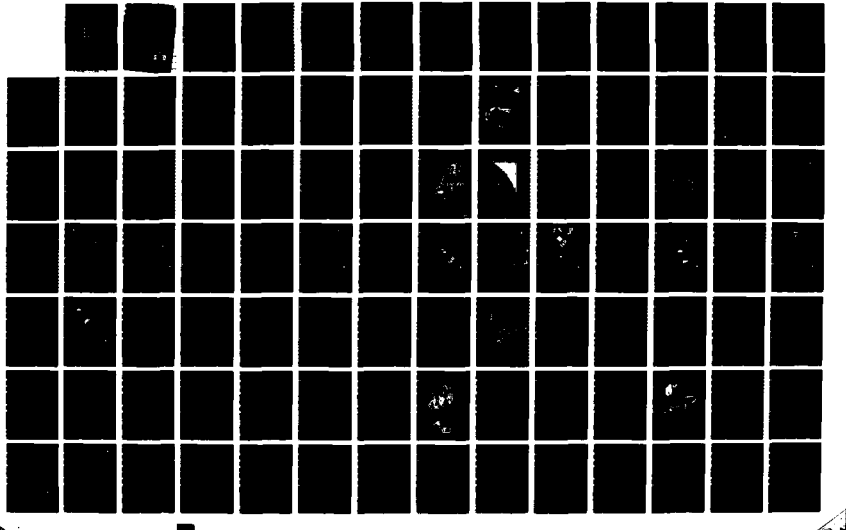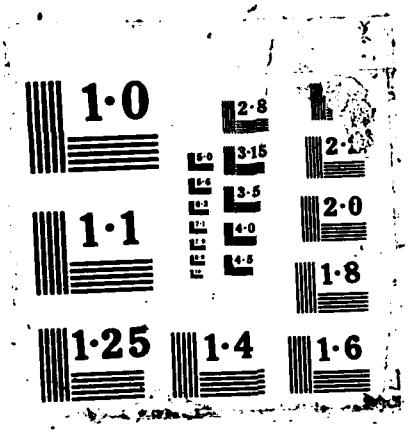
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PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

ELMENDORF AIR FORCE BASE
ALASKA

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

MARCH 1, 1988

FINAL REPORT (30 JULY 1986 to 23 JULY 1987)

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

PREPARED FOR
ALASKAN AIR COMMAND
ELMENDORF AFB, ALASKA 99506

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

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PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

FINAL REPORT

FOR

ELMENDORF AIR FORCE BASE
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ALASKAN AIR COMMAND
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MARCH 1, 1988

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Twelve sites were investigated at Elmendorf AFB during the Phase II, Stage 2 field evaluation of the IRP. The sites were investigated through the drilling, installing, and sampling 11 new monitor wells, three base water supply wells, and four surface water samples.

Two ground water systems exist beneath the base, and they are typically separated by a thick clay unit. The depth to water table varies from zero to as much at 50 to 60 feet. The shallow aquifer has been contaminated in the past and is vulnerable to future contamination, but the deeper aquifer is not in significant danger. The principal source of water for the base and the adjacent City of Anchorage is surface water upstream of the base; makeup wells generally extend to the deep aquifer.

Parameters for which there are no enforceable standards indicate contamination of the shallow aquifer at the base. Low levels of purgeable halocarbons were detected in base well BW-1, Sites D-5, D-7, D-17, IS-1, and SP-11. Petroleum hydrocarbons were detected at Sites D-5, SP-7, and SP-10, SP-2, SP-12, SP-14, and SP-11. Purgeable aromatics were present at Sites SP-7 and SP-10.

Sites SP-7 and SP-10 are recommended for remedial action. Additional analyses are needed to confirm the results of the Phase II, Stage 2 field investigation.

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PREFACE

As part of the U.S. Air Force Installation Restoration Program (IRP), investigations were undertaken at twelve sites on Elmendorf Air Force Base, Alaska, to determine whether hazardous material contamination is present. This report, prepared by Dames & Moore under Contract No. F33615-83-D-4002, Order No. 0036, presents the results of the Phase II, Stage 2, IRP investigations. The period of work reported on herein was 30 July 1986 through 23 July 1987. The field investigations were directed by Mr. Michael W. Ander and supervised by Mr. Jon Michael Stanley. Well installation and sampling were supervised by Ms. Amy Lamborg and Ms. Kay Tauscher. Mr. Brian Coulter assisted in sampling wells. The geophysical survey was conducted by Mr. Thomas S. Jensen. Additional assistance in data compilation and analysis, report preparation, and administrative management was provided by Ms. Carol J. Scholl and Ms. Beverly Harper. Drilling was subcontracted to Tester Drilling Services, Inc., Anchorage, Alaska; chemical analyses to UBTL, Inc., of Salt Lake City, Utah; and surveying to Kean and Associates, Anchorage, Alaska. Maj Richard Carmichael, Technical Services Division, USAF Occupation and Environmental Health Laboratory (OEHL), was the Technical Monitor.

Approved:

Glenn D. Martin
Contract Program Manager

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SUMMARY

Elmendorf Air Force Base (AFB) is located in the Greater Anchorage Area Borough, Alaska, and borders the city of Anchorage to the south and Fort Richardson, an Army base, to the east. It is located on the Anchorage Plain, a large alluvial fan, at the junction of Knik and Turnagain Arms of Cook Inlet, a glacial trough. The base has been in operation since 1940, and its current host is the 21st Tactical Fighter Wing.

The Phase II, Stage 2 field evaluation of the Installation Restoration Program (IRP) consisted of investigations at the following 12 sites:

- Site D-5 - Sanitary Landfill;
- Sites SP-7 and SP-10 - Pumphouse No. 3;
- Site D-7 - Sanitary Landfill;
- Site SP-5 - JP-4 Tank Spill;
- Site SP-12 - JP-4 Fuel Line Leak;
- Site D-17 - Shop Waste Disposal;
- Site SP-11 - JP-4 Fuel Line Leak;
- Site FT-1 - Fire Training Area;
- Site SP-2 - JP-4 Fuel Line Leak;
- Site SP-14 - MOGAS Spill; and
- Site IS-1 - Building 42-400 Floor Drains.

The field investigation consisted of the following activities:

1. Performance of magnetometer surveys at Sites D-5 and D-7 to determine the boundaries of the site;

2. Performance of soil gas surveys at Sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14;

3. Drilling, soil sampling, and geologic logging of eleven borings at seven sites;

4. Installation of monitor wells in the eleven new borings; and

5. Analysis of selected ground and surface water samples from the eleven new monitor wells, the existing nineteen monitor wells (installed during Phase II, Stage 1), four base water supply wells, three locations along Ship Creek, and one location on Cherry Hill Ditch for petroleum hydrocarbons, purgeable halocarbons, purgeable aromatics, pesticides, lead, total dissolved solids (TDS), and major cations and anions.

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE SP-5			SITES SP-7 and SP-10		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			W-7	W-8	Trip Blank	W-3	W-4		
Benzene	ug/L	0.25	N.D.	N.D.	N.D.	4800	N.D.	N.E.	N.E.
Ethyl Benzene	ug/L	0.75	N.D.	N.D.	N.D.	620	N.D.	N.E.	N.E.
Toluene	ug/L	0.64	N.D.	N.D.	N.D.	8200	N.D.	N.E.	N.E.
m-Xylene	ug/L	0.45	N.D.	N.D.	N.D.	3000	N.D.	N.E.	N.E.
o-Xylene	ug/L	0.78	N.D.	N.D.	N.D.	2600	N.D.	N.E.	N.E.
TDS	mg/L	10.0	460[a]	390[a]	11.	470[a]	500[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.D.	N.D.	N.D.	51.[a]	1.9[a]	N.E.	N.E.
pH	S.U.	0.1	7.0	6.8	N.A.	6.7	6.4	N.E.	6.5-8.5
Temperature	°C	0.1	7.0	8.1	N.A.	5.5	7.5	N.E.	N.E.
Specific Conductivity	umhos/cm	10	930	575	N.A.	669	421	N.E.	N.E.
Alkalinity (as $CaCO_3$)	mg/L	10.0	350	290	N.D.	N.A.	N.A	N.E.	N.E.
Bicarbonate (as $CaCO_3$)	mg/L	10.0	350	290	N.D.	N.A.	N.A.	N.E.	N.E.
Nitrate + Nitrite (as N)	mg/L	0.02	4.9	1.1	0.05	N.A.	N.A.	10	N.E.
Total Phosphate	mg/L	1.0	1.	2.	N.D.	N.A.	N.A.	N.E.	N.E.
Chloride Ion	mg/L	0.1	120	47	N.D.	N.A.	N.A.	N.E.	250
Sulfate Ion	mg/L	0.1	20	10	N.D.	N.A.	N.A.	N.E.	250
Fluoride Ion	mg/L	0.05	0.1	0.2	N.D.	N.A.	N.A.	1.4-2.4	N.E.
Bromide Ion	mg/L	0.1	0.7	0.3	N.D.	N.A.	N.A.	N.E.	N.E.
Boron	ug/L	5.0	N.D.	N.D.	66.	N.A.	N.A.	N.E.	N.E.
Barium	ug/L	2.0	120	56.	N.D.	N.A.	N.A.	1000	N.E.
Calcium	ug/L	10.0	120000	80000	14.	N.A.	N.A.	N.E.	N.E.
Chromium	ug/L	7.0	13.	11.	10.	N.A.	N.A.	50	N.E.
Magnesium	ug/L	30.0	38000	22000	N.D.	N.A.	N.A.	N.E.	N.E.
Manganese	ug/L	2.0	210	5.	N.D.	N.A.	N.A.	N.E.	50
Molybdenum	ug/L	8.0	48.	N.D.	N.D.	N.A.	N.A.	N.E.	N.E.
Nickel	ug/L	15.0	N.D.	20.	N.D.	N.A.	N.A.	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE D-5						SITE D-7					PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			GW-1A	GW-1B	GW-1B (FAC)[a]	GW-1C	W-1	W-2	GW-2A	GW-2B	GW-2C	W-5	W-6		
1,1-Dichloroethane	ug/L	0.49	N.D.	4.7	NA	N.D.	N.D.	N.D.	N.D.	1.5	3.5	N.D.	N.D.	N.E.	N.E.
trans-1,2-Dichloroethene	ug/L	0.42	N.D.	N.D.	NA	1.1	3.2	1.3	N.D.	6.9	3.1	N.D.	N.D.	N.E.	N.E.
Methylene Chloride	ug/L	0.34	N.D.	2.6	NA	0.72	N.D.	0.57	0.80	3.0	3.1	1.8	0.63	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	N.D.	0.49	NA	0.58	N.D.	0.48	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
1,1,1-Trichloroethane	ug/L	0.53	N.D.	32.0	NA	N.D.	N.D.	N.D.	N.D.	N.D.	N.D	N.D.	N.D.	N.E.	N.E.
Trichloroethene (TCE)	ug/L	0.60	N.D.	2.7	NA	N.D.	N.D.	N.D.	N.D.	2.3	0.66	N.D.	N.D.	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.441	N.D.	0.60	NA	0.51	N.D.	N.D.	N.D.	1.3	1.2	0.99	0.56	N.E.	N.E.
TDS	mg/L	10.0	180[a]	130[a]	NA	140[a]	130[a]	81.0	140[a]	190[a]	210[a]	130[a]	90[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	1.0[a]	N.D.	0.5	N.D.[a]	0.2[a]	N.D.	N.D.[a]	N.D.[a]	N.D.[a]	3.9[a]	0.7[a]	N.E.	N.E.
pH	S.U.	0.1	6.1	6.4	NA	5.9	6.7	6.9.	6.7	6.1	5.8	5.7	6.5	N.E.	6.5-8.5
Temperature	°C	0.1	5.0	5.0	NA	5.0	6.0	4.8	3.5	5.0	5.4	4.8	5.0	N.E.	N.E.
Specific Conductivity	umhos/cm	10	138	390	NA	62	206	147	127	364	384	125	134	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	BASE WELLS				SHIP CREEK			PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			BW-1	BW-2	BW-52	Trip Blank	SC-1	SC-2	SC-3		
Chloroform	ug/L	0.45	N.D.	N.D.	1.2	N.D.	N.D.	N.D.	N.D.	100 (Tot. THM)	N.E.
Methylene Chloride	ug/L	0.34	3.7	N.D.	N.D.	32.	N.D.	N.D.	N.D.	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	0.77	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
1,1,1-Trichloroethane	ug/L	0.53	0.63	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E	N.E.
Trichloroethene (TCE)	ug/L	0.60	1.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.44	0.83	N.D.	N.D.	0.94	0.54	N.D.	N.D.	N.E.	N.E.
TDS	mg/L	10	130[a]	110[a]	140[a]	N.A.	60.[a]	60.[a]	60.[a]	N.E.	500
Lead	mg/L	0.005	N.D.	N.D.	N.D.	N.A.	0.009	0.010	0.005	0.05	N.E.
Calcium	ug/L	10	N.A.	N.A.	N.A.	34.	N.A.	N.A	N.A.	N.E.	N.E.
Cadmium	ug/L	4.0	N.A.	N.A.	N.A.	6.	N.A.	N.A.	N.A.	10	N.E.
Chromium	ug/L	7.0	N.A.	N.A.	N.A.	18.	N.A.	N.A.	N.A.	50	N.E.
Nickel	ug/L	15.0	N.A.	N.A.	N.A.	16.	N.A.	N.A.	N.A.	N.E.	N.E.
pH	S.U.	0.1	6.3	6.4	7.5	N.A.	N.A.	5.2	N.A.	N.E.	6.5-8.5
Temperature	°C	0.1	5.8	6.2	10.0	N.A.	N.A.	8.3	N.A.	N.E.	N.E.
Specific Conductivity	umhos/cm	10	177	147	236	N.A.	N.A.	101	N.A.	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE FT-1		SITE SP-2			SITE SP-12		SITE SP-14		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			GW-5A	W-15	W-16	GW-6A	GW-6A(FQC)[a]	GW-3A	W-9	GW-7A	W-17		
TDS	mg/L	10.0	460[a]	290[a]	320[a]	320[a]	NA	400[a]	420[a]	330[a]	270[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.D.	N.D.	0.8[a]	61.	120[a]	0.1[a]	N.D.[a]	N.D.[a]	N.D.[a]	N.E.	N.E.
pH	S.U.	0.1	6.1	6.0	7.2	6.9	NA	7.5	7.2	7.2	7.1	N.E.	6.5-8.5
Temperature	°C	0.1	5.5	5.0	7.0	7.0	NA	7.0	5.1	5.9	6.0	N.E.	N.E.
Specific Conductivity	umhos/cm	10	614	361	442	457	NA	537	627	377	345	N.E.	N.E.

PARAMETER	UNIT	DETECTION LIMIT	SITE D-17					SITE IS-1			SITE SP-11		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			W-10	W-11	W-12	W-13	CH-1	W-18	W-19	W-18 (FQC)[a]	W-14	GW-4A		
Dibromochloromethane	ug/L	0.31	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.6 (Tot. THM)	100	N.E.
1,1-Dichloroethane	ug/L	0.49	N.D.	N.D.	N.D.	N.D.	N.D.	1.4[a]	6.1[a]	1.3	N.D.	N.D.	N.E.	N.E.
1,2-Dichloroethane	ug/L	0.44	N.D.	N.D.	N.D.	1.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
trans-1,2-Dichloroethene	ug/L	0.42	N.D.	16.	30.	15.	N.D.	N.D.	N.D.	N.D.	N.D.	2.4.	N.E.	N.E.
Methylene Chloride	ug/L	0.34	19.	3.7	6.3	N.D.	N.D.	N.D.	N.D.[a]	N.D.	N.D.	N.D.	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	N.D.	N.D.	1.6	N.D.	N.D.	N.D.	N.D.	N.D.	0.53	0.46	N.E.	N.E.
1,1,1 Trichloroethane	ug/L	0.53	N.D.	N.D.	N.D.	N.D.	N.D	N.D.	2.4[a]	N.D.	N.D.	N.D.	N.E.	N.E.
Trichloroethene (TCE)	ug/L	0.60	N.D.	47.	26.	5.2	N.D.	N.D.	N.D.	N.D.	N.D.	3.0	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.44	N.D.	0.62	N.D.	0.68	N.D.	N.D.	N.D.[a]	N.D.	N.D.	0.49	N.E.	N.E.
TDS	mg/L	10.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	220[a]	220[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.A.	N.A.	N.A.	N.A.	N.A	N.A.	N.A.	N.A.	N.D.[a]	19.[a]	N.E.	N.E.
pH	S.U.	0.1	7.3	6.2	5.5	7.1	5.1	6.8	6.6	N.A.	7.5	7.5	N.E.	6.5-8.5
Temperature	°C	0.1	5.0	5.0	7.8	7.1	7.3	7.0	4.8	N.A.	5.0	6.8	N.E.	N.E.
Specific Conductivity	umhos/cm	10	388	571	626	620	496	739	640	N.A.	295	330	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

Two aquifers underlie Elmendorf AFB, a shallow ground water system and a deep artesian system. These aquifers are typically separated by substantial thicknesses of confining materials such as the Bootlegger Cove Clay. Both aquifers contain very permeable sand and gravel units. Due to topographic controls, the depth to the water table varies from zero to as much as 50 to 60 feet. Based on available data, it appears that the deep artesian aquifer is not in significant danger of contamination, but the shallow aquifer has been contaminated in the past and is vulnerable to contamination in the future.

In several instances the secondary drinking water standard for pH was exceeded in two base wells, two surface water samples, and twelve out of thirty monitor wells tested. As an isolated parameter, this exceedance is not considered significant.

Detectable levels of purgeable halocarbons were found in one base well (BW-1), one surface water sample (not confirmed because of presence in trip blank) and in monitor wells at Sites D-5, D-7, D-17, SP-11, and IS-1. Purgeable aromatics were detected in elevated concentrations at Sites SP-7 and SP-10. Petroleum hydrocarbons were found at Sites D-5, SP-7, SP-10, D-7, SP-2, SP-12, and SP-11.

The following summarizes our recommendations and rationale:

Sites	Recommended Action	Rationale
	SITES WARRANTING FURTHER INVESTIGATION (CATEGORY 2)	
General	Resample base supply wells BW-1, BW-2, BW-52, and BW-16 (if accessible) and analyze purgeable halocarbons (USEPA 601), pH, temperature, and specific conductivity.	To confirm the Stage 2 analyses and learn if time of sampling impacted concentrations detected.
	Resample Ship Creek in three areas, with one sampling station located near Site SP-11 and analyze for purgeable halocarbons (USEPA 601) and petroleum hydrocarbons (USEPA 418.1), pH, temperature, and specific conductivity.	To learn if time of sampling impacted concentrations detected.

Sites	Recommended Action	Rationale
	SITES WARRANTING FURTHER INVESTIGATION (CATEGORY 2) (Continued)	
General (Cont.)	Resample and analyze for TDS (USEPA 160.1) at all sites except D-17 and IS-1; for petroleum hydrocarbons (USEPA 418.1) at Ship Creek, Sites D-5, D-7, SP-7, SP-10, SP-12, SP-2, and SP-14; pesticides (USEPA 608) at D-7; and purgeable halocarbons (USEPA 601) at Site IS-1. Include:	To confirm the results of Stage 2 analysis.
Sites D-5 and D-7	Resample and analyze for purgeable halocarbons (USEPA 601).	To confirm the presence of purgeable halocarbons detected during Stage 2 analyses.
	Investigate by means of interviews the nature and use of the "hazardous waste" disposal area near landfill D-7.	To learn if this area is possibly impacting ground water quality.
Site SP-5	Resample and analyze for ICP scan metals (USEPA 200.7 ICP).	To determine if concentrations, on reanalysis, exceed standards.
Site D-17	Resample and analyze for purgeable halocarbons (USEPA 601).	To confirm the results of Stage 2 analyses.
Site SP-11	Resample and analyze for purgeable halocarbons (USEPA 601).	To confirm the results of Stage 2 analyses.
Site FT-1	Resample and analyze for petroleum hydrocarbons (USEPA 418.1).	To confirm the results of Stage 2 analyses.
	SITES REQUIRING REMEDIAL ACTIONS (CATEGORY 3)	
Sites SP-7 and SP-10	Monitor well W-3 for petroleum hydrocarbon concentrations through time while pumping. Indirectly investigate, by means of soil gas survey, the extent of plume. Install recovery wells.	Possible alternatives to begin remediation at this spill site.

I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DOD) initiated the Installation Restoration Program (IRP) to investigate and mitigate any environmental contamination that may be present at DOD facilities as a result of handling or disposing of hazardous materials. The IRP was issued as Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 in 1981. The U.S. Air Force (USAF) implemented DEQPPM 81-5 in 1982 as a four-phase program:

Phase I Program Identification/Records Search
Phase II Program Confirmation and Quantification
-Several Stages as Necessary
Phase III Technology Base Development
Phase IV Corrective Action

The Phase I study at Elmendorf Air Force Base (AFB), Anchorage, Alaska, was completed by Engineering-Science (1983). Dames & Moore was retained by the USAF under Contract Number F33615-83-D-4002, Order 0019, to conduct the Phase II, Stage 1 field evaluation which was completed in March 1986 (Dames & Moore, 1986). In July 1986, under the same contract, Order 0036, Dames & Moore was again retained to conduct the Phase II, Stage 2, field evaluation.

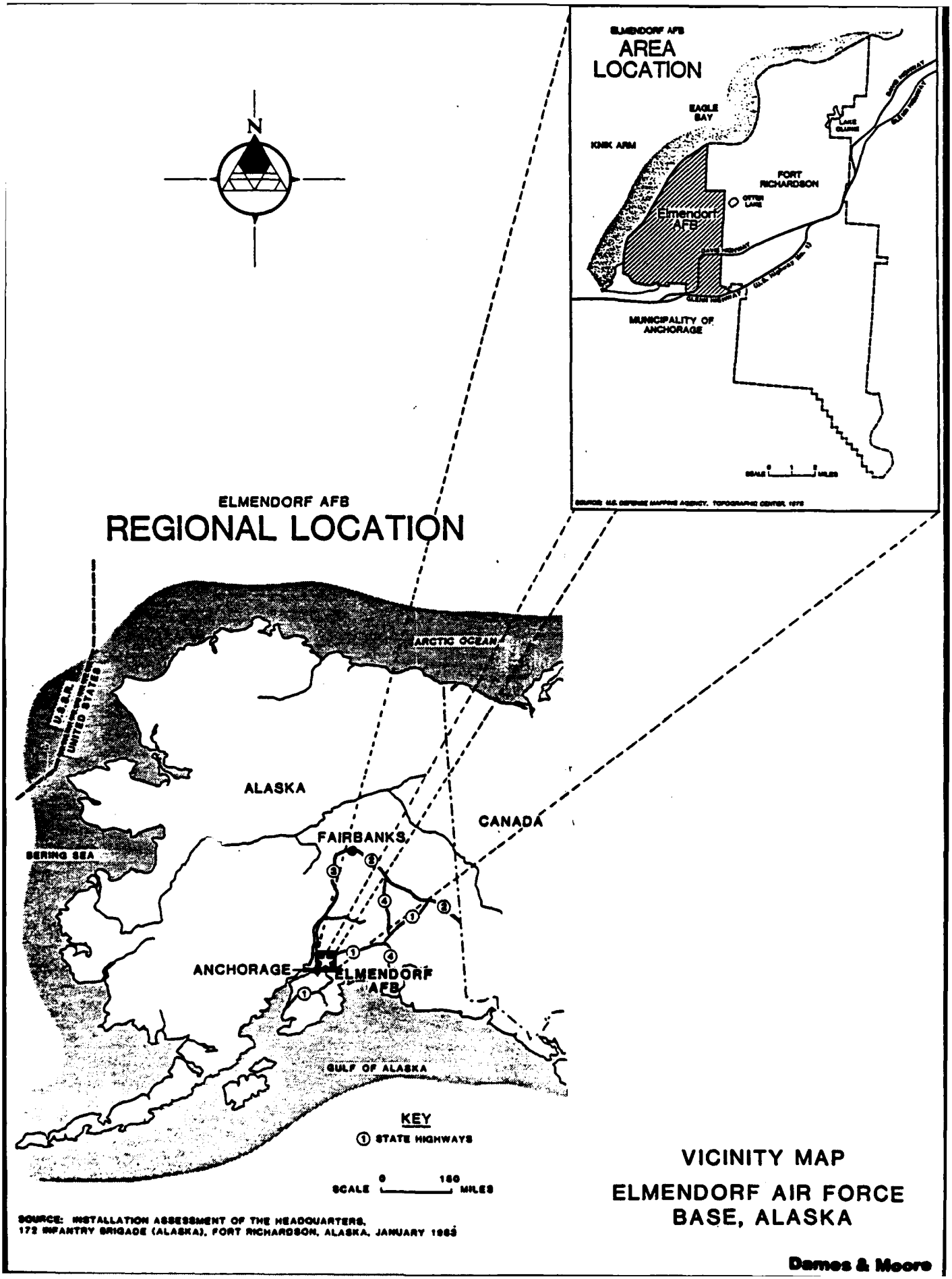
The location of Elmendorf AFB is provided on the Vicinity Map, Plate 1. This report presents the results of Dames & Moore's Phase II, Stage 2 field and laboratory investigations in the vicinity of selected waste disposal and handling areas of Elmendorf AFB. Chemical analyses were performed by UBTL, Inc., of Salt Lake City, Utah, as subcontractor to Dames & Moore. Drilling services were provided by Tester Drilling Services, Inc., and surveying by Kean and Associates, both of Anchorage, Alaska.

B. PURPOSE AND SCOPE

The purposes of the field evaluation portion of Phase II, Stage 2, of the IRP were to:

1. Confirm the presence of suspected contamination within the specified areas of investigation;

2. Determine the magnitude of contamination and the potential for migration of those contaminants in various environmental media;



SOURCE: INSTALLATION ASSESSMENT OF THE HEADQUARTERS, 172 INFANTRY BRIGADE (ALASKA), FORT RICHARDSON, ALASKA, JANUARY 1985

VICINITY MAP
ELMENDORF AIR FORCE BASE, ALASKA

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3. Identify public health and environmental hazards of migrating pollutants based on State or Federal Standards for those contaminants; and

4. Delineate additional investigations required beyond this stage to reach the Phase II objectives.

The scope of work as outlined for Phase II, Stage 2, of the IRP consisted of the following activities:

1. Performance of magnetometer surveys at Sites D-5 and D-7 to determine the boundaries of the sites;

2. Performance of soil gas surveys at Sites S-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14;

3. Drilling, soil sampling, and geologic logging of eleven borings at seven sites on Elmendorf AFB;

4. Installation of monitor wells in the eleven new borings;

5. Analysis of selected ground and surface water samples from the eleven new monitor wells, the existing nineteen monitor wells (installed during Phase II, Stage 1), four base water supply wells, three locations along Ship Creek, and one location on the Cherry Hill Ditch for petroleum hydrocarbons, purgeable halocarbons, purgeable aromatics, pesticides, lead, total dissolved solids (TDS), and major cations and anions; and

6. Preparation of this report which presents the findings.

Field work began on 30 July 1986 and continued, in several stages, through 23 July 1987.

C. HISTORY OF ELEMENDORF AFB AND WASTE DISPOSAL OPERATIONS

The initial construction of Elmendorf Air Force Base, then known as Elmendorf Field, began in June 1940. It was formally designated as Fort Richardson in November 1940, and was under the jurisdiction of the U.S. Army until March 1951. At that time, the U.S. Air Force assumed control of the original Fort Richardson facilities, which were renamed Elmendorf AFB.

The first Air Force unit arrived in February 1941, and other units rapidly were deployed there during World War II. Presently, the host organization on Elmendorf AFB is the 21st Tactical Fighter Wing, the largest organization within the Alaska Air Command (AAC). Numerous other organizations are also tenants on the base.

Prior to 1981, wastes generated at Elmendorf AFB were handled in several manners. During the 1940s through the early 1960s, used oils, fuels and solvents were drained into storm sewers or to floor drains that discharged directly to dry wells beneath or adjacent to the respective facilities. Some were discharged to surface drainage ditches. Some combustible chemicals were burned for fire training, and waste oils were occasionally spread on roads for dust control. From the mid-1960s to the early 1980s, the wastes generated at Elmendorf AFB industrial facilities were generally stored in centralized storage tanks. Small amounts of wastes were still discharged as noted above. Since mid-1981, all waste chemicals have been temporarily stored at a hazardous waste storage area. The Defense Property Disposal Office (DPDO), located on Elmendorf AFB north of Site D-5, arranges for disposal of the wastes. Only minor amounts of wastes, primarily from small spills, still enter the floor drains of various shop facilities (Engineering-Science, 1983).

D. DESCRIPTION OF SITES

Engineering-Science (1983) identified 48 sites within Elmendorf AFB where potentially hazardous materials were generated, disposed of, or used in some activity. Each site was rated during the Phase I study using the Hazard Assessment Rating Methodology (HARM) developed by JRB Associates, Inc. (1980). This rating procedure utilizes site characteristics, waste characteristics, potential for contaminant migration, and waste management practices to identify sites warranting further investigation. Ranking scores of 12 of the sites were deemed sufficiently high to warrant field investigation. A scope of work was issued to Dames & Moore in June 1984 under Contract F33615-83-D-4002, Order 0019, for Phase II, Stage 1, investigations, and on 30 July 1986 under Order 0036, for Phase II, Stage 2, investigations at the following sites:

Site D-5 - Sanitary Landfill
Sites SP-7 and SP-10 - Pumphouse No. 3
Site D-7 - Sanitary Landfill
Site SP-5 - JP-4 Tank Spill
Site SP-12 - JP-4 Fuel Line Leak
Site D-17 - Shop Waste Disposal
Site SP-11 - JP-4 Fuel Line Leak
Site FT-1 - Fire Training Area
Site SP-2 - JP-4 Fuel Line Leak
Site SP-14 - MOGAS Spill
Site IS-1 - Building 42-400 Floor Drains

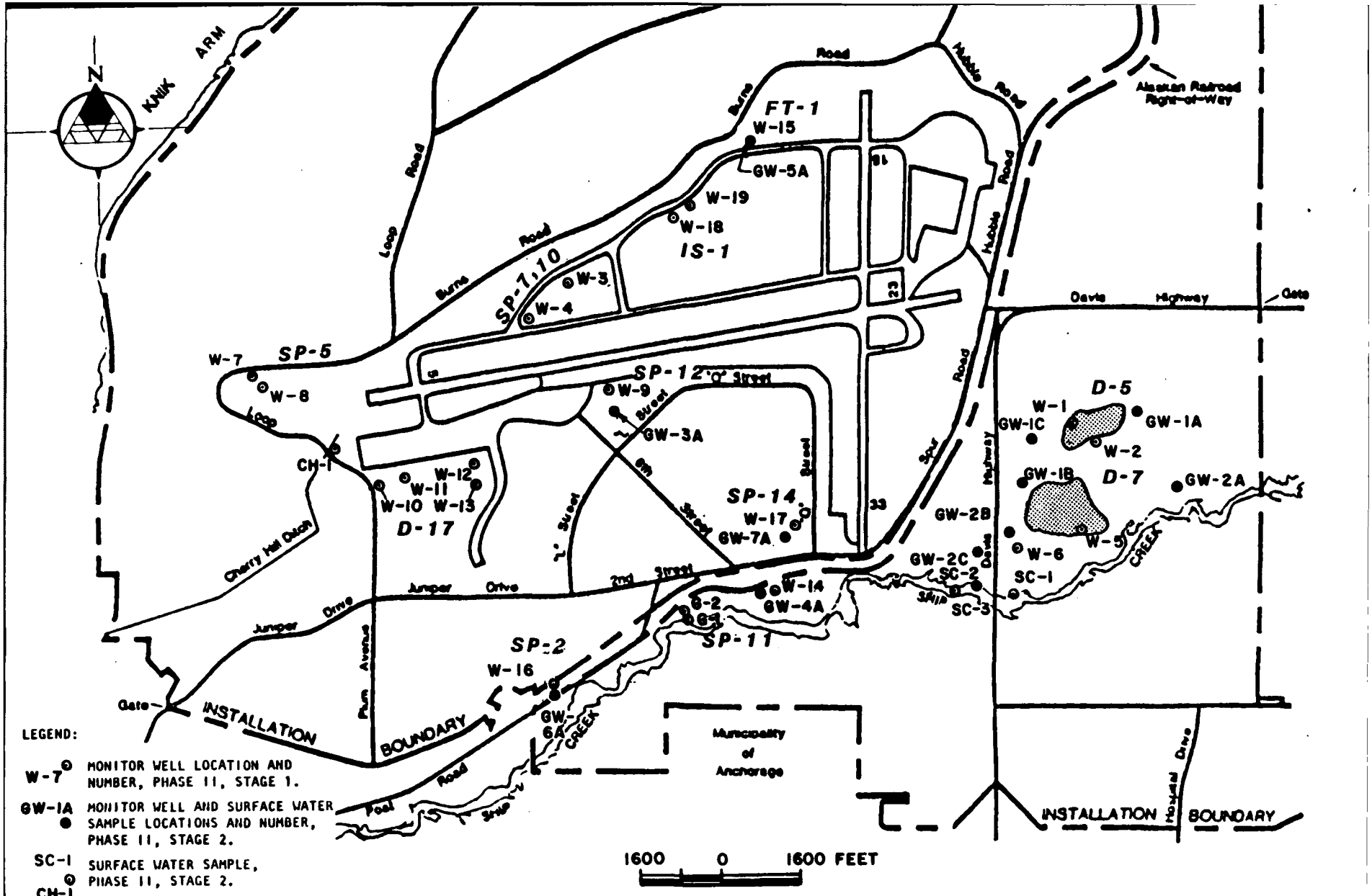
These sites are shown on Plate 2 and are described below.

1. Site D-5: Sanitary Landfill

This partially abandoned sanitary landfill occupies approximately 65 acres and lies on the southeast portion of the base, an area geologically dominated by gravelly till. Trench and fill procedures were used at this site to dispose of general refuse, scrap metal, spent chemicals, and other scrap materials from 1951 to 1973. The trenches were generally excavated 14 to 16 feet below grade; however, one 50-foot wide by 30-foot deep trench was reportedly excavated on the east side of the site. The exact locations of these trenches and the lateral extent of the fill are unknown but the electromagnetic (EM) survey conducted during the present investigation indicates that the entire 65 acres has possibly been used as a landfill at various periods of time. The majority of the landfill has been closed and is presently covered with brush, small to large trees, and grasses. The extreme northeastern end of the site has a large pile of scrap metal, including car bodies, tanks, drums, and other metal, on the surface and numerous other scattered locations had scrap metal on the surface. A clearing in the northcentral portion of the site is presently being used to dispose of scrap metal and mattresses. A gravel extraction operation is currently underway which encompasses a portion of the site including Phase II, Stage 1, Well W-2C, which is on the northern edge of the gravel pit. The pit is approximately 30 feet deep.

2. Sites SP-7 and SP-10: Pumphouse No. 3 JP-4 Fuel Spills

Pumphouse No. 3 is located just north of the east-west runway and has been the site of large and small fuel spills. During 1964-1965, a 50,000-gallon JP-4 fuel spill occurred as the result of a pumphouse failure (SP-10). On 27 September 1980, approximately 36,000 gallons of JP-4 was



LEGEND:

- W-7 ⊙ MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 1.
- GW-1A ● MONITOR WELL AND SURFACE WATER SAMPLE LOCATIONS AND NUMBER, PHASE II, STAGE 2.
- SC-1 ⊙ CH-1 SURFACE WATER SAMPLE, PHASE II, STAGE 2.
- G-2 ⊙ SURFACE SEDIMENT SAMPLE, PHASE II, STAGE 1.
- SP-11 SITE LOCATION AND NUMBER, PHASE II, STAGES 1 AND 2.

LOCATION OF SITES AND MONITOR WELLS, PHASE II, STAGES 1 AND 2 ELMENDORF AFB, ALASKA

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spilled onto the ground through a vent pipe due to a valve failure (SP-7). Little or no fuel was recovered from either of these spills. Almost all of the fuel seeped into the gravelly soil near the pumphouse.

3. Site D-7: Sanitary Landfill

In use since 1965, this sanitary landfill occupies approximately 35 acres and has been used for the disposal of base-generated general refuse, scrap metal, construction rubble, drums of asphalt, empty pesticide containers, and, in the 1960s, miscellaneous small quantities of shop wastes. Two pits, 30 to 40 feet deep, have been operated using area fill methods. The south pit was closed in March 1982 and covered with 2 to 4 feet of local soil and topsoil that was seeded. Three monitor wells, located within the limits of the south pit fill, indicate the bottom of the fill is within 5 feet of the water table. These wells have not been sampled regularly. An active "hazardous waste" disposal area, apparently used primarily for disposal of asbestos is in use in the extreme southeast portion of the site.

4. Site SP-5: JP-4 Tank Spill

Bulk Fuel Storage Tanks Nos. 601 through 604, buried in the Elmendorf Moraine, have been the site of numerous spills since these aviation gasoline (AVGAS) storage tanks were installed in the early 1940s. They are interconnected and gravity fed without check valves between the tanks. A 60,000-gallon AVGAS spill occurred in the mid-1960s with no recovery of fuel. In August of 1974, an estimated 33,000 gallon spill of JP-4 occurred with approximately 16,000 gallons of fuel recovered. Fuel from this tank system has been observed seeping from the hillside into a fuel/water separator and into the ditch adjacent to the roadway northwest of the west end of the east-west runway.

5. Site SP-12: JP-4 Fuel Line Leak

An underground fuel line leak of approximately 1,000 gallons of JP-4 was detected at this site in 1971. The site is located near Fire Station No. 1, just south of the east-west runway, on porous gravelly till.

6. Site D-17: Shop Waste Disposal

A natural trench near the east-west runway was used during the 1950s and 1960s as a disposal area for waste solvents, paint thinners, and other

liquid wastes generated in shop operations. The waste materials were poured directly onto the permeable soil at the site. The area has been covered with soil and is used as a parking area for heavy equipment or is grass- or brush-covered.

7. Site SP-11: JP-4 Fuel Line Leak

An unknown quantity of JP-4 leaked from an underground fuel line leak in 1978. The spilled fuel leaked from the bank of a stream north of two 840,000-gallon JP-4 storage tanks.

8. Site FT-1: Fire Training Area

The fire training area has been used from the 1940s until the present. During each exercise, 250 to 3,000 gallons of contaminated waste oils, paint thinners, waste fuel, wash solvents, and/or clean JP-4 fuel are spread on a water-saturated and bermed burn area and ignited. Protein foam or chlorobromomethane is then used to extinguish the fire. Generally, the burn area remains saturated with unconsumed waste fuel following the exercise.

9. Site SP-2: JP-4 Fuel Line Leak

As a result of a fuel line leak, an unknown quantity of JP-4 fuel seeped out of the bank southeast of Bldg. 22-010, near a culvert crossing Bluff Road, during 1964-1965. Periodic seeps have been noted in this area throughout the 1950s and 1960s. This spill site is near Ship Creek.

10. Site SP-14: MOGAS Spill

In 1965, a 1,500-gallon motor gasoline (MOGAS) spill occurred at a former service station located near Bldg. 11-110 at the corner of 36th Street and P Street. The spilled fuel, which seeped into the porous gravelly till, was not recovered.

11. Site IS-1: Bldg. 42-400 Floor Drains

Bldg. 42-400 (Hangar No. 10) has been used for fuel loading operations. Past spills, up to 1,300 gallons, have occurred at the facility. The building floor drains discharge into dry wells in gravelly soil at each end of the building (Engineering-Science, 1983).

E. IDENTIFICATION OF POLLUTANTS SAMPLED

Based on the wastes present in the above sites and the results of chemical analyses of samples from the Phase II, Stage 1, investigation, potential contaminants include petroleum hydrocarbons, volatile organics, pesticides, lead, and major cations and anions. The analytical program is provided in Table 1.

F. IDENTIFICATION OF THE FIELD TEAM

The field work for Phase II, Stage 2, was accomplished under the overall supervision of Mr. Jon Michael Stanley, Senior Engineering Geologist. Borehole drilling and monitor well installation were completed under the supervision of Ms. Amy D. Lamborg and Ms. Kay L. Tauscher, both Assistant Geologists. The well development and water sampling program was accomplished by Mr. Stanley, Ms. Lamborg, Ms. Tauscher, and Mr. Brian Coulter. The geophysical survey was conducted by Mr. Thomas S. Jensen, Senior Geologist/Geophysicist. Drilling services were provided by Tester Drilling Services, Inc., and surveying was conducted by Kean and Associates, both of Anchorage, Alaska. Appendix J contains biographies of key personnel.

TABLE 1

DETAILED ANALYTICAL PROGRAM
METHODS OF ANALYSIS AND REPORTED DETECTION LIMITS,
WATER QUALITY CRITERIA AND SAMPLING SCHEME
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II, STAGE 2

						NUMBER OF SAMPLES PER PARAMETER BY SITE						
PARAMETER	METHOD	UNITS	DETECTION LIMIT	PRIMARY DRINKING WATER STANDARDS	SECONDARY DRINKING WATER STANDARDS	BASE WELLS	SHIP CREEK	D-5 D-7	SP-7, SP-10, SP-12 FT-1, SP-2 SP-14	D-17 IS-1	SP-5	SP-11
Purgeable Halocarbons	EPA 601[a]	ug/L	MDL[b]	Total Trihalo-methanes = 100	N.E.	3	3	10	0	7	0	2
Bromodichloromethane	EPA 601[a]	ug/L	0.35	N.E.	N.E.							
Bromoform	EPA 601[a]	ug/L	0.45	N.E.	N.E.							
Bromomethane	EPA 601[a]	ug/L	0.33	N.E.	N.E.							
Carbon Tetrachloride	EPA 601[a]	ug/L	0.46	N.E.	N.E.							
Chlorobenzene	EPA 601[a]	ug/L	0.37	N.E.	N.E.							
Chloroethane	EPA 601[a]	ug/L	0.38	N.E.	N.E.							
2-Chloroethylvinyl Ether	EPA 601[a]	ug/L	0.44	N.E.	N.E.							
Chloroform	EPA 601[a]	ug/L	0.45	N.E.	N.E.							
Chloromethane	EPA 601[a]	ug/L	0.49	N.E.	N.E.							
Dibromochloromethane	EPA 601[a]	ug/L	0.31	N.E.	N.E.							
1,2-Dichlorobenzene	EPA 601[a]	ug/L	0.29	N.E.	N.E.							
1,3-Dichlorobenzene	EPA 601[a]	ug/L	0.42	N.E.	N.E.							
1,4-Dichlorobenzene	EPA 601[a]	ug/L	0.41	N.E.	N.E.							
Dichlorodifluoromethane	EPA 601[a]	ug/L	0.33	N.E.	N.E.							
1,1-Dichloroethane	EPA 601[a]	ug/L	0.49	N.E.	N.E.							
1,2-Dichloroethane	EPA 601[a]	ug/L	0.44	N.E.	N.E.							
1,1-Dichloroethene	EPA 601[a]	ug/L	0.49	N.E.	N.E.							
trans-1,2-Dichloroethene	EPA 601[a]	ug/L	0.42	N.E.	N.E.							
1,2-Dichloropropane	EPA 601[a]	ug/L	0.20	N.E.	N.E.							
cis-1,3-Dichloropropene	EPA 601[a]	ug/L	0.58	N.E.	N.E.							
trans-1,3-Dichloropropene	EPA 601[a]	ug/L	0.39	N.E.	N.E.							
Methylene Chloride	EPA 601[a]	ug/L	0.34	N.E.	N.E.							
1,1,2,2-Tetrachloroethane	EPA 601[a]	ug/L	0.38	N.E.	N.E.							
Tetrachloroethene	EPA 601[a]	ug/L	0.38	N.E.	N.E.							
1,1,1-Trichloroethane	EPA 601[a]	ug/L	0.53	N.E.	N.E.							
1,1,2-Trichloroethane	EPA 601[a]	ug/L	0.51	N.E.	N.E.							
Trichloroethene	EPA 601[a]	ug/L	0.60	N.E.	N.E.							
Trichlorofluoromethane	EPA 601[a]	ug/L	0.44	N.E.	N.E.							
Vinyl Chloride	EPA 601[a]	ug/L	0.54	N.E.	N.E.							

[a]"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," Federal Register, Volume 49, Number 209, Friday, October 26, 1984.
[b]Determined according to the procedure in Federal Register Friday, October 26, 1984, Part VIII.
[c]"Methods for Chemical Analysis of Water and Wastes," EPA Manual 600/4-79-020, USEPA, March 1983.
[d]"Standard Methods for the Examination of Water and Wastewater," AHPA, AWWA, WPCF, 16th Ed, 1985.
N.E. = No Criterion Established.
N.A. = Not Applicable
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TABLE 1

PARAMETER	METHOD	UNITS	DETECTION LIMIT	PRIMARY DRINKING WATER STANDARDS	SECONDARY DRINKING WATER STANDARDS	NUMBER OF SAMPLES PER PARAMETER BY SITE: BASE WELLS	SHIP CREEK	D-5 D-7	SP-7, SP-10, SP-12, FT-1, SP-2 SP-14	D-17 IS-1	SP-5	SP-11
Purgeable Aromatics	EPA 602[a]	ug/L	MDL[b]	N.E.	N.E.	3	3	10	10	0	2	2
Benzene	EPA 602[a]	ug/L	0.25	N.E.	N.E.							
Chlorobenzene	EPA 602[a]	ug/L	0.35	N.E.	N.E.							
1,2-Dichlorobenzene	EPA 602[a]	ug/L	0.47	N.E.	N.E.							
1,3-Dichlorobenzene	EPA 602[a]	ug/L	0.93	N.E.	N.E.							
1,4-Dichlorobenzene	EPA 602[a]	ug/L	0.44	N.E.	N.E.							
Ethylbenzene	EPA 602[a]	ug/L	0.75	N.E.	N.E.							
Toluene	EPA 602[a]	ug/L	0.64	N.E.	N.E.							
m-Xylene	EPA 602[a]	ug/L	0.45	N.E.	N.E.							
o-Xylene	EPA 602[a]	ug/L	0.78	N.E.	N.E.							
p-Xylene	EPA 602[a]	ug/L	0.78	N.E.	N.E.							
Filterable Residue (TDS)	EPA 160.1[c]	mg/L	10.	N.E.	500	3	3	10	10	0	2	2
Petroleum Hydrocarbons	EPA 418.1[c]	mg/L	0.2	N.E.	N.E.	3	3	10	10	0	2	2
Lead	EPA 239.2[c]	mg/L	0.005	0.05	N.E.	3	3	0	0	0	0	2
Alkalinity	EPA 301.2[b]	mg/L	10.	N.E.	N.E.	0	0	0	0	0	0	2
Bicarbonate	EPA 310.2[b]	mg/L	10.	N.E.	N.E.	0	0	0	0	0	0	2
Carbonate	EPA 310.2[b]	mg/L	10.	N.E.	N.E.	0	0	0	0	0	0	2
Nitrate + Nitrite	EPA 353.2[c]	mg/L	0.02	10 (Nitrate)	N.E.	0	0	0	0	0	0	2
Total Phosphate	EPA 365.4[c]	mg/L	0.1	N.E.	N.E.	0	0	0	0	0	0	2
Chloride Ion	A429[d]	mg/L	0.1	N.E.	250	0	0	0	0	0	0	2
Sulfate Ion	A429[d]	mg/L	0.1	N.E.	250	0	0	0	0	0	0	2
Fluoride Ion	A429[d]	mg/L	0.05	1.4-2.4	N.E.	0	0	0	0	0	0	2
Bromide Ion	A429[d]	mg/L	0.1	N.E.	N.E.	0	0	0	0	0	0	2

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ICP Scan	EPA 200.7[c]	ug/L	MDL[b]			0	0	0	0	0	0	2
Silver	EPA 200.7[c]	ug/L	7.	50	N.E.							
Aluminum	EPA 200.7[c]	ug/L	45.	N.E.	N.E.							
Arsenic	EPA 200.7[c]	ug/L	53.	50	N.E.							
Boron	EPA 200.7[c]	ug/L	5.	N.E.	N.E.							
Barium	EPA 200.7[c]	ug/L	2.	1000	N.E.							
Beryllium	EPA 200.7[c]	ug/L	0.3	N.E.	N.E.							
Calcium	EPA 200.7[c]	ug/L	10.	N.E.	N.E.							
Cadmium	EPA 200.7[c]	ug/L	4.	10	N.E.							
Cobalt	EPA 200.7[c]	ug/L	7.	N.E.	N.E.							
Chromium	EPA 200.7[c]	ug/L	7.	50	N.E.							
Copper	EPA 200.7[c]	ug/L	6.	N.E.	1000							
Iron	EPA 200.7[c]	ug/L	7.	N.E.	300							
Magnesium	EPA 200.7[c]	ug/L	30.	N.E.	N.E.							
Manganese	EPA 200.7[c]	ug/L	2.	N.E.	50							
Molybdenum	EPA 200.7[c]	ug/L	8.	N.E.	N.E.							
Nickel	EPA 200.7[c]	ug/L	15.	N.E.	N.E.							
Lead	EPA 200.7[c]	ug/L	42.	50	50							
Antimony	EPA 200.7[c]	ug/L	32.	N.E.	N.E.							
Selenium	EPA 200.7[c]	ug/L	75.	10	N.E.							
Thallium	EPA 200.7[c]	ug/L	40.	N.E.	N.E.							
Vanadium	EPA 200.7[c]	ug/L	8.	N.E.	N.E.							
Zinc	EPA 200.7[c]	ug/L	2.	N.E.	5000							
Pesticides	EPA 608[a]	ug/L	MDL[b]	N.E.	N.E.	0	0	10	0	0	0	0
Aldrin	EPA 608[a]	ug/L	0.005	N.E.	N.E.							
alpha-BHC	EPA 608[a]	ug/L	0.0004	N.E.	N.E.							
beta-BHC	EPA 608[a]	ug/L	0.001	N.E.	N.E.							
delta-BHC	EPA 608[a]	ug/L	0.002	N.E.	N.E.							
Lindane	EPA 608[a]	ug/L	0.004	4.0	N.E.							
Chlordane	EPA 608[a]	ug/L	0.01	N.E.	N.E.							
4,4'-DDD	EPA 608[a]	ug/L	0.001	N.E.	N.E.							
4,4'-DDE	EPA 608[a]	ug/L	0.001	N.E.	N.E.							
4,4'-DDT	EPA 608[a]	ug/L	0.005	N.E.	N.E.							
Dieldrin	EPA 608[a]	ug/L	0.003	N.E.	N.E.							
Endosulfan I	EPA 608[a]	ug/L	0.006	N.E.	N.E.							
Endosulfan II	EPA 608[a]	ug/L	0.004	N.E.	N.E.							
Endosulfan Sulfate	EPA 608[a]	ug/L	0.018	N.E.	N.E.							
Endrin	EPA 608[a]	ug/L	0.002	0.2	N.E.							
Endrin Aldehyde	EPA 608[a]	ug/L	0.021	N.E.	N.E.							
Heptachlor	EPA 608[a]	ug/L	0.01	N.E.	N.E.							
Heptachlor Epoxide	EPA 608[a]	ug/L	0.003	N.E.	N.E.							
Toxaphene	EPA 608[a]	ug/L	0.1	5.0	N.E.							
pH	field	S.U.	0.1	N.E.	6.5 TO 8.5	3	3	10	14	7	2	2
Temperature	field	°C	0.1	N.E.	N.E.	3	3	10	14	7	2	2
Conductivity	field	umhos/cm	10	N.E.	N.E.	3	3	10	14	7	2	2

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II. ENVIRONMENTAL SETTING

A. PHYSICAL GEOGRAPHY

Elmendorf Air Force Base is located in the Greater Anchorage Area Borough, Alaska, and borders the City of Anchorage to the south and Fort Richardson, an Army post, to the east. Land surface elevations range from sea level along the shore of Knik Arm of Cook Inlet to about 380 feet MSL on the crest of the Elmendorf Moraine near Bldg. 42-500.

Elmendorf AFB is located at the junction of Knik and Turnagain Arms of Cook Inlet, a glacial trough. Elmendorf AFB, Fort Richardson, and the City of Anchorage are all located on a lowland that rises from sea level to about 1,000 feet at the front of the Chugach Mountains. The Chugach Range rises abruptly to elevations of more than 3,500 feet. The lowland, a broad alluvial fan, is characterized by areas of ground moraine, drumlin fields, eskers, and outwash plains. A major glacial feature, the Elmendorf Moraine, extends east-west across the base. Broad alluvial channels are also present at several locations on the lowland. Regional drainage is from the bordering mountains across the lowland surface via streams to Cook Inlet.

The average annual precipitation at the base is 15.5 inches with the majority of the rainfall confined to the months of June through January. The average snowfall is 68 inches, primarily confined to November through March. The mean monthly temperatures range from a low of 11°F in January to a high of 58°F in July (Engineering-Science, 1983).

B. REGIONAL GEOLOGY AND HYDROGEOLOGY

The Anchorage Plain is a large alluvial fan on the east shore of a wide estuarine basin whose prominent margins are formed by the Kenai, Chugach, Talkeetna, Tordrillo, and Chigmit Mountains. Regional bedrock is exposed east of the study area along the Chugach Mountain flanks. The bedrock there is principally undifferentiated Mesozoic age metamorphic material, including slate, sandstone, and miscellaneous volcanic rock. Tertiary sedimentary rocks of the Kenai Group have been encountered in deep wells penetrating the unconsolidated sediments of the Anchorage Lowland. This consolidated unit unconformably overlies the Mesozoic metamorphics and consists of siltstone, coal, sandstone, and conglomerate. The Tertiary sequence forms a bedrock surface that apparently slopes abruptly away from

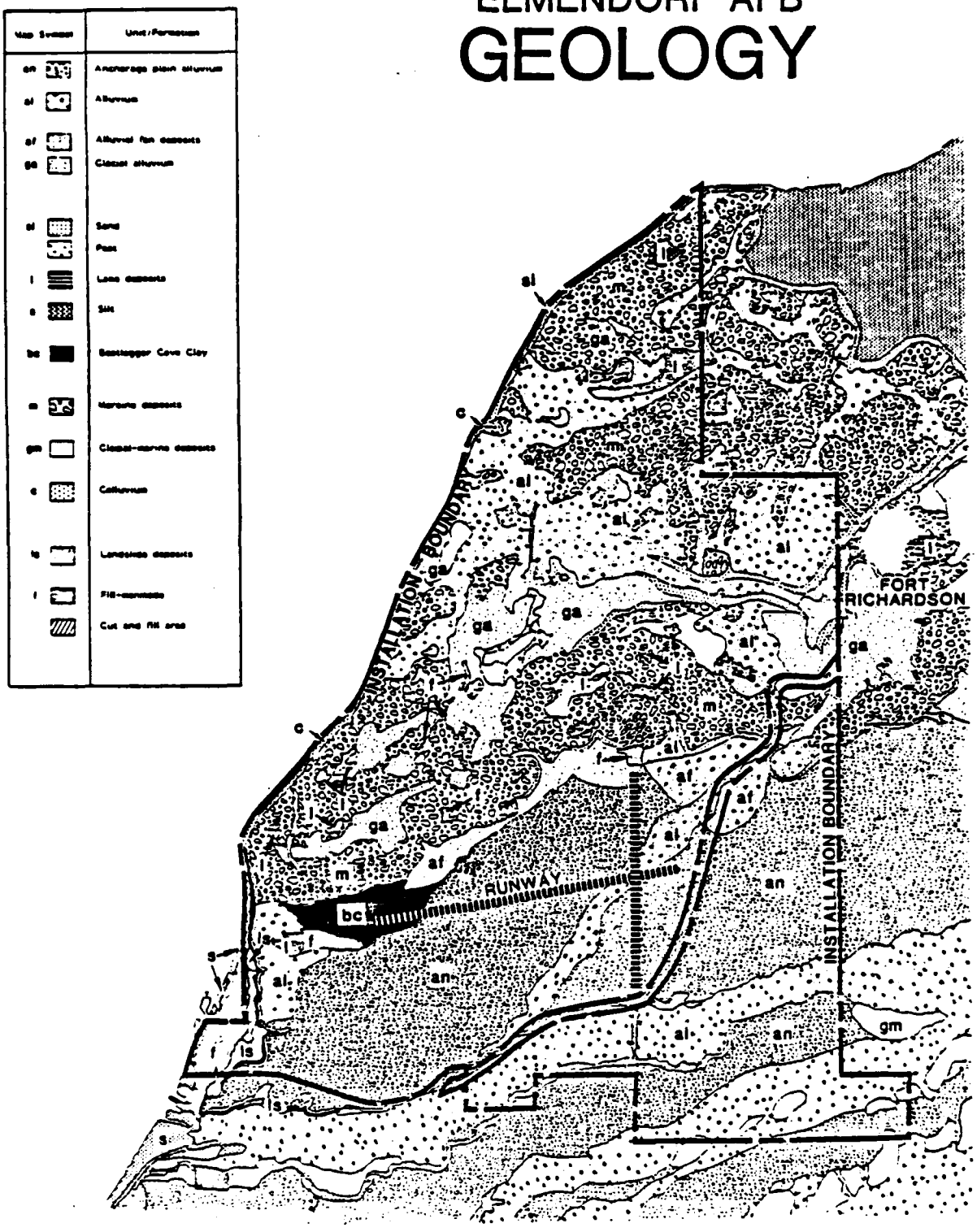
its exposure in the Chugach Foothills toward Knik Arm. The steep slope of the surface may be related to the Border Ranges Fault, which has a north-south alignment, just east of the area at the base of the Chugach Mountains.

On the Anchorage Plain, the consolidated geologic deposits are overlain by substantial accumulations of unconsolidated material, primarily glacial drift and marine deposits, that was deposited during several glacial episodes in Pleistocene time (Péwé, 1975). A well drilled near Elmendorf AFB Bldg. 22-001 encountered 764 feet of unconsolidated material over bedrock. A map of the distribution of the surficial sediments at Elmendorf AFB is provided as Plate 3. Generally, the surficial geology of the area is dominated by two types of unconsolidated deposits: (1) coarse-grained, fairly well sorted stream and delta deposits in the southern (flatlands) portion of the base comprising relatively clean sands and gravels associated with stream channel development or glacial outwash; and (2) fine-grained, poorly sorted glacial materials in the northern (uplands) portion of the base that are heterogeneous mixtures of boulders, cobbles, gravel, sand, silt, and clay in hilly morainal topography. The contacts shown on the map are approximate. The total thickness of unconsolidated materials is estimated to be approximately 800 feet in the areas investigated (Engineering-Science, 1983).

A generalized geologic section along Ship Creek is provided on Plate 4. The sand, gravel, and till deposits shown are known to be discontinuous and to grade into one another both horizontally and vertically (Péwé, 1975; Engineering-Science, 1983). Sand units, in particular, are very difficult to correlate, even over short distances. Buried sand lenses may intersect one another, may pinch out, or may be imperfectly separated by intervening tills.

Two aquifers occur in the unconsolidated units underlying the Anchorage Plain: a shallow aquifer comprised of four units and an artesian aquifer made up of three units. The near-surface silt and clay unit shown on Plate 4 is the marine Bootlegger Cove Clay, which forms the lower limit of the shallow surface aquifer and the confining layer of the deeper artesian aquifer. Water, originating as precipitation, snowmelt, or leakage through stream beds, recharges both aquifers, primarily along the Chugach Mountain front. Water in the aquifers moves downslope under the influence of gravity until it discharges to area streams or Cook Inlet or is withdrawn by wells. Because the clay unit forms a ground water dam where it is exposed along the coastline, the unconfined aquifer does not

ELMENDORF AFB
GEOLOGY



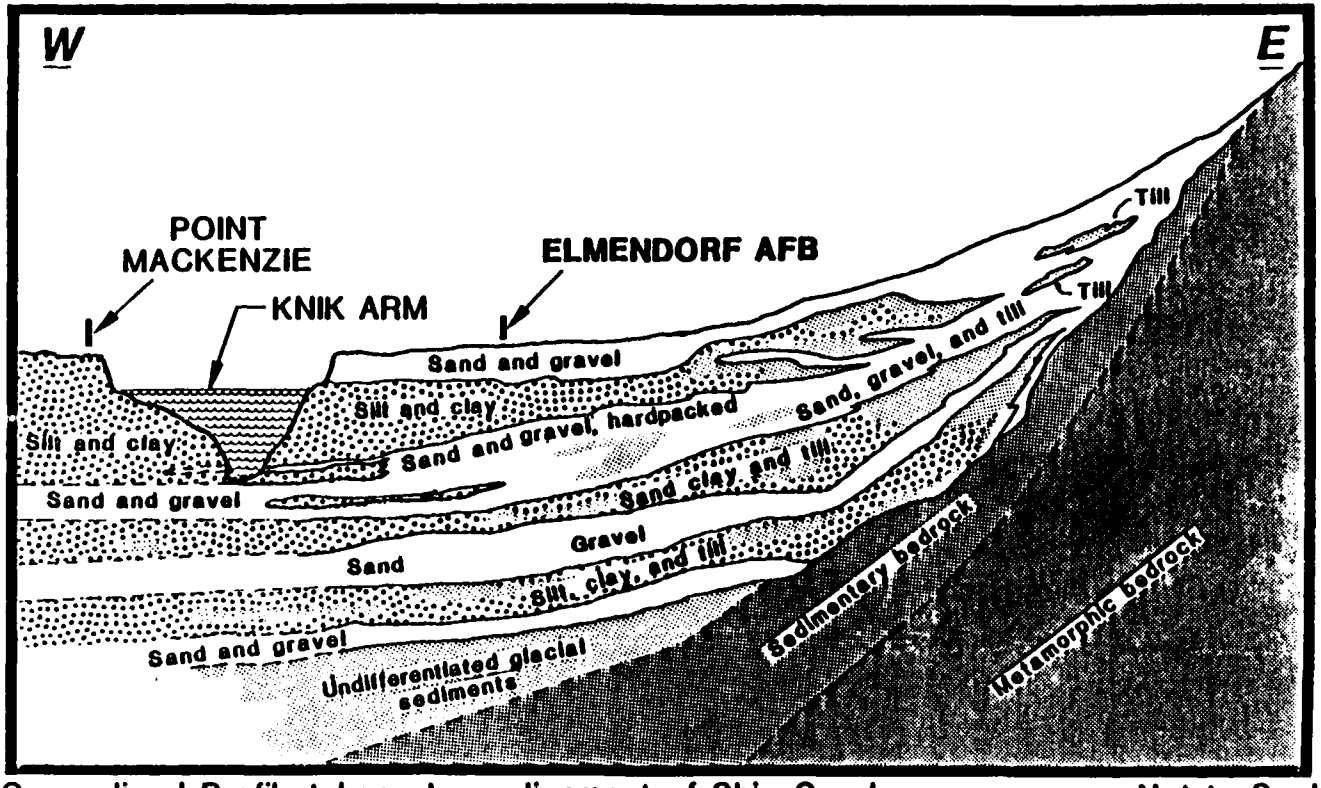
SOURCE: SCHMOLL AND DOBROVOLNY (1972)

SCALE 0 400 FEET

SURFICIAL GEOLOGY OF ELMENDORF AFB AREA

Dames & Moore

PLATE 3



Generalized Profile taken along alignment of Ship Creek Not to Scale

GENERALIZED GEOLOGIC CROSS-SECTION ALONG SHIP CREEK ELMENDORF AFB, ALASKA

SOURCE; MODIFIED FROM FREETHY AND SCULLY, 1980

Dames & Moore

discharge to Cook Inlet except through Ship Creek (Weeks, 1970). The shallow aquifer lies from 0 to 50 feet below the ground surface and is expected to yield from nil to 1,500 gallons per minute (gpm). The average hydraulic gradient of this aquifer is estimated to be 20 feet per mile. The artesian aquifer lies approximately 100 feet below the ground surface and is expected to yield from 5 to 1,500 gpm. The average hydraulic gradient of the artesian aquifer is estimated to be 25 feet per mile (Engineering-Science, 1983). The piezometric head of the artesian aquifer is variable but, due to deep ground water extraction, generally lies below the bottom of the shallow aquifer (Nelson, 1982).

The relationship between Ship Creek and the shallow aquifer is complex. In the upper reach of the stream, from the Chugach Mountains to about the Davis Highway, the stream loses water to the ground water. The lower reach of the stream, from Davis Highway to Cook Inlet, gains from the shallow aquifer. Where Ship Creek is entrenched in the Bootlegger Cove Clay, ground water is directed to the stream first, rather than to Knik Arm, resulting in increased flow in Ship Creek and in a complex ground water flow system (Engineering-Science, 1983).

C. GENERAL HYDROGEOLOGY

Both aquifers recognized below the Anchorage plain underlie Elmendorf AFB. The base receives most of its water supplies from Ship Creek via a diversion structure on Fort Richardson, but makeup supplies are obtained as needed from standby wells, which generally extend into the artesian aquifer. The Municipality of Anchorage also acquires most of its water supply from the diversion structure and deep wells. A water supply pipeline is, however, under construction which will carry water from Ekultna Lake to the municipal water system.

1. Shallow Ground Water System at Elmendorf AFB

The hydrogeologic units of the shallow ground water system include alluvial fan deposits, alluvial and outwash deposits, morainal (till) deposits, and tidal deposits occurring at or near the ground surface. The major characteristics of the deposits can be summarized as follows (Engineering-Science, 1983):

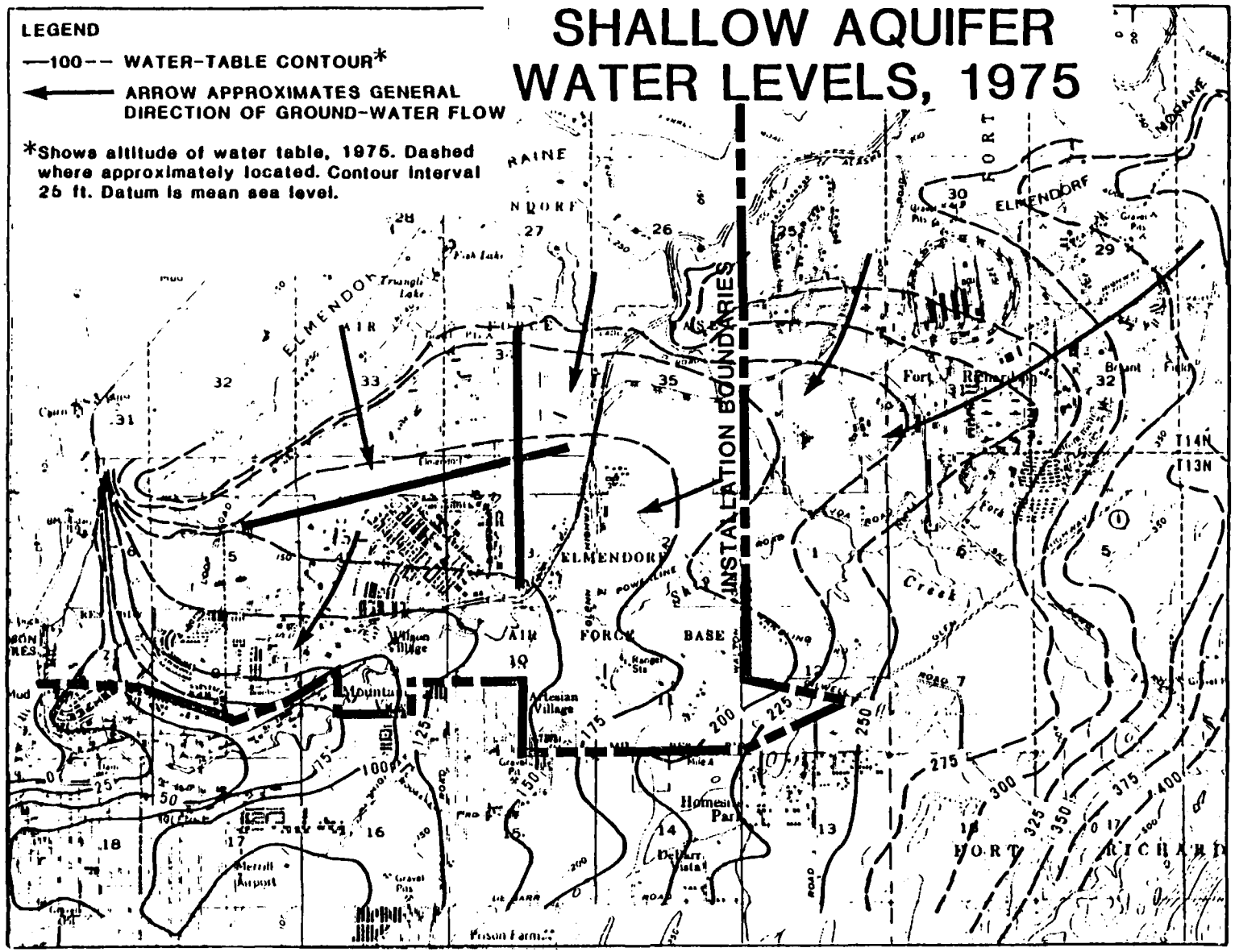
Hydrogeologic Unit	Topographic Setting	Lithology	Estimated Thickness (ft)	Permeability (cm/sec)	Yield Range (gpm)
Alluvial Fan	Stream valleys and lowlands	Sand and gravel	30 - 100	very high ($>1 \times 10^{-1}$)	500-1500
Alluvial and Outwash	Lowlands	Sand and gravel	10 - 50	high (1×10^{-1} to 1×10^{-2})	10-100
Moraine (Till)	Uplands	Boulder, cobble, gravel, sand, silt, and clay mixture	10 - 300	moderate to low (1×10^{-1} to 1×10^{-3})	5-50
Tidal	Tidal zone	Silt and clay	50 - 250	low (1×10^{-2} to 1×10^{-3})	nil

Plate 5 provides water levels for the shallow aquifer in 1975. The average hydraulic gradient is calculated to be approximately 20 feet per mile. Water levels north of the south edge of the Elmendorf Moraine are not well understood because of a lack of information in that area. Due to topographic controls, the depth to the water table below the ground surface varies from zero to as much as 50 to 60 feet. Utilization of the shallow aquifer units as a source of potable water has been limited because of contamination problems. The primary threat to the shallow ground water system is from on-site sewage treatment and disposal systems discharging effluent to the permeable surficial soils. Other major sources of contamination are sanitary landfills (Engineering-Science, 1983).

Estimates of vertical permeabilities of two confining units between the shallow ground water aquifer and the underlying confined (artesian) aquifers are 1×10^{-2} and 2×10^{-4} feet per day (Nelson, 1982). Further, the hydraulic pressure within the artesian unit will tend to force water from the unit vertically through the confining layer and, in effect, minimize or eliminate infiltration into the artesian system. Therefore, it can be expected that petroleum products will migrate to the more permeable shallow ground water system and then move laterally out of the system to Ship Creek or other surface water bodies (Engineering-Science, 1983). It appears, therefore, that the deep artesian aquifer is not in significant danger of contamination in the near future, but the shallow aquifer has been contaminated in the past and is vulnerable to contamination in the future.

ELMENDORF AFB

SHALLOW AQUIFER WATER LEVELS, 1975



SOURCE: MODIFIED FROM FREETHEY, 1976

PLATE 5

Hydrogeologic Unit	Topographic Setting	Lithology	Estimated Thickness (ft)	Permeability (cm/sec)	Yield Range (gpm)
Outwash	Lowlands	Sand and gravel	100 - 300	very high (>1 x 10^{-1})	200-1500
Alluvium	Lowlands	Sand	200 - 400	moderate (1 x 10^{-2} to 1 x 10^{-3})	200-700
Till	Uplands	Mixed	50 - 300	variable but generally low (1 x 10^{-1} to 1 x 10^{-7})	5-50

Most of the municipal water system wells are installed in the outwash unit of the artesian aquifer. Plate 6 provides potentiometric surface contours for 1969 within the artesian system in the general area. The effects of ground water extraction from wells in the area near Ship Creek are shown by the depression in the water surface centered on Ship Creek. The artesian system hydraulic gradient is interpolated to be 25 feet per mile at the base. The water quality of the artesian aquifer is good (Engineering-Science, 1983).

D. SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

This section presents the results of the investigations conducted during Phase II, Stages 1 (Dames & Moore, 1986) and 2, at the 11 previously listed sites at Elmendorf AFB. The logs of monitor wells installed during Stage 2 are presented in Appendix D. The Phase II, Stage 2, field program is described in Section III and the results of the chemical analyses are presented in Section IV.

1. Site D-5

Site D-5 served as the base landfill from 1951 to 1973, but it is now partially abandoned and covered with trees, brush, and grasses. Two monitor wells, W-1 and W-2, were drilled to a depth of 57 feet west and south of the assumed limits of the landfill during Phase II, Stage 1. Monitor well W-2 was installed in borehole W-2C. However, debris encountered at 15 feet in W-1 suggested it may have been within fill. Buried drums found in the trench walls of the active landfill (Site D-7)

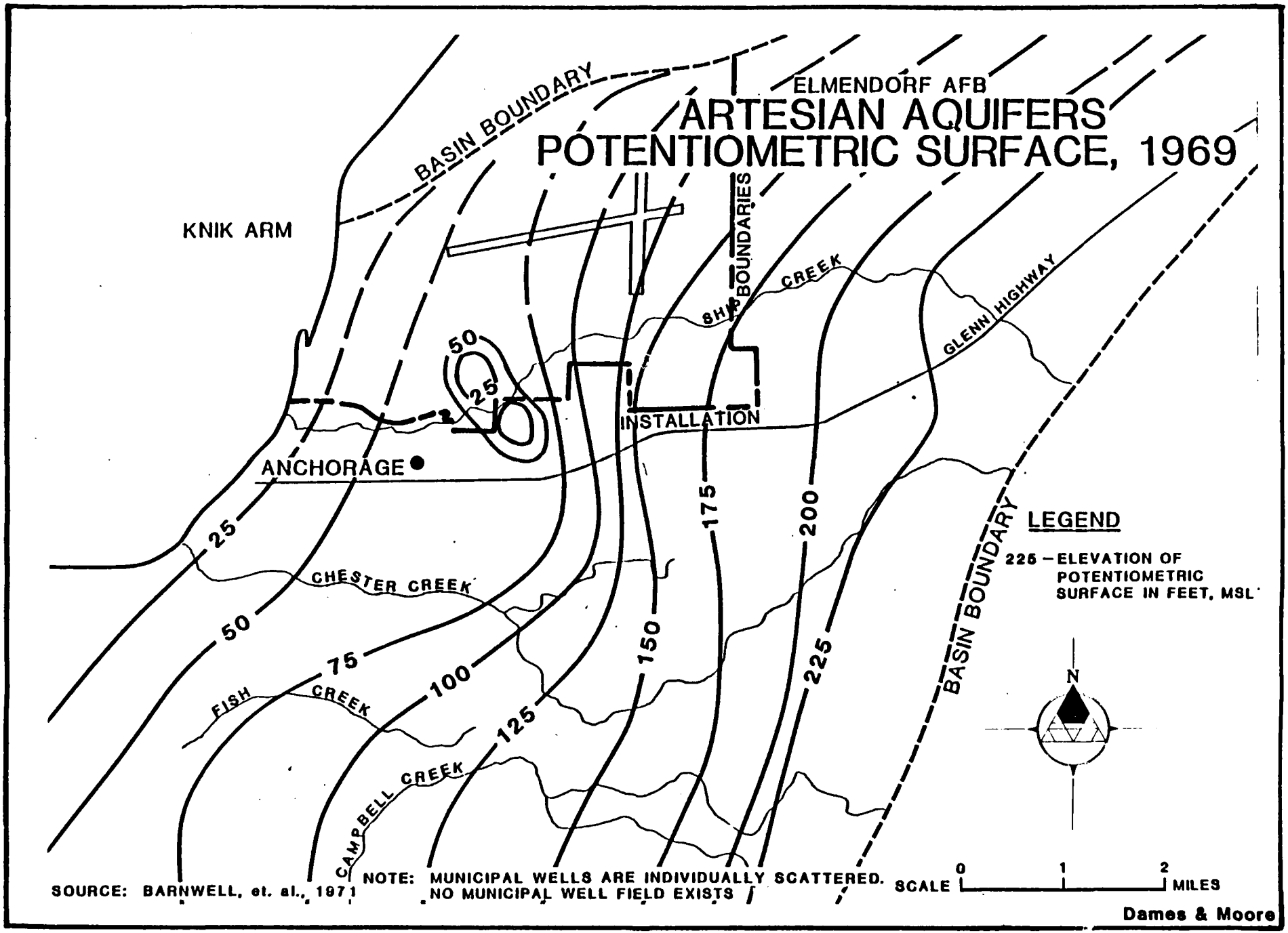

ELMENDORF AFB
ARTESIAN AQUIFERS
POTENTIOMETRIC SURFACE, 1969
BASIN BOUNDARY
KNIK ARM
SHS BOUNDARIES
CREEK
GLENN HIGHWAY
INSTALLATION
ANCHORAGE
CHESTER CREEK
FISH CREEK
CAMPBELL CREEK
BASIN BOUNDARY
25
50
75
100
125
150
175
200
225
LEGEND
225 – ELEVATION OF POTENTIOMETRIC SURFACE IN FEET, MSL
N
SOURCE: BARNWELL, et. al., 1971
NOTE: MUNICIPAL WELLS ARE INDIVIDUALLY SCATTERED. NO MUNICIPAL WELL FIELD EXISTS
SCALE 0 1 2 MILES
Dames & Moore

PLATE 6

indicated W-2C may have also been within the landfill. Boreholes W-2A and W-2B, drilled east of borehole W-2C, were abandoned at 15.0 feet. These suspicions were confirmed by the magnetometer survey conducted on the site, as described below, which indicated that the landfill extended a considerable distance farther to the north. Based on the results of the magnetometer survey and analysis of the available ground water data, one monitor well (GW-1A) was installed upgradient of the site to establish background levels and two monitor wells (GW-1B and GW-1C) were installed along the western (downgradient) edge of the landfill to intercept pollutant plumes that may be moving out from the landfill. The locations of the boreholes and wells are shown on Plates 2 and 7.

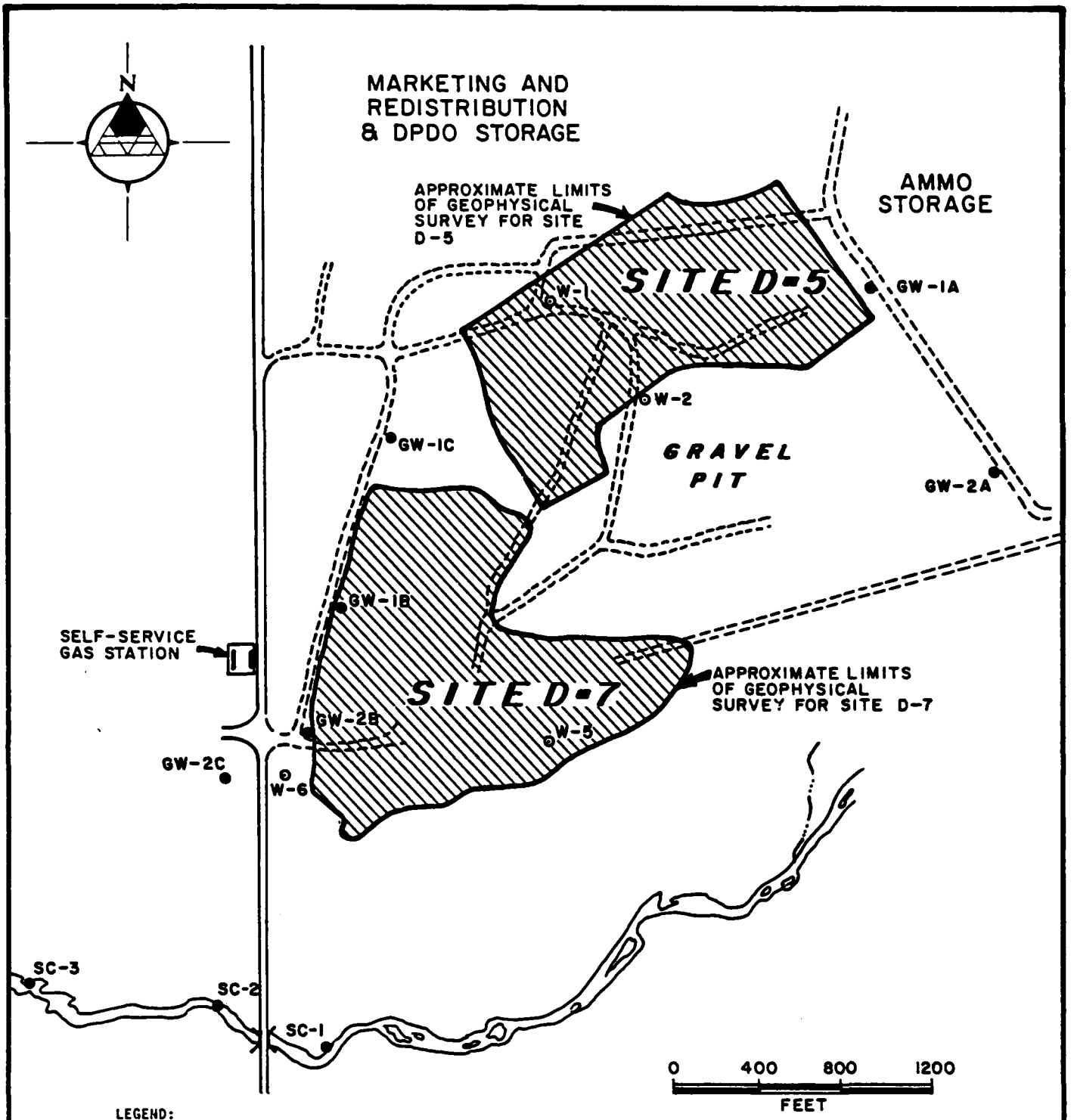
The subsurface profile at Site D-5 consists of gravelly sand over sand with minor amounts of gravel and silt. Water was encountered in wells W-1 and W-2 at 37 feet (9 July 1984 and 11 July 1984, respectively) at 42.5 feet in well GW-1A (16 September 1986), at 36.0 feet in well GW-1B (21 September 1986), and at 41.5 feet in well GW-1C (22 September 1986). Ground water flow is indicated to be south-southwest rather than directly toward Ship Creek, which loses water to the shallow aquifer in this area (see Plate 5).

Borings done in 1984 in the deicing drum storage area northwest of the landfill found outwash sand and gravel with minor amounts of silty sand. Depth to ground water was approximately 43 feet and the ground water gradient was to the west (Donohue, 1984).

The moisture contents of the analyzed soil samples from wells W-1 and W-2 were 10 and 13 percent, respectively. High explosimeter readings [100 percent of the lower explosive limit (LEL)] necessitated abandoning boreholes W-2A and W-2B at approximately 15 feet. Borehole W-2C had explosimeter readings of 23 percent LEL in the upper 30 feet. Monitor well W-2 was installed in borehole W-2C. HNU photoionization meter readings of soils sampled from wells GW-1A, GW-1B, and GW-1C were all 0 ppm.

2. Sites SP-7 and SP-10

Pumphouse No. 3 is the location of at least two major and several small JP-4 fuel spills. Two monitor wells, W-3 and W-4, were completed to depths of 40 and 32 feet, respectively during Phase II, Stage 1. Extensive underground pipes and tanks necessitated locating the wells off the direct spill area, but base personnel indicated fuel spilled at Pumphouse No. 3 and the adjacent apron runs toward well W-4 (see Plates 2 and 8). No additional wells were drilled at this site during the Phase II, Stage 2 investigation.



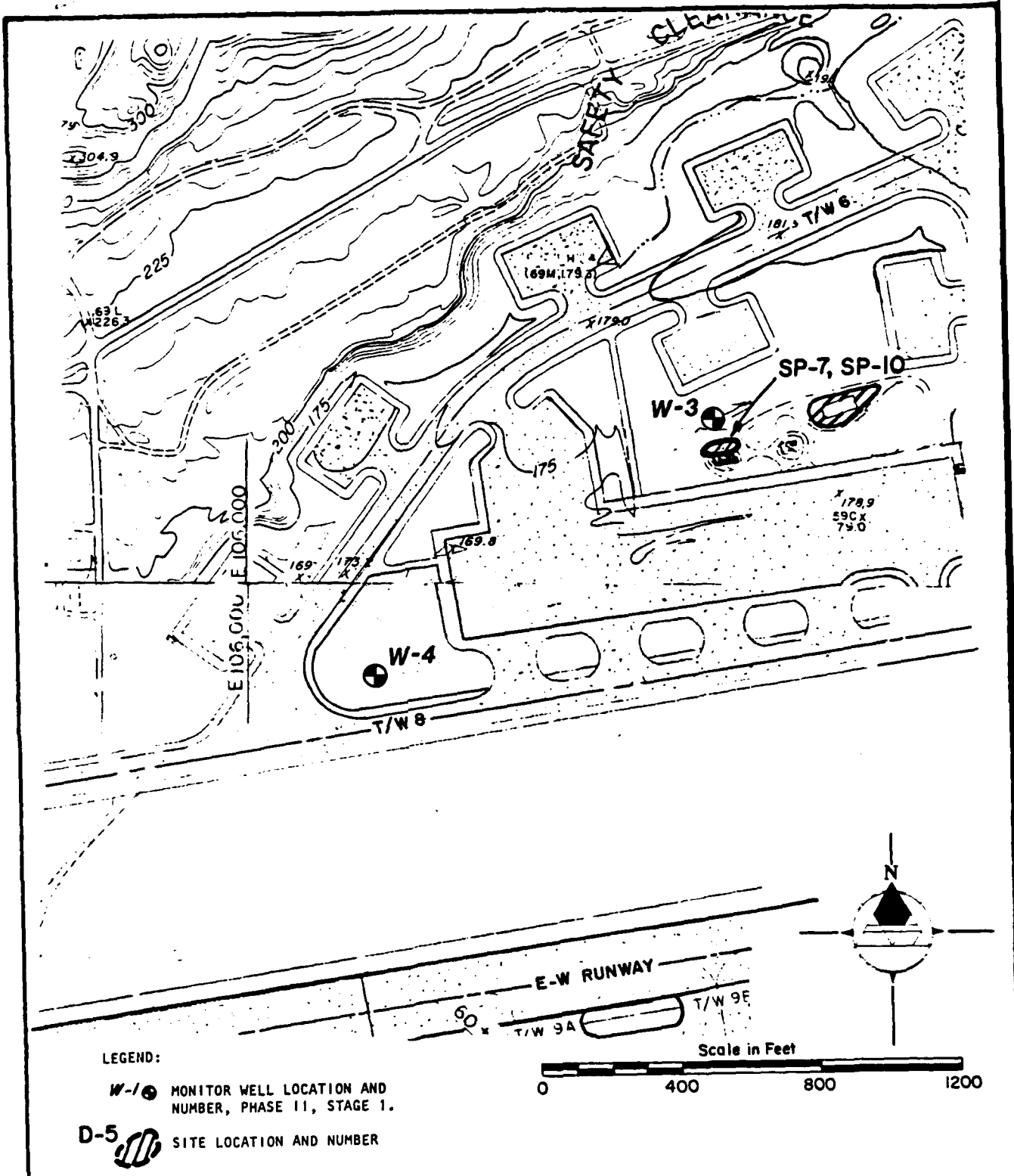
SOURCE:

ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ALASKA DRWG. G-7, SHEETS 3 & 4, DATED 1966.

SITE D-5, ABANDONED BASE LANDFILL AND SITE D-7, BASE LANDFILL, MONITOR WELLS W-1, W2 W-1, W-2, W-5, W-6, GW-1A GW-1B, GW-1C, GW-2A, GW-2B, GW-2C

Dames & Moore

PLATE 7



SITES SP-7 AND SP-10, FUEL SPILLS, MONITOR WELLS W-3 AND W-4

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 8

The subsurface profile at this site is difficult to correlate between the two monitor wells (W-3 and W-4). The materials at well W-3 consist primarily of sand with lesser amounts of gravel and silt. At well W-4, the material in the upper 13 feet consists of gravelly sand with small amounts of silt. Below 13 feet, the materials vary from clayey silt to silty clay. Water was encountered at 20.5 feet in W-3 and 12 feet in W-4 on 22 June 1984.

Soil samples were analyzed to have 6.4 percent moisture in W-3 and 14 percent moisture in W-4. Explosimeter and HNU photoionization meter readings were at background levels during drilling operations in both boreholes.

3. Site D-7

Site D-7 is the location of the base landfill that has been in use since 1965. Two monitor wells, W-5 and W-6, were completed to depths of 56.5 feet during the Phase II, Stage 1 investigation at the locations shown on Plates 2 and 7. One additional borehole, W-6A, was initiated and abandoned when high explosimeter readings were found at shallow depths. Well W-5 was drilled, in part, through the southern edge of the landfill due to access problems with moving off the edge of the landfill. Borehole W-6A was drilled at what was assumed to be the edge of the landfill but was found to be in fill material. W-6B is located northwest of the landfill and hydraulically downgradient. Well W-6 was installed in borehole W-6B. All three boreholes were located in open fields. Based on the results of the magnetometer survey and analysis of the available ground water data, one monitor well (GW-2A) was installed upgradient of the site to establish background levels, one monitor well (GW-2B) was installed along the northern (downgradient) edge of the landfill to intercept pollutant plumes that may be moving out from the landfill, and one monitor well (GW-2C) was installed approximately 600 feet hydraulically downgradient of the site to determine the possible extent of any pollutant plumes. The locations of the boreholes and wells are shown on Plates 2 and 7.

The subsurface materials in well W-5 consisted of 21 feet of landfill material over sand with varying amounts of gravel and sandy gravel. Water was encountered at 32.0 feet on 6 June 1984. The materials in borehole W-6A consisted of landfill debris. The materials in borehole W-6B consisted of approximately 7.5 feet of silt with varying amounts of coarse material overlying gravelly sand and sand with trace amounts of silt and gravel. Water was encountered at 34.0 feet on 8 June 1984. The materials

encountered in wells GW-2A, GW-2B, and GW-2C consisted generally of sand and gravelly sand with lesser amounts of silt. Water was encountered at 43.5 feet in well GW-2A (18 September 1986), at 41.5 feet in well GW-2B (19 September 1986), and at 30.0 feet in well GW-2C (23 September 1986).

The moisture content of a soil sample from wells W-5 and W-6B were 3.1 percent and 26 percent, respectively. Except for borehole W-6A, explosimeter and HNU photoionization meter readings were at background levels at this site.

4. Site SP-5

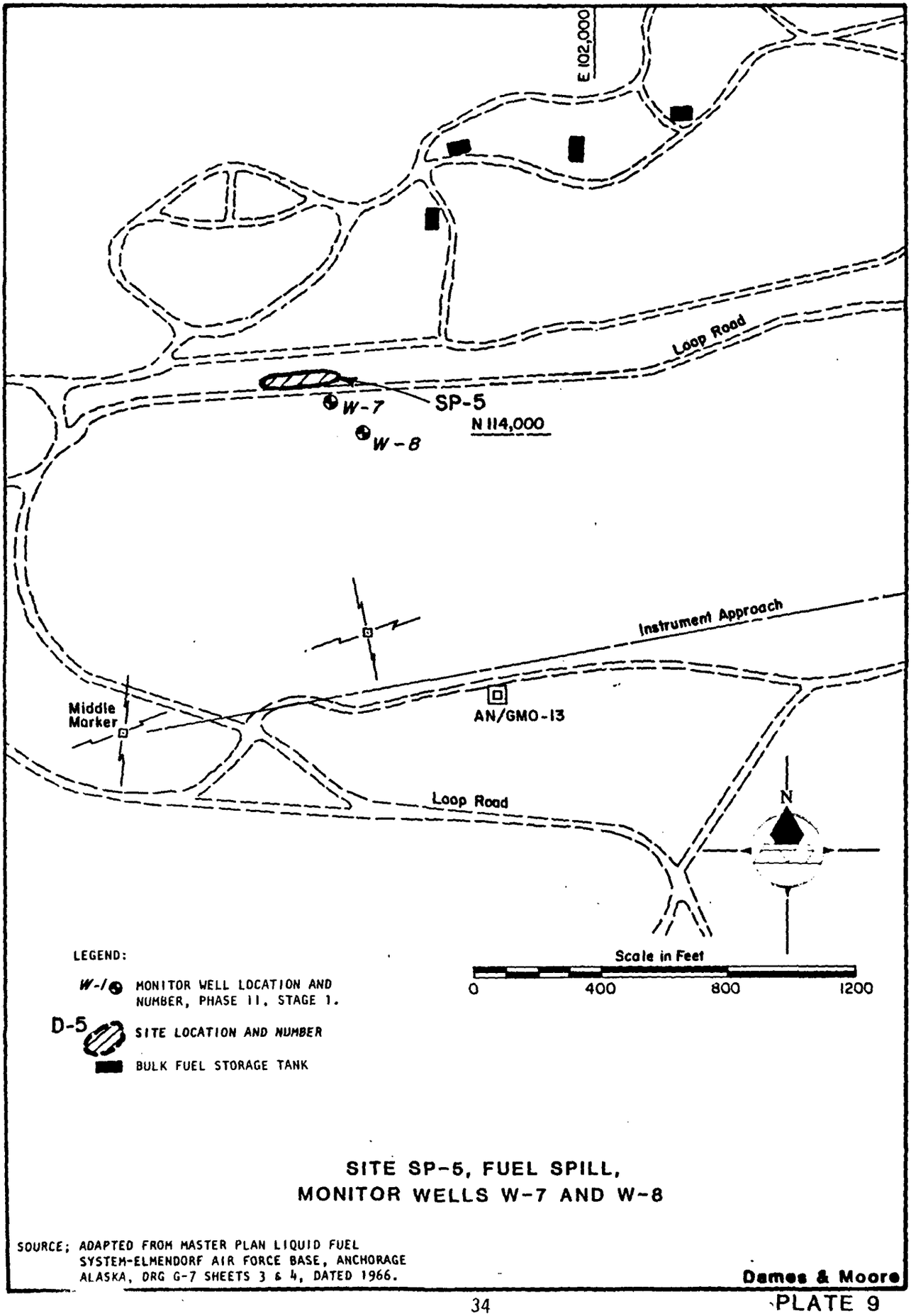
This site is the location of numerous fuel spills from the Bulk Fuel Storage Tanks Nos. 601 through 604. Two monitor wells were installed southeast of the location of a large fuel seep to depths of 26.5 feet at the locations shown on Plates 2 and 9. Well W-7 was located on the south side of Loop Road because of high explosimeter readings on the north side at the ground surface. As noted in the Phase II Presurvey Report (Dames & Moore, 1983), fuel seeps were observed and a strong fuel odor was detected on the north side of the road. This same condition was also observed as late as the Phase II, Stage 2, investigation during September 1986. The wells were installed in an open field covered with low grasses. No additional wells were installed at this site during the Phase II, Stage 2 investigation.

The subsurface materials at this site are sand with varying amounts of clayey silt and clay. Water was encountered in both wells at 5.0 feet below the ground surface on 13 June 1984, although the ground surface well W-8 is several feet lower in elevation than at well W-7. This indicates that the water table surface roughly follows the ground surface contour. That is, the ground water gradient is roughly south in the vicinity of this site.

The moisture contents of analyzed soil samples from these wells ranged from 12 to 16 percent. Explosimeter and HNU photoionization meter readings were at background levels at both well locations.

5. Site SP-12

This is the site of an approximately 1,000-gallon JP-4 underground fuel line leak. One monitor well, W-9, was completed to a depth of 42.0 feet at the site during the Phase II, Stage 1 investigation shown on Plates 2 and 10. The well is located south of the fuel line, near Fire Station



SITE SP-5, FUEL SPILL, MONITOR WELLS W-7 AND W-8

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 9

No. 1, in a field covered with low grasses. Based on analysis of available hydraulic data, a second well (GW-3A) was installed approximately 350 feet hydraulically downgradient of W-9, west of the fire station. The locations of the wells are shown on Plates 2 and 10.

Subsurface materials at this site consist of sand and gravel with minor amounts of silt. Water was encountered at a depth of 22.5 feet in well W-9 (18 June 1984) and at a depth of 25.0 feet in well GW-3A (12 September 1986). Analyzed soil samples from well W-9 contained 11 and 12 percent moisture. Explosimeter and HNU photoionization meter readings were at background levels at the borehole.

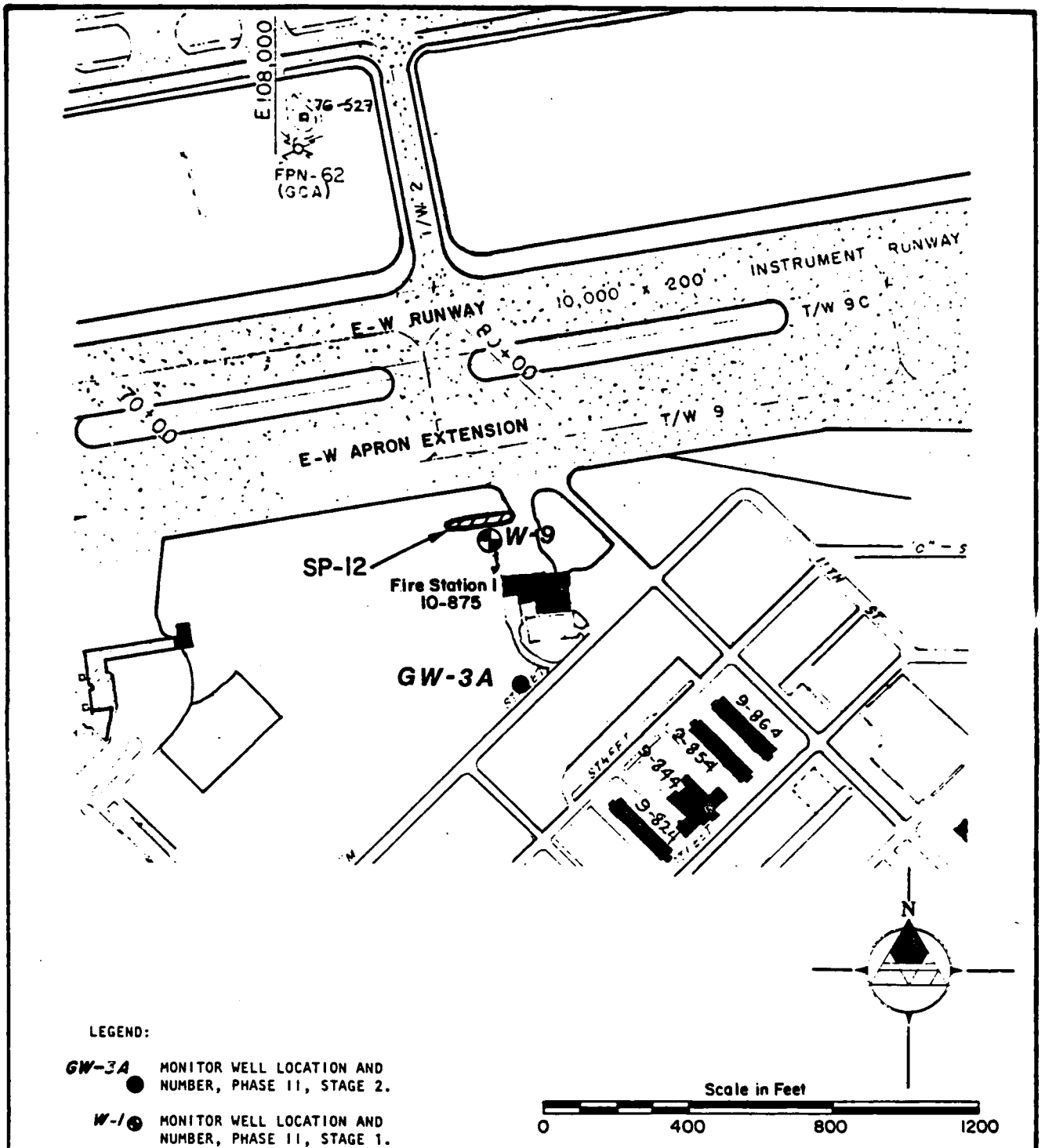
6. Site D-17

Site D-17 consists of abandoned disposal trenches used for shop wastes. Four monitor wells were installed in areas presumed to be at the margins of the disposal areas during the Phase II, Stage 1 investigation at locations shown on Plates 2 and 11. Due to regrading and revegetation of the general area, it was not possible to detect the exact locations of the former disposal areas. Wells W-10, W-11, W-12, and W-13 were completed to depths of 31.5, 31.5, 36.5, and 35.5, respectively, at the locations shown on Plate 11. No additional wells were installed at this site during the Phase II, Stage 2 investigation.

The subsurface materials at this site consist primarily of sand and gravel with varying amounts of silt; however, a relatively thick stratum of clay was encountered in wells W-10 and W-12 at 15.5 and 25.5 feet, respectively. Water was encountered at depths of 10.0 to 13.0 feet. Explosimeter and HNU photoionization meter readings were at background levels at the well locations.

7. Site SP-11

This site is the location of a JP-4 underground fuel line leak of unknown volume. One monitor well, W-14, was installed west of the pumphouse, Bldg. 23-714, on the bank of the stream to a depth of 25.5 feet during the Phase II, Stage 1 investigation. An additional well (GW-4A) was installed approximately 300 feet hydraulically downgradient, based on analysis of available hydraulic data, of well W-14 to help determine the extent of migration of contaminants. The locations of the wells are shown on Plates 2 and 12.

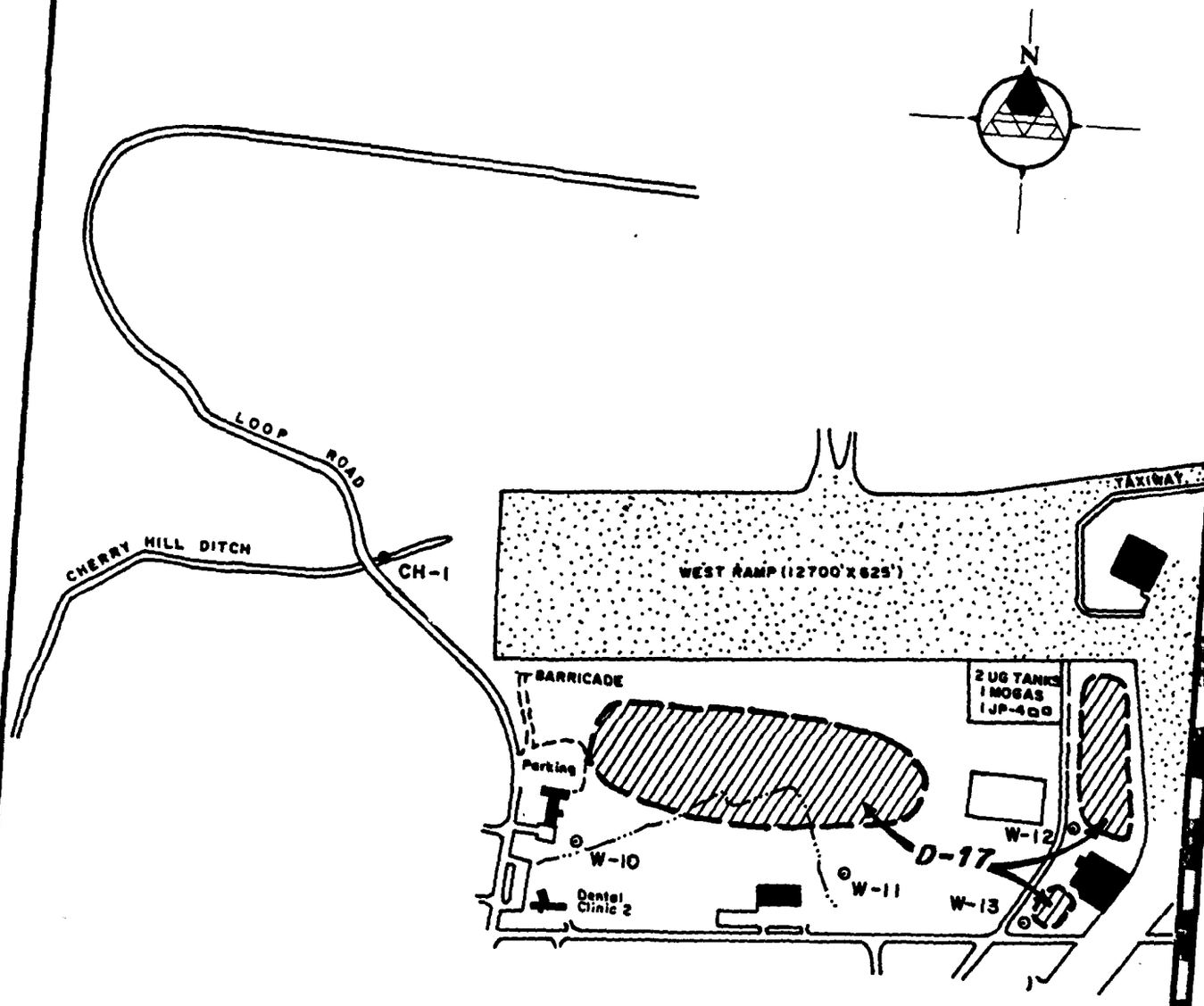


SITE SP-12, UNDERGROUND FUEL LEAK, MONITOR WELL W-9, GW-3A

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 10



LEGEND:

CH-1 ● SURFACE SAMPLE LOCATION AND NUMBER, PHASE II, STAGE 2.

W-10 ⊙ MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE I.

D-17 SITE LOCATION NUMBER

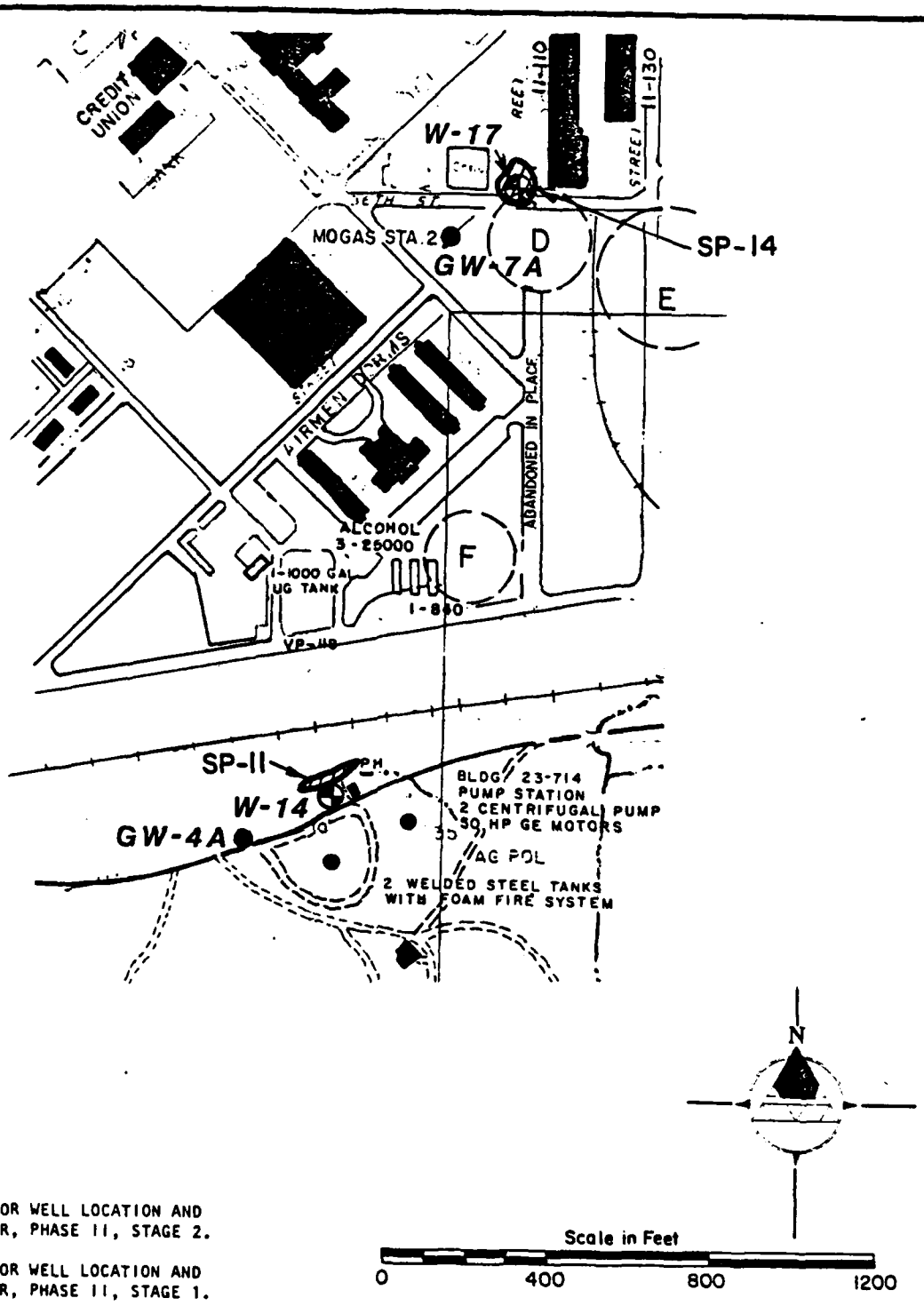
SOURCE:

ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ALASKA DRWG. G-7, SHEETS 3 & 4, DATED 1966.

SITE D-17, ABANDONED DISPOSAL AREAS FOR SHOPS MONITOR WELLS W-10, W-11, W-12, AND W-13 AND SURFACE SAMPLE CH-1

Dames & Moore

PLATE 11



LEGEND:

GW-4A ● MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 2.

W-1 ⊕ MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 1.

D-5 SITE LOCATION AND NUMBER

SITE SP-11, UNDERGROUND FUEL LINE LEAK AND SITE SP-14, GASOLINE SPILL, MONITOR WELLS W-14, W-17, GW-7A AND GW-4A

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 12

The subsurface materials are sand and gravel with small amounts of silt. Water was encountered at a depth of 5.0 feet, approximately the same elevation as the water surface in the adjacent creek in well W-14 (21 June 1984). Water was encountered at a depth of 7.5 feet in well GW-4 but rose to 2.0 feet (11 September 1986). Soil moisture content in analyzed samples from well W-14 was 15 and 21 percent. The explosimeter reading in well W-14 was 4 percent LEL during drilling and the HNU reading as 100 ppm at 5 feet. In well GW-4A, the HNU reading at 10 feet was 5 ppm and it was noted that the sample smelled like sewage. At 15 feet, it was noted that the sample smelled like fuel, an oil sheen was observed on the drill pipe, and the HNU reading was 5 ppm.

In addition, two bottom sediment grab samples were additionally taken in the wetland during the Phase II, Stage 1 investigation, approximately 1,800 feet west-southwest of the pumphouse. These samples contained 29 and 66 percent moisture.

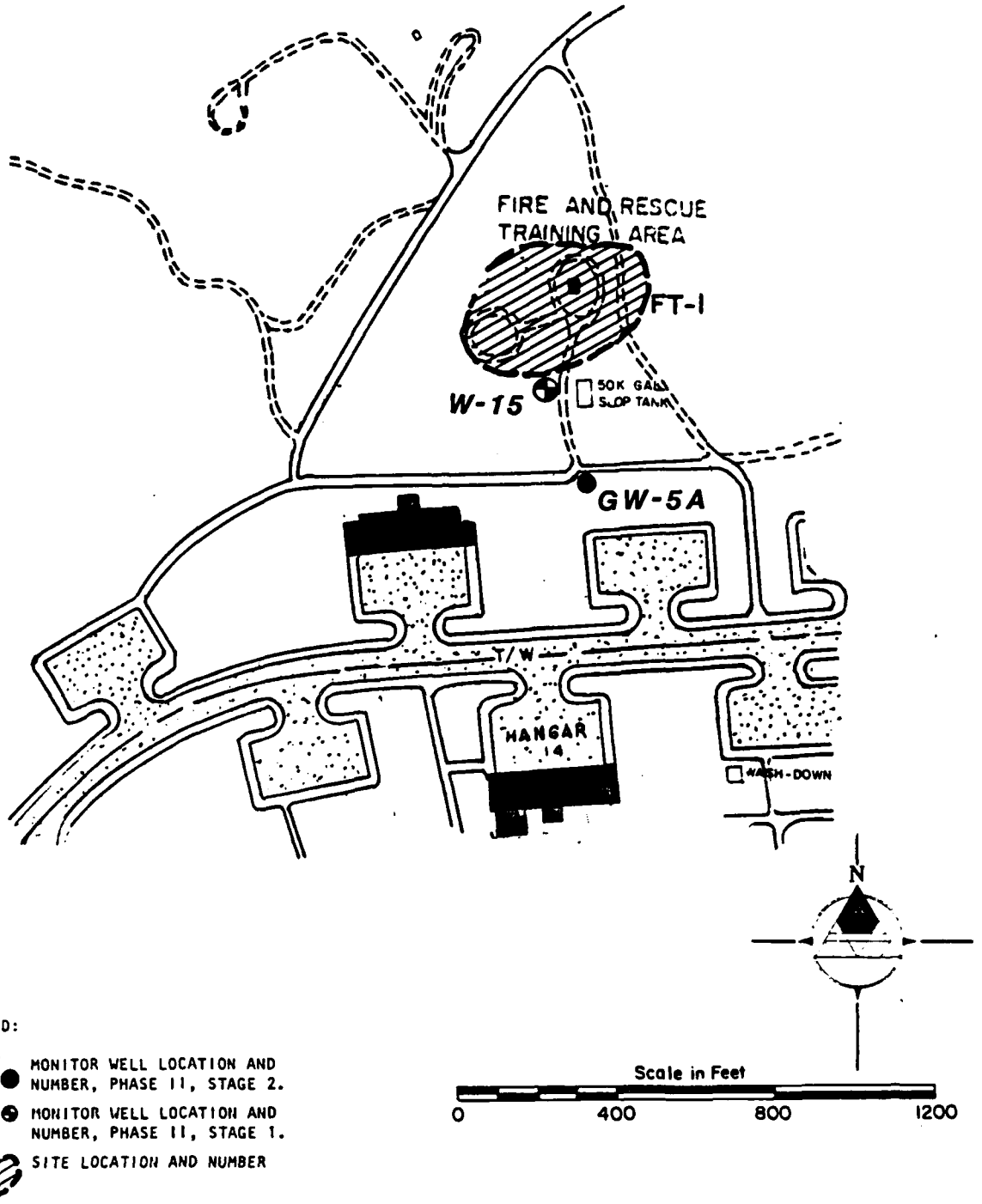
8. Site FT-1

FT-1 is the site of the fire training area where large quantities of contaminated oils and fuels and clean fuels have been spread on the ground surface and ignited to provide fire extinguishment training. One monitor well, W-15, was installed during the Phase II, Stage 1 investigation approximately 300 feet southwest of the site, in an open, gravel-covered area, to a depth of 60.5 feet. A second well, GW-5A, was installed during the Phase II, Stage 2 investigation approximately 500 feet hydraulically downgradient of the site, based on available data, to a depth of 51.5 feet. The well locations are shown on Plates 2 and 13.

The subsurface materials encountered consist primarily of sand with varying amounts of gravel and silt. Water was encountered at 42.0 feet in well W-15 (12 June 1984) and at 45.0 feet in well GW-5A (14 September 1986). Moisture contents in the analyzed soil samples from well W-15 were 12 and 14 percent. Explosimeter and HNU photoionization meter readings were at background levels at the well locations.

9. Site SP-2

This is the site of a JP-4 underground fuel line leak of unknown quantity near Bldg. 22-010. One monitor well, W-16, was installed during the Phase II, Stage 1 investigation near a culvert under Bluff Road, approximately 150 feet southwest of Bldg. 22-010, to a depth of 52.0 feet.



SITE FT-1, FIRE TRAINING AREA, MONITOR WELL W-15 AND GW-5A

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 13

An additional well, GW-6A, was installed during the Phase II, Stage 2 investigation near the top edge of the bluff south of Bldg. 22-010 to a depth of 40.0 feet. The locations of the wells are shown on Plates 2 and 14.

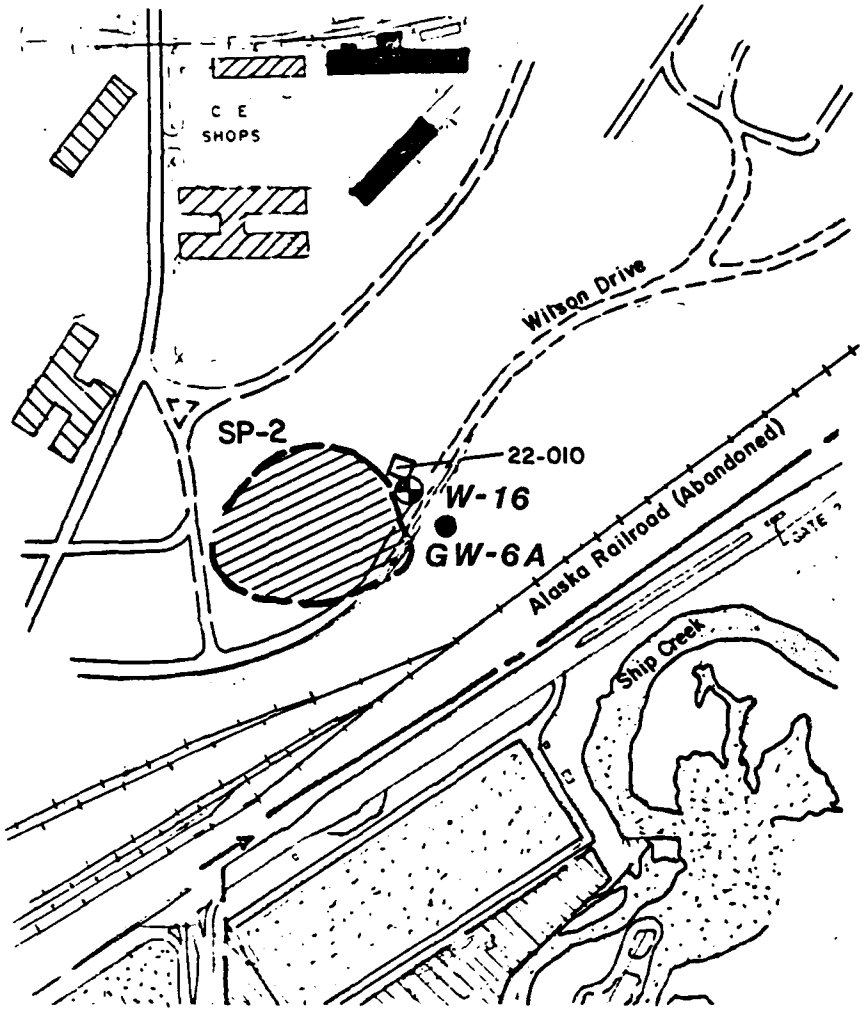
Subsurface materials encountered in well W-16 consist primarily of sand with varying amounts of gravel and silt. Water was encountered at a depth of 32.0 feet on 20 June 1984. Moisture contents in samples from well W-16 that were analyzed contained 11 and 39 percent moisture. In well GW-6A, subsurface materials consisted of approximately 20 feet of silt with lesser amounts of clay and gravel overlying sand with minor amounts of gravel. Water was encountered at a depth of 30.0 feet (13 September 1986). In well W-16, the explosimeter reading was 4 percent LEL and the HNU photoionization meter readings were 14 ppm at 35 feet and 140 ppm at 45 feet. In well GW-6A, HNU readings were nil from the surface to 25 feet, 15 ppm at 30 feet, 20 ppm at 35 feet, and 13 ppm at 40 feet. Samples below 30 feet were noted to be saturated with water and fuel and a benzene odor was detected coming from the samples.

A pond located between the base of the bluff and the Alaska Railroad tracks was noted to be covered with a multi-color sheen which could indicate the presence of petroleum products or natural organics. No odor was noted and no samples were taken. The material behaves more like a natural organic waxy film than petroleum hydrocarbon. Ship Creek lies approximately 150 yards south of the pond and railroad tracks.

10. Site SP-14

Site SP-14 is the location of a 1,500-gallon MOGAS spill at a former service station near Bldg. 11-110. One monitor well, W-17, was installed during the Phase II, Stage 1 investigation to a depth of 50.5 feet, south of the assumed location of the station. A second well, GW-7A, was installed during the Phase II, Stage 2 investigation, approximately 200 feet hydraulically downgradient of the station, based on available data. The well locations are shown on Plates 2 and 12.

The subsurface materials encountered in well W-7 consisted primarily of sand with varying amounts of gravel and silt. Water was encountered at a depth of 28.0 feet on 19 June 1984. Analyzed soil samples contained 29 and 31 percent moisture. In well GW-7A, subsurface materials consisted of approximately 8 feet of silt overlying sand with varying amounts of gravel and silt. Water was encountered at a depth of 31.0 feet (10 September 1986). In well W-17, HNU readings were 8 ppm at 5 feet and 40 ppm at 15 feet. In well GW-7A, HNU readings were nil throughout the boring.



LEGEND:

GW-6A ● MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 2.

W-16 ⊕ MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 1.

D-5 SITE LOCATION AND NUMBER

SITE SP-2, UNDERGROUND FUEL LINE LEAK, MONITOR WELLS W-16 AND GW-6A

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 14

11. Site IS-1

This is the Bldg. 42-400 (Hangar No. 10) site at which fuel loading operations have been conducted. Numerous small spills have occurred at the facility, and most of the fuel has flowed into floor drains and, hence, into dry wells at each end of the building. Two monitor wells, W-18 and W-19, were installed to depths of 47.0 and 51.5 feet, respectively, immediately adjacent to the dry wells at the locations shown on Plates 2 and 15.

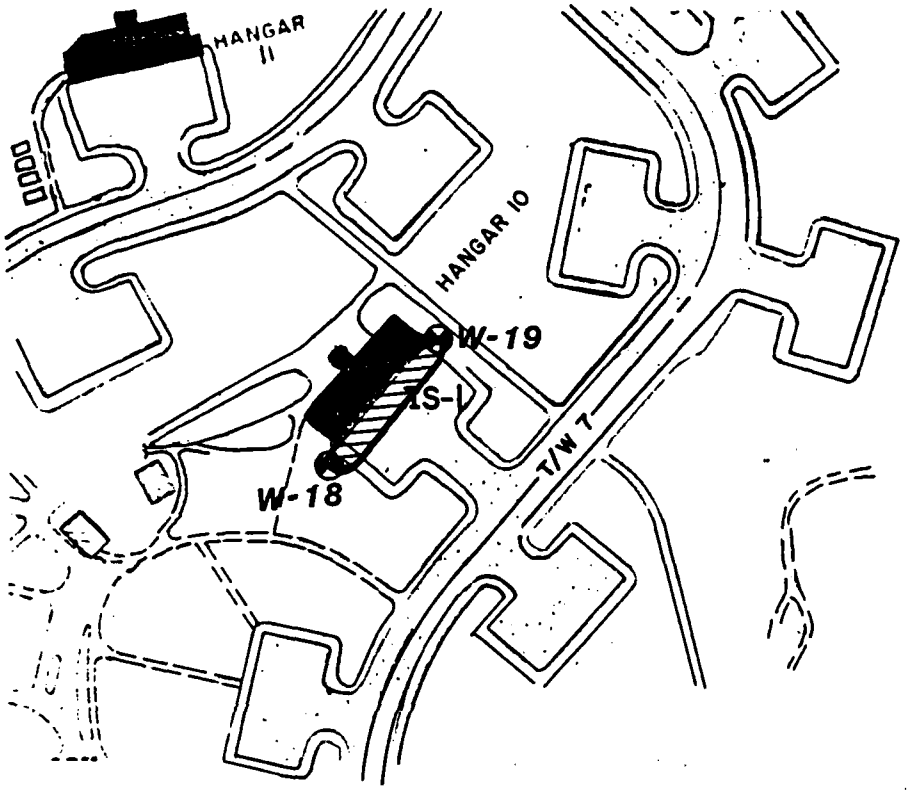
The subsurface materials at Site IS-1 consist primarily of sand with varying amounts of gravel and silt. Water was encountered at 27.5 and 30.0 feet on 23 June 1984 in wells W-18 and W-19, respectively. Moisture contents in analyzed soil samples were 27 and 29 percent. Explosimeter and HNU photoionization meter readings were at background levels at the borehole locations.

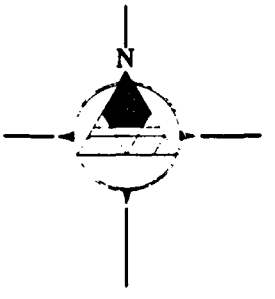
E. HISTORIC GROUND WATER PROBLEMS

1. Shallow Aquifer

Utilization of the shallow aquifer as a source of drinking water has been limited because of contamination problems. The primary threat to this coarse-grained, shallow aquifer is from septic systems serving single-family dwellings, but other incidents of contamination have been reported. An infiltration gallery located at Ship Creek within the Anchorage city limits was abandoned when it became contaminated with kerosene, and leachate contamination has been reported at the Merrill Field municipal landfill south of Elmendorf AFB (Engineering-Science, 1983).

The only studies to date that have found ground water contamination under Elmendorf AFB that probably originated from on-base activities are a study of the deicing drum storage area for a proposed hazardous waste storage facility and the Phase II, Stage 1 investigation. The priority pollutant 1,1-dichloroethane has contaminated ground water at the deicing drum storage area (Donohue, 1984). Possible contamination of 11 sites was reported in the Phase II, Stage 1 report (Dames & Moore, 1986). A study of the abandoned base landfill near Ship Creek failed to detect contamination at that site (Engineering-Science, 1983).





Scale in Feet

0 400 800 1200

LEGEND:

W-1 MONITOR WELL LOCATION AND NUMBER, PHASE II, STAGE 1.

D-5 SITE LOCATION AND NUMBER

SITE IS-1, FUEL SPILLS, MONITOR WELLS W-18 AND W-19

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 15

2. Artesian Aquifer

The water quality of the artesian aquifer is good, as discussed previously, and the possibility of contamination of this deep aquifer is generally remote. Most of the subsurface water supply facilities are extracting water from the artesian aquifer (Engineering-Science, 1983).

F. LOCATIONS OF WELLS ON AND OFF BASE

Elmendorf AFB derives its water supply from the Ship Creek reservoir on Fort Richardson and from supplementary wells on the base. Some remote facilities not connected to the central utilities system have individual wells. There are 21 active and 23 inactive or abandoned wells on the base. Five municipal wells are located near the base, of which three are inactive. No records are available of the locations of small-diameter, low-yield wells that may be near the base. The locations of the wells on and off base are shown on Plate 16. Information about these wells is listed in Table 2 (Engineering-Science, 1983).

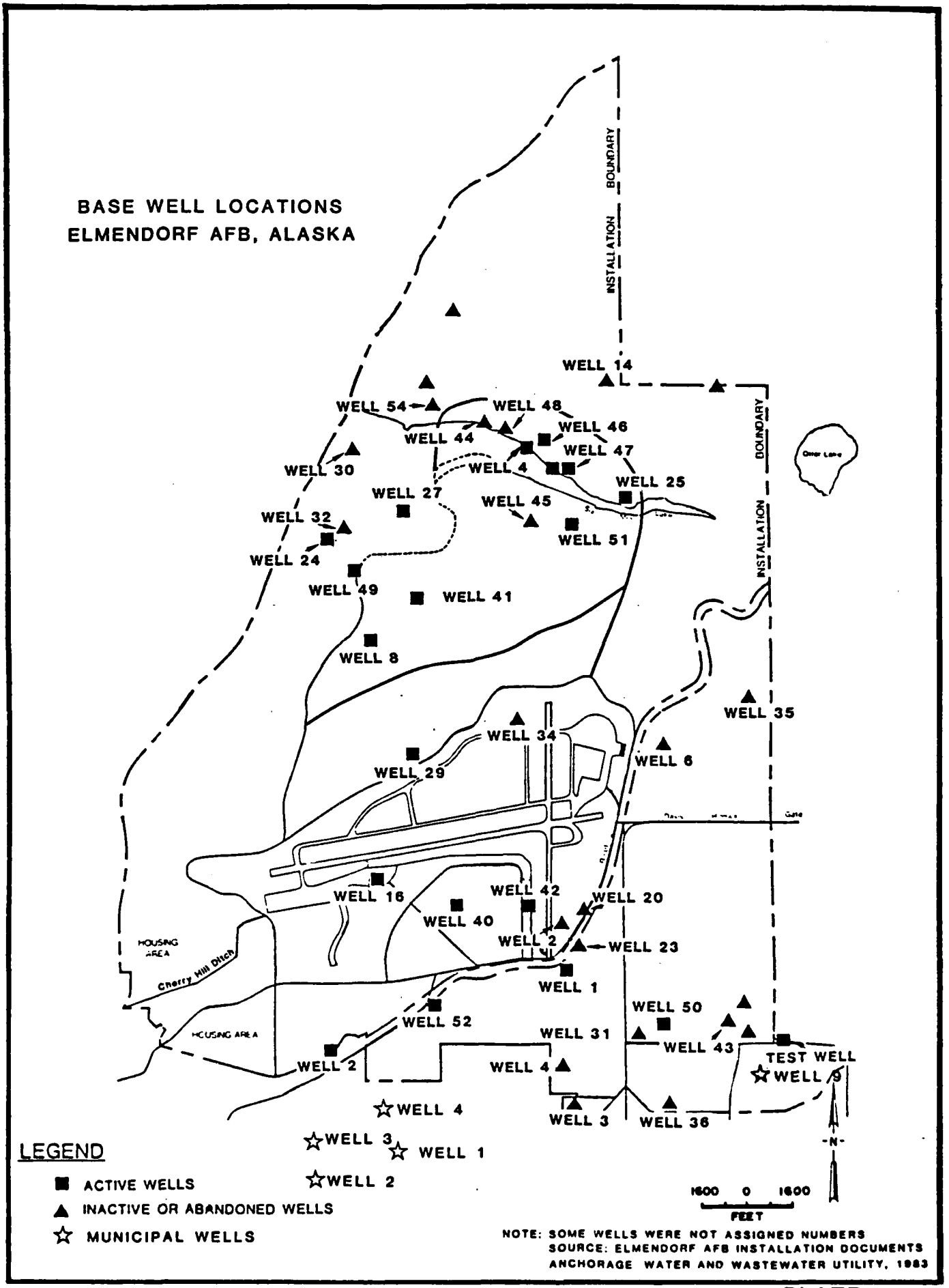

BASE WELL LOCATIONS
ELMENDORF AFB, ALASKA
INSTALLATION BOUNDARY
INSTALLATION BOUNDARY
WELL 14
WELL 54
WELL 48
WELL 46
WELL 44
WELL 47
WELL 30
WELL 4
WELL 25
WELL 27
WELL 45
WELL 32
WELL 51
WELL 24
WELL 49
WELL 41
WELL 8
WELL 35
WELL 34
WELL 6
WELL 29
WELL 16
WELL 42
WELL 20
WELL 40
WELL 2
WELL 23
HOUSING AREA
Cherry Hill Ditch
WELL 1
WELL 50
WELL 52
WELL 31
WELL 43
HOUSING AREA
WELL 2
WELL 4
TEST WELL
WELL 3
WELL 36
WELL 4
WELL 3
WELL 1
WELL 2
LEGEND
ACTIVE WELLS
INACTIVE OR ABANDONED WELLS
MUNICIPAL WELLS
-N-
1600 0 1600
FEET
NOTE: SOME WELLS WERE NOT ASSIGNED NUMBERS
SOURCE: ELMENDORF AFB INSTALLATION DOCUMENTS
ANCHORAGE WATER AND WASTEWATER UTILITY, 1983

PLATE 16

TABLE 2

WELLS AT ELMENDORF AFB

WELL	BUILDING	DEPTH (ft)	AQUIFER*	YIELD (gpm)	CONDITION	LOCATION
1	23-990	16.	S	1350	in use	South of North-South Runway
2	22-001	850.	A	840	in use	South of West Power Plant
4	65-600	78.	S	7	in use	Returnagain Six Mile Lake
8	52-140	252.	A	12	in use	EMS Office Loop Road
16	32-189	228.	A	95	in use	Standby Diesel Plant
24	52-668	38.	S	8	in use	Generals Cabin Green Lake
25	63-320	155.	A	9	in use	Underground Six Mile Lake
27	62-250	210.	A	12	in use	Receiver Site
29	42-500	406.	A	40	in use	C.A.P.
39	35-750	141.	A	115	in use	Transmitter Ft. Richardson
40	5-800	209.	A	228	in use	AAC 5-800
41	52-820	56.	S	12	in use	Hillberg Lake Ski Bowl
42	11-200	225.	A	139	in use	DAC Building
43	24-800	159.	A	54	in use	USAF Hospital
46	63-621	60.	S	10	in use	Chalet MAC Six Mile Lake
47	63-740	23.	S	16	in use	CE Shady Lane Six Mile Lake
49	52-560	130.5	A	16	in use	Green Lake Rec Area
50	BLM	-	-	-	in use	Oil Well Road
51	63-501	-	-	-	in use	6981st Rec Area Six Mile Lake
52	23-100	166.	A	36	in use	Golf Course Pro Shop
53	62-145	125.	A	8	in use	EMS Ammo Storage Six Mile Lake
23	33-358	71.	S	36	inactive	Riding Stables
32	52-725	246.	A	12	inactive	Gun Site No. 1
34	53-125	186.	A	12	inactive	Gun Site No. 10
45	63-552	40.	S	50	inactive	Ranch Six Mile Lake
48	63-612	109.5	A	30	inactive	Field Maint. Six Mile Lake
54	62-140	-	-	-	inactive	EMS Six Mile Lake
2 old	33-000	78.	S	30	inactive	Old Round House
3	23-400	153.	A	104	inactive	Artesian Village, South
6	44-544	314.	A	40	inactive	Old 625 Radar
30	62-700	142.	A	18	inactive	Fish Camp D Battery
31	24-500	158.	A	60	inactive	BLM Old C Battery
--	64-560	-	-	-	inactive	--
35	44-705	405.	A	12	inactive	Site No. 3
36	24-025	189.	A	12	inactive	Site No. 5
4 old	23-396	45.	S	35	abandoned	Artesian Village, North
14	73-400	60.	S	12	abandoned	Old AFSC Receiver Site
20	52-812	70.	S	9	abandoned	Hillberg Lake (Resident)
--	--	202.	A	12	abandoned	Site No. 6
--	--	189.	A	12	abandoned	Site No. 2
44	63-615	87.	S	20	abandoned	Six Mile Lake, 21st Trans

*A = artesian, S = shallow.
Note: Three wells on Hospital Line: 1. 1000 gpm; 2. 1000 gpm; 3. 800 gpm.
Source: Installation Documents, 1983.

III. FIELD PROGRAM

A. FIELD PROGRAM DEVELOPMENT

The field program portion of the Phase II, Stage 2, study consisted of:

1. Performing a magnetometer survey at Sites D-5 and D-7;

2. Drilling, soil sampling, installing and developing eleven monitor wells at seven sites, and measuring water levels at twelve sites on the base;

3. Performing soil gas surveys at Sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14;

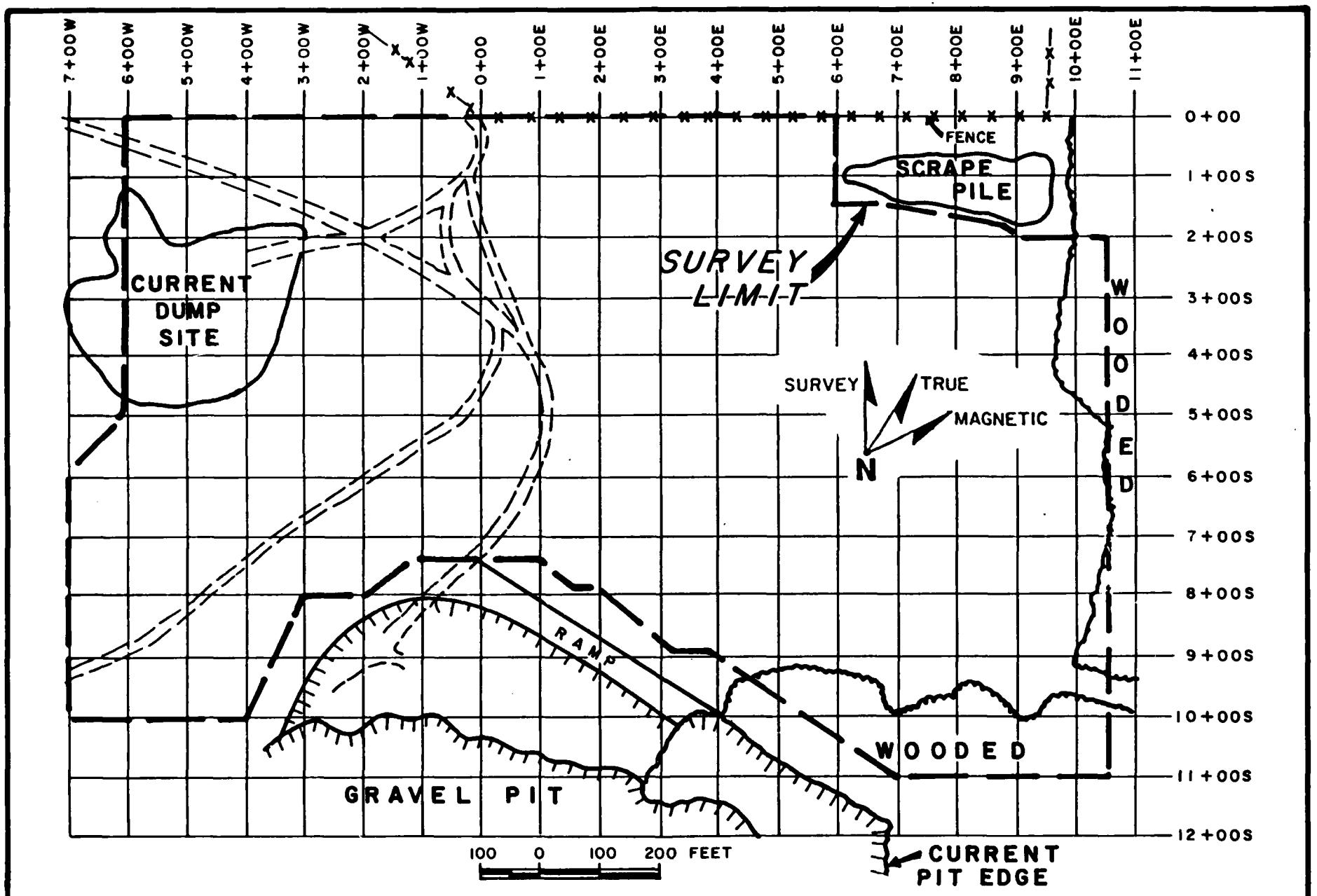
4. Preparing geologic logs for each monitor well; and

5. Collecting samples for water quality analyses from the eleven new monitor wells, the existing nineteen monitor wells installed during the Phase II, Stage 1 investigation, three locations along Ship Creek, one location on Cherry Hill Ditch, and four base water supply wells.

B. FIELD PROGRAM IMPLEMENTATION

1. Geophysical Surveys

The abandoned base landfill (Site D-5) and what is termed the base landfill (Site D-7) were surveyed using a magnetometer in order to define the landfill limits and the configuration of burial areas. Site D-5 (see Plates 2 and 17) is located immediately southward from the DPDO Storage Yard. Site D-7 (see Plates 2 and 18) lies to the east of the intersection of Davis Highway and Second Street. Although it has been referred to as the base landfill, Site D-7 is closed and covered. The current base landfill, now in use, is located between Sites D-5 and D-7. A gravel pit has been opened to the south of Site D-5 and northeast of D-7, northeast of the current landfill. A truck scale, trailer offices, storage containers, conveyors, tractor trailers and heavy equipment, all in use in conjunction with the gravel pit operations and state roadwork, were located within the survey areas for Site D-7 at the time of the field work.



AIR PHOTO SOURCE:

AIR PHOTO TECH; ANCHORAGE, ALASKA,
DATED: 9-2-84.

PLAN, NORTH GRID
SITE D-5
ELMENDORF AFB, ALASKA

Dames & Moore

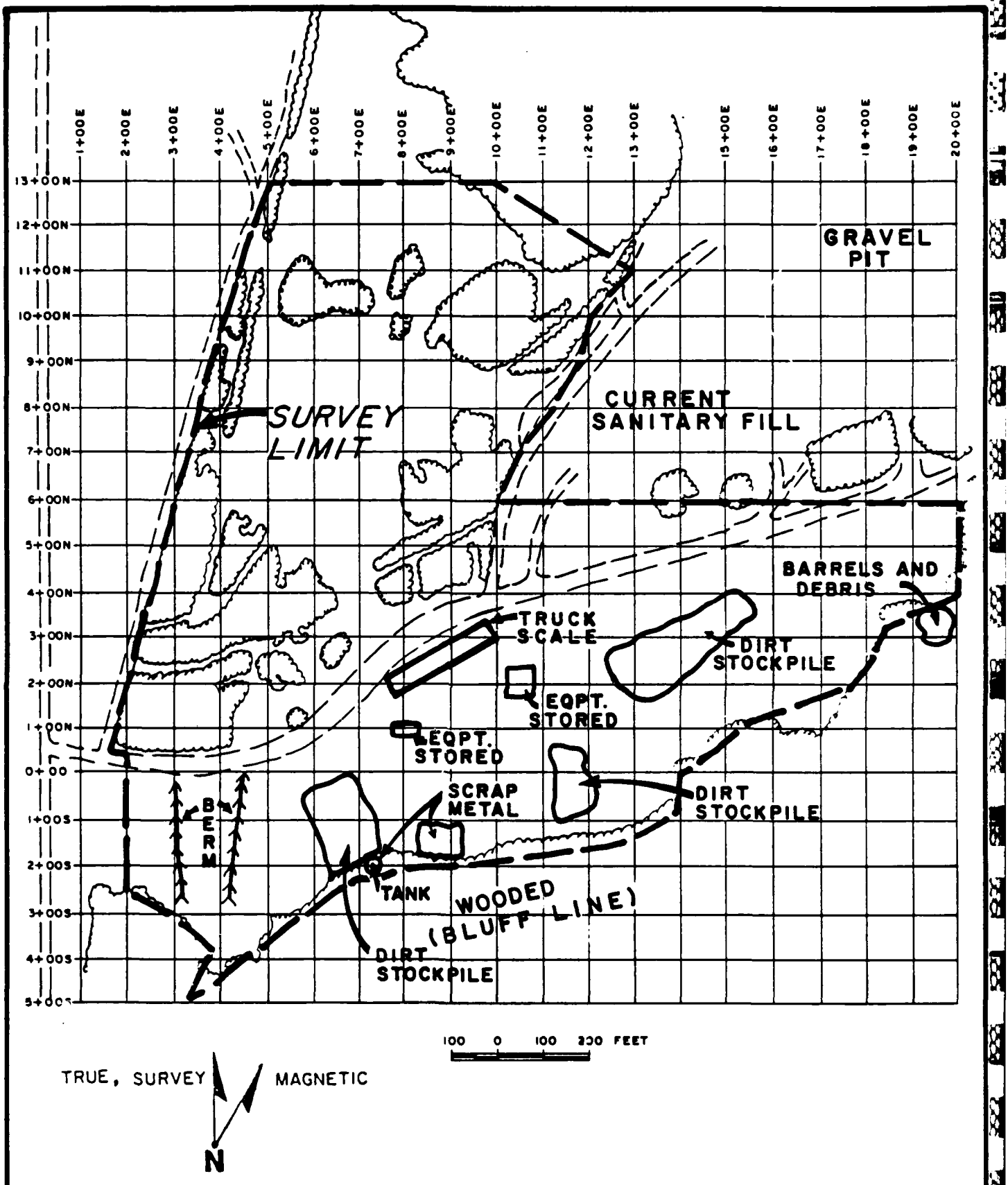
PLATE 17

Site D-5 is covered by new growth trees eastward of the DPDO Yard gate and is generally open to the west. An active dump area is located southwest of the DPDO Yard gate. Grid stations were established for the investigation of Site D-5 using the west post of the DPDO Yard gate as the 0 + 00 N, 0 + 00 E point. The grid was oriented with east-west parallel to the DPDO Yard fence (east of the gate). This orientation makes grid north approximately 45° west of true north as shown on Plate 17. The surveyed area extended from approximately 10 + 50 E to 7 + 00 W and from 0 + 00 N to 11 + 00 S. The south-central portion of the gridded area was excluded from the survey, as this area is part of the gravel pit operations. Stage 1 monitor wells W-1 (survey 0 + 10 E, 1 + 40 S) and W-2 (survey 1 + 20 E, 7 + 65 S) are located within the area of survey. The survey and grid area covering Site D-5 and adjacent areas are hereafter referred to as the North Grid.

Site D-7, as previously described, is covered and a portion is now in use as a staging area for the gravel pit and highway construction operations. In addition, there are several topsoil stockpiles located over this area. Near the entrance to the landfill area, several berms have been constructed. Grid stations for the magnetometer investigation of Site D-7 were established using a point 24 feet east of the east pavement edge of Davis Highway and 78 feet south of the centerline of Second Street (where it intersects Davis Highway) as the 0 + 00 N, 0 + 00 E point. Survey north was established parallel to Davis Highway making it coincident with true north (see Plate 18). The surveyed area was L-shaped because of the exclusion of the current landfill. The eastern limit of the survey was at approximately station 20 + 00 E; the western limit at approximately 1 + 50 E. The survey extended from the bluffline along Ship Creek, northward to station 6 + 00 N in the area of the current landfill and to station 13 + 00 N over the remainder of the area. The northwest portion of the survey is covered by grassy areas with frequent stands of trees. The survey and grid area covering site D-7 and adjacent areas are hereafter referred to as the South Grid.

Grid stationing and line-brushing through wooded areas for the North Grid was done by Kean and Associates, land surveyors. Stationing and brushing over the South Grid was done by Dames & Moore.

The magnetometer survey was conducted using an EDA OMNI-IV tie-line magnetometer. The OMNI-IV is a microprocessor-based, proton precession magnetometer consisting of a sensor, staff and control unit. In the configuration used in this survey, the sensor contains two sensing units spaced at a 1 meter vertical separation. The lower sensor was supported at a height of approximately 2.4 meters above the ground surface by a staff.



AIR PHOTO SOURCE:

AIR PHOTO TECH; ANCHORAGE, ALASKA,
DATED: 9-2-84.

PLAN, SOUTH GRID
SITE D-7
ELMENDORF AFB, ALASKA

Dames & Moore

PLATE 18

Operated in the gradiometer mode, the OMNI-IV was used to obtain simultaneous measurements of the total magnetic field intensity from the upper and lower sensors at each survey station. The difference between the lower and upper sensor was automatically calculated to yield the vertical magnetic gradient. Temporal changes in the earth's normal magnetic field were corrected using a base station and tie points. Readings were obtained at 25-foot spacings along each survey line, with lines spaced 100 feet apart. A listing of the diurnally corrected total field and vertical gradient data is presented in Appendix K. The field measurements were made during August and September 1986.

A post-plot of the points occupied for magnetometer readings over the North Grid is shown on Plates K-5 and K-12 in Appendix K. The Total Magnetic Field Intensity Map (TFI) for the North grid is shown on Plate K-1 and the Vertical Magnetic Gradient Map (VMG) on Plate K-3, Appendix K. The contour maps were generated by computer using Golden Software's "TOPO". Data gridding was done on 25-foot spacings and the Kriging algorithm was used for grid interpolation. The TFI map for the North grid is contoured on a 200 gamma interval, the VMG map on a 100 gamma interval. In order to aid in visualization of the contour map data, three-dimensional surface representations of the TFI and VMG data were constructed using Golden Software's "SURF" and are presented on Plates K-2 and K-4 in Appendix K. A similar post-plot maps and representations for the South Grid are presented on Plates K-23, K-30, K-37, K-20, and K-22.

The contour maps for the North and South Grids have been expanded in scale in order to assist in identification of magnetic anomaly patterns. The North Grid was divided into east and west halves, the South grid into three segments -- east, southwest and northeast. TFI and VMG contour maps and corresponding three-dimensional surface representations for the two segments of the North Grid and three segments of the South Grid are provided in Appendix K. The contour interval on the gradient maps is at 50 gammas.

2. Well Installation

Eleven boreholes were drilled for installation of monitor wells at seven sites. The borings were drilled using a truck-mounted rotary drill rig with 8-inch diameter hollow-stem augers operated by Tester Drilling Services, Inc., of Anchorage, Alaska. The boreholes were sampled at 5-foot intervals for stratigraphic purposes. Descriptions of the soils encountered were made in the field by the Dames & Moore geologist and recorded on field logs used to prepare the geologic logs for each boring.

No samples from these borings were retained for testing. Samples were collected using a 2.0- or 2.5-inch split spoon sampler, driven by a 340-pound drop hammer, at 5-foot intervals. The sampler was thoroughly cleaned with an Alconox detergent and distilled water solution and rinsed with methanol followed by distilled water before and after each use.

The boreholes were monitored for organic vapors and explosive gases during drilling using an HNU photoionization meter and an explosimeter. Readings were taken with both meters at the top of the borehole during drilling and immediately before sampling operations and recorded on the field borehole logs.

The casing installed for the monitor wells is a nominal 2-inch (2.375-inch O.D. by 2.067-inch I.D.) Schedule 40 PVC pipe and well screen. The screen has a 0.010-inch slot size with a 0.25-inch space between slots. There are three parallel rows of horizontal slots factory-sawed along the length of each screen. The bottom of the well is sealed with a short plug section. All pipe and screen sections were coupled with threaded joints; no PVC solvent or metal parts were used. The wells have 10 feet of screen installed so that the upper 2 feet of screen extends above the water table. Above the screen, blank casing is installed to a nominal 1 to 2 feet above the ground surface. The top of the well casing is sealed with a slip-on PVC cap. The construction details for the monitor wells are given in Table 3. The installation record for each well is provided in Appendix D.

The annular space from the bottom of the well to 2 feet above the screen was backfilled with bagged mason's or silica sand. A 2-foot bentonite plug was placed in the annulus above the sand and the remainder of the annulus was backfilled to the surface with a cement-bentonite grout mixture. A concrete cap (composed of sand and cement) was poured at the ground surface and sloped away from the well. The installation was completed by placing a 5-foot length of 6-inch diameter steel pipe with a lockable cap into the concrete pad and over the well pipe. The protective casing extends a nominal 2 to 3 feet above the ground surface. In some cases, 3-inch diameter steel guard posts were installed radially approximately 3 feet out from the well casing to provide additional protection for the well. The well covers were locked with identically keyed locks and the Base Bioenvironmental Engineers (BEEs) and Civil Engineers (CEs) were provided with keys.

All of the wells were developed using a hand-operated 1.7-inch pump rated at 2.75 gallons per minute. The pump is constructed of PVC, stainless steel, and Buna N seals. The development procedure consisted of

TABLE 3

MONITOR WELL CONSTRUCTION DETAILS AND SURVEY DATA
FOR WELLS AND BORINGS
ELMENDORF AFB
PHASE II, STAGES 1 AND 2

WELL NO.	COORDINATES EASTING	COORDINATES NORTHING	ELEV. TOP WELL COVER[a]	ELEV. TOP PVC PIPE[a]	ELEV. TOP GROUND[a]	DEPTH[b]	SCREENED INTERVAL[b] FROM	SCREENED INTERVAL[b] TO	ELEV. H20 6/84[a]	ELEV. H20 12/84[a]	ELEV. H20 9/86[a]
W-1	117171.7	113162.2	211.54	211.54	210.30	59	34	59	173.30	171.40	170.99
W-2	117534.7	112657.4	211.17	211.07	209.70	59	32	59	172.20	172.40	172.17
GW-1A	119337.4	113497.6	218.24	217.91	215.40	51	41	51	d	d	173.71
GW-1B	116082.3	111609.5	205.46	205.20	202.60	44	34	44	d	d	168.20
GW-1C	116339.2	112386.2	211.97	211.45	209.00	49.5	40	49.5	d	d	168.90
W-3	117333.5	115806.5	178.74	178.59	177.30	35	10	35	156.80	158.20	157.34
W-4	106429.9	115048.1	171.06	170.48	169.90	32	17	32	157.90	156.50	158.18
W-5	117305.6	111032.4	207.34	207.12	205.80	52	27	52	171.80	172.60	172.97
W-6	116010.4	110682.2	201.46	201.04	199.90	57	32	57	167.90	167.00	167.29
GW-2A	119235.0	112408.3	222.31	222.19	219.60	50.5	40	50.5	d	d	177.19
GW-2B	115936.9	110999.8	201.64	201.23	198.50	41.5	29	41.5	d	d	167.23
GW-2C	115359.3	110614.8	197.33	197.12	193.80	37	27	37	d	d	164.77
W-7	100848.7	114084.5	220.26	218.61	218.80	25	3	25	213.80	213.90	217.01
W-8	100971.0	114000.5	216.77	216.37	215.30	25	5	25	210.30	210.70	214.52
W-9	108580.7	113778.8	175.65	175.65	174.90	36	11	36	152.90	153.40	152.35
GW-3A	108637.2	113419.7	175.25	174.65	176.70	33	23	33	d	d	151.25
W-10	103583.0	111439.0	149.72	149.33	148.00	30	5	30	137.50	137.50	138.23
W-11	104630.8	111656.0	150.55	150.51	149.10	30	5	30	139.10	139.90	139.91
W-12	105544.3	111807.2	------e	153.81	154.30	35	10	35	141.30	139.30	141.71
W-13	105328.6	111418.5	154.14	154.09	152.40	25	10	25	139.40	139.40	138.29
W-14	111350.7	109917.1	137.72	137.63	136.30	25	3	25	131.30	------c	134.03
GW-4A	111083.0	109794.9	139.66	139.38	135.60	11	1	11	d	d	132.88
W-15	111113.9	119053.7	204.93	204.62	203.20	60	35	60	161.20	162.60	160.42
GW-5A	111158.4	118881.3	206.33	206.21	204.20	50	40	50	d	d	160.68
W-16	106870.9	107997.1	141.08	140.81	139.50	55	27	55	107.50	108.80	108.31
GW-6A	107033.1	108001.1	140.38	140.27	138.20	38	28	38	d	d	108.32
W-17	111742.7	111441.2	180.55	180.57	179.40	50	23	50	151.40	151.30	150.42
GW-7A	111606.7	111296.2	181.40	181.19	179.00	40	30	40	d	d	149.09
W-18	109444.4	116732.5	188.74	188.75	187.10	45	17	45	159.60	160.80	159.25
W-19	109706.5	116996.6	189.60	189.46	188.20	50	25	50	158.20	161.20	159.46

[a]Feet above mean sea level.
[b]Feet below ground surface.
[c]No reading obtained, well frozen.
[d]Not installed until 1986.
[e]Well covering missing.

pumping the monitor well until the water flowing from the pump outlet became clear or until it became obvious that further effort was not going to improve the clarity of the water being discharged.

3. Surface Water Sampling

Surface water samples were collected at one location in Cherry Hill Ditch, and three locations in Ship Creek.

Cherry Hill Ditch was sampled at the point of intersection between the ditch and Loop Road. Water was taken from the ditch using a laboratory-cleaned glass jar, and placed in laboratory prepared containers with appropriate preservatives. The samples were immediately stored on ice in insulated shipping containers. Temperature, conductivity, and pH were measured on water from this location.

Ship Creek was sampled approximately 300 feet east of the Davis Highway bridge crossing Ship Creek (SC-1); approximately 300 feet west of the Davis Highway bridge (SC-2); and approximately 800 feet west of the Davis Highway bridge (SC-3). The same sampling procedures were employed as described for those used at Cherry Hill Ditch. Temperature, conductivity, and pH meters were extremely difficult to transport to stations SC-1 and SC-3. These parameters were measured at SC-2.

4. Well Sampling

Prior to sample collection, each well was pumped continuously until three or more casing volumes of water had been removed. Following pumping, the wells were purged using a Teflon® bailer suspended from a monofilament nylon line dedicated to each well. Temperature, conductivity, and pH measurements of the water were made on consecutive samples from the well. The well was considered to have stabilized when three successive readings of the above parameters gave equivalent values. The forms used for the stabilization testing are included in Appendix E. Immediately following stabilization of the well, samples were collected with a bottom discharge Teflon® bailer and placed in prepared containers with appropriate preservatives. The samples were immediately stored on ice in insulated shipping containers.

At the end of each sampling day the ground water and surface water samples were shipped via counter-to-counter air courier service to the testing laboratories [UBTL in Salt Lake City, Utah, and USAF Occupational and Environmental Health Laboratory (OEHL) at Brooks AFB, Texas], where the samples were received the following day.

The pump, bailer, and the various probes and containers used during sampling and field testing were thoroughly cleaned and rinsed after each use. All field instruments were calibrated before and during use to ensure accuracy. Static water levels were measured during drilling operations and again during sampling.

Chain-of-custody forms were prepared and accompanied the samples from the field to the laboratory. These records document the integrity of the samples at each point of transfer, from field personnel to shippers to the laboratory staff. The signatures of the individuals relinquishing and accepting custody of the samples and the date and time appear on the records at each point of transfer (see Appendix G).

5. Soil Gas Survey

A cursory soil gas survey was attempted at Site SP-7 and SP-10 and at Site FT-1. A reading of 300 ppm was measured in the ditch at Site SP-7 and SP-10 when the HNU photoionization meter probe was held within fractions of an inch of the contaminated surface. No readings above background levels (approximately 1 ppm) were, however, measured at any other location in the vicinity of wells W-7 and W-8. The soil surface was disturbed in an attempt to release any gases that may have been trapped by surface vegetation. In addition, no levels were measureable inside the first culvert crossing under the road downstream of the spill site or the swampy area at the culvert outlet.

At Site FT-1, no readings above background levels were measureable at any location at the site, including at the surface of the fire training area inside the bermed area on which fuel is spread.

Based on the lack of results from these tests, the soil gas survey was abandoned.

C. SAMPLING PROCEDURES AND REFERENCED METHODS

The ground water and soil samples were analyzed in accordance with U.S. Environmental Protection Agency (USEPA) methods. Table 1 presents the detailed listing of the analytical methods employed for the analysis of ground water and soil samples. Details of the analytical procedures are provided in Appendix F. The Technical Operations Plan (TOP), Appendix L, presents a description of field sampling procedures.

D. SAMPLING REPRESENTATION RELIABILITY AND INTEGRITY

In the UBTL analytical report dated May 15, 1987, it was noted that several water sample analyses did not meet holding time requirements. Monitor wells were resampled in July, 1987 and analyzed for those parameters with elapsed holding times. The analytical results presented in Table 4, comprehend both 1986 and 1987 samples, and do meet required holding times.

1. Ground Water Sampling

The ground water quality samples are considered to be reliable by virtue of the well construction and sampling procedures followed in the field to ensure that the samples were representative, by virtue of the quality control procedures in the laboratory, and because of the monitor well locations.

2. Surface Water Sampling

The surface water quality samples are considered to be reliable because of the sampling procedures employed in the field to ensure that the samples were representative and by virtue of the quality control procedures in the laboratory.

IV. DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

This section presents a discussion of the geophysical surveys conducted at two base landfills, Sites D-5 and D-7, and the chemical analysis of ground water and surface water samples collected during field investigations at eleven sites within Elmendorf AFB (Plate 2). This section also discusses the significance of these analytical results. Site specific geology and hydrogeology is discussed in Section II and the field investigations are described in Section III.

A. DISCUSSION OF RESULTS

As listed in Table 1, water samples were analyzed for purgeable halocarbons, purgeable aromatics, TDS, petroleum hydrocarbons, lead, alkalinity, bicarbonate, carbonate, nitrate + nitrite, total phosphate, chloride ion, pesticides, and ICP (Inductively Coupled Plasma) metals screen of twenty-five metals, and field measured for pH, temperature, and conductivity.

Three base water supply wells were analyzed for purgeable halocarbons, purgeable aromatics, lead and TDS. A fourth base well, BW-16 was to be sampled for the same parameters. Because at the time of sampling electric power was not available for the pump in this well, BW-16 was not sampled. Ship Creek surface water samples were analyzed for purgeable halocarbons, purgeable aromatics, lead, TDS, and petroleum hydrocarbons. Ground water from the landfill Sites, D-5 and D-7, was analyzed for purgeable halocarbons, purgeable aromatics, TDS, pesticides and petroleum hydrocarbons. Samples of ground water from spill sites SP-7, SP-10, SP-5, SP-12, SP-11, SP-2, andSP-14 were analyzed for purgeable aromatics, TDS, and petroleum hydrocarbons. Additionally, ground water from Site SP-5 was analyzed for major cations and anions and ground water from SP-11 was analyzed for purgeable halocarbons. At Sites D-17 and IS-1 ground water was analyzed for purgeable halocarbons and one surface water sample from the Cherry Hill Ditch near Site D-17 was analyzed for the same parameter. Table 4 lists water quality analysis results above the limits of detection. Appendix I contains reduced analytical data from the Phase II, Stage 1 investigation.

1. Base Water Supply Wells

Three base water supply wells, BW-1, BW-2, and BW-52 (Plates 2 and 16) were sampled on October 15, 1986, and analyzed for purgeable halocarbons, purgeable aromatics, lead, and TDS. Base well BW-1 had detectable levels

TABLE 4

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE SP-5			SITES SP-7 and SP-10		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			W-7	W-8	Trip Blank	W-3	W-4		
Benzene	ug/L	0.25	N.D.	N.D.	N.D.	4800	N.D.	N.E.	N.E.
Ethyl Benzene	ug/L	0.75	N.D.	N.D.	N.D.	620	N.D.	N.E.	N.E.
Toluene	ug/L	0.64	N.D.	N.D.	N.D.	8200	N.D.	N.E.	N.E.
m-Xylene	ug/L	0.45	N.D.	N.D.	N.D.	3000	N.D.	N.E.	N.E.
o-Xylene	ug/L	0.78	N.D.	N.D.	N.D.	2600	N.D.	N.E.	N.E.
TDS	mg/L	10.0	460[a]	390[a]	11.	470[a]	500[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.D.	N.D.	N.D.	51.[a]	1.9[a]	N.E.	N.E.
pH	S.U.	0.1	7.0	6.8	N.A.	6.7	6.4	N.E.	6.5-8.5
Temperature	°C	0.1	7.0	8.1	N.A.	5.5	7.5	N.E.	N.E.
Specific Conductivity	umhos/cm	10	930	575	N.A.	669	421	N.E.	N.E.
Alkalinity (as $CaCO_3$)	mg/L	10.0	350	290	N.D.	N.A.	N.A	N.E.	N.E.
Bicarbonate (as $CaCO_3$)	mg/L	10.0	350	290	N.D.	N.A.	N.A.	N.E.	N.E.
Nitrate + Nitrite (as N)	mg/L	0.02	4.9	1.1	0.05	N.A.	N.A.	10	N.E.
Total Phosphate	mg/L	1.0	1.	2.	N.D.	N.A.	N.A.	N.E.	N.E.
Chloride Ion	mg/L	0.1	120	47	N.D.	N.A.	N.A.	N.E.	250
Sulfate Ion	mg/L	0.1	20	10	N.D.	N.A.	N.A.	N.E.	250
Fluoride Ion	mg/L	0.05	0.1	0.2	N.D.	N.A.	N.A.	1.4-2.4	N.E.
Bromide Ion	mg/L	0.1	0.7	0.3	N.D.	N.A.	N.A.	N.E.	N.E.
Boron	ug/L	5.0	N.D.	N.D.	66.	N.A.	N.A.	N.E.	N.E.
Barium	ug/L	2.0	120	56.	N.D.	N.A.	N.A.	1000	N.E.
Calcium	ug/L	10.0	120000	80000	14.	N.A.	N.A.	N.E.	N.E.
Chromium	ug/L	7.0	13.	11.	10.	N.A.	N.A.	50	N.E.
Magnesium	ug/L	30.0	38000	22000	N.D.	N.A.	N.A.	N.E.	N.E.
Manganese	ug/L	2.0	210	5.	N.D.	N.A.	N.A.	N.E.	50
Molybdenum	ug/L	8.0	48.	N.D.	N.D.	N.A.	N.A.	N.E.	N.E.
Nickel	ug/L	15.0	N.D.	20.	N.D.	N.A.	N.A.	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

TABLE 4

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE D-5						SITE D-7					PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			GW-1A	GW-1B	GW-1B (FAC)[a]	GW-1C	W-1	W-2	GW-2A	GW-2B	GW-2C	W-5	W-6		
1,1-Dichloroethane	ug/L	0.49	N.D.	4.7	NA	N.D.	N.D.	N.D.	N.D.	1.5	3.5	N.D.	N.D.	N.E.	N.E.
trans-1,2-Dichloroethene	ug/L	0.42	N.D.	N.D.	NA	1.1	3.2	1.3	N.D.	6.9	3.1	N.D.	N.D.	N.E.	N.E.
Methylene Chloride	ug/L	0.34	N.D.	2.6	NA	0.72	N.D.	0.57	0.80	3.0	3.1	1.8	0.63	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	N.D.	0.49	NA	0.58	N.D.	0.48	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
1,1,1-Trichloroethane	ug/L	0.53	N.D.	32.0	NA	N.D.	N.D.	N.D.	N.D.	N.D.	N.D	N.D.	N.D.	N.E.	N.E.
Trichloroethene (TCE)	ug/L	0.60	N.D.	2.7	NA	N.D.	N.D.	N.D.	N.D.	2.3	0.66	N.D.	N.D.	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.441	N.D.	0.60	NA	0.51	N.D.	N.D.	N.D.	1.3	1.2	0.99	0.56	N.E.	N.E.
TDS	mg/L	10.0	180[a]	130[a]	NA	140[a]	130[a]	81.0	140[a]	190[a]	210[a]	130[a]	90[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	1.0[a]	N.D.	0.5	N.D.[a]	0.2[a]	N.D.	N.D.[a]	N.D.[a]	N.D.[a]	3.9[a]	0.7[a]	N.E.	N.E.
pH	S.U.	0.1	6.1	6.4	NA	5.9	6.7	6.9.	6.7	6.1	5.8	5.7	6.5	N.E.	6.5-8.5
Temperature	°C	0.1	5.0	5.0	NA	5.0	6.0	4.8	3.5	5.0	5.4	4.8	5.0	N.E.	N.E.
Specific Conductivity	umhos/cm	10	138	390	NA	62	206	147	127	364	384	125	134	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987

TABLE 4

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	BASE WELLS				SHIP CREEK			PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			BW-1	BW-2	BW-52	Trip Blank	SC-1	SC-2	SC-3		
Chloroform	ug/L	0.45	N.D.	N.D.	1.2	N.D.	N.D.	N.D.	N.D.	100 (Tot. THM)	N.E.
Methylene Chloride	ug/L	0.34	3.7	N.D.	N.D.	32.	N.D.	N.D.	N.D.	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	0.77	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
1,1,1-Trichloroethane	ug/L	0.53	0.63	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E	N.E.
Trichloroethene (TCE)	ug/L	0.60	1.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.44	0.83	N.D.	N.D.	0.94	0.54	N.D.	N.D.	N.E.	N.E.
TDS	mg/L	10	130[a]	110[a]	140[a]	N.A.	60.[a]	60.[a]	60.[a]	N.E.	500
Lead	mg/L	0.005	N.D.	N.D.	N.D.	N.A.	0.009	0.010	0.005	0.05	N.E.
Calcium	ug/L	10	N.A.	N.A.	N.A.	34.	N.A.	N.A	N.A.	N.E.	N.E.
Cadmium	ug/L	4.0	N.A.	N.A.	N.A.	6.	N.A.	N.A.	N.A.	10	N.E.
Chromium	ug/L	7.0	N.A.	N.A.	N.A.	18.	N.A.	N.A.	N.A.	50	N.E.
Nickel	ug/L	15.0	N.A.	N.A.	N.A.	16.	N.A.	N.A.	N.A.	N.E.	N.E.
pH	S.U.	0.1	6.3	6.4	7.5	N.A.	N.A.	5.2	N.A.	N.E.	6.5-8.5
Temperature	°C	0.1	5.8	6.2	10.0	N.A.	N.A.	8.3	N.A.	N.E.	N.E.
Specific Conductivity	umhos/cm	10	177	147	236	N.A.	N.A.	101	N.A.	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

TABLE 4

ANALYTICAL RESULTS ABOVE DETECTION LIMITS
WATER SAMPLES
ELMENDORF AFB
IRP PHASE II STAGE 2

PARAMETER	UNIT	DETECTION LIMIT	SITE FT-1		SITE SP-2			SITE SP-12		SITE SP-14		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			GW-5A	W-15	W-16	GW-6A	GW-6A(FQC)[a]	GW-3A	W-9	GW-7A	W-17		
TDS	mg/L	10.0	460[a]	290[a]	320[a]	320[a]	NA	400[a]	420[a]	330[a]	270[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.D.	N.D.	0.8[a]	61.	120[a]	0.1[a]	N.D.[a]	N.D.[a]	N.D.[a]	N.E.	N.E.
pH	S.U.	0.1	6.1	6.0	7.2	6.9	NA	7.5	7.2	7.2	7.1	N.E.	6.5-8.5
Temperature	°C	0.1	5.5	5.0	7.0	7.0	NA	7.0	5.1	5.9	6.0	N.E.	N.E.
Specific Conductivity	umhos/cm	10	614	361	442	457	NA	537	627	377	345	N.E.	N.E.

PARAMETER	UNIT	DETECTION LIMIT	SITE D-17					SITE IS-1			SITE SP-11		PRIMARY DRINKING WATER STANDARD	SECONDARY DRINKING WATER STANDARD
			W-10	W-11	W-12	W-13	CH-1	W-18	W-19	W-18 (FQC)[a]	W-14	GW-4A		
Dibromochloromethane	ug/L	0.31	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.6 (Tot. THM)	100	N.E.
1,1-Dichloroethane	ug/L	0.49	N.D.	N.D.	N.D.	N.D.	N.D.	1.4[a]	6.1[a]	1.3	N.D.	N.D.	N.E.	N.E.
1,2-Dichloroethane	ug/L	0.44	N.D.	N.D.	N.D.	1.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.E.	N.E.
trans-1,2-Dichloroethene	ug/L	0.42	N.D.	16.	30.	15.	N.D.	N.D.	N.D.	N.D.	N.D.	2.4.	N.E.	N.E.
Methylene Chloride	ug/L	0.34	19.	3.7	6.3	N.D.	N.D.	N.D.	N.D.[a]	N.D.	N.D.	N.D.	N.E.	N.E.
Tetrachloroethene	ug/L	0.38	N.D.	N.D.	1.6	N.D.	N.D.	N.D.	N.D.	N.D.	0.53	0.46	N.E.	N.E.
1,1,1-Trichloroethane	ug/L	0.53	N.D.	N.D.	N.D.	N.D.	N.D	N.D.	2.4[a]	N.D.	N.D.	N.D.	N.E.	N.E.
Trichloroethene (TCE)	ug/L	0.60	N.D.	47.	26.	5.2	N.D.	N.D.	N.D.	N.D.	N.D.	3.0	N.E.	N.E.
Trichlorofluoromethane	ug/L	0.44	N.D.	0.62	N.D.	0.68	N.D.	N.D.	N.D.[a]	N.D.	N.D.	0.49	N.E.	N.E.
TDS	mg/L	10.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	220[a]	220[a]	N.E.	500
Petroleum Hydrocarbons	mg/L	0.2	N.A.	N.A.	N.A.	N.A.	N.A	N.A.	N.A.	N.A.	N.D.[a]	19.[a]	N.E.	N.E.
pH	S.U.	0.1	7.3	6.2	5.5	7.1	5.1	6.8	6.6	N.A.	7.5	7.5	N.E.	6.5-8.5
Temperature	°C	0.1	5.0	5.0	7.8	7.1	7.3	7.0	4.8	N.A.	5.0	6.8	N.E.	N.E.
Specific Conductivity	umhos/cm	10	388	571	626	620	496	739	640	N.A.	295	330	N.E.	N.E.

N.A. = Not analyzed for this parameter.
N.D. = None detected.
N.E. = No criterion established.
[a] = Monitor wells resampled July, 1987.

of several purgeable halocarbons. Methylene chloride at 3.7 ug/L, tetrachlorethene at 0.77 ug/L, 1,1,1-trichloroethane at 0.63 ug/L, trichloroethene at 1.2 mg/L, and trichlorofluoromethane at 0.83 ug/L were detected in water from this well. The pH was slightly lower, at 6.3, than the Secondary Drinking Water Standard (SDWS). The TDS in this sample was 130 mg/L. Lead and purgeable aromatics were not detected. Base well BW-2 had a TDS level of 110 mg/L and a pH of 6.4, slightly below the SDWS. No other parameters were detected. In base well BW-52, chloroform was found at a level of 1.2 ug/L and TDS at 140 mg/L. The water sample from BW-52 had been chlorinated prior to sampling. No other analytes were detected. The trip blank which accompanied the base well samples was found to contain 32 ug/L of methylene chloride and 0.94 ug/L of trichlorofluroromethane.

2. Ship Creek Surface Water Samples

Surface water samples from Ship Creek (see Plates 2 and 7) were obtained at stations SC-1, located due south of landfill D-7 and approximately 300 feet east of the Davis Highway bridge crossing Ship Creek, at SC-2 approximately 600 feet downstream of SC-1 and southeast of well GW-2C and at SC-3, 1,100 feet downstream of SC-1 and south of base well BW-1. The TDS values for these samples were 60. mg/L each for SC-1, SC-2, and SC-3. The pH measured at station SC-2 was 5.2, below the SDWS. Trichlorofluoromethane was detected only in SC-1 at a level of 0.54 ug/L, however the trip blank which accompanied this sample contained 0.94 ug/L of this compound. No other purgeable halocarbons or purgeable aromatics or petroleum halocarbons were detected in these samples. Lead was reported at 0.009 mg/L in SC-1, 0.010 mg/L in SC-2, and 0.005 in SC-3.

3. Geophysical Surveys; Sites D-5 and D-7

Landfill waste generally contains a significant volume of ferrous material. The ferrous material in the waste results in the production of anomalies to the earth's normal magnetic field. Generally, a higher than normal total field intensity (TFI) is found over the landfill waste. Associated with the high, a low is generally found nearby. Similarly, strong positive vertical gradients are expected in areas of these magnetic highs and negative gradients in areas of the lows. Frequently, the vertical gradient pattern provides better resolution in evaluating anomalies. As can be noted on the TFI and vertical magnetic gradient (VMG) maps of both grids, significant anomalies are present.

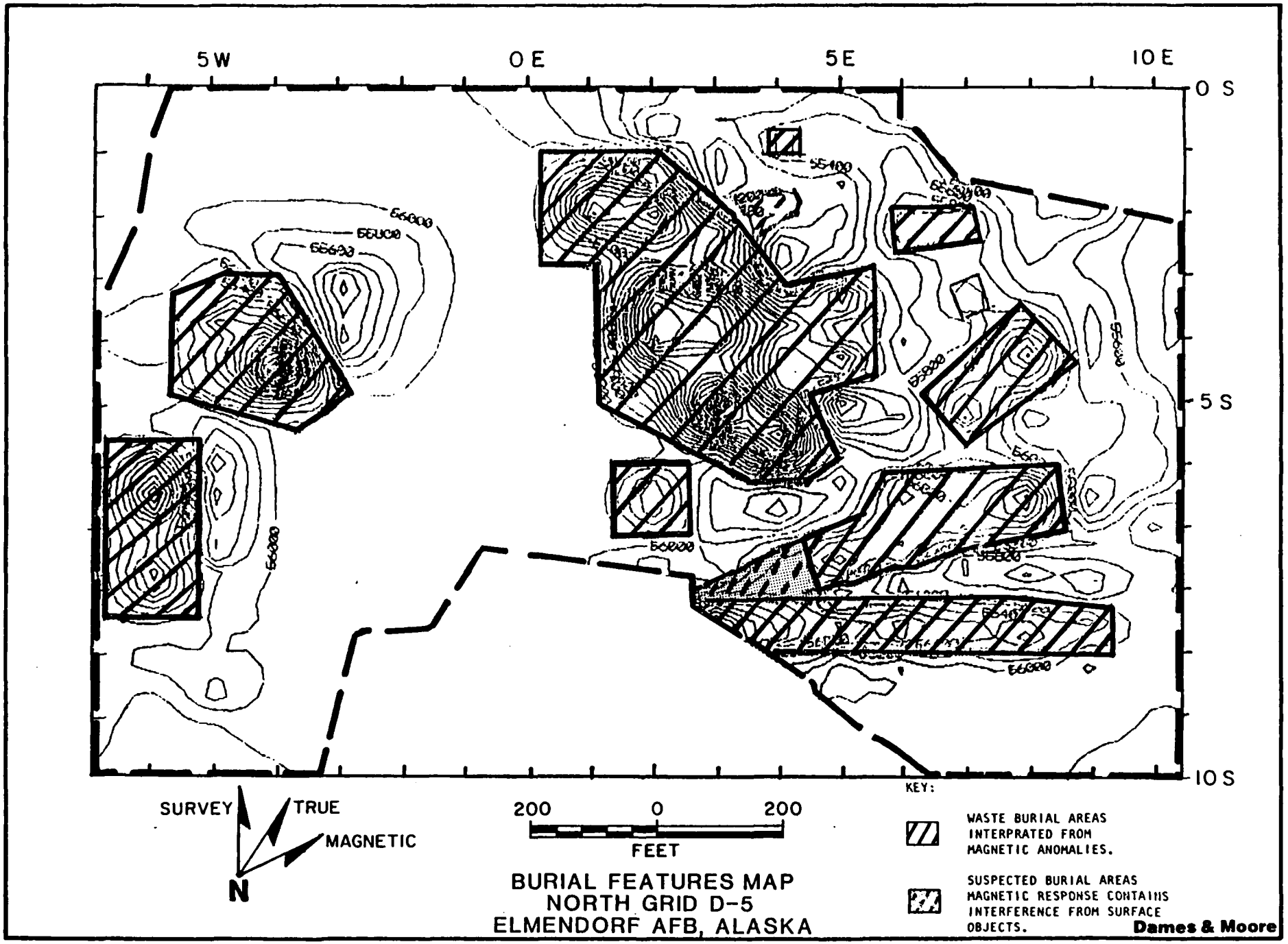

5W
0 E
5E
10 E
0 S
5 S
10 S
SURVEY
TRUE
MAGNETIC
N
200
0
200
FEET
KEY:
WASTE BURIAL AREAS INTERPRATED FROM MAGNETIC ANOMALIES.
SUSPECTED BURIAL AREAS MAGNETIC RESPONSE CONTAINS INTERFERENCE FROM SURFACE OBJECTS.
BURIAL FEATURES MAP
NORTH GRID D-5
ELMENDORF AFB, ALASKA
Dames & Moore

PLATE 19

The VMG maps for each section of the north and south grids contain numerous positive and negative anomalies. As the positive anomalies are generally a good indicator of buried waste, maps have been prepared and are presented in Appendix K, where the positive and negative gradients have been separated.

Following is a discussion of the interpretation of the magnetometer survey conducted over each grid.

a. North Grid

Three strong anomalies sets characterize the North Grid: the largest anomaly set occurs between 0 + 00 E and 5 + 00 E, from 1 + 00 S to 6 + 00 S; a second at approximately 4 + 00 W, 4 + 00 S; the third at 6 + 00 W, from 6 + 00 S to 8 + 00 S. Additional, moderately strong anomalies are found at 2 + 00 E, 6 + 50 S and 7 + 00 E, 5 + 00 S. Two linear patterns of anomalies are found in the southeast quadrant of the North grid, these being oriented generally east-west (survey). Additional lesser strength anomalies are also noted in the eastern half of the grid.

Little surficial evidence of waste was noted during the survey. The area indicated at 4 + 00 N, 4 + 00 S is an active dump area containing primarily bedsprings and mattresses and corrugated culvert. The linear features in the southeast quadrant intersect the gravel pit haul ramp and waste was observed in the cut wall on the north side of the ramp. The southernmost linear feature is coincident with a ridge-like topographic high observed in the field.

No indication is found of the presence of burial sites within areas where more mature tree stands exist. The burial site shown in the southwest quadrant, although surrounded by more mature trees, is itself covered by a younger stand. The west-central portion of the North grid is found to not show any evidence of burial.

Plate 19 illustrates the locations which are interpreted to contain buried waste within the North grid.

b. South Grid

The magnetic anomaly pattern for the South grid is more complex than that of the North grid, the result of all of the facilities and equipment occurring there in conjunction with the gravel pit operation. Table 5 itemizes some of the more significant objects which may alter the anomaly pattern of the landfill.

TABLE 5

OBJECT IDENTIFICATION FOR ANOMALIES DETECTED IN SOUTH GRID

NORTH COORDINATE	EAST COORDINATE	OBJECT
2 + 00 N	10 + 25 E to 10 + 50 E	Conveyors
1 + 00 N	7 + 25 E to 7 + 75 E	Conveyors
2 + 00 N Trailers	8 + 00 E to 9 + 00 E	Truck Scale &
1 + 00 S	8 + 00 E	Storage Container
2 + 50 N to 1 + 00 S	7 + 00 E to 10 + 00 E	Scattered rebar mesh, pipe, frames, wire rope cable, etc.

A sequence of anomalies indicative of burial is found along the southern limit of the survey area. The strongest anomaly is at 17 + 00 E, 2 + 00 N. Other anomalies are found at 14 + 50 E, 1 + 00 N; 13 + 00 E, 0 + 00 N; from 10 + 00 E to 12 + 00 E, 1 + 00 S; 7 + 00 E, 2 + 00 S and; 5 + 00 E, 3 + 00 S. Two very strong anomalies are found in the northwest section of the South grid. Other more moderate strength anomalies are found interspersed throughout the south-central portion of the South grid.

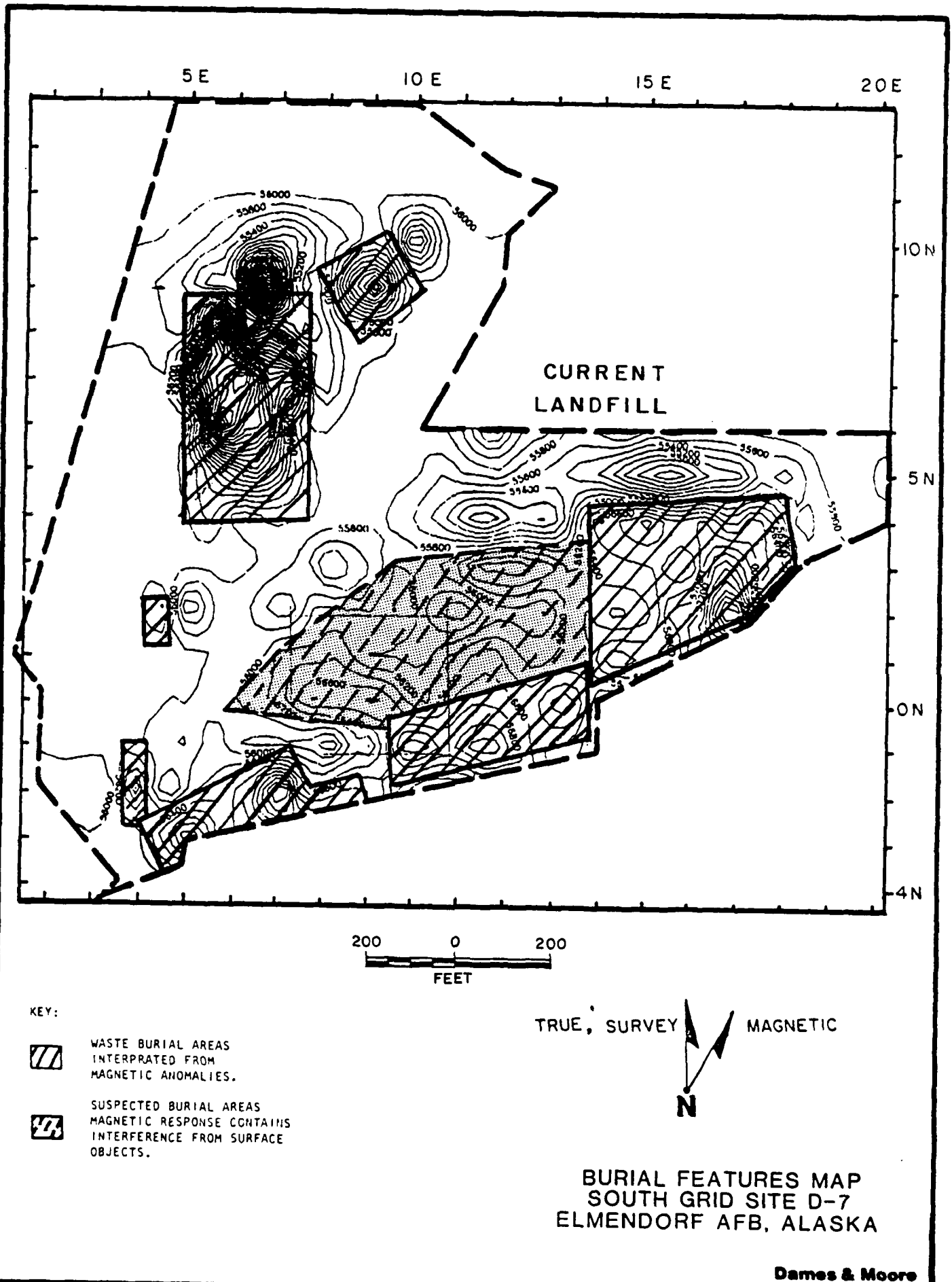
Surficial evidence of waste was observed during the survey at several locations. Though not within the survey area, discarded barrels were noted in the flood plain of Ship Creek to the south of location 19 + 50 E, 4 + 00 N. A large steel tank or boiler vessel was seen near station 7 + 25 E, 2 +00 S. Discarded fencing, metal signs, and light poles were observed between 8 + 20 E and 9 + 20 E from 1 + 00 S to 2 + 00 S. Building and/or paving material were seen in the area of both burial areas marked in the northwest section of the South grid. The strength of the anomaly of the larger of these two areas suggests burial of a significant amount of steel. The burial area shown at 4 + 00 E, from 1 + 00 S to 2 + 50 S is coincident with one of the berms near the landfill entrance. Several discarded barrels were observed in the stand of trees immediately northeast of the landfill entrance.

Although they are enclosed by the boundaries indicated for burial or suspected burial, two areas in the south grid may not actually have been used for burial. These are: from 10 + 00 E to 12 + 50 E near 2 + 00 N and; in the area of 14 +50 E, 2 + 00 N.

Plate 20 illustrates the locations which are interpreted to contain buried waste within the South Grid. The dashed area is believed to be part of the former landfill, but the anomaly patterns show possible interference from surface objects.

4. Site D-5

During the Phase II, Stage 1 sampling, monitor wells W-1 and W-2 were found to have low levels of TOX (53 ug/L and 34 ug/L, respectively), and low levels of oil and grease (4.0 mg/L and 4.6 mg/L, respectively). During the Phase II, Stage 2 analyses, the upgradient well GW-1A was found to have 180 mg/L TDS and 1.0 mg/L of petroleum hydrocarbons. No detectable concentrations of purgeable halocarbons, purgeable aromatics, or pesticides were found in this well. The pH concentration in this well was 6.1,



BURIAL FEATURES MAP
SOUTH GRID SITE D-7
ELMENDORF AFB, ALASKA

Dames & Moore

PLATE 20

slightly exceeding the SDWS. The downgradient wells were found to contain detectable levels of purgeable halocarbons. W-1 had a level of 3.2 ug/L of trans-1,2-dichloroethene, 0.2 mg/L of petroleum hydrocarbons, and a TDS of 130 mg/L. In W-2, trans-1,2-dichloroethene was detected at 1.3 ug/L, methylene chloride was at 0.57 ug/L, tetrachloroethene was at 0.48 ug/L, and TDS at 81.0 mg/L. In well GW-1B, the following analytes and concentrations were detected: 1,1-dichloroethane, 4.7 ug/L; methylene chloride, 2.6 ug/L; tetrachloroethene, 0.49 ug/L; 1,1,1-trichloroethane, 32.0 ug/L; trichloroethene, 2.7 ug/L; trichlorofluoromethane, 0.60 ug/L; and TDS at 130 mg/L. The pH, 6.4 was slightly lower than the SDWS. In well GW-1C, the parameters detected and concentrations were: trans-1,2-dichloroethene, 1.1 ug/L; methylene chloride, 0.72 ug/L; tetrachloroethene, 0.58 ug/L; trichlorofluoromethane, 0.51 ug/L; and TDS, 140 mg/L. The pH concentration of 5.9 in GW-1C was below the SDWS.

Plate 21 presents a ground water table map for water level readings taken during October 1986, in the nineteen Stage 1 and eleven Stage 2 monitor wells. A computer-generated contour relief map of the water table, based on these same readings, is presented in Plate 22. Because of a lack of data points (monitor well water level elevations) along the corners of mapped area, the water level contours in these areas are not as firmly established as the data presented for the main body of the map. In particular, it is believed that the area in the southwest corner of the map should have contours reflecting a more southwesterly flow toward Ship Creek. For Site D-5, the ground water gradient is approximately 16 feet per mile to the southwest.

5. Sites SP-7 and SP-10

Wells W-3 and W-4, installed during Phase II, Stage 1, near this spill site at Pumphouse No. 3, had evidence of water quality degradation during the earlier investigation. In W-3, TOC, oil and grease at 56 mg/L, and specific conductance were elevated. Water quality in W-4, as indicated by the TOX, oil and grease, and specific conductance was slightly degraded.

The Stage 2 analytical results indicated 1.9 mg/L of petroleum hydrocarbons were present in monitor well W-4. This sample also had a slightly excessive pH of 6.4 that exceeded the SDWS, and a TDS concentration of 500 ug/L. Dectectable concentrations of purgeable aromatics were not detected in the sample obtained from monitor well W-4, but were detected in the sample obtained from monitor well W-3 in the following concentrations: benzene, 4800 ug/L; ethyl benzene, 620 ug/L; toluene, 8200 ug/L; m-xylene, 3000 ug/L; o-xylene, 2600 ug/L. Petroleum hydrocarbons were detected at 51.0 mg/L and TDS was at 470 mg/L. The specific conductance was also elevated at 669 umhos/cm.

The ground water gradient for Sites SP-7 and SP-10, as illustrated on Plates 21 and 22, is approximately 16 feet per mile to the south-southeast.

6. Site D-7

During the Phase II, Stage 1 investigation, water quality in W-5 was found to be degraded with TOX at 80 ug/L and oil and grease at 5.8 mg/L. Water quality in W-6 was close to expected background.

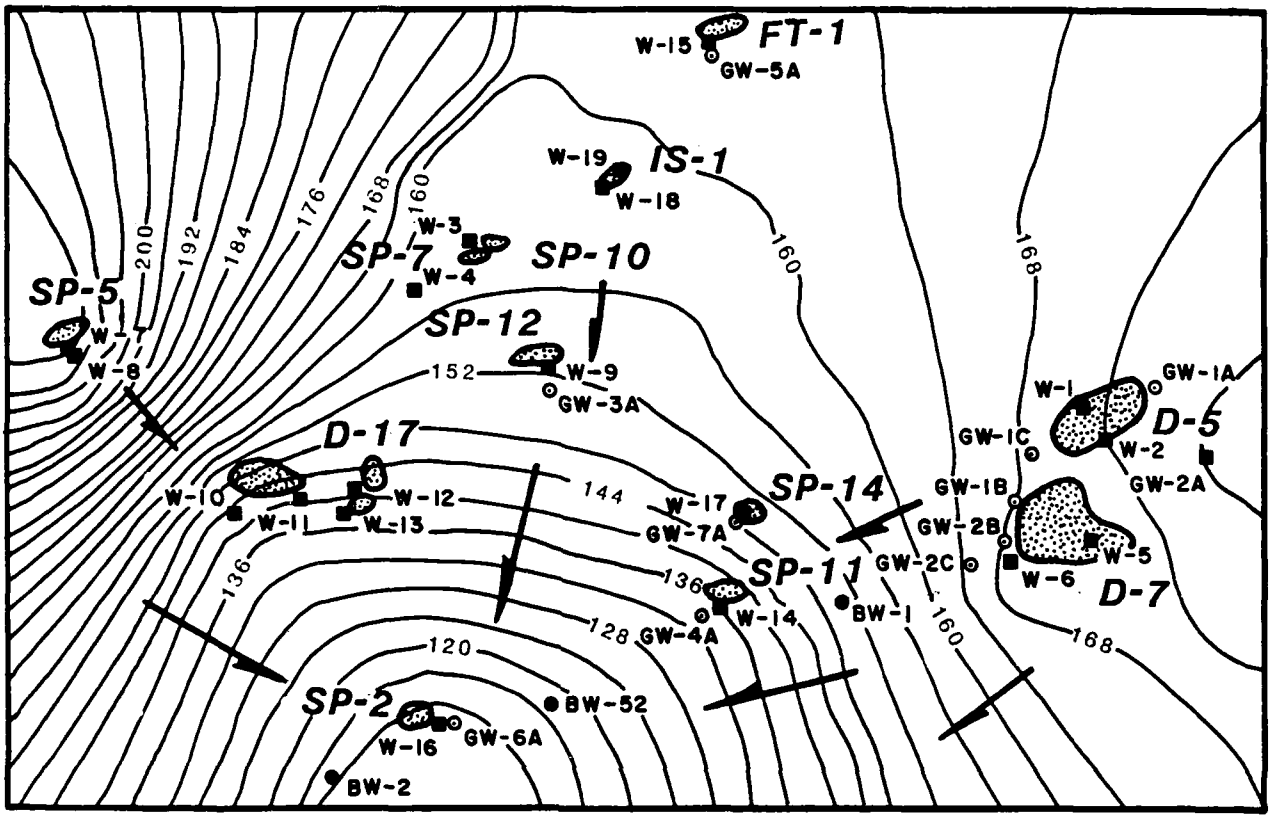
The upgradient well, GW-2A, was found to have methylene chloride at 0.80 ug/L and TDS concentration of 140 mg/L. The downgradient wells were found to have low levels of purgeable halocarbons. W-5 had 1.8 ug/L of methylene chloride, 0.99 ug/L of trichlorofluoromethane, 3.9 mg/L of petroleum hydrocarbons and 130 mg/L TDS. The SDWS for pH was exceeded at 5.7 in this well. Well W-6 has 0.63 ug/L of methylene chloride, 0.56 ug/L of trichlorofluoromethane and a TDS concentration of 90.0 mg/L. Wells GW-2B and GW-2C were both found to have the same contaminants. The respective concentrations for GW-2B and GW-2C were: 1,1-dichloroethene, 1.5 ug/L and 3.5 ug/L; trans-1,2-dichloroethene, 6.9 ug/L and 3.1 ug/L; methylene chloride, 3.0 ug/L and 3.1 ug/L; trichloroethene, 2.3 ug/L and 0.66 ug/L; trichlorofluoromethane, 1.3 ug/L and 1.2 ug/L; TDS, 190.0 mg/L and 210.0 mg/L. Both wells had pH levels, at 6.1 and 5.8, respectively, which exceed the SDWS.

The gradient for Site D-7 is approximately 24 feet per mile to the southwest, as illustrated on Plates 21 and 22.

7. Site SP-5

The two wells, W-7 and W-8, at this site of numerous leaks from Bulk Storage Tanks Nos. 601 through 604, were found to have only slightly degraded water quality with respect to TOC and oil and grease levels during the Stage 1 survey. The Stage 1 analyses did indicate that W-7 may be in a contaminant plume because of a specific conductance of 1074 umhos/cm and a pH of 12.15. The specific conductance in W-8 was 317 umhos/cm and a pH of 9.5.

During the Stage 2 analyses, purgeable halocarbons and petroleum hydrocarbons were below detection in both wells. TDS was at 460.0 mg/L in W-7 and 390.0 mg/L in W-8. Major anions and cations were included in the analytical program for Site SP-5. The following parameters were detected in Wells W-7 and W-8: alkalinity (reported at $CaCO_3$), 350.0 mg/L and 290.0



LEGEND:

W-15 ■ MONITOR WELL INSTALLED DURING PHASE II, STAGE 1.

GW-5A ⊙ MONITOR WELL INSTALLED DURING PHASE II, STAGE 2.

BW-2 ● BASE SUPPLY WELL

SITE NUMBERS AND AREA MONITORED

—192— GROUND WATER CONTOUR LINE (CONTOUR INTERVAL 4 FEET)

INDICATES GROUND WATER FLOW DIRECTION

NOTE:

DATA NEAR MAP CORNERS ARE INFERRED.

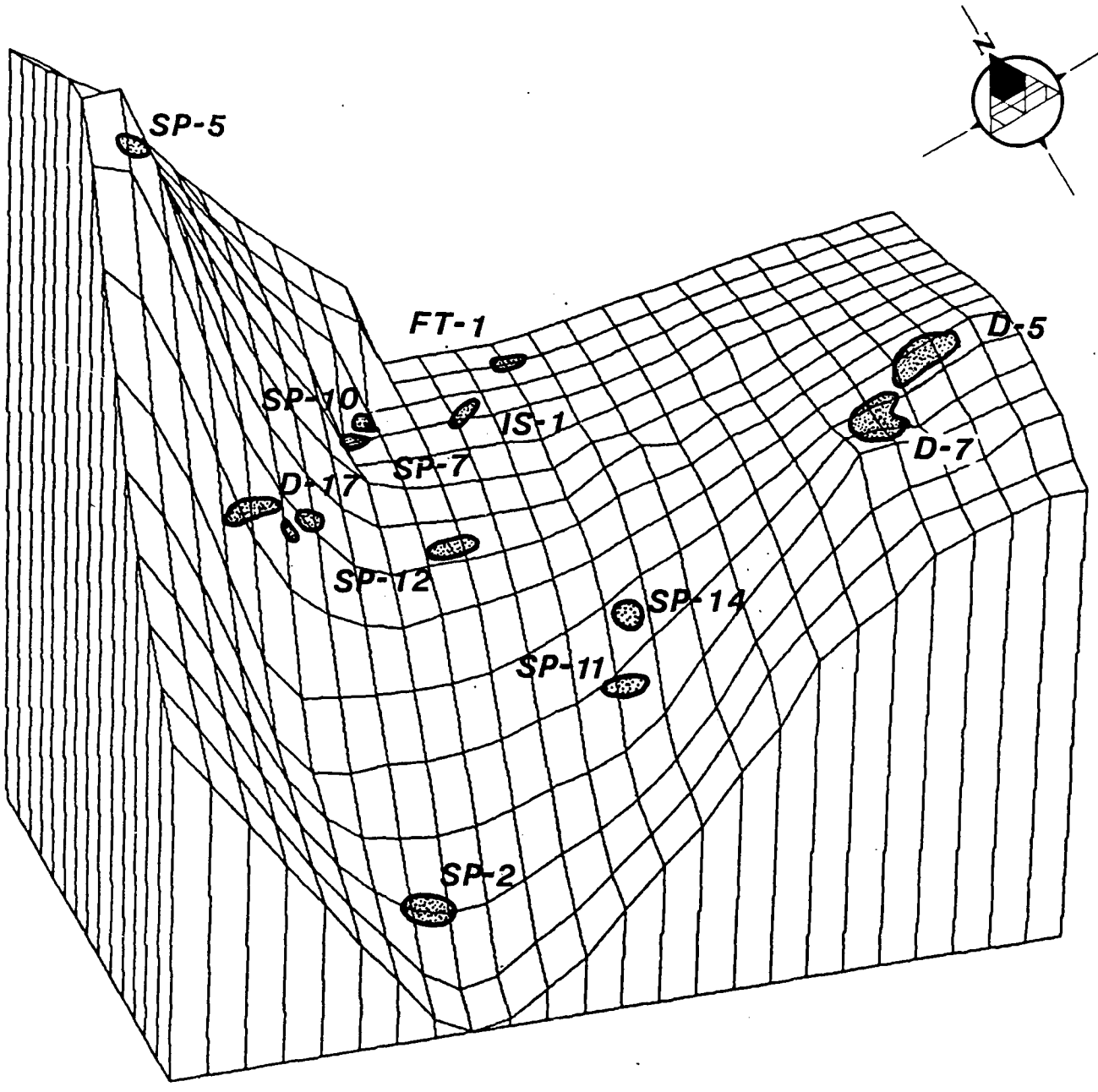
3000 0 3000 FEET

N

GROUND WATER SURFACE CONTOUR MAP
ELMENDORF AFB, ALASKA

Dames & Moor

PLATE 21



KEY:

APPROXIMATE SITE LOCATIONS

SCALES ARE DISTORTED DUE TO PERSPECTIVE RENDERING:

3000 0 3000 FEET
NORTH—SOUTH

3000 0 3000 FEET
EAST—WEST

GROUND WATER SURFACE
CONTOUR RELIEF MAP
ELMENDORF AFB, ALASKA

Dames & Moore

PLATE 22

mg/L; bicarbonate (reported as $CaCO_3$ and is the sole contributor to alkalinity), 350.0 mg/L and 290.0 mg/L; nitrate + nitrite (as N), 4.9 mg/L and 1.1 mg/L; total phosphate, 1.0 mg/L and 2.0 mg/L; chloride ion, 120 mg/L and 47.0 mg/L; sulfate ion, 20.0 mg/L and 10.0 mg/L; fluoride ion, 0.1 mg/L and 0.2 mg/L; bromide ion, 0.7 mg/L and 0.3 mg/L; barium, 120.0 ug/L and 56.0 ug/L; calcium, 120,000 ug/L and 80,000 ug/L; chromium, 13.0 ug/L and 11.0 ug/L; magnesium, 38,000 ug/L and 22,000 ug/L; manganese, 210.0 ug/L (exceeds the SDWS of 50 ug/L) and 5.0 ug/L; molybdenum, 48.0 ug/L in W-7 and below detection in W-8; and nickel, below detection in W-7 and 20.0 ug/L in W-8. The specific conductance was elevated in W-7 at 930 umhos/cm and somewhat elevated in W-8 at 575 umhos/cm.

The ground water gradient, as presented on Plates 21 and 22 is approximately 104 feet per mile to the southeast at Site SP-5.

8. Site SP-12

The results of the Stage 1 analyses from monitor well W-9 indicated only minor contamination with low levels of oil and grease (110 mg/L) and slightly elevated specific conductance (477 umhos/cm).

The Stage 2 analyses carried out on newly installed well GW-3A and well W-9 indicated no detectable purgeable aromatics and no detectable petroleum hydrocarbons in W-9 and a concentration of 0.1 mg/L petroleum hydrocarbons in GW-3A. A TDS level of 400.0 mg/L in GW-3A and 420.0 mg/L in W-9 was measured. The specific conductance was elevated in both wells at 537 umhos/cm in GW-3A and 627 umhos/cm in W-9.

A ground water gradient of 32 feet per mile to the south-southwest was calculated for Site SP-12 as illustrated on Plates 21 and 22.

9. Site D-17

The four monitor wells installed around abandoned disposal trench for shop wastes indicated moderately degraded water quality (elevated TOX, TDS, and specific conductance) during the Stage 1 sampling.

The four wells were resampled and a surface water sample was obtained from a ditch draining the site. These five water samples were tested for purgeable halocarbons, pH, temperature, and specific conductance. Methylene chloride was detected in W-10 at a concentration of 19.0 ug/L, in W-11 at 3.7 ug/L and in W-12 at 6.3 ug/L. Monitor wells W-11, W-12, and

W-13 had trans-1,2-dichloroethene at concentrations of 16.0 ug/L, 30.0 ug/L, and 15.0 ug/L, respectively and trichloroethene at concentrations of 47.0 ug/L, 26.0 ug/L and 5.2 ug/L, respectively. Well W-12 contained 1.6 ug/L of tetrachloroethene and Well W-13 contained 1.1 ug/L of 1,2-dichloroethane. Trichlorofluoromethane was found in W-11 at 0.62 ug/L and W-13 at 0.68 ug/L. Purgeable halocarbons were not detected in the surface water sample from Cherry Hill Ditch (CH-1 samples). The pH in wells W-11 (6.2), W-12 (5.5), and the water from Cherry Hill Ditch (5.1) exceeded the SDWS. The specific conductance for wells W-11 (571 umhos/cm), W-12 (626 umhos/cm), and W-13 (620 umhos/cm) as well as the water from the ditch (496 umhos/cm) were elevated.

As illustrated on Plates 21 and 22, the ground water gradient for the general vicinity of Site D-17 is 40 feet per mile to the south-southwest.

10. Site SP-11

Most of the results during the Stage 1 investigation for the water from W-14 indicated either assumed ambient concentrations or values below the limit of detection. However, there were elevated levels of oil and grease in soils in wetlands adjacent to site SP-11, the site of a JP-4 underground fuel line leak (Appendix I). During the Stage 2 investigation, purgeable aromatics were not detected in W-14 or newly installed GW-4A; however, purgeable halocarbons were detected. In W-14, 0.53 ug/L of tetrachloroethene was detected. In GW-4A, the following parameters and concentrations were found: dibromochloromethane, 1.6 ug/L; trans-1, 2-dichloroethene, 2.4 ug/L; tetrachloroethene, 0.46 ug/L; trichloroethene, 3.0 ug/L; trichlorofluoromethane, 0.49 ug/L. Petroleum hydrocarbons were not detected in W-14, but were detected at a concentration of 19.0 mg/L in GW-4A.

A ground water gradient of 40 feet per mile to the south-southwest was calculated for Site SP-11 as shown on Plates 21 and 22.

11. Site FT-1

During Stage 1, monitor well W-15 at the fire training area had an oil and grease concentration, specific conductance, and pH levels above the inferred background levels. The Stage 2 analyses revealed no concentrations of purgeable aromatics or petroleum hydrocarbons above the detection limit in either W-15 or GW-5A. The pH in both wells (W-15 at 6.0 and GW-5A at 6.1) exceed the SDWS. The specific conductivity in GW-5A is elevated at 614 umhos/cm.

Site FT-1 has a calculated gradient of 8 feet per mile to the south-southwest and is illustrated on Plates 21 and 22.

12. Site SP-2

In monitor well W-16, oil and grease and specific conductance levels were elevated during the Stage 1 study at SP-2, the site of a JP-4 underground fuel line leak. The Stage 2 analyses indicate petroleum hydrocarbons at a level of 0.8 mg/L in W-16 and 61.0 mg/L in GW-6A installed 100 feet downgradient from W-16. Specific conductivity was elevated in both wells, 442 umhos/cm in W-16 and 457 umhos/cm in GW-6A.

Site SP-2 has a ground water gradient of 40 feet per mile to the south- southeast as shown on Plates 21 and 22.

13. Site SP-14

Water from monitor well W-17, installed near this MOGAS spill site, was found to have oil and grease at a concentration of 4.7 mg/L during the Stage 1 investigation. During Stage 2, purgeable aromatics were below detection in W-17 and newly installed GW-7A. Petroleum hydrocarbons were not detected in either well.

A gradient of 48 feet per mile to the south-southwest, as shown on Plates 21 and 22, was calculated for Site SP-14.

14. Site IS-1

During the Stage 1 study monitor wells W-18 and W-19 were installed near this site of numerous spills that flowed from floor drains to dry wells. Some water quality degradation during Stage 1 was indicated in W-18 with specific conductance (663 umhos/cm) and TOX (150 ug/L) above expected background and levels of oil and grease at 2.5 mg/L in W-18 and 1.7 mg/L in W-19. The Stage 2 analyses indicates a level of 1,1-dichloroethane in W-18 of 2 ug/L and in W-19 of 10.0 ug/L. In W-19, methylene chloride was detected at 0.45 ug/L, 1,1,1-trichloroethane at 3.0 ug/L and trichlorofluoromethane at 0.43 ug/L. The specific conductivity was elevated in both wells, W-18 at 739 umhos/cm and W-19 at 640 umhos/cm.

The gradient at Site IS-1 is approximately 8 feet per mile to the south as shown on Plates 21 and 22.

15. Reliability of Ground Water and Surface Water Analyses

The majority of the ground water and surface water quality analyses are considered to be reliable by virtue of the well construction and sampling procedures followed in the field to ensure that the samples are representative, by virtue of quality control procedures in the laboratory, and because of the monitor well locations.

The monitor wells were screened above and below the water table where low density organic contaminants would be concentrated. After the monitor wells were installed, they were thoroughly developed by pumping to remove effects of drilling and installation and to improve the flow of ground water into the wells. Pumping was continued until the discharge was clear of sediment. At least three casing volumes of water were purged from the monitor wells prior to sampling to ensure that the samples were representative of ground water in the formation. The monitor well samples were collected with a Teflon® bailer equipped with a bottom discharging device to minimize agitation and consequent aeration of the sample, which could volatilize organic chemicals.

The downgradient monitor wells were installed at locations where it was assumed they would most likely intercept ground water transporting contaminants from the waste or spill sites. That is, they are located either near the edge of the waste or spill as practicable in an area believed to be downgradient of the site or in areas at a specific distance downgradient to intercept suspected plumes from the sites.

The upgradient wells were located in areas assumed to be removed from the influence of the site under question.

The presence of several contaminants in trip blanks require qualification of some of the chemical analyses.

In the trip blank which accompanied the base water supply well samples, two purgeable halocarbons were detected. Methylene chloride, at a concentration of 32. ug/L and trichlorofluoromethane, at a concentration of 0.94 ug/L, were found. The presence of methylene chloride at this concentration is believed to be due to laboratory background or trip contamination and therefore the concentration detected in base well BW-1, 3.7 ug/L, cannot be confirmed.

The presence of trichlorofluoromethane (Freon 11) in one Ship Creek sample (SC-1 at 0.54 ug/L) and one base well sample (BW-1 at 0.83 ug/L) strongly suggests that the low levels of trichlorofluoromethane reported by UBTL are probably due to laboratory background. A thorough survey by UBTL personnel located no source of this substance in the laboratory. The judgment has been made that this material should be reported as its actual source is unknown. Resampling at three Air Force bases during the summer of 1987 did not detect trichlorofluoromethane in the smaller suite of samples analyzed and tends to support the conjecture that this parameter was either a trip or laboratory contaminant.

In the trip blank accompanying samples from Site SP-5, filterable residue (TDS) at a concentration of 11. mg/L and nitrate + nitrite at a concentration of 0.05 mg/L is attributed to laboratory background rather than trip contamination.

The two trip blanks on which ICP (Inductively Coupled Plasma) metal scans were performed had the following metals present:

	TRIP BLANK SP-5	TRIP BLANK BASE WELLS
boron	66. ug/L	N.D.
calcium	14. ug/L	34. ug/L
cadmium	N.D.	6 ug/L
chromium	10. ug/L	18. ug/L
nickel	N.D.	16. ug/L

As boron and cadmium were not detected in the two wells from Site SP-5, these concentrations will not present a problem in the interpretation of results. The presence of calcium at low concentrations in the trip blanks is four to five orders of magnitude lower than the concentrations detected in the wells. It is believed these low levels in the trip blanks can be ignored. The presence of low concentrations of chromium and nickel, which are in the same concentration range as the metals detected in the wells, precludes a firm judgment as to the levels of contamination for these metals in the Site SP-5 monitor wells.

The laboratory quality control (QC) program is described in Appendix F. In general, analyses of duplicate and spiked samples were satisfactory. Details of the gas chromatographic columns are presented in the transmittal letter from UBTL in Appendix H.

16. Background Concentrations

The major categories of water analyses performed during the Phase II, Stage 2 survey are purgeable halocarbons, purgeable aromatics, pesticides, petroleum hydrocarbons, filterable residue (TDS), lead, and major cations and anions.

It is assumed that purgeable halocarbons, purgeable aromatics, and pesticides would have background concentrations below the limits of detection as these parameters are man-made chemicals and would not be found in the natural environment. Similarly, the background concentration for petroleum hydrocarbons is assumed to be below detection as the glacial terrain underlying Elmendorf AFB would not, under normal circumstances, have natural sources of petroleum hydrocarbons. For these four categories, the results of the Stage 2 analyses carried out on a number of monitor wells and several base supply wells support the contention that concentrations below the detection limit are representative of background concentrations.

The presence of lead in very low concentrations may be naturally occurring at Elmendorf AFB. Lead was found in the surface water samples from Ship Creek at concentrations near the detection limit (0.005 mg/L), but was below detection in base water supply wells and two monitor wells (W-14 and GW-4A) at Site SP-11. Background concentrations, although supported by a slim data base, are assumed to be either below or near the detection limit of 0.005 mg/L.

B. SIGNIFICANCE OF FINDINGS

Based on the results described in the previous section and on the hydrogeology described in Sections II and IV, this section will estimate, to the degree possible, the extent of contamination at each site and the risk to human health, if any, that the contamination passes. Human health could be threatened if any area water supply wells are contaminated or in danger of being contaminated. This would happen if a well completed in the shallow aquifer were directly downgradient from a contaminant source, or if a well into the deeper artesian aquifer provide a conduit for contaminants to enter the lower aquifer.

1. Extent of Contamination at Base Supply Wells

The single sampling event of October 15, 1986, suggests that there is water quality degradation in base supply well BW-1 and possibly BW-52. Although the analytical results for low levels of methylene chloride and trichlorofluoromethane may be discounted due to the presence of these substances in the accompanying trip blank, other purgeable halocarbons were found at low, but detectable, levels. BW-1 was found to contain tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene (TCE) and BW-52 had a low level of chloroform. According to Elmendorf installation documents (see Table 2), BW-1 is finished at a depth of 16 feet in the shallow aquifer and is a high yielding well (1350 gpm). BW-52 is finished at a depth of 166 feet in the artesian aquifer and yields 8 gpm. Both of these wells are located downgradient of landfills D-5 and D-7 (see Plates 16 and 21). BW-52 is also located downgradient of Sites SP-11 and SP-14. In the case of BW-52, it is believed that the chloroform concentration of 1.2 ug/L (this concentration does not exceed the PDWS of 100 ug/L for total trihalomethanes) is due to the chlorination treatment of the water sample prior to sampling. For BW-1, the low levels of purgeable halocarbons are believed to be due to the location of this base well located within the plume(s) from the landfill area (Sites D-5 and D-7). The following purgeable halocarbons were detected in BW-1 and in landfill monitor wells. Tetrachloroethene was found in low concentrations in downgradient wells from Site D-5; 1,1,1-trichloroethane was found in one downgradient well from Site D-5; and trichloroethene (TCE) was found in downgradient wells from both Sites D-5 and D-7.

The significance of the presence of purgeable halocarbons in BW-1 is dependent on whether the concentrations detected in the October 15, 1986 sample are indicative of actual concentrations or were influenced by the time of sampling. As indicated on page 6 of the Statement of Work, the wells were sampled during maximum ground water flow conditions following several weeks of heavy precipitation. The soils in the areas of the landfills would have experienced the maximum period of flushing, thereby leaching out contaminants normally adhering to soils in the unsaturated (vadose) zone. However, BW-1 is a shallow well and is located in a major stream valley, Ship Creek, which receives run-off from the northeast, east, and southeast. The headwaters of Ship Creek originate in the Chugach Mountains. The increased volume of water passing through the soils at BW-1 following large precipitation events, potentially could dilute contaminant concentrations below levels that may be considered typical at this well.

The current evidence strongly suggests degraded water quality with the presence of low levels of contaminants rated as carcinogens [National Toxicology Program lists tetrachloroethene, 1,1,1-trichloroethane, trichloroethene as compounds presenting clear evidence of carcinogenicity (A.D. Little, 1985)].

2. Extent of Contamination Ship Creek

The surface water samples from Ship Creek had low levels of lead which did not exceed the PDWS. The presence of trichlorofluoromethane is not confirmed as the substance was detected in a trip blank. The pH, at 5.2 at Station SC-2, exceeds the SDWS but is not believed to be an indication of degraded water quality. Low pH is not unusual in streams that drain northern wetlands where boggy conditions are common.

3. Extent of Contamination at Site D-5

Ground water quality downgradient of Site D-5 is degraded with low levels of purgeable halocarbons. Ground water from three monitor wells (GW-1A, GW-1B, and GW-1C) was more acidic than the range permitted by the SDWS (6.5 to 8.5).

Of the seven purgeable halocarbons detected in the Site D-5 monitor wells, four [methylene chloride, tetrachloroethene, 1,1,1-trichloroethane, and trichlorethene (TCE)] are considered to be carcinogenic by the National Toxicological Program [(NTP) A.D. Little, 1985]. As stated in Section IV.B.1., these findings are significant as base water supply wells BW-1 and BW-52 are located downgradient of the landfills. It is believed that the water quality degradation detected in BW-1 is at least partially attributable to Site D-5.

4. Extent of Contamination at Sites SP-7 and SP-10

The analyses from the Stage 2 sampling indicate there is contamination of the ground water with purgeable aromatics at monitor well W-3. This well contained elevated levels of benzene (4800 ug/L), ethyl benzene (620 ug/L), toluene (8200 ug/L), m-xylene (3000 ug/L), o-xylene (2600 ug/L) and petroleum hydrocarbons (51.0 mg/L). Monitor well W-4 is located 1200 feet to the southwest of W-3; this direction is not directly downgradient of the spill sites but was positioned as close as was feasible to the downgradient direction (see Plate 8) since taxi-ways surround the spill site. The high

levels of a known carcinogen (benzene), and four other purgeable aromatics, indicate pronounced water quality degradation at least on a local scale. W-9, installed to monitor Site SP-12, is located 2400 feet downgradient of Site SP-7/10 and had no detectable purgeable aromatics.

5. Extent of Contamination at Site D-7

Contamination of the ground water by purgeable halocarbons is indicated by the Stage 2 analyses. The upgradient well, GW-2A, had a low concentration of only one contaminant, methylene chloride (0.80 yg/L) and this concentration may be due to laboratory contamination. The downgradient wells contained low levels of 1,1,-dichloroethane, trans-1,2-dichloroethene, trichloroethene, methylene chloride, and trichlorofluoromethane. The presence of the latter two contaminants may also be due to laboratory or trip contamination.

In the area east of Site D-7 and south of the gravel pit, there is an area designated as a hazardous waste receptor. The methods of disposal and types of materials disposed of are not known. Consequently, it is not known what impact, if any, this area has on ground water quality in the vicinity of the landfills.

As with Site D-5, the significance of this contamination is related to the impact on base water supply wells, BW-1 and BW-52. Both wells are located downgradient of Site D-7 (see Plates 2 and 21). Two of the contaminants, methylene chloride and trichloroethene (TCE), found in the D-7 monitor wells are listed as carcinogens by the National Toxicological Program (A. D. Little, 1985).

6. Extent of Contamination at Site SP-5

The Stage 2 results performed on the two wells indicate no contamination by purgeable aromatics or petroleum hydrocarbons. The manganese concentration of 210.0 ug/L in W-7 suggests minor water quality degradation as this exceeds the SDWS of 50.0 ug/L. Several analyses present ambiguous results. The TDS concentration in W-7 is 460.0 mg/L, exceeding the SDWS. The field measured conductivity at this well yields a specific conductivity of 930 umhos/cm which reflects the elevated TDS value. The presence of chromium at 10. ug/L in the trip blank accompanying the Site SP-5 samples and at 18. ug/L in the base well trip blank makes a clear

judgment as to the actual level of chromium detected in W-7 and W-8 very difficult. The levels detected do not exceed the PDWS. Nickel was detected at 20.0 ug/L in W-8 and was not found in SP-5 trip blank; however, it was detected at 16 ug/L in the base well trip blank. The concentration of 20.0 ug/L does not exceed any current standard.

The remainder of the results do not indicate a ground water quality problem in the vicinity of Site SP-5.

7. Extent of Contamination at Site SP-12

In the Stage 2 analysis of monitor well W-9, and newly installed monitor well GW-3A, an elevated concentration of specific conductance was detected. These values were 627 umhos/cm and 537 umhos/cm, respectively. These values suggest that the ground water in this localized area may be slightly degraded. Base well 40 located hydraulically downgradient of Site S-12 does not appear to be impacted by the minor contamination at this site.

8. Extent of Contamination at Site D-17

The elevated levels of TOX and TDS during the Stage 1 investigation were reinvestigated during the Stage 2 study by analyzing the ground water from the four monitor wells in the vicinity of the disposal trenches and sampling surface water from Cherry Hill Ditch receiving surficial drainage from Site D-17. Degradation of water quality was confirmed by the detection of the following purgeable halocarbons in some of the wells: 1,2-dichloroethane; trans-1,2-dichloroethene; trichlorofluoromethane; methylene chloride; tetrachloroethene; and trichloroethene (TCE). The last three compounds are classified as carcinogens by the National Toxicological Program (A. D. Little, 1985). Although the concentrations of purgeable halocarbons were one to two orders of magnitude above the detection limit, the location of this site with respect to base supply wells does not appear to pose and immediate threat to human health. At the time of sampling, October 10, 1986, water discharging to Cherry Hill Ditch did not have detectable levels of purgeable halocarbons.

9. Extent of Contamination at Site SP-11

Water quality results from the two wells downgradient of this fuel line leak indicate an elevated level (19.0 mg/L) of petroleum hydrocarbons in GW-4A and detectable levels of purgeable halocarbons in both wells.

Dibromochloromethane, trans-1,2-dichloroethane, tetrachloroethene, trichloroethene, and trichlorofluoromethane were detected in GW-4A. Tetrachloroethene was detected in W-14. These analyses indicate water quality degradation in the area downgradient of the site.

The two areas of concern regarding Site SP-11 include the possible impact on the water quality in Ship Creek and the effects on base supply well BW-52. At the time of the sampling event, water quality in Ship Creek did not appear to be effected as only one purgeable halocarbon (trichlorofluoromethane) was detected in one sample from the Creek. It is believed that this compound may be attributable to trip or laboratory contamination. Also, GW-52 was found to have a low concentration of chloroform, perhaps attributable to chlorination, as the only purgeable halocarbon in the sample. The current sampling event at SP-11 suggests no impact to either surface or ground water.

10. Extent of Contamination at Site FT-1

The Stage 2 analytical results from the two downgradient wells at the fire training area indicate little impact on ground water quality. Petroleum hydrocarbons and purgeable aromatics were not detected. The pH in both wells exceed the SDWS and the specific conductivity in GW-5A is elevated at 614 umhos/cm. No active wells are located directly downgradient of this site and impact on the base water supply is believed to be insignificant.

11. Extent of Contamination at Site SP-2

Both wells downgradient of this site have detectable levels of petroleum hydrocarbons of 0.8 mg/L (W-16) and 61.0 mg/L (GW-6A). The impact to base water supply well BW-2 is unclear. Well BW-2 is located approximately 2000 feet to the southwest of Site SP-2. The ground water gradient in this general vicinity is to the southeast, based on the computer-generated water table map as shown on Plate 21. However, as stated in Section IV.A.4., it is believed that a more southwesterly gradient in this portion of the map is more accurate. Certainly, surface water flow in this area is to the south-southwest toward Ship Creek. The concern with base water supply well BW-2 is the appearance of an oily sheen on the water sample obtained from this well, although no petroleum hydrocarbons or purgeable aromatics were detected in the BW-2 water sample. Because well BW-2 is completed at a depth of 850 feet in the artesian

aquifer (see Table 2), it is presumed that Site SP-2 does not pose a threat to human health. It remains to be determined if the oily sheen on water from BW-2 is a one-time event or if some source of on-going contamination regularly generates this condition.

12. Extent of Contamination at SP-14

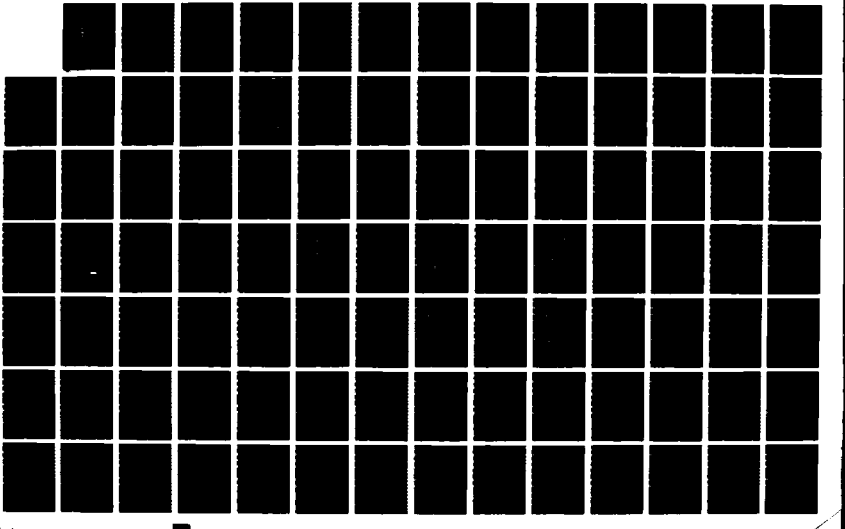
The current set of analytical data which represents ground water collected at this site suggests that the subsurface water has not been effected by the MOGAS spill. This is indicated through the absence of petroleum hydrocarbons and purgeable aromatics. However, since a base well (BW-52) is located downgradient of the spill area, resampling of the ground water is recommended in order to confirm the current set of analysis.
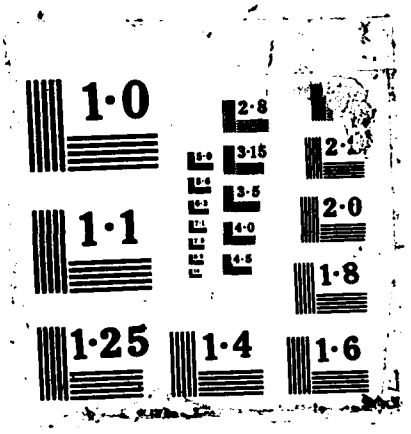
13. Extent of Contamination at IS-1

The water quality degradation detected at this site during the Stage 1 investigation was confirmed by the presence of purgeable halocarbons in monitor wells W-18 and W-19, during the Stage 2 study. These wells also contained concentrations of 1,1,-dichloroethane at 1.4 ug/L and 6.1 ug/L, respectively. In addition to the above mentioned parameters, monitor well W-19 also contained a concentration of 1,1,1-trichloroethane at a concentration of 2.4 ug/L.

The closest base supply well is BW-29, located approximately 1,700 feet northwest and upgradient of the site. BW-29 is completed at a depth of 406 feet in the artesian aquifer and has a yield of 40 gpm (Table 2). By virtue of the location, depth, and yield of BW-29 it is not believed that this well will be impacted by Site IS-1. It appears that only local water quality in the vicinity of IS-1 is degraded as a result of the activities at this site.

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CONFIRMATION/QUANTIFICATION STAG (U) DAMES AND MOORE
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V. ALTERNATIVE MEASURES

This section presents several alternatives considered for further action regarding the environmental contamination and potential for human health hazards at Elmendorf AFB. The alternatives include further site investigation with the installation of additional monitor wells, the establishment of a ground water monitoring program, and the remediation of a spill site.

The results of the Phase II, Stage 2 investigation confirm the conclusions of the Stage 1 study regarding the existence of ground water contamination in the downgradient vicinity of the landfills, Sites D-5 and D-7, and in the vicinity of Sites SP-7 and SP-10, the area near Site D-17, SP-11, SP-2, and IS-1. Probable ground water degradation was indicated in base supply well BW-1. Minimal or no ground water degradation was detected during the Stage 2 sampling effort in Ship Creek, base supply wells BW-2 and BW-52, and Sites FT-1, SP-12, SP-5, and SP-14. With the exception of Sites SP-7 and SP-10, the levels of contamination are generally low. Although the majority of the contaminants detected are low in concentration, the presence of certain purgeable halocarbons in the ground water in the area near the landfills, in base supply well BW-1, Sites D-17, IS-1, and SP-11 are of concern.

1. General - Resampling

a. Confirmation Analyses

Certain sets of analytical data yielded results which are in need of confirmation by an additional round of sampling. In some instances, the concentrations were low, near the limit of detection, but significant because of the possible impact to human health. In other instances, it is suspected that the time of sampling following a long period of precipitation, may have diluted the contaminant concentrations in the ground water to levels lower than what might be considered more typical as a yearly average.

This alternative would involve sampling for purgeable halocarbons at base supply well BW-1, Ship Creek, Sites D-5, D-7, D-17, and SP-11; and sampling for ICP scan metals at Site SP-5.

aquifer (see Table 2), it is presumed that Site SP-2 does not pose a threat to human health. It remains to be determined if the oily sheen on water from BW-2 is a one-time event or if some source of on-going contamination regularly generates this condition.

12. Extent of Contamination at SP-14

The current set of analytical data which represents ground water collected at this site suggests that the subsurface water has not been effected by the MOGAS spill. This is indicated through the absence of petroleum hydrocarbons and purgeable aromatics. However, since a base well (BW-52) is located downgradient of the spill area, resampling of the ground water is recommended in order to confirm the current set of analysis.

13. Extent of Contamination at IS-1

The water quality degradation detected at this site during the Stage 1 investigation was confirmed by the presence of purgeable halocarbons in monitor wells W-18 and W-19, during the Stage 2 study. These wells also contained concentrations of 1,1,-dichloroethane at 1.4 ug/L and 6.1 ug/L, respectively. In addition to the above mentioned parameters, monitor well W-19 also contained a concentration of 1,1,1-trichloroethane at a concentration of 2.4 ug/L.

The closest base supply well is BW-29, located approximately 1,700 feet northwest and upgradient of the site. BW-29 is completed at a depth of 406 feet in the artesian aquifer and has a yield of 40 gpm (Table 2). By virtue of the location, depth, and yield of BW-29 it is not believed that this well will be impacted by Site IS-1. It appears that only local water quality in the vicinity of IS-1 is degraded as a result of the activities at this site.

2. Soil Gas Surveys

An alternative which was briefly explored but not rigorously executed during Stage 2 is the concept of soil gas surveys at spill sites. The current analytical data set indicates petroleum hydrocarbon contamination at Sites SP-7, SP-10, SP-2, SP-11, and possible contamination at SP-12 and SP-14. A soil gas survey carried out with an OVA unit in shallow boreholes (depths of 3 to 5 feet) in the area downgradient of Sites SP-7 and SP-10 would help to delineate the plume associated with the spills. Because of the presence of taxiways and flight aprons immediately downgradient of these sites, a comprehensive grided survey may not be feasible. An alternative method would be to perform a soil gas survey along two lines of boreholes. One line of boreholes, spaced on 100-foot centers and located 200 feet south of monitor well W-3 could be used to define the width of the plume immediately downgradient of the site. An additional set of borings on 300-foot centers in the infield area south of taxiway 8 would monitor the more distant portion of the plume, if it exists.

Grided surveys, with boreholes to depths of 2 to 5 feet dependent on site conditions, may be feasible for Sites SP-2 and SP-11. If results of the next set of petroleum hydrocarbon analyses indicate significant contamination, soil gas surveys for Sites SP-12 and SP-14, would be likely candidates for this technique.

VI. RECOMMENDATIONS

The recommendations presented in this section have 3 primary purposes:

1. To identify those sites where further action is deemed warranted;

2. To confirm the existence and magnitude of contamination beneath the base identified during Phase II, Stage 2 investigations; and

3. To aid in establishing the distance of migration of contaminants under and off base.

Various alternative measures for achieving these purposes, along with a discussion of the information that would be obtained, are presented in Section V. The following are Dames & Moore recommendations for the sites requiring further investigations.

A. SITES WHERE FURTHER ACTIONS ARE DEEMED UNWARRANTED (CATEGORY 1)

Based on the results of sampling and the analytical data generated during the Phase II, Stage 2 investigation, it is recommended that all sites be considered for further action. The current set of analyses suggest that two sites may be likely candidates for Category 1. However, resampling of these sites is recommended to confirm that minimal or no ground water contamination is present in these areas. The sites that may warrant no further action are: SP-12 and SP-14.

B. SITES WARRANTING FURTHER INVESTIGATION (CATEGORY 2)

1. General

It is recommended that the three base water supply wells BW-1, BW-2, and BW-52 be resampled and that BW-16 should be included if it is actively used. The presence of purgeable halocarbons in BW-1, of chloroform in BW-52, and of an oily sheen on the water sample from BW-2 need to be reinvestigated. The current data strongly suggests that BW-1 is contaminated. It is not known if the time of sampling in October 1986, adequately reflected ambient contaminant concentrations detected in BW-1. The position of this well in the Ship Creek watershed and its construction as a high yield well make it a potential receptor for plumes from landfills D-5 and D-7.

It is also recommended that Ship Creek be resampled during a period more nearly approaching the base flow of the stream (i.e., late winter). The reliability of the analysis indicating the presence of one purgeable halocarbon, trichlorofluoromethane in sample SC-1, is in question and resampling and analysis is recommended. It would be worthwhile to move one sampling location to the vicinity of Site SP-11. Monitor well GW-4A, at SP-11 had detectable levels of purgeable halocarbons and elevated petroleum hydrocarbons. Sampling Ship Creek immediately downstream of SP-11 will permit assessment of possible contaminants coming from this site into the stream in this area.

2. Sites D-5 and D-7

Resampling the monitor wells from both sites is recommended to confirm the current set of analyses. The Stage 2 study indicated that contaminant plumes with detectable levels of purgeable halocarbons and perhaps petroleum hydrocarbons are leaching from the landfills. Some of the detected halocarbons (tetrachloroethene, 1,1,1-trichloroethane, trichloroethane, and methylene chloride) are known carcinogens. Because base supply well BW-1 is directly downgradient from the landfills, it is important to confirm the current set of analyses and establish if this data is representative of conditions through time.

It is recommended that the monitor wells for Sites D-5 and D-7 be sampled and analyzed for purgeable halocarbons (USEPA 601), petroleum hydrocarbons (USEPA 418.1), TDS (USEPA 160.1), pH, temperature, and specific conductivity.

Dames & Moore understands that a "hazardous waste" disposal area exists to the east-northeast of D-7 and south of D-5. It is recommended that this site be investigated initially through a records search and interviews with personnal who have knowledge of the site. Based on the results of this investigation additional studies in the area may be warranted.

3. Site SP-5

It is recommended that ICP scan metals (USEPA 200.7 ICP) be reanalyzed to clarify the ambiguous data for these metals. In particular chromium and nickel concentrations, found in trip blanks as well as in Site SP-5 samples need clarification confirmation of the presence of nickel in well W-8 as needed. It is not believed that the manganese concentration of 210.0 ug/L, although exceeding the SDWS of 50 ug/L, is a threat to human health.

4. Site SP-12

Based on the current Stage 2 analyses, it is recommended that monitor wells W-16 and GW-6A be resampled and analyzed for TDS (USEPA 160.1) and petroleum hydrocarbons (USEPA 418.1) and for pH, temperature, and conductivity. If no standards are exceeded in this next round of analyses, then it is recommended that Site SP-12 be placed in Category 1, requiring no further action.

5. Site D-17

It is recommended that the monitor wells from Site D-17 be resampled for purgeable halocarbons (USEPA E601), pH, temperature, and specific conductivity. If the repeat analyses confirm the levels of purgeable halocarbons (i.e., one to two orders of magnitude above the detection limits) detected during Stage 2, then it is recommended that Site D-17 be placed in Category 3, requiring remedial actions. If the levels of contaminants decrease but are still detectable, then long-term monitoring may be required.

6. Site SP-11

Because of the low levels of purgeable halocarbons in both monitor wells, and the elevated concentration (19.0 mg/L) of petroleum hydrocarbons in GW-4A, it is recommended that these analyses be confirmed by an additional round of analyses. Although base water supply well BW-52 did not appear to be effected by the contaminants from Site SP-11, the proximity of this fuel line leak to nearby wetlands draining into Ship Creek, is of concern. The confirmation of Stage 2 analyses would then warrant classifying this area as a Category 3 site requiring remedial action. Because of the sensitivity of wetlands to petroleum hydrocarbons pollution, it is believed that removing the source of further pollution, rather than treatment in the wetlands area, would be the least damaging to the environment.

It is recommended that the wells be resampled and analyzed for petroleum hydrocarbons (USEPA 418.1), purgeable halocarbons (USEPA 601), pH, temperature, and specific conductivity. If warranted, it is recommended that remediation include the pumping and treating of water from well GW-4A and periodic analyses of ground water for petroleum hydrocarbons and purgeable halocarbons to determine if contaminant levels decrease.

7. Site FT-1

It is recommended, that resampling of FT-1 monitor wells to obtain TDS (USEPA 160.1) pH, temperature, specific conductivity, and petroleum hydrocarbons be carried out to ensure that ground water standards are being met.

8. Site SP-2

To confirm the analysis of Stage 2, it is recommended that wells W-16 and GW-6A be resampled and analyzed for TDS (USEPA 160.1), petroleum hydrocarbons (USEPA 418.1), pH, temperature and specific conductivity. Although base well BW-2 does not appear impacted by Site SP-2, the current levels of petroleum hydrocarbons were measured within 600 feet of Ship Creek. If the current analyses are confirmed, it is recommended that Site SP-2 be placed in Category 3, requiring remedial actions.

9. Site SP-14

The reported quantity of the spill, 1,500 gallons of MOGAS at a former service station located near Bldg. 11-110, occurred in 1965. The current levels of petroleum hydrocarbons (3.5 mg/L) in the downgradient well is not believed to present a threat to base well BW-52. A resampling and analysis for petroleum hydrocarbons (USEPA 418.1), TDS (USEPA 160.1), pH, temperature, and specific conductivity is needed to confirm current analyses. It is anticipated that the reanalysis will be similar to that reported on Table 4 and, therefore, the site will be reclassified as Category 1, no further action.

10. Site IS-1

A resampling and analysis of ground water from both wells at this site is needed to confirm the analyses of Stage 2. It is recommended that W-18 and W-19 be retested for purgeable halocarbons (USEPA 601), pH, temperature and specific conductivity. The placement of this site in Category 1 or Category 3 is dependent on the results of the next set of samples.

C. SITES REQUIRING REMEDIAL ACTIONS (CATEGORY 3)

1. Sites SP-7 and SP-10

Based on the elevated levels of purgeable aromatics and petroleum hydrocarbons in monitor well W-3, it is recommended that Sites SP-7 and SP-10 be placed in Category 3, sites requiring remedial actions. Possible remedial actions include long-term monitoring of the site concurrent with removal and treatment of contaminated ground water. The position of W-3 is in the nearby vicinity of the fuel spills; W-4 is located 1200 feet to the southwest of W-3. Monitor well W-4, which had no detectable purgeable aromatics was placed as close to the downgradient direction as was feasible due to the location of aircraft taxiways and is not directly downgradient of the site. Therefore, the extent of the plume from the area of the spill sites is not known. As an initial remedial measure, pumping and treating of ground water for a short period of time from W-3 will indicate if the elevated concentrations detected in W-3 are a local phenomenon or part of a larger plume.

If initial results indicate W-3 is in an extensive plume, it would be helpful to drill a series of ten borings to a depth of 5 feet on 100-foot centers located approximately 200 feet south of monitor well W-3 and an additional set of borings on 300-foot centers in the infield area just south of taxiway 8. These boring would be monitored with an OVA unit to determine the areas of highest soil gas concentrations. Upon determination of the highest concentrations, a decision could be made as to the number and optimum placement for recovery wells.

APPENDIX A

DEFINITIONS, NOMENCLATURE, AND UNITS OF MEASUREMENT

DEFINITIONS, NOMENCLATURE, AND UNITS OF MEASUREMENT

AAC	Alaskan Air Command
adsorption	Adherence of gas molecules or of ions or molecules in solutions to the surfaces of solids with which they are in contact.
AFB	Air Force Base
alluvial channel	A channel whose bed is composed of alluvium.
alluvial fan	Alluvial material deposited as a cone or fan at the base of a mountain slope.
alluvium	Unconsolidated sediments deposited during comparatively recent geologic time by a stream or other body of running water.
aquiclude	A body of relatively impermeable rock that is capable of absorbing water slowly but functions as an upper or lower boundary of an aquifer and does not transmit ground water rapidly enough to supply a well or spring.
aquifer	A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.
aquitard	A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer.
aromatic	Designating cyclic organic compounds characterized by a high degree of stability in spite of their apparent unsaturated bonds and best exemplified by benzene and related structures, but also evident in other compounds.
artesian	Ground water confined under hydrostatic pressure.
as N	As weight of nitrogen
AVGAS	Aviation gasoline
BEE	Bioenvironmental Engineer
°C	Degree(s) Centigrade
CE	Civil Engineer
cm/sec	Centimeter(s) per second
conductivity	A measure of the ability of a solution to carry an electric current, which is dependent upon the presence of ions in the water.

cone of depression	A depression in the potentiometric surface of a body of water that has the shape of an inverted cone and develops around a well from which water is being withdrawn.
conglomerate	The consolidated equivalent of gravel, both in size range and in the essential roundness and sorting of its constituent particles.
Cretaceous	A period of geologic time thought to have covered the span between 144 and 66.4 million years ago. Also, the corresponding system of rocks.
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DESEP	Civil Engineering/Environmental Planning
Devonian	A period of geologic time thought to have covered the span between 408 and 360 million years ago. Also, the corresponding system of rocks.
DOD	Department of Defense
downgradient	In the direction of decreasing hydraulic static head; the direction in which ground water flows.
DPDO	Defense Property Disposal Office
drawdown	The difference between the height of the water table and that of the water in a well; reduction of the pressure head as a result of the withdrawal of free water. Also called cone of depression.
drumlin	A low, smoothly rounded, elongated and oval hill, mound, or ridge of compact glacial till, built under the margin of the ice and shaped by its flow, or carved out of an older moraine by readvancing ice; its longer axis is parallel to the direction of movement of the ice.
effluent	A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.
EM	Electromagnetic
esker	A long, low, narrow, sinuous, steep-sided ridge or mound composed of irregularly stratified sand and gravel that was deposited by a subglacial or englacial stream flowing between ice walls or in an ice tunnel of a continuously retreating glacier, and was left behind when the ice melted.
°F	Degree(s) Fahrenheit
fluvial	Of or pertaining to rivers; produced by the action of a stream or river.

FSI	Felec Services, Inc.
ft	Foot, feet
glaciofluvial outwash plain	A broad, outspread, flat or gently sloping alluvial sheet of stratified detritus (chiefly sand and gravel) removed from a glacier by meltwater streams and deposited in front of the margin of an active glacier.
gpd/ft	Gallon(s) per day per foot
gpm	Gallon(s) per minute
ground moraine	The rock debris dragged along in and beneath a glacier or ice sheet; also, this material after it has been deposited or released from the ice during ablation, to form an extensive, fairly even thin layer of till, having a gently rolling surface.
HARM	Hazard Assessment Rating Methodology
HNU	A type of photoionization detector for measurement of organic vapors
hydraulic gradient	In an aquifer, the rate of change of pressure head per unit of distance of flow at a given point and in a given direction.
in.	Inch(es)
IRP	Installation Restoration Program
Jurassic	A period of geologic time thought to have covered the span between 208 and 144 million years ago. Also, the corresponding system of rocks.
LEL	Lower explosive limit
Mesozoic Age	A period of geologic time thought to have covered the span between 245 and 66.4 million years ago; includes the Triassic, Jurassic, and Cretaceous periods. Also, the corresponding system of rocks.
metamorphic	Rocks that have undergone mineralogical and structural adjustment to physical and chemical conditions that have been imposed at depth, below the surface zones of weathering and cementation, and that differ from the conditions under which the rocks in question originated.
mg/g	Milligram(s) per gram
mg/L	Milligram(s) per liter
ml	Milliliter(s)

µg/g	Microgram(s) per gram
µg/L	Microgram(s) per liter
MOGAS	Motor gasoline
monitor well	A well used to measure ground water levels and to obtain samples.
moraine	A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice in a variety of topographic landforms that are independent of control by the surface on which the drift lies.
msl	Mean sea level
No.	Number
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
OEHL/TS	Occupational and Environmental Health Laboratory/Technical Services
outwash	Stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or the margin of an active glacier.
outwash plain	A broad, outspread, flat or gently sloping, alluvial sheet of outwash deposited by meltwater streams flowing in front of or beyond the terminal moraine of a glacier, and formed by coalescing outwash fans; the surface of a broad body of outwash.
pH	Negative logarithm of hydrogen ion concentration; measurement of acids and bases.
PCB(s)	Polychlorinated biphenyl(s); highly toxic to aquatic life; PCBs persist in the environment for long periods of time and are biologically accumulative.
PDWS	Primary drinking water standard(s)
percolation	Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.
permafrost	Any soil, subsoil, or other surficial deposit, or even bedrock, occurring in arctic or subarctic regions at a variable depth beneath the earth's surface in which a temperature below freezing has existed continuously for 2 years to tens of thousands of years.

permeability	The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.
phenols	Any of various acidic compounds analogous to phenol and regarded as hydroxyl derivatives of aromatic hydrocarbons.
Pleistocene	An epoch of geologic time thought to have covered the span between 1.6 million and 10,000 years ago.
POL	Petroleum, oil and lubricants
porosity	The property of a rock, soil, or other material of containing interstices.
potentiometric surface	An imaginary surface representing the static head of ground water and defined by the level to which water will rise in a well.
ppm	Part(s) per million
Precambrian Age	Geologic time before the beginning of the Paleozoic; it is equivalent to about 90 percent of geologic time and ended approximately 570 million years ago.
PVC	Polyvinyl chloride
QC	Quality control
Quaternary	A period of geologic time thought to have covered the last 2 or 3 million years. Also, the corresponding system of rocks.
RCRA	Resource Conservation and Recovery Act
Recent	An epoch of geologic time thought to have covered the last 10,000 years.
schist	A rock formed by dynamic metamorphism that has a high degree of planar arrangement of textural or structural features, and so can readily be split into thin flakes or slabs.
SDWS	Secondary drinking water standard(s)
specific capacity	The rate of discharge of a water well per unit of drawdown, commonly expressed as gallons per minute per foot.
specific conductivity	With reference to the movement of water in soil, a factor expressing the volume of transported water per unit of time in a given area.
STP	Sewage treatment plant

stratigraphy	The systematic arrangement or partitioning of the sequence of rock strata into units with reference to any or all of the many different characteristics, properties, or attributes the strata may possess. Also, the interpretation of these units in terms of their origin, occurrence, environment, thickness, lithology, composition, age, and relation to other geologic concepts.
TAC	Tactical Air Command
TAC/NORAD	Tactical Air Command/North American Air Defense Command
TCE	Trichloroethylene
TDS	Total dissolved solids
Tertiary	The first period of the Cenozoic era, thought to have covered the span of time between 66 and 3 to 2 million years ago.
TFWC	Tactical Fighter Weapons Center
till	Unsorted and unstratified drift, generally unconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier, and consisting of a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape.
TOC	Total organic carbon
TOP	Technical Operations Plan
TOX	Total organic halogens
transmissivity	The rate at which water is transmitted through a unit width under a unit hydraulic gradient.
upgradient	In the direction of increasing hydraulic static head; the opposite of the direction in which ground water flows.
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
water table	That surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

APPENDIX B

STATEMENT OF WORK

REF: 55X

CONTRACTOR'S COPY

55X

ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 21

2. PROC INSTRUMENT ID NO. (PIIN)	3. CALL/ORDER NO.	4. DATE OF ORDER*	5. REQUISITION/PURCHASE REQUEST PROJECT NO.	6. CERTIFIED FOR NATIONAL DEFENSE UNDER
F33615-83-D-4002	0036	86JUL30	FY7624-86-01012	DO-S1

Mark all packages & papers with this number.

DOC REG 2/DMS REG 1 RATING

7. ISSUED BY CODE FQ8419

DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB OH 45433-6503
CONTRACT NEGOTIATOR:
GLENNITH C. JOHNSON
PHONE: (513)-255-3042

8. ADMINISTERED BY CODE S1403A

DCASMA CHICAGO
O'HARE INTERNATIONAL AIRPORT
P.O. BOX 66911
CHICAGO IL 60666-0911

9. CONTRACTOR NAME AND ADDRESS CODE 1S346 FACILITY CODE

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE IL 60068

PHONE: (312)-297-6120
COUNTY: COOK

MAILING DATE
SEP 19 1986
DUPLICATE ORIGINAL

IF "9" FOR MULTIPLE FACILITIES SEE SECT "G"

10. MAIL INVOICES TO

11. DISCOUNT FOR PROMPT PAYMENT

				NET DAYS
1ST	N	%	DAYS	
2ND		%	DAYS	OTHER
3RD		%	DAYS	IF "9" SEE SECT "B"

12A. PURCHASE OFFICE POINT OF CONTACT

LRX/L72/LRX

12B. RESERVED FOR SERVICE/AGENCY USE

13. PAYMENT WILL BE MADE BY CODE S1402A IF "9" SEE SECT "G"

DCASR CHICAGO
O'HARE INTERNATIONAL AIRPORT
P.O. BOX 66475
CHICAGO IL 60666-0475

14. TYPE CONTRACTOR	15. SECURITY A. CLAS	B. DATE OF DD 254
A	U	

16. CONTRACT ADMINISTRATION DATA A. FAST PAY	B. CONTRACT (1) KIND	(2) TYPE	C. ABSTRACT RECIP ADP POINT	D. SPL CONT PROVISIONS	E. CONT ADMIN FUNC LMT	17. (RESERVED)	18. SVC/AGENCY USE	19. SURV CRIT	20. TOTAL AMOUNT
	0	9						C	NOT-TO-EXCEED $ 175,623.00

21. APPROPRIATION AND ACCOUNTING DATA

A. ACCT CLA	B. ACRN	C. APPROPRIATION	D. LIMIT SUBHEAD	E. SUPPLEMENTAL ACCOUNTING CLASSIFICATION
0	AA	5763400		306 4740 5H4499 000007 59200 000000 528500

F. CPN RECIPIENT DODAAD	G. OBLIGATION AMOUNT	H. NON-CLIN/ELIN PAYMENT PROV	I. SVC AGENCY USE
F28500	$175,623.00		FY7624-86-01012

22A. TYPE OF ORDER

DELIVERY [X]
PURCHASE [ ]

B. NON-DOD CONTRACT NO.
This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.

Reference your _____

Furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155* (EXCEPT CLAUSE NO 13 APPLIES ONLY IF THIS BOX [ ] IS CHECKED, AND NO IS IF THIS BOX [ ] IS CHECKED), special provisions _____ and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)( ) or as specified in the schedule if within the U.S., its possessions or Puerto Rico; if otherwise, under 2304(a)(6).

[ ] If checked, Additional General Provisions apply, supplier shall [illegible] "Acceptance" on DD Form 1155 and return ___ copies.

*If quantity accepted by the Government is same as quantity ordered, indicated by ✓ mark. If different enter actual quantity accepted below quantity ordered and encircle.

23. UNITED STATES OF AMERICA BY: HOWARD E. MARKS JR. 9/12/86 (YYMMMDD)
BY: NAME OF CONTRACTING/ORDERING OFFICER AND DATE

24. TOTAL

25. DIFFERENCES

25. QUANTITY ORDERED HAS BEEN
[ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS STATED

26. SHIP NO.

27. D.O. VOUCHER NO.

29. INITIALS

[ ] PARTIAL [ ] FINAL

31. PAID BY

32. Amount Verified Correct For

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

30. PAYMENT
[ ] COMPLETE [ ] PARTIAL [ ] FINAL

33. CHECK NUMBER

34. BILL OF LADING NO.

35. I CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT

SIGNATURE AND TITLE OF CERTIFYING OFFICER

36. RECEIVED AT	37. RECEIVED BY	38. DATE RECEIVED	39. TOTAL CONTAINERS	40. S/R ACCOUNT NUMBER	41. S/R VOUCHER NO.

AFSC FORM 700 AUG 80

*When used as a formal contract this will be the effective date.

AFSC—Andrews AFB Md 1980

PREVIOUS EDITION IS OBSOLETE.

PART I SECTION B OF THE SCHEDULE SUPPLIES LINE ITEM DATA	1. PROC INSTRUMENT ID NO. (PIIN) F33615-83-D-4002	2. SPIIN 0036	3. PAGE 2 OF 21

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0001	1	LO	$ N	$ N

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
U	AA	N		

14. SITE CODES A.PSA B.ACP C.POD: D D D
15. NOUN: AIR SAMPLING, ANALYSIS, AND DATA
16. SVC/AGENCY USE:

17. PR/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %	19. CONTRACT PERCENT FEE %	20. SVC ID NO.	21. ITEM/PROJ MGR
FY7624-86-01011-0001				FY7624

22. 1ST DISCOUNT A. % B. DAYS	23. 2ND DISCOUNT A. % B. DAYS	24. 3RD DISCOUNT A. % B. DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER % B. UNDER %	27. TYPE CONTRACT	28. OPR
					Y	

29. DESCRIPTIVE DATA

CONDUCT WORK IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT# 1 , THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

THIS DELIVERY ORDER CONFIRMS THE VERBAL AUTHORITY TO PROCEED GIVEN BY THE CONTRACTING OFFCER TO THE CONTRACTOR ON 86 JUL 10 PURSUANT TO THE "EMERGENCY SERVICES" CLAUSE OF THE BASIC CONTRACT. DO NOT DUPLICATE.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0002	1	LO	$ N	$ N

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
U	AA	N		

14. SITE CODES A.PSA B.ACP C.POD: D D D
15. NOUN: SUPPORT (0001)
16. SVC/AGENCY USE:

17. PR/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %	19. CONTRACT PERCENT FEE %	20. SVC ID NO.	21. ITEM/PROJ MGR
FY7624-86-01011-0002				FY7624

22. 1ST DISCOUNT A. % B. DAYS	23. 2ND DISCOUNT A. % B. DAYS	24. 3RD DISCOUNT A. % B. DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER % B. UNDER %	27. TYPE CONTRACT	28. OPR
					Y	

29. DESCRIPTIVE DATA

PROVIDE SUPPORT IN ACCORDANCE WITH THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT.

THIS DELIVERY ORDER CONFIRMS THE VERBAL AUTHORITY TO PROCEED GIVEN BY THE CONTRACTING OFFCER TO THE CONTRACTOR ON 86 JUL 10 PURSUANT TO THE "EMERGENCY SERVICES" CLAUSE OF THE BASIC CONTRACT. DO NOT DUPLICATE.

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.

N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED
E = ESTIMATED
– (IN QTY AND $) = DECREASE
+ OR – (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: $ = SOURCE, D = DESTINATION, O = INTERMEDIATE

AFSC FORM JAN 80 705 PREVIOUS EDITION WILL BE USED.

AFSC—Andrews AFB Md 1980

PART I SECTION B OF THE SCHEDULE SUPPLIES LINE ITEM DATA	1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIIN	3.
	F33615-83-D-4002	0036	PAGE 3 OF 21

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0004	1	LO	$ N	$ N

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
U	AA	N		

14. SITE CODES A.PGA B.ACP C.FOB: D D D

15. NOUN: CHEM/PHYS ANALYSIS AND DATA

16. SVC/AGENCY USE

17. PR/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %	19. CONTRACT PERCENT FEE %	20. SVC ID NO.	21. ITEM/PROJ MGR
FY7624-86-01012-0004				FY7624

22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER % B. UNDER %	27. TYPE CONTRACT	28. OPR
					J	

29. DESCRIPTIVE DATA

PERFORM CHEMICAL TESTS IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT# 1 , THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

THIS DELIVERY ORDER CONFIRMS THE VERBAL AUTHORITY TO PROCEED GIVEN BY THE CONTRACTING OFFCER TO THE CONTRACTOR ON 86 JUL 10 PURSUANT TO THE "EMERGENCY SERVICES" CLAUSE OF THE BASIC CONTRACT. DO NOT DUPLICATE.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
			$	$

9. SCTY CLAS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR

14. SITE CODES A.PGA B.ACP C.FOB

15. NOUN

16. SVC/AGENCY USE

17. PR/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP %	19. CONTRACT PERCENT FEE %	20. SVC ID NO.	21. ITEM/PROJ MGR

22. 1ST DISCOUNT A. % B.DAYS	23. 2ND DISCOUNT A. % B.DAYS	24. 3RD DISCOUNT A. % B.DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER % B. UNDER %	27. TYPE CONTRACT	28. OPR

29. DESCRIPTIVE DATA

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.

N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED

E = ESTIMATED
– (IN QTY AND $) = DECREASE
+ OR – (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: $ = SOURCE, D = DESTINATION, O = INTERMEDIATE

AFSC FORM JAN 80 705

PREVIOUS EDITION WILL BE USED.

AFSC—Andrews AFB Md 1980

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
Elmendorf Air Force Base, Alaska

I. DESCRIPTION OF WORK

The overall objective of the Phase II investigation is to define the magnitude, extent, direction and rate of movement of identified contaminants. A series of staged field investigations may be required to meet this objective.

During the initial survey (Stage 1) performed at Elmendorf AFB, twelve sites (Sites D-5, SP-7, SP-10, D-7, SP-5, SP-12, D-17, SP-11, FT-1, SP-2, SP-14, IS-1) were investigated by a generalized approach consisting of installing monitoring wells and sampling soils and groundwater for basic screening parameters (i.e.. Total Organic Carbon, Total Organic Halogens, Oils and Greases, etc.).

This Stage 2 effort will build on the information gathered for all the sites previously investigated in Stage 1 to obtain information to completely characterize groundwater hydrology and site contamination. Additional monitoring wells will be installed and sampling performed to characterize groundwater hydrology and identify any contaminants migrating from these sites. A general water level survey will be performed, along with monitoring of selected base water supply wells.

The purpose of this task is to undertake a field investigation at Elmendorf Air Force Base, Alaska: (1) to confirm the presence of suspected contamination within the specified areas of investigation; (2) to determine the magnitude of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on State or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The Phase I and Phase II, Stage 1 IRP Reports (mailed under separate cover) incorporate the background, description and previous studies of all the sites for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. Technical Operations Plan

Develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description for the proposed work effort. (See Sequence No. 19, Item VI below). This plan shall be explicit with regard to field procedures. The format for the TOP is provided under separate cover. The TOP shall be mailed to the USAFOEHL POC within two (2) weeks after Notice to Proceed for this delivery order.

B. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection at study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations (i.e., drilling and sampling) as specified in Sequence No. 7, Item VI below). Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with the regulatory agencies.

C. General Field Work

1. Installation of Groundwater Monitoring Wells

a. Monitor ambient air during all well drilling and soil boring work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs.

b. Determine the exact location of all monitor wells and soil borings during the planning/mobilization phase of the field investigation. Consult with the Alaskan Air Command Bioenvironmental Engineering (AAC/SGPB) to minimize disruption of station activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work.

c. Comply with the U.S. EPA Publication 330/9-S1-002, NEIC Manual for Groundwater/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

d. All well drilling, development, purging, and sampling methods must conform to State and other applicable regulatory agency requirements. Cite references in an appendix of the Report.

e. Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

f. Drill all monitoring wells using the following specifications:

(1) Drill all wells using techniques most appropriate for the geological formation underlying each site. If drilling fluid additives such as bentonite or polymers are used, ensure their components will not interfere with the chemical analyses to be performed on samples. Biodegradable organic drilling fluid additives are not permitted. Also, if an additive is used, split a sample of the additive. Analyze one part of the sample and send the other part to USAFOEHL/SA for analysis. Prior to well completion, flush all boreholes constructed with drilling mud by using drinking water.

(2) Take samples for stratigraphic control purposes at 5-foot intervals, where possible, and log them. Include pilot boring logs and well completion summaries in the Final Report (Sequence No. 4, Item VI, below).

(3) Drill a maximum of 11 wells. Total footage of all wells in this task shall not exceed 580 linear feet. Refer to the site specific details in Section ID.

(4) Construct each well with 2-inch inside diameter Schedule 40 PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Screen each well using 2-inch diameter casing having up to 0.010 inch slots; use the same material as that of the casing. Cap the bottom of the screen. Flush thread all connections.

(5) Screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all wells a minimum of 10 feet. A minimum of 8 feet of well screen should be below the groundwater table if feasible. -High seasonal fluctuations in groundwater levels should be considered when designing the intervals of well screening needed.

g. Complete all monitoring wells using the following specifications:

(1) Once the casing is installed, allow the soil formation to collapse around the well screen, if appropriate. Where required, use a gravel pack of washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a bentonite seal (two foot minimum) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with bentonite cement grout.

(2) Well surface completion will depend upon location. AAC/SGPB will determine which method is used at each well:

(a) If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and cement a protective locking lid in place. The protective lid shall consist of a cast-iron valve box assembly centered in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

(b) If an above ground surface completion is used, extend the well casing two or three feet above land surface. Prove an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid at the casing. Install three

3-inch diameter steel guard posts if AAC/SGPB determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

Provide locks for all wells. Turn the lock keys over to the AAC/SGPB POC following completion of the field work.

(3) Develop each well with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible.

(4) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 feet. Horizontally locate the new wells to an accuracy of 1.0 feet and record the position on both project and site specific maps. Use bench marks traceable to a USCGS or USGS survey marker if available.

(5) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 feet. Report in terms of mean sea level. Measure static water levels in wells at the time of well development and prior to sampling.

2. Well Abandonment

a. Determine available techniques for well abandonment that are applicable to the type of monitoring wells installed and geological conditions at each well site. After consultation with the USAFOEHL and AAC POCs, abandon any Stage 1 well that is damaged or inoperable. A maximum of eight wells will be abandoned as part of this effort. Recommend the technique(s) appropriate to the future abandonment of all other monitoring wells (abandonment not part of this contract).

b. Tremie grout abandoned wells to the surface with a bentonite grout. It is especially important to insure that they be adequately resealed to preclude future migration of contaminants.

c. Permanently mark each location where wells were abandoned. Record the location on a project map for each specific site.

3. Well Cleanup. Remove any well cuttings if requested by the AAC POC and clean the general area following the completion of each well.

4. Sampling and Analysis

a. Strictly comply with the sampling techniques, maximum holding times, and preservation of samples as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,

2nd Edition (USEPA, 1984); and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983). All chemical analyses (water and soil) shall meet the required limits of detection for the applicable EPA method identified in Appendix 1.

b. Allow wells to stabilize after development for a minimum of one day before sampling.

c. Sample wells during maximum groundwater flow conditions (late summer/early fall). Consider weather and hydrogeological parameters in the decision making process. As the first step of groundwater sampling operations at each well, take water level measurements to the nearest 0.01 foot with respect to an established surveyed point on top of the well casing. After measurements are taken, purge the well using a submersible pump. Purge until a minimum of three complete well volumes of water have been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized, using the following criteria: pH ± 0.1 unit, temperature ± 0.5°C, specific conductance ± 10 µmhos. Include the final measurements in the results section of the draft and final reports

d. Collect well water samples with a Teflon bailer. During sample collection from all wells, examine the surface of the water table for the presence of hydrocarbons and, if applicable, measure the thickness of the hydrocarbon layer. If floating hydrocarbons are noted, use a "thief sampler" or similar device to collect the water sample.

e. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report specified in Item VI below.

f. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the base POC. The base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the base POC for packaging the split samples. Immediately ship (within 24 hours) the POC selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

Include the following information with the samples sent to the USAFOEHL:

(1) Purpose of sample (analyte and sample group)

(2) Installation name (base)

(3) Sample number

(4) Source/location of sample

(5) Contract Task Numbers and Title of Project

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

(7) Volumes removed before sample taken

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

(9) Preservatives used

(10) Date and time collected

(11) Collector's name or initials

Forward this information with each sample by properly completing an AF Form 2752A "Environmental Sampling Data" and/or AF Form 2752B "Environmental Sampling Data - Trace Organics", working copies of which have been provided under separate cover. Label each sample container to reflect the data in (1), (2), (3), (4), (9), (10), and (11). In addition, copies of field logs documenting sample collection should accompany the samples.

Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

g. Analyze an additional 10% of all samples, for each parameter, for field quality control purposes (field duplicates), as indicated in Appendix 1. . Include all quality control procedures and data in draft and final reports. Duplicates shall be indistinguishable from other analytical samples so that the analytical personnel cannot determine which samples are duplicates.

h. For those methods which employ gas chromatography (GC) as the analytical technique (i.e., E602, SW8080, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL); confirm positive concentrations by second-column GC. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of the report. Include the results of all second-column GC confirmational analyses in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes upon the first-column analysis.

The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of actual number of field samples (to include field QA/QC samples). The total number of samples for each GC method listed in Appendix 1 includes this allowance.

i. Analyze water collected as specified in Section D for those parameters summarized in Appendix 3. The required detection limits and methods for these analyses are delineated in Appendix 1.

j. All chemical/physical analyses shall conform to state and other applicable federal and local regulatory agency legal requirements. If a regulatory agency requires that an analysis or analyses be performed in a certified laboratory, assure compliance with the requirement by furnishing documentation showing laboratory certification with the first analyses results to USAFOEHL/TS.

5. Decontamination Procedures

a. Decontaminate all sampling equipment prior to use and between samples to avoid cross contamination. Wash equipment with a laboratory-grade detergent followed by clean water, solvent (methanol) and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely.

b. Dedicate a monofilament line or steel wire used to lower bailers for each well; do not use a line in more than one well. The calibrated water level indicator for measuring well volume and fluid elevation must be decontaminated before use in each well.

c. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated areas, if possible.

6. Plot and map all field data collected for each site according to surveyed positions. Identify or estimate the nature of contamination and the magnitude and potential for contaminant flow within each site to receiving steams and groundwater.

7. Conduct a premobilization survey of all base sites. The purpose of the survey is to meet with base personnel, finalize the actual field techniques used in the effort, evaluate condition of Stage 1 wells and designate borehole and monitoring well locations. USAFOEHL representatives will accompany the contractor during the premobilization survey, if possible. Regulatory agency representatives may also accompany the contractor during the premobilization survey. The USAFOEHL Program Manager will notify the contractor not later than one week following the Notice to Proceed (NTP) of the exact number of personnel to accompany the contractor on the premobilization survey.

9. Any precious metals encountered on USAF installations during site investigations remain the property of the U.S. Air Force. Disclose the area of discovery to only the USAFOEHL program manager and the base commander. Discontinue work at the area of discovery until receiving guidance from the USAFOEHL. Work scheduled in other areas shall continue.

D. Specific Site Work

In addition to items delineated above, conduct the following specific actions at the sites listed below:

1. Base Water Table Map

Prepare a detailed water table map of the entire base. This map shall be based upon accurate water table elevation from all accessible water table wells, Stage 1 monitoring wells, and surface water bodies on the station. A maximum of 30 water elevations shall be determined. The water levels shall be obtained by survey accurate to 0.01 foot vertically and 10 feet horizontally.

2. Water Supply Wells

Obtain water samples from base water supply wells numbers 1, 2, 16 and 52 (4 total) and analyze for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602) TDS and lead.

3. Ship Creek

Conduct a surface water sampling program for Ship Creek, based upon the results of the water table survey. Obtain one upstream water sample and samples from two different downstream locations. One of the downstream sample should be obtained just downstream of the point where Ship Creek changes from a losing to a gaining stream. Analyze the sample (3 total) for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), TDS and lead.

4. Sites D-5 and D-7

a. Conduct a metal detector survey to determine the boundaries of D-5 and D-7.

b. After site boundaries are determined, emplace four monitoring wells (2 at D-5 and 2 at D-7) approximately 100 feet downgradient of and parallel to the site boundaries. Install two upgradient monitoring wells, one for each site.

c. Obtain one water sample from each monitoring well at the sites, existing wells W-1, W-2, W-5, W-6 and the six new wells. Analyze each sample (10 total) for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), chlorinated organic pesticides (EPA Method 608), and TDS.

5. Sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14

a. Conduct a soil gas survey using an HNU or similar instrument to determine the areal extent of fuel contamination at each spill site.

b. Based upon the results of the soil gas survey and the locations of the base water supply wells, emplace one monitoring well each downgradient of sites SP-12, SP-11, FT-1, SP-14 and SP-2.

c. Obtain one water sample from each monitoring well at the sites, existing wells W-3, W-4, W-7, W-8, W-9, W-14, W-15, W-16, and W-17 and the five new wells. Analyze each sample (14 total) for petroleum hydrocarbons, purgeable aromatics (EPA Method 602) and TDS. In addition, analyze the water samples from wells W-7 and W-8 for major cations and anions and analyze the water samples from well W-14 and the new well downgradient of SP-11 for purgeable halocarbons (EPA Method 601) and lead.

6. Sites D-17 and IS-1

a. Obtain one groundwater sample from each monitoring well at the site, W-10, W-11, W-12, W-13, W-18 and W-19.

b. Obtain one surface water sample from Cherry Hill Ditch just east of Loop Road.

c. Analyze each water sample (7 total) for purgeable halocarbons (EPA Method 601).

E. General Guidance

1. Be cognizant of and observe the AF base rules and regulations while working in the area.

2. A minimum of 7 days advance notice prior to arrival on the base must be given to the AAC/SGPB. Clearance must be granted prior to arrival at the station.

F. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, and incorporate them into the next monthly R&D Status Reports to be forwarded to the USAFOEHL. In addition to the results, report the following: the time and dates for sample collection, extraction (if applicable) and analysis; the methods used and method detection limits achieved; a cross-reference for laboratory sample numbers and field sample numbers; a cross-reference of field sample numbers to sites; and include the chain-of-custody form for those sample data.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI below) and forward the report to USAFOEHL for review prior to submission of the draft report.

3. Immediately report to the USAFOEHL Program Manager via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking water aquifer). Follow the telephone notification with a written notice and lab raw data (e.g., chromatograms, etc.) within three days.

G. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI below) for Air Force review and comment. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality results, available geohydrologic cross sections, and laboratory and field QA/QC information. Follow the USAFOEHL supplied format (mailed under separate cover). The format is an integral part of this delivery order.

2. Results, conclusions and recommendations concerning the sites listed in this task which were produced in the technical report(s) of the previous staged work of IRP Phase II (mailed under separate cover), shall be used in the data reduction to plot any trends and arrive at the conclusions and recommendations of this effort's technical report (Sequence 4, Item VI below). The technical report of this effort shall be accomplished so that the report will reflect the combined up-to-date trend of each of the IRP Phase II sites listed herein.

3. In the results section, include water analysis results, field quality control sample data, internal laboratory quality controlled data (lab blanks, lab spikes, and lab duplicates), and laboratory quality assurance information. Provide second column confirmation results and include which columns were used, the conditions existing, and retention times. Summarize the specific collection techniques, analytical method, holding time, and limit of detection for each analyte (Standard Methods, EPA, etc.) in the Appendix.

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental consequences of discovered contamination, where known, based upon State or Federal standards.

5. In the recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination, where known.

c. Category III sites are those that will require remedial actions (ready for IRP Phase IV). In the recommendations for Category III sites, include any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any

dependency between sites in different categories. Include a list of candidate remedial action alternatives, including Long Term Monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, including a cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations.

6. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved final technical report in a separately bound document. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites by using contractor recommendations as a decision basis. Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when prioritizing sites. For Category III sites slated for long-term monitoring, develop site-specific estimates which detail the costs associated with (1) permanent installation of monitoring wells; (2) groundwater sampling interface equipment, including permanent installations of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of groundwater, etc. Only the cost requirement outlined in Sequence No. 2, Item VI, need be submitted.

H. Meetings

The contractor's project leader shall attend 2 meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall last for a duration of two eight hour days. Meeting location is anticipated to be Anchorage AK.

II. SITE LOCATIONS AND DATES:

Elmendorf Air Force Base

Dates to be established.

III. BASE SUPPORT:

A. Prior to any contractor digging or drilling, locate underground utilities and issue digging permits.

B. Provide the contractor with existing engineering plans, drawings, diagrams, aerial photographs, etc., as needed to evaluate sites under investigation.

C. Provide escort into restricted areas.

D. Arrange for and have available prior to the start-up of field work, the following services, materials, work space, and items of equipment to support the contractor conducting the survey:

1. Personnel identification badges and vehicle passes and/or entry permits.

2. An area (preferably paved) where drilling equipment can be cleaned and decontaminated. A source of potable water (i.e., ordinary outdoor water faucet) and 110/115 VAC electrical outlet must be available within 25 feet of the area for steam cleaner hookup.

3. A temporary office area not to exceed 100 square feet equipped with a Class A telephone for local and long distance phone calls. Contractor shall pay for any long distance telephone calls made by his personnel from this phone.

E. The base POC will select 10% of the split samples provided by the contractor, package them, and ensure they are picked up by the contractor within 24 hours of sample receipt.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Program Manager
Ms Dee A. Sanders
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AUTOVON 240-2158/2159
1-800-821-4528

2. MAJCOM and Elmendorf AFB Monitor
Lt Col David A. Nuss
AAC/SGPB
Elmendorf AFB AK 99506-5000
(907) 552-4282
AUTOVON 317-552-4282

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, and which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
20 (TOP)*	I.A	OTIME	86AUG14	86AUG14		15
7 (Health & Safety)	I.B	OTIME	86AUG14	86AUG14		3
3 (Prelim Data)	I.F.2	OTIME	***	***		3
4 (Tech. Rpt)	I.F.1	ONE/R	86NOV28	87JAN30	87APR30	**
2 (Cost Est)	I.G.6	O/TIME				*****
14		Monthly	86AUG29	86AUG29	****	3
15		Monthly	86AUG29	86AUG29	****	3

*The Technical Operations Plans (TOP) required for this stage is due within 2 weeks of the Notice to Proceed (NTP).

**Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force comments into the second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with a copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute remaining 24 copies of each draft report and 49 copies of the final report as specified by the USAFOEHL.

***Upon completion of the total analytical effort before submission of the first draft report.

****Submit monthly hereafter.

*****Submit with final report only.

Appendix 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter[a]	Method[c] Extraction/ Analysis)	Detection Limit	No. of Samples	QC	Total Samples
Petroleum hydrocarbons	E418.1	100 µg/L	27	3	30
Purgeable Halocarbons	E601	d	26	2	42[f]
Purgeable Aromatics	E602	d	31	3	51[f]
Pesticides	E608	d	10	1	17[f]
Total Dissolved Solids (TDS)	E160.1	10 mg/L[e]	31	3	34
Lead	E239.2	0.005 mg/L[e]	9	1	10
Major Cations and Anions[b]	E200.7, A403 A429	b			

[a]Specific analytes for purgeable organics and Pesticides are listed in Appendix 2.

[b]Major Cations and Anions shall be determined using the following analytical methods for the listed parameters and detection limits:

E200.7 Inductively coupled Plasma (ICP) Metals Screen for all 25 metals, with detection limits listed in the methods.

A403 Alkalinity, with carbonate, bicarbonate and hydroxide alkalinity determined with detection limits of 10 mg/L per species.

A429 Anions by Ion Chromatography for all 7 anions, with detection limits of 0.05 mg/L for fluoride and 0.1 mg/L for other anions.

[c]The methods cited in the analysis protocols come from the following sources:

"A" Methods — Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)

"E" Methods — E100 through E500 Methods
Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79-020 (USEPA, 1983)

E600 Series Methods
Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater
USEPA
Federal Register, Vol 49, No 209, 26 Oct 1984

[d]Detection limits for all parameters analyzed by GC shall be as stated in the respective methods. Report results for organics in water as µg/l; in soil as mg/kg. Positive identification is required for all analytes having concentration higher than the method detection limit; confirm positive concentrations by second-column GC. Analytes which cannot be confirmed shall be reported as "Not Dectected" in the body of the report. Include the results of both first and second-column data in the appendix of the report. Base the quantification of confirmed analytes upon the first-column analysis.

[e]Report results as mg/L. Report no more than two significant figures for any concentrations.

[f]Total number of samples includes second-column confirmation on 50% of field samples (to include field QC samples).

Appendix 2

Volatile Halocarbons - EPA Method 601

Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Chloromethane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene (TCE)
Trichlorofluoromethane
Vinyl chloride

Purgeable Aromatics-- EPA Method 602

Benzene
Chlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Ethylbenzene
Toluene

Chlorinated Organic Pesticides-- Method E608

Aldrin
alpha-BHC
beta-BHC
delta-BHC
gamma-BHC
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Toxaphene

Appendix 3

Analyses by Site
Elmendorf AFB

Analyte	Water Supply Wells	Ship Creek	Site D-5	Site SP-7	Site SP-10	Site D-7	Site SP-5	Site SP-12	Site D-17	Site SP-11	Site FT-1	Site SP2	Site SP-14	Site IS-1
Purgeable Halocarbons (E601)	4	3	5	--	--	5	--	--	4	2	--	--	--	3*
Purgeable Aromatics (E602)	4	3	5	1	1	5	2	2	--	2	2	2	2	--
Lead	4	3	--	--	--	--	--	--	--	2	--	--	--	--
TDS	4	3	5	1	1	5	2	2	--	2	2	2	2	--
Pesticides (E608)	--	--	5	--	--	5	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons	--	3	5	1	1	5	2	2	--	2	2	2	2	--
Major Cation and Anions	--	--	--	--	--	--	2	--	--	--	--	--	--	--

*Includes sample from Cherry Hill Ditch

PART I SECTION F OF THE SCHEDULE SUPPLIES SCHEDULE DATA	1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIIN	3. PAGE 21 OF 21
	F33615-83-D-4002	0036	

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0001	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87JUL31	A.	A. 1	U	FY7624	
B.	B.	B.	D.	D.	D.
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 86NOV28.
C. ALL DATA SHALL BE DELIVERED IAW ATTACHMENT# 1 OF THE BASIC CONTRACT AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 87APR30.
D. THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0002	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87JUL31	A.	A. 1	U	FY7624	
B.	B.	B.	D.	D.	D.
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 86NOV28.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0004	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87JUL31	A.	A. 1	U	FY7624	
B.	B.	B.	D.	D.	C.
C.	C.	C.	E.	E.	E.

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 86NOV28.
C. ALL CHEMICAL ANALYSIS DATA SHALL BE DELIVERED IAW ATTACHMENT# 2 AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 87APR30.
D. THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A

*REPRESENTS A NET INCREASE/DECREASE WHEN NO + OR – APPEARS AFTER THE ITEM NO.
E = ESTIMATED
– (IN QTY) = DECREASE
+ OR – (IN ITEM NO.) = ADDITION OR DELETION

APPENDIX C

WELL NUMBERING SYSTEM

GROUND WATER WELL, BASE SUPPLY WELL, AND SURFACE WATER SAMPLE NUMBERING SYSTEM

GROUND WATER MONITOR WELLS

The ground water monitor well numbering system consists of two fields. The Phase II, Stage 1 wells are numbered W-number. The well numbers were given sequentially by installation date. The Stage 2 wells are numbered GW-number, letter. The third field indicates the sequential order in which the wells were drilled, lettered consecutively beginning with the letter "A."

Phase II Sites	Stage 1 Monitor Wells	Stage 2 Monitor Wells
Site D-5 - Sanitary Landfill	W-1, W-2	GW-1A, GW-1B, GW-1C
Sites SP-7 and SP-10 - Pumphouse No. 3 JP-4 Fuel Spills	W-3, W-4	
Site D-7 - Sanitary Landfill	W-5, W-6	GW-2A, GW-2B, GW-2C
Site SP-5 - JP-4 Tank Spill	W-7, W-8	
Site SP-12 - JP-4 Fuel Line Leak	W-9	GW-3A
Site D-17 - Shop Waste Disposal	W-10, W-11, W-12, W-13	
Site SP-11 - JP-4 Fuel Line Leak	W-14	GW-4A
Site FT-11 - Fire Training Area	W-15	GW-5A
Site SP-2 - JP-4 Fuel Line Leak	W-16	GW-6A
Site SP-14 - MOGAS Spill	W-17	GW-7A
Site IS-1 - Building 42-400 Floor Drains	W-18, W-19	

BASE SUPPLY WELLS

As listed in Table 2 of the text, the following base supply wells were sampled:

Well	Building	Depth (ft)	Aquifer	Yield (gpm)	Condition	Location
BW-1	23-990	16	S	1350	in use	S of N-S runway
BW-2	22-001	850	A	840	in use	S of W power plant
BW-3	23-100	166	A	36	in use	Golf course pro shop

SURFACE WATER SAMPLES

Three surface water samples were obtained from Ship Creek:

Sample Number	Location with Respect to Bridge on Davis Highway
SC-1	300 feet upstream
SC-2	300 feet downstream
SC-3	500 feet downstream

One water sample, CH-1, was obtained from Cherry Hill Ditch at Site D-17, as shown in Plate 2.

APPENDIX D

BORING AND WELL COMPLETION LOGS

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL SAND SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL SAND CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

SOIL CLASSIFICATION CHART

MATERIAL SIZE	PARTICLE SIZE			
	LOWER LIMIT		UPPER LIMIT	
	MILLIMETERS	SIEVE SIZE*	MILLIMETERS	SIEVE SIZE*
SAND				
FINE	.074	#200*	0.42	#40*
MEDIUM	0.42	#40*	2.00	#10*
COARSE	2.00	#10*	4.76	#4*
GRAVEL				
FINE	4.76	#4*	19.1	3/4"*
COARSE	19.1	3/4"*	76.2	3"*
COBBLES	76.2	3"*	304.8	12*
BOULDERS	304.8	12*	914.4	36"

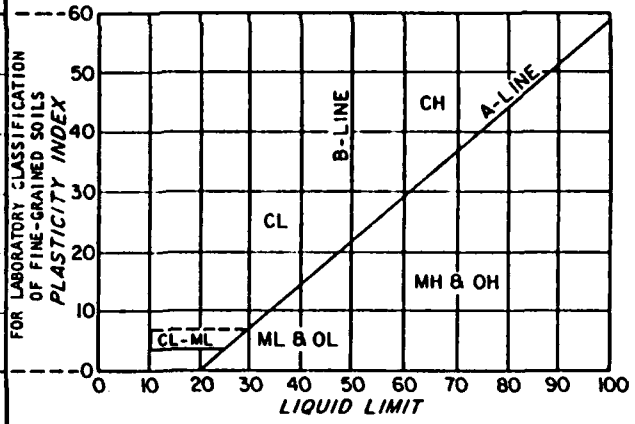
*U.S. STANDARD *CLEAR SQUARE OPENINGS

GRADATION CHART

EXPLANATION:

15 — THE NUMBER OF BLOWS REQUIRED TO DRIVE THE 2.0" O.D. BY 1.4" I.D. STANDARD SPLIT SPOON SAMPLER 12" OR LENGTH INDICATED WITH A 140 POUND HAMMER FALLING 30".

DEPTH OF DISTURBED SAMPLE OBTAINED WITH THE SPLIT SPOON SAMPLER.



PLASTICITY CHART

NOTES: 1. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE CLASSIFICATIONS OR INTERMIXED STRATA.

2. WHEN USED ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS:

COHESIVE SOILS (APPROXIMATE SHEARING STRENGTH IN KSF)		COHESIONLESS SOILS	
VERY SOFT	LESS THAN 0.25	VERY LOOSE	THESE ARE USUALLY
SOFT	0.25 TO 0.5	LOOSE	BASED ON AN EXAMINATION
MEDIUM STIFF	0.5 TO 1.0	MEDIUM DENSE	OF SOIL SAMPLES,
STIFF	1.0 TO 2.0	DENSE	PENETRATION RESISTANCE,
VERY STIFF	2.0 TO 4.0	VERY DENSE	AND SOIL DENSITY DATA
HARD	GREATER THAN 4.0		

3. WHEN USED ON THE BORING LOGS, THE FOLLOWING TERMS INDICATE THE PERCENTAGES OF THE MINOR SOIL COMPONENTS: SOME; 10 TO 20% TRACE; 0 TO 10%

4. ELEVATIONS REFER TO MEAN SEA LEVEL (MSL).

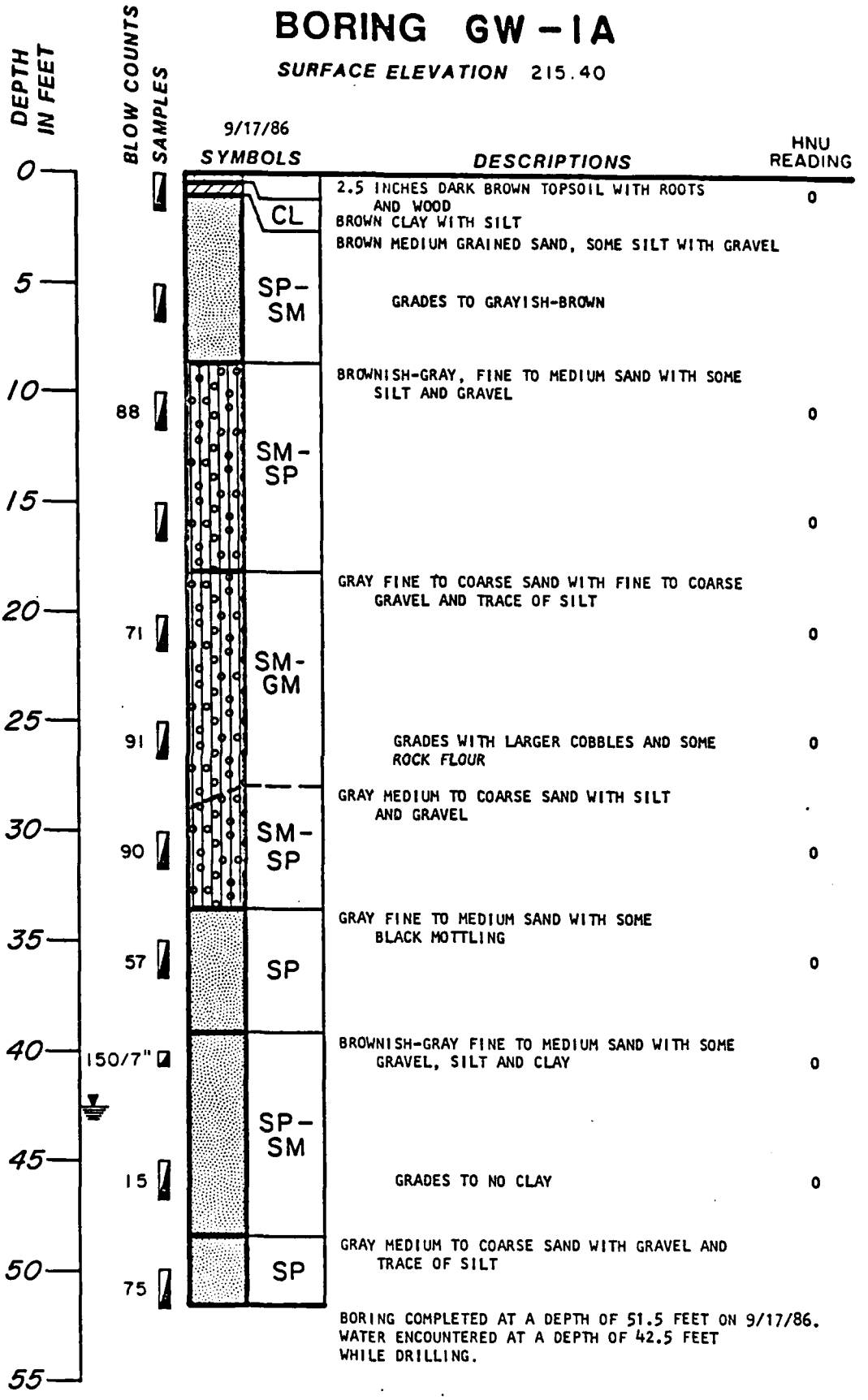
UNIFIED SOIL CLASSIFICATION SYSTEM AND KEY TO LOG OF BORINGS

Dames & Moore

PLATE D-1

BORING GW-1A

SURFACE ELEVATION 215.40



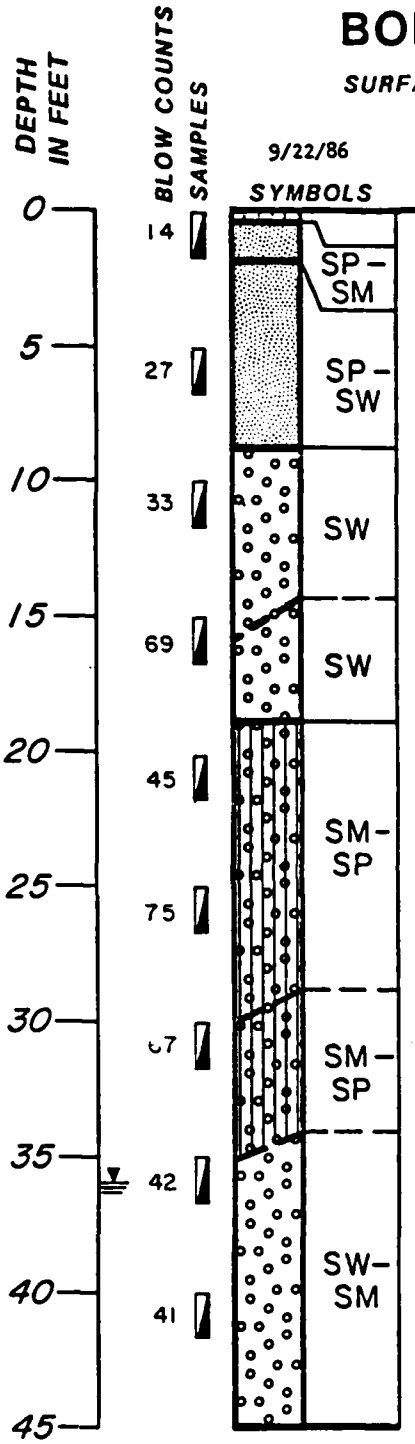
LOG OF BORING

PLATE D-2

BORING GW-1B

SURFACE ELEVATION 202.60

9/22/86



DESCRIPTIONS	HNU READING
2 INCHES BROWN TOPSOIL WITH LEAVES AND ROOTS 2 INCHES BROWN CLAY BLACK FINE GRAINED SAND WITH SILT AND TRACE OF GRAVEL, SLIGHT ODOR	0
BROWN FINE TO COARSE SAND WITH GRAVEL AND SILT	
GRADES TO TRACE OF GRAVEL	0
GRAYISH-BROWN FINE TO COARSE SAND WITH FINE TO COARSE GRAVEL AND SILT	0
GRADES TO BROWN FINE TO COARSE SAND WITH SILT AND SOME GRAVEL	0
GREENISH-GRAY MEDIUM TO COARSE SAND WITH GRAVEL AND SILT	0
GRADES TO LESS SILT	0
GRADES TO BROWN FINE GRAINED SAND WITH MEDIUM, ROUNDED GRAVEL AND TRACE OF SILT	0
BROWN FINE TO COARSE SAND WITH GRAVEL AND SOME TO TRACE OF SILT	0

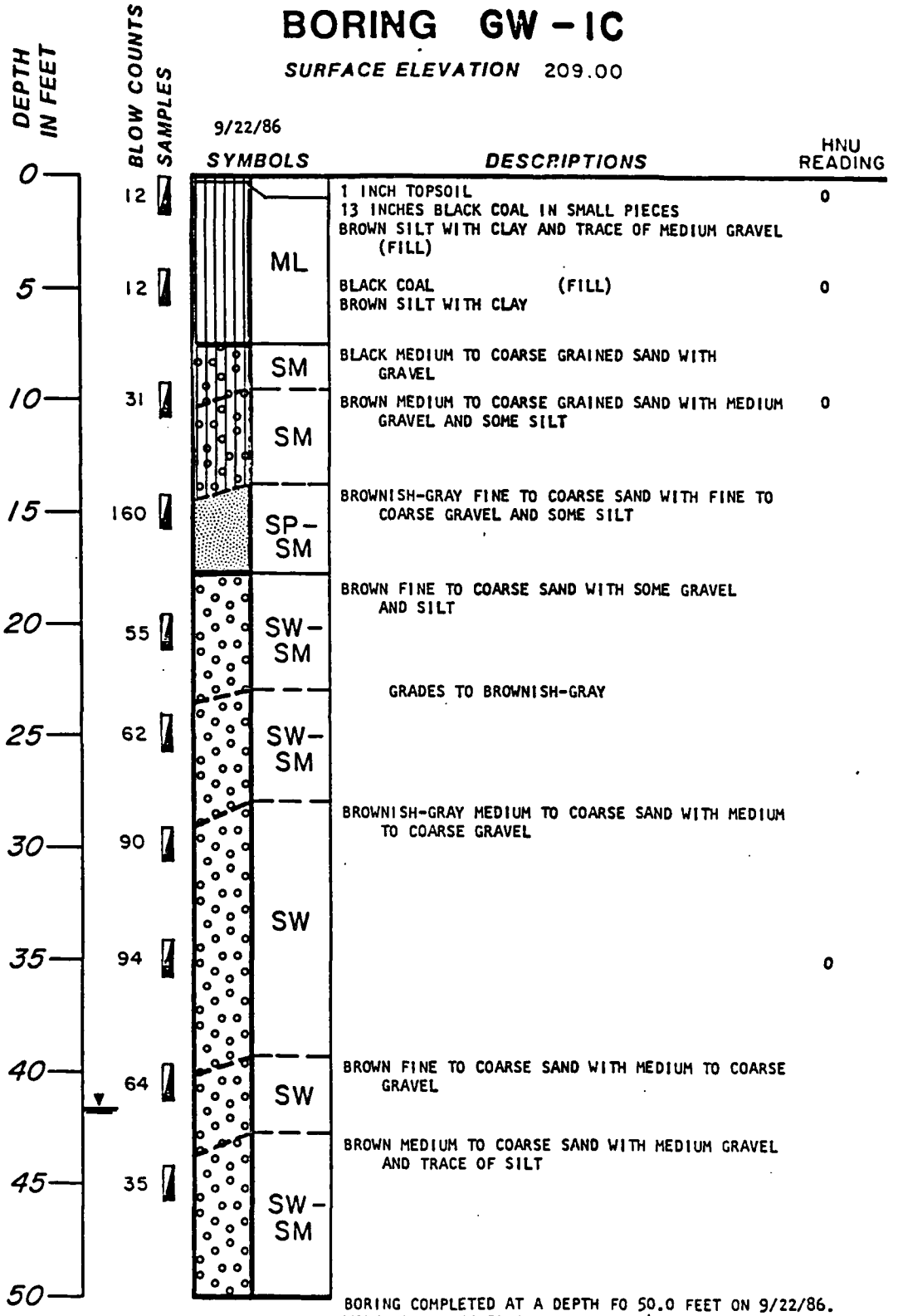
BORING COMPLETED AT A DEPTH OF 45.0 ON 9/21/86.
WATER ENCOUNTERED AT A DEPTH OF 36.0 FEET
WHILE DRILLING.

LOG OF BORING

PLATE D-3

BORING GW-1C

SURFACE ELEVATION 209.00

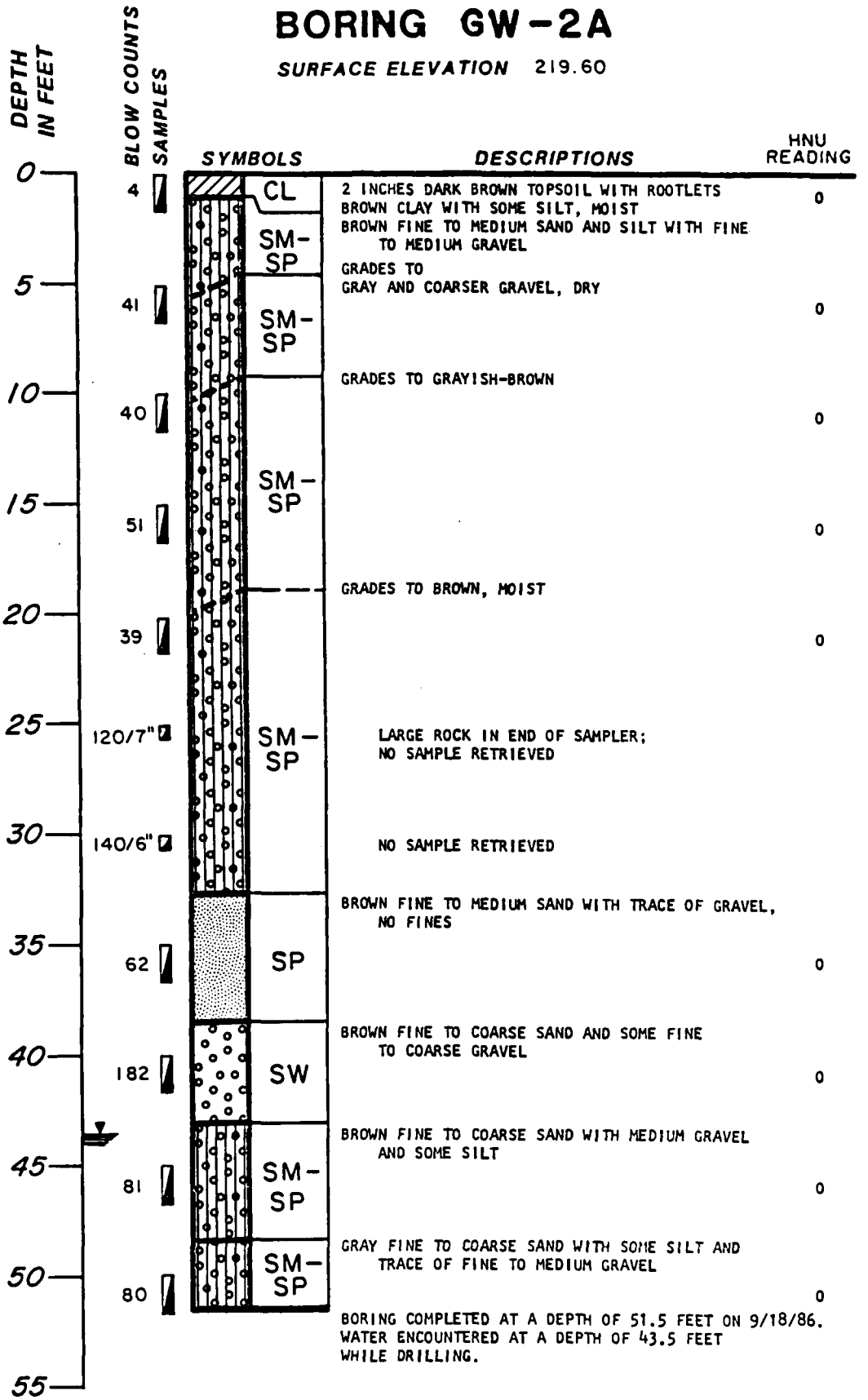


LOG OF BORING

PLATE D-4

BORING GW-2A

SURFACE ELEVATION 219.60

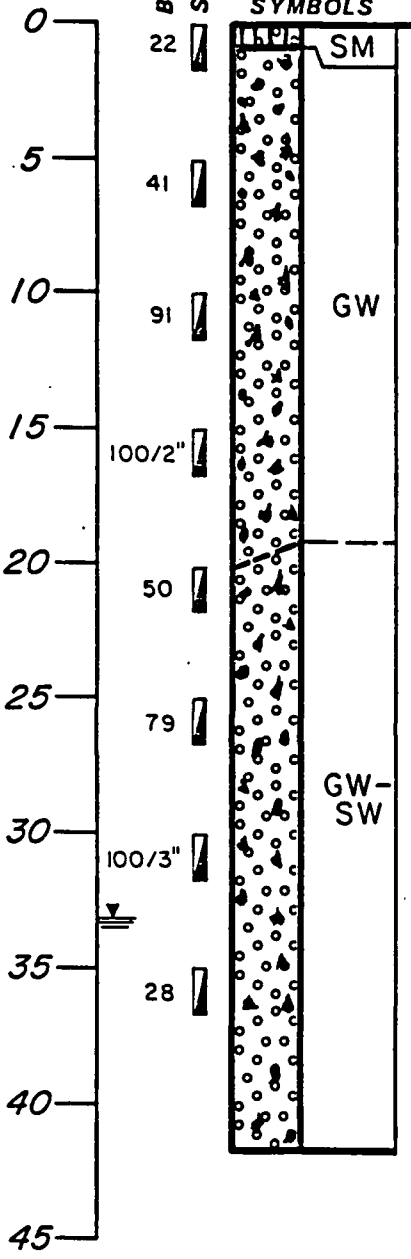


LOG OF BORING

PLATE D-5

BORING GW-2B

SURFACE ELEVATION 198.50



DESCRIPTIONS	HNU READING
BROWN SANDY SILT WITH TRACE OF FINE GRAVEL	0
BROWN SANDY GRAVEL WITH TRACE OF SILT	0
	0
	0
BROWN FINE TO COARSE SILTY SAND AND GRAVEL	0
	0
	0
	0
	0

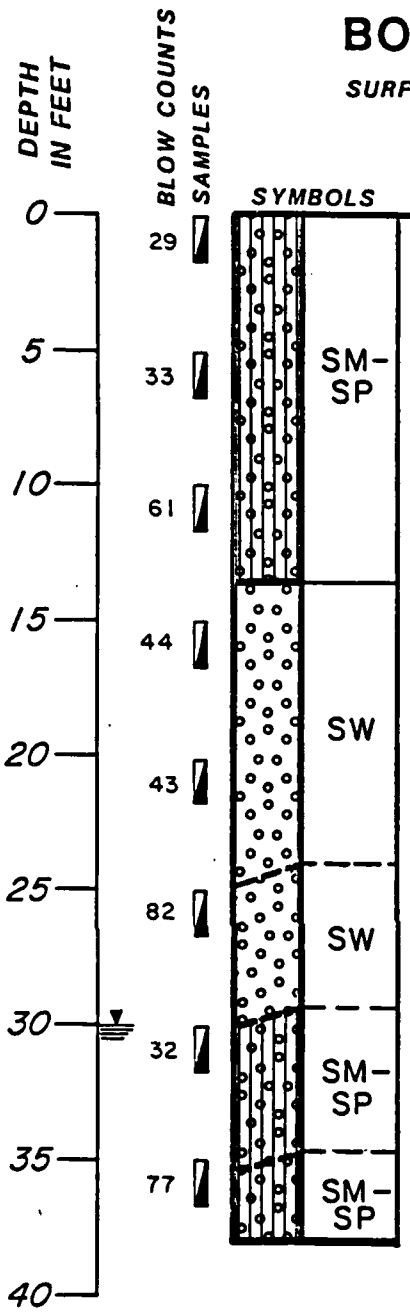
BORING COMPLETED AT A DEPTH OF 41.5 FEET ON 9/19/86.
WATER ENCOUNTERED AT A DEPTH OF 33.0 FEET
WHILE DRILLING.

LOG OF BORING

PLATE D-6

BORING GW-2C

SURFACE ELEVATION 193.80



DESCRIPTIONS	HNU READING
BROWN FINE TO MEDIUM SAND WITH SILT AND TRACE OF GRAVEL	
GRADES TO MORE GRAVEL	
BROWN FINE TO COARSE SAND AND SOME MEDIUM GRAVEL	
BROWN FINE TO MEDIUM SAND WITH MEDIUM TO LARGE GRAVEL AND NO FINES	
BROWN MEDIUM TO COARSE SAND WITH MEDIUM TO COARSE GRAVEL AND TRACE TO SOME SILT	
GRAY FINE TO COARSE SAND WITH MEDIUM TO COARSE GRAVEL AND SILT SEWAGE.ODOR?	

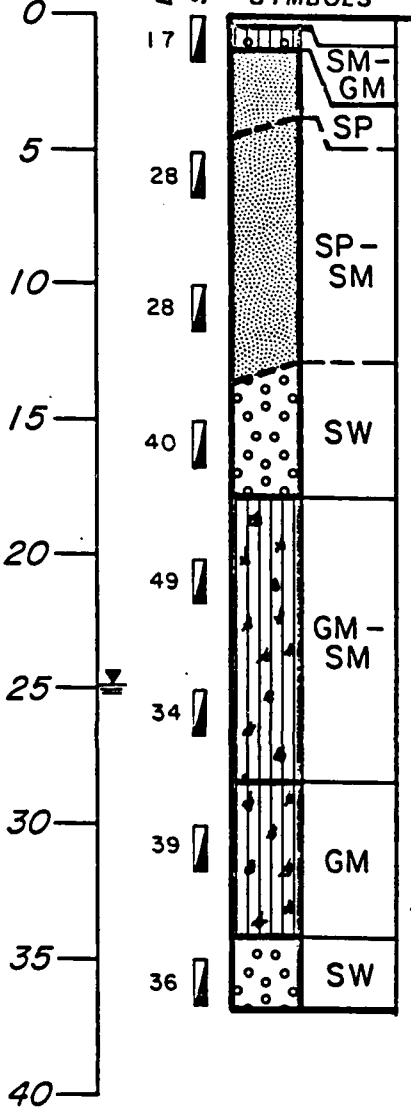
BORING COMPLETED AT A DEPTH OF 38.0 FEET ON 9/23/86.
WATER ENCOUNTERED AT A DEPTH OF 30.0 FEET WHILE DRILLING.
HNU INSTRUMENT NOT FUNCTIONING.

LOG OF BORING

PLATE D-7

BORING GW-3A

SURFACE ELEVATION 176.70



SYMBOLS	DESCRIPTIONS	HNU READING
SM-GM	2 INCHES TOPSOIL WITH ROOTLETS BROWN SILT WITH SOME SAND AND GRAVEL	0
SP	BROWN FINE TO MEDIUM SAND WITH TRACE TO SOME GRAVEL	
SP-SM	GRADES TO SOME GRAVEL AND TRACE OF SILT	0
		0
SW	BROWN AND GRAY FINE TO COARSE SAND WITH FINE TO COARSE GRAVEL AND TRACE OF SILT	0
GM-SM	BROWN SANDY GRAVEL WITH SOME SILT	0
		0
GM	BROWNISH-GRAY SANDY GRAVEL WITH SOME GRAY SILT, BLACK "GLOBS", SOLUBLE IN WATER, NO ODOR, IN BOTTOM OF SAMPLE	0
SW	BROWN FINE TO COARSE SAND WITH FINE TO COARSE GRAVEL	0

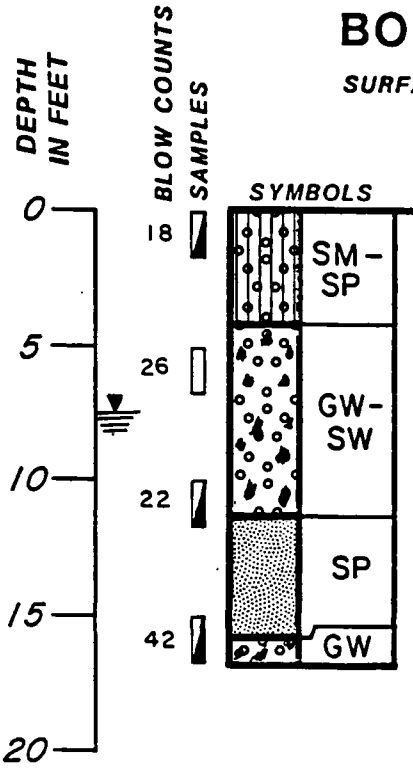
BORING COMPLETED AT A DEPTH OF 36.5 FEET ON 9/12/86.
WATER ENCOUNTERED AT A DEPTH OF 25.0 FEET WHILE DRILLING.

LOG OF BORING

PLATE D-8

BORING GW-4A

SURFACE ELEVATION 135.60



SYMBOLS	*DESCRIPTIONS*	HNU READING
SM-SP	1.5 INCHES TOPSOIL BROWN FINE TO MEDIUM SAND WITH SOME GRAVEL AND TRACE OF SILT	DOWNHOLE READING 55ppm
GW-SW	GRAY MEDIUM TO COARSE SAND WITH FINE TO COARSE GRAVEL SAMPLE NOT RETRIEVED	100ppm
SP	GRAY FINE TO MEDIUM SAND OILY SHEEN ON PIPE SMELLS LIKE SEWAGE	5ppm
GW	GRAY SANDY GRAVEL WITH TRACE OF SILT SMELLS LIKE FUEL	

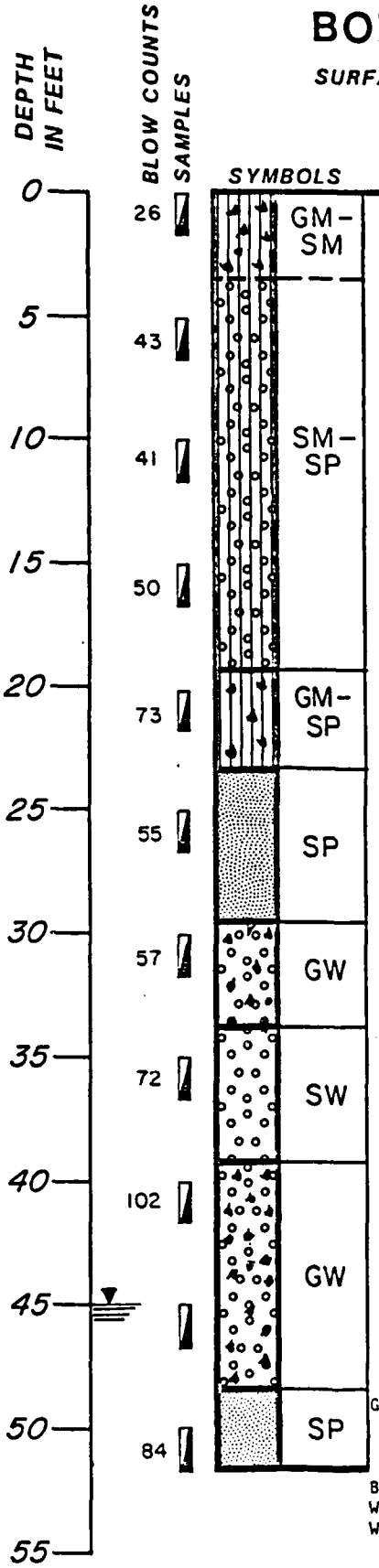
BORING COMPLETED AT A DEPTH OF 16.5 FEET ON 9/11/86.
WATER ENCOUNTERED AT A DEPTH OF 7.5 FEET
WHILE DRILLING.

LOG OF BORING

PLATE D-9

BORING GW-5A

SURFACE ELEVATION 204.20



SYMBOLS	DESCRIPTIONS	HNU READING
GM-SM	BROWN MEDIUM TO COARSE SAND WITH SILT AND GRAVEL	0
SM-SP	GRAYISH-BROWN FINE TO MEDIUM SAND WITH SILT AND FINE TO MEDIUM GRAVEL AND ROCK FLOUR, DRY	0
	GRADES TO MOIST	0
		0
GM-SP	BROWN FINE TO MEDIUM SAND WITH FINE TO COARSE GRAVEL AND SILT, DRY	0
SP	BROWN FINE SAND WITH SOME FINE TO MEDIUM GRAVEL, MOIST	0
GW	BROWN SANDY GRAVEL WITH TRACE OF SILT, DRY	0
SW	BROWN FINE TO MEDIUM SAND WITH MEDIUM TO COARSE ROUNDED GRAVEL, DRY	0
GW	BROWN FINE TO COARSE SAND AND FINE TO COARSE GRAVEL	0
	GRADES TO SOME SILT	
SP	GRAYISH-BROWN MEDIUM TO COARSE SAND WITH GRAVEL	

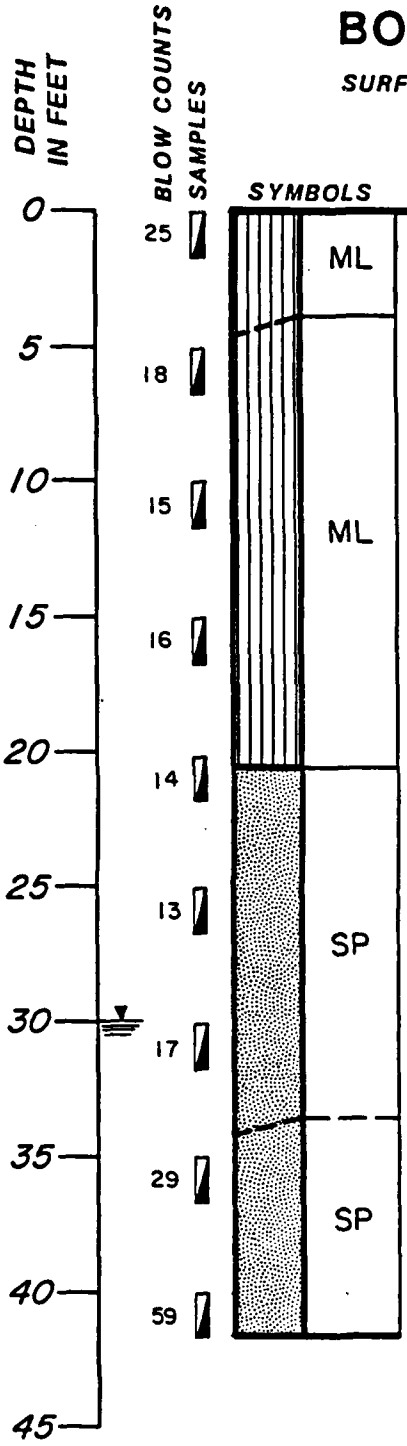
BORING COMPLETED AT A DEPTH OF 51.5 FEET ON 9/14/86.
WATER ENCOUNTERED AT A DEPTH OF 45.0 FEET
WHILE DRILLING.

LOG OF BORING

PLATE D-10

BORING GW-6A

SURFACE ELEVATION 138.20



DESCRIPTIONS	HNU READING
2 INCHES TOPSOIL REDDISH-BROWN SILTY CLAY WITH SOME FINE TO COARSE GRAVEL	0
DARK BROWN CLAYEY SILT WITH TRACE OF GRAVEL, SOIL IS SOFT AND DRY	0
LARGE PIECE OF WOOD IN END OF SAMPLE	0
	0
BROWN FINE TO MEDIUM SAND WITH TRACE TO SOME GRAVEL AND TRACE SILT	0
	0
BOTTOM 4 INCHES OF SAMPLE APPEAR TO BE SATURATED WITH FUEL, BENZENE - LIKE ODOR STEEL GRAY COLOR IN SATURATED SAND	15ppm
DARK GRAY MEDIUM TO COARSE SAND WITH GRAVEL. SATURATED WITH FUEL - WATER MIXTURE. SILVER METALLIC APPEARING MATERIAL MIXED THROUGHOUT SAMPLE	20ppm 13ppm BOREHOLE READING
STRONG FUEL ODOR	13ppm

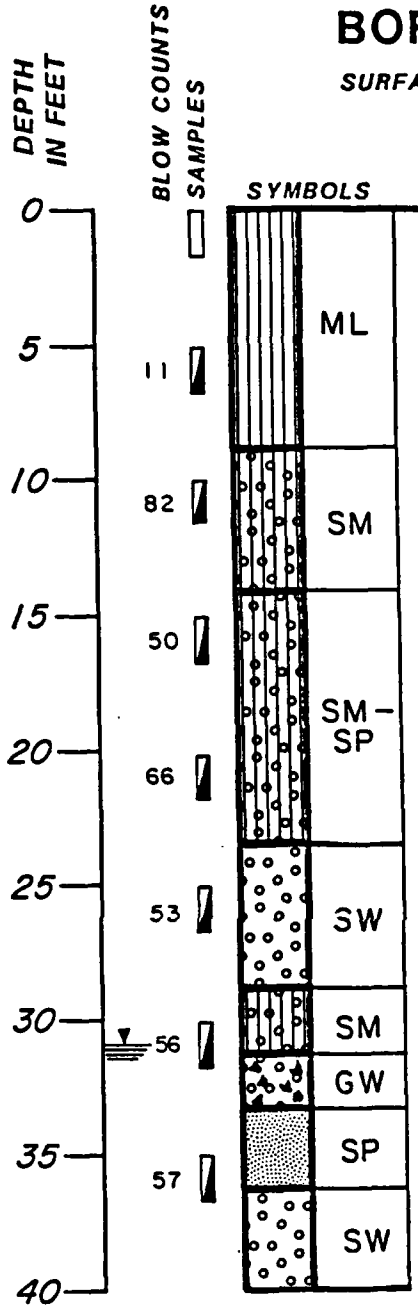
BORING COMPLETED AT A DEPTH OF 41.5 FEET ON 9/13/86.
WATER ENCOUNTERED AT A DEPTH OF 30.0 FEET WHILE DRILLING.

LOG OF BORING

PLATE D-11

BORING GW-7A

SURFACE ELEVATION 179.00



SYMBOLS	DESCRIPTIONS	HNU READING
ML	3 INCHES TOPSOIL DARK BROWN TO BROWN CLAYEY SILT WITH SOME GRAVEL	0
SM	GRAYISH-BROWN SAND WITH GRAVEL AND SILT	0
SM-SP	BROWN FINE TO COARSE SAND WITH TRACE OF GRAVEL AND SILT	0 0
SW	BROWNISH-GRAY MEDIUM TO COARSE SAND WITH FINE TO COARSE GRAVEL	0
SM	GRAYISH-BROWN MEDIUM TO COARSE SAND, DRY	
GW	1 INCH BLACK MEDIUM TO COARSE SAND - GREASY FEEL, LOOKS LIKE OIL BUT NO ODOR, WATER SOLUBLE, HNU = 0 GRAY FINE TO COARSE GRAVEL WITH SAND	0
SP	BROWN MEDIUM TO COARSE SAND	0
SW	BROWN MEDIUM TO COARSE SAND WITH FINE TO MEDIUM GRAVEL AND TRACE OF SILT	

BORING COMPLETED AT A DEPTH OF 40.0 FEET ON 9/11/86.
WATER ENCOUNTERED AT A DEPTH OF 31.0 FEET WHILE DRILLING.

LOG OF BORING

PLATE D-12

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 215.4

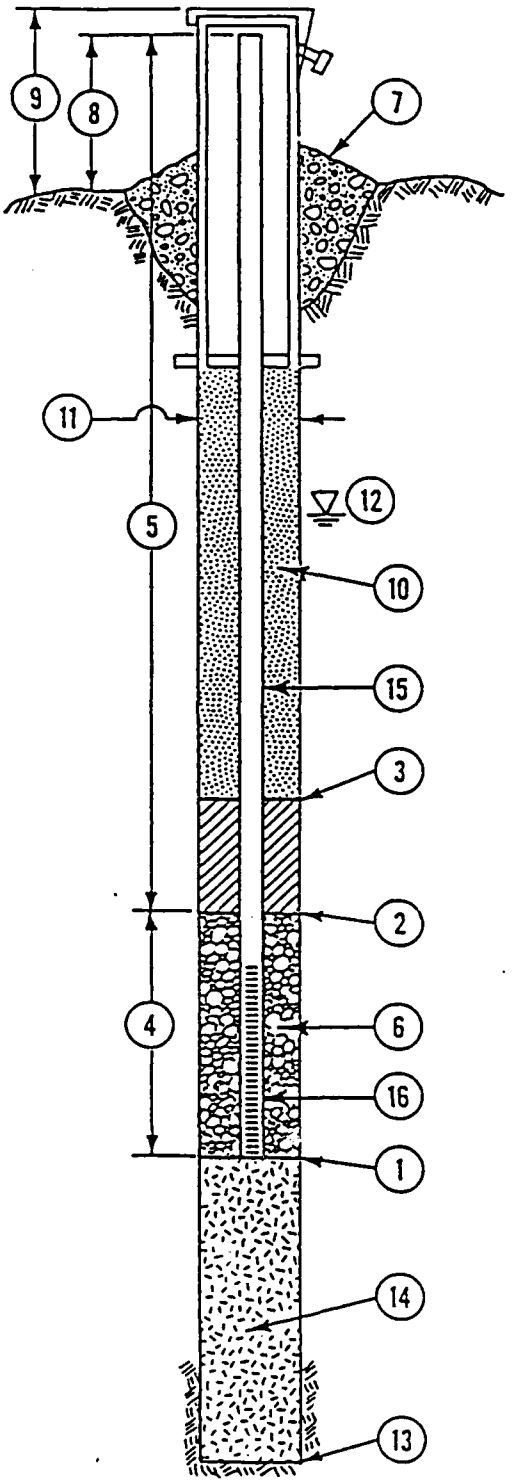
TOP OF WELL CASING ELEVATION 217.91

JOB NUMBER 1016-215

BORING NUMBER GW1-A

DATE 9/16/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 51.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 41.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 39.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 53.51 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.51 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 2.84 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL Cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 42.5 FEET.*
13. TOTAL DEPTH OF BOREHOLE 51.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 202.6

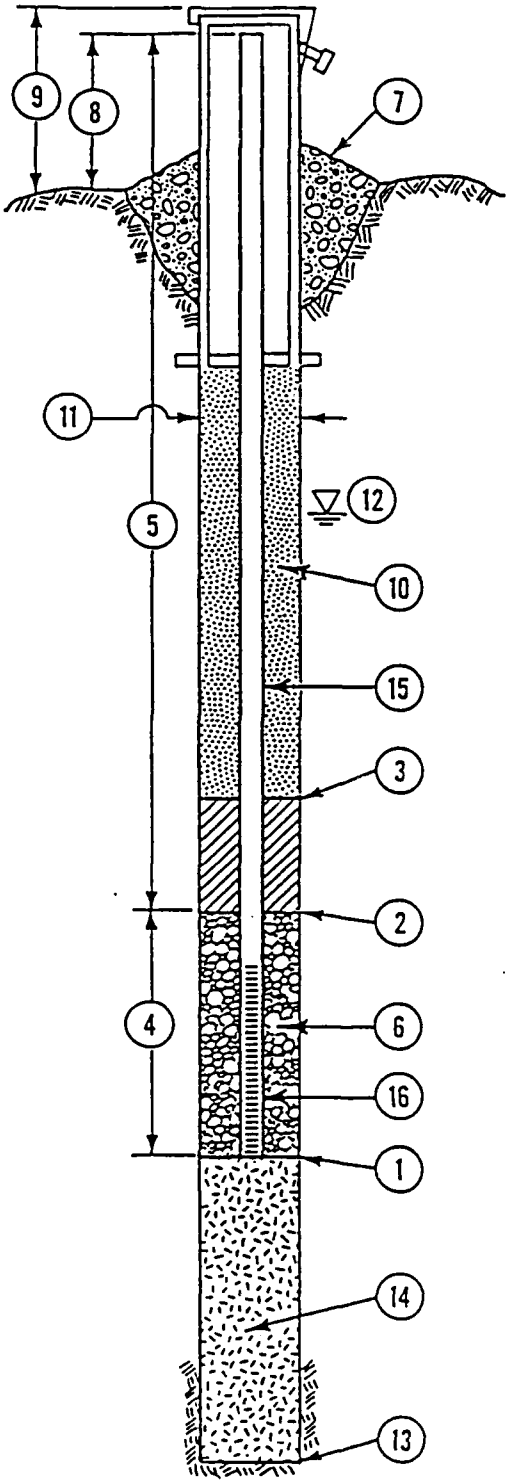
TOP OF WELL CASING ELEVATION 205.20

JOB NUMBER 1016-265

BORING NUMBER GW-1B

DATE 9/21/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 44.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 34.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 32.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 46.6 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.6 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 2.86 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 36.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 45.0 FEET.*
14. TYPE OF LOWER BACKFILL ——.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 209±

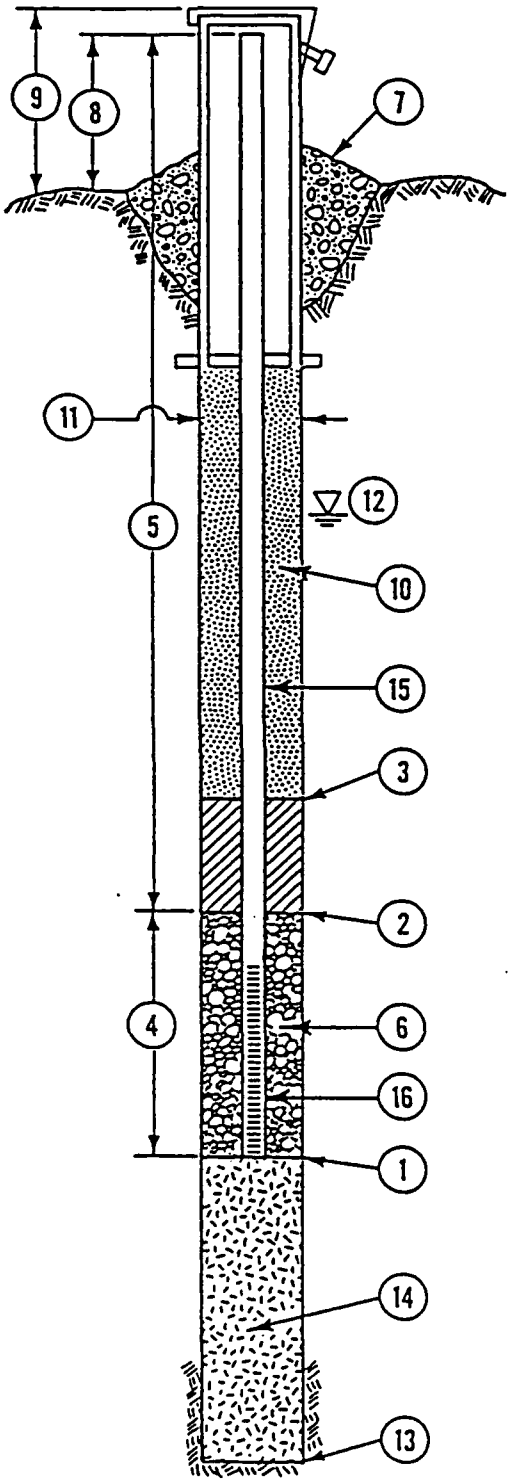
TOP OF WELL CASING ELEVATION 211.45

JOB NUMBER 1016-265

BORING NUMBER GW-1C

DATE 9/22/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE [redacted] FEET.* 49.5
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 40.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 38.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 51.95 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.45 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
   HEIGHT ABOVE GROUND 2.47 FEET.
   LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL Cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 41.5 FEET.*
13. TOTAL DEPTH OF BOREHOLE 50.0 FEET.*
14. TYPE OF LOWER BACKFILL ——.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 219.6

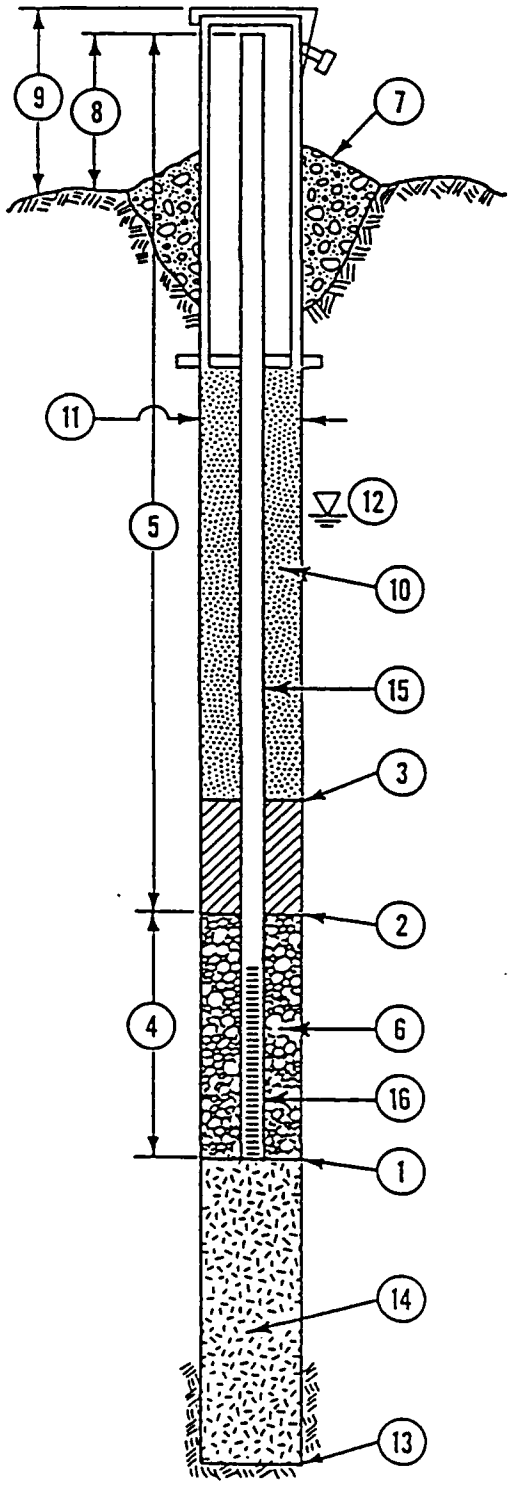
TOP OF WELL CASING ELEVATION 222.19

JOB NUMBER 1016-265

BORING NUMBER GW-2A

DATE 9/18/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 50.5 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 40.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 38.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 53.09 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.59 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
   HEIGHT ABOVE GROUND 2.71 FEET.
   LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 43.5 FEET.*
13. TOTAL DEPTH OF BOREHOLE 50.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

PIEZOMETER DETAIL INFORMATION SHEET

GROUND SURFACE ELEVATION 1985

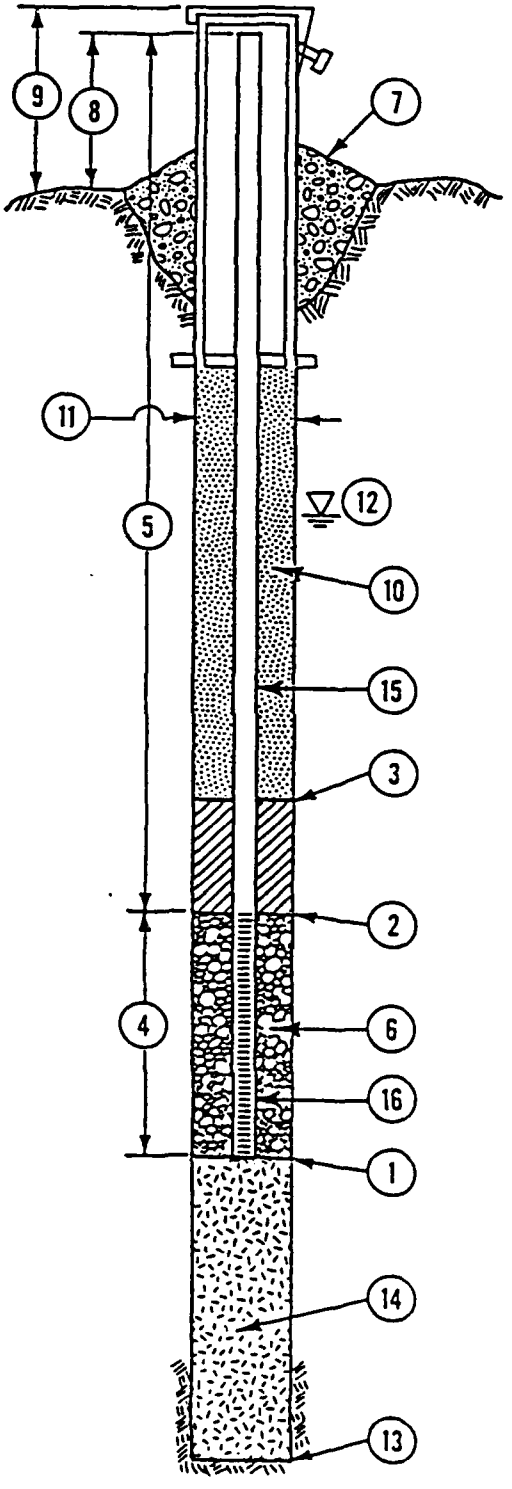
TOP OF WELL CASING ELEVATION 2012.3

JOB NUMBER 10116-216

BORING NUMBER GW-2B

DATE 9-19-96

LOCATION Elmendorf AFB



(1) DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 41.5 FEET.*

(2) DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 29.0 FEET.*

(3) DEPTH TO TOP OF SEAL (IF INSTALLED) 27.0 FEET.*

(4) LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010.

(5) TOTAL LENGTH OF PIPE 44.23 FEET AT 2 INCH DIAMETER.

(6) TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Natural to top of water -- then #8 (Med-co) silica sand

(7) CONCRETE CAP. (YES) NO (CIRCLE ONE)

(8) HEIGHT OF WELL CASING ABOVE GROUND 2.73 FEET.

(9) PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 3.14 FEET.
LOCKING CAP? (YES) NO (CIRCLE ONE)

(10) TYPE OF UPPER BACKFILL Grout.

(11) BOREHOLE DIAMETER 6 INCHES.

(12) DEPTH TO GROUND WATER 33.0 FEET.*

(13) TOTAL DEPTH OF BOREHOLE 41.5 FEET.*

(14) TYPE OF LOWER BACKFILL Natural; silica sand

(15) PIPE MATERIAL PVC.

(16) SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

PIEZOMETER INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 1932

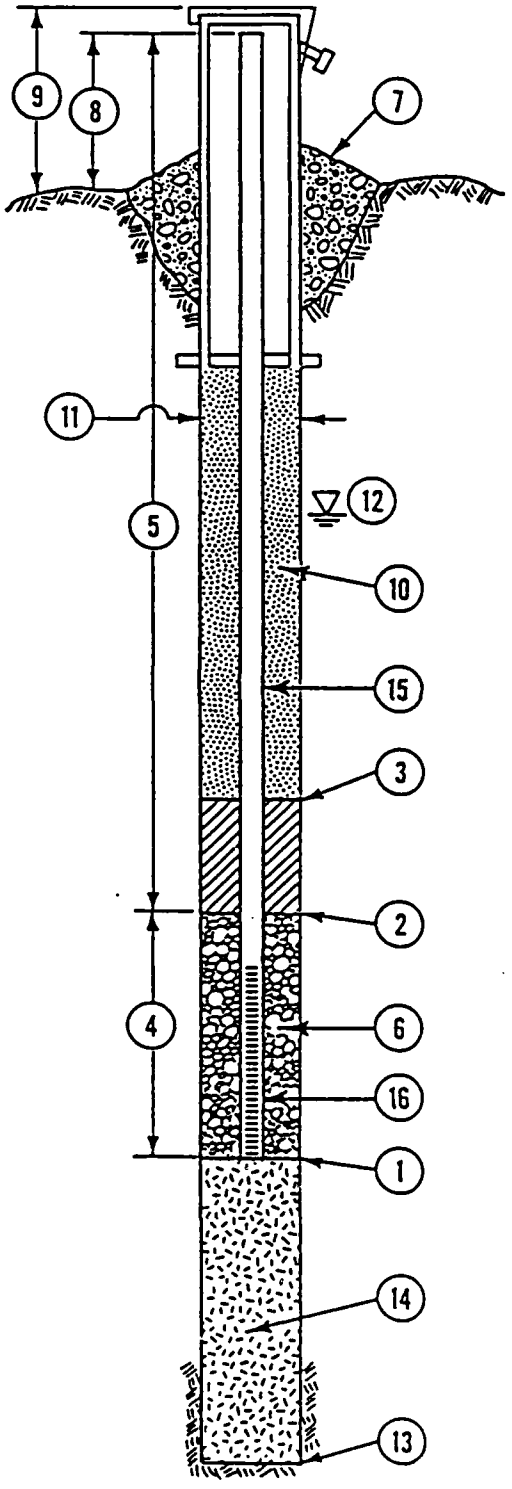
TOP OF WELL CASING ELEVATION 1972

JOB NUMBER 1016-265

BORING NUMBER GW-2C

DATE 9/23/86

LOCATION Elmendorf AFB



(1) DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 37.0 FEET.*

(2) DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 27.0 FEET.*

(3) DEPTH TO TOP OF SEAL (IF INSTALLED) 25.0 FEET.*

(4) LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010.

(5) TOTAL LENGTH OF PIPE 40.32 FEET AT 2 INCH DIAMETER.

(6) TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE natural.

(7) CONCRETE CAP. (YES) NO (CIRCLE ONE)

(8) HEIGHT OF WELL CASING ABOVE GROUND 3.32 FEET.

(9) PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
HEIGHT ABOVE GROUND 3.53 FEET.
LOCKING CAP? (YES) NO (CIRCLE ONE)

(10) TYPE OF UPPER BACKFILL Cement-bentonite gra

(11) BOREHOLE DIAMETER 8 INCHES.

(12) DEPTH TO GROUND WATER 30.0 FEET.*

(13) TOTAL DEPTH OF BOREHOLE 38.0 FEET.*

(14) TYPE OF LOWER BACKFILL —.

(15) PIPE MATERIAL PVC.

(16) SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 1737

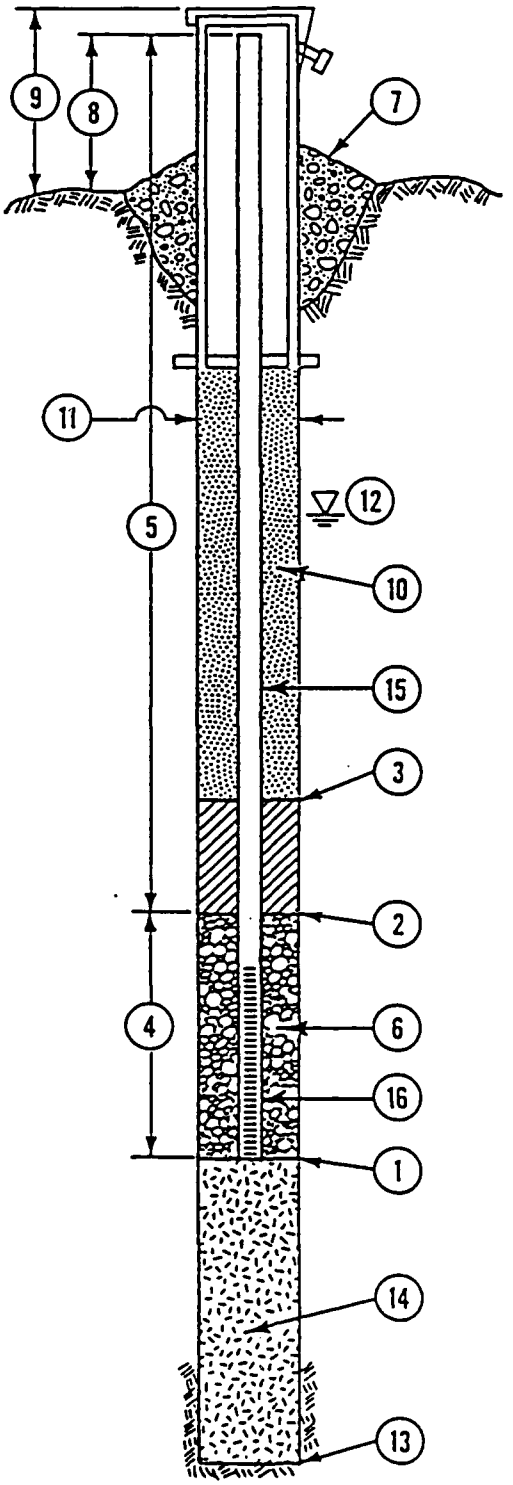
TOP OF WELL CASING ELEVATION 1746.5

JOB NUMBER 1016-265

BORING NUMBER GW3-A

DATE 9/12/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 33.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 23.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 21.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 33.95 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 0.95 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 1.55 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL Cement-bentonite grout
11. BOREHOLE DIAMETER 9 INCHES.
12. DEPTH TO GROUND WATER 25.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 35.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 1356

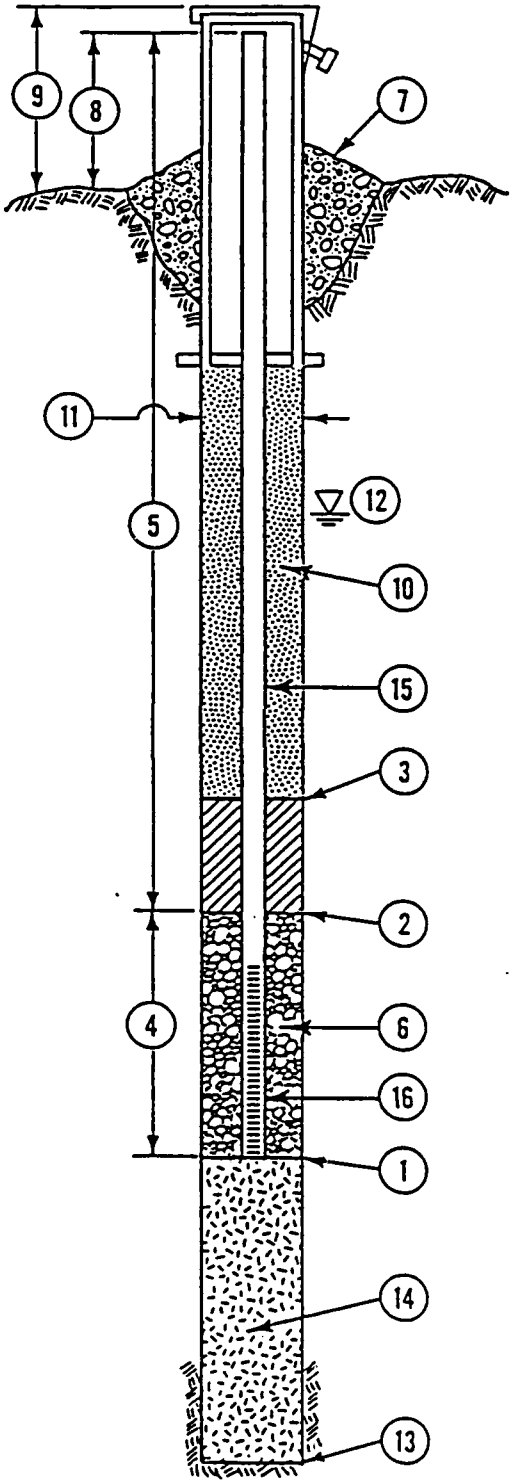
TOP OF WELL CASING ELEVATION 1393

JOB NUMBER 1016-265

BORING NUMBER GW4-A

DATE 9/11/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 14.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 1.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 14.78 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 3.78 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
   HEIGHT ABOVE GROUND 4.06 FEET.
   LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL —.
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 2.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 15.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 2042

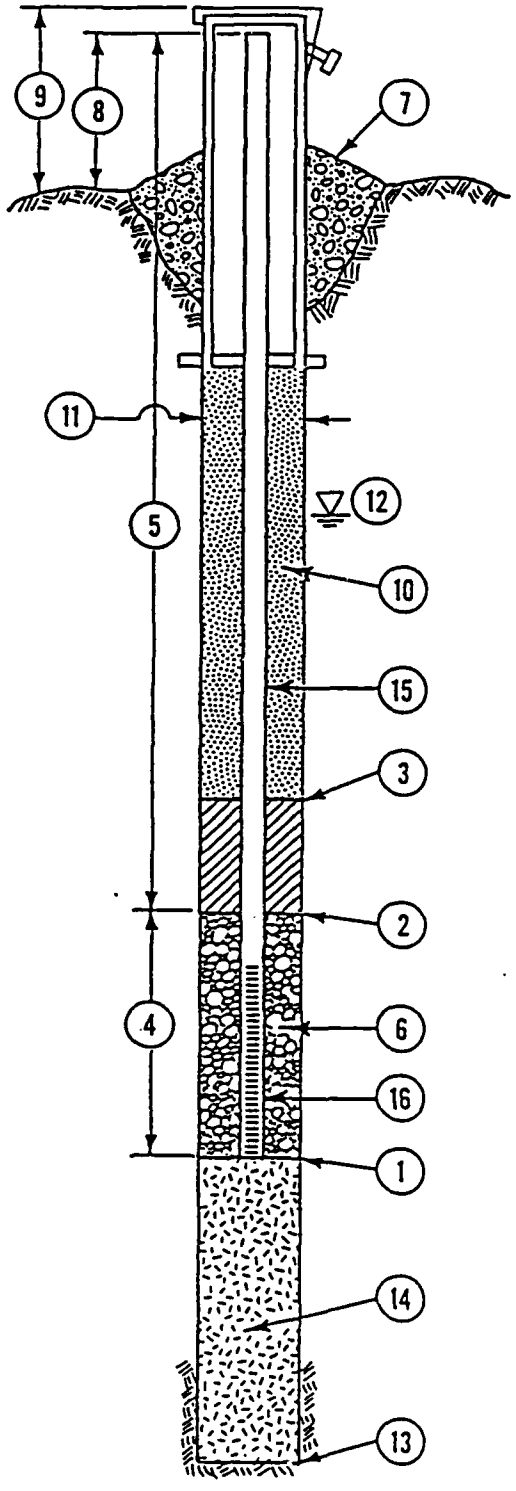
TOP OF WELL CASING ELEVATION 2062.1

JOB NUMBER 1016-265

BORING NUMBER GW5-A

DATE 9/14/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 50.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 40.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 38.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 52.01 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.01 FEET.
9. PROTECTIVE CASING? (YES) HEIGHT ABOVE GROUND 2.13 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL Cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 45.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 50.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 1382

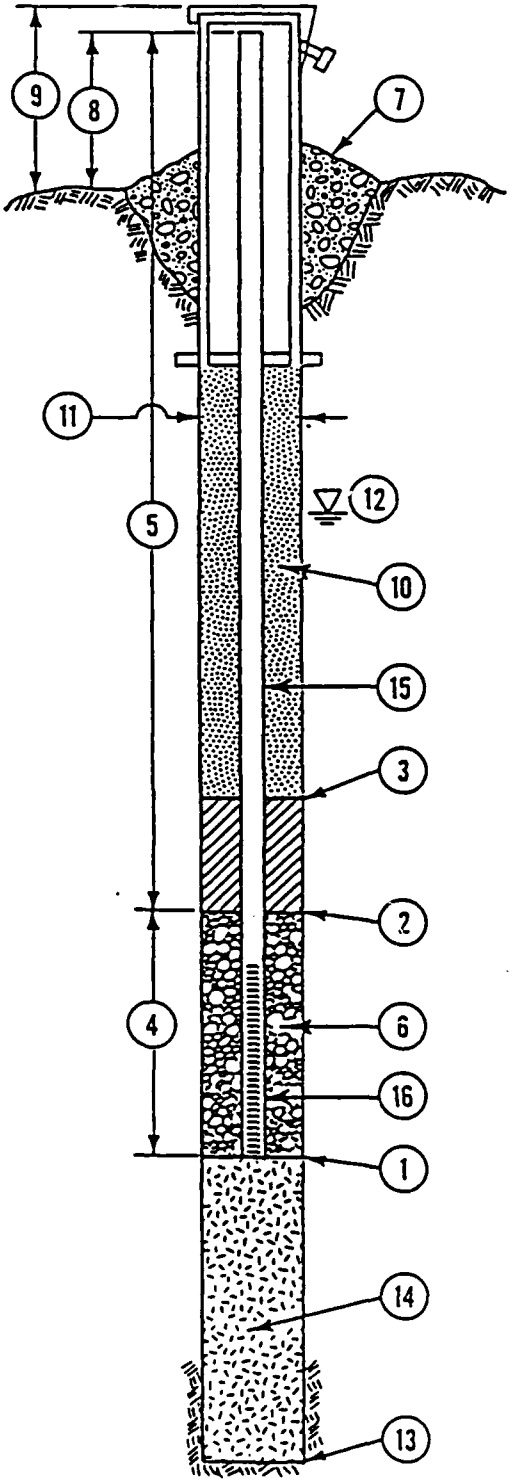
TOP OF WELL CASING ELEVATION 1402.7

JOB NUMBER 1016-265

BORING NUMBER GW6-A

DATE 9/13/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 38.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 28.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 26.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 40.07 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.07 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 2.18 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL cement-bentonite grout
11. BOREHOLE DIAMETER 9 INCHES.
12. DEPTH TO GROUND WATER 30.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 40.0 FEET.*
14. TYPE OF LOWER BACKFILL ——.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION 179.0

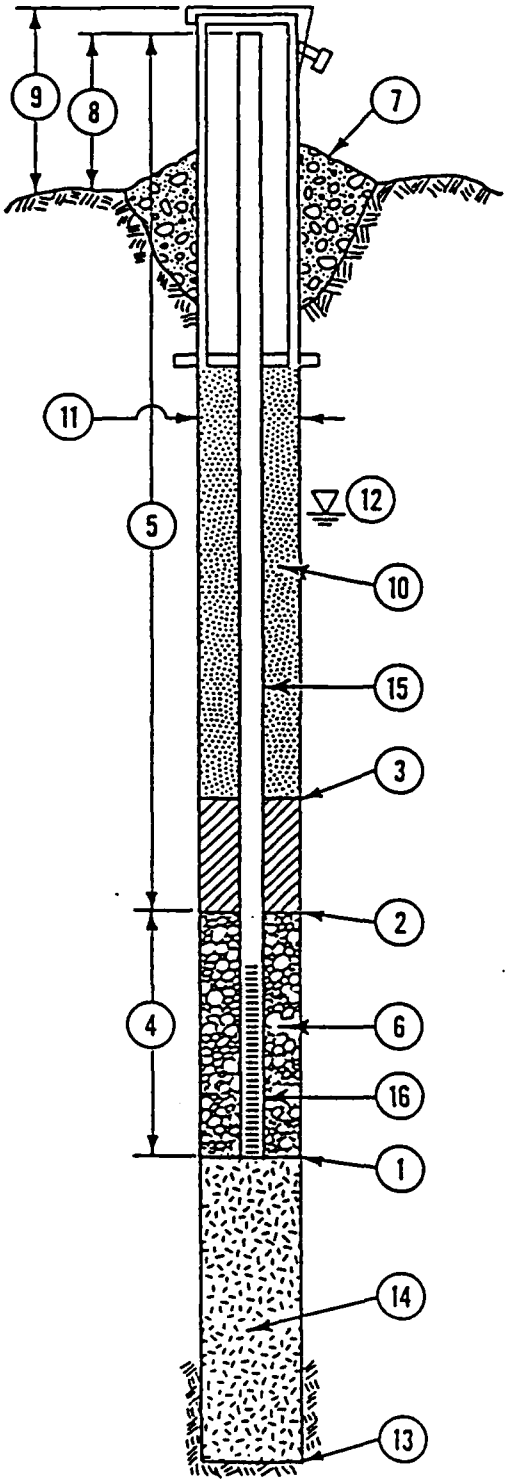
TOP OF WELL CASING ELEVATION 181.2

JOB NUMBER 1016-265

BORING NUMBER GW 7-A

DATE 9/10/86

LOCATION Elmendorf AFB



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 40.0 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 30.0 FEET.*
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 28.0 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 42.19 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE Sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.19 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 2.40 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL cement-bentonite grout
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 31.0 FEET.*
13. TOTAL DEPTH OF BOREHOLE 40.0 FEET.*
14. TYPE OF LOWER BACKFILL —.
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

APPENDIX E

FIELD RAW DATA

WELL NO. GW-1A STABILIZATION TEST

DATE: 10/4/86 TIME: 1830

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	95	89	88	85	85					
pH: ± 0.1 pH unit	7.05	6.5	6.1	6.2	6.1					
Temperature: ± 0.5°C	6.0	5.2	5.1	5.0	5.0					
Color	light brown	same	same	same	same					
Odor of Discharge	none	none	none	none	none					

WELL NO. GW-1B STABILIZATION TEST

DATE: 10/5/86 TIME: 1400

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	240	240	241							
pH: ± 0.1 pH unit	6.5	6.4	6.4							
Temperature: ± 0.5°C	5.5	5.2	5.0							
Color	grayish brown	Same	brownish gray							
Odor of Discharge	none	none	none							

WELL NO. GW-1C STABILIZATION TEST

DATE: 10/5/86 TIME: 0930

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	109	105	100	100						
pH: ± 0.1 pH unit	5.45	5.9	5.9	5.85						
Temperature: ± 0.5°C	5.0	5.5	5.0	5.0						
Color	light brown	same	same	same						
Odor of Discharge	none	none	none	none						

WELL NO. GW-2A STABILIZATION TEST

DATE: 10/6/86 TIME: 1730

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	79	75	75	75	75					
pH: ± 0.1 pH unit	6.23	6.42	6.7	6.7	6.7					
Temperature: ± 0.5°C	4.5	3.8	3.5	3.5	3.5					
Color	light gray brown	same	light brown	same	same					
Odor of Discharge	none	none	none	none	none					

WELL NO. GW-2B STABILIZATION TEST

DATE: 10/6/86 TIME: 1200

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	230	230	228	220	225					
pH: ± 0.1 pH unit	6.15	6.1	6.1	6.1	6.1					
Temperature: ± 0.5°C	5.9	5.9	5.1	5.0	5.0					
Color	gray brown	light gray	same	clear gray	same					
Odor of Discharge	slight sewage odor	slight foul	same	same	same					

WELL NO. GW-2C STABILIZATION TEST

DATE: 10/6/86 TIME: 1430

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	259	249	242	240						
pH: ± 0.1 pH unit	5.85	5.85	5.80	5.80						
Temperature: ± 0.5°C	7.9	5.9	5.4	5.4						
Color	brown	brown	same	same						
Odor of Discharge	none	none	none	none						

WELL NO. GW-3A STABILIZATION TEST

DATE: 10/1/86 TIME: 0930

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	320	330	332	333						
pH: ± 0.1 pH unit	7.5	7.5	7.45	7.45						
Temperature: ± 0.5°C	6.0	5.2	5.1	5.1						
Color	light brown	same	same	same						
Odor of Discharge	none	none	none	none						

WELL NO. GW-4A STABILIZATION TEST

DATE: 10/2/86 TIME: 1800

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	220	218	215							
pH: ± 0.1 pH unit	7.6	7.5	7.5							
Temperature: ± 0.5°C	7.2	6.8	6.8							
Color	cloudy brownish gray	same	same							
Odor of Discharge	Petro-leum	same	same							

WELL NO. GW-5A STABILIZATION TEST

DATE: 10/9/86 TIME: 1400

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	390	390	385							
pH: ± 0.1 pH unit	5.95	6.0	6.05							
Temperature: ± 0.5°C	5.5	5.5	5.5							
Color	cloudy brown	same								
Odor of Discharge	none	none								

WELL NO. GW-6A STABILIZATION TEST

DATE: 10/2/86 TIME: 1200

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	301	300	300	300						
pH: ± 0.1 pH unit	6.6	6.8	6.9	6.85						
Temperature: ± 0.5°C	8.5	7.5	7.1	7.0						
Color	dark gray	cloudy gray	gray tan	same						
Odor of Discharge	Petro-leum	fuel odor, strong	fuel, strong	same						

WELL NO. GW-7A STABILIZATION TEST

DATE: 9/30/86 TIME: 1620

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	255	248	242	240	240					
pH: ± 0.1 pH unit	7.35	7.0	7.2	7.15	7.15					
Temperature: ± 0.5°C	7.5	6.5	6.0	6.0	6.0					
Color	grayish brown	Same	same	grayish tan	same					
Odor of Discharge	none	none	none	none	none					

WELL NO. W-1 STABILIZATION TEST

DATE: 10/5/86 TIME: 1730

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	137	135	131							
pH: ± 0.1 pH unit	6.75	6.65	6.65							
Temperature: ± 0.5°C	6.5	6.0	6.0							
Color	none	none	none							
Odor of Discharge	none	none	none							

WELL NO. W-2 STABILIZATION TEST

DATE: 10/5/86 TIME: 1930

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	92	90	90							
pH: ± 0.1 pH unit	7.0	6.9	6.9							
Temperature: ± 0.5°C	5.0	4.9	4.8							
Color	light brown	same	same							
Odor of Discharge	none	none	none							

WELL NO. W-3 STABILIZATION TEST

DATE: 10/7/86 TIME: 1300

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	420	420	420							
pH: ± 0.1 pH unit	6.77	6.7	6.7							
Temperature: ± 0.5°C	5.3	5.5	5.5							
Color	light clear gray	same	same							
Odor of Discharge	strong fuel odor	same	same							

Note: Abundant oil globules and gasoline sheen.

WELL NO. W-4 STABILIZATION TEST

DATE: 10/7/86 TIME: 1500

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	345	320	285	280	280					
pH: ± 0.1 pH unit	6.4	6.4	6.45	6.5	6.4					
Temperature: ± 0.5°C	7.5	7.5	7.5	7.5	7.5					
Color	cloudy gray	Same	light cloudy gray	Same	Same					
Odor of Discharge	Petro. and rotten eggs.	Same	Same	fainter	Same					

WELL NO. W-5 STABILIZATION TEST

DATE: 10/8/86 TIME: 1230

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	80	78	77							
pH: ± 0.1 pH unit	5.75	5.7	5.65							
Temperature: ± 0.5°C	5.3	4.9	4.8							
Color	clear	same	same							
Odor of Discharge	none	none	none							

WELL NO. W-6B STABILIZATION TEST

DATE: 10/8/86 TIME: 0830

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	82	85	85	83						
pH: ± 0.1 pH unit	7.05	6.55	6.45	6.45						
Temperature: ± 0.5°C	5.0	4.9	4.9	5.0						
Color	cloudy brown	same	light brown	light brown						
Odor of Discharge	none	none	none	none						

WELL NO. W-7 STABILIZATION TEST

DATE: 10/8/86 TIME: 1800

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	700	600	600	610						
pH: ± 0.1 pH unit	7.5	7.5	7.5	7.0						
Temperature: ± 0.5°C	7.5	7.0	7.2	7.0						
Color	cloudy gray	same	same	same						
Odor of Discharge	slight petro. odor	same	same	same						

Note: Pumped dry 3x

WELL NO. W-8 STABILIZATION TEST

DATE: 10/8/86 TIME: 1530

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	393	390	389							
pH: ± 0.1 pH unit	6.80	6.85	6.75							
Temperature: ± 0.5°C	8.2	8.0	8.1							
Color	cloudy gray	Same	Same							
Odor of Discharge	none	none	none							

Note: Pumped dry 3x

WELL NO. W-9 STABILIZATION TEST

DATE: 10/1/86 TIME: 1300

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	403	400	398							
pH: ± 0.1 pH unit	7.3	7.2	7.2							
Temperature: ± 0.5°C	6.1	6.0	5.9							
Color	gray-tan	same	gray							
Odor of Discharge	none	none	none							

WELL NO. W-10 STABILIZATION TEST

DATE: 10/4/86 TIME: 1530

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	250	245	240							
pH: ± 0.1 pH unit	7.4	7.35	7.3							
Temperature: ± 0.5°C	5.4	5.1	5.0							
Color	dark gray	same	same							
Odor of Discharge	none	none	none							

Note: Pumped almost dry.
Abundant fine-medium grained sand stopping up pump.

WELL NO. W-11 STABILIZATION TEST

DATE: 10/4/86 TIME: 1130

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	350	353	353							
pH: ± 0.1 pH unit	6.3	6.25	6.2							
Temperature: ± 0.5°C	5.1	5.0	5.0							
Color	reddish brown	brown	light brown							
Odor of Discharge	none	none	none							

WELL NO. W-12 STABILIZATION TEST

DATE: 10/3/86 TIME: 1000

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	410	420	420							
pH: ± 0.1 pH unit	5.5	5.6	5.5							
Temperature: ± 0.5°C	7.5	7.5	7.8							
Color	dark gray	same	same							
Odor of Discharge	none	none	none							

Note: Oil sheen on water.

WELL NO. W-13 STABILIZATION TEST

DATE: 10/4/86 TIME: 0900

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	390	409	400	408						
pH: ± 0.1 pH unit	7.05	7.05	7.05	7.1						
Temperature: ± 0.5°C	7.1	7.1	7.0	7.1						
Color	dark gray	same	same	same						
Odor of Discharge	none	none	none	none						

Note: Pumped dry.

WELL NO. W-14 STABILIZATION TEST

DATE: 10/2/86 TIME: 1530

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	190	185	182							
pH. ± 0.1 pH unit	7.5	7.55	7.5							
Temperature: ± 0.5°C	5.5	5.3	5.0							
Color	cloudy brown	same	same							
Odor of Discharge	Petro-leum	same	none							

WELL NO. W-15 STABILIZATION TEST

DATE: 10/9/86 TIME: 1530

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	220	220	223							
pH: ± 0.1 pH unit	6.1	6.1	6.0							
Temperature: ± 0.5°C	5.5	5.5	5.0							
Color	clear	same								
Odor of Discharge	none	none								

WELL NO. W-16 STABILIZATION TEST

DATE: 10/1/86 TIME: 1600

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	295	290	290							
pH: ± 0.1 pH unit	7.2	7.25	7.22							
Temperature: ± 0.5°C	7.5	7.0	7.0							
Color	gray cloudy	same	gray							
Odor of Discharge	fecal + rotten eggs	very strong fuel odor	same							

Note: Oil sheen on water.

WELL NO. W-17 STABILIZATION TEST

DATE: 9/30/86 TIME: 1430

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	122	120	220	220						
pH: ± 0.1 pH unit	6.95	7.2	7.2	7.1						
Temperature: ± 0.5°C	7.0	6.0	6.2	6.0						
Color	clear	same	same	same						
Odor of Discharge	none	none	none	none						

WELL NO. W-18 STABILIZATION TEST

DATE: 10/7/86 TIME: 1030

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	469	480	480	485						
pH: ± 0.1 pH unit	6.8	6.75	6.75	6.8						
Temperature: ± 0.5°C	6.5	7.0	7.0	7.0						
Color	light gray	clear light gray	clear	clear						
Odor of Discharge	foul, rotten eggs	same	same	same						

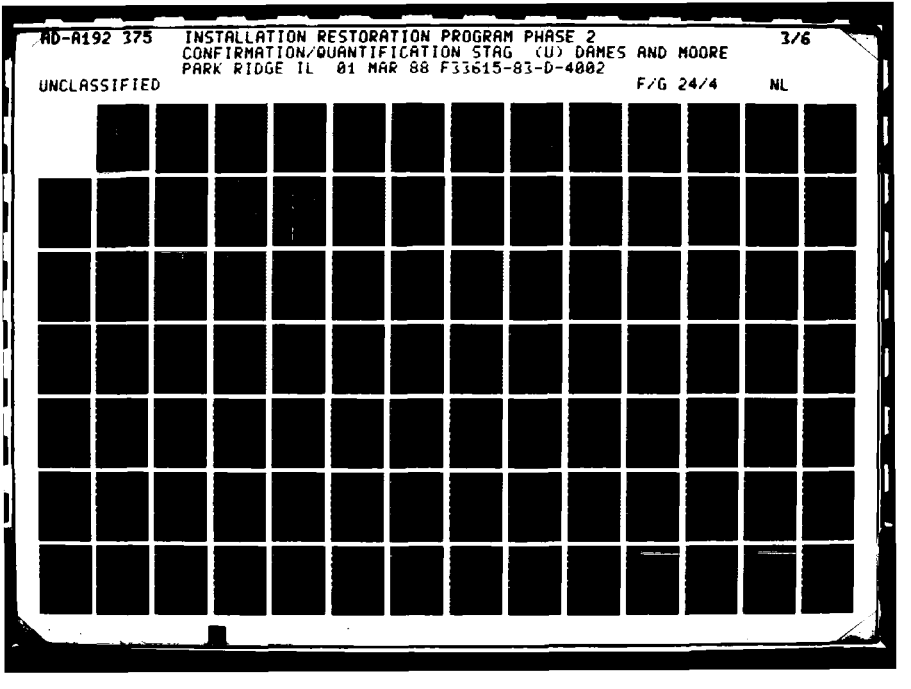
WELL NO. W-19 STABILIZATION TEST
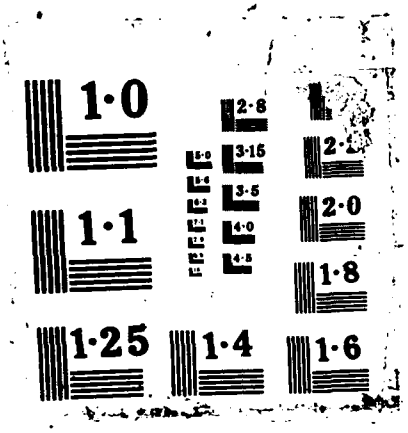
DATE: 10/7/86 TIME: 0830

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Field Conductivity: µmhos/cm	369	390	395	393						
pH: ± 0.1 pH unit	6.25	6.55	6.6	6.6						
Temperature: ± 0.5°C	5.0	5.0	5.0	4.8						
Color	Slight. cloudy	clear	clear	clear						
Odor of Discharge	none	none	none	none						

APPENDIX F

FIELD AND LABORATORY QUALITY CONTROL PROCEDURES


AD-A192 375 INSTALLATION RESTORATION PROGRAM PHASE 2 3/6
CONFIRMATION/QUANTIFICATION STAG (U) DAMES AND MOORE
PARK RIDGE IL 01 MAR 88 F33615-83-D-4002
UNCLASSIFIED F/G 24/4 NL


1·0
1·1
1·25
2·8
3·15
3·5
4·0
1·4
2·0
1·8
1·6

FIELD AND LABORATORY QUALITY CONTROL PROGRAMS

FIELD INVESTIGATION QUALITY CONTROL PROGRAM

The Technical Operations Plan (TOP) presented in Appendix L describes the methods and procedures that were used to accomplish the tasks defined during the Stage 2 investigation at Elmendorf AFB. Guidelines of the Occupational Safety and Health Administration (OSHA), United States Environmental Protection Agency (USEPA), and USAF, as well as previous investigations at Elmendorf AFB, were reviewed to select the methods that would be most appropriate for this investigation. The TOP is designed primarily to give guidance to personnel in the field and to ensure that standard methods of investigation are used.

LABORATORY QUALITY CONTROL PROGRAM

UBTL is an accredited laboratory of the American Industrial Hygiene (AIHA) Association (No. 17) and, as such, participates in an extensive interlaboratory proficiency analytical testing program sponsored by the National Institute for Occupational Safety and Health (NIOSH). In addition, UBTL is currently licensed by the Center for Disease Control (CDC) to perform chemical and clinical analyses of biological specimens and is State of Utah/USEPA approved for environmental analyses. The comprehensive internal quality control program at UBTL is detailed as follows.

Introduction

UBTL has implemented an effective system for Quality Control (QC) for samples analyzed from Elmendorf AFB. Procedures that are employed include:

1. Services of a full-time Quality Control/Quality Assurance Section;
2. Preparation of internal quality control samples;
3. Collection and evaluation of quality control data;
4. Generation of quality control charts; and
5. Instrument calibration and maintenance.

Sample Analyses

At least one blank sample and one reagent blank are included with each set of analyses and processed through the complete analytical procedure in order to detect any contamination in either collection media or reagents. In addition, duplicate analyses are accomplished on a minimum of 10 percent of all samples submitted from the field. Internal quality control samples, generated in the laboratory and

containing known quantities of specified analyte(s), are run at the rate of 10 percent of the total field sample workload. At the completion of the analysis of a sample set, each chemist calculates his results and reports the results on the Analytical Report Form. Results for replicated samples and internal quality control samples are reported on the computer-generated Quality Control Data Sheet. Before the results are submitted to the Group Leader, another peer chemist analyst is assigned to check results for possible errors in the calculations. He must approve results reported on both the quality control sheet and the sample sheet. The Group Leader, after his evaluation of the data, gives the report sheets to the Quality Assurance Specialist (QAS) for his evaluation and implementation of any required action.

Specific steps are followed when any one QC sample result is determined to be out of control in connection with the analysis of a field sample set. QC charts with adjusted control limits of $\pm$ 3 standard deviations will generally be used to determine whether a result is out of control. If QC results are in control, the QAS signs off the report. It is then reviewed by the Section Head for accuracy of the results. Upon final approval of the reports by the QAS and the Section Head, the reports are sent to the sponsor.

The paperwork containing the raw data for a sample set (i.e., chart paper, computer readouts, paper tapes, calibration curves, tables of data, etc.) is collected and placed in an 8½- by 11-inch envelope that has been labeled with sample numbers, analyst, date, and other pertinent information. The envelopes are filed by laboratory number for possible future reference and data retrieval. Raw data for each sample analysis are therefore readily available, if needed.

Quality Control Sample Data Analysis

A record of the preparation of internal QC samples is detailed in the QC log book maintained by the QAS. As appropriate, a set of QC samples is distributed to the chemist along with each sample set at an average rate of at least 10 percent of the submitted samples. The analyses and data evaluations are performed for these QC samples, along with the submitted samples, and results are tabulated on the computer-generated Quality Control Data Sheet. At least duplicate results are reported for each internal QC sample.

QC charts are generated for each analyte through the analysis of QC sample results. Each result is divided by the theoretical value to standardize results so that data from all concentrations can be directly compared for accuracy and precision. When a control data set of N sample results has been accumulated, the following statistics are calculated: mean percent recovery, replicate standard deviation, and set standard deviation. These statistics are then used to determine accuracy and precision QC limits.

The control data set is updated after evaluation of 20 successive QC samples and includes data on the 50 most recent results. Any control sample analysis that is beyond accuracy or precision limits is not used in the subsequent determination of new limits.

External Quality Control Programs

In addition to internally generated QC data, other information concerning QC is provided by the participation of UBTL in four interlaboratory QC programs: NIOSH Proficiency Analytical Testing (PAT) Program; two CDC Blood Lead QC Programs; and State of Utah Environmental Quality Control Program. The PAT Program and the CDC Blood Lead Programs involve the participation of more than 100 laboratories on a nationwide basis. The PAT Program addresses the analysis of filter samples for lead, cadmium, zinc, free silica, and asbestos and the analysis of charcoal tubes for various organic solvents.

Laboratory Data Reduction

A significant fraction of the Chemistry Department's work involves data processing. Mathematical models, based upon analysis of standard solutions or samples, are generated in order to determine the quantity of analyte present in the samples. Considerable time and effort are saved by the utilization of automated data processing procedures. Data processing by the computer can include, for example, calculations, generation of standard calibration curves, mathematical modeling of standard curves, statistical analyses, and the generation of hard copy output. Advantages intrinsic to the use of an automated system include more accurate calculations, immediate and accurate generation of data plots, fewer transcription errors, and no calculation errors after programs have been verified and documented. In general, the types of data that are processed are those derived from the following techniques: atomic absorption and flame emission spectroscopy, gas and liquid chromatography, optical absorbance spectrophotometry, specific ion electrode, fluorescence spectroscopy, and wet chemistry determinations. Similar functions are employed for QC data. In addition, the data system is utilized to store QC data, provide statistical analyses, and generate and update QC charts. The advantage of the provision for statistical analyses and the production of QC charts by automation is that the charts may be easily updated with minimal effort. QC data and any required action may, therefore, be provided on a daily basis.

Reporting Procedures

The analytical data are reported to the sponsor at the completion of each sample set. The report includes the following items:

1. A memorandum describing the sample set; the condition and appearance (i.e., homogeneity, integrity, etc.) of the samples upon receipt at UBTL; the method, equipment, and technique used in the determination; any interferences that were observed; and any unusual circumstances that may have occurred during the analysis. [The limit(s) of detection are also reported.]

2. UBTL Analytical Report Form, including field ID number, laboratory ID number, identification of the analytes, results of each determination, limit(s) of detection, and comments.

3. Other items, such as copies of strip chart recorder output, computer printout sheets, and other raw data (to be included as required).

Instrumentation

Each major equipment item at the UBTL Chemistry Department undergoes a routine preventive maintenance check on a regular schedule. This check is accomplished by a trained engineer. In addition, performance checks are made by the analyst prior to the analysis of each set of samples. This involves the analysis of one or more standards and a comparison of the values obtained with previous results and conditions. This information is recorded in an instrumentation log.

When an instrument or apparatus malfunctions and the problem is not readily corrected, the appropriate Section Head is notified. If it is determined that a visit by the service representative is required, a service call is scheduled and the QAS is notified. Action by the service representative is recorded by the QAS in the Instrument Maintenance Log, and the appropriate customer field and service order forms are filed, by instrument, in the Instrument Maintenance Log Supplement File. In an effort to monitor and maintain instrument specifications, logs for each of the AA spectrophotometers, the gas chromatographs (GC), the X-ray diffractometer (X-ray), and the mass spectrometers (MS) have been provided for the analytical chemists' use each time an analysis is performed. The AA instrumentation logs contain entries for date, analyst, lamp number (if more than one lamp is available), standard concentration (recommended in manual), reading in milliabsorbence units, and a column for when instrumental parameters differ from the recommended conditions listed in the manual. The GC, X-ray, and MS logs contain entries for date, time, analyst, set identification number, and comments on parameters or performance.

Training

UBTL has established a continuing program of training of current personnel with respect to QC procedures. In addition, an intensive program for the training of recently recruited personnel in both analytical methods and techniques and QC policies has been implemented. It is the responsibility of the QAS and the Laboratory Director to train all laboratory personnel.

Results of the Laboratory QC Program

The results of the QC analyses for ground water, surface water, and base supply well samples are presented on pages H-25 through H-46 in Appendix H, Analytical Reports.

In general, the laboratory QC program produced analyses of duplicate and spiked samples that were satisfactory. Details of the gas chromatographic columns are presented in the transmittal letter from UBTL in Appendix H.

The transmittal letter from UBTL in Appendix H discusses assumed contamination of trip blanks.

APPENDIX G

CHAIN-OF-CUSTODY RECORDS

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: USAF – Elmendorf AFB

Project Title: IRP Phase II Stage 2

Job No.: 1016-265

Field Personnel (Signature): Kay L. Tauscher

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
9/30	14:30	W-17 /1	Water	5	Elmendorf AFB	SP-14
9/30	17:00	GW-7A /2	Water	5	Elmendorf AFB	SP-14
10/1	9:30	GW-3A /3	Water	5	Elmendorf AFB	SP-12
10/1	13:00	W-9 /4	Water	5	Elmendorf AFB	SP-12
10/1	16:00	W-16 /5	Water	5	Elmendorf AFB	SP-2

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Kay L. Tauscher	10-1-86	9:00	STAT EXPRESS			STAT EXPRESS	10/2/86	1430		10/2/86	1430
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: USAF/Elmendorf AFB

Project Title: IRP phase II stage III

Job No.:

Field Personnel (Signature): Joseph. Tauscher

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10-2	12:30	GW-6A/6	Water	5	Elmendorf AFB	SP-2
10-2	15:30	W-14/7	Water	9	Elmendorf AFB	SP-11
10-2	16:00	GW-4A/3	Water	9	Elmendorf AFB	SP-11

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	10/2	23:06	Stat Express			Stat Express	10/3/2	1230	[signature]	10/3/2	1230
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

G-2

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Anchorage, AK; USAF

Project Title: USAF Phase II Stg. 2, IRP

Job No. 10116-265

Field Personnel (Signature): Amy D Lamberg

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/3	10:00	W-12 / #9	Water	~~4~~ 3	D-17	
10/4	16:45	Field QC #1	Water	3		
10/4	9:00	W-13 / #10	Water	3	D-17	
10/4	11:30	W-11 / #11	Water	3	D-17	
10/4	16:45	W-10 / #12	Water	3	D-17	
10/4	18:30	GW-1A / #13	Water	9	D-5	
10/5	11:00	GW-1C / #14	Water	8	D-5	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Amy Lamberg	10/5	21:30	Stat Express			Stat Express	10/6/20	1145	M. Simmons	10/6/20	1145
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Anchorage, AK. USAF

Project Title: USAF Phase II Stg 2 IRP

Job No. 1016-265

Field Personnel (Signature): Mary D Saunders

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/5	11:00	GW-1C / #14	Water	1	D-5	
		Trip Blank, Pb	Water	1		
10/4	18:30	field QC #2	Water	1		Petroleum Hydrocarbons
10/4	18:30	lab QC	Water	1		Nitrates / Nitrites
10/5	14:00	GW-1B / #15	Water	9	D-5	
10/5	17:30	W-1 / #16	Water	6	D-5	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Mary D Saunders	10/5	21:30	Stat Express			Stat Express	10/6/86	1145	M Simmons	10/6/86	1145
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Anchorage, AK						Field Personnel (Signature): Amy D Lamborg
Project Title: USAF Phase II Stage 2 IRP					Job No. 1016-265	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/5	9:30	W-2 / #17	Water	3	D-5	TDS; Pet.-Hyd; Pest.
10/5	17:30	W-1 / #16	Water	3	D-5	TDS; Pet-Hyd; Pest.
10/6	15:00	GW-2C / #19	Water	2	D-7	Pest., Pet-Hyd.
10/6	17:30	GW-2A / #20	Water	3	D-7	Pest; Pet-Hyd; TDS
10/6	12:00	GW-2B / #18	Water	2	D-7	TDS, Pet.-Hyd.

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Amy Lamborg	10/6/86	2300 SIMI EXPRESS	M. Simmons	10/7/86	1007						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client	Elmendorf AFB, Anchorage, AK					Field Personnel (Signature)
Project Title	USAF Phase II Stage 2 IRP				Job No. 1016-265	Amy P Lamberg
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/6	17:30	lab QC/GW-2A	Water	1	D-7	TDS

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Amy Lamberg	10/6/86	2300 STAT	M Saminoski	10/7/86	1007						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client	Elmendorf AFB, Anchorage, AK				Field Personnel (Signature)
Project Title	USAF Phase II Stage 2, IRP			Job No. 1016-265	Amy D Lamborg
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/6	12:00	field QC/GW-2B	Water	1	D-7	Pesticides
10/6	15:00	lab QC/GW-2C	Water	1	D-7	Pesticides
10/6	17:30	lab QC/GW-2A	Water	1	D-7	Pesticides
10/6	17:30	lab QC/GW-2A	Water	1	D-7	TDS
10/6	15:00	lab QC/GW-2C	Water	1	D-7	Pesticides
		trip blank	Water	1		Pesticides
10/6	15:00	field QC/GW-2C	Water	1	D-7	TDS
10/6	12:00	lab QC/GW-2B	Water	1	D-7	Pesticides
		trip blank	Water	1		TDS
10/6	15:00	lab QC/GW-2C	Water	1	D-7	TDS
10/6	15:00	GW-2C/#19	Water	7	D-7	TDS/VOA, VOlt
10/6	15:00	GW-2A/#20	Water	6	D-7	VOA, VOlt
10/6	12:00	GW-2B/#18	Water	7	D-7	VOA, VOlt, Pest.
10/5	19:30	W-2/#17	Water	6	D-5	VOA, VOlt
10/6	12:00	lab QC/GW-2B	Water	1	D-7	TDS

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Amy Lamborg	10/6/86	2300 STPI	M. Simmons	10/7/86	1007						
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: USAF Elmendorf AFB

Project Title: USAF - IRP Phase II Stage II

Job No. 1016-265-007

Field Personnel (Signature): Kay L. Laucher

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/7	9:00	W-19/21	Water	3	Site IS-1	
10/7	10:30	W-18/22	"	3	Site IS-1	
10/7	13:00	W-3/23	"	5	SP-7/SP-10	
10/7	15:00	W-4/24	"	5	SP-7/SP-10	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
K. Laucher	10/7	18:00	Stat Express			Stat Express	10/8/92	1030	M Sunnon	10/8/92	1030
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB Anchorage, Ak. USAF

Project Title: USAF Phase II Sig. 2, IRP

Job No. 1016-265

Field Personnel (Signature): Amy D Hunter

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/8	9:30	W-6B/#25	Water	9	D-7	3(601's); 3(602's); TDS; Pet Hyd; Res
10/8	9:30	W-6B/#25	"	6 (LAB QC's)	D-7	3(601's); 3(602's);
10/8	9:30	W-6B/#25	"	1 (FIELD QC)	D-7	Pet. Hyd.
		trip blank	"	3		3(602's)
10/8	12:30	W-5/#26	"	9	D-7	3(601's); 3(602's); TDS, Pest. Pet Hyd
		trip blank	"	3		Nit/Nit. Anions; TCP
10/8	15:30	W-8/#27	"	4	SP-5	TDS; Nit/Nit, Anions; TCP
10/8	15:30	W-8/#27	"	6 (LAB QC's)	SP-5	3(602's), Anions; TCP; ALK
10/9	16:00	W-15/#30	"	1	FT-1	Pet Hyd

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Amy Hunter	10/9/88	18:30	Stat Express			Stat Express	10/10/88	1105	M Simmons	10/10/88	1105
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Anchorage AK USAF

Project Title: USAF Phase II, Sta 2, IRP

Job No. 1016-265

Field Personnel (Signature): Penny Fairbanks

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/8	15:30	W-8 / #27	Water	5	SP-5	3(602's); AK; Pet Hyd
		trip blank	"	3		VOA's
10/9	15:30	W-8 / #27	"	1 (LAB QC)	SP-5	Pet. Hyd.
10/8	8:30	W-6b / #25	"	1 (LAB QC)	D-7	Pet Hyd
10/8	12:30	W-7 / #28	"	9 9	SP-5	3(602's); AK; Metals; N.Y.Mtl; Pet Hyd; TDS; ICP
10/8	12:30	W-7 / #28	"	7 6 (LAB QC)	SP-5	3(602's); Metals; Pet Hyd; ICP; Nit/Nit
10/9	14:00	GW-5A / #29	"	5	FT-1	3(602's); Pet Hyd, TDS
10/9	16:00	W-15 / #30	"	4	FT-1	3(602's); TDS

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Penny Fairbanks	10/9/90	19:00	Stat Express	~~10/10/90~~ 10/10/90	1105	Stat Express	10/10/90	1105	M Simmons	10/10/90	1105
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client	Elmendorf AFB Anchorage, AK - USAF					Field Personnel (Signature)
Project Title	IRP Site 2, FTP				Job No. 10116-365	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/10	1540	SC-2/#34	Water	6	Ship Creek	3(40's), 3(.02's) TDS Pet H.
10/10	1540	SC-2/#34	"	2	Ship Creek	QC's -- Pet H., lead
10/10	1400	CH-1/#31	"	3	D-17	3(40's)
[redacted]						
10/10	1430	SC-3/#32	"	9	Ship Creek	3(40's), 3(.02's), lead, TDS, Pet H.

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	10/11/88	1133	Stat Exp			Stat Exp.	10/11/88	1140		10/11/88	1140
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB Anchorage AK / USAF

Project Title: USAF PH II Sta 2 IRP

Job No. 1016-265

Field Personnel (Signature): [signature]

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
10/15	0830	BW-2/35	Water	8	Base Well	3(601's). 3(602's). TDS. lead
10/15	0830	BW-2/35	"	1	Base well	LQC ; lead
10/15	0911	BW-1/36	"	8	Base well	3(601's) 3(602's). TDS lead
10/15	0945	BW-52/37	"	8	Base well	3(601's). 3(602's). TDS lead
		trip blanks	"	7		Past. 2(Pet-Hy.) ICP. 3(601's)
10/16	1500	SC-1/#33	"	9	Ship Creek	lead. TDS. Pet Hy 3(601) 3(602)
10/16	1540	SC-2/#34	"	1	Ship Creek	FIELD QC, lead
10/16	1540	SC-2/#34	"	1	Ship Creek	lead

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	10/15	1126	Stat Express			Stat Exp	10/16/92	1140	M Simmons	10/16/92	1140
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Alaska USAFOEHL

Project Title: Phase II Stage 2 IRP (Summer 1987)

Job No. 1016-265-007

Field Personnel (Signature): [signature]

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/21/87	1820	W-4 #44	Water	1	SP-7	TDS
	"	W-4, #45				Ret. Hydro.
	1825	W-3, #46				TDS
	"	W-3, #47				Ret. Hydro. Lab QC
	"	W-3, #48				Ret. Hydro.
	1549	W-12 #49		3	IS-1	601
		W-12, #50				601 Lab QC
		W-12, #51				601 Field QC
		W-12, #52				601 Lab QC
		W-12, #53				601 Trip Blank (Labeled)
	1437	W-14, #54				601

There is an extra Sample W-3 #49 Ret. Hyd Lab QC

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	7/21/87								[signature]	7/22/87	1130
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client Elmendorf AFB, Alaska USAFOEHL						Field Personnel (Signature)
Project Title Phase II Stage 2 IRP (Summer 1987)					Job No. 1016-265-007	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
			Water			

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
									[signature]	7/30/91	0738
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Alaska USAFOEHL

Project Title: Phase II Stage 2 IRP (Summer 1987)

Job No. 1016-265-007

Field Personnel (Signature): [signature]

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/6	1200	GW-7A, #15	Water	1	SP-14	TDS
		GW-7A, #16				TDS Lab QC
		GW-7A, #17				TDS Lab QC
		GW-7A, #18				TDS Field QC
		GW-7A, #19				TDS Field QC
		GW-7A, #20				Pet. Hydro.
	1048	W-17, #21				TDS
		W-17, #22			↓	Pet. Hydro.
	1425	W-7, #23			SP-5	TDS
	1524	W-8, #24			SP-5	TDS
	1735	W-16, #25			SP-2	TDS
		W-16, #26				Pet. Hydro.
	1837	GW-6A, #27				TDS
		GW-6A, #28	↓	↓		Pet. Hydro.
↓		GW-6A, #29			↓	Pet. Hydro. Lab QC

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	7/6/87		[signature]						[signature]	7/7/87	0730
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Alaska USAFOEHL						Field Personnel (Signature)
Project Title: Phase II Stage 2 IRP (Summer 1987)					Job No. 1016-265-007	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/16	1837	GW-6A #30	Water	1	SP-2	Pet. Hydro Lab QC
"	"	GW-6A #31	"	1	SP-2	Pet. Hydro Field QC

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	7/16/87									7/17/87	0730
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client	Elmendorf AFB, Alaska USAFOEHL				Field Personnel (Signature)
Project Title	Phase II Stage 2 IRP (Summer 1987)			Job No. 1016-265-007	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/20	0946	SC-1 #32	Water	1	Ship Creek	TDS
	0946	SC-1, #33				Pet. Hydro
	0955	SC-2, #34				TDS
	0955	SC-2, #35				Pet. Hydro
	1010	SC-3, #36				TDS
	1010	SC-3, #37				Pet. Hydro
	1343	BW-1, #38			Base well	TDS
	1313	BW-2, #39				TDS
	1400	BW-52, #40				TDS
	1244	W-14, #41			SP-11	TDS
	1244	W-14, #42			SP-11	Pet Hydro
	1040	CH-1, #43		3	D-17	601

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	7/20/87									7/21/87	1130
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Chain of Custody

7/22 Shipped

W-5 #55
#56
#57

Change to

W-6

W-6 #64
#65
#66

Change to

W-5

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Alaska USAFOEHL

Field Personnel (Signature): [signature]

Project Title: Phase II Stage 2 IRP (Summer 1987)

Job No. 1016-265-007

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/22	1508	W-6, #55	Water	W-6 #55	D-7	TDS
	"	W-6, #56		W-6 #56	D-7	Pet Hyd
	"	W-6, #57		W-6 #5	D-7	Pest
	2250	GW-2A #58				TDS
	"	GW-2A #59	As per Carole Shuttle			Pet Hyd
	"	GW-2A #60	7/27/87 0900			Pest
	1916	GW-2C #61				TDS
	"	GW-2C #62				Pet Hyd
	"	GW-2C #63				Pest
	1640	W-5, #64	W-5 #64			TDS
	"	W-5, #65	W-5 #65			Pet Hyd
	"	W-5, #66	W-5 #66			Pest
		#44				

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]									[signature] as	7/24/87	1100
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client: Elmendorf AFB, Alaska USAFOEHL

Field Personnel (Signature):

Project Title: Phase II Stage 2 IRP (Summer 1987)

Job No. 1016-265-007

Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/22	0951	GW-1B, #67	Water	1	D-5	TDS
	"	GW-1B, #68				Pet Hyd Field QC
	"	GW-1B, #69				Pet Hyd Field QC
	"	GW-1B, #70				Pet Hyd Lab QC
	"	GW-1B, #71				Pet Hyd Lab QC
	"	GW-1B, #72				Pet Hyd
	"	GW-1B, #73				Pet Hyd Trip Blank
	2144	GW-1A, #74				TDS
	"	GW-1A, #75				Pet Hyd
	1102	GW-1C, #76				TDS
	"	GW-1C, #77				Pet Hyd
	1207	W-1, #78				TDS
	1207	W-1, #79				Pet Hyd

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	7/22/87								[signature]	7/23/87	1100
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client	Elmendorf AFB, Alaska USAFOEHL					Field Personnel (Signature)
Project Title	Phase II Stage 2 IRP (Summer 1987)				Job No. 1016-265-007	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks
7/22	1805	GW-2B, #00	Water	1	D-7	TDS
		GW-2B, #01				Pest Hyd
		GW-2B, #02				Pest Lab QC
		GW-2B, #03				Pest Lab QC
		GW-2B, #04				Pest Field QC
		GW-2B, #05				Pest.
		GW-2B, #06				Pest Trip Blank

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	7/22									7/24/87	1100
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

APPENDIX H

ANALYTICAL REPORTS

DataChem

May 15, 1987
Refer to: 87D464

Carol Scholl
Dames & Moore
1550 Northwest Highway
Park Ridge, Illinois 60068

Re: F33615-83-D-4002, Elmendorf AFB

Dear Ms. Scholl:

With regard to our telephone conversation of May 13, 1987 concerning the Elmendorf AFB analytical results, the following comments are offered and amended report pages are enclosed.

1. Alkalinity, Bicarbonate, and Carbonate
The total alkalinity of each sample was determined by EPA 310.2 which is an automated colorimetric procedure. The pH of each sample was measured and used with the total alkalinity data to compute the amounts of bicarbonate and carbonate present in each sample. The alkalinity of samples W-7/SP-5 and W-8/SP-5 may be attributed solely to bicarbonate. The holding times for bicarbonate and carbonate would be the same in this case as the holding time for alkalinity (14 days) because they were calculated from the alkalinity results. The bicarbonate and carbonate are reported as $CaCO_3$ in order to make them comparable to the total alkalinity. Bicarbonate (as $CaCO_3$) x 1.22 = HCO_3^- and Carbonate (as $CaCO_3$) x 0.6 = CO_3^{-2}, with all concentrations in mg/liter.

2. The data originally reported as nitrate actually represent the sum of nitrate plus nitrite which is, in fact, the result generated by the referenced method (EPA 353.2). The data reported for nitrite have been deleted. The samples for nitrate plus nitrite were preserved with sulfuric acid and stored at 4 °C. Their holding time under those conditions was 28 days.

3. EPA 365.4 employs a digestion step which converts all of the phosphorus present in the sample to a single form for measurement. Thus, it is a total phosphorus method. The samples for total phosphorus were preserved with sulfuric acid and stored at 4 °C. Their holding time under those conditions was 28 days.

Sincerely,

Sim D. Lessley

Sim D. Lessley, Ph.D.
Associate Director

SDL:jno
Enclosure

520 Wakara Way, Research Park
Salt Lake City, Utah 84108
801 583-3600

UTAH BIOMEDICAL TEST LABORATORY
DIVISION OF DESERET RESEARCH COMPANY
520 WAKARA WAY SALT LAKE CITY UTAH 84108
801 583-3600

March 13, 1987
Refer to: 87D246

Mr. Michael W. Ander
Dames & Moore
1550 Northwest Highway
Park Ridge, Illinois 60068

Re: F33615-83-D-4002, Elmendorf AFB

Dear Mr. Ander:

Enclosed with this letter is a copy of UBTL's report of the analysis of water and soil samples from the Elmendorf AFB.

Comments upon the analyses are offered in the following paragraphs.

Purgeable Halocarbons in Water by EPA Method 601

A 5 mL sample of water was purged with helium. Any analytes present were collected on a trap consisting of activated charcoal, Tenax, and silica gel. The trap was then heated to 180 °C and the analytes were flushed onto a 8' x 2 mm i.d. glass column packed with 1% SP-1000 on Carbopack B. A temperature program starting at 45 °C and proceeding at 6 °C/minute to 225 °C was used to separate the analytes. A Hall 700A electroconductivity detector in the halogen mode was used for detection and quantification of the analytes.

Any samples that were found to contain target analytes at or above the UBTL method detection limit (MDL) were re-analyzed using an 8' x 2 mm glass second column packed with 0.2% Carbowax 1500 on Carbopack C with temperature programming from 45 °C to 175 °C at 6 °C per minute. A total of 22 of the field samples were confirmed using the second column.

To date UBTL has not been able to identify a source of trichlorofluoromethane (Freon 11) in the laboratory. The appearance of low levels of trichlorofluoromethane in one of the Ship Creek samples and in one of the four trip blanks strongly suggests that the low levels of trichlorofluoromethane reported by UBTL probably are due to laboratory background.

Purgeable Aromatics in Water by EPA Method 602

A 5 mL sample of water was purged with helium. Any analytes present were collected on a trap consisting of activated charcoal, Tenax, and

silica gel. The trap was then heated to 180 °C and the analytes were flushed onto a 8' x 2 mm i.d. glass column packed with 1% SP-1000 on Carbopack B. A thermal program starting at 45 °C and proceeding at 6 °C/minute to 225 °C was used to separate the analytes. A photoionization detector equipped with a 10 eV bulb was used for detection and quantification of the analytes.

One second column confirmation was required for the purgeable aromatics analyses.

Pesticides in Water by EPA Method 608

The analysis was performed on a Varian 3700 gas chromatograph equipped with an electron capture detector. A 6' x 2 mm glass column packed with 1.5% SP-2250/1.95% SP-2401 on 100/120 mesh Supelcoport was used isothermally at 200 °C. Nitrogen was used as the carrier gas.

No second column confirmation was required.

Trip Blanks

The following trip blank data are probably the result of laboratory background rather than trip contamination.

Sample	Filterable Residue (TDS)	Nitrate
Trip Blank SP-5	11 mg/L	0.05 mg/L

The ICP data reported for chromium and nickel should be regarded with caution because of the presence of those elements in one or two of the trip blanks. The reported levels are low.

The original chain of custody sheets are enclosed.

Sincerely,

Sim D. Lessley, Ph.D.
Associate Director

SDL:jno

Enclosure

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)								
Bromodichloromethane	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND
Bromoform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND
Bromomethane	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND
Chloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND
Chloroform	EPA 601 (1)	ug/L	0.45		ND	ND	1.2	ND	ND	ND	ND
Chloromethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	EPA 601 (1)	ug/L	0.34		3.7	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	EPA 601 (1)	ug/L	0.38		0.77	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.53		0.63	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND
Trichloroethene (TCE)	EPA 601 (1)	ug/L	0.60		1.2	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	EPA 601 (1)	ug/L	0.44		0.83	ND	ND	0.54	ND	ND	ND
Vinyl Chloride	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND

Reviewed and Approved by Jim D. Leasley

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-1B D-5	GW-1C D-5	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7	W-10 D-17
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)											
Bromodichloromethane	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	EPA 601 (1)	ug/L	0.49		4.7	ND	ND	ND	ND	1.5	3.5	ND	ND	ND
1,2-Dichloroethane	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	EPA 601 (1)	ug/L	0.42		ND	1.1	3.2	1.3	ND	6.9	3.1	ND	ND	ND
1,2-Dichloropropane	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	EPA 601 (1)	ug/L	0.34		2.6	0.72	ND	0.57	0.80	3.0	3.1	1.8	0.63	19.
1,1,2,2-Tetrachloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	EPA 601 (1)	ug/L	0.38		0.49	0.58	ND	0.48	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.53		32.	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene (TCE)	EPA 601 (1)	ug/L	0.60		2.7	ND	ND	ND	ND	2.3	0.66	ND	ND	ND
Trichlorofluoromethane	EPA 601 (1)	ug/L	0.44		0.60	0.51	ND	ND	ND	1.3	1.2	0.99	0.56	ND
Vinyl Chloride	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

USTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #:	W-11	W-12	W-13	CH-1*	W-14	GW-4A	W-18	W-19	Trip Blank
Site :					D-17	D-17	D-17	D-17	SP-11	SP-11	IS-1	IS-1	SP-11
urgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)										
Bromodichloromethane	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	1.6	ND	ND	ND
1,2-Dichlorobenzene	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	1.4	6.1	ND
1,2-Dichloroethane	EPA 601 (1)	ug/L	0.44		ND	ND	1.1	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	EPA 601 (1)	ug/L	0.42		16.	30.	15.	ND	ND	2.4	ND	ND	ND
1,2-Dichloropropane	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	EPA 601 (1)	ug/L	0.34		3.7	6.3	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	EPA 601 (1)	ug/L	0.38		ND	1.6	ND	ND	0.53	0.46	ND	ND	ND
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.53		ND	ND	ND	ND	ND	ND	ND	2.4	ND
1,1,2-Trichloroethane	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene (TCE)	EPA 601 (1)	ug/L	0.60		47.	26.	5.2	ND	ND	3.0	ND	ND	ND
Trichlorofluoromethane	EPA 601 (1)	ug/L	0.44		0.62	ND	0.68	ND	ND	0.49	ND	ND	ND
Vinyl Chloride	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND	ND	ND

D" indicates that the parameter was not detected.

* Indicates monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	Trip Blank SP-5	Trip Blank Base Wells	Trip Blank D-7	W-18(FQC) IS-1 *	Trip Blank IS-1(W-18) *
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)						
Bromodichloromethane	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND
Bromoform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Bromomethane	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND
Carbon Tetrachloride	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND
Chlorobenzene	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND
Chloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
Chloroform	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Chloromethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
Dibromochloromethane	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND
Dichlorodifluoromethane	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND
1,1-Dichloroethane	EPA 601 (1)	ug/L	0.49		ND	ND	ND	1.3	ND
1,2-Dichloroethane	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
1,2-Dichloropropane	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND
Methylene Chloride	EPA 601 (1)	ug/L	0.34		ND	32.	ND	ND	ND
1,1,2,2-Tetrachloroethane	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
Tetrachloroethene	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.53		ND	ND	ND	ND	ND
1,1,2-Trichloroethane	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND
Trichloroethene (TCE)	EPA 601 (1)	ug/L	0.60		ND	ND	ND	ND	ND
Trichlorofluoromethane	EPA 601 (1)	ug/L	0.44		ND	0.94	ND	ND	ND
Vinyl Chloride	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND

H-7

ND" indicates that the parameter was not detected.

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: / Site :	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1B D-5	GW-1C D-5
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)										
Benzene	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND

"ND" Indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7	W-3 SP-7	W-4 SP-10
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)										
Benzene	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	4800	ND
Chlorobenzene	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	620	ND
Toluene	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	8200	ND
m-Xylene	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	3000	ND
o-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	2600	ND
p-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: / Site :	GW-3A SP-12	W-9 SP-12	GW-4A SP-11	W-14 SP-11	GW-5A FT-1	W-15 FT-1	GW-6A SP-2	W-16 SP-2	GW-7A SP-14
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)										
Benzene	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

USTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	W-17 SP-14	W-7 SP-5	W-8 SP-5	Trip Blank SP-5	Trip Blank SP-11	Trip Blank D-7
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)							
Benzene	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND
Chlorobenzene	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND
Ethylbenzene	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND
Toluene	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND
m-Xylene	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND
o-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND
p-Xylene	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

USTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: / Site :	GW-1A D-5	GW-1B D-5	GW-1C D-5	GW-2A* D-7	GW-2B* D-7	GW-2C* D-7	W-1 D-5	W-2 D-5
Pesticides	EPA 608 (1)	ug/L	MDL (2)									
Aldrin	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND	ND	ND
alpha-BHC	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	EPA 608 (1)	ug/L	0.002		ND	ND	ND	ND	ND	ND	ND	ND
Lindane	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	EPA 608 (1)	ug/L	0.004		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	EPA 608 (1)	ug/L	0.03		ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endrin	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	EPA 608 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	W-5 * D-7	W-6B D-7	W-6 * D-7	Trip Blank * D-7 (GW-2B)	Trip Blank D-5	Trip Blank Base Wells
Pesticides	EPA 608 (1)	ug/L	MDL (2)							
Aldrin	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND
alpha-BHC	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
beta-BHC	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
delta-BHC	EPA 608 (1)	ug/L	0.002		ND	ND	ND	ND	ND	ND
Lindane	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
Chlordane	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
4,4'-DDD	EPA 608 (1)	ug/L	0.004		ND	ND	ND	ND	ND	ND
4,4'-DDE	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
4,4'-DDT	EPA 608 (1)	ug/L	0.03		ND	ND	ND	ND	ND	ND
Dieldrin	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
Endosulfan I	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endosulfan II	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endrin	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
Endrin Aldehyde	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Heptachlor	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
Toxaphene	EPA 608 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1B D-5
Filterable Residue (TDS)	EPA 160.1 (3)	mg/L	10.		130 *	110 *	140 *	60 *	60 *	60 *	180 *	130 *
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2					ND *	ND *	ND *	1.0 *	ND *
Lead	EPA 239.2 (3)	mg/L	0.005		ND	ND	ND	0.009	0.010	0.005		

"ND" indicates that the parameter was not detected.

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: / Site :	GW-1C D-5	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7	W-3 SP-7	W-4 SP-10
Filterable Residue (TDS)	EPA 160.1 (3)	mg/L	10.		140 *	130 *	81.	140 *	190 *	210*	130	110	470 *	500 *
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2		ND *	0.2 *	ND	ND *	ND *	ND *	3.9	ND	51. *	1.9*
Lead	EPA 239.2 (3)	mg/L	0.005											

"ND" indicates that the parameter was not detected.

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-3A SP-12	W-9 SP-12	GW-4A SP-11	W-14 SP-11	GW-5A FT-1	W-15 FT-1	GW-6A SP-2	W-16 SP-2	GW-7A SP-14
Filterable Residue (TDS)	EPA 160.1 (3)	mg/L	10.		400 *	420*	220 *	220*	460 *	2[illegible]0 *	320 *	320*	330 *
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2		0.1 *	ND *	19. (4)*	ND *	ND	ND	61. *	0.8 (5)*	ND *
Lead	EPA 239.2 (3)	mg/L	0.005				ND	ND					

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"ND" indicates that the parameter was not detected.
* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-6A(FQC) SP-2	GW-1B(FQC) D-5	W-6 D-7	Trip Blank FT-1(GW-5A)	Trip Blank SP-14(GW-7A)
Filterable Residue (TDS)	EPA 160.1 (3)	mg/L	10.				90 *		
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2		120 *	0.5 *	0.7*	ND*	ND*
Lead	EPA 239.2 (3)	mg/L	0.005						

"ND" indicates that the parameter was not detected.
* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	W-17 SP-14	W-7 SP-5	W-8 SP-5	Trip Blank SP-5	Trip Blank SP-11
Filterable Residue (TDS)	EPA 160.1 (3)	mg/L	10.		270 *	460 *	390*		
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2		ND *	ND	ND	ND	
Lead	EPA 239.2 (3)	mg/L	0.005						ND
Alkalinity (as $CaCO_3$)(†)	EPA 310.2 (2)	mg/L	10.			350	290	ND	
Bicarbonate (as $CaCO_3$)(†)	EPA 310.2 (2)	mg/L	10.			350	290	ND	
Carbonate (as $CaCO_3$)(†)	EPA 310.2 (2)	mg/L	10.			ND	ND	ND	
Nitrate + Nitrite (as N)(†)	EPA 353.2 (3)	mg/L	0.02			4.9	1.1	0.05	
Total Phosphate	EPA 365.4 (3)	mg/L	1.			1.	2.	ND	
Chloride Ion	A429 (4)	mg/L	0.1			120	47	ND	
Sulfate Ion	A429 (4)	mg/L	0.1			20	10	ND	
Fluoride Ion	A429 (4)	mg/L	0.05			0.1	0.2	ND	
Bromide Ion	A429 (4)	mg/L	0.1			0.7	0.3	ND	

(†) Amended 05/13/87
* Indicated monitor well resampled July, 1987.

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Field #: Site :	W-7 SP-5	W-8 SP-5	Trip Blank SP-5	Trip Blank Base Wells
ICP Scan	EPA 200.7 (3)	ug/L	MDL*					
Silver	EPA 200.7 (3)	ug/L	7.		ND	ND	ND	ND
Aluminum	EPA 200.7 (3)	ug/L	45.		ND	ND	ND	ND
Arsenic	EPA 200.7 (3)	ug/L	53.		ND	ND	ND	ND
Boron	EPA 200.7 (3)	ug/L	5.		ND	ND	66.	ND
Barium	EPA 200.7 (3)	ug/L	2.		120	56.	ND	ND
Beryllium	EPA 200.7 (3)	ug/L	0.3		ND	ND	ND	ND
Calcium	EPA 200.7 (3)	ug/L	10.		120000	80000	14.	34.
Cadmium	EPA 200.7 (3)	ug/L	4.		ND	ND	ND	6.
Cobalt	EPA 200.7 (3)	ug/L	7.		ND	ND	ND	ND
Chromium	EPA 200.7 (3)	ug/L	7.		13.	11.	10.	18.
Copper	EPA 200.7 (3)	ug/L	6.		ND	ND	ND	ND
Iron	EPA 200.7 (3)	ug/L	7.		ND	ND	ND	ND
Magnesium	EPA 200.7 (3)	ug/L	30.		38000	22000	ND	ND
Manganese	EPA 200.7 (3)	ug/L	2.		210	5.	ND	ND
Molybdenum	EPA 200.7 (3)	ug/L	8.		48.	ND	ND	ND
Nickel	EPA 200.7 (3)	ug/L	15.		ND	20.	ND	16.
Lead	EPA 200.7 (3)	ug/L	42.		ND	ND	ND	ND
Antimony	EPA 200.7 (3)	ug/L	32.		ND	ND	ND	ND
Selenium	EPA 200.7 (3)	ug/L	75.		ND	ND	ND	ND
Thallium	EPA 200.7 (3)	ug/L	40.		ND	ND	ND	ND
Vanadium	EPA 200.7 (3)	ug/L	8.		ND	ND	ND	ND
Zinc	EPA 200.7 (3)	ug/L	2.		ND	ND	ND	ND

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Holding Time Summary

Parameter	Method	Field #: / Site:	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1B D-5	SW-1C D-5	W-1 D-5
Sampling Date			10/15/86 07/20/87 *	10/15/86 07/20/87 *	10/15/86 07/20/87 *	10/10/86 07/20/87*	10/10/86 07/20/87*	10/10/86 07/20/87*	10/05/86 07/22/87 *	10/05/86 07/22/87 *	10/05/86 07/22/87 *	10/05/86 07/22/87 *
Purgeable Halocarbons	EPA 601(1)											
Date Analyzed			10/18/86	10/18/86	10/18/86	10/19/86	10/19/86	10/19/86	10/15/86	10/15/86	10/15/86	10/15/86
Elapsed Time			3 days	3 days	3 days	9 days	9 days	9 days	10 days	10 days	10 days	10 days
Purgeable Aromatics	EPA 602(1)											
Date Analyzed			10/18/86	10/18/86	10/18/86	10/19/86	10/19/86	10/19/86	10/16/86	10/16/86	10/16/86	10/16/86
Elapsed Time			3 days	3 days	3 days	9 days	9 days	9 days	11 days	11 days	11 days	11 days
Pesticides	EPA 608(1)											
Date Extracted									10/10/86	10/10/86	10/10/86	10/10/86
Elapsed Time									5 days	5 days	5 days	5 days
Date Analyzed									10/22/86	10/22/86	10/22/86	10/22/86
Elapsed Time									17 days	17 days	17 days	17 days
Filterable Residue (TDS)	EPA 160.1(3)											
Date Analyzed			07/22/87	07/22/87	07/22/87	07/22/87	07/22/87	07/22/87	07/28/87	07/28/87	07/28/87	07/28/87
Elapsed Time			2 days *	2 days *	2 days *	2 days *	2 days *	2 days *	6 days *	6 days *	6 days *	6 days *
Petroleum Hydrocarbons	EPA 418.1 (3)											
Date Analyzed						08/06/87	08/06/87	08/06/87	08/13/87	08/13/87	08/13/87	08/13/87
Elapsed Time						17 days *	17 days *	17 days *	22 days *	22 days *	22 days *	22 days *
Lead	EPA 239.2 (3)											
Date Analyzed			10/23/86	10/23/86	10/23/86	10/23/86	10/23/86	10/23/86				
Elapsed Time			8 days	8 days	8 days	13 days	13 days	13 days				

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Holding Time Summary

Parameter	Method	Field #: / Site :	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7	W-3 SP-7	W-4 SP-7	GW-3A SP-12	W-9 SP-12
Sampling Date			10/05/86	10/06/86 07/22/87*	10/06/86 07/22/87*	10/06/86 07/22/87*	10/08/86 07/22/87*	10/08/86 07/22/87*	10/07/86 07/21/87*	10/07/86 07/21/87*	10/01/86 07/21/87*	10/01/86 07/17/87*
Purgeable Halocarbons	EPA 601(1)											
Date Analyzed			10/15/86	10/17/86	10/17/86	10/17/86	10/17/86	10/17/86				
Elapsed Time			10 days	11 days	11 days	11 days	9 days	9 days				
Purgeable Aromatics	EPA 602(1)											
Date Analyzed			10/16/86	10/14/86	10/14/86	10/14/86	10/14/86	10/14/86	10/15/86	10/15/86	10/13/86	10/13/86
Elapsed Time			11 days	8 days	8 days	8 days	6 days	6 days	8 days	8 days	12 days	12 days
Pesticides	EPA 608(1)											
Date Extracted			10/10/86	07/28/87*	07/28/87*	07/28/87*	07/28/87*	07/28/87*				
Elapsed Time			5 days	6 days	6 days	6 days	6 days	6 days				
Date Analyzed			10/22/86	07/29/87	07/29/87	07/29/87	07/29/87	07/29/87				
Elapsed Time			17 days	1 day	1 day	1 day	1 day	1 day				
Filterable Residue	EPA 160.1(3)											
Date Analyzed			11/04/86	07/28/87	07/28/87	07/28/87	07/28/87	07/28/87	07/23/87	07/23/87	07/22/87	07/22/87
Elapsed Time			30 days	6 days*	6 days*	6 days*	6 days*	6 days*	2 days*	2 days*	1 day*	5 days*
Petroleum Hydrocarbons	EPA 418.1 (3)											
Date Analyzed			11/03/86	08/13/87	08/13/87	08/13/87	08/13/87	08/13/87	08/06/87	08/06/87	08/06/87	08/06/87
Elapsed Time			29 days	22 days*	22 days*	22 days*	22 days*	22 days*	16 days*	16 days*	16 days*	20 days*
Lead	EPA 239.2 (3)											
Date Analyzed												
Elapsed Time												

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Holding Time Summary

Parameter	Method	Field #: / Site :	GW-4A SP-11	W-14 SP-11	GW-5A FT-1	W-15 FT-1	GW-6A SP-2	W-16 SP-2	GW-7A SP-14	W-17 SP-14	W-7 SP-5	W-8 SP-5
Sampling Date			10/02/86 * 07/17/87	10/02/86 * 07/20/87	10/09/86 * 07/17/87	10/09/86 * 07/17/87	10/02/86 * 07/18/87	10/01/86 * 07/18/87	09/30/86 * 07/18/87	09/30/86 * 07/18/87	10/08/86 * 07/18/87	10/08/86 * 07/18/87
Purgeable Halocarbons	EPA 601(1)											
Date Analyzed			10/14/86	10/14/86								
Elapsed Time			12 days	12 days								
Purgeable Aromatics	EPA 602(1)											
Date Analyzed			10/14/86	10/14/86	10/17/86	10/17/86	10/13/86	10/13/86	10/13/86	10/13/86	10/17/86	10/17/86
Elapsed Time			12 days	12 days	8 days	8 days	11 days	12 days	13 days	13 days	9 days	9 days
Filterable Residue	EPA 160.1(3)											
Date Analyzed			07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *	07/22/87 *
Elapsed Time			5 days	2 days	5 days	5 days	4 days	4 days	4 days	4 days	4 days	4 days
Petroleum Hydrocarbons	EPA 418.1 (3)											
Date Analyzed			08/06/87 *	08/06/87 *	11/03/86	11/03/86	08/06/87 *	08/06/87 *	08/06/87 *	08/06/87 *	11/03/86	11/03/86
Elapsed Time			20 days	17 days	25 days	25 days	19 days	19 days	19 days	19 days	26 days	26 days
Lead	EPA 239.2 (3)											
Date Analyzed			10/17/86	10/17/86								
Elapsed Time			15 days	15 days								

* Indicates monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Holding Time Summary

Parameter	Method	Field #: / Site :	W-10 D-17	W-11 D-17	W-12 D-17	W-13 D-17	CH-1 D-17	W-18 IS-1	W-19 IS-1	Trip Blank SP-5	Trip Blank SP-11	Trip Blank D-7	Trip Blank Base Well
Sampling Date			10/04/86	10/04/86	10/03/86	10/04/86	07/20/87 *	07/21/87 *	07/21/87 *	10/08/86	10/02/86	10/06/86	10/15/86
Purgeable Halocarbons	EPA 601(1)												
Date Analyzed			10/14/86	10/14/86	10/14/86	10/14/86	07/27/87 *	07/27/87 *	07/27/87 *		10/14/85	10/17/86	10/18/86
Elapsed Time			10 days	10 days	11 days	10 days	7 days	6 days	6 days		12 days	11 days	3 days
Purgeable Aromatics	EPA 602(1)												
Date Analyzed										10/17/86	10/14/86	10/14/86	
Elapsed Time										9 days	12 days	8 days	
Pesticides	EPA 608(1)												
Date Extracted													10/17/86
Elapsed Time													2 days
Date Analyzed													10/22/86
Elapsed Time													7 days
Filterable Residue	EPA 160.1(3)												
Date Analyzed													
Elapsed Time													
Petroleum Hydrocarbons	EPA 418.1 (3)												
Date Analyzed										11/03/86			
Elapsed Time										26 days			
Lead	EPA 239.2 (3)												
Date Analyzed											10/17/86		
Elapsed Time											15 days		

* Indicated monitor well resampled July, 1987.

DATACHEM ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Holding Time Summary

Parameter	Method	Field #: Site :	Trip Blank D-7(GW-2B)	Trip Blank SP-11(W-14)*	Trip Blank FT-1(GW-5A)*	Trip Blank SP-14(GW-7A)*	Trip Blank IS-1(W-18)*	Trip Blank D-5(GW-1B)*
Date Sampled			07/22/87	07/20/87	07/17/87	07/18/87	07/21/87	07/22/87
Purgeable Halocarbons								
Date Analyzed							07/27/87	
Elapsed Time							6 days	
Pesticides	EPA 608 (1)							
Date Extracted			07/28/87					
Elapsed Time			6 days					
Date Analyzed			07/29/87					
Elapsed Time			1 day					
Petroleum Hydrocarbons	EPA 418.1 (3)							
Date Analyzed				08/06/87				08/13/87
Elapsed Time				17 days				21 days
Filterable Residue	EPA 160.1 (3)							
Date Analyzed					07/22/87	07/22/87		
Elapsed Time					5 days	4 days		

* Indicated monitor well resampled July, 1987.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Holding Time Summary

Parameter	Method	Field #: Site	W-7 SP-5	W-8 SP-5	Trip Blank SP-5
Sampling Date			10/08/86	10/08/86	10/08/86
Anion Analysis (IC)	A429 (4)				
Date Analyzed			10/17/86	10/17/86	10/17/86
Elapsed Time			9 days	9 days	9 days
Alkalinity (as $CaCO_3$)(†)	EPA 310.2 (3)				
Date Analyzed			10/16/86	10/16/86	10/16/86
Elapsed Time			8 days	8 days	8 days
Bicarbonate (as $CaCO_3$)(†)	EPA 310.2 (3)				
Date Analyzed			10/16/86	10/16/86	10/16/86
Elapsed Time			8 days	8 days	8 days
Carbonate (as $CaCO_3$)(†)	EPA 310.2 (3)				
Date Analyzed			10/16/86	10/16/86	10/16/86
Elapsed Time			8 days	8 days	8 days
Nitrate + Nitrite (as N)(†)	EPA 353.2 (3)				
Date Analyzed			11/04/86	11/04/86	11/04/86
Elapsed Time			27 days	27 days	27 days
Total Phosphate	EPA 365.4 (3)				
Date Analyzed			10/27/86	10/27/86	10/27/86
Elapsed Time			19 days	19 days	19 days

(†) Amended 05/13/87

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Holding Time Summary

Parameter	Method	Field #: Site :	W-7 SP-5	W-8 SP-5	Trip Blank SP-5	Trip Blank Base Wells
Sampling Date			10/08/86	10/08/86	10/08/86	10/15/86
ICP Scan	EPA 200.7 (3)					
Date Analyzed			10/29/86	10/29/86	10/29/86	10/29/86
Elapsed Time			21 days	21 days	21 days	14 days

UBTL QUALITY CONTROL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Method Blank
Purgeable Halocarbons											
Chlorobenzene	EPA 601 (1)	ug/L	0.37	BW-2	ND	10.	87%	BW-2	ND	ND	ND
				GW-1C	ND	10.	64%	GW-1C	ND	ND	
				W-14	ND	10.	65%	W-14	ND	MD	
Chloroform	EPA 601 (1)	ug/L	0.45	BW-2	ND	10.	99%	BW-2	ND	ND	ND
				GW-1C	ND	10.	81%	GW-1C	ND	ND	
				W-14	ND	10.	86%	W-14	ND	MD	
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49	BW-2	ND	10.	120%	BW-2	ND	ND	ND
				GW-1C	ND	10.	95%	GW-1C	ND	ND	
				W-14	ND	10.	84%	W-14	ND	MD	
Tetrachloroethene	EPA 601 (1)	ug/L	0.38	BW-2	ND	10.	98%	BW-2	ND	ND	ND
				GW-1C	0.58	10.	68%	GW-1C	0.58	0.59	
				W-14	0.53	10.	67%	W-14	0.53	0.51	
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.53	BW-2	ND	10.	98%	BW-2	ND	ND	ND
				GW-1C	ND	10.	78%	GW-1C	ND	ND	
				W-14	ND	10.	82%	W-14	ND	MD	
Trichloroethene (TCE)	EPA 601 (1)	ug/L	0.60	BW-2	ND	10.	57%	BW-2	ND	ND	ND
				GW-1C	ND	10.	77%	GW-1C	ND	ND	
				W-14	ND	10.	54%	W-14	ND	MD	
Purbeable Aromatics											
Benzene	EPA 602 (1)	ug/L	0.25	BW-2	ND	10.	107%	BW-2	ND	ND	ND
				GW-1C	ND	10.	96%	GW-1C	ND	ND	
				W-14	ND	10.	86%	W-14	ND	MD	
Toluene	EPA 602 (1)	ug/L	0.64	BW-2	ND	10.	114%	BW-2	ND	ND	ND
				GW-1C	ND	10.	78%	GW-1C	ND	ND	
				W-14	ND	10.	81%	W-14	ND	MD	

"ND" indicates that the parameter was not detected.

DATACHEM QUALITY CONTROL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Method Blank
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)								
Bromodichloromethane	EPA 601 (1)	ug/L	0.35					W-18	ND	ND	ND
Bromoform	EPA 601 (1)	ug/L	0.45					W-18	ND	ND	ND
Bromomethane	EPA 601 (1)	ug/L	0.63					W-18	ND	ND	ND
Carbon Tetrachloride	EPA 601 (1)	ug/L	0.46					W-18	ND	ND	ND
Chlorobenzene	EPA 601 (1)	ug/L	0.37	W-18	ND	10.	81%	W-18	ND	ND	ND
Chloroethane	EPA 601 (1)	ug/L	0.38					W-18	ND	ND	ND
2-Chloroethylvinyl Ether	EPA 601 (1)	ug/L	0.44					W-18	ND	ND	ND
Chloroform	EPA 601 (1)	ug/L	0.45	W-18	ND	10.	90%	W-18	ND	ND	ND
Chloromethane	EPA 601 (1)	ug/L	0.49					W-18	ND	ND	ND
Dibromochloromethane	EPA 601 (1)	ug/L	0.31					W-18	ND	ND	ND
1,2-Dichlorobenzene	EPA 601 (1)	ug/L	0.29					W-18	ND	ND	ND
1,3-Dichlorobenzene	EPA 601 (1)	ug/L	0.42					W-18	ND	ND	ND
1,4-Dichlorobenzene	EPA 601 (1)	ug/L	0.41					W-18	ND	ND	ND
Dichlorodifluoromethane	EPA 601 (1)	ug/L	0.33					W-18	ND	ND	ND
1,1-Dichloroethane	EPA 601 (1)	ug/L	0.49					W-18	1.4	1.3	ND
1,2-Dichloroethane	EPA 601 (1)	ug/L	0.44					W-18	ND	ND	ND
1,1-Dichloroethene	EPA 601 (1)	ug/L	0.49	W-18	ND	10.	85%	W-18	ND	ND	ND
trans-1,3-Dichloroethene	EPA 601 (1)	ug/L	0.42					W-18	ND	ND	ND
1,2-Dichloropropane	EPA 601 (1)	ug/L	0.20					W-18	ND	ND	ND
cis-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.58					W-18	ND	ND	ND
trans-1,3-Dichloropropene	EPA 601 (1)	ug/L	0.39					W-18	ND	ND	ND
Methylene Chloride	EPA 601 (1)	ug/L	0.34					W-18	ND	ND	ND
1,1,2,2-Tetrachloroethane	EPA 601 (1)	ug/L	0.38					W-18	ND	ND	ND
Tetrachloroethene	EPA 601 (1)	ug/L	0.38	W-18	ND	10.	78%	W-18	ND	ND	ND
1,1,1-Trichloroethane	EPA 601 (1)	ug/L	0.58	W-18	ND	10.	87%	W-18	ND	ND	ND
1,1,2-Trichloroethane	EPA 601 (1)	ug/L	0.51					W-18	ND	ND	ND
Trichloroethene	EPA 601 (1)	ug/L	0.60	W-18	ND	10.	78%	W-18	ND	ND	ND
Trichlorofluoromethane	EPA 601 (1)	ug/L	0.44					W-18	ND	ND	ND
Vinyl Chloride	EPA 601 (1)	ug/L	0.54					W-18	ND	ND	ND

"ND" indicates that the parameter was not detected.

UBTL QUALITY CONTROL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Method Blank
Pesticides											
Aldrin	EPA 608 (1)	ug/L	0.007	LAB-QC	ND	0.2	95%				
Lindane	EPA 608 (1)	ug/L	0.005	LAB-QC	ND	0.2	105%				
4,4'-DDT	EPA 608 (1)	ug/L	0.03	LAB-QC	ND	0.5	102%				
Dieldrin	EPA 608 (1)	ug/L	0.005	LAB-QC	ND	0.5	90%				
Endrin	EPA 608 (1)	ug/L	0.006	LAB-QC	ND	0.5	124%				
Heptachlor	EPA 608 (1)	ug/L	0.007	LAB-QC	ND	0.2	95%				
Petroleum Hydrocarbons	EPA 418.1 (3)	mg/L	0.2	GW-1A	ND	21.	90%				
				GW-2B	ND	21.	86%				
				W-15	ND	0.8	112%				
				W-16	6.3	0.8	100%				
Lead	EPA 239.2 (3)	mg/L	0.005	SC-1	0.009	0.048	110%	SC-2	0.010	ND	ND
				W-14	0.005	0.048	116%				
Alkalinity (as $CaCO_3$)(†)	EPA 310.2 (3)	mg/L	10.	W-8 (5)	57.	39.	99%				
Nitrate + Nitrite (as N)(†)	EPA 353.2 (3)	mg/L	0.02	W-8	1.1	0.49	86%				
Total Phosphate	EPA 365.4 (3)	mg/L	1.	W-7	1.	10.	107%				
Chloride	A479 (4)	mg/L	0.1	W-7	120	38	109%				
Sulfate	A479 (4)	mg/L	0.1	W-7	20	40	118%				
Fluoride	A479 (4)	mg/L	0.05	W-7	0.1	0.4	130%				
Bromide	A479 (4)	mg/L	0.1	W-7	0.7	0.8	114%				
ICP Scan	EPA 200.1 (3)	ug/L									
Beryllium			0.3	W-8	ND	100	94%				
Cadmium			4.	W-8	ND	100	83%				
Chromium			7.	W-8	ND	400	84%				
Cobalt			7.	W-8	ND	1000	82%				
Copper			6.	W-8	ND	500	102%				
Vanadium			8.	W-8	ND	1000	90%				

(†) Amended 05/13/87

"ND" indicates that the parameter was not detected.

DATACHEM QUALITY CONTROL REPORT

Elmendorf AFB - Water Samples

Parameter	Method	Units	Detection Limit	Spiked Sample	Initial Value	Spike Conc.	Percent Recovered	Split Sample	First Value	Second Value	Matrix Dup.
Pesticides	EPA 608 (1)	ug/L	MDL (2)								
Aldrin	EPA 608 (1)	ug/L	0.007	GW-2B	ND	0.2	65%	GW-2B	ND	ND	ND
alpha-BHC	EPA 608 (1)	ug/L	0.006					GW-2B	ND	ND	ND
beta-BHC	EPA 608 (1)	ug/L	0.006					GW-2B	ND	ND	ND
delta-BHC	EPA 608 (1)	ug/L	0.002					GW-2B	ND	ND	ND
Lindane	EPA 608 (1)	ug/L	0.005	GW-2B	ND	0.2	105%	GW-2B	ND	ND	ND
Chlordane	EPA 608 (1)	ug/L	0.01					GW-2B	ND	ND	ND
4,4'-DDD	EPA 608 (1)	ug/L	0.004					GW-2B	ND	ND	ND
4,4'-DDE	EPA 608 (1)	ug/L	0.005					GW-2B	ND	ND	ND
4,4'-DDT	EPA 608 (1)	ug/L	0.03	GW-2B	ND	0.5	80%	GW-2B	ND	ND	ND
Dieldrin	EPA 608 (1)	ug/L	0.005	GW-2B	ND	0.5	96%	GW-2B	ND	ND	ND
Endosulfan I	EPA 608 (1)	ug/L	0.01					GW-2B	ND	ND	ND
Endosulfan II	EPA 608 (1)	ug/L	0.01					GW-2B	ND	ND	ND
Endosulfan Sulfate	EPA 608 (1)	ug/L	0.01					GW-2B	ND	ND	ND
Endrin	EPA 608 (1)	ug/L	0.006	GW-2B	ND	0.5	78%	GW-2B	ND	ND	ND
Endrin Aldehyde	EPA 608 (1)	ug/L	0.01					GW-2B	ND	ND	ND
Heptachlor	EPA 608 (1)	ug/L	0.007	GW-2B	ND	0.2	80%	GW-2B	ND	ND	ND
Heptachlor Epoxide	EPA 608 (1)	ug/L	0.006					GW-2B	ND	ND	ND
Toxaphene	EPA 608 (1)	ug/L	0.25					GW-2B	ND	ND	ND
Petroleum Hydrocarbons	EPS 418.1 (3)	mg/L	0.1 (2)	GW-1B	ND	1.6	120%	GW-1B	ND	ND	ND
				SC-3	ND	0.4	100%	GW-6A	61.	62.	
Filterable Residue	EPA 160.1 (3)	mg/L	10. (2)					GW-5A	460	440	ND
								GW-7A	330	330	
								SC-3	60	60	
								W-9	420	420	

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1f D-5
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
Bromodichloromethane (f)	EPA 601 (1)	ug/L	0.35		ND	ND	.69	ND	ND	ND	ND	ND
Bromodichloromethane (s)	EPA 601 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromoform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
Bromoform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromomethane (f)	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane (s)	EPA 601 (1)	ug/L	0.63		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Carbon Tetrachloride (f)	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride (s)	EPA 601 (1)	ug/L	0.46		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 601 (1)	ug/L	0.37		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
2-Chloroethylvinyl Ether (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	1.2	ND	ND	ND	ND	ND
Chloroform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	POS	NEG	NEG	NEG	NEG	NEG
Chloromethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dibromochloromethane (f)	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane (s)	EPA 601 (1)	ug/L	0.31		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1I D-5
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
1,2-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.29		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.41		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dichlorodifluoromethane (f)	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane (s)	EPA 601 (1)	ug/L	0.33		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	4.7
1,1-Dichloroethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	POS
1,2-Dichloroethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	1.6
1,2-Dichloroethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethene (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
trans-1,2-Dichloroethene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,2-Dichloropropane (f)	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane (s)	EPA 601 (1)	ug/L	0.20		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
cis-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.58		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1I D-5
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
trans-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.39		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Methylene Chloride (f)	EPA 601 (1)	ug/L	0.34		3.7	ND	ND	ND	ND	ND	ND	2.6
Methylene Chloride (s)	EPA 601 (1)	ug/L	0.34		POS	NEG	NEG	NEG	NEG	NEG	NEG	POS
1,1,2,2-Tetrachloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Tetrachloroethene (f)	EPA 601 (1)	ug/L	0.38		0.77	ND	ND	ND	ND	ND	ND	0.49
Tetrachloroethene (s)	EPA 601 (1)	ug/L	0.38		POS	NEG	NEG	NEG	NEG	NEG	NEG	POS
1,1,1-Trichloroethane (f)	EPA 601 (1)	ug/L	0.53		0.63	ND	ND	ND	ND	ND	ND	32.
1,1,1-Trichloroethane (s)	EPA 601 (1)	ug/L	0.53		POS	NEG	NEG	NEG	NEG	NEG	NEG	POS
1,1,2-Trichloroethane (f)	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane (s)	EPA 601 (1)	ug/L	0.51		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Trichloroethene (TCE) (f)	EPA 601 (1)	ug/L	0.60		1.2	ND	ND	ND	ND	ND	ND	2.7
Trichloroethene (TCE) (s)	EPA 601 (1)	ug/L	0.60		POS	NEG	NEG	NEG	NEG	NEG	NEG	POS
Trichlorofluoromethane (f)	EPA 601 (1)	ug/L	0.44		0.83	ND	ND	0.54	ND	ND	ND	0.60
Trichlorofluoromethane (s)	EPA 601 (1)	ug/L	0.44		POS	NEG	NEG	POS	NEG	NEG	NEG	POS
Vinyl Chloride (f)	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride (s)	EPA 601 (1)	ug/L	0.54		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-1C D-5	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
Bromodichloromethane (f)	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane (s)	EPA 601 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromoform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
Bromoform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromomethane (f)	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane (s)	EPA 601 (1)	ug/L	0.63		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Carbon Tetrachloride (f)	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride (s)	EPA 601 (1)	ug/L	0.46		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 601 (1)	ug/L	0.37		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
2-Chloroethylvinyl Ether (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
Chloroform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloromethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dibromochloromethane (f)	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane (s)	EPA 601 (1)	ug/L	0.31		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	GW-1C D-5	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
1,2-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.29		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.41		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dichlorodifluoromethane (f)	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane (s)	EPA 601 (1)	ug/L	0.33		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	1.5	3.5	ND	ND
1,1-Dichloroethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	POS	POS	NEG	NEG
1,2-Dichloroethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethene (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
trans-1,2-Dichloroethene (f)	EPA 601 (1)	ug/L	0.42		1.1	3.2	1.3	ND	6.9	3.1	ND	ND
trans-1,2-Dichloroethene (s)	EPA 601 (1)	ug/L	0.42		POS	POS	POS	NEG	POS	POS	NEG	NEG
1,2-Dichloropropane (f)	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane (s)	EPA 601 (1)	ug/L	0.20		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
cis-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.58		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-1C D-5	W-1 D-5	W-2 D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
trans-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.39		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Methylene Chloride (f)	EPA 601 (1)	ug/L	0.34		0.72	ND	0.57	0.80	3.0	3.1	1.8	0.63
Methylene Chloride (s)	EPA 601 (1)	ug/L	0.34		POS	NEG	POS	POS	POS	POS	POS	POS
1,1,2,2-Tetrachloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Tetrachloroethene (f)	EPA 601 (1)	ug/L	0.38		0.58	ND	0.48	ND	ND	ND	ND	ND
Tetrachloroethene (s)	EPA 601 (1)	ug/L	0.38		POS	NEG	POS	NEG	NEG	NEG	NEG	NEG
1,1,1-Trichloroethane (f)	EPA 601 (1)	ug/L	0.53		ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane (s)	EPA 601 (1)	ug/L	0.53		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1,2-Trichloroethane (f)	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane (s)	EPA 601 (1)	ug/L	0.51		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Trichloroethene (TCE) (f)	EPA 601 (1)	ug/L	0.60		ND	ND	ND	ND	2.3	0.66	ND	ND
Trichloroethene (TCE) (s)	EPA 601 (1)	ug/L	0.60		NEG	NEG	NEG	NEG	POS	POS	NEG	NEG
Trichlorofluoromethane (f)	EPA 601 (1)	ug/L	0.44		0.51	ND	ND	ND	1.3	1.2	0.99	0.56
Trichlorofluoromethane (s)	EPA 601 (1)	ug/L	0.44		POS	NEG	NEG	NEG	POS	POS	POS	POS
Vinyl Chloride (f)	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride (s)	EPA 601 (1)	ug/L	0.54		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

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UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-10 D-17	W-11 D-17	W-12 D-17	W-13 D-17	CH-1 D-17	W-14 SP-11	GW-4A SP-11	W-18 IS-1
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
Bromodichloromethane (f)	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane (s)	EPA 601 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromoform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
Bromoform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Bromomethane (f)	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane (s)	EPA 601 (1)	ug/L	0.63		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Carbon Tetrachloride (f)	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride (s)	EPA 601 (1)	ug/L	0.46		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 601 (1)	ug/L	0.37		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
2-Chloroethylvinyl Ether (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloroform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	0.72	ND	ND	ND	ND
Chloroform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chloromethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dibromochloromethane (f)	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND	ND	1.6	ND
Dibromochloromethane (s)	EPA 601 (1)	ug/L	0.31		NEG	NEG	NEG	NEG	NEG	NEG	POS	NEG

"ND" indicates that the parameter was not detected.

DATACHEM ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	CH-1 D-17	W-18 IS-1	W-18(FQC) IS-1	W-19 IS-1	Trip Blank IS-1(W-18)
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)						
Bromodichloromethane (f)	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND
Bromodichloromethane (s)	EPA 601 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG
Bromoform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Bromoform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG
Bromomethane (f)	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND
Bromomethane (s)	EPA 601 (1)	ug/L	0.63		NEG	NEG	NEG	NEG	NEG
Carbon Tetrachloride (f)	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND
Carbon Tetrachloride (s)	EPA 601 (1)	ug/L	0.46		NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 601 (1)	ug/L	0.37		NEG	NEG	NEG	NEG	NEG
Chloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
Chloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
2-Chloroethylvinyl Ether (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG
Chloroform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Chloroform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG
Chloromethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
Chloromethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG
Dibromochloromethane (f)	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND
Dibromochloromethane (s)	EPA 601 (1)	ug/L	0.31		NEG	NEG	NEG	NEG	NEG

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UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-10 D-17	W-11 D-17	W-12 D-17	W-13 D-17	CH-1 D-17	W-14 SP-11	GW-4A SP-11	W-18 IS-1
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
1,2-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.29		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.41		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dichlorodifluoromethane (f)	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane (s)	EPA 601 (1)	ug/L	0.33		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	1.1	ND	2.0
1,1-Dichloroethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	POS
1,2-Dichloroethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	3.9	1.1	ND	ND	ND	ND
1,2-Dichloroethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	POS	NEG	NEG	NEG	NEG
1,1-Dichloroethene (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
trans-1,2-Dichloroethene (f)	EPA 601 (1)	ug/L	0.42		ND	16.	30.	15.	ND	ND	2.4	ND
trans-1,2-Dichloroethene (s)	EPA 601 (1)	ug/L	0.42		NEG	POS	POS	POS	NEG	NEG	POS	NEG
1,2-Dichloropropane (f)	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane (s)	EPA 601 (1)	ug/L	0.20		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
cis-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.58		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

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DATACHEM ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	CH-1 D-17	W-18 IS-1	W-18(FQC) IS-1	W-19 IS-1	Trip Blank IS-1(W-18)
Purgeable Halocarbons (cont.)	EPA 601 (1)	ug/L	MDL (2)						
1,2-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.29		NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.41		NEG	NEG	NEG	NEG	NEG
Dichlorodifluoromethane (f)	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND
Dichlorodifluoromethane (s)	EPA 601 (1)	ug/L	0.33		NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethane (f)	EPA 601 (1)	ug/L	0.49		ND	1.4	1.3	6.1	ND
1,1-Dichloroethane (s)	EPA 601 (1)	ug/L	0.49		NEG	POS	POS	POS	NEG
1,2-Dichloroethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
1,2-Dichloroethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethene (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
1,1-Dichloroethene (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG
trans-1,3-Dichloroethene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
trans-1,3-Dichloroethene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG
1,2-Dichloropropane (f)	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND
1,2-Dichloropropane (s)	EPA 601 (1)	ug/L	0.20		NEG	NEG	NEG	NEG	NEG
cis-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND
cis-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.58		NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-10 D-17	W-11 D-17	W-12 D-17	W-13 D-17	CH-1 D-17	W-14 SP-11	GW-4A SP-11	W-18 IS-1
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)									
trans-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.39		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Methylene Chloride (f)	EPA 601 (1)	ug/L	0.34		19.	3.7	6.3	ND	ND	ND	ND	ND
Methylene Chloride (s)	EPA 601 (1)	ug/L	0.34		POS	POS	POS	NEG	NEG	NEG	NEG	NEG
1,1,2,2-Tetrachloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Tetrachloroethene (f)	EPA 601 (1)	ug/L	0.38		ND	ND	1.6	ND	ND	.53	.46	ND
Tetrachloroethene (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	POS	NEG	NEG	POS	POS	NEG
1,1,1-Trichloroethane (f)	EPA 601 (1)	ug/L	0.53		ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane (s)	EPA 601 (1)	ug/L	0.53		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,1,2-Trichloroethane (f)	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane (s)	EPA 601 (1)	ug/L	0.51		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Trichloroethene (TCE) (f)	EPA 601 (1)	ug/L	0.60		ND	47.	26.	5.2	ND	ND	3.0	ND
Trichloroethene (TCE) (s)	EPA 601 (1)	ug/L	0.60		NEG	POS	POS	POS	NEG	NEG	POS	NEG
Trichlorofluoromethane (f)	EPA 601 (1)	ug/L	0.44		ND	0.62	ND	0.68	ND	ND	0.49	ND
Trichlorofluoromethane (s)	EPA 601 (1)	ug/L	0.44		NEG	POS	NEG	POS	NEG	NEG	POS	NEG
Vinyl Chloride (f)	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride (s)	EPA 601 (1)	ug/L	0.54		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

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DATACHEM ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	CH-1 D-17	W-18 15-1	W-18(FQC) 15-1	W-19 15-1	Trip Blank 15-1(W-18)
Purgeable Halocarbons (cont.)	EPA 601 (1)	ug/L	MDL (2)						
trans-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND
trans-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.39		NEG	NEG	NEG	NEG	NEG
Methylene Chloride (f)	EPA 601 (1)	ug/L	0.34		ND	ND	ND	ND	ND
Methylene Chloride (s)	EPA 601 (1)	ug/L	0.34		NEG	NEG	NEG	NEG	NEG
1,1,2,2-Tetrachloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
Tetrachloroethene (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
Tetrachloroethene (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
1,1,1-Trichloroethane (f)	EPA 601 (1)	ug/L	0.53		ND	ND	ND	2.4	ND
1,1,1-Trichloroethane (s)	EPA 601 (1)	ug/L	0.53		NEG	NEG	NEG	POS	NEG
1,1,2-Trichloroethane (f)	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND
1,1,2-Trichloroethane (s)	EPA 601 (1)	ug/L	0.51		NEG	NEG	NEG	NEG	NEG
Trichloroethene (f)	EPA 601 (1)	ug/L	0.60		ND	ND	ND	ND	ND
Trichloroethene (s)	EPA 601 (1)	ug/L	0.60		NEG	NEG	NEG	NEG	NEG
Trichlorofluoromethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
Trichlorofluoromethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG
Vinyl Chloride (f)	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND
Vinyl Chloride (s)	EPA 601 (1)	ug/L	0.54		NEG	NEG	NEG	NEG	NEG

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UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	W-19 IS-1	Trip Blank SP-11	Trip Blank SP-5	Trip Blank Base Wells	Trip Blank D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)						
Bromodichloromethane (f)	EPA 601 (1)	ug/L	0.35		ND	ND	ND	ND	ND
Bromodichloromethane (s)	EPA 601 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG
Bromoform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Bromoform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG
Bromomethane (f)	EPA 601 (1)	ug/L	0.63		ND	ND	ND	ND	ND
Bromomethane (s)	EPA 601 (1)	ug/L	0.63		NEG	NEG	NEG	NEG	NEG
Carbon Tetrachloride (f)	EPA 601 (1)	ug/L	0.46		ND	ND	ND	ND	ND
Carbon Tetrachloride (s)	EPA 601 (1)	ug/L	0.46		NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 601 (1)	ug/L	0.37		ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 601 (1)	ug/L	0.37		NEG	NEG	NEG	NEG	NEG
Chloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
Chloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
2-Chloroethylvinyl Ether (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG
Chloroform (f)	EPA 601 (1)	ug/L	0.45		ND	ND	ND	ND	ND
Chloroform (s)	EPA 601 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG
Chloromethane (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
Chloromethane (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG
Dibromochloromethane (f)	EPA 601 (1)	ug/L	0.31		ND	ND	ND	ND	ND
Dibromochloromethane (s)	EPA 601 (1)	ug/L	0.31		NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	W-19 IS-1	Trip Blank SP-11	Trip Blank SP-5	Trip Blank Base Wells	Trip Blank D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)						
1,2-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.29		ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.29		NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 601 (1)	ug/L	0.41		ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 601 (1)	ug/L	0.41		NEG	NEG	NEG	NEG	NEG
Dichlorodifluoromethane (f)	EPA 601 (1)	ug/L	0.33		ND	ND	ND	ND	ND
Dichlorodifluoromethane (s)	EPA 601 (1)	ug/L	0.33		NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethane (f)	EPA 601 (1)	ug/L	0.49		10.	ND	ND	ND	ND
1,1-Dichloroethane (s)	EPA 601 (1)	ug/L	0.49		POS	NEG	NEG	NEG	NEG
1,2-Dichloroethane (f)	EPA 601 (1)	ug/L	0.44		ND	ND	ND	ND	ND
1,2-Dichloroethane (s)	EPA 601 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG
1,1-Dichloroethene (f)	EPA 601 (1)	ug/L	0.49		ND	ND	ND	ND	ND
1,1-Dichloroethene (s)	EPA 601 (1)	ug/L	0.49		NEG	NEG	NEG	NEG	NEG
trans-1,2-Dichloroethene (f)	EPA 601 (1)	ug/L	0.42		ND	ND	ND	ND	ND
trans-1,2-Dichloroethene (s)	EPA 601 (1)	ug/L	0.42		NEG	NEG	NEG	NEG	NEG
1,2-Dichloropropane (f)	EPA 601 (1)	ug/L	0.20		ND	ND	ND	ND	ND
1,2-Dichloropropane (s)	EPA 601 (1)	ug/L	0.20		NEG	NEG	NEG	NEG	NEG
cis-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.58		ND	ND	ND	ND	ND
cis-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.58		NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

USTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	W-19 IS-1	Trip Blank SP-11	Trip Blank SP-5	Trip Blank Base Wells	Trip Blank D-7
Purgeable Halocarbons	EPA 601 (1)	ug/L	MDL (2)						
trans-1,3-Dichloropropene (f)	EPA 601 (1)	ug/L	0.39		ND	ND	ND	ND	ND
trans-1,3-Dichloropropene (s)	EPA 601 (1)	ug/L	0.39		NEG	NEG	NEG	NEG	NEG
Methylene Chloride (f)	EPA 601 (1)	ug/L	0.34		0.45	ND	1.2	32.	ND
Methylene Chloride (s)	EPA 601 (1)	ug/L	0.34		POS	NEG	NEG	POS	NEG
1,1,2,2-Tetrachloroethane (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
Tetrachloroethene (f)	EPA 601 (1)	ug/L	0.38		ND	ND	ND	ND	ND
Tetrachloroethene (s)	EPA 601 (1)	ug/L	0.38		NEG	NEG	NEG	NEG	NEG
1,1,1-Trichloroethane (f)	EPA 601 (1)	ug/L	0.53		3.0	ND	ND	ND	ND
1,1,1-Trichloroethane (s)	EPA 601 (1)	ug/L	0.53		POS	NEG	NEG	NEG	NEG
1,1,2-Trichloroethane (f)	EPA 601 (1)	ug/L	0.51		ND	ND	ND	ND	ND
1,1,2-Trichloroethane (s)	EPA 601 (1)	ug/L	0.51		NEG	NEG	NEG	NEG	NEG
Trichloroethene (TCE) (f)	EPA 601 (1)	ug/L	0.60		ND	ND	ND	ND	ND
Trichloroethene (TCE) (s)	EPA 601 (1)	ug/L	0.60		NEG	NEG	NEG	NEG	NEG
Trichlorofluoromethane (f)	EPA 601 (1)	ug/L	0.44		0.43	ND	ND	0.94	ND
Trichlorofluoromethane (s)	EPA 601 (1)	ug/L	0.44		POS	NEG	NEG	POS	NEG
Vinyl Chloride (f)	EPA 601 (1)	ug/L	0.54		ND	ND	ND	ND	ND
Vinyl Chloride (s)	EPA 601 (1)	ug/L	0.54		NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	BW-1 Base Wells	BW-2 Base Wells	BW-52 Base Wells	SC-1 Ship Creek	SC-2 Ship Creek	SC-3 Ship Creek	GW-1A D-5	GW-1B D-5
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)									
Benzene (f)	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND
Benzene (s)	EPA 602 (1)	ug/L	0.25		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 602 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,2-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.47		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.93		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Ethylbenzene (f)	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene (s)	EPA 602 (1)	ug/L	0.75		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Toluene (f)	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	ND
Toluene (s)	EPA 602 (1)	ug/L	0.64		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
m-Xylene (f)	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene (s)	EPA 602 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
o-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
p-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	GW-1C D-5	W-1 D-5	W-2 D-5	GW-1A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6B D-7
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)									
Benzene (f)	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND
Benzene (s)	EPA 602 (1)	ug/L	0.25		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 602 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,2-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.47		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.93		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Ethylbenzene (f)	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene (s)	EPA 602 (1)	ug/L	0.75		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Toluene (f)	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	ND
Toluene (s)	EPA 602 (1)	ug/L	0.64		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
m-Xylene (f)	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene (s)	EPA 602 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
o-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
p-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-3 SP-7	W-4 SP-10	GW-3A SP-12	W-9 SP-12	GW-4A SP-11	W-14 SP-11	GW-5A FT-1	W-15 FT-1	GW-6A SP-2
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)										
Benzene (f)	EPA 602 (1)	ug/L	0.25		4800	ND	ND	ND	ND	ND	ND	ND	ND
Benzene (s)	EPA 602 (1)	ug/L	0.25		POS	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 602 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,2-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.47		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.93		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Ethylbenzene (f)	EPA 602 (1)	ug/L	0.75		620	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene (s)	EPA 602 (1)	ug/L	0.75		POS	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Toluene (f)	EPA 602 (1)	ug/L	0.64		8200	ND	ND	ND	ND	ND	ND	ND	ND
Toluene (s)	EPA 602 (1)	ug/L	0.64		POS	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
m-Xylene (f)	EPA 602 (1)	ug/L	0.45		3000	ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene (s)	EPA 602 (1)	ug/L	0.45		POS	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
o-Xylene (f)	EPA 602 (1)	ug/L	0.78		2600	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene (s)	EPA 602 (1)	ug/L	0.78		POS	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
p-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: / Site :	W-16 SP-2	GW-7A SP-14	W-17 SP-14	W-7 SP-5	W-8 SP-5	Trip Blank SP-5	Trip Blank SP-11	Trip Blank D-7
Purgeable Aromatics	EPA 602 (1)	ug/L	MDL (2)									
Benzene (f)	EPA 602 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND
Benzene (s)	EPA 602 (1)	ug/L	0.25		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlorobenzene (f)	EPA 602 (1)	ug/L	0.35		ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (s)	EPA 602 (1)	ug/L	0.35		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,2-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.47		ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.47		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,3-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.93		ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.93		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
1,4-Dichlorobenzene (f)	EPA 602 (1)	ug/L	0.44		ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (s)	EPA 602 (1)	ug/L	0.44		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Ethylbenzene (f)	EPA 602 (1)	ug/L	0.75		ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene (s)	EPA 602 (1)	ug/L	0.75		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Toluene (f)	EPA 602 (1)	ug/L	0.64		ND	ND	ND	ND	ND	ND	ND	ND
Toluene (s)	EPA 602 (1)	ug/L	0.64		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
m-Xylene (f)	EPA 602 (1)	ug/L	0.45		ND	ND	ND	ND	ND	ND	ND	ND
m-Xylene (s)	EPA 602 (1)	ug/L	0.45		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
o-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
p-Xylene (f)	EPA 602 (1)	ug/L	0.78		ND	ND	ND	ND	ND	ND	ND	ND
p-Xylene (s)	EPA 602 (1)	ug/L	0.78		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

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UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-1A D-5	GW-1B D-5	GW-1C D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-1 D-5	W-2 D-5
Pesticides												
Aldrin (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND	ND	ND
Aldrin (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
alpha-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
alpha-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
beta-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
delta-BHC (f)	EPA 608 (1)	ug/L	0.002		ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC (s)	EPA 608 (1)	ug/L	0.002		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Lindane (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
Lindane (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Chlordane (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Chlordane (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDD (f)	EPA 608 (1)	ug/L	0.004		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD (s)	EPA 608 (1)	ug/L	0.004		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDE (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDT (f)	EPA 608 (1)	ug/L	0.03		ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT (s)	EPA 608 (1)	ug/L	0.03		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Dieldrin (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

DATACHEM ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-5 D-7	W-6 D-7	Trip Blank D-7(GW-2B)
Pesticides/PCBs										
Aldrin (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND
Aldrin (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG	NEG	NEG
alpha-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
alpha-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG
beta-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
beta-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG
delta-BHC (f)	EPA 608 (1)	ug/L	0.002		ND	ND	ND	ND	ND	ND
delta-BHC (s)	EPA 608 (1)	ug/L	0.002		NEG	NEG	NEG	NEG	NEG	NEG
Lindane (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
Lindane (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG
Chlordane (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Chlordane (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDD (f)	EPA 608 (1)	ug/L	0.004		ND	ND	ND	ND	ND	ND
4,4'-DDD (s)	EPA 608 (1)	ug/L	0.004		NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDE (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
4,4'-DDE (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG
4,4'-DDT (f)	EPA 608 (1)	ug/L	0.03		ND	ND	ND	ND	ND	ND
4,4'-DDT (s)	EPA 608 (1)	ug/L	0.03		NEG	NEG	NEG	NEG	NEG	NEG
Dieldrin (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND	ND	ND
Dieldrin (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-1A D-5	GW-1B D-5	GW-1C D-5	GW-2A D-7	GW-2B D-7	GW-2C D-7	W-1 D-5	W-2 D-5
Pesticides (continued)												
Endosulfan I (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Endosulfan II (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Endosulfan Sulfate (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Endrin (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
Endrin (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Endrin Aldehyde (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Heptachlor (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Heptachlor Epoxide (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
Toxaphene (f)	EPA 608 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene (s)	EPA 608 (1)	ug/L	0.25		NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

DATACHEM ANALYTICAL REPORT

Elmendorf AFB - Water Samples

Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	GW-2A D-7	GW-2B D-	GW-2C D-7	W-5 D-7	W-6 D-7	Trip Blank D-7(GW-2B)
Pesticides/PCBs										
Endosulfan I (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endosulfan I (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG
Endosulfan II (f)	EPA 608 (1)	ug/L	0.[illegible]		ND	ND	ND	ND	ND	ND
Ensodulfan II (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG
Endosulfan Sulfate (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endosulfan Sulfate (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG
Endrin (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
Endrin (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG
Endrin Aldehyde (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND	ND	ND
Endrin Aldehyde (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG	NEG	NEG
Heptachlor (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND	ND	ND
Heptachlor (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG	NEG	NEG
Heptachlor Epoxide (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND	ND	ND
Heptachlor Epoxide (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG	NEG	NEG
Toxaphene (f)	EPA 608 (1)	ug/L	0.25		ND	ND	ND	ND	ND	ND
Toxaphene (s)	EPA 608 (1)	ug/L	0.25		NEG	NEG	NEG	NEG	NEG	NEG

END NOTES

(1) "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," USEPA, Federal Register, Volume 49, Number 209, 26 October 1984.

(2) Determined according to the procedure in Federal Register, 26 October 1984, Part VIII.

(3) "Methods for Chemical Analysis of Water and Wastes," EPA Manual 600/4-79-200, USEPA, March 1983.

(4) Sample extract over volume. Value $\leq$ 19.

(5) Sample extract under volume. Value $\geq$ 0.8 $\leq$ 1.2.

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	W-5 D-7	W-6B D-7	Trip Blank D-7	Trip Blank Base Wells
Pesticides								
Aldrin (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND
Aldrin (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG
alpha-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND
alpha-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG
beta-BHC (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND
beta-BHC (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG
delta-BHC (f)	EPA 608 (1)	ug/L	0.002		ND	ND	ND	ND
delta-BHC (s)	EPA 608 (1)	ug/L	0.002		NEG	NEG	NEG	NEG
Lindane (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND
Lindane (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG
Chlordane (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND
Chlordane (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG
4,4'-DDD (f)	EPA 608 (1)	ug/L	0.004		ND	ND	ND	ND
4,4'-DDD (s)	EPA 608 (1)	ug/L	0.004		NEG	NEG	NEG	NEG
4,4'-DDE (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND
4,4'-DDE (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG
4,4'-DDT (f)	EPA 608 (1)	ug/L	0.03		ND	ND	ND	ND
4,4'-DDT (s)	EPA 608 (1)	ug/L	0.03		NEG	NEG	NEG	NEG
Dieldrin (f)	EPA 608 (1)	ug/L	0.005		ND	ND	ND	ND
Dieldrin (s)	EPA 608 (1)	ug/L	0.005		NEG	NEG	NEG	NEG

"ND" indicates that the parameter was not detected.

UBTL ANALYTICAL REPORT
Elmendorf AFB - Water Samples
Second Column Confirmation

Parameter	Method	Units	Detection Limit	Field #: Site :	W-5 D-7	W-6B D-7	Trip Blank D-7	Trip Blank Base Wells
Pesticides (continued)								
Endosulfan I (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND
Endosulfan I (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG
Endosulfan II (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND
Endosulfan II (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG
Endosulfan Sulfate (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND
Endosulfan Sulfate (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG
Endrin (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND
Endrin (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG
Endrin Aldehyde (f)	EPA 608 (1)	ug/L	0.01		ND	ND	ND	ND
Endrin Aldehyde (s)	EPA 608 (1)	ug/L	0.01		NEG	NEG	NEG	NEG
Heptachlor (f)	EPA 608 (1)	ug/L	0.007		ND	ND	ND	ND
Heptachlor (s)	EPA 608 (1)	ug/L	0.007		NEG	NEG	NEG	NEG
Heptachlor Epoxide (f)	EPA 608 (1)	ug/L	0.006		ND	ND	ND	ND
Heptachlor Epoxide (s)	EPA 608 (1)	ug/L	0.006		NEG	NEG	NEG	NEG
Toxaphene (f)	EPA 608 (1)	ug/L	0.25		ND	ND	ND	ND
Toxaphene (s)	EPA 608 (1)	ug/L	0.25		NEG	NEG	NEG	NEG

(1) "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," USEPA, Federal Register, Volume 49, Number 209, 26 October 1984.
(2) Determined according to the procedure in Federal Register, 26 October 1984, Part VIII.
(3) "Methods for Chemical Analysis of Water and Wastes," EPA Manual 600/4-79-020, USEPA, March 1983.
(4) "Standard Methods for the Examination of Water and Wastewater," AHPA, AWWA, WPCF, 16th Edition, 1985.
(5) Sample diluted 1:5 for spiking purposes.

"N" indicates that the parameter was not detected.

APPENDIX I

REFERENCES AND REDUCED DATA FROM PHASE II, STAGE 1 INVESTIGATION

REFERENCES

American Public Health Association, 1985, Standard Methods for the Examination of Water and Wastewater, 16th edition. APHA, Washington, D.C.

American Society for Testing and Materials, 1980, Annual Book of Standards, Part 31, Water. ASTM, Philadelphia, Pennsylvania.

Barnwell, W.W., George, R.S., Dearborn, L.L., Weeks, J.B., and Zenone, C., 1971, Water for Anchorage. USGS Open File Report.

Dames & Moore, 1983, Presurvey Report, IRP Phase IIa, for Elmendorf Air Force Base, Alaska (October).

_____, 1986, Installation Restoration Program, Phase II - Confirmation/Quantification, Stage 1, for Elmendorf Air Force Base, Alaska (March).

Donohue & Associates, 1984, Unpublished report on Elmendorf AFB DPDS Proposed Hazardous Waste Storage Facility.

Engineering-Science, 1983, Installation Restoration Program, Phase I - Records Search, Elmendorf AFB, Alaska.

Federal Register, 1984, Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. Vol. 49, No. 209 (Friday, October 26).

Freethy, G.W., 1976, Preliminary Report on Water Availability in the Lower Ship Creek Basin, Anchorage, Alaska. USGS Water Resources Investigation, 48-75.

JRB Associates, Inc., 1980, Methodology for Rating the Hazard Potential of Waste Disposal Sites. McLean, Virginia.

Little, Arthur D., Inc., 1985, The Installation Restoration Program Toxicology Guide, Volume 1. Harry G. Armstrong Aerospace Medical Research Laboratory, Aerospace Medical Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio.

Nelson, G.L., 1982, Vertical Movement of Ground Water Under the Merrill Field Landfill, Anchorage, Alaska. USGS Open File Report 82-1016, 24 p.

Péwé, T.L., 1975, Quaternary Geology of Alaska. USGS Professional Paper 835, 145 p.

Resource Conservation and Recovery Act of 1976. 42 USCA §6901 et seq.

Safe Drinking Water Act. 42 USCA §300f et seq.

Schmoll, H.R., and Dobrovolny, E., 1972, Generalized Geologic Map of Anchorage and Vicinity, Alaska. USGS Miscellaneous Investigations Map I-787-A.

U.S. Environmental Protection Agency, 1979, Methods for Chemical Analysis of Water and Wastes. Manual EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.

_____, 1982, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846, Second Edition.

Weeks, J.B., 1970, The Relationship Between Surface Water and Ground Water in Ship Creek near Anchorage, Alaska. USGS Professional Paper 700-B, pp. B224-B226.

TABLE I-1

PARAMETERS, LIMITS OF DETECTION FOR SOIL AND GROUND WATER ANALYSES, AND WATER QUALITY CRITERIA

PARAMETER	LIMIT OF DETECTION, SOIL	LIMIT OF DETECTION, WATER	WATER QUALITY CRITERIA*
Total organic carbon (TOC)	--	1000. µg/L	NE
Total organic halogen (TOX)	--	10. µg/L	NE
Total dissolved solids (TDS)	--	1000. µg/L	NE
Lead	6. µg/g	10. µg/L	0.5 mg/L
Phenol	5. µg/g	10. µg/L	NE
Oil and grease	0.008 mg/g	500. µg/L	NE
2,4-D	0.05 µg/g	0.05 µg/L	0.1 mg/L
2,4,5-T	0.10 µg/g	0.05 µg/L	NE
2,4,5-TP (Silvex)	0.05 µg/g	0.05 µg/L	0.01 mg/L

*Primary drinking water standard (40 CFR 142) and equivalent State of Alaska Section 18 AAC 80.050.

Notes: -- indicates parameter not tested.
NE = no criterion established.
mg/g = milligrams per gram
µg/g = micrograms per gram
mg/L = milligrams per liter
µg/L - micrograms per liter

Source: Dames & Moore, 1986.

TABLE I-2

UBTL ANALYTICAL REPORT
ELMENDORF AFB - WATER ANALYSES

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-5		SP-7/SP-10		D-7		SP-5		SP-12
				W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9
TOC	415.1[a]	mg/L	1.	2.	ND	8.	5.	1.	ND	4.	2.	ND
TOX	9020[b]	µg/L	10.	53.	34.	--	--	80.	44.	--	--	--
TDS	160.1[a]	mg/L	1.	170.	95.	--	--	220.	82.	--	--	--
Lead	239.2[a]	µg/L	10.	ND	ND	--	--	--	--	ND	ND	--
Phenol	420.2[a]	µg/L	10.	ND	ND	--	--	ND	ND	--	--	--
Oil and grease	413.2[a]	mg/L	0.5	4.0	4.6	56.	5.7	5.8	1.1	d	2.6	1.0
2,4-D	615[c]	µg/L	0.05	e	e	--	--	--	--	--	--	--
2,4,5-T	615[c]	µg/L	0.05	ND	ND	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	615[c]	µg/L	0.05	ND	ND	--	--	--	--	--	--	--
Field specific conductance @ 25°C	--	µmhos/cm	--	174.	131.	538.	433.	181.	95.	1074.	317.	477.
pH	--	std.	--	7.05	7.15	6.75	7.20	7.05	7.05	12.15	9.5	7.25

[a]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.
[b]Test Methods for Evaluating Solid Waste, SW-846, 2nd ed., July 1982, Modified for use on an O.I. Corp. Model 610 TOX Analyzer.
[c]EPA Method 615 for chlorinated herbicides in water.
[d]Sample lost in analysis.
[e]2,4-D could not be determined because of an interference.
ND = not detected.

Source: Dames & Moore, 1986.

TABLE I-2 (continued)

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-17 W-10	D-17 W-11	D-17 W-12	D-17 W-13	SP-11 W-14	FT-1 W-15	SP-2 W-16	SP-14 W-17	AS-1 W-18	AS-1 W-19
TOC	415.1[a]	mg/L	1.	3.	5.	2.	15.	ND	ND	1.	ND	6.	1.
TOX	9020[b]	µg/L	10.	77.	110.	140.	140.	48.	45.	--	--	150.	52.
TDS	160.1[a]	mg/L	1.	360.	380.	380.	260.	200.	--	--	--	--	--
Lead	239.2[a]	µg/L	10.	--	--	--	--	ND	ND	--	ND	20.	ND
Phenol	420.2[a]	µg/L	10.	ND	ND	ND	ND	ND	ND	--	--	ND	ND
Oil and grease	413.2[a]	mg/L	0.5	1.2	3.1	1.0	2.7	1.7	3.9	8.6	4.7	2.5	1.7
2,4-D	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
2,4,5-T	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
2,4,5-TP (Silvex)	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
Field specific conductance @ 25°C	--	µmhos/cm	--	368.	521.	487.	324.	307.	343.	422.	307.	663.	509.
pH	--	std.	--	7.55	7.2	7.15	7.45	8.15	8.1	7.2	7.2	7.25	7.2

TABLE I-3

UBTL ANALYTICAL REPORT
ELMENDORF AFB - SOIL ANALYSES[a]

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-5 W-1-9 35'	D-5 W-2-9 40'	SP-7/SP-10 W-3-5 20'	SP-7/SP-10 W-4-3 12'	D-7 W-5-8 35'	D-7 W-6-8 35'	SP-5 W-7-2 5'	SP-5 W-8-2 5'	SP-12 W-9-7 25'	SP-12 W-9-9 35'	SP-11 W-14-2 5'	SP-11 W-14-3 10'
Lead	239.1[b,c]	µg/g	6.	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	420.2[b]	µg/g	5.	ND	ND	--	--	--	--	--	--	--	--	--	--
Oil and grease	413.2[b]	mg/g	0.008	ND	0.025	0.13	0.106	--	--	0.036	ND	0.013	0.020	0.014	ND
Moisture	Grav.	%	--	10.	13.	6.4	14.	3.1	26.	12.	16.	11.	12.	15.	11.
2,4-D	8150[d]	µg/g	0.05	--	--	--	--	ND	ND	--	--	--	--	--	--
2,4,5-T	8150[d]	µg/g	0.1	--	--	--	--	ND	ND	--	--	--	--	--	--
2,4,5-TP (Silvex)	8150[d]	µg/g	0.05	--	--	--	--	ND	ND	--	--	--	--	--	--

[a]Results have been corrected for percent moisture and, therefore, are reported on a dry weight basis.

[b]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983, Modified for use with soil samples.

[c]Soil samples were acid digested for lead analysis.

[d]Test Methods for Evaluating Solid Waste, SW-846, 2nd ed., July 1982.

ND = not detected.

Source: Dames & Moore, 1986.

TABLE I-3 (continued)

PARAMETER	METHOD	UNITS	DETECTION LIMIT	FT-1 W-15-10 45'	FT-1 W-15-11 50'	SP-2 W-16-8 35'	SP-2 W-16-9 40'	SP-14 W-17-7 30'	SP-14 W-17-8 35'	IS-1 W-18-7 30'	IS-1 W-19-7 30'	SP-11 G-1 surface	SP-11 G-2 surface
Lead	239.1[b,c]	µg/g	6.	--	--	--	--	20.	25.	--	--	--	--
Phenol	420.2[b]	µg/g	5.	--	--	--	--	--	--	--	--	--	--
Oil and grease	413.2[b]	mg/g	0.008	0.040	ND	0.028	ND	1.33	ND	0.33	ND	3.0	0.159
Moisture	Grav.	%	--	12.	14.	11.	39.	31.	29.	27.	29.	29.	66.
2,4-D	8150[d]	µg/g	0.05	--	--	--	--	--	--	--	--	--	--
2,4,5-T	8150[d]	µg/g	0.1	--	--	--	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	8150[d]	µg/g	0.05	--	--	--	--	--	--	--	--	--	--

APPENDIX J

BIOGRAPHIES OF KEY PERSONNEL

Curriculum Vitae

MICHAEL W. ANDER

Title Senior Environmental Scientist/Associate

Expertise Environmental Analysis/Impact Assessment
Environmental Auditing

Experience With Firm Conducts and manages hazardous waste contamination studies for industrial and government clients throughout the United States. Joined Dames & Moore in 1973.

Senior Environmental Scientist/Associate

- Environmental audits and risk assessments for several industrial facilities in the Midwest.
- Geohydrologic assessment of a chemically contaminated plant site in Michigan, including evaluation of containment and treatment measures.
- Geohydrologic assessment of a chemical waste disposal facility in Michigan.
- Environmental studies and development of remedial actions for over thirty PCB-contaminated industrial sites throughout the Midwest.
- Environmental analysis and impact assessment report for a 600-megawatt electric coal-fired power plant in Missouri.
- Assessment of the impact to benthic and fish communities generated by the increase of industrial effluent to a river in northern Illinois.
- Land reclamation study for a highly acidic, abandoned coal strip mine in north-central Illinois.
- Evaluation of the environmental enhancement resulting from the dredging of polluted sediments from the Little Calumet River in Illinois.
- Study of the economic and environmental implications of developing low-head hydroelectric power on the Fox River in Illinois.
- Environmental assessment of lead in the soils and ground water near a battery reprocessing plant in Illinois.
- Environmental assessment of selected river basins, tributary to the Illinois River, for a statewide stream survey for the Illinois Environmental Protection Agency. Project involved the analysis of nearly 2,000 benthic samples.

Assistant Project Manager

- Environmental baseline studies and impact assessment of copper/zinc mine in northern Wisconsin, including analysis and evaluation of fisheries, plankton, and periphitic algae with special emphasis on water chemistry and benthis macroinvertebrates.
- Preparation and coordination of final safety analysis report and an environmental report of a nuclear power plant in Missouri.

Principal Investigator/Aquatic Ecologist

- Environmental studies required for the preparation of permit applications and reclamation plans for several coal mines and a coal preparation plant in eastern Kentucky.
- Environmental assessment of dredging an estuary and salt marsh for a chemical plant in South Carolina. Project included an analysis and evaluation of fisheries, plankton, and water chemistry with special emphasis on the collection and analysis of benthic macroinvertebrates.

Project Quality Assurance Coordinator

- Management of numerous projects requiring quality assurance in compliance with Nuclear Regulatory Commission regulations.
- Implementation of Dames & Moore's quality assurance manual on all nuclear-related projects.

Past Experience

Four years experience in aviation electronics.

Aviation Electronics Technican, U.S. Navy (1969-1973)

- Maintenance of electronic systems of A-7 attact aircraft.
- Counselor, Naval Drug Rehabilitation Center.

Academic Background

M.S. (1970), biological sciences, and B.S. (1967), biological sciences. Northern Illinois University

Citizenship

United States

Countries Worked In

United States

Langugage Proficiency

English

***Professional* Affiliations**

North American Benthological Society; International Oceanographic Foundation; Illinois Association of Environmental Professionals; Ecological Society of America.

Registrations

Certified SCUBA Diver

† † †

Curriculum Vitae

BRIAN COULTER

Title: Environmental Scientist

Expertise:
Limnology
Surface Hydrology
Aquatic Ecology

Experience with Firm

Duluth Air Force Station, Duluth, Minnesota
- o Soil and water sampling in wetlands area as part of an abandoned landfill survey.

Assistant Chemist, Wisconsin Power & Light
- o Streamline procedures for coal analysis lab.
- o Develop QA/QC for coal analysis procedures.
- o Analysis of coal.

Field Technician, Spotsylvania Co., Virginia
- o Design and build monitoring system to determine PNA and metals.
- o Install system around suspected odor problem.

Field Technician, Alaska Department of Energy and Conservation
- o Develop air sampling train for the reactants of a urea-formaldehyde reaction.
- o Air sample sixty homes in suspected area of contamination.

Field Technician, Clear Air Force Station, Clear, Alaska
- o Develop and stabilize groundwater wells using hand pump.
- o Sample wells for possible contaminants from abandoned landfills.
- o Analyze water for physical and chemical characteristics such as pH, conductivity, temperature, etc.

Field Technician, Four County Landfill, Culver, Indiana
- o Boring log descriptions.
- o Analyze soil for physical and chemical characteristics such as pH, effervescence, color, etc.
- o Gamma log borings.

Past Experience

Dorman Manufacturing Co., Monroe, Wisconsin
- o Laboratory analysis of food products.
- o Develop calibration technique for sodium probe.
- o Revise computer program.

Environmental Task Force, Stevens Point, Wisconsin (1982)
- o Gather and prepare water samples for analysis.
- o Perform inorganic water analysis.
- o Data reduction. Clam Lake Field Station, Clam Lake, Wisconsin (1981).

Clam Lake Field Station, Clam Lake, Wisconsin (1981)
- o Determine physical, chemical, and biological parameters of lake and adjacent wetlands area with interdisciplinary team.
- o Map soils, flora, and fauna using air photos and plots.
- o Present recommendations on management of section with regard to timber and wildlife management.

Academic Background

B.S. (1982) Resource Management/Water Resources, University of Wisconsin-Stevens Point.
EPA approved course on asbestos, "Practices and Procedures in Asbestos Control".

Citizenship

United States

Language Proficiency

English, Spanish

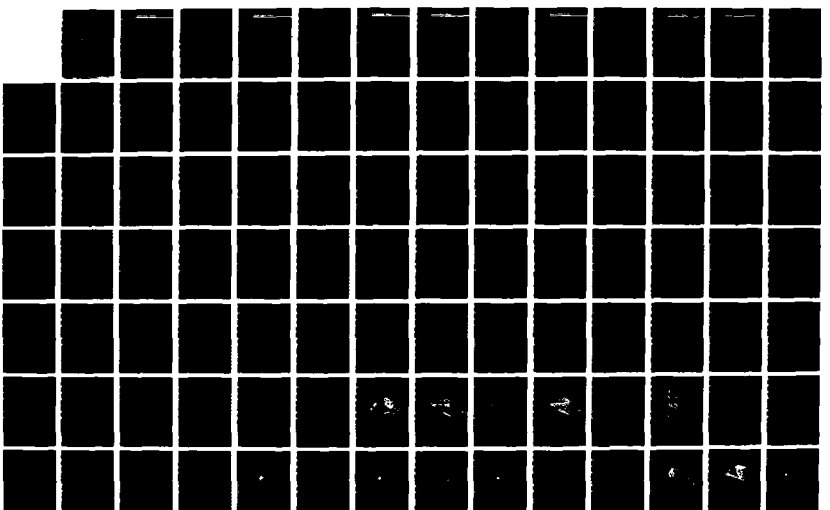
Professional Affiliations

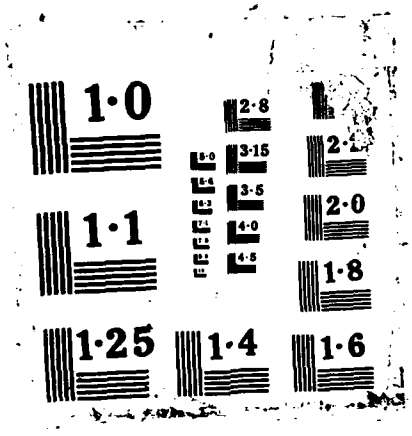
American Water Resources Association

BC:je
05/14/87

AD-A192 375 INSTALLATION RESTORATION PROGRAM PHASE 2 4/6
CONFIRMATION/QUANTIFICATION STAG (U) DAMES AND MOORE
PARK RIDGE IL 01 MAR 88 F33615-83-D-4002

UNCLASSIFIED F/G 24/4 NL




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Curriculum Vitae

BEVERLY J. HARPER

Title Project Ecologist

Expertise Environmental Analysis and Impact Assessment
Aquatic Ecology

Experience with Firm Conducts and manages environmental studies and impact assessments for industrial and government clients throughout the United States. Joined Dames & Moore in 1973 and rejoined the firm in 1985 after a 2-year absence.

Principal Investigator/Aquatic Ecologist

- o Evaluation of the environmental enhancement resulting from the dredging of polluted sediments from the Little Calumet River in Illinois.
- o Coordination of environmental baseline studies and impact assessment for a copper/zinc mine in northern Wisconsin.
- o Environmental assessment of potential chemical contamination in the Menominee River, Wisconsin.
- o Environmental site assessments of various sites throughout the country for purposes of acquisition.
- o Assessment of the impact to aquatic communities by the increase of industrial effluent to a river in northern Illinois.
- o Zooplankton specialist with experience in environmental studies in Florida, Maryland, South Carolina, Texas, and Wisconsin.
- o Supervision of the Environmental Laboratory, Park Ridge office. Implemented laboratory quality assurance program.
- o Supervision of the analysis of data from several environmental studies.
- o Team leader for various environmental field investigations.
- o Technical reviewer for biology sections for a nuclear power plant biological monitoring study.
- o Biological studies and environmental monitoring for various nuclear power plant projects construction and operating licensing.

Assistant Project Manager

- o Preparation and coordination of Final Safety Analysis and Environmental Reports for a nuclear power plant in Kansas and other nuclear plants nationwide.
- o Environmental baseline studies and impact assessment for a 600-megawatt electric coal-fired power plant in Missouri.
- o Hazardous waste field investigations, feasibility studies, and cleanup strategies for numerous U.S. Air Force facilities throughout the United States.

Academic Background	B.S., Biology, Northern Illinois University, 1971. Coursework completed towards M.S. with emphasis in Ecology, Northern Illinois University.
Citizenship	United States
Countries Worked In	United States
Language Proficiency	English
Professional Affiliations	North American Benthological Society International Oceanographic Foundation National Audubon Society

nl-ts

Curriculum Vitae

THOMAS E. JENSEN

Title Senior Geologist/Geophysicist

Expertise
Engineering Geophysics
Applied Instrumentation
General Geology

Experience With Firm

Principal Investigator

- Seismic investigations to develop engineering properties using combinations of seismic refraction, uphole/downhole, crosshole, surface wave, and ambient motion studies; conducted for nuclear and fossil-fueled power plants, nuclear fuel storage reprocessing and research facilities, fault investigations, and correctional facilities.
- Reconnaissance and feasibility studies for depth of bedrock, bedrock topography, water table, and rippability using seismic refraction methods.
- Evaluation of soil improvement through geophysical testing.
- Geotechnical investigation for water bottom and subsurface conditions for a pipeline river crossing using high resolution reflection, side-scan sonar, and bottom probes.
- Vibration control and attenuation studies of production quarrying and excavation blasting operations; conducted for nuclear power plants, a nuclear fuel processing facility, a petroleum pipeline and sewer interceptor, and residential and commercial structures.
- Vibration monitoring of production and excavation blasting, pile driving, earthwork, and machinery operation.
- Recommendations and performance evaluation of controlled blasting operations for smoothwall excavations.
- Borehole geophysical logging.
- Electrical resistivity profiling and depth sounding.
- Rock mechanics studies for a longwall coal mining demonstration.
- Geologic and hydrogeologic studies for baseline data to prepare environmental impact assessment and permit applications.
- Structure evaluation by high resolution seismic reflection surveys, test drilling, borehole logging and uphole surveys for a field scale test site for aquifer storage and for compressed air energy storage.

Project Manager

- Preparation of soils, geology, hydrology, and sociocultural baseline reports for an environmental impact assessment.
- Rock mechanics studies for a longwall coal mining demonstration.

Technical Reviewer
- Provide technical review of seismic investigations for nuclear-related projects.
- Review of high resolution marine reflection and refraction surveys.
- Review of test blasting, blast monitoring, and attenuation studies.

Past Experience

Geophysicist, Texaco Incorporated, Houston, Texas and New Orleans, Louisiana
- Involved in interpretation of offshore Gulf of Mexico seismic refraction data.
- Participated in preparation of map packages for lease sales.

Academic Background

B.S. and M.S., geology, Northern Illinois University
Seminar and workshops on engineering geophysics, Colorado School of Mines

Professional Affiliations

Society of Exploration Geophysicists

Registrations

Geophysicist, California

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Curriculum Vitae

AMY D. LAMBORG

Title

Assistant Geologist

Expertise

Geology, Geohydrology

Experience with Firm

- o Supervised field investigations of several large hydrogeologic/hazardous waste projects for U.S. Air Force. Field efforts included monitor well installation and sampling, soil boring description and sampling, and surface water and surface soil sampling for bases in Fairbanks, Clear, and Anchorage, Alaska and Duluth, Minnesota.
- o Completed geohydrological field investigation at a hazardous waste landfill in Plymouth, Indiana, which included monitor well installation, soil sampling, and slug testing.
- o Performed site assessment at a plastics manufacturing plant in north-central Illinois. Program included collecting composite soil and water samples for analyses.
- o Logged test pits, collected soil and water samples, and installed monitor wells for railroad yards in Chicago, Illinois.
- o Sampled drums of hazardous waste at an industrial site in Elgin, Illinois.

Past Experience

Geologist, Amoco Production Company
- o Evaluated wells for recompletion potential, southeastern New Mexico.

Geologist, Wayne Pryor and Associates
- o Constructed structure and isopach maps for Mississippian formations in south-central Illinois.

Geological Technician, Gulf Oil Company
- o Constructed regional cross sections, structure and isopach maps from computer data base for offshore Gulf Coast.

Academic Background

M.S., Geology, University of Cincinnati, 1986. Thesis topic: "Development and Distribution of Primary and Secondary Porosity in the Salem Limestone, South-Central Illinois."
B.A., Geology, Earlham College, 1980

Awards

Amoco Production Company Fellowship, 1983
University Graduate Scholarship, 1982
Teaching Assistantship, 1982
Weber Scholar - Athlete Award, 1980

Countries Worked in

United States
Argentina

Language Proficiency

English
Spanish

Professional Affiliations

American Association of Petroleum Geologists

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Curriculum Vitae

Carol Jean Scholl

Title Project Geologist

Expertise Geology
Ground-Water Hydrology

Experience With Firm Provides consultation on geologic and ground-water aspects of the firm's hazardous waste, nuclear and mining projects. Joined Dames & Moore in 1973 and rejoined the firm in 1983.

Project Geologist

- Performed cost-effectiveness analyses of alternate disposal methods for hazardous waste contaminated soils.
- Designed and managed hazardous waste field investigations at U.S. Air Force installations in seven states. The program involved the analysis and evaluation of hazardous materials in soil and ground water including fuels, solvents and trace metals.
- Managed field investigations to assess the environmental impacts of the uncontrolled disposal of heavy metals and industrial wastes in till plain soils.

Staff Geologist

- Planned and managed a hydrogeologic investigation of a waste management facility for a petrochemical firm.
- Performed environmental assessments on the impacts of landfills to the environment.
- Designed and managed a field investigation involving the impact of a chemical process facility on ground water and surface water quality.
- Prepared personnel safety plans for investigations at hazardous waste sites.
- Served as Dames & Moore's group contact coordinator for the Electric Power Research Institute's Seismic Risk Hazard Analysis Program performed in the eastern United States.
- Prepared responses to questions posed by the Nuclear Regulatory Commission concerning faulting studies for a nuclear power plant in southern Indiana.

Assistant Geologist

- Assisted in the compilation and reduction of ground-water data for preliminary safety analysis reports for three potential nuclear power plant sites in Kansas, Missouri and

Illinois.

- Participated in detailed field structural geological studies of a potential nuclear power plant site in Pennsylvania.
- Performed engineering geological duties for a rock coring and soil sampling program at a nuclear power plant site in northwestern Illinois.
- Assisted in the reduction of ground-water data for a hydrologic study of a proposed coal strip mine in eastern Montana.

Past Experience

A total of ten years experience in geology education and research.

Head of Group Programs/Instructor of Geology, Field Museum of Natural History, Chicago

- Supervised professional and clerical staff members of a division of the Department of Education.
- Participated in planning and decisions regarding departmental policies, budgets and procedures.
- Instructed school groups, adult volunteers and other adult groups in geology.
- Trained adult volunteers to present geology tours.
- Supervised a manned exhibit featuring a hands-on environment of natural history specimens.

Graduate Teaching Fellow and Associate/Graduate Teaching Assistant, Miami University, Oxford, Ohio

- Studies course work toward Ph.D., with emphasis on geochemistry and mineralogy.

Academic Background

M.S. (1970), geology, Miami University, Oxford, Ohio
B.S. (1966), geology, Kent State University, Ohio

Citizenship

United States

Countries Worked In

United States

Language Proficiency

English

Professional Affiliations

American Association for the Advancement of Science; Mineralogical Society of America; National Water Well Association.

Curriculum Vitae

JON MICHAEL STANLEY

Title Senior Engineering Geologist

Expertise
Engineering Geology
Geotechnical Engineering
Project Management

Experience with Firm

- Engineering aspects of transportation corridors, port sites, and mining facilities and dams for a lead/zinc mine in northwestern Alaska. Regional engineering geology, quantification of potential engineering problems along alternative routes and offshore geotechnical engineering for a port site.
- Engineering geology, foundation design, and wastewater treatment and disposal systems design for a U.S. Navy building on Adak, Alaska.
- Engineering geology for a runway extension for the State of Alaska and the City of Unalaska at Dutch Harbor, Alaska.
- Coordination of a drilling program covering 460 miles of the Trans-Alaska Pipeline System including drilling operations, laboratory testing, engineering analyses, and reporting.
- Review of hazardous waste disposal areas and preparation and implementation of an investigation program at three major U.S. Air Force installations and five DEW Line sites in Alaska.
- Coordination of onshore logistics for an offshore geotechnical investigation utilizing a 195-foot drill-equipped vessel operating in the Bering, Chukchi, and Beaufort seas.
- Assessment of geohazards along State Route 178 in the Kern River Canyon, Kern County, California.
- Soil and ground water contamination assessment for Chevron's Bakersfield, California refinery.
- Assessment of hydrogeologic conditions in conjunction with a soil and ground water assessment at the Kodak Distribution Center, San Ramon, California.
- Assessment of gasoline spills at a San Mateo, California gas station.

Past Experience

- Senior Civil Engineer, Alyeska Pipeline Service Company. General civil engineering including engineering project management, soils investigations, below-ground pipeline stability monitoring, field visual surveillance of below-ground pipeline, development of computer systems for below-ground pipeline monitoring and stability analysis, and coordination of field test hole drilling and monitoring device installation programs. Mapping of ground water flow and flow control planning including through pump testing and water level monitoring.

- o Owner, Geological Engineering Services. General geological and civil engineering including soils investigations, subdivision development engineering, water supply and sewage treatment and disposal systems design, road design, construction inspection, and environmental engineering.
- o Manager of Kenai District Field Office, Alaska Department of Environmental Conservation. Responsible for review of plans for subdivisions, water supply systems and sewage treatment and disposal systems, inspection of public water supplies and wastewater treatment and disposal systems, enforcement of DEC regulations, and preparation of legal actions. Reviewed both chemical and oil waste disposal practices in the Sterling hazardous waste disposal area and plans for sewage disposal facilities in several areas on the Kenai Peninsula. Reviewed plans for fish waste disposal facilities in several areas on the Kenai Peninsula. Provided supervision for oil spill monitoring for south-central and southwest Alaska.
- o Senior and Staff Engineer, R&M Consultants. Coordination of soils investigations, computer processing of data, preparation of numerous technical and data presentation reports, foundation investigations, and subdivision investigations.

Academic Background

Postgraduate courses in engineering and business management and arctic engineering, 1980-1982
B.S., Geological Engineering, University of Alaska, Fairbanks, 1974
Washington State University, Pullman, 1966-1967
University of Alaska, Fairbanks, 1965-1966

Registration

Professional Geologist, Alaska, License No. AA 0059, 1982

Professional Affiliations

American Institute of Professional Geologists, 1982, CPGS No. 6082
Association of Engineering Geologists
Association of Ground Water Scientists and Engineers
Alaska Section, American Water Resources Association
Alaska Ground Water Association (Secretary/Treasurer, 1983-1984)
Alaska Geological Society

Publications

Thomas, H.P., E.R. Johnson, J.M. Stanley, J.A. Shuster, and S.W. Pearson, "Pipeline Stabilization Project at Atigun Pass," in Proceedings of the Third International Symposium on Ground Freezing, Hanover, New Hampshire, June 1982.

Stanley, J.M., and J.E. Cronin, "Investigation and Implications of Subsurface Conditions Beneath the Trans-Alaska Pipeline in Atigun Pass," in Proceedings of the Fourth International Conference on Permafrost, July 1983 (in preparation).

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Curriculum Vitae

KAY L. TAUSCHER

Title	Staff Geologist
Expertise	Geology Hydrogeology
Experience with Firm	Assistant Geologist, 1985-1987

- o Investigated and completed hydrogeologic evaluations for the potential risks of leaking underground storage tanks at 56 sites across the nation.
- o Performed geologic and ground water investigations of the Ashtabula, Ohio area.
- o Completed hydrogeologic investigation of the Moscow, Ohio area for a large utility company.
- o Analyzed data and prepared the report for a major coal conversion project in Ohio.
- o Compiled a regulation assessment for underground storage tanks for 12 states and 20 localities across the nation.
- o Supervised the installation, development, and sampling of monitoring wells, and took composite soil samples for laboratory analysis on potential burning grounds at an ammunitions plant in Joliet, Illinois.
- o Completed field investigations on a PCB contamination site in Mentor, Ohio, which included drilling, soil sampling, and test pit operations.
- o Participated in hydrogeologic field investigations at a chemical plant in Morris, Illinois.
- o Completed sampling program of drums and underground storage tanks at an industrial site in Chicago, Illinois.
- o Performed ground water and geologic investigations for a utility plant site in southeastern Ohio.
- o Participated in onshore and offshore geotechnical field investigations at a utility site in Ashtabula, Ohio, which included drilling and test pit operations.
- o Supervised geotechnical field work at a future road site in Schaumburg, Illinois.
- o Completed geotechnical investigations for a future building foundation in the St. Louis, Missouri area.
- o Sampled surface water, seeps, and soils for laboratory analysis at a chemical plant in Carpentersville, Illinois.
- o Supervised boring investigations, monitoring well installation, and performed monitoring well sampling at a paper mill spray irrigation field in central Ohio.

- Completed a reevaluation of a Hazard Ranking Score for a large industrial client's landfill that had been proposed for addition to the National Priorities List.
- Participated in the field work for several large hydrogeologic investigations for United States Air Force facilities in Alaska.
- Performed a site contamination assessment of a subsurface irrigation field in Woodstock, Illinois.

Staff Geologist, 1987

- Managed and completed a second phase hydrogeologic investigation and ground water monitoring program for a paper mill wastewater spray field in central Ohio.
- Managed and assisted in the design of a three-phased site contamination assessment of an abandoned railyard in Chicago, Illinois.
- Designed and managed a site contamination assessment of a 120-acre railyard in Schiller Park, Illinois.
- Assisted in the design and management of a hydrogeologic contamination investigation near Reed City, Michigan.

Academic Background

Coursework completed toward M.S. with emphasis in sedimentology and clay mineralogy, University of Cincinnati, Ohio.

B.S., Geology, 1983, University of Louisville, Kentucky.

Undergraduate coursework in civil engineering, Vanderbilt University, Nashville, Tennessee.

Awards

University Graduate Scholarship, 1984, University of Cincinnati
University Graduate Scholarship, 1985, University of Cincinnati

Publications

Co-authored a paper on "Prioritizing Your Underground Storage Tanks," to be presented at the 1987 American Society of Civil Engineers National Conference on Environmental Engineering, Orlando, Florida

Language Proficiency

English
German

Other Work-Related Activity

Completing coursework toward P.A.D.I. Dive Master (SCUBA)

Seminars

Participated in Dames & Moore Health and Safety Seminar (1985)
Attended a USEPA Ground Water Seminar Series (1987)

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APPENDIX K

GEOPHYSICAL TRACINGS

MAGNETOMETER DATA

NORTH GRID

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
% GRADIENT
Date: 5 SEP 86
Operator: 5316
Reference field: 56155.3
Datum subtracted: 0.0
Records: 333
Bat: 17.0 Volt Lithium: 3.54 Volt
Last time update: 8/14 18:00:00
Start of print: 9/06 7:46:56

Ref. Fld 56155.3 .06 0.0 12:12:43 78

Pos: 9+00 S Date: 5 SEP 86 #2

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
10+00 E	55944.5T	.06	1.5	12:20:31	78
9+00 E	55847.0T	.05	1.9	12:22:59	78
8+00 E	56392.4T	.06	2.2	12:24:11	78
7+00 E	56016.5T	.05	2.3	12:24:55	78
6+00 E	55923.3T	.06	2.4	12:25:34	78
5+00 E	55722.0T	.05	2.6	12:26:22	78
4+00 E	56050.1T	.06	2.9	12:27:59	78

Pos: 8+00 S Date: 5 SEP 86 #9

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
3+00 E	56018.5T	.06	3.3	12:29:46	78
2+00 E	56072.8T	.07	3.4	12:30:46	78

Pos: 6+00 S Date: 5 SEP 86 #11

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
1+00 E	56036.1T	.05	3.8	12:32:39	78
0+00 E	56082.1T	.05	4.0	12:33:43	78
1+00 W	56102.0T	.05	4.2	12:34:39	78
2+00 W	56061.3T	.05	4.4	12:35:43	78
3+00 W	56068.5T	.05	4.5	12:36:17	78
4+00 W	56066.1T	.05	4.6	12:36:49	78
5+00 W	54624.6T	.19	4.7	12:37:28	78
6+00 W	57598.8T	.21	4.9	12:38:04	77
7+00 W	56083.4T	.06	5.0	12:38:44	78

Ref. Fld 56161.0 .05 5.7 12:42:09 78

Ref. Fld 56160.5 .05 5.2 13:30:23 78

Line: 10+00 E Date: 5 SEP 86 #22

POSITION	FIELD	ERR	DRIFT	TIME	DS
2+00 S	55898.4	.11	6.0	13:37:19	78
	17.4				
2+25 S	55930.2	.11	6.1	13:38:00	78
	12.3				
2+50 S	55951.0	.10	6.1	13:38:16	78
	13.0				

2+75	S	55961.6	.09	6.2	13:38:34	78
		6.6				
3+00	S	55972.4	.11	6.2	13:39:03	78
		11.1				
3+25	S	55969.1	.10	6.3	13:39:18	78
		8.9				
3+50	S	55963.1	.11	6.3	13:39:36	78
		11.8				
3+75	S	55957.6	.10	6.4	13:39:54	78
		10.3				
4+00	S	55946.3	.10	6.4	13:40:14	78
		10.5				
4+25	S	55929.3	.11	6.4	13:40:32	78
		12.3				
4+50	S	55870.1	.09	6.5	13:40:54	78
		14.1				
4+75	S	55707.0	.10	6.5	13:41:17	78
		-4.0				
5+00	S	55494.5	.08	6.6	13:41:36	78
		-107.1				
5+25	S	55489.7	.10	6.6	13:41:55	78
		-100.9				
5+50	S	55666.5	.10	6.7	13:42:19	78
		17.9				
5+75	S	55351.8	.10	6.7	13:42:38	78
		-146.0				
6+00	S	55394.8	.10	6.7	13:42:55	78
		-159.7				

Line: 10+50 E Date: 5 SEP 86 #39

POSITION		FIELD	ERR	DRIFT	TIME	DS
6+00	S	55841.5	.07	7.0	13:44:53	78
		5.9				
5+75	S	55810.1	.09	7.1	13:45:57	78
		10.7				
5+50	S	55861.3	.10	7.2	13:46:17	78
		13.8				
5+25	S	55891.6	.10	7.2	13:46:35	78
		13.2				
5+00	S	55918.9	.09	7.3	13:47:17	78
		12.1				

Line: 10+00 E Date: 5 SEP 86 #44

POSITION		FIELD	ERR	DRIFT	TIME	DS
6+25	S	55403.6	.10	8.8	13:59:00	78
		-132.3				
6+50	S	55836.5	.10	8.8	13:59:28	78
		3.6				
6+75	S	56147.6	.11	8.9	13:59:47	78
		67.3				
7+00	S	56336.4	.10	8.9	14:00:08	78
		96.6				
7+25	S	56060.0	.07	8.9	14:00:27	78
		15.6				
7+50	S	55839.9	.06	9.0	14:00:41	78
		-18.0				

7+75	S	55873.1	.10	9.0	14:00:54	78
		6.0				
8+00	S	55893.3	.10	9.0	14:01:10	78
		11.3				
8+25	S	55894.1	.11	9.1	14:01:25	78
		12.5				
8+50	S	55905.7	.11	9.1	14:01:38	78
		9.2				
8+75	S	55922.9	.10	9.1	14:01:52	78
		7.7				
9+00	S	55944.5T	.11	9.2	14:02:05	78
		6.0				
9+25	S	55962.5	.11	9.3	14:02:37	78
		5.3				
9+50	S	55985.4	.08	9.3	14:02:56	78
		5.3				
9+75	S	55995.6	.11	9.4	14:03:19	78
		5.8				
10+00	S	56003.5	.07	9.5	14:03:43	78
		2.4				
10+25	S	56009.1	.06	9.6	14:03:55	78
		1.8				
10+50	S	56014.2	.07	9.6	14:04:09	78
		2.1				
10+75	S	56017.7	.08	9.7	14:04:29	78
		3.0				
11+00	S	56019.2	.06	9.7	14:04:45	78
		1.5				

Line: 9+00 E Date: 5 SEP 86 #64

POSITION		FIELD	ERR	DRIFT	TIME	DS
11+00	S	56011.4	.08	11.7	14:13:29	78
		3.0				
10+75	S	56006.7	.08	11.9	14:14:23	78
		2.7				
10+50	S	55994.5	.08	11.9	14:14:45	78
		2.0				
10+25	S	55980.5	.08	12.0	14:15:04	78
		1.3				
10+00	S	55961.8	.12	12.1	14:15:16	78
		3.8				
9+75	S	55932.0	.09	12.1	14:15:28	78
		-0.1				
9+50	S	55855.6	.10	12.1	14:15:41	78
		-7.8				
9+25	S	55731.4	.10	12.2	14:15:58	78
		-30.2				
9+00	S	55847.0T	.11	12.3	14:16:11	78
		-9.5				
8+75	S	56020.4	.09	12.4	14:16:25	78
		-115.0				
8+50	S	56754.3	.10	12.5	14:16:40	78
		252.7				
8+25	S	56108.4	.09	12.7	14:16:58	78
		98.8				
8+00	S	55227.7	.07	12.8	14:17:13	78
		-136.7				

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7+75 S 55462.3 .11     13.0 14:17:28 78
          -38.5
7+50 S 55777.1 .08     13.1 14:17:42 78
           46.0
7+25 S 56195.6 .12     13.2 14:17:58 78
          242.2
7+00 S 55732.4 .06     13.3 14:18:10 78
           47.5
6+75 S 55161.7 .12     13.4 14:18:22 78
         -105.6
6+50 S 54925.7 .11     13.5 14:18:35 78
         -212.6
6+25 S 55301.9 .12     13.7 14:18:51 78
          -26.4
6+00 S 55639.1 .09     13.9 14:19:08 78
           28.4
5+75 S 55683.5 .11     19.8 14:30:15 78
           62.5
5+50 S 55605.8 .09     20.0 14:30:29 78
            0.9
5+25 S 55934.1 .13     20.1 14:30:46 78
          130.3
5+00 S 55528.0 .11     20.3 14:31:00 78
          -39.0
4+75 S 55432.3 .08     20.4 14:31:14 78
           -0.9
4+50 S 55402.6 .09     20.5 14:31:27 78
           -7.7
4+25 S 55290.8 .12     20.6 14:31:43 78
          -38.7
4+00 S 55277.3 .12     20.8 14:31:56 78
           -1.0
3+75 S 55293.4 .08     20.9 14:32:11 78
           -7.8
3+50 S 55357.4 .11     21.0 14:32:24 78
           -6.0
3+25 S 55454.6 .11     21.2 14:32:42 78
          -57.7
3+00 S 55633.6 .09     21.3 14:32:58 78
           13.3
2+75 S 55691.6 .09     21.4 14:33:11 78
           14.9
2+50 S 55656.2 .08     21.6 14:33:27 78
           -2.2
2+25 S 55516.5 .08     21.7 14:33:41 78
          -56.4
2+00 S 54920.2 .09     21.8 14:33:57 78
         -212.7

Line:    8+00 E    Date:   5 SEP 86    #101
POSITION   FIELD   ERR    DRIFT    TIME    DS
  1+75 S 55279.7 .19     28.1 14:45:37 78
         -416.8
  2+00 S 55228.7 .14     28.7 14:46:39 78
         -143.0
  2+25 S 55193.7 .08     28.8 14:46:57 78
          -84.6
  2+50 S 55259.3 .11     29.0 14:47:12 78
          -16.4
```

2+75	S	55376.7	.11	29.1	14:47:29	78
		-17.7				
3+00	S	55473.2	.10	29.3	14:47:45	78
		-27.1				
3+25	S	55536.0	.13	29.4	14:48:01	78
		-116.3				
3+50	S	55989.3	.11	29.6	14:48:20	78
		53.0				
3+75	S	56253.6	.08	29.7	14:48:35	78
		-17.3				
4+00	S	56894.2	.13	29.9	14:48:52	78
		54.7				
4+25	S	57580.3	.14	30.0	14:49:05	78
		358.5				
4+50	S	56607.6	.10	30.1	14:49:20	78
		-11.8				
4+75	S	56575.6	.13	30.3	14:49:34	78
		122.4				
5+00	S	55530.7	.08	30.4	14:49:46	78
		-126.0				
5+25	S	55346.4	.08	30.5	14:50:00	78
		-84.3				
5+50	S	55736.1	.12	30.6	14:50:15	78
		-14.4				
5+75	S	55907.6	.12	30.7	14:50:29	78
		-71.2				
6+00	S	55854.6	.15	30.9	14:50:42	78
		-151.6				
6+25	S	57198.7	.08	34.7	14:57:51	78
		149.5				
6+50	S	57923.7	.11	34.8	14:58:04	78
		324.8				
6+75	S	57444.3	.10	35.1	14:58:30	78
		276.6				
7+00	S	56704.6	.06	35.2	14:58:45	78
		70.5				
7+25	S	56295.2	.08	35.4	14:59:02	78
		27.0				
7+50	S	55698.7	.09	35.5	14:59:15	78
		9.6				
7+75	S	55048.0	.09	35.6	14:59:28	78
		-200.5				
8+00	S	56022.7	.09	35.7	14:59:41	78
		111.4				
8+25	S	56245.8	.10	35.9	14:59:58	78
		-45.3				
8+50	S	56574.8	.07	36.0	15:00:12	78
		-19.1				
8+75	S	57162.4	.07	36.1	15:00:28	78
		199.5				
9+00	S	56392.4	T.06	36.3	15:00:41	78
		-21.5				
9+25	S	55807.5	.05	35.9	15:00:56	78
		-83.1				
9+50	S	55834.6	.10	35.5	15:01:11	78
		-16.3				

9+75	S	55891.3	.11	34.9	15:01:32	78
		0.7				
10+00	S	55929.6	.10	32.9	15:02:43	78
		5.3				
10+25	S	55949.3	.11	32.4	15:02:59	78
		6.5				
10+50	S	55962.2	.10	32.0	15:03:13	78
		5.0				
10+75	S	55972.1	.10	31.5	15:03:31	78
		4.3				
11+00	S	55980.8	.07	31.0	15:03:50	78
		3.5				

Line: 7+00 E Date: 5 SEP 86 #139

POSITION		FIELD	ERR	DRIFT	TIME	DS
11+00	S	55990.9	.09	13.1	15:14:23	78
		2.9				
10+75	S	55984.0	.07	11.9	15:15:04	78
		1.0				
10+50	S	55974.4	.08	11.2	15:15:31	78
		2.7				
10+25	S	55960.0	.10	10.7	15:15:46	78
		3.2				
10+00	S	55936.8	.10	10.4	15:15:59	78
		4.1				
9+75	S	55900.7	.09	10.0	15:16:13	78
		-2.2				
9+50	S	55854.4	.10	9.3	15:16:37	78
		-5.6				
9+25	S	55831.9	.12	8.8	15:16:55	78
		-29.9				
9+00	S	56016.5T	.12	8.1	15:17:16	78
		-66.8				
8+75	S	57076.3	.11	8.2	15:17:40	78
		294.7				
8+50	S	56633.9	.07	8.3	15:18:03	78
		131.6				
8+25	S	56195.8	.07	8.4	15:18:21	78
		47.6				
8+00	S	56003.3	.07	8.4	15:18:36	78
		35.1				
7+75	S	55580.2	.07	8.5	15:18:51	78
		-51.0				
7+50	S	55242.1	.07	8.6	15:19:04	78
		-184.3				
7+25	S	56463.3	.08	8.6	15:19:18	78
		61.5				
7+00	S	57275.4	.08	8.7	15:19:31	78
		186.5				
6+75	S	56862.7	.10	8.8	15:19:45	78
		-60.2				
6+50	S	56506.8	.10	8.8	15:19:59	78
		-83.2				
6+25	S	56749.0	.10	8.9	15:20:16	78
		145.3				
6+00	S	56585.4	.07	9.0	15:20:29	78
		-48.9				

5+75	S	56225.7	.07	11.0	15:27:23	78
		-66.8				
5+50	S	56031.5	.09	11.1	15:27:41	78
		-141.7				
5+25	S	57499.1	1.7	11.2	15:27:58	78
		369.0				
5+00	S	56720.3	.06	11.3	15:28:14	78
		113.3				
4+75	S	56462.4	.08	11.3	15:28:28	78
		100.9				
4+50	S	56130.3	.07	11.4	15:28:47	78
		-14.4				
4+25	S	56089.9	.08	11.5	15:29:02	78
		44.6				
4+00	S	55655.0	.07	11.6	15:29:17	78
		-101.3				
3+75	S	55589.1	.10	11.7	15:29:32	78
		-46.9				
3+50	S	56201.8	.09	11.7	15:29:50	78
		168.7				
3+25	S	56178.3	.07	11.8	15:30:07	78
		81.3				
3+00	S	55921.2	.08	11.9	15:30:21	78
		-7.4				
2+75	S	55953.5	.08	12.0	15:30:34	78
		18.6				
2+50	S	55777.7	.09	12.0	15:30:51	78
		-21.6				
2+25	S	56290.8	.16	12.1	15:31:08	78
		342.3				
2+00	S	56250.3	.07	12.2	15:31:25	78
		141.7				
1+75	S	55595.9	.08	12.3	15:31:44	78
		-50.1				
1+50	S	54984.9	.09	12.4	15:32:07	78
		-229.4				
Ref. Fld		56169.9	.07	14.6	15:39:22	78
Ref. Fld		56170.8	.06	15.5	16:20:43	78

Line: 6+00 E Date: 5 SEP 86 #180

POSITION		FIELD	ERR	DRIFT	TIME	DS
0+25	S	55036.8	.10	23.9	16:38:49	78
		-188.3				
0+50	S	54751.7	.10	24.3	16:39:44	78
		-273.9				
0+75	S	55540.2	.08	24.7	16:40:31	78
		-226.7				
1+25	S	55881.1	.12	27.2	16:46:02	78
		-316.2				
1+50	S	55633.5	.08	27.8	16:47:10	78
		-128.7				
1+75	S	55835.9	.06	27.9	16:47:27	78
		1.6				
2+00	S	56135.9	.07	28.0	16:47:39	78
		72.6				

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2+25 S 56245.2 .06     28.1 16:47:53 78
          114.3
2+50 S 56185.7 .06     28.2 16:48:06 78
          121.5
2+75 S 55288.3 .08     28.3 16:48:21 78
          -57.3
3+00 S 55483.5 .08     28.5 16:48:43 78
           50.4
3+25 S 55399.7 .07     28.6 16:48:57 78
          -95.7
3+50 S 55591.9 .07     28.7 16:49:10 78
          -12.4
3+75 S 55649.7 .07     28.8 16:49:24 78
           10.8
4+00 S 55265.1 .07     28.9 16:49:44 78
         -106.8
4+25 S 55422.4 .08     29.0 16:49:57 78
           52.8
4+50 S 55476.3 .09     29.1 16:50:11 78
         -142.0
4+75 S 55955.6 .08     29.3 16:50:25 78
          145.1
5+00 S 55453.8 .07     29.4 16:50:38 78
          -35.1
5+25 S 55146.4 .10     29.5 16:50:51 78
         -216.1
5+50 S 55943.0 .08     29.6 16:51:05 78
           53.5
5+75 S 55608.7 .06     29.7 16:51:18 78
          -79.1
6+00 S 55892.8 .07     29.8 16:51:35 78
         -157.9
6+25 S 57217.9 .08     33.7 17:00:02 78
          196.6
6+50 S 57106.5 .06     33.8 17:00:15 78
          114.4
6+75 S 56891.7 .08     33.9 17:00:29 78
           83.6
7+00 S 56906.9 .08     34.0 17:00:42 78
           71.4
7+25 S 57024.3 .06     34.2 17:00:57 78
           20.1
7+50 S 57266.4 .12     34.3 17:01:12 78
          272.8
7+75 S 55444.2 .13     34.4 17:01:30 78
         -250.4
8+00 S 55546.3 .08     34.6 17:01:49 78
         -143.2
8+25 S 56580.7 .07     34.7 17:02:04 78
           13.9
8+50 S 57198.6 .06     34.8 17:02:17 78
          113.0
8+75 S 57325.5 .07     34.9 17:02:32 78
          205.2
9+00 S 55923.3T.07     35.1 17:02:52 78
         -119.6
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9+25	S	55720.5	.08	35.4	17:03:13	78
		-43.7				
9+50	S	55837.3	.07	35.6	17:03:28	78
		-8.7				
9+75	S	55859.2	.06	35.8	17:03:44	78
		-6.9				
10+00	S	55907.1	.08	36.1	17:03:59	78
		-6.9				
10+25	S	55941.7	.07	36.5	17:04:29	78
		-4.3				
10+50	S	55959.5	.07	36.9	17:04:53	78
		-1.5				
10+75	S	55970.2	.06	37.2	17:05:12	78
		1.3				

Line: 5+00 E Date: 5 SEP 86 #222

POSITION		FIELD	ERR	DRIFT	TIME	DS
10+00	S	55870.6	.10	53.5	17:22:59	78
		-0.3				
9+75	S	55829.0	.07	54.3	17:23:52	78
		-11.6				
9+50	S	55746.5	.09	55.0	17:24:38	78
		-19.1				
9+25	S	55648.1	.10	55.5	17:25:06	78
		-44.9				
9+00	S	55722.0	T.10	55.8	17:25:25	78
		-135.8				
8+75	S	57282.9	.09	55.4	17:26:15	78
		181.0				
8+50	S	57252.9	.08	55.3	17:26:33	78
		106.6				
8+25	S	56052.3	.06	55.1	17:26:48	78
		3.5				
8+00	S	55807.8	.08	54.9	17:27:08	78
		-159.9				
7+75	S	56979.2	.07	54.8	17:27:25	78
		91.7				
7+50	S	57562.4	.08	54.7	17:27:40	78
		144.1				
7+25	S	56985.1	.09	54.6	17:27:53	78
		62.7				
7+00	S	56144.0	.07	54.4	17:28:07	78
		-60.4				
6+75	S	56023.4	.07	54.3	17:28:19	78
		0.2				
6+50	S	55922.8	.07	54.2	17:28:35	78
		-44.2				
6+25	S	55510.1	.10	54.1	17:28:49	78
		-128.1				
6+00	S	55961.0	.08	53.9	17:29:06	78
		-54.3				
5+75	S	56583.6	.08	53.8	17:29:18	78
		239.7				
5+50	S	55498.7	.08	53.7	17:29:30	78
		-121.6				
5+25	S	55091.1	.08	53.6	17:29:42	78
		28.9				

5+00	S	54285.0	.11	53.5	17:29:55	78
		-295.7				
4+75	S	55466.6	.06	49.7	17:37:03	78
		-7.3				
4+50	S	56970.7	.13	49.6	17:37:17	78
		351.3				
4+25	S	57506.8	12.	49.5	17:37:33	58
		43.7				
4+00	S	55973.6	.11	49.4	17:37:46	78
		142.2				
3+75	S	55719.0	.06	49.2	17:38:00	78
		-25.6				
3+50	S	56840.4	.07	49.1	17:38:15	78
		16.6				
3+25	S	57407.0	.08	49.0	17:38:30	78
		247.5				
3+00	S	55894.6	.07	48.9	17:38:42	78
		-8.1				
2+75	S	55069.6	.09	48.7	17:38:58	78
		-99.4				
2+50	S	55084.9	.09	48.6	17:39:12	78
		28.6				
2+25	S	55068.8	.11	48.5	17:39:24	78
		-61.6				
2+00	S	54740.2	.08	48.4	17:39:37	78
		-105.7				
1+75	S	55224.5	.10	48.2	17:39:55	78
		140.9				
1+50	S	54736.3	.11	47.9	17:40:32	78
		-300.8				
1+25	S	55432.1	.11	47.7	17:40:54	78
		9.8				
1+00	S	55663.8	.08	47.4	17:41:29	78
		86.6				
0+75	S	55494.9	.11	47.3	17:41:46	78
		-20.0				
0+50	S	55477.3	.08	47.1	17:42:10	78
		-82.1				
0+25	S	55252.0	.07	46.8	17:42:34	78
		-58.5				

Line: 4+00 E Date: 5 SEP 86 #262

POSITION		FIELD	ERR	DRIFT	TIME	DS
0+25	S	55105.9	.08	32.3	18:10:16	78
		-30.8				
0+50	S	55169.9	.10	32.0	18:10:56	78
		-59.0				
0+75	S	55799.8	.14	31.8	18:11:17	78
		157.3				
1+00	S	55821.9	.11	31.6	18:11:35	78
		124.4				
1+25	S	55209.1	.08	31.5	18:11:51	78
		-21.2				
1+50	S	54855.0	.13	31.4	18:12:04	78
		-24.1				
1+75	S	55446.7	.08	31.3	18:12:17	78
		190.7				

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2+00 S 55517.7 .12     31.1 18:12:30 78
         165.9
2+25 S 54864.0 .09     31.0 18:12:43 78
        -116.4
2+50 S 54454.6 .09     30.9 18:12:56 78
        -308.4
2+75 S 54335.4 .28     30.8 18:13:11 78
        -415.8
3+00 S 54495.2 .91     30.5 18:13:41 78
        -460.6
3+25 S 56025.3 .15     30.4 18:13:58 78
         170.0
3+50 S 56227.9 .13     30.3 18:14:12 78
        -214.0
3+75 S 57694.8 2.0     30.1 18:14:26 68
         437.3
4+00 S 56402.1 .07     29.9 18:14:49 78
          45.1
4+25 S 56529.4 .10     29.8 18:15:03 78
         243.5
4+50 S 56399.2 .11     29.7 18:15:18 78
         123.8
4+75 S 56436.8 .07     29.6 18:15:32 78
          59.4
5+00 S 57549.9 .07     29.4 18:15:46 78
         200.3
5+25 S 58338.9 .10     24.3 18:25:38 78
         239.0
5+50 S 59680.8 1.0     24.0 18:26:10 78
         428.4
5+75 S 58979.3 .09     23.9 18:26:23 78
         307.0
6+00 S 57274.9 .07     23.8 18:26:37 78
          67.6
6+25 S 55896.3 .08     23.6 18:26:51 78
        -109.8
6+50 S 55360.5 .08     23.5 18:27:04 78
        -152.1
6+75 S 55117.3 .09     23.4 18:27:16 78
        -191.9
7+00 S 55664.4 .08     23.3 18:27:28 78
        -148.7
7+25 S 56532.1 .11     23.2 18:27:40 78
         -17.6
7+50 S 56538.9 .08     23.1 18:27:55 78
        -128.1
7+75 S 56911.8 .08     22.9 18:28:09 78
          44.9
8+00 S 56508.6 .09     22.8 18:28:23 78
         -25.5
8+25 S 57178.2 .09     22.7 18:28:38 78
         240.2
8+50 S 57253.4 .08     22.6 18:28:52 78
        -104.6
8+75 S 57833.7 .11     22.4 18:29:06 78
         322.0
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9+00	S	56050.1	T.06	22.2	18:29:29	78
		-64.0				

Line: 3+00 E Date: 5 SEP 86 #298

POSITION		FIELD	ERR	DRIFT	TIME	DS
8+75	S	58756.6	5.5	54.0	18:42:28	78
		54.2				
8+50	S	58428.9	.08	55.4	18:43:04	78
		120.1				
8+25	S	57798.6	.08	56.1	18:43:21	78
		253.3				
8+00	S	56018.5	T.07	56.7	18:43:35	78
		-111.9				
7+75	S	55600.8	.07	56.4	18:43:50	78
		-99.6				
7+50	S	56251.7	.12	56.1	18:44:04	78
		103.0				
7+25	S	56055.5	.08	55.9	18:44:17	78
		-0.6				
7+00	S	55667.2	.07	55.6	18:44:30	78
		-84.5				
6+75	S	55701.8	.11	55.3	18:44:43	78
		-61.4				
6+50	S	55689.2	.09	54.9	18:45:02	78
		-60.9				
6+25	S	55728.6	.12	54.6	18:45:14	78
		-66.5				
6+00	S	55886.2	.09	54.4	18:45:27	78
		-85.3				
5+75	S	56441.8	.10	54.1	18:45:41	78
		-119.5				
5+50	S	57788.9	.08	53.8	18:45:54	78
		-82.7				
5+25	S	59578.7	.09	53.5	18:46:07	78
		183.0				
5+00	S	61305.8	.18	53.2	18:46:21	68
		466.0				
4+75	S	58995.3	.11	52.9	18:46:36	78
		-260.9				
4+50	S	58247.6	.09	52.6	18:46:49	78
		-267.0				
4+25	S	57952.8	.12	52.3	18:47:02	78
		-353.0				
4+00	S	59423.6	.07	51.9	18:47:21	78
		73.8				
3+75	S	58599.5	1.3	43.7	18:53:47	78
		-321.9				
3+50	S	58969.5	2.8	43.3	18:54:06	68
		528.2				
3+25	S	58077.4	.45	42.8	18:54:30	78
		370.1				
3+00	S	56873.3	.09	42.5	18:54:44	78
		211.1				
2+75	S	56295.5	.08	42.1	18:55:05	78
		0.3				
2+50	S	56661.0	.08	41.8	18:55:18	78
		101.7				

2+25	S	57129.7	1.2	41.5	18:55:31	78
		343.4				
2+00	S	56214.0	.09	41.3	18:55:43	78
		125.2				
1+75	S	54552.3	.79	41.0	18:55:55	68
		-408.1				
1+50	S	54827.2	.08	40.7	18:56:09	78
		108.7				
1+25	S	54731.4	.10	40.4	18:56:24	78
		-71.9				
1+00	S	54627.7	.07	40.0	18:56:41	78
		-5.6				
0+75	S	55090.3	.09	39.7	18:56:57	78
		22.8				
0+50	S	55352.2	.08	39.4	18:57:11	78
		-9.0				
0+25	S	54907.2	.08	39.1	18:57:26	78
		-123.9				
Ref. Fld		56190.6	.05	35.3	19:00:20	78

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
& GRADIENT
Date: 6 SEP 86
Operator: 5316
Reference field: 56155.3
Datum subtracted: 0.0
Records: 305
Bat: 17.2 Volt Lithium: 3.54 Volt
Last time update: 8/14 18:00:00
Start of print: 9/07 8:27:16

Ref. Fld 56151.6 .04 -3.7 12:03:19 78

Line: 2+00 E Date: 6 SEP 86 #2

POSITION	FIELD	ERR	DRIFT	TIME	DS
0+25 S	55401.4	.06	8.2	12:17:20	78
	-25.1				
0+50 S	54795.8	.11	8.7	12:17:59	78
	-96.3				
0+75 S	54496.9	.16	9.1	12:18:29	78
	-380.8				
1+00 S	55871.4	.11	9.3	12:18:42	78
	-78.0				
1+25 S	56954.3	.11	9.5	12:18:57	78
	327.7				
1+50 S	56090.6	.11	9.7	12:19:09	78
	-297.1				
1+75 S	58120.0	3.2	10.4	12:20:00	68
	408.3				
2+00 S	58862.7	2.1	10.6	12:20:15	48
	636.7				
2+25 S	58068.7	.07	10.8	12:20:29	78
	192.6				
2+50 S	57316.9	.07	11.1	12:20:46	78
	99.6				
2+75 S	56598.6	.10	11.2	12:20:59	78
	-264.1				
3+00 S	57843.3	.07	11.4	12:21:12	78
	-64.3				
3+25 S	58912.1	.10	11.6	12:21:25	78
	44.4				
3+50 S	59379.8	3.1	11.8	12:21:39	68
	523.6				
3+75 S	58735.1	.06	12.0	12:21:51	78
	-9.9				
4+00 S	59731.4	1.4	12.2	12:22:04	78
	450.9				
4+25 S	58383.0	.07	16.1	12:26:43	78
	94.1				
4+50 S	57256.4	.08	16.3	12:26:56	78
	-148.7				

```
4+75 S 56999.9 .07     16.4 12:27:07 78
         -157.1
5+00 S 56828.6 .08     16.7 12:27:22 78
         -125.6
5+25 S 56456.3 .10     16.9 12:27:40 78
          -54.1
5+50 S 56110.8 .09     17.1 12:27:55 78
          -72.2
5+75 S 55985.5 .07     17.3 12:28:11 78
          -97.5
6+00 S 56224.7 .10     17.5 12:28:25 78
          -87.8
6+25 S 56995.1 .11     17.8 12:28:40 78
          125.0
6+50 S 56969.8 .10     18.0 12:28:57 78
           80.8
6+75 S 57094.2 .09     18.2 12:29:13 78
          157.8
7+00 S 56565.8 .12     18.5 12:29:30 78
           70.0
7+25 S 55936.3 .10     18.7 12:29:44 78
          -44.6
7+50 S 55735.6 .10     18.9 12:29:58 78
          -28.2
7+75 S 55516.1 .12     19.1 12:30:13 78
         -106.8
8+00 S 56072.8T.12     19.4 12:30:32 78
         -212.4

Line:   1+00 E   Date:  6 SEP 86    #34
POSITION  FIELD  ERR   DRIFT   TIME   DS
7+50 S 56004.8 .11      7.8 12:38:00 78
          -25.0
7+25 S 56007.3 .11      6.1 12:39:06 78
           -4.4
7+00 S 56026.8 .10      5.7 12:39:21 78
           -7.6
6+75 S 56030.6 .09      4.1 12:40:20 78
           -8.2
6+50 S 56021.3 .10      3.8 12:40:35 78
          -10.3
6+25 S 56022.4 .09      3.4 12:40:48 78
          -10.3
6+00 S 56036.1T.09      3.0 12:41:03 78
          -10.5
5+75 S 56051.2 .08      3.0 12:41:18 78
           -4.9
5+50 S 56060.6 .08      3.0 12:41:29 78
           -8.7
5+25 S 56073.5 .08      3.0 12:41:42 78
          -14.8
5+00 S 56085.6 .09      3.1 12:41:54 78
          -21.2
4+75 S 56097.2 .08      3.1 12:42:06 78
          -19.7
4+50 S 56117.7 .09      3.1 12:42:18 78
```

		-17.0					
4+25	S	56112.2	.09		3.1	12:42:30	78
		-28.1					
4+00	S	56193.7	.10		3.2	12:42:43	78
		2.8					
3+75	S	56086.8	.10		3.7	12:47:16	78
		-37.0					
3+50	S	56086.0	.09		3.7	12:47:28	78
		-30.9					
3+25	S	56193.5	.10		3.8	12:47:40	78
		24.1					
3+00	S	56124.0	.11		3.8	12:47:54	78
		-52.2					
2+75	S	56225.4	.09		3.8	12:48:06	78
		-69.6					
2+50	S	56536.1	.11		3.9	12:48:21	78
		-118.7					
2+25	S	57421.9	.10		3.9	12:48:33	78
		-156.8					
2+00	S	58871.5	1.7		3.9	12:48:45	78
		245.6					
1+75	S	58128.2	.09		3.9	12:49:00	78
		145.1					
1+50	S	57431.0	.10		4.0	12:49:13	78
		182.9					
1+25	S	56848.1	.10		4.0	12:49:27	78
		140.9					
1+00	S	55736.4	.07		4.0	12:49:40	78
		-156.2					
0+75	S	55752.1	.11		4.0	12:49:53	78
		-42.7					
0+50	S	55723.6	.10		4.1	12:50:11	78
		-12.3					
0+25	S	55687.0	.09		4.1	12:50:34	78
		-58.0					

Line: 0+00 E Date: 6 SEP 86 #64

POSITION		FIELD	ERR	DRIFT	TIME	DS
0+25	S	55828.4	.10	5.5	13:01:41	78
		-5.9				
0+50	S	55930.0	.12	5.5	13:01:57	78
		-5.5				
0+75	S	55980.6	.11	5.6	13:02:08	78
		-2.0				
1+00	S	56003.6	.10	5.6	13:02:20	78
		-1.6				
1+25	S	56021.0	.08	5.6	13:02:32	78
		-12.6				
1+50	S	56070.9	.09	5.8	13:04:19	78
		-45.0				
1+75	S	56081.3	.09	5.9	13:04:31	78
		-12.9				
2+00	S	56085.4	.10	5.9	13:04:42	78
		-10.4				
2+25	S	56074.7	.09	5.9	13:04:55	78
		-12.6				

2+50	S	56105.6	.09	5.9	13:05:08	78
		1.7				
2+75	S	56074.2	.08	6.0	13:05:21	78
		-15.5				
3+00	S	56150.4	.09	6.0	13:05:33	78
		28.5				
3+25	S	56101.8	.11	6.0	13:05:45	78
		-2.6				
3+50	S	56074.7	.08	6.0	13:05:57	78
		-6.1				
3+75	S	56071.0	.08	6.1	13:06:09	78
		-4.3				
4+00	S	56062.9	.09	6.1	13:06:22	78
		-6.3				
4+25	S	56049.3	.07	6.1	13:06:34	78
		-31.5				
4+50	S	56100.0	.09	6.1	13:06:48	78
		-10.4				
4+75	S	56084.4	.08	6.2	13:07:01	78
		-1.7				
5+00	S	56079.7	.09	6.2	13:07:13	78
		-4.3				
5+25	S	56099.0	.09	7.0	13:14:09	78
		6.5				
5+50	S	56084.5	.09	7.1	13:14:24	78
		4.4				
5+75	S	56040.4	.10	7.1	13:14:39	78
		-54.9				
6+00	S	56082.1T	.09	7.2	13:15:00	78
		0.0				
6+25	S	56076.8	.09	7.2	13:15:14	78
		-0.7				
6+50	S	56064.4	.08	7.2	13:15:29	78
		-19.6				
6+75	S	56071.1	.10	7.2	13:15:42	78
		2.3				
7+00	S	56051.6	.09	7.0	13:17:00	78
		1.0				
7+25	S	56043.3	.09	7.0	13:17:13	78
		-9.4				
7+50	S	56059.0	.09	7.0	13:17:37	78
		0.0				

Line: 1+00 W Date: 6 SEP 86 #94

POSITION		FIELD	ERR	DRIFT	TIME	DS
7+50	S	56067.2	.09	5.7	13:29:49	78
		3.6				
7+25	S	56066.7	.08	5.7	13:30:07	78
		1.7				
7+00	S	56068.6	.09	5.7	13:30:27	78
		2.6				
6+75	S	56063.2	.10	5.6	13:30:41	78
		3.7				
6+50	S	56067.7	.09	5.6	13:30:55	78
		2.0				
6+25	S	56075.6	.09	5.6	13:31:07	78

		-0.8				
6+00	S	56102.0	T.10	5.5	13:31:26	78
		6.9				
5+75	S	56094.7	.10	5.5	13:31:42	78
		7.0				
5+50	S	56068.2	.09	5.5	13:31:56	78
		0.3				
5+25	S	56072.0	.09	5.4	13:32:10	78
		2.9				
5+00	S	56074.6	.10	5.4	13:32:23	78
		4.4				
4+75	S	56072.6	.10	5.4	13:32:36	78
		5.7				
4+50	S	56074.4	.10	5.3	13:32:49	78
		7.2				
4+25	S	56069.7	.09	5.3	13:33:04	78
		3.8				
4+00	S	56069.5	.10	5.2	13:33:18	78
		2.0				
3+75	S	56138.1	.10	5.2	13:33:31	78
		49.1				
3+50	S	56071.1	.10	5.2	13:33:44	78
		4.8				
3+25	S	56075.5	.10	5.1	13:34:00	78
		6.2				
3+00	S	56073.1	.08	5.1	13:34:24	78
		3.2				
2+75	S	56072.6	.09	5.0	13:34:45	78
		2.4				
2+50	S	56075.8	.08	5.0	13:34:58	78
		-8.2				
2+25	S	56183.2	.07	4.9	13:35:11	78
		49.4				
2+00	S	56071.1	.09	4.9	13:35:24	78
		-3.6				
1+75	S	56069.9	.08	4.9	13:35:41	78
		-0.2				
1+50	S	56076.7	.08	4.8	13:35:57	78
		0.2				
1+25	S	56080.4	.09	4.8	13:36:12	78
		2.7				
1+00	S	56076.7	.10	4.7	13:36:39	78
		-0.3				
0+75	S	56069.5	.10	4.6	13:37:00	78
		-3.2				
0+50	S	56091.6	.09	4.6	13:37:20	78
		14.3				
0+25	S	55988.1	.10	4.5	13:37:44	78
		-19.9				
0+00	S	55994.2	.11	4.4	13:38:22	78
		-11.3				
Ref. Fld		56159.1	.05	3.8	13:41:52	78
Ref. Fld		56157.1	.05	1.8	14:21:14	78

Line: 2+00 W Date: 6 SEP 80 #107

POSITION		FIELD	ERR	DRIFT	TIME	DS
8+00	S	56066.3	.08	4.5	14:26:40	78
		3.7				
7+75	S	56071.7	.10	4.6	14:26:57	78
		3.5				
7+50	S	56074.5	.08	4.7	14:27:09	78
		3.0				
7+25	S	56075.8	.09	4.8	14:27:24	78
		3.0				
7+00	S	56080.3	.09	4.9	14:27:36	78
		3.2				
6+75	S	56076.6	.08	5.0	14:27:48	78
		2.6				
6+50	S	56073.6	.09	5.1	14:28:00	78
		3.6				
6+25	S	56070.9	.10	5.2	14:28:13	78
		3.4				
6+00	S	56061.3T	.09	5.5	14:28:38	78
		2.2				
5+75	S	56053.4	.08	5.5	14:28:56	78
		1.6				
5+50	S	56044.7	.08	5.6	14:29:08	78
		1.4				
5+25	S	56023.9	.08	5.6	14:29:20	78
		0.9				
5+00	S	56006.2	.07	5.7	14:29:34	78
		0.5				
4+75	S	55996.2	.09	5.7	14:29:46	78
		0.3				
4+50	S	55995.0	.08	5.8	14:30:00	78
		-2.7				
4+25	S	55927.8	.09	5.8	14:30:13	78
		4.1				
4+00	S	55866.9	.10	5.9	14:30:28	78
		-12.4				
3+75	S	55846.1	.10	6.3	14:32:02	78
		8.9				
3+50	S	55771.7	.10	6.4	14:32:16	78
		-9.6				
3+25	S	55646.2	.11	6.4	14:32:28	78
		-65.7				
3+00	S	55680.9	.13	6.5	14:32:41	78
		-45.4				
2+75	S	55816.5	.13	6.5	14:32:56	78
		22.8				
2+50	S	55622.8	.12	6.6	14:33:09	78
		-72.3				
2+25	S	55874.7	.10	6.7	14:33:24	78
		1.2				
2+00	S	56061.4	.11	6.7	14:33:37	78
		15.5				
1+75	S	56126.0	.09	6.8	14:33:51	78
		26.3				
1+50	S	56075.0	.09	6.8	14:34:08	78
		3.0				

Line: 3+00 W Date: 6 SEP 86 #154

POSITION	FIELD	ERR	DRIFT	TIME	DS
8+00 S	56064.6	.09	10.1	14:46:51	78
	3.5				
7+75 S	56067.9	.09	10.2	14:47:23	78
	3.9				
7+50 S	56067.8	.09	10.3	14:47:38	78
	2.2				
7+25 S	56070.6	.09	10.3	14:47:50	78
	4.2				
7+00 S	56070.7	.09	10.4	14:48:02	78
	3.8				
6+75 S	56072.2	.09	10.4	14:48:14	78
	5.2				
6+50 S	56070.7	.09	10.5	14:48:25	78
	3.5				
6+25 S	56068.5	.10	10.5	14:48:36	78
	2.4				
6+00 S	56068.5T	.09	10.6	14:48:46	78
	4.1				
5+75 S	56042.3	.07	10.6	14:48:59	78
	-5.4				
5+50 S	56015.5	.08	10.6	14:49:12	78
	-13.8				
5+25 S	55998.3	.08	10.6	14:49:25	78
	-45.3				
5+00 S	56338.7	.10	10.7	14:50:06	78
	17.6				
4+75 S	55799.1	.09	10.7	14:50:18	78
	-171.1				
4+50 S	55743.7	.10	10.7	14:50:30	78
	-1.1				
4+25 S	55059.3	.11	10.8	14:50:42	78
	-140.2				
4+00 S	54735.7	.12	10.8	14:50:54	78
	-220.1				
3+75 S	55073.3	.09	10.8	14:51:09	78
	-79.7				
3+50 S	54999.0	.09	10.8	14:51:24	78
	-116.1				
3+25 S	54638.8	.07	10.9	14:51:46	78
	-134.3				
3+00 S	54565.5	.09	10.9	14:52:16	78
	-168.2				
2+75 S	55794.3	.08	11.0	14:52:35	78
	53.9				
2+50 S	55710.4	.10	11.0	14:52:52	78
	-17.8				
2+25 S	55814.2	.12	11.0	14:53:10	78
	6.2				
2+00 S	55949.0	.10	11.1	14:53:37	78
	11.0				
1+75 S	56040.4	.10	11.1	14:54:00	78
	-8.4				
1+50 S	56147.3	.09	11.1	14:54:13	78

		44.1				
1+25	S	56056.3	.09	11.2	14:54:32	78
		-1.4				

Line: 4+00 W Date: 6 SEP 86 #182

POSITION		FIELD	ERR	DRIFT	TIME	DS
1+00	S	56064.6	.11	12.9	15:10:00	78
		-7.4				
1+25	S	56146.4	.08	13.0	15:10:36	78
		10.7				
1+50	S	56036.2	.09	13.0	15:10:49	78
		-8.0				
1+75	S	56021.8	.08	13.0	15:11:01	78
		4.5				
2+00	S	55967.9	.08	13.0	15:11:13	78
		5.7				
2+25	S	55864.6	.10	13.0	15:11:27	78
		6.2				
2+50	S	55588.9	.13	13.1	15:12:16	78
		-17.9				
2+75	S	55356.9	.08	13.2	15:12:30	78
		-108.4				
3+00	S	55760.8	.11	13.2	15:12:48	78
		-13.8				
3+25	S	56272.9	.12	13.3	15:13:25	78
		77.7				
3+50	S	56524.9	.10	13.3	15:13:38	78
		68.4				
3+75	S	56769.4	.10	13.3	15:13:52	78
		75.4				
4+00	S	57337.4	.08	13.3	15:14:05	78
		102.9				
4+25	S	58821.2	.11	13.4	15:14:23	78
		287.8				
4+50	S	61052.6	7.3	13.4	15:14:38	37
		1483.9				
4+75	S	57933.8	.10	13.5	15:15:38	77
		-172.2				
5+00	S	56698.4	.07	13.5	15:15:51	78
		-118.8				
5+25	S	56282.8	.10	13.6	15:16:09	78
		-39.8				
5+50	S	56138.9	.09	13.6	15:16:23	78
		-12.9				
5+75	S	56078.6	.09	13.6	15:16:38	78
		-4.6				
6+00	S	56066.1T	.09	13.7	15:16:57	78
		0.9				
6+25	S	56075.0	.10	13.8	15:17:12	78
		6.1				
6+50	S	56045.1	.09	13.9	15:17:26	78
		6.7				
6+75	S	56035.6	.07	14.0	15:17:38	78
		5.1				
7+00	S	56031.6	.06	14.1	15:17:49	78
		2.7				

7+25	S	56029.0	.07	14.3	15:18:03	78
		2.6				
7+50	S	56026.9	.07	14.4	15:18:15	78
		2.9				
7+75	S	56025.2	.08	14.5	15:18:27	78
		5.1				
8+00	S	56025.9	.08	14.6	15:18:39	78
		3.0				
8+25	S	56020.7	.08	23.6	15:34:20	78
		0.6				
8+50	S	56020.3	.09	23.8	15:34:41	78
		-2.5				
8+75	S	56022.2	.10	23.9	15:34:59	78
		-0.3				
9+00	S	56037.2	.09	24.1	15:35:11	78
		7.3				
9+25	S	56040.8	.09	24.2	15:35:25	78
		12.4				
9+50	S	56030.8	.09	24.5	15:35:56	78
		-4.0				
9+75	S	56080.8	.09	24.6	15:36:10	78
		-8.9				
10+00	S	56063.5	.09	24.8	15:36:26	78
		5.3				

Line: 5+00 W Date: 6 SEP 86 #219

POSITION		FIELD	ERR	DRIFT	TIME	DS
10+00	S	56224.5	.10	25.2	15:37:15	78
		191.3				
9+75	S	55507.2	.09	25.6	15:37:50	78
		-243.2				
9+50	S	55769.9	.10	25.7	15:38:05	78
		4.8				
9+25	S	55956.5	.10	25.8	15:38:19	78
		10.5				
9+00	S	56005.1	.09	26.0	15:38:32	78
		10.4				
8+75	S	55996.1	.10	26.1	15:38:49	78
		0.6				
8+50	S	55963.8	.10	26.3	15:39:02	78
		-6.8				
8+25	S	55884.3	.11	26.4	15:39:13	78
		-25.8				
8+00	S	55890.5	.14	26.5	15:39:25	78
		-100.3				
7+75	S	56353.0	.11	26.6	15:39:38	78
		167.2				
7+50	S	55108.9	.09	26.7	15:39:51	78
		-241.6				
7+25	S	55349.2	.13	26.8	15:40:05	78
		-141.6				
7+00	S	55625.3	.09	27.0	15:40:20	78
		72.8				
6+75	S	55131.1	.09	27.4	15:41:02	78
		-87.2				
6+50	S	54912.9	.13	27.6	15:41:19	78

		-223.8				
6+25	S	55606.2	.15	27.7	15:41:37	78
		129.8				
6+00	S	54624.6T	.45	28.0	15:42:00	68
		-472.7				
5+75	S	55510.5	.18	28.0	15:42:23	78
		286.3				
5+50	S	55481.5	.14	28.1	15:42:43	78
		-100.6				
5+25	S	55854.1	.11	28.2	15:43:07	78
		5.6				

Line: 6+00 W Date: 6 SEP 86 #239

POSITION		FIELD	ERR	DRIFT	TIME	DS
10+00	S	56416.2	.13	35.1	16:17:00	78
		54.1				
9+75	S	56237.6	.11	35.2	16:17:32	78
		-19.0				
9+50	S	56102.0	.09	35.2	16:17:47	78
		-2.1				
9+25	S	55876.1	.09	35.4	16:18:29	78
		-24.2				
9+00	S	55986.3	.09	35.4	16:18:46	78
		0.3				
8+75	S	56063.3	.10	35.5	16:19:01	78
		-5.1				
8+50	S	56200.2	.10	35.5	16:19:14	78
		-17.9				
8+25	S	56743.8	.12	35.6	16:19:34	78
		26.3				
8+00	S	57408.7	.08	35.7	16:19:58	78
		10.7				
7+75	S	57766.1	.09	35.7	16:20:17	78
		206.1				
7+50	S	56896.0	.14	35.8	16:20:35	78
		65.1				
7+25	S	57226.6	.08	35.8	16:20:51	78
		148.7				
7+00	S	56795.0	.07	35.9	16:21:16	78
		-95.4				
6+75	S	58023.1	.12	36.0	16:21:47	78
		280.1				
6+50	S	58617.7	15.	36.1	16:22:02	48
		-157.2				
6+25	S	57476.3	1.0	36.2	16:22:34	78
		349.9				
6+00	S	57598.8T	.13	36.3	16:22:55	78
		332.7				
5+75	S	56399.2	.08	36.3	16:23:20	78
		-3.2				
5+50	S	55869.7	.08	36.2	16:23:37	78
		-69.4				
5+25	S	55961.1	.11	36.1	16:23:56	78
		-24.1				
5+00	S	56207.9	.11	36.1	16:24:11	78
		-37.0				

Line: 7+00 W Date: 6 SEP 86 #260

POSITION	FIELD	ERR	DRIFT	TIME	DS
10+00 S	56027.0	.11	21.9	17:26:12	78
	11.3				
9+75 S	56033.6	.10	21.7	17:26:45	78
	6.5				
9+50 S	56029.8	.11	21.7	17:26:58	78
	2.3				
9+25 S	56053.1	.11	21.4	17:28:08	78
	6.1				
9+00 S	56065.7	.11	21.4	17:28:22	78
	3.9				
8+75 S	56078.8	.10	21.3	17:28:41	78
	3.8				
8+50 S	56096.0	.10	21.2	17:28:56	78
	5.3				
8+25 S	56106.6	.10	21.2	17:29:14	78
	5.8				
8+00 S	56105.5	.14	21.1	17:29:30	78
	5.0				
7+75 S	56092.0	.10	21.0	17:29:47	78
	-3.7				
7+50 S	56095.8	.12	21.0	17:30:01	78
	-2.0				
7+25 S	56104.6	.10	20.9	17:30:16	78
	0.4				
7+00 S	56113.2	.10	20.9	17:30:31	78
	0.0				
6+75 S	56115.7	.11	20.8	17:30:44	78
	-1.0				
6+50 S	56115.8	.11	20.8	17:30:59	78
	-0.7				
6+25 S	56107.4	.10	20.7	17:31:11	78
	1.9				
6+00 S	56083.4T	.11	20.6	17:31:30	78
	-2.4				
5+75 S	56087.2	.10	20.6	17:31:43	78
	1.5				
5+50 S	56097.8	.11	20.6	17:31:54	78
	2.8				
5+25 S	56104.4	.11	20.6	17:32:07	78
	1.5				
5+00 S	56118.9	.10	20.6	17:32:23	78
	0.5				

Line: 5+00 W Date: 6 SEP 86 #281

POSITION	FIELD	ERR	DRIFT	TIME	DS
3+00 S	56420.1	.11	21.6	17:47:09	78
	-12.1				
2+75 S	56282.5	.11	21.6	17:47:43	78
	50.9				
2+50 S	55832.7	.09	21.6	17:47:57	78
	-78.2				
2+25 S	55896.8	.10	21.7	17:48:14	78
	-0.4				

2+00	S	55989.6	.09	21.7	17:48:29	78
		7.3				
1+75	S	56032.8	.10	21.7	17:48:48	78
		2.8				
1+50	S	56062.1	.10	21.7	17:49:04	78
		4.1				
1+25	S	56085.0	.15	21.8	17:49:42	78
		4.2				
1+00	S	56147.5	.10	21.8	17:49:57	78
		13.1				
0+75	S	56095.6	.11	21.8	17:50:12	78
		-12.9				

Line: 6+00 W Date: 6 SEP 86 #291

POSITION		FIELD	ERR	DRIFT	TIME	DS
3+50	S	56383.1	.11	21.9	17:52:13	78
		5.9				
3+25	S	56079.6	.11	21.9	17:52:39	78
		-51.2				
3+00	S	56039.5	.11	22.0	17:52:51	78
		-20.7				
2+75	S	56034.1	.10	22.0	17:53:02	78
		-7.8				
2+50	S	56030.8	.11	22.0	17:53:14	78
		-4.7				
2+25	S	56047.0	.10	22.0	17:53:25	78
		0.5				
2+00	S	56060.9	.10	22.0	17:53:37	78
		3.0				
1+75	S	56083.5	.10	22.0	17:53:51	78
		6.6				
1+50	S	56083.4	.11	22.0	17:54:03	78
		1.6				
1+25	S	56071.8	.10	22.1	17:54:15	78
		-3.3				
1+00	S	56126.0	.11	22.2	17:55:46	78
		11.8				
0+75	S	56137.9	.10	22.2	17:56:04	78
		6.5				
0+50	S	56120.8	.10	22.2	17:56:18	78
		6.7				
0+25	S	56100.1	.09	22.2	17:56:38	78
		5.8				
Ref. Fld		56177.7	.05	22.4	17:58:45	78

MAGNETOMETER DATA

SOUTH GRID

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
& GRADIENT
Date: 7 SEP 86
Operator: 5316
Reference field: 56102.0
Datum subtracted: 0.0
Records: 121
Bat: 18.1 Volt Lithium: 3.52 Volt
Last time update: 9/12 17:32:00
Start of print: 9/13 6:18:19

Ref. Fld 56102.0 .05 0.0 16:05:43 78

Pos: 5+00 E Date: 7 SEP 86 #2

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
1+00 N	56036.6T	.05	0.3	16:08:56	78
0+00 N	56015.4T	.04	0.5	16:10:31	78
1+00 S	56134.1T	.05	0.6	16:11:06	78
2+00 S	55843.3T	.05	0.6	16:11:46	78
3+00 S	57502.1T	.08	0.7	16:12:26	78

Pos: 12+50 E Date: 7 SEP 86 #7

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
6+00 N	56138.9T	.05	1.5	16:19:54	78
5+00 N	55589.8T	.11	1.7	16:21:13	78
4+00 N	54925.1T	.07	1.8	16:21:55	78
3+00 N	56466.0T	.04	1.8	16:22:36	78
2+00 N	55927.1T	.05	2.0	16:24:08	78
1+00 N	56022.4T	.05	2.1	16:24:49	78
0+00 N	56441.0T	.05	2.2	16:25:38	78
1+00 S	56612.0T	.05	2.3	16:26:37	78

Pos: 17+50 E Date: 7 SEP 86 #15

Tie-Line	FIELD	ERR	DRIFT	TIME	DS
6+00 N	55849.9T	.07	2.8	16:31:24	78
5+00 N	55668.3T	.05	2.9	16:32:14	78
4+00 N	56644.6T	.06	3.0	16:32:59	78
3+00 N	56496.9T	.05	3.1	16:34:27	78
2+00 N	55145.3T	.07	3.3	16:35:31	78

Ref. Fld 56105.8 .05 3.8 16:39:50 78

Ref. Fld 56110.1 .05 8.1 19:48:47 78

Line: 6+00 N Date: 7 SEP 86 #22

POSITION	FIELD	ERR	DRIFT	TIME	DS
10+00 E	55959.6	.09	10.0	19:53:33	78
	41.1				
10+25 E	55872.3	.08	10.1	19:53:50	78
	-13.9				
11+25 E	56395.0	.10	10.9	19:55:38	78

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                -46.7
11+50 E 57071.5 .12     11.0 19:55:52 78
                143.8
11+75 E 57249.9 2.5     11.1 19:56:05 68
                421.9
12+00 E 56270.9 .09     11.1 19:56:17 78
                -12.8
12+25 E 56233.6 .11     11.3 19:56:32 78
                 47.7
12+50 E 56138.9T.11     11.5 19:57:01 78
                -39.2
12+75 E 56167.5 .10     11.5 19:57:18 78
                -14.4
13+00 E 55928.8 .10     11.6 19:57:34 78
                -53.7
13+25 E 55773.9 .10     11.6 19:57:47 78
                -29.1
13+50 E 55741.6 .09     11.7 19:58:03 78
                 -4.4
13+75 E 55828.3 .12     11.8 19:58:18 78
                 -4.5
14+00 E 55887.5 .09     11.8 19:58:32 78
                -14.1
14+25 E 56075.1 .10     11.9 19:58:45 78
                -23.9
14+50 E 56191.8 .12     11.9 19:58:57 78
                -51.0
14+75 E 56048.5 .10     12.0 19:59:08 78
                -28.9
15+00 E 55808.9 .09     12.1 19:59:40 78
                -32.0
15+25 E 55692.7 .11     13.7 20:05:57 78
                -68.5
15+50 E 56165.4 .20     14.0 20:07:10 78
                299.1
15+75 E 55932.8 .11     14.1 20:07:40 78
                -22.0
16+00 E 55868.9 .10     14.1 20:07:53 78
                -19.1
16+25 E 55825.7 .11     14.2 20:08:04 78
                -13.5
16+50 E 55832.1 .09     14.2 20:08:18 78
                 -1.7
16+75 E 55825.2 .11     14.3 20:08:33 78
                  4.7
17+00 E 55838.3 .09     14.4 20:08:50 78
                 13.7
17+25 E 55831.4 .10     14.5 20:09:18 78
                  5.5
17+50 E 55849.9T.10     14.6 20:09:32 78
                  5.4
17+75 E 55869.5 .13     14.5 20:09:48 78
                  6.0
18+00 E 55890.8 .12     14.4 20:10:02 78
                 14.6
18+25 E 55911.0 .11     14.3 20:10:14 78
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			9.8			
18+50	E	55930.1	.10	14.3	20:10:26	78
			9.7			
18+75	E	55940.0	.11	14.2	20:10:38	78
			9.2			
19+00	E	55947.2	.11	14.1	20:10:50	78
			12.4			
19+25	E	55953.0	.12	14.0	20:11:01	78
			18.1			
19+50	E	55969.0	.10	13.9	20:11:14	78
			12.7			
19+75	E	55969.3	.12	13.8	20:11:26	78
			9.2			
20+00	E	55940.0	.10	13.7	20:11:42	78
			-6.9			

Line: 5+00 N Date: 7 SEP 86 #60

POSITION		FIELD	ERR	DRIFT	TIME	DS
20+00	E	56067.4	.10	8.3	20:24:21	78
			1.5			
19+75	E	55949.1	.11	8.1	20:24:49	78
			-28.3			
19+50	E	55920.6	.09	7.9	20:25:15	78
			8.7			
19+25	E	55842.8	.10	7.8	20:25:30	78
			4.5			
19+00	E	55871.1	.09	7.7	20:25:42	78
			10.8			
18+75	E	55806.6	.09	7.6	20:25:55	78
			10.5			
18+50	E	55684.9	.09	7.5	20:26:07	78
			9.0			
18+25	E	55458.1	.10	7.4	20:26:19	78
			-8.8			
18+00	E	55150.6	.13	7.3	20:26:32	78
			-111.9			
17+75	E	55365.6	.12	7.2	20:26:49	78
			-34.3			
17+50	E	55668.3T	.12	7.0	20:27:11	78
			70.3			
17+25	E	55214.9	.12	7.0	20:27:26	78
			-41.8			
17+00	E	54757.1	.12	7.0	20:27:39	78
			-147.4			
16+75	E	54904.9	.11	7.1	20:27:51	78
			-67.2			
16+50	E	54860.1	.13	7.1	20:28:02	78
			-15.9			
16+25	E	54734.8	.10	7.2	20:28:13	78
			-54.7			
16+00	E	54488.2	.13	7.2	20:28:26	78
			-142.0			
15+75	E	54294.1	.11	7.2	20:28:38	78
			-258.0			
15+50	E	54099.9	.16	7.3	20:28:54	78
			-366.3			

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15+25 E 54250.8 .11      7.3 20:29:07 78
          -222.8
15+00 E 54445.0 .13      7.4 20:29:23 78
          -128.4
14+75 E 54526.8 .14      9.8 20:41:32 78
           -92.6
14+50 E 54703.2 .13      9.8 20:41:52 78
           -65.7
14+25 E 54986.8 .16      9.9 20:42:04 78
           -32.6
14+00 E 55119.6 .14      9.9 20:42:16 78
            -9.1
13+75 E 55280.8 .16     10.0 20:42:29 78
             0.3
13+50 E 55209.0 .13     10.0 20:42:51 78
          -148.0
13+25 E 55405.2 .16     10.1 20:43:06 78
           170.8
13+00 E 55496.4 .11     10.1 20:43:19 78
            15.3
12+75 E 55578.5 .09     10.2 20:43:34 78
            -1.7
12+50 E 55589.8T.13     10.3 20:43:54 78
           -47.5
12+25 E 55663.1 .11     10.2 20:44:07 78
           -53.4
12+00 E 55755.9 .09     10.0 20:44:20 78
            35.7
11+75 E 56101.7 .13      9.7 20:44:40 78
           178.9
11+50 E 55850.5 .11      9.5 20:44:55 78
             5.9
11+25 E 55818.2 .10      9.3 20:45:07 78
            -2.6
11+00 E 55927.7 .09      9.1 20:45:21 78
             1.3
10+50 E 55504.9 .09      8.6 20:46:00 78
           -77.9
10+25 E 55797.7 .13      8.2 20:46:25 78
          -121.1
10+00 E 55840.9 .08      8.0 20:46:39 78
           -27.0

Line:   4+00 N   Date:  7 SEP 86   #100
POSITION  FIELD  ERR   DRIFT   TIME    DS
10+00 E 55512.5 .11      0.4 20:55:40 78
            11.2
10+25 E 55427.1 .10      0.0 20:56:06 78
            10.2
10+50 E 55332.7 .13     -0.1 20:56:17 78
             9.3
10+75 E 55088.8 .13     -0.3 20:56:29 78
            -7.3
11+00 E 54855.9 .12     -0.4 20:56:41 78
           -59.9
11+25 E 54599.0 .14     -0.6 20:56:53 78
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		-191.7				
11+50	E	54567.5	.15	-0.8	20:57:04	78
		-237.6				
11+75	E	54689.5	.14	-0.9	20:57:16	78
		-177.9				
12+00	E	54982.1	.14	-1.1	20:57:28	78
		-15.5				
12+25	E	55222.9	.12	-1.3	20:57:40	78
		7.5				
12+50	E	54925.1T	.14	-1.7	20:58:06	78
		-150.5				
12+75	E	54910.3	.13	-1.5	20:58:22	78
		-68.0				
13+00	E	55104.6	.12	-1.3	20:58:33	78
		-15.5				
13+25	E	55257.1	.14	-1.2	20:58:44	78
		-132.3				
13+50	E	56255.5	.16	-1.0	20:58:55	78
		110.8				
13+75	E	56473.4	.10	-0.8	20:59:06	78
		-132.9				
14+00	E	57097.9	.12	-0.6	20:59:18	78
		185.9				
14+25	E	56555.3	.10	-0.5	20:59:30	78
		-68.2				
14+50	E	56967.2	.10	-0.2	20:59:48	78
		177.8				
14+75	E	56898.2	.11	0.0	20:59:59	78
		86.6				
15+00	E	57269.2	.11	0.2	21:00:10	78
		273.6				
Ref. Fld		56112.6	.05	10.6	21:11:23	78

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
& GRADIENT
Date: 13 SEP 86
Operator: 5316
Reference field: 56102.0
Datum subtracted: 0.0
Records: 289
Bat: 17.2 Volt Lithium: 3.54 Volt
Last time update: 9/13 13:48:00
Start of print: 9/13 20:54:09

Ref. Fld 56090.7 .06 -11.3 13:49:03 78

Line: 2+00 N Date: 13 SEP 86 #2

POSITION	FIELD	ERR	DRIFT	TIME	DS
10+00 E	56173.0	.06	-13.0	14:08:00	78
	164.1				
10+25 E	55667.4	.07	-13.0	14:08:32	78
	100.2				
11+00 E	55320.7	.09	-13.1	14:09:10	78
	144.0				
11+25 E	55644.8	.06	-13.1	14:09:33	78
	-40.9				
11+50 E	55837.0	.06	-13.2	14:09:46	78
	19.3				
11+75 E	55924.6	.07	-13.2	14:09:58	78
	39.7				
12+00 E	55891.9	.07	-13.2	14:10:09	78
	13.4				
12+25 E	55936.3	.07	-13.2	14:10:22	78
	13.8				
12+50 E	55927.1T	.07	-13.3	14:10:44	78
	-14.4				
12+75 E	55642.7	.06	-13.4	14:11:02	78
	-157.3				
13+00 E	55946.0	.07	-14.5	14:12:48	78
	-48.5				
13+25 E	56254.6	.06	-14.7	14:13:09	78
	-1.3				
13+50 E	56439.9	.06	-14.8	14:13:21	78
	46.9				
13+75 E	56402.8	.07	-15.0	14:13:39	78
	12.0				
14+00 E	56413.5	.06	-15.2	14:13:58	78
	71.4				
14+25 E	56034.1	.07	-15.4	14:14:12	78
	-85.5				
14+50 E	56105.8	.06	-15.5	14:14:26	78
	-61.0				
14+75 E	56386.9	.05	-15.7	14:14:40	78
	15.2				

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15+00 E 56275.0 .08    -15.8 14:14:53 78
          2.4
15+25 E 56313.2 .08    -20.9 14:23:14 78
        -81.5
15+50 E 57250.6 .07    -21.1 14:23:32 78
        163.9
15+75 E 57208.9 .07    -21.2 14:23:45 78
         90.9
16+00 E 57008.1 .07    -21.8 14:24:38 78
         87.0
16+25 E 57046.4 .06    -21.9 14:24:52 78
        -85.1
16+50 E 58275.6 .11    -22.1 14:25:04 78
        280.2
16+75 E 58922.7 .17    -22.2 14:25:18 78
        291.7
17+00 E 59227.8 .12    -22.5 14:25:45 78
        292.3
17+25 E 57675.2 .11    -22.6 14:25:59 78
        176.2
17+50 E 55145.3T.12    -23.1 14:26:40 78
        -313.5
17+75 E 55130.0 .10    -22.7 14:27:03 78
        -92.9

Line:    1+00 N    Date: 13 SEP 86    #32
POSITION  FIELD  ERR    DRIFT    TIME    DS
15+25 E 56527.6 .09     -0.7 14:44:39 78
        -263.4
15+00 E 56872.3 .07     -0.1 14:45:07 78
        -17.5
14+75 E 56764.2 .07      0.3 14:45:24 78
        -130.3
14+50 E 56876.7 .08      0.6 14:45:40 78
        -66.8
14+25 E 57091.2 .07      0.9 14:45:54 78
        108.9
14+00 E 56780.0 .06      1.2 14:46:08 78
         12.7
13+75 E 56200.3 .07      1.7 14:46:33 78
        -156.2
13+50 E 56298.8 .05      2.0 14:46:48 78
        -17.0
13+25 E 56269.2 .06      2.4 14:47:08 78
         41.3
13+00 E 56249.1 .07      2.7 14:47:20 78
         48.8
12+75 E 56076.2 .07      3.0 14:47:37 78
        -44.4
12+50 E 56022.4T.06      3.4 14:47:53 78
        -82.0
12+25 E 56296.2 .06      3.5 14:48:09 78
         44.8
12+00 E 56219.7 .07      3.7 14:48:22 78
        -62.4
11+75 E 56552.1 .06      3.9 14:48:45 78
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                35.5
11+50 E 56628.0 .07      4.1 14:48:57 78
                79.5
11+25 E 56470.9 .07      4.2 14:49:09 78
                88.6
11+00 E 56174.1 .07      4.3 14:49:21 78
               -41.1
10+75 E 56309.4 .07      4.6 14:49:40 78
                44.9
10+50 E 56135.8 .07      4.7 14:49:52 78
                -4.9
10+25 E 55877.4 .06      4.8 14:50:05 78
               -61.9
10+00 E 55919.5 .07      5.0 14:50:18 78
               -73.6
 9+75 E 55933.7 .08      9.9 14:57:42 78
               -35.0
 9+50 E 55988.5 .11     10.1 14:57:55 78
                -4.1
 9+25 E 55997.6 .07     10.2 14:58:09 78
               -19.1
 9+00 E 55951.9 .07     10.3 14:58:20 78
               -45.1
 8+75 E 56029.1 .08     10.5 14:58:32 78
               -82.3
 8+50 E 56298.9 .08     10.6 14:58:44 78
                33.2
 8+25 E 56464.3 .07     10.7 14:58:56 78
                 3.4
 8+00 E 56216.4 .07     10.9 14:59:08 78
               -47.3
 7+00 E 56352.5 .08     11.4 14:59:59 78
              -110.3
 6+75 E 55962.2 .07     11.7 15:00:23 78
               -74.0
 6+50 E 55759.3 .09     11.8 15:00:34 78
               -75.1
 6+25 E 55869.8 .10     12.0 15:00:46 78
               -16.3
 6+00 E 55916.3 .10     12.1 15:00:58 78
                -3.6
 5+75 E 55923.4 .12     12.2 15:01:11 78
               -11.2
 5+50 E 56021.0 .10     12.4 15:01:29 78
                15.1
 5+25 E 56029.6 .06     12.7 15:01:51 78
               -15.2
 5+00 E 56036.6T.06     13.0 15:02:14 78
               -21.0
 4+75 E 56062.8 .06     13.1 15:02:35 78
                -7.2
 4+50 E 56055.9 .06     13.1 15:02:49 78
                -7.2
 4+25 E 56060.7 .06     13.3 15:03:11 78
                -8.2
```

Line: 0+00 N Date: 13 SEP 86 #74

POSITION	FIELD	ERR	DRIFT	TIME	DS
2+00 E	56027.1	.08	21.4	15:28:02	78
	-7.9				
2+25 E	56000.3	.07	21.5	15:28:19	78
	-9.4				
2+50 E	56046.1	.06	21.6	15:28:30	78
	-5.6				
2+75 E	56059.6	.09	21.6	15:28:44	78
	-36.0				
3+25 E	55999.6	.07	21.7	15:29:01	78
	-6.6				
3+50 E	56080.8	.08	22.1	15:30:00	78
	3.4				
3+75 E	56078.4	.08	22.1	15:30:11	78
	-0.7				
4+00 E	56055.5	.07	22.2	15:30:23	78
	-15.0				
4+25 E	56049.1	.07	22.3	15:30:36	78
	-6.1				
4+50 E	56000.0	.06	22.4	15:30:54	78
	-54.2				
4+75 E	55990.5	.07	22.4	15:31:08	78
	-34.1				
5+00 E	56015.4T	.09	22.6	15:31:30	78
	0.4				
5+25 E	55998.6	.07	22.6	15:31:45	78
	-2.1				
5+50 E	55976.4	.08	22.5	15:31:58	78
	-4.9				
5+75 E	55952.7	.10	22.4	15:32:09	78
	-4.1				
6+00 E	55948.0	.10	22.3	15:32:21	78
	-5.1				
6+25 E	56014.4	.09	22.2	15:32:33	78
	-22.0				
6+50 E	56225.7	.08	22.2	15:32:46	78
	19.5				
6+75 E	56150.4	.06	22.1	15:33:01	78
	-45.2				
7+00 E	56259.2	.10	22.0	15:33:13	78
	-35.9				
7+25 E	56439.2	.08	21.9	15:33:25	78
	-21.2				
7+50 E	56693.7	.08	21.8	15:33:41	78
	-55.3				
7+75 E	56910.7	.07	21.7	15:33:53	78
	20.7				
8+00 E	56765.8	.07	21.6	15:34:08	78
	-14.8				
8+25 E	56825.8	.09	18.6	15:41:50	78
	-9.4				
8+50 E	56835.0	.09	18.5	15:42:03	78
	88.6				
8+75 E	56685.1	.08	18.5	15:42:15	78
	2.2				

9+00	E	56908.9	.08	18.4	15:42:29	78
		38.3				
9+25	E	56870.2	.08	18.3	15:42:41	78
		28.9				
9+50	E	56574.2	.08	18.2	15:42:53	78
		-5.6				
9+75	E	56384.0	.07	18.1	15:43:07	78
		-44.2				
10+00	E	56307.8	.07	18.0	15:43:19	78
		-14.1				
10+25	E	55960.1	.06	18.0	15:43:33	78
		-188.4				
10+50	E	56453.2	.10	17.9	15:43:46	78
		-29.4				
10+75	E	56649.4	.10	17.8	15:43:58	78
		54.1				
11+00	E	56639.5	.14	17.7	15:44:10	78
		25.6				
11+25	E	56821.8	.10	17.6	15:44:23	78
		111.2				
11+50	E	56781.0	.09	17.5	15:44:38	78
		68.0				
11+75	E	56707.5	.07	17.4	15:44:59	78
		-36.7				
12+00	E	56748.2	.08	17.3	15:45:16	78
		-16.4				
12+25	E	56540.1	.07	17.2	15:45:34	78
		-56.5				
12+50	E	56441.0T	.09	16.9	15:46:07	78
		-57.8				
12+75	E	56622.1	.11	17.0	15:46:21	78
		3.6				
13+00	E	56911.7	.07	17.2	15:46:34	78
		85.4				
13+25	E	57011.5	.07	17.4	15:46:47	78
		-10.2				
13+50	E	56901.3	.06	17.6	15:47:03	78
		64.0				
13+75	E	56333.3	.07	17.9	15:47:22	78
		-128.9				
14+00	E	55707.9	.07	18.2	15:47:49	78
		-176.2				

Line: 1+00 S Date: 13 SEP 86 #122

POSITION		FIELD	ERR	DRIFT	TIME	DS
2+00	E	56070.3	.09	33.2	16:06:03	78
		4.0				
2+25	E	56063.9	.10	37.7	16:11:33	78
		5.0				
2+50	E	56054.7	.08	38.2	16:12:05	78
		2.0				
2+75	E	56077.0	.07	38.3	16:12:19	78
		9.3				
3+25	E	56095.1	.08	39.3	16:13:30	78
		-8.6				
3+50	E	55942.8	.08	39.5	16:13:46	78

			-51.9			
3+75	E	56302.3	.09	39.7	16:13:59	78
			141.1			
4+00	E	56157.2	.08	39.9	16:14:13	78
			127.1			
4+25	E	55762.9	.13	40.2	16:14:34	78
			-167.3			
4+50	E	55976.0	.14	41.3	16:15:52	78
			-56.4			
4+75	E	55974.8	.09	41.5	16:16:07	78
			31.7			
5+00	E	56134.1	T.09	41.7	16:16:20	78
			100.0			
5+25	E	55711.4	.07	41.6	16:16:34	78
			-145.3			
5+50	E	56104.0	.07	41.5	16:16:46	78
			54.8			
5+75	E	56236.8	.09	41.1	16:17:37	78
			92.4			
6+00	E	55812.1	.07	41.0	16:17:57	78
			-14.2			
6+25	E	55762.7	.09	40.4	16:19:10	78
			-50.9			
6+50	E	55749.5	.09	39.9	16:20:14	78
			-77.6			
6+75	E	55720.5	.10	39.3	16:21:26	78
			-90.8			
7+00	E	55660.7	.10	39.1	16:21:55	78
			-66.6			
7+25	E	55770.2	.10	38.9	16:22:15	78
			9.5			
7+50	E	55654.5	.12	38.7	16:22:37	78
			-86.6			
7+75	E	55797.6	.13	38.6	16:22:56	78
			-51.7			
8+00	E	55515.2	.14	38.3	16:23:25	78
			-355.8			
8+25	E	55155.6	5.6	34.1	16:32:11	68
			-879.9			
8+50	E	55988.0	.10	33.8	16:32:43	78
			-198.4			
8+75	E	56412.0	.09	32.4	16:35:38	78
			-142.5			
9+00	E	55583.5	.54	32.3	16:35:54	68
			-472.5			
9+25	E	56512.0	.11	32.2	16:36:10	78
			-68.4			
9+50	E	56672.4	.09	32.1	16:36:23	78
			-35.8			
9+75	E	57564.8	.07	31.9	16:36:40	78
			135.8			
10+00	E	57328.4	.11	31.8	16:36:57	78
			19.2			
10+25	E	57392.3	.11	31.6	16:37:15	78
			122.2			
10+50	E	56939.0	.08	31.2	16:38:10	78

		-80.6				
10+75	E	56912.4	.07	31.1	16:38:24	78
		-90.6				
11+00	E	57071.4	.07	31.0	16:38:38	78
		-46.3				
11+25	E	57353.0	.08	30.6	16:39:26	78
		110.8				
11+50	E	57223.6	.09	30.2	16:40:13	78
		64.4				
11+75	E	57502.2	.09	30.0	16:40:34	78
		208.7				
12+00	E	56904.9	.09	29.9	16:40:55	78
		-1.4				
12+25	E	56868.3	.07	29.8	16:41:09	78
		128.5				
12+50	E	56612.0T	.10	29.5	16:41:34	78
		57.1				
12+75	E	56371.7	.08	30.7	16:41:49	78
		-6.0				
13+00	E	56304.4	.07	32.0	16:42:02	78
		11.3				
13+25	E	56387.0	.07	33.5	16:42:19	78
		36.9				
13+50	E	56428.9	.07	35.0	16:42:35	78
		84.5				
13+75	E	55911.8	.06	36.3	16:42:49	78
		-74.2				
14+00	E	56008.8	.11	39.1	16:43:19	78
		-0.7				

Line: 2+00 S Date: 13 SEP 86 #170

POSITION		FIELD	ERR	DRIFT	TIME	DS
11+00	E	55809.5	.10	195.4	17:11:22	78
		-17.1				
10+75	E	55806.0	.09	198.4	17:11:55	78
		-22.4				
10+50	E	55793.8	.08	199.7	17:12:08	78
		-33.0				
10+25	E	55805.4	.10	201.0	17:12:22	78
		-39.5				
10+00	E	55961.6	.10	203.2	17:12:46	78
		-79.9				
9+75	E	56288.9	.11	205.5	17:13:11	78
		-43.0				
9+50	E	56497.0	.09	206.8	17:13:25	78
		-50.8				
9+25	E	56649.2	.10	208.1	17:13:38	78
		-63.9				
9+00	E	56849.5	.08	209.4	17:13:52	78
		-37.9				
8+75	E	56857.9	.07	210.9	17:14:09	78
		24.4				
8+50	E	56857.8	.08	212.3	17:14:24	78
		-24.4				
8+25	E	56779.8	.09	213.6	17:14:39	78
		17.1				

7+50	E	56146.2	.09	219.4	17:15:40	78
		-172.7				
7+25	E	58576.0	8.1	221.3	17:16:01	47
		975.9				
7+00	E	57980.5	.13	223.3	17:16:22	78
		332.5				
6+75	E	57493.1	.09	236.3	17:18:42	78
		269.3				
6+50	E	56662.6	.08	241.1	17:19:34	78
		51.1				
6+25	E	56732.2	.09	243.0	17:19:54	78
		96.9				
6+00	E	56589.5	.08	244.3	17:20:08	78
		112.6				
5+75	E	56123.4	.07	245.4	17:20:20	78
		-90.2				
5+50	E	56247.6	.08	246.5	17:20:33	78
		-8.8				
5+25	E	56281.1	.09	247.6	17:20:45	78
		54.9				
5+00	E	55843.3T	.10	249.9	17:21:08	78
		1.0				
4+75	E	55457.8	.07	245.2	17:21:19	78
		-171.0				
4+50	E	55771.1	.11	239.6	17:21:31	78
		1.1				
4+25	E	55680.3	.07	228.3	17:21:54	78
		-25.0				
4+00	E	57954.5	37.	200.0	17:22:55	35
		745.6				
3+75	E	55993.5	.07	180.2	17:23:37	78
		24.9				
3+50	E	55906.3	.07	172.7	17:23:53	78
		20.2				
3+25	E	55918.6	.08	165.2	17:24:08	78
		6.8				
3+00	E	55753.0	.09	156.7	17:24:27	78
		-192.1				
2+75	E	55920.1	.08	150.1	17:24:41	78
		2.2				
2+50	E	55887.2	.06	144.5	17:24:53	78
		4.5				
2+25	E	56018.9	.08	132.2	17:25:19	78
		96.8				
2+00	E	55766.0	.07	125.6	17:25:32	78
		-13.4				

Line: 3+00 S Date: 13 SEP 86 #205

POSITION		FIELD	ERR	DRIFT	TIME	DS
2+75	E	56047.6	.10	106.8	17:26:13	78
		4.1				
3+00	E	55971.0	.07	66.3	17:27:39	78
		-23.1				
3+25	E	56035.1	.07	59.7	17:27:52	78
		-4.8				
3+50	E	56055.5	.08	52.1	17:28:08	78

		-0.2				
3+75	E	56116.5	.09	46.5	17:28:20	78
		11.4				
4+00	E	56102.1	.08	41.8	17:28:31	78
		-7.7				
4+25	E	56209.1	.07	35.2	17:28:45	78
		-31.8				
4+50	E	56731.7	.08	29.5	17:28:56	78
		175.6				
4+75	E	56684.4	.07	23.9	17:29:09	78
		-8.0				
5+00	E	57502.1T	.09	16.3	17:29:25	78
		277.1				
5+25	E	57364.4	.09	16.4	17:29:40	78
		105.8				
5+50	E	57068.8	.08	16.6	17:29:52	78
		107.7				
5+75	E	56315.0	.06	17.0	17:30:24	78
		-51.4				

Line: 4+00 S Date: 13 SEP 86 #218

POSITION		FIELD	ERR	DRIFT	TIME	DS
4+75	E	56031.6	.08	18.8	17:32:56	78
		-73.4				
4+50	E	56178.5	.07	19.2	17:33:26	78
		-12.7				
4+25	E	56099.4	.06	19.3	17:33:40	78
		14.0				
4+00	E	56114.7	.08	19.6	17:34:00	78
		-4.8				
3+75	E	56113.6	.08	20.0	17:34:41	78
		13.2				

Line: 4+50 S Date: 13 SEP 86 #223

POSITION		FIELD	ERR	DRIFT	TIME	DS
3+25	E	56104.3	.08	20.6	17:35:30	78
		-5.4				

Line: 3+00 N Date: 13 SEP 86 #224

POSITION		FIELD	ERR	DRIFT	TIME	DS
7+00	E	55897.4	.11	30.7	17:49:27	78
		7.7				
7+25	E	55843.7	.11	30.9	17:49:46	78
		8.8				
7+50	E	55755.2	.11	31.1	17:50:02	78
		13.7				
7+75	E	55570.3	.14	31.3	17:50:19	78
		-3.9				
8+00	E	55218.7	.11	31.5	17:50:36	78
		-141.4				
8+25	E	55118.4	.11	31.7	17:50:53	78
		-211.9				
8+50	E	55418.7	.13	31.9	17:51:12	78
		-51.7				
8+75	E	55470.4	.10	32.1	17:51:24	78
		-43.9				

9+00	E	55618.0	.10	32.2	17:51:37	78
		-4.7				
9+25	E	55739.3	.12	32.4	17:51:49	78
		17.0				
9+50	E	56075.0	.13	32.5	17:52:02	78
		173.4				
9+75	E	55981.0	.07	32.7	17:52:15	78
		-11.7				
10+00	E	55965.3	.07	32.8	17:52:26	78
		-86.3				
11+00	E	56288.2	.09	33.2	17:53:01	78
		83.7				
11+25	E	56655.8	.09	33.4	17:53:17	78
		135.9				
11+50	E	56824.7	.08	33.6	17:53:28	78
		152.0				
11+75	E	56603.9	.10	33.7	17:53:41	78
		-31.1				
12+00	E	56812.0	.08	33.9	17:53:57	78
		36.2				
12+25	E	56878.4	.16	34.1	17:54:12	78
		89.0				
12+50	E	56466.0T	.11	34.9	17:55:16	78
		-9.0				
12+75	E	56624.7	.10	35.4	17:55:32	78
		104.5				
13+00	E	56549.0	.12	35.8	17:55:44	78
		71.5				
13+25	E	56221.7	.10	36.1	17:55:55	78
		43.5				
13+25	E	56033.9	.09	37.5	17:56:36	78
		-20.3				
13+50	E	56153.5	.10	38.2	17:56:59	78
		-37.9				
13+75	E	56370.8	.10	39.9	17:57:52	78
		9.4				
14+00	E	56498.0	.10	40.7	17:58:15	78
		24.6				
14+25	E	56508.7	.10	41.2	17:58:31	78
		10.3				
14+50	E	56551.8	.10	43.1	17:59:29	78
		29.7				
14+75	E	56541.2	.09	43.7	17:59:48	78
		28.6				
15+00	E	56549.9	.08	44.4	18:00:08	78
		56.0				
15+25	E	56666.4	.09	46.0	18:00:58	78
		102.6				
15+50	E	56591.6	.13	46.5	18:01:15	78
		181.5				
15+75	E	56367.4	.09	47.1	18:01:33	78
		143.0				
16+00	E	56302.7	.09	47.6	18:01:48	78
		-73.1				
16+25	E	56934.5	.08	48.0	18:02:00	78
		24.0				

16+50	E	57485.5	.06	48.6	18:02:16	78
		35.7				
16+75	E	57839.1	.06	49.0	18:02:31	78
		49.5				
17+00	E	57241.9	.11	49.5	18:02:44	78
		-49.4				
17+25	E	57142.2	.09	49.9	18:02:57	78
		123.6				
17+50	E	56496.9T	.07	50.5	18:03:14	78
		-110.5				
17+75	E	56622.1	.10	55.8	18:04:01	78
		3.9				
18+00	E	56715.8	.10	57.2	18:04:13	78
		121.4				
18+25	E	55510.8	.08	60.6	18:04:43	78
		-195.2				

Line: 4+00 N Date: 13 SEP 86 #268

POSITION		FIELD	ERR	DRIFT	TIME	DS
15+25	E	56953.2	.09	77.3	18:07:06	78
		137.3				
15+50	E	56673.0	.09	85.6	18:08:18	78
		28.4				
15+75	E	56605.7	.10	87.7	18:08:36	78
		4.7				
16+00	E	56819.2	.08	88.9	18:08:47	78
		43.1				
16+25	E	56962.1	.09	90.5	18:09:00	78
		15.4				
16+50	E	56742.9	.11	92.1	18:09:14	78
		3.3				
16+75	E	56273.9	.08	93.5	18:09:27	78
		-124.2				
17+00	E	56180.8	.09	95.1	18:09:40	78
		-68.6				
17+25	E	57044.8	.08	96.5	18:09:52	78
		161.6				
17+50	E	56644.6T	.11	99.1	18:10:14	78
		27.4				
17+75	E	56421.7	.10	98.8	18:10:29	78
		35.1				
18+00	E	56157.7	.12	98.6	18:10:41	78
		103.8				
18+25	E	55426.0	.07	98.3	18:10:52	78
		-90.8				
18+50	E	55493.9	.09	98.0	18:11:06	78
		-27.0				
18+75	E	55675.6	.10	97.8	18:11:19	78
		-3.9				
19+00	E	55805.6	.09	96.1	18:12:34	78
		-14.8				
19+25	E	55851.7	.11	95.5	18:13:02	78
		-11.7				
19+50	E	55879.9	.10	95.2	18:13:16	78
		-13.3				
19+75	E	55900.0	.11	94.9	18:13:31	78

		-14.2			
20+00	E	55979.9	.10	94.5	18:13:48 78
		0.6			
20+25	E	55948.5	.09	93.9	18:14:16 78
		-4.7			
Ref.	Fld	56182.4	.05	80.4	18:24:38 78

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
& GRADIENT
Date: 15 SEP 86
Operator: 5316
Reference field: 56102.0
Datum subtracted: 0.0
Records: 139
Bat: 17.5 Volt Lithium: 3.54 Volt
Last time update: 9/13 13:48:00
Start of print: 9/15 21:12:26

Ref. Fld 56119.0 .05 17.0 18:06:05 78

Line: 1+00 N Date: 15 SEP 86 #2

POSITION	FIELD	ERR	DRIFT	TIME	DS
4+75 E	56068.0	.09	17.8	18:10:09	78
	-6.2				
4+50 E	56059.8	.08	17.9	18:10:23	78
	-7.7				
4+25 E	56062.4	.08	17.9	18:10:36	78
	-7.9				
4+00 E	56077.9	.07	18.0	18:10:52	78
	-12.8				
3+75 E	56092.7	.09	18.1	18:11:13	78
	-6.2				
3+50 E	56090.9	.09	18.1	18:11:32	78
	-1.5				
3+25 E	56089.3	.08	18.2	18:11:49	78
	1.0				
3+00 E	55894.7	.07	18.3	18:12:12	78
	-80.2				
2+75 E	56143.9	.11	18.4	18:12:38	78
	33.8				
2+50 E	56154.9	.09	18.4	18:12:57	78
	14.9				
2+25 E	56113.9	.09	18.5	18:13:17	78
	-0.9				
2+00 E	56097.1	.10	18.6	18:13:37	78
	-12.9				
1+75 E	56099.7	.09	18.6	18:13:57	78
	-4.7				
1+50 E	56142.9	.08	18.8	18:14:30	78
	9.5				

Ref. Fld 56120.9 .05 18.9 18:14:55 78

Line: 2+00 N Date: 15 SEP 86 #17

POSITION	FIELD	ERR	DRIFT	TIME	DS
1+75 E	56168.9	.11	18.7	18:18:14	78
	25.4				
2+00 E	56146.0	.09	18.7	18:18:40	78

		-3.9				
2+25	E	56158.6	.09	18.6	18:18:57	78
		15.9				
2+50	E	56103.5	.08	18.6	18:19:16	78
		-7.0				
2+75	E	56085.5	.09	18.6	18:20:09	78
		0.0				
3+00	E	56101.2	.09	18.5	18:20:27	78
		22.4				
3+25	E	56074.7	.08	18.5	18:20:45	78
		-5.4				
3+50	E	56043.8	.08	18.5	18:21:07	78
		-15.8				
3+75	E	56044.3	.06	18.5	18:21:27	78
		-76.2				
4+00	E	56171.6	.08	18.4	18:22:00	78
		-16.5				
4+25	E	56240.1	.07	18.4	18:22:19	78
		75.9				
4+50	E	56591.7	.08	18.4	18:22:37	78
		-22.3				
4+75	E	56376.8	.08	18.4	18:22:53	78
		46.8				
5+00	E	54685.9	1.2	18.3	18:23:11	58
		-628.1				
5+25	E	55326.2	.12	18.3	18:23:38	78
		-51.3				
5+50	E	55806.6	.10	18.3	18:23:55	78
		2.1				
5+75	E	55925.3	.10	18.3	18:24:09	78
		4.8				
6+00	E	55935.5	.09	18.2	18:24:28	78
		4.2				
6+25	E	55871.2	.10	18.2	18:24:41	78
		-5.7				
6+50	E	55778.0	.11	18.2	18:24:55	78
		-6.1				
6+75	E	55574.4	.10	18.2	18:25:14	78
		-50.5				
7+00	E	55464.7	.08	18.2	18:25:30	78
		-92.8				
7+25	E	55354.8	.10	18.1	18:25:45	78
		-159.0				
7+50	E	55693.5	.10	18.1	18:26:00	78
		-68.4				
7+75	E	56124.5	.09	18.1	18:26:19	78
		-147.8				
9+25	E	56052.1	.09	18.0	18:28:19	78
		50.5				
9+50	E	56347.7	.09	17.9	18:28:40	78
		149.7				
9+75	E	56035.9	.09	17.9	18:28:55	78
		50.8				

Line: 3+00 N Date: 15 SEP 86 #45

POSITION	FIELD	ERR	DRIFT	TIME	DS

```
9+75 E 55917.0 .11     17.8 18:30:08 78
          -12.9
9+50 E 56052.0 .13     17.8 18:30:20 78
           169.1
9+25 E 55780.0 .06     17.8 18:30:32 78
            45.1
9+00 E 55629.8 .10     17.8 18:30:44 78
             5.5
8+75 E 55561.3 .10     17.8 18:30:57 78
             8.1
8+50 E 55450.1 .10     17.7 18:31:09 78
           -30.1
8+25 E 55193.0 .08     17.7 18:31:20 78
          -155.9
8+00 E 55175.5 .10     17.7 18:31:35 78
          -176.8
7+75 E 55555.0 .08     17.7 18:31:49 78
          -12.3
7+50 E 55757.0 .11     17.7 18:32:03 78
             9.5
7+25 E 55850.4 .11     17.7 18:32:19 78
             7.5
7+00 E 55905.9 .11     17.6 18:32:37 78
             6.6
6+75 E 55951.3 .11     17.6 18:32:54 78
             0.0
6+50 E 56018.4 .11     17.6 18:33:14 78
             0.6
6+25 E 56074.8 .08     17.6 18:33:32 78
             9.3
6+00 E 56062.3 .09     17.5 18:33:46 78
           -7.5
5+75 E 56103.1 .09     17.5 18:34:00 78
             0.2
5+50 E 56096.4 .06     17.5 18:34:15 78
           -6.2
5+25 E 56126.2 .10     17.5 18:34:32 78
             6.0
5+00 E 56084.6 .10     17.5 18:34:56 78
             0.3
4+75 E 56044.4 .09     17.4 18:35:22 78
           -1.0
4+50 E 56081.8 .09     17.4 18:35:43 78
             4.7
4+25 E 56083.0 .08     17.4 18:36:01 78
             2.4
4+00 E 56096.9 .08     17.4 18:36:20 78
             4.6
3+75 E 56097.0 .08     17.3 18:36:46 78
             2.1
3+50 E 56101.2 .08     17.3 18:37:15 78
             4.2
3+25 E 56095.5 .08     17.2 18:37:49 78
           -1.5
3+00 E 56094.1 .08     17.2 18:38:10 78
           -0.3
```

2+75	E	56059.6	.09	17.2	18:38:27	78
		-3.1				
2+50	E	56095.4	.09	17.2	18:38:45	78
		-8.6				
2+25	E	56111.2	.06	17.1	18:39:07	78
		-3.6				
2+00	E	56162.8	.08	17.0	18:40:39	78
		25.2				
Ref. Fld		56118.9	.05	16.9	18:41:44	78

Line: 4+00 N Date: 15 SEP 86 #78

POSITION		FIELD	ERR	DRIFT	TIME	DS
2+25	E	56130.5	.09	16.8	18:44:40	78
		13.1				
2+50	E	56137.0	.11	16.8	18:45:20	78
		12.1				
2+75	E	56119.2	.10	16.8	18:45:47	78
		2.1				
3+00	E	56122.9	.09	16.8	18:46:04	78
		4.2				
3+25	E	56122.2	.09	16.8	18:46:19	78
		2.1				
3+50	E	56126.3	.10	16.7	18:46:34	78
		-1.6				
3+75	E	56114.7	.08	16.7	18:46:51	78
		24.4				
4+00	E	56119.4	.08	16.7	18:47:04	78
		2.6				
4+25	E	56114.8	.09	16.7	18:47:22	78
		-1.9				
4+50	E	56137.8	.09	16.7	18:47:38	78
		-0.8				
4+75	E	56174.1	.07	16.7	18:47:54	78
		3.6				
5+00	E	56079.1	.08	16.7	18:48:11	78
		-71.5				
5+25	E	56257.4	.08	16.7	18:48:26	78
		-89.7				
5+50	E	56742.5	.11	16.7	18:48:40	78
		212.7				
5+75	E	56188.5	.07	16.6	18:48:58	78
		-8.4				
6+00	E	55850.1	.08	16.6	18:49:16	78
		-76.3				
6+25	E	55892.0	.11	16.6	18:49:31	78
		-24.1				
6+50	E	55972.0	.09	16.6	18:49:44	78
		-1.8				
6+75	E	56003.8	.10	16.6	18:49:57	78
		-12.6				
7+00	E	56048.0	.10	16.6	18:50:14	78
		-23.0				
7+25	E	56021.6	.08	16.6	18:50:52	78
		38.3				
7+50	E	55998.9	.08	16.6	18:51:06	78

		-1.7				
7+75	E	56024.9	.10	16.5	18:51:25	78
		37.7				
8+00	E	55962.6	.08	16.5	18:51:42	78
		5.7				
8+25	E	55941.1	.11	16.5	18:51:59	78
		7.4				
8+50	E	55913.7	.10	16.5	18:52:17	78
		4.7				
8+75	E	55908.1	.10	16.5	18:52:33	78
		-6.0				
9+00	E	55805.6	.13	16.5	18:52:50	78
		-65.6				
9+25	E	55864.7	.10	16.5	18:53:17	78
		11.7				
9+50	E	55712.0	.10	16.4	18:53:31	78
		-0.7				
9+75	E	55710.3	.12	16.4	18:53:46	78
		25.2				

Line: 5+00 N Date: 15 SEP 86 #109

POSITION		FIELD	ERR	DRIFT	TIME	DS
9+75	E	55831.9	.14	16.4	18:54:57	78
		-36.1				
9+50	E	55903.6	.12	16.4	18:55:29	78
		3.0				
9+25	E	55857.6	.11	16.3	18:55:57	78
		-5.6				
9+00	E	55865.5	.10	16.3	18:56:11	78
		-21.6				
8+75	E	55990.8	.10	16.3	18:56:24	78
		25.4				
8+50	E	55938.9	.08	16.3	18:56:39	78
		-4.7				
8+25	E	55944.2	.09	16.3	18:56:59	78
		-0.1				
8+00	E	55977.9	.11	16.3	18:57:13	78
		-22.7				
7+75	E	55950.0	.13	16.3	18:57:30	78
		-43.1				
7+50	E	56235.6	.12	16.3	18:57:46	78
		74.5				
7+25	E	56306.5	.12	16.3	18:57:59	78
		-260.1				
7+00	E	57400.8	.08	16.2	18:58:39	78
		231.9				
6+75	E	57185.6	.09	16.2	18:59:09	78
		142.2				
6+50	E	58030.4	.11	16.2	18:59:25	78
		245.6				
6+25	E	57749.5	.07	16.2	18:59:37	78
		19.7				
6+00	E	57305.8	.10	16.2	18:59:57	78
		-119.0				
5+75	E	57212.1	.08	16.2	19:00:10	78
		24.3				

5+50	E	56788.2	.11	16.2	19:00:25	78
		253.5				
5+25	E	56424.1	.10	16.1	19:00:38	78
		-117.1				
5+00	E	56177.7	.09	16.1	19:00:54	78
		-23.0				
4+75	E	56217.5	.08	16.1	19:01:09	78
		8.4				
4+50	E	56143.2	.10	16.1	19:01:22	78
		-2.3				
4+25	E	56150.7	.08	16.1	19:01:35	78
		-1.5				
4+00	E	56140.9	.07	16.1	19:01:50	78
		-0.1				
3+75	E	56120.8	.07	16.1	19:02:07	78
		-14.5				
3+50	E	56123.2	.09	16.1	19:02:29	78
		-0.1				
3+25	E	56106.4	.09	16.1	19:02:44	78
		-3.3				
3+00	E	56126.2	.09	16.0	19:03:02	78
		3.1				
2+75	E	56151.7	.09	16.0	19:03:20	78
		20.5				
2+50	E	56127.7	.07	16.0	19:03:35	78
		5.2				
Ref. Fld		56117.9	.05	15.9	19:05:17	78

EDA OMNI-IV Tie-line MAG Ser #15004
TOTAL FIELD DATA (Tieline corrected)
& GRADIENT
Date: 16 SEP 86
Operator: 5316
Reference field: 56102.0
Datum subtracted: 0.0
Records: 251
Bat: 17.4 Volt Lithium: 3.54 Volt
Last time update: 9/13 13:48:00
Start of print: 9/16 14:53:27

Ref. Fld 56106.4 .06 4.4 8:28:02 78

Line: 6+00 N Date: 16 SEP 86 #2

POSITION	FIELD	ERR	DRIFT	TIME	DS
9+75 E	55919.7	.10	6.6	8:53:09	78
	3.7				
9+50 E	55932.4	.08	6.7	8:53:54	78
	8.2				
9+25 E	55923.6	.10	6.7	8:54:07	78
	8.7				
9+00 E	55905.9	.12	6.8	8:54:20	78
	4.5				
8+75 E	55926.1	.11	6.8	8:54:34	78
	10.2				
8+50 E	55956.8	.11	6.8	8:54:46	78
	71.7				
8+25 E	55822.3	.10	6.8	8:55:01	78
	-11.2				
8+00 E	55718.0	.10	6.8	8:55:22	78
	-43.9				
7+75 E	55777.5	.10	6.9	8:55:38	78
	-66.0				
7+50 E	55839.3	.13	6.9	8:55:50	78
	-122.6				
7+25 E	56034.2	.15	6.9	8:56:03	78
	-255.6				
7+00 E	57292.2	.09	6.9	8:56:17	78
	-159.4				
6+75 E	59400.8	.12	7.0	8:56:31	78
	338.3				
6+50 E	59595.0	.10	7.0	8:56:43	78
	335.1				
6+25 E	58947.3	.06	7.0	8:56:56	78
	6.8				
6+00 E	59909.4	.72	7.0	8:57:08	58
	592.7				
5+75 E	61756.4	19.	7.1	8:57:37	28
	2626.3				
5+50 E	59671.9	6.3	7.1	8:57:51	68
	696.5				

5+25	E	55993.0	5.9	7.1	8:58:11	28
		-1244.3				
5+00	E	56057.3	.12	7.1	8:58:33	78
		-102.2				
4+75	E	56104.3	.12	7.5	9:02:00	78
		-33.4				
4+50	E	56103.9	.11	7.5	9:02:13	78
		-17.0				
4+25	E	56099.9	.12	7.5	9:02:29	78
		-7.0				
4+00	E	56092.1	.10	7.5	9:02:45	78
		-8.2				
3+75	E	56120.5	.11	7.6	9:03:04	78
		14.2				
3+50	E	56093.6	.10	7.6	9:03:18	78
		-2.7				
3+25	E	56100.4	.11	7.6	9:03:31	78
		2.1				
3+00	E	56088.1	.11	7.6	9:03:45	78
		-0.7				
2+75	E	56112.7	.10	7.6	9:03:59	78
		7.6				

Line: 7+00 N Date: 16 SEP 86 #31

POSITION		FIELD	ERR	DRIFT	TIME	DS
3+00	E	56100.0	.09	8.6	9:14:52	78
		10.9				
3+25	E	56070.0	.10	8.7	9:15:18	78
		0.5				
3+50	E	56045.3	.11	8.7	9:15:30	78
		-15.8				
3+75	E	56211.7	.12	8.7	9:15:44	78
		106.0				
4+00	E	56105.9	.11	8.7	9:15:57	78
		45.3				
4+25	E	56069.1	.10	8.8	9:16:13	78
		-3.9				
4+50	E	56015.2	.10	8.8	9:16:27	78
		-71.7				
4+75	E	55833.9	2.8	8.8	9:16:41	68
		-784.9				
5+00	E	57880.8	.15	8.8	9:16:53	78
		-56.2				
5+25	E	59127.2	.28	9.3	9:22:09	78
		361.7				
5+50	E	59609.7	.06	9.3	9:22:23	78
		15.5				
5+75	E	59347.8	.10	9.3	9:22:35	78
		-293.8				
6+00	E	60415.0	.10	9.4	9:22:48	78
		183.2				
6+25	E	60720.7	.18	9.4	9:23:01	78
		321.5				
6+50	E	60084.0	4.0	9.4	9:23:15	58
		629.4				
6+75	E	57149.9	.30	9.4	9:23:36	68

		-454.6					
7+00	E	58268.4	.09		9.5	9:23:54	78
		167.7					
7+25	E	59560.3	9.0		9.5	9:24:20	48
		1024.3					
7+50	E	56242.0	.29		9.5	9:24:38	78
		-55.5					
7+75	E	54665.3	.09		9.5	9:24:54	78
		-199.3					
8+00	E	55323.7	.10		9.6	9:25:08	78
		-25.8					
8+25	E	55606.7	.11		9.6	9:25:26	78
		-0.4					
8+50	E	55707.3	.10		9.6	9:25:42	78
		-19.9					
8+75	E	55849.5	.13		9.6	9:25:56	78
		-1.2					
9+00	E	55921.9	.09		9.7	9:26:09	78
		-1.9					
9+25	E	55940.3	.10		9.7	9:26:28	78
		0.3					
9+50	E	55922.6	.10		9.7	9:26:43	78
		5.0					
9+75	E	55920.2	.10		9.7	9:26:58	78
		5.1					
10+00	E	55924.4	.11		9.8	9:27:11	78
		7.8					
10+25	E	55924.0	.09		9.8	9:27:33	78
		7.9					
10+50	E	55906.9	.09		9.8	9:27:49	78
		3.6					

Line: 8+00 N Date: 16 SEP 86 #62

POSITION		FIELD	ERR	DRIFT	TIME	DS
11+25	E	55784.9	.09	11.0	9:40:54	78
		-0.1				
11+00	E	55840.1	.09	11.1	9:41:30	78
		9.3				
10+75	E	55798.5	.10	11.1	9:41:46	78
		-9.0				
10+50	E	55850.0	.09	11.1	9:41:59	78
		6.5				
10+25	E	55915.6	.09	11.1	9:42:12	78
		10.7				
10+00	E	55930.3	.13	11.1	9:42:23	78
		12.5				
9+75	E	55897.2	.09	11.2	9:42:37	78
		10.7				
9+50	E	55836.1	.13	11.2	9:43:04	78
		12.2				
9+25	E	55608.8	.12	11.2	9:43:24	78
		17.0				
9+00	E	55622.5	.08	11.3	9:43:37	78
		-11.9				
8+75	E	55734.5	.10	11.3	9:43:54	78
		-1.0				

9+50	E	55719.6	.10	11.3	9:44:08	78
		1.0				
9+25	E	55594.3	.11	11.3	9:44:21	78
		-2.6				
9+00	E	55407.9	.11	11.3	9:44:33	78
		0.0				
7+75	E	55030.5	.11	11.4	9:44:47	78
		-33.7				
7+50	E	54660.3	.11	11.4	9:45:11	78
		-145.1				
7+25	E	55383.4	.12	11.4	9:45:25	78
		104.9				
7+00	E	55429.5T	.10	11.5	9:45:43	78
		-83.5				
6+75	E	56467.8	.10	11.8	9:46:03	78
		35.9				
6+50	E	56249.3	.15	12.1	9:46:19	78
		112.8				
6+25	E	53551.8	11.	12.4	9:46:36	58
		-229.8				
6+00	E	56626.3	11.	13.1	9:47:12	48
		-923.3				
5+75	E	63056.9	1.0	13.4	9:47:32	35
		987.9				
5+50	E	58616.6	.48	13.7	9:47:46	66
		-444.7				
5+25	E	55907.3	.11	13.9	9:48:00	78
		-257.9				
5+00	E	55652.7	.11	14.1	9:48:12	78
		-94.1				
4+75	E	55723.6	.13	18.5	9:52:18	78
		-40.5				
4+50	E	55818.1	.10	18.8	9:52:33	78
		-1.9				
4+25	E	55906.6	.10	19.0	9:52:48	78
		12.3				
4+00	E	55926.1	.09	19.3	9:53:00	78
		-0.3				
3+75	E	55947.6	.10	19.5	9:53:16	78
		5.7				
3+50	E	55958.5	.11	19.8	9:53:31	78
		0.0				
3+25	E	55909.1	.12	20.0	9:53:45	78
		-62.8				

Line: 9+00 N Date: 16 SEP 86 #95

POSITION		FIELD	ERR	DRIFT	TIME	DS
3+50	E	55894.5	.09	31.5	10:04:29	78
		-0.1				
3+75	E	55912.8	.09	32.2	10:05:04	78
		6.0				
4+00	E	55894.6	.11	32.4	10:05:17	78
		8.1				
4+25	E	55767.7	.09	32.6	10:05:30	78
		-14.7				
4+50	E	55767.5	.10	32.8	10:05:43	78

```
                8.2
4+75 E 55650.4 .10      33.1 10:05:56 78
               -5.3
5+00 E 55502.6 .10      33.3 10:06:11 78
               -0.9
5+25 E 55354.4 .12      33.6 10:06:25 78
              -35.7
5+50 E 54879.5 .11      33.8 10:06:36 78
              -93.1
5+75 E 54623.0 .16      34.0 10:06:48 78
             -236.4
6+00 E 56127.7 .89      34.2 10:07:00 68
             508.9
6+25 E 52889.0 5.5      34.4 10:07:13 78
             167.0
6+50 E 49298.1 21.      34.8 10:07:34 47
             -120.4
6+75 E 50816.0 .22      35.3 10:07:59 78
             -376.4
7+00 E 53932.5T1.7      35.6 10:08:15 68
             411.9
7+25 E 55466.1 .12      35.2 10:08:31 78
             376.1
7+50 E 55701.2 .10      34.7 10:08:51 78
             175.1
7+75 E 55039.2 .09      34.2 10:09:10 78
             -75.8
8+00 E 55415.5 .10      33.9 10:09:25 78
             -41.6
8+25 E 56449.8 .10      33.6 10:09:37 78
               1.7
8+50 E 57551.3 .14      33.0 10:10:01 78
             -213.0
8+75 E 57155.4 .10      32.5 10:10:18 78
              57.1
9+00 E 58960.7 .52      32.1 10:10:37 48
             671.8
9+25 E 57696.4 .11      31.7 10:10:53 78
             222.2
9+50 E 56156.5 .09      31.2 10:11:10 78
             -90.6
9+75 E 55990.9 .12      30.7 10:11:28 78
             -46.3
10+00 E 55979.5 .11     30.2 10:11:49 78
             -15.3
10+25 E 55876.2 .10     29.8 10:12:04 78
              -6.6
10+50 E 55887.6 .11     29.5 10:12:16 78
               0.7
10+75 E 55933.3 .09     28.9 10:12:43 78
              14.3
11+00 E 55932.2 .10     28.3 10:13:06 78
              15.6
11+25 E 55907.8 .08     28.0 10:13:18 78
              10.1
11+50 E 55887.0 .10     27.5 10:13:36 78
```

		11.5			
11+75	E	55816.2	.09	27.2	10:13:49 78
		8.7			
Ref. Fld		56100.2	.06	-1.8	10:32:54 78

Line: 10+00 N Date: 16 SEP 86 #130

POSITION		FIELD	ERR	DRIFT	TIME	DS
3+75	E	56037.4	.11	-9.5	10:50:36	78
		0.4				
4+00	E	56026.8	.11	-9.7	10:50:54	78
		2.9				
4+25	E	56032.0	.12	-9.8	10:51:08	78
		13.6				
4+50	E	55990.1	.10	-9.9	10:51:23	78
		29.7				
4+75	E	55920.7	.11	-10.0	10:51:39	78
		9.3				
5+00	E	56060.1	.16	-10.1	10:51:56	78
		225.3				
5+25	E	55797.4	.10	-10.2	10:52:13	78
		7.2				
5+50	E	55725.5	.10	-10.3	10:52:28	78
		26.2				
5+75	E	55692.3	.11	-10.5	10:52:42	78
		60.7				
6+00	E	55515.7	.12	-10.5	10:52:54	78
		59.5				
6+25	E	55336.5	.11	-10.6	10:53:06	78
		37.7				
6+50	E	55169.2	.12	-10.7	10:53:18	78
		59.1				
6+75	E	55058.7	.12	-10.8	10:53:30	78
		55.2				
7+00	E	54888.2T	.11	-11.0	10:53:50	78
		29.7				
7+25	E	54860.3	.21	-11.0	10:54:07	78
		7.0				
7+50	E	55179.9	.11	-10.9	10:54:18	78
		45.5				
7+75	E	55475.1	.10	-10.8	10:54:31	78
		10.5				
8+00	E	55667.8	.11	-10.8	10:54:47	78
		17.8				
8+25	E	55734.7	.10	-10.7	10:54:59	78
		8.1				
8+50	E	55713.8	.09	-10.6	10:55:12	78
		-42.2				
8+75	E	56105.8	.09	-10.5	10:55:28	78
		126.3				
9+00	E	56124.4	.13	-10.5	10:55:45	78
		54.5				
9+25	E	55972.8	.11	-10.4	10:56:03	78
		207.5				
9+50	E	55898.2	.16	-10.3	10:56:19	78
		282.7				

9+75	E	54225.4	.34	-10.2	10:56:40	78
		-408.0				
10+00	E	54461.8	.15	-10.1	10:57:05	78
		-273.0				
10+25	E	55392.0	.11	-9.9	10:57:26	78
		-116.3				
10+50	E	55778.8	.13	-9.7	10:58:09	78
		-1.2				
10+75	E	55919.9	.11	-9.5	10:58:49	78
		9.5				
11+00	E	55967.3	.09	-9.3	10:59:27	78
		9.5				
11+25	E	55991.9	.10	-9.3	10:59:40	78
		12.1				
11+50	E	55996.1	.12	-9.2	10:59:54	78
		11.4				
11+75	E	55996.5	.08	-9.1	11:00:09	78
		12.5				
12+00	E	55980.5	.11	-9.0	11:00:23	78
		10.7				

Line: 11+00 N Date: 16 SEP 86 #164

POSITION		FIELD	ERR	DRIFT	TIME	DS
13+00	E	55986.2	.10	-4.1	11:16:37	78
		8.9				
12+75	E	56017.9	.11	-3.9	11:17:04	78
		14.9				
12+50	E	56028.0	.12	-3.9	11:17:17	78
		7.4				
12+25	E	56037.3	.11	-3.8	11:17:29	78
		7.9				
12+00	E	56044.9	.11	-3.8	11:17:41	78
		8.6				
11+75	E	56044.1	.12	-3.7	11:17:55	78
		5.4				
11+50	E	56060.7	.11	-3.6	11:18:14	78
		0.2				
11+25	E	56059.9	.12	-3.5	11:18:35	78
		9.2				
11+00	E	56059.5	.12	-3.4	11:18:57	78
		9.0				
10+75	E	56054.0	.11	-3.3	11:19:11	78
		12.0				
10+50	E	56034.1	.11	-3.2	11:19:25	78
		11.8				
10+25	E	56025.6	.11	-3.2	11:19:36	78
		11.0				
10+00	E	56024.8	.11	-3.0	11:20:01	78
		16.4				
9+75	E	56013.0	.13	-3.0	11:20:13	78
		17.2				
9+50	E	56006.1	.11	-2.9	11:20:24	78
		18.8				
9+25	E	55999.3	.11	-2.9	11:20:36	78
		13.4				
9+00	E	56003.0	.12	-2.8	11:20:48	78

		15.7				
8+75	E	56051.2	.11	-2.7	11:21:00	78
		11.7				
8+50	E	56045.3	.11	-2.7	11:21:12	78
		10.1				
8+25	E	56041.5	.12	-2.6	11:21:24	78
		11.5				
8+00	E	56051.4	.11	-2.5	11:21:38	78
		17.5				
7+75	E	56124.3	.09	-2.5	11:21:51	78
		47.1				
7+50	E	56060.8	.11	-2.4	11:22:04	78
		13.4				
7+25	E	56067.8	.11	-2.3	11:22:16	78
		17.6				
7+00	E	56059.5T	.10	-2.2	11:22:35	78
		19.6				
6+75	E	56045.0	.11	-2.2	11:22:52	78
		16.7				
6+50	E	56034.9	.10	-2.2	11:23:05	78
		14.1				
6+25	E	56033.6	.10	-2.2	11:23:17	78
		11.6				
6+00	E	56034.3	.11	-2.2	11:23:31	78
		11.2				
5+75	E	56038.4	.12	-2.2	11:23:44	78
		11.8				
5+50	E	56042.4	.12	-2.2	11:23:56	78
		10.3				
5+25	E	56061.3	.09	-2.2	11:24:08	78
		17.6				
5+00	E	56071.4	.11	-2.2	11:24:20	78
		12.9				
4+75	E	56073.9	.10	-2.1	11:24:48	78
		11.7				
4+50	E	56066.9	.10	-2.1	11:25:03	78
		7.6				
4+25	E	56065.4	.10	-2.1	11:25:17	78
		5.8				
4+00	E	56037.1	.10	-2.1	11:25:54	78
		-5.2				

Line: 12+00 N Date: 16 SEP 86 #201

POSITION		FIELD	ERR	DRIFT	TIME	DS
4+50	E	56139.2	.09	-1.2	11:43:31	78
		13.7				
4+75	E	56143.6	.11	-1.2	11:44:16	78
		7.2				
5+00	E	56168.4	.11	-1.2	11:44:29	78
		54.3				
5+25	E	56117.2	.11	-1.1	11:44:47	78
		3.1				
5+50	E	56132.9	.11	-1.1	11:45:00	78
		17.1				
5+75	E	56121.2	.10	-1.1	11:45:14	78
		7.2				

6+00 E	56118.2	.11	-1.1	11:45:29	78
	2.3				
6+25 E	56127.1	.11	-1.1	11:45:44	78
	8.3				
6+50 E	56124.9	.10	-1.1	11:45:59	78
	10.9				
6+75 E	56123.1	.11	-1.1	11:46:15	78
	8.4				
7+00 E	56121.9T	.10	-1.0	11:46:36	78
	7.8				
7+25 E	56120.9	.11	-1.0	11:47:03	78
	7.2				
7+50 E	56122.5	.11	-1.0	11:47:17	78
	8.5				
7+75 E	56118.8	.11	-1.0	11:47:30	78
	8.1				
8+00 E	56117.6	.11	-1.0	11:47:42	78
	3.7				
8+25 E	56107.2	.13	-1.0	11:47:55	78
	4.3				
8+50 E	56112.1	.10	-1.0	11:48:08	78
	8.8				
8+75 E	56108.8	.12	-1.1	11:48:21	78
	9.3				
9+00 E	56106.5	.11	-1.1	11:48:34	78
	9.1				
9+25 E	56107.5	.11	-1.1	11:48:48	78
	8.7				
9+50 E	56107.8	.11	-1.1	11:49:00	78
	9.4				
9+75 E	56107.4	.11	-1.1	11:49:12	78
	10.2				
10+00 E	56112.3	.11	-1.1	11:49:25	78
	9.1				
10+25 E	56105.5	.11	-1.1	11:49:37	78
	3.4				
10+50 E	56112.5	.10	-1.1	11:49:53	78
	11.2				
10+75 E	56107.0	.10	-1.2	11:50:19	78
	7.5				
11+00 E	56107.0	.11	-1.2	11:50:37	78
	6.8				
11+25 E	56110.6	.11	-1.2	11:51:04	78
	6.3				

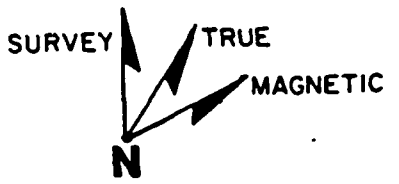
Line: 13+00 N Date: 16 SEP 86 #229

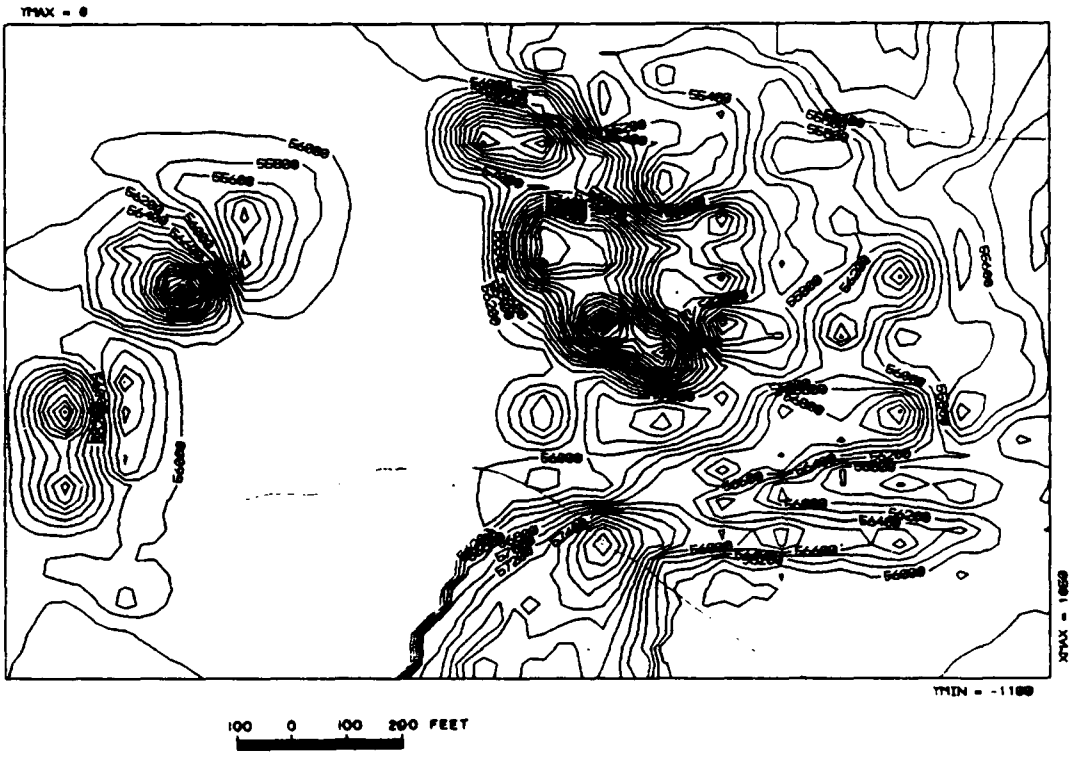
POSITION	FIELD	ERR	DRIFT	TIME	DS
10+00 E	56131.0	.12	-1.5	11:55:18	78
	7.3				
9+75 E	56128.6	.14	-1.5	11:55:46	78
	10.3				
9+50 E	56164.3	.15	-1.5	11:56:02	78
	9.2				
9+25 E	56132.5	.11	-1.5	11:56:17	78
	8.8				
9+00 E	56131.2	.13	-1.5	11:56:36	78

		5.4				
8+75	E	56139.0	.11	-1.6	11:56:49	78
		9.4				
8+50	E	56142.7	.11	-1.6	11:57:02	78
		7.5				
8+25	E	56141.0	.12	-1.6	11:57:18	78
		5.9				
8+00	E	56164.6	.10	-1.6	11:57:31	78
		17.7				
7+75	E	56152.9	.11	-1.6	11:57:46	78
		12.9				
7+50	E	56152.2	.11	-1.6	11:57:58	78
		7.3				
7+25	E	56150.5	.11	-1.6	11:58:09	78
		8.4				
7+00	E	56152.2T	.11	-1.7	11:58:21	78
		7.5				
6+75	E	56155.9	.10	-1.7	11:58:36	78
		13.4				
6+50	E	56150.5	.10	-1.7	11:58:49	78
		9.7				
6+25	E	56141.6	.11	-1.7	11:59:02	78
		4.4				
6+00	E	56170.7	.10	-1.7	11:59:14	78
		8.9				
5+75	E	56140.5	.10	-1.7	11:59:26	78
		-2.1				
5+50	E	56151.1	.10	-1.7	11:59:38	78
		8.8				
5+25	E	56141.9	.11	-1.7	11:59:54	78
		4.2				
5+00	E	56162.5	.12	-1.7	12:00:06	78
		7.0				
4+75	E	56156.8	.11	-1.7	12:00:20	78
		2.9				
Ref. Fld		56100.7	.05	-1.3	12:27:16	78

SITE D-5

NORTH GRID

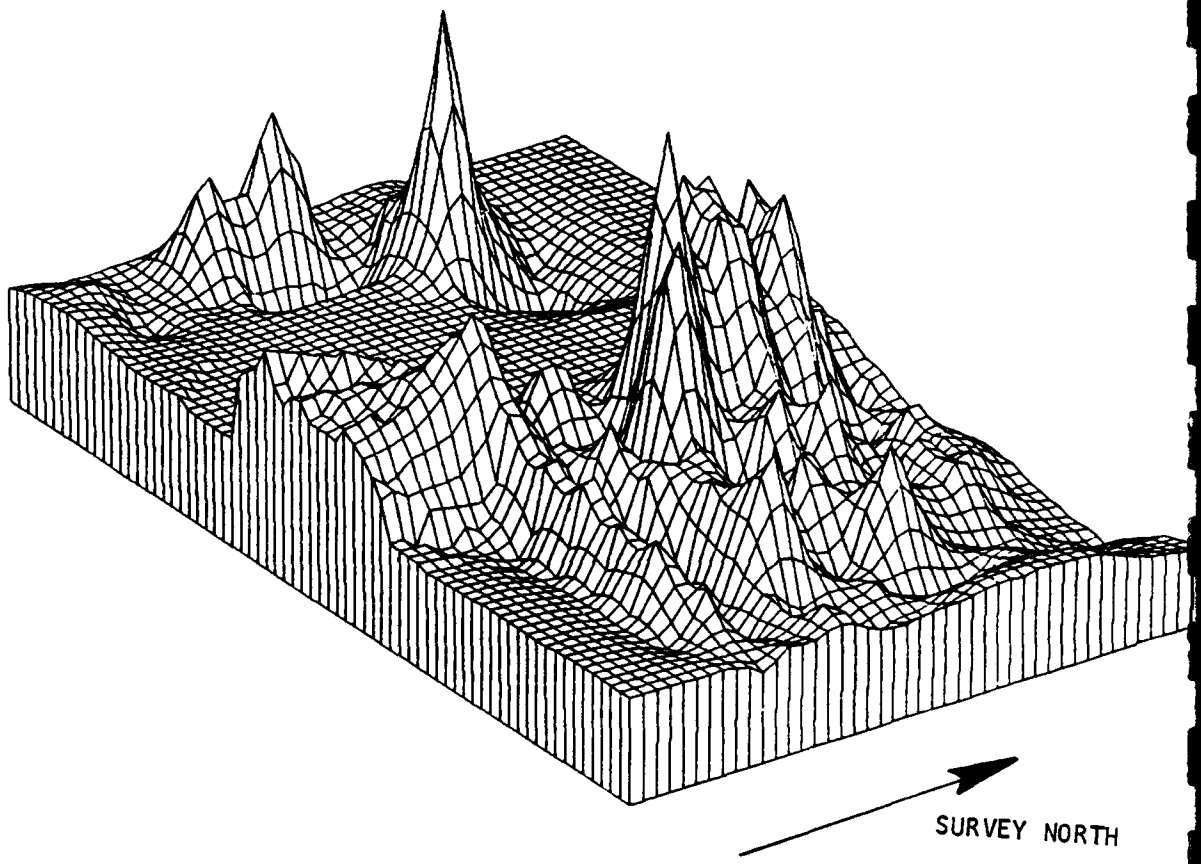




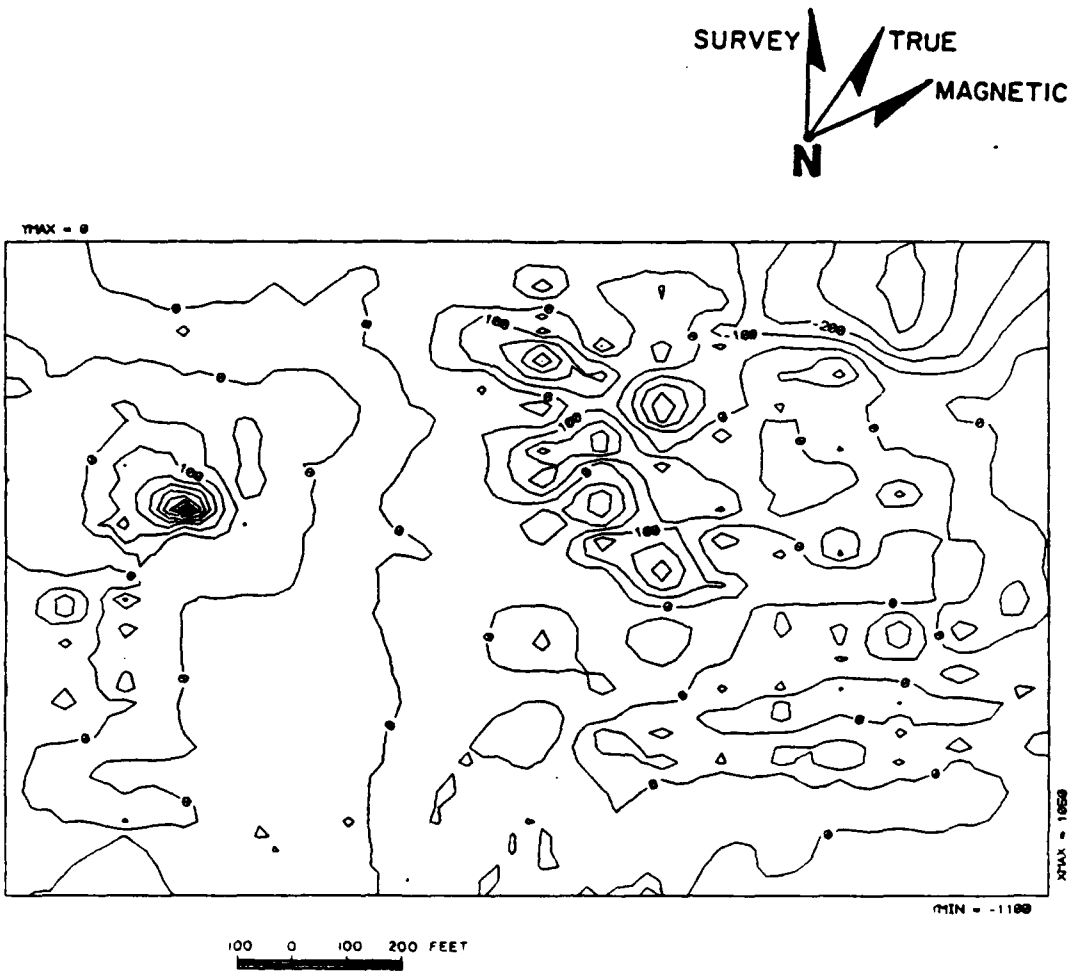
Scale

contour interval: 200 gammas

TOTAL MAGNETIC FIELD INTENSITY NORTH GRID



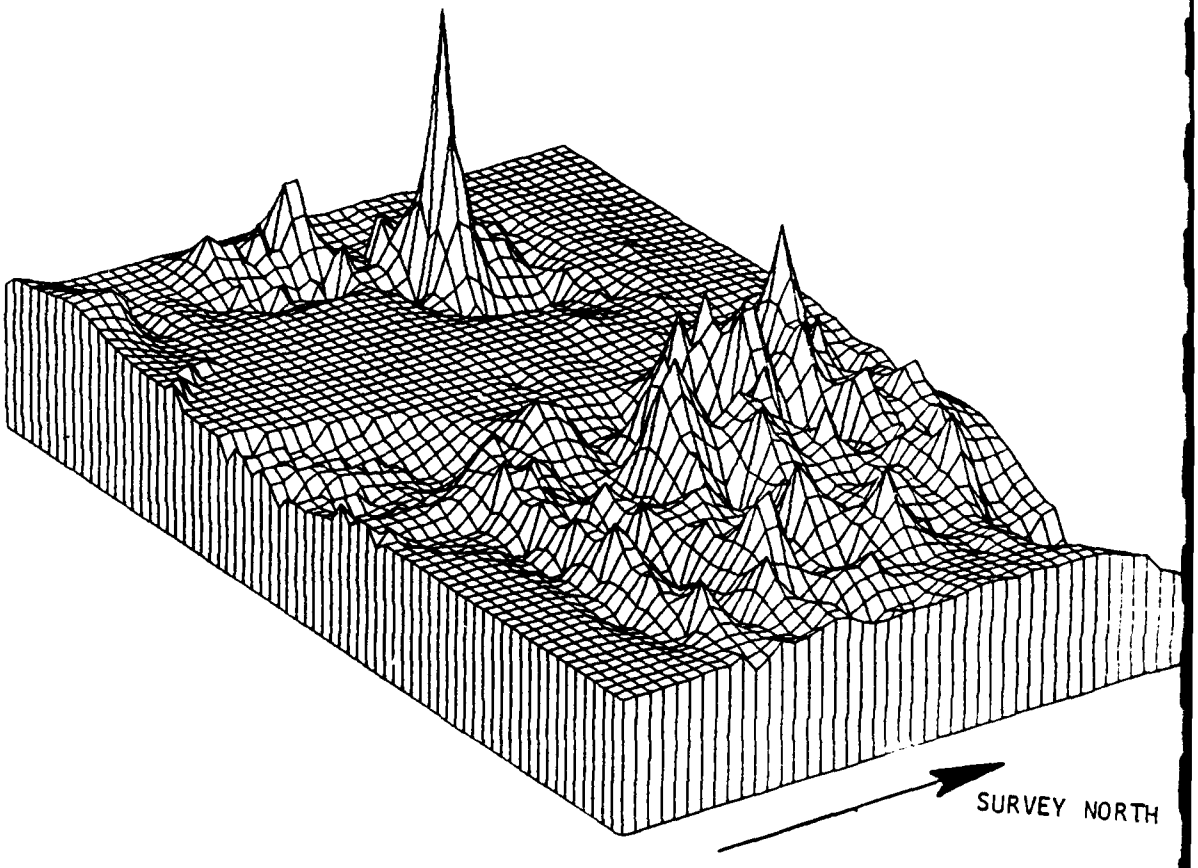
TOTAL MAGNETIC FIELD INTENSITY
NORTH GRID
(VIEWED FROM SOUTHEAST)



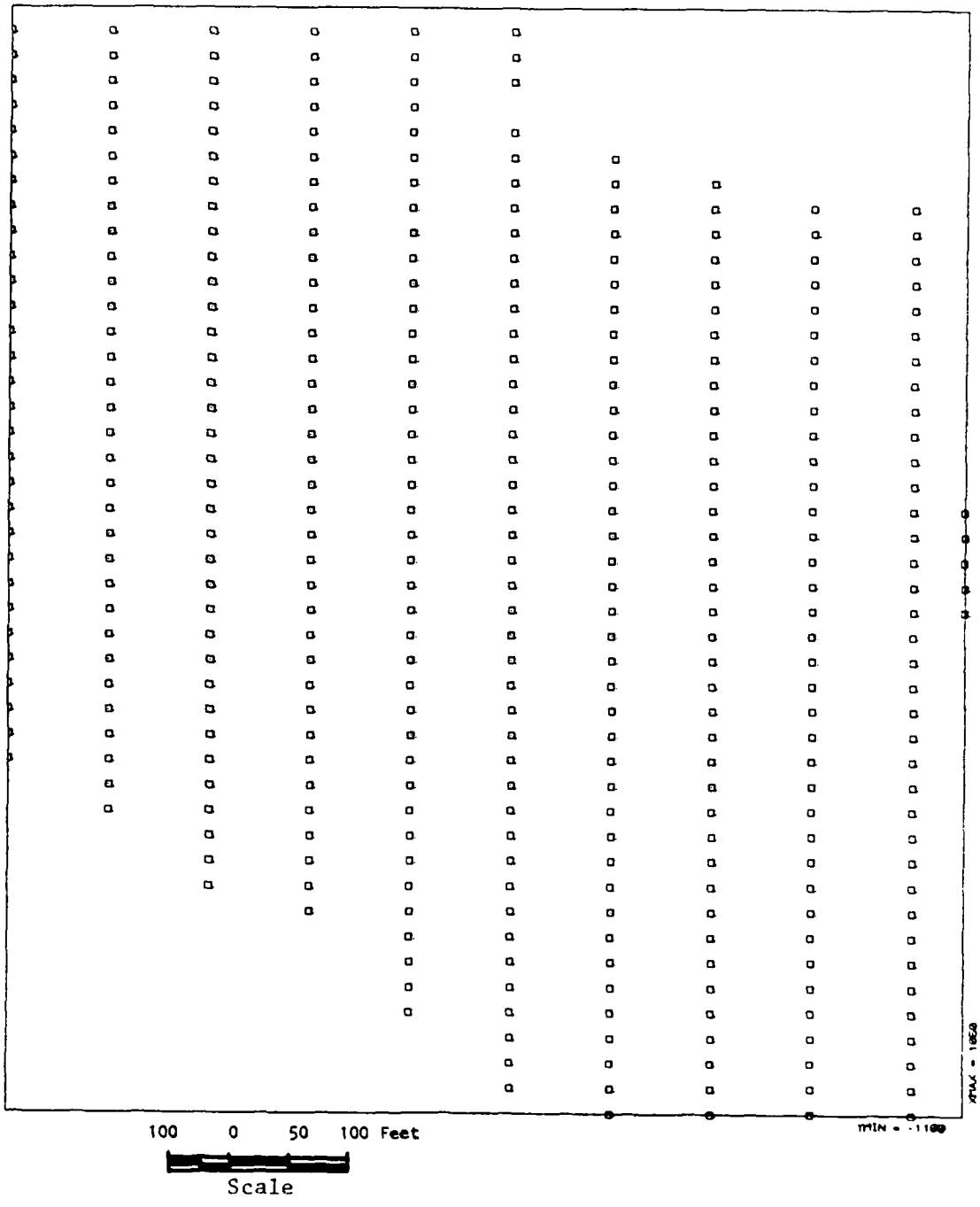
Scale

contour interval: 100 gammas

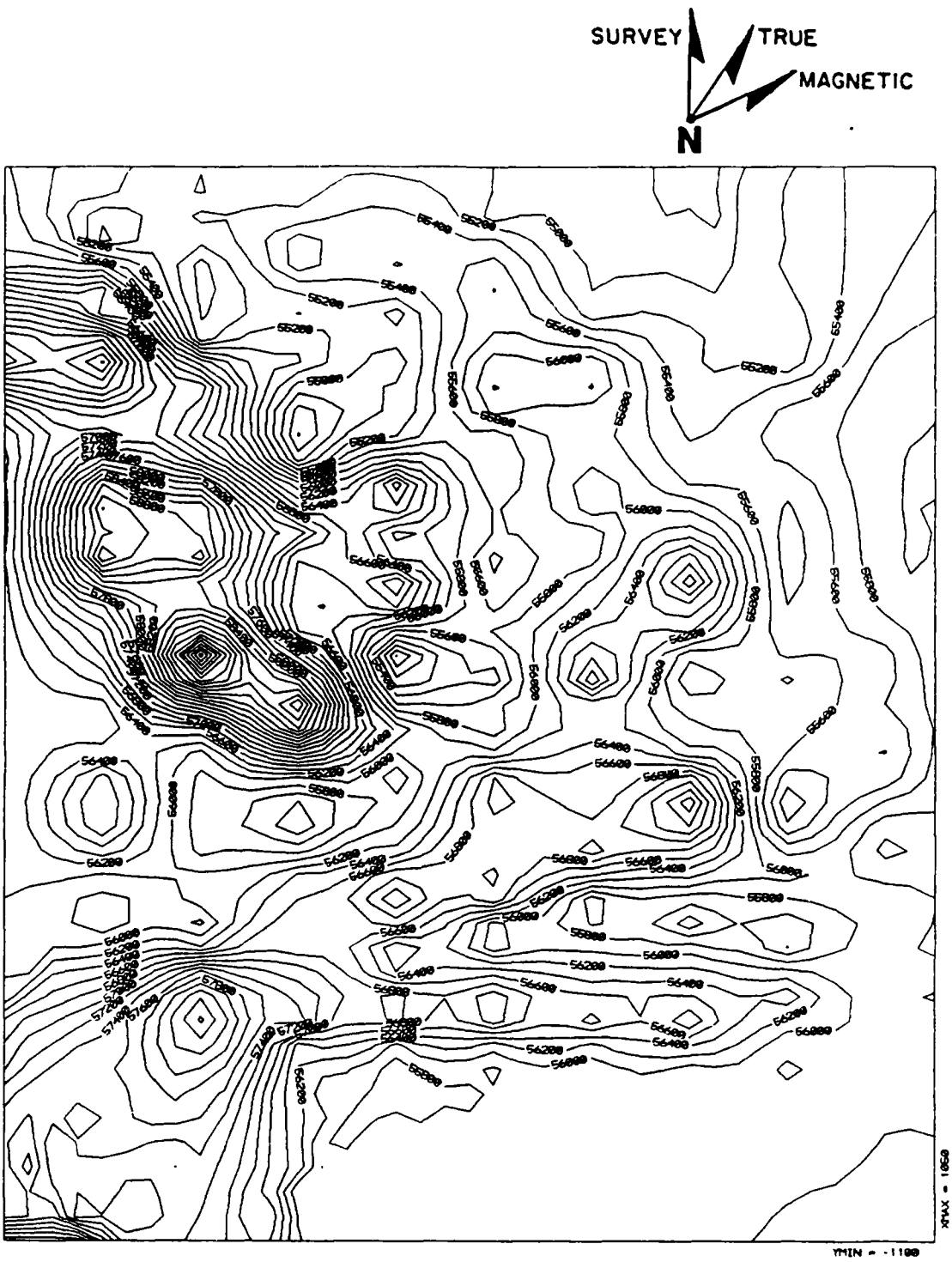
VERTICAL MAGNETIC GRADIENT NORTH GRID



VERTICAL MAGNETIC
GRADIENT
NORTH GRID
(VIEWED FROM SOUTHEAST)



MAGNETOMETER SURVEY
READING STATIONS
NORTH GRID (E1/2)

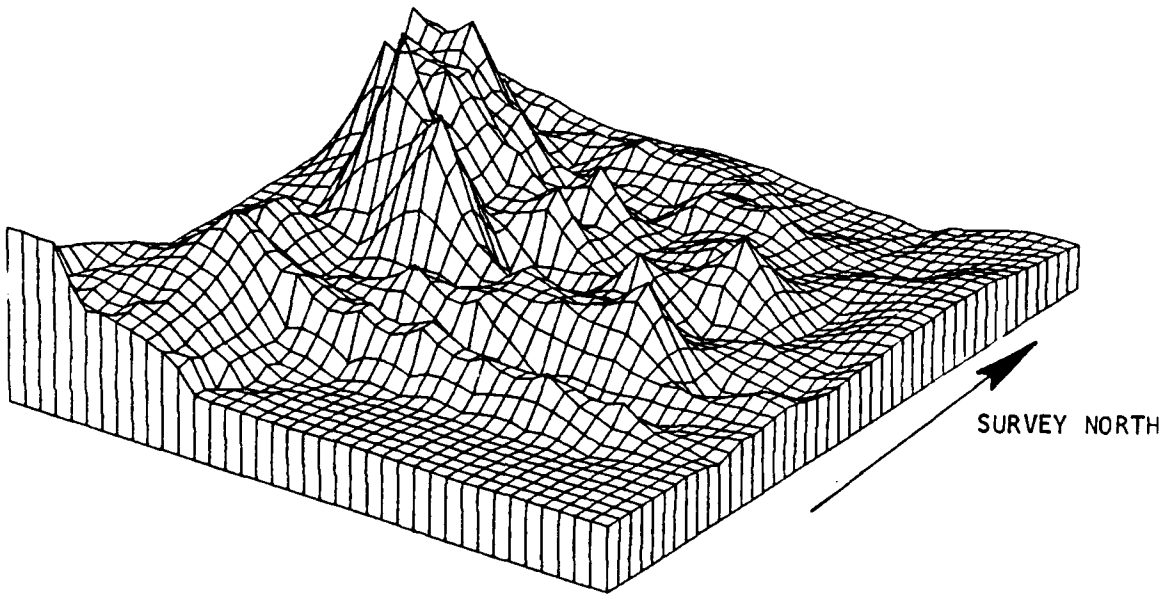


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Scale

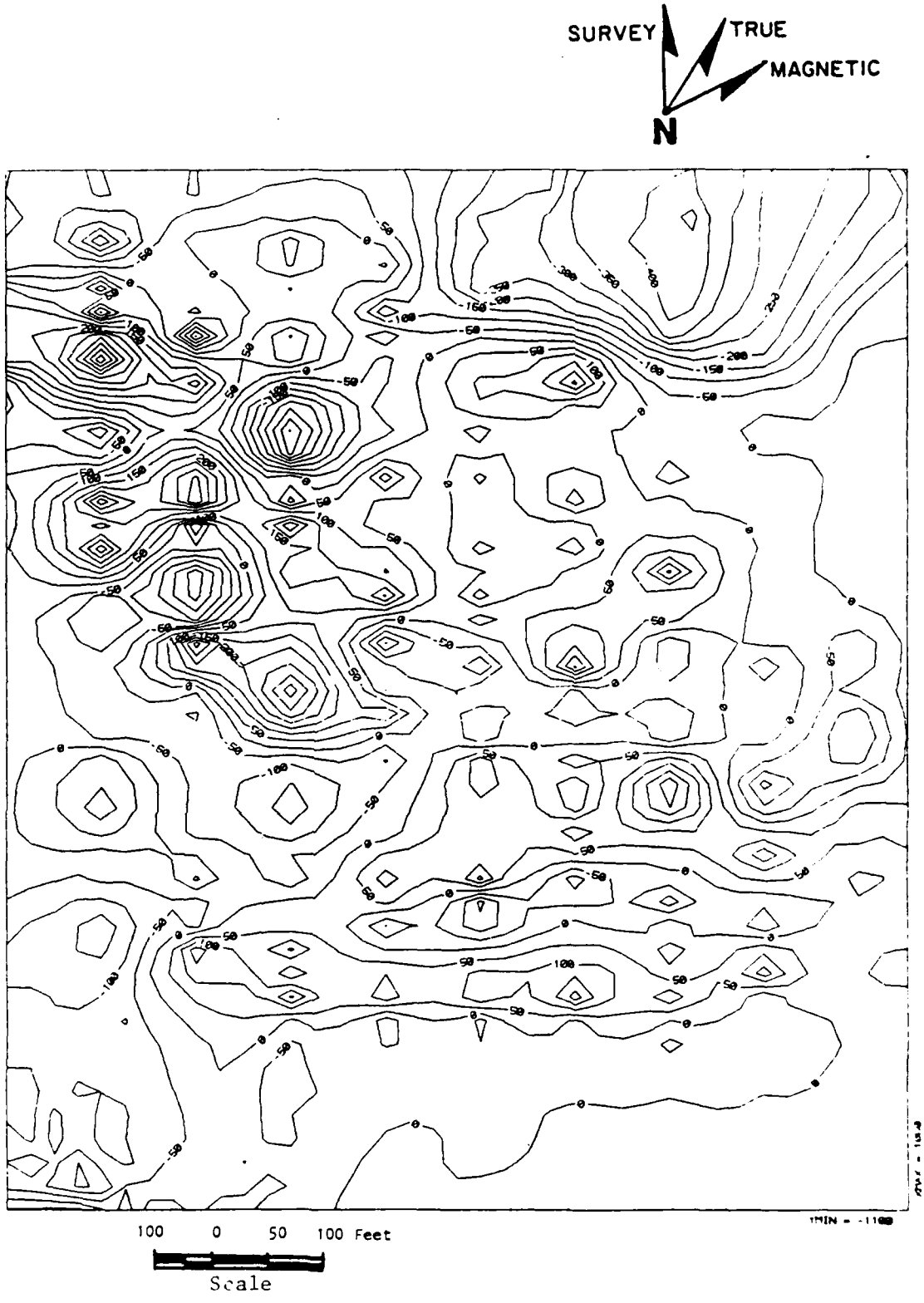
TOTAL MAGNETIC FIELD INTENSITY NORTH GRID (E1/2)

contour interval: 200 gammas



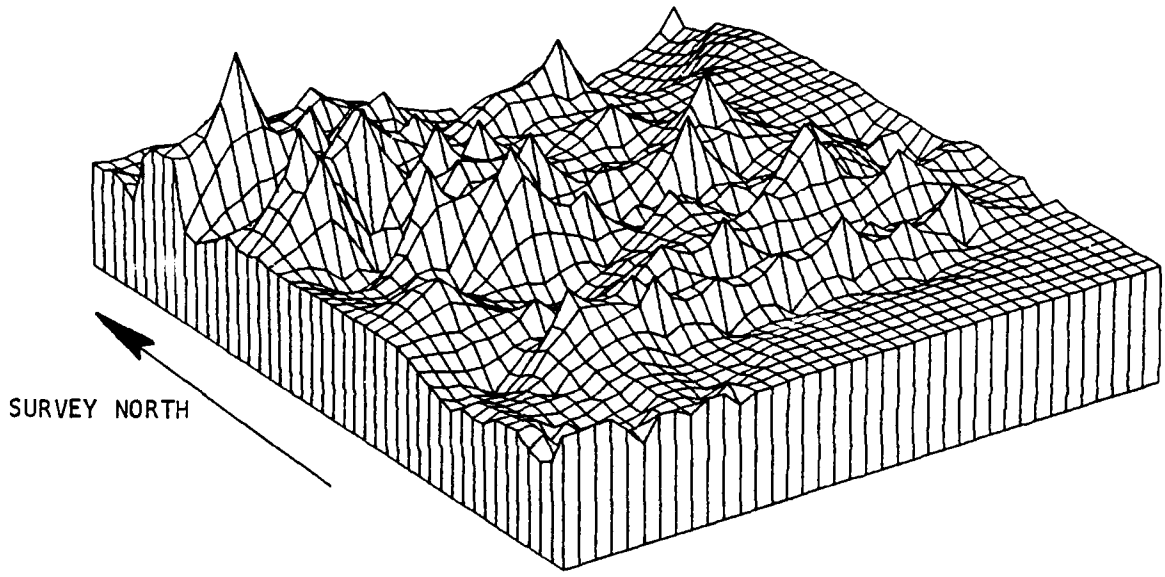
ELMENDORF - NORTH E 1/2 (FROM SE)

TOTAL MAGNETIC FIELD INTENSITY
NORTH GRID (E1/2)
(VIEWED FROM SOUTHEAST)



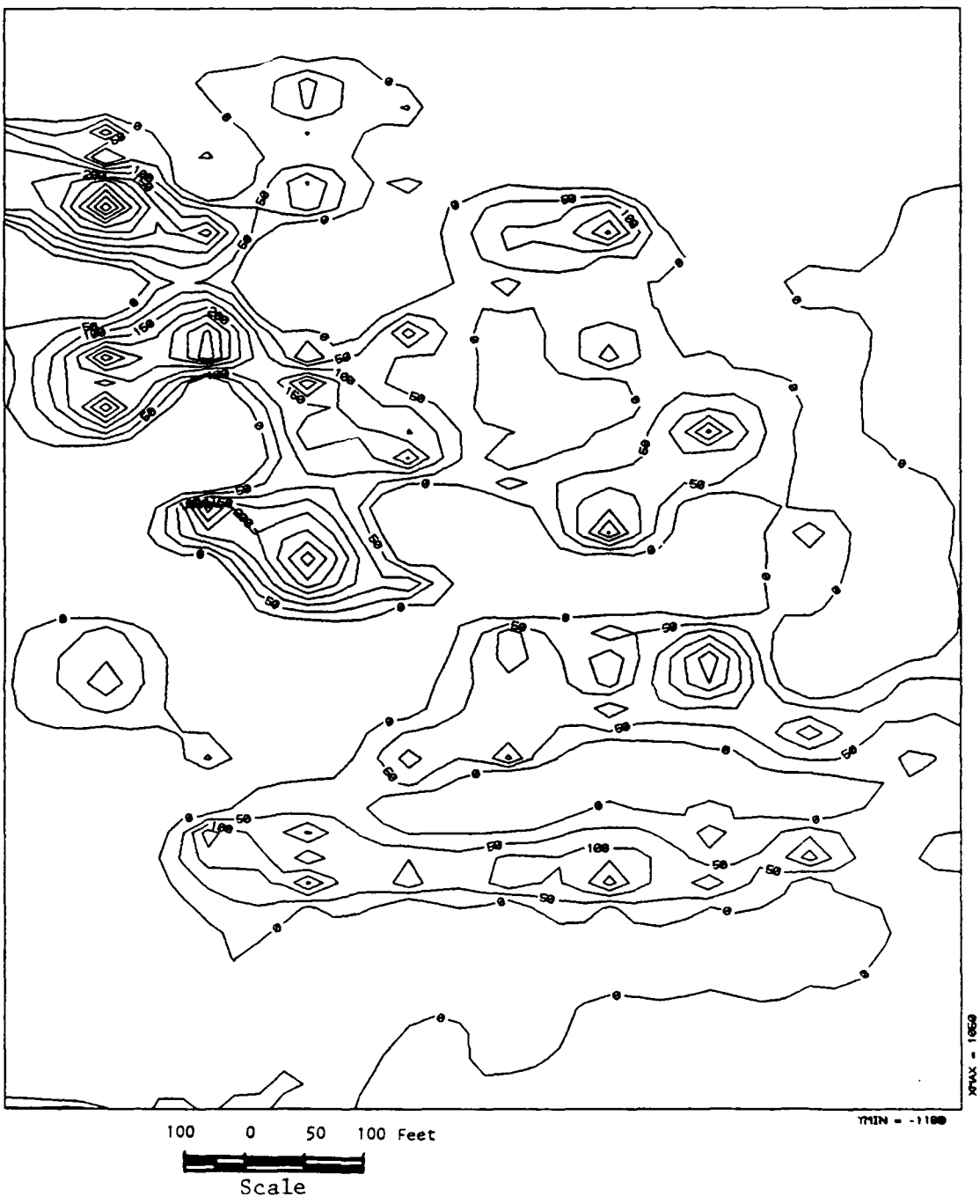
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VERTICAL MAGNETIC GRADIENT NORTH GRID (E1/2)



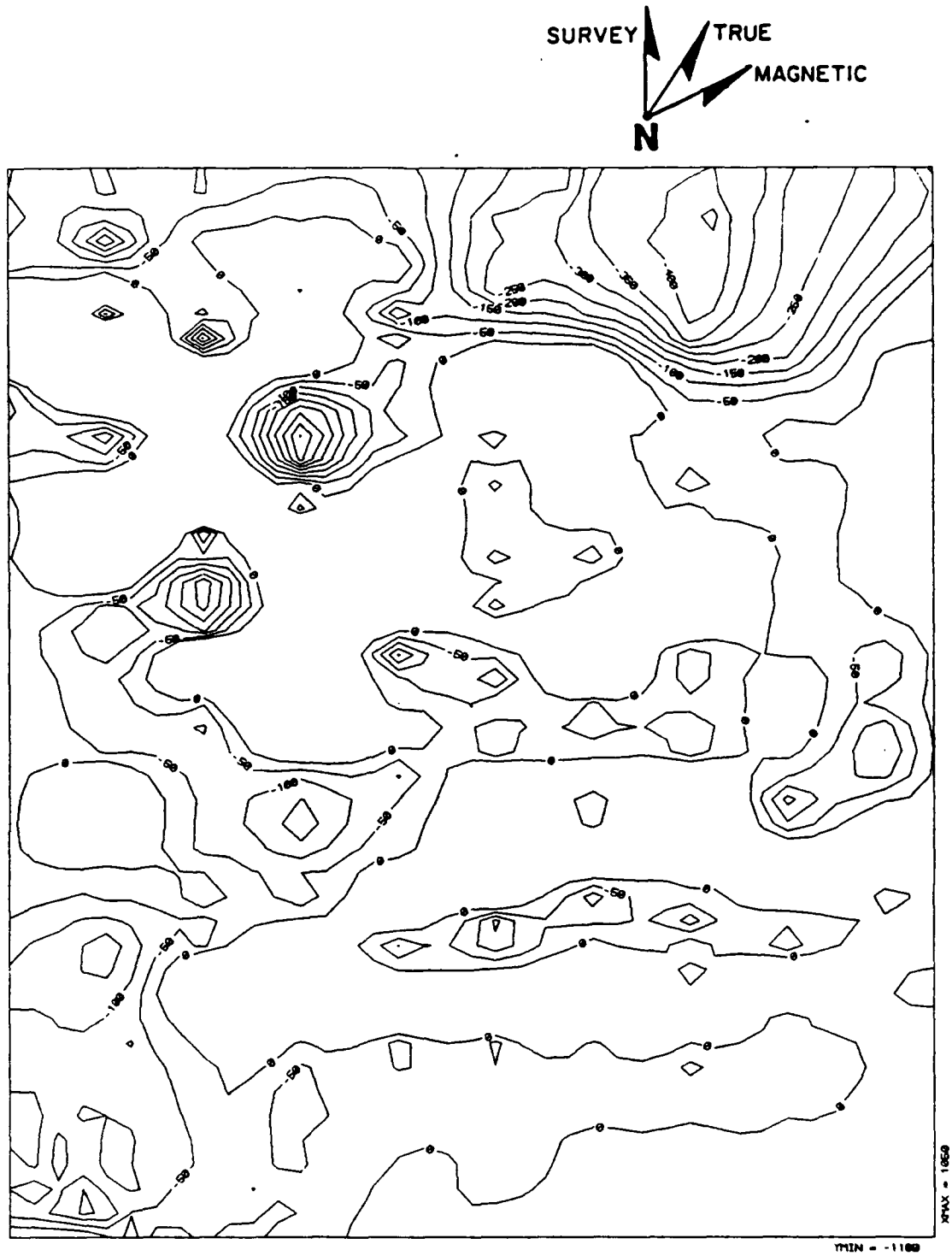
ELMENDORF - E 1/2 (FROM SW)

VERTICAL MAGNETIC GRADIENT
NORTH GRID (E1/2)
(VIEWED FROM SOUTHWEST)



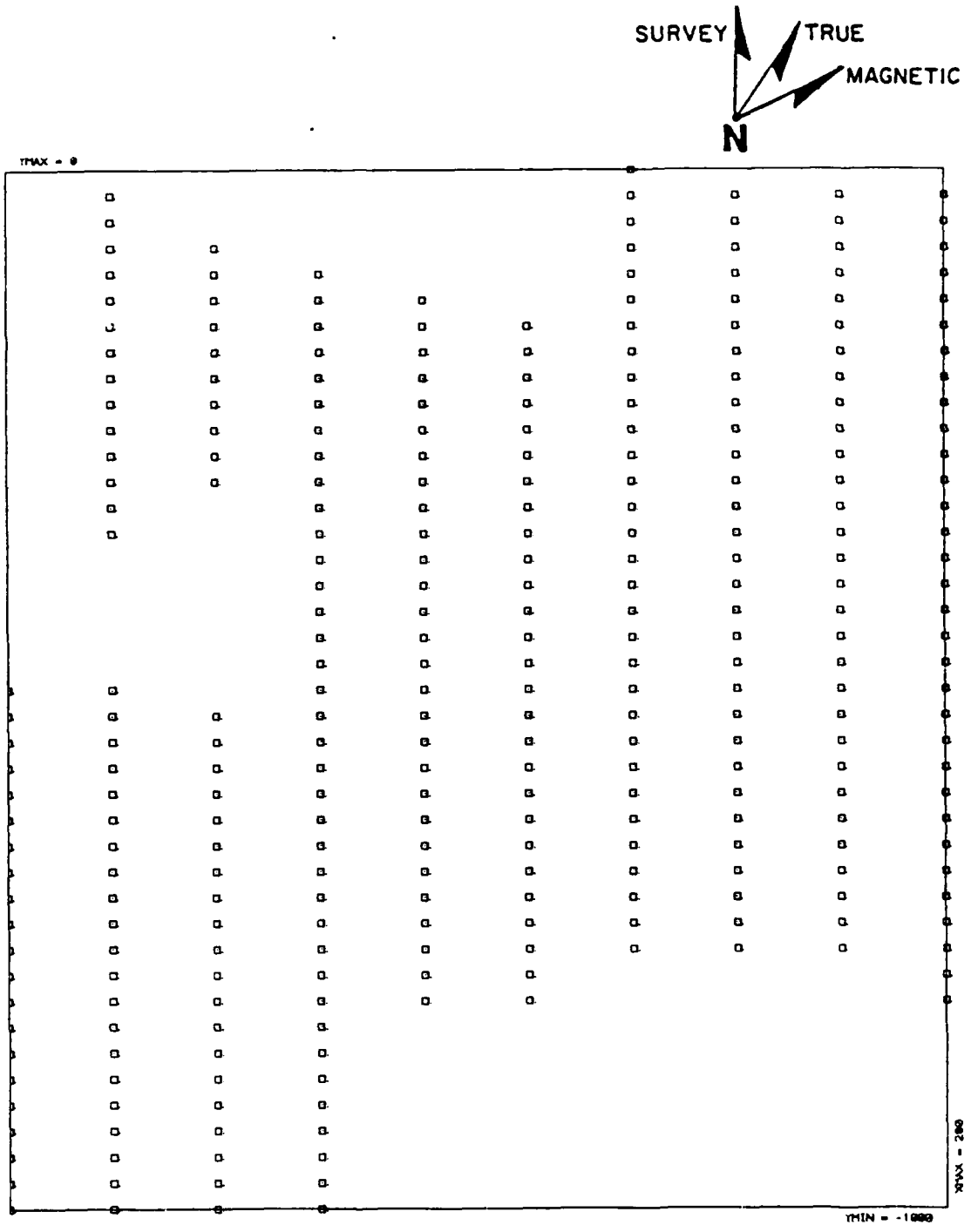
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POSITIVE VERTICAL MAGNETIC GRADIENT VALUES NORTH GRID (E1/2)

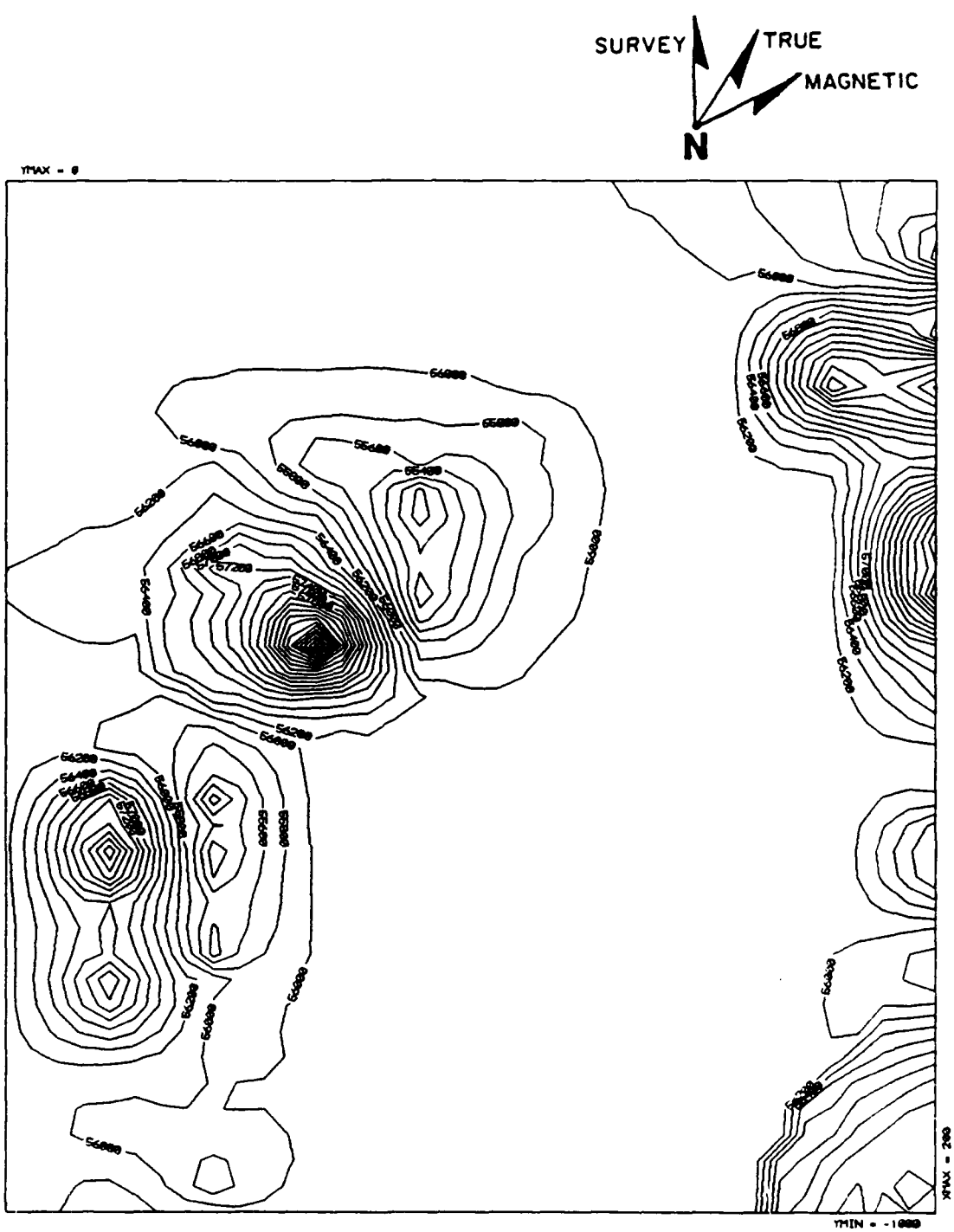


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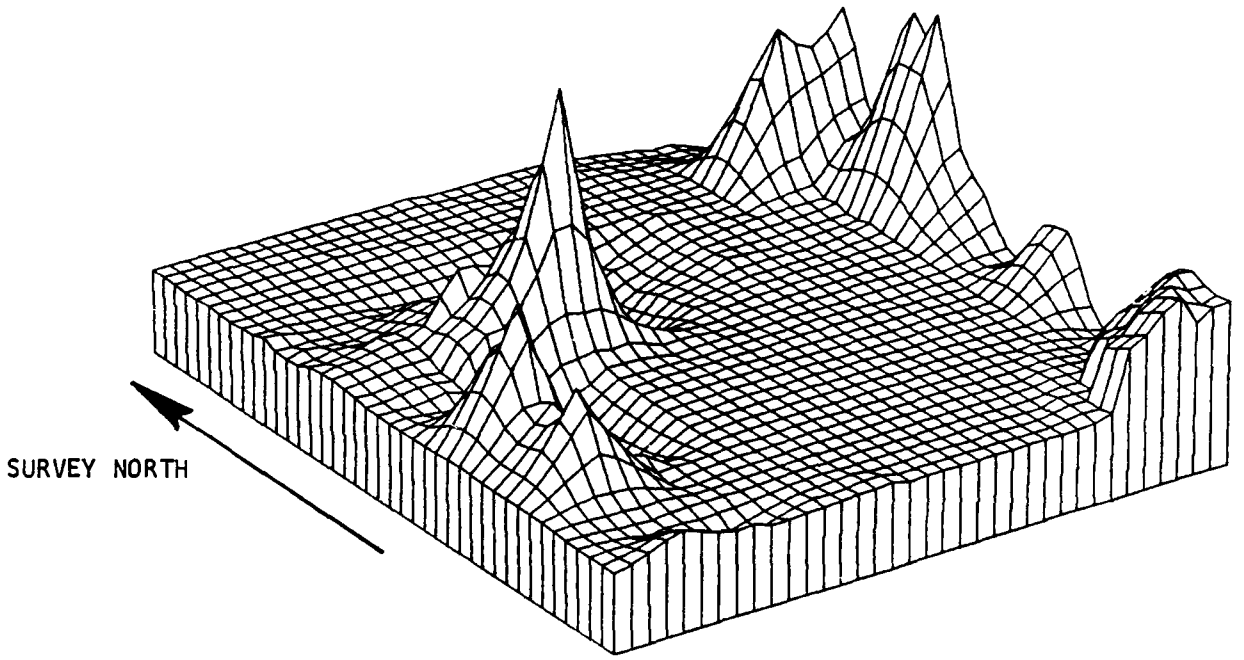


MAGNETOMETER SURVEY
READING STATIONS
NORTH GRID (W1/2)



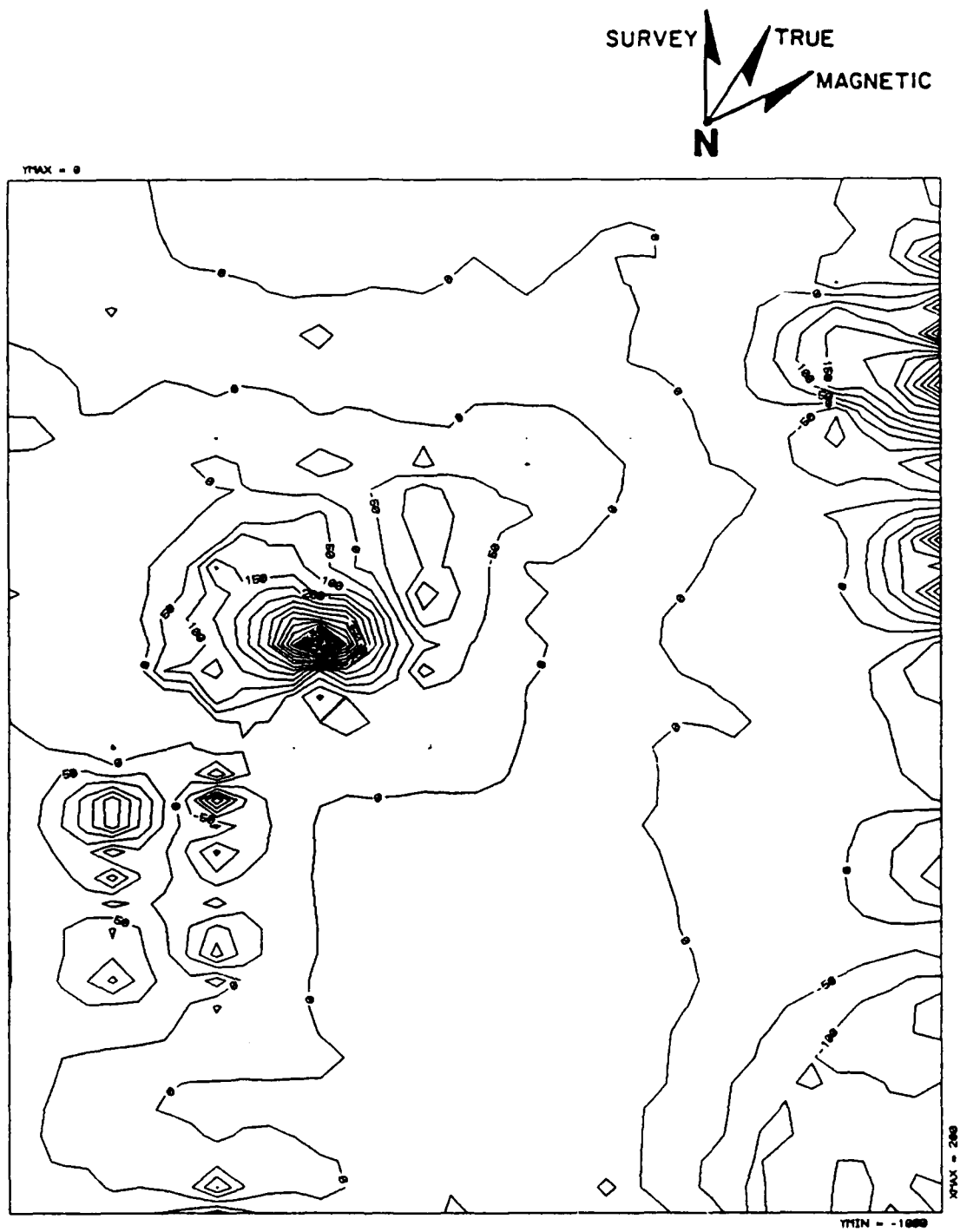
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TOTAL MAGNETIC FIELD INTENSITY NORTH GRID (W1/2)



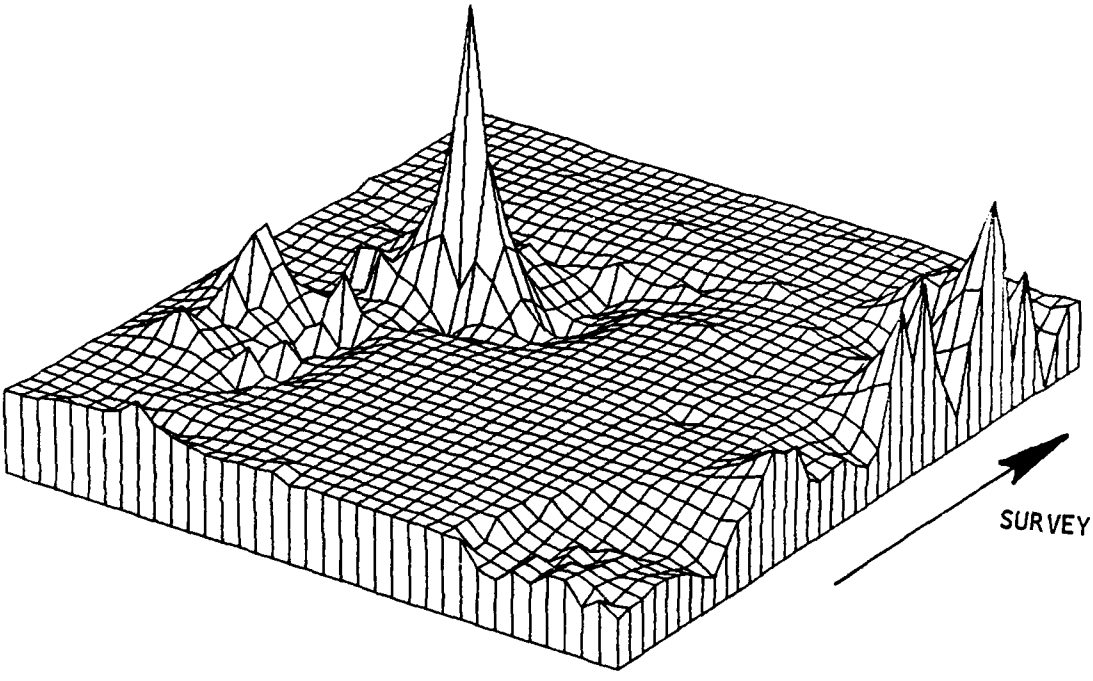
ELMENDORF - NORTH W 1/2 (FROM SW)

TOTAL MAGNETIC FIELD INTENSITY NORTH GRID (W1/2)



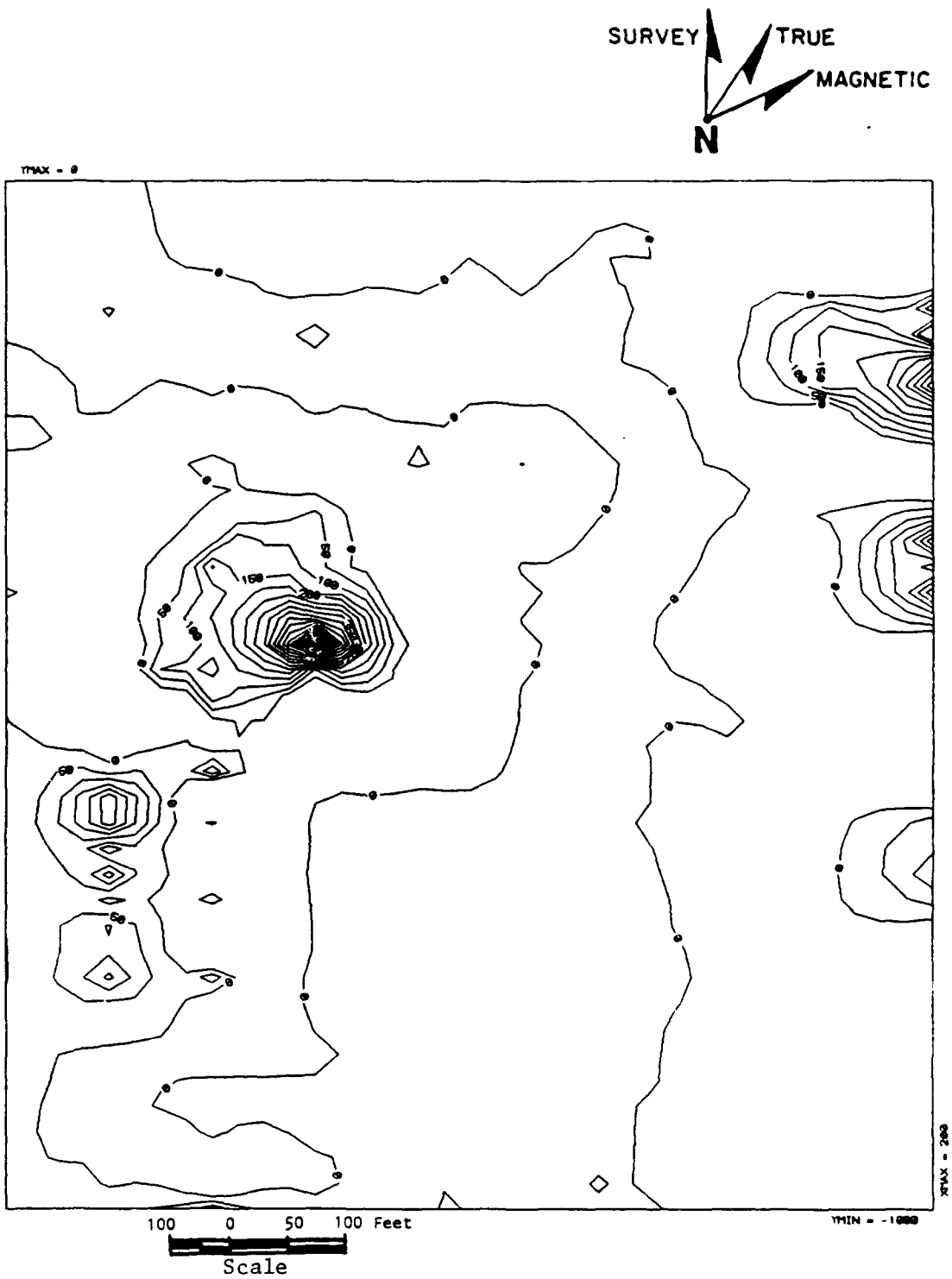
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VERTICAL MAGNETIC GRADIENT NORTH GRID (W1/2)



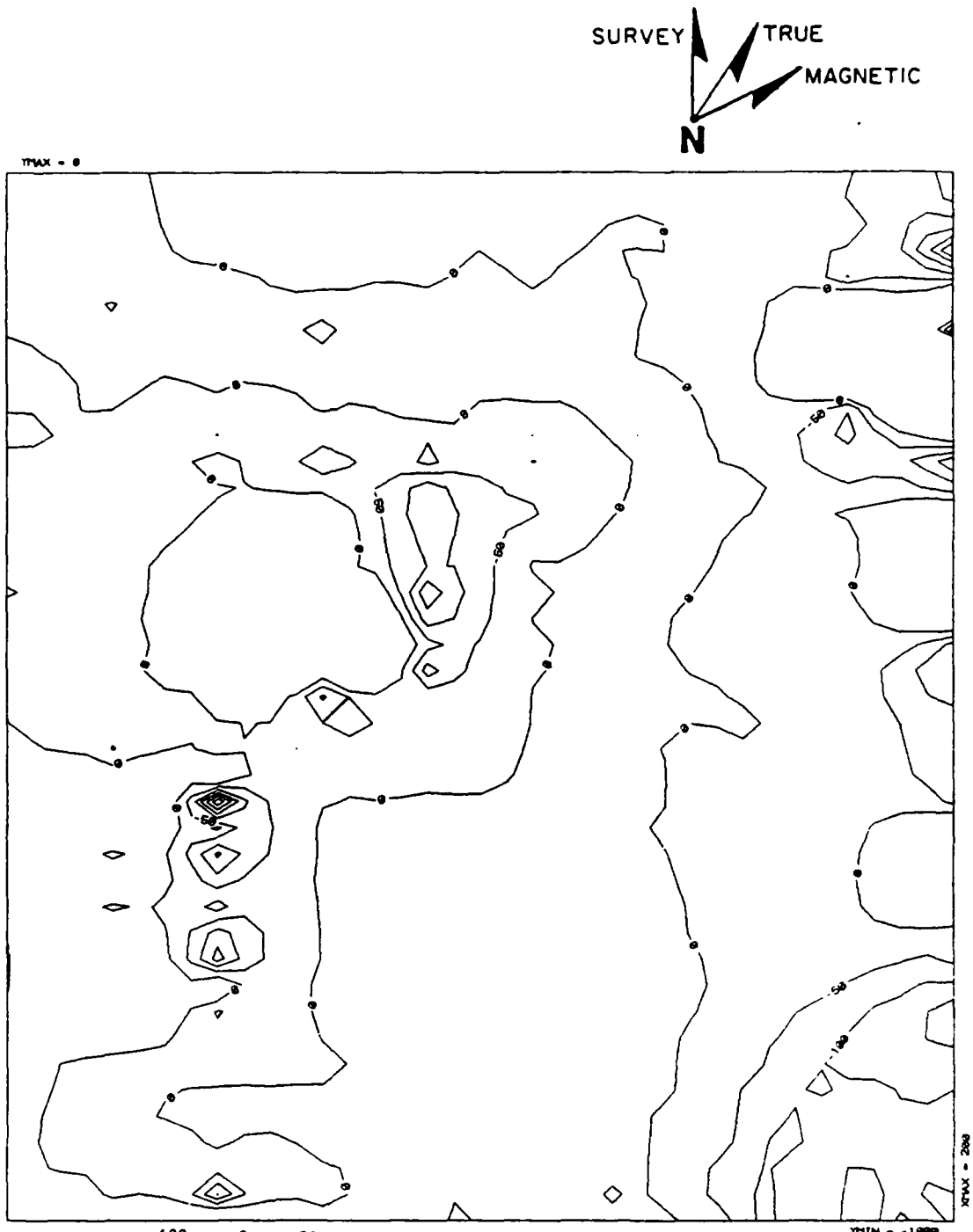
ELMENDORF – W 1/2 (FROM SE)

VERTICAL MAGNETIC GRADIENT NORTH GRID (W1/2)



contour interval: 50 gammas

POSITIVE VERTICAL MAGNETIC GRADIENT VALUES NORTH GRID (W1/2)

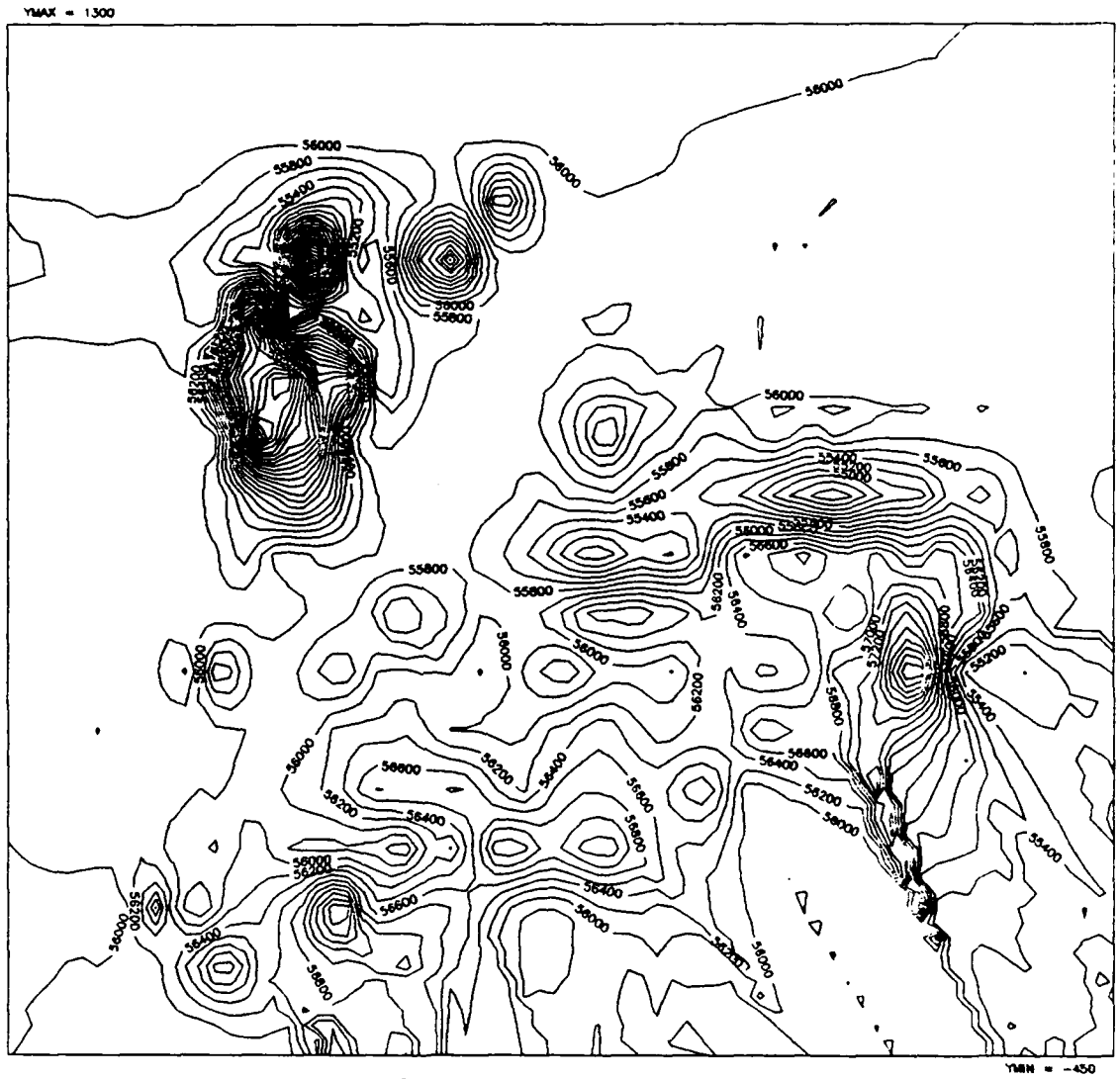


NEGATIVE VERTICAL MAGNETIC GRADIENT VALUES NORTH GRID (W1/2)

contour interval: 50 gammas

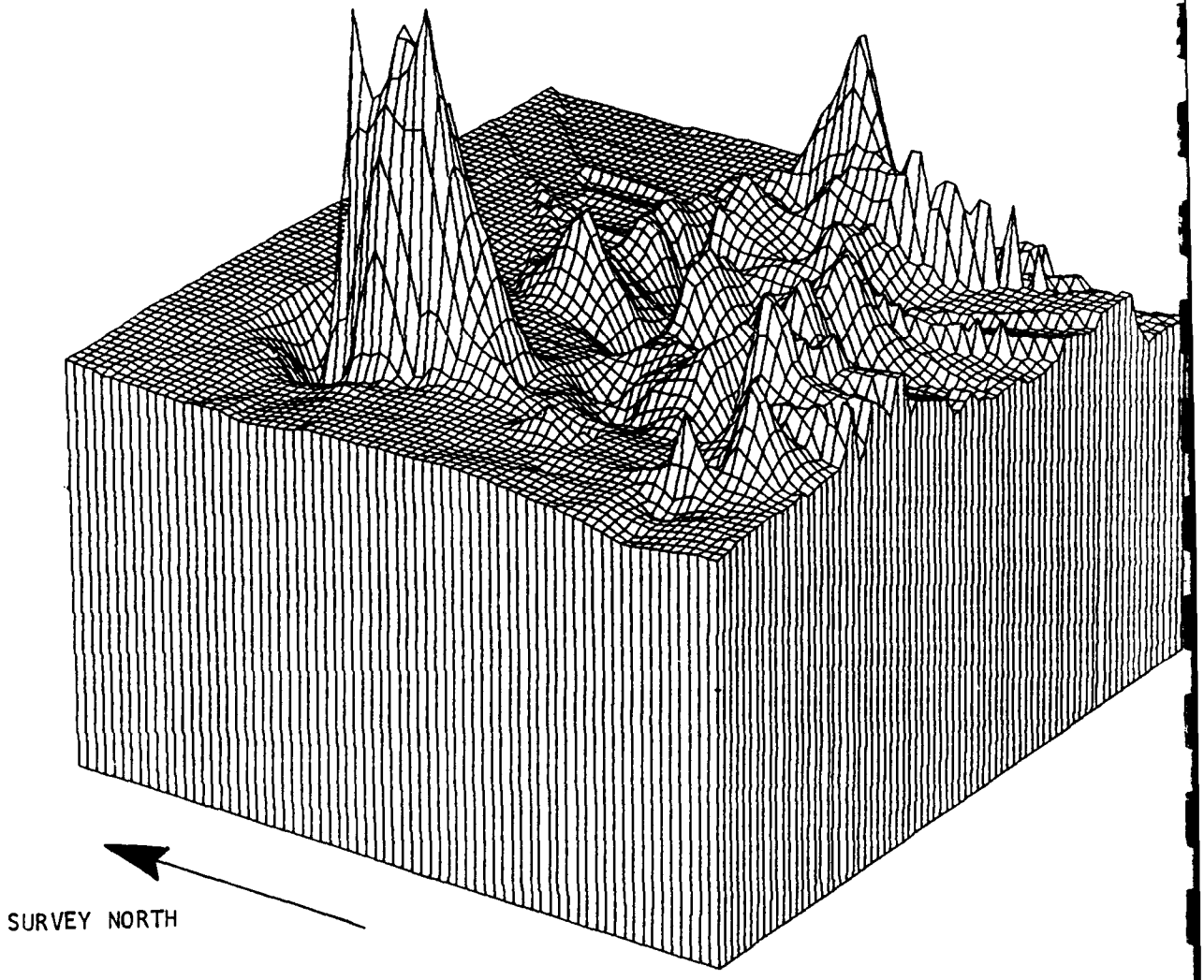
SITE D-7

SOUTH GRID

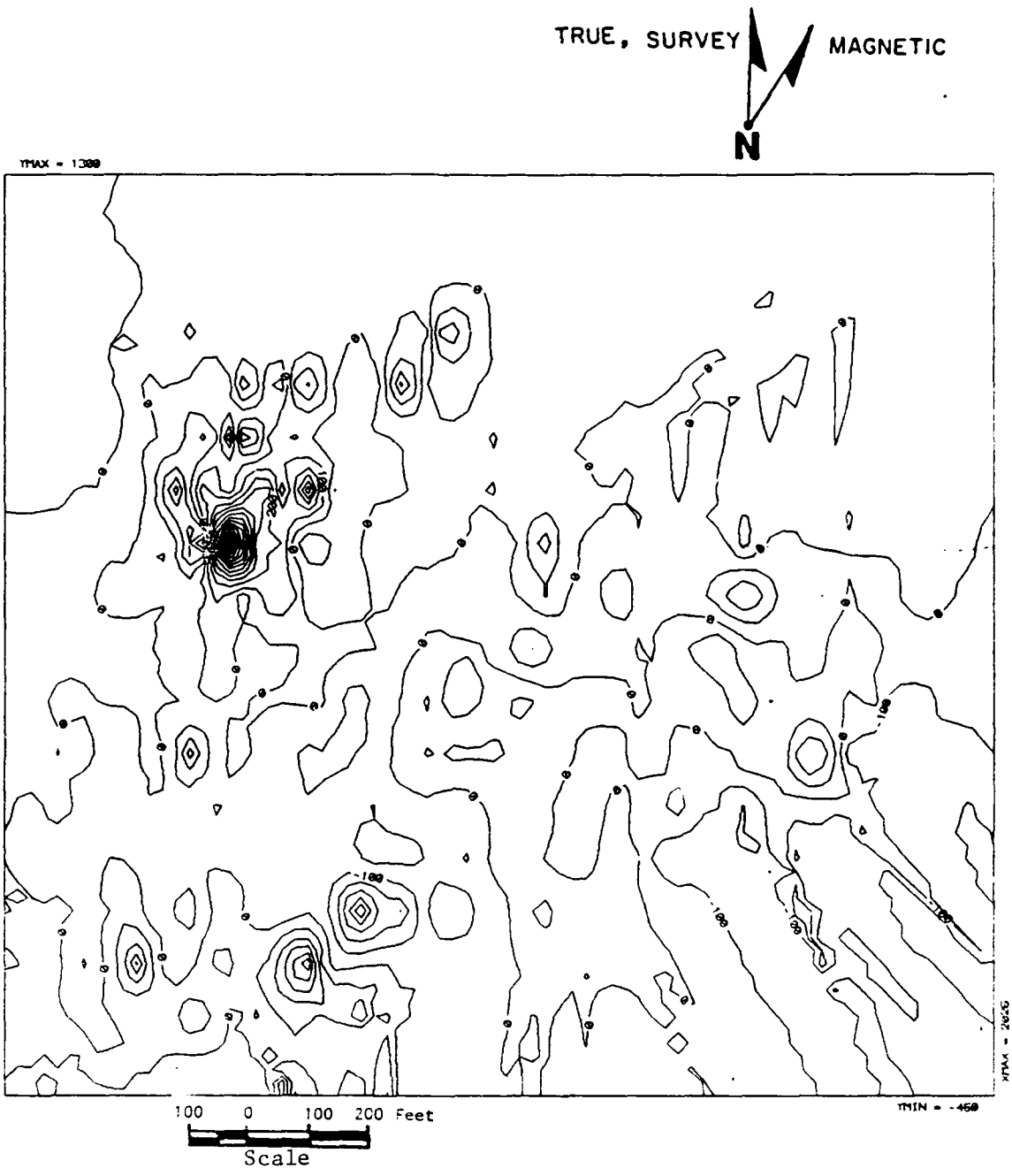


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TOTAL MAGNETIC FIELD INTENSITY SOUTH GRID



TOTAL MAGNETIC FIELD INTENSITY
SOUTH GRID
(VIEWED FROM SOUTHWEST)

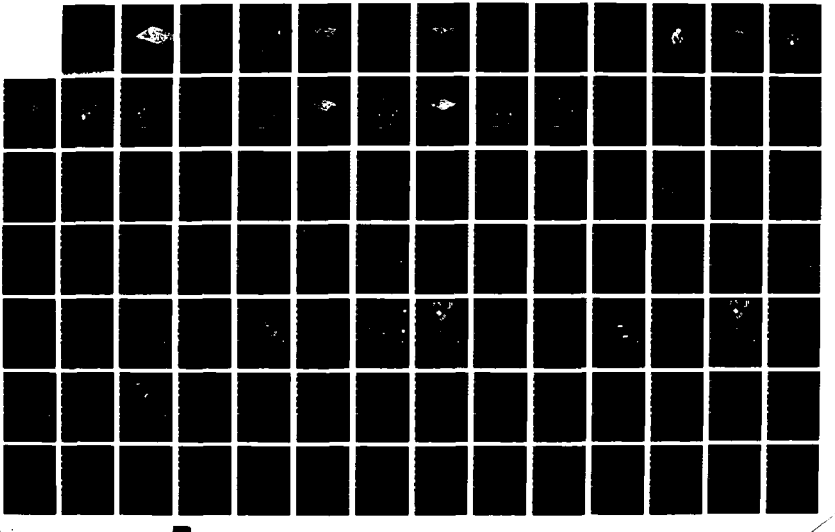


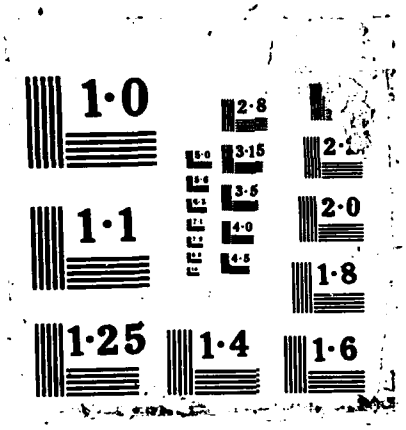
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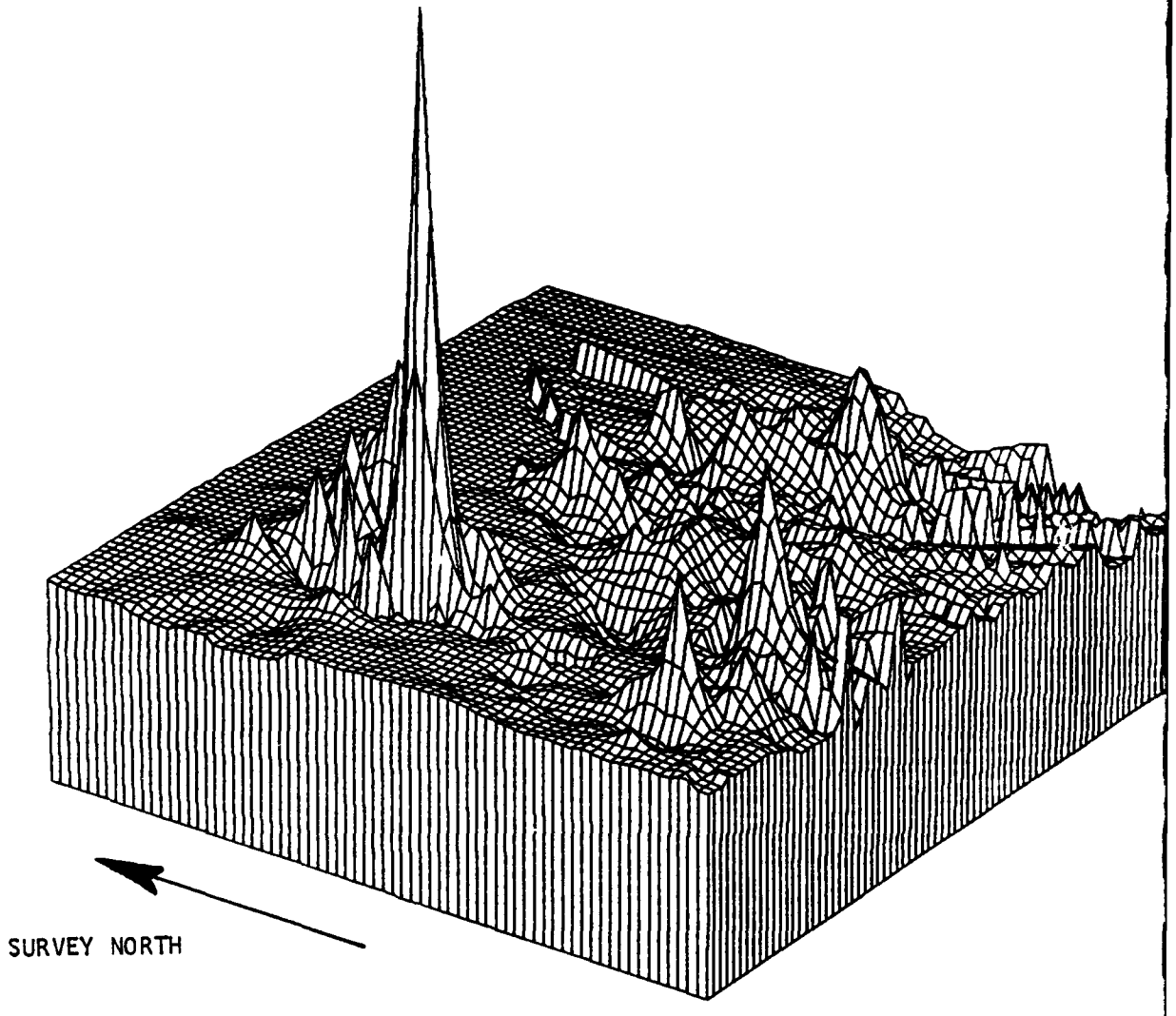
VERTICAL MAGNETIC
GRADIENT
SOUTH GRID

AD-A192 375 INSTALLATION RESTORATION PROGRAM PHASE 2 5/6
CONFIRMATION/QUANTIFICATION STAG (U) DAMES AND MOORE
PARK RIDGE IL 01 MAR 88 F33615-83-D-4002

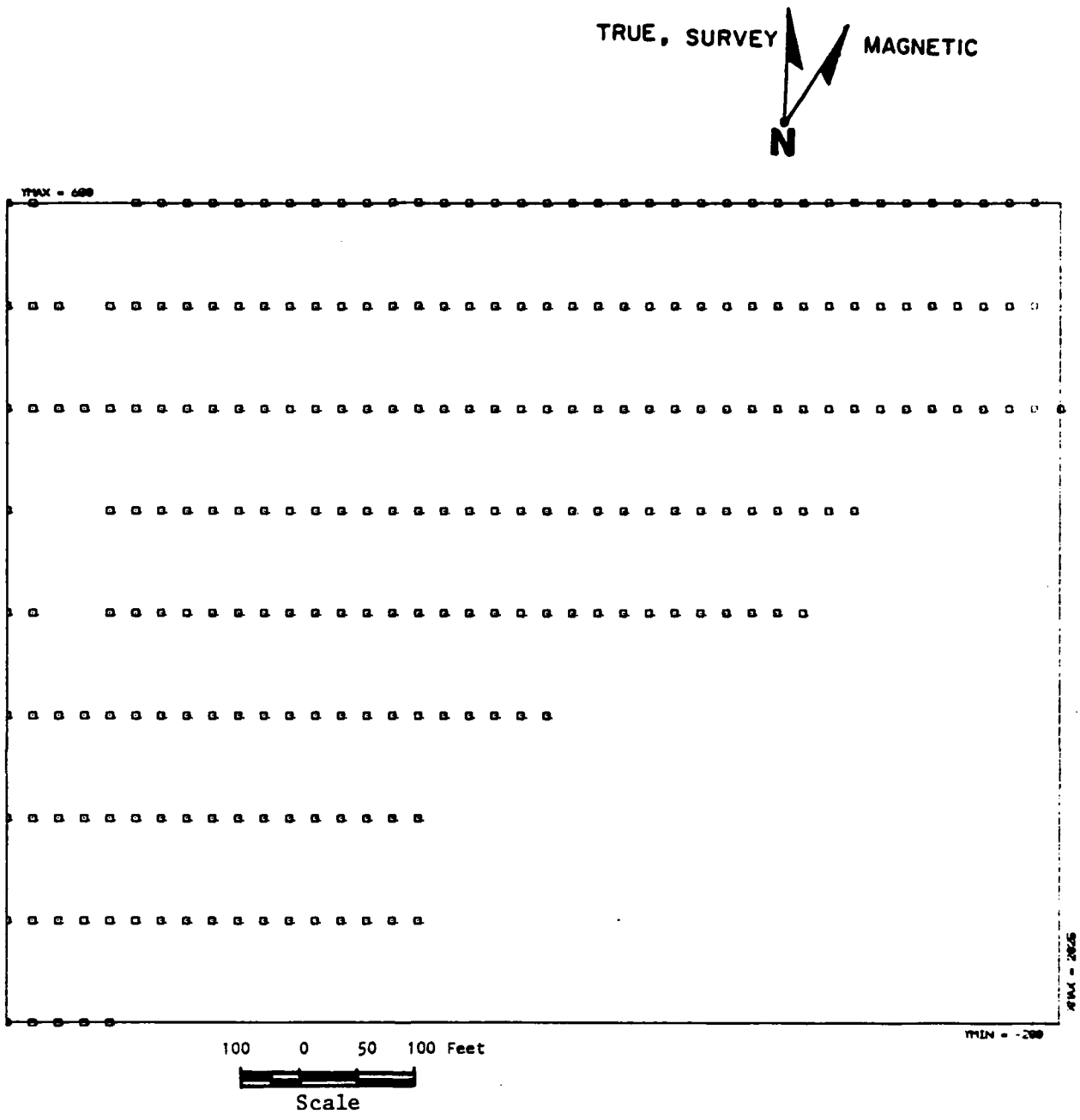
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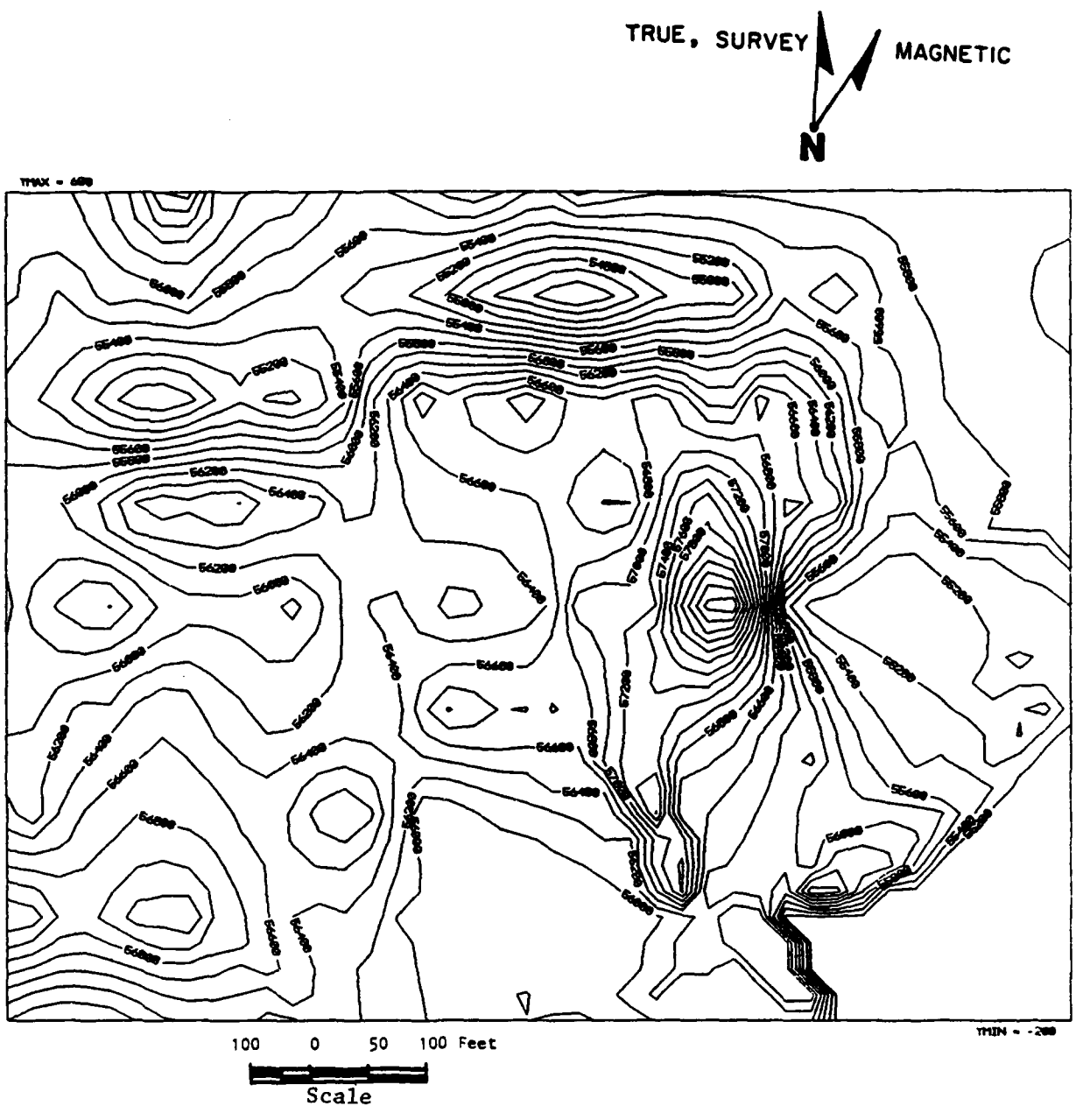

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VERTICAL MAGNETIC GRADIENT
SOUTH GRID
(VIEWED FROM SOUTHWEST)

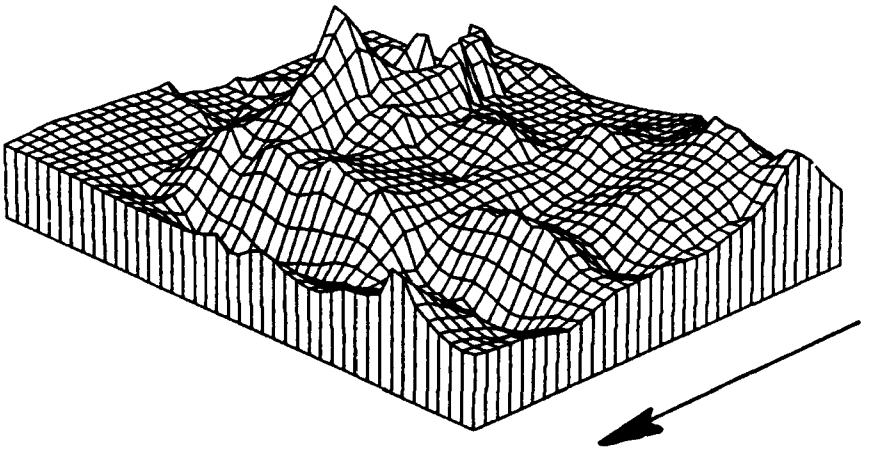


MAGNETOMETER
SURVEY READING STATIONS
SOUTH GRID (E1/3)



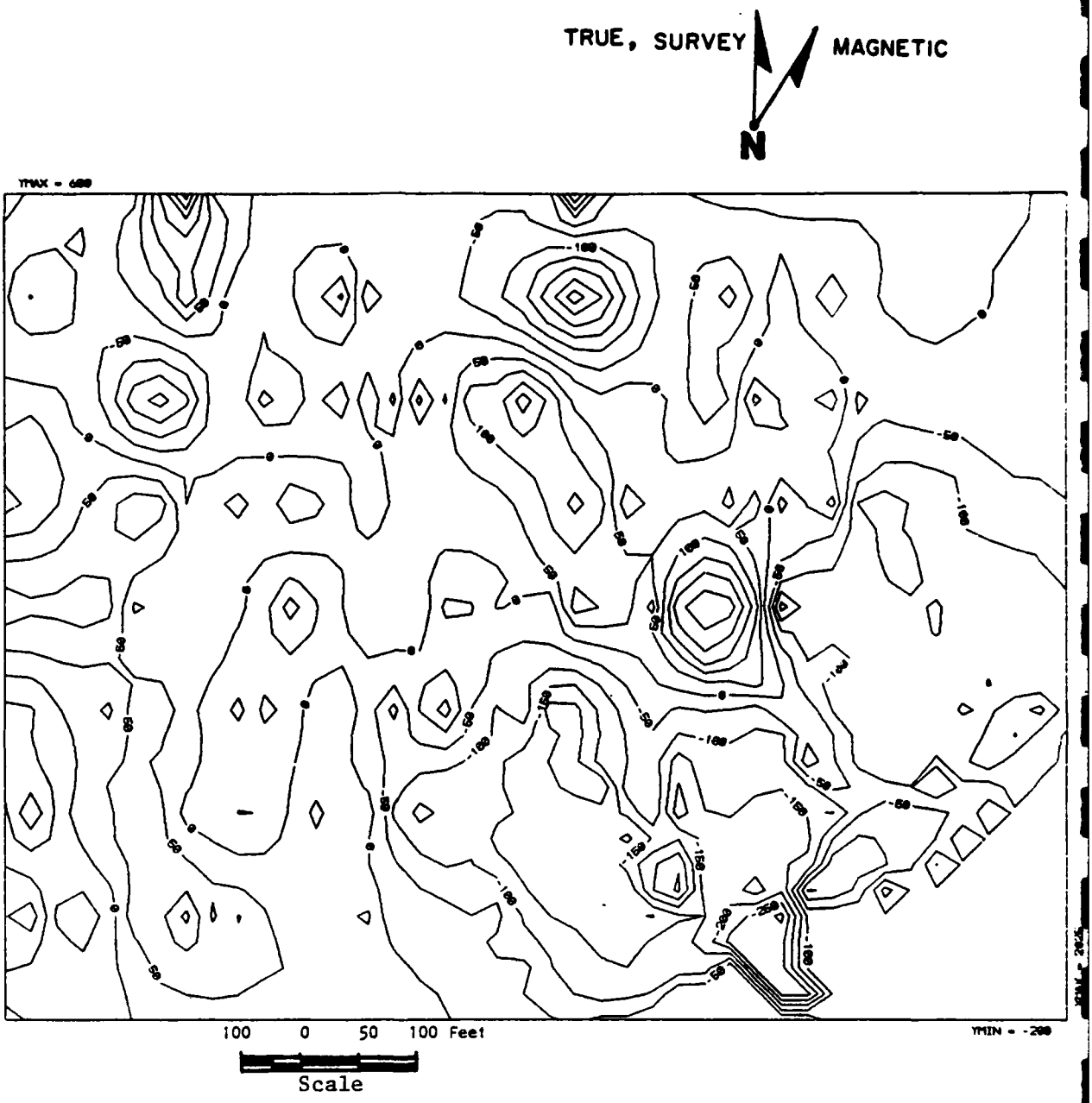
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TOTAL MAGNETIC FIELD INTENSITY SOUTH GRID (E1/3)



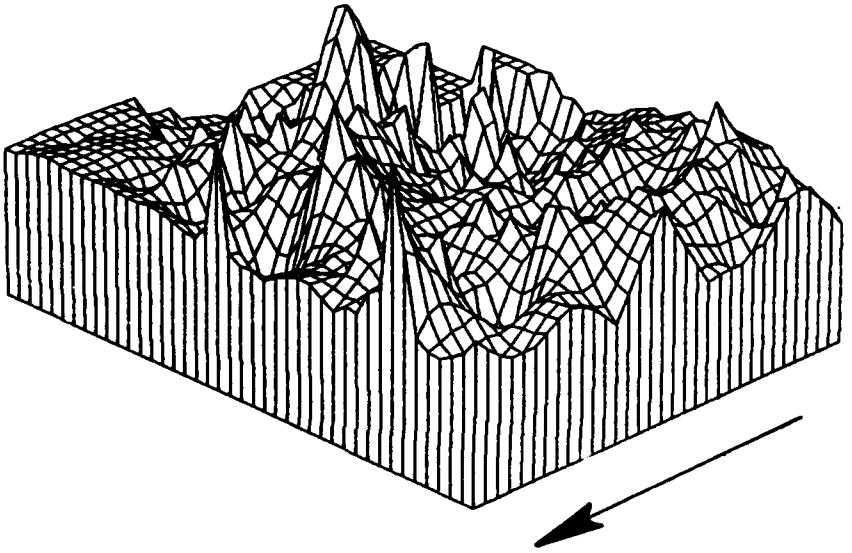
SURVEY NORTH

TOTAL MAGNETIC FIELD INTENSITY SOUTH GRID (E1/3) (VIEWED FROM NORTHWEST)



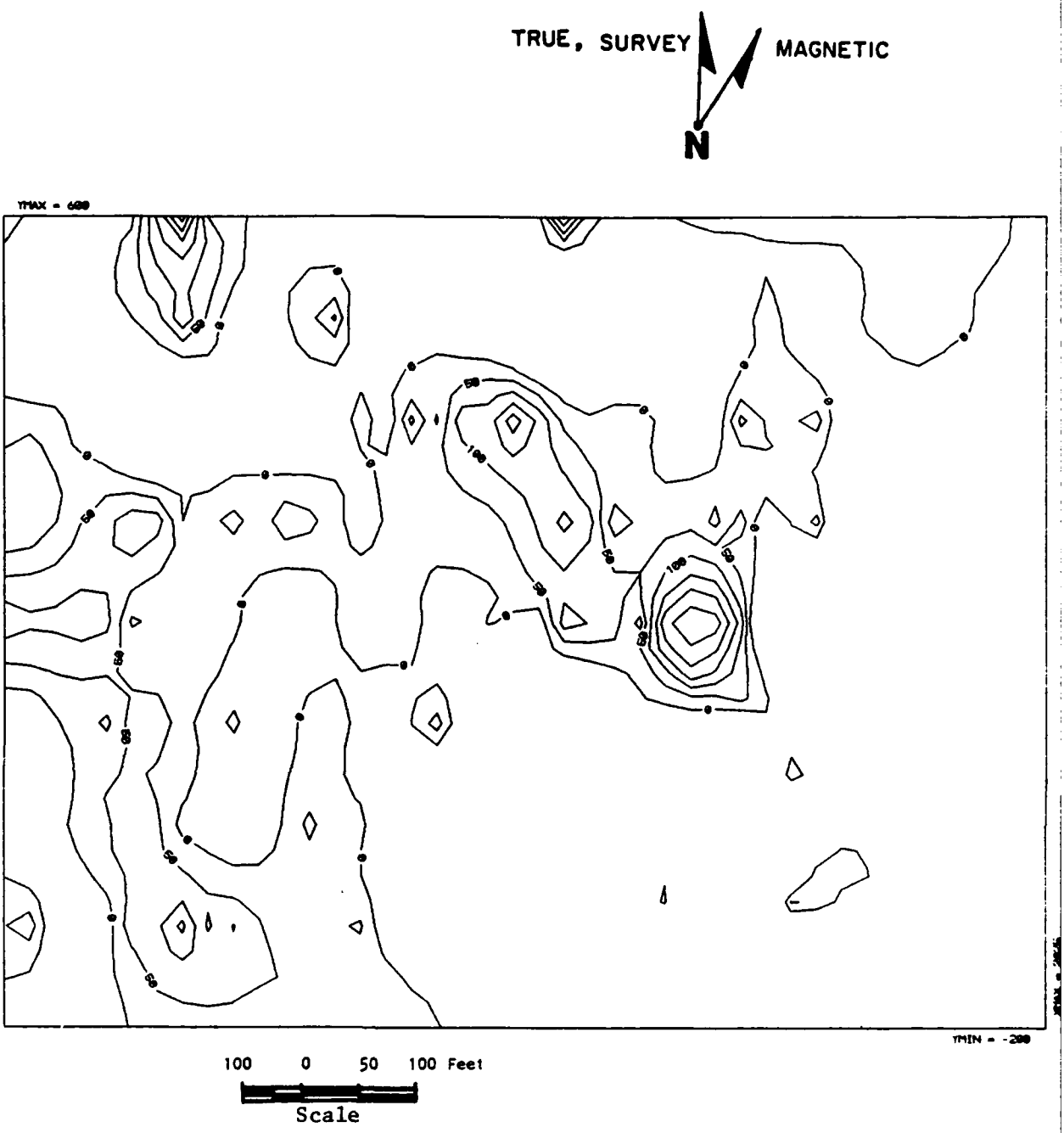
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VERTICAL MAGNETIC GRADIENT SOUTH GRID (E1/3)



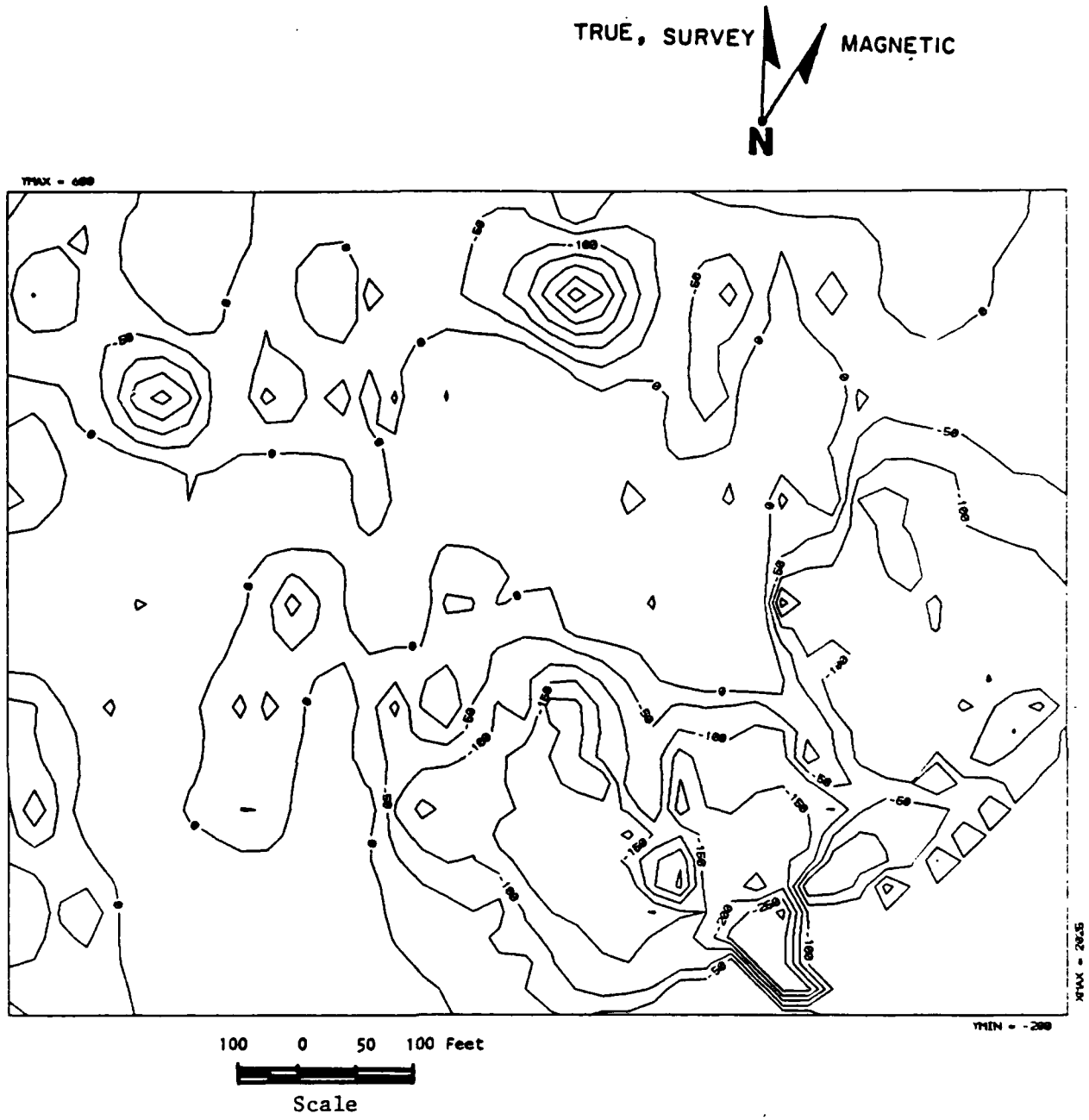
SURVEY NORTH

VERTICAL MAGNETIC GRADIENT
SOUTH GRID (E1/3)
(VIEWED FROM NORTHWEST)



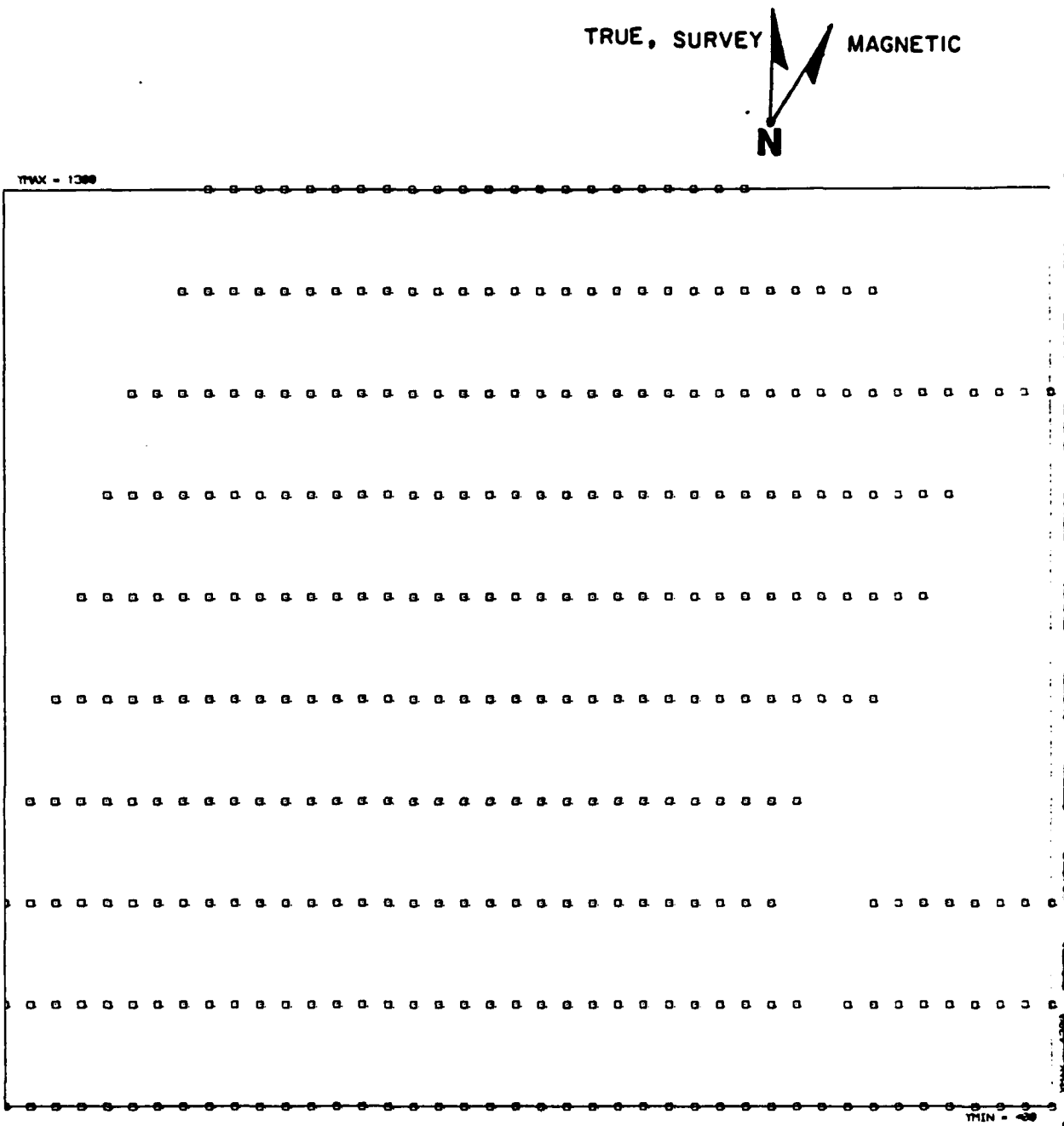
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POSITIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (E1/3)

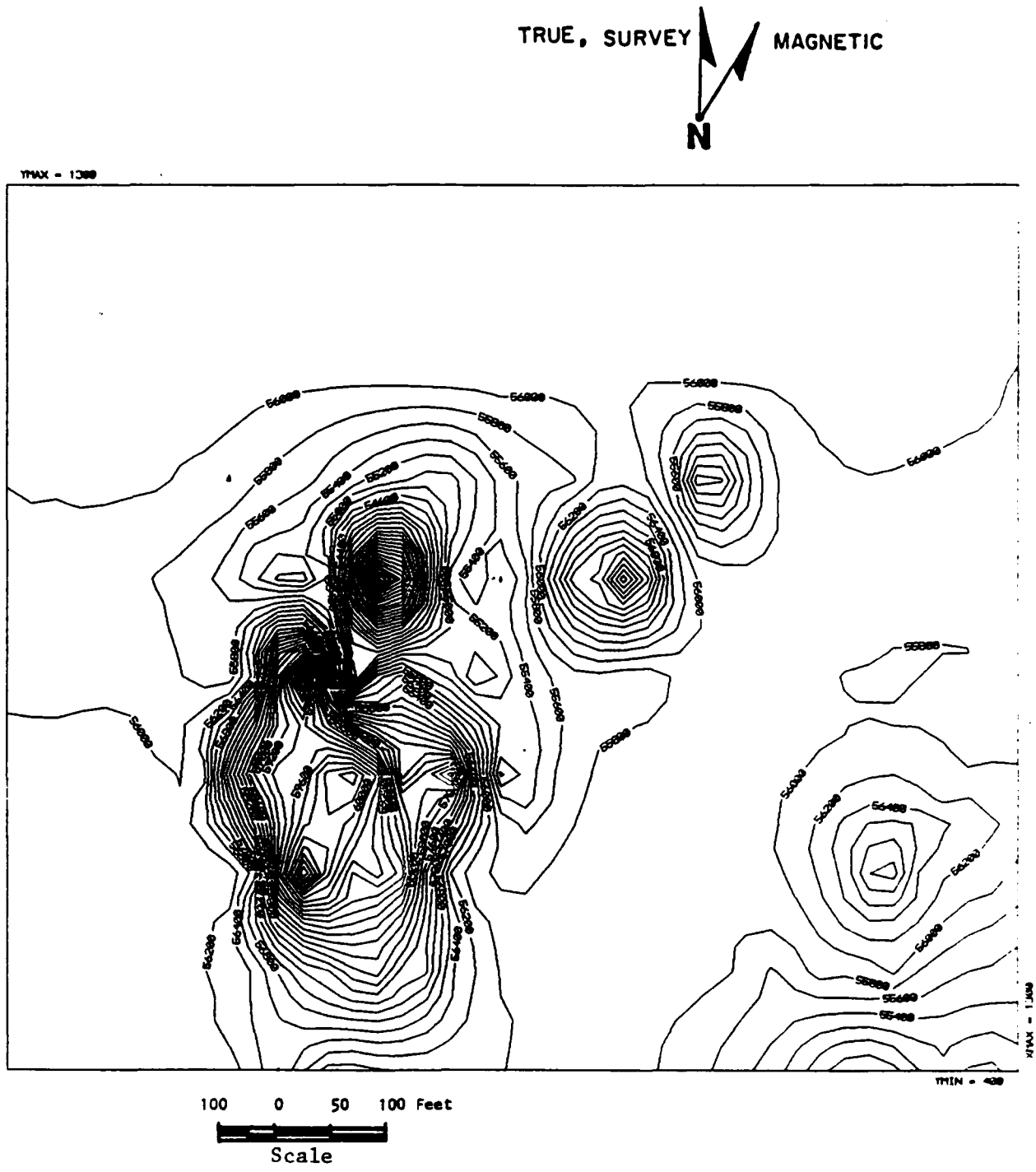


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NEGATIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (E1/3)

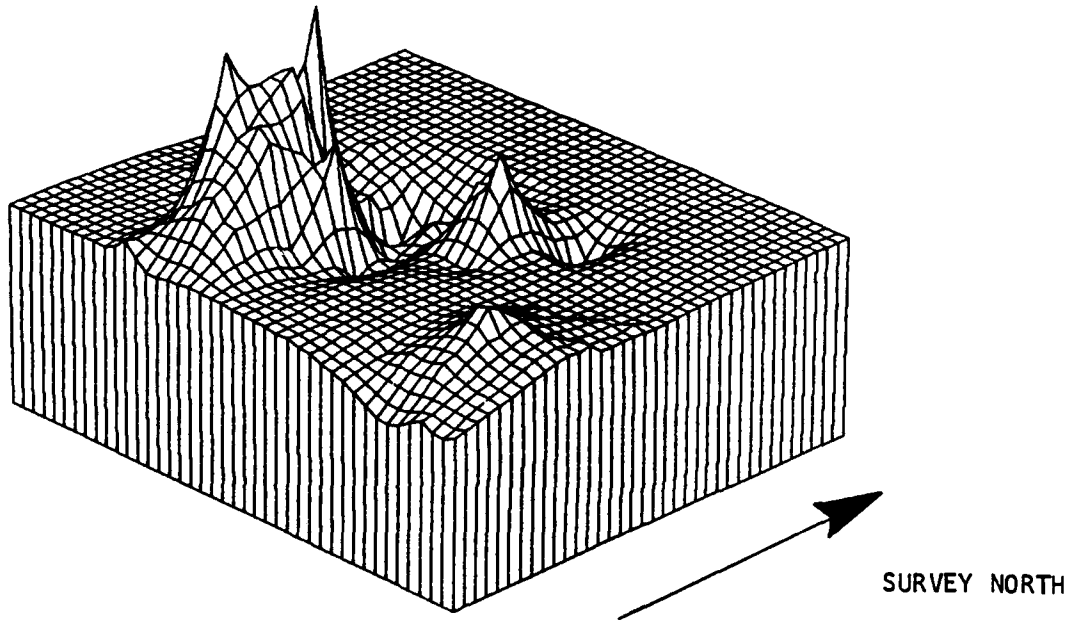


MAGNETOMETER SURVEY
READING STATIONS
SOUTH GRID (NW1/3)

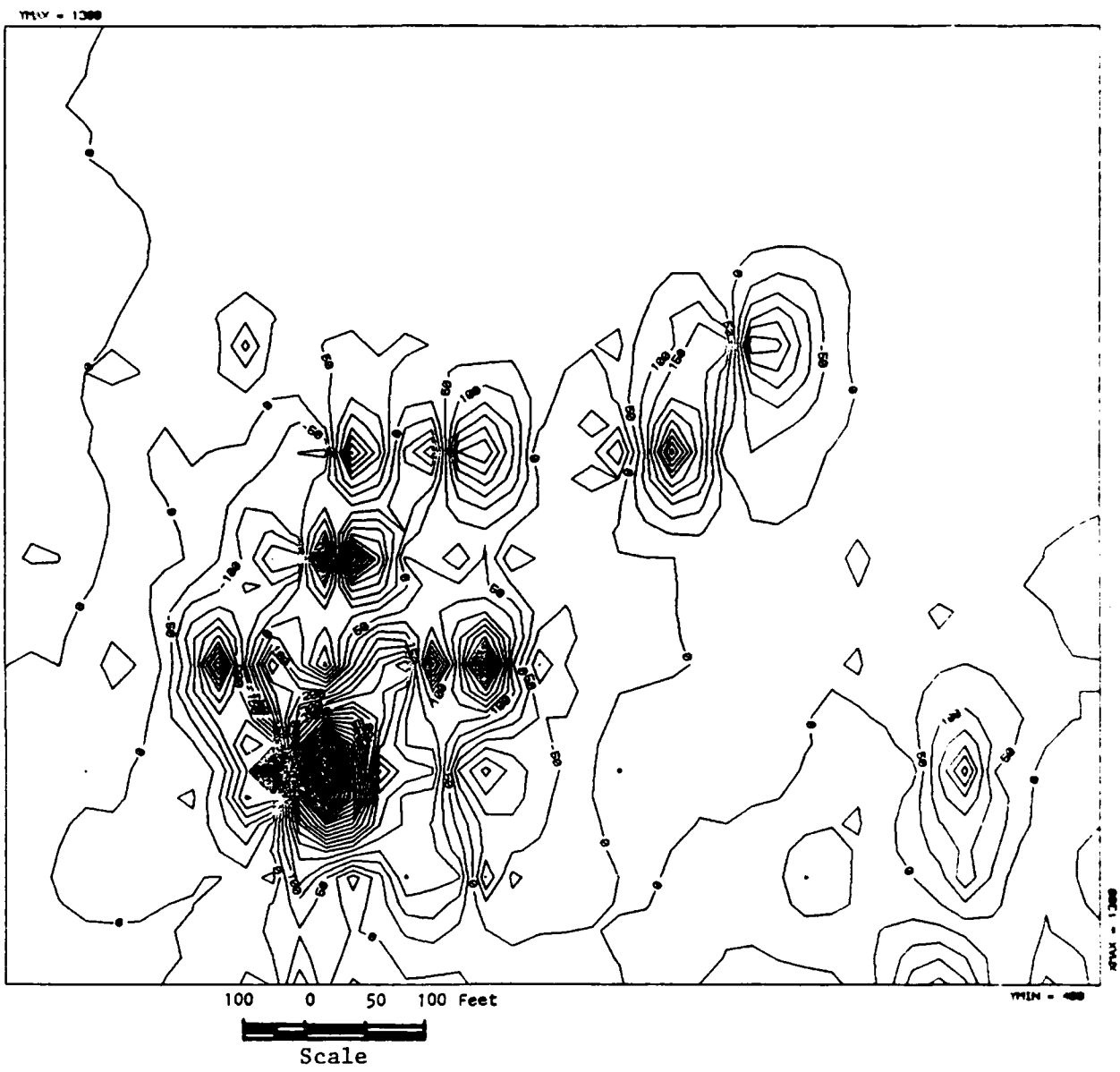


contour interval: 200 gammas

TOTAL MAGNETIC FIELD INTENSITY SOUTH GRID (NW1/3)

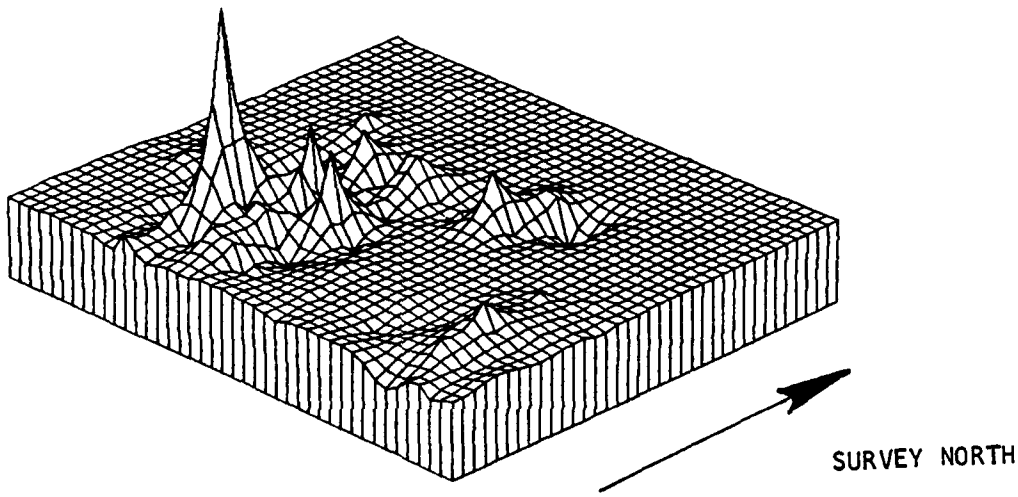


TOTAL MAGNETIC FIELD INTENSITY
SOUTH GRID (NW1/3)
(VIEWED FROM SOUTHEAST)

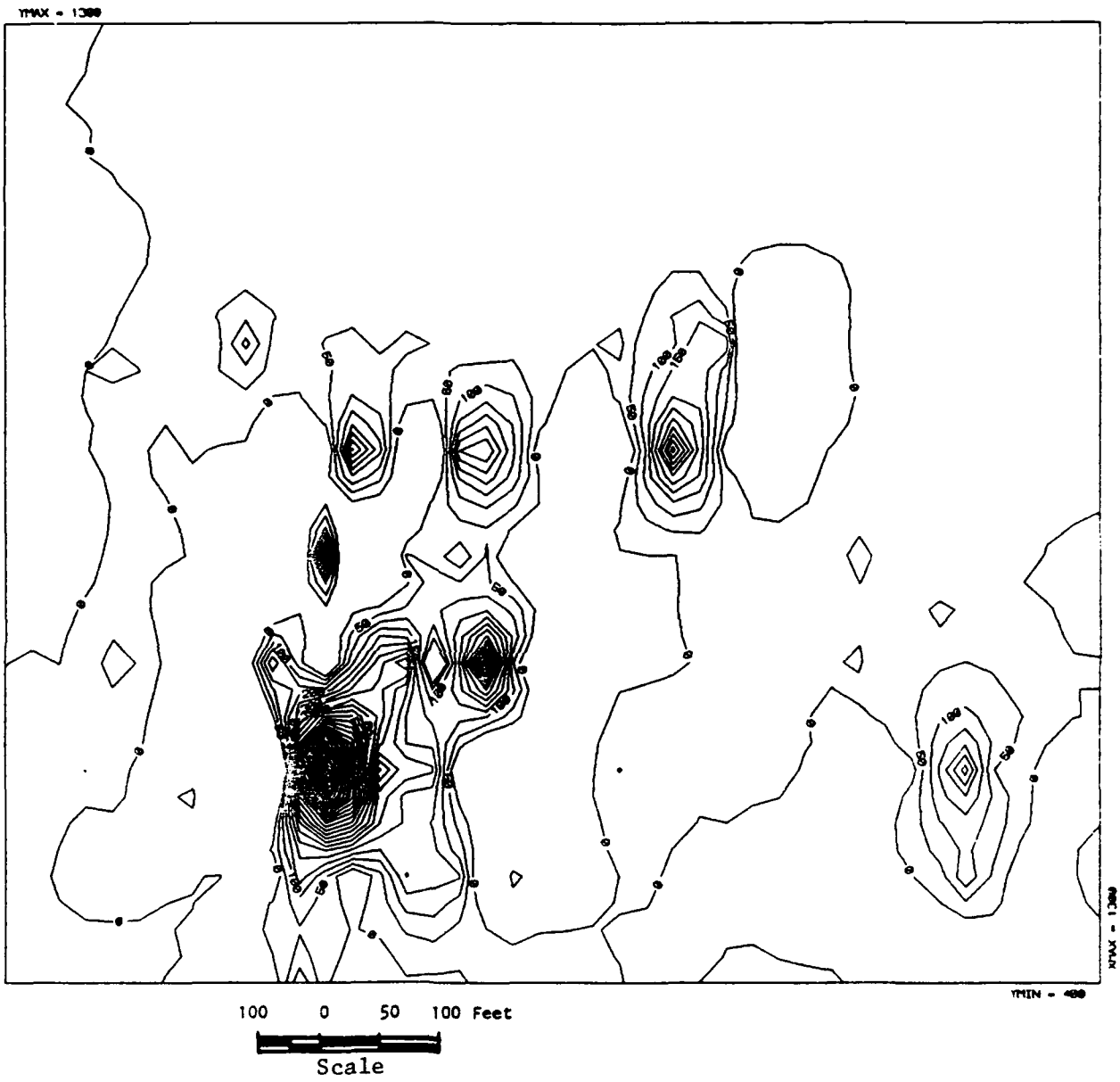


contour interval: 50 gammas

VERTICAL MAGNETIC GRADIENT SOUTH GRID (NW1/3)

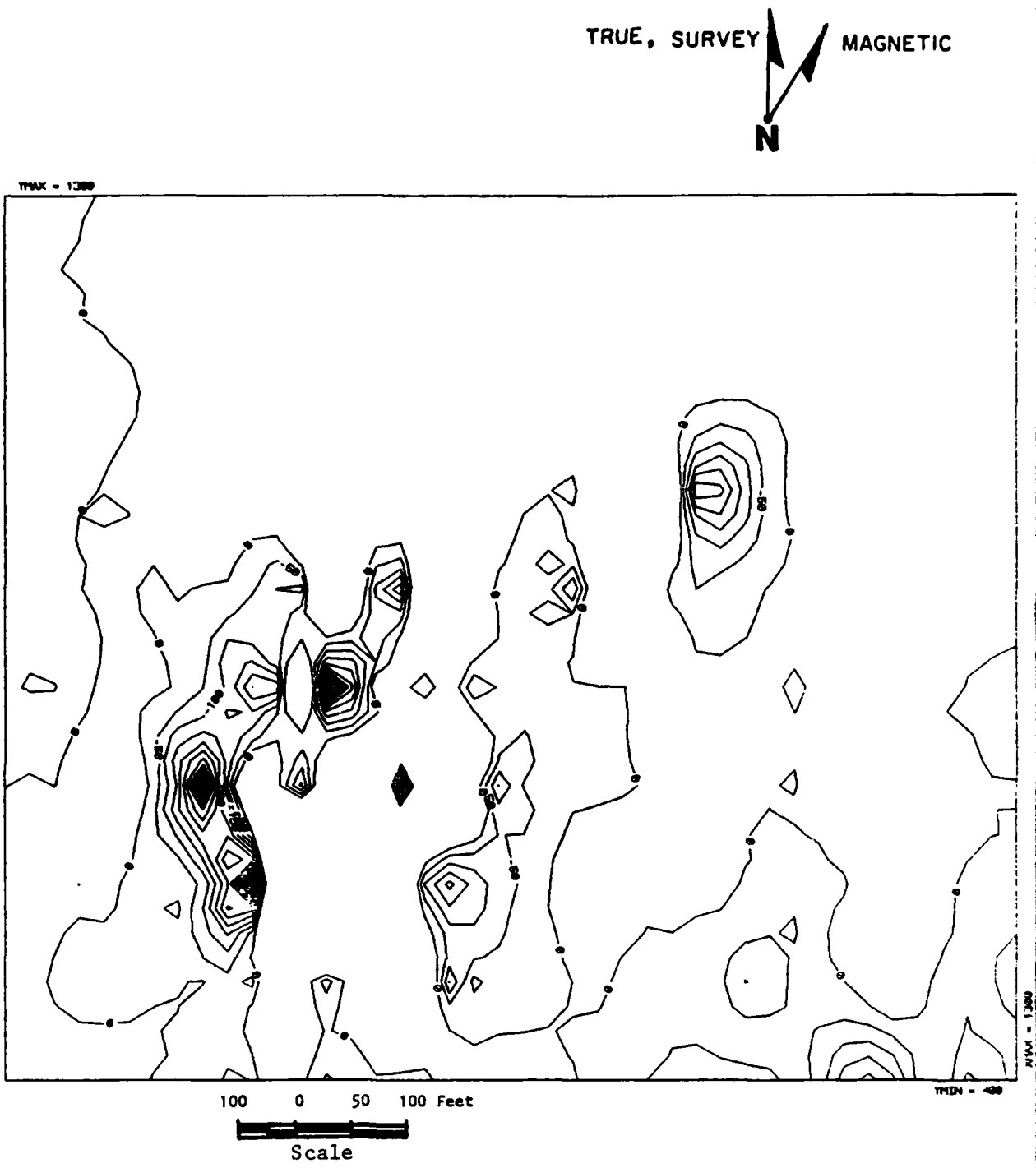


VERTICAL MAGNETIC GRADIENT
SOUTH GRID (NW 1/3)
(VIEWED FROM SOUTHEAST)



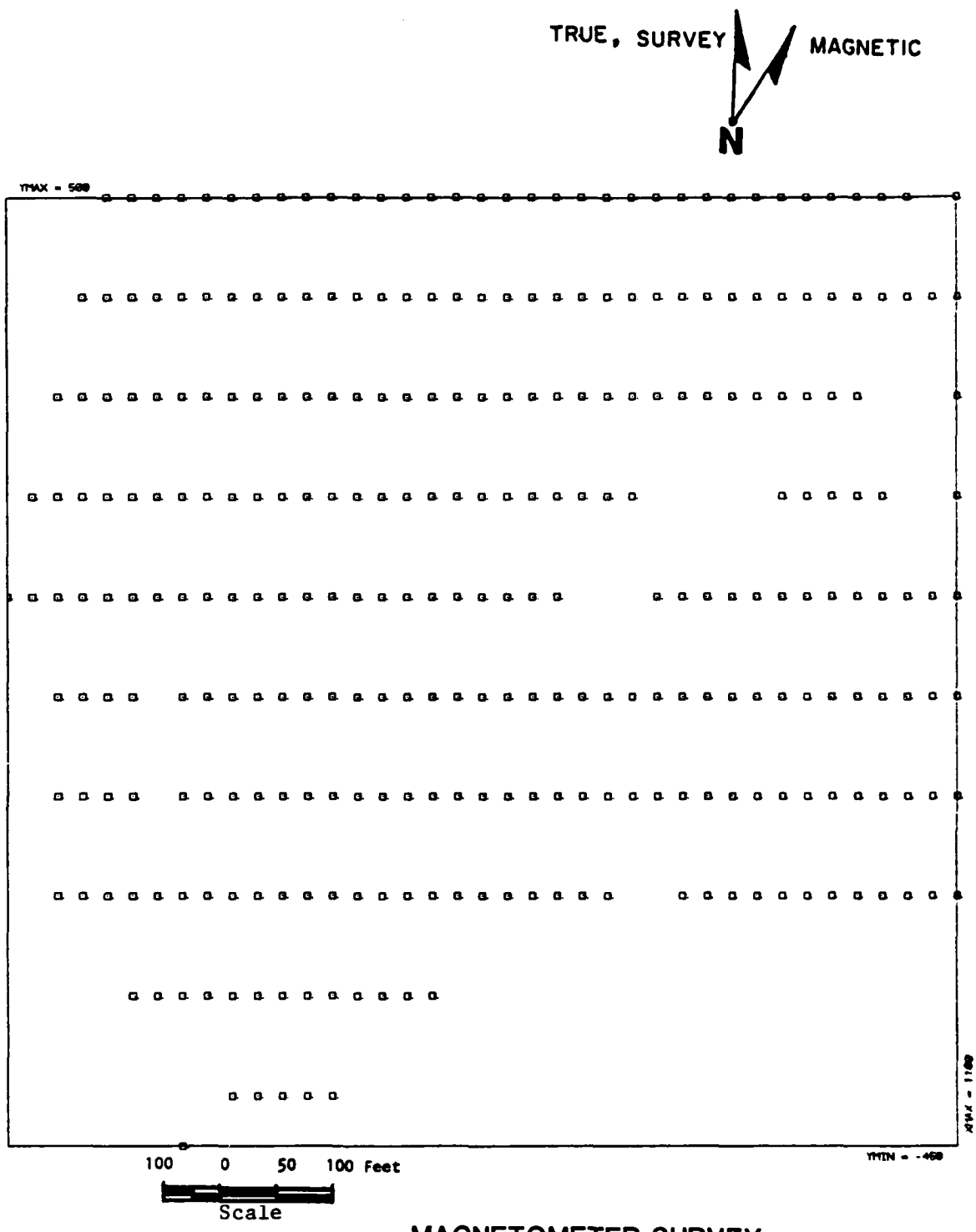
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POSITIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (NW1/3)

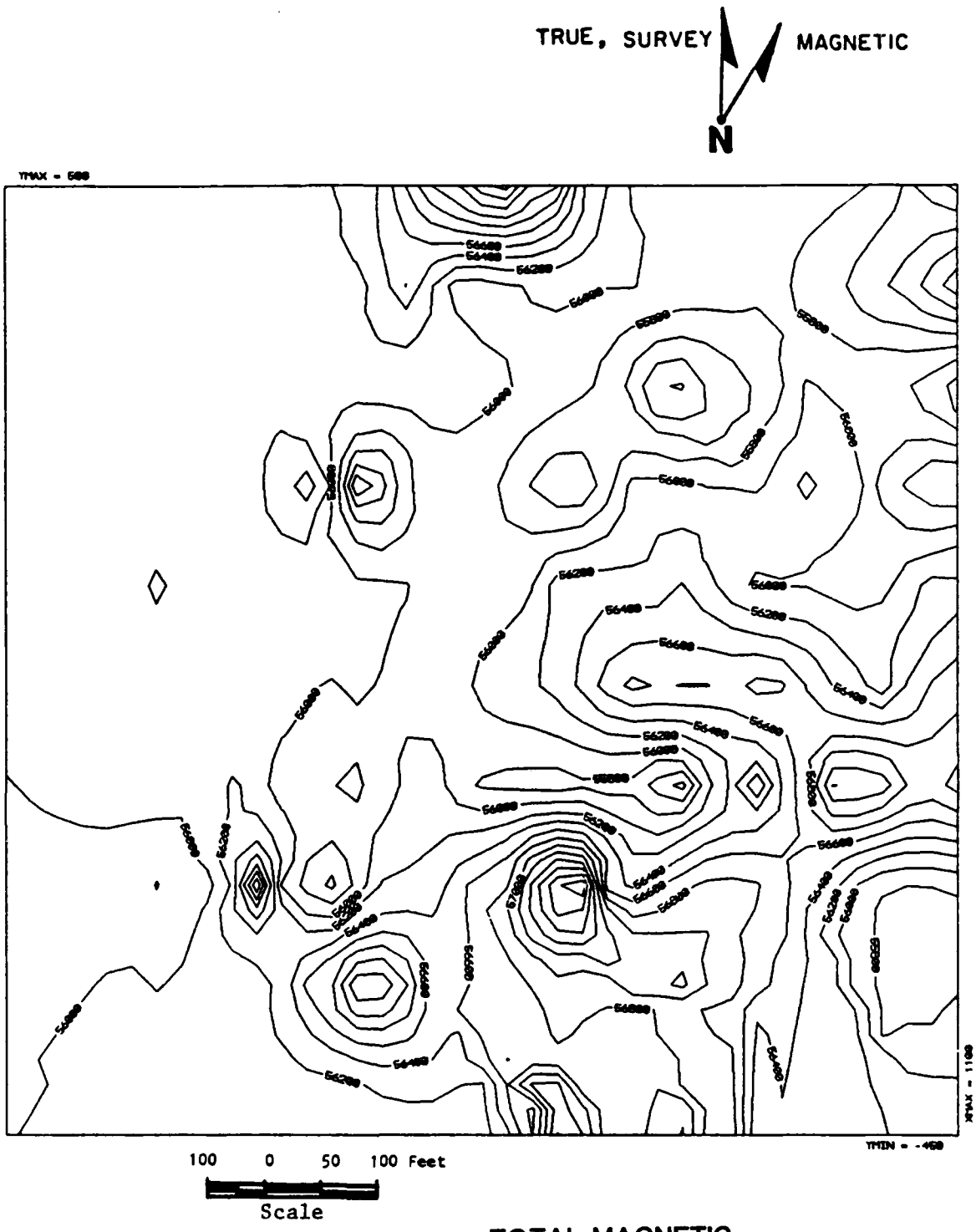


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NEGATIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (NW 1/3)

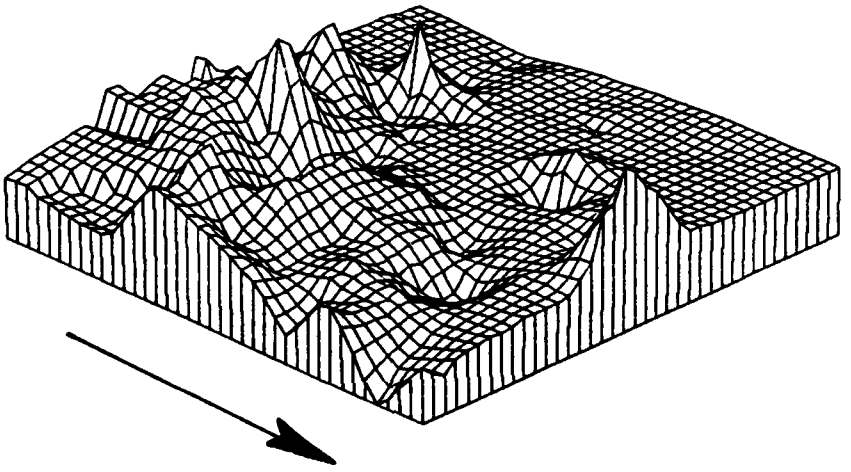


MAGNETOMETER SURVEY
READING STATIONS
SOUTH GRID (SW 1/3)



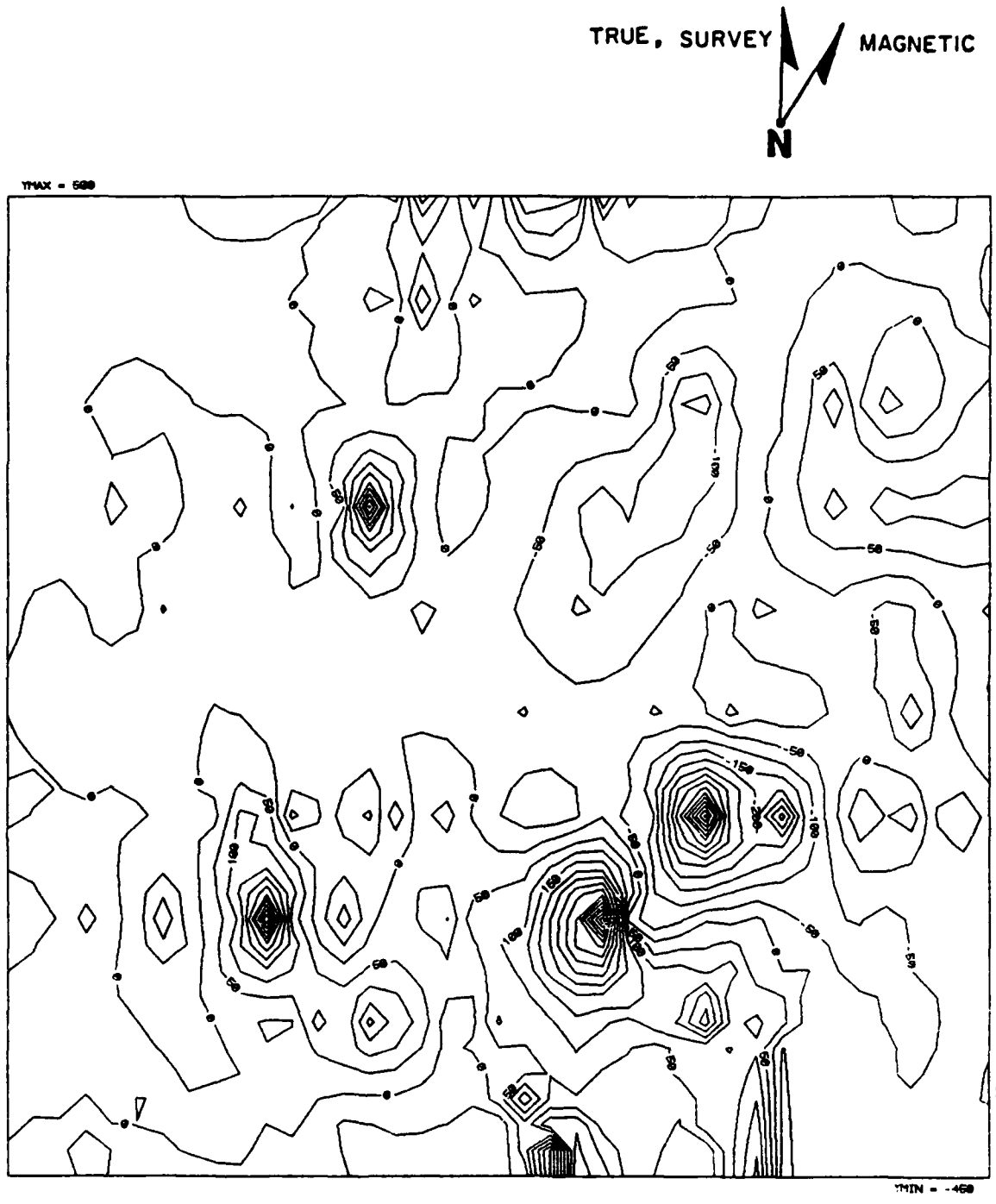
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TOTAL MAGNETIC FIELD INTENSITY SOUTH GRID (SW1/3)



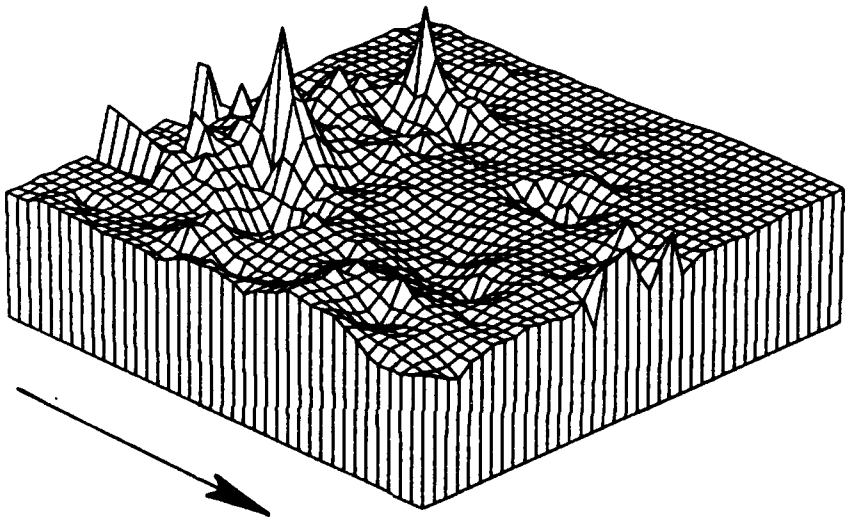
SURVEY NORTH

TOTAL MAGNETIC FIELD INTENSITY
SOUTH GRID (SW 1/3)
(VIEWED FROM NORTHEAST)



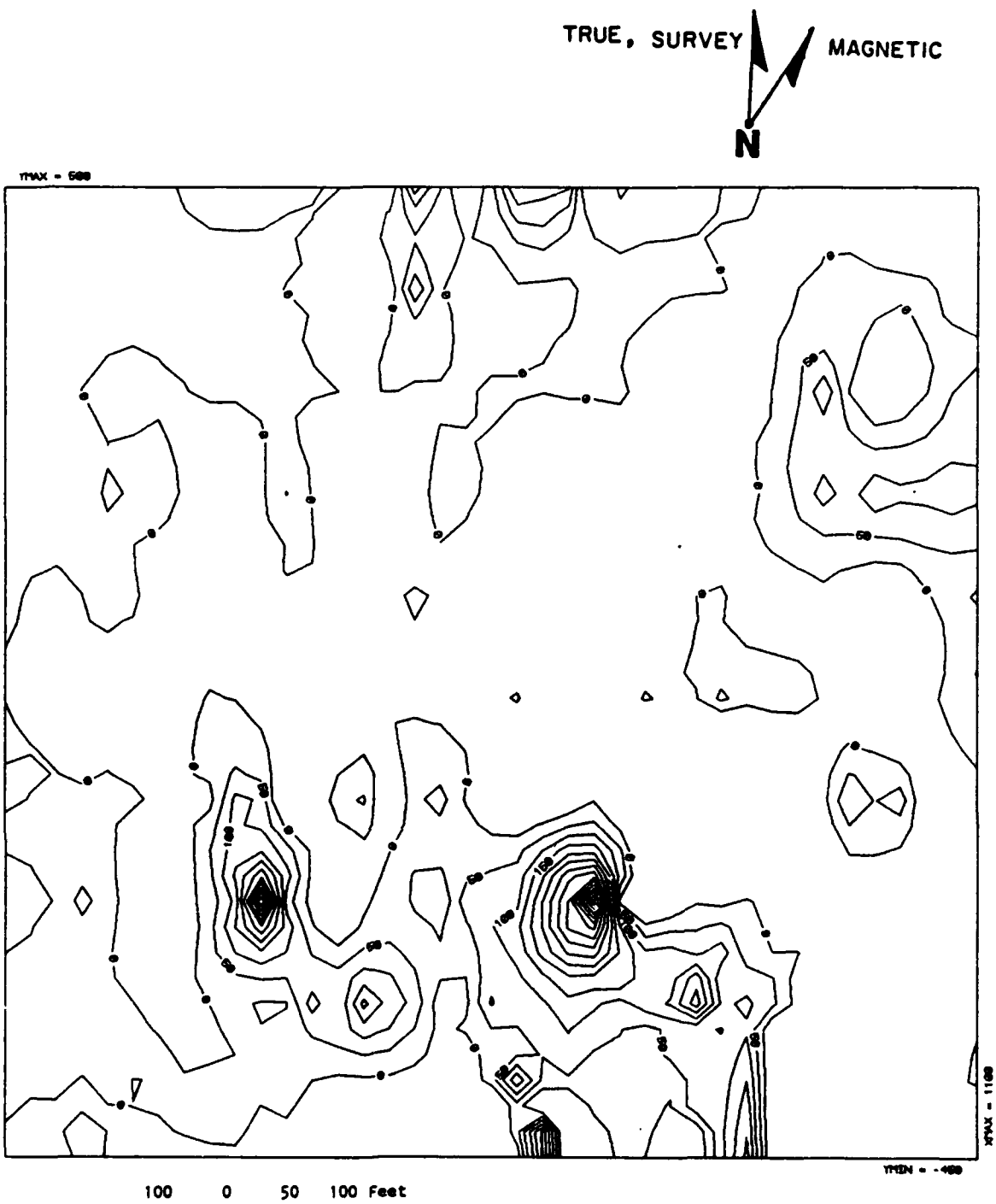
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VERTICAL MAGNETIC GRADIENT SOUTH GRID (SW1/3)



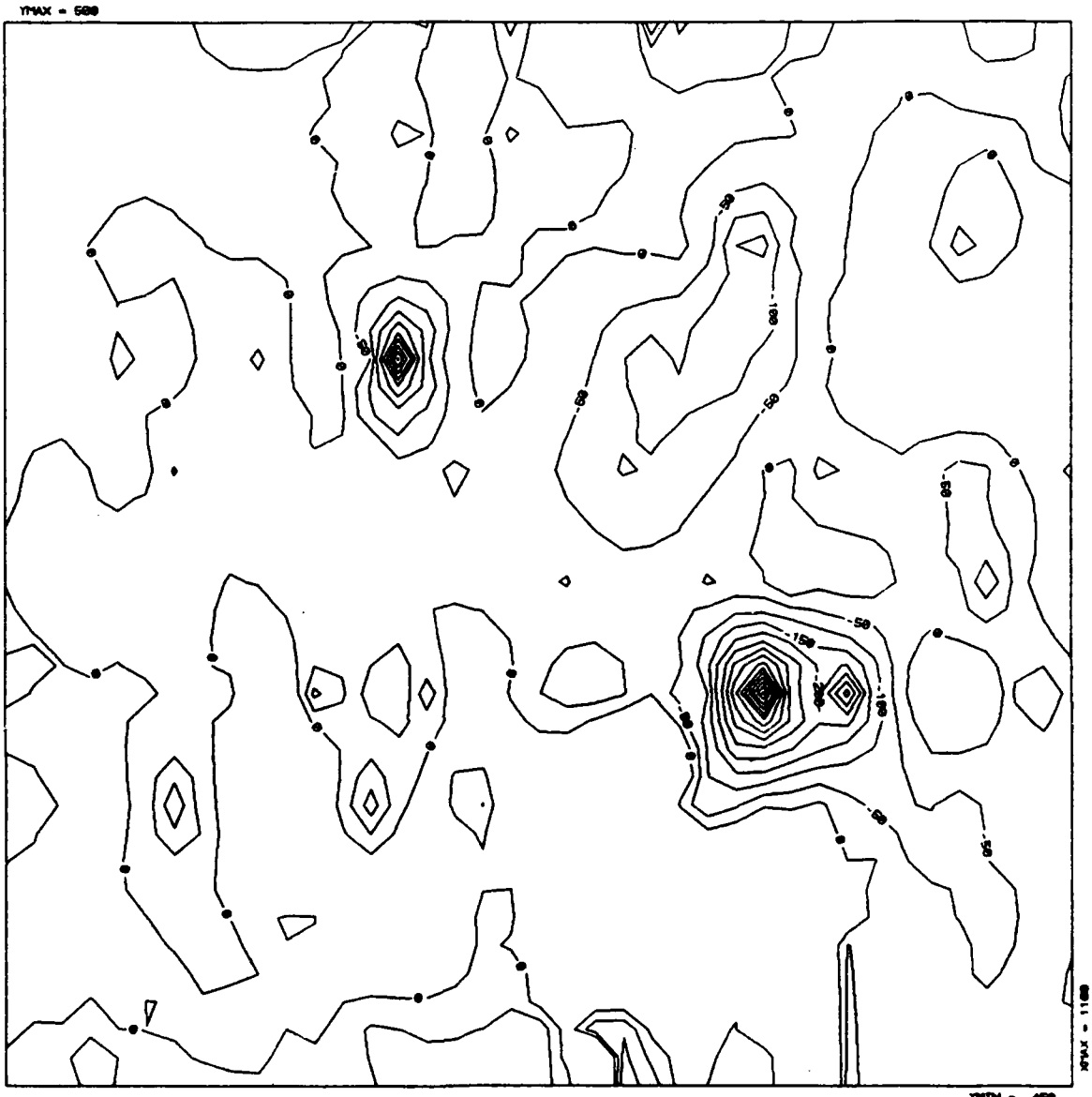
SURVEY NORTH

VERTICAL MAGNETIC GRADIENT
SOUTH GRID (SW1/3)
(VIEWED FROM NORTHEAST)



contour interval: 50 gammas

POSITIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (SW1/3)



contour interval: 50 gammas

NEGATIVE VERTICAL MAGNETIC GRADIENT VALUES SOUTH GRID (SW1/3)

APPENDIX L

DAMES & MOORE TECHNICAL OPERATIONS PLAN (TOP) AND HEALTH AND SAFETY PLAN

INSTALLATION RESTORATION PROGRAM

PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

TECHNICAL OPERATIONS PLAN
FOR

ELMENDORF AFB, ALASKA

ALASKA AIR COMMAND

JANUARY 27, 1987

PREPARED BY

DAMES & MOORE
1550 NORTHWEST HIGHWAY
PARK RIDGE, ILLINOIS 60068

CONTRACT NO. F33615-83-D-4002, Order 0036

OEHL TECHNICAL MONITOR: Dr. DeeAnn Sanders

PREPARED FOR

UNITED STATES AIR FORCE

OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (OEHL)

BROOKS AIR FORCE BASE, TEXAS 78235-5501

D&M Job No. 01016-265-007

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TECHNICAL OPERATIONS PLAN
INSTALLATION RESTORATION PROGRAM, PHASE II, STAGE 2
ELMENDORF AIR FORCE BASE, ALASKA

1.0 INTRODUCTION

This Technical Operations Plan (TOP) describes the methods and procedures that will be used to accomplish the objectives of the Phase II, Stage 2 field investigation of the United States Air Force (USAF) Installation Restoration Program (IRP) for Elmendorf Air Force Base (AFB), Alaska. The IRP is a nationwide effort intended to identify, evaluate the extent of, and mitigate environmental contamination potentially induced by the mobilization and migration of hazardous or toxic chemicals from past disposal or other handling practices at USAF facilities. On the basis of the findings of the Phase I study (Engineering-Science, 1983) and the Phase II, Stage 1 Problem Confirmation Study (Dames & Moore, 1986), the USAF Occupational and Environmental Health Laboratory (OEHL) retained Dames & Moore under Contract No. F33615-83-D-4002, Order No. 0036, to conduct a Phase II, Stage 2 study at Elmendorf AFB.

The Phase I and Phase II, Stage 1 reports were carefully reviewed, and their recommendations for the Phase II, Stage 2 program were considered.

1.1 PURPOSE AND SCOPE

The purpose of the TOP is to detail the methods and procedures that will be used to accomplish the tasks defined during the Stage 2 Investigation at Elmendorf AFB. Guidelines of the Occupational Health and Safety Administration (OSHA), United States Environmental Protection Agency (USEPA), and USAF, as well as previous investigations at Elmendorf AFB, were reviewed to select the methods that would be most appropriate for this investigation. The TOP is designed primarily to give guidance to personnel in the field and to ensure that standard methods of investigation are used. However, not all field problems can be anticipated, and the field personnel must exercise professional judgment when applying the guidelines.

The purpose of the Phase II Stage 2 investigation at Elmendorf AFB, as described in this TOP, is to conduct a field investigation, with subsequent laboratory analysis of collected samples, data interpretation and reporting, to accomplish the following objectives.

- Confirm the presence of suspected contamination within the specified areas of investigation;

- Determine the magnitude of contamination and the potential for migration of those contaminants in various environmental media;

- Identify public health and environmental hazards of migration pollutants based on State or Federal Standards for those contaminants; and

- Delineate additional investigations required beyond this stage to reach the Phase II objectives.

The Stage 2 effort at Elmendorf will involve the following additional investigations:

- Preparation of a base water table map;

- Sampling of base water supply well numbers 1, 2, 16, and 52;

- Surface water sampling of Ship Creek;

- A metal detector survey, ground water sampling, and installation of additional monitor wells at sites D-5 and D-7;

- A soil gas survey, ground water sampling and the installation of additional monitor wells at sites SP-12, SP-11, FT-1, SP-14, and SP-2;

- A soil gas survey and ground water sampling at sites SP-7, SP-10, and SP-5; and

- Additional surface and ground water sampling at Sites D-17 and IS-1.

The recommended program requires the installation of 11 additional ground water monitoring wells and 4 soil borings. Sampling for chemical constituent analysis will be conducted at the 11 new monitor wells, and 19 existing monitor wells (numbers W-1 through W-19), for the parameters listed in Table 1-1. In addition, a metal detector survey will be conducted at sites D-5 and D-7, to determine the boundaries of these sites, and a soil gas survey will be conducted at sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11 and SP-14, to determine the extent of fuel contamination.

TABLE 1-1

ANALYTICAL PROGRAM

PARAMETER	METHOD EXTRACTION/ ANALYSIS[a]	WATER SUPPLY WELLS	SHIP CREEK	SITE D-5	SITE SP-7	SITE SP-10	SITE D-7	SITE SP-5	SITE SP-12	SITE D-17	SITE SP-11
Purgeable Halocarbons	E601	4	3	5	--	--	5	--	--	4	2
Purgeable Aromatics	E602	4	3	5	1	1	5	2	2	--	2
Lead	E239.2 (or method of standard additions)[e]	4	3	--	--	--	--	--	--	--	2
Total Dissolved Solids (TDS)	E160.1	4	3	5	1	1	5	2	2	--	2
Pesticides	E608	--	--	5	--	--	5	--	--	--	--
Petroleum Hydrocarbons	E418.1	--	3	5	1	1	5	2	2	--	2
Major Cation and Anions	E200.7-ICP E403 IC Auto Analyzer	--	--	--	--	--	--	2	--	--	--

TABLE 1-1 (Cont'd)

ANALYTICAL PROGRAM

PARAMETER	METHOD EXTRACTION/ ANALYSIS	SITE FT-1	SITE SP-2	SITE SP-14	SITE IS-1	No. of SAMPLES	QUALITY CONTROL[b]	TOTAL SAMPLES
Purgeable Halocarbons	E601	--	--	--	3*	27[c]	2	43[d]
Purgeable Aromatics	E602	2	2	2	--	32[c]	3	52[d]
Lead	E239.2 (or method of standard additions)[e]	--	--	--	--	10[c]	2	12
Total Dissolved Solids (TDS)	E160.1	2	2	2	--	31	3	34
Pesticides	E608	--	--	--	--	11[c]	2	18[d]
Petroleum Hydrocarbons	E418.1	2	2	2	--	28[c]	3	31
Major Cation and Anions	E200.7-ICP E403 IC Auto Analyzer	--	--	--	--	2	0	2
Bentonite, drilling fluid additive		--	--	--	--	3	0	3

TABLE 1-1 (Cont'd)

ANALYTICAL PROGRAM

* Includes sample from Cherry Hill Ditch

Bentonite, (drilling fluid additive) Modified EP Toxicity Extraction

[a] The methods cited in the analysis protocols come from the following sources: E100 through E500 Methods - "Methods for Chemical Analysis of Water and Wastes", EPA Manual 600/4-79-020 (USEPA, 1983). E600 Series Methods - "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 49 FR 209 (1984). SW Methods - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," USEPA, SW-846, 2nd Edition, 1984.

[b] QC field samples include duplicates, trip blanks and rinse (field) blanks.

[c] Includes one additional sample for analysis for drilling fluid additive as specified in SOW pg 2. C.1.f.

[d] Total number of samples include second-column confirmation on 50% of samples (to include field QC samples).

[e] If a matrix effect is encountered, the Method of Standard Additions will be employed.

1.2 INSTALLATION DESCRIPTION AND HISTORY

1.2.1 Brief History of Elmendorf AFB and Waste Disposal Operations

The initial construction of Elmendorf Air Force Base, then known as Elmendorf Field, began in June 1940. It was formally designated as Fort Richardson in November 1940, and was under the jurisdiction of the U.S. Army until March 1951. At that time, the U.S. Air Force assumed control of the original Fort Richardson facilities, which were renamed Elmendorf AFB.

The first Air Force unit arrived in February 1941, and other units rapidly were deployed there during World War II. Presently, the host organization on Elmendorf AFB is the 21st Tactical Fighter Wing, the largest organization within the Alaska Air Command. Numerous other organizations are also tenants on the base.

Prior to 1981, wastes generated at Elmendorf AFB were handled in several manners. During the 1940s through the early 1960s, used oils, fuels and solvents were drained into storm and sanitary sewers or to floor drains that discharged directly to dry wells beneath or adjacent to the respective facilities. Some were discharged to surface drainage ditches. Some combustible chemicals were burned for fire training, and waste oils were occasionally spread on roads for dust control. From the mid-1960s to the early 1980s, the wastes generated at Elmendorf AFB industrial facilities were generally stored in centralized storage tanks. Small amounts of wastes were still discharged as noted above. Since mid-1981, all waste chemicals have been temporarily stored at a hazardous waste storage area. The Defense Property Disposal Office (DPDO), located on Elmendorf AFB north of Site D-5, arranges for disposal of the wastes. Only minor amounts of wastes, primarily from small spills, still enter the floor drains of various shop facilities (Engineering-Science, 1983).

1.2.2 Physical Geography

Elmendorf Air Force Base is located in the Greater Anchorage Area Borough, Alaska, and borders the City of Anchorage to the south and Fort Richardson, an Army post, to the east. Land surface elevations range from sea level along the shore of Knik Arm of Cook Inlet to about 380 feet MSL on the crest of the Elmendorf Moraine near Bldg. 42-500.

Elmendorf AFB is located at the junction of Knik and Turnagain Arms of Cook Inlet, a glacial trough. Elmendorf AFB, Fort Richardson, and the City of Anchorage are all located on a lowland that rises from sea level to about 1,000 feet at the front of the Chugach Mountains. The Chugach Range

of Anchorage are all located on a lowland that rises about 1,000 feet at the front of the Chugach Mountains. The Chugach Range

alluvial fan, is characterized by areas of ground moraine, drumlin fields, eskers, and outwash plains. A major glacial feature, the Elmendorf Moraine, extends east-west across the base. Broad alluvial channels are also present at several locations on the lowland. Regional drainage is from the bordering mountains across the lowland surface via streams to Cook Inlet.

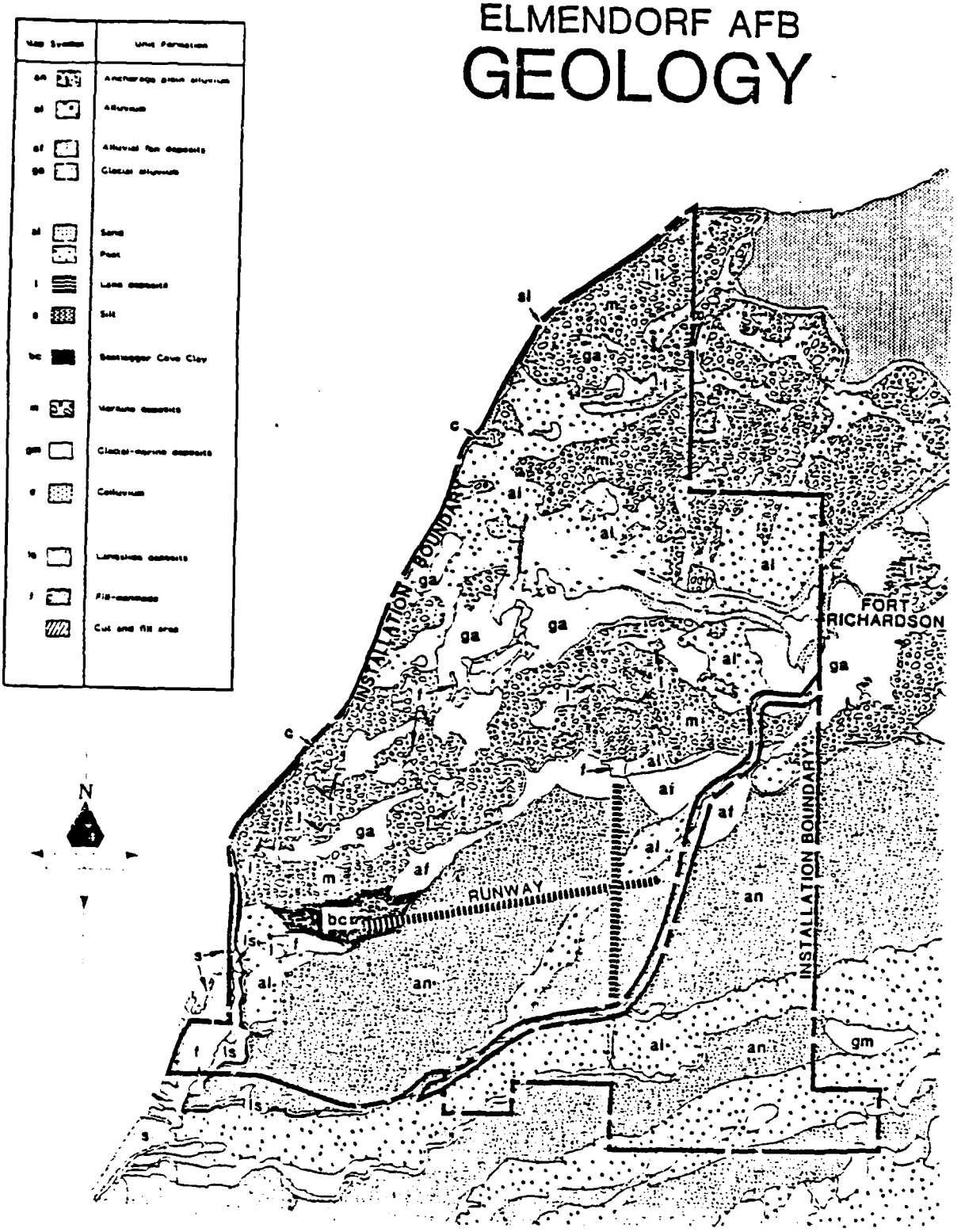
The average annual precipitation at the base is 15.5 inches with the majority of the rainfall confined to the months of June through January. The average snowfall is 68 inches, primarily confined to November through March. The mean monthly temperatures range from a low of 11°F in January to a high of 58°F in July (Engineering-Science, 1983).

1.2.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The Anchorage Plain is a large alluvial fan on the east shore of a wide estuarine basin whose prominent margins are formed by the Kenai, Chugach, Talkeetna, Tordrillo, and Chigmit Mountains. Regional bedrock is exposed east of the study area along the Chugach Mountain flanks. The bedrock there is principally undifferentiated Mesozoic age metamorphic material, including slate, sandstone, and miscellaneous volcanic rock. Tertiary sedimentary rocks of the Kenai Group have been encountered in deep wells penetrating the unconsolidated sediments of the Anchorage Lowland. This consolidated unit unconformably overlies the Mesozoic metamorphics and consists of siltstone, coal, sandstone, and conglomerate. The Tertiary sequence forms a bedrock surface that apparently slopes abruptly away from its exposure in the Chugach Foothills toward Knik Arm. The steep slope of the surface may be related to the Border Ranges Fault, which has a north-south alignment, just east of the area at the base of the Chugach Mountains.

On the Anchorage Plain, the consolidated geologic deposits are overlain by substantial accumulations of unconsolidated material, primarily glacial drift and marine deposits, that was deposited during several glacial episodes in Pleistocene time (Péwé, 1975). A well drilled near Elmendorf AFB Bldg. 22-001 encountered 764 feet of unconsolidated material over bedrock. A map of the distribution of the surficial sediments at Elmendorf AFB is provided as Plate 1. Generally, the surficial geology of the area is dominated by two types of unconsolidated deposits: (1) coarse-grained, fairly well sorted stream and delta deposits in the southern (flatlands) portion of the base comprising relatively clean sands and gravels associated with stream channel development or glacial outwash; and (2) fine-grained, poorly sorted glacial materials in the northern

ELMENDORF AFB
GEOLOGY



SOURCE: SCHMOLL AND DOBROVOLNY (1972)

SCALE 0 400 FEET

SURFICIAL GEOLOGY OF
ELMENDORF AIR FORCE BASE AREA

Dames & Moore

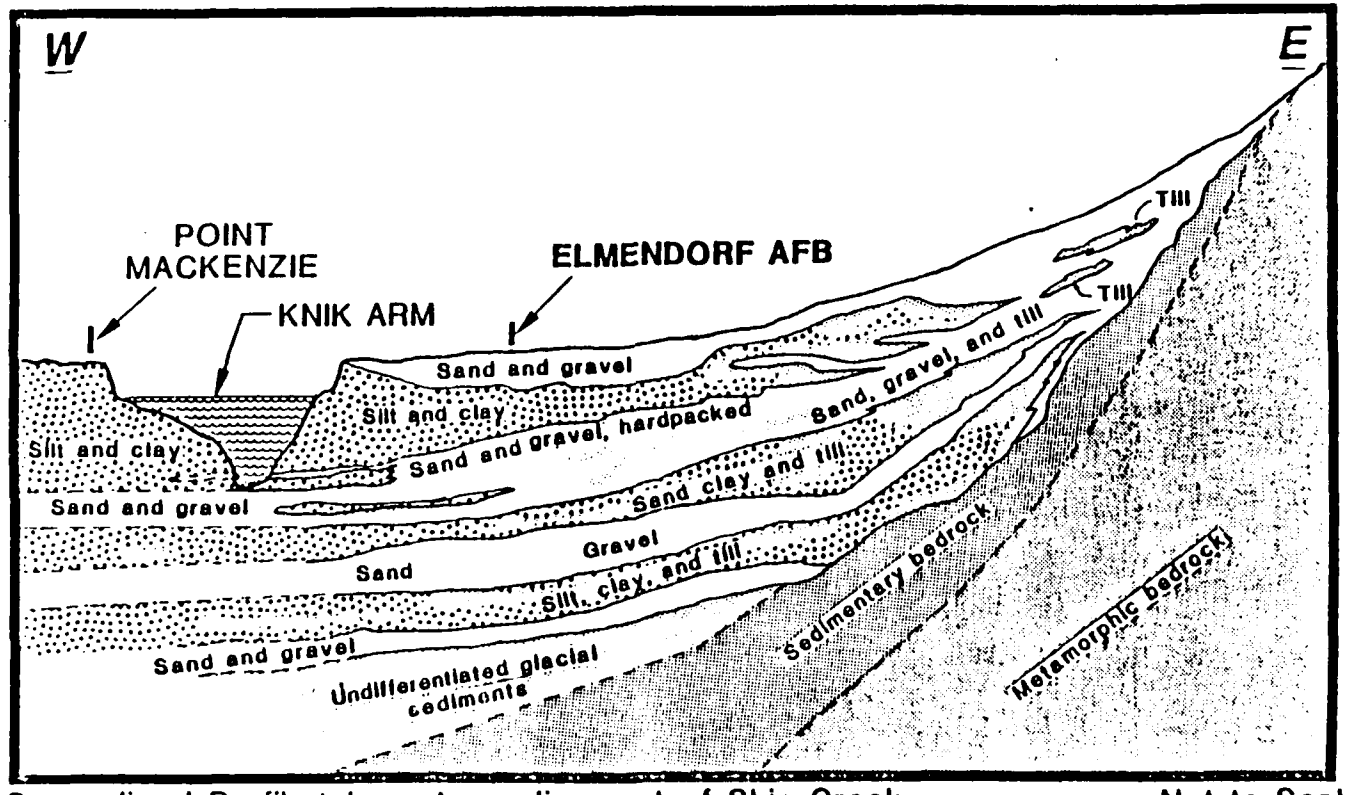
PLATE 1

(uplands) portion of the base that are heterogeneous mixtures of boulders, cobbles, gravel, sand, silt, and clay in hilly morainal topography. The contacts shown on the map are approximate. The total thickness of unconsolidated materials is estimated to be approximately 800 feet in the areas investigated (Engineering-Science, 1983).

A generalized geologic section along Ship Creek is provided on Plate 2. The sand, gravel, and till deposits shown are known to be discontinuous and to grade into one another both horizontally and vertically (Péwé, 1975; Engineering-Science, 1983). Sand units, in particular, are very difficult to correlate, even over short distances. Buried sand lenses may intersect one another, may pinch out, or may be imperfectly separated by intervening tills.

Two aquifers occur in the unconsolidated units underlying the Anchorage Plain: a shallow aquifer comprised of four units and an artesian aquifer made up of three units. The near-surface silt and clay unit shown on Plate 2 is the marine Bootlegger Cove Clay, which forms the lower limit of the shallow surface aquifer and the confining layer of the deeper artesian aquifer. Water, originating as precipitation, snowmelt, or leakage through stream beds, recharges both aquifers, primarily along the Chugach Mountain front. Water in the aquifers moves downslope under the influence of gravity until it discharges to area streams or Cook Inlet or is withdrawn by wells. Because the clay unit forms a ground water dam where it is exposed along the coastline, the unconfined aquifer does not discharge to Cook Inlet except through Ship Creek (Weeks, 1970). The shallow aquifer lies from 0 to 50 feet below the ground surface and is expected to yield from nil to 1,500 gallons per minute (gpm). The average hydraulic gradient of this aquifer is estimated to be 20 feet per mile. The artesian aquifer lies approximately 100 feet below the ground surface and is expected to yield from 5 to 1,500 gpm. The average hydraulic gradient of the artesian aquifer is estimated to be 25 feet per mile (Engineering-Science, 1983). The piezometric head of the artesian aquifer is variable but, due to deep ground water extraction, generally lies below the bottom of the shallow aquifer (Nelson, 1982).

The relationship between Ship Creek and the shallow aquifer is complex. In the upper reach of the stream, from the Chugach Mountains to about the Davis Highway, the stream loses water to the ground water. The lower reach of the stream, from Davis Highway to Cook Inlet, gains from the water table. Where Ship Creek is entrenched in the Bootlegger Cove Clay, ground water is directed to the stream first, rather than to Knik Arm, resulting in increased flow in Ship Creek and in a complex ground water flow system (Engineering-Science, 1983).



Generalized Profile taken along alignment of Ship Creek — Not to Scale

GENERALIZED GEOLOGIC CROSS-SECTION ALONG SHIP CREEK
ELMENDORF AFB, ALASKA

SOURCE; MODIFIED FROM FREETHY AND SCULLY, 1980

Dames & Moore

PLATE 2

1.2.4 General Hydrogeology

The two aquifers recognized below the Anchorage plain underlie Elmendorf AFB. The base receives most of its water supplies from Ship Creek via a diversion structure on Fort Richardson, but makeup supplies are obtained as needed from standby wells, which generally extend into the artesian aquifer. The Municipality of Anchorage also acquires most of its water supply from the diversion structure and deep wells.

1.2.4.1 Shallow Ground Water System at Elmendorf AFB

The hydrogeologic units of the shallow ground water system include alluvial fan, alluvial and outwash deposits, morainal (till) deposits, and tidal deposits occurring at or near the ground surface. The average hydraulic gradient of the shallow aquifer is calculated to be approximately 20 feet per mile (Engineering-Science, 1983 and Dames & Moore, 1986). Water levels north of the south edge of the Elmendorf Moraine are not well understood because of a lack of information in that area. Due to topographic controls, the depth to the water table below the ground surface varies from zero to as much as 50 to 60 feet. Utilization of the shallow aquifer units as a source of potable water has been limited because of contamination problems. The primary threat to the shallow ground water system is from on-site sewage treatment and disposal systems discharging effluent to the permeable surficial soils. Other major sources of contamination are sanitary landfills (Engineering-Science, 1983).

Estimates of vertical permeabilities of two confining units between the shallow ground water aquifer and the underlying confined (artesian) aquifers are 1×10^{-2} and 2×10^{-4} feet per day (Nelson, 1982). Further, the hydraulic pressure within the artesian unit will tend to force water from the unit vertically through the confining layer and, in effect, minimize or eliminate infiltration into the artesian system. Therefore, it can be expected that petroleum products will migrate to the more permeable shallow ground water system and then move laterally out of the system to Ship Creek or other surface water bodies (Engineering-Science, 1983). It appears, therefore, that the deep artesian aquifer is not in significant danger of contamination in the near future, but the shallow aquifer has been contaminated in the past and is vulnerable to contamination in the future.

1.2.4.2 Deep Artesian Ground Water System Under Elmendorf AFB

The hydrogeologic units of the deep artesian ground water system include sand and gravel outwash deposits, alluvial sands, and mixed till

deposits. These units are typically overlain by substantial thicknesses of confining materials such as the Bootlegger Cove Clay. The major characteristics of the deposits have been summarized (Engineering-Science, 1983 and Dames & Moore, 1986). Most of the municipal water system wells are installed in the outwash unit of the Artesian aquifer. Potentiometric surface contours for 1969 within the artesian system in the general area were reported previously (Dames & Moore, 1986) and showed the effects of ground water extraction from wells in the area near Ship Creek. The artesian system hydraulic gradient has been interpolated to be 25 feet per mile at the base, and the water quality of the aquifer reported to be good (Engineering-Science, 1983).

1.2.5 Locations of Wells On and Off Base

Elmendorf AFB derives its water supply from the Ship Creek reservoir on Fort Richardson and from supplementary wells on the base. Some remote facilities not connected to the central utilities system have individual wells. There are 21 active and 23 inactive or abandoned wells on the base. Five municipal wells are located near the base, of which three are inactive. No records are available of the locations of small-diameter, low-yield wells that may be near the base. The locations of the wells on and off base are shown on Plate 3. Information about these wells is listed in Table 2 (Engineering-Science, 1983).

1.2.6 Historic Ground Water Problems

1.2.6.1 Shallow Aquifer

Utilization of the shallow aquifer as a source of drinking water has been limited because of contamination problems. The primary threat to this coarse-grained, shallow aquifer is from septic systems serving single-family dwellings, but other incidents of contamination have been reported. An infiltration gallery located at Ship Creek within the Anchorage city limits was abandoned when it became contaminated with kerosene, and leachate contamination has been reported at the Merrill Field municipal landfill south of Elmendorf AFB (Engineering-Science, 1983).

The only study to date that has found ground water contamination under Elmendorf AFB that probably originated from on-base activities is an as-yet incomplete study of the deicing drum storage area for a proposed hazardous waste storage facility. The priority pollutant 1,1-dichloroethane has contaminated ground water at that site (Donohue, 1984). A study of the abandoned base landfill near Ship Creek failed to detect contamination at that site (Engineering-Science, 1983).

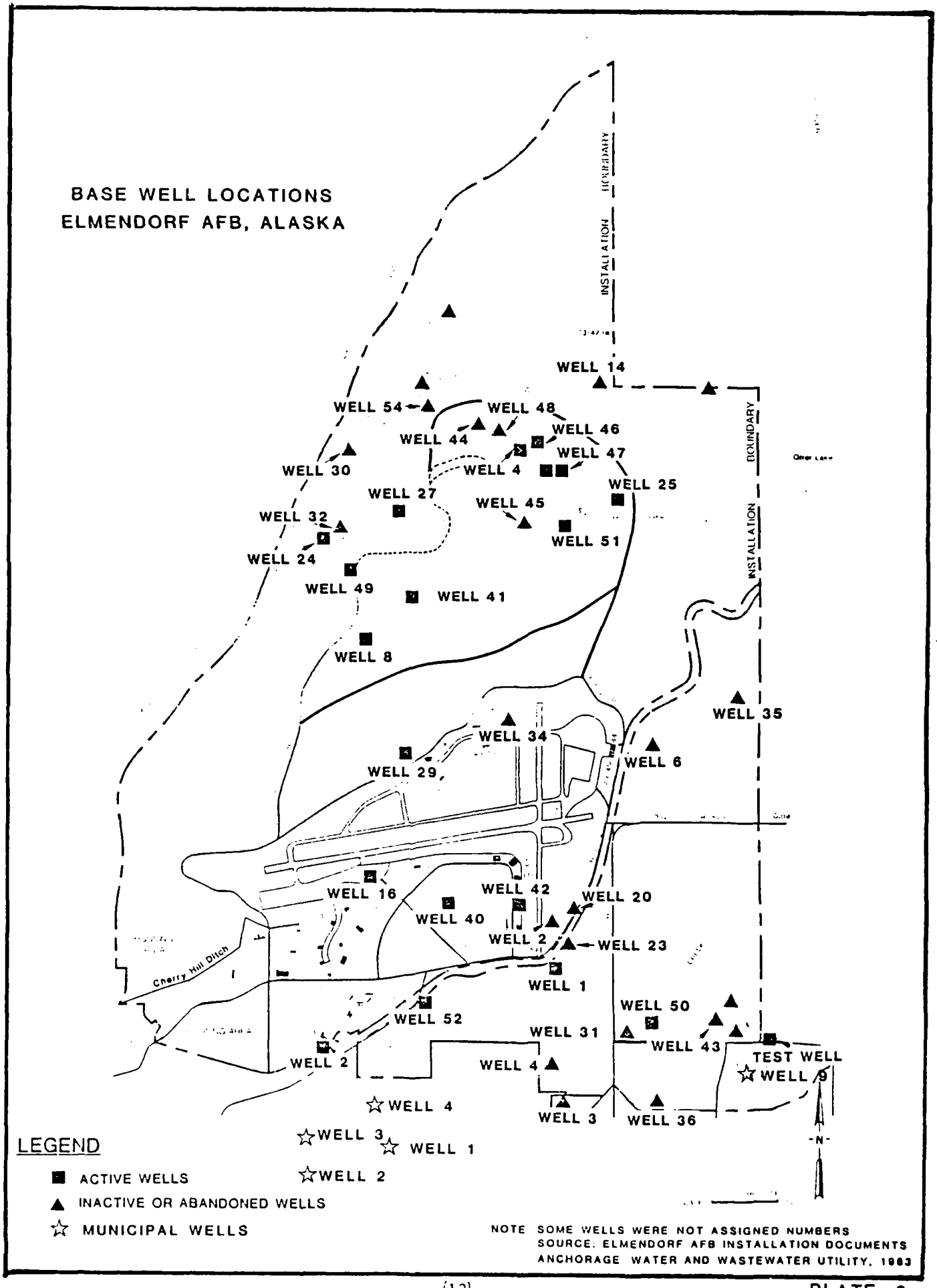

BASE WELL LOCATIONS
ELMENDORF AFB, ALASKA
INSTALLATION BOUNDARY
INSTALLATION BOUNDARY
WELL 14
WELL 54
WELL 48
WELL 46
WELL 44
WELL 47
WELL 30
WELL 4
WELL 25
WELL 27
WELL 45
WELL 32
WELL 51
WELL 24
WELL 49
WELL 41
WELL 8
WELL 35
WELL 34
WELL 6
WELL 29
WELL 16
WELL 42
WELL 20
WELL 40
WELL 2
WELL 23
Cherry Hill Ditch
WELL 1
WELL 50
WELL 52
WELL 31
WELL 43
TEST WELL
WELL 2
WELL 4
WELL 9
WELL 4
WELL 3
WELL 36
WELL 3
WELL 1
WELL 2
LEGEND
ACTIVE WELLS
INACTIVE OR ABANDONED WELLS
MUNICIPAL WELLS
-N-
NOTE SOME WELLS WERE NOT ASSIGNED NUMBERS
SOURCE: ELMENDORF AFB INSTALLATION DOCUMENTS
ANCHORAGE WATER AND WASTEWATER UTILITY, 1983

PLATE 3

TABLE 2

WELLS AT ELMENDORF AFB

WELL	BUILDING	DEPTH (ft)	AQUIFER*	YIELD (gpm)	CONDITION	LOCATION
1	23-990	16.	S	1350	in use	South of North-South Runway
2	22-001	850.	A	840	in use	South of West Power Plant
4	65-600	78.	S	7	in use	Returnagain Six Mile Lake
8	52-140	252.	A	12	in use	EMS Office Loop Road
16	32-189	228.	A	95	in use	Standby Diesel Plant
24	52-668	38.	S	8	in use	Generals Cabin Green Lake
25	63-320	155.	A	9	in use	Underground Six Mile Lake
27	62-250	210.	A	12	in use	Receiver Site
29	42-500	406.	A	40	in use	C.A.P.
39	35-750	141.	A	115	in use	Transmitter Ft. Richardson
40	5-800	209.	A	228	in use	AAC 5-800
41	52-820	56.	S	12	in use	Hillberg Lake Ski Bowl
42	11-200	225.	A	139	in use	DAC Building
43	24-800	159.	A	54	in use	USAF Hospital
46	63-621	60.	S	10	in use	Chalet MAC Six Mile Lake
47	63-740	23.	S	16	in use	CE Shady Lane Six Mile Lake
49	52-560	130.5	A	16	in use	Green Lake Rec Area
50	BLM	-	-	-	in use	Oil Well Road
51	63-501	-	-	-	in use	6981st Rec Area Six Mile Lake
52	23-100	166.	A	36	in use	Golf Course Pro Shop
53	62-145	125.	A	8	in use	EMS Ammo Storage Six Mile Lake
23	33-358	71.	S	36	inactive	Riding Stables
32	52-725	246.	A	12	inactive	Gun Site No. 1
34	53-125	186.	A	12	inactive	Gun Site No. 10
45	63-552	40.	S	50	inactive	Ranch Six Mile Lake
48	63-612	109.5	A	30	inactive	Field Maint. Six Mile Lake
54	62-140	-	-	-	inactive	EMS Six Mile Lake
2 old	33-000	78.	S	30	inactive	Old Round House
3	23-400	153.	A	104	inactive	Artesian Village, South
6	44-544	314.	A	40	inactive	Old 625 Radar
30	62-700	142.	A	18	inactive	Fish Camp D Battery
31	24-500	158.	A	60	inactive	BLM Old C Battery
--	64-560	-	-	-	inactive	--
35	44-705	405.	A	12	inactive	Site No. 3
36	24-025	189.	A	12	inactive	Site No. 5
4 old	23-396	45.	S	35	abandoned	Artesian Village, North
14	73-400	60.	S	12	abandoned	Old AFSC Receiver Site
20	52-812	70.	S	9	abandoned	Hillberg Lake (Resident)
--	--	202.	A	12	abandoned	Site No. 6
--	--	189.	A	12	abandoned	Site No. 2
44	63-615	87.	S	20	abandoned	Six Mile Lake, 21st Trans

*A = artesian, S = shallow.

Note: Three wells on Hospital Line: 1. 1000 gpm; 2. 1000 gpm; 3. 800 gpm.

Source: Installation Documents, 1983.

1.2.6.2 Artesian Aquifer

The water quality of the artesian aquifer is good, as discussed previously, and the possibility of contamination of this deep aquifer is generally remote. Most of the subsurface water supply facilities are extracting water from the artesian aquifer (Engineering-Science, 1983).

1.3 DESCRIPTION AND HISTORY OF INDIVIDUAL SITES

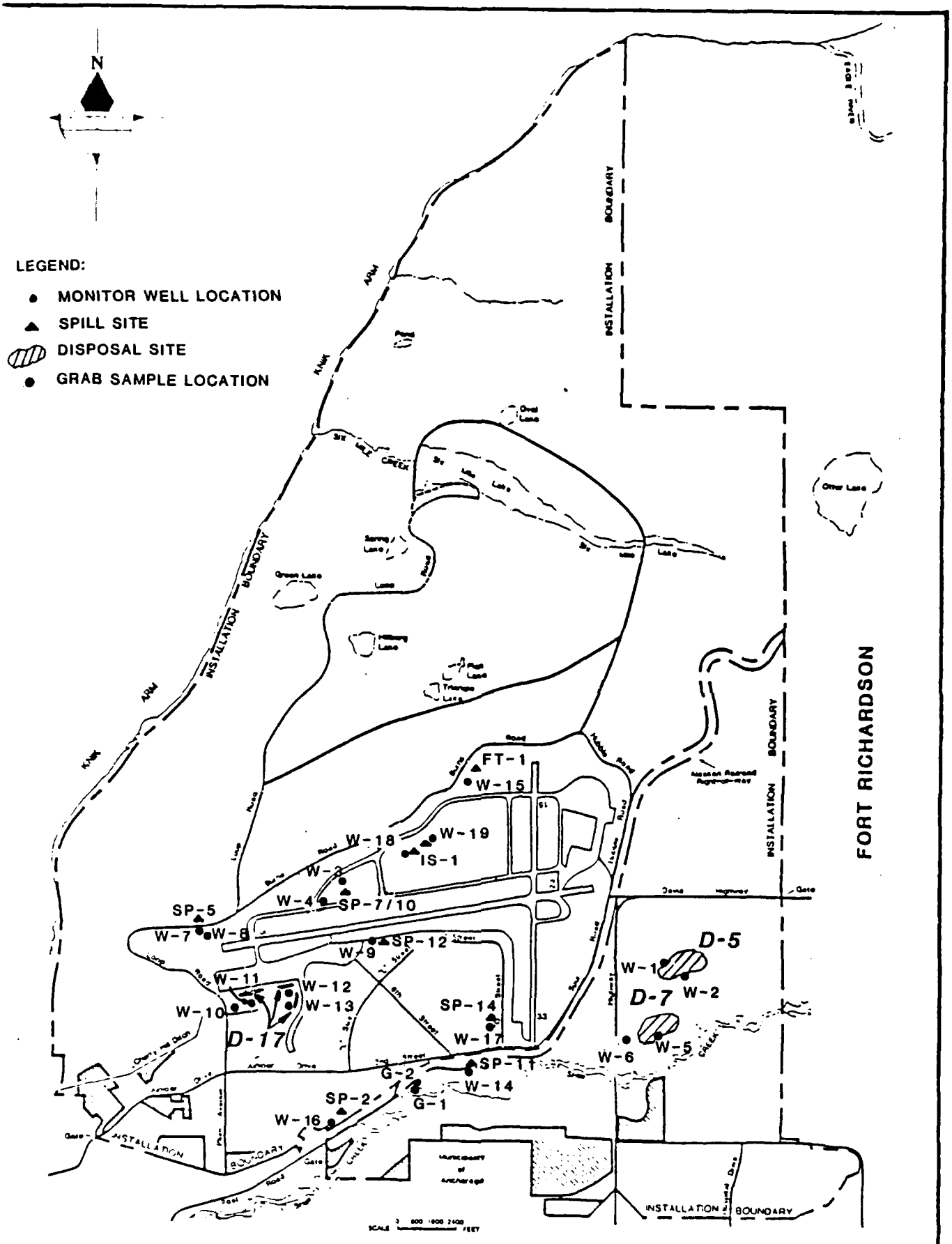
Engineering-Science (1983) identified 48 sites within Elmendorf AFB where potentially hazardous materials were generated, disposed of, or used in some activity. Each site was rated on the basis of potential contamination and/or surface or subsurface migration of wastes. By that rating system, 11 sites were assessed to have moderate potential for environmental contamination and were judged to warrant further investigation. A scope of work was issued to Dames & Moore in June 1984 under Contract F33615-83-D-4002, Order 0019, for Phase II, Stage 1 investigations. Investigations were carried out at the following 11 priority sites:

Site D-5 - Sanitary Landfill
Sites SP-7 and SP-10 - Pumphouse No. 3
Site D-7 - Sanitary Landfill
Site SP-5 - JP-4 Tank Spill
Site SP-12 - JP-4 Fuel Line Leak
Site D-17 - Shop Waste Disposal
Site SP-11 - JP-4 Fuel Line Leak
Site FT-1 - Fire Training Area
Site SP-2 - JP-4 Fuel Line Leak
Site SP-14 - MOGAS Spill
Site IS-1 - Building 42-400 Floor Drains

These sites are shown on Plate 4 and are described below.

1.3.1 Sanitary Landfill

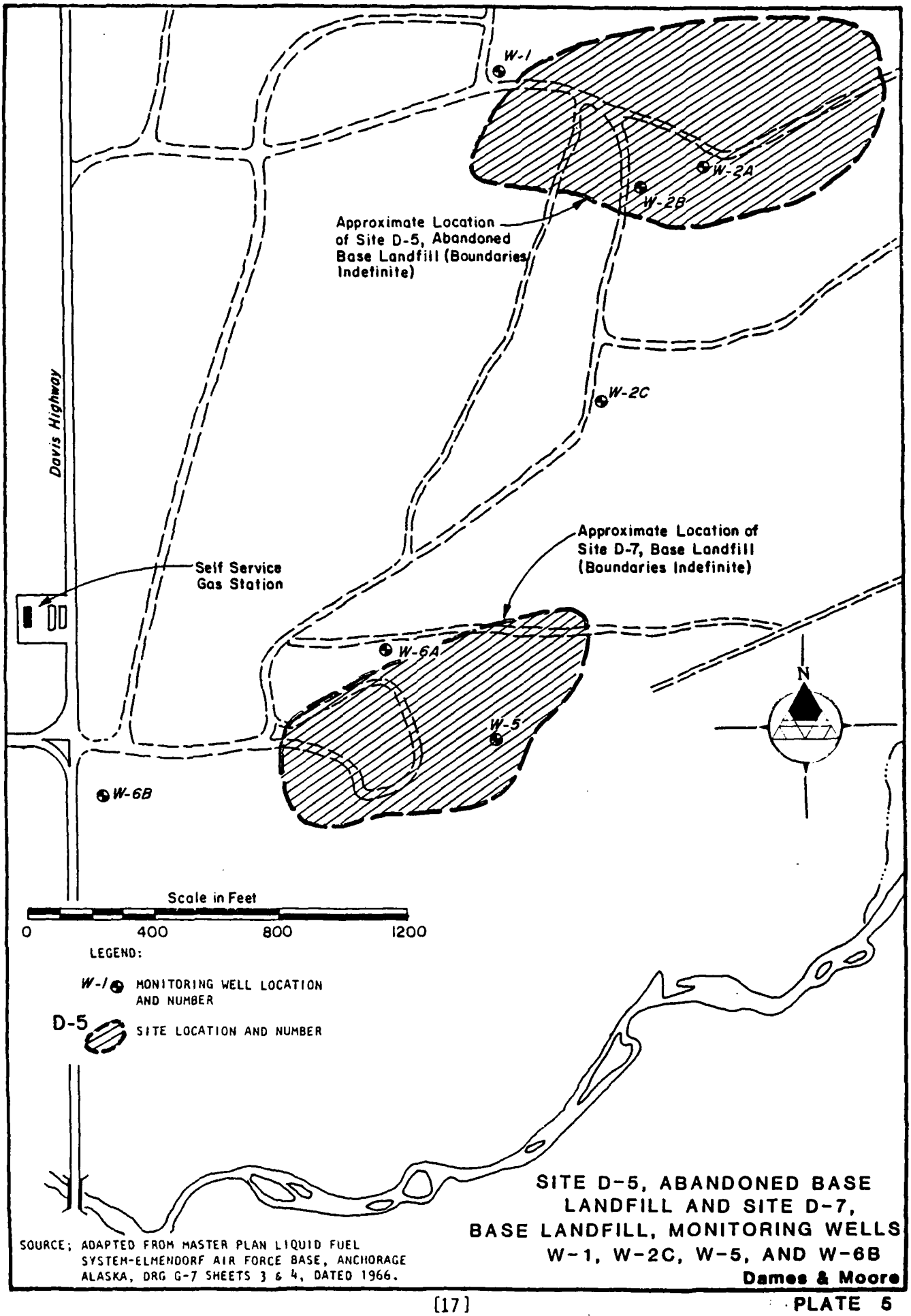
Site D-5 served as the base landfill from 1951 to 1973, but it is now abandoned and covered with trees, brush, and grasses. Two monitor wells, W-1 and W-2C, were drilled to a depth of 57 feet west and south of the assumed limits of the fill; however, debris encountered at 15 feet in W-1 suggests it may be within fill, and buried drums found in the trench walls of the active landfill (Site D-7) indicate W-2C may also be within the landfill (see Plate 5).



LOCATIONS OF WASTE DISPOSAL SITES AND MONITORING WELLS
ELMENDORF AIR FORCE BASE, ALASKA

Dames & Moore

PLATE 4



SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

SITE D-5, ABANDONED BASE LANDFILL AND SITE D-7, BASE LANDFILL, MONITORING WELLS W-1, W-2C, W-5, AND W-6B

Dames & Moore

PLATE 5

The subsurface profile at Site D-5 consists of 25 to 30 feet of gravelly sand over sand with minor amounts of gravel and silt. Water was encountered in both borings at approximately 37 feet below ground surface. Ground water flow in this area is probably toward the west-southwest, rather than directly to Ship Creek, which loses water to the ground water in this area.

Borings done in the deicing drum storage area northwest of the landfill found outwash sand and gravel with minor amounts of silty sand. Depth to ground water was approximately 43 feet. Ground water flow was to the west (Donohue, 1984).

The moisture contents of the analyzed soil samples were 10 and 13 percent. High explosimeter readings [100 percent of the lower explosive limit (LEL)] necessitated abandoning boreholes W-2A and W-2B at approximately 15 feet. Borehole W-2C had explosimeter readings of 23 percent LEL in the upper 30 feet.

Two monitor wells, W-1 and W-2, were installed and sampled at this abandoned landfill. W-1 was found to be located within the filled area, and W-2 is believed to be downgradient from the fill. No lead was detected in either well, and the other parameters tested were either not detected or were in low concentrations. As would be expected, W-1, which is below fill, has slightly lower water quality than W-2 (see Table 3). The soil sample from W-1 had no detectable phenol or oil and grease; phenol was not detected in the W-2 sample, but some oil and grease was found (see Table 4).

The ground water analyses from Site D-5 indicate very little contamination at W-1 and W-2. Water from well W-1 exhibited elevated TOX and TDS. The water quality in these wells suggests the wells may not be located within the contaminant plume(s) from the landfill. Since the exact locations of the disposal trenches are unknown, the plume(s) could be very difficult to locate, and the extent of contamination beneath Site D-5 would be difficult to determine.

Water levels in W-1 and W-2 and in the adjacent stretch of Ship Creek indicate a southwesterly ground water flow direction in this area. A base well, No. 1, at the south end of the north-south runway, appears to be directly downgradient from Site D-5. Since well No. 1 is finished at 16 feet in the shallow aquifer, and has a relatively high capacity (1,350 gpm), its water quality could be threatened by Site D-5.

TABLE 3

UBTL ANALYTICAL REPORT
ELMENDORF AFB - WATER ANALYSES

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-5		SP-7/SP-10		D-7		SP-5		SP-12
				W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9
TOC	415.1[a]	mg/L	1.	2.	ND	8.	5.	1.	ND	4.	2.	ND
TOX	9020[b]	µg/L	10.	53.	34.	--	--	80.	44.	--	--	--
TDS	160.1[a]	mg/L	1.	170.	95.	--	--	220.	82.	--	--	--
Lead	239.2[a]	µg/L	10.	ND	ND	--	--	--	--	ND	ND	--
Phenol	420.2[a]	µg/L	10.	ND	ND	--	--	ND	ND	--	--	--
Oil and grease	413.2[a]	mg/L	0.5	4.0	4.6	56.	5.7	5.8	1.1	d	2.6	1.0
2,4-D	615[c]	µg/L	0.05	e	e	--	--	--	--	--	--	--
2,4,5-T	615[c]	µg/L	0.05	ND	ND	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	615[c]	µg/L	0.05	ND	ND	--	--	--	--	--	--	--
Field specific conductance @ 25°C	--	µmhos/cm	--	174.	131.	538.	433.	181.	95.	1074.	317.	477.
pH	--	std.	--	7.05	7.15	6.75	7.20	7.05	7.05	12.15	9.5	7.25

[a]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.

[b]Test Methods for Evaluating Solid Waste, SW-846, 2nd ed., July 1982, Modified for use on an O.I. Corp. Model 610 TOX Analyzer.

[c]EPA Method 615 for chlorinated herbicides in water.

[d]Sample lost in analysis.

[e]2,4-D could not be determined because of an interference.

ND = not detected.

TABLE 3 (continued)

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-17 W-10	D-17 W-11	D-17 W-12	D-17 W-13	SP-11 W-14	FT-1 W-15	SP-2 W-16	SP-14 W-17	IS-1 W-18	IS-1 W-19
TOC	415.1[a]	mg/L	1.	3.	5.	2.	15.	ND	ND	1.	ND	6.	1.
TOX	9020[b]	µg/L	10.	77.	110.	140.	140.	48.	45.	--	--	150.	52.
TDS	160.1[a]	mg/L	1.	360.	380.	380.	260.	200.	--	--	--	--	--
Lead	239.2[a]	µg/L	10.	--	--	--	--	ND	ND	--	ND	20.	ND
Phenol	420.2[a]	µg/L	10.	ND	ND	ND	ND	ND	ND	--	--	ND	ND
Oil and grease	413.2[a]	mg/L	0.5	1.2	3.1	1.0	2.7	1.7	3.9	8.6	4.7	2.5	1.7
2,4-D	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
2,4,5-T	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
2,4,5-TP (Silvex)	615[c]	µg/L	0.05	--	--	--	--	ND	--	--	--	--	--
Field specific conductance @ 25°C	--	µmhos/cm	--	368.	521.	487.	324.	307.	343.	422.	307.	663.	509.
pH	--	std.	--	7.55	7.2	7.15	7.45	8.15	8.1	7.2	7.2	7.25	7.2

TABLE 4

UBTL ANALYTICAL REPORT
ELMENDORF AFB - SOIL ANALYSES[a]

PARAMETER	METHOD	UNITS	DETECTION LIMIT	D-5		SP-7/SP-10		D-7		SP-5		SP-12		SP-11	
				W-1-9 35'	W-2-9 40'	W-3-5 20'	W-4-3 12'	W-5-8 35'	W-6-8 35'	W-7-2 5'	W-8-2 5'	W-9-7 25'	W-9-9 35'	W-14-2 5'	W-14-3 10'
Lead	239.1[b,c]	µg/g	6.	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	420.2[b]	µg/g	5.	ND	ND	--	--	--	--	--	--	--	--	--	--
Oil and grease	413.2[b]	mg/g	0.008	ND	0.025	0.13	0.106	--	--	0.036	ND	0.013	0.020	0.014	ND
Moisture	Grav.	%	--	10.	13.	6.4	14.	3.1	26.	12.	16.	11.	12.	15.	11.
2,4-D	8150[d]	µg/g	0.05	--	--	--	--	ND	ND	--	--	--	--	--	--
2,4,5-T	8150[d]	µg/g	0.1	--	--	--	--	ND	ND	--	--	--	--	--	--
2,4,5-TP (Silvex)	8150[d]	µg/g	0.05	--	--	--	--	ND	ND	--	--	--	--	--	--

[a]Results have been corrected for percent moisture and, therefore, are reported on a dry weight basis.

[b]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983, Modified for use with soil samples.

[c]Soil samples were acid digested for lead analysis.

[d]Test Methods for Evaluating Solid Waste, SW-846, 2nd ed., July 1982.

ND = not detected.

TABLE 4 (continued)

PARAMETER	METHOD	UNITS	DETECTION LIMIT	FI-1 W-15-10 45'	FI-1 W-15-11 50'	SP-2 W-16-8 35'	SP-2 W-16-9 40'	SP-14 W-17-7 30'	SP-14 W-17-8 35'	IS-1 W-18-7 30'	IS-1 W-19-7 30'	SP-11 G-1 surface	SP-11 G-2 surface
Lead	239.1[b,c]	µg/g	6.	--	--	--	--	20.	25.	--	--	--	--
Phenol	420.2[b]	µg/g	5.	--	--	--	—	--	--	--	--	--	--
Oil and grease	413.2[b]	mg/g	0.008	0.040	ND	0.028	ND	1.33	ND	0.33	ND	3.0	0.159
Moisture	Grav.	%	--	12.	14.	11.	39.	31.	29.	27.	29.	29.	66.
2,4-D	8150[d]	µg/g	0.05	--	--	--	--	--	--	--	--	--	--
2,4,5-T	8150[d]	µg/g	0.1	--	--	--	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	8150[d]	µg/g	0.05	--	--	--	--	--	--	--	--	--	--

High explosimeter readings in boreholes 2-A and 2-B may have been caused by methane gas, a common byproduct of waste decomposition, or by waste fuel disposal at the site. Methane gas migration from the landfill site could endanger human health if adjacent properties are developed; an explosion hazard at the landfill could endanger site operations.

The 1,1-dichloroethane contamination found by Donohue & Associates (1984) at the deicing drum storage area northwest of Site D-5 could threaten the water quality in base well No. 1. The contaminated area is believed to be directly upgradient from this shallow, high capacity well.

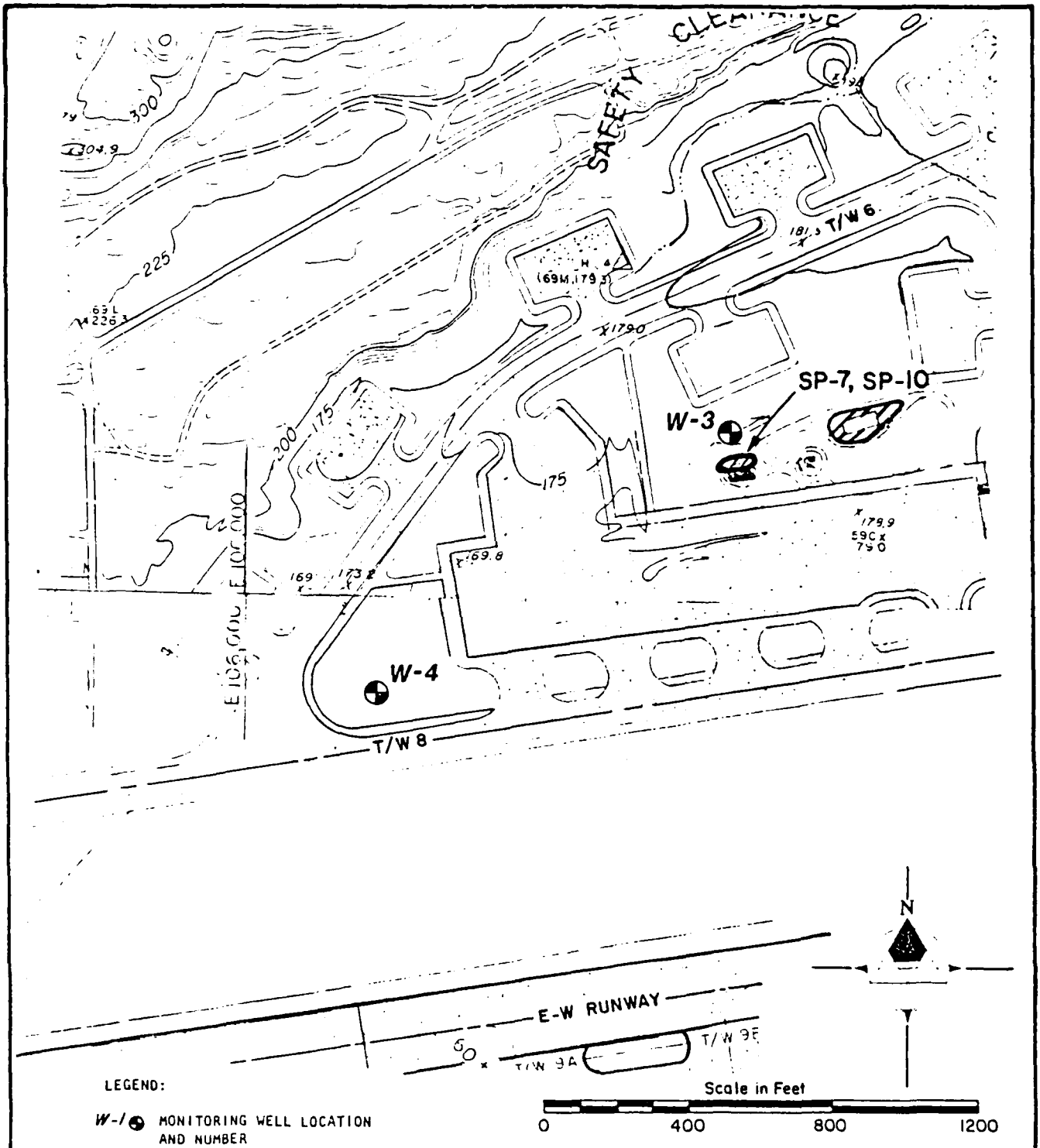
1.3.2 Sites SP-7 and SP-10 - Pumphouse No. 3

Pumphouse No. 3 is the location of at least two major and several small JP-4 fuel spills. Two monitor wells, W-3 and W-4, were completed to depths of 40 and 32 feet, respectively. Extensive underground pipes and tanks necessitated locating the wells off the direct spill area, but base personnel indicated fuel spilled at Pumphouse No. 3 and the adjacent apron runs toward W-4 (Plate 6).

The subsurface profile at this site is difficult to correlate between the two boreholes (W-3 and W-4). The materials at borehole W-3 consist primarily of sand with lesser amounts of gravel and silt. At borehole W-4, the material in the upper 13 feet consists of gravelly sand with small amounts of silt. Below 13 feet, the materials vary from clayey silt to silty clay. Water was encountered at 20.5 feet in W-3 and 12 feet in W-4 on 22 June 84.

Soil samples were analyzed to have 6.4 percent moisture in W-3 and 14 percent moisture in W-4. Explosimeter and HNU photoionization meter readings were at background levels during drilling operations in both boreholes.

Wells W-3 and W-4 were installed near this spill site at Pumphouse No. 3. TOC, oil and grease, and specific conductance in W-3 are all elevated, and pH is low. Oil and grease in this well, at 56 mg/L, is well over expected background. Water quality in W-4, as indicated by the TOC and oil and grease, is only slightly degraded; but the specific conductance, at 433 µmhos/cm, is above expected background and suggests other contaminants may be present. The soil samples from W-3 and W-4 were also moderately contaminated with oil and grease (0.13 and 0.106 mg/g dry weight, respectively).



SITES SP-7 AND SP-10, FUEL SPILLS, MONITORING WELLS W-3 AND W-4

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 6

The analyses of ground water near Pumphouse No. 3 indicate contaminants from fuel spills have reached the ground water at W-3 and have probably spread at least as far as W-4. TOC, oil and grease, and specific conductance in W-3 are all elevated, and pH is low. Specific conductance is relatively higher in W-4, and TOC and oil and grease are slightly elevated.

Preliminary ground water flow data indicate no water supply wells are directly downgradient from this spill site; therefore, the threat to human health appears minimal at this time.

1.3.3 Site D-7 - Sanitary Landfill

Site D-7 is the location of the base landfill that has been in use since 1965. Two monitor wells, W-5 and W-6B, were completed to depths of 56.5 feet at the locations shown on Plate 5. One additional borehole, W-6A, was initiated and abandoned when high explosimeter readings were found at shallow depths. Borehole W-5 was drilled, in part, through the southern edge of the landfill due to access problems with moving off the edge of the fill. Borehole W-6A was drilled at what was assumed to be the edge of the landfill but was found to be in landfill material. W-6B is west of the fill area. All three boreholes were located in open fields.

The subsurface materials in borehole W-5 consisted of 21 feet of landfill material over sand with varying amounts of gravel and sandy gravel. Water was encountered at 32.0 feet on 6 June 84. The materials in borehole W-6B consisted of approximately 7.5 feet of silt with varying amounts of coarse material overlying gravelly sand and sand with trace amounts of silt and gravel. Water was encountered at 34.0 feet on 8 June 84.

The moisture content of a soil sample in W-5 was 3.1 percent; in W-6B it was 26 percent. Except for borehole W-6A, explosimeter and HNU photoionization meter readings were at background levels at this site.

Two monitor wells were installed adjacent to the abandoned cell of this landfill. Water quality in W-5 is degraded, with TOX at 80 µrg/L and oil and grease at 5.8 mg/L. Specific conductance and TOC were close to expected background levels in W-5. Water quality in W-6 is close to expected background. Herbicides were not detectable in the soil samples from W-5 and W-6.

As with Site D-5, water analyses at Site D-7 indicate very little contamination and suggest W-5 and W-6 are not located within the leachate

plume of the landfill. TOX and oil and grease were slightly elevated in W-5; water quality in W-6 was close to expected background. Water levels in these wells indicate the landfill is upgradient of base well No. 1; water quality in that well may be threatened by contaminants from the landfill. Methane gas migration could pose a human health hazard unless adjacent land use options were limited; a potential explosion hazard exists at the site.

1.3.4 Site SP-5 - JP-4 Tank Spill

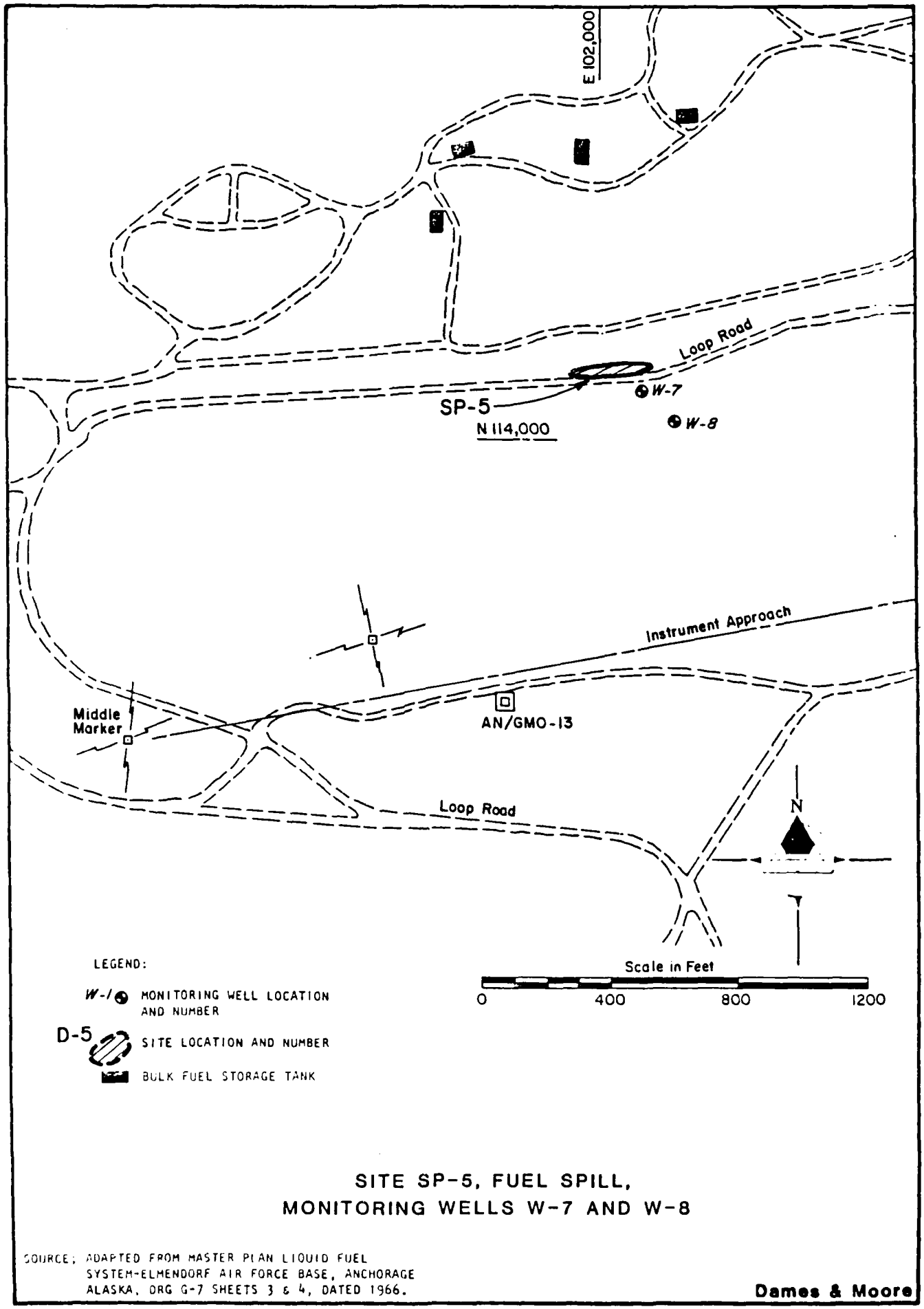
This site is the location of numerous fuel spills from the Bulk Fuel Storage Tanks Nos. 601 through 604. Two monitor wells were installed southeast of the location of a large fuel seep to depths of 26.5 feet at the locations shown on Plate 7. Borehole W-7 was located on the south side of Loop Road because of high explosimeter readings on the north side at the ground surface. As noted in the Phase II Presurvey Report (Dames & Moore, 1983), fuel seeps were observed and a strong fuel odor was detected on the north side of the road. The boreholes were installed in an open field covered with low grasses.

The subsurface materials at this site are sand with varying amounts of clayey silt and clay. Water was encountered in both boreholes at 5.0 feet below the ground surface on 13 June 84, although borehole W-8 is several feet lower in elevation than borehole W-7. This indicates that the water table surface roughly follows the ground contour. That is, ground water flows to the south in the vicinity of this site.

The moisture contents of analyzed soil samples ranged from 12 to 16 percent. Explosimeter and HNU photoionization meter readings were at background levels at both borehole locations.

No lead was detected in W-7 or W-8 at the site of the numerous leaks from Bulk Storage Tanks Nos. 601 through 604. TOC levels in both wells and oil and grease in W-8 indicate only slightly degraded water quality, but the specific conductance (1074 µrmhos/cm) and pH (12.15) in W-7 suggest it is in a contaminant plume. Specific conductance (317 µrmhos/cm) and pH (9.5) in W-8 are also somewhat elevated. No oil and grease was detected in the soil sample from W-8, but the W-7 sample did have a moderate amount of oil and grease (0.036 mg/g dry weight).

Results of the water quality analysis at this spill site are unclear. The availabie data show elevated readings of pH in W-7 and W-8, an elevated specific conductance reading in W-7, lead concentrations below detection



SITE SP-5, FUEL SPILL, MONITORING WELLS W-7 AND W-8

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, ORG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 7

limits, and TOC at background concentration levels. The results of the oil and grease analysis are incomplete because the W-7 oil and grease sample was lost during analysis. While no specific conclusions can be drawn from these results, the high pH and specific conductance indicate apparent ground water contamination in W-7 and possibly in W-8. Conclusions about the source of contamination or the extent of the plume cannot be drawn from the data. While it does not appear that water supply wells are directly threatened by Site SP-5, a threat to human life at this site, in the form of an explosion hazard, is indicated by the high explosimeter readings at the surface on the north side of Loop Road.

1.3.5 Site SP-12 - JP-4 Fuel Line Leak

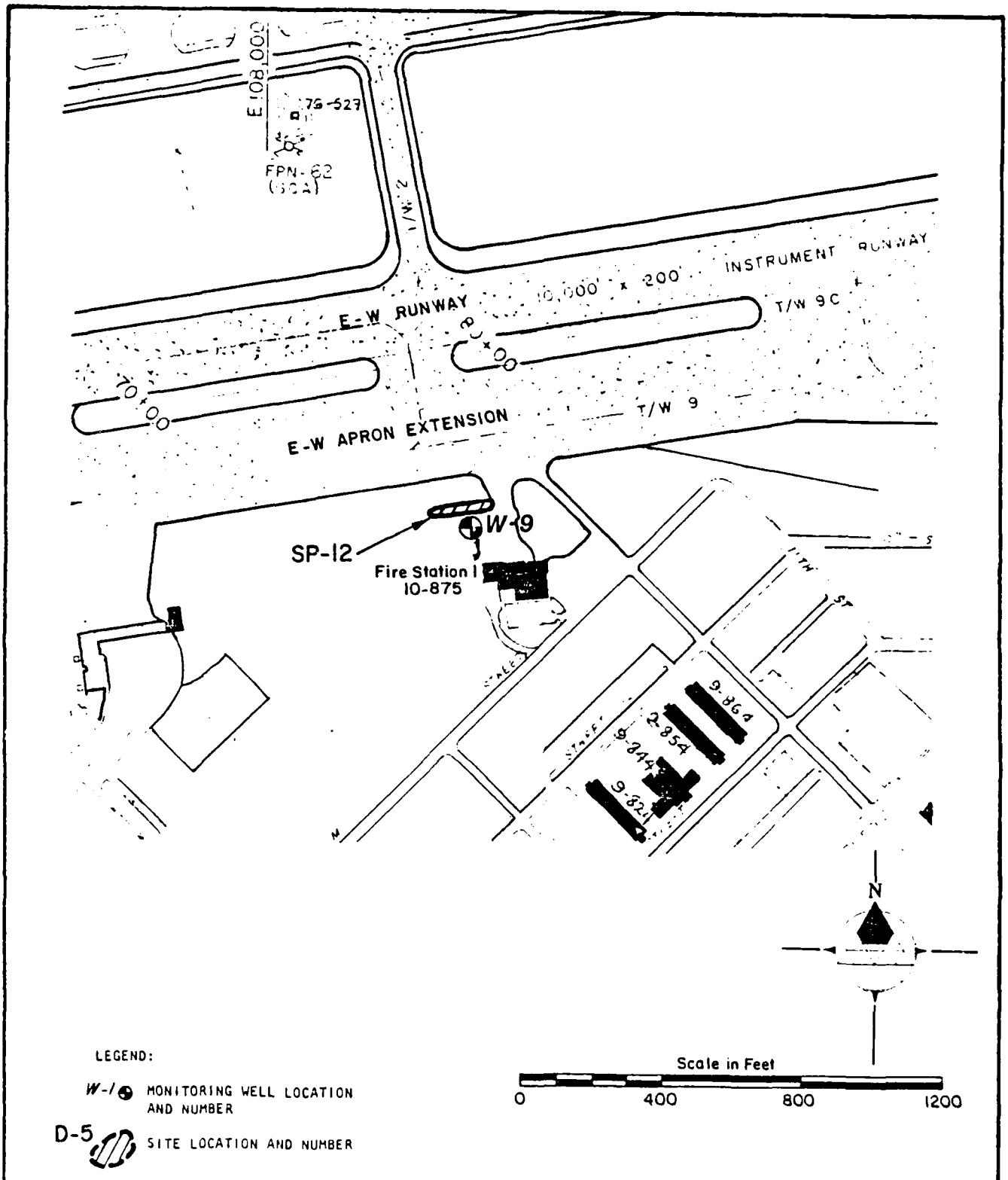
This is the site of an approximately 1,000-gallon JP-4 underground fuel line leak. One monitor well, W-9, was completed to a depth of 42.0 feet at the location shown on Plate 8. The well is located south of the fuel line, near Fire Station No. 1, in a field covered with low grasses.

Subsurface materials in W-9 consist of sand and gravel with minor amounts of silt. Water was encountered at a depth of 22.5 feet on 18 June 84. Soil samples contained 11 and 12 percent moisture. Explosimeter and HNU photoionization meter readings were at background levels at the borehole.

One well, W-9, was installed near this site of a large JP-4 fuel spill. No TOC was detected in this well, and oil and grease was very low, but specific conductance, which is moderately high at 477 µrmhos/cm, suggests other contaminants may be present. Relatively low levels of oil and grease (0.013 and 0.020 mg/g dry weight) were found in the soil samples.

Only a moderate amount of contamination, as indicated by the specific conductance in W-9, has been found at this site of a large JP-4 fuel spill. This suggests W-9 is located on the periphery, rather than in the center, of the contaminant plume. The extent of subsurface contamination at this site cannot be estimated from one well.

Base well No. 40 appears to be downgradient from the spill, but unless well No. 40 is improperly constructed, its depth (228 feet) into the lower aquifer should protect it from contamination and should, therefore, minimize the threat to human health from Site SP-12.



SITE SP-12, UNDERGROUND FUEL LEAK, MONITORING WELL W-9

SOURCE, ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

1.3.6 Site D-17 Shop Waste Disposal

Site D-17 consists of abandoned disposal trenches for shop wastes. Four monitor wells were installed in areas presumed to be at the margins of the disposal areas at locations shown on Plate 9. Due to regrading and revegetation of the general area, it was not possible to detect the exact locations of the former disposal areas. The wells were completed to depths of 31.5, 31.5, 36.5, and 35.5 feet for boreholes W-10, W-11, W-12, and W-13, respectively, at the locations shown on Plate 11.

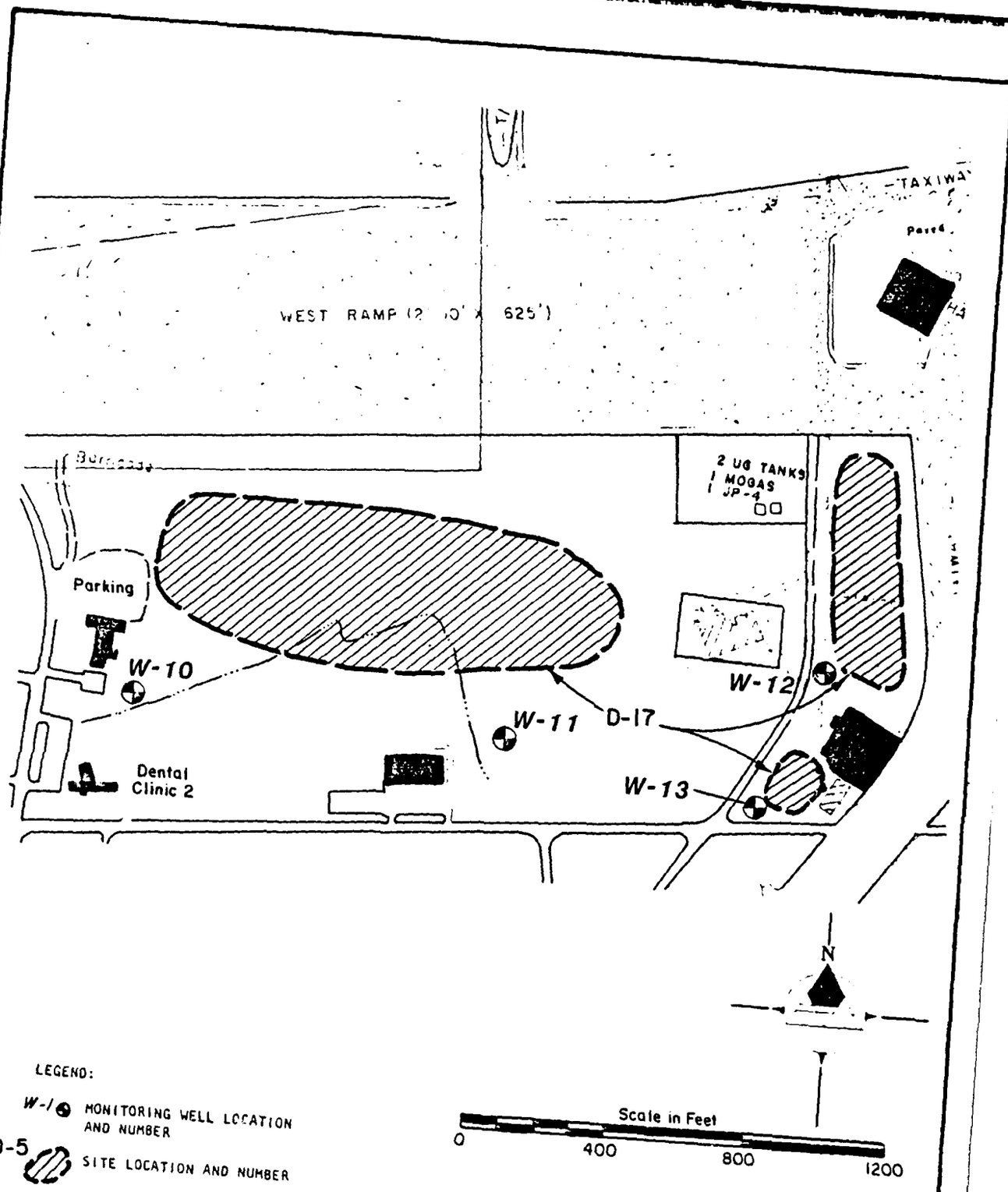
The subsurface materials at this site consist primarily of sand and gravel with varying amounts of silt; however, a relatively thick stratum of clay was encountered in W-10 and W-12 at 15.5 and 25.5 feet, respectively. Water was encountered at depths of 10.0 to 13.0 feet. Explosimeter and HNU photoionization meter readings were at background levels at the borehole locations.

Four monitor wells were installed around this abandoned disposal trench: W-10, W-11, W-12, and W-13. Overall, water quality in these four wells is moderately degraded. TOX and TDS levels are well above inferred background, and TOC in W-13, at 15 mg/L, is high. Specific conductance in all these wells is somewhat elevated, especially in W-11 and W-12, where it is 521 and 487 µmhos/cm, respectively.

The water analyses from the four wells (W-10 through W-13) near this disposal trench indicate water quality has been degraded at this site. TOX and TDS are well above expected background levels, and TOC is high (15 mg/L) in W-13. Specific conductance is also elevated in all four wells. Although the site does not appear to be directly upgradient from base water supply wells, its proximity to Cherry Hill Ditch could result in a human health hazard. Contaminated ground water may be discharged to the ditch, especially during rainy periods; unless access to the ditch is limited, an impact on human health is possible, even off the base.

1.3.7 Site SP-11 - JP-4 Fuel Line Leak

This site is the location of a JP-4 underground fuel line leak of unknown volume. Fuel was noted to be seeping from the bank of a small stream that flows west, through a wetland, into Ship Creek (Dames & Moore, 1983). The seeps were noted again during the 1984 drilling and sampling program. One monitor well, W-14, was installed west of the pumphouse, Bldg. 23-714, on the bank of the stream to a depth of 25.5 feet at the location shown on Plate 10.

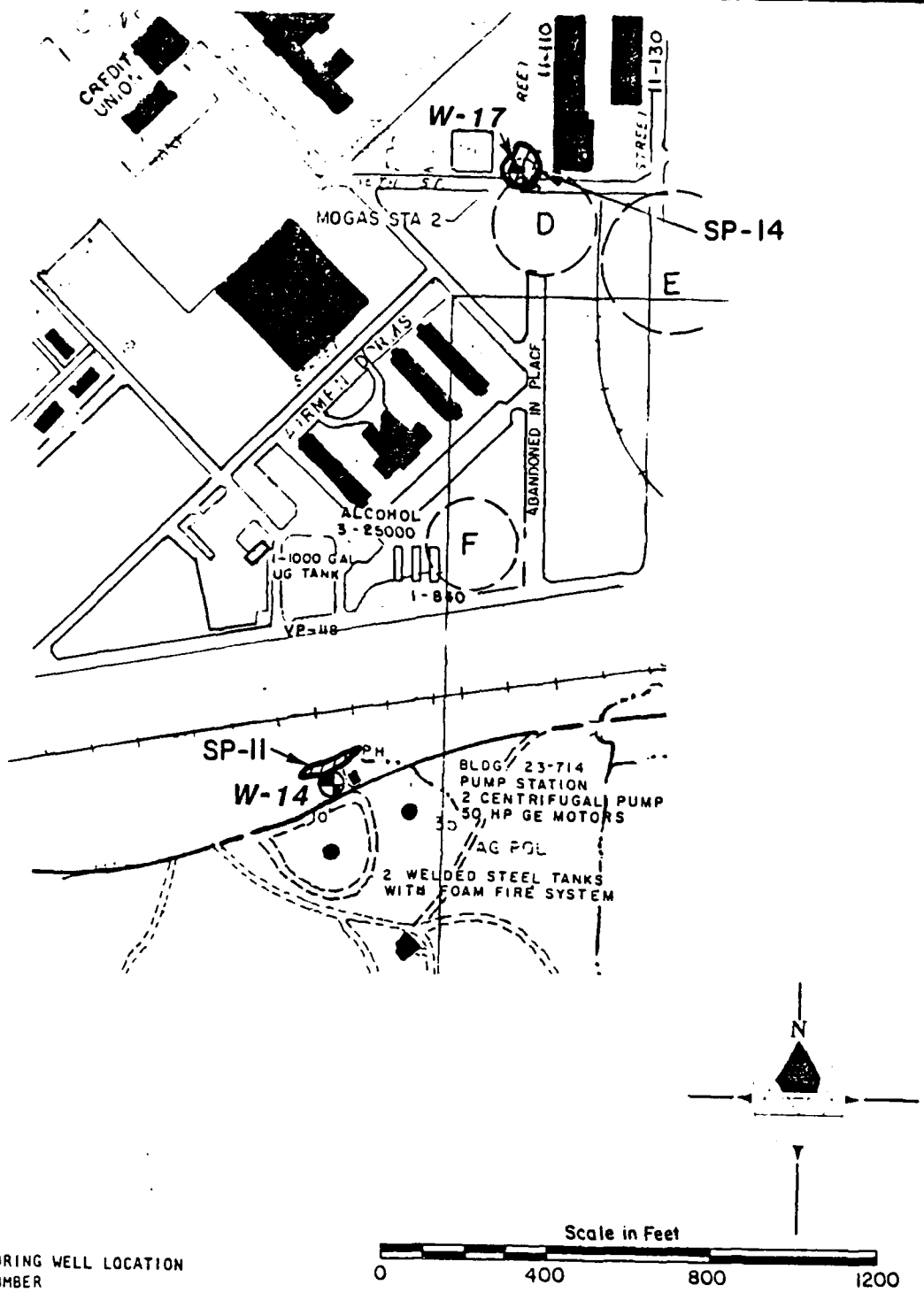


SITE D-17, ABANDONED DISPOSAL AREAS FOR SHOPS, MONITORING WELLS W-10, W-11, W-12, AND W-13

SOURCE: ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 9



LEGEND:

W-1 MONITORING WELL LOCATION AND NUMBER

D-5 SITE LOCATION AND NUMBER

SITE SP-11, UNDERGROUND FUEL LINE LEAK AND SITE SP-14, GASOLINE SPILL, MONITORING WELLS W-14 AND W-17

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 10

The subsurface materials are sand and gravel with small amounts of silt. Water was encountered at a depth of 5.0 feet, approximately the same elevation as the water surface in the adjacent creek, on 21 June 84. Soil moisture in the analyzed samples was 15 and 21 percent. Explosimeter and HNU photoionization meter readings were low at the borehole location; the explosimeter reading was 4 percent LEL, and the HNU reading was 100 ppm at 5 feet.

Two bottom sediment grab samples were taken in the wetland, approximately 1,800 feet west-southwest of the pumphouse (Plate 11). These samples contained 29 and 66 percent moisture.

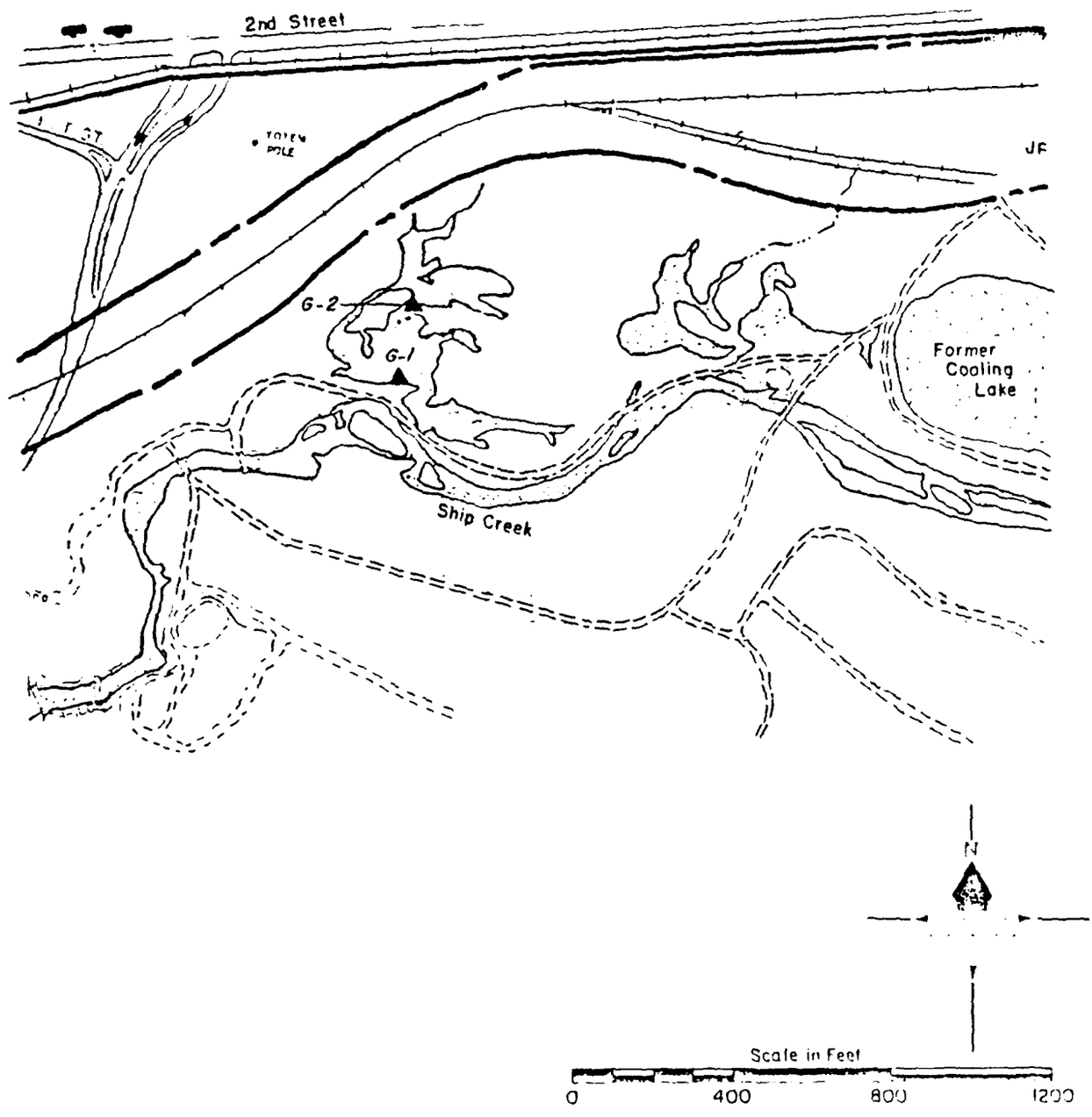
W-14 was installed near this site of a JP-4 underground fuel line leak. No TOC, lead, phenol, or pesticides were detected in this well, and TOX, TDS, and specific conductance levels were only slightly above expected background. However, pH, at 8.15, was elevated in W-14. Little oil and grease was detected in the W-14 soil samples, but one of the surface samples from the adjacent wetland, G-1, had a relatively high oil and grease concentration of 3.0 mg/g dry weight. G-2, the second wetland sample, had moderately high oil and grease at 0.159 mg/g dry weight.

The results of almost all the water quality analyses from W-14, the one well installed near this fuel line leak, are very near expected background levels. The elevated pH (at 8.15) suggests there has probably been some contamination of ground water at the site. Further, the oil and grease levels in grab samples in the nearby wetland (G-1 and G-2) indicate surface water contamination as well.

This site is close to base well No. 1, and although it is probably downgradient from that shallow well, the contaminant plume could be intersected by the well's cone of depression. This may present a human health risk. Further, surface water contamination from Site SP-11 could threaten the fish hatchery on Ship Creek downstream from the base.

1.3.8 Site FT-1 - Fire Training Area

FT-1 is the site of the fire training area where large quantities of contaminated oils and fuels and clean fuels have been spread on the ground surface and ignited to provide fire extinguishment training. One monitor well, W-15, was installed approximately 300 feet southwest of the site, in an open, gravel-covered area, to a depth of 60.5 feet at the location shown on Plates 3 and 12.



LEGEND:

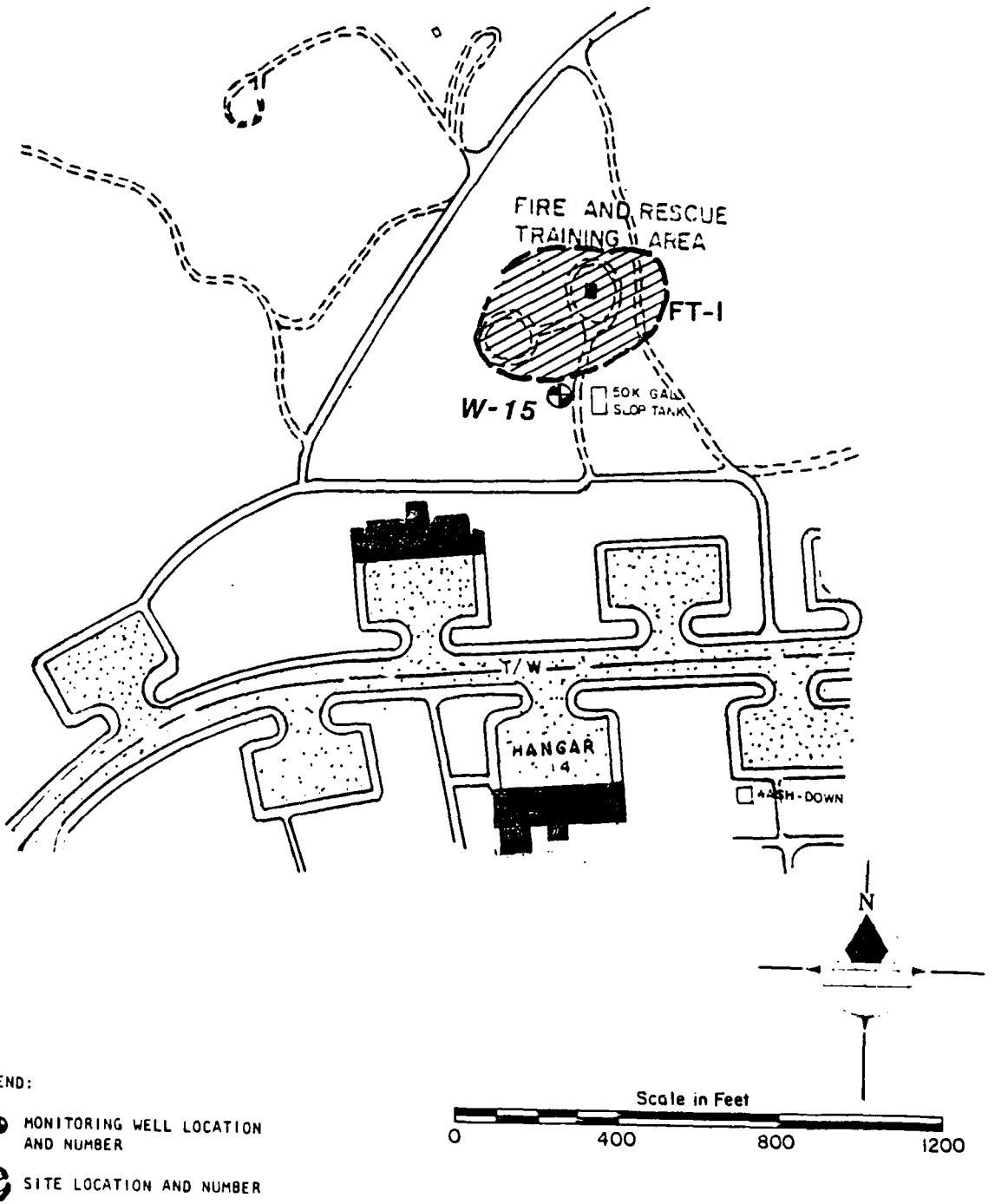
G1▲ GRAB SAMPLE LOCATIONS

SWAMP NEAR SITE SP-11,
SWAMP SEDIMENT GRAB SAMPLE G-1 AND G-2

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 11



SITE FT-1, FIRE TRAINING AREA,
MONITORING WELL W-15

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 12

The subsurface materials encountered consist primarily of sand with varying amounts of gravel and silt. Water was encountered at 42.0 feet on 12 June 84. Moisture contents in the analyzed soil samples were 12 and 14 percent. Explosimeter and HNU photoionization meter readings were at background levels at the borehole locations.

One well, W-15, was installed near the fire training area. No TOC, lead, or phenol was detected in W-15, but oil and grease, specific conductance, and pH were higher than inferred background levels. The soil samples from W-15 indicated slightly elevated oil and grease at 45 feet and none detected at 50 feet.

Slightly elevated oil and grease, specific conductance, and pH indicate W-15 is probably located on the periphery of a contaminant plume from the fire training area. The oil and grease found in a soil sample at 45 feet indicates contamination is relatively deep at this site.

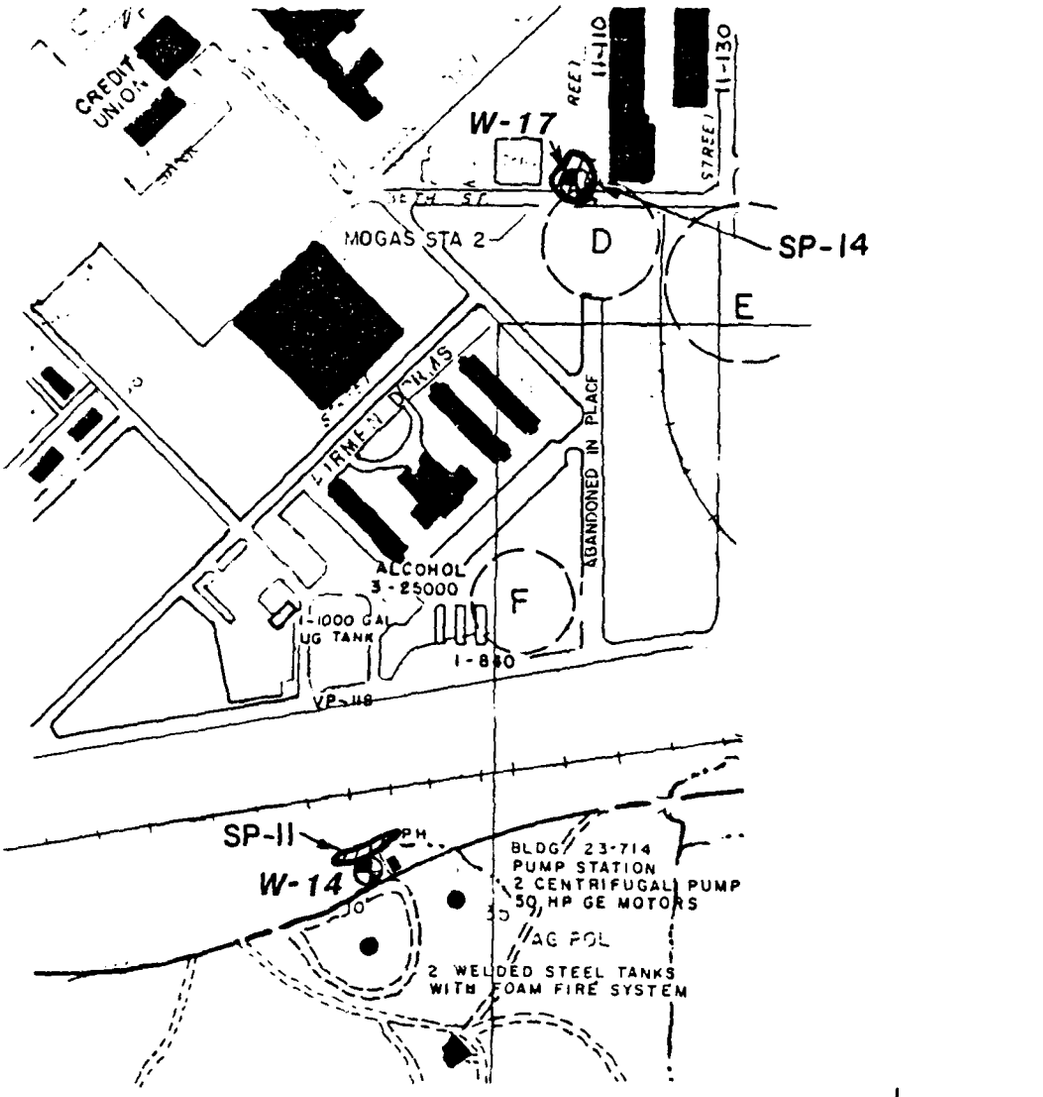
No active base wells are directly downgradient from Site FT-1; therefore, the threat to the water supply is limited. There is, however, an inactive well (base well No. 34 at gun site No. 10) that, if poorly completed, could act as a conduit for contaminants in the surface aquifer to enter the lower aquifer.

1.3.9 Site SP-2 - JP-4 Fuel Line Leak

This is the site of a JP-4 underground fuel line leak of unknown quantity near Bldg. 22-010. One monitor well, W-16, was installed near a culvert under Bluff Road, approximately 150 feet southwest of Bldg. 22-010, to a depth of 52.0 feet at the location shown on Plates 3 and 13.

Subsurface materials in W-16 are primarily sand with varying amounts of gravel and silt. Water was encountered at a depth of 32.0 feet on 20 June 84. Soil samples had 11 and 39 percent moisture. Explosimeter and HNU photoionization meter readings were low at the borehole location; the explosimeter reading was 4 percent LEL, and the HNU readings were 14 ppm at 35 feet and 140 ppm at 45 feet.

W-16 was installed near the site of this JP-4 underground fuel line leak. TOC was low in this well, but oil and grease and specific conductance levels indicate some contamination is present. Soil samples from W-16 had slightly elevated oil and grease at 35 feet and none detected at 40 feet.



LEGEND:

W-1 MONITORING WELL LOCATION AND NUMBER

D-5 SITE LOCATION AND NUMBER

SITE SP-11, UNDERGROUND FUEL LINE LEAK AND SITE SP-14, GASOLINE SPILL, MONITORING WELLS W-14 AND W-17

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 13

W-16 is probably located on the edge of a plume from this underground fuel line leak; oil and grease and specific conductance levels are only slightly elevated. Detectable oil and grease in a soil sample from 35 feet suggests relatively deep contamination.

The proximity of this site to base well No. 2 is not likely to pose a threat to human health because well No. 2 is very deep (850 feet) into the lower aquifer, assuming No. 2 is properly completed to exclude water from the upper aquifer.

1.3.9.1 Site SP-14 - MOGAS Spill

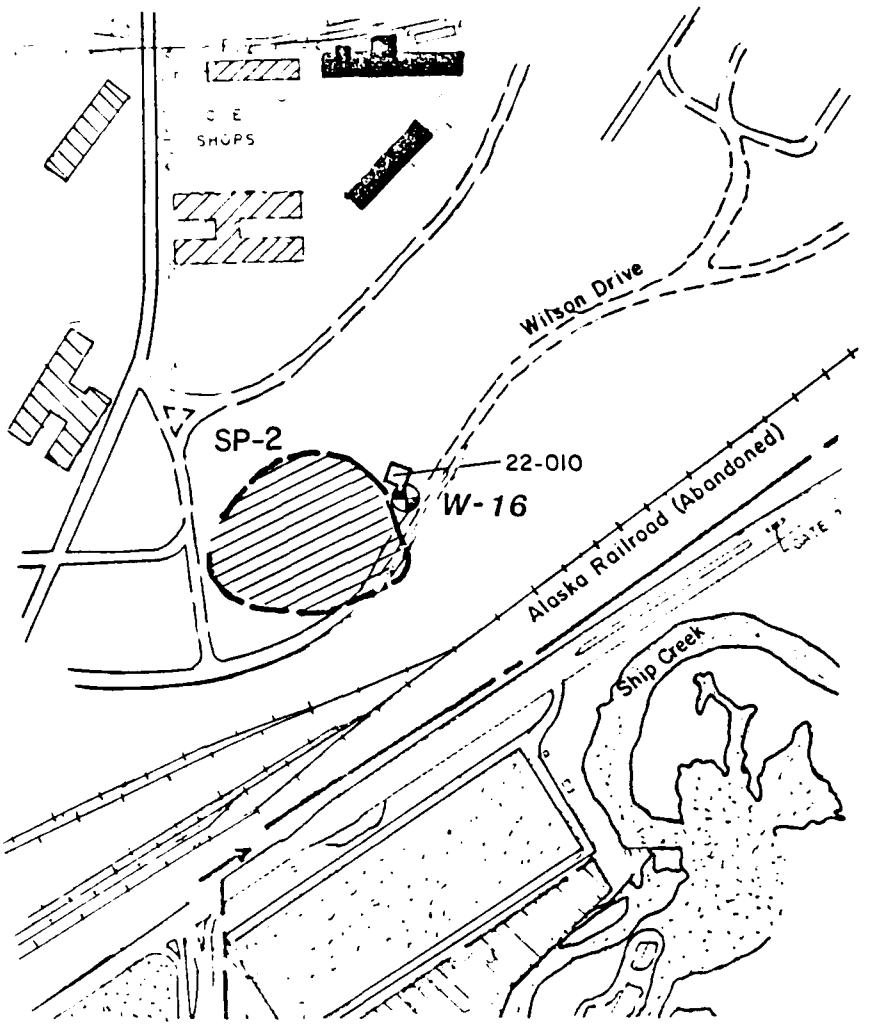
Site SP-14 is the location of a 1,500-gallon MOGAS spill at a former service station near Bldg. 11-110. One monitor well, W-17, was installed to a depth of 50.5 feet, south of the assumed location of the station, as shown on Plates 3 and 14.

The subsurface materials encountered consist primarily of sand with varying amounts of gravel and silt. Water was encountered at a depth of 28.0 feet on 19 June 84. Analyzed soil samples were 29 and 31 percent moisture. Explosimeter and HNU photoionization meter readings were low at the borehole location; the HNU readings were 8 ppm at 5 feet and 40 ppm at 15 feet.

One well, W-17, was installed near this MOGAS spill site. Water analyses found no detectable TOC or lead in this well, and oil and grease was only slightly elevated at 4.7 mg/L. Specific conductance, at 268 µmhos/cm, is also only slightly above inferred background. The soil samples at this site, however, indicate the area may be contaminated. Oil and grease was elevated at 30 feet in W-17 (0.92 mg/g), although it was undetectable at 35 feet. Lead in both samples was three to four times the detection limit for soils.

Most of the results of analyses from W-17, the one well installed near the site of this MOGAS spill, are very near inferred background levels; however, the detection of oil and grease in a soil sample from 30 feet suggests relatively deep contamination.

The site is close to base well No. 1, and although it is probably upgradient from that shallow well, the contaminant plume from Site SP-14 may intersect the well's cone of depression. Such a situation could pose a human health hazard. Further, as this well is near Ship Creek, contamination entering the stream could threaten the fish hatchery downstream.



N

Scale in Feet

0 400 800 1200

LEGEND:

W-1 MONITORING WELL LOCATION AND NUMBER

D-5 SITE LOCATION AND NUMBER

SITE SP-2, UNDERGROUND FUEL LINE LEAK, MONITORING WELL W-16.

SOURCE; ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1366.

Dames & Moore

PLATE 14

1.3.9.2 Site IS-1 - Building 42-400 Floor Drains

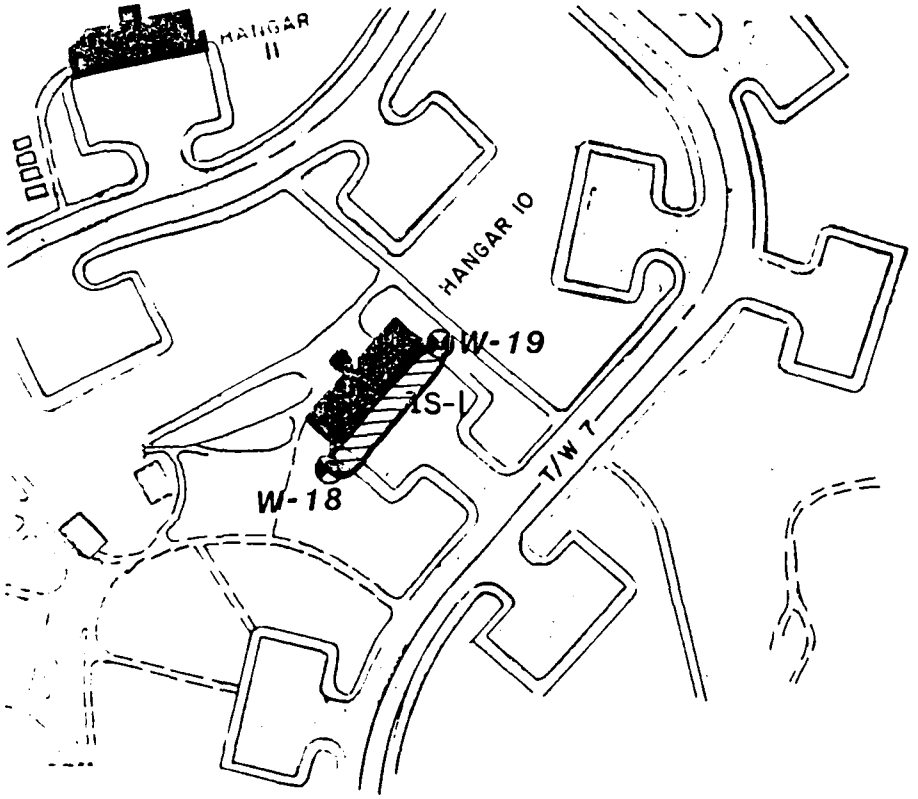
This is the Bldg. 42-400 (Hangar No. 10) site at which fuel loading operations have been conducted. Numerous small spills have occurred at the facility, and most of the fuel has flowed into floor drains and, hence, into dry wells at each end of the building. Two monitor wells, W-18 and W-19, were installed to depths of 47.0 and 51.5 feet, respectively, immediately adjacent to the dry wells at the locations shown on Plates 3 and 15.

The subsurface materials at Site IS-1 consist primarily of sand with varying amounts of gravel and silt. Water was encountered at 27.5 and 30.0 feet on 23 June 84 in boreholes W-18 and W-19, respectively. Moisture contents in analyzed soil samples were 27 and 29 percent. Explosimeter and HNU photoionization meter readings were at background levels at the borehole locations.

W-18 and W-19 were installed near this site of numerous spills that flowed from floor drains to dry wells. The results of analyses indicate some water quality degradation. Specific conductance (663 µrmhos/cm) and TOX (150 µrg/L) are well above expected background, as is lead at 20 µrg/L. This lead level, however, is well below the primary water quality standard of 50 µrg/L. Oil and grease in W-18 was relatively low, and phenol was not detectable. No lead or phenol was detected in W-19, and TOC, TOX, and oil and grease levels were relatively low, but specific conductance (509 µrmhos/cm) was moderately high, indicating possible contamination. The soil sample from 30 feet in W-18 had a relatively high oil and grease concentration (0.33 mg/g dry weight), but oil and grease was not detected in W-19 soil.

Water quality is somewhat degraded at this site where numerous fuel spills flowed from floor drains to dry wells. W-18, in particular, has degraded water quality with elevated TOX, specific conductance, lead, and oil and grease contaminated soil at 30 feet. There is no apparent reason for elevated conductivity values at this site.

No base wells appear to be directly downgradient from Site IS-1; therefore, the threat to the water supply is limited.



N

LEGEND:

W-1 MONITORING WELL LOCATION AND NUMBER

D-5 SITE LOCATION AND NUMBER

Scale in Feet

0 400 800 1200

SITE IS-1, FUEL SPILLS, MONITORING WELLS W-18 AND W-19

SOURCE: ADAPTED FROM MASTER PLAN LIQUID FUEL SYSTEM-ELMENDORF AIR FORCE BASE, ANCHORAGE ALASKA, DRG G-7 SHEETS 3 & 4, DATED 1966.

Dames & Moore

PLATE 15

2.0 SITE INVESTIGATION SUMMARY

2.1 OVERALL FACILITY

The recommended program addresses all twelve of the original sites evaluated under the Phase II, Stage 1 investigation. These sites will be investigated under Phase II, Stage 2 by the addition of eleven new monitor wells. Also, a metal detector survey will be conducted at Sites D-5 and D-7 to determine the boundaries of this site, and a soil gas survey will be made at sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14 to determine the extent of fuel contamination. In addition, a water table survey map will be prepared for the entire base, and water supply wells 1, 2, 16, and 52 will be sampled for chemical analysis. Finally, a surface water sampling and analysis program will be conducted for Ship Creek.

2.2 INVESTIGATION OF INDIVIDUAL SITES

2.2.1 Base Water Table Map

In order to accurately establish the direction of ground water flow and contaminant migration under Elmendorf AFB, a detailed water table map will be prepared for the entire base. Ground water flow under the base is complicated by the relationship of the ground water system to Ship Creek. In the upper reaches, the stream loses water to the ground water, while in the lower reaches, Ship Creek gains from the ground water. The boundary between the losing and gaining portions of the stream is on the base, near the landfills. The change between losing and gaining from the stream significantly impacts direction of ground water flow and contaminant migration on the base. Further, in the lower, gaining reach of the stream, almost all of the ground water that flows under the southern populated portion of the base is diverted to Ship Creek by a change in subsurface material from sand to clay at Cook Inlet. The result of this diversion is that all ground water contamination at the base could affect water quality in Ship Creek. Finally, a detailed water table map is necessary to accurately locate any additional monitor wells needed to determine the extent of contamination at the base. This map will be based upon accurate water table elevations from all accessible water table wells, Stage 1 monitor wells and surface water bodies on the base. A maximum of 30 water elevations will be determined, with water levels obtained by survey accurate to 0.01 foot vertically and 10 feet horizontally.

2.2.2 Base Water Supply Well Sampling

Base well No. 1 is apparently directly downgradient of the base landfills (Sites D-7 and D-5) and is completed in the shallow aquifer. The potential for contamination of this well is great. Other active base wells may be downgradient from spill or dump sites. They include wells No. 2 (Site SP-2), No. 52 (Site SP-11), No. 42 (Site D-5) No. 40 (Site D-5), and No. 16 (Site SP-12). All of these wells are completed in the deeper, artesian aquifer; the potential for contamination of these wells is limited if they are completed properly (that is, if they are not inducing leakage from the upper aquifer). To assess whether they have been affected, these wells will be sampled and analyzed for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), TDS, and lead.

2.2.3 Ship Creek Sampling

Shallow ground water flowing under the southern portion of Elmendorf AFB discharges to Ship Creek rather than directly to Cook Inlet. Ground water contamination at the base could, therefore, affect water quality in the stream and may have an adverse impact on the fish hatchery. To assess this impact, a surface water sampling program will be conducted at Ship Creek, based on the results of the water table survey. One upstream water sample and samples from two different downstream locations will be obtained, with one of the samples collected just downstream of the point where Ship Creek changes from a losing to a gaining stream. The three samples collected will be analyzed for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), TDS, and lead.

2.2.4 Sites D-5 and D-7

The wells installed during Phase II, Stage 1 apparently did not intersect the expected contaminant plume from these landfills. The burial of waste at the landfill sites was done in a haphazard fashion spread out over a relatively large area. Surface conditions do not give any indication of the location of buried waste. Because of the heterogeneous nature of the landfill (isolated pockets of waste spread over a large area), it is possible that the monitor wells in the landfill area will not intercept a contaminant plume.

A metal detector survey will be conducted to determine the boundaries of Sites D-5 and D-7. The survey will proceed by running traverse lines with the instrument parallel to the assumed boundaries. The frequency of positive indications per 100-foot length of traverse will be recorded on a

map. If few positive indications are recorded, the traverse will be rerun 100 feet closer to the assumed center of the site. Conversely, if many positive indications are recorded, the traverse will be moved farther out until the boundaries of the site are found. If it is found that aerial photographs, through time, are available to help delineate the boundaries of the landfills, these will be used to expedite the boundary survey.

After the site boundaries are determined, it is recommended that four monitor wells (two at D-5 and two at D-7) be installed approximately 100 feet downgradient and parallel to the downgradient boundaries of the sites. The individual wells should be located directly downgradient of the areas with the greatest concentrations of metal objects as indicated by the survey. In addition, two monitor wells should be installed upgradient of the sites. The wells should be constructed using the same specifications as used during construction of the Phase II, Stage 1 wells. The new wells, and existing wells W-1, W-2, W-5, and W-6 should be sampled and analyzed for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602) chlorinated organic pesticides (EPA Method 680), and TDS.

2.2.5 Sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14

An HNU survey will be employed to delineate the areal extent of near-surface organic contaminants resulting from the spill sites. After establishing sampling grids at each site, shallow auger borings (less than 5 feet deep) will be drilled with a small drilling rig or similar equipment. The soil cuttings on the auger would be inspected for any signs of contaminants. After inspection, small diameter PVC pipes equipped with caps will be inserted into the borings, the borings would be backfilled, and soil gases would be allowed to collect for 2 or more days within the PVC pipes. Subsequently, HNU readings will be taken from the pipes and plotted to define the concentration gradients of soil gases. Based on the results of the soil gas survey and the locations of base water supply wells, one monitor well each will be installed downgradient of sites SP-12, SP-11, FT-1, SP-14, and SP-2.

Water samples will be collected from each monitor well at the site, including existing wells W-3, W-4, W-7, W-8, W-9, W-14, W-15, W-16, and W-17 along with the five new wells installed. Each sample will be analyzed for petroleum hydrocarbons, purgeable aromatics (EPA Method 602) and TDS. In addition, water samples from wells W-7 and W-8 will be analyzed for major cations and anions, and samples from well W-14 and the new well downgradient of SP-11 for purgeable halocarbons (EPA Method 601) and lead.

2.2.6 Sites D-17 and IS-1

Since the TOX values found in water samples collected from these sites during the Phase II Stage 1 sampling were relatively high (77 to 140 µg/L at D-17 and 150 µg/L at IS-1), additional sampling and analysis should be conducted for purgeable hydrocarbons. Specifically, one ground water sample should be collected from each of existing wells, W-10, W-11, W-12, W-13, W-18 and W-19. In addition, one surface water sample should be collected from Cherry Hill Ditch just east of Loop Road. These seven (7) water samples will be analyzed for purgeable hydrocarbons by EPA Method 601.

3.0 FIELD SETUP

3.1 DETAILED WORK PLAN

3.1.1 Planning

- Contact USAFOEHL and AAC regarding meeting time and place.
- AAC contacts station POC to establish meeting specifics.
- Contact surveyor subcontractor regarding first survey start date.
- Contact drilling subcontractor regarding start date.
- Notify chemistry laboratory subcontractor to prepare bottles (cleaning, preservatives, etc.) and shipping containers.
- Make travel arrangements.
- Write Purchase Orders for PVC pipe/screen, drilling subcontractor, surveying subcontractor, chemistry subcontractor.
- Assemble and assess condition of all field equipment and supplies.
- Replace, repair, and supplement field equipment and supplies.
- Prepare Technical Operations Plan and submit to USAFOEHL.
- Brief field personnel on SOW; provide with TOP.
- Order health and safety equipment.

3.1.2 Mobilization

- Senior engineer mobilizes from Seattle; geophysicist mobilizes from Santa Barbara; field engineer mobilizes from Chicago.
- Survey crew mobilizes from Anchorage.
- Drilling subcontractor mobilizes from Anchorage.
- Field equipment is sent from California and Chicago.
- Field supplies are sent from California and Chicago. Remaining supplies are purchased in Alaska.
- Rent vehicles, locate housing.
- Field equipment, supplies, chemistry bottles, and shipping containers are stored in base temporary office area (SOW, p. 12, III.D.3).

- o Decontamination area is tested (i.e., water pressure, electrical hookups, etc.) (SOW, p. 12, III.D.2).

- o Dames & Moore personnel review existing engineering plans, drawings, diagrams, aerial photographs, etc. to evaluate sites to be investigated.

- o PVC inspection at point of delivery.

3.1.3 On-Site Setup

- o Senior engineer meets with AAC officials, base POC, and USAFOEHL Technical Monitor. Statement of work reviewed; boring locations for wells/borings are discussed and tentative locations are staked and numbered. Underground utilities are located and access problems resolved. Determine if any Phase II Stage 1 wells are to be abandoned.

- o Air Force personnel brief Dames & Moore personnel, drilling and surveying crews on rules and regulations involved with working on base. Briefings may involve several meetings as mobilization of personnel is staggered (geophysics, first; survey, second; drill and sampling, third; final survey, fourth).

- o USAF issues personnel identification badges and vehicle passes and/or entry permits.

- o Orientation of survey crew to locate existing wells and surface water bodies (if any) to be included in preliminary survey.

- o Preparation of preliminary water table map.

- o Senior engineer briefs geophysicist on site specific conditions for Site D-5 and Site D-7. Discusses information gained from preliminary survey and construction of water table map. Geophysicist and Senior engineer establish grids for geophysical survey. USAF clearance on work granted.

- o Orientation of drilling crew to site conditions, discussion of well/boring locations in light of preliminary water table map data.

- o Finalizing well/boring locations with base POC. Air Force gives clearance and sign-off on digging permits.

- o Senior engineer orients field engineer to site conditions and proposed boring locations.

- o Discussion with base POC regarding handling procedures and 10% selection process of samples to be sent to OEHL, San Antonio.

- o Commence drilling operations.

3.2 DAMES & MOORE HEALTH AND SAFETY PLAN

Project Name and Number: Phase II, Stage 2 Environmental Investigation
01016-265-07

Project Site Location: Elmendorf Air Force Base, Anchorage Alaska

Project Manager: John S. Flickinger

On-Site Safety Officer: J. Michael Stanley

Plan Preparer: Michael W. Ander

Preparation Date: September 5, 1986

Plan Approvals:

Office Safety Coordinator

Michael W. Ander (date)

Managing Principal-in-Charge

Glenn D. Martin (date)

Project Manager

John S. Flickinger (date)

I. PURPOSE

The purpose of this Plan is to assign responsibilities, establish personnel protection standards, specify mandatory operating procedures, and provide for contingencies that may arise while operations are being conducted at the site.

II. APPLICABILITY

The provisions of the Plan are mandatory for all on-site Dames & Moore employees and subcontractors engaged in hazardous material management activities including but not limited to initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization.

III. RESPONSIBILITIES

A. Site Project Manager (SPM)

The SPM shall direct on-site investigation and operational efforts. At the site, the SPM, assisted by the On-Site Safety Officer, has the primary responsibility for:

1. Assuring that appropriate personnel protective equipment is available and properly utilized by all on-site personnel.

2. Assuring that personnel are aware of the provisions of this Plan, are instructed in the work practices necessary to ensure safety, and in planned procedures for dealing with emergencies.

3. Assuring that personnel are aware of the potential hazards associated with site operations (see Tables 1 and 2).

4. Monitoring the safety performance of all personnel to ensure that the required work practices are employed.

5. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances.

6. Preparing any accident/incident reports (see attached Accident Report Form).

7. Assuring the completion of Plan Acceptance and Feedback forms attached herein.

B. Project Personnel

Project personnel involved in on-site investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

2. Implementing Project Health and Safety Plans, and reporting to the SPM for action any deviations from the anticipated conditions described in the Plan.

3. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SPM.

IV. BACKGROUND

A. Site History

Based on preliminary site evaluations conducted during the Phase II Stage 1 investigation of Elmendorf Air Force Base, Alaska, there appear to be eleven (11) areas that may have generated significant environmental contamination over the lifetime of the facility. Suspected contaminants have been identified:

1. Site D-5, Sanitary Landfill (1951-1973)

This landfill, covering a 17-acre area was in operation from 1951 through 1973 and utilized the trench and fill method of burial. Materials disposed of include general refuse, construction rubble, drums of spent chemicals, and partially full herbicide and paint cans. One small area, located near the west end of the site, is still in use. Two monitor wells W-1 and W-2 were installed and sampled at this location. No lead or phenol was detected in either well. However, TOX and TDS were slightly elevated in the W-1 at 53 µg/L and 170 mg/L and in W-2 at 34 µg/L and 95 mg/L respectively. Oil and grease was present at 4.0 mg/L in W-1 and 4.6 mg/L in W-2. The pH was 7.05 in W-1 and 7.15 in W-2 and specific conductance 174 µmhos/cm in W-1 and 181 µmhos/cm in W-2.

Soil samples from this site indicate that phenol was below detection limits. Oil and grease was only slightly elevated at .025 mg/g in W-2 and below detection limit in W-1.

2. Sites SP-7 and SP-10, Pumphouse No. 3, JP-4 Fuel Spills

During 1964-1965, a 50,000 gallon JP-4 fuel spill occurred; the entire spill was unrecovered and seeped into the site soils. In 1980, approximately 36,000 gallons of JP-4 was spilled onto the ground during refueling of a C-5 aircraft. Seven hundred gallons of this spill were recovered; the remainder was lost to the soil.

Two monitor wells W-3 and W-4 were installed at sites SP-7 and SP-10. Oil and grease were slightly elevated at 56.0

mg/L in W-3 and 5.7 mg/L in W-4. pH and specific conductance were 6.75 and 538 μmhos/cm in W-3 and 7.20 and 433 μmhos/cm in W-4.

Soil analysis indicates that oil and grease is only slightly elevated at 0.13 mg/g in W-3 and 0.106 mg/g in W-4.

3. Site D-7, Sanitary Landfill (1965-Present)

This site, covering approximately 12 acres, was used for disposal of general refuse, scrap metal, construction rubble, drums of asphalt, empty pesticide containers, and miscellaneous small quantities of shop waste (1960's only).

Two monitor wells W-5 and W-6 were installed and sampled at D-7 site. Water analysis indicates that phenol was not detected in these samples. However TOX and TDS were slightly elevated at 80 μg/L and 220 mg/L in W-5 and 44 μg/L and 82 mg/L in W-6, respectively. Oil and grease was also elevated at 5.8 mg/L in W-5 and 1.1 mg/L in W-6. Specific conductance and pH were noted as 181 μmhos/cm and 7.05 in W-5 and 95 μmhos/cm and 7.05 in W-6.

Soil analysis from this site indicates that the herbicides, 2,4-D; 2,4,5-T; and 2,4,5-TP (Silvex) were below detection limits.

4. Site SP-5, JP-4 Tank Spill

This site, Bulk Fuel Storage Tanks Nos. 601-604, has been the location of numerous spills since installation of the AVGAS storage tanks in the early 1940s. A 60,000-gallon AVGAS spill, none of which was recovered, occurred in the mid-1960s. In 1974, an estimated 33,000-gallon spill of JP-4 jet fuel occurred when an underground tank was overfilled. Approximately 17,000 gallons of the fuel seeped into the ground northwest of the tanks. During the site visit, a strong fuel odor was noted in the area, and fuel seeps were observed along a large area of the hillside near the road.

Two monitor wells W-7 and W-8 were installed at site SP-5. Water analysis from these wells indicates that lead is below detection limits in both wells. Oil and grease is only slightly elevated at 2.6 mg/L in W-8 and not detected in W-7. pH and specific conductance are noted at 12.15 and 1074 μmhos/cm in W-7 and 9.5 and 317 μmhos/cm in W-8, respectively.

In soil analyses, oil and grease was only slightly elevated at .036 mg/g in W-7 and below detection limits in W-8.

5. Site SP-12, JP-4 Line Leak

In 1971, a leak was detected in a JP-4 line. It is estimated that 1000 gallons of JP-4 were spilled. The majority of the spill was recovered, and contaminated soil was removed for disposal at the base landfill (Site D-7).

One monitor well W-9 was installed and sampled at Site SP-12. Oil and grease was slightly elevated at 1.0 mg/L. The specific conductance was reported at 477 μmhos/cm and pH at 7.25.

Two soil samples were analyzed at the site. One from a depth of 25 feet and the other from 35 feet. Oil and grease was only slightly elevated at .013 mg/g at 25' depth and at .020 mg/g at 35' depth.

6. Site D-17, Shop Waste Disposal Site

This site, a natural trench area near the runway plus two other areas now used for parking and equipment storage, was used during the 1950s and 1960s as a disposal area for waste solvents, paint thinners, and other liquid wastes generated in shop operations. No vegetative distress was noted during the Phase I and Phase II site visits.

Four monitor wells W-10, W-11, W-12, and W-13 were installed and sampled at this site. Water analysis from this site indicates elevated TOX and TDS at 77 μg/L and 360 mg/L in W-10, 110 μg/L and 380 mg/L in W-11, 140 μg/L and 380 mg/L in W-12, and 140 μg/L and 260 mg/L in W-13, respectively. Both lead and phenol were below detection limits in these wells. The specific conductance was reported at 368, 521, 487, and 324 μmhos/cm in W-10, 11, 12, and 13, respectively.

No soil samples were analyzed at this site.

7. Site SP-11, JP-4 Line Leak

A JP-4 leak was discovered in 1978 along the banks of a small stream north of the base golf course and Ship Creek. An undetermined quantity of fuel was lost as a result of an underground pipe crack. Although the pipe was repaired, fuel presently is seeping from the bank of the stream.

One monitor well, W-14, was installed at Site SP-11. Water analysis from this well indicates that TOX and TDS are elevated at 48 μg/L and 200 mg/L, respectively. Lead and phenol were below detection limits. Oil and grease was slightly elevated at 1.7 mg/L. Specific conductance at 25°C was 307 μmhos/cm and pH was determined to be 8.15.

Two soil samples were analyzed from depths of 5 feet and 10 feet from this well. The oil and grease was barely above

detection limit in the 5-foot sample at .014 mg/g and not detectable in the 10-foot sample. Two grab-samples from the surface were also analyzed. Oil and grease was slightly elevated at 3.0 mg/g and 0.159 mg/g, respectively.

8. Site FT-1, Fire Training Area (1940s-Present)

This site, located just west of the north end of the north-south airstrip, has been used as the fire training area from the 1940s to the present. Until 1974, training activities occurred approximately on a monthly basis; from 1974 to 1978 on a semi-annual basis; and since 1978 on a quarterly basis. Waste oils, paint thinners, waste fuel, and waste solvents were used as fuel in the past. During each exercise, 250 to 3000 gallons of the above materials were used and extinguished with protein foams or chlorobromomethane. Since 1974, only clean JP-4 fuel has been used. According to base personnel, the burn area remained saturated with unconsumed fuel following each fire training exercise.

One monitor well, W-15, was installed at this site. The water analysis indicated that TOX was slightly elevated at 45 µg/L and TDS was not detectable. Lead and phenol were found to be below detection limits. Oil and grease was slightly elevated at 3.9 mg/L. The specific conductance and pH were 342 µmhos/cm and 8.1, respectively.

Two soil samples were analyzed from depths of 45 feet and 50 feet. Oil and grease was slightly elevated in the 45-foot sample at 0.040 mg/g and not detectable in the 50-foot sample.

9. Site SP-2, JP-4 Fuel Line Leak

Located along Post Road near Building 22-010, an unknown quantity of JP-4 seeped out of a bank near a drainage ditch during 1964-1965. This leak was the result of a fuel line leak, and the area was known for periodic seeps throughout the 1950s and 1960s. No fuel was recovered at this location.

One monitor well, W-16, was installed at site SP-2. Oil and grease was elevated at 8.6 mg/L. Specific conductance was noted at 422 µmhos/cm and the pH at 7.2.

Two soil samples from depths of 35 and 40 feet were analyzed from this well. Oil and grease was slightly elevated in the 35-foot sample at 0.028 mg/g and undetectable in the 40-foot sample.

10. Site SP-14, MOGAS Spill

Located in the existing parking lot behind Building 11-110, this site, formerly a gas station, was the location of a 1500-gallon MOGAS spill in 1965. No fuel was recovered, as the material seeped into the ground.

One monitor well, W-17, was installed and sampled at this site. Lead was below detection limits. Oil and grease was slightly elevated at 4.7 mg/L. The specific conductance and pH were noted at 307 umhos/cm and 7.2, respectively.

Two soil samples were analyzed from depths of 30-feet and 35 feet. Lead was elevated at 20 µg/g and 25 µg/g, respectively. Oil and grease was slightly elevated in the 30-foot sample at 1.33 mg/g and not detectable in the 35-foot sample.

11. Site IS-1, Building 42-400 Floor Drains

Two wells, W-18 and W-19, were installed and sampled at this site. The water analysis from these samples indicates that TOX was elevated at 150 µg/L in W-18 and 52 µg/L in W-19. In W-18, lead was found to be slightly elevated at 20 µg/L and not detectable in W-19. Phenol was not present in either sample. Oil and grease was slightly elevated in both samples at 2.5 mg/L in W-18 and 1.7 mg/L in W-19. Specific conductance was noted at 663 µmhos/cm in W-18 and 509 µmhos/cm in W-19 and pH was 7.25 in W-18 and 7.2 in W-19.

Two soil samples were analyzed at this site, one from each well. Both samples were taken from a depth of 30 feet. Oil and grease was slightly elevated in W-18 at 0.33 µg/g and below detection limit in W-19.

B. Dames & Moore Activity

Monitor wells will be installed and soil samples will be taken at all 11 prioritized sites. An additional two grab samples of the swamp sediments near SP-11 will also be gathered for testing.

C. Suspected Hazards

Suspected hazards are presented in as much detail as is currently available. These are POL (waste petroleum, oils, and solvents) products, JP-4 fuel, AVGAS, MOGAS, paint, unknown pesticides and herbicides, and chlorobromomethane.

V. EMERGENCY CONTACTS AND PROCEDURES

Should any situation or unplanned occurrence require outside or support services, the appropriate contact from the following list should be made:

Agency	Person to Contact		Telephone
Police			552-4444
Fire			117
Ambulance			552-3333
Hospital			552-3333
D&M Site Project Manager	J. M. Stanley	(office) (home)	907/562-3366
D&M Industrial Hygiene and Safety Director	L. Birnbaum	(office) (home)	914/735-1200 914/783-0026

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on scene.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

A. Personnel on site should use the "buddy" system (pairs). Buddies should prearrange hand signals or other means of emergency signals for communication in case of lack of radius or radio breakdown (see the following items).

B. In emergencies, the following hand signals are suggested:

1. Hand gripping throat: out of air, can't breathe.
2. Grip partner's wrist or place both hands around wasit: leave area immediately, no debate!
3. Hands on top of head: need assistance.
4. Thumbs up: OK, I'm all right, I understand.
5. Thumbs down: No, negative.

C. Site work area entrance and exit routes should be planned, and emergency escape routes delineated by the Project Manager.

D. Visual contact should be maintained between pairs on site, with the team remaining in close proximity in order to assist each other in case of emergencies.

E. In the event that any member of the field crew experiences any adverse effects or symptoms of exposure while on scene, the entire field crew should immediately halt work and act according to the instructions provided by the Project Manger.

F. Wind indicators visible to all on-site personnel should be provided by the Project Manager to indicate possible routes for upwind escape.

G. The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated should result in the evacuation f the field team and reevaluation of the hazard and the level of protection required.

H. In the event that an accident occurs, the PM is to complete an Accident Report Form for submittal to the MPIC of the office, with a copy to the Health and Safety Program Office. The MPIC should assure that followup action is taken to correct the situation that caused the accident.

VI. HAZARD CHARACTERISTICS, MONITORING METHODS, AND PROTECTION REQUIRED

Exposure Limits and Recognition Qualities

Information concerning exposure limits and recognition qualities of the contaminants that are suspected to be on site is presented in Table 1.

Symptoms of Overexposure, Potential Chronic Effects, and First-Aid Treatment

Symptoms of overexposure to the suspected contaminants, potential chronic effects of these substances, and first-aid treatment information are presented in Table 2.

Monitoring Methods, Action Levels, and Protective Measures

Methods for monitoring for suspected contaminants, action levels, and protective measures to be used for various contaminant concentration levels are presented in Table 3.

Protective Equipment Required for On-Site Activities

The protective equipment required may vary, depending on the concentrations and dispersion of contaminants encountered during each phase of the work. Table 4 specifies protective equipment required for each on-site activity.

TABLE 1

EXPOSURE LIMITS AND RECOGNITION QUALITIES

COMPOUND	EXPOSURE STANDARD[a]	RECOGNITION QUALITIES		
		COLOR	ODOR	STATE
Gasoline	300 ppm	None to pale brown or pink	Gasoline (0.25 ppm)[b]	Liquid
Benzene	1 ppm	None	Aromatic	Liquid
Xylene	100 ppm	None	Aromatic	Liquid
Toluene	200 ppm	None	Aromatic	Liquid

[a]OSHA permissible exposure limit of ACGIH Threshold Limit Value

[b]Odor detection threshold.

TABLE 2

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS, AND FIRST-AID TREATMENT

COMPOUND	SYMPTOMS OF OVEREXPOSURE			POTENTIAL CHRONIC EFFECTS
	EYE	SKIN	INHALATION/INGESTION	
Gasoline	Irritation	Irritation, drying	Irritation of mucous membranes, dizziness, uncoordination, coughing, gagging	---
Benzene	Irritation	Dermatitis	Giddiness, headache, nausea, fatigue, staggering gait	Aplastic anemia, leukemia
Xylene	Irritation	Dermatitis	Dizziness, uncoordination, nausea	Central nervous system, liver and kidney damage
Toluene	--	Dermatitis	Fatigue, confusion, dizziness, headache	Central nervous system, liver and kidney damage

GENERAL FIRST-AID TREATMENT

Eye - Irrigate immediately
Skin - Soap wash promptly
Inhalation - Move to fresh air
Ingestion - Get medical attention

TABLE 3

HAZARD MONITORING METHOD, ACTION LEVELS, AND PROTECTIVE MEASURES

Hazard	Monitoring Method	Action Level	Protective Measures
Explosive Atmosphere	Explosimeter or Combustible Gas Meter	< 10% LEL	Continue working
		10 - 15% LEL	Continue working with continuous monitoring
		> 25% LEL	EVACUATE the area -- EXPLOSION HAZARD

TABLE 4

PROTECTIVE EQUIPMENT REQUIRED FOR ON-SITE ACTIVITIES

Actvity/Location	Protective Equipment
During drilling and sampling	Half-face respirator with organic vapor cartridges*
	Nitrile gloves
	Rubber boots (steel toed)
	Hard hat with splash shield
	Disposable Tyvek coveralls

*If photoionization detector reading is greater than 300 ppm.

ATTACHMENT 1

PROTECTIVE EQUIPMENT

I. INTRODUCTION

When field investigation activities are conducted where atmospheric contamination is known or suspected to exist, where there is a potential for the generation of vapors or gases, or where direct contact with toxic substances may occur, equipment to protect personnel must be worn. Respirators are used to protect against inhalation and ingestion of atmospheric contaminants. Protective clothing is worn to protect against contact with and possible absorption of chemicals through the skin. In addition to protective clothing and respiratory protection, safe work practices must be followed. Good personal hygiene practice prevents ingestion of toxic materials.

Personnel equipment to be used has been divided into two categories commensurate with the degree of protection required, namely Levels C and D protection.

II. LEVELS OF PROTECTION

A. Level C

1. Personal Protective Equipment

- Air-purifying respirator (MSHA/NIOSH approved)
- Disposable chemical resistant coveralls
- Gloves, outer, working gloves
- Gloves, inner, chemical resistant
- Boots, steel toe and shank
- Hard hat (face shield)
- Rubber boots, outer, chemical resistant (disposable)

2. Criteria for Selection

a. Air concentrations of identified substances are such that reduction to at or below the substance's exposure limit is necessary and the concentration is within the service limit of the cartridge.

b. Atmospheric contaminant concentrations do not exceed the Immediately Dangerous to Life or Health (IDLH) levels.

c. Contaminant exposure to unprotected areas (head and neck) are within skin exposure guidelines, or dermal hazards do not exist.

d. Job functions have been determined not to require a higher level of protection.

B. Level D

1. Personal Protective Equipment

- Coveralls
- Boots/shoes, safety or chemical resistant, steel toe and shank
- Boots, outer (chemical resistant disposables)
- Hard hat (face shield)
- Gloves

2. Criteria for Selection

a. No indication of any atmospheric hazards.

b. Work function precludes dusting, splashes, immersion, or potential for exposure to any chemicals.

3. Guidance on Selection Criteria

a. Level D protection is primarily a work uniform and should not be worn in any area where the potential for contamination exists.

b. In situations where respiratory protection is not necessary, but site activities are needed, chemical resistant garments -- *high quality or disposable* -- must be worn.

III. RESPIRATORY PROTECTION

The following procedures should be used for respiratory protection:

A. Inspect all washers, diaphragms, and facepiece-to-face seal area for any tears, pinholes, deformation, or brittleness. Should any of these exist, use a different respirator.

B. Place the respirator on the face, tighten and use both a positive and a negative pressure test, prior to entering the site, to assure a proper fit. Checking for proper fit involves the following:

1. Negative Pressure Test

Close off the inlet opening of the cartridge or the breathing tube by covering it with the palm of the hand or by replacing the tap seal. Gently inhale so that the facepiece collapses slightly, and hold the breath for 10 seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is satisfactory.

2. Positive Pressure Test

Remove the exhalation valve cover. Close off the exhalation valve with the palm of the hand. Exhale gently so that a slight positive pressure is built up in the facepiece. If no outward leakage of air is detected at the periphery of the facepiece, the face fit is satisfactory. (Note: With certain devices, removal of the exhaust valve cover is very difficult, making the test almost impossible to perform.)

ATTACHMENT 2

DAMES & MOORE STANDARD OPERATING PROCEDURES

WORK PRACTICES

1. Smoking, eating, drinking, and chewing tobacco are prohibited in the contaminated or potentially contaminated area.

2. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surface (i.e., ground, etc.).

3. All field crew members should make use of their senses (all senses) to alert them to potentially dangerous situations (i.e., presence of strong and irritating or nauseating odors).

4. Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid if possible.

5. Prevent splashing of the contaminated materials.

6. Field crew members shall be familiar with the physical characteristics of investigations, including:

   - wind direction
   - accessibility to associates, equipment, vehicles
   - communication
   - hot zone (areas of known or suspected contamination)
   - site access
   - nearest water sources

7. The number of personnel and equipment in the contaminated area should be minimized consistent with site operations.

8. All wastes generated during D&M and/or subcontractor activities on site should be disposed of as directed by the Field Activity Leader.

HALF-FACE RESPIRATORS

Inspection Procedure

1. Look for breaks or tears in the headband material. Also stretch to check the elasticity.

2. Make sure all headbands, fasteners, and adjusters are in place and not bent.

3. Check the facepiece for dirt, cracks, tears, or holes. The rubber should be flexible, not stiff.

4. Look at the shape of the facepiece for possible distortion that may occur if the respirator is not protected during storage.

5. Check the exhalation valve located near the chin between the cartridges by the following:

   - Unsnap the cover;

   - Lift the valve and inspect the seat and valve for cracks, tears, dirt, and distortion; and

   - Replace the cover. It should spin freely.

6. Check both inhalation valves (inside the cartridge holders). Look for same signs as above.

7. Check the yoke for cracks.

8. Make sure the cartridge holders are clean. Make sure the gaskets are in place and the threads are not worn. Also look for cracks and other damage.

9. Check the cartridges for dents or other damage, especially in the threaded part.

Donning Procedure

1. Screw the cartridge into the holder hand-tight so there is a good seal with the gasket in the bottom of the holder, but don't force it. If the cartridge won't go in easily, back it out and try again.

2. Always use cartridges made by the same manufacturer who made the respirator.

3. Place the facepiece over the bridge of your nose and swing the bottom in so that it rests against your chin.

4. Hold the respirator in place and fasten the top strap over the crown of your head.

5. Fit the respirator on your face and fasten the strap around your neck. Don't twist the straps. Use the metal slide to tighten or loosen the fit, but not too tight.

6. Test the fit by:

   - Lightly covering the exhalation valve with the palm of your hand. Exhale. If there is a leak, you will feel the air on your face.

- Covering the cartridges with the palms of your hands. Again, don't press too hard. Inhale. The facepiece should collapse against your face.

- If there is a leak with either test, adjust the headbands or reposition the facepiece and test until no leakage is detected.

Sanitizing Procedure

1. Remove all cartridges, plugs, or seals not affixed to their seats.

2. Remove elastic headbands.

3. Remove exhalation cover.

4. Remove speaking diaphragm or speaking diaphragm/exhalation valve assembly.

5. Remove inhalation valves.

6. Wash facepiece and breathing tube in cleaner/sanitizer powder mixed with warm water, preferably at 120° to 140°F. Wash components separately from the facemask, as necessary. Remove heavy soil from surfaces with a hand brush.

7. Remove all parts from the wash water and rinse twice in clean warm water.

8. Air dry parts in a designated clean area.

9. Wipe facepieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

MONITORING EQUIPMENT INSTRUCTIONS

A. Combustible Gas Indicators (CGIs)/Explosimeters

In addition to the instructions found below, all CGIs should be calibrated prior to use, in an uncontaminated, fresh air environment. Furthermore, units incorporating an aspirator bulb or other air-drawing device should be checked for leaks in the following manner:

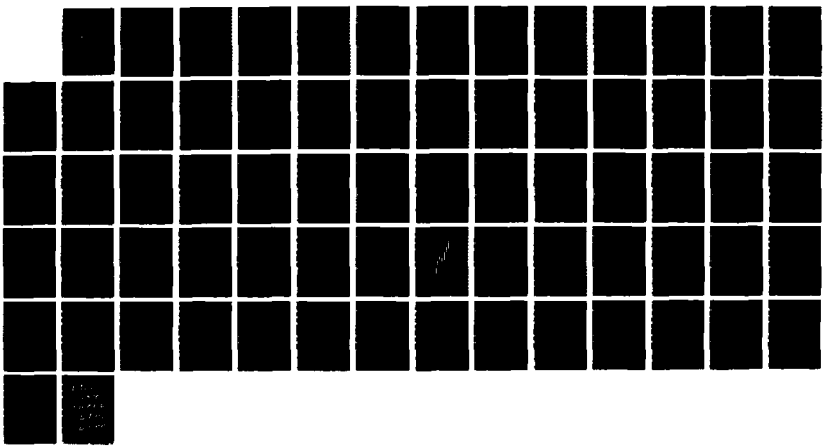
- Attach all hoses, probes, and other air-drawing devices to CGI.

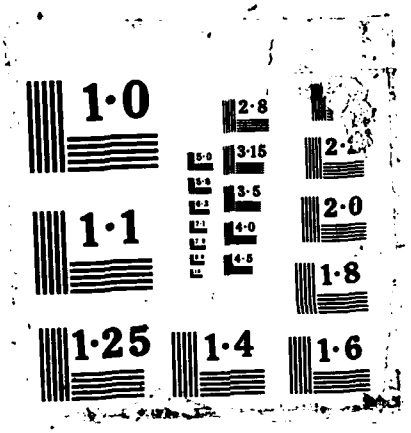
- Place a finger over probe or hose end.

- Operate pump or squeeze aspirator bulb.

AD-A192 375 INSTALLATION RESTORATION PROGRAM PHASE 2 6/6
CONFIRMATION/QUANTIFICATION STAG (U) DAMES AND MOORE
PARK RIDGE IL 01 MAR 88 F33615-83-D-4002

UNCLASSIFIED F/G 24/4 NL




1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
2·0
1·8
1·4
1·6

In a leak-free system, bulb remains collapsed or pump labors. In a leaking system, bulb regains its shape or pump does not labor.

1. MSA Explosimeter Combustible Gas Indicator

   a. Turn explosimeter on by lifting end of "on-off" bar on "rheostat" knob and rotating "rheostat" knob clockwise 1/4 turn.

   b. Flush instrument with fresh air by squeezing and releasing aspirator bulb about five times.

   c. Rotate "rheostat" knob until meter needle rests at zero (Avoid large clockwise rotation, which sends large current through filament, perhaps shortening its useful life.)

   d. To sample, place hose or probe end in atmosphere to be measured and operate aspirator bulb about five times.

   e. Read percent of lower explosive limit (LEL) as meter needle fluctuates from a steady-state level to a higher level each time the aspirator bulb is flexed. The steady-state reading indicates the "true" value.

   f. Turn explosimeter off by lifting end of "on-off" bar on "rheostat" knob and rotating it counterclockwise until it "clicks." "On-off" bar retracts into "rheostat" knob.

B. Photoionization Detector

1. Before attaching the probe, check the function switch on the control panel to make sure it is in the off position.

2. Attach the probe by plugging in the 12-pin plug to the interface on the readout module.

3. Turn the 6-position function switch to the battery check position. The needle on the meter should read within or above the green battery arc on the scale. If not, recharge the battery. If the red indicator comes on, the battery should be recharged.

4. Turn the function switch to any range setting. Look into the end of the probe briefly to see if the lamp is on. If it is on, it will give a purple glow. Do not stare into the probe for any length of time, as UV light can damage your eyes. The instrument is now ready for operation.

5. To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the span pot produces a downscale deflection, while counterclockwise

rotation yields an upscale deflection. Note: No zero gas is needed, since this is an electronic zero adjustment. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. Wait 15 to 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

6. Turn function switch to the 0-20, 0-200, or 0-2000 position.

7. Place probe in the atmosphere to be monitored. If the needle moves to the upper limit of the scale, change the function switch to the next position.

ENVIRONMENTAL SAMPLES

Environmental samples must be packaged and shipped according to the following procedure:

1. Packaging

   a. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag.

   b. Place sample in a fiberboard container or metal picnic cooler that has been lined with a large polyethylene bag.

   c. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.

   d. Seal large bag.

   e. Seal or close outside container.

   Environmental samples may also be packaged following the procedures outlined later for samples classified as "flammable liquids" or "flammable solids." Requirements for marking, labeling, and shipping papers do not apply.

2. Marking/Labeling

   Sample containers must have a completed sample identification tag, and the outside container must be marked "Environmental Sample." The appropriate side of the container must be marked "This End Up," and arrows should be drawn accordingly. No DOT marking and labeling is required.

3. Shipping Papers

   No DOT shipping papers are required.

4. Transportation

   There are no DOT restrictions of mode of transportation.

FORM #IHST-1

REVIEW RECEIPT

PROJECT HEALTH AND SAFETY PLAN

Instructions: This form is to be completed by each person to work on the site and returned to the Program Director-Industrial Hygiene and Safety.

Job No. 01016-261-07

Project: Phase II, Stage 2 Environmental Investigation
Elmendorf Air Force Base, Alaska

Rev. No. 0 Date: 09/05/86

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

_____
Signed

_____
Date

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for future revisions:

PLEASE RETURN TO THE FIRMWIDE HEALTH AND SAFETY OFFICE - WP

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT			DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (include area code)		
NAME OF INJURED OR ILL EMPLOYEE			
DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT	
NARRATIVE DESCRIPTION OF ACCIDENT			
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED			LOST TIME YES ☐ NO ☐
PROBABLE DISABILITY (check one) FATAL ☐	LOST WORK DAY WITH ___ DAYS AWAY FROM WORK ☐	LOST WORK DAY WITH ___ DAYS OF RESTRICTED ACTIVITY ☐	NO LOST WORK DAY ☐ FIRST AID ONLY ☐
CORRECTIVE ACTION TAKEN BY REPORTING UNIT			
CORRECTIVE ACTION THAT REMAINS TO BE TAKEN (by whom and by when)			
NAME OF SUPERVISOR		TITLE	
SIGNATURE		DATE	

3.3 SUBCONTRACTOR INFORMATION

3.3.1 Chemistry Subcontractor

UBTL, Inc.
520 Wakara Way
Salt Lake City, Utah 84108
Telephone: 801/584-3232

3.3.2 Surveying Subcontractor

Kean and Associates
6510 Homer Drive
Anchorage, Alaska 99518
Telephone: 907/349-6431

3.3.3 Drilling Subcontractor

Tester Drilling Services, Inc.
1601 East 84th Court, Suite 106
Anchorage, Alaska 99507
Telephone: 907/349-7214

4.0 CALIBRATION OF FIELD EQUIPMENT

All field equipment will be calibrated according to the manufacturers' specifications, as described below. The personnel assigned to take measurements in the field will assemble as much equipment as feasible in the laboratory prior to mobilization to the site. The personnel will become familiar with the calibration of all instruments, as outlined in the respective manuals, and will make all calibrations that can be made at that time. Pertinent sections of the respective manuals will be photocopied for reference in the field, and all equipment that will be necessary for field calibration, such as buffer solutions and calibration gases, will be assembled.

LIST OF FIELD EQUIPMENT

4.1 Metal Locator
4.2 Hand Pump
4.3 Vacuum Pump
4.4 Water Filters
4.5 Total Organic Vapor Analyzer
4.6 Explosimeter
4.7 Conductivity Meter
4.8 pH Meter
4.9 Thermometer (Thermocouple)
4.10 Bailers
4.11 Decontamination Supplies
4.12 Respirators, Cartridges, and Filters
4.13 Locks

4.1 METAL LOCATOR

The Discovery Electronic TF-600 is a ground-reject metal locator capable of screening out spurious responses produced by metal litter and variations in soil conditions. The TF-600 requires that an instrument nulling procedure be followed to optimize survey results. This is accomplished at the start of a survey using the mode selector and two nulling controls present on the instrument panel following the procedures prescribed in the Instrument Operations Manual. Frequently, once set, the nulling controls need not be changed through the course of the entire survey. As a standard practice, the nulling process is performed at the start of each survey day.

Systems performance is verified by passing the TF-600 over a visible metallic object and noting the tone response of the instrument.

4.2 HAND PUMP

A Brainard Kilman 1.7-inch hand pump will be used for well development and purging. This is a PVC pump with a 2.75-gpm pumping rate. An external power source is not required to operate this manual pump. The only calibration applicable for this type of equipment is an initial measurement of the length and internal diameter of the pump piping to confirm the stated volume capacity. Prior to use, the threads and check valve will be inspected to ensure a tight seal. The performance of the "O" ring seal will also be tested. During purging, the evacuated water will be placed in containers to determine the volume of water removed.

4.3 VACUUM PUMP

A Millipore vacuum pressure pump, Model XX60-000-000, will be used to pull water samples through a filter prior to metals analysis. No calibration is necessary for this piece of equipment. Performance level is monitored by two gauges, one on the suction and the other on the discharge side of the pump.

4.4 WATER FILTERS

QED Environmental Systems Sample Pro high capacity field filters will be used to filter sediments from water to be sampled for metals. The filter used will be a 0.45-micron filter, Model FF-8000. The filtered water sample will then be free of soil particles larger than 0.45 microns containing metals or minerals that could give false high readings of metals. No calibration is required for this type of equipment. The filters are commercially packaged to prevent contamination. The integrity of the package will be visually inspected prior to use.

4.5 TOTAL ORGANIC VAPOR ANALYZER

The analyzer used will be an HNU Model P1-101. The HNU is a quantitative instrument that measures the total concentration of numerous organic vapors in the air. The instrument is used primarily as a safety or screening device to determine the presence and concentration of organic vapors. The HNU is battery operated and lightweight, making it very useful in actual field monitoring projects. The instrument is calibrated by introducing pressurized gas from a cylinder with a known organic concentration into the detector. Once the concentration has stabilized, the display of the instrument is adjusted to match the known concentration. A calibration of this type is performed prior to each usage of the

instrument. If the output differs greatly from the known concentration, the initial procedure to remedy the problem is a thorough cleaning of the instrument. The cleaning process normally removes foreign materials that affect the calibration of the instrument. If this procedure does not remedy the problem, further troubleshooting is performed until the problem is resolved. If the problem cannot be resolved by Dames & Moore technicians, the instrument is returned to the manufacturer for repair.

4.6 EXPLOSIMETER

An MSA Model 2A explosimeter will be used to determine the presence of explosive gases or vapors in ambient air. The instrument is used primarily as a safety device to determine whether the atmosphere contains vapors or gases in sufficient quantities to be explosive. The explosimeter is calibrated by plumbing a small quantity of explosive gases into the instrument and comparing the instrument's output with the known gas concentration. This calibration is performed before each field use. The instrument is cleaned after each field assignment. All components are checked for proper working order and replaced as necessary.

4.7 CONDUCTIVITY METER

A YSI Model 33 S-C-T meter will be used to measure water conductivity. To calibrate, the meter is turned off and the level indicator is adjusted to zero on the readout face. Next, the meter switch is set to "red line" and the level indicator is adjusted to the red line marking on the readout face.

4.8 pH METER

A Fisher Model 107 pH Meter will be used to measure water pH. The meter has polymer body, gel-filled combination electrodes. These are compact pH analysis probes that incorporate a reference and a measuring element. To calibrate, connect the electrodes to the meter and remove the protective cap. Rinse the electrode in distilled water. Immerse the electrode in pH buffer 7.00 and allow sufficient time for the electrode to stabilize. Adjust the STANDARDIZE control for the correct readout. Rinse the electrode in distilled water. Immerse electrode in pH buffer 4.01, set the TEMPERATURE knob to that of the buffer 4.01, and allow sufficient time for the electrode to stabilize. Adjust the SLOPE control for the correct readout as indicate 4.00. Rinse electrode in distilled water. The meter is calibrated and ready for use.

To operate, standardize in buffer 7.00 and rinse in distilled water. Immerse electrode in sample and set TEMPERATURE knob to the sample temperature. The readout indicates the pH value of the sample. When the sample temperature is other than the temperature of the buffer, allow enough time for the electrode and readout to stabilize. Always rinse the electrode in distilled water after use and replace cap. The cap should be maintained with buffer 4.01 or KCL. If a hard coating has been allowed to form on the bulb, remove by chemical means; for soft coatings, soak in water or detergent. Do not abrade.

4.9 THERMOMETER (THERMOCOUPLE)

A Fluke Model 80TK will be used to measure the temperature of gases and liquids. This device has a range of -50°C to 1000°C to an accuracy of ±1.0°C. This instrument is calibrated by comparison with a Hewlett-Packard Model 2804A quartz thermometer standard. The calibration is performed by placing the standard's probe and the probe of the thermocouple in identical water baths. The output of the thermocouple is adjusted to correspond with the standard. The calibration is performed once a year but is more frequently checked with respect to other thermometers.

4.10 BAILERS

Teflon bottom discharge bailers manufactured by Timco Mfg., Inc., will be used for well sampling. The only calibration applicable for this type of equipment is an initial measurement of the length and internal diameter of the bailer to confirm the stated volume capacity. Prior to use, the threads will be inspected to ensure that connections are tight. The bailer will be inspected for scratches or dents that could also affect the integrity of the equipment. The operation of the discharge mechanism will be tested prior to use. The bailer will be packaged for transport to minimize the effects of jostling.

4.11 DECONTAMINATION SUPPLIES

All sampling equipment will be decontaminated prior to use and between samples to avoid cross-contamination. As specified in the Statement of Work, decontamination supplies will include methanol, laboratory-grade detergent, and distilled water. Certified grade methanol will be used to ensure high purity. Alconox laboratory-grade detergent (Fisher Scientific Company) will be used due to its low sudsing and low residue properties.

The final rinsing of equipment will be done using commercially available distilled water. All decontamination supplies will be transported sealed in unbreakable containers. The containers will be visually inspected for leaks or contamination prior to each use.

4.12 RESPIRATORS, CARTRIDGES, AND FILTERS

Half mask, combination filter/cartridge respirators will be donned by sampling personnel when field situations warrant. The respirators will be fitted with GMA cartridges with Type F filters for removal of organic vapors, dusts, and mists. These are NIOSH (National Institute for Occupational Safety and Health) tested, and NIOSH and MSHA (Mine safety and Health Administration) approved. The GMA cartridge is approved for use in atmospheres containing at least 19.5 percent oxygen and less than 0.1 percent organic vapors by volume.

4.13 LOCKS

Good quality, reasonably priced padlocks will be placed on each monitor well to discourage tampering and vandalism. The locks will be purchased from a locksmith supplier and will be performance tested at the time of purchase and when placed on a well. As per Alaskan Air Command request, the locks will be keyed alike to avoid the possibility of confusion among keys.

5.0 PREVENTIVE MAINTENANCE OF FIELD EQUIPMENT

All field equipment will be maintained according to manufacturers' specifications, as discussed below. As described in Section IV, all equipment will be assembled in the laboratory, if feasible, for calibration prior to mobilization. At this time, the equipment will be checked to ensure that it is in proper working order, and any required maintenance will be performed. Tools and equipment that may be needed for field maintenance will be assembled, and pertinent sections of the manuals will be photocopied for reference in the field.

LIST OF FIELD EQUIPMENT REQUIRING PREVENTIVE MAINTENANCE

5.1 Metal Locator
5.2 Hand Pump
5.3 Vacuum Pump
5.4 Total Organic Vapor Analyzer
5.5 Explosimeter
5.6 Conductivity Meter
5.7 pH Meter
5.8 Thermocouple
5.9 Bailers

5.1 METAL LOCATOR

Instrument field maintenance consists solely of battery replacement when the battery indicator meter shows low power.

5.2 HAND PUMP

The hand pump is packed and handled to minimize dents to the piping or damage to the pipe threads or check valve. When stored, the "O" rings should be kept in darkness to prevent deterioration so that a tight seal will be maintained when in use. When in use, it is important that the inner pump cylinder is not jammed down hard or pushed down into the sediment in the bottom of the well. This action has the potential to cause damage to the check valve, "O" ring seal assembly, and/or pump cylinder. A "holding dog" will be used to hold the pump assembly up in the well a safe distance (typically 2 feet) from the sediments at the bottom of the well.

5.3 VACUUM PUMP

The vacuum pump is packed and handled so as to prevent damage. The plug and cord are visually inspected prior to going into the field for defects that could cause a short. Electrical problems will be repaired before the pump is taken to the field. The pump bearings are kept lubricated. Seals are inspected and replaced when damaged or deteriorated. The pump is tested and repaired as necessary before it is taken to the field.

5.4 TOTAL ORGANIC VAPOR ANALYZER

The detector must be kept clean for accurate operation. Foreign materials can be rinsed or wiped off or blown out of the detector. The cord between the analyzer and the recorder should not be wound tightly, and will be visually inspected for integrity before going into the field. A new cord will be ordered from the manufacturer if problems are found. A battery check indicator is included on the equipment and will be checked prior to going into the field and prior to use. The batteries will be charged if found to be weak. The analyzer, probe, and meter are packed securely and handled so as to minimize the chance of damaging parts.

5.5 EXPLOSIMETER

This instrument is cleaned after each field use and is calibrated before each field use. At the time of calibration, all components of the explosimeter are checked for proper working order and are replaced as necessary. Batteries are checked before going into the field and before use and are replaced as necessary. The explosimeter is packed and handled to prevent damage.

5.6 CONDUCTIVITY METER

The conductivity meter and detector are transported in a protective foam-lined case. The cell is tested before going into the field using the test feature and is repaired by the manufacturer as necessary. The contact between the detector and the recorder must be kept clean and can be wiped, rinsed, or blown out. The detector is cleaned with distilled water rinses after each use.

5.7 pH METER

The electrode probe should be kept clean and stored in a protective plastic boot. The probe and meter are packed in a foam-padded case for transport. Prior to use, the batteries are checked by sliding the "batt chk" switch to the right and noting whether the dial moves to the green "batt chk" area. Extra 9-volt batteries will be on hand in the event the batteries do not check.

5.8 THERMOCOUPLE

The thermocouple is checked annually for accuracy. If erroneous readings are shown during calibration, or suspected while in the field, the thermocouple will be either repaired or replaced. No other preventive maintenance is required except for care during handling.

5.9 BAILERS

The bailers will be visually inspected to ensure that connections are not stripped and that there are no holes or dents. The operation of the check valve will be tested before going into the field and cleaned, repaired, or replaced as necessary.

6.0 FIELD ANALYTICAL PROCEDURES AND DATA REPORTING

6.1 CHEMICAL DATA

Sections 10.3 and 10.4 describe field chemical analysis and sampling for off-site analysis, respectively. Field chemical data, including pH, temperature, conductivity, HNU, and LEL readings, will be tabulated for presentation in the investigation report. Results of chemical analysis by Dames & Moore's subcontractor, UBTL, will be presented as received from the subcontractor. A typical report will include the method used for analysis of each parameter, units, and detection limits. Water and soil quality control reports will accompany the analytical results and will include data on percent recovery on spiked samples (10 percent), duplicate sample analysis (10 percent), and trip and field blank analysis.

6.2 HYDRAULIC DATA

A Falling Head or Instant Recharge test will be used during this phase of the investigation. It will be conducted on the upgradient well at Site 32 to determine the hydraulic conductivity of the surficial aquifer. It consists of injecting a known volume of water or "slug" of water into the boring or instrumentation and recording the rate at which the induced water level returns to the static water level. The amount of water to be injected is generally less than 50 gallons but is variable. Factors such as permeability of the formation depth to static water level, saturated formation thickness and boring diameter are considered to determine the amount required to achieve valid results.

6.3 SOIL BORING DATA

Soil boring data will be collected in the field by an experienced Dames & Moore geologist or soils specialist, as described in Section 8.2. During boring operations, lithologic descriptions and stratigraphic logs will be developed. Special emphasis will be placed on field identification of contaminated soils that are encountered. The edited Dames & Moore logs (Figure 8.1) will be included in the appendix of the report, and the significance of soil conditions relative to contaminant migration will be discussed on a site-by-site basis. If a correlation exists between borings, scaled cross sections may be drafted to illustrate these correlations.

6.4 SURVEYING DATA

Surveying data will be presented in the appendix of the report as received from the Dames & Moore surveying subcontractor. The data will include elevations and locations of all wells installed during the field effort using benchmarks traceable to USCGS or USGS survey markers, if available. Elevations of significant bodies of standing water and elevations and locations of preexisting wells will also be included. The survey data, in conjunction with water level measurements (Section 10.1), will be used to construct contour maps of the ground water surface. Individual figures will be drafted for each site showing the locations of monitoring wells, borings, sampling points, known pumping locations, and inferred direction of ground water flow.

7.0 SAMPLE NUMBERING SYSTEM

7.1 PROJECT IDENTIFICATION

The project shall be identified on sample labels as Elmendorf AFB with assigned Dames & Moore job number for the project.

7.2 SITE IDENTIFICATION

The sites shall be identified according to the following list:

1. Site D-5 - Sanitary Landfill
2. Sites SP-7 and SP-10 - Pumphouse No. 3
3. Site D-7 - Sanitary Landfill
4. Site SP-5 - JP-4 Tank Spill
5. Site SP-12 - JP-4 Fuel Line Leak
6. Site D-17 - Shop Waste Disposal
7. Site SP-11 - JP-4 Fuel Line Leak
8. Site FT-1 - Fire Training Area
9. Site SP-2 - JP-4 Fuel Line Leak
10. Site SP-14 - MOGAS Spill
11. Site IS-1 - Building 42-400 Floor Drains

7.3 SEQUENCE NUMBER

Each sample shall be numbered sequentially as it is logged in the field in the master sample log.

7.4 SAMPLE DEPTH

Identification of soil samples shall include the depth interval (in feet from the ground surface) from which the sample was taken.

7.5 SPLIT SAMPLING

Soil split samples will be collected by vertically dividing each ASTM split spoon sample and placing each division into a separate sample container. Subsequent split spoon samples will be collected and divided in this same manner until adequate amounts of soil have been collected. As with water samples, all split soil samples will be identified using the standard numbering system.

7.6 SAMPLE TYPES AND EXAMPLES OF SAMPLE NUMBERS

7.6.1 Sample Type

The following abbreviations will be used to indicate sample type:

SW = Surface water

W = Ground water

SS = Surface sediment

B = Soil from boring

BW = Soil from well

7.6.2 Examples of Sample Numbers

Sample labels will contain the following information:

D&M Job Number

Location: Elmendorf AFB

Date

Time

Sampler's Initials

Sample Type

Sample Number

Purpose of Sample (Analyte and Sample Group)

Preservatives Used

The sample number consists of four to five fields. Field 1 indicates the sample type, as given in Section 7.5.1. Field 2 indicates the site, as numbered in Section 7.2. Field 3 will be lettered consecutively starting with A for each set of samples of a given type at a given site. Field 4 gives the depth from which the sample was obtained. This field applies only to soil from borings and wells (sample types B and BW). Field 5 (field 4 for sample types SW, W, and SS) is the sequence number (see Section 7.3).

Example 1: B 1-A, 0-1.5', 53

Field 1: B The sample type is a soil from a boring

Field 2:	1	The sample is from Site 1, D-5, Sanitary Landfill
Field 3:	A	This sample is from the first soil boring drilled at Site 1
Field 4:	0-1.5'	The sample was obtained from a depth of 0 to 1.5 feet
Field 5:	53	This was the 53rd sample to be logged in the master sample log

Example 2: W 3-C, 63

Field 1:	W	The sample type is a ground water sample
Field 2:	3	The sample is from Site 3, D-7, Sanitary Landfill
Field 3:	C	The sample was obtained from the third well drilled at Site 3
Field 4:	63	This was the 63rd sample to be logged in the master sample log

7.7 BLANKS, SPIKES, AND DUPLICATES

Water sample field blanks, trip blanks, and duplicates will aggregate to an additional 10% of the sampling effort. Trip blanks will be prepared by UBTL, the Laboratory subcontractor, using field sample collection containers and double distilled/deionized water. The trip blanks will accompany sample bottles through the entire sample history. This type of blank permits a determination of the laboratory's cleaning procedures of sample containers; these bottles will remain sealed until opened for analysis. Field blanks will be prepared in the field with distilled water rinsed through the decontaminated bailer. This type of blank serves as a check on the field cleaning procedures.

Trip blanks and field blanks will be identified using the same numbering system as for standard samples to ensure that no preferential treatment is given to quality control samples. In general, quality control samples will be labeled as such only in the Dames & Moore master sample log and will be identified by their sequence number.

Field duplicate water sampling will also be conducted for quality control purposes. Duplicate samples will be collected by sequentially filling two sample bottles with water from a single sample collection. All duplicate water samples will receive identical treatment and will be identified using the same numbering system established for standard samples.

Laboratory spiked samples will be prepared and analyzed by UBTL for all chemical analyses performed. Laboratory duplicate analyses will also be performed. The laboratory spiked samples and laboratory duplicate samples will each comprise an additional 10% of individual sampling parameters. Results of laboratory spiked samples will be identified by UBTL and labeled with the standard sample numbering sequence, plus an additional identifier denoting that results reported are laboratory spike and duplicate analyses.

8.0 DRILLING AND INSTALLATION OF GROUND WATER MONITOR WELLS

8.1 DRILLING

The choice of drilling methods is influenced by two main factors: (1) the need to minimize the introduction of foreign material that may influence the results of chemical analyses; and (2) the need to penetrate diverse geologic materials.

All borings will be initiated using hollow-stem augers and will be extended by this method to auger refusal or to the required total depth. If difficulties are encountered such that this method proves ineffective, alternate methods will be proposed to the Technical Monitor for approval.

For ground water monitoring, wells will be augered to a maximum depth of 50 feet. Drilling locations and screening lengths for the eight additional wells to be installed in the Phase II, Stage 2 investigation have been detailed in Section II.

8.2 SOIL SAMPLING

Soil samples will be collected at 5-foot intervals during the drilling of borings in which monitor wells will be installed. Samples will be obtained using an ASTM split spoon sampler driven 18 inches with a 140-pound hammer.

Each soil sample will be logged in the field by a Dames & Moore geologist or soils specialist. The standard Dames & Moore field drilling log is shown in Figure 8.1. Information recorded on this form includes sample descriptions using the Unified Soil Classification System, boring location, drilling and sampling method, sampling interval, and hammer blows per 6-inch advance of the split spoon.

Split spoon decontamination and sample shipping are discussed in Sections 11.1 and 12, respectively.

8.3 MONITOR WELL CONSTRUCTION AND COMPLETION

Monitor wells will be installed in accordance with USEPA Publication 330/9-51-002, NEIC Manual for Ground Water/Subsurface Investigations at

Dames & Moore

LOCATION OF BORING

JOB NO	CLIENT	LOCATION

DRILLING METHOD:

BORING NO

SHEET OF

SAMPLING METHOD:

DRILLING START FINISH

WATER LEVEL					TIME	TIME
TIME						
DATE					DATE	DATE
CASING DEPTH						

DATUM ELEVATION

DRILLING CONTR.

No. 52216

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO / SAMPLE DEPTH	BLOWS/FT SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						0	
						1	
						2	
						3	
						4	
						5	
						6	
						7	
						8	
						9	
						0	

SURFACE CONDITIONS:

BY _____ DATE _____ CHK'D BY _____

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FIGURE 8-1

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FIELD LOG

Hazardous Waste Sites. The casing installed for the monitor wells will be a nominal 2-inch (2.375-inch O.D. by 2.067-inch I.D.) Schedule 40 PVC pipe and well screen. The screen is 0.010-inch slot size with a 0.25-inch space between slots. There are three parallel rows of horizontal slots factory-sawed along the length of each screen. All pipe and screen sections will be coupled with threaded joints; no PVC solvent or metal parts will be used. Each well will have enough screen installed (minimum of 10 feet) so that at least 2 feet of screen extends above the water table. Above the screen, blank casing will be installed to a nominal 2 to 3 feet above the ground surface.

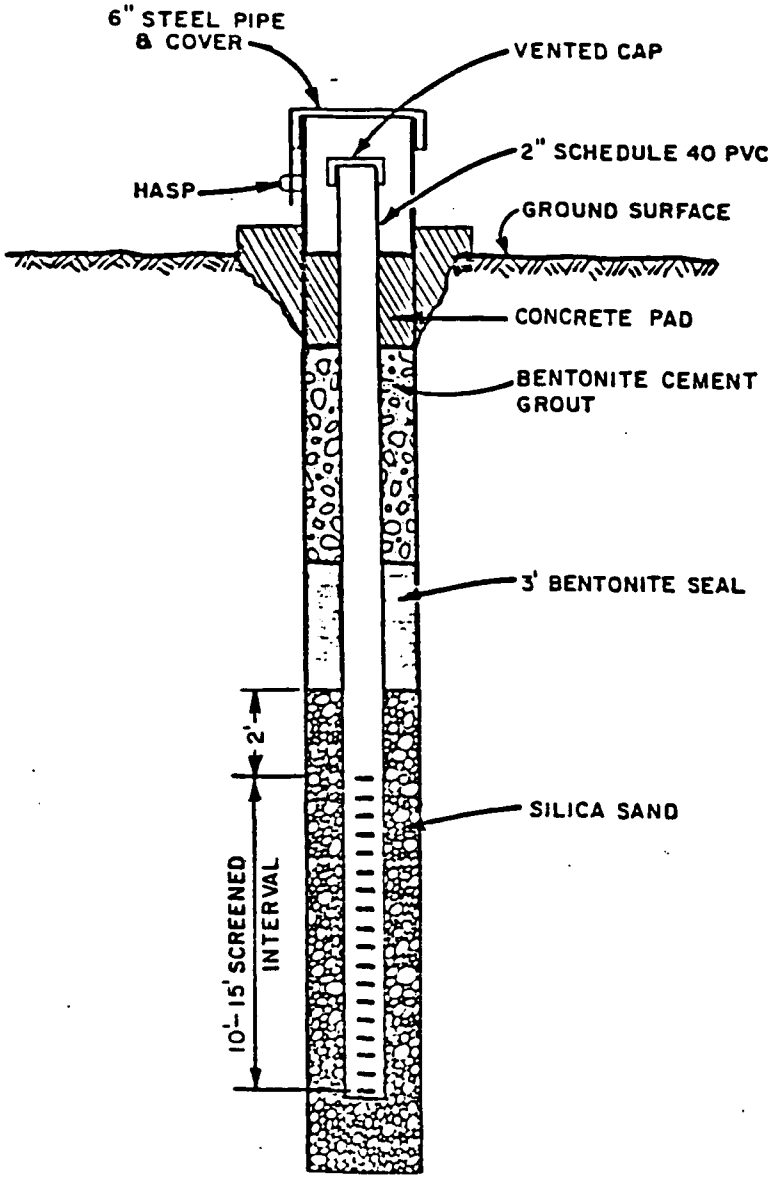
After the casing is installed, the natural materials in the annular space will be allowed to collapse around the well screen if these materials are appropriate. If necessary, supplemental washed, rounded silica sand or gravel (with a grain size distribution compatible with the screen and soil formation) will be added to form a sand/gravel pack from the bottom of the borehole to 2 feet above the top of the screen. A 2- to 3-foot thick bentonite seal will be tremied above the sand/gravel pack. The bentonite will be checked to ensure that a complete seal exists.

The remainder of the annular space will be filled with a cement-bentonite mixture to about 1.5 feet from the ground surface. A concrete cap will be poured to the ground surface and form a 2-foot by 2-foot by 4-inch concrete pad at the surface. The installation will be completed by embedding a 5-foot length of 6-inch diameter steel pipe with a locking cap approximately 2.5 feet into the concrete cap and over the well pipe. Locks will be provided for all wells, and they will be keyed alike.

If the well is located in an area frequented by vehicular traffic, three 3-inch diameter steel guard posts will be installed radially from each wellhead. The guard posts will be 5 feet in total length and will be recessed 2 feet into the ground. The protective steel casing will be painted, and the well number will be marked on the steel casing exterior. Typical well construction is illustrated in Figure 8.2.

All boreholes will be monitored for organic vapors and explosive gases during drilling using an HNU photoionization meter and an explosimeter. Readings will be taken with both meters at the top of the borehole during drilling and immediately before sampling operations. The readings will be recorded in a field notebook.

Each soil sample will be tested with the HNU; readings will be recorded on the boring logs adjacent to the sample description.



(NOT TO SCALE)

FIGURE 8-2
TYPICAL MONITOR WELL INSTALLATION

Dames & Moore

8.4 WELL DEVELOPMENT AND SAMPLING

All wells will be developed after completion to insure that relatively sediment-free water samples can be obtained. Prior to well completion, all well boreholes constructed with drilling mud will be flushed with potable water. The method of development will depend upon the equipment available. Air-lift pumping or the use of a submersible pump are the preferred methods for this project. It is anticipated that a Brainard-Kilman 1.7" hand pump will be used to develop the wells. After thorough decontamination of the assembly, the pump is inserted in the well. During the pumping process, water fills the annulus between the actuating pipe and the extension pipe to the point that it flows from the well head outlet. Volume of discharge water will be measured at this point. Pumping rates can be easily adjusted to formation conditions to avoid too rapid a rate of discharge and possible disturbance of the sand/gravel pack.

If air-lift pumping is used, the development procedure will consist of pumping air down the monitor well through a nominal 0.75-inch diameter flexible ABS pipe that extends to or near the bottom of the hole. Air will be supplied by a 125-cfm air compressor with valves to control the volume of air injected into the well. Water and gravel flow to the surface in the annulus between the 0.75-inch and 2-inch diameter pipes and can be discharged through a 2-inch elbow and extension pipe to the ground surface. Pumping and surging by alternately turning the air supply on and off is usually continued until the discharge water becomes clear or until it becomes obvious that further efforts are not going to improve the clarity of the water being discharged.

Each well will be allowed to stabilize after development for a minimum of 1 day before purging. Prior to sample collection, each well will be purged until a minimum of three casing volumes of water have been removed. Purging will continue until pH, temperature, specific conductance, color, and odor of the discharge have stabilized, using the following criteria: pH, $\pm$0.1 standard unit; temperature, $\pm$0.5°C; specific conductance, $\pm$10 µmhos/cm.

Samples will be collected from the wells using a Teflon bottom discharge bailer. The bailer will be suspended in the well using a dedicated monofilament line and will be raised and lowered by hand. Prepared sampling containers with appropriate preservatives will be filled and immediately stored in insulated shipping containers.

If floating hydrocarbons are noted on the surface of the water table, the thickness of the hydrocarbon layer will be measured, and the floating hydrocarbons will be collected using a thief sampler.

At the end of each sampling day, the water samples will be shipped via air cargo to the testing laboratories (UBTL in Salt Lake City, Utah, and OEHL at Brooks AFB, Texas), where the samples will be received the following day. The soil samples will be stored in prewashed glass containers and frozen at the end of each working day. They will be shipped to the testing laboratories at the same time as the water samples are shipped.

8.5 GEOPHYSICAL LOGGING

No geophysical logging of the boreholes is anticipated during this field investigation.

8.6 BOREHOLE AND WELL ABANDONMENT

After consultation with the USAFOEHL and the Eielson POCs, and visual inspection and sounding of the Stage 1 wells, it will be determined whether any of the Stage 1 wells are damaged or inoperable. If so, a maximum of five wells will be abandoned as part of this investigation.

Boreholes (drilled solely for soil sampling) and damaged/inoperable wells will be abandoned by tremieing a lean bentonite-cement grout from the borehole/well bottom to the surface to ensure an adequate seal and preclude possible future migration of contaminants.

The locations of soil borings and abandoned wells will be marked in the field by means of labeled metal markers affixed in the cement grout. The locations of the soil borings and abandoned wells will be recorded on the project map for each specific site.

9.0 PUMP TEST

Pump tests, per se, will not be conducted during this investigation. A falling head or instant recharge test, as described in Section 6.2, will be employed to determine the hydraulic conductivity of the surficial aquifer.

10.0 GROUND WATER MONITORING AND SAMPLING

10.1 GROUND WATER LEVEL MEASUREMENT

The depth to ground water will be measured in each well from a reference notch cut in the PVC casing. This measurement will be made to the closest 0.01 foot using an electronic water level indicator or a ploper device. The distance from the top of the PVC to the ground surface will be recorded to the nearest 0.1 foot.

Water levels will be measured once each day on 3 consecutive days of the field effort in each well. These triplicate measurements will be useful for confirming that the wells have stabilized, or for recognizing the magnitude of short-term ground water fluctuations.

10.2 SURVEYING OF WELLS

In order to establish ground water flow patterns, two surveys will be made of all monitor wells and of key surface water elevations. The first survey, carried out before field operations commence, will be performed on Stage 1 wells and surface water elevations. A preliminary water table map will be constructed from these data. The second survey will encompass both Stage 1 and Stage 2 wells. The elevations of the top of the PVC will be measured to an accuracy of 0.01 foot, and horizontal locations will be accurate to 1.0 foot. The surveys will be tied to a reference datum point traceable to a USCGS or USGS survey marker. The final water table map will be based on data from both surveys to provide an accurate presentation of ground water flow patterns at the base.

10.3 ON-SITE ANALYSIS

Before water samples are collected for shipment to the laboratory, and after the wells have stabilized, a separate water sample from each well and surface water sampling location will be analyzed in the field for pH, conductivity, temperature, and color. Meters will be calibrated and maintained as described in Sections 4.0 and 5.0. The pH meter will be calibrated before each set of measurements using standard buffer solutions. Calibration of the thermometer and the conductivity meter will be checked in the laboratory before commencement of the field effort. All instrument probes will be rinsed with distilled water between measurements. The sample will be placed in a clean container against a white background when determining color. Since temperature can affect conductivity and pH readings, all measurements will be taken consecutively on the same sample.

Precautions will be taken to obtain a representative sample as described in Section 10.4.

Soil samples will be monitored in the field for organic vapors using an HNU photoionization meter. The readings will be taken immediately after opening the split spoon and will be recorded directly on the boring logs. The boreholes will be monitored with both the HNU and the explosimeter during drilling.

10.4 SAMPLING FOR OFF-SITE ANALYSIS

Ground water samples will be obtained from monitoring wells after proper well development (Section 8.4) using a Teflon bailer. Prior to sample collection, a stabilization test will be performed on each well to ensure that standing water in the well casing has been removed and that the sample will be representative of the aquifer. To perform the test, the well will be air-lift or hand pumped while monitoring the pH, temperature, and specific conductance of the discharge. When three successive readings (taken at intervals of one well volume) give equivalent values, the well is considered to have stabilized. Values are considered equivalent if they fall within the following ranges:

Specific conductance (temperature corrected): $\pm$ 10 µmhos/cm

pH: $\pm$ 0.1 pH unit

Temperature: $\pm$ 0.5°C

A form to be filled out during the stabilization test is given in Figure 10.1. The sample will be transferred directly from the bailer through the bottom-discharge device to the sample container supplied by the laboratory. Containers will be filled to capacity to minimize the loss of volatile constituents to the head space.

Subsurface soil samples will be obtained using standard split spoon methods, as described in Section 8.2. After the sample has been logged, a stainless steel spoon will be used to transfer the sample to a glass sample jar with a Teflon-lined cap. As much of the sample as possible will be placed in the jar, but if the jar does not have the capacity, the greatest concentration of contamination, as indicated by visual examination or HNU readings, will be selectively collected.

Surface soil samples will be collected in a similar manner, using a stainless steel sampling spoon or spade.

Figure 10-1

STABILIZATION TEST

PARAMETER	WELL VOLUME EXTRACTED									
	1	2	3	4	5	6	7	8	9	10
Specific conductance (temperature corrected) ± 10 mhos/cm										
pH: ± 0.1 pH unit										
Temperature: ± 0.5°C										
Color										
Odor of Discharge										

11.0 DECONTAMINATION PROCEDURES

11.1 DRILLING, SOIL SAMPLING, AND MONITOR WELL INSTALLATION

Precautions will be taken not to introduce contaminants into the well during drilling and well installation. The rear end of the drill rig, augers, and rods will be steam cleaned between holes except in the case where the hole is moved only a short distance because of refusal on boulders.

Split spoon samplers will be decontaminated after each sample according to the following procedure:

1. Wash with laboratory-grade detergent, rinse with clean water;

2. Wash with methanol, rinse with distilled water; and

3. Air dry until the equipment is completely dry.

11.2 WELL DEVELOPMENT AND SLUG TESTS

Wells will be developed by air-lift or submersible pumping, as described in Section 8.4. Any part of the air-lift equipment or submersible pump that is placed down the hole will be decontaminated after developing each well using the procedure in Section 11.1. Teflon bailers will be decontaminated using the method for split spoons. A dedicated monofilament line will be used to lower the bailer in each well. The line will not be used in more than one well.

The same method of decontamination will be used for equipment used during stabilization tests.

11.3 WATER LEVEL MEASUREMENT

The probe used for water level measurements will be decontaminated between wells using the procedures described in Section 11.1.

11.4 WATER SAMPLING

Water samples will be obtained by bailing using a Teflon bailer suspended on a dedicated monofilament line as described in Section 10.4.

The bailer will be decontaminated as described in Section 11.1 after each sampling. The monofilament line will be discarded after use in one well.

11.5 SEDIMENT SAMPLING

Sediment sampling devices, including stainless steel spoons and spatulas, shall be decontaminated after collection of each sample using the same procedures as for split spoon samplers, described in Section 11.1.

11.6 SAMPLE HANDLING

Samples will be handled by personnel wearing nitrile gloves to avoid contamination. The sample containers will be well cushioned with packing materials when they are placed in the insulated cooling chests for transport to the laboratories. Care will be taken to seal bottle/vial caps tightly. Extra insurance against opening in transit will be provided by sealing the caps with filament tape for medium concentration samples.

11.7 PERSONNEL DECONTAMINATION

A personnel decontamination station shall be established at a location approved by base personnel. Persons working on the site shall report to the station for decontamination before leaving the base. In most instances, removal of protective clothing will suffice for decontamination. The station will have facilities for storage of reusable protective clothing and for the disposal of clothing contaminated beyond reuse. Also, facilities for decontaminating hands, boots, and gloves, consisting of detergent wash and tap water rinse, shall be provided. Facilities for sanitizing respirators using manufacturers' instructions shall be provided.

12.0 SAMPLE HANDLING AND PACKAGING

12.1 SPLIT SAMPLE PROCEDURES

In order for split sample analysis to be valid, the split sample must be as homogeneous as possible. Split spoon samples should be split vertically so that vertical stratification of contaminants will be equally distributed between the samples.

Split ground water samples will be collected at the same time using the same bailer. Half the bailer volume will be poured into each jar until the jars are full. Sample containers, preservatives, and handling will be identical for each member of the split sample.

12.2 SAMPLE CONTAINERS

Sample containers will be provided by UBTL. The containers will be either plastic or glass with Teflon-lined lids and will be pretreated with the preservatives listed in Table 12.1 (taken from Sabel and Clark, 1985).

12.3 SAMPLE HANDLING AND DECONTAMINATION

After collection in the field, all samples will be brought to an area adjacent to the personnel decontamination area for decontamination of sample containers. The sample containers will be handled with gloves until decontaminated with a detergent wash and tap water rinse if spills have occurred on the outside of the container. Care must be taken to avoid damaging the label during decontamination. The samples will be stored on ice and will be shipped to UBTL at the end of each day's sampling via overnight delivery. Shipping to OEHL will follow the POC's choosing 10 percent of the split samples for analysis by that laboratory.

12.4 PROCEDURES FOR PACKING LOW CONCENTRATION SAMPLES

Packing procedures will follow recommendations given in the USEPA manual, "Field Monitoring and Sampling of Hazardous Materials," Section 2, Part 5 (January 1983), as described for environmental samples, which are those samples obtained from upgradient and downgradient of the site (not at the actual site) and do not have any indications of gross contamination. These samples will be packaged as follows:

- Place the labeled and sealed sample container in a polyethylene bag and seal the bag;

- Place the sample in a metal or plastic picnic cooler containing a waterproof container of ice or an ice substitute and dividers to keep sample jars separated to minimize the possibility of breakage; and

- Seal the cooler with the latch and with packaging tape.

12.5 PROCEDURES FOR PACKING MEDIUM CONCENTRATION SAMPLES

Medium concentration samples will be packed in the same manner as described in Section 12.4 for low concentration samples. However, an effort will be made to identify, by visual examination in the field, any samples suspected of having elevated contaminant concentrations. These samples will be segregated and packed in a separate container, to the extent allowed by prevailing field conditions. Containers for these samples will be sealed with tape in addition to the normal processing used on all samples collected.

TABLE 12-1

SAMPLE HANDLING PROCEDURES

PARAMETER	CONTAINER[a]	PRESERVATIVE[b,c]	MAXIMUM HOLDING TIME[d]
Metals[e]			
(except Cr^{+6} and Hg)	P, G	HNO_3 to pH < 2	6 months
Petroleum Hydrocarbons	G	Cool, 4°C; H_2SO_4 to pH < 2	28 days
Organic Tests[f]			
Purgeable halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]	14 days
Purgeable aromatics	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]; HCl to pH < 2[j]	14 days
Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]; adjust pH to 4-5[k]	14 days
Phenols	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]	7 days until extraction, 40 days after extraction
Phthalate esters	G, Teflon-lined cap	Cool, 4°C;	7 days until extraction, 40 days after extraction
Nitrosamines[g]	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$[f]	7 days until extraction, 40 days after extraction

TABLE 12.1 (continued)

PARAMETER	CONTAINER[a]	PRESERVATIVE[b,l]	MAXIMUM HOLDING TIME[c]
PCBs	G, Teflon-lined cap	Cool, 4°C; pH 5-9	7 days until extraction, 40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]; store in dark	7 days until extraction, 40 days after extraction
Haloethers	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]	7 days until extraction, 40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
TCDD	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[f]	7 days until extraction, 40 days after extraction
Pesticides Test			
Pesticides	G, Teflon-lined septum	Cool, 4°C; pH 5-9[h]	7 days until extraction, 40 days after extraction
Radiological Tests			
Alpha, beta and radium	P, G	HNO_3 to pH < 2	6 months
Total Dissolved Solids	P, G	Cool, 4°C	7 days
Major Cations	See Metals		

TABLE 12.1 (continued)

PARAMETER	CONTAINER[a]	PRESERVATIVE[b,1]	MAXIMUM HOLDING TIME[c]
Major Anions			
Bromide	P, G	None required	28 days
Chloride	P, G	None required	28 days
Fluoride	P	None required	28 days
Nitrate-nitrite	P, G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Phosphorous, total	P, G	Cool 4°C H_2SO to pH < 2	28 days
Sulfate	P, G	Cool 4°C	28 days

[a] Polyethylene (P) or glass (G).

[b] Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[c] When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of this section, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: hydrochloric acid (HCl) in water solutions at concentrations of 0.04% or less by weight (pH about 1.96 or greater); nitric acid (HNO_3) in water solutions at concentrations of 0.15% or less by weight (pH about 1.62 or greater); sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% or less by weight (pH about 1.15 or greater); and sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% or less by weight (pH about 12.30 or less).

TABLE 12.1 (continued)

[d] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

[e] Samples should be filtered immediately on site before adding preservative for dissolved metals.

[f] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds

[g] Should only be used in the presence of residual chlorine.

[h] Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

[i] Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[j] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[k] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the anlysis of aldrin, add 0.008% $Na_2S_2O_3$.

Reference: Sabel and Clark, 1985.

13.0 SAMPLE CUSTODY AND DOCUMENTATION

13.1 SAMPLE IDENTIFICATION DOCUMENTS

Each sample shall be identified using the sample numbering system described in Section 7.0. A label on each sample container will contain the following information:

- Dames & Moore Job Number
- Location of Collection
- Time of Collection
- Date of Collection
- Sample Type
- Sampler's Initials
- Purpose of Sample
- Preservatives Used

At the end of each day's sampling effort, and before the samples are shipped to the analytical laboratory, this information will be recorded in the master sample log. Each sample will be assigned a unique sequence number, to be recorded both in the log and on the label, that will be used to identify the samples and to correlate with laboratory sample numbers assigned by UBTL.

13.2 CHAIN-OF CUSTODY RECORDS

A sample chain-of-custody form to be used during this investigation is illustrated in Figure 13-1. Chain-of-custody procedures will be followed so that the possession of a sample can be traced from the time of collection until the data are used in legal proceedings. One or more chain-of-custody forms will accompany each set of samples shipped from the site. Each time the custody of the samples is transferred, the form is signed by both the person relinquishing and the person receiving the samples. A copy of the form will be retained by the sampler, who will fill in the information on sample identity and who will also be the first person to relinquish the sample. If the sample containers appear to have been

DAMES & MOORE CHAIN-OF-CUSTODY RECORD

Sample Source & Client						Field Personnel (Signature)
Project Title					Job No.	
Date	Time	Sample I.D. No.	Sample Type	No. of Containers	Sampling Site	Remarks

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

FIGURE 13-1
DAMES & MOORE CHAIN-OF-CUSTODY RECORD

opened or tampered with, this should be noted by the person receiving the samples under the section entitled "Remarks."

13.3 FIELD LOG BOOKS

Each Dames & Moore professional shall maintain a personal field log book while on the site. Information recorded in the log book shall be written in an objective, factual manner so that persons reading the entries will be able to determine the sequence of events as they occurred in the field. If notes are made in the log book by someone other than the owner of the book, this should be indicated by the writer's signature and date. Information to be recorded in the field log book will include:

- Date and time of entry;
- Sample number;
- Sample description;
- Method of sampling;
- Location of sampling;
- Sketch of sample location;
- Field measurements such as pH, conductivity, HNU and temperature;
- Names and phone numbers of field contacts, drillers, and persons on site;
- Materials used in well construction; and
- Driller's standby and drilling time.

In addition to the above information, the following forms will be used to record detailed data:

- Dames & Moore Boring Log (Figure 8-1) - used in the field to record detailed sample descriptions and drilling methods;
- Field Memorandum (Figure 13-2) - used to outline daily activities for information of project manager and file records; and

FIELD MEMORANDUM

ACTION	INFO	
To:		File:
		X-Ref:
		Date:

From: Reply Required By:

Subject:

Reference(s):

ROUTING

FIGURE 13-2

DAMES & MOORE

FIELD MEMORANDUM

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION _____

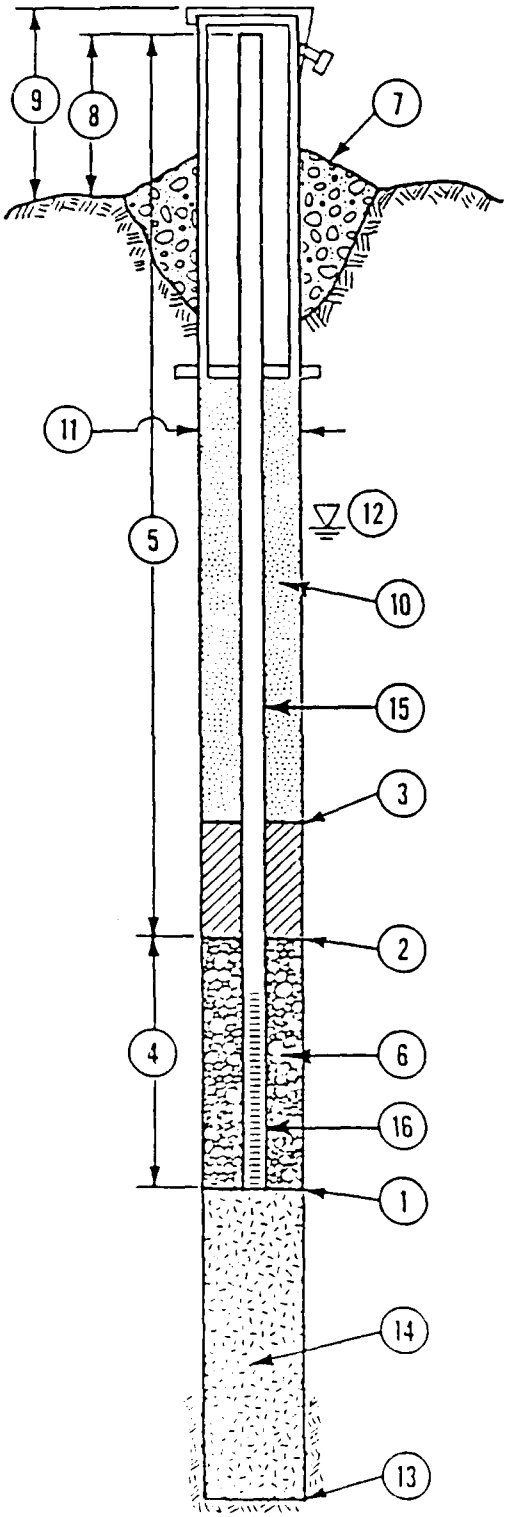
TOP OF WELL CASING ELEVATION _____

JOB NUMBER _____

BORING NUMBER _____

DATE _____

LOCATION _____



(1) DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE_____FEET.*

(2) DEPTH TO BOTTOM OF SEAL (IF INSTALLED) _____FEET.*

(3) DEPTH TO TOP OF SEAL (IF INSTALLED) _____FEET.*

(4) LENGTH OF WELL SCREEN_____FEET.
SLOT SIZE_____.

(5) TOTAL LENGTH OF PIPE_____FEET AT _____INCH DIAMETER.

(6) TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE_____.

(7) CONCRETE CAP. YES NO (CIRCLE ONE)

(8) HEIGHT OF WELL CASING ABOVE GROUND _____FEET.

(9) PROTECTIVE CASING? YES NO (CIRCLE ONE)
HEIGHT ABOVE GROUND_____FEET.
LOCKING CAP? YES NO (CIRCLE ONE)

(10) TYPE OF UPPER BACKFILL_____.

(11) BOREHOLE DIAMETER_____INCHES.

(12) DEPTH TO GROUND WATER_____FEET.*

(13) TOTAL DEPTH OF BOREHOLE_____FEET.*

(14) TYPE OF LOWER BACKFILL_____.

(15) PIPE MATERIAL_____.

(16) SCREEN MATERIAL_____.

*(DEPTH FROM GROUND SURFACE)

FIGURE 13-3

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

- Piezometer Detail Information Sheet (Figure 13-3) - used to record details of well installation.

Other forms are described in appropriate sections of this plan.

13.4 CORRECTIONS TO DOCUMENTATION

Any errors or mistakes in original field data shall be crossed out with a single line, and the person making the correction shall initial it. No data shall be erased.

In some circumstances, original documents may be transcribed, making appropriate changes and eliminating errors. In these cases, the successive documents shall be dated and numbered as sequential drafts.

13.5 TRAFFIC REPORTS

Knowledge of sample status will be maintained through review and evaluation of Dames & Moore field engineer reports, discussions with field personnel, and through contact with UBTL on a periodic basis. In this way, a working knowledge of sample traffic will be available through the project.

13.6 SHIPPING OF SAMPLES

Samples will be shipped at the end of each day's sampling efforts via overnight delivery to UBTL and/or OEHL. Sample packing procedures are given in Section 12.4.

14.0 SITE CLEANUP

A certain amount of trash will be generated from site investigation activities, including protective clothing, gloves, and cement bags. This material, assuming it has not been contaminated, will be disposed of in the proper locations (dumpsters, rubbish disposal areas) on site. Each site will be policed after completion of activities to ensure that no trash remains.

Soil wastes will be generated from drilling activities, but becausedrilling will not be conducted directly in the areas of dumping, it is expected that the soil will have only very low concentrations of contaminants. The soil from each hole will be monitored with the HNU and explosimeter. Any soil showing an organic vapor reading of less than 50 ppm and an LEL reading of less than 25 percent and having no unusual colors or odors will be considered uncontaminated and will be disposed of by spreading on site. Samples exceeding these criteria will be sealed in new 55-gallon drums. The same criteria will be used to determine if protective clothing has been contaminated. Any such contaminated clothing will be drummed along with the soil. The drums will become the property of the base, who will assume responsibility for their proper disposal.

15.0 FIELD TEAM ORGANIZATION AND RESPONSIBILITIES

15.1 ORGANIZATION

The Dames & Moore project organization for the Phase II Stage 2 investigation at Elmendorf AFB will be as follows:

- Project Director: Mr. Glenn D. Martin, Associate, Managing Principal-in-Charge
- Principal Investigator: Mr. Mike Ander, Associate
- Project Manager: Mr. John Flickinger, Senior Environmental Chemist
- Principal Staff Assistant: Ms. Carol Scholl, Staff Geologist
- Field Manager: Mr. Mike Stanley
- Geophysical Investigations: Mr. Tom Jensen

A number of additional Dames & Moore staff level personnel will assist in field operations, data interpretation and report preparation as necessary.

15.2 RESPONSIBILITIES

Responsibilities for the individuals identified in Section 15.1 will be as follows:

- Project Director: Mr. Glenn D. Martin -- Responsible for overall project direction and surveillance.
- Principal Investigator: Mr. Mike Ander -- The primary point of contact with OEHL and other Dames & Moore personnel, and the principal senior investigator responsible for project technical activities.
- Project Manager: Mr. John Flickinger -- Assistant to Mike Ander in project management and a secondary point of contact with OEHL. Responsible for technical oversight of all project chemistry activities during data collection and analysis.
- Principal Staff Assistant: Ms. Carol Scholl -- Assistant to Mssrs. Ander and Flickinger, in project management, coordination, and operation.

- Field Manager: Mr. Mike Stanley -- Responsible for organization and direction of field investigations. He will mobilize the field team, to include Dames & Moore assistant professionals or technicians and drilling and surveying subcontractors. He will stake locations of all sampling points and boring locations, review the site safety plan with site personnel, and monitor the initial drilling activities.

  In addition, he will be responsible for proper recording and transmittal of field records, and shipment of samples to UBTL for analysis.

- Geophysical Investigations: Mr. Tom Jenson -- Will conduct all site geophysical surveys and be responsible for all geophysical data interpretation and analysis.

15.3 TRAINING

15.3.1 Dames & Moore Personnel

The Dames & Moore personnel of staff level and above to be utilized on this job all have professional degrees in relevant fields, an previous experience in similar types of investigations. All field personnel will be thoroughly briefed on the appropriate safety measures specific to work on this project, and will have received safety training in accordance with Dames & Moore's firmwide Health and Safety Program.

15.3.2 Subcontractors

All site subcontractors will be thoroughly briefed on the following key aspects of project work:

- Project scope of work pertaining to the subcontractors anticipated role;

- Site Health and Safety considerations; and

- Timetable, cost, and other limitations pertinent to successful completion of the project within contractual scope.

Subcontractors selected will be experienced in related types of investigation, and have a demonstrated technical ability to complete their designated tasks.

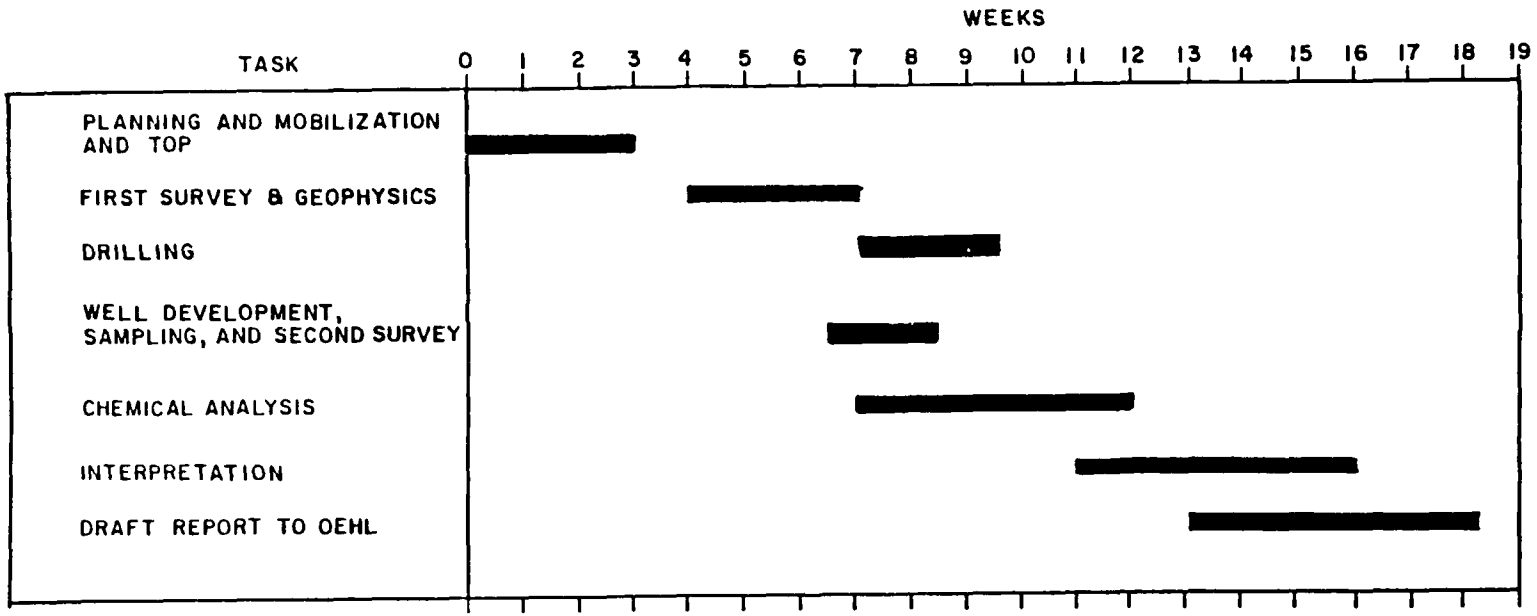


FIGURE 16-1

PROPOSED SCHEDULE FOR PHASE II STAGE 2
INVESTIGATION AT EIELSON AFB, ALASKA

Dames & Moore

16.0 SCHEDULE

Dames & Moore would be in a position to commence field work on this project within 3 weeks of receipt of the Work Order for Phase II, Stage 2. Figure 16-1 presents the milestone chart of the proposed schedule. The schedule assumes that drilling will commence immediately upon completion of the first survey and geophysical investigation. The project duration from time of receipt of the Work Order to submittal of the draft report is estimated to be 17 weeks, i.e., submittal of the first draft to USAFOEHL the week of November 28, 1986. It is anticipated that subsequent drafts will be submitted 4 weeks after receipt of review comments.

17.0 REFERENCES

ADEC, 1983, Wells A and B Water Samples. Personal communication from Stan Justice, Environmental Engineer, to Carol D. Hughes, Col., Base Commander, 343 CSG; Eielson AFB, Alaska (June 30).

CH2M Hill, 1982, Installation Restoration Program Records Search for Eielson Air Force Base, Alaska (November).

Dames & Moore, 1986, Installation Restoration Program Phase II -- Confirmation/Quantification Stage 1 final Report (March 11).

Sabel, G.V., and Clark, T.P., 1985, Procedures for ground water monitoring: Minnesota Pollution Control Agency Guidelines. MPCA, Roseville (April).

U.S. Air Force, 1983, Drinking Water Treatment Not Meeting State Standards. Personal communication from John M. Clegg, Jr., Capt., USAF, BSC, Chief, Bioenvironmental Engineering, SGPB, Eielson AFB, Alaska, to 343 COMPW/CC, 343 CSG/CC, and 343 CSG/DE (April 25).

APPENDIX A

SITE SAFETY PLAN

SEE SECTION 3.2

APPENDIX B

STATEMENT OF WORK

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
Elmendorf Air Force Base, Alaska

I. DESCRIPTION OF WORK

The overall objective of the Phase II investigation is to define the magnitude, extent, direction and rate of movement of identified contaminants. A series of staged field investigations may be required to meet this objective.

During the initial survey (Stage 1) performed at Elmendorf AFB, twelve sites (Sites D-5, SP-7, SP-10, D-7, SP-5, SP-12, D-17, SP-11, FT-1, SP-2, SP-14, IS-1) were investigated by a generalized approach consisting of installing monitoring wells and sampling soils and groundwater for basic screening parameters (i.e.. Total Organic Carbon, Total Organic Halogens, Oils and Greases, etc.).

This Stage 2 effort will build on the information gathered for all the sites previously investigated in Stage 1 to obtain information to completely characterize groundwater hydrology and site contamination. Additional monitoring wells will be installed and sampling performed to characterize groundwater hydrology and identify any contaminants migrating from these sites. A general water level survey will be performed, along with monitoring of selected base water supply wells.

The purpose of this task is to undertake a field investigation at Elmendorf Air Force Base, Alaska: (1) to confirm the presence of suspected contamination within the specified areas of investigation; (2) to determine the magnitude of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on State or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The Phase I and Phase II, Stage 1 IRP Reports (mailed under separate cover) incorporate the background, description and previous studies of all the sites for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. Technical Operations Plan

Develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description for the proposed work effort. (See Sequence No. 19, Item VI below). This plan shall be explicit with regard to field procedures. The format for the TOP is provided under separate cover. The TOP shall be mailed to the USAFOEHL POC within two (2) weeks after Notice to Proceed for this delivery order.

B. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection at study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations (i.e., drilling and sampling) as specified in Sequence No. 7, Item VI below). Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with the regulatory agencies.

C. General Field Work

1. Installation of Groundwater Monitoring Wells

a. Monitor ambient air during all well drilling and soil boring work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs.

b. Determine the exact location of all monitor wells and soil borings during the planning/mobilization phase of the field investigation. Consult with the Alaskan Air Command Bioenvironmental Engineering (AAC/SGPB) to minimize disruption of station activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work.

c. Comply with the U.S. EPA Publication 330/9-S1-002, NEIC Manual for Groundwater/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

d. All well drilling, development, purging, and sampling methods must conform to State and other applicable regulatory agency requirements. Cite references in an appendix of the Report.

e. Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

f. Drill all monitoring wells using the following specifications:

(1) Drill all wells using techniques most appropriate for the geological formation underlying each site. If drilling fluid additives such as bentonite or polymers are used, ensure their components will not interfere with the chemical analyses to be performed on samples. Biodegradable organic drilling fluid additives are not permitted. Also, if an additive is used, split a sample of the additive. Analyze one part of the sample and send the other part to USAFOEHL/SA for analysis. Prior to well completion, flush all boreholes constructed with drilling mud by using drinking water.

(2) Take samples for stratigraphic control purposes at 5-foot intervals, where possible, and log them. Include pilot boring logs and well completion summaries in the Final Report (Sequence No. 4, Item VI, below).

(3) Drill a maximum of 11 wells. Total footage of all wells in this task shall not exceed 580 linear feet. Refer to the site specific details in Section ID.

(4) Construct each well with 2-inch inside diameter Schedule 40 PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Screen each well using 2-inch diameter casing having up to 0.010 inch slots; use the same material as that of the casing. Cap the bottom of the screen. Flush thread all connections.

(5) Screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all wells a minimum of 10 feet. A minimum of 8 feet of well screen should be below the groundwater table if feasible. High seasonal fluctuations in groundwater levels should be considered when designing the intervals of well screening needed.

g. Complete all monitoring wells using the following specifications:

(1) Once the casing is installed, allow the soil formation to collapse around the well screen, if appropriate. Where required, use a gravel pack of washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a bentonite seal (two foot minimum) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with bentonite cement grout.

(2) Well surface completion will depend upon location. AAC/SGPB will determine which method is used at each well:

(a) If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and cement a protective locking lid in place. The protective lid shall consist of a cast-iron valve box assembly centered in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

(b) If an above ground surface completion is used, extend the well casing two or three feet above land surface. Prove an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid at the casing. Install three

3-inch diameter steel guard posts if AAC/SGPB determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

Provide locks for all wells. Turn the lock keys over to the AAC/SGPB POC following completion of the field work.

(3) Develop each well with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible.

(4) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 feet. Horizontally locate the new wells to an accuracy of 1.0 feet and record the position on both project and site specific maps. Use bench marks traceable to a USCGS or USGS survey marker if available.

(5) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 feet. Report in terms of mean sea level. Measure static water levels in wells at the time of well development and prior to sampling.

2. Well Abandonment

a. Determine available techniques for well abandonment that are applicable to the type of monitoring wells installed and geological conditions at each well site. After consultation with the USAFOEHL and AAC POCs, abandon any Stage 1 well that is damaged or inoperable. A maximum of eight wells will be abandoned as part of this effort. Recommend the technique(s) appropriate to the future abandonment of all other monitoring wells (abandonment not part of this contract).

b. Tremie grout abandoned wells to the surface with a bentonite grout. It is especially important to insure that they be adequately resealed to preclude future migration of contaminants.

c. Permanently mark each location where wells were abandoned. Record the location on a project map for each specific site.

3. Well Cleanup. Remove any well cuttings if requested by the AAC POC and clean the general area following the completion of each well.

4. Sampling and Analysis

a. Strictly comply with the sampling techniques, maximum holding times, and preservation of samples as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,

2nd Edition (USEPA, 1984); and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983). All chemical analyses (water and soil) shall meet the required limits of detection for the applicable EPA method identified in Attachment 1.

b. Allow wells to stabilize after development for a minimum of one day before sampling.

c. Sample wells during maximum groundwater flow conditions (late summer/early fall). Consider weather and hydrogeological parameters in the decision making process. As the first step of groundwater sampling operations at each well, take water level measurements to the nearest 0.01 foot with respect to an established surveyed point on top of the well casing. After measurements are taken, purge the well using a submersible pump. Purge until a minimum of three complete well volumes of water have been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized, using the following criteria: pH ± 0.1 unit, temperature ± 0.5°C, specific conductance ± 10 µmhos. Include the final measurements in the results section of the draft and final reports

d. Collect well water samples with a Teflon bailer. During sample collection from all wells, examine the surface of the water table for the presence of hydrocarbons and, if applicable, measure the thickness of the hydrocarbon layer. If floating hydrocarbons are noted, use a "thief sampler" or similar device to collect the water sample.

e. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report specified in Item VI below.

f. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the base POC. The base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the base POC for packaging the split samples. Immediately ship (within 24 hours) the POC selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

Include the following information with the samples sent to the USAFOEHL:

(1) Purpose of sample (analyte and sample group)

(2) Installation name (base)

(3) Sample number

(4) Source/location of sample

(5) Contract Task Numbers and Title of Project

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

(7) Volumes removed before sample taken

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

(9) Preservatives used

(10) Date and time collected

(11) Collector's name or initials

Forward this information with each sample by properly completing an AF Form 2752A "Environmental Sampling Data" and/or AF Form 2752B "Environmental Sampling Data - Trace Organics", working copies of which have been provided under separate cover. Label each sample container to reflect the data in (1), (2), (3), (4), (9), (10), and (11). In addition, copies of field logs documenting sample collection should accompany the samples.

Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

g. Analyze an additional 10% of all samples, for each parameter, for field quality control purposes (field duplicates), as indicated in Attachment 1. Include all quality control procedures and data in draft and final reports. Duplicates shall be indistinguishable from other analytical samples so that the analytical personnel cannot determine which samples are duplicates.

h. For those methods which employ gas chromatography (GC) as the analytical technique (i.e., E602, SW8080, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL); confirm positive concentrations by second-column GC. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of the report. Include the results of all second-column GC confirmational analyses in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes upon the first-column analysis.

The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of actual number of field samples (to include field QA/QC samples). The total number of samples for each GC method listed in Attachment 1 includes this allowance.

i. Analyze water collected as specified in Section D for those parameters summarized in Attachment 3. The required detection limits and methods for these analyses are delineated in Attachment 1.

j. All chemical/physical analyses shall conform to state and other applicable federal and local regulatory agency legal requirements. If a regulatory agency requires that an analysis or analyses be performed in a certified laboratory, assure compliance with the requirement by furnishing documentation showing laboratory certification with the first analyses results to USAFOEHL/TS.

5. Decontamination Procedures

a. Decontaminate all sampling equipment prior to use and between samples to avoid cross contamination. Wash equipment with a laboratory-grade detergent followed by clean water, solvent (methanol) and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely.

b. Dedicate a monofilament line or steel wire used to lower bailers for each well; do not use a line in more than one well. The calibrated water level indicator for measuring well volume and fluid elevation must be decontaminated before use in each well.

c. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated areas, if possible.

6. Plot and map all field data collected for each site according to surveyed positions. Identify or estimate the nature of contamination and the magnitude and potential for contaminant flow within each site to receiving steams and groundwater.

7. Conduct a premobilization survey of all base sites. The purpose of the survey is to meet with base personnel, finalize the actual field techniques used in the effort, evaluate condition of Stage 1 wells and designate borehole and monitoring well locations. USAFOEHL representatives will accompany the contractor during the premobilization survey, if possible. Regulatory agency representatives may also accompany the contractor during the premobilization survey. The USAFOEHL Program Manager will notify the contractor not later than one week following the Notice to Proceed (NTP) of the exact number of personnel to accompany the contractor on the premobilization survey.

9. Any precious metals encountered on USAF installations during site investigations remain the property of the U.S. Air Force. Disclose the area of discovery to only the USAFOEHL program manager and the base commander. Discontinue work at the area of discovery until receiving guidance from the USAFOEHL. Work scheduled in other areas shall continue.

D. Specific Site Work

In addition to items delineated above, conduct the following specific actions at the sites listed below:

1. Base Water Table Map

Prepare a detailed water table map of the entire base. This map shall be based upon accurate water table elevation from all accessible water table wells, Stage 1 monitoring wells, and surface water bodies on the station. A maximum of 30 water elevations shall be determined. The water levels shall be obtained by survey accurate to 0.01 foot vertically and 10 feet horizontally.

2. Water Supply Wells

Obtain water samples from base water supply wells numbers 1, 2, 16 and 52 (4 total) and analyze for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602) TDS and lead.

3. Ship Creek

Conduct a surface water sampling program for Ship Creek, based upon the results of the water table survey. Obtain one upstream water sample and samples from two different downstream locations. One of the downstream sample should be obtained just downstream of the point where Ship Creek changes from a losing to a gaining stream. Analyze the sample (3 total) for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), TDS and lead.

4. Sites D-5 and D-7

a. Conduct a metal detector survey to determine the boundaries of D-5 and D-7.

b. After site boundaries are determined, emplace four monitoring wells (2 at D-5 and 2 at D-7) approximately 100 feet downgradient of and parallel to the site boundaries. Install two upgradient monitoring wells, one for each site.

c. Obtain one water sample from each monitoring well at the sites, existing wells W-1, W-2, W-5, W-6 and the six new wells. Analyze each sample (10 total) for petroleum hydrocarbons, purgeable organics (EPA Methods 601 and 602), chlorinated organic pesticides (EPA Method 608), and TDS.

5. Sites SP-7, SP-10, SP-5, SP-12, FT-1, SP-2, SP-11, and SP-14

a. Conduct a soil gas survey using an HNU or similar instrument to determine the areal extent of fuel contamination at each spill site.

b. Based upon the results of the soil gas survey and the locations of the base water supply wells, emplace one monitoring well each downgradient of sites SP-12, SP-11, FT-1, SP-14 and SP-2.

c. Obtain one water sample from each monitoring well at the sites, existing wells W-3, W-4, W-7, W-8, W-9, W-14, W-15, W-16, and W-17 and the five new wells. Analyze each sample (14 total) for petroleum hydrocarbons, purgeable aromatics (EPA Method 602) and TDS. In addition, analyze the water samples from wells W-7 and W-8 for major cations and anions and analyze the water samples from well W-14 and the new well downgradient of SP-11 for purgeable halocarbons (EPA Method 601) and lead.

6. Sites D-17 and IS-1

a. Obtain one groundwater sample from each monitoring well at the site, W-10, W-11, W-12, W-13, W-18 and W-19.

b. Obtain one surface water sample from Cherry Hill Ditch just east of Loop Road.

c. Analyze each water sample (7 total) for purgeable halocarbons (EPA Method 601).

E. General Guidance

1. Be cognizant of and observe the AF base rules and regulations while working in the area.

2. A minimum of 7 days advance notice prior to arrival on the base must be given to the AAC/SGPB. Clearance must be granted prior to arrival at the station.

F. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, and incorporate them into the next monthly R&D Status Reports to be forwarded to the USAFOEHL. In addition to the results, report the following: the time and dates for sample collection, extraction (if applicable) and analysis; the methods used and method detection limits achieved; a cross-reference for laboratory sample numbers and field sample numbers; a cross-reference of field sample numbers to sites; and include the chain-of-custody form for those sample data.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI below) and forward the report to USAFOEHL for review prior to submission of the draft report.

3. Immediately report to the USAFOEHL Program Manager via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking water aquifer). Follow the telephone notification with a written notice and lab raw data (e.g., chromatograms, etc.) within three days.

G. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI below) for Air Force review and comment. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality results, available geohydrologic cross sections, and laboratory and field QA/QC information. Follow the USAFOEHL supplied format (mailed under separate cover). The format is an integral part of this delivery order.

2. Results, conclusions and recommendations concerning the sites listed in this task which were produced in the technical report(s) of the previous staged work of IRP Phase II (mailed under separate cover), shall be used in the data reduction to plot any trends and arrive at the conclusions and recommendations of this effort's technical report (Sequence 4, Item VI below). The technical report of this effort shall be accomplished so that the report will reflect the combined up-to-date trend of each of the IRP Phase II sites listed herein.

3. In the results section, include water analysis results, field quality control sample data, internal laboratory quality controlled data (lab blanks, lab spikes, and lab duplicates), and laboratory quality assurance information. Provide second column confirmation results and include which columns were used, the conditions existing, and retention times. Summarize the specific collection techniques, analytical method, holding time, and limit of detection for each analyte (Standard Methods, EPA, etc.) in the Appendix.

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental consequences of discovered contamination, where known, based upon State or Federal standards.

5. In the recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination, where known.

c. Category III sites are those that will require remedial actions (ready for IRP Phase IV). In the recommendations for Category III sites, include any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any

dependency between sites in different categories. Include a list of candidate remedial action alternatives, including Long Term Monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, including a cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations.

6. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved final technical report in a separately bound document. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites by using contractor recommendations as a decision basis. Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when prioritizing sites. For Category III sites slated for long-term monitoring, develop site-specific estimates which detail the costs associated with (1) permanent installation of monitoring wells; (2) groundwater sampling interface equipment, including permanent installations of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of groundwater, etc. Only the cost requirement outlined in Sequence No. 2, Item VI, need be submitted.

H. Meetings

The contractor's project leader shall attend 2 meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall last for a duration of two eight hour days. Meeting location is anticipated to be Anchorage AK.

II. SITE LOCATIONS AND DATES:

Elmendorf Air Force Base

Dates to be established.

III. BASE SUPPORT:

A. Prior to any contractor digging or drilling, locate underground utilities and issue digging permits.

B. Provide the contractor with existing engineering plans, drawings, diagrams, aerial photographs, etc., as needed to evaluate sites under investigation.

C. Provide escort into restricted areas.

D. Arrange for and have available prior to the start-up of field work, the following services, materials, work space, and items of equipment to support the contractor conducting the survey:

1. Personnel identification badges and vehicle passes and/or entry permits.

2. An area (preferably paved) where drilling equipment can be cleaned and decontaminated. A source of potable water (i.e., ordinary outdoor water faucet) and 110/115 VAC electrical outlet must be available within 25 feet of the area for steam cleaner hookup.

3. A temporary office area not to exceed 100 square feet equipped with a Class A telephone for local and long distance phone calls. Contractor shall pay for any long distance telephone calls made by his personnel from this phone.

E. The base POC will select 10% of the split samples provided by the contractor, package them, and ensure they are picked up by the contractor within 24 hours of sample receipt.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Program Manager
Ms Dee A. Sanders
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AUTOVON 240-2158/2159
1-800-821-4528

2. MAJCOM and Elmendorf AFB Monitor
Lt Col David A. Nuss
AAC/SGPB
Elmendorf AFB AK 99506-5000
(907) 552-4282
AUTOVON 317-552-4282

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, and which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
20 (TOP)*	I.A	OTIME	86AUG14	86AUG14		15
7 (Health & Safety)	I.B	OTIME	86AUG14	86AUG14		3
3 (Prelim Data)	I.F.2	OTIME	***	***		3
4 (Tech. Rpt)	I.F.1	ONE/R	86NOV28	87JAN30	87APR30	**
2 (Cost Est)	I.G.6	O/TIME				*****
14		Monthly	86AUG29	86AUG29	****	3
15		Monthly	86AUG29	86AUG29	****	3

*The Technical Operations Plans (TOP) required for this stage is due within 2 weeks of the Notice to Proceed (NTP).

**Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force comments into the second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with a copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute remaining 24 copies of each draft report and 49 copies of the final report as specified by the USAFOEHL.

***Upon completion of the total analytical effort before submission of the first draft report.

****Submit monthly hereafter.

*****Submit with final report only.

Attachment 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter[a]	Method[c] Extraction/ Analysis)	Detection Limit	No. of Samples	QC	Total Samples
Petroleum hydrocarbons	E418.1	100 µg/L	27	3	30
Purgeable Halocarbons	E601	d	26	2	42[f]
Purgeable Aromatics	E602	d	31	3	51[f]
Pesticides	E608	d	10	1	17[f]
Total Dissolved Solids (TDS)	E160.1	10 mg/L[e]	31	3	34
Lead	E239.2	0.005 mg/L[e]	9	1	10
Major Cations and Anions[b]	E200.7, A403 A429	b			

[a]Specific analytes for purgeable organics and Pesticides are listed in Attachment 2.

[b]Major Cations and Anions shall be determined using the following analytical methods for the listed parameters and detection limits:

E200.7 Inductively coupled Plasma (ICP) Metals Screen for all 25 metals, with detection limits listed in the methods.

A403 Alkalinity, with carbonate, bicarbonate and hydroxide alkalinity determined with detection limits of 10 mg/L per species.

A429 Anions by Ion Chromatography for all 7 anions, with detection limits of 0.05 mg/L for fluoride and 0.1 mg/L for other anions.

[c]The methods cited in the analysis protocols come from the following sources:

"A" Methods — Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)

"E" Methods — E100 through E500 Methods
Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79-020 (USEPA, 1983)

E600 Series Methods
Methods for Organic Chemical Analysis of Municipal
and Industrial Wastewater
USEPA
Federal Register, Vol 49, No 209, 26 Oct 1984

[d]Detection limits for all parameters analyzed by GC shall be as stated in the respective methods. Report results for organics in water as µg/l; in soil as mg/kg. Positive identification is required for all analytes having concentration higher than the method detection limit; confirm positive concentrations by second-column GC. Analytes which cannot be confirmed shall be reported as "Not Dectected" in the body of the report. Include the results of both first and second-column data in the appendix of the report. Base the quantification of confirmed analytes upon the first-column analysis.

[e]Report results as mg/L. Report no more than two significant figures for any concentrations.

[f]Total number of samples includes second-column confirmation on 50% of field samples (to include field QC samples).

Attachment 2

Volatile Halocarbons - EPA Method 601

Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Chloromethane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene (TCE)
Trichlorofluoromethane
Vinyl chloride

Purgeable Aromatics-- EPA Method 602

Benzene
Chlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Ethylbenzene
Toluene

Chlorinated Organic Pesticides-- Method E608

Aldrin
alpha-BHC
beta-BHC
delta-BHC
gamma-BHC
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Toxaphene

Attachment 3

Analyses by Site
Elmendorf AFB

Analyte	Water Supply Wells	Ship Creek	Site D-5	Site SP-7	Site SP-10	Site D-7	Site SP-5	Site SP-12	Site D-17	Site SP-11	Site FT-1	Site SP2	Site SP-14	Site IS-1
Purgeable Halocarbons (E601)	4	3	5	--	--	5	--	--	4	2	--	--	--	3*
Purgeable Aromatics (E602)	4	3	5	1	1	5	2	2	--	2	2	2	2	--
Lead	4	3	--	--	--	--	--	--	--	2	--	--	--	--
TDS	4	3	5	1	1	5	2	2	--	2	2	2	2	--
Pesticides (E608)	--	--	5	--	--	5	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons	--	3	5	1	1	5	2	2	--	2	2	2	2	--
Major Cation and Anions	--	--	--	--	--	--	2	--	--	--	--	--	--	--

*Includes sample from Cherry Hill Ditch

END

DATE

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