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0-10'	Equigranular quartzose sand subangular to subrounded av. 1-2 mm in size. 80% quartz, 10% feldspar, 10% mafics. Clean.
10'-20'	Same as 0-10
20-30	Same as 0-10
30-40	Same as 0-10
40-50	Same as 0-10
50-60	Same as 0-10 - Detrital fragments up to 1 mm in size.
60-70	Same as 0-10
70-80	Fragments coarser av. 4-6 mm in size up to 10-12 mm. Moderate amount of silt and clay cement.
80-90	Silty, clayey quartzose sand. Subangular to subrounded fragments up to 10-12 mm in size, less than 1 mm
90-100	Same as 80-90, Detrital fragments coarser av. 4-6 mm in size Mafics with some epidote
100-110	Same as 80-90
110-120	Same as 80-90. Very few fragments
120-130	Silt, clay and carbonate quartzose sand. Subangular to subrounded fragments av. 4-6 mm in size.
130-140	Same as 120-130
140-150	Very fine silt, clay and carbonate mudstone with 3-5% fragments of quartz, feldspar and mafics inter mixed.
150-160	Same as 120-130.
160-170	Same as 120-130.
170-180	Same as 120-130
180-190	Same as 120-130 - with some gypsum
190-200	Same as 140-150
200-210	Same as 140-150

210-220	Same as 140-150
220-230	Same as 140-150. Some of the clasts up to 20 mm in size, av. less than 1m
230-240	Same as 220-230
240-250	Same as 140-150
250-260	Same as 140-150
260-270	Same as 140-150
270-280	Same as 140-150
280-290	Same as 140-150
290-300	Same as 140-150
300-310	Same as 140-150
310-320	Same as 140-150
320-330	Same as 140-150
330-340	Same as 140-150
340-350	Same as 140-150
350-360	Same as 140-150
360-370	Same as 140-150
370-380	Same as 140-150
380-390	Same as 140-150
390-400	Silt, clay and carbonate mixture with fragments of quartz 80%, feldspar 10% and mafics 10%. Subangular to subrounded av. less than 1 mm up to 6-8mm in size
400-410	Same as 390-400
410-420	Same as 390-400
420-430	Same as 140-150
430-440	Same as 140-150
440-450	Same as 140-150
450-460	Same as 140-150

460-470	Same as 140-150
470-480	Very fine silt, clay and carbonate mudstone with 3-5% detrital fragments of quartz, feldspar and mafics less than 1mm in size.
480-490	Same as 470-480
490-500	Same as 470-480
500-510	Same as 470-480
510-520	Same as 470-480
520-530	Same as 470-480
530-540	Equigranular quartzose chips, subangular av. 2-4 mm in size. Quartz 80%, Feldspar 10%, mafics 10%. Silt, clay and carbonate mixture moderate.
540-550	Same as 530-540
550-560	Clean chips. Quartzose subangular to subrounded av. 4-6 mm in size clast fragments with carbonate rind. Quartz 80%, Feldspar 10%, mafics 10%.
560-570	Same as 550-560 - But moderate amount of silt, clay and carbonate mixture
570-580	Same as 550-560. Clean chips.
580-590	Same as 560-570
590-600	Same as 560-580
600-610	Same as 560-570
610-620	Same as 560-570
620-630	Same as 570-580
630-640	Same as 570-580
640-650	Same as 570-580
650-660	Same as 570-580
660-670	Same as 570-580

670-680	Same as 570-580
680-690	Same as 570-580
690-700	Same as 570-580
700-710	Same as 570-580
710-720	Same as 570-580
720-730	Same as 570-580 - chips up to 8-10 mm in size
730-740	Same as 570-580 - chips up to 12-15 mm in size
740-750	Same as 730-740
750-760	Same as 730-740
7650-760	Same as 730-740 - wood chips
760-770	Same as 560-570 - wood chips
770-780	Same as 760-770
780-790	Same as 560-570
790-800	Same as 560-570
800-810	Same as 560-570
810-820	Same as 560-570
820-830	Same as 560-570
830-840	Same as 560-570
840-850	Same as 560-570
850-860	Same as 560-570
860-870	Same as 560-570
870-880	Same as 560-570
880-890	Same as 560-570, chip av 2-4 mm in size
890-900	Same as 570-580 - wood chips
900-910	Same as 570-580
910-920	Same as 570-580, wood chips
920-930	Same as 570-580. Wood chips

930-940	Same as 570-580
940-950	Same as 560-570
950-960	Same as 560-570
960-970	Same as 560-570
970-980	Same as 560-570
980-990	Same as 560-570
990-1000	Same as 550-560 . Wood chips - Additive
1000-1010	Same as 550-560 - wood chips "
1010-1020	Same as 560-570 - wood chips "
1020-1030	Silt, clay and carbonate mud with 2-3% subangular - subrounded quartzose clastic fragments, Av. less than 1 mm in size
1030-1040	Same as 1020-1030
1040-1050	Same as 550-560
1050-1060	NO Sample
1060-1070	Same as 550-560
1070-1080	Same as 560-570
1080-1090	Same as 560-570
1090-1100	Same as 560-570
1100-1110	Same as 560-570
1110-1120	Same as 560-570 Fragments up to 2-4 mm in size.
1120-1130	Same as 550-560
1130-1140	Same as 550-560 wood chips Additive
1140-1150	Same as 550-560 - wood chips "
1150-1160	Same as 550-560 wood chips "
1160-1170	Same as 550-560 wood chips "
1170-1180	Same as 550-560 - wood chips "
1180-1190	Same as 550-560 - wood chips

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1190-1200	Same as 550-560 wood chips additive
1200-1210	Same as 560-570 wood chips "
1210-1220	Same as 560-570 wood chips "
1220-1230	Same as 560-570 wood chips
1230-1240	Same as 560-570 wood chips
1240-1250	Same as 550-560 wood chips - Slight alteration of plagioclase to clay.
1250-1260	Same as 550-560 - wood chips
1260-1270	Same as 550-560 - wood chips

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#2

0-10 Carbonaceous silty quartzose sandstone Subangular to subrounded fragments of quartz 80%, feldspar 10% and matics 10%. Detrital fragments average size 1-2 mm with some coarse clasts up to 10 mm in size.

10-20 Same as above

20-30 Same as above - 5% more abundant coarse clasts 10 mm in size.

30-40 "

40-50 "

50-60

60-70

70-80 Same as above - 1-2% pebble clasts up to 1" in size

80-90

90-100 Same as above - Some pebble clasts up to 2" in size

100-110

110-120 Same as above - Very equigranular

120-130 "

130-140 "

140-150 "

150-160 "

160-170 "

170-180 "

180-190 "

190-200 Same as above - Some coarse clasts up to 10-15 mm in size

200-210 "

210-220 "

220-230 Calcareous clay silt with 1-2% quartz and matics very fine to .5 mm

230-240	Same as 220-230
240-250	
250-260'	
260-270	
270-280	
280-290	
290-300	
300-310	
310-320	
320-330	
330-340	
340-350	Same as above - 1-2% clast material of quartz and mafics 1-2 mm av. up to 10-15 mm in size
350-360	Same as above - 1-2% clasts up to 2" in size
360-370	" "
370-380	Same as 350-360 -
380-390	Silty quartzose sand - same as 0-220'
390-400	Same as 380-390 - Much finer to 1 mm in size
400-410	Same as 390-400 - "
410-420	Same as above
420-430	Calcareous clay-silt with 1-2% quartz and mafics very fine to .5 mm in size
430-440	Same as 420-430'
440-450	"
450-460'	"
460-470	"
470-480	"
480-490	"
490-500	

500-510	Same as above (420-430)
510-520	"
520-530	
530-540	
540-550	
550-560	
560-570	
570-580	Quartzose sands – Calcareous kinds – Subangular to subrounded fragments of quartz 80% feldspar 10% and mafics 10%. Average size 1-2mm with some clasts up to 10 mm in size.
580-590	Minor amount of calcareous cement, Angular to subangular fragments of quartz 80% feldspar 10% and mafics 10%. Average size 3-5 mm. clean not much clay-silt.
590-600	Same as 580-590
600-610	"
610-620	
620-630	
630-640	Same as above – Sample is dirty there is very fine clay and silt material.
640-650	Same as above – Fine clay, silt material less detrital fragments
650-660	Same as above – More detrital than fine clay & silt
660-670	Same as above 650-660
670-680	Same as above 650-660 – Some slivers needles of gypsum
680-690	Same as 670-680 "
690-700	Same as 680-690 "
700-710	Same as 690-700 "
710-720	Quartzose Angular to subangular clean fragments of quartz, feldspar and mafics. Equigranular Av. 2-3 mm in size. Calcareous coating of grains.

(word)

720-730	Same as 710-720 - Gypsum slivers noted
730-740	Same as 720-730
740-750	Same as 730-740
750-760	Same as 740-750
760-770	Same as 750-760
770-780	Same as 760-770
780-790	Same as 770-780
790-800	Same as 780-790
800-810	Same as 790-800
810-820	Same as 800-810
820-830	Same as 810-820
830-840	Same as 820-830
840-850	Same 830-840 No carbonate
850-860	" 840-850 "
860-870	" 850-860 "
870-880	" 860-870 "
880-890	" 870-880 - No carbonate
890-900	Cleem Quartzose chips - Subangular to subrounded clasts of quartz 80% feldspar 10%, mafics 10% av. 5-7 mm up to 12 to 14 mm in size. Some carbonate coating
900-910	Same as 890-900
910-920	Same as 890-900
920-930	Same as 890-900
930-940	Same as 890-900
940-950	Same as 890-900 - Silt, clay and carbonaceous mud
950-960	Silt, clay and carbonaceous mud with 5% fragments of subangular to subrounded clasts of quartzose chips and mafics. Av. 3-5 mm in size.

960-970	Same as 950'-960'
970-980	Same as 950-960. Less fragments 1-2%
980-990	Same as 890-900
990-1000	Same as 890-900
1000-1010	Same as 940-950
1010-1020	Same as 890-900
1020-1030	Same as 890-900
1030-1040	Same as 890-900
1040-1050	Same as 890-900
1050-1060	Same as 950-960
1060-1070	Same as 950-960
1070-1080	Same as 950-960
1080-1090	Same as 950-960
1090-1100	Same as 950-960 - 3% fragments
1100-1110	Same as 890-900 with silt, clay and carbonaceous mud.
1110-1120	Same as 1100-1110
1120-1130	Same as 1100-1110
1130-1140	Same as 1100-1110
1140-1150	Same as 890-900 - Clean
1150-1160	Same as 890-900
1160-1170	Same as 890-900
1170-1180	Same as 890-900
1180-1190	Same as 890-900
1190-1200	Same as 890-900
1200-1210	Same as 890-900
1210-1220	Same as 890-900 - Some clasts up to 20mm in size
1220-1230	Same as 1210-1220

1230-1240	Same as 950-960
1240-1250	Same as 950-960
1250-1260	Same as 970-980
1260-1270	Same as 970-980
1270-1280	Same as 970-980
1280-1290	Same as 970-980
1290-1300	Same as 970-980
1300-1310	Same as 890-900
1310-1320	Same as 890-900
1320-1330	Same as 890-900
1330-1340	Same as 890-900
1340-1350	Same as 890-900
1350-1360	Same as 890-900
1360-1370	Same as 890-900
1370-1380	Same as 890-900
1380-1390	Same as 890-900
1390-1400	Same as 890-900
1400-1410	Same as 890-900
1410-1420	Same as 890-900
1420-1430	Same as 890-900
1430-1440	Same as 890-900
1440-1450	Same as 890-900
1450-1460	Same as 890-960
1460-1470	Same as 890-900
1470-1480	Same as 890-900
1480-1490	Same as 890-900
1490-1500	Same as 890-900

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1500 - 1510	Same 890-900
1510 - 1520	Same 890-900
1520 - 1530	Same 890-900
1530 - 1540	Same as 890-900
1540 - 1550	Same as 890-900
1550 - 1560	Same as 890-900
1560 - 1570	Same as 890-900
1570 - 1580	Same as 890-900
1580 - 1590	Same as 890-900
1590 - 1600	Same as 890-900
1600 - 1610	Same as 890-900
1610 - 1620	Same as 890-900
1620 - 1630	Same as 890-900
1630 - 1640	Same as 950-960 - Detrital fragments up to 70%
1640 - 1650	Same as 890-900
1650 - 1660	Same as 890-900
1660 - 1620	Same as 890-900
1670 - 1680	Same as 890-900
1680 - 1690	Same as 890-900
1690 - 1700	Same as 1630-1640
1700 - 1710	Same as 890-900
1710 - 1720	Same as 890-900
1730 - 1730	Same as 890-900
1730 - 1740	Same as 890-900
1740 - 1750	Same as 890-900
1750 - 1760	Same as 890-900
1760 - 1770	Same as 890-900
1770 - 1780	Same as 1630-1640

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1780-1790	Same as 890-900
1790-1800	Same as 890-900
1800-1810	Same as 890-900 – Alteration of some Feldspars to clay,
1810-1820	Same as 1800 - 1810
1820-1830	Same as 1800-1810
1830-1840	Same as 890-900
1840-1850	Same as 890-900
1850-1860	Same as 890-900
1860-1870	Same as 890-900
1870-1880	Same as 890-900
1880-1890	Same as 890-900
1890-1900	Same as 890-900
1900-1910	Same as 890-900
1910-1920	Same as 890-900
1920-1930	Same as 890-900
1930-1940	Same as 890-900
1940-1950	Same as 890-900
1950-1960	Same as 890-900
1960-1970	Same as 890-900
1970-1980	Same as 890-900
1980-1990	Same as 890-900
1990-2000	Same as 950-960 Detrital fragments up to 90%
2000-2010	Same as 890-900
2010-2020	Same as 890-900
2020-2030	Same as 890-900
2030-2040	Same as 890-900
2040-2050	Same as 890-900
2050-2060	Same as 890-900

2060-2070	Same as 890-900
2070-2080	Same as 890-900
2080-2090	Same as 890-900
2090-2100	Same as 890-900
2100-2110	Same as 890-900
2110-2120	Same as 890-900
2120-2130	Same as 890-900
2130-2140	Same as 890-900
2140-2150	Same as 950-960 Detrital fragments up to 90%
2150-2160	Same as 890-900
2160-2170	Same as 890-900
2170-2180	Same as 890-900
2180-2190	Same as 890-900
2190-2200	Same as 890-900
2200-2210	Same as 890-900 Alteration of some feldspars to clay
2210-2220	Same as 2200-2210
2220-2230	Same as 2200-2210
2230-2240	Same as 950-960
2240-2250	Silt, clay, and carbonaceous mud. No clastic fragments
2250-2260	Same as 2240-2250
2260-2270	Same as 890-900
2280-2280	Same as 890-900
2280-2290	Same as 890-900 - Alteration of some feldspars to clay
2290-2300	Same as 890-900 - Alteration of some feldspars to clay
2300-2310	Same as 890-900
2310-2320	Same as 890-900 Alteration of some feldspars to clay
2320-2330	Same as 890-900 Alteration of some feldspars to clay

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2330-2340	Same as 950-960 70% clast fragments
2340-2350	Same as 950-960 - 40% clast fragments
2350-2360	Same as 950-960 90% clast fragments
2360-2370	Same as 890-900
2370-2380	Same as 890-900
2380-2390	Same as 890-900
2390-2400	Same as 890-900
2400-2410	Same as 890-900 Alteration of some feldspars to clay
2410-2420	Same as 890-900 Alteration of some feldspar to clay
2420-2430	Same as 890-900 Alteration of some feldspars to clay
2430-2440	No Sample
2440-2450	No Sample
2450-2460	No Sample
2460-2470	No Sample

2470-2480	Silty Clay Quartzose sand → Equigranular, poorly sorted, Angular to subangular quartz 80%, feldspar 10% matrix 10%. Carbonate cement. Av. 1-2 mm with some up to 8 mm.
2480-2490'	Same as above
2490-2500	Same as above
2500-2510	Same as above — not as much silty, clay mixture — more fragments
2510-2520	Same as above. A lot of silt and clay material
2520-2530	Same as above — A lot of silt and clay material
2530-2540	Same as above
2540-2550	Same as above - not as much silt and clay material
2550-2560	Same as above A lot of silt and clay material
2560-2570	Same as above "
2570-2580	Same as above "
2580-2590	Same as above "
2590-2600'	Subangular to subrounded - Av. size 4-6 mm. Limited silt and clay sample clean.
2600-2610	Same as above - more silt and clay
2610-2620	Same as above — Less detrital fragments and more silt and clay.
2620-2630	Same as above — "
2630-2640	Same as above
2640-2650	Same as above
2650-2660	Same as above up to 1mm in size (95%)
2660-2670 (5%)	Detrital fragments the same as above but less fragments and finer. More silt and clay material with carbonate.
2670-2680	Same as 2660-2670
2680-2690	Same as above
2690-2700	Same as above

2700-2710	Silty, clay quartzose sand. Subangular to subrounded detrital fragments Av. size 4-6 mm with some up to 10 mm. 80% quartz, 10% feldspar and 10% mafics. Increase in detrital fragments decrease in silt, and clay: Caboon in the silt and clay mixture. 70% fragments 30% silt and clay mixture
2710-2720	50% Detrital fragments same as above but have decreased, 95% silt and clay mixt ~~has increased~~.
2720-2730	Same as 2710-2720 2% fragments — 98% silt and clay
2730-2740	Trace of fragments same as above. Silt and clay mixture with carbonate
2740-2750	Same as 2730-2740
2750-2760	Same as 2730-2740
2760-2770	Same as 2730-2740
2770-2780	Same as 2730-2740
2780-2790	Same as 2730-2740
2790-2800	Same as 2730-2740
2800-2810	Same as 2730-2740
2810-2820	Same as 2730-2740
2820-2830	Same as 2730-2740
2830-2840	Same as 2730-2740
2840-2850	Same as 2730-2740
850-2860	Same as 2700-2710 - clastic fragment up to 4-6 mm in size
2860-2870	Same as 2700-2710 - Clastic fragments up to 4-6 mm in siz
2870-2880	Same as 2700-2710 - Clastic fragments up to 4-6 mm in size.
880-2890	Silt, clay and carbonate mud with 5% fragment of quartz, feldspar and mafics up to 2mm. in size

2890-2900	98% Silt, clay and carbonate mud with 2% fragments of quartz, feldspar and mafics subangular to subrounded up to 2 mm in size
2900-2910	Same as 2890-2900
2910-2920	Same as 2890-2900 but 95% silt, clay and carbonate mud with 5% fragments.
2920-2930	Same as 2910-2920
2930-2940	90% Quartzose sand with 10% silt, clay, and carbonate. 70% quartz, 10% feldspar, 10% mafics. Subangular to subrounded Av. 2-4 mm in size up to 10 mm.
2940-2950	Same as 2890-2900
2950-2960	Same as 2930-2940
2960-2970	Same as 2890-2900
2970-2980	Same as 2890-2900
2980-2990	Same as 2910-2920
2990-3000	Same as 2930-2940
3000-3010	Same as 2930-2940 - Av. size up to 1 mm.
3010-3020	Same as 3000-3010
3020-3030	Silt, clay and carbonate mud with 5% fragment of subangular to subrounded quartz, feldspar, and mafics up to 2 mm in size.
3030-3040	Same as 2930-2940
3040-3050	Same as 3030-3040
3050-3060	Same as 3030-3040
3060-3070	Increase in silt, clay and carbonate mud with 30% fragments of sub-angular to subrounded quartz, feldspar and mafics up to 2mm in size
3070-3080	Same as 2930-2940
3080-3090	Same as 3020-3030
3090-3100	Same as 2930-2940
3100-3110	Same as 2930-2940
3110-3120	Same as 2930-2940

3120-3130	Same as 3060-3070
3130-3140	Same as 3060-3070
3140-3150	Same as 3060-3070
3150-3160	Same as 3060-3070
3160-3170	Same as 3020-3030
3170-3180	Same as 3020-3030
3180-3190	Same as 3020-3030
3190-3200	Clean Equigranular Quartzose sand detrital fragments made up of quartz, feldspar and mafics which average 4mm in size.
3200-3210	Same as 3060-3070
3210-3220	Same as 3020-3030
3220-3230	Same as 3190-3200
3230-3240	Same as 3060-3070
3240-3250	Same as 3020-3030
3250-3260	Same as 3060-3070

PROGRESS REPORT

GEOTHERMAL EXPLORATION PROGRAM

HILL AIR FORCE BASE

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LIST OF ILLUSTRATIONS

INTRODUCTION

This report summarizes the results obtained to date for a program designed to locate geothermal resources, if such occur, at Hill Air Force Base (Hill AFB), Utah. This work is being carried out under modification A002 to Department of Energy Contract DE-AC07-78ET28392, issued to the University of Utah with the University of Utah Research Institute designated as a sub-contractor. The assessment of geothermal resources at Hill AFB is part of a cooperative agreement between the Departments of Energy and Defense.

TARGET CONCEPT

Geothermal resources suitable for space heating may occur at Hill AFB. It is anticipated that they would be similar to nearby resources of this quality at Ogden Hot Springs (56°C, 11 km N), Utah Hot Springs (56°C, 18 km N), and Hooper Hot Springs (57°C, 13 km W). These hot spring sites are postulated to be "deep-circulation" systems, with meteoric water infiltrating through fractures in the ground, being heated by the earth's thermal gradient, and rising to the surface by circulation through faults or fractures. Zones of geologic structure such as faults that could allow upward circulation of heated waters thus form the primary exploration target at Hill AFB.

EXPLORATION PROGRAM

A phased exploration program has been designed to identify favorable geologic structures, and then to test these structures for thermal fluids. Phase I consists of orientation studies, Phase II is detailed geoscientific studies, Phase III is thermal gradient hole drilling, and Phase IV, if appropriate, will consist of production hole drilling.

This report summarizes work conducted under Phases I and II of the program. Phase III drilling is in progress as of the date of this report.

PHASE I

Task I-1 Compilation of Available Geoscience Data

Bedrock under Hill AFB is postulated to be similar to the Precambrian, Paleozoic, and Mesozoic sedimentary rocks occurring in the adjacent Wasatch Mountains. These rocks are part of the geologic area known as the "overthrust belt", where extensive low-angle faulting has taken place. The Wasatch Mountains are truncated on the west by the Wasatch Fault zone which possibly forms conduits for the deep circulation of water.

The bedrock underlying the valley is covered by alluvial materials which were deposited before and during the existence of Lake Bonneville and as part of the delta constructed by the Weber River. Coarser, porous beds within the alluvial sequence form extensive near-surface cold-water aquifers which could effectively mask any underlying thermal reservoirs.

Task I-2 Lineament Analyses

Lineaments are detectable on black and white and color photography and infrared imagery. The dominant set of lineaments on the photos trends approximately N35^{o}W, and a secondary set trends approximately N30^{o}E to N40^{o}E. These lineaments are not related to cultural features and may indicate the presence of geological structures. No infrared lineaments were detected on Hill AFB, but an east-west trending lineament is present near the mouth of Weber Canyon, east of Hill AFB. The thermal lineament on the infrared images may be associated with a boundary between different soil types.

Task I-3 Orientation Mercury Survey

Two soil sampling traverses were conducted in the vicinity of Ogden Hot Springs to test known thermal waters and known geologic features away from thermal waters for anomalous concentrations of mercury. Sixty sites were sampled on the two traverses. Mercury concentrations were highest near Ogden Hot Springs, where values above 1400 parts per billion were obtained. The influence of geologic structures on soil mercury concentrations away from the hot spring could not be separated from the effects of changes in bedrock type and soils.

Task I-4 Water Sampling

Water samples from the Weber River, six wells on the base, four nearby wells, five cold springs and four hot springs in the general area were analyzed for major and trace element composition. Figure 1 shows sample site locations and Table 1 locates sites by name and presents results of analyses. These results do not conclusively demonstrate that the cold water has mixed with a hot water component.

Task I-5 Gravity Survey

Gravity data along two east-west profiles (Figure 2) were collected near Hill AFB. Except for a few stations at the eastern ends of the lines, the station spacing was 500 feet (152 meters). Station locations were surveyed to within one foot (.305 meters) horizontally and most elevations were measured to 0.1 feet (0.031 meters). A few station elevations were measured using altimeters with $\pm$ 3 feet (.91 meters) accuracy.

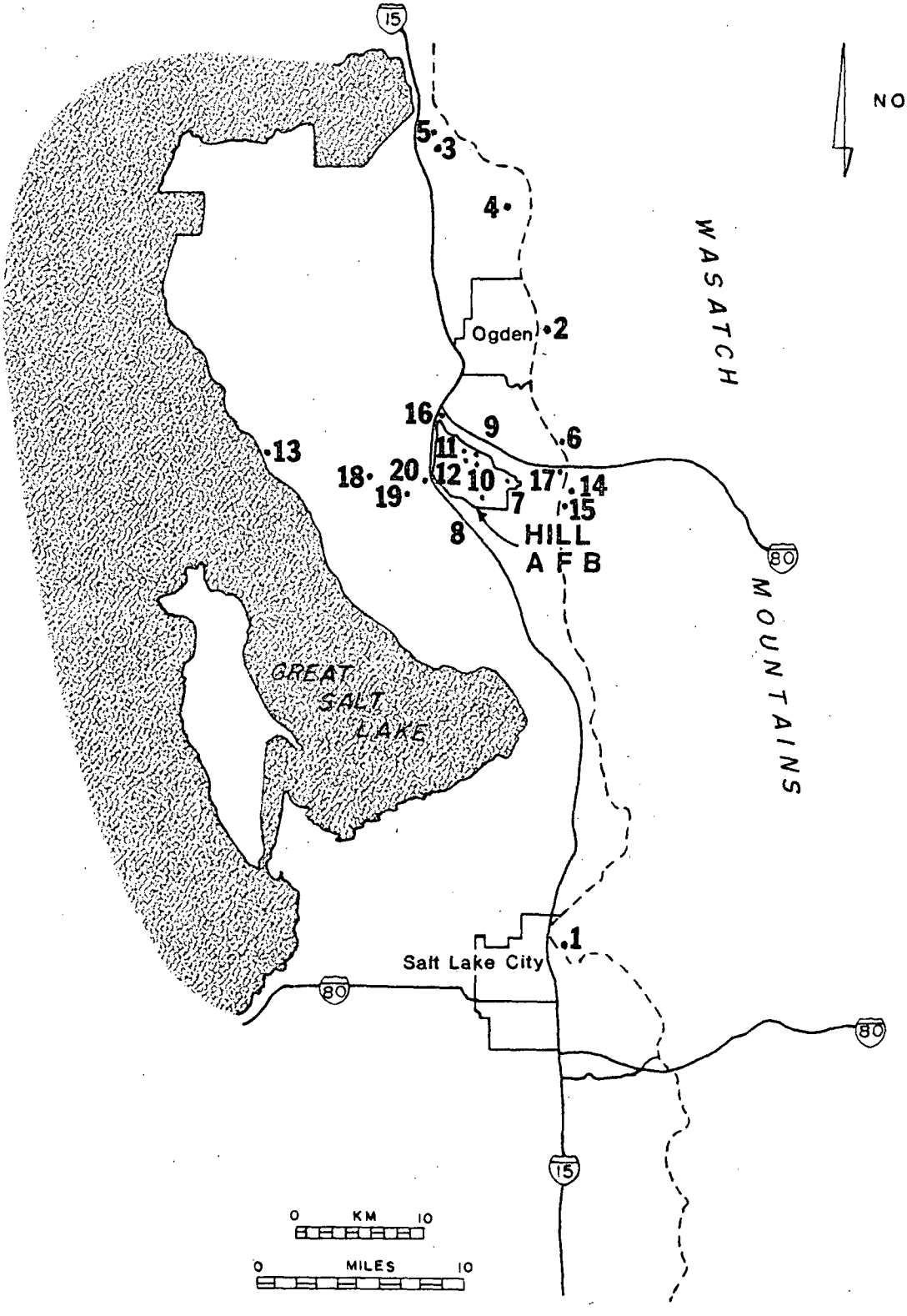


Figure 1 Water sampling sites

TABLE 1

WATER ANALYSES

Temperature, pH, and HCO_3 were determined in field.

F was determined by specific ion electrode, Cl by Ag nitrate titration, total dissolved solids gravimetrically.

Other elements were determined by Inductively Coupled Plasma Spectrophotometer (ICP).

Ag, Al, As, Au, Be, Bi, Cd, Ce, Co, Cr, Cu, La, Mo, Ni, P, Pb, Sb, Sn, Te, Th, U, V, W, Zr were not detected above the limit of quantitative detection of the ICP.

Locations are based on the Bureau of Land Management system of land subdivision.

n = not detected.

TABLE 1

HOT SPRINGS

Spring Name Location		Wasatch (B-1-1)25cd	Odgen (B-6-1)23cc	Utah (B-7-2)14d	Hooper (8-5-3)27
ESL #		1	2	3	13
Temp.	^{o}C	41.5	56.0	56.0	57.0
pH		7.2	7.1	6.3	6.5
tds	mg/l	6,650	9,040	21,800	3,830
HCO_3	ppm	274	214	211	233
Na	ppm	2,281	2,948	7,064	2,326
K	ppm	91	354	910	222
Ca	ppm	503	344	1,023	477
SiO_2	ppm	15	45	32	28
Mg	ppm	95	6.6	24	76
Fe	ppm	0.06	1.9	5.0	1.8
Ti	ppm	0.09	n	n	n
Sr	ppm	9.5	8.5	23	10
Ba	ppm	n	0.5	0.7	1.6
Mn	ppm	n	0.7	2.1	1.4
Zn	ppm	0.3	n	n	0.2
Li	ppm	1.1	6.9	14	2.4
B	ppm	1.2	3.2	3.7	0.9
F	mg/l	1.8	3.6	3.4	0.9
Cl	mg/l	4,820	5,060	11,900	4,720

TABLE 1 (continued)

WELLS - OFF HILL AFB

Location		(B-5-2)13ba	(B-5-2)34	(B-4-2)12bb	(B-4-2)1dba
ESL #		16	18	19	20
Temp.	^{o}C	14.0	15.0	13.0	13.0
pH		8.6	7.7	7.7	7.7
tds	mg/l	620	250	320	320
HCO_3	ppm	126	266	286	311
Na	ppm	9.1	19	20	24
K	ppm	1.2	2.7	3.4	4.2
Ca	ppm	35	69	84	76
SiO_2	ppm	5.8	13	14	13
Mg	ppm	7.2	17	18	20
Fe	ppm	0.2	0.6	0.5	0.6
Ti	ppm	0.1	n	n	n
Sr	ppm	0.1	0.2	0.2	0.2
Ba	ppm	n	0.3	0.3	0.3
Mn	ppm	n	n	n	n
Zn	ppm	0.05	0.04	0.2	n
Li	ppm	n	n	n	n
B	ppm	n	n	n	n
F	mg/l	n	0.9	.04	.13
Cl	mg/l	13	23	25	23

TABLE 1 (Continued)

COLD SPRINGS AND WEBER RIVER

Spring		Barker Trout Farm	Near Utah HS	Hamre Spring	South of Weber Canyon	Private	Weber River
Location		(B-7-1)34	(B-7-2)14	(B-5-1)25bb	(B-5-1)36aa	(B-5-1)36a	(B-5-1)25
ESL #		4	5	6	14	15	17
Temp.	°C	10.0	27.5	12.0	11.0	12.0	10.0
pH		7.5	7.5	7.2	7.2	8.0	8.1
tds	mg/l		1780	680	620	630	230
HCO_3	ppm	257	184	134	68	161	122
Na	ppm	8.3	389	21	7.9	12	8.9
K	ppm	1.2	63	2.5	0.8	1.3	1.5
Ca	ppm	55	28	37	19	43	65
SiO_2	ppm	7.1	18	14	8.3	5.3	6.4
Mg	ppm	24	1.5	9.7	3.2	9.2	9.9
Fe	ppm	0.5	0.7	0.2	0.6	0.4	0.8
Ti	ppm	n	n	0.1	n	n	n
Sr	ppm	0.1	0.6	0.1	0.04	0.2	0.1
Ba	ppm	n	n	n	n	n	n
[illegible]n	ppm	n	n	n	n	n	n
[illegible]n	ppm	0.02	n	0.1	n	n	0.6
Li	ppm	n	0.7	n	n	n	n
B	ppm	n	0.6	n	0.7	n	n
F	mg/l	n	5.7	n	n	n	n?
Cl	mg/l	14	535	19	9	19	15

TABLE 1 (continued)

WELLS - ON HILL AFB

Hill AFB Well Number / Location		4 (B-5-1)33	5 (B-5-1)5	3 (B-5-1)29	2 (B-5-1)29	7 (B-5-1)30	6 (B-5-1)30
ESL #		7	8	9	10	11	12
Temp.	^{o}C	11.5	17.0	13.0	15.0	13.0	14.0
pH		7.7	7.5	7.5	7.4	7.5	7.9
tds	mg/l	660	740	770	900	820	760
HCO_3	ppm	297	306	283	305	290	289
Na	ppm	33	42	17	20	19	20
K	ppm	6.5	7.4	2.0	2.1	2.0	2.1
Ca	ppm	52	58	81	76	74	77
SiO_2	ppm	19	16	9.8	10	10	10
Mg	ppm	16	16	18	18	18	18
Fe	ppm	0.6	1.6	0.6	0.5	0.5	0.03
Ti	ppm	0.1	n	n	n	n	0.1
Sr	ppm	0.2	0.2	0.3	0.3	0.3	0.3
Ba	ppm	0.2	0.4	0.2	0.2	0.3	0.2
Mn	ppm	0.4	0.2	n	n	n	n
Zn	ppm	n	0.1	0.07	n	n	0.1
Li	ppm	n	0.03	n	n	.02	.02
B	ppm	n	n	n	n	n	n
F	mg/l	0.1	0.1	n	0.1	n	0.7
Cl	mg/l	23	24	21	21	21	24

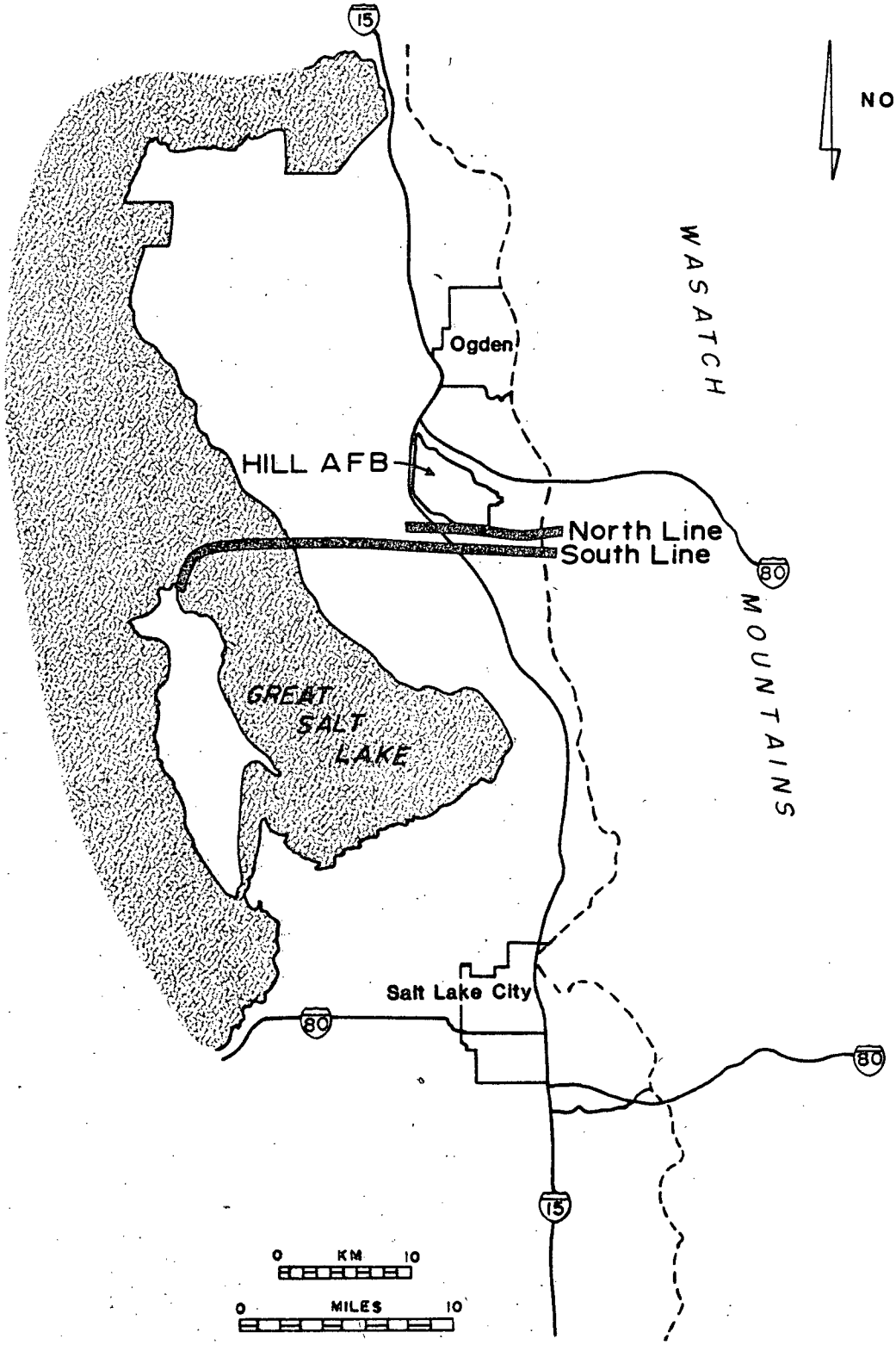
The measured gravity data were corrected for instrument drift and terrain. Complete Bouguer gravity data were computed and regional effects removed. Then the data were interpreted using a 2 1/2-dimensional algorithm. The complete Bouguer Gravity data and interpreted models for both profiles are shown in Figures 3 and 4. Both a constant density model and a variable density with depth model were used in the analyses; the computed gravity shows a good fit to the observed data.

All models indicate the valley between the Wasatch Mountains and the eastern edge of the Great Salt Lake is underlain by a graben, probably bounded on both sides by one or more normal faults. The east side appears to show several down-dropped blocks of basement rock. The models indicate that a major buried fault may be located near the eastern edge of Hill AFB. The variable density gravity model for both lines suggests that there could be a small horst structure underlying at least the eastern half of Hill AFB. This structure is also evident in the seismic data. The depth to solid bedrock increases rapidly from 3000 feet (.9 km) at the eastern edge of Hill AFB to 9300 feet (2.85 km) at the western edge. Since gravity models are non-unique, these depths represent one interpretation and, if in error, should be considered minimum estimates of depth to basement.

PHASE II

Task II-1 Further Geochemical Work

The highest concentration of mercury detected during Phase I was immediately adjacent to the thermal water discharge area at Odgen Hot Springs. The lack of thermal water in the near-surface alluvium of Hill AFB implied that mercury studies would probably not be useful in siting thermal gradient or production holes.



LOCATION OF GRAVITY PROFILES
HILL AIR FORCE BASE, UTAH

FIGURE 2

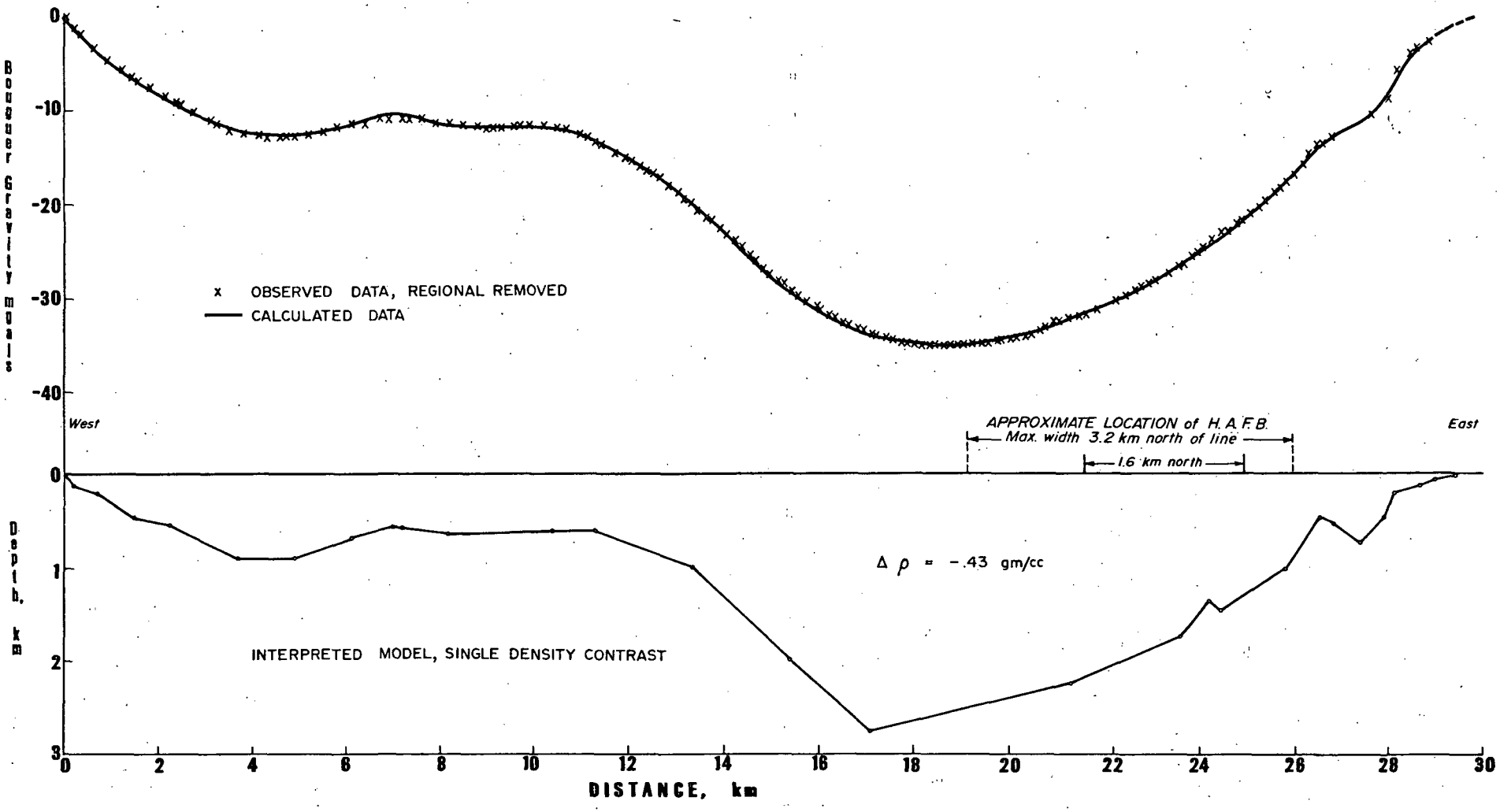


Figure 3a Bouguer Gravity and Interpreted 2 – D Model for South Line Gravity Profile Hill Air Force Base, Utah

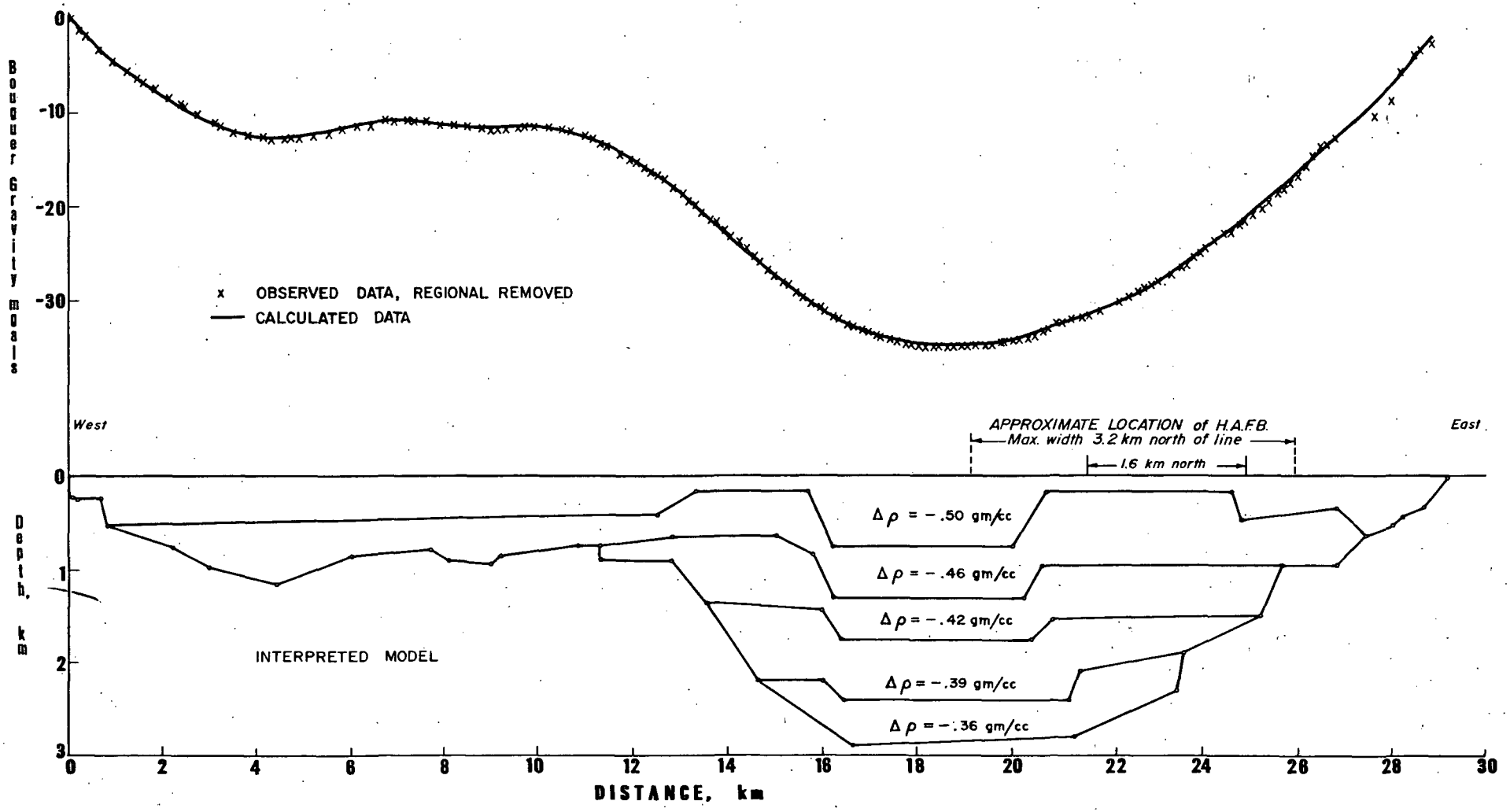


Figure 3b Bouguer Gravity Data Interpretation of South Line, Variable Density Model Hill Air Force Base, Utah

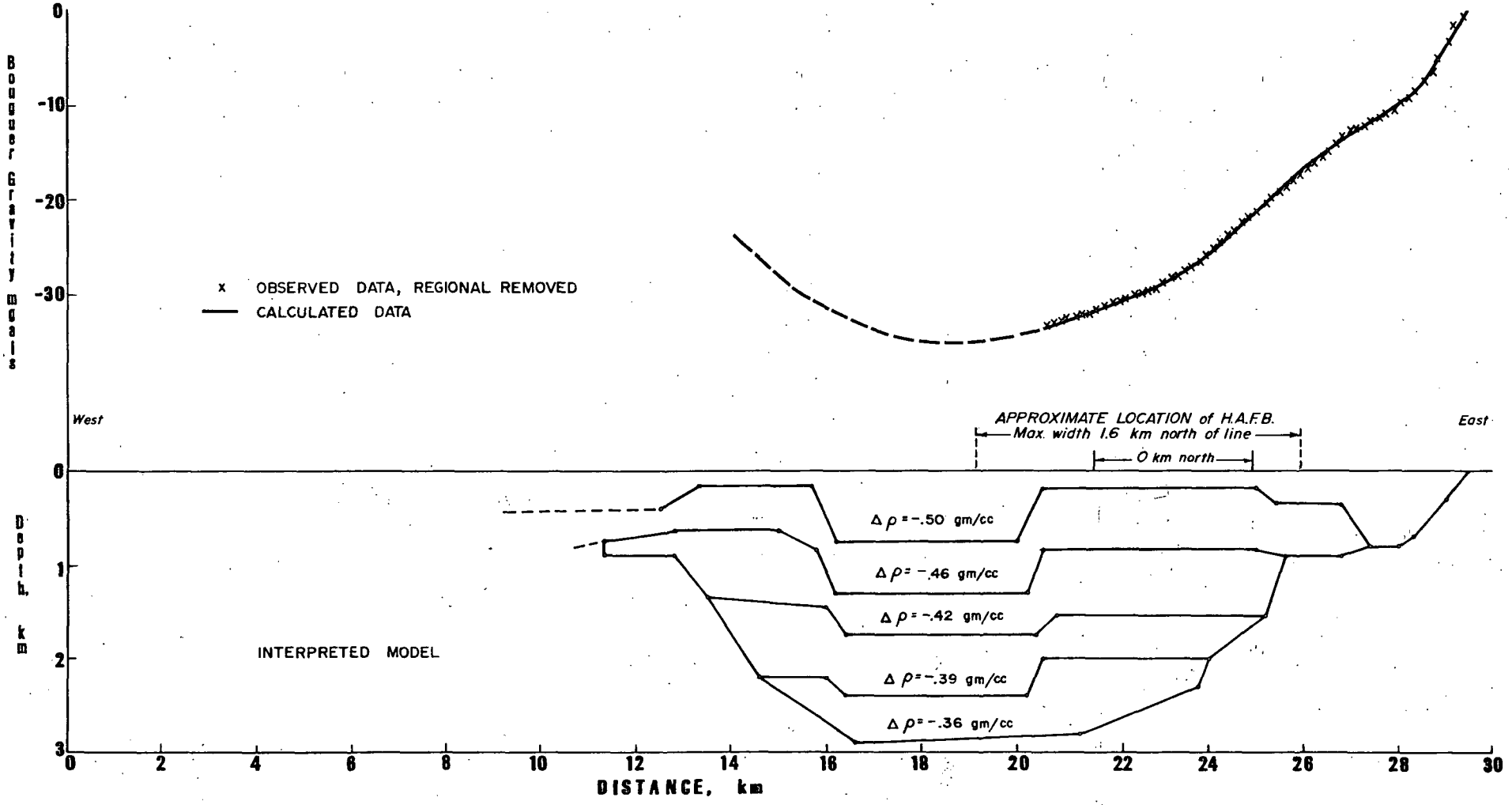


Figure 4 Bouguer Gravity Data Interpretation of North Line, Variable Density Model Hill Air Force Base, Utah

Results of Phase I sampling of water wells on Hill AFB did not indicate major amounts of mixing of thermal with non-thermal water in known aquifers, and further sampling of water was not attempted.

Task II-2 Detailed Gravity

Results obtained during Phase I gravity studies permitted detailed modeling of gravity in the vicinity of Hill AFB and further acquisition of data was not attempted.

Task II-3 Seismic Survey

A VIBROSEIS* reflection seismic survey was conducted on and in the vicinity of Hill AFB with two east-west lines and one north-south tie line. The three lines and vibrator points are shown in Figure 5, the processed data from the three lines are shown in Figures 6, 7, and 8, and the processing parameters are given in Table 2.

Preliminary interpreted fault locations are indicated on overlays by heavy black lines. Several strong seismic reflections, quite coherent over the entire prospect, are highlighted by narrow yellow lines in the overlays. The majority, and the most important of the faults, are normal faults dipping to the west. The data quality rapidly diminishes below 1.2 to 1.5 seconds, hence, fault traces as drawn are somewhat speculative beyond these times.

PHASE III

Two sites for thermal gradient holes were chosen on the basis of geophysical and geochemical studies. The first hole was targeted to intersect geologic structures near the east edge of Hill AFB, where seismic studies

*TM Continental Oil Company

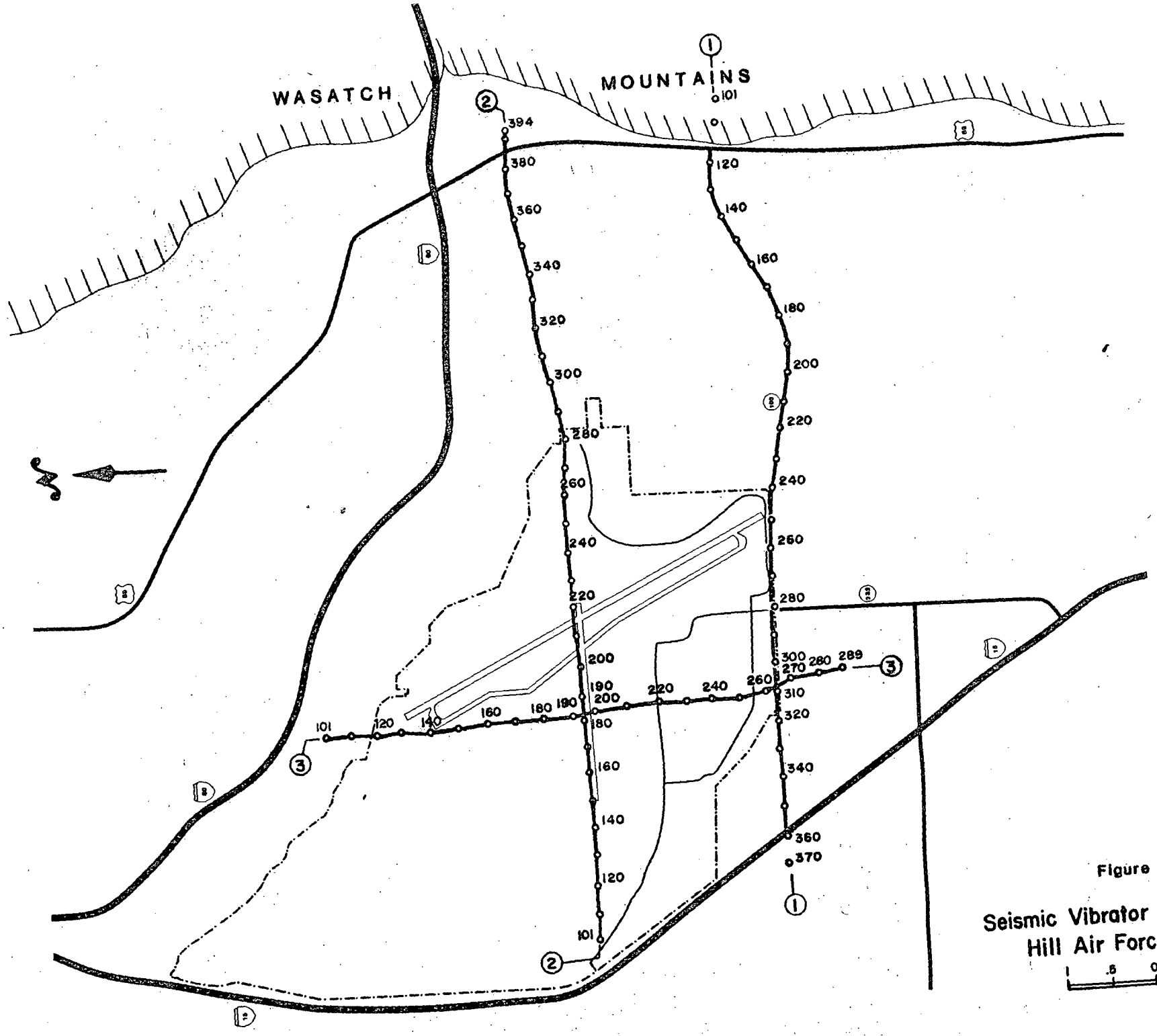


Figure 5

Seismic Vibrator Point Locations
Hill Air Force Base, Utah

TABLE 2

PROCESSING PARAMETERS

Demultiplex/Sum + Correlation

CDP sort

Datum Stations 4800 feet @ V(E) 5000 ft/sec

Velocity Analyses
Normal Moveout

Mute

Automatic Statics - Trace Generated

CDP Stack 1/Root (N)

Filter 15-18, 55-60 Hertz, 0.0-1.5 sec.
13-15, 40-50 Hertz, 1.5-5.0 sec.

Trace Equalization - Time Variant 0.5 sec. window

Coherency

Deconvolution 28 MS. GAP 100 MS Operator

Final Filter 15-18, 55-60 Hertz, 0.0-1.5 sec.
13-15, 40-50 Hertz, 1.5-5.0 sec.

Trace Equalization - Time Variant 0.5 sec. window.

indicate depth to bedrock is shallowest. This hole was planned to be about 2000 feet deep, but drilling difficulties and resultant high costs determined termination at 1270 feet. The second hole is sited near the south gate and is targeted for a depth of 3500 to 4000 feet with a current depth of 1670 feet.

The moderately deep nature of these gradient holes is necessary to measure thermal gradients that will not be disturbed by the cold regional aquifers. Upon completion of the drilling and analysis of the data gathered in Phase III, options for program continuation or termination will be presented.

Phased Geoscience Exploration Program

Target Concept: Precipitation on the Wasatch Mountains could infiltrate to moderate depth and be heated by the earth's thermal gradient. This heated groundwater might rise along faults that may be present beneath Hill Air Force Base; these faults are the primary target. Deep alluvial aquifers, which may contain water circulating away from the faults, are a secondary target.

Phase I: Baseline Studies

Geology - Photogeologic interpretation - to locate linear surface features that may reflect buried fault and fracture systems. Old and recent photography is being examined.
Infrared Imagery - thermal anomalies will be identified and compared with linear features on aerial photographs.
Ground check - photo and infrared anomalies will be investigated for geologic structures.

Geochemistry - Hg orientation survey - spatial associations of Hg with known fault and thermal spring localities near Hill Air Force Base (AFB) will be examined for Hg signatures.
Chemical characterization of waters - thermal and non-thermal waters will be analyzed for trace element concentrations. Mixing of warm water with cool water may be detectable.

Geophysics - Gravity profiles (may include magnetic profiles) - detailed traverses on Hill AFB to identify changes in geophysical properties, which might be related to faults that are covered by alluvium. The thickness of alluvium will be estimated.

Phase II: Refine target models

Geochemistry - Hg studies - if Hg signatures can be identified during Phase I, a traverse across a fault defined by geologic mapping close to or within Hill AFB will be made. If the traverse identifies anomalous Hg related to the fault, one or two more traverses will be made within the base to aid in delineation of faults.

Geophysics - Vibroseis survey - will aid in identification of buried faults beneath Hill AFB, and may identify fault intersections that are attractive targets.

Phase III: Thermal gradient drilling to refine target models

Geochemistry - Downhole studies - Hg and trace element analyses of drill cuttings and waters will be made, to identify thermal zones and water mixing.

Geophysics - Gradient hole drilling - if near-surface thermal effects are identified, 5 shallow (500') and 1 deep (2,000') gradient holes will be drilled to test the anomalies.

If near-surface thermal effects are masked by cold aquifers, 2 deep (2,000') holes will be drilled to potential targets.

Phase IV: Production Hole Drilling

Drilling will proceed if target identificaton techniques employed in Phases I, II, and III indicate a potential fault or fault intersection beneath Hill AFB.

SSC
1845 Sherman
Suite 300

---

1 blk NE Compolibrary

INQUIRY

FROM THE

PURCHASING DEPARTMENT
UNIVERSITY OF UTAH
RESEARCH INSTITUTE

391 Chipeta Way
SALT LAKE CITY, UTAH 84108
An Equal Opportunity Employer

TED
FYI
D.

Date July 9, 1979

Inquiry No. 1689 (ESL)

PLEASE NOTE CAREFULLY

This inquiry implies no obligation on the part of the Research Institute.

Bids will be rejected if received unsigned and/or if received after the due date and hour.

SEE ADDITIONAL TERMS AND CONDITIONS GOVERNING BIDS ON REVERSE SIDE.

Bidder's Utah Sales Tax License #.....

Your Proposal #.....

This quote firm for ..... days.

Please quote your lowest net prices, terms, and time of delivery on the following items **F. O. B. RESEARCH INSTITUTE SALT LAKE CITY, UTAH 84108**

Quotations will be received until ONE o'clock P.M. July 20, 1979

SUBMIT YOUR QUOTATION ON ~~THIS~~ SHEETS ENCLOSED TO THE PURCHASING DEPARTMENT

William L. Christensen
Purchasing Agent

If additional information needed, contact William L. Christensen (801) 581-5226
TWX 910-925-5283

Item No.	Quantity	Items and Specifications	Unit	Net Price of Unit	Total
		THIS IS NOT AN ORDER THE FOLLOWING OR AN EQUIVALENT SATISFACTORY TO THE RESEARCH INSTITUTE (Give complete specifications of alternates) Drilling for geothermal research activities as per attached specifications dated July 9, 1979:			

To PURCHASING DEPARTMENT
RESEARCH INSTITUTE

Date.....

We propose to furnish above items at prices listed opposite each, and guarantee that if the order is placed with us we will furnish these goods in accordance with your specifications shown above unless otherwise indicated. Above quotations are F.O.B. RESEARCH INSTITUTE.

TERMS.....Shipment will be made ..... days after receipt of order.

.....
COMPANY

By.....

FORM NO. 5 1M 2/77

July 9, 1979

SPECIFICATIONS

The University of Utah Research Institute (UURI), under contract with the U. S. Department of Energy, plans to undertake a program of drilling as part of its geothermal activities. The purposes of the drilling are: (1) to measure temperature gradients in the holes and (2) to obtain samples of the rock units for laboratory studies.

Dates	-The drilling will be undertaken between July 20 and September 15, 1979. The exact dates are subject to discussion between the University of Utah and the drilling contractor and will take into account weather, fire danger, and other factors.
Number of Holes	-Approximately 3 holes will be drilled but the exact number will depend on drilling rates and costs.
Location	-Holes will be drilled at sites on or near Hill Air Force Base, Clearfield, Utah.
Hole Size	-Holes will be drilled to a diameter necessary to obtain depths specified below. Possible diameter would be 8-3/4" to 1000', 6-3/4" below.
Equipment	-The drilling will be done with rotary techniques. The contractor will furnish pumps for mud and cement.
Hole Depth	-Precise hole depths will be determined during drilling by client, but are expected to be in the range of 2000' to 4000'.
Groundwater Conditions	-A variety of groundwater conditions are expected, including flowing artesian conditions. The contractor will be equipped to handle artesian conditions and to backfill the drill holes with cement (grout).

Drilling Fluid	-Holes will be drilled with water and/or mud. Drilling mud may have to be confined in tanks at one site, as mud pits may not be allowed.
Steel Casing	-All holes will be cased if necessary to comply with existing State and Federal regulations.
Inner Casing	-A bottom-capped 2 inch I.D. steel inner casing will be inserted and secured in each hole to total depth, then filled with water. Temperature gradients will be measured inside the casing.
Materials	-The drilling contractor will furnish on-site all materials including but not limited to bits, cement, steel casing, lost circulation materials, and mud materials.
Logs	-A driller's log showing rock types and groundwater conditions will be required for each hole. Detailed lithologic logging will be done by UURI.
Sampling	-Drillers will be required to supply chip samples from 10 foot intervals.
Geology	-The holes will be drilled beginning in alluvium (interbedded gravel, sand, silt, and clay) (see Appendix A).
Site Preparation	-Holes will be drilled on pre-existing sites or on sites prepared by UURI (or Hill A.F.B.).
Regulations	-The drilling contractor will comply with the geothermal regulations of the U. S. Geological Survey and all other existing regulations regarding drilling, and air and water quality.
Crew Size	-The contractor will furnish an experienced two- or three-man crew on-site during all working hours.
Cost Summaries	-The contractor will be required to furnish daily cost summaries on-site.
Option To Extend	-UURI may at any time during the term of this contract exercise an option to extend this contract for the drilling of an additional hole or holes and the contractor shall agree to such contract extension.
Liability Insurance	-The contractor shall work in accordance with the requirements of the Workmen's Compensation Laws, and shall protect himself by liability insurance.
Bidding Procedure	-All bids should show the following items separately: (1) Mobilization and demobilization - cost per mile on total. (2) Moves between holes - cost per hour. (3) Rotary drilling - cost per foot and/or cost per hour.

(4) Standby at request of UURI - cost per hour.
(5) Installing casing - cost per hour.
(6) Water truck, if required, including driver - cost per day.
(7) Expendable items.
(8) Description of equipment that will be used by contractor.

Bidder facilities, equipment, past performance and performance capabilities shall be a factor in the award. The Bidder's capability to begin work soon after contract is awarded will be a factor with award.

INVITATION TO BID

Program of drilling for geothermal research activities, per attached specifications dated July 9, 1979.

All bids should show the following items separately:

1. Mobilization and demobilization - cost per mile or total. $_____

2. Moves between holes - cost per hour or mile. $_____

3. Rotary drilling - cost per foot. $_____/per foot

   and/or

4. Rotary drilling - cost per hour. $_____/per hour

5. Standby at the request of UURI - cost per hour. $_____/per hour

6. Installing casing - cost per hour. $_____/per hour

7. Water truck, if required, including driver. $_____/per day

8. Expendable items to be reimbursed by UURI; bits, cement, mud, inner casing, etc. (give % above cost for handling). _____%

DESCRIPTION OF EQUIPMENT

(A) Drilling Rig. Complete drilling rig with the major items being:

Drill: Make, model, and age _____

_____

Drill truck: Make, model, and GVW _____

_____

Mud pump: Make, model, and size _____

_____

Drill pipe: Length, size, type of tool joints _____

_____

Drill collars: Number, length, size _____

_____

Portable mud pit: Capacity and number of baffles _____

_____

Mast capacity (rated hook load) _____

Raised mast height (above ground) _____

(B) Water Truck.

Truck: Make, model, GVW _____

_____

Tank: Capacity _____

_____

(C) Service Pick-Up.

Truck: Make, model, GVW _____

_____

(D) Personnel.

Driller(s) name and experience (years) _____

_____

_____

Bidder facilities, equipment, past performance and performance capabilities shall be a factor in the award. The Bidder's capabilitiy to begin work soon after contract is awarded will be a factor with award.

CONTRACTORS LIABILITY INSURANCE

The contractor shall carry on his work in accordance with the requirements of the Workmen's Compensation Laws and shall not reject the provisions thereof during the life of the contract. He shall also protect himself by liability insurance against any and all claims for damages to person or property which may arise out of operations under this contract.

Drill Contractor_____

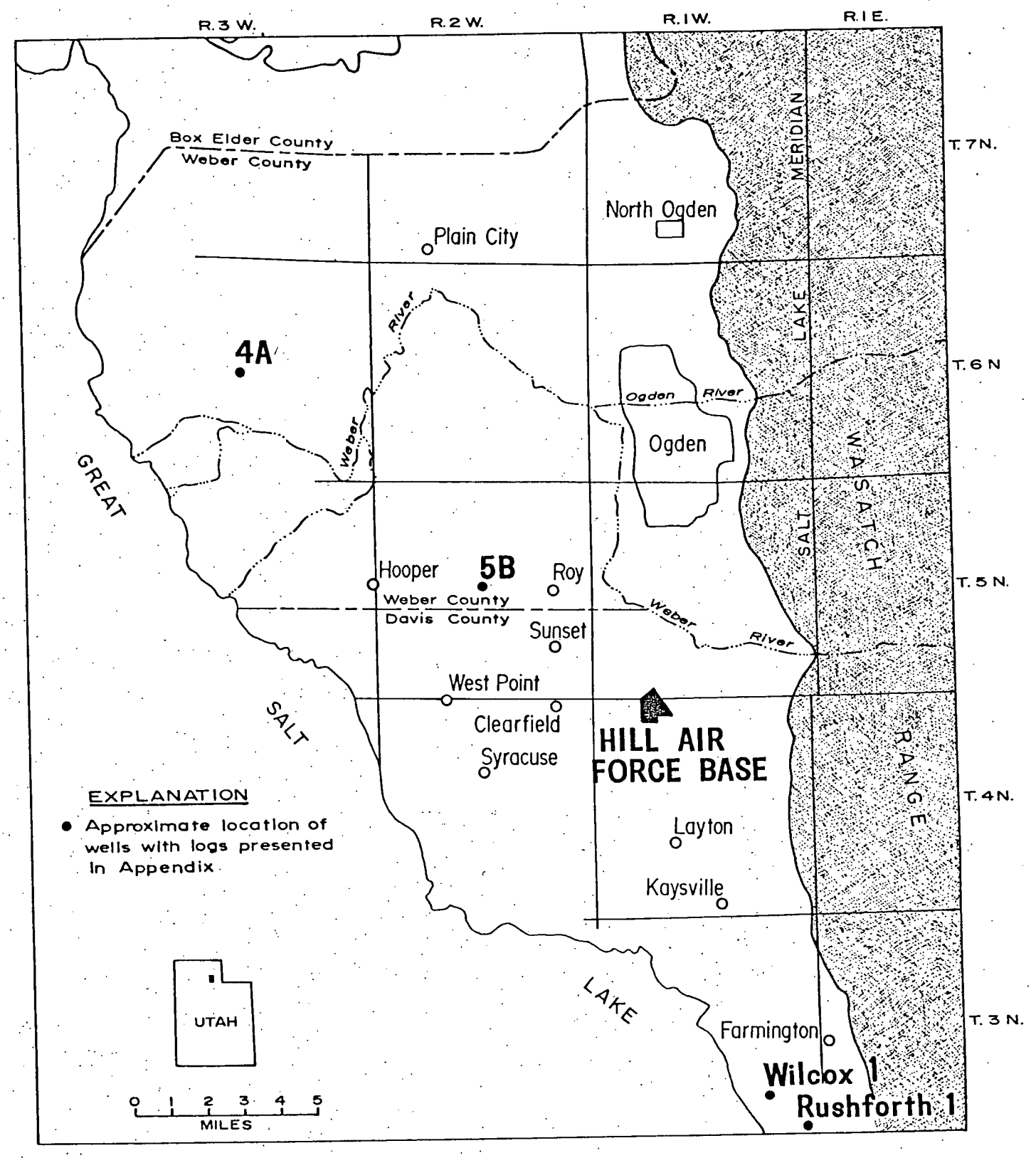
Address_____

_____

Telephone_____

Signature_____

Dated_____


R.3 W.
R.2 W.
R.1 W.
R.1 E.
T.7N.
T.6 N
T.5 N.
T.4N.
T.3 N.
Box Elder County
Weber County
Davis County
North Ogden
Plain City
4A
5B
Ogden
Hooper
Roy
Sunset
West Point
Clearfield
Syracuse
HILL AIR FORCE BASE
Layton
Kaysville
Farmington
Wilcox 1
Rushforth 1
Weber River
Ogden River
GREAT SALT LAKE
SALT LAKE MERIDIAN
WASATCH RANGE
EXPLANATION
Approximate location of wells with logs presented in Appendix
UTAH
0 1 2 3 4 5
MILES

One option that was mentioned but not discussed in detail is to drill a deep hole, and if no production is found, case back to the shallow aquifers.

5) Actions items for ESL are:

a) The final report should be finished within six weeks.

b) We probably should be ready to site a deep hole.

c) The Air Force would like an executive summary included in the report.

Duncan

Duncan Foley

DF:gm

cc: P. M. Wright
W. Forsberg
W. E. Glenn
D. Chapman

SSC–20-A

NOTEGRAM

COMPANY: Seismograph Service Corp.

FROM: John Smatla PLACE Denver, Colo. DATE Dec. 14, 79

TO: Ted Glenn
U.U.R.I.

Dear Ted,

Here are all the velocity panels for Hill AFB prospect. Each sheet is coded with the CDP (common depth point) number, which is the center of the stacked group, and each velocity for that same group of traces.

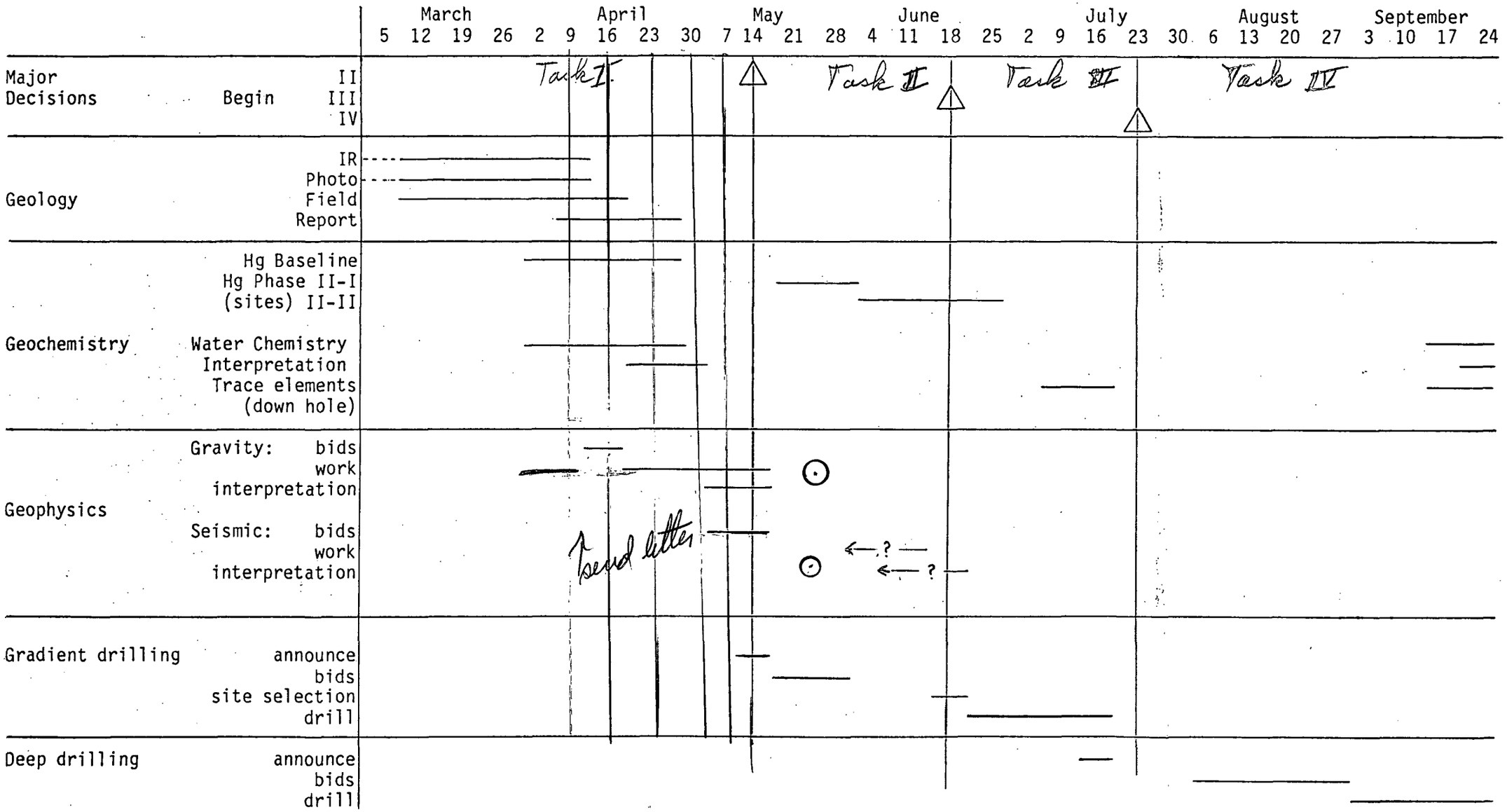
The reels are being prepared, and will be shipped soon. I am also enclosing a migrated section from line 1 for your file.

If you have any ~~other~~ requests, please let me know.

Thanks,

John Smatla

MILESTONES - HILL AIR FORCE BASE
Earth Science Lab and Department of Geology and Geophysics
University of Utah



APR 27 1979

GEOPHYSICAL SERVICE INC.

SERVICES GROUP

TEXAS INSTRUMENTS
INCORPORATED

April 24, 1979

Purchasing Department
U. of U. Research Institute
420 Chipeta Way, Suite 100
Research Park
Salt Lake City, Utah 84108

Dear Sir:

Geophysical Service Inc. is pleased to submit the following proposal to provide a Vibrator crew for your prospect in northern Utah. It is understood that about 18 miles of program is involved.

Field Crew

Equipment

- 1 DFS IV 48 channel recording system
- 1 CFS System, 48 trace
- 3 T.I. X2 Vibrators equipped with high frequency electronics, (two working at all times)
- 1 Vibrator service truck
- Auxiliary vehicles as required
- *200 strings of phones (9 phones per string)
- 72 groups of cables

Personnel

- Party Manager
- Surveyor
- 3 Vibrator Operators
- 1 Vibrator Mechanic
- 1 Instrument Engineer
- 13 Line Helpers

* 18 phones per group maximum.

MAILING ADDRESS: 2460 W. 26TH AVENUE, SUITE 400-C • DENVER, COLORADO 80211 • TELEPHONE 303-455-2783

Collection Parameters

- 48 trace recording
- 2 millisecond sample rate
- 2400% coverage
- 18 geophones per group
- 12 second sweep length
- 4 second final record length

Data Processing

Data collected will be processed using the following sequences.

Preliminary Stack

- Correlation
- True Amplitude Recovery
- Trace Edit
- Time Variant (or Invariant) Deconvolution
- Time Variant Scaling
- Normal Moveout
- Datum Correction
- Preliminary Stack
- Band Pass Digital Filter (Gould Display)

Analysis

- Velocity Analysis at 1 mile intervals (Gould Displays)
- Residual Static Analysis

Final Stack

- Normal Moveout
- Residual Static Application
- Final CDP Stack
- Band Pass Digital Filter
- Time Variant Equalization (One film and one print)
- Migration (One film and one print)

Excluded from the price quotations are the following items:

- Cost of any processing tapes to be retained by COMPANY
- Cost of reproductions of sections other than those listed above.
- Cost of special processing other than specified above.

Compensation

Mobilization - No charge, if the award is announced by May 1, 1979. Otherwise - $6000.

Production -

24 fold, 16 sweeps/VP, 110' G.I., 48 trace - $7530/mile

Per extra sweep per mile - $207

Other -

Parameter testing time will be provided at $535 per hour.
Standby time due to client cause, lack of program, permits, etc., $500 per hour (10 hours per day maximum).

Ancillary Costs

The following costs incurred by GSI will be reimbursed by COMPANY at invoice cost plus 7½% handling fee.

1. Permit fees and damages, unless due to GSI negligence.
2. Dozer charges, if required.

The crew will be available about May 5, 1979, unless committed to other work prior to acceptance of this proposal by UURI.

If you have any questions, please feel free to call me at our Denver office. Thank you for this opportunity to be of service.

Sincerely yours,

Richard A Maxwell

Richard A. Maxwell
Area Manager

Bob McMasters

Owner's protective policy

SSC work only

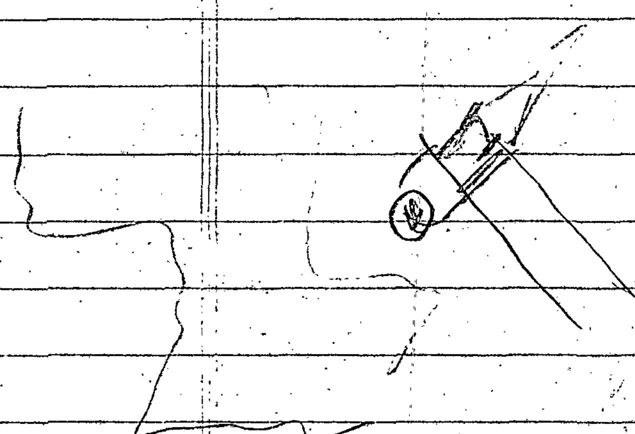
Bodily Injury & Property Damage

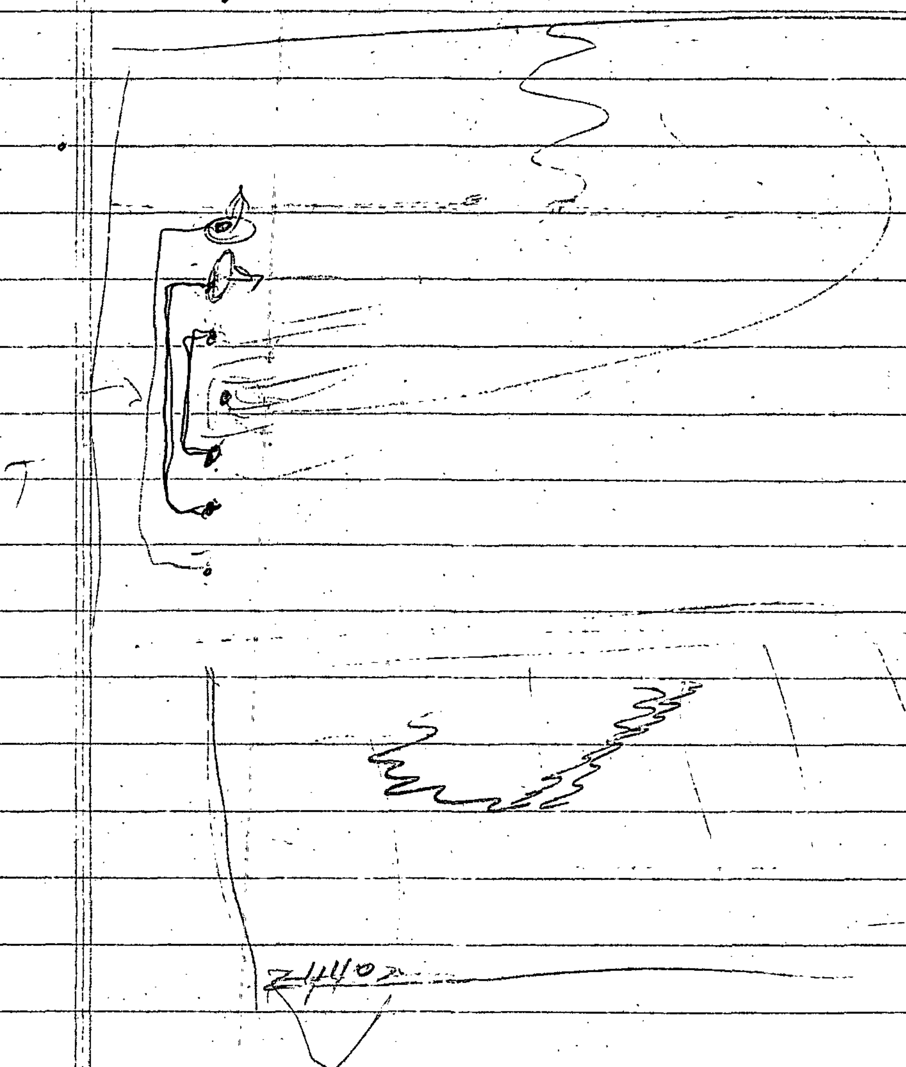
does not cover trespass

" " " known damage

e.g. pack ground

$500/job $1,000,000





Mail RFB's to

GSI, Teledyne, Western, GSC, CGG, SSC, United Geophysical.

on 4/12/79

deadline 4/30/79

response

4/23/79	Western	No.
4/25/79	GSC	No.
4/23/79	Teledyne	No.
4/30/79	SEC	Yes
4/24/79	GSI	Yes
United & CGG	as of 4/30/79	Nothing

7530
4 2 18

60240
7530

135,540 +

Seismograph Service Corporation
A SUBSIDIARY OF RAYTHEON COMPANY
300 COLUMBINE BLDG. • 1845 SHERMAN STREET
DENVER, COLORADO 80203

APR 30 1979

April 25, 1979

303-861-4476

UNIVERSITY OF UTAH RESEARCH INSTITUTE
Earth Science Laboratory
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84100

Attention: Mr. Ted Glenn

Subject: VIBROSEIS Seismic Project - HILL AIR FORCE BASE AREA, Utah
REQUEST FOR BID

Dear Mr. Glenn:

In response to your letter of April 12, 1979. We welcome the opportunity of bidding both on the data acquisition and data processing for this assignment.

Please refer to Attachment I and II for price quotes and description of equipment.

The only problems that we see with the operation are: 1. Aircraft Noise 2. Proximity of houses and utility installations to seismic line

Concerning the latter, our basic policy is that our vibrators shake no closer than 660 feet from any man-made structure - i.e. houses, water wells, etc. This limitation would prove a distinct problem. The crew would also have to obtain maps of buried sewer-lines, water lines, and culverts & water well location. Considering the frequency of the pilot signal (15-80 Hz), it is unlikely that enough ground motion would be generated to harm the above even at distances of 100 feet or less. However, our policy would be effected unless we were directed by the CLIENT to approach these structures closer than 660 feet. If it is decided to proceed with operations in spite of this limitation, we would recommend that house-owners be warned of the approach of the vibrators and that permission be granted to have man stand close to the house to warn of significantly large ground disturbance caused by the vibrators as they pass by. In the event of perceptible ground motion, then the vibrators would cease shaking that location and move on to the next safe station.

We appreciate the opportunity of being considered for your work. Should any points need clarification or elaboration, please do not hesitate to call me (303) 861-4476.

Respectfully submitted,

SEISMOGRAPH SERVICE CORPORATION

D. R. Seifert, Area Manager

DRS:js
Attachments I & II

ATTACHMENT II

EQUIPMENT

1 Texas Instruments DFS IV 48 Channel, Instantaneous Floating Point 96 trace Digital Field System recording unsummed data in SEG "B" Format, equipped for CDP recording and mounted in a four wheel drive truck

4 VIBK-1000 Vibrators with SSC VIBK electronics mounted on tandem diesel trucks or four wheel drive VIBO tractors

24 20-D 8Hz/or 10Hz Digital grade geophones per trace

Summing and Cross-Correlation to be performed on trailer mounted PHOENIX System

Plus necessary vehicles and personnel to effect an efficient operation

ATTACHMENT I

Price Schedule

DATA ACQUISITION

A. For following field parameters:

110 feet station spacing
Minimum of 3 operative vibrators (4 on crew)
No. of sweeps/Vibrator/VP - 16
Record Length - 18 seconds
Sweep Length - 14 seconds
Sweep frequency - 15-80 Hz (to be assessed in field)
No. of Geophones per pattern - 24
48 Channel Recording System

For 2400% CDP Data (VP Interval - 110 feet) ---- $5,150.00/mile

For 1200% CDP Data (VP Interval - 220 feet) ---- $3,850.00/mile
(These prices include highway flagging personnel costs. These prices do not include permit fees or damages, archaeological fees, dozers or road graders (if necessary) and any special licencing, bonds or sales tax - these items would be passed on the CLIENT at cost).

Output to CLIENT ---- Summed, Cross-Correlated Data

B. Experimental Time ---- $475.00/hour

C. Mobilization Costs ---- ?
Total mileage from previous location to prospect divided by 35 mph x $475.00/hr.

D. Geophone/Cable pickup costs (if necessary) ---- $475.00/day
Please note that this is considered necessary if line is located in heavily populated areas and is readily accessible to public.

DATA PROCESSING (Denver)

To include application of static and dynamic corrections, stack, deconvolution (if necessary), filtering, surface consistent and/or correlation automatic static corrections, final filtering, display.
---- $23.50 record

Migration ---- $1.50 per stacked trace

Initial processing and analysis of experimental data can be performed on PHOENIX mini-computer system at crew headquarters at no additional charge

Extra PHOENIX time (if necessary) ---- $80.00/hr

5150.00
475.00
+1200.10
6825.00

Total 6825 Est.

Litton

WESTERN GEOPHYSICAL

P. O. Box 3118, Englewood, Colorado 80111 (303) 770-8360

Denver Tech. Center, Bldg. 29, 8455 E. Prentice

Charles Dick, Vice President, Western U. S. Operations

April 23, 1979

Purchasing Department
University of Utah Research Institute
420 Chipeta Way, Suite 100
Salt Lake City, Utah 84108

RE: ESL-1

Attention: William L. Christensen

Gentlemen:

Western Geophysical Company of America regrets that because of prior commitment of equipment and personnel in the time period requested, we will not be able to submit a proposal to the above referenced inquiry.

We sincerely appreciate being considered for the project and desire to be considered for future work.

Very truly yours,

Charles W. Dick

CWD/pn

cc: Mr. Ted Glenn✓

Geophysical Systems Corporation

1024 South Arroyo Parkway
Pasadena, California 91105
(213) 441-1153

April 25, 1979

Mr. William E. Glenn
University of Utah Research Institute
Earth Science Laboratory
391 Chipeta Way, Suite A
Salt Lake City, Utah 84108

Dear Mr. Glenn:

Re: Your letter dated April 12, 1979 and Inquiry No. ESL-1

We have received your above letter and request for proposal for a seismic survey in the vicinity of Hill Air Force Base in Utah. Due to the rather long distance between the present location of our nearest field party in Texas and the prospect area, it would appear that move in costs would be (quite) high with respect to the scope of the actual survey. For this reason we have not submitted a bid on your bid form.

We wish one of our crews was more conveniently located, because our type of system, with its large number of channels (256 minimum), close trace spacing (80 feet maximum), point source point detector mode of operations, high CDP fold (for example 128 fold), VARISWEEP™, residual statics from refraction first breaks, sign bit type recording and data processing on-site on a nightly basis offer important advantages over other conventional approaches presently used. Some of these techniques were described very briefly in the brochure I sent to you recently. Because of efficiencies built into our system, the costs of our surveys generally are very competitive with other conventional crews.

We appreciate your interest in our company and look forward to being able to work with you sometime.

Very truly yours,

S. J. Allen

SJA/mbp

4/12/79 meeting

HILL AIR FORCE BASE
BUDGET SUMMARY

	Phase I	Phase II	Phase III	TOTAL
SALARY	$10,825	$ 4,932	$ 2,807	$ 18,564
HOURLY	980	0	2,000	2,980
BENEFITS	2,657	1,184	794	4,635
SUPPLIES	1,600	1,300	500	3,400
TRAVEL	1,700	1,200	100	3,000
PUBLICATIONS	0	0	200	200
DATA PROCESSING	600	0	0	600
OTHER	0	108,000	150,000	258,000
INDIRECT COSTS	9,111	3,853	3,028	15,992
MGT. ALLOWANCE	1,923	8,432	11,160	21,515
TOTAL	$29,396	$128,901	$170,589	$328,886

HAFB meeting 3/13/79 S.H. Ward Presiding

need master milestone
t=0 is 3/12/79
indicating reporting dates.
get a package to-gether for 22nd

S40 T 40

re- interpret gravity

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

AGENDA

HILL AIR FORCE BASE GEOTHERMAL PROJECT

Meeting: 0900 March 22, 1979
Earth Science Laboratory
University of Utah Research Institute
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108
801-581-5283

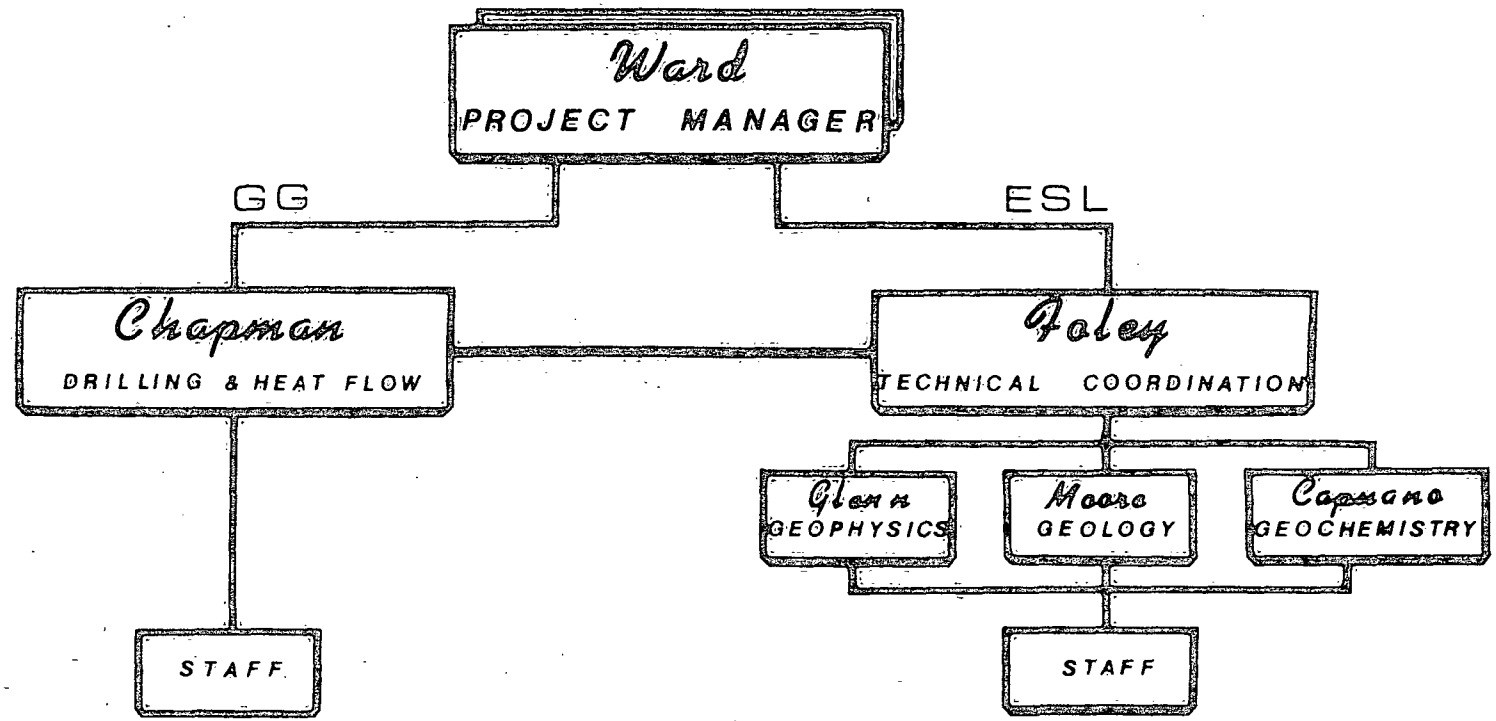
0900-0910	Introduction	C.R. Nichols
0910-0930	Air Force Objectives & Management	-
0930-1000	DOE Contractual, Management, and Public Relations Matters	C.R. Nichols
1000-1020	UU/UURI Management	S.H. Ward
1020-1050	Technical Plan & Milestones	D. Foley
1050-1200	Discussion	

Hill Air Force Base Meeting

Name	Affiliation
Duncan Foley	ESL/UURI
Clayton Nichols	DOE/ID
Marshall Reed	DOE-HQ/U.S.G.S.
Joe Moore	ESL/UURI
Regina Capuano	ESL/UURI
Ted Glenn	ESL/UURI
Mike Aimone	USAF
Paul Davis	Hill AFB
Robert Gray	DOE/WASH
John Griffith	DOE/ID
Stanley H. Ward	ESL/UURI and GG/UU
David S. Chapman	GG/UU
George Kastanos	USAF/Air Force Logistics Command
Bruce Sibbett	ESL/UURI

22 March 1979

GG/UU AND ESL/UURI MANAGEMENT STRUCTURE FOR HILL AIR FORCE BASE GEOTHERMAL PROJECT



Hill Air Force Base Geothermal Project

Scope of Proposed Work

for

University of Utah/University of Utah Research Institute

The exploration program designed to locate geothermal resources which may or may not occur at Hill Air Force Base will be carried out in four phases as follows:

Phase 1: Orientation geological, geochemical, and geophysical work.

Phase 2: Detailed geological, geochemical, and geophysical work.

Phase 3: Drilling of several temperature gradient holes and interpretation of the results.

Phase 4: Drilling of a production well and if needed, a reinjection well.

At the conclusion of each phase, decisions will be made regarding a) the specifications for work under the succeeding phase, and b) whether or not to carry the project forward.

Detailed tasks to be performed by UU/UURI are as follows:

Phase 1

Task 1-1. Available geoscience data will be compiled, examined, and interpreted for relevance to the exploration problem at Hill Air Force Base.

Task 1-2. Interpretation of the available aerial photography and of the infrared imagery recently flown by EG&G, Inc. in Las Vegas, Nevada, will be performed and the results will be geologically evaluated by field work. The purpose and aim of this work will be to search for

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

May 4, 1979

Dr. Stanley J. Laster
University of Tulsa
600 College Avenue
Tulsa, Oklahoma 74104

Dear Stan:

Enclosed are the GSI and SSC bids we reviewed over the phone. If your current thoughts are different from our previous discussion, please let me know. We are accepting the SSC bid and the work should begin about 5/10/79 and be completed by June 20, 1979. I will call on you sometime in mid June for review of the data and data processing.

Sincerely yours,

Ted Glenn
Senior Geophysicist

TG:srm

enc.

cc: w/o enc.
D. Foley
W. Forsberg
S. Ward

(b) Provide adequate and timely consideration of the potentialities of known minority business enterprises in all "make-or-buy" decisions.

(c) Assure that known minority business enterprises will have an equitable opportunity to compete for subcontracts, particularly by arranging solicitations, time for the preparation of bids, quantities, specifications and delivery schedules so as to facilitate the participation of minority business enterprises.

(d) Maintain records showing (i) procedures which have been adopted to comply with the policies set forth in this clause, including the establishment of a source list of minority enterprises, (ii) awards to minority business enterprises on the source list and (iii) specific efforts to identify and award contracts to minority business enterprises.

(e) Include the Utilization of Minority Business Enterprises clause in subcontracts which offer substantial minority business enterprises subcontracting opportunites.

(f) Cooperate with the Contracting Officer in any studies and surveys of the contractor's minority business enterprises procedures and practices that the Contracting Officer may from time to time conduct.

(g) Submit periodic reports of subcontracting to known minority business enterprises with respect to the records referred to in sub-parargraph (d), above, in such form and manner and at such time (not more often than quarterly) as the Contracting Officer may prescribe.

The contractor further agrees to insert, in any subcontract hereunder which may exceed $500,000, provisions which shall conform substantially to the language of this clause, including this paragraph (g), and to notify the Contracting Officer of the names of such subcontractors.

E. E. O. 11758 - Employment of Handicapped Persons

Title 20, Chapter VI, Subchapter C, Part 741 of the Code of Federal Regulations requires government contractors and subcontractors to take affirmative action to employ and advance in employment qualified handicapped individuals. The regulations in this part apply to all government contracts in excess of $2,500.

Contractor agrees that the following provisions which are set forth in the regulations promulgated pursuant to the Rehabilitation Act of 1973 is made a part of any existing or future contract between the contractor and client:

(a) The contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

(b) The contractor agrees that, if a handicapped individual files a complaint with the contractor that he is not complying with the requirements of the Act, he will (1) investigate the complaint and take appropriate action consistent with the requirements of 20 CFR 741.29 and (2) maintain on file for three years, the record regarding the complaint and the actions taken.

(c) The contractor agrees that, if a handicapped individual files a complaint with the Department of Labor that he has not complied with the requirements of the Act, (1) he will cooperate with the Department in its investigation of the complaint, and (2) he will provide all pertinent information regarding his employment practices with respect to the handicapped.

(d) The contractor agrees to comply with the rules and regulations of the Secretary of Labor in 20 CRF Ch VI, Part 741.

(e) In the event of the contractor's non-compliance with the requirements of this clause, the contract may be terminated or suspended in whole or in part.

(f) This clause shall be included in all subcontracts over $2,500.00.

TELEDYNE EXPLORATION

2014 NORTH BIG SPRING

MIDLAND, TEXAS 79701

(915) 682-5383

APR 30 1979

April 23, 1979

Mr. Ted Glenn
University of Utah Research Institute
Earth Science Laboratory
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108

Dear Mr. Glenn:

We acknowledge receipt of your request for bid on a Vibroseis survey in the vicinity of Hill Air Force Base.

We sincerely regret we are unable to present a bid on this survey, as all of our parties are under contract for the forseeable future.

Thank you for the opportunity, and we hope we may be considered in the future.

Very truly yours,

TELEDYNE EXPLORATION COMPANY

E. L. Campbell

ELC:rm

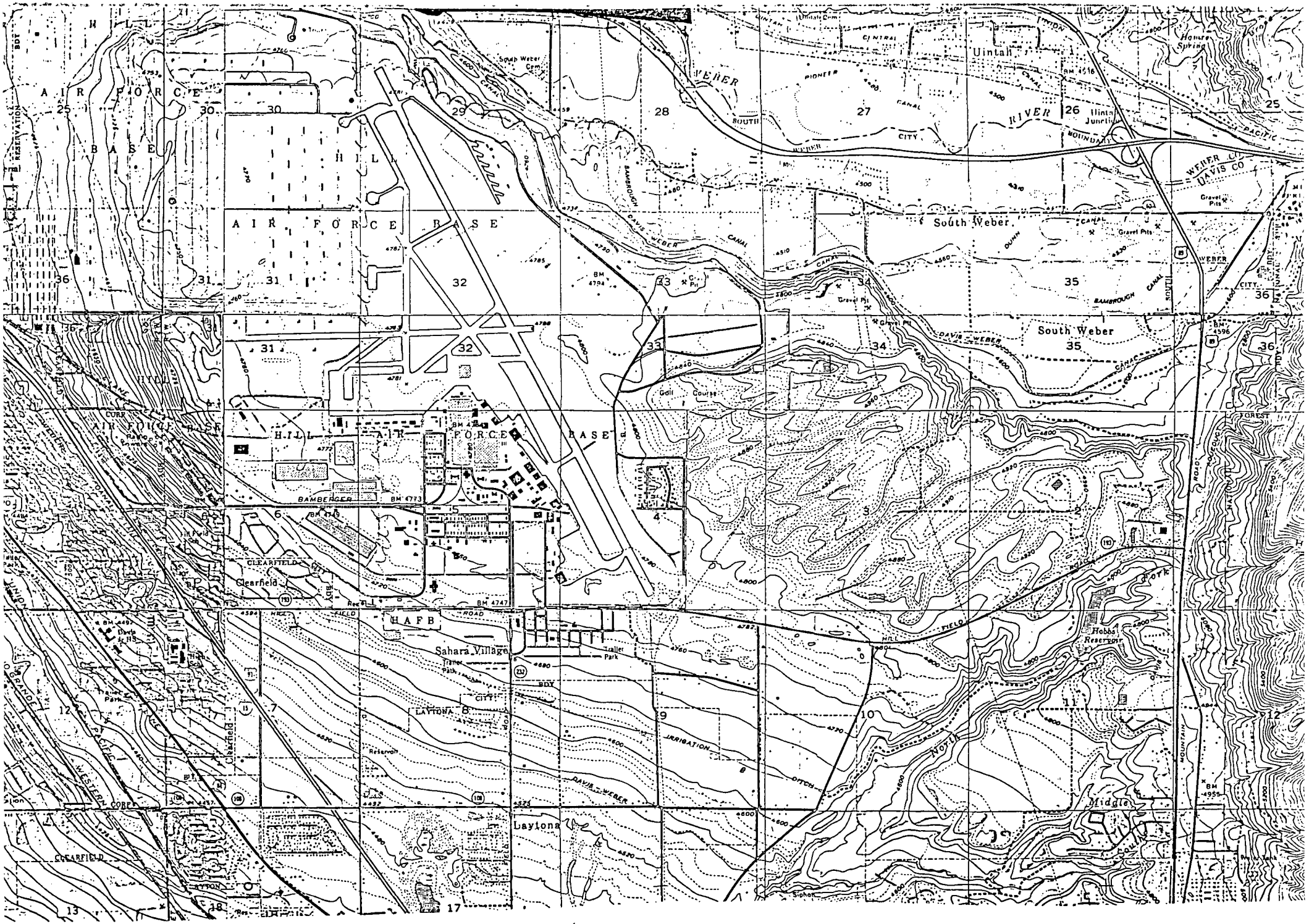


Figure 3: Line Location Map.

Initiation and Operation of SSC Seismic Survey #AFB

5/14/79 Survey crew arrives and lays out seismic lines with 110 foot station intervals.

5/15/79 Seismic equipment arrives. Dudley Seifert & I discuss noise survey via phone. I then reviewed it with Lester since we were both at Marina del Rey.

5/16/79 Crew starts noise survey and vibrators predic down

5/17/79 no work done - equipment problems

5/18/79 got part of noise survey finished

5/19/79 finished noise survey

5/20/79 reviewed noise survey data with Smatlak of SSC - crew idle today.

5/21/79 equipment problems - no survey accomplished to-day. Dudley called on survey parameters.

5/22/79 John Smatlak called: cost to date about $9050 for mobilization and noise study. Lay called, permitting

in order. No fees as yet. People want access to data. Walk-on permission only on small part of line 2 but not a serious problem. N5 line will have to await results of E40 lines, since we may wish to move it.

8/23/79 called Tad Vernon, crew chief, & found out that they got 43 miles on 22nd. Still having cable problems but should finish 1 mile to-day. $2253 for Tues. 4325 miles - $11303 total.

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

May 25, 1979

Seismograph Service Corporation
Box 1590
Tulsa, Oklahoma 74102

Attention: Mr. G. E. Randolph

Gentlemen:

SUBJECT: Subcontract Between University of Utah Research Institute and Seismograph Service Corporation.

Enclosed herewith are three (3) copies of the subject contract for your signature. We shall appreciate your returning two (2) signed copies to us. Also enclosed are the required purchase order and applicable general provisions of our prime contract.

Sincerely,

Ted Glenn
Senior Geophysicist

TG:srm

enc.

UNIVERSITY OF UTAH
RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE A
SALT LAKE CITY, UTAH 84108
801-581-5283

1959

22 May, 1979

To: UU/UURI Hill Base Project Team Members

From: D. Foley

Re: Technical Review

The next meeting with DGE/ID and USAF personnel will be at ESL at 9 AM, June 14, 1979. At this meeting the Air Force wishes to be brought up to date on our exploration efforts.

I will contact each of you in the next few days to try to find a suitable time to have a preliminary meeting.

Duncan

Emily F. Williams
122 Rencon Street
Apt. F.
Santa Cruz, Calif.
no phone

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
420 CHIPETA WAY, SUITE 120
SALT LAKE CITY, UTAH 84108
TELEPHONE 801-581-5283

MEMORANDUM

TO: W. Forsberg

FROM: T. Glenn

DATE: June 19, 1979

SUBJECT: Projected Costs of Seismic Survey of Hill Air Force Base

All costs are actual unless otherwise noted.

Line 1	5.08 mi	26,162
Line 2	6.08 mi	31,312
Line 3	3.75 mi	19,312
	14.91 mi	76,786
Mobilization		2,375
Geophone Pickup		1,425
Noise Survey 11 hrs		5,225
Standby 8 hrs		3,800
(may be more standby)		
		12,825
		89,611
Processing		
Line 1		
228 records		5,358.00
Line 2		
273 records		6,415.50
Line 3		
est.		3,948.00
Migration est.		2,100.00
		17,821.50
Petty Cash est.		
(insurance, permits, etc.)		1,000.00
		108,432.00

TG:dj
cc: D. Foley

Ted Glenn

SUBCONTRACT BETWEEN

UNIVERSITY OF UTAH RESEARCH INSTITUTE

and

SEISMOGRAPH SERVICE CORPORATION

THIS AGREEMENT entered into by and between UNIVERSITY OF UTAH RESEARCH INSTITUTE (UURI), a corporation, hereinafter referred to as "Contractor", and SEISMOGRAPH SERVICE CORPORATION, a corporation, hereinafter referred to as "Subcontractor".

WHEREAS, the University of Utah Research Institute has entered into a subcontract with the University of Utah under Contract No. DE-AC07-79ET27119, hereinafter referred to as the Prime Contract, and,

WHEREAS, the parties hereto desire to enter into a subcontract under said Prime Contract for the performance of certain work for the consideration hereinafter set forth:

NOW, THEREFORE, IT IS AGREED AS FOLLOWS:

SPECIAL PROVISIONS

This subcontact is subject to the applicable general provisions of said prime contract DE-AC07-79ET27119 (See Appendix A) which is incorporated in and made a part of this subcontract by reference.

ARTICLE I - STATEMENT OF WORK

Subcontractor during the period of May 9, 1979 to June 20, 1979 will perform tasks as described in the following Program Description:

PROGRAM DESCRIPTION

The Earth Science Laboratory of the University of Utah Research Institute and the Department of Geology and Geophysics, University of Utah will carry out a vibroseis exploration program in the vicinity of Hill Air Force Base south of Ogden, Utah. The location is shown on the attached index map (Figure 1). The survey will consist of two 5.5 mile (approximate) east-west profiles and a crossing 3.5 mile (approximate) north-south profile. The proposed three line locations are shown in Figure 2. Line 1 parallels a major road. Most of line 2 and of line 3 cross the air base. The east end of line 2 crosses open fields and a gravel pit. The south end of line 3 parallels a power line road. If survey logistics require movement of lines, this will be arranged by mutual agreement.

The survey is intended to resolve a basin and range type graben structure. The depth to alluvial reflectors and bedrock and the location of faults in both the alluvium and bedrock are the desired results of the survey. The geologic model is shown in Figure 3. It is not presumed to be correct but may depict the true model in a general sense. The model was derived from a simplified interpretation of widely spaced gravity data. The model suggests we need to resolve reflecting horizons from 1000 to 6000 feet depth.

The survey area is crossed by major freeways and railroads, contains the busy Hill Air Force Base runways and contains numerous housing subdivisions. Cultural noise may be significant and the survey will be preceeded by a noise study. The model resolution may require a pre-survey investigation of optimum gap, group interval, sampling rate and data processing.

The Subcontractor is required to carry out all the field work for this project, including data processing.

Field work must be completed by June 15, 1979, and the final report and all data must be transmitted to the Earth Science Laboratory by June 20, 1979.

The Statement of Work may be adjusted by mutual consent when required to satisfy the project objectives.

The field equipment will consist of the following:

1 Texas Instruments DFS IV 48 Channel, Instantaneous Floating Point 9-track Digital Field System recording unsummed data in SEG "B" Format, equipped for CDP recording and mounted in a four wheel drive truck.

4 VIBK-1000 Vibrators with SSC VIBK electronics mounted on tandem diesel trucks or four wheel drive VIBO tractors.

24 20-D 8Hz/or 10Hz Digital grade geophones per trace.
Summing and Cross-Correlation to be performed in Subcontractors Denver Office and/or on trailer mounted PHOENIX System. Output from the trailer mounted PHOENIX system will be available for review at the end of each day for monitoring data quality and establishing parameters. Plus necessary vehicles and personnel to effect an efficient operation.

The data acquisition will adhere to the following parameter and prices. The Contractor shall have the right to change between the 2400% CDP Data (110 feet group interval) and 1200% CDP Data (220 feet group interval) as determined from a study of the daily processed data.

DATA ACQUISITION

A. For following field parameters:

110 feet station spacing	
Minimum of 3 operative vibrators (4 on crew)	
No. of sweeps/Vibrator/VP	- 16
Record Length	- 18 seconds
Sweep Length	- 14 seconds (to be assessed in field)
Sweep Frequency	- 15-80 Hz (to be assessed in field)
No. of Geophones per pattern	- 24
48 Channel Recording System	
Sample Rate	- 2 ms or 4 ms (to be assessed in field)

For 2400% CDP Data (VP Interval - 110 feet) ----$5,150.00/mile

For 1200% CDP Data (VP Interval - 220 feet) ----$3,850.00/mile
(These prices include highway flagging personnel costs. These prices do not include fees or damages, archaeological fees, dozers or road graders (if necessary) and any special licencing, bonds or sales tax - these items would be passed on the Contractor at cost).

Output to Contractor ---- Summed, Cross-Correlated Data and Data Tapes.

B. Experimental Time ---- $475.00/hours

C. Mobilization Costs ----$2500.00 (approx.)
Total mileage from previous location to prospect divided by 35 mph x $475/hr.

D. Geophone/Cable pickup costs (if necessary) ---- $475.00/day
Please note that this is considered necessary if line is located in heavily populated areas and is readily accessible to public.

E. Insurance coverage for client during survey, personal and property damage claim to $1,000,000.00 ---- $500.00

F. Data acquisition costs will be supplied daily to the Principal Investigator or designated representative.

DATA PROCESSING (Denver)

To include application of static and dynamic corrections, stack, deconvolution (if necessary), filtering, surface consistent and/or correlation automatic static corrections, final filtering, display. Processes data tapes included.
---- $23.50 record

Migration ---- $1.50 per stacked trace.

Initial processing and analysis of experimental data can be performed on PHOENIX mini-computer system at crew headquarters at no additional charge.

Extra PHOENIX time (if necessary) ---- $80.00/hr.

I. Subcontractor Requirements, Field-Work

The Subcontractor shall furnish all personnel, supplies, equipment and services to carry out the project according to the following schedule:

A. Management. The Subcontractor will furnish a Project Manager who will supervise field operations and coordinate data reduction under the general supervision of the Principal Investigator (PI), Earth Science Laboratory/University of Utah Research Institute, or a representative designated by the PI.

B. Permitting. The Subcontractor will obtain written permission for all vibrator points, recording sites, and access roads. All locations must be acceptable to the PI, Earth Science Laboratory/University of Utah Research Institute.

C. Vibrator Points. The Subcontractor shall operate the vibroseis equipment in a safe manner according to State and Federal regulations. The Subcontractor shall be solely responsible for determining the distance judged to be safe when operating vibrators near houses, pipelines, roads and other manmade objects.

D. Recording. The Subcontractor will furnish all observing personnel, recording equipment and supplies. Equipment shall be maintained in excellent condition to insure a minimum of down time. The equipment must provide magnetic tape recording digital format, with at least 800 BPI density or better, and a timing resolution of 2 or 4 milliseconds depending on field

recording parameters selected. True amplitude must be maintained. The format of the final magnetic tapes supplied to the UURI/ESL must be compatible with the University of Utah's UNIVAC 1108 computer and 9-track tape drives: IBM 2400 Series Magnetic Tape Drive at 800 Bytes per inch. EBCDIC data format on tapes is required. Physical record length can not exceed 10,000 bytes.

1. Analogue records must be available daily for inspection in the field by the P.I. or designated representative. Gain recording must be available on the tape for true amplitude recovery.

E. Surveying. The Subcontractor will furnish all personnel and equipment necessary to locate all vibrator and recording sites on USGS 7-1/2 minute quadrangle maps, or equivalent. Elevations must be recorded to six feet or better.

F. Land Renovation. The Subcontractor will perform all necessary renovation to the vibratory points, recording sites, etc., to satisfy the Permittors.

G. Insurance - Liability to Third Persons. In order to provide for potential disasters and damages during the course of the work, the Subcontractor is required to procure insurance for the range of $1.00 to $1,000,000.00.

II. Subcontractor Requirements, Data

The Subcontractor will provide all digital magnetic tapes, analogue field recordings and the following record sections from each vibrator point, all of which will become the property of the Contractor. All recording, daily data processing and final data processing shall adhere to specifications given in

Program Description.

III. Reporting Requirements

Reports on the progress of the research projects will be required from the Subcontractor. A report in five (5) copies will be submitted with the final copies of the processed data. The report shall include detailed discussion of technial survey parameters, line locations, recording and vibrator site-coordinates, processing parameters, and recommendations for further processing. Data to be submitted include magnetic tapes of field and processed data analogue field records, data sheets of field recordings and instrument parameters.

ARTICLE II - TECHNICAL AND ADMINISTRATIVE SUPERVISION

A. Technical Direction of this subcontract shall be given by Dr. Stanley H. Ward, P.I. and Director, Earth Science Laboratory/University of Utah Research Institute.

B. Paragraph A above shall not be construed as permitting the changing of the scope or other terms of this subcontract without execution of a written amendment hereto.

ARTICLE III - ALLOWABLE COSTS AND PAYMENT

A. The Subcontractor shall be reimbursed for the performance of this subcontract in accordance with the following additional terms:

1. The total estimated cost for approximately fifteen (15) line miles, of vibroseis survey performed hereunder is not to exceed $108,800.00.

B. Payments shall be made upon submission of invoices detailing

allowable incurred costs. Invoices and deliverables will be submitted as follows:

1. Subcontractor invoices shall be submitted to UURI at:

University of Utah Research Institute
420 Chipeta Way
Salt Lake City, Utah 84108
Attn: Mr. Richard Thomsen.

2. Subcontractor deliverables shall be sent to UURI at:

University of Utah Research Institute
Earth Science Laboratory
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108
Attn: W. E. Glenn

ARTICLE IV - GENERAL PROVISIONS

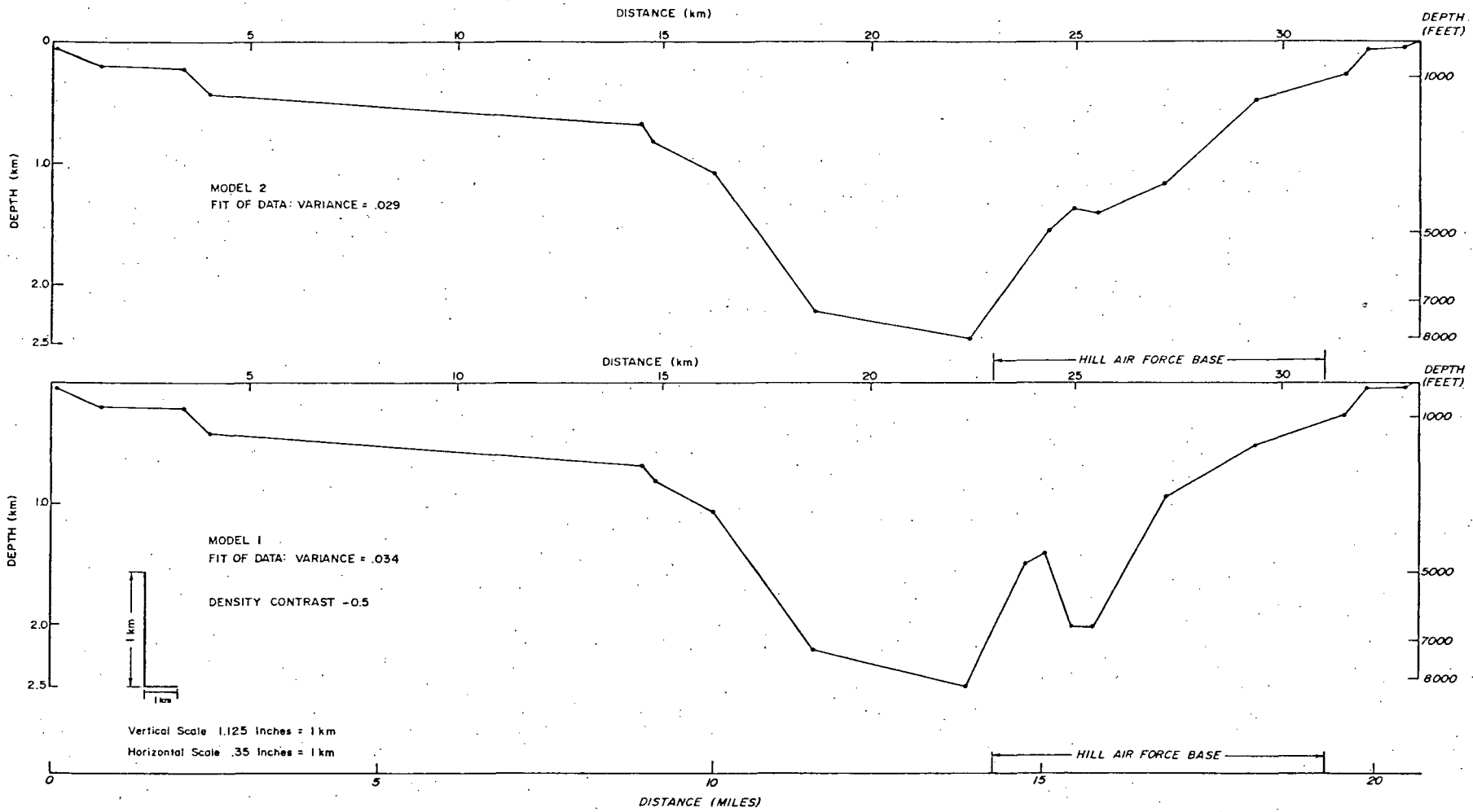
The clauses listed in Appendix A are incorporated and made a part hereof. Wherever necessary to make the aforesaid clauses applicable to this subcontract, the term "contractor" shall be deemed to refer to "subcontractor", the term "contracting office" or "government" shall be deemed to refer to the University of Utah Research Institute, and the term "contract" shall be deemed to refer to this subcontract.

ARTICLE V

The provisions of this subcontract may be modified only as agreed to in writing by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this subcontract on the last day and year herein below written, which is the date of signing by the last signatory hereto. Effective date of this subcontract to be May 9, 1979.

UNIVERSITY OF UTAH RESEARCH INSTITUTE:	SEISMOGRAPH SERVICE CORPORATION:
By: N L Partridge	By: A E Randolph
Title: President University of Utah Research Institute	Title: Asst. Vice President
Date: 11 May 1979	Date: June 4, 1979



ESL

Preliminary Interpretation of Gravity Data
Hill Air Force Base and Vicinity

FIGURE 2

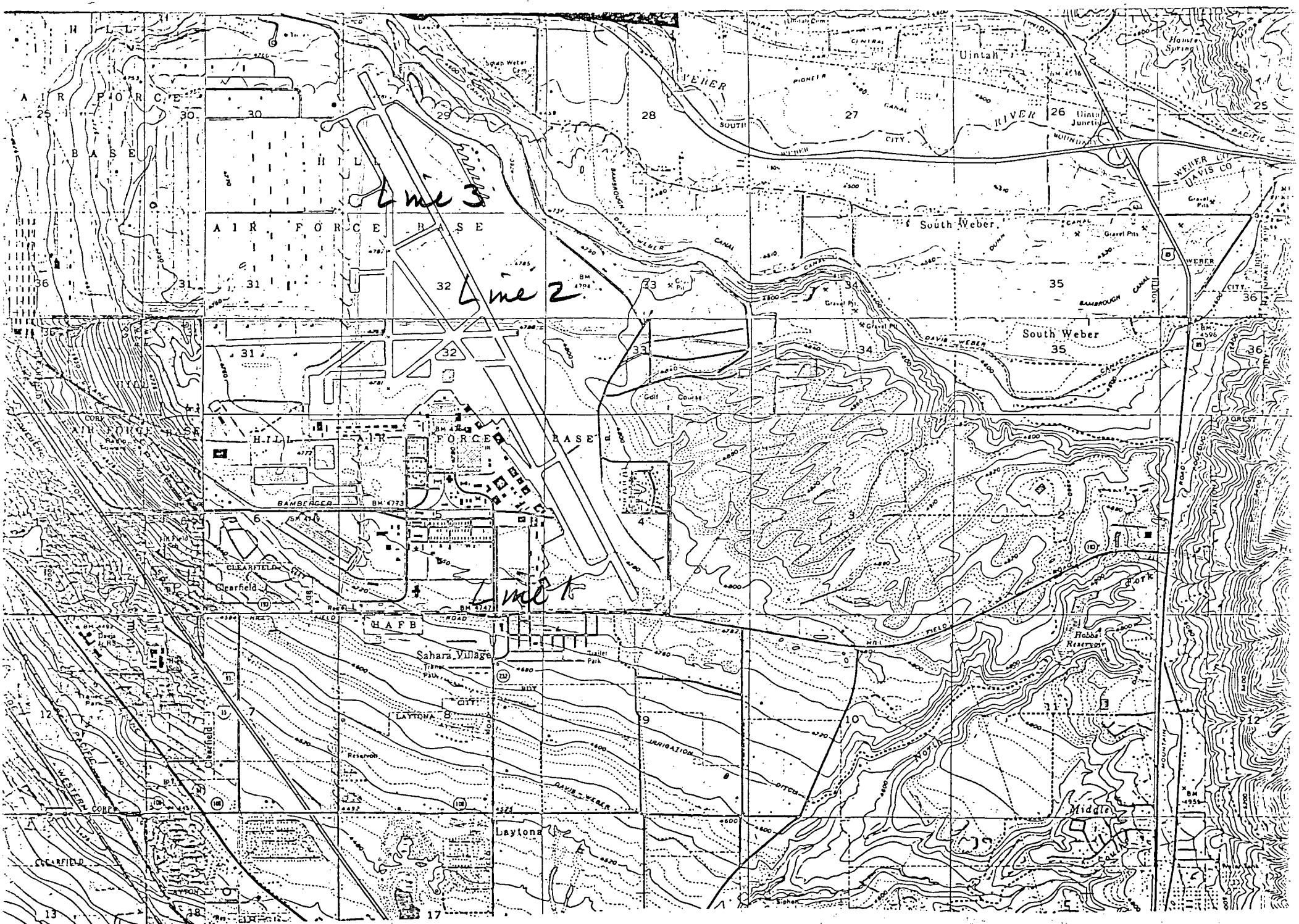
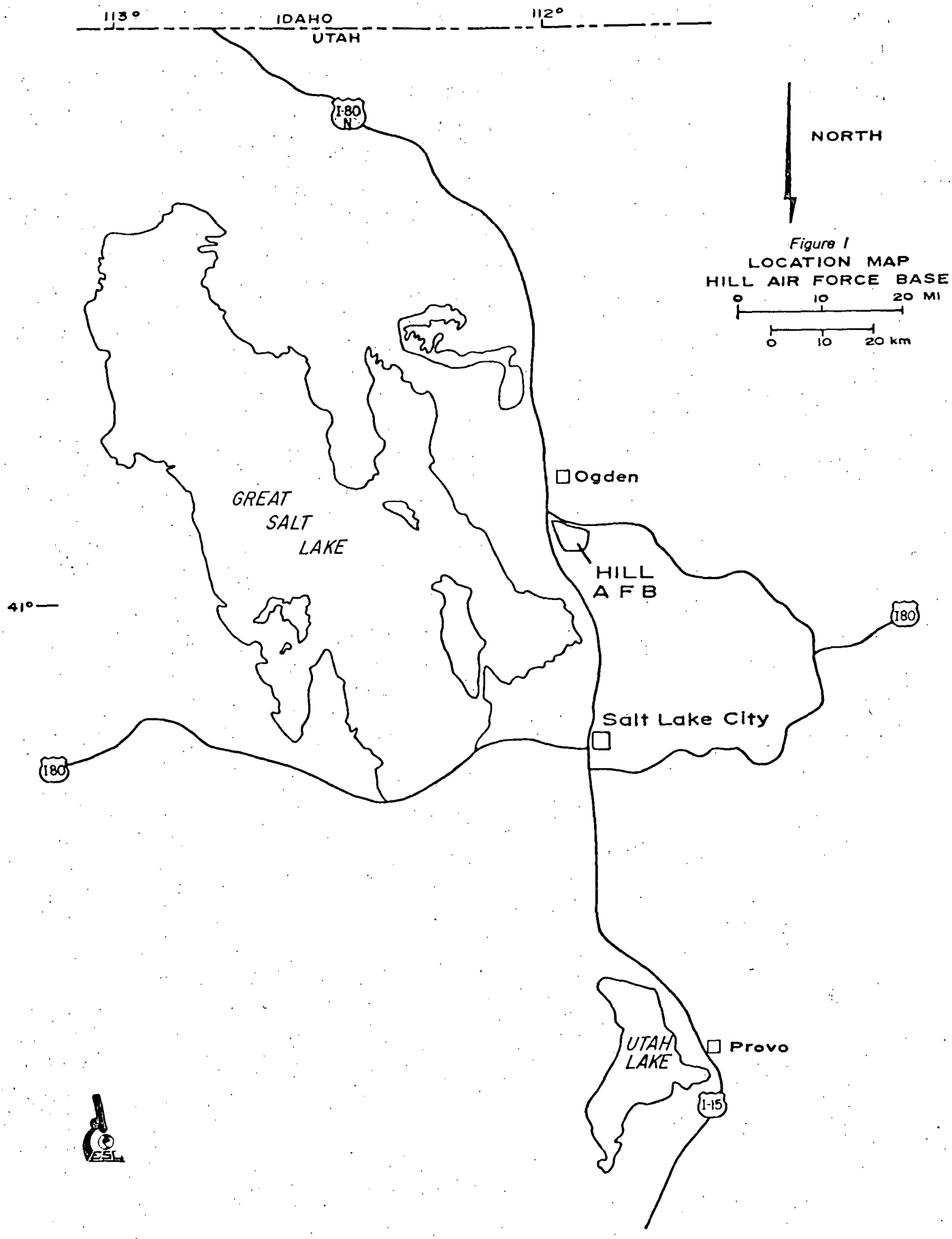


Figure 3: Line Location Map.


113°
IDAHO
UTAH
112°
I-80 N
NORTH
Figure 1
LOCATION MAP
HILL AIR FORCE BASE
0 10 20 MI
0 10 20 km
Ogden
GREAT SALT LAKE
HILL A F B
41°
180
180
Salt Lake City
UTAH LAKE
Provo
I-15
ESL

JOE WEST Company
Insurance Corner FIFTEENTH and ROCKFORD
1419 EAST FIFTEENTH STREET • TULSA, OKLAHOMA 74120
SINCE 1922
AREA CODE 918
582-2271

May 4, 1979

University of Utah
Research Institute Earth Science Laboratory
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84100

ATTN: Mr. Ted Glenn

RE: Owners' Protective Liability
Policy #38 C 729308

Gentlemen:

We are pleased to enclose the captioned policy which provides Owners' Protective Liability coverage for vibroseis work being done by Seismograph Service Corporation.

This policy is written through Hartford Accident and Indemnity Company for the period 5-3-79 to 5-3-80, and has a $1,000,000. Single Limit of Liability.

We trust you will find the enclosed to be in order.

Yours very truly,

JOE WEST COMPANY

Robert McMasters

Robert McMasters

RMcM/ek

Enclosure

cc: Seismograph Service Corporation
P. O. Box 1590
Tulsa, Oklahoma 74102

TED – FYI

Appendix A not included -- Duncan

July 6, 1979

SPECIFICATIONS

The University of Utah Research Institute, under contract with the U. S. Department of Energy, plans to undertake a program of drilling as part of its geothermal activities. The purposes of the drilling are: (1) to measure temperature gradients in the holes and (2) to obtain samples of the rock units for laboratory studies.

Dates	-The drilling will be undertaken between July 16 and September 15, 1979. The exact dates are subject to discussion between the University of Utah and the drilling contractor and will take into account weather, fire danger, and other factors.
Number of Holes	-Approximately 3 holes will be drilled but the exact number will depend on drilling rates and costs.
Location	-Holes will be drilled at sites on or near Hill Air Force Base, Clearfield, Utah.
Hole Size	-Holes will be drilled to a diameter necessary to obtain depths specified below. Possible diameter would be 8-3/4" to 1000', 6-3/4" below.
Groundwater Conditions	-A variety of groundwater conditions are expected, including flowing artesian conditions. The contractor will be equipped to handle artesian conditions and to backfill the drill holes with cement (grout).
Drilling Fluid	-Holes will be drilled with air and/or mud. Drilling mud may have to be confined in tanks at one site, as mud pits may not be allowed.
Steel Casing	-All holes will be cased if necessary to comply with existing State and Federal regulations.
Plastic Casing	-A bottom-capped 2 inch I.D. steel inner casing will be inserted and secured in each hole to total depth, then filled with water. Temperature gradients will be measured inside the casing.
Materials	-The drilling contractor will furnish on-site all materials including but not limited to bits, cement, steel casing, lost circulation materials, and mud materials.
Logs	-A driller's log showing rock types and groundwater conditions will be required for each hole. Detailed lithologic logging will be done by client.

Sampling -Drillers will be required to supply chip samples from 10 foot intervals.

Geology -The holes will be drilled beginning in alluvium (interbedded gravel, sand, silt, and clay) (see Appendix A).

Site Preparation -Holes will be drilled on pre-existing sites or on sites prepared by the client.

Regulations -The drilling contractor will comply with the geothermal regulations of the U. S. Geological Survey and all other existing regulations regarding air and water quality.

Crew Size -The contractor will furnish an experienced two- or three-man crew on-site during all working hours.

Cost Summaries -The contractor will be required to furnish daily cost summaries on-site.

Option To Extend -The client may at any time during the term of this contract exercise an option to extend this contract for the drilling of an additional hole or holes and Contractor shall agree to such contract extension.

Bidding Procedure -All bids should show the following items separately:

(1) Mobilization and demobilization - cost per mile on total.
(2) Moves between holes - cost per hour.
(3) Down-hole hammer drilling - cost per hour or cost per foot.
(4) Rotary drilling - cost per hour or cost per foot.
(5) Standby at client's request - cost per hour.
(6) Installing casing - cost per hour.
(7) Water truck, if required, including driver - cost per day.
(8) Expendable items.
(9) Crew travel time (to and from site) - cost per hour.
(10) Personal living allowance - per day for crew.
(11) Description of equipment.

INVITATION TO BID

Program of shallow drilling for geothermal research activities, per attached specifications dated July , 1979.

All bids should show the following items separately:

1. Mobilization and demobilization - cost per mile or total. $_____

2. Moves between holes - cost per hour or mile. $_____

3. Rotary drilling - cost per hour. $_____/per hour

   and/or

4. Rotary drilling - cost per foot. $_____/per foot

5. Standby at client's request - cost per hour $_____/per hour

6. Installing casing - cost per hour. $_____/per hour

7. Water truck, if required, including driver. $_____/per day

8. Expendable items to be reimbursed by client; bits, cement, mud, inner casing, etc. (give % above cost for handling). _____%

Description of Equipment

(A) Drilling Rig. Complete drilling rig with the major items being:
Drill: Make, model, and age

Drill truck: Make, model, and GVW

Mud pump: Make, model, and size

Drill pipe: Length, size, type of tool joings

Drill collars: Number, Length, size

Portable mud pit: Capacity and number of baffles

(B) Water Truck.
Truck: Make, model, GVW

Tank: Capacity

(C) Service Pick-Up.
Truck: Make, model, GVW

Needs to be expanded

(D) Personnel:
Driller(s) name and experience (years)

Bidder facilities, equipment, past performance and performance capabilities shall be a factor in the award. The Bidder's capability to begin work soon after contract is awarded will be a factor with award.

CONTRACTORS LIABILITY INSURANCE

The contractor shall carry on his work in accordance with the requirements of the Workmen's Compensation Laws and shall not reject the provisions thereof during the life of the contract. He shall also protect himself by liability insurance against any and all claims for damages to person or property which may arise out of operations under this contract.

Drill Contractor_____

Address_____

_____

Telephone_____

Signature_____

Date_____

6/15/79

303 - 861 - 4476

mob	2375	
3 hrs geo. pick	1425	
dep	5225	
Line 1	26162	5.08 mi
" 2	31003 (est)	6.02 "
" 3	18025 est	3.5 "

Sandy Blvd	3800	
misc	8000	
	96000	
processed	18500	
	114,500	108,00
	6,500	
	108,500	

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 8

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. *(If applicable)*
A002	3/12/79		

5. ISSUED BY CODE
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

6. ADMINISTERED BY *(If other than block 5)* CODE

7. CONTRACTOR NAME AND ADDRESS *(Street, city, county, state, and ZIP Code)* CODE FACILITY CODE

The University of Utah
717 Mineral Science Building
Salt Lake City, Utah 84112
Attention: W. L. Forsberg

8.
☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ *(See block 9)*
☒ MODIFICATION OF CONTRACT/ORDER NO. DE-AC07-78ET28392
DATED 10/19/77 *(See block 11)*

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods: (a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA *(If required)*

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of agreement of the Parties.
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

The above-numbered contract is hereby modified to include performance of the work set forth in Attachment I, Statement of Work (SOW), entitled "Hill Air Force Base Geothermal Project" dated March 12, 1979.

1. STATEMENT OF WORK

The Contractor shall provide, or subcontract (subject to necessary approvals) for, the necessary personnel, facilities, services, materials, and documentation to perform the work described in Attachment I, Statement of Work, entitled "Hill Air Force Base Geothermal Project," in accordance with the terms and conditions of this Supplemental Agreement.

2. PERIOD OF PERFORMANCE

The period of performance for Phases I through III of the SOW is March 12, 1979, through September 30, 1979. If required and authorized, Phase IV shall be completed within the shortest reasonable time possible.

(Continued)

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13. ☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 2 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
BY _____ (Signature of person authorized to sign)	BY _____ (Signature of Contracting Officer)
15. NAME AND TITLE OF SIGNER *(Type or print)*	16. DATE SIGNED
	18. NAME OF CONTRACTING OFFICER *(Type or print)*: R. E. Simonds, Director, Contracts Management Division
	19. DATE SIGNED: 7/25/79

30-101-01

☆ U.S. GOVERNMENT PRINTING OFFICE: 1967—694-008

3. REPORTS

The Contractor shall prepare and deliver to DOE the reports described in Attachment I, "Statement of Work," and in accordance with the Reporting Requirements section in said Attachment I.

4. OBLIGATION OF FUNDS, ESTIMATE OF COSTS

A. Obligation of Funds. The amount obligated by the Government with respect to this Supplemental Agreement is $334,723.00.

B. Estimate of Costs. The estimated cost of the work under this Supplemental Agreement is $334,723.00 for Phases I through III of the SOW, which includes a total fixed fee of $14,500.00 for the subcontractor, University of Utah Research Institute. If desired, DOE shall authorize the funding of Phase IV.

5. DATE OF INCURRENCE OF COSTS

The Contractor shall be entitled to reimbursement for costs incurred in an amount not to exceed $65,000.00 on or after March 12, 1979, which, if incurred after this Supplemental Agreement had been entered into, would have been reimbursable under the provisions of the contract.

6. LIABILITY AND INDEMNIFICATION

The Government will not be liable for payment of damages for injuries to any person, or loss of life or personal property, or loss suffered or sustained and arising from the work performed under this Supplemental Agreement. The Contractor agrees to indemnify and save the Government harmless from any and all claims, demands, damages, actions, costs, or charges against the Government arising as the result of the above-mentioned injuries, damages, or loss, except for any such damages or claims arising out of the negligent act of the Government or its employees in the course of their official duties.

HILL AIR FORCE BASE GEOTHERMAL PROJECT

STATEMENT OF WORK

March 12, 1979

The Contractor shall enter into a program designed to locate and exploit geothermal resources at Hill Air Force Base. This program shall be carried out in phases as follows:

Phase I: Orientation geological, geochemical, and geophysical.

Phase II: Detailed geological, geochemical, and geophysical.

Phase III: Drilling of several temperature gradient holes and interpretation of the results.

Phase IV: Drilling of a production well and, if needed, a reinjection well.

At the conclusion of each phase, decisions will be made regarding the specifications for work under the succeeding phase, and whether or not to continue the project.

Detailed tasks to be performed by the Contractor are as follows:

Phase I - Task I-1 Available geoscience data shall be compiled, examined, and interpreted for relevance to the exploration problem at Hill Air Force Base.

Task I-2 Interpretation of the available aerial photography and of the infrared (IR) imagery shall be performed and the results shall be geologically evaluated. The purpose of this work shall be to search for features shown on the photographic and IR imagery which could represent subsurface faulting.

Task I-3 An orientation mercury geochemical survey shall be performed by determining whether mercury is present with either known hot springs, or known geologic structures in the vicinity of Hill Air Force Base.

Task I-4 A chemical characterization of known thermal waters near Hill Air Force Base shall be made and compared with that of nearby non-thermal waters to determine whether or not the thermal waters have an identifying signature and whether or not environmentally damaging contaminants such as fluorine or boron are present in the nearby thermal waters.

Task I-5 Available gravity data shall be interpreted to help determine thickness of unconsolidated valley fill material around and under Hill Air Force Base. One to three detailed gravity profiles shall be surveyed to determine whether or not faulting is detected beneath valley fill by such a survey. The results shall be interpreted in the context of the regional gravity data base already available.

Task I-6 A report shall be written which records the current status of geologic knowledge and plans for delineation of potential geothermal resources at Hill Air Force Base.

Phase II

Task II-1 Contingent upon the results of Task I-3 and Task I-4, a detailed geochemical survey shall be made of soils and/or waters at and near Hill Air Force Base for the purposes of locating any subsurface faults and to improve the understanding of regional hydrology.

Task II-2 Contingent upon the results of Task I-5, further detailed gravity data will be obtained on and near Hill Air Force Base and will be evaluated in terms of the thickness of valley fill material and for the general location of subsurface faulting.

Task II-3 A detailed seismic reflection survey, possibly using a vibroseis unit as a source, shall be surveyed over roughly 17 line-miles of traverse to locate and pinpoint as drill targets any subsurface faulting.

Task II-4 A report shall be written on all the above data and their interpretations for the purpose of consolidation and dissemination of information. Based on this report, the locations of subsequent thermal gradient holes shall be recommended.

Phase III

Task III-1 Contingent upon the results of previous efforts, one to six thermal gradient holes shall be drilled to depths varying up to 2000 feet or

more. Hole depth cannot presently be specified pending more detailed data on valley fill thickness and determination of subsurface geothermal targets. Holes shall be sited to intersect interpreted subsurface faults or other suspected thermal aquifers. The purposes of the drilling shall be to check for thermal waters and/or encouragement that thermal waters are located nearby. At present, it is anticipated that a total of about 6000 feet of drilling will be conducted. The Contractor shall procure the services of an appropriate drilling subcontractor and shall supervise the drilling.

Task III-2 Detailed lithologic studies shall be performed on the samples from the thermal gradient holes specified in Task III-1. Other geological and geochemical studies shall be performed on the samples as deemed appropriate at that time.

Task III-3 Appropriate geophysical logging shall be accomplished on the holes drilled under Task III-1. The minimum logging shall be temperature vs. depth. The exact number and type of logs to be run shall be based upon the temperature log and the results of Task III-2. The hole shall be left open, but cased for heat flow measurement.

Task III-4 Based upon all of the above results, a report shall be written for the purpose of justifying either the location and specifications for a production well, or termination of the project.

Phase IV

Task IV-1 If a production well appears to be feasible, geological guidance shall be provided by the Contractor. The actual decision making and drilling shall be the responsibility of DOE.

Task IV-2 Geological, geochemical, and geophysical study of the samples from the production well shall be performed as appropriate. The minimum result of this work shall be geologic logging of well samples, geochemical characterization of natural well waters produced from the well, and temperature logging.

Task IV-3 Contingent upon the above results, a reinjection well may be sited and drilled. If siting of such a well requires further geologic study, this will be specified at that time. The actual decision making and drilling shall be the responsibility of DOE.

U. S. DEPARTMENT OF ENERGY

REPORTING REQUIREMENTS CHECKLIST

DOE Form CR-537
(1-78)

(See Instructions on Reverse)

FORM APPROVED
OMB NO. 38R-0190

1. IDENTIFICATION	2. OBLIGATION INSTRUMENT: MODIFICATION NO. A002
University of Utah	CONTRACT NO. DE-AC07-78ET28392

3. REPORTING REQUIREMENTS

A. PROJECT MANAGEMENT	Frequency
1. ☐ Management Plan	
2. ☐ Milestone Schedule & Status Report	
3. ☐ Cost Plan	
4. ☐ Manpower Plan	
5. ☒ Contract Management Summary Report	M
6. ☒ Project Status Report	M
7. ☐ Cost Management Report	
8. ☐ Manpower Management Report	
9. ☒ Conference Record	A
10. ☐ Hot Line Report	

B. TECHNICAL INFORMATION REPORTING	Frequency
1. ☐ Notice of Energy RD&D Project (SSIE)	
2. ☒ Technical Progress Report	A
3. ☐ Topical Report	
4. ☒ Final Technical Report	F
C. PMS/MINI-PMS	
1. Cost Performance Report	
☐ Format 1 WBS	
☐ Format 2 Functional	
☐ Format 3 Baseline	
☐ Format 5 Problem Analysis	
2. ☐ Cost/Schedule Status Report	
3. ☐ Management Control System Description	
4. ☐ Summary System Description	
5. ☐ WBS Dictionary	

FREQUENCY CODES:
A – As Required
C – Contract Change
F – Final (End of Contract)
M – Monthly
O – One Time (Soon After Contract Award)
Q – Quarterly
S – Semi-Annually
X – Mandatory for Delivery with Proposals/Bid
Y – Yearly or Upon Contract Renewal

4. SPECIAL INSTRUCTIONS

5. ATTACHED HEREWITH:

☒ Report Distribution List ☐
☐ WBS/Reporting Category ☐

6. PREPARED BY (Signature and date):	7. REVIEWED BY (Signature and date):

REPORTING REQUIREMENTS CHECKLIST

PURPOSE

A checklist to identify and communicate additional reporting requirements which are not otherwise set forth in the General Purpose clauses of DOE contracts and agreements. It will be included as part of the contract or agreement. This form will be completed for each proposed contract or agreement and can be modified as required in Special Instructions to adapt it to a specific situation.

INSTRUCTIONS

Item 1 – Enter the title as indicated in the Procurement Request, Interagency Agreement, or initiating memorandum.

Item 2 – Enter the identification number of the Procurement Request or Interagency Agreement, the date of the memorandum, and contract number after award.

Item 3 – Check spaces to indicate plans and reports required. For each reporting requirement checked, indicate frequency of delivery in column provided using one of the frequency codes shown.

3.A.1 *Management Plan* – The contractor's plan to manage the effort described in the statement of work or similar document. It will contain management methodologies, control systems, and procedures he will use. Includes milestones and other planning schedules, organizational identification and descriptions, and special and critical plans, such as test plans, plans for handling of Government owned property. Work breakdown structures, key personnel identification, and methods for monitoring progress toward objectives may be required.

3.A.2 *Milestone Schedule and Status Report* – The contractor's milestone schedule for all work breakdown structure items, line items, or deliverables specified in the contract. Updated periodically (usually monthly) with status, progress toward completion, and percent completion of each line item and of the total contract.

3.A.3 *Cost Plan* – A baseline plan for incurring costs on a contract or agreement to measure progress in terms of cost; update and forecast contract fund requirements; plan funding changes; and develop fund requirements and budget estimates.

3.A.4 *Manpower Plan* – A baseline plan to allocate manpower to each reporting category identified in the contract or agreement.

3.A.5 *Contract Management Summary Report* – A single-page graphic presentation of integrated cost, major milestones, and manpower for rapid visual analysis and trend forecasting.

3.A.6 *Project Status Report* – A periodic report to communicate to DOE management an assessment of contract status, to explain variances and problems, and to discuss any other areas of concern or achievements.

3.A.7 *Cost Management Report* – A periodic report of the status of costs compared to the Cost Plan. Data is used to: report actual and projected accrued costs; evaluate performance against plan; identify actual and potential problem areas; construct cost experience for projects and budgeting efforts; and, to verify the reasonableness of contractors' invoices.

3.A.8 *Manpower Management Report* – A periodic report of the status of actual and projected manpower expenditure against the Manpower Plan. Data is used to evaluate performance against plan; identify actual and potential problem areas; and to construct manpower experience for projections and planning efforts.

3.A.9 *Conference Record* – Documentation of the contractor's understanding of significant decisions, direction or redirection or required actions resulting from any meeting with DOE representatives.

3.A.10 *Hot Line Report* – A hardcopy report by the fastest means available, (TWX, etc) documenting critical problems, emergency situations, and important technical breakthroughs.

3.B.1 *Notice of Energy R&D Project* – A formatted, two-page report to provide information on unclassified DOE R&D projects for dissemination to the scientific, technical, and industrial communities and to the public. Also provides information to the Smithsonian Scientific Information Exchange.

3.B.2 *Technical Progress Report* – A formal, structured technical report, submitted periodically to communicate project results for dissemination to Government agencies, the scientific, technical and industrial communities and the public.

3.B.3 *Topical Report* – A special technical report prepared when a project has reached a point at which a major milestone or a significant phase has been completed, when unexpected results have been achieved, when it is logical to summarize results achieved, or when a new scientific or technological finding is deemed to warrant prompt publication.

3.B.4 *Final Technical Report* – Technical Progress Report reporting final results of DOE supported RD&D and scientific projects.

3.C *PMS/Mini-PMS*

1) *Cost Performance Report (PMS Application)*

Format 1 – Reports current period and cumulative budget, actual costs and earned value data by work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

Format 2 – Reports current period and cumulative budget, actual costs, and earned value data by contractor functional elements.

Format 3 – Provides periodic updating to the established performance measurement baseline. Incorporates authorized contract changes and internal re-planning into the performance measurement baseline.

Format 5 – Provides a narrative analysis of contract variances.

2) *Cost/Schedule Report (Mini-PMS Application)* – Periodic, usually monthly, report of cumulative budget, actual costs and earned value by summary work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

3) *System Description (PMS Application)* – Contractor's description of the management control system to be used in performing contract work. Must address all elements of the PMS criteria.

4) *Summary System Description (Mini-PMS Application)* – Contractor's summarized description of the management control system to be used in performing contract work.

5) *WBS Dictionary* – Lists and defines work breakdown structure. For more detailed instructions see PMS Manual.

Frequency Codes – Each code must have an identified time period (i.e., As Required – 5 days after event occurrence). These time periods are suggested in the solicitation and negotiated at contract award.

Item 4 – Identify any special reporting requirements not indicated in Item 3 and/or qualifiers to those selected. (Use additional sheets as necessary.)

Item 5 – Check appropriate blocks.

Report Distribution List – A comprehensive informative listing of reports by frequency of submission, addresses and number of copies for each addressee.

Reporting Categories (level of detail) – An identification by WBS level of task elements for which reporting will be required by DOE.

Item 6 – Signature of person or persons preparing the checklist and the date prepared. Preparation is by person or persons responsible for preparation of Procurement Request or Statement of Work.

Item 7 – Signature of the person reviewing the checklist and date reviewed.

* U.S. GOVERNMENT PRINTING OFFICE: 1978--281-130/ 514

MODIFICATION
NO. A002
CONTRACT NO.
DE-AC07-78ET28392

ADDRESSEES:	MANAGEMENT PLAN	HOT LINE REPORT	CONFERENCE REPORT	PROJECT STATUS REPORT	ENERGY RD&D WORK IN PROGRESS	TECHNICAL PROGRESS REPORT	COST PLAN	COST MANAGEMENT REPORT	FUNDS RECONCILIATION REPORT	MANPOWER PLAN	MANPOWER MANAGEMENT REPORT	MILESTONE PLAN AND MANAGEMENT REPORT	CONTRACT MANAGEMENT REPORT	EARNED VALUE PERFORMANCE REPORT	FINAL TECHNICAL REPORT	TOPICAL REPORT	SPECIAL INSTRUCTIONS
NO. OF REPORT COPIES																	
J. L. Griffith, Chief Research & Engineering Branch Energy and Technology Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401			5	5		5									1		10
ORTIC P.O. Box E Oak Ridge, Tennessee 37830																	1
R. E. Simonds, Director Contracts Management Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401			1	1		1									1		1
E. G. Jones, Director Financial Management Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401															1		

REPORT DISTRIBUTION LIST

Purpose:

The Report Distribution List is used to identify the required number of standardized plans and reports and to indicate the individual or office to which they will be delivered.

Instructions:

Contract Number	The contract number is as officially stated in the contract and cannot be entered at this time. This information should be entered when contract award is made.
Addressees	Specify the individual(s) or office(s) to which the report(s) will be delivered.
No. of Report Copies	Identify the number of copies of a particular report to be delivered to each addressee.
Special Instructions	This section of the form is used for pertinent instructions to amplify other information on the form.

NON-NEGOTIABLE

FRONTIER AIRLINES

8250 SMITH ROAD • DENVER, COLORADO 80207

Kwickee

SMALL PACKAGE SHIPMENT

SHIPPER [illegible] A/F ACCOUNT NO. 00018302

CONSIGNEE UNIX 420 Chipeta Way Salt Lake City, Utah CONSIGNEE TEL. NO. 583-0346

FINAL DESTN. Salt Lake City CONTENTS Paper records

ROUTING

TO	FLIGHT NUMBER
SLC	FL 16
	FL
	FL

DECLARED VALUE $

WEIGHT 2

	PREPAID
EXCESS VALUE	$25.00
TAX	2.25
TOTAL	27.25

CONSIGNEE'S SIGNATURE

K 35019

CONSIGNEE COPY

Seismograph Service Corporation

A SUBSIDIARY OF RAYTHEON COMPANY

TRANSMITTAL MEMORANDUM
SSC—1033-C

DATE: August 16, 1979

PLEASE ACKNOWLEDGE RECEIPT AND RETURN GREEN COPY TO:

- ☐ P.O. BOX 1590, TULSA, OKLAHOMA 74102
- ☐ 605 WEST OHIO, MIDLAND, TEXAS 79702
- ☐ OTHER
- ☐ 9000 SOUTHWEST FREEWAY, SUITE 320, HOUSTON, TEXAS 77074
- ☒ 300 COLUMBINE BLDG., 1845 SHERMAN STREET, DENVER, COLORADO 80203

ATTENTION OF: J.E. Smatla

SHIP TO

CLIENT: UNIVERSITY OF UTAH RESEARCH INSTITUTE	SHIP VIA: Mail
ADDRESS: 391 Chipetaway Suite 120	CHARGE:
Salt Lake City, Utah 84108	PROSPECT:
ATTENTION: Ted Glenn	LINE NUMBER:
PHONE:	JOB NUMBER:
	RETURN DATA TO THIS OFFICE: ☐ Yes ☒ No
	SHIPPED BY:

JOB NUMBER	LINE NUMBER	SP to SP	PROFILES	FILMS/REELS	AREA OR TYPE PROCESS	COPIES OF SECTIONS/ TRANSMITTALS TO
	2 -- Copies of Final Report					

RECEIVED BY: Ted Glenn

DATE:

NOTE: Films should be stored flat except for temporary storage.

M E M O

TO: Duncan Foley

FROM: Ted Glenn

SUBJECT: HAFB Seismic Data Processing

DATE: June 21, 1979

Stan Laster and I visited SSC in Denver on June 19 and reviewed the seismic data processing. We made certain processing requests and indicated the results were needed very quickly.

To date they have only processed Line 1 beyond the brute stack stage. Some processing of Line 2 had been done but was done incorrectly. Line 3 has not been touched. The further processing of Line 1, primarily a better velocity analysis, deconvolution and statics corrections has improved the coherency of the near-surface reflectors but has partially diminished the deeper reflectors. I left SSC my colored copies of the field brute stacks for Lines 1 and 2. Both Seifert and Laster felt these sections provided a good reference for appropriate stacking. The stacking velocity choices are both critical and difficult. However, I believe most of the reflections that I had colored on the brute stacks and I felt they should do no worse after the more sophisticated processing was done on the data. To enhance any deeper reflections I suggested they stack only the far traces. The actual process, called muting, will zero all near traces and all data after the first air wave arrival on all traces. Laster and SSC people felt they should study the effect of the deconvolution operator. The convolution operator specs and whether to convolve before or after stacking will both be thoroughly investigated.

Stan Laster felt the data were very good and the processing was being properly done. He indicated that his input might not be further required. I suggested that, at the very least, he critically review our final interpretation of the data.

In retrospect I feel we could have used a 165 feet group interval and left the remaining survey parameters the same, including the asymetric spread. Laster and Seifert agreed, although Laster felt an in-line array would be a viable option. Laster commented that he does not see the reason the symmetric spread is so popular.

I told SSC that we wanted a fairly complete set of processed seismic sections by June 30, which is about 10 days late. I think we should initiate drilling bids based on at least 2000 feet deep holes. Site selection can take place the first week of July.

cc: S. H. Ward
D. Chapman

Ted Glenn

THE UNIVERSITY OF UTAH

DEPARTMENT OF GEOLOGY AND GEOPHYSICS
COLLEGE OF MINES AND MINERAL INDUSTRIES
717 MINERAL SCIENCE BLDG.
SALT LAKE CITY, UTAH 84112

August 1, 1978

SPECIFICATIONS

The University of Utah under terms of research grants from the National Science Foundation, the U.S. Geological Survey, and the U.S. Department of Energy plans to undertake a program of shallow drilling as part of its geothermal research activities. The purposes of the drilling are: (1) to measure temperature gradients in the holes and (2) to obtain samples of the rock units for laboratory studies.

Dates - The drilling will be undertaken between ~~August 1~~ and ~~October 1, 1978.~~ The exact dates are subject to discussion between the University of Utah and the drilling contractor and will take into account weather, fire danger, and other factors.

Number of Holes - Approximately ~~12~~ 3 holes will be drilled but the exact number will depend on drilling rates and costs.

Location - Holes will be drilled at sites in western and southwestern Utah. ~~Detailed locations are given in Appendix A.~~ All sites will be within 100 yards of all-weather roads.

Hole size - Holes will be drilled to a diameter of 4 3/4 - 6 inches.

Equipment - The drilling will be done with ~~a combination of~~ rotary and ~~down hole hammer (percussion)~~ techniques. The contractor will furnish pumps for mud and cement.

Hole depth - Hole depth will ~~vary from 300 - 500 feet.~~

Groundwater conditions - A variety of groundwater conditions are expected including flowing artesian conditions. The contractor will be equipped to handle artesian conditions and to backfill the drill holes with cement (grout).

Drilling fluid - Holes will be drilled with air and/or mud. Drilling mud must be confined in tanks as mud pits will not be allowed.

Steel casing - All holes will be cased if necessary to comply with existing State and Federal regulations.

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717 MINERAL SCIENCE BLDG.
SALT LAKE CITY, UTAH 84112

Plastic casing -A bottom-capped 2 inch I.D. schedule 40 PVC plastic inner casing will be inserted and secured in each hole to total depth, then filled with water. Temperature gradients will be measured inside the plastic casing.

Materials -The drilling contractor will furnish on-site all materials including but not limited to bits, cement, steel casing, plastic casing, lost circulation materials, and mud materials.

Logs -A driller's log showing rock types and groundwater conditions will be required for each hole.

Geology -The holes will be drilled ~~beginning~~ in alluviam ~~or rhyolite~~ (see Appendix A).

Site preparation -Holes will be drilled on pre-existing sites or on sites prepared by the client.

Regulations -The drilling contractor will comply with the geothermal regulations of U.S. Geological Survey and all other existing regulations regarding air and water quality.

Crew size -The contractor will furnish an experienced two- or three-man crew on-site during all working hours.

Cost summaries -The contractor will be required to furnish daily cost summaries on-site.

Option to extend -The ~~Operator~~ Client may at any time during the term of this contract exercise ~~its~~ option to extend this contract for the drilling of an additional hole or holes and Contractor shall agree to such contract extension.

Bidding procedure -All bids should show the following items separately:

(1) Mobilization and demobilization - cost per mile or total.
(2) Moves between holes - cost per hour.
(3) Down-hole hammer drilling - cost per hour or cost per foot.
(4) Rotary drilling - cost per hour or cost per foot.
(5) Standby at client's request - cost per hour.
(6) Installing casing - cost per hour.
(7) Water truck, if required, including driver - cost per day.
(8) Expendable items.
(9) Crew travel time (to and from site) - cost per hour.
(10) Personal living allowance - per day for crew.
(11) Description of equipment.

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COLLEGE OF MINES AND MINERAL INDUSTRIES
717 MINERAL SCIENCE BLDG.
SALT LAKE CITY, UTAH 84112

INVITATION TO BID

Program of shallow drilling for geothermal research activities, per attached specifications dated June 1, 1978.

All bids should show the following items separately:

1.	Mobilization and demobilization - cost per mile or total.	$ _____	
2.	Moves between holes - cost per hour or mile.	$ _____	
~~3.~~	~~Down-hole-hammer drilling - cost per hour.~~	$ _____	per hour
4.	Rotary drilling - cost per hour.	$ _____	per hour
and/or ~~5.~~	~~Down-hole-hammer drilling - cost per foot.~~	$ _____	per foot
6.	Rotary drilling - cost per foot.	$ _____	per foot
7.	Standby at client's request - cost per hour.	$ _____	per hour
8.	Installing casing - cost per hour.	$ _____	per hour
9.	Water truck, if required, including driver.	$ _____	per day
10.	Expendable items to be reimbursed by University; bits, cement, mud, PVC pipe, etc. (give % above cost for handling).	$ _____	%
11.	Crew travel time (to and from site) - cost per hour.	$ _____	per hour
12.	Personnel living allowance - per day for crew.	$ _____	per day

Description of equipment
(a) Type and capability of rig.

(b) Compressor capacity in c. f. m. and p. s. i.

Bidder facilities, equipment, past performance and performance capabilities shall be a factor in the award. The Bidder's capability to begin work soon after contract is awarded will be a factor with award.

THE
UNIVERSITY
OF UTAH

DEPARTMENT OF GEOLOGY
AND GEOPHYSICS

COLLEGE OF MINES AND
MINERAL INDUSTRIES
717 MINERAL SCIENCE BLDG.
SALT LAKE CITY, UTAH 84112

CONTRACTORS LIABILITY INSURANCE

The contractor shall carry on his work in accordance with the requirements of the Workmen's Compensation Laws and shall not reject the provisions thereof during the life of the contract. He shall also protect himself by liability insurance against any and all claims for damages to person or property which may arise out of operations under this contract.

Drill Contractor _____ Signature _____

Address _____ Date _____

COMPLETION REPORT

Well: Davis No. 1 Date: July 17, 1974

Area: Brigham City Lease No: _____

[X] New Field Wildcat [ ] Development Well [ ] Shallower Pool Test

[ ] New Pool Wildcat [ ] Extension [ ] Deeper Pool Test

Location: 2370 feet from North line, Zero feet from West line (approx.)

SW $\frac{1}{4}$ NE $\frac{1}{4}$

Section 16, Township 10 North, Range 2 West

County: Box Elder County State: Utah

Operator: Geothermal Kinetics Inc.

Elevation: KB 4261' Gr 4240.9' Total Depth: Driller 11,000' Log 10,986'

Drilling Commenced: February, 1974 Drilling Completed: June 22, 1974

Rig Released: June, 1974 Well Completed: September, 1974

Sample Tops: (unadjusted)

Jefferson	4380'
Manning Canyon Shale	5360'
Great Blue	6210'
Lodgepole	7120'
Swan Peak	7840'

Sample Cuttings: 10-foot samples from approximately 2200 feet

Log Tops:*

	Quaternary	Surface to 580'
	Salt Lake Group	580 to 4438'
Dev.	Jefferson & Water Canyon	4438 to 5365'
	Manning Canyon	5365 to 6222'
	Great Blue	6222 to 6730'
Miss.	Humbug	6730 to 7100'
	Lodgepole	7100 to 7850'
Ord.	Fish Haven	?
	Swan Peak	7850'

Status: Shut-In

Producing Formation: Brigham Formation (?)

Perforations: Unknown

Stimulation: Unknown

Production: Hot Water

Plug Back Depth: Unknown

Plugs: Unknown

Hole Size: 17$\frac{1}{4}$" from surface to 3233'; 12$\frac{1}{4}$" from 3233 to 9582'; 8$\frac{1}{2}$" from 9582 to 10,388'; 6" from 10,388 to 11,000'

Casing/Tubing: 13 3/8" from surface to 3233'; 9 5/8" Liner from 3233 to 8973'; 7" liner from 8720 to 10,388'.

Logging - Mud: Chem-Gel from surface to 9582 feet; air-mist, mud, aerated water to 11,000 feet

Mechanical: Dresser Atlas - IES, 206-3233'; DIL 3288-9595'; CNL, 206-9584'; CDL, 206-9577', CAL, 206-7013'; Temp 206-7013'; Velocity Log 200-8300'; TDL - Unknown

Contractor: Geothermal Kinetics

Completion Report Prepared by: G. G. Francis

Remarks: Stratigraphic section is highly faulted.*

* Refer to diagrammatic structure section for fault information.

John Lowe

SYNOPSIS

Operator:	Geothermal Kinetics Inc.
Well:	Davis No. 1
Location:	2370 feet FNL and zero feet FWL (approximate), Sec. 16, T. 10 N., R. 2 W., Box Elder County, Utah
Area:	Brigham City, Utah
Elevation:	KB 4261 feet, GL 4250.9 feet
Spudded:	February 1974 2-20-74
Ceased Drilling:	June 22, 1974
Completed:	Hot water
Status:	Shut-In
Total Depth:	DTD 11,000 feet, LTD 10,986 feet
Hole Size:	$17\frac{1}{2}$" from surface to 3233 feet; $12\frac{1}{4}$" from 3233 to 9582 feet; $8\frac{1}{2}$" from 9582 to 10,388 feet; 6" from 10,388 to 11,000 feet.
Contractor:	Geothermal Kinetics Inc.
Drilling Medium:	Chem-Gel from surface to 9582 feet; air-mist, mud, aerated water to 11,000 feet.
Lost Circulation:	None
Cores:	None
Drill Stem Tests:	One open hole (8215-8300 feet) 10,354 - 10,792
Mud Logs and Company:	Baroid from 2124 to 11,000 feet
Mechanical Logs:	Dresser Atlas IES 206 to 3233 feet GRN 9450 - 10,975 DIL 3288 to 9595 feet CNL 206 to 9584 feet CDL 206 to 9577 feet CAL 206 to 7013 feet Temp 206 to 11,000 feet Velocity Log 200 to 8300 feet TDL - Unknown
Samples:	10-foot samples from 2124 to 11,000 feet
Well Site Geologists:	Ward Austin (Geothermal Kinetics) G. G. Francis (Mountain Fuel)
Drilling Foreman:	

COMPLETION REPORT (cont.)

Well: Davis No. 1

Area: Brigham City

Cored Intervals (recovery): None

Tabulation of Drill Stem Tests:

No.	Interval	IHP	IFP (min.)	ISIP (min.)	FFP (min.)	FSIP (min.)	FHP	Samples Caught	Remarks
1	8215-8300	4032	None	None	189-811(105)	2933(60)	4032	Water*	Rec. 800' mud & 947' muddy salt water. Bottom hole mud temperature 210° F. Swan Peak Formation

* WATER ANALYSIS

Bicarbonate	333.5	ppm
Calcium	1,677	ppm
Chloride	25,350	
Magnesium	2,450	ppm
Sulfate	13,990	ppm
Silica	305	ppm
Iron	2,480	ppm
Sodium	5,672	ppm
Lead	15.6	ppm
Potassium	1,890	ppm
Boron	36.2	ppm
Other Ions	253.7	ppm
Total Solids	54,453	ppm

MOUNTAIN FUEL
SUPPLY COMPANY
Natural Gas Service

WELLSITE
QUANTITATIVE LOG INTERPRETATION

Well: Davis #1 Field:
Location: County: Sevier State: Utah

Depth	ϕ_{AL}	ΔT	ϕ_D	ϕ_{ii}	R_w		R_t		S_w	Remarks
0 - 521 ft									*	Quaternary
560 - 4438									*	Tertiary
4450 - 4470		83	2.55	11						Dolomite + Evaporite
4510 - 4520		130	2.12	30						Shale + Evaporite
4548 - 4562		65	2.51	22						Dolomite
4678 - 4703		70	2.50	19						Sandy Dolomite
4760 - 4770		60	2.51	16						Dolomite (Dimy?)
4800 - 4900										Calcareous Shale
4995 - 5010		68	2.45	22						Dolomite
5320 - 5350		68	2.60	14						Dolomite
Interval 4438 to 5365 is Devonian Beirdneau formation + upper Hyrum Dolomite member. Possible unconformity in this interval										
									*	Beirdneau 4438
									*	Manning Canyon Shale 5365
6290 - 6300		52	2.54	2	poor reading					Limstone
									*	Great Blue 6222
6800 - 6810		98	2.28	26						Sandstone (?)
6850 - 60		58	2.5	0	poor reading					Siliceous limestone
6955 - 60		0	2.46	5	poor reading					Siliceous limestone
7208 - 20		57	2.57	15						Limestone
7640 - 50		55	2.50	6						Limestone
7760 - 70		70	2.55	4						Qzt
									*	Humbug 6692
normal fault between 6300 - 6600 ft in Great Blue, also normal fault between 6800 - 7000 in Humbug										

Doug Thomas — Company Geologist
Company Engineer
Logging Engineer
May 2, 1974 — Date

MOUNTAIN FUEL
SUPPLY COMPANY
Natural Gas Service

WELLSITE QUANTITATIVE LOG INTERPRETATION

Well: _____ Field: _____

Location: _____ County: _____ State: _____

Depth	ϕ_{AL}		ϕ_D		R_w		R_t		S_w	Remarks
									*	Lodgepole 7100ft
					wellbore		mt			normal fault
										Swan Peak 7850
Thrust fault at approx 8000 - 8650 - repeated Swan										
		Peak								
From approximately 7100 ft										Log calculations extremely
										Tenuous
		..								Dead oil stain 10,740 ft
										Interbedded with marine shale

Greg Francis — Company Geologist

_____ — Company Engineer

_____ — Logging Engineer

May 2, 1974 — Date

8 June '79

Ted – Ted Vernon is expecting a call tomorrow (Sat.)
- George may have some data from line 2 ready for you tomorrow
- They should be finishing line 2 today or very early tomorrow finished Sat.
- Line 3 (the N-S one) has been realigned at its N end, away from the pads
- Line 3 will be started at the N end
- They will be working now until they finish

- Please leave this pile of material on your office, & I'll grab it Monday to work up something for the USAF on Thursday

- I'll be in next week, & if questions arise, I'll call you at the motel

- I'll check in with Ted Vernon on Monday

Processing of Line 1 in Denver should be finished about Tues noon

Processing Dick Dietz

Seismograph Service Corporation
A SUBSIDIARY OF RAYTHEON COMPANY
P. O. BOX 1590 · 6200 E. 41st STREET · TULSA, OKLAHOMA 74102

June 4, 1979

University of Utah Research Institute
Earth Science Laboratory
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108

Attention: Mr. Ted Glenn, Senior Geophysicist

Gentlemen:

Enclosed are two signed copies of the Subcontract between University of Utah Research Institute and Seismograph Service Corporation.

I hereby acknowledge receipt of your Purchase Order No. 1526 dated May 11, 1979 in the maximum amount of $108,800.00, and the applicable general provisions of your prime contract.

Yours very truly,

SEISMOGRAPH SERVICE CORPORATION

G. E. Randolph, Asst. Vice President

GER:me
Enclosures

Hill BASE MEETING 23 Oct 79

Name		
Duncan Foley	ESL-UURI	581-5283
Wil Forsberg	ESL-UURI	581-5806
JOHN GRIFFITH	DOE-ID	208 526 1668
S.H. WARD	ESL-UURI	581-5283
Ted Glenn	"	581-8145
A.J. Nowowiejski	Hill AFB	-3071
L. Paul Davis	"	777-2087
REGINA CAPUANO	ESL-UURI	581-5149
SUSAN PRESTWICH	DOE-ID	208-526-1147
Keith W Jones	EG&G Idaho	208-526-9876
DAVID R. Cole	ESL-UURI	581-8505
Major GEORGE KASTANOS	HQ, AIR FORCE LOGISTICS COMMAND	513-257-4107

Ted,

Dudley & I went over the three lines and did a bit of rough interpretation of the Tertiary - Quaternary structure. The red Arrows being high (↔) the black lows (*). This may show some of the problems on the East END of line 1.

John

IMPORTANT MESSAGE

TO Ted

DATE 9/8 TIME 8:45 A. M. / P. M.

WHILE YOU WERE OUT

M. Dick Ebright

OF Dresser Atlas

Area Code & Exchange 722-3627

TELEPHONED		PLEASE CALL	✓
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	
	RETURNED YOUR CALL		

Message re: Logging at Hill Air Force Base.

Operator A

Hill base meeting 28 Feb. 80

Duncan Foley	ESL/UURI	801-581-3155
Wil Forsberg	ESL/UURI	801-581-8208
Bob Nacke	2LT, USAF	777-2087
GEORGE KASTANOS	AFLC/DEMC	513-257-4107
Ted Glenn	ESL/UURI	801-581-8155
NEAL SCHEEL	HILL AFB	777-2087
DAVID COLE	ESL/UURI	801-581-6875
D Chapman.	Univ. of Utah Geology and Geophysics	801-581-6820
John Griffith	DOE/DGE/ID	208-526-0087

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 8

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
A002	3/12/79		

5. ISSUED BY CODE
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

6. ADMINISTERED BY (If other than block 5) CODE

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) CODE FACILITY CODE

The University of Utah
717 Mineral Science Building
Salt Lake City, Utah 84112
Attention: W. L. Forsberg

8.
☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)
☒ MODIFICATION OF CONTRACT/ORDER NO. DE-AC07-78ET28392
DATED 10/19/77 (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods: (a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of agreement of the Parties.
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

The above-numbered contract is hereby modified to include performance of the work set forth in Attachment I, Statement of Work (SOW), entitled "Hill Air Force Base Geothermal Project" dated March 12, 1979.

1. STATEMENT OF WORK

The Contractor shall provide, or subcontract (subject to necessary approvals) for, the necessary personnel, facilities, services, materials, and documentation to perform the work described in Attachment I, Statement of Work, entitled "Hill Air Force Base Geothermal Project," in accordance with the terms and conditions of this Supplemental Agreement.

2. PERIOD OF PERFORMANCE

The period of performance for Phases I through III of the SOW is March 12, 1979, through September 30, 1979. If required and authorized, Phase IV shall be completed within the shortest reasonable time possible.

(Continued)

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13. ☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 2 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
BY _____ (Signature of person authorized to sign)	BY _____ (Signature of Contracting Officer)
15. NAME AND TITLE OF SIGNER (Type or print)	16. DATE SIGNED
18. NAME OF CONTRACTING OFFICER (Type or print) R. E. Simonds, Director Contracts Management Division	19. DATE SIGNED 7/25/79

30-101-01

☆ U.S. GOVERNMENT PRINTING OFFICE: 1967—654-008

3. REPORTS

The Contractor shall prepare and deliver to DOE the reports described in Attachment I, "Statement of Work," and in accordance with the Reporting Requirements section in said Attachment I.

4. OBLIGATION OF FUNDS, ESTIMATE OF COSTS

A. Obligation of Funds. The amount obligated by the Government with respect to this Supplemental Agreement is $334,723.00.

B. Estimate of Costs. The estimated cost of the work under this Supplemental Agreement is $334,723.00 for Phases I through III of the SOW, which includes a total fixed fee of $14,500.00 for the subcontractor, University of Utah Research Institute. If desired, DOE shall authorize the funding of Phase IV.

5. DATE OF INCURRENCE OF COSTS

The Contractor shall be entitled to reimbursement for costs incurred in an amount not to exceed $65,000.00 on or after March 12, 1979, which, if incurred after this Supplemental Agreement had been entered into, would have been reimbursable under the provisions of the contract.

6. LIABILITY AND INDEMNIFICATION

The Government will not be liable for payment of damages for injuries to any person, or loss of life or personal property, or loss suffered or sustained and arising from the work performed under this Supplemental Agreement. The Contractor agrees to indemnify and save the Government harmless from any and all claims, demands, damages, actions, costs, or charges against the Government arising as the result of the above-mentioned injuries, damages, or loss, except for any such damages or claims arising out of the negligent act of the Government or its employees in the course of their official duties.

Task I-5 Available gravity data shall be interpreted to help determine thickness of unconsolidated valley fill material around and under Hill Air Force Base. One to three detailed gravity profiles shall be surveyed to determine whether or not faulting is detected beneath valley fill by such a survey. The results shall be interpreted in the context of the regional gravity data base already available.

Task I-6 A report shall be written which records the current status of geologic knowledge and plans for delineation of potential geothermal resources at Hill Air Force Base.

Phase II

Task II-1 Contingent upon the results of Task I-3 and Task I-4, a detailed geochemical survey shall be made of soils and/or waters at and near Hill Air Force Base for the purposes of locating any subsurface faults and to improve the understanding of regional hydrology.

Task II-2 Contingent upon the results of Task I-5, further detailed gravity data will be obtained on and near Hill Air Force Base and will be evaluated in terms of the thickness of valley fill material and for the general location of subsurface faulting.

Task II-3 A detailed seismic reflection survey, possibly using a vibroseis unit as a source, shall be surveyed over roughly 17 line-miles of traverse to locate and pinpoint as drill targets any subsurface faulting.

Task II-4 A report shall be written on all the above data and their interpretations for the purpose of consolidation and dissemination of information. Based on this report, the locations of subsequent thermal gradient holes shall be recommended.

Phase III

Task III-1 Contingent upon the results of previous efforts, one to six thermal gradient holes shall be drilled to depths varying up to 2000 feet or

more. Hole depth cannot presently be specified pending more detailed data on valley fill thickness and determination of subsurface geothermal targets. Holes shall be sited to intersect interpreted subsurface faults or other suspected thermal aquifers. The purposes of the drilling shall be to check for thermal waters and/or encouragement that thermal waters are located nearby. At present, it is anticipated that a total of about 6000 feet of drilling will be conducted. The Contractor shall procure the services of an appropriate drilling subcontractor and shall supervise the drilling.

Task III-2 Detailed lithologic studies shall be performed on the samples from the thermal gradient holes specified in Task III-1. Other geological and geochemical studies shall be performed on the samples as deemed appropriate at that time.

Task III-3 Appropriate geophysical logging shall be accomplished on the holes drilled under Task III-1. The minimum logging shall be temperature vs. depth. The exact number and type of logs to be run shall be based upon the temperature log and the results of Task III-2. The hole shall be left open, but cased for heat flow measurement.

Task III-4 Based upon all of the above results, a report shall be written for the purpose of justifying either the location and specifications for a production well, or termination of the project.

Phase IV

Task IV-1 If a production well appears to be feasible, geological guidance shall be provided by the Contractor. The actual decision making and drilling shall be the responsibility of DOE.

Task IV-2 Geological, geochemical, and geophysical study of the samples from the production well shall be performed as appropriate. The minimum result of this work shall be geologic logging of well samples, geochemical characterization of natural well waters produced from the well, and temperature logging.

Task IV-3 Contingent upon the above results, a reinjection well may be sited and drilled. If siting of such a well requires further geologic study, this will be specified at that time. The actual decision making and drilling shall be the responsibility of DOE.

U. S. DEPARTMENT OF ENERGY

REPORTING REQUIREMENTS CHECKLIST

DOE Form CR-537
(1-78)

(See Instructions on Reverse)

FORM APPROVED
OMB NO. 38R-0190

1. IDENTIFICATION	2. OBLIGATION INSTRUMENT: MODIFICATION NO. A002
University of Utah	CONTRACT NO. DE-AC07-78ET28392

3. REPORTING REQUIREMENTS

A. PROJECT MANAGEMENT	Frequency	B. TECHNICAL INFORMATION REPORTING	Frequency
1. ☐ Management Plan		1. ☐ Notice of Energy RD&D Project (SSIE)	
2. ☐ Milestone Schedule & Status Report		2. ☒ Technical Progress Report	A
3. ☐ Cost Plan		3. ☐ Topical Report	
4. ☐ Manpower Plan		4. ☒ Final Technical Report	F
5. ☒ Contract Management Summary Report	M	C. PMS/MINI-PMS	
6. ☒ Project Status Report	M	1. Cost Performance Report	
7. ☐ Cost Management Report		☐ Format 1 WBS	
8. ☐ Manpower Management Report		☐ Format 2 Functional	
9. ☒ Conference Record	A	☐ Format 3 Baseline	
10. ☐ Hot Line Report		☐ Format 5 Problem Analysis	
		2. ☐ Cost/Schedule Status Report	
		3. ☐ Management Control System Description	
		4. ☐ Summary System Description	
		5. ☐ WBS Dictionary	

FREQUENCY CODES:

A – As Required
C – Contract Change
F – Final (End of Contract)
M – Monthly
O – One Time (Soon After Contract Award)
Q – Quarterly
S – Semi-Annually
X – Mandatory for Delivery with Proposals/Bid
Y – Yearly or Upon Contract Renewal

4. SPECIAL INSTRUCTIONS

5. ATTACHED HEREWITH:

☒ Report Distribution List
☐ WBS/Reporting Category
☐
☐

6. PREPARED BY (Signature and date):	7. REVIEWED BY (Signature and date):

REPORTING REQUIREMENTS CHECKLIST

PURPOSE

A checklist to identify and communicate additional reporting requirements which are not otherwise set forth in the General Purpose clauses of DOE contracts and agreements. It will be included as part of the contract or agreement. This form will be completed for each proposed contract or agreement and can be modified as required in Special Instructions to adapt it to a specific situation.

INSTRUCTIONS

Item 1 — Enter the title as indicated in the Procurement Request, Interagency Agreement, or initiating memorandum.

Item 2 — Enter the identification number of the Procurement Request or Interagency Agreement, the date of the memorandum, and contract number after award.

Item 3 — Check spaces to indicate plans and reports required. For each reporting requirement checked, indicate frequency of delivery in column provided using one of the frequency codes shown.

3.A.1 *Management Plan* — The contractor's plan to manage the effort described in the statement of work or similar document. It will contain management methodologies, control systems, and procedures he will use. Includes milestones and other planning schedules, organizational identification and descriptions, and special and critical plans, such as test plans, plans for handling of Government owned property. Work breakdown structures, key personnel identification, and methods for monitoring progress toward objectives may be required.

3.A.2 *Milestone Schedule and Status Report* — The contractor's milestone schedule for all work breakdown structure items, line items, or deliverables specified in the contract. Updated periodically (usually monthly) with status, progress toward completion, and percent completion of each line item and of the total contract.

3.A.3 *Cost Plan* — A baseline plan for incurring costs on a contract or agreement to measure progress in terms of cost; update and forecast contract fund requirements; plan funding changes; and develop fund requirements and budget estimates.

3.A.4 *Manpower Plan* — A baseline plan to allocate manpower to each reporting category identified in the contract or agreement.

3.A.5 *Contract Management Summary Report* — A single-page graphic presentation of integrated cost, major milestones, and manpower for rapid visual analysis and trend forecasting.

3.A.6 *Project Status Report* — A periodic report to communicate to DOE management an assessment of contract status, to explain variances and problems, and to discuss any other areas of concern or achievements.

3.A.7 *Cost Management Report* — A periodic report of the status of costs compared to the Cost Plan. Data is used to: report actual and projected accrued costs; evaluate performance against plan; identify actual and potential problem areas; construct cost experience for projects and budgeting efforts; and, to verify the reasonableness of contractors' invoices.

3.A.8 *Manpower Management Report* — A periodic report of the status of actual and projected manpower expenditure against the Manpower Plan. Data is used to evaluate performance against plan; identify actual and potential problem areas; and to construct manpower experience for projections and planning efforts.

3.A.9 *Conference Record* — Documentation of the contractor's understanding of significant decisions, direction or redirection or required actions resulting from any meeting with DOE representatives.

3.A.10 *Hot Line Report* — A hardcopy report by the fastest means available, (TWX, etc) documenting critical problems, emergency situations, and important technical breakthroughs.

3.B.1 *Notice of Energy R&D Project* — A formatted, two-page report to provide information on unclassified DOE R&D projects for dissemination to the scientific, technical, and industrial communities and to the public. Also provides information to the Smithsonian Scientific Information Exchange.

3.B.2 *Technical Progress Report* — A formal, structured technical report, submitted periodically to communicate project results for dissemination to Government agencies, the scientific, technical and industrial communities and the public.

3.B.3 *Topical Report* — A special technical report prepared when a project has reached a point at which a major milestone or a significant phase has been completed, when unexpected results have been achieved, when it is logical to summarize results achieved, or when a new scientific or technological finding is deemed to warrant prompt publication.

3.B.4 *Final Technical Report* — Technical Progress Report reporting final results of DOE supported RD&D and scientific projects.

3.C *PMS/Mini-PMS*

1) *Cost Performance Report (PMS Application)*

Format 1 — Reports current period and cumulative budget, actual costs and earned value data by work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

Format 2 — Reports current period and cumulative budget, actual costs, and earned value data by contractor functional elements.

Format 3 — Provides periodic updating to the established performance measurement baseline. Incorporates authorized contract changes and internal re-planning into the performance measurement baseline.

Format 5 — Provides a narrative analysis of contract variances.

2) *Cost/Schedule Report (Mini-PMS Application)*— Periodic, usually monthly, report of cumulative budget, actual costs and earned value by summary work breakdown structure elements. Identifies cost and schedule variances and provides contractor's estimate to complete comparisons to budgets.

3) *System Description (PMS Application)* — Contractor's description of the management control system to be used in performing contract work. Must address all elements of the PMS criteria.

4) *Summary System Description (Mini-PMS Application)* — Contractor's summarized description of the management control system to be used in performing contract work.

5) *WBS Dictionary* — Lists and defines work breakdown structure. For more detailed instructions see PMS Manual.

Frequency Codes — Each code must have an identified time period (i.e., As Required — 5 days after event occurrence). These time periods are suggested in the solicitation and negotiated at contract award.

Item 4 — Identify any special reporting requirements not indicated in Item 3 and/or qualifiers to those selected. (Use additional sheets as necessary.)

Item 5 — Check appropriate blocks.

Report Distribution List — A comprehensive informative listing of reports by frequency of submission, addresses and number of copies for each addressee.

Reporting Categories (level of detail) — An identification by WBS level of task elements for which reporting will be required by DOE.

Item 6 — Signature of person or persons preparing the checklist and the date prepared. Preparation is by person or persons responsible for preparation of Procurement Request or Statement of Work.

Item 7 — Signature of the person reviewing the checklist and date reviewed.

*U.S. GOVERNMENT PRINTING OFFICE: 1978--281-130/ 514

MODIFICATION
NO. A002
CONTRACT NO.
DE-AC07-78ET28392

ADDRESSEES:	NO. OF REPORT COPIES														SPECIAL INSTRUCTIONS
	MANAGEMENT PLAN	HOT LINE REPORT	CONFERENCE REPORT	PROJECT STATUS REPORT	ENERGY RD&D WORK IN PROGRESS	TECHNICAL PROGRESS REPORT	COST PLAN	COST MANAGEMENT REPORT	FUNDS RECONCILIATION REPORT	MANPOWER MANAGEMENT REPORT	MANPOWER PLAN	MILESTONE PLAN AND MANAGEMENT REPORT	CONTRACT MANAGEMENT REPORT	EARNED VALUE PERFORMANCE SUMMARY REPORT	FINAL TECHNICAL REPORT	TOPICAL REPORT	
J. L. Griffith, Chief Research & Engineering Branch Energy and Technology Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401			5	5		5								1	10		
ORTIC P.O. Box E Oak Ridge, Tennessee 37830															1		
R. E. Simonds, Director Contracts Management Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401			1	1		1								1	1		
E. G. Jones, Director Financial Management Division U.S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401														1			

REPORT DISTRIBUTION LIST

Purpose:

The Report Distribution List is used to identify the required number of standardized plans and reports and to indicate the individual or office to which they will be delivered.

Instructions:

Contract Number	The contract number is as officially stated in the contract and cannot be entered at this time. This information should be entered when contract award is made.
Addressees	Specify the individual(s) or office(s) to which the report(s) will be delivered.
No. of Report Copies	Identify the number of copies of a particular report to be delivered to each addressee.
Special Instructions	This section of the form is used for pertinent instructions to amplify other information on the form.

GSA - Ogden Utah
May '80

GEOTHERMAL EXPLORATION AT HILL AIR FORCE BASE, OGDEN, UTAH

GLENN, W.E., FOLEY, D., CAPUANO, R., SIBBETT, B., COLE, D., WARD, S.H., Earth Science Laboratory, University of Utah Research Institute, Salt Lake City, Utah 84108; CHAPMAN, D.S., Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112.

A phased exploration program for geothermal resources at Hill Air Force Base near Ogden, Utah was conducted by the University of Utah as part of a cooperative agreement between the U.S. Departments of Energy and Defense. Lineaments detected on infra-red and aerial photographs have northwest, northeast, and east orientations. A soil Hg survey demonstrates an anomaly near Ogden Hot Springs, but was not continued on the base. Geochemical analyses of hot spring, cold spring, and well waters on and near the base demonstrate significant changes of water chemistry in the area. Chemical geothermometer calculations yield low temperatures, and mixing of thermal waters with cold aquifers can not be conclusively demonstrated. Non-unique, variable and constant density modeling of gravity data indicate that bedrock increases in depth from 0.9 km at the east side of the base to 2.85 km at the west side of the base. Reflection seismic traverses across the base indicate that west-dipping normal faults are major structural features beneath the base. Results of the preliminary studies were used to target two thermal gradient holes. The thermal regime in both holes showed evidence of disturbance by the cold water aquifers of the Weber River Delta. The hole at the eastern edge of the base was drilled to 384 m and has a bottom hole temperature of 13°C. The hole drilled at the south gate reached a depth of 993m and had a bottom hole temperature of 40°C recorded immediately after drilling.

OPERATIONS REPORT

ON A VIBROSEIS SEISMIC SURVEY

CONDUCTED IN

DAVIS COUNTY, UTAH

HILL AIR FORCE BASE PROSPECT

FOR

UNIVERSITY OF UTAH RESEARCH INSTITUTE

SALT LAKE CITY, UTAH

Seismograph Service Corporation
A SUBSIDIARY OF RAYTHEON COMPANY
P.O. BOX 1590 TULSA, OKLAHOMA

C O N T E N T S

INTRODUCTION

A seismic survey utilizing the VIBROSEIS* method was conducted in the vicinity of Hill Air Force Base, Utah, during the period of May 16 to June 12, 1979, for the University of Utah Research Institute.

The objective of the survey was to define subsurface geologic structures in and below the Tertiary section, particulary deep-seated faulting.

Because of the anticipated high noise levels (traffic & airplane), the prolificity of man-made structures, - houses, buried sewer-electric-water pipes, underground storage reservoirs, water wells - and because of its inherent flexibility, the VIBROSEIS* system was selected as the energy source of choice.

The prospect consisted of two east-west lines and one north-south tie line totalling 14.91 miles of surface traverse.

*Trademark of Continental Oil Company

GENERAL DISCUSSION

Production field recording was preceded by an experimental program (Appendix III) from which optimum field recording parameters were selected and which confirmed the feasibility of using reflection seismology to obtain the geological objectives required. It must be stated that the recording parameters selected were designed primarily to penetrate to depths of 8,000 feet or less.

Field operations were frequently interrupted by heavy traffic, aircraft movement and security fences. Data quality noticeably deteriorated as a function of this noise, however the multiple raypaths and power of cross-correlation inherent in the use of the VIBROSEIS* system enabled the acquisition of fair to good quality data.

2400% Common Depth-Point production data were digitally recorded using S.S.C. manufactured tractor mounted vibrators as the synchronized, swept frequency energy source. (Appendix VI) The recorded field data were summed and cross-correlated and quality controlled by an on-site, trailer-mounted PHOENIX 704 mini-computer system which also output preliminary processed data for initial viewing.

Final processing and display of the data were performed on a PHOENIX "I" system at SEISMOGRAPH SERVICE CORPORATION regional office in Denver, Colorado. (Appendix VII)

*Trademark of Continental Oil Company

CONCLUSIONS & RECOMMENDATIONS

The results obtained from the seismic survey show that the Tertiary objectives were well achieved. Data objectives below the Tertiary section, if the boundry can be established, were fair quality, with many fault associated events evident. The Tertiary data were of good quality, delinitating many interbedded horizions. Shallow sub-surface structures may be directly related to deeper than Tertiary events. Well control should resolve any questions as to the depth of the Tertiary section.

If future seismic surveys are to be run in the general area, Seismograph Service Corporation would recommend the following changes or implementations. The VIBROSEIS* source should be used, utilizing larger vibrator trucks with more mass, therefore inducing more signal power into the ground. It should be noted that more power may be undesireable near buildings, homes, and underground reservoirs.

Since noise appeared to be the largest problem in obtaining good data results, the survey could be conducted in the evening-night time hours, when traffic is at a minimum. Seismograph Service Corporation, due to insurance regulations, could not vibrate during these hours.

No final interpretation is submitted.

Respectfully submitted,

SEISMOGRAPH SERVICE CORPORATION

By: J.E. Smatla, Supervisor

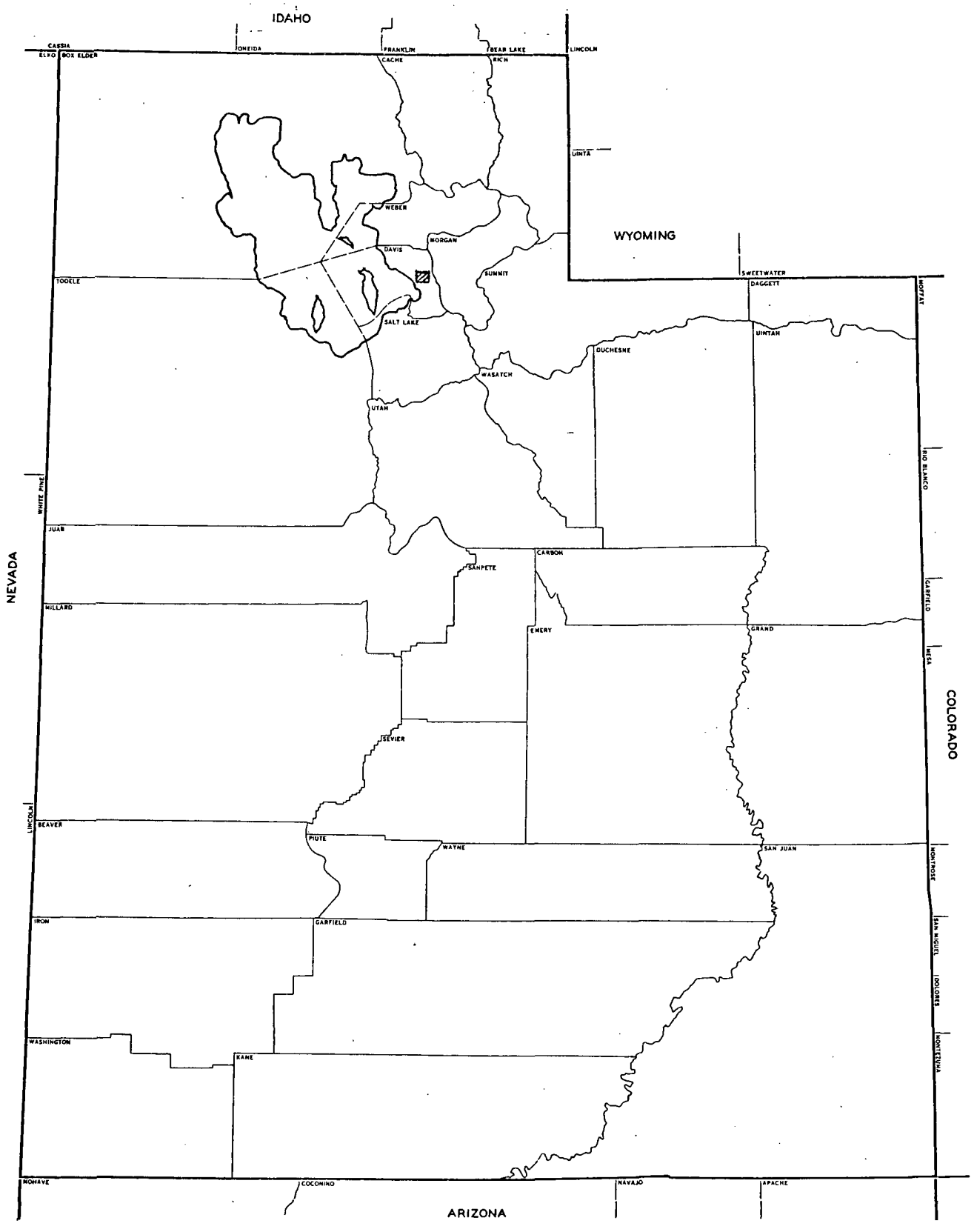
By: D.R. Seifert, Area Manager

/js
August 8, 1979

*Trademark of Continental Oil Company

APPENDIX I

INDEX MAP OF UTAH



APPENDIX II

PHYSIOGRAPHY

Topography:	Flat, partially river bisected
Population:	Densely populated
Culture:	55% airforce Base, 35% Highway, 10% ranchland
Drainage:	Well drained. Weber river drains westward at north boundary of the prospect
Soil:	Sand - gravel
Weather:	Hot, some afternoon rain, little wind
Roads:	50% highways - access roads, 50% none
Access to area from headquarters:	All lines within 5 miles of the headquarters
Traverse difficulties:	Caused by: Heavy highway traffic, Air Force Base security areas, many fences, drainage ditches

APPENDIX III

EXPERIMENTAL

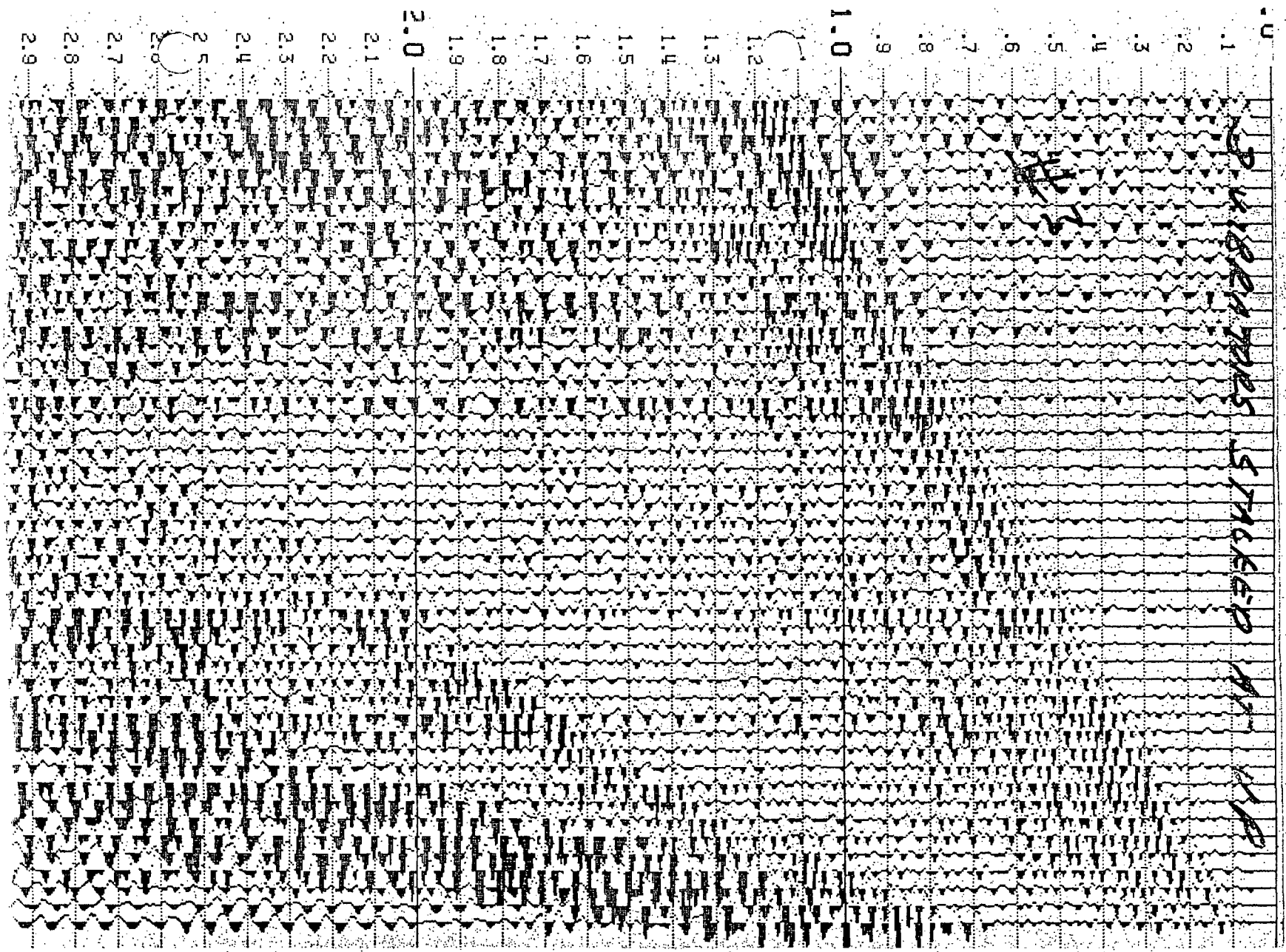
Noise spread
Geophone pattern
Source pattern
Sweep comparions

Object:

Three parallel spreads utilizing 16 stations each were layed out with 110 foot station intervals. On one spread a 110 foot inline geophone pattern was used. The second spread used a 220 foot geophone inline pattern. The third spread consisted of 24 phones bunched in a two foot circle about each recording station for noise analysis.
Sweeps of 56-14 Hz and 15-80 Hz were used, recording both 2 & 4 milliseconds with the 15-80 Hz sweep. These sweeps were vibrated from distances of 440, 2200, and 3960 feet into these spreads utilizing 110 feet, 220 feet, and stacke vibrator patterns, 16 sweeps per vibrato and three vibrators.

Results:

The results of these comparions were adequate to determine the parameters to be used for field recording and these are indicated under "Operation Methods".


2.0
1.0
.0
Experimental
Phones bunched at VP
Vibrators stacked at VP
24 phones/trace 3 Vibs/Tr
56-14 Hz Sweep 4 ms

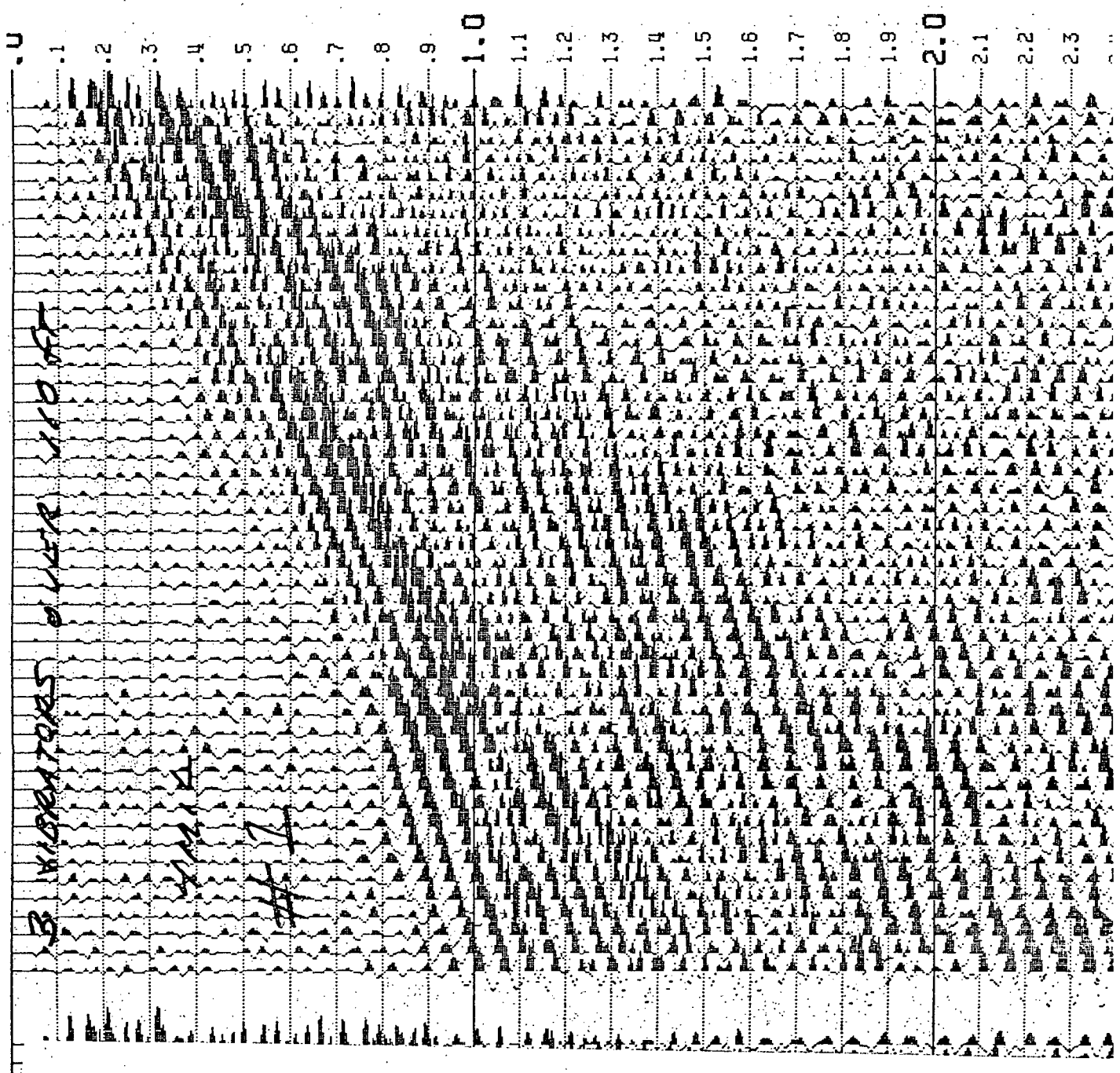
Experimental

24 phones over 110 feet

Record B = 3 Vibs over 220 feet

56-14 Hz Sweep 4 ms

Record A = 3 Vibs over 110 feet



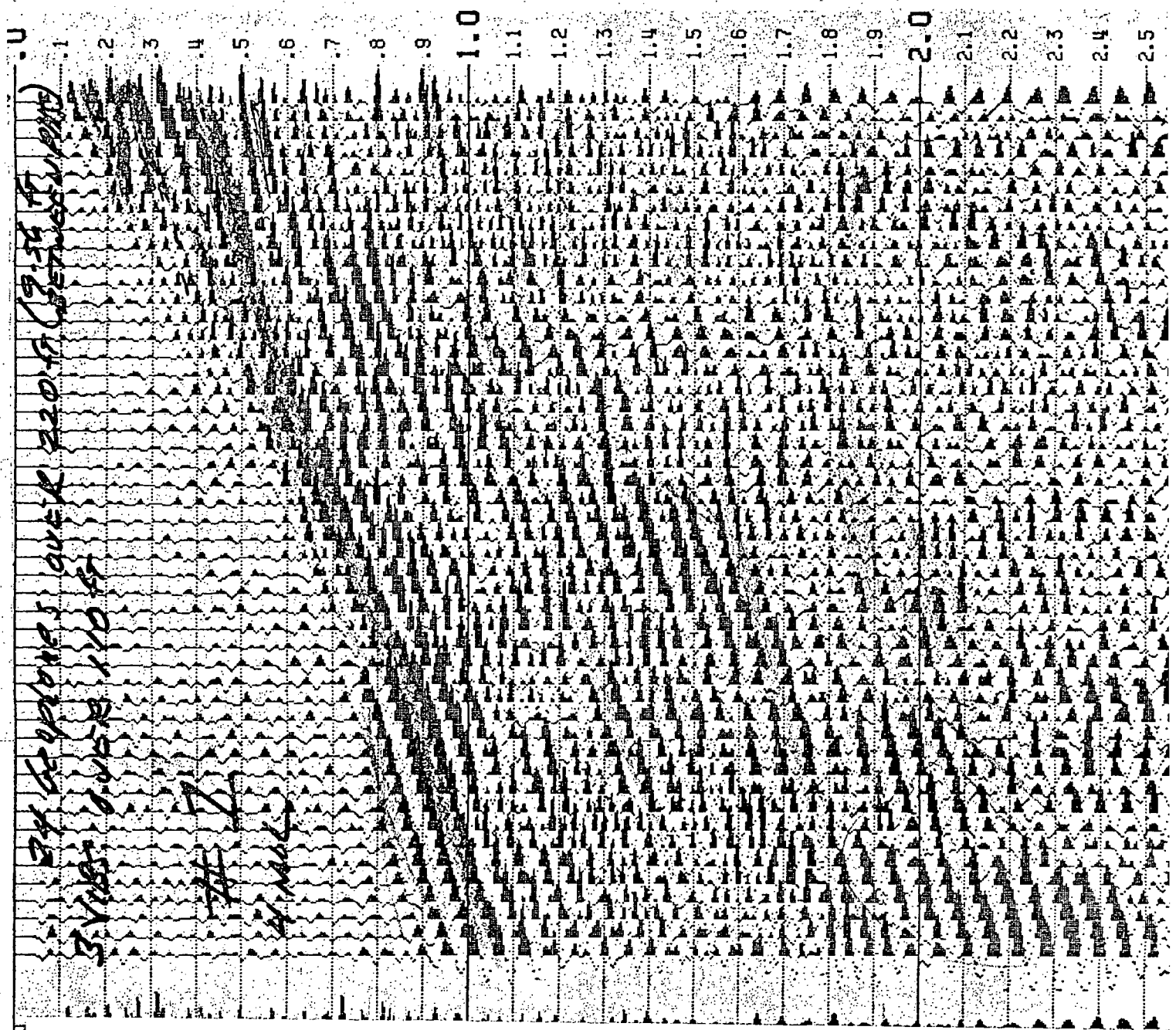
Experimental

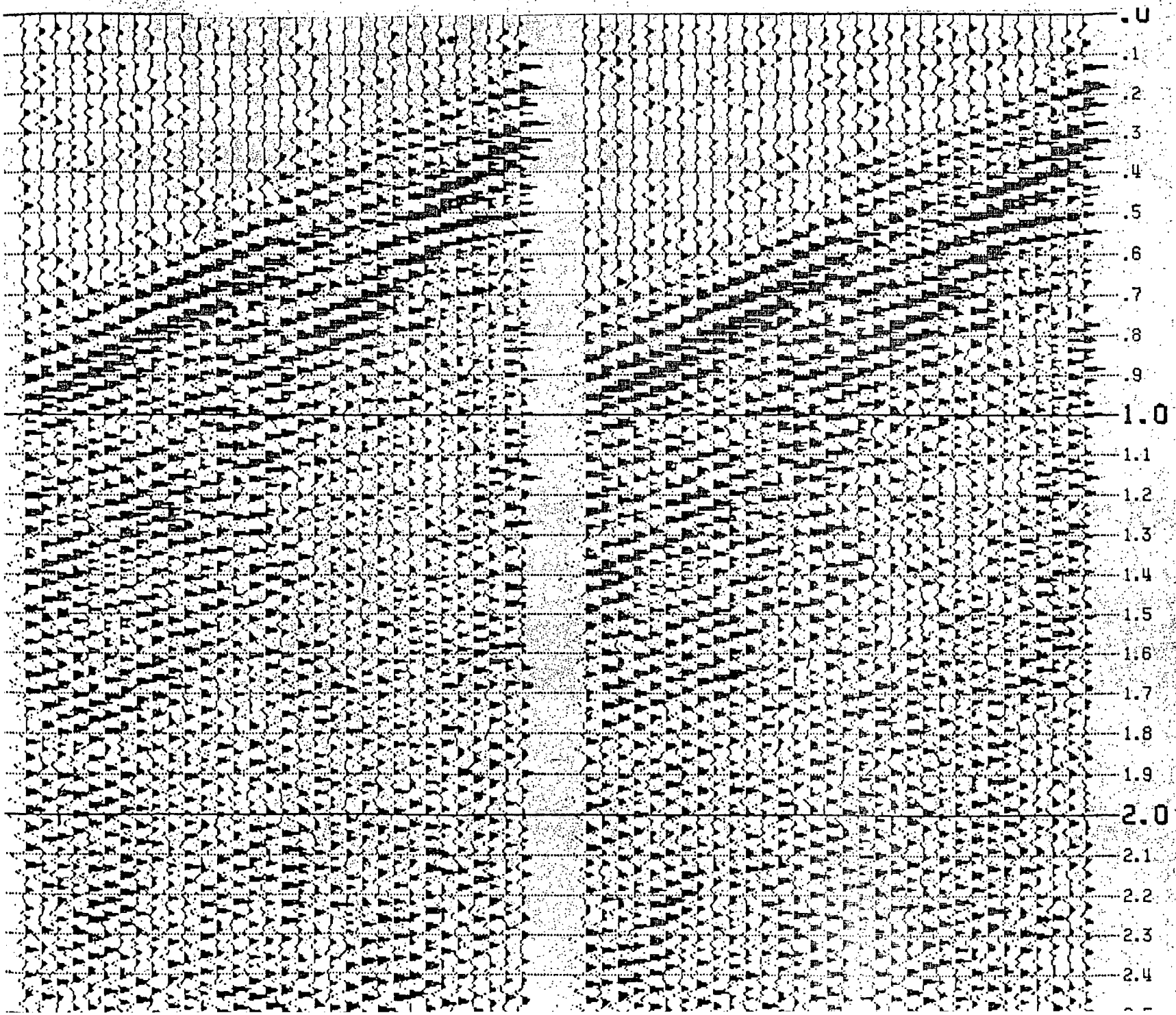
24 phones over 220'

Record B = 3 Vibs over 220 feet

56-14 Hz Sweep 4 ms

Record A = 3 Vibs over 110 feet





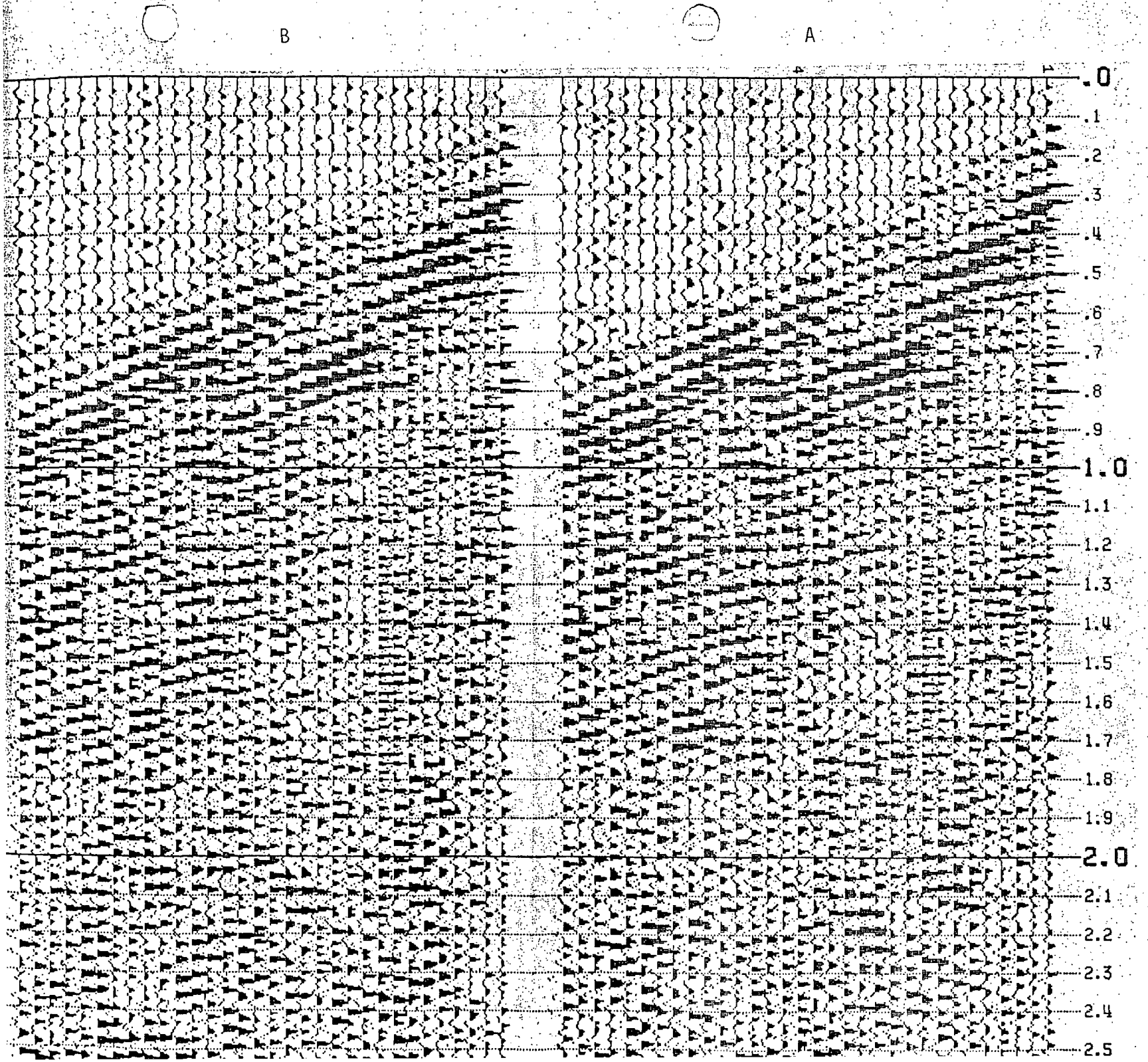
Experimental

15-80 Hz Sweep 2 ms

3 Vibs over 110' pattern
Record A

24 phones over 110 feet

3 Vibs over 220' pattern
Record B



Experimental

15-80 Hz Sweep 2 ms

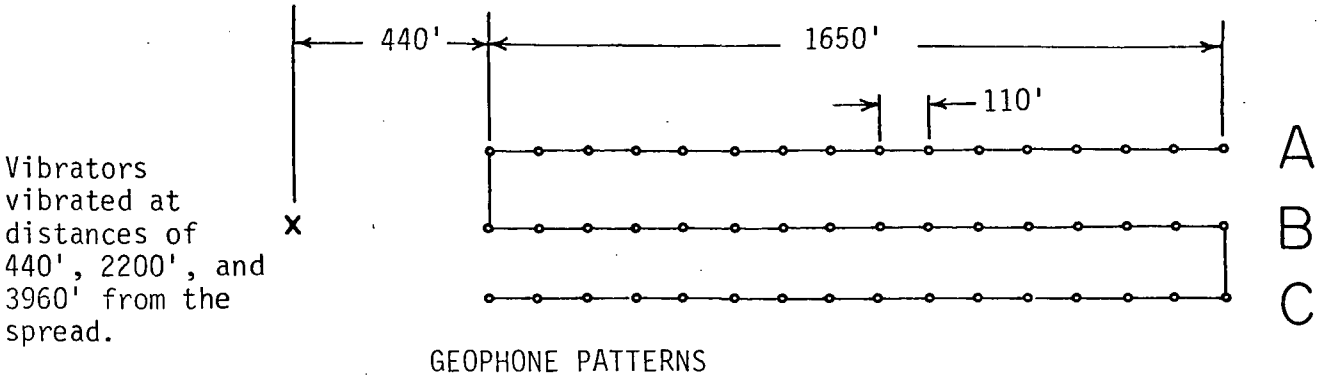
3 Vibs over 220' patte
Record B

24 phones over 220 fee

3 Vibs over 110' patte
Record A

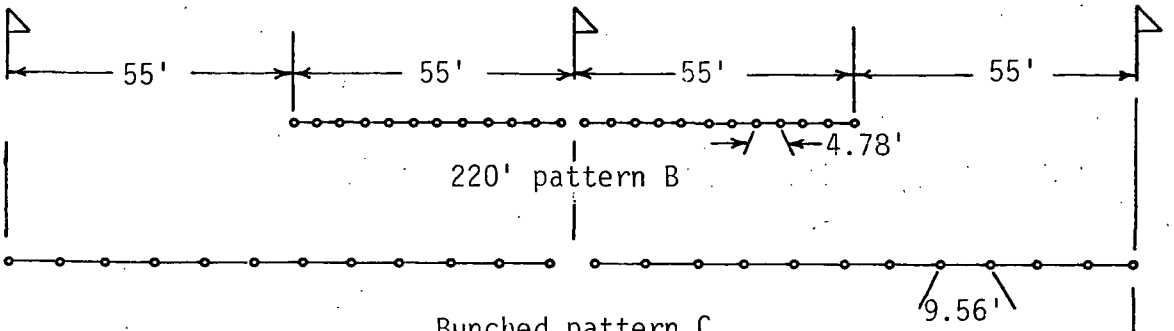
EXPERIMENTAL PROGRAM

GEOPHONE SPREAD LAYOUT

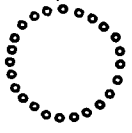


Vibrators vibrated at distances of 440', 2200', and 3960' from the spread.

GEOPHONE PATTERNS



Bunched pattern C



24 phones in 2' circle

VIBRATOR PATTERNS

APPENDIX IV

OPERATING STATISTICS

Crew Headquarters:	Clearfield, Utah South Gate - Hill Air Force Base
Starting Date:	May 16, 1979 (Experimental)
Completion Date:	June 12, 1979 (Line 3)
Work Days:	22 days
Total Hours:	266.5
Profiles Completed:	629
Linear Miles	14.91
Length Line 1	5.08 miles
" " 2	6.08 miles
" " 3	3.75 miles

APPENDIX V

PERSONNEL AND EQUIPMENT

Instrument Truck Number:	2951
Observers:	R.K. Fain and G. Lucero
Vibrator Mechanic:	D.G. Varner
SSC Tractor Vibrator number:	3141
SSC Tractor Vibrator number:	3142
SSC Tractor Vibrator number:	3143
SSC Tractor Vibrator number:	3144
Permit Agent:	R.O. Markham
Surveyors:	E.K. Phelps and R. Strang
Rodman:	L.A. Haddaway and M.O. MacConnel
Party Manager:	T.H. Vernon
Seismologist/Phoenix Operator:	G. Flechtner
Supervisor:	J.E. Smatla

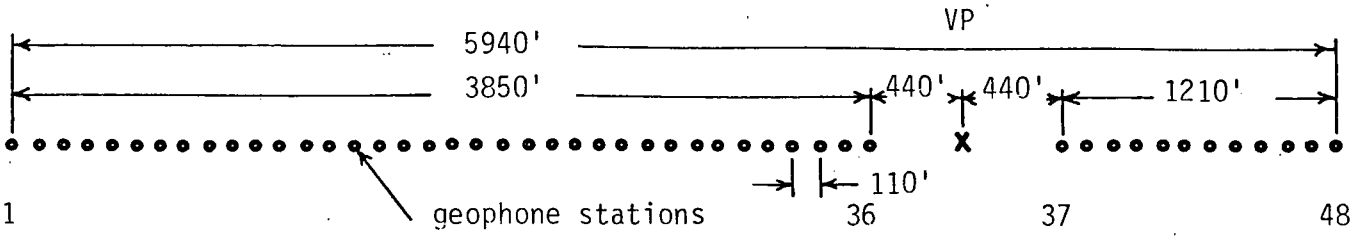
APPENDIX VI

OPERATION METHODS

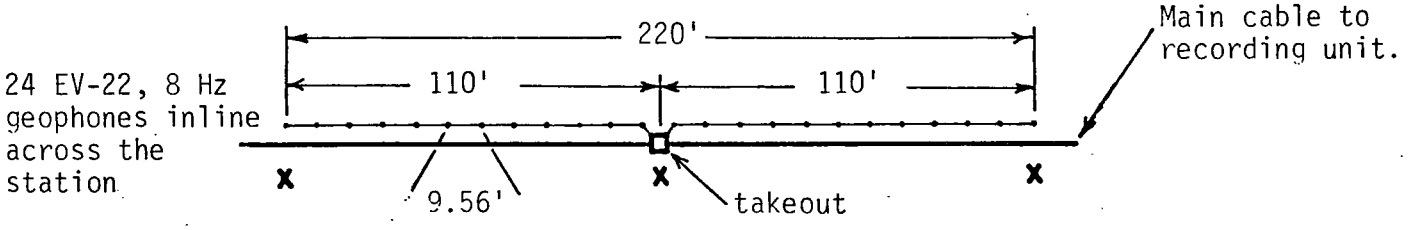
Method used:	24 fold common depth point
Recording spread used:	Inline asymettrical (36 traces west, 12 traces east)
Offset distance: (source center to nest center)	440 feet - near traces (36,37) 4920 feet - far trace
Station spacing:	110 feet
Geophone interval:	9.56 feet between phones - centered on the recording station with first phone 4.78 feet from station flag. Total pattern length of 220 feet by 0 feet wide. 2 strings of 12 phones connected in series - parallel giving 24 phones per nest.
Geophone type:	EV-22, 8 Hz phones
VP Interval:	220 feet
Vibrator pattern:	3 or 4 vibrators inline for total pattern length of 220 feet. 55 feet spacing when using 3 vibrators, approximately 37 feet spacing when using 4 vibrators
Number of sweeps per vibrator per trace:	16 over 220 feet
Sweep:	56-14 Hz 14 sec duration
Equipment: Type vibrators:	Center mount, SSC-VIBK Tractor mounted. (Appendix V)

A diagram illustrating the geophone arrangement & vibrator pattern is shown on page 18.

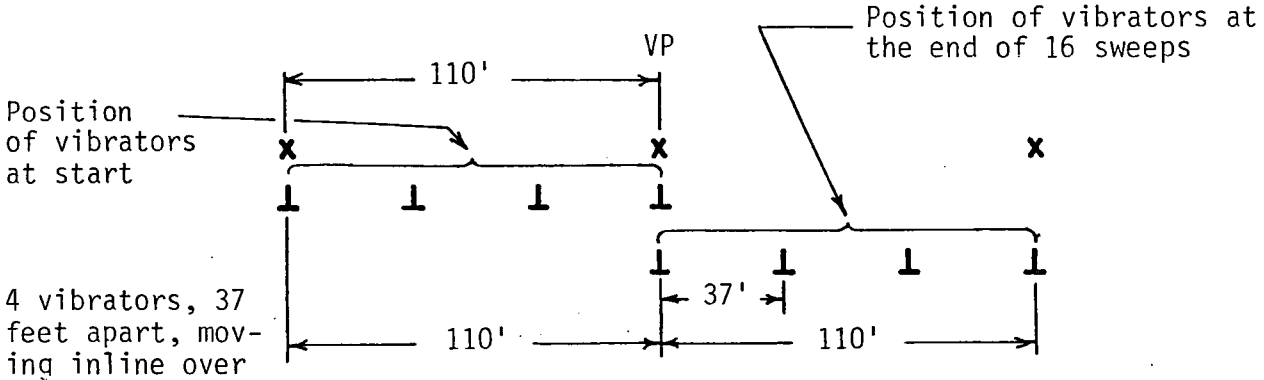
GENERALIZED FIELD LAYOUT



DETAIL OF GEOPHONE ARRANGEMENT



DETAIL OF VIBRATOR PATTERN



3 vibrators, 55 feet apart, moving inline over 220 feet

16 sweeps per vibrator

Sweep frequency: 56-14 Hz

Contract #2882
Hill Air Force Base Prospec
Davis County, Utah

APPENDIX VI (Contd.)

OPERATION METHODS (Contd.)

Instrumentation:	
Amplifier recorder system	DFS IV
Number of channels used	48
Field filter:	12 Hz lowcut, 62 Hz Hicut, 60 cycle notch filter in
Tape:	.5 inch, 9 track
Format:	SEG-B, 800 BPI
Summing and correlation:	In trailer-mounted PHOENIX 704 mini-computer system
Sample rate:	Recorded/processed at 4 ms

APPENDIX VII

PRE-STACK CORRECTIONS

Seismic datum:	4800 feet
Correctional Velocity:	5000 feet per second

REPLAY PROCESSING

Filter:	15-18-55-60 Hz 0-1.5 sec 13-15-40-50 Hz 1.5-4.0 sec
Trace muting:	90ms at 0 distance 1300ms at 4920 feet
Sample rate:	4 ms
Deconvolution:	28 ms predictive
Statics:	Automatic CDP alignments
Automatic Gain Control:	Time variant
Migration:	Wave equation
Final Presentations:	Film display 24 fold common depth point Migration of line

UGMS
DUSHENE CO

	SEC	T	R	DEPTH	°F	
✓ (1)	11 NE	1N	4W	1654	76° ✓	45
✓ (2)	29 SW	2N	2W	6730	113° ✓	45
✓ (3)	32 NE	2S	8W	4075	85° ✓	45
UINTA (4)	12	4S	1W	8004	162° ✓	
✓ 4 (5)	9	4S	4W	8079	162° ✓	45
✓ 5 (6)	16 NW	4S	4W	8002	176° ✓	45
✓ 6 (7)	17 NE	4S	4W	3162	104 ✓	45
✓ 7 (8)	22 NE	2N	3W	5111	95 ✓	
✓ 8 (9)	6	4S	1W	11489	198 ✓	
✓ 9 (10)	5	4S	5W	7533	141 ✓	12.7
				8302	170 ✓	
10 (11)	16 SE	4S	7W	9021	204 ✓	

all 45°

DUCHESNE Co

P.I

2 O
3 O
4 O
5 O
9 O
10 O
11 O
12 O
13 O
14 O
15 O
16 O
17 O
18 O
19 O
20 O
21 O
22 O
23 O
24 O
25 O
26 O
27 O
28 O
29 O
30 O
31 O

32 O
33 O
35 O
✓ 36 △
37 O
38 O
39 O
40 O
41 O
42 O
43 O
44 O
45 O
46 O
47 O
48 O
49 O
50 O
51 O
52 O
60 O
63 O
73 O
81 O
82 ● 45.6°C/fm
83 △
84 O

128 O
129 O
130 O

UGMS

1 △
2 O
3 O
4 O
5 O
6 O
7 O
8 O
9 O
10 O

57
10
67

METRIC
DUCHESNE Co

See	T	R	depth	°C	°C/km	amb
9	2S	1W	627	33.3	42	7.2
10	9S	17E	1707	85.0	46	7.2

TOTAL ALL WELLS: 67
Anomalous Wells: 2