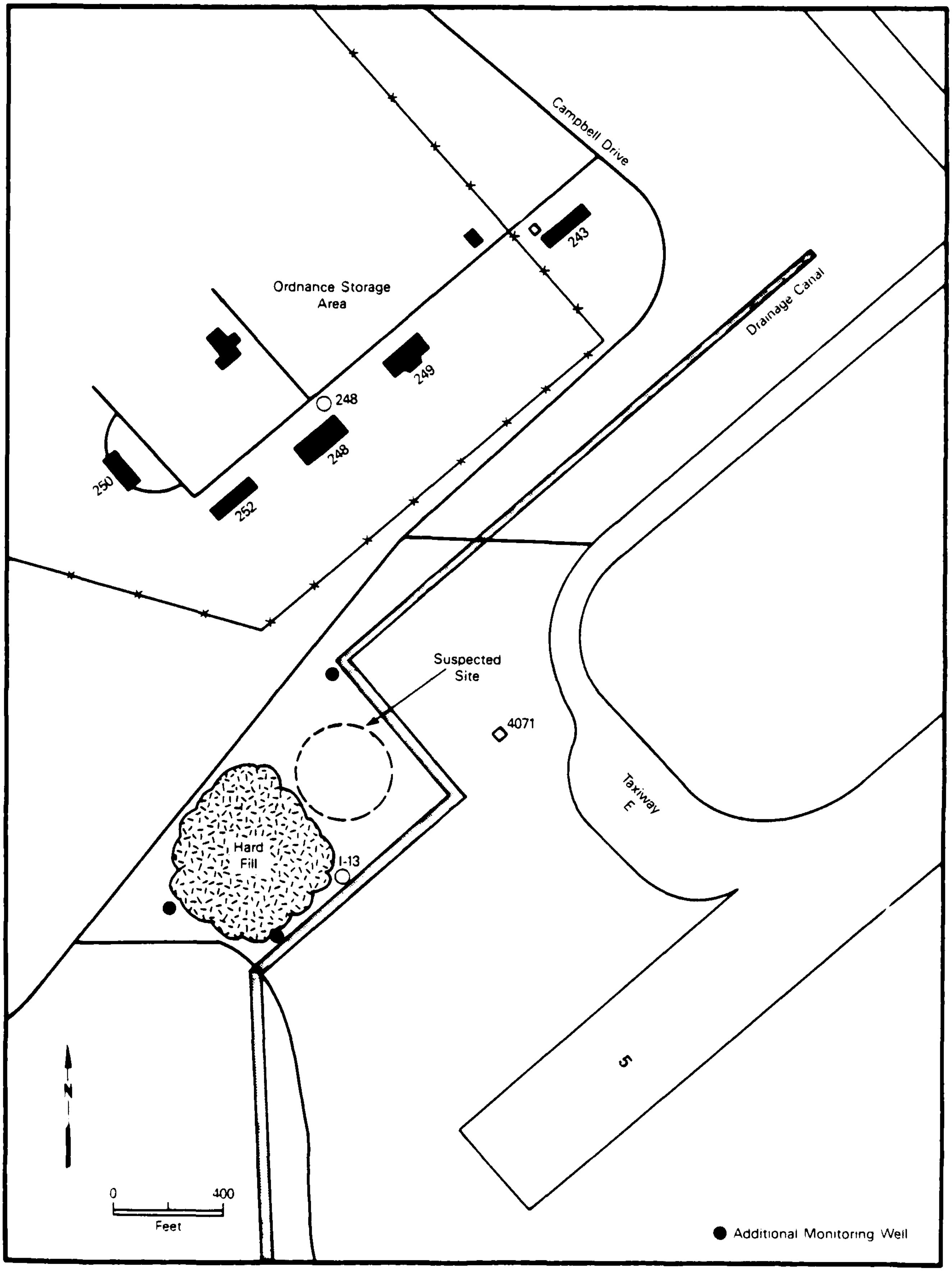


Figure 6-6. Recommended Monitoring: FPTA-2

in soils adjacent to the canal and in sediment within the canal, in conjunction with a strong interconnection between surface water and groundwater, indicate that shallow groundwater just east or southeast of the compound is contaminated.

Installation of two additional monitoring wells, at the locations shown in Figure 6-7, is recommended. During the wet season surface water and sediment samples should be collected at four locations along the previously sampled canal. These samples, plus ones from the two new wells, should undergo analysis for lead and organic Priority Pollutants. If volatile organics are detected in any of the surface water or groundwater samples, more detailed analysis will be required.

6.2.8 Electroplating Waste Disposal Site (SP-1)

Stage 1 results reveal inorganic contamination at this site in soils, sediments, and groundwater. Soil and sediment contamination levels are much higher than in groundwater. Specific contaminants of concern in soils and sediments are chromium, lead, nickel, zinc, and cyanide. Nickel, and to a lesser degree, lead and chromium, are of greatest concern in groundwater.

It is recommended that Stage 2 efforts at this site focus on the role of surface water as a contaminant pathway, and on determining if the groundwater contamination is statistically significant. The first goal can be met by sampling the canal water and sediments southeast of Building 159 at two locations (see Figure 6-8) during the wet season. These would be collected during or subsequent to a rainfall so that contributory runoff could also be sampled at two locations. This will allow for an assessment of the contaminant load in the canal and the relative contaminant contribution of the runoff.

Because the levels of inorganic contaminants downgradient of this site are close to the range of background levels taken from the literature, the three Stage 1 wells should be resampled with analysis for the Stage 1 parameters. Analysis of these results and comparison with Stage 1 results will allow for a determination of the statistical significance of the elevated

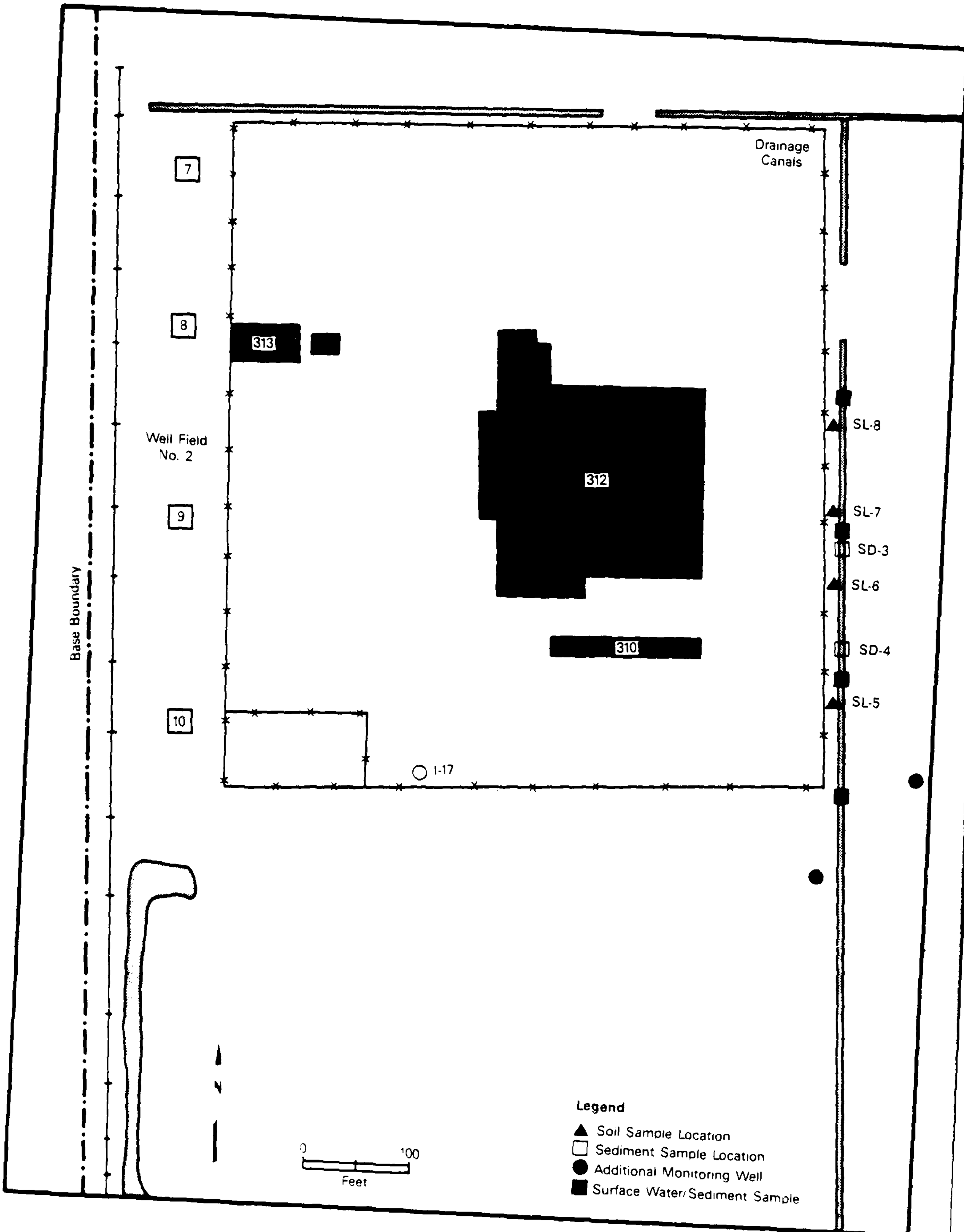


Figure 6-7. Recommended Monitoring: SP-2

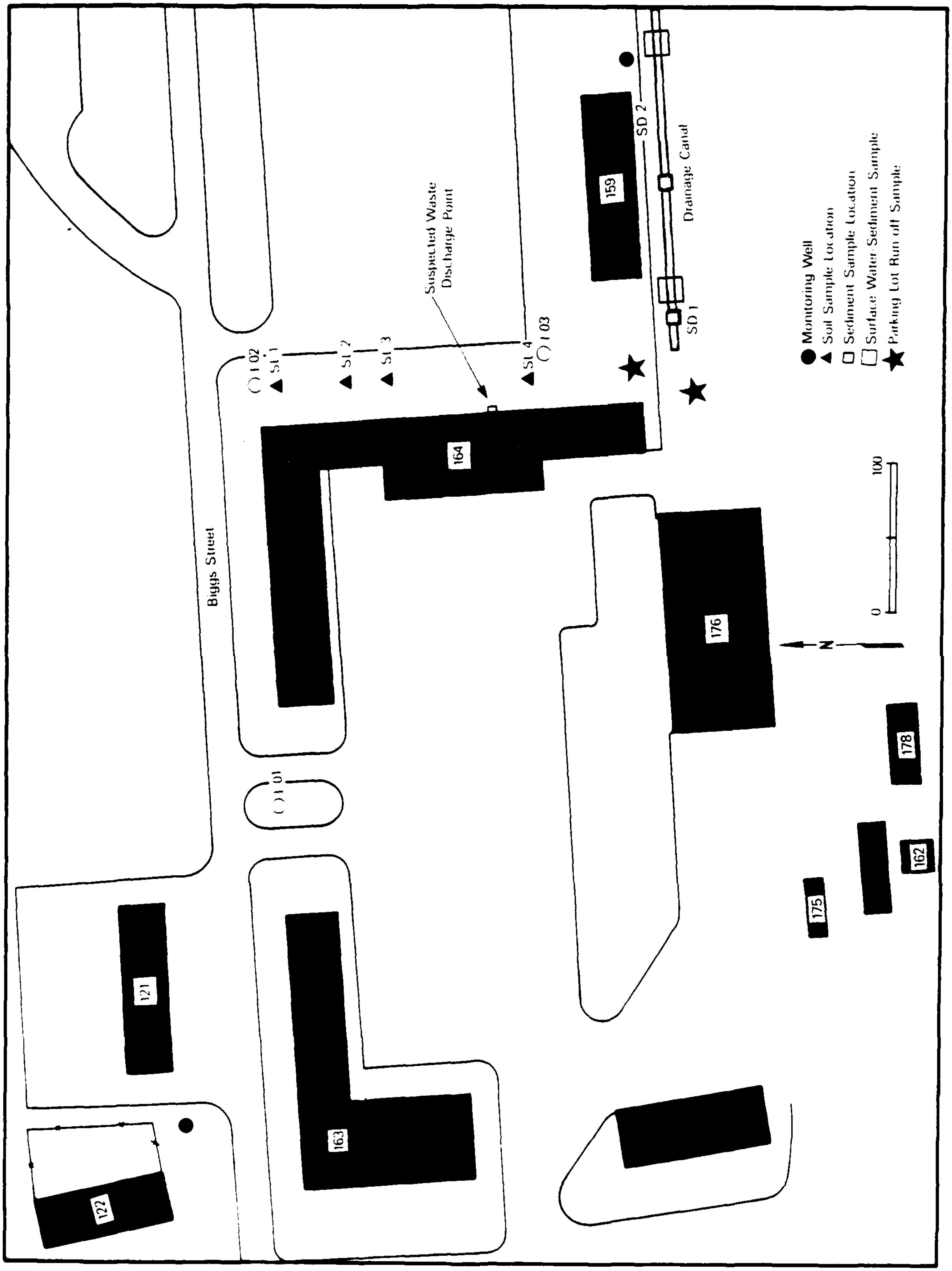


Figure 6-8. Recommended Monitoring: SP-1

level of inorganics and allow for a more confident appraisal of the environmental impact of this site. In addition, two additional wells should be installed as indicated in Figure 6-8 and sampled in an identical manner to the Stage 1 wells.

A. GLOSSARY OF ABBREVIATIONS & DEFINTIONS

ABBREVIATIONS

AF	Air Force
AFB	Air Force Base
AFFF	Aqueous Film Forming Foam
AFLC	Air Force Levels of Concern
ALS	Above Land Surface
AMSL	Above Mean Sea Level
ASQC	Ambient Soil Quality Criteria
AVGAS	Aviation Gasoline
AWQC	Ambient Water Quality Criteria
BLS	Below Land Surface
BX	Base Exchange
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeter second
DBC	dibutyl chlorendate
DDT	1,1,1-trichloro-2,2 bis(p-chlorophenyl)ethane
DET	Detachment
DOD	Department of Defense
EPA	Environmental Protection Agency
FIS	Fighter Interceptor Squadron
FPTA	fire protection training area
ft/day	feet per day
ft/sec	feet per second
ft/year	feet per year
gal/min	gallons per minute
gpd	gallons per day
HARM	Hazardous Assessment Rating Methodology
ID	Inside Diameter
IRP	Installation Restoration Program
JP-4	jet propulsion fuel #4
MOGAS	Motor Gasoline
NLS	Normal Levels in Soil
OD	outside diameter
OEHL	Occupational and Environmental Health Laboratory
O&G	Oil and Grease
POL	Petroleum, Oils and Lubricants
ppb	parts per billion (equivalent to micrograms per liter-µg/l)
ppm	parts per million (equivalent to milligrams per liter - mg/l)
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation & Recovery Act
SAIC	Science Applications International Corp.
SDWA	Safe Drinking Water Act
TAC	Tactical Air Command
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOX	Total Organic Halogens
USAFOEHL	United States Air Force Occupational & Environmental Health Laboratory

DEFINITIONS

aquiclude -	a body of relatively impermeable rock that is capable of absorbing water slowly but does not transmit it rapidly enough to supply a well or spring.
aquifer -	a body of rock that is sufficiently permeable to conduct ground water and yield economically significant quantities of water to wells and springs.
brachiopod -	any solitary marine invertebrate belonging to the Phylum Brachiopoda, characterized by two bilaterally symmetrical valves.
bryozoan -	any invertebrate belonging to the Phylum Bryozoa and characterized chiefly by colonial growth, a calcareous skeleton, and a V-shaped digestive tract.
coelenterates -	solitary or colonial animals of the Phylum Coelenterata, whose bodies consist of ectodermal (outer) and endodermal (inner) layers, but lack a mesoderm (intermediate layer).
Darcy's Law -	the flow rate through a porous media is proportional to the head loss and inversely proportional to the length of the flow path (Todd 1980). Expressed mathematically the relationship is: $Q = -KA \frac{dh}{dl}$ where Q = flow rate (L^3/T); K = hydraulic conductivity (L/T); A = cross sectional area through which flow is taking place (L^2); dh = head loss (L); dl = length of the flow path (L)
diagnosis -	process involving physical and chemical changes in sediment after deposition that converts it to consolidated rock.
dissolution -	the process of dissolving, or more rarely, of melting.
gastropod -	a member of the Phylym Mollusca, usually with a calcareous exoskeleton or shell, which is asymmetrical coiled, and without intenal chambers or partitions.
laterite -	red residual soil developed in humid tropical and subtropical regions of good drainage. It is leached of silica and contains concentrations particularly of iron and aluminum hydroxides.
lithification -	that complex of processes that converts a newly deposited sediment into an indurated rock.

DEFINITIONS (Continued)

marl -	a calcareous clay, or intimate mixture of clay and particles of calcite or dolomite, usually fragments of shells.
massive -	of homogeneous structure, without stratification, flow-banding, foliation, schistosity and the like; said of the structure of some rocks.
matrix -	in a rock in which certain grains are much larger than he others, the grains of smaller size comprise the matrix.
micrite -	a limestone with very fine subcrystalline texture, such as comprises most of a sublithographic limestone. Mud sized calcium carbonate.
oolite -	a spherical to ellipsoidal body, 0.25 to 2.00 mm in diameter, which may or not have a nucleus, and has a concentric or radial structure.
packstone -	a limestone containing lime mud, but still particle supported.
peloid -	a sand-size nonskeletal particle resembling a pellet but for which no particular origin is implied.
permeability -	the permeability of rock is its capacity for transmitting fluid.
porosity -	the ratio of the aggregate volume of interstices in a rock or soil to its total volume.
transmissivity -	the rate at which water of prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient.
vug -	a cavity, often with a mineral lining of different composition from that of the surrounding rock.
water table -	the upper surface of a zone of saturation except where that surface is formed by an impermeable boundary.

Dictionary of Geological Terms, 1974.

B. MEASURING UNIT CONVERSIONS

MEASURING UNIT CONVERSION TABLE

S.I. UNITS	LENGTH	METRIC
inch (in)	x 2.54	= centimeter (cm)
foot (ft)	x 0.3048	= meter (m)
mile (mi)	x 1.608	= kilometer (km)
	VOLUME	
U.S. gallon (gal)	x 0.0038	= cubic meter (m^3)
cubic feet (ft^3)	x 0.0283	= cubic meter
acre-foot (ac. ft)	1233.48	= cubic meter
	AREA	
square inch (in^2)	x 6.452	= square centimeter (cm^2)
square foot (ft^2)	x 0.09	= square meter (m^2)
acre (ac)	x 0.4047	= hectare (ha)
	MASS	
ounce (oz)	X 28	= gram (g)
pound (lb)	x 0.45	= kilogram (kg)
short ton	x 0.9	= metric ton (t)
	DENSITY	
Pounds per cubic foot (pcf)	x 0.016	= grams per cubic centimenter (g/cm^3)
	HYDRAULIC CONDUCTIVITY	
gallons per day per square foot (gpd/ft^2)	x 4.72×10^{-5}	= centimeters per second (cm/sec)
Darcy	x 8.58×10^{-4}	= centimeters per second
	TRANSMISSIVITY	
gallons per foot per day (gpd/ft)	x 0.012	= square meters per day (m^2/d)
square feet per day (ft^2/dy)	X 0.093	= square meters per day (m^2/d)

C. SCOPE OF WORK

0 3 AUG 1984

Installation Restoration Program
Phase II Field Evaluation
Homestead AFB FL

I. Description of Work

The purpose of this task is to determine if environmental contamination has resulted from waste disposal practices, fuel spills and fire training activities at Homestead AFB FL; to provide estimates of the magnitude and extent of contamination, should contamination be found; to identify potential environmental consequences of migrating pollutants; to identify any additional environmental investigations and their attendant costs necessary to properly evaluate the magnitude, extent, and direction of movement of discovered contaminants.

Ambient air monitoring of hazardous and/or toxic material for the protection of contractor and Air Force personnel shall be accomplished when necessary, especially during the drilling operation.

The presurvey report (mailed under separate cover) and Phase I IRP report (mailed under separate cover) incorporated background and description of the sites for this task. To accomplish the survey effort, the contractor shall take the following steps:

A. General

1. Determine the aerial extent of each site by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared, and by field reconnaissance.

2. Locations where surface water, sediment, and core samples are collected shall be marked with a permanent marker, and the location recorded on a site map.

3. Aquifier characteristics to be determined by one day pump test.

4. A total of 19 ground-water monitoring wells shall be installed. The exact location of the wells shall be determined in the field.

5. Ground-water Monitoring Well Installation. Ground-water monitoring wells shall be drilled using 6-inch O.D. hollow-stem augers. Should the borehole collapse when the augers are withdrawn, the hole shall be redrilled using 10-inch O.D. (6-inch I.D.) hollow-stem augers to target depth, and the well shall be set down the 6-inch auger annulus. Each ground-water monitoring well shall be constructed of 4-inch I.D. Schedule 40 PVC casing and screen. Each well shall be an average of 20 feet in depth. The screened interval in each well shall consist of 0.010 inch slotted PVC screen, depending upon the geologic findings during the drilling operation, and 15 feet of screen shall be set. A gravel pack or sand pack, as determined in the field as suitable for the soil formation, shall be emplaced around the well screen. The gravel pack shall extend 1 foot above the top of the screen. A one foot layer of bentonite pellets shall be placed above the gravel pack to seal the screened interval, and the seal shall be completed using a bentonite grout mixture to the surface. Each well shall be provided with a surface grout seal and 6-inch

steel protective casing with locking cap. All wells shall be developed until they produce clear, sand-free water. Each well shall be clearly numbered with exterior paint and be provided with three guard posts placed radially away from each well.

6. Ground water monitoring wells shall comply with U.S. EPA publication 330/9-81-002 NEIC Manual for Groundwater/Subsurface Investigations at Hazardous Waste Sites, and State of Florida requirements for monitoring well installation. All wells shall be developed, water levels measured, and locations surveyed and recorded on a site map. Only screw type joints shall be used. Glue fittings are not permitted.

7. All water samples shall be analyzed on site by the contractor for pH, temperature, and specific conductance. Sampling, maximum holding time, and preservation of samples shall comply strictly with the following references: Standard Methods for the Examination of Water and Wastewater, 15th Ed. (1980), pp 35-42; ASTM, Section 11, Water and Environmental Technology; and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp xiii to xix (1979). All water samples shall be analyzed using minimum detection levels, as specified in Attachment 1.

8. The contractor shall split all water and soil samples. One set of samples shall be analyzed by the contractor and the other set of samples shall be forwarded for analysis through overnight delivery to:

USAF OEHL/SA
Bldg 140
Brooks AFB TX 78235

The samples sent to the USAF OEHL/SA shall be accompanied by the following information:

(a) Purpose of sample (analyte)

(b) Installation name (base)

(c) Sample number (on containers)

(d) Source/location of sample

(e) Contract Task Numbers and Title of Project

(f) Method of collection (bailer, suction pump, air-lift pump, etc.)

(g) Volumes removed before sample taken

(h) Special Conditions (use of surrogate standard, special nonstandard preservations, etc.)

(i) Preservatives used

This information shall be forwarded with each sample by properly completing an AF Form 2752 (copy of form and instructions on proper completion mailed under separate cover). In addition, copies of field logs documenting sample collection should accompany the samples. Chain-of-custody records for all samples, field blanks, and quality control duplicates shall be maintained. All contractor QA/QC program analysis results shall be included in the analytical results of draft final report (as specified in Item VI below).

9. Field data collected for each site shall be plotted and mapped. The nature of contamination and the magnitude and potential for contaminant flow within each site to receiving streams and ground waters shall be determined or estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status report, as specified in Item VI below.

B. In addition to items delineated in A above, conduct the following specific actions at sites identified on Homestead AFB FL:

1. Site SP-1. Electroplating Waste Disposal Site

a. Install three ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and two wells shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 60 feet.

b. Collect one ground-water sample from each of the three new wells and two existing wells, one from Well Field No. 1 and one from Well Field No. 2.

c. Each ground-water sample shall be analyzed for cadmium, total chromium, hexavalent chromium, copper, nickel, lead, zinc, and cyanide.

d. Collect four near-surface soil samples with a hand auger in the vicinity of Building 164.

e. Each soil sample shall be analyzed for cadmium, total chromium, hexavalent chromium, copper, nickel, lead, zinc, and cyanide.

f. Collect surface water and sediment samples from two locations along the canal system traversing from north to south and lying just east of Building 164. One sampling location shall be upstream and the second sampling location shall be downstream on the canal relative to the site. A maximum of two surface water and two sediment samples shall be analyzed.

g. Each surface water and sediment sample shall be analyzed for cadmium, total chromium, hexavalent chromium, copper, nickel, lead, zinc, and cyanide.

2. Site SP-4. POL Tank Farm Leak

a. Install three ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and two wells shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 60 feet.

b. Collect one ground-water sample from each of the three new wells and one existing well from Well Field No. 2.

c. Each ground-water sample shall be analyzed for Oil and Grease-Infrared Method (O&G/IR), Total Organic Carbon (TOC), Total Organic Halogens (TOX), and total lead.

3. Site SP-7. Spills at Aircraft Washrack

a. Install three ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and two wells shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 60 feet.

b. Collect one ground-water sample from each well.

c. Each ground-water sample shall be analyzed for O&G/IR, TOC, and TOX.

4. Site FPTA-3. Fire Protection Training Area 3

a. Install three ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and two wells shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 60 feet.

b. Collect one ground-water sample from each well.

c. Each ground-water sample shall be analyzed for O&G/IR, TOC, and TOX.

5. Site FPTA-2. Fire Protection Training Area 2

a. Install one downgradient ground-water monitoring well in the immediate vicinity of the site. Well shall be an average of 20 feet in depth; total footage drilled shall not exceed 20 feet.

b. Collect one ground-water sample from the new well and the existing base well located between Building 252 and Building 248.

c. Each ground-water sample shall be analyzed for O&G/IR, TOC, and TOX.

6. Site SP-6. Gasoline Leak at BX Service Station

a. Install one downgradient ground-water monitoring well to the east of the service station, Building 343. The two downgradient wells installed for Site SP-4, POL Tank Farm Leak, shall serve as a source of upgradient water quality samples for this site.

b. Collect one ground-water sample from the well.

c. The ground-water sample shall be analyzed for O&G/IR TOC, TOX and total lead.

7. Site P-2. Entomology Storage Area

a. Install two ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and one well shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 40 feet

b. Collect one ground-water sample from each of the two new wells and one well from each of the two on-base well fields.

c. Each ground-water sample shall be analyzed for the pesticides specified in Attachment 1.

8. Site SP-2. Oil Leakage Behind Motor Pool

a. Install one ground-water monitoring well in the immediate vicinity of the site. Well shall be an average of 20 feet in depth; total footage drilled shall not exceed 20 feet.

b. Collect one ground-water sample from the well.

c. The ground-water sample shall be analyzed for O&G/IR and total lead.

d. Collect four near-surface soil samples with a hand auger around the motor pool fence line.

e. Each soil sample shall be analyzed for O&G/IR and total lead.

f. Collect surface water and sediment samples from two locations along the canal just east of Building 312. One sampling location shall be upstream and the second sampling location shall be downstream on the canal relative to the site. A maximum of two surface water and two sediment samples shall be analyzed.

g. Each surface water and sediment sample shall be analyzed for O&G/IR and total lead.

9. Site SP-5. Leak at Flight Apron Pump Station No. 9

a. Install two ground-water monitoring wells in the immediate vicinity of the site. One well shall be placed upgradient of the site and one well shall be placed downgradient of the site. Wells shall be an average of 20 feet in depth; total footage drilled shall not exceed 40 feet.

b. Collect one ground-water sample from each well.

c. Each ground-water sample shall be analyzed for O&G/IR, TOC, and TOX.

10. Site P-3. Residual Pesticide Disposal Area

a. Collect six near-surface soil samples with a hand auger in a grid pattern over the area.

b. Each soil sample shall be analyzed for the pesticides specified in Attachment 1.

C. Well Installation and Clean-up

The well and boring area shall be cleaned following the completion of each well and boring. Drill cuttings shall be removed and the general area clean. If hazardous waste is generated in the process of well installation, the contractor shall be responsible for proper containerization of drill cuttings for eventual government disposal. The contractor shall determine those drill cuttings suspected as being hazardous waste based upon discoloration, odor, or organic vapor detection instrument. The contractor shall test two samples of the suspected hazardous waste for EP Toxicity and Ignitability as specified in Attachment 1. Disposal of drill cuttings is not the responsibility of the contractor.

D. Results of all sampling and analysis shall be tabulated and incorporated in the Informal Technical Information report (Sequence 3, Atch 1 and sequence 2, Atch 3 as specified in Item VI below) and forwarded to USAF OEHL/TS for review.

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL, as specified in Item VI below, for Air Force review and comment. This report shall include a discussion of the regional site specific hydrogeology, well and boring logs, data from water level surveys, water quality and soil analysis results, available geohydrologic cross sections, groundwater and gradient vector maps, and laboratory quality assurance information. The report shall follow the USAF OEHL format (mailed under separate cover).

2. The recommendation section will address each site and list them by categories. Category I will consist of sites where no further action, including remedial action, is required. Data for these sites are considered sufficient to rule out unacceptable health or environmental risks. Category II sites are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. Category III sites are sites that will require remedial actions (ready for IRP Phase IV actions). In each case the contractor will summarize or present the results of field data, environmental or regulatory criteria, or other pertinent information supporting these conclusions.

F. Cost Estimates

The contractor shall provide cost estimates for all additional work recommended to permit proper determination of contaminants. The recommendations provided shall include all efforts required to determine the magnitude and direction of movement of discovered contaminants along with an estimate of the time required to accomplish the proposed effort. This information shall be provided in a separately bound appendix to the final report.

G. Meetings

The contractor's project leader shall attend one meeting with Air Force officials and regulatory agency representatives to present and discuss results of this investigation. This meeting shall take place at Homestead AFB FL for eight hours at a time to be specified by the USAF OEHL.

II. Site Location and Dates:

Homestead AFB FL
Time and Dates
To be established

III. Base Support: Land surveying of 19 wells and 14 soil sampling locations by Civil Engineering.

IV. Government Furnished Property: Bulldozer or Front-end Loader

V. Government Points of Contact:

1. 1Lt Maria R. LaMagna
USAF OEHL/TS
Brooks AFB TX 78235
(512) 536-2158
AV 240-2158

2. Capt Jesse D. Humberd
USAF Hospital/SGPB
Homestead AFB FL 33039
(305) 257-6141
AV 791-6141

3. Col Jerry P. Dougherty
HQ TAC/SGPAE
Langley AFB VA 23665
(804) 764-2180
AV 432-5857

VI. In addition to sequence numbers 1, 5 and 11 which are applicable to all orders, the reference numbers below are applicable to this order. Also shown are data applicable to this order:

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
Atch 1					
4	ONE/R	85FEB28	85MAR20	85JUL30	*
3	O/TIME	**	**		2
Atch 3					
2	O/TIME	**	**		2

*Two Draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with one copy of the second draft report. Upon USAF OEHL acceptance of the second draft report, the contractor shall distribute the remaining copies per a USAF OEHL prepared distribution list. The contractor shall supply the USAF OEHL with 20 copies of each draft report and 50 copies plus the original camera-ready copy of the final report.

**Upon completion

{Attachment 1
Levels of Detection Required

Levels of Detection are for water unless shown otherwise:

Analyte		Analytical Method	Detection Limit	No. Samples
Oil and Grease (IR)		EPA 413.2	100 µg/L (waters); 100 µg/g (soil)	18W; 6S
*Total Organic Carbon (TOC)		EPA 415.1	1000 µg/L	15W
*Total Organic Halogens (TOX)		EPA 9020	5 µg/L (waters); 5 µg/g (soil)	15W
pH		EPA 150.1	±0.1 unit	29W
Specific Conductance		EPA 120.1	1 µmho/cm	29W
Cadmium	(1)	EPA 213.2	10 µg/L	7W; 6S
Total Chromium	(1)	EPA 218.1	50 µg/L (waters) 5 µg/g (soil)	7W; 6S
Hexavalent Chromium		Standard 312 B (15th Ed.)	50 µg/L	7W; 6S
Copper	(2)	EPA 220.1	20 µg/L	7W; 6S
Nickel		EPA 249.1	100 µg/L	7W; 6S
Lead	(1)	EPA 239.2	20 µg/L (waters) 2 µg/g (soil)	15W; 12S
Zinc	(2)	EPA 289.1	50 µg/L	7W; 6S
Cyanide		EPA 335.3	10 µg/L	7W; 6S
EP Toxicity		40 CFR 261.24	**	2
Ignitability		40 CFR 261.21	***	2
Aldrin		~~Standard 509A~~ SW-846	0.02 µg/l	4W; 6S
DDT isomer		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Dieldrin		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Endrin	(1)	~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Heptachlor		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Heptachlor Epoxide		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Lindane	(1)	~~Standard 509A~~ SW-846	0.01 µg/L	4W; 6S
Methoxychlor	(1)	~~Standard 509A~~ SW-846	0.20 µg/L	4W; 6S
Diazinon		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Malathion		~~Standard 509A~~ SW-846	0.10 µg/L	4W; 6S
Parathion		~~Standard 509A~~ SW-846	0.02 µg/L	4W; 6S
Toxaphene	(1)	~~Standard 509A~~ SW-846	1.00 µg/L	4W; 6S
2,4-D	(1)	~~Standard 509B~~ SW-846	0.06 µg/L	4W; 6S
2,4,5-T		~~Standard 509B~~ SW-846	0.06 µg/L	4W; 6S
2,4,5-TP (Silvex)	(1)	~~Standard 509B~~ SW-846	0.06 µg/L	4W; 6S
Sevin		~~Standard 509A~~ American Chemical Society Symposium Series #136	~~0.10 µg/L~~ 1.0 mg/L	4W; 6S

For soils, use the detection levels shown above, but report values as micrograms pesticide per gram of soil.

*Detection levels for TOX and TOC must be three times the noise level of the instrument. Laboratory distilled water must show no response. If so, corrections of positive results must be made.

**Metal	ug/L of Solution
As	10
Ba	200
Cd	10
Cr	50
Pb	20
Hg	1
Se	10
Ag	10

***Find if sample is ignitable at 140 degrees F or below. If so, it is a hazardous waste.

(1) = Primary Drinking Water Standard, 40 CFR 141.11.

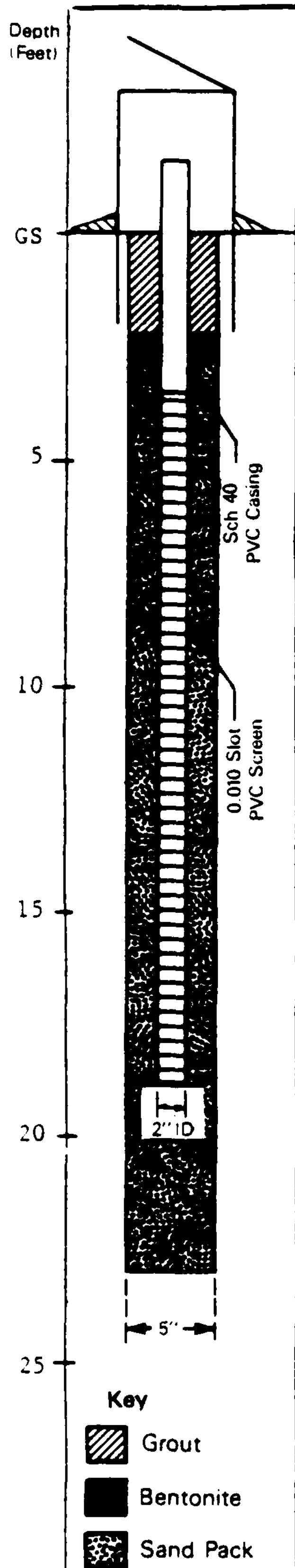
(2) = Secondary Drinking Water Standard, 40 CFR 143.3.

D. WELL CONSTRUCTION SUMMARIES AND CORE DESCRIPTIONS

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-01



Drilling Summary:

Total Depth: 22.5' BGS Drillers: Magistro
Borehole Diameter(s): 5" McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ______ Bit(s): Hollow Stem Augers
Top of Casing: ______ Drilling Fluid Type: ______
Supervisory Geologist: Vickers Amount Use: ______
Log Book No. 2 pp. 21 Water Level: 8.0' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD Diameter: 2" ID
Length: 5' casing and 15' screen Slot: 0.010
Filter: Material: 6/20 Sand Setting: 18.4'-3.4' BGS
Setting: 22.5'-2.8' BGS Seals: Type: Bentonite
Grout: Type: Cement and Clay Setting: 2.8'-2.3' BGS
Setting: 2.3' BGS-Cap Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 1.6"

Time Log:

	Started	Completed
Drilling:	11/20	11/20
Installation:	11/20	11/20
Water Level Reading:	11/20 14:10	
Development :	11/29	11/29

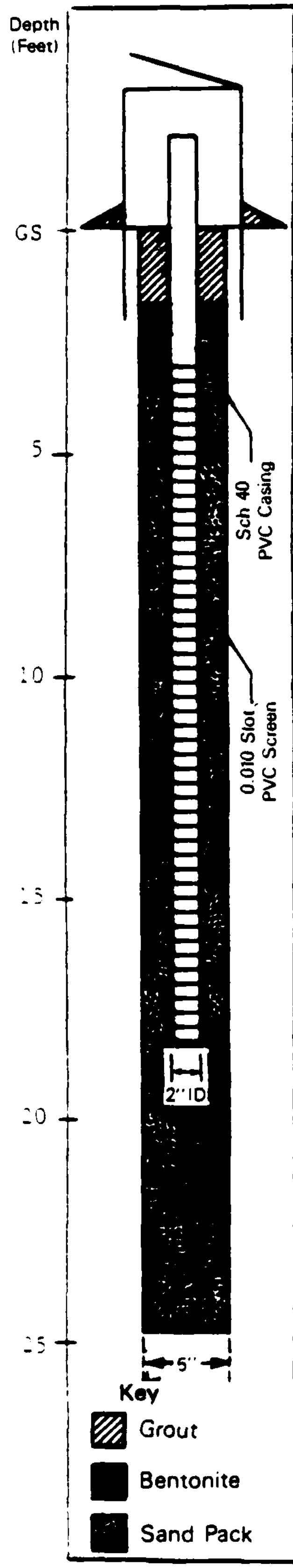
Well Development:

Method/Equipment: Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 2 to 5 gpm
Volume Pumped: 150 to 200 gal

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-02



Drilling Summary:

Total Depth: 24.8' BGS Drillers: Cooper
Borehole Diameter(s): 5" Martin
Rig Type: Acker AD-2
Elevation: Land Surface: ______ Bit(s): Hollow Stem Auger
Top of Casing: ______ Drilling Fluid Type: ______
Supervisory Geologist: Spooner Amount Use: ______
Log Book No. 1 pp. 10, 11 Water Level: 6.0' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD Diameter: 2" ID
Length: 5' casing and 15' screen Slot: 0.010
Filter: Material: 6/20 Sand Setting: 18.0'-3.0'
Setting: 24.8'-2.3' BGS Seals: Type: Bentonite
Grout: Type: Cement and Clay Setting: 2.3'-1.8' BGS
Setting: 1.8' BGS-Cap Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 2.0'

Time Log:

	Started	Completed
Drilling:	11/20	11/20
Installation:	11/20	11/20
Water Level Reading:	11/20 10:56	
Development :	11/29	11/29

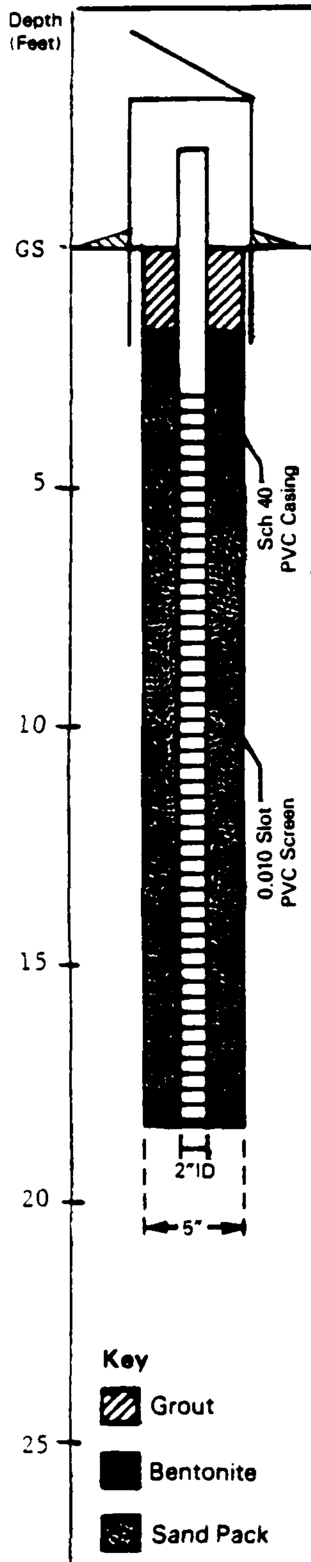
Well Development:

Method/Equipment: Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 5gpm (intermittant)
Volume Pumped: 200 gal (?)

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-03



Drilling Summary:

Total Depth: 18.1' BGS
Drillers: Cooper, Martin
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ______
Bit(s): Hollow Stem Auger
Top of Casing: ______
Drilling Fluid Type: ______
Supervisory Geologist: Spooner
Amount Use: ______
Log Book No. 1 pp. 12, 13
Water Level: 7.0' BGS

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 18.1' - 3.1' BGS
Setting: 18.1' - 2.3' BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 2.3' - 1.8' BGS
Setting: 1.8' BGS-Cap
Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 1.9' Above GS

Time Log:

	Started	Completed
Drilling:	11/20	11/20
Installation:	11/20	11/20
Water Level Reading:	11/20 13:53	
Development :	11/28	11/28

Well Development:

Method/Equipment: Centrifugal Pump - 3HP
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 5gpm
Volume Pumped: 240 gal

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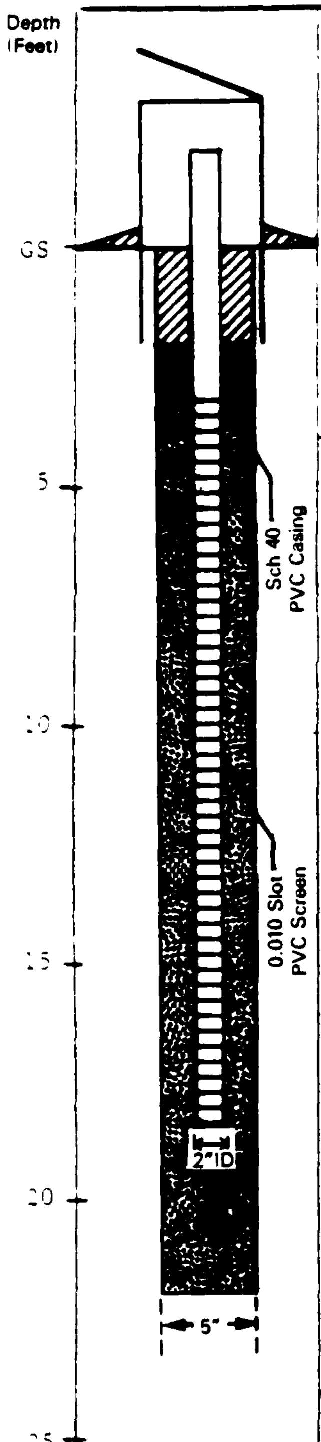
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ______   Well No.: I-04



Key
- Grout
- Bentonite
- Sand Pack

Drilling Summary:

Total Depth: 21.5' BGS   Drillers: Magistro
Borehole Diameter(s): 5"   McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ______   Bit(s): Hollow Stem Auger
Top of Casing: ______   Drilling Fluid Type: ______
Supervisory Geologist: Vickers   Amount Use: ______
Log Book No. 2 pp. 18, 19   Water Level: ______

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD   Diameter: 2" ID
Length: 5' casing and 15' screen   Slot: 0.010
Filter: Material: 6/20 Sand   Setting: 18.0-3.0' BGS
Setting: 21.5' - 2.6' BGS   Seals: Type: Bentonite
Grout: Type: Cement and Clay   Setting: 2.6' - 2.1' BGS
Setting: 2.1' BGS-cap   Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 2.0'

Time Log:

	Started	Completed
Drilling:	11/19	11/19
Installation:	11/19	11/19
Water Level Reading:		
Development:	11/29	11/29

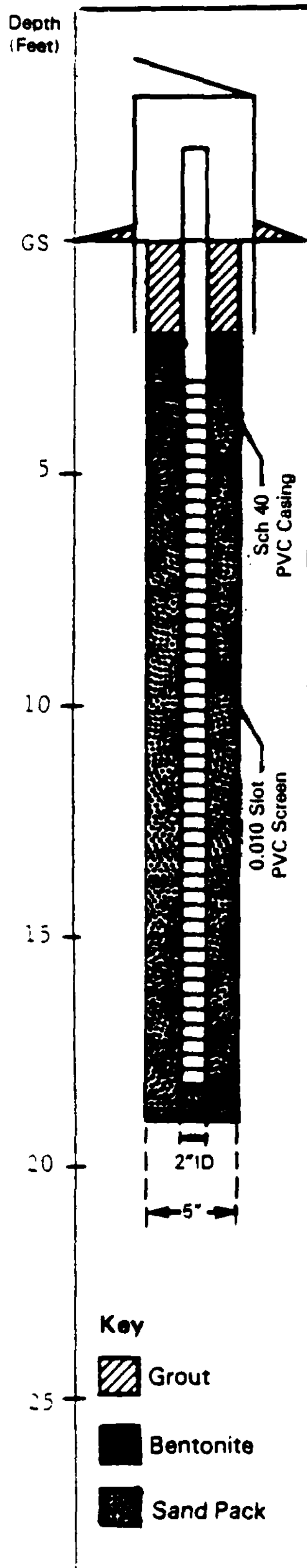
Well Development:

Method/Equipment: Air Compressor then Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: Intermittent with Air compressor; 5gpm with pump
Volume Pumped: 100 gal

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ____   Well No.: I-05



Drilling Summary:

Total Depth: 18.7' BGS   Drillers: Cooper, Martin

Borehole Diameter(s): 5"

Rig Type: Acker AD-2

Elevation: Land Surface: ____   Bit(s): Hollow Stem Augers

Top of Casing: ____   Drilling Fluid Type: ____

Supervisory Geologist: Spooner   Amount Use: ____

Log Book No. 1 pp. 4, 5   Water Level: 5.7' BGS

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC

Diameter: 2" ID ____ OD   Diameter: 2" ID

Length: 5' casing and 15' screen   Slot: 0.010

Filter: Material: 6/20 Sand   Setting: 18.0 - 3.0' BGS

Setting: 18.7' - 2.5' BGS   Seals: Type: Bentonite

Grout: Type: Cement and Clay   Setting: 2.5' - 2.0' BGS

Setting: 2.0' BGS-cap   Surface Casing: 6" steel with locking Lid

Other: ____

Stick up = 2.0' Above GS

Time Log:

	Started	Completed
Drilling:	11/17	11/17
Installation:	11/17	11/17
Water Level Reading:	11/17 15:17	
Development:	11/29	11/29

Well Development:

Method/Equipment: Centrifugal Pump

Static Depth to Water: ____

Pumping Depth to Water: ____

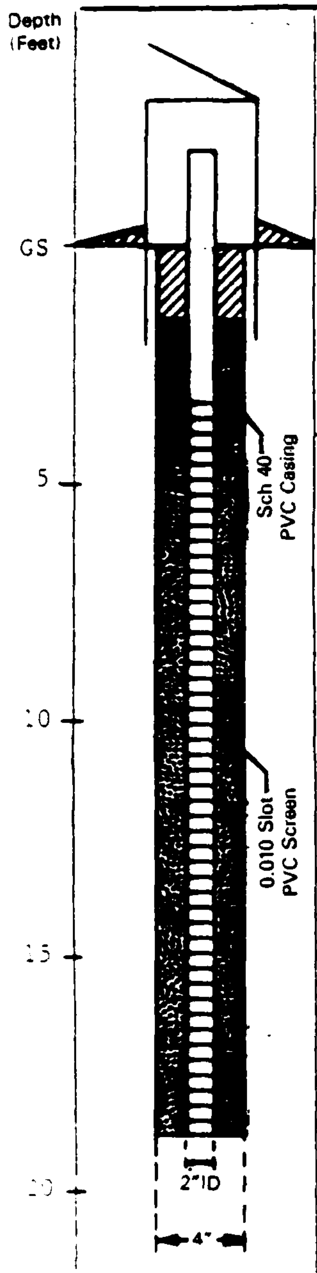
Pumping Rate: 5gpm

Volume Pumped: 120gpm

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ____   Well No.: I-06



Key
- Grout
- Bentonite
- Sand Pack

Drilling Summary:

Total Depth: 18.3' BGS   Drillers: Magistro
Borehole Diameter(s): 4"   McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ____   Bit(s): 4" Core Barrel
Top of Casing: ____   Drilling Fluid Type: Water
Supervisory Geologist: Vickers   Amount Use: ____
Log Book No. 2 pp. 15, 16   Water Level: 6.6' BGS

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC
Diameter: 2" ID ____ OD   Diameter: 2" ID
Length: 5' casing and 15' screen   Slot: 0.010
Filter: Material: 6/20 Sand   Setting: 18.1' - 3.1' BGS
Setting: 18.3' - 2.3' BGS   Seals: Type: Bentonite
Grout: Type: Cement and Clay   Setting: 2.3' - 1.5' BGS
Setting: 1.5' BGS-cap   Surface Casing: 6" steel with locking Lid
Other: ____

Stick up = 1.9' Above GS

Time Log:

	Started	Completed
Drilling:	11/17	11/17
Installation:	11/17	11/17
Water Level Reading:	11/17 15:05	
Development:	11/29	11/29

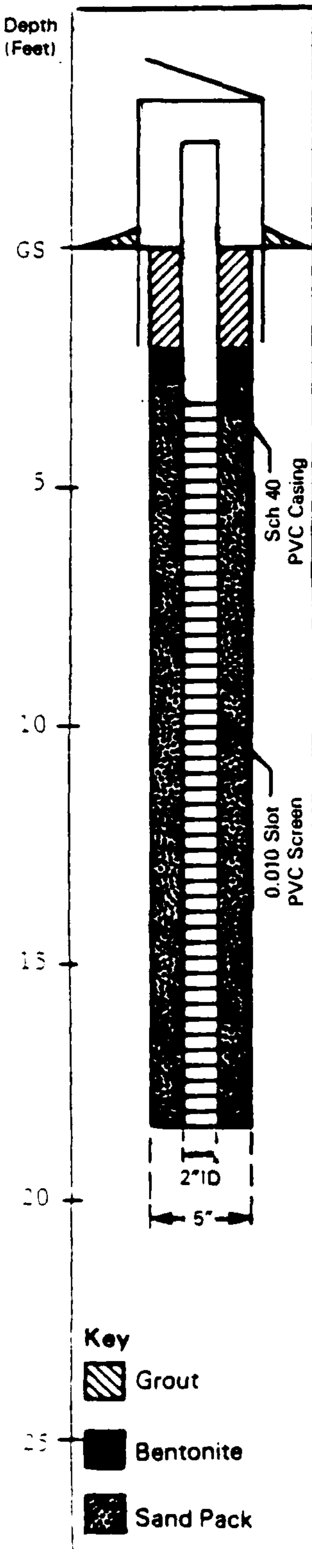
Well Development:

Method/Equipment: Centrifugal Pump
Static Depth to Water: ____
Pumping Depth to Water: ____
Pumping Rate: 5gpm
Volume Pumped: 100gal

JRB ASSOCIATES
A Company of Science Applications, Inc.
8400 Westpark Drive, McLean, Virginia 22102

WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ______   Well No.: I-07



Drilling Summary:

Total Depth: 18.1' BGS   Drillers: Magistro
Borehole Diameter(s): 5"   McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ______   Bit(s): Hollow Stem Augers
Top of Casing: ______   Drilling Fluid Type: ______
Supervisory Geologist: Vickers   Amount Use: ______
Log Book No. 2 pp. 3, 4   Water Level: 6.6' BGS

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD   Diameter: 2" ID
Length: 5' casing and 15' screen   Slot: 0.010
Filter: Material: 6/20 Sand   Setting: 17.9' - 2.9' BGS
Setting: 17.9' - 2.6' BGS   Seals: Type: Bentonite
Grout: Type: Cement and Clay   Setting: 2.6' - 2.0' BGS
Setting: 2.0' - Surface cap   Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 2.1' AGS

Time Log:

	Started	Completed
Drilling:	11/14	11/14
Installation:	11/14	11/14
Water Level Reading:	11/14 10:23	11/14
Development:	11/27	11/27

Well Development:

Method/Equipment: Rotary Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 0.5gpm
Volume Pumped: 125gal

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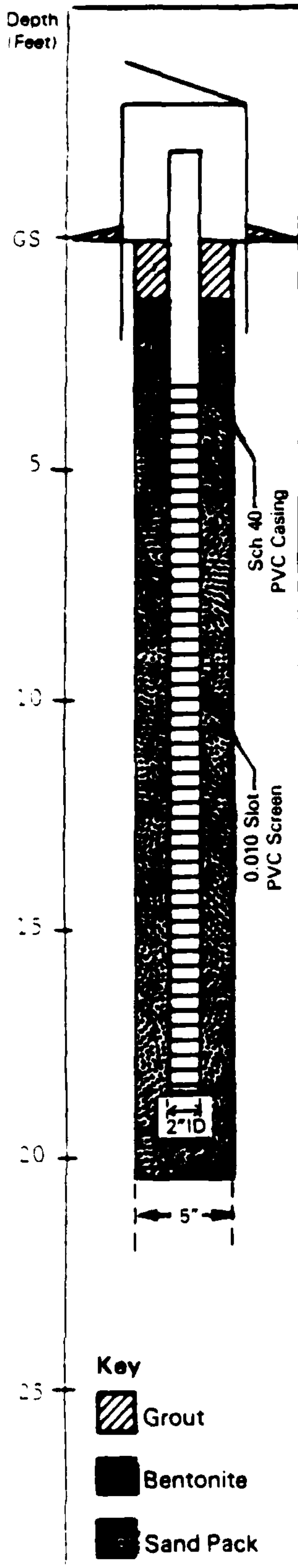
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-08



Drilling Summary:

Total Depth: 20' BGS
Drillers: Magistro, McCall
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ______
Bit(s): Hollow Stem Auger
Top of Casing: ______
Drilling Fluid Type: ______
Supervisory Geologist: Vickers
Amount Use: ______
Log Book No. 2 pp. 1-3/6-8
Water Level: 6.2' BGS

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 18.1' - 3.1' BGS
Setting: 20.0' - 1.7 BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 1.7' - 1.2' BGS
Setting: 1.2' BGS-cap
Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 1.9' Above GS

Time Log:

	Started	Completed
Drilling:	11/13	11/15
Installation:	11/15	11/15
Water Level Reading:	11/14 15:15	
Development:	11/27, 11/28	11/28

Well Development:

Method/Equipment: Rotary Pump, then Centrifugal
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 0.5gpm then 5gpm
Volume Pumped: 350 gal

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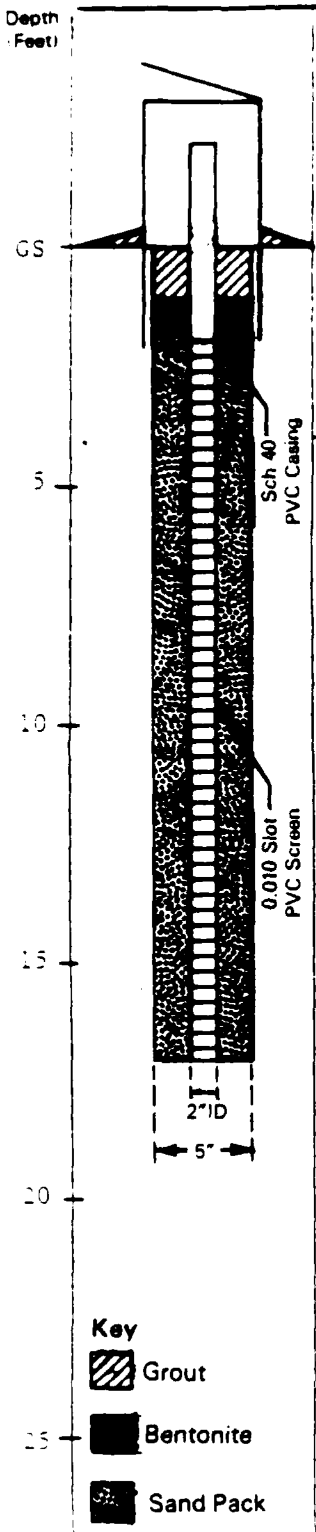
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ____ Well No.: L-09



Drilling Summary:

Total Depth: 16.8' BGS Drillers: Magistro
Borehole Diameter(s): 5" McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ____ Bit s: Hollow Stem Auger
Top of Casing: ____ Drilling Fluid Type: ____
Supervisory Geologist: Vickers Amount Use: ____
Log Book No. 2 pp. 5 Water Level: 5.8' BGS 11/14 13:14

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC
Diameter: 2" ID ____ OD Diameter: 2" ID
Length: 3.8' casing and 15' screen Slot: 0.010
Filter: Material: 6/20 Sand Setting: 16.8' - 1.8' BGS
Setting: 16.8' - 1.6' BGS Seals: Type: Bentonite
Grout: Type: Cement and Clay Setting: 1.6' - 1.0' BGS
Setting: 1.0' - Surface cap Surface Casing: 6" steel with locking Lid
Other: ____

Stick up = 2' Above GS

Time Log:

	Started	Completed
Drilling:	11/14	11/14
Installation:	11/14	11/14
Water Level Reading:	11/14 13:14	
Development:	11/28	11/28

Well Development:

Method/Equipment: Centrifugal Pump and Hose
Static Depth to Water: ____
Pumping Depth to Water: ____
Pumping Rate: 5gpm
Volume Pumped: 160 gal

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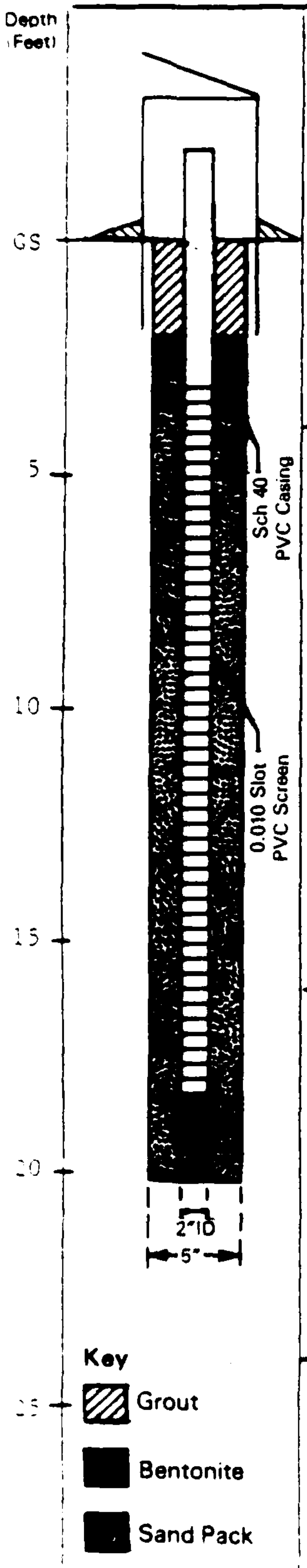
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-10



Drilling Summary:

Total Depth: 19.9' BGS Drillers: Cooper
Borehole Diameter(s): 5" Martin
Rig Type: Acker AD-2
Elevation: Land Surface: ______ Bit(s): Hollow Stem Augers
Top of Casing: ______ Drilling Fluid Type: ______
Supervisory Geologist: Spooner Amount Use: ______
Log Book No. 1 pp. 8, 9 Water Level: 4.5' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD Diameter: 2" ID
Length: 5' casing and 15' screen Slot: 0.010
Filter: Material: 6/20 Sand Setting: 18.0' - 3.0' BGS
Setting: 19.9' - 2.5' BGS Seals: Type: Bentonite
Grout: Type: Cement and Clay Setting: 2.5' - 2.0' BGS
Setting: 2.0' BGS-cap Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 2.0'

Time Log:

	Started	Completed
Drilling:	11/19	11/19
Installation:	11/19	11/19
Water Level Reading:	11/19 14:12	
Development:	11/28	11/28

Well Development:

Method/Equipment: Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 5gpm
Volume Pumped: 105 gal

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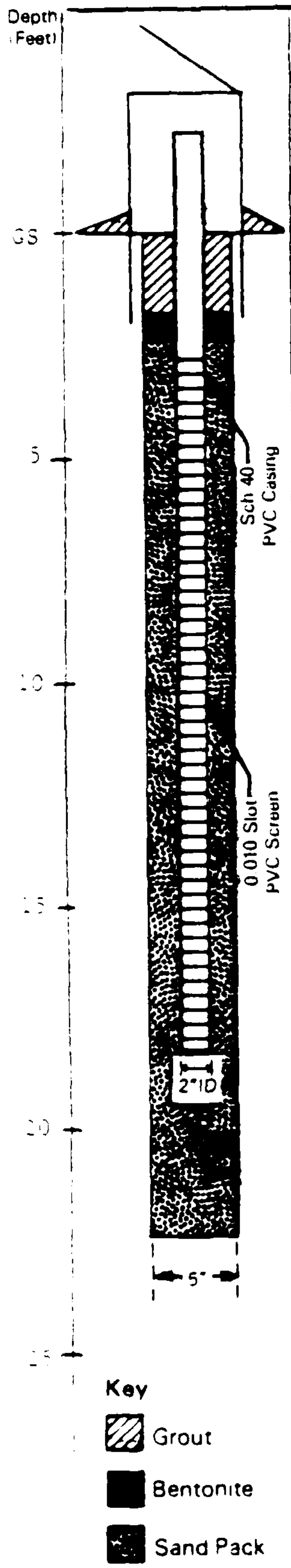
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ________   Well No.: I-11



Drilling Summary:

Total Depth: 22.2' BGS
Drillers: Cooper, Martin
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ________
Bit(s): Hollow Stem Augers
Top of Casing: ________
Drilling Fluid Type: ________
Supervisory Geologist: Spooner
Amount Use: ________
Log Book No. 1 pp. 6, 7
Water Level: 4.5' BGS

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ________ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 17.9' - 2.9' BGS
Setting: 22.2' - 2.3' BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 2.3' - 1.8' BGS
Setting: 1.8' BGS-cap
Surface Casing: 6" steel with locking Lid
Other: ________

Stick up = 2.1'

Time Log:

	Started	Completed
Drilling:	11/19	11/19
Installation:	11/19	11/19
Water Level Reading:	11/19 10:30	
Development:	11/28	11/28

Well Development:

Method/Equipment: Centifugal Pump
Static Depth to Water: ________
Pumping Depth to Water: ________
Pumping Rate: 5gpm
Volume Pumped: 155 gal

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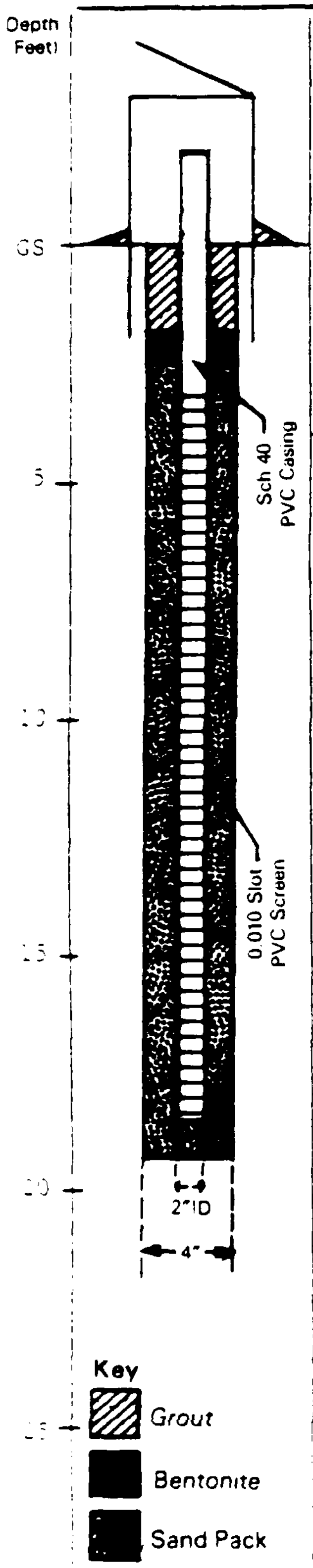
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-12



Drilling Summary:

Total Depth: 19' BGS Drillers: Magistro

Borehole Diameter(s): 4" McCall

Rig Type: Acker AD-2

Elevation: Land Surface: ______ Bit(s): 4" Core Barrel

Top of Casing: ______ Drilling Fluid Type: Water

Supervisory Geologist: Vickers Amount Use: ______

Log Book No. 2 pp. 17, 18 Water Level: 5.0' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC

Diameter: 2" ID ______ OD Diameter: 2" ID

Length: 5' casing and 15' screen Slot: 0.010

Filter: Material: 6/20 Sand Setting: 18.2' - 3.2' BGS

Setting: 19' - 2.5' BGS Seals: Type: Bentonite

Grout: Type: Cement and Clay Setting: 2.5' - 1.9' BGS

Setting: 1.9' BGS-cap Surface Casing: 6" steel with locking Lid

Other: ______

Stick up = 1.8'

Time Log:

	Started	Completed
Drilling:	11/19	11/19
Installation:	11/19	11/19
Water Level Reading:	11/19 10:52	
Development:	11/28	11/28

Well Development:

Method Equipment: Centrifugal Pump

Static Depth to Water: ______

Pumping Depth to Water: ______

Pumping Rate: 5gpm

Volume Pumped: 105 gal

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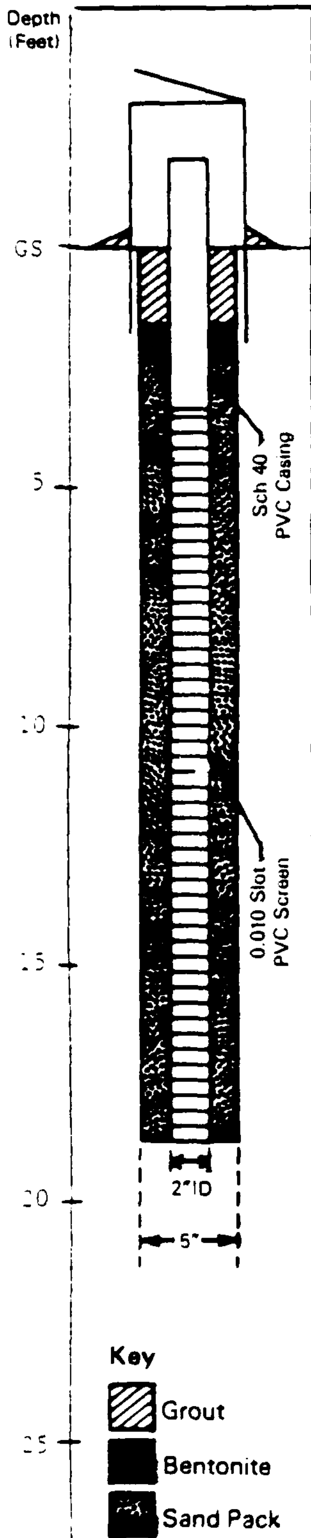
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-13



Drilling Summary:

Total Depth: 18.3' BGS
Drillers: Magistro, McCall
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ______
Bit(s): Hollow Stem Auger
Top of Casing: ______
Drilling Fluid Type: ______
Supervisory Geologist: Vickers
Amount Use: ______
Log Book No. 2 pp. 8, 9
Water Level: ______

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 18.3' - 3.3' BGS
Setting: 18.3' - 2.3' BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 2.3' - 1.7' BGS
Setting: 1.7' BGS-cap
Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 1.7' Above GS

Time Log:

	Started	Completed
Drilling:	11/13	11/13
Installation:	11/13	11/13
Water Level Reading:		
Development:	12/12	12/12

Well Development:

Method Equipment: Centrifugal
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: 5gpm
Volume Pumped: 250 gal

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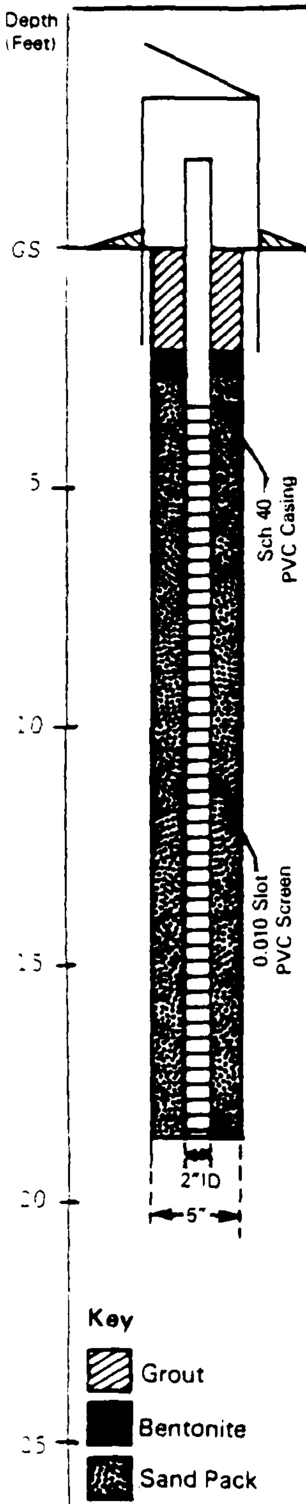
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ________   Well No.: I-14



Drilling Summary:

Total Depth: 18.2' BGS   Drillers: Magistro
Borehole Diameter(s): 5"   McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ________   Bit(s): Hollow Stem auger
Top of Casing: ________   Drilling Fluid Type: ________
Supervisory Geologist: Vickers   Amount Use: ________
Log Book No. 2   pp. 19, 20   Water Level: ________

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC
Diameter: 2" ID ____ OD   Diameter: 2" ID
Length: 5' casing and 15' screen   Slot: 0.010
Filter: Material: 6/20 Sand   Setting: 18.2' - 3.2' BGS
Setting: 18.2' - 2.6' BGS   Seals: Type: Bentonite
Grout: Type: Cement and Clay   Setting: 2.6' - 2.1' BGS
Setting: 2.1' BGS-cap   Surface Casing: 6" steel with locking Lid
Other: ________

Stick up = 1.8' BGS

Time Log:

	Started	Completed
Drilling:	11/20	11/20
Installation:	11/20	11/20
Water Level Reading:		
Development:	11/29	11/29

Well Development:

Method/Equipment: Centrifugal Pump
Static Depth to Water: ________
Pumping Depth to Water: ________
Pumping Rate: 2.5gpm
Volume Pumped: 170 gal

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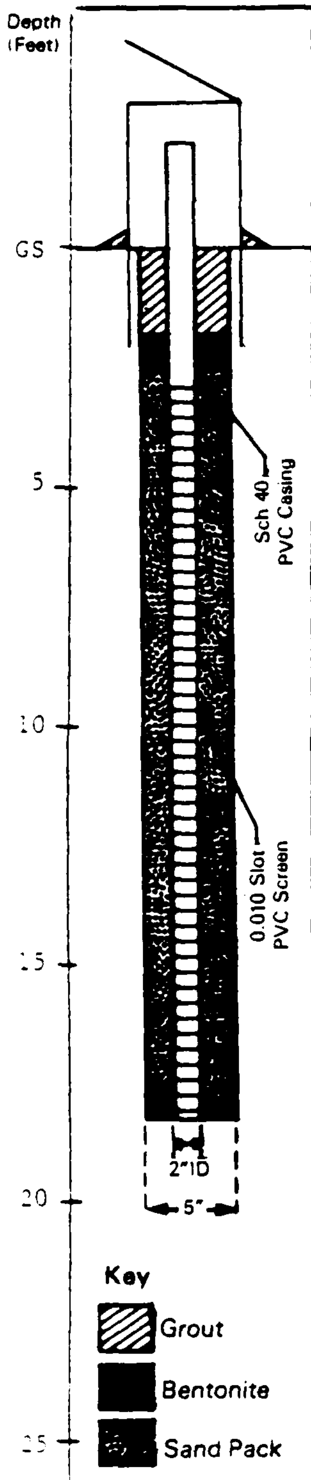
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ______ Well No.: I-15



Drilling Summary:

Total Depth: 17.9' BGS
Drillers: Magistro, McCall
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ______
Bit(s): Hollow Stem Augers
Top of Casing: ______
Drilling Fluid Type: ______
Supervisory Geologist: Vickers
Amount Use: ______
Log Book No. 2 pp. 11, 12
Water Level: 7.0' BGS

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 17.9' - 2.9' BGS
Setting: 17.9' - 2.6' BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 2.6' - 1.8' BGS
Setting: 1.8' BGS-cap
Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 2.1

Time Log:

	Started	Completed
Drilling:	11/16	11/16
Installation:	11/16	11/16
Water Level Reading:	11/16 10:20	
Development:	11/30	11/30

Well Development:

Method/Equipment: Air compressor and Hose then Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: Intermittent with Air Compressor; 5gpm w/pump
Volume Pumped: 150 gal with pump

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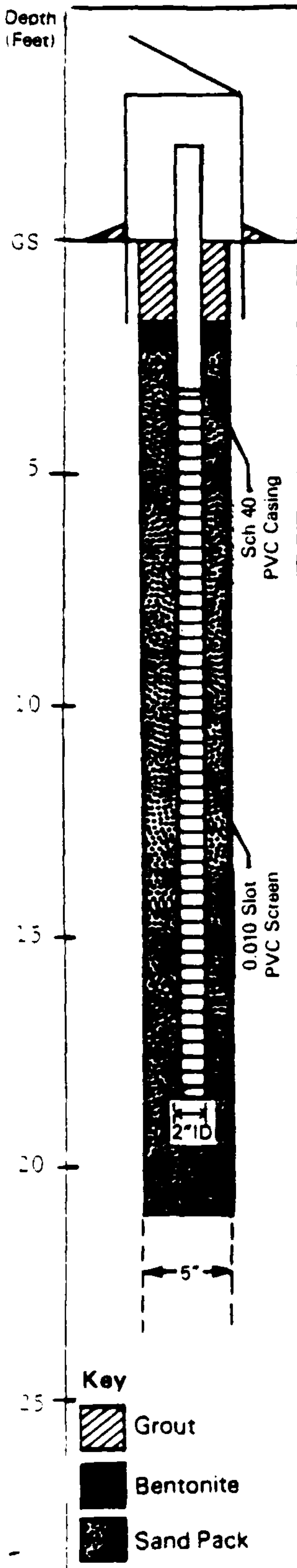
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ______   Well No.: I-16



Drilling Summary:

Total Depth: 20.6' BGS
Drillers: Magistro, McCall
Borehole Diameter(s): 5"
Rig Type: Acker AD-2
Elevation: Land Surface: ______
Bit(s): Hollow Stem Augers
Top of Casing: ______
Drilling Fluid Type: ______
Supervisory Geologist: Vickers
Amount Use: ______
Log Book No. 2 pp. 9-11
Water Level: 6.45' BGS

Well Design:

Casing: Material: SCH 40-PVC
Screen: Material: SCH 40-PVC
Diameter: 2" ID ______ OD
Diameter: 2" ID
Length: 5' casing and 15' screen
Slot: 0.010
Filter: Material: 6/20 Sand
Setting: 18.1' - 3.1' BGS
Setting: 20.6' - 2.3' BGS
Seals: Type: Bentonite
Grout: Type: Cement and Clay
Setting: 2.3' - 1.8' BGS
Setting: 1.8' BGS-cap
Surface Casing: 6" steel with locking Lid
Other: ______

Stick up = 1.9' Above GS

Time Log:

	Started	Completed
Drilling:	11/15	11/15
Installation:	11/15	11/16
Water Level Reading:	11/15 15:09	
Development:	11/130	11/30

Well Development:

Method/Equipment: Air compressor and Hose then Centrifugal Pump
Static Depth to Water: ______
Pumping Depth to Water: ______
Pumping Rate: Intermittent with Air Compressor; 2.5gpm w/pump
Volume Pumped: 125 gal with pump

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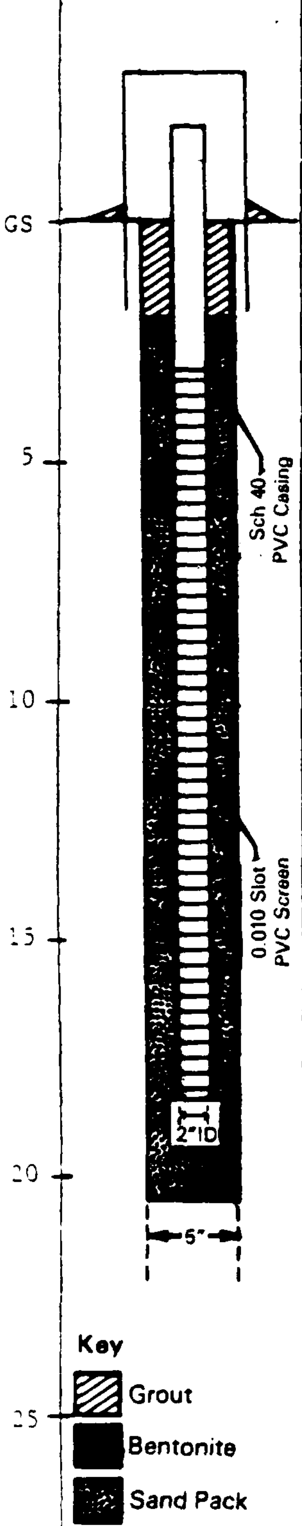
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ____ Well No.: I-17



Drilling Summary:

Total Depth: 20.2' BGS Drillers: Magistro
Borehole Diameter(s): 5" McCall
Rig Type: Acker AD-2
Elevation: Land Surface: ____ Bit(s): Hollow Stem Auger
Top of Casing: ____ Drilling Fluid Type: ____
Supervisory Geologist: Vickers Amount Use: ____
Log Book No. 2 pp. 23, 24 Water Level: 4.8' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC
Diameter: 2" ID ____ OD Diameter: 2" ID
Length: 5' casing and 15' screen Slot: 0.010
Filter: Material: 6/20 Sand Setting: 18.0' - 3.0' BGS
Setting: 20.2' - 2.5' BGS Seals: Type: Bentonite
Grout: Type: Cement and Clay Setting: 2.5' - 2.0' BGS
Setting: 2.0 BGS-cap Surface Casing: 6" steel with locking Lid
Other: ____

Stick up = 2.0' Above GS

Time Log:

	Started	Completed
Drilling:	11/26	11/26
Installation:	11/26	11/26
Water Level Reading:	11/26 10:50	
Development:	11/29	11/29

Well Development:

Method/Equipment: Air Compressor and Hose then Centrifugal Pump
Static Depth to Water: ____
Pumping Depth to Water: ____
Pumping Rate: Intermittent with Air Compressor; 2.5gpm w/pump
Volume Pumped: 100 gal

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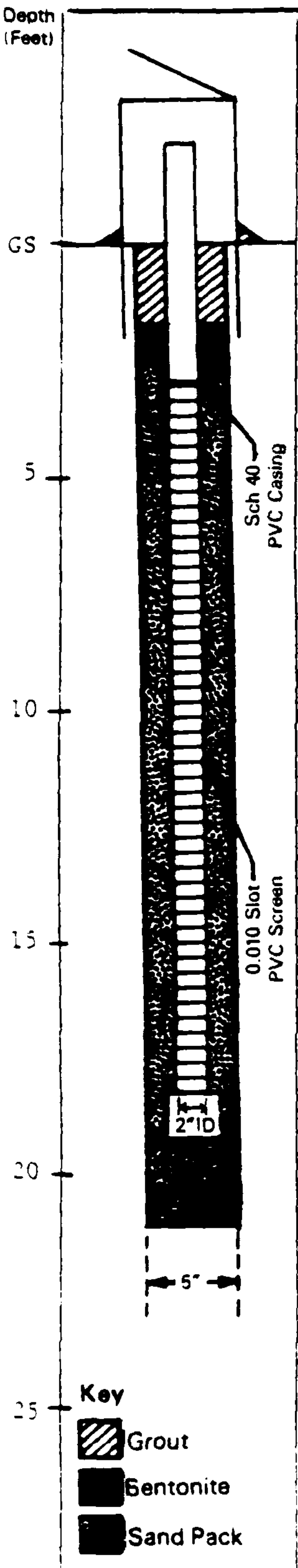
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB Owner: ____ Well No.: I-18



Drilling Summary:

Total Depth: 20.7' BGS Drillers: Cooper, Martin

Borehole Diameter(s): 5"

Rig Type: Acker AD-2

Elevation: Land Surface: ____ Bit(s): Hollow Stem Auger

Top of Casing: ____ Drilling Fluid Type: ____

Supervisory Geologist: Spooner Amount Used: ____

Log Book No. 1 pp. 2, 3 Water Level: 3.4' BGS

Well Design:

Casing: Material: SCH 40-PVC Screen: Material: SCH 40-PVC

Diameter: 2" ID ____ OD Diameter: 2" ID

Length: 5' casing and 15' screen Slot: 0.010

Filter: Material: 6/20 Sand Setting: 17.9' - 2.9' BGS

Setting: 20.7' - 2.3' BGS Seals: Type: Bentonite

Grout: Type: Cement and Clay Setting: 2.3' - 1.8' BGS

Setting: 1.8' BGS-cap Surface Casing: 6" steel with locking Lid

Other: ____

Stick up = 2.1' Above GS

Time Log:

	Started	Completed
Drilling:	11/17	11/17
Installation:	11/17	11/17
Water Level Reading:	11/17 11:21	
Development:	11/30	11/30

Well Development:

Method/Equipment: Centrifugal Pump

Static Depth to Water: ____

Pumping Depth to Water: ____

Pumping Rate: 5gpm

Volume Pumped: 115 gal

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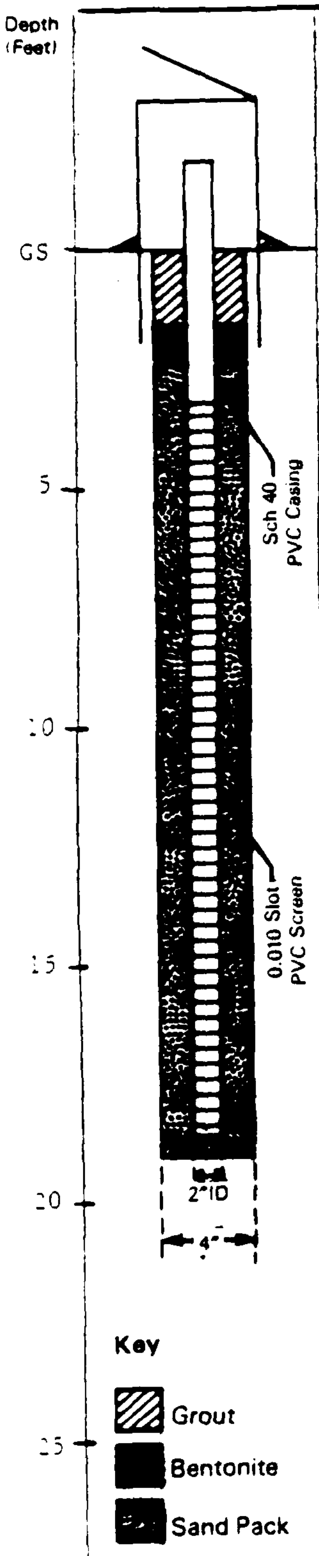
WELL CONSTRUCTION SUMMARY

Project: Homestead AFB   Owner: ________   Well No.: I-19



Drilling Summary:

Total Depth: 18.6' BGS   Drillers: Magistro, McCall

Borehole Diameter(s): 4"

Rig Type: Acker AD-2

Elevation: Land Surface: ________   Bit(s): 4" Core Barrel

Top of Casing: ________   Drilling Fluid Type: Water

Supervisory Geologist: Vickers   Amount Use: ________

Log Book No. 2 pp. 14, 15   Water Level: 1.6' BGS

Well Design:

Casing: Material: SCH 40-PVC   Screen: Material: SCH 40-PVC

Diameter: 2" ID ____ OD   Diameter: 2" ID

Length: 5' casing and 15' screen   Slot: 0.010

Filter: Material: 6/20 Sand   Setting: 18.2' - 3.2' BGS

Setting: 18.6' - 2.3' BGS   Seals: Type: Bentonite

Grout: Type: Cement and Clay   Setting: 2.3' - 1.6' BGS

Setting: 1.6' BGS-cap   Surface Casing: 6" steel with locking Lid

Other: ________

Stick up = 1.8' Above GS

Time Log:

	Started	Completed
Drilling:	11/17	11/17
Installation:	11/17	11/17
Water Level Reading:	11/17 11:50	
Development:	11/30	11/30

Well Development:

Method/Equipment: Centrifugal Pump

Static Depth to Water: ________

Pumping Depth to Water: ________

Pumping Rate: 5gpm

Volume Pumped: 65gal

WELL I-06

CORE LOG

DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET BLS)
Recovery: 0.3 ft. Off-white fossiliferous oolitic limestone. Micritic matrix 30-50% porosity. Vertical dissolution cavaties (major one is 0.5 inch dia.). Partially sand-filled cavities with evidence of secondary calcite replacement. Fossil fragments.	10	0-10
Recovery: 0.8 ft. Off-white to white fossiliferous oolitic limestone. Micritic matrix. 40-60% porosity. Dissolution cavities trend in variable directions (slanted worm burrows?). No common orientation of fossils: gastropod, brachiopod, (bryozoan?). Sand-filled cavities. Secondary calcite replacement. Yellow staining.	10	10-20

WELL I-12

CORE LOG

DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET BLS)
Recovery = 0.4 ft. + fragments. Off-white to white fossiliferous oolitic limestone. Micritic matrix. 30-50% porosity. Nondirectional dissolution cavities, with some horizontal worm borings. Sand and secondary calcite replacement in cavities. Fossil fragments.	10	0-10
Recovery = 0.9 ft. Off white to white fossiliferous oolitic limestone. Micritic matrix 30-50% porosity. Nondirectional dissolution cavities. Secondary calcite replacement. Brachiopod (whole) and bryozoan.	10	10-20

CORE LOG

DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET BLS)
Recovery - Fragments Grey to off-white fossiliferous oolitic limestone. 0.5 inch root from 0.5' below ground surface.	5	0-5
Recovery = 0.3 ft. Off-white fossiliferous oolitic limestone. Micritic matrix. 30-50% porosity. Dissolution cavities inclined 45 degrees to vertical (worm burrows?). Sand and secondary calcite replacement evident in cavities.	5	5-10
Recovery = 1.5 ft. Off-white fossiliferous oolitic limestone. Micritic matrix. 30-50% porosity. Horizontal, nondirectional dissolution cavities (worm burrows?). Sand and secondary calcite replacement evident in some of the cavities. Yellow staining. Brachiopods.	10	10-20

CORE LOG

DESCRIPTION	THICKNESS (FEET)	DEPTH (FEET BLS)
Recovery = 0.3 ft. + fragments. Off-white, fossiliferous, oolitic limestone. Micritic matrix. 40-60% porosity. Soil-filled dissolution cavities with minor calcite replacement. Fine roots evident in cavities. Dissolution cavities horizontal to nondirectional. Fossil coral fragments.	10	0-10
Recovery = 1.0 ft. Off-white, fossiliferous, oolitic limestone. Micritic matrix. 30-50% porosity. Horizontal to slanted dissolution cavities (worm burrows). Secondary calcite replacement with sand near top of core section. Yellow staining. Gastropods, brachiopods, and other fossil fragments.	10	10-20

E. SAMPLING AND ANALYTICAL PROCEDURES

APPENDIX E

SAMPLING PROCEDURES/QUALITY ASSURANCE/QUALITY CONTROL

Groundwater

Upon completion of all monitor wells, groundwater samples were collected from all monitor wells. The following sampling methods were observed:

- The depth to water was measured using wet tape or electric tape methods immediately before sampling each well. The measuring point is the surveyed point, clearly marked on the top of the casing.
- All monitor wells were purged using a 2-inch diameter, portable submersible pump until a volume between three or five times the calculated volume of water in the well was removed.
- After at least five times the well water volume was removed, a sample was obtained using a Teflon bailer.
- Field analyses performed included pH, temperature, and conductivity.
- All equipment lowered into the wells or otherwise in contact with the sampled water was washed with a low residue laboratory soap and rinsed with distilled water before the next well was sampled.
- All samples were refrigerated or kept on ice to maintain 4°C or below immediately after sampling.
- Refer to Attachment 1 for details of the sampling procedure.

Soils and Sediments

At the sites where soil and sediment samples were collected, the following sampling methods were observed:

- All equipment used to collect and transfer samples to the sample containers was washed with a low residue laboratory soap and rinsed with distilled water before each sample was collected.
- A stainless steel trowel was used to excavate and transfer samples to the sample containers.
- All samples were refrigerated or kept on ice to maintain 4°C or below immediately after sampling.
- Refer to Attachment 1 for details of the sampling procedure.
- Sample locations were marked with stakes and flagging to enable surveyors to locate sample points on a base map.

Sample Preservation

After samples were taken, they were sent to the SAIC laboratory for analysis as rapidly as possible to ensure that the most accurate and reliable data can be obtained. In general, storage at low temperature is the best way to preserve samples, although the length of time a sample can be held varies with the analyte. Some types of samples require the addition of a chemical preservative. A description of preservation techniques and holding times is presented in Table E-1.

Packing of Samples

Packaging procedures for environmental laboratory samples followed EPA recommended procedures. These procedures are outlined as follows:

- Samples were packaged in metal or plastic clad coolers lined with plastic. The container was taped shut and the drain plug at the bottom was secured to prevent leakage. The container was marked "THIS END UP" in the proper position.

- For each well, one or more samples, as needed, was collected in clean laboratory prepared bottles.

- Sample bottles were labeled with waterproof markings including
  - date of sample
  - time of sample
  - preservation method
  - analyses to be performed.

- Glass containers were packed in the shipping container in a manner which minimized the possibility of breakage or leakage. Screw-type lids were tightened and secured with tape. Large glass bottles were separated by a cushioned material such as vermiculite, foam, or carvedout styrofoam. Small glass bottles were packed in the shipping container with cushioning material.

- Plastic containers were packed with a cushioning material to prevent leakage by puncture. Screw-type lids were tightened and taped securely.

- Ice or blue-ice was sealed in plastic bags or containers prior to packaging in shipping containers.

Table E-1

CONTAINERS, PRESERVATION, AND HOLDING TIMES

Measurement	Container	Preservative	Maximum Holding Time
Acidity	P	Cool, 4°C	14 days
Alkalinity	P	Cool, 4°C	14 days
Ammonia	P	Cool, 4°C H_2SO_4 to pH<2	28 days
Biochemical oxygen demand	P	Cool, 4°C	48 hours
Biochemical oxygen demand Carbonaceous	P	Cool, 4°C	48 hours
Bromide	P	None required	28 days
Chemical oxygen demand	P	Cool, 4°C H_2SO_4 to pH<2	28 days
Chloride	P	None required	28 days
Chlorine, total residual	P	Determine on site	2 hours
Color	P	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	P	Cool, 4°C NaOH to pH>12 0.008% $Na_2S_2O_3$	14 days
Dissolved oxygen			
Probe	G bottle & top	Determine on site	1 hour
Winkler	G bottle & top	Fix on site	8 hours
Fluoride	P	None required	28 days
Hardness	P	HNO_3 to pH<2	6 months
Hydrogen ion (pH)	P	Determine on site	2 hours
Kjeldahl and organic nitrogen	P	Cool, 4°C H_2SO_4 to pH<2	28 days
Metals			
Chromium VI	P	Cool, 4°C	48 hours
Mercury	P	HNO_3 to pH<2 0.05% $K_2Cr_2O_7$	28 days
Metals except above	P	HNO_3 to pH<2	6 months
Nitrate	P	Cool, 4°C	48 hours
Nitrate-nitrite	P	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrite	P	Cool, 4°C	48 hours
Oil and Grease	G	Cool, 4°C H_2SO_4 to pH<2	28 days
Organic Carbon	G	Cool, 4°C H_2SO_4 to pH<2	28 days
Organic Compounds Extractables (including phthalates, nitrosamines, organochlorine pesticides, PCB's, nitroaromatics, isophorone, polynuclear aromatic hydrocarbons, haloethers, chlorinated hydrocarbons and TCDD)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$	7 days (until extraction) 30 days (after extraction)
Extractables (phenols)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$	7 days (until extraction) 30 days (after extraction)
Purgeables (halocarbons, aromatics, Acrolein, and Acrylonitrile)	G, teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$	14 days
Orthophosphate	P	Filter on site Cool, 4°C	48 hours
Pesticides	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$	7 days (until extraction) 30 days (after extraction)
Phenols	G	Cool, 4°C H_2SO_4 to pH<2	28 days
Phosphorus (elemental)	G	Cool, 4°C	48 hours
Phosphorus, total	P, G	Cool, 4°C H_2SO_4 to pH<2	28 hours
Residue, total	P	Cool, 4°C	14 days
Residue, filterable	P	Cool, 4°C	14 days
Residue, nonfilterable	P	Cool, 4°C	7 days
Residue, settleable	P	Cool, 4°C	7 days
Residue, volatile	P	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific conductance	P	Cool, 4°C	28 days
Sulfate	P	Cool, 4°C	28 days
Sulfide	P	Cool, 4°C Zinc Acetate	28 days

Samples were shipped to the laboratory for analysis so that a minimum amount of time was spent in transit. Samples were accompanied with a chain of custody record and delivered to the laboratory person authorized to receive samples.

Upon receipt at the laboratory, personnel assigned to receive samples inspected the conditions of the sample and sample seal, checked the information on the sample label against that on the chain of custody record, assigned a laboratory number, logged in the sample, and stored the sample until analysis.

Quality Assurance/Quality Control

During the sampling effort, quality control samples were collected based on the type of sampling being conducted. The following quality control samples were collected:

- Each day during the sampling of groundwater a field blank, bailer wash, and a replicate were collected and sent to the laboratory for analysis.
- During sediment/soil sampling a duplicate sample was randomly collected and submitted for analysis for every 10 samples.

The Field Supervisor ensured that all sampling protocols were strictly followed and that samples were delivered for shipment within the time allocated.

In the laboratory, quality assurance was routinely performed as part of the analysis of all samples. These methods are EPA accepted and were strictly followed to ensure accurate and meaningful data.

ATTACHMENT 1

SAMPLING INSTRUCTIONS:
HOMESTEAD AFB PHASE II STAGE 1
(Prepared by SAIC Laboratories)

(Note: For samples taken in duplicate, double number of containers)

WATER

1. Oil and Grease: Use 1-liter glass bottle. Rinse bottle with approximately 50 ml of sample and discard, fill bottle approximately 90% full with sample; add approximately 1-2 ml of HCl* (1-2 squirts with enclosed pipet), cap and invert 2-3 times; place on ice.

2. TOC (Total organic carbon): Use 120 ml amber glass bottles. Add approximately 1 ml H_2SO_4** (1 squirt with enclosed pipet) to empty bottle, add sample until bottle is completely filled (no head space) cap and invert bottle, if air bubble exist repoen and add more sample. Store on ice. Note: Teflon (shiny) side of cap septa faces sample and white dull side faces up.

3. TOX (Total organic halides): 120 ml amber glass bottlese. Add a few drops (5) of 1M sodium sulfite and 1 ml (1 squirt) of HNO_3*** to the empty bottle; add sample until bottle is completely filled (no head space) cap and invert bottle; if air bubble exists, reopen and add more sample. Store on ice. Note: Teflon (shiny) side of cap septa faces samples and white dull side faces up (U.S. EPA, 1982c).

4. Metals: Use 1 liter plastic (LPE) bottle. Fill bottle approximately 3/4 with sample, and 2 ml (1 squirt) of HNO_3. Cap and invert 2-3 times; store on ice.

5. Cyanide: Use 1 liter plastic (LPE) bottle. Rinse bottle with approximately 50 ml of sample and discard; fill bottle greater than 3/4 full and add 2 ml (2 squirts) of 10N NaOH***** cap and invert 2-3 times; place on ice.

6. Organics: (includes B/N/A, Pesticide, PCB): Use 1 gallon amber bottles with Teflon liners. Rinse bottle with approximately 50 ml of sample and discard. Fill bottle 90% full with sample and cap. Store on ice.

---

*HCl = Hydrochloric Acid

**H_2SO_4 = Sulfuric Acid

***HNO_3 = Nitric Acid

****H_3PO_4 = Phosphoric Acid

*****NaOH = Sodium Hydroxide

SEDIMENT/SOILS

1. All solid parameters are collected in 2-32 oz. wide mouth jars. Fill as full as possible, pour off any excess H_2O.

Chain of Custody:

Every sample should have a SAIC label attached and filled out. List all samples and any comments on enclosed shipping record forms. Keep original (White) copy and send remaining copies with samples. Tape ice chest shut and initial tape seam.

---

*HCl = Hydrochloric Acid

**H_2SO_4 = Sulfuric Acid

***HNO_3 = Nitric Acid

****H_3PO_4 = Phosphoric Acid

*****NaOH = Sodium Hydroxide

F. CHAIN-OF-CUSTODY FORMS

Pg 1 of C

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.

DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. HAFB-1

CONSIGNEE

Name: B. Vickers, JFB Associates
No., Street: Homestead AFB
City, State, Zip: Homestead, FL 33034

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	~~Ext. Organics~~ TOX	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
w I-7	12/7	08:45	3	SP-7	X														X						X				
w I-8	"	09:05	3	"	X														X						X				
w I-9	"	09:20	3	"	X														X						X				
w I-10	"	10:30	3	FPTA-3	X														X						X				
w I-11	"	11:00	3	"	X														X						X				
w I-12	"	11:40	3	"	X														X						X				
w Bailer	"	11:00	3	QA/QC	X														X						X				
w Replicate	"	"	3	" (FPTA-3:I-11)	X														X						X				
w Wash	"	"	3	"	X														X						X				
s SL-9	12/7	14:15	1	P-3							X																		
s SL-10	"	14:35	1	"							X																		
s SL-11	"	15:00	1	"							X																		
s SL-12	"	15:05	1	"							X																		
s SL-13	"	15:15	1	"							X																		
	Total No. Containers																												

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
B. Vickers	12/10/84	14:00	Lem Kearz	12/10	1400			
Shipping Method	**Shipped By (sign)**		**Courier From Airport (sign)**	**Date**	**Time**	**Received By Contract Lab (sign)**	**Date**	**Time**
			B. Pmubin	12-11	1050	[illegible]	12/11	1050

Pg 2

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. HAFB-1

CONSIGNEE

Name: B. Vickers, JRB Associates

No., Street: Homestead AFB

City, State, Zip: Homestead, FL 33034

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics Cr	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
SL-14	12/7	15:25	↑	P-3 (see below for QA/QC)							X																		
I-1	12/10	08:00	3	SP-1					X	X							X												
I-2	"	08:20	3	"					X	X							X												
I-3	"	08:50	3	"					X	X							X												
SL-1	"	09:05	1	"					X	X							X												
SL-2	"	09:10	1	"					X	X							X												
SL-3	"	09:20	1	"					X	X							X												
SL-4	"	09:30	1	"					X	X							X												
~~SL~~-QA/QC	12/7	15:00	1	~~P-3~~ Replicate (P-3: SL-11)							X																		
Blank	12/10	08:20	3	QA/QC					X	X							X												
Bailer Wash	"	08:20	3	"					X	X							X												
Replicate	"	08:20	3	QA/QC (SP-1: I-2)					X	X							X												
Replicate	"	09:30	1	QA/QC (SP-1: SL-4)					X	X							X												

Total No. Containers:

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
B. Vickers	12/10/84	1400	[illegible signature]	12/10	1400			
Shipping Method / **Shipped By (sign)**			**Courier From Airport (sign)**	**Date**	**Time**	**Received By Contract Lab (sign)**	**Date**	**Time**
			B. Philbin	12-11	1050	[illegible signature]	12/11	1050

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SAMPLE SHIPPING RECORD

JRB

Sheet No. HAFB-2

CONSIGNEE

Name: B. Vickers, JRB Associates
No., Street: Homestead AFB
City, State, Zip: Homestead, FL 33034

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	~~Vol. Organics~~ TOX	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides (CS)	Herbicides	~~LMWHC~~ Total lead	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
G-530	12/12	13:20	4	Well Field 1 - USGS Well					X	X	X						X												
Bailer Wash	12/12	13:00	4	QA/QC					X	X	X						X												
Blank	"	"	4	"					X	X	X						X												
Replicate	"	"	4	QA/QC (Well Field 1: S-530)					X	X	X						X												
Well 10	12/12	14:10	7	Well Field 2			X		X	X	X						X		X						X				
SD-1	12/12	11:50	1	SP-1 : Sediments					X	X							X												✓
SD-2	12/12	12:00	1	SP-1 : Sediments					X	X							X												✓
I-15	12/11	08:30	1	P-2							X																		
I-16	12/11	09:00	1	P-2							X																		
Bailer Wash	12/11	08:50	1	QA/QC							X																		
Blank	12/11	08:50	1	QA/QC							X																		
Replicate	12/11	08:50	1	QA/QC (well I-16)							X																		
SL-5	12/11	10:13	1	SP-2									X												X				
SL-6	12/11	10:05	1	SP-2									X												X				
	Total No. Containers		32																										

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
B. Vickers	12/13	13:10						
Shipping Method / Shipped By (sign): Fed X			Courier From Airport (sign): B. Philbin	12.14	1100	Received By Contract Lab (sign): Michael K Burhol	12/14	1100

White-SAI Canary-Lab Representative Pink-Contract Lab Goldenrod-Lab Returns to SAI

Pg 2 of 2

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.

DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

JRB

Shipment No: HAFB-2

CONSIGNEE

Name: B Vickers, JRB Associates
No., Street: Homestead AFB
City, State, Zip: Homestead, FL 33034

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	~~Vol. Organics~~ TOX	Surv. Vol. Organics	~~Trace Metals~~ Total lead	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
SL-7	12/11	09:55	1	SP-2					X																X				
SL-8	12/11	09:50	1	SP-2					X																X				
Replicate	12/11	10:13	1	QA/QC (SP-2: SL-5)					X																X				
SD-3	12/11	15:30	1	SP-2					X																X				
SD-4	12/11	15:45	1	SP-2					X																X				
I-14	12/12	08:30	4	SP-6			X		X										X						X				
I-5	12/12	09:00	4	SP-4			X		X										X						X				
I-6	12/12	09:20	4	"			X		X										X						X				
Blank	12/12	09:20	4	"			X		X										X						X				
Bailer Wash	12/12	09:20	4	"			X		X		not rec'd dec								X						X				
Replicate	12/12	09:20	4	"			X		X										X						X				
I-4	12/12	09:55	4	"			X		X										X						X				
I-17	12/12	10:10	2	SP-2					X																X				
	Total No. Containers		35																										

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
B. Vickers	12/13	13:10						
Shipping Method / **Shipped By (sign)**			**Courier From Airport (sign)**	**Date**	**Time**	**Received By Contract Lab (sign)**	**Date**	**Time**
Fed X			[illegible]			[illegible]	12/14	1100

Pg 1 of 1

SAMPLE SHIPPING RECORD

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476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

JRB

Shipment No: HAFB-3

CONSIGNEE

Name: B. Vickers
JRB Associates

No., Street: Homestead AFB

City, State, Zip: Homestead FL 33034

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics TOX	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
24-8	12/13	13:55	3	Existing well (Fire Hydrant) Ammunitions Storage Area						X	~~X~~								X						X				Organic
I-13	12/13	14:20	3	FPTA-2						X									X						X				Water
I-19	12/13	14:35	3	SP-5						X									X						X				
...ile: wash	"	"	3	QA/QC						X									X						X				
...eplicate	"	"	3	QA/QC (I-19)						X									X						X				
Blank	"	"	3	QA/QC						X									X						X				
I-18	"	15:00	2	SP-5						X									X										

Total No. Containers: 20

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
B. Vickers	12/17	12:40						

Shipping Method	Shipped By (sign)	Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	Date	Time
		B Pahlbin	12/18	1100	Michael K. Buck	12/18	1100

White-SAI Canary-Lab Representative Pink-Contract Lab Goldenrod-Lab Returns to SAI

Pg 1 of 2

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. H-35-1

CONSIGNEE

LAUCK TESTING LAB

No. Street

City, State, Zip

ATTN. JIM OWENS

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	TOX	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
85-5011	12/11	1400	1	BAILER WASH																✓									H2O
85-5012			1	BLANK																✓									
85-5013			1	I-7																✓									
85-5014			1	I-8																✓									
85-5015			1	I-9																✓									
85-5016			1	I-10																✓									
85-5017			1	I-11																✓									
85-5018			1	REP. I-11																✓									
85-5019			1	I-12																✓									
85-5020			1	BAILER WASH															✓										
85-5021			1	BLANK															✓										
85-5022			1	I-7															✓										
85-5023			1	I-8															✓										
85-5024			1	I-9															✓										
SUB	Total No. Containers		14																										

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
[illegible signature]	12/11					FED EX	12/11	1500
Shipping Method / Shipped By (sign)			Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	Date	Time
AIRBILL # 0243723152						[illegible signature]	12/12	1000

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

SAMPLE SHIPPING RECORD

Shipment No. H-351-1

CONSIGNEE

Name: LAUCKS TESTING LAB

No. Street:

City, State, Zip:

ATTN: TIM OWENS

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
85-5025	12/7		1	I-10															✓										H2O
85-5026			1	I-11															✓										
85-5027			1	REP. I-11															✓										
			1	I-12															✓										

SUB Total No. Containers: 4

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
[illegible]	[illegible]					FEDEX	12/11	1500

Shipping Method	Shipped By (sign)	Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	Date	Time
	AIRBILL 02437215				[illegible]	12-12	1000

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. H-351-2

CONSIGNEE

Name: LAUCKS TESTING LAB

No. Street:

City, State, Zip:

ATTN. JIM OWENS

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
85-5065	12/10/84	1530H	1	BAILER WASH QA/QC													✓												
85-5066			1	BLANK QA/QC													✓												
85-5067			1	I-1 SP-1													✓												
85-5068			1	REPLICATE: SP-1: I-2													✓												
85-5069			1	SP-1: I-2													✓												
85-5070			1	SP-1: I-3													✓												

Total No. Containers: 6

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
Michael Buchanan						FED EX	12/12	1600
Shipping Method / Shipped By (sign): AIRBILL# 024372471			Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	12-13	1000

12/12

7

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. H-351-2

CONSIGNEE

Name: Lancke Testing Lab attn. Jim Owens

No. Street:

City, State, Zip:

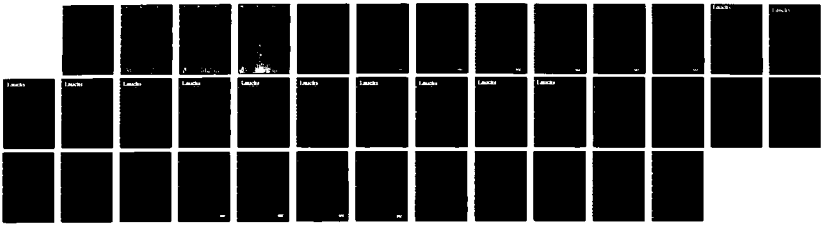
SAMPLE ANALYSIS

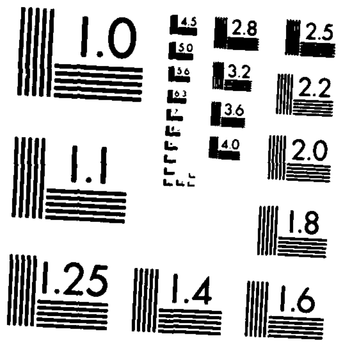
Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	~~[illegible]~~ TOX	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
85-5297	12/12	1600	1														✓												Water
85-5298			1														✓												
85-5299			1														✓												
85-5300			1														✓												
85-5301			1														✓												
85-5312			1																✓										
85-5315			1																✓										
85-5314			1																✓										
85-5315			1																✓										
85-5316			1																✓										
85-5317			1																✓										
85-5318			1																✓										
85-5319			1																✓										
85-5320			1																	✓									
SMB	Total No. Containers		14																										

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
[illegible]	12/17	1600				FEDEX	12/17	1600
Shipping Method / Shipped By (sign)			Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	Date	Time
AIRBILL# [illegible]						[illegible]	12/[illegible]	1000

AD-A171 579 INSTALLATION RESTORATION PROGRAM PHASE II 3/3
CONFIRMATION/QUANTIFICATION STA (U) SCIENCE
APPLICATIONS INTERNATIONAL CORP MCLEAN VA
UNCLASSIFIED P A SPOONER ET AL. 07 MAR 86 F/G 13/2 NL





MICROCOPY RESOLUTION TEST

NATIONAL BUREAU OF STANDARDS

Bj Oct 2 / 18

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. 4-351-2

CONSIGNEE

Name: Lauck's Testing Lab

No. Street:

City, State, Zip:

attn Jim Owens

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Remarks
85-5321	10/12	1600	1		water
85-5322			1		
85-5323			1		
85-5324			1		
85-5325			1		
85-5326			1		
85-5327			1		

Sample No.	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD 7 Dt	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date
85-5321																✓								
85-5322																✓								
85-5323																✓								
85-5324																✓								
85-5325																✓								
85-5326																✓								
85-5327																✓								

S/B Total No. Containers: 7

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
Michael [illegible]	10/17	1600				FEDEX	10/17	1530
Shipping Method / Shipped By (sign)			**Courier From Airport (sign)**	Date	Time	**Received By Contract Lab (sign)**	Date	Time

Ko- 195-2

SAMPLE SHIPPING RECORD

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. H-351-5

CONSIGNEE

Name: Laucks Testing Lab
No. Street:
City, State, Zip:

attn. Jim Owens

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	~~TOC~~ TOX	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
85-5441	12/13	3P	1	Bldg. 248															✓										Water
85-5442			1	I-13															✓										
85-5443			1	I-19															✓										
85-5444			1	Bailer Wash															✓										
85-5445			1	Rep. (SP-5: I-19)															✓										
85-5446			1	Blank															✓										
85-5447			1	I-18															✓										
85-5448			1	Bldg. 248																✓									
85-5449			1	I-13																✓									
85-5450			1	I-19																✓									
85-5451			1	Bailer Wash																✓									
85-5452			1	Rep. (SP-5: I-19)																✓									
85-5453			1	Blank																✓									
85-5454			1	I-18																✓									

Total No. Containers: 14

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
						Federal Express	12/20	1330
Shipping Method / Shipped By (sign)			**Courier From Airport (sign)**	**Date**	**Time**	**Received By Contract Lab (sign)**	**Date**	**Time**
Air Bill #0243704226						[illegible signature]	12/21	1000

SAMPLE SHIPPING RECORD

17-20 2

SCIENCE APPLICATIONS, INC.
DIVISION OF ENVIRONMENTAL CHEMISTRY AND GEOCHEMISTRY
476 PROSPECT STREET, LA JOLLA, CA 92038 • (619) 456-2791

Shipment No. H-351-3

CONSIGNEE

Name: Laucks Testing Lab

No. Street:

City, State, Zip:

attn Jim Owens

SAMPLE ANALYSIS

Sample No.	Sample Date	Packed Time	No. Containers	Sample Description	Ext. Organics	Surv. Ext. Organics	Vol. Organics	Surv. Vol. Organics	Trace Metals	Other Inorganics	Pesticides	Herbicides	LMWHC	HMWHC	Radionuclides	Drugs	Cyanide	pH	TOC	BOD	TSS	VSS	DOC	POC	Oil and Grease	Lipids	Part. Size Dis.	Sediment Core Date	Remarks
[illegible]271	12/12	1500	1	SL-1													✓												Sediment
[illegible]272			1	SL-2													✓												
[illegible]			1	SL-3													✓												
[illegible]			1	SL-4													✓												
[illegible]			1	Rep (SP-1: SL-4)													✓												
[illegible]	12/12	1500	1	SD-2													✓												
[illegible]			1	SD-1													✓												
[illegible]			1	Rep. (SD-2: SP-1)													✓												

SHB Total No Containers: 8

SHIPPING CHAIN OF CUSTODY

SAI (by) (sign)	Date	Time	Received By (sign)	Date	Time	Received By Courier (sign)	Date	Time
						Federal Express	12/20	1330

Shipping Method	Shipped By (sign)	Courier From Airport (sign)	Date	Time	Received By Contract Lab (sign)	Date	Time
	Air Bill #024370426				[illegible]	12/21	1000

White-SAI Canary-Lab Representative Pink-Contract Lab Goldenrod-Lab Returns to SAI

G. ANALYTICAL DATA

QUALITY CONTROL REPORT

HOMESTEAD AFB

Parameter	Replicate		Spike Value	Spike Level	Recovery %
TOC	3.0/2.9		6.3	17	107
TOX	0.115/0.105		0.01	0.016	14
			0.01	0.045	62
Phenol	0.050/0.050		<0.005	0.051	102
	2.6/1.6		0.2	1.6	78
Cn-	0.056/0.055		<0.005	0.055	100
Oil and Grease	insufficient sample to do		linear curve	see attached	
Metals Cr	(SL-1/SP-1)	47.1/82.2/72.2			
	(SL-2/SP-1)	8.40/7.72/7.48	7.87	171	98
Cd	(SL-1/SP-1)	4.04/4.85/6.04			
	(SL-2/SP-1)	0.427/0.400/0.447	0.425	10	109
Cu	(SL-1/SP-1)	70.3/85.7/86.6			
	(SL-2/SP-1)	9.29/6.92/9.93	8.71	102	73
Pb	(SL-1/SP-1)	143/186/187			
	(SL-2/SP-1)	48.8/45.3/58.6	50.9	243	101
Ni	(SL-1/SP-1)	14.2/16.4/18.5			
	(SL-2/SP-1)	6.50/5.89/7.97	6.79	43	103
Zn	(SL-1/SP-1)	626/755/772			
	(SL-2/SP-1)	55.1/48.7/54.2	54.2	391	114
Pesticide/Herbicides			P,P' DDT Spike		
SL 10					43
SL 10-2					44
SL 11					55
SL 11-Rep					43
SL 12					45
SL 13					36
SL 14					27

HOMESTEAD - AFB

SAMPLE LOCATION	OIL & GREASE ppm	CYANIDE ppm	PHENOLS mg/l	TOX mg/l	TOC mg/l	PESTICIDES/ HERBICIDES	POC mg/l
I-7 (SP-7)	0.15			0.01	93.		28.
I-8 (SP-7)	0.51			0.02	170.		32.
I-9 (SP-7)*	6.49			0.03	62.		13.
I-9 (SP-7)*	732000.0						
I-10 (FPTA-3)	0.16			<0.010	98.		46.
I-11 (FPTA-3)	0.18			0.02	64.		25.
I-11R (FPTA-3)	<0.10			0.02	58.		19.
I-12 (FPTA-3)	2.59			0.02	90.		27.
Bailer Wash - 5051	<0.10						
Field Blank - 5052	<0.10						
Field Blank - 5222	<0.10						
Bailer Wash - 5223	<0.10						
Well #10	<0.10	0.007		0.039	5.4	ND	4.8
I-4	5.19			0.044	37.		26.
I-5	4.29			0.10	19.		11.
I-6	0.47			0.049	10.		6.1
I-6R	<0.10			0.052	12.		7.4
I-14	0.83			0.036	47.		30.
I-17	<0.10						
SL-5 (SP-2)	21900.0						
SL-5R (SP-2)	26600.0						
SL-6 (SP-2)	1540.0						
SL-7 (SP-2)	586.0						
SL-8 (SP-2)	983.0						
SD-03 (SP-2)	749.0						
SD-4 (SP-2)	822.0						
Bldg. 248 (FPTA-2)	<0.10			0.025	2.2		0.5
I-13 (FPTA-2)	0.18			2.2	5.6		1.9
I-19 (SP-5)	0.11			0.026	7.0		3.8
Bailer Wash - 5438	0.19			0.020	0.6		0.1
I-19R (SP-5)	0.13			0.025	9.4		5.9
Field Blank - 5440	1.20			0.018	1.2		0.3
Field Blank - 5328						ND	

*The oil phase residing over the aqueous phase of sample I-9 (SP-7) was analyzed as a separate sample.

HOMESTEAD - AFB

SAMPLE LOCATION	% SOLIDS	OIL & GREASE ppm	CYANIDE ppm	PHENOLS mg/l	TOX mg/l	TOC	PESTICIDES/ HERBICIDES ppb	POC mg/l
BW 5020						1.1		<0.1
FB 5021						1.6		0.2
BW 5065			<0.005					
FB 5066			<0.005					
I-1			<0.005					
I-2R			<0.005					
I-2			<0.005					
I-3			<0.005					
I-15							ND	
I-16							ND	
I-16-Rep							ND	
I-18					0.046	22.		14.
SL 1	72.9		1.3					
SL 2	91.1		0.6					
SL 3	82.1		0.7					
SL 4	73.3		0.8					
SL 4-Rep	72.2		0.8					
SL 9							P,P' DDT 86	
SL 10-1							P,P' DDD 82	
							P,P' DDT 670	
							methoxychlor 89	
SL 10-2							P,P' DDD 77	
							P,P' DDT 620	
							methoxychlor 120	
SL 11							Dieldrin 42	
							P,P' DDT 260	
SL 11-Rep							Aldrin 36	
							Dieldrin 33	
							P,P' DDT 200	

SAMPLE LOCATION	% SOLIDS	OIL & GREASE ppm	CYANIDE ppm	PHENOLS mg/l	TOX mg/l	TOC	PESTICIDES/ HERBICIDES ppb	POC mg/l
SL 12							Aldrin 74	
							Dieldrin 29	
							P,P' DDT 370	
							methoxychlor 86	
SL 13							ND	
SL 14							P,P' DDT 26	
SD2		83.8	3.0					
SD-1		87.0	0.6					
SD 2-Rep		84.0	3.9					
BW 5297			0.007					
FB 5298			0.007					
S 530-Rep			0.009				ND	
S 530			0.012				ND	
FB 5312						0.4		<0.1
FB 5329							ND	
BW 5313						0.4		<0.1
BW 5320					0.041			
FB 5321					0.039			
BW 5330							ND	
BW 5331							ND	

SAIC

TRACE METALS IN WATERS COLLECTED FROM HOMESTEAD AFB
(Values in ug/l unless otherwise noted)

SAMPLE LOCATION	Cd	Cr	CR(VI)	Cu	Pb	Ni	Zn
Bailer Wash	<0.200	<0.500		1.17	1.07	<5.00	6.55
Blank	<0.200	<0.500		0.842	1.22	<5.00	8.72
I-1/SP-1	0.215	19.7		4.22	7.79	10.6	
I-2 Rep./SP-1	<0.200	<0.500		4.80	9.02	9.24	15.7
I-2/SP-1	0.239	<0.500		5.30	6.77	10.8	15.9
I-3/SP-1	0.372	<0.500		6.95	5.66	16.9	16.3
Bailer Wash			<0.052				
Blank			<0.052				
I-1/SP-1			0.301				
I-2 Rep./SP-1			<0.052				
I-2/SP-1			<0.052				
I-3/SP-1			1.73				
Blank	<0.200	<0.500		0.967	1.97	<5.00	12.2
I-5/SP-4					9.47		
I-4/SP-4					13.3		
I-6/SP-4					2.22		
I-14/SP-6					15.9		
I-17/SP-2					7.74		
Bailer Wash	<0.200	<0.500		1.29	2.93	<5.00	17.0
Well S-530/Well Field #1	<0.200	0.672		1.87	2.27	<5.00	18.8
Well S-530 Rep./Well Field #1	<0.200	0.794		1.79	3.71	<5.00	16.7
Well 10/Well Field #2	<0.200	<0.500		4.30	2.66	<5.00	32.5
Blank			<0.052				
Bailer Wash			<0.052				
Well S-530/Well Field #1			0.299				
Well 10/Well Field #2			<0.052				
Well S-530 Rep./Well Field #1			0.161				

E/MS-9/#17

TRACE METALS IN SOILS COLLECTED FROM HOMESTEAD AFB
(Values in ug/l dry weight unless otherwise noted)

SAMPLE LOCATION	Cd	Cr	Cu	Pb	Ni	Zn
SL-1/SP-1	4.77	67.2	80.9	172.	16.4	718.
SL-2/SP-1	0.694	15.6	18.1	88.3	12.9	123.
SL-3/SP-1	0.821	28.1	30.5	108.	41.6	145.
SL-4/SP-1	1.20	35.5	111.	210.	45.8	282.
SL-4 Rep./SP-1	1.14	36.2	115.	201.	42.5	235.
SD-2	5.62	89.6	44.9	1179.	14.0	917.
SD-1	1.24	15.7	13.8	110.	3.40	129.
SD-2 Rep.	6.95	70.1	45.2	1173.	12.2	798.
SL-5				624.		
SL-5 Rep.				226.		
SL-6				228.		
SL-7				723.		
SL-8				185.		
SD-03				927.		
SD-4				1066.		

Laucks Testing Laboratories, Inc.

940 South Harney Street, Seattle, Washington 98108 (206) 767-5060

Chemistry, Microbiology, and Technical Services

Certificate

CLIENT Science Applications International Corporation
476 Prospect Street
La Jolla, CA 92038
ATTN: Dana Errett

LABORATORY NO 87750

DATE Feb. 5, 1985

PO #11-850423-38

REPORT ON WATER & SOIL

SAMPLE IDENTIFICATION Submitted 12/11/84 and identified as shown:

TESTS PERFORMED AND RESULTS

1) 85-4679 9-3 12/3/84
2) 85-4680 9-4 12/3/84
3) 85-4704 9-1 12/3/84
4) 85-4705 10-1 12/3/84
5) 85-4706 10-2 12/3/84
6) 85-4707 10-3 12/3/84
7) 85-4708 10-3R 12/3/84
8) 85-4709 Boiler Wash 12/3/84
9) 85-4710 Field Blank 12/3/84
10) 85-4711 9-1 12/3/84
11) 85-4712 9-2 12/3/84
12) 85-4713 9-3 12/3/84
13) 85-4714 9-4 12/3/84
14) 85-4715 10-1 12/3/84
15) 85-4665 9-1 12/3/84
16) 85-4666 9-2 12/3/84
17) 85-4667 9-3 12/3/84
18) 85-4668 9-4 12/3/84
19) 85-4669 10-1 12/3/84
20) 85-4670 10-2 12/3/84
21) 85-4671 10-3 12/3/84
22) 85-4672 10-3R 12/3/84
23) 85-4673 Boiler Wash 12/3/84
24) 85-4674 Field Blank 12/3/84
25) 85-4716 10-2 12/3/84
26) 85-4717 10-3 12/3/84
27) 85-4718 10-3R 12/3/84
28) 85-4719 Boiler Wash 12/3/84
29) 85-4720 Field Blank 12/3/84
30) 85-4767 812-56 Dover xyz 12/6/84 0905 mwp005 ET
31) 85-4768 812-56 Dover xyz 12/6/84 0900 mwp006 ET
32) 85-4769 812-56 Dover xyz 12/6/84 0930 mwp007 ET
33) 85-4770 812-56 Dover xyz 12/6/84 0950 mwp001
34) 85-4771 812-56 Dover t-1 12/6/84 1015 mw001

Laucks Testing Laboratories, Inc.

940 South Harney Street, Seattle, Washington 98108 (206) 767-5060

Chemistry, Microbiology, and Technical Services

Certificate

SAI

LABORATORY NO 87750

35) 85-4772 812-56 t-1 12/6/84 1106 mw--2
36) 85-4773 812-56 t-1 12/6/84 1145 004
37) 85-4774 812-56 t-1 12/6/84 1406 101
38) 85-4775 812-56 t-1 12/6/84 14345 102
39) 85-4776 812-56 t-1 12/6/84 1530 103
40) 85-4777 812-56 Dover QA-8 12/6/84 0831
41) 85-4778 812-56 QA-9 12/6/84 0830
42) 85-4779 812-56 QA-10 12/6/84 1145
43) 85-4780 812-56 Dover-T-1 12/6/84 1015 mw001
44) 85-4781 812-56 Dover-t-1 12/6/84 1100 002
45) 85-4782 812-56 Dover-T-1 12/6/84 1145 004
46) 85-4783 812-56 Dover-T-1 12/6/84 1400 101
47) 85-4784 812-56 Dover-T-1 12/6/84 1445 102
48) 85-4785 812-56 Dover-T-1 12/6/84 1530 103
49) 85-4786 812-56 Dover-QA-8 12/6/84 0830
50) 85-4787 812-56 QA-9 12/6/84 0830
51) 85-4788 812-56 QA-10 12/6/84 1145
52) 85-4789 812-56 Dover-T-1 12/6/84 MW001
53) 85-4790 812-56 Dover-T-1 12/6/84 1100 002
54) 85-4791 812-56 Dover-T-1 12/6/84 1145 004
55) 85-4792 812-56 Dover-T-1 12/6/84 1400 101
56) 85-4793 812-56 Dover-T-1 12/6/84 1445 102
57) 85-4794 812-56 Dover-T-1 12/6/84 1530 103
58) 85-4795 812-56 Dover QA-8 12/6/84 0830
59) 85-4796 812-56 QA-0 12/6/84 1890
60) 85-4797 812-56 QA-10 12/6/84 1145
61) 85-4820 812-56 Dover T-1 12/6/84 1015 MW001
62) 85-4821 812-56 Dover T-1 12/6/84 1145 002
63) 85-4822 812-56 Dover-T-1 12/6 1145 mw004
64) 85-4823 812-56 Dover-T-1 12/6 1400 101
65) 85-4824 812-56 Dover-T-1 12/6 1445 102
66) 85-4025 812-56 Dover-T-1 12/6 1530 103
67) 85-4826 812-56 Dover-T-1 12/6 0830 QA-8
68) 85-4827 812-56 Dover-T-1 12/6 0830 QA-9
69) 85-4828 812-56 Dover-T-1 12/6 1145 QA-10
70) 85-4857 12/5/84 Field Blank
71) 85-4858 12/5/84 35w-1
72) 85-4859 12/5/84 35w-3
73) 85-4860 12/5/84 8sw-1
74) 85-4861 12/5/84 8sw-1R

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LABORATORY NO 87750

75) 85-4862 12/5/84 8sw-2
76) 85-4864 12/5/84 12/sw-1
77) 85-4865 12/5/84 12sw-2
78) 85-4866 12/6/84 8sd-1
79) 85-4867 12/6/84 8sd-2
80) 85-4868 12/6/84 9sd-1
81) 85-4869 12/6/84 9sd-2
82) 85-4870 12/6/84 10sd-1
83) 85-4871 12/8/84 10sd-2
84) 85-4872 12/5 Field Blank
85) 85-4873 12/5 3sw-1
86) 85-4874 12/5 8sw-3
87) 85-4875 12/5 8sw-1
88) 85-4876 12/5 8sw-1R
89) 85-4877 12/5 8sw-2
90) 85-4879 12/5 10sw-1
91) 85-4880 12/5 12sw-1
92) 85-4881 12/5 12sw-2
93) 85-4882 12/5 Field Blank
94) 85-4883 10/6/84 Field Blank
95) 85-4884 10/5/84 3sw-1
96) 85-4885 10/5/84 8sw-1R
97) 85-4886 10/5/84 8sw-2
98) 85-4887 10/5/84 9sw-1
99) 85-4675 12/3/84 7-1
100) 85-4676 12/3/84 7-2
101) 85-4677 12/3/84 7-3
102) 85-4678 12/3/84 9-2
103) 85-4839 Dover 005c-p6-102 12/6/84 1445 gp-84-0483
104) 85-5011 hafb qa/qc 12/7/84 1100 Bailer Wash Vickers
105) 85-5012 hafb qa/qc 12/7/84 Field Blank
106) 85-5013 hafb sp-7 12/7/84 0848 I-7
107) 85-5014 hafb 12/7/84 0905 I-8
108) 85-5015 hafb 12/7/84 0928 I-9
109) 85-5016 hafb rpta3 12/7/84 1030 I-10
110) 85-5017 hafb fpta3 12/7/84 1100 I-11
111) 85-5018 hafb qa-qc 12/7/84 1100 I-11 Rep fota3
112) 85-5019 hafb fpta3 12/7/84 1140 I-12
113) 85-5020 hafb qa/qc 12/7/84 1100 Bailer Wash
114) 85-5021 hafb qa/qc 12/7/84 1100 Field Blank

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115) 85-5022 hafb sp-7 12/7/84 0845 I-7
116) 85-5023 hafb sp-7 12/7/84 906 I-8
117) 85-5024 hafb sp-7 12/7/84 0928 I-9
118) 85-5025 hafb fpta3 12/7/84 1030 I-10
119) 85-5026 hafb fpta3 12/7/84 1100 I-11
120) 85-5027 hafb qa/qc 12/7/84 1100 I-11 fpta3 Rep.
121) 85-4985 3-sw-2 5/Dec/84
122) 85-4986 3-sw-3 5/Dec/84
123) 85-5987 3-sw-1 5/Dec/84
124) 85-4988 9-sw-2 12/6/84
125) 85-4989 10-sw-1 12/5/84
126) 85-4990 10-sw-2 12/5/84
127) 85-4996 Field Blank 12/6/84
128) 85-5001 Field Blank 12/6/84
129) 85-4997 3-sw-2 12/5/84
130) 85-4998 9-sw-1 12/6/84
131) 85-4999 9-sw-2
132) 85-5002 B-sw-2 12/5/84
133) 85-5003 9-sw-2 12/6/84
134) 85-5004 10-sw-2 12/5/84
135) 85-4916 Field Blank Sediment
136) 85-4917 sd-1 12/6/84
137) 85-4918 3sd-2 12/6/84
138) 85-4919 3sd-3 12/6/84
139) 85-4920 12sd-1 12/6/84
140) 85-4921 12sd-2 12/6/84
141) 85-4866 8sd-1 12/6/84
142) 85-5028 hafb fpta-3 11/7/84 1140 I-12
143) 85-4964 sw003 12/7/84 1040 North Ditch Dover
144) 85-4965 sw004 12/7/84 1015 North Ditch Dover
145) 85-4966 sw005 12/7/84 1000 North Ditch Dover
146) 85-4967 sw006 12/7/84 0930 North Ditch Dover
147) 85-4968 sw007 12/7/84 0900 North Ditch Dover
148) 85-4969 sw008 12/7/84 0830 North Ditch Dover
149) 85-4970 qa-11 12/7/84 0830
150) 85-4971 sw003 12/7/84 1040 North Ditch Dover
151) 85-4972 sw004 12/7/84 1015 North Ditch Dover
152) 85-4973 sw005 12/7/84 1000 North Ditch Dover
153) 85-4974 sw006 12/7/84 0930 North Ditch Dover
154) 85-4975 sw007 12/7/84 0900 North Ditch Dover

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155) 85-4976 sw008 12/7/84 0820 North Ditch Dover
156) 85-4977 qa-11 12/7/84 0550 North Ditch Dover
157) 85-4935 sw003 12/7/84 1040 North Ditch Dover
158) 85-4938 sw004 12/7/84 1015 North Ditch Dover
159) 85-4939 sw005 12/7/84 1000 North Ditch Dover
160) 85-4940 sw006 12/7/84 0930 North Ditch Dover
161) 85-4941 sw007 12/7/84 0906 North Ditch Dover
162) 85-4942 sw008 12/7/84 0820 North Ditch Dover
163) 85-4943 qa-11 12/7/84 0830 North Ditch Dover
164) 85-4951 sw003 12/7 1040 North Ditch Dover AFB
165) 85-4952 sw004 12/7 1015 North Ditch Dover AFB
166) 85-4953 sw005 12/7 1000 North Ditch Dover AFB
167) 85-4954 sw006 12/7 0930 North Ditch Dover AFB
168) 85-4955 sw007 12/7 0900 North Ditch Dover AFB
169) 85-4956 sw008 12/7 0830 North Ditch Dover AFB
170) 85-4957 qa-11 12/7 0830 North Ditch Dover AFB
171) 85-5065 hafb qa/qc 12/10/84 0835 Boiler Wash Vichers
172) 85-5066 hafb qa/qc 12/10/84 0835 Blank Vickers
173) 85-5067 hafb sp-1 12/10/84 0800 I-1 Vickers
174) 85-5068 hafb qa/qc 12/10/84 0820 replicate sp-1, I-2
175) 85-5069 hafb sp-1 12/10/84 0820 I-2
176) 85-5070 hafb sp-1 12/10/84 0850 I-3
177) 85-~~4922/ 2 of 2 hafb 12/sd-1 12/6/84~~
~~178) 85-4923 hafb 12 sd-2 12/6/84~~
179) 85-4924 ~~hafb~~ 9sd-1 12/6/84
180) 85-4925 ~~hafb~~ 9sd-2 12/6/84
181) 85-4926 ~~hafb~~ 10sd-1 12/6/84
182) 85-4927 ~~hafb~~ 10sd-2 12/6/84
183) 85-4928 ~~hafb~~ 3sd-1 12/6/84
184) 85-4929 ~~hafb~~ 3sd-2 12/6/84
185) 85-4930 ~~hafb~~ 3sd-3 12/6/84
186) 85-4931 ~~hafb~~ 8sd-1 12/6/84
187) 85-4932 ~~hafb~~ 8sd-2 12/6/84
188) 85-4933 ~~hafb~~ Field Blank Sediments 12/6/84

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Note: Water samples were reported in parts per million (mg/L), and soil samples were reported in parts per million (mg/kg), on a dry basis.

Sample #	Total Organic Carbon	Purgeable Organic Carbon
1	7.4	1.8
2	46.	5.3
3	47.	6.9
4	16.	6.3
5	22.	13.
6	77.	3.9
7	70.	3.5
8	1.2	0.2
9	5.8	0.2
30	5.0	1.0
31	3.3	1.5
32	20.	14.
33	11.	7.2
34	3.0	1.4
35	3.7	0.6
36	2.5	0.3
37	3.4	0.2
38	11.	1.6
39	74.	32.
40	2.4	0.4
41	1.2	L/0.1
42	1.8	0.1
70	0.8	0.2
71	8.9	1.1
72	25.	0.9
73	6.2	0.3
74	8.0	0.3
75	23.	1.2
76	2.4	0.7
77	3.0	0.7
99	37.	6.5
100	9.4	5.3
101	21.	8.9
102	5.3	3.3
113	1.1	L/0.1
114	1.6	0.2
115	93.	28.
116	170.	32.
117	62.	13.
118	98.	46.
119	64.	25.
120	58.	19.
127	1.0	L/0.1
129	8.2	1.9
130	6.3	2.4
131	7.3	2.0
142	90.	27.
150	16.	11.
151	11.	0.9
152	8.9	0.5
153	7.7	0.2
154	5.8	0.3
155	4.5	0.2
156	0.6	L/0.1
188*	0.4	L/0.1

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LABORATORY NO

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Sample #	Cyanide, parts per million
52	L/0.005
53	L/0.005
54	L/0.005
55	L/0.005
56	L/0.005
57	L/0.005
58	L/0.005
59	L/0.005
60	L/0.005
103	L/0.005
164	L/0.005
165	L/0.005
166	L/0.005
167	L/0.005
168	L/0.005
169	L/0.005
170	L/0.005
171	L/0.005
172	L/0.005
173	L/0.005
174	L/0.005
175	L/0.005
176	L/0.005

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	parts per million		parts per million	%
Sample #	Phenols	Sample #	Phenols	Total Solids
15	L/0.005	98	L/0.005	---
16	L/0.005	121**	L/0.005	---
17	L/0.005	122	L/0.005	---
18	L/0.005	123**	0.008	---
19	L/0.005	124	L/0.005	---
20	L/0.005	125	L/0.005	---
21	L/0.005	126	L/0.005	---
22	L/0.005	157	L/0.005	---
23	0.006	158	L/0.005	---
24	L/0.005	159	L/0.005	---
61	L/0.005	160	L/0.005	---
62	L/0.005	161	L/0.005	---
63	L/0.005	162	L/0.005	---
64	L/0.005	163	L/0.005	---
65	0.016	179	0.2	28.1
66	6.3	180	1.0	28.4
67	L/0.005	181	L/0.005	71.3
68	L/0.005	182	L/0.005	70.5
69	L/0.005	183	0.4	50.5
93**	0.007	184	0.6	53.6
94**	0.007	185	L/0.005	73.6
95	L/0.005	186	0.4	72.5
96**	0.010	187	L/0.2	26.1
97**	0.015	188**	0.010	---

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Sample #	Total Organic Halogens (parts per million)	Total Solids (parts per million)	Sample #	Total Organic Halogens (parts per million)	Total Solids (parts per million)
10	0.23	---	90	0.33	---
11	0.24	---	91	0.45	---
12	0.23	---	92	0.38	---
13	0.20	---	104	0.01	---
14	0.19	---	105	0.01	---
25	1.4	---	106	0.01	---
26	0.20	---	107	0.02	---
27	0.55	---	108	0.03	---
28	0.49	---	109	L/0.010	---
29	0.20	---	110	0.02	---
43	0.33	---	111	0.02	---
44	0.26	---	112	0.02	---
45	0.26	---	128	0.05	---
46	0.32	---	132	0.11	---
47	0.46	---	133	0.05	---
48	7.5	---	134	0.07	---
49	0.33	---	135	0.37	---
50	0.23	---	136	2.4	63.0
51	0.23	---	137	4.1	73.1
78	1.6	81.9	138	2.5	74.2
79	1.8	71.6	139	2.4	62.8
80	2.3	69.8	140	2.4	76.2
81	5.1	31.2	141	0.21	---
82	2.1	75.0	143	2.6	77.3
83	2.2	83.6	144	0.11	---
84	0.25	---	145	0.06	---
85	0.16	---	146	0.09	---
86	0.35	---	147	0.06	---
87	0.80	---	148	0.09	---
88	0.28	---	149	0.08	---
89	0.14	---			

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Key

L/ indicates "less than".
* sample was received unpreserved and with headspace.
** samples for phenols were received unpreserved.

Respectfully submitted,

Laucks Testing Laboratories, Inc.

Mike Nelson

MN:veg

Laucks Testing Laboratories, Inc.

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APPENDIX A

Replicate Quality Control Report

Sample	Analyte	Replicate 1	Replicate 2	% Relative Error	Control Limits
52	Cyanide	L/0.005	L/0.005	0.	0-10
60		L/0.005	L/0.005	0.	0-10
164		0.053	0.055	4.	0-10
176		0.056	0.055	2.	0-10
65	Phenol	0.053	0.066	6.	0-10
126		0.051	0.051	0.	0-10
163		0.050	0.050	0.	0-10
179		2.6	1.6	48.	0-10
1	TOC	7.2	7.4	3.	0-9
34		3.0	2.9	3.	0-9
10	TOX	0.224	0.228	2.	*
43		0.33	0.37	11.	*
85		0.16	0.19	17.	*
104		0.014	0.014	0.	*
132		0.115	0.105	9.	*
80		0.160	0.150	6.	*
73	TOC	6.2	5.8	7.	0-9
114		1.6	1.5	6.	0-9
119		64.	64.	0.	0-9
142		90.	89.	1.	0-9

* No limits established

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APPENDIX B

Spike Quality Control Report

Sample	Analyte	Sample Found	Spike Level	Samp & Spike Found	% Recovery	Control Limits
53	Cyanide	L/0.005	0.050	0.053	106.	*
164		L/0.005	0.050	0.053	106.	*
176		L/0.005	0.050	0.055	110.	*
65	Phenol	0.016	0.050	0.066	100.	*
126		L/0.005	0.050	0.051	102.	*
163		L/0.005	0.050	0.050	100.	*
179		0.2	1.8	1.6	78.	*
1	TOC	7.4	10.	18.	106.	83-120
11	TOX	0.048	0.050	0.048	0.	*
44		0.026	0.050	0.048	44.	*
86		0.035	0.050	0.052	34.	*
105		0.004	0.050	0.040	73.	*
133		0.01	0.050	0.016	14.	*
128		0.01	0.050	0.045	62.	*
79		0.026	0.050	0.064	76.	*
73	TOC	6.2	10.	17.	108.	83-120
130		6.3	10.	17.	107.	83-120

* No limits established

TURBINE FUEL TEST REPORT
SPECIFICATION MIL-T-5624
GRADE JP-4

ENERGY MANAGEMENT LABORATORY
DET 21 SA-ALC/SFTLC
MACDILL AFB FL 33608

LAB REPORT NBR: 84-F-1788
DATE RECEIVED: 27 NOV 84
QUANTITY REP: N/I
CONTRACTOR: N/I
CONTRACT NBR: GOVT OWNED
SUBMITTED BY:
31ST SUPPLY SQDN/LGSF
HOMESTEAD AFB, FL
33039

REPORT DATE: 30 NOV 84
DATE SAMPLED: 20 NOV 84
SAMPLE NBR: 84-5911
ADDRESS: HOMESTEAD AFB FL
SAMPLING PT: N/I

	APPEARANCE	CLEAR
	COLOR	DARK STRAW
	ODOR	USUAL
	VISIBLE FREE WATER ML/GAL	0.0
D 2887	DISTILLATION IBP DEG F	90
	10 % REC DEG F	160
	20 % REC DEG F	222
	50 % REC DEG F	358
	90 % REC DEG F	475
	FINAL BOILING PT DEG F	535
D 323	VAPOR PRESSURE ,PSI	2.4
D 381	EXISTENT GUM, MG/100 ML	19.2
M 5327	FUEL SYSTEM ICING INHIBITOR, VOL %	0.00
D 3237	LEAD MG/L	25.00

GAS CHROMATOGRAPH SHOWS TYPICAL PATTERN OF UNWEATHERED JP-4 WITH RESPECT TO EARLY BOILING HYDROCARBONS.

REF TELECON BETWEEN CAPT HUMBERD AND L. FINCHER.

REPORTED BY:

ELIZABETH C. WILLIAMS
CHEMIST

APPROVED BY:

LLOYD C. FINCHER
CHIEF, ENERGY MANAGEMENT LABORATORY
DIRECTORATE OF ENERGY MANAGEMENT

H. REFERENCES

REFERENCES

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I. RESUMES

DOUGLAS J. SARNO

EDUCATION

University of Virginia: B.S., Civil Engineering (1984)

EXPERIENCE

At JRB, Mr. Sarno has performed a great deal of work on the Remedial Investigation/Feasibility Study for the Stringfellow Superfund site in California (top priority site in the state). His work has included a detailed investigation of the sites' history, the determination of on-site treatment techniques, removal options, an assessment of applicable technologies, and the development and screening of remedial alternatives.

Mr. Sarno has worked extensively on the in-situ treatment of groundwater and soils project JRB is designing, constructing, and testing for EPA and the Air Force at Kelly Air Force Base, San Antonio, Texas. He was one of the primary designers of the treatment system and will perform a key role in the field operations which include well drilling, construction, operation, and a detailed sampling and analysis program.

Mr. Sarno gained considerable field experience in the field investigation operations for the Air Force Installation Restoration Program at Homestead Air Force Base. In this role he gained experience in the sampling of contaminated groundwater, soil, and sediments and associated chain-of-custody, quality assurance, and health and safety procedures. He has been trained in the use of sampling equipment and associated decontamination procedures. He also gained considerable experience in the proper use of level "C" safety protection.

Mr. Sarno performed a survey and evaluation of classification technologies and equipment in order to assess their application to the separation by grain size of contaminated sediments. He is currently coordinating a testing program with various manufacturers of this equipment to determine effectiveness under different conditions.

Mr. Sarno has authored chapters in technical manuals (being prepared at JRB for EPA) on dredging techniques and surface water control technologies.

Mr. Sarno's experience is bolstered by coursework in open surface flow, sanitation engineering, fluid mechanics, soil mechanics and environmental geology. His senior thesis work involved an independent study of the nation's hazardous waste problems and management techniques. He performed extensive research into the situation presently existing at the U.S. Titanium toxic waste site located in Nelson County, VA. The problems at this site dealt primarily with contaminated sediments disposed in a landfill and he gained great familiarity with the techniques used in their control. As a result, he presented several suitable remedial action alternatives which included slurry trench construction, top and bottom seals, excavation, and in-situ neutralization.

Mr. Sarno has also successfully completed the EIT examination.

Verified for accuracy by: Douglas J. Sarno Date: 3/28/85

PHILIP A. SPOONER

EDUCATION

Virginia Polytechnic Institute and State University: BS, Agronomy, Soils Option (1977)

EXPERIENCE

Mr. Spooner is a Soil Scientist with JRB's Technical Services Division. he has over seven years experience in evaluating the environmental aspects of land and soil used for waste disposal, with particular emphasis on hazardous waste site investigation for remedial planning. Mr. Spooner has recently completed the development of a technical handbook on Slurry Trench Construction for Pollutant Migration Control, recently published as the First of the New EPA Superfund series documents (EPA-540/2-84-001). He has also recently completed a study on the compatibility of grouts with hazardous wastes, also for EPA. In addition to project manager, Mr. Spooner was a principal investigator and author for these tasks.

Mr. Spooner is currently task manager for the IRP Phase II investigation at Homestead AFB, Florida, and is in charge of a site characterization effort at Kelly, AFB, Texas, for a demonstration project involving biologic reclaimation of contaminated groundwater.

Mr. Spooner has been involved in numerous waste site investigations, from preliminary assessments to detailed hydrogeologic studies. He participated in the planning and initial field work for the long-term monitoring at the Lipari Superfund site in Glochester Co. NJ. He participated in a field investigation of nine disposal sites at the Naval Air Development Center in Warminster, PA, which involved the installation of over twenty groundwater monitoring and observation wells. Mr. Spooner has also managed an EPA Region III groundwater enforcement case in West Virginia. This work involved the installation of nine new monitoring wells and sampling of contaminated groundwater. Mr. Spooner was responsible for planning all phases of this investigation from monitoring network design and sampling plan preparation, to the disposal of contaminated drilling wastes. He also oversaw preparation of the final report and provided expert witness testimony on behalf of EPA and the U.S. Justice Department. This work has resulted in a complex consent decree for site clean-up and remediation.

Mr. Spooner also participated in an extensive groundwater monitoring project at Love Canal in Niagara Falls, NY. During this project, he served as Chief Soil Scientist for JRB and was one of several geologic supervisors overseeing the installation of groundwater monitoring wells.

Verified for Accuracy by: Philip A Spooner Date: 6/3/85

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Earlier, Mr. Spooner worked on a technical handbook entitled, "Remedial Actions for Waste Disposal Sites." This manual, (EPA-6-82-006), deals with the various measures that can be taken to slow or halt pollution from wastes in a disposal site, and involves studying the techniques and costs of these measures. Mr. Spooner is also working on the update of this manual currently underway by JRB. He has also worked on a training manual and seminar on the hazardous waste site investigation process. This work involved the entire site investigation procedure from site discovery through investigation, sampling and remedial planning.

Mr. Spooner also helped to develop, field test, and refine a methodology for rating the hazard potential of waste disposal sites. This methodology was tested on over thirty sites in EPA Region II, and was distributed to all EPA Regions for their initial site ranking needs.

PUBLICATIONS

Spooner, P., et al Slurry Trench Construction for Pollution Migration Control, (EPA-540/2-84-00). For U.S. EPA, Office of Research and Development. 1984.

Spooner, P., Hunt, G., Hodge V. and Wagner, P., Compatibility of Grouts with Hazardous Wastes (NTIS #PB84-139732) for U.S. EPA, Office of Research and Development. 1984.

Spooner, P., Wetzel, R. and Grube, W. Slurry Trench Construction of Pollution Migration Cut-Off Walls. Paper presented at the 9th Annual EPA Hazardous Waste Research Symposium. May 3, 1983, Cincinnati, Ohio.

Spooner, P. Wetzel, R. and Grube, W. Pollution Migration Cut-Off using Slurry Trench Construction. Paper presented at the National Conference on Management of Uncontrolled Hazardous Waste Sites. Nov. 30, 1982, Washington, D.C.

Paige, S., Harrison, E., Hunt, G., Wagner, K., Rogoshewski, P. and Spooner, P., Techniques for Evaluation Environmental Processes Associated with Land Disposal of Specific Hazardous Materials. For U.S. EPA, Office of Solid Waste. 1982.

Spooner, P., and Kufs, C. DOW #40, Case 4; Groundwater Contamination Study; Nitro, West Virginia for U.S. EPA Office of Water Enforcement and Region III Enforcement Division. 1981.

Rogoshewski, P., Bryson, H., Lee, P., Wagner, K. and Spooner, P., Manual for Remedial Actions at Waste Disposal Sites. For U.S. EPA, Office of Research and Development. 1980. Published by EPA June, 1982.

Kufs, C., Spooner, P., Wetzel, R. and Caldwell, S. Methodology for Rating the Hazard Potential of Waste Disposal Sites. For U.S. EPA, Office of Research and Development. 1980.

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Shocket, A., Wagner, K., Spooner, P. and Burgher, B. Level I Materials Balance: Achylamide. For U.S. EPA Office of Toxic Substances. 1979.

AFFILIATIONS

Virginia Association of Professional Soil Scientists, Pedologist, 1982.

Verified for Accuracy by: Philip A. Spooner Date: 6/3/85

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BRIAN C. VICKERS

EDUCATION

University of California, Berkeley: B.A., Geology 1981

EXPERIENCE

Mr. Vickers is a geologist in the Geotechnical Assessment Group of JRB's Waste Management Department. His principal responsibilities include implementing geological and hydrological investigations. His tasks include supervising the drilling of monitoring wells and borings, characterizing site lithology, designing and completing monitoring wells, collecting water quality and soil samples, conducting aquifer tests and analyzing geologic and hydrologic data.

Mr. Vickers is currently involved in investigating the magnitude and extent of environmental contamination caused by past activities at designated sites under Phase II of the United States Air Force's Installation Restoration Program (IRP). In addition, he is working on the characterization of the hydrogeology at the site of a former evaporation pit for an EPA sponsored study of in-situ bioreclamation.

Mr. Vickers implemented hydrological and geological investigations in California with TERA Corporation prior to joining JRB. These investigations supported both environmental assessments for permit applications under the Resource Conservation and Recovery Act (RCRA) and groundwater availability assessments for facility planning. Projects included constructing a monitoring well system and collecting and analyzing data on lithology and water quality for a proposed hazardous waste facility in Kern County, CA, and coordinating pump tests to determine groundwater availabiltiy for irrigation in Santa Cruz County, CA.

Mr. Vickers expanded the computer modeling capabilities of TERA through program acquisition, compilation and testing, in support of hydrologic and geologic investigations. His innovative applications of solute transport and groundwater flow models included the simulation of subsurface migration from a hazardous waste facility in Kern County, and simulating drawdown impacts for both an unconfined aquifer in Santa Cruz County, CA and a semi-confined system in Trinity County, CA.

PROFESSIONAL AFFILIATIONS

National Water Well Association
Geological Society of America

Verified for accuracy by: Brian C. Vickers Date: 5/6/85

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J. SAFETY PLAN

APPENDIX J

HEALTH AND SAFETY

The maintenance of good health and the provision for the safety of on-site personnel was a major concern during Phase II activities. To this end, SAIC identified both medical surveillance and safety programs which afforded on-site personnel more than adequate protection. The main points of this plan included medical examination and safety equipment use and procedures. Each of these points is described in greater detail in the following sections.

J.1 MEDICAL EXAMINATIONS

All site investigation team members undergo health monitoring directed by SAIC corporate policy so that their health may be protected through early detection of symptoms of exposure to toxic substances and screening for their physical ability to perform the job. The health monitoring is accomplished through a system of medical examinatons: a preliminary screening examination and periodic follow-up examinations. These examinations serve to monitor the health of the site investigators, to assess their ability to perform the job, to detect symptoms of exposure to toxic substances, and to assess potential problems.

J.2 PERSONNEL SAFETY

In order to provide the greatest degree of safety to on-site personnel, field personnel were provided with personal protective equipment. SAIC also developed the decontamination procedures that were followed either routinely at the end of the day or for the treatment of accidental exposure to potentially hazardous chemicals.

J.2.1 Safety Equipment

Numerous items of safety equipment were required in performing the field work.

Level C protection was selected for the groundwater sampling effort and drilling. This consists of the following personal protective equipment:

- Half-face air-purifying respirator with rganic cartridges
- Safety goggles (non-vented)
- 2-piece, chemical-resistant coveralls
- Gloves-chemical protective
- Boots-chemical protective.

A full complement of spare safety equipment were kept at the site so that damaged or malfunctioning equipment could be replaced immediately. In addition to the personal safety equipment, the following equipment was kept at the site:

- Eye wash kit
- First aid kit
- Paper towels
- Clean drinking water.

Procedures that were employed to ensure personnel health and safety follow:

1. Designated safety equipment was worn at all times
2. Wearing of contact lenses was avoided when possible.
3. Eating, drinking, smoking, chewing gum, chewing tobacco, or open flames was not permitted in the immediate vicinity of the drill sites. Gloves were removed and hands and forearms will be washed before eating, drinking, or smoking.
4. A "safe" area was designated at the site where drinking water and washing facilities were available.
5. Proper decontamination procedures were followed before leaving the site area.
6. Soil, rock, and groundwater samples were not handled without protective gloves.
7. Additional safety equipment including respirator and goggles or face shields, as appropriate, were put on at the first sign or suspected sign of free hazardous material (odor or taste detected or sound of gas release).

J.3 EMERGENCY PROCEDURES

A site-related emergency is defined as an accident, illness, or personal exposure to hazardous substances. The response to an emergency situation is two-fold: obtaining assistance and treating the problem.

All SAIC supervisory geologists and sampling teams will have a list of emergency telephone numbers including police, fire department, hospital, and poison control center.

In case of a health-related emergency, appropriate first aid will be applied by personnel at the site until medical assistance arrives. In the event of exposure to hazardous materials, the victims will be moved away from the contaminated area, then treated.

If a site related emergency occurs during the site investigation to either a team member or another party, the supervisory geologist is responsible for notifying the corporate Health and Safety Officer and submitting an incident report. Another team member may submit the report if the supervisory geologist is unable to do so.

The incident report will include the following:

- Date, time, and place of occurrence
- Person(s) involved
- Type of incident
- Description of incident and action taken
- Recommendations for prevention of a similar occurrence.

The supervisory geologist and corporate health and safety officer will discuss the incident as well as possible solutions for preventing a recurrence or the incident.

The report must be signed and dated by the person completing it. The health and safety officer will sign and date the report upon receipt. All incident reports and follow-up action on the incidents will be kept on file by the corporate Health and Safety Officer.

END
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