GL01616

THERMAL POWER
COMPANY

Operator: Thermal Power Company

Well: Utah State 72-16 ML-25128

Location: 990 feet south and 990 feet west from the northeast corner of Section 16, T27S/R9W, SLB&M, Beaver County, Utah.

Elevation:

Take all measurements from top KB.
Keep hole full at all times.
Check operation of BOE each round trip or daily, whichever first occurs.

Drilling Program

1. Drill 26" or 27½" hole to 40'+ to fit 20" casing. Cement with Class B cement treated with 2% $CaCl_2$ to fill annulus to cellar floor. Use 2 centralizers. Drill rat hole.

2. Drill 17½" hole to 650' to fit 13-3/8" casing.

3. Cement 13-3/8", 54.5#, K-55, buttress casing at 650' with 400 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel and 40% silica flour. (100% excess). Run guide shoe with insert fillup. Tack weld and Bakerlok bottom 4 collars, weld shoe solid. Use top rubber plug only, plug holding head. Bump plug on shoe. Use 3 centralizers.

4. After 4 hours (or cement is firm), land 13-3/8" casing. Weld on 12" Series 900 WKM geothermal wellhead. Test weld with 1000 psig. Install 12" Series 900 Shaffer double hydraulic control gate and Hydril GK. All blowout preventers on this well to have high temperature packing elements. Test each preventer, casing, kelly cock, valves and check valve in kill line and blow down line valves to 1000 psig. for five minutes. Notify Utah Division of Water Rights to witness preventer tests 3 days in advance of testing (801/586-4231, Cedar City, Gerald Stoker). Enter test results on tour sheet.

5. Drill 12¼" hole to 1820' to fit 9-5/8" casing. One or more cores may be taken. Run Schlumberger Induction, FDC/CNL and Sonic logs at 1820'.

6. Cement 9-5/8", 40#, K-55, buttress casing at 1820' with 350 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel, 40% silica flour and 0.3-0.4% HLX-C214 retarder (% retarder to be determined by maximum thermometers). (40% excess). Run fillup shoe and fillup collar on shoe joint. Tack weld top and bottom, bottom 4 collars, weld shoe solid. Use top and bottom rubber plug and plug holding head. Centralize 40' above shoe and every 5th joint above shoe. Have WKM (505/327-3359, Farmington, Sug Roberts) install centralizing elements in 12" head prior to cementing.

7. Land 9-5/8" casing. WKM install 12" Series 900 by 10" Series 600 14" stroke casing spool. Test pack off with 1000 psig. Install 10" gate valve, two double hydraulic Shaffer control gates, Hydril GK and Grant rotating head. All equipment to have high temperature packing elements. Test all blowout preventers, casing and valving as before with 1000 psig. for five minutes each. Notify Utah DWR to witness preventer tests. Enter test results on tour sheets.

8. Drill 8½" hole to total depth, estimated at 6,000'. One or more cores may be taken. Run Schlumberger logs as ordered. Complete or abandon. 7" casing may be run as protection or production casing if required.

9. Survey hole angle every 2-300', on dull bits. Drillable wing stablizers are to be run in 12¼" and 8½" holes, and 17½" hole if required. A multi-shot or wireline angle survey may be run if hole angle exceeds 5° over several thousand feet. Run drill pipe float valve in 8½" hole and have "wet plug" with valve in open position on floor at all times.

10. Install ABC mud logging service at shoe of 20" conductor. Record continuous mud in and out temperature, H_2S, CH_4, lithology, drilling rate. Have pit level indicator and intercom to drillers station. Take 2 sets W&D samples every 10' above 1800' and every 5' below 1800'. Mail daily copies of the mud log to:

Thermal Power Co. (3 copies) 601 California Street San Francisco, CA 94108 Attn.: W. L. D'Olier	Hathaway Engineering (1 copy) 3382 El Camino, Suite 37 Sacramento, CA 95821

Keep 3 copies up to date and spliced in trailer.

11. Mud Program. American Mud Company 505/327-2525

Surface-650'.	Water and gel, 8.3-9.0 ppg.
650'-TD	Milford City water, add sodium chloride if required.

Have lost circulation material on location.

12. Run and record maximum recording thermometers on each Totco run.

13. Telephone numbers:

Thermal Power Company	415/981-5700	
W. L. D'Olier	415/982-5630	Nites
	805/833-8313	Weekend
W. N. Hathaway	916/489-1206	Office
	916/944-3884	Home
H. E. Wheeler	916/485-2715	

October 14th, 1976

9 (2)

Geothermal Resources Well Summary Report

SUBMIT IN DUPLICATE

Operator THERMAL POWER COMPANY Well No. UTAH STATE 72-16 ML-25128

Sec. 16, T. 27S., R. 9W., SL B. & M. ROOSEVELT Field BEAVER County.

Location 990' South and 990' West from the Northeast corner of Section 16.
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level 5880 feet

All depth measurements taken from top of Kelly Bushing which is 21 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

The information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date January 17th, 1977 Signed W. E. D'Olier

Hathaway Engineering (Engineer or Geologist) (Superintendent) Title Vice President (President, Secretary or Agent)

Commenced drilling October 22, 1976

Completed drilling December 31, 1976

Total depth 1254' Plugged depth

Junk

GEOLOGICAL MARKERS	DEPTH
Alluvium w/zones of hydrothermal alteration	0' - 290'
Conglomerate	290' - 425'
Granite (fractured)	425' - 1254' (T.D.)

Commenced producing not yet on production. (Date)

Geologic age at total depth: 9-15 mybp

Date	Static test Shut-in well head		Production Test Data								
			Total Mass Flow Data					Separator Data			
	Temp. °F	Pres. Psig	Lbs/Hr	Temp. °F	Pres. Psig.	Enthalpy	Orifice	Water cuft/Hr	Steam Lbs/Hr	Pres. Psig.	Te
	Short Preliminary test on 12-30-76 indicated mass flow capability is approximately 1,000,000 pounds per hour of steam and hot water, with flowing wellhead pressure of 355 psig and temperature of 432°F.										

Casing Record (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Dep if th
20"	85	Surface	94#	N	S	H-40	26"	200	
13-3/8"	580	Surface	54.5#	N	S	K-55	17½"	400	
9-5/8"	1,098	Surface	40#	N	S	K-55	12¼"	650	

Perforated Casing

(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was analysis of effluent made? NO Cement BondLogs Surface to 522' Surface to 999' Temperature log depths Surface t 50' to 1(Surface

History of Geothermal Resources Well

SUBMIT IN DUPLICATE

OPERATOR THERMAL POWER COMPANY FIELD ROOSEVELT

Well No. UTAH STATE 72-16 ML-25128, Sec. 16, T. 27S., R. 9W., SL B. & M.

Date January 17th, 1977 Signed W. L. D'Olier

W. L. D'Olier

601 California Street

San Francisco, CA 94108 415/981-5700 Title Vice President

(Address) (Telephone Number) (President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data and zone temperature.

Date	
1976	
10-22	Rigged up Loffland Brothers Company Rig No. 5. Spudded well at 4:00 P.M. Drilled 12¼" hole to 85' and then opened up hole to 26". Ran 20" O.D., 94#, H-40, Buttress Conductor Casing to 85'.
10-23	Cemented 20" casing to surface with 200 sacks Class B Cement containing 2% Calcium Chloride. Landed 20" casing. Installed 20" Hydril GK BOP. Drilled 17½" hole to 163' with 9 ppg mud. Alpha Beta Gamma logging equipment installed and commenced operating at 85'.
10-24	Drilled 17½" hole to 312', with mud. Well started flowing water. Built up mud weight to 10.5 ppg and killed well. Displaced 900 cubic feet of slurry consisting of Class B Cement, Perlite and Silica Flour through drill pipe at 252'. Shut well in.
10-25	Stood cemented. Ran in hole with 17½" bit and found top of cement at 100'. Cleaned out cement to 156' with 9.8 ppg mud.
10-26	Cleaned out cement to 261'. Well started flowing water. Mixed mud to higher weight.
10-27	Mixed mud to 12.2 ppg.
10-28	Mixed mud to 14 ppg and killed water flow. Cleaned out to 312'. Displaced 100 sacks of 16 ppg neat construction cement at 286'.
10-29	Stood cemented. Drilled 17½" hole to 319' with 13.3 ppg mud.
10-30	Drilled 17½" hole to 498' with 13.5 ppg mud.
10-31	Drilled 17½" hole to 585' with 14.5 ppg mud. Well flowed small amount of water diluting 14.5 ppg mud.

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Date	
1976	
11-1	Built mud weight to 15.2 ppg and ran 13-3/8", 54.5#, K-55, Buttress Seamless casing to 580'. Used float shoe and 5 centralizers. Cemented with 400 sacks Class B Cement mixed 1:1 with Perlite, 40% Silica Flour and 2% Gel. Obtained good cement returns to surface.
11-2	Stood cemented. Some hot water flow surfaced from annulus between 13-3/8" and 20" casing strings. Waited on Halliburton to cement annulus.
11-3	Small hot water flow commenced in cellar outside 20" casing. Filled cellar with 15.8# slurry neat cement. Pumped 360 sacks Class B Cement mixed with 40% Silica Flour, 2% Gel and ½% HR-5 Retarder down annulus between 13-3/8" and 20" casing strings. Some fresh cement appeared in cellar and water flow in cellar stopped.
11-4	Stood cemented.
11-5	Ran Schlumberger Cement Bond Log, w/Gamma Ray and Temperature Survey. Excellent bond from surface to 100', fair bond from 100' to 260', excellent bond from 260' to 522' (top of cement plug inside 13-3/8" casing). Cleaning out cement from cellar.
11-6	Cleaning out cement from cellar. Landed 13-3/8" casing.
11-7	Installed 12" Series 900 Shaffer Double BOP, Hydril GK BOP, and Grant Rotating Head. Tested casing and Shaffer blind rams with 1000 psig, pipe rams with 1500 psig, Hydril with 600 psig, Kelly Cock with 1000 psig and kill lines with 1500 psig. All O.K. Cleaned out cement plug inside 13-3/8" casing to 565' with 12¼" bit.

History of Geothermal Resources Well

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Date	
1976	
11-8	Cleaned out remaining cement plug in 13-3/8" casing and drilled out casing shoe. Drilled 12¼" hole to 633' with water. Well started flowing hot water. Built mud weight to 14.2 ppg and killed flow. Ran short flow test.
11-9	Drilled 12¼" hole to 742'. Mud weight cut from 14.2 ppg to 10.1 ppg from hot water entry and CO_2 gas.
11-10	Drilled 12¼" hole to 836'. Ran short flow test. Installed de-gasser to eliminate CO_2 from mud. Installed cooling loop for mud.
11-11	Mixed mud weight to 15.2 ppg and drilled 12¼" hole to 879'.
11-12	Drilled 12¼" hole to 990' with 15.2 ppg mud.
11-13	Drilled 12¼" hole to 1089' with 14.9 ppg mud.
11-14	Drilled 12¼" hole to 1208' with 15.2 ppg mud.
11-15	Drilled 12¼" hole to 1245' with 15.3 ppg mud. Lost complete mud returns at 1245'. Ran short flow test on well.
11-16	Shut in well. Mixed mud. Waited on Otis snubbing equipment.
11-17	Ran Agnew and Sweet Temperature Survey. Waited on Otis snubbing equipment.
11-18	Mixing mud and waiting on Otis snubbing equipment.
11-19	Installing Otis snubbing equipment.

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Date	
1976	
11-20	Snubbed drill string out of hole and closed well in with Shaffer blind rams.
11-21	Rigging up to snub in Halliburton EZSV Retainer-bridge plug.
11-22	Ran EZSV and set at 207'.
11-23	Displaced 40 sacks Class B Cement mixed 1:1 with Perlite, 40% Silica Flour, ½% CFR-2 and 4/10% HR-5 at 206'. Stood cemented.
11-24	Tested casing and BOP at 1000 psig. Mixed mud.
11-25	Installed master valve and extension spool. Small hot water seep observed from ground about 25' SW of Well. Also very small hot water seep observed outside 20" Conductor Casing in cellar.
11-26	Rigged up BOP stack. Tested blind rams and 13-3/8" casing with 1400 psig O.K.
11-27	Stripped in hole with Grant Turbodrill and 12¼" bit and found top cement at 88'.
11-28	Drilled out 1' of cement plug when cones on bit locked. Pulled out of hole and ran back in with new 12¼" bit and double Grant Turbodrill.
11-29	Drilled out cement plug to 174'.
11-30	Pulled out of hole and added 8" drill collars to drill string. Drilled out cement plug to 186'.

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Date	
1976	
12-1	Drilled out cement plug to 189'.
12-2	Drilled out cement plug to 207'. Drilled on EZSV Retainer at 207', came loose with strong jolt.
12-3	Grant Turbodrill ceased upward working. Pushed Retainer down to 580'. Would not push farther. Started pulling out of hole.
12-4	Finished pulling out of hole. Layed down Grant Turbodrill.
12-5	Ran in hole with 12¼" bit and 8" drill collars. Pushed Retainer down to 694'.
12-6	Pushed Retainer to 1235' where it stopped.
12-7	Ran second Halliburton EZSV Retainer to 629' where it stopped. Set same.
12-8	Pulled out of hole with drill string and EZSV Setting Tool. Started running drill string in hole with 12¼" bit and 8" drill collars.
12-9	Finished running in hole. Drilled on Retainer No. 2 for 5 minutes when it started moving downhole. Pushed Retainer No. 2 to 1239' where it stopped. Pulled out of hole.
12-10	Started in hole with Halliburton EZSV Retainer No. 3.
12-11	Set Retainer No. 3 at 1144'. Preparing to place cement plug on top of Retainer No. 3.
12-12	Pipe stuck. Freed same with water circulation.

History of Geothermal Resources Well

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Date	
1976	
12-13	Pulled out of hole.
12-14	Rigged down Otis snubbing equipment. Ran in hole open ended.
12-15	Placed cement plug at 1138' with 35 sacks Class B Cement mixed 1:1 with Perlite, 40% Silica Flour, ½% CFR-2 and 3/10% HR-5.
12-16	Ran 12¼" bit and cleaned out hole to 1100'. Circulated water to cool hole, then displaced water with 16 ppg mud.
12-17	Ran 9-5/8", 40#, K-55, Buttress Casing to 1098'. Casing equipped with float shoe, float collar on top first joint, stab-in float collar on top second joint, centralizers 10' down on first joint and on top of third joint.
12-18	Circulated water around casing to cool hole. Displaced water with mud. Ran in hole with drill pipe and stab-in tool. Stabbed into special stab-in float collar, circulated cold water, then displaced with 15 ppg mud and cemented casing with 650 sacks Class B Cement mixed with 40% Silica Flour, ½% CFR-2 and 3/10% HR-5. Slurry weighed 15.6 ppg. Displaced cement in drill pipe with water, pulled stab-in tool out of float collar and circulated cold water inside 9-5/8" casing.
12-19	Circulated water inside 9-5/8" casing to allow cement to set properly. Displaced water with 15 ppg mud and pulled drill pipe out of hole. Cut off 9-5/8" casing.
12-20	Landed 9-5/8" casing in expansion spool. Installed BOP Stack consisting of 1-10" Series 600 master valve, 1-10" Series 900 Shaffer Double BOP, 2-10" Series 900 Hydril GK BOP's, and 1 Grant Rotating Head. Tested casing with 1000 psig for 5 minutes O.K. Tested BOP Stack. Tried to run Schlumberger CBL, but tool stopped at 260' in caked mud.

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Date	
1976	
12-21	Cleaned out hole and ran logs in water. Ran CBL to 999' and Temperature log to 1012'. CBL indicated excellent bonding from 999' up to 85', then good to fair bonding from 85' to surface. Temperature log inconclusive due to unstabilized temperature of water.
12-22	Ran in hole with 8½" bit and cleaned out cement and drilled out float collars to 1092'. Pulled 8½" bit and ran 8½" mill. Milled out cement and float shoe and cleaned out to Retainer. Milled on Retainer.
12-23	Milled out Retainer. Ran 8½" bit and milled and pushed Retainer to 1241' with 13.6 ppg mud. Displaced mud with water. Pulled out of hole.
12-24	Tested well. Shut well in. Shut rig down at 4:00 P.M. for Holidays.
12-25	Rig shut down for Holidays.
12-26	Rig shut down for Holidays.
12-27	Commenced operations at 8:00 A.M. Lowered well pressure by pumping in water and mud. Ran in hole with 8½" bit.
12-28	Mixed mud to 16.4 ppg. Cleaned out Retainers and drilled new hole from 1245' to 1247'.
12-29	Pulled out of hole and changed bits. Drilled to 1254'.
12-30	Tested well.
12-31	Installed 12" Series 400 master valve above 10" Series 600 master valve and closed in well. Rigged down. Released rig at 4:00 P.M.

THERMAL POWER COMPANY
Utah State Well No. 72-16
Sec. 16, T27S, R9W, SLB&M, Beaver County, Utah
Loffland Rig No. 5
Spud: 10/23/76 Completed: 12/31/76

Bit No.	Bit Size	Bit Mfg.	Bit Type	Serial No. of Bit	Jet Size 1 2 3	Depth Out	Ftge.	Total Hrs.Run	Weight 1000 lbs.	Rotary RPM	Pump Pressure
1	12¼"	HTC	XIG	62685 retip	14 14 14	85	85			60	600
2	17½	HTC	OSC3AJ	RR166	16 16 0	288	203	4	10/15	50/60	300
3	17½	SEC	S88	RR	16 0 0	525	217	36-3/4	10/25	55/60	400
4	12¼	HTC	OSC16	RR	open	595	70	1-¼			
5	12¼	HTC	X44	MW020	20 20 20	836	241	23-3/4	40	50	600
6	12¼	HTC	X44	MX944	20 20 20	1208	369	57¼	30/35	50/60	900/1200
7	12¼	SEC	M88	439675	24 24 24	1245	37				
8	12¼	HTC	OWVJ	ZN860	open	1245	drilling cement				
9	12¼	HTC	OSC12	XZ264		drilling cement to 207'					
10	12¼	HTC	OWV	TZ935		" "					
11	12¼	HTC	OWV	ZX457	open	no hole					
12	12¼	HTC	OWV	RR							
13	8½	HTC	ODV	SJ828		no hole					
14	8½	HTC	J7	VM456	open	drilling cement					
15	8½	HTC	V7	VR633	open	drill out plug to 1247'					
16	8½	HTC	V7	VM456		drill out plug					

OF
9/28/77

Copy 1/2

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Branch of Experimental Geochemistry and Mineralogy
345 Middlefield Road, Menlo Park, California 94025

November 14, 1977

Keith Davis
Thermal Power Co.
601 California St.
San Francisco, Ca 94108

Dear Keith:

I enclose chemical analyses of water collected last April from your Utah State 72-16 well at Roosevelt Hot Springs. As Rudisill has probably told you the premature end of the flow test prevented our collection of properly separated steam and water samples. The water analyses appear O.K. but the "steam condensates" are also all water. The calculated aquifer temperature and aquifer chloride contents are a little lower than those for the 14-2 well and if possible I would like to resample the well to see if this is real. The gas analyses are in progress and I will send them but the goal/steam ratio will also suffer from the poor steam/water separation. We may be able to obtain some sort of a number by analysing for chloride in the gas bottles. The ion ratios are very similar in 14-2 and 72-16:

	14-2	72-16
Cl/SiO_2	5.7	6.2
Na/K	5.5	5.0
Cl/Na	1.7	1.6

so probably the gas contents are similar.

I hope these analyses are of use to you. Gene Ciancanelli has requested a copy but I thought this should come from you.

Best regards,

Alfred H. Truesdell

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NEW DOWNHOLE CHEMISTRY PROGRAM--VERSION OF 11/1/77
WELL NUMBER?  THERMAL US 72-16
DATE OF COLLECTION? APRIL 1977
PRESSURE UNITS: ABSOLUTE- BARS=1,KG/CM2=2,PSI=3
                GAUGE-    BARS=4,KG/CM2=5,PSI=6
ENTER SILENCER PRESSURE,UNITS 0.8 1
    IN BARS ABSOLUTE= 0.8
ENTER SEPARATOR PRESSURE,UNITS 288 6
    IN BARS ABSOLUTE= 20.5569088
COLLECTION POINT? (SILENCER=0,SEPARATOR=1) 1
ENTER CHLORIDE,SILICA IN PPM  3110 510
ENTER ENTHALPY AND UNITS(1=JOULES,2=CALORIES,3=BTU (1047) 1
WATER FRACTION IN SILENCER=0.769360372016
WATER IN SEPARATOR HAS 3110 PPM CL
                   AND 510 PPM SIO2
WATER FRACTION IN SEPARATOR= 0.919548317554
ENTHALPY OF AQUIFER FLUID IN JOULES/GM
    MEASURED=1047,FROM SILICA=1067.87343644
    IN BTU/LB= 450.128976784 AND 459.102939189
AQUIFER TEMPERATURE
    FROM ENTHALPY=242.029951288,FROM SILICA=246.381892532
WATER IN AQUIFER HAS 2859.79526759 PPM CL
                   AND 468.969641953 PPM SIO2
EXCESS ENTHALPY=-20.8734364375 (IN BTU/LB= -8.97396235491)
PERCENT STEAM IN AQUIFER= -1.20327840858
```

estimated downhole temperature

The underlined numbers are most important

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WELL NUMBER? 14-2 ROOSEVELT
DATE OF COLLECTION? NOV 76
PRESSURE UNITS: ABSOLUTE- BARS=1,KG/CM2=2,PSI=3
                GAUGE-    BARS=4,KG/CM2=5,PSI=6
ENTER SILENCER PRESSURE,UNITS 0.8 1
    IN BARS ABSOLUTE= 0.8
ENTER SEPARATOR PRESSURE,UNITS 177 6
    IN BARS ABSOLUTE= 13.0037252
COLLECTION POINT? (SILENCER=0,SEPARATOR=1) 1
ENTER CHLORIDE,SILICA IN PPM  3650 640
ENTER ENTHALPY AND UNITS(1=JOULES,2=CALORIES,3=BTU) 1160 1
WATER FRACTION IN SILENCER=0.813813537005
WATER IN SEPARATOR HAS 3650 PPM CL
                   AND 640 PPM SIO2
WATER FRACTION IN SILENCER= 0.837623385938
ENTHALPY OF AQUIFER FLUID IN JOULES/GM
    MEASURED=1160,FROM SILICA=1135.30850473
    IN BTU/LB= 498.710232158 AND 488.094799971
AQUIFER TEMPERATURE
    FROM ENTHALPY=265.14228723,FROM SILICA=260.189390499
WATER IN AQUIFER HAS 3057.32528567 PPM CL
                   AND 536.0789542 PPM SIO2
EXCESS ENTHALPY=24.6914952671 (IN BTU/LB= 10.6154432187)
PERCENT STEAM IN AQUIFER= 1.48611429399
```

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

ANALYTICAL STATEMENT

Lab. No. RO7-77-3

RECEIVED
NOV 28 1977
TPC

Source: Roosevelt # 2 Water

Location:
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll:

Disch. _____, Temp. (°F.) _____
Date of coll.: _____
Collected by: Truesdell
WBF:

Analyst: _____
Date completed: 28 Oct 77
Checked by: _____

	mg/l	me/l
SiO_2	510	
Al		
Fe		
Mn		
As		
Ca	12.4	
Mg	0.29	
Sr	1.36	
Ba		
Na	1800	
K	380	
Li	15.0	
NH_4		
Cation totals:		

	mg/l	me/l
HCO_3	181	
CO_3		
OH		
SO_4	33	
Cl	2110	
F	5.2	
Br		
I		
NO_2		
NO_3		
PO_4		
B	26.4	
Anion totals:		

$SO_4^=$ by Ba^{+2} Turbimetric

Dissolved solids:
Calculated (mg/l) 6074
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) 297
N. C. Hardness as $CaCO_3$ (mg/l) 71.5

Specific conductance (micromhos at 25°C) _____
pH 7.83 ; Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

RECEIVED
NOV 28 1977
TPC

Source: Roosevelt #1 Condensate

ANALYTICAL STATEMENT
Lab. No. RU7-77-2

Location:

____¼ Sec.____, T.____, R.____

Point of coll:

Disch.____, Temp. (°F.)____
Date of coll.:
Collected by:
WBF:

Analyst:
Date completed:
Checked by:

	mg/l	me/l		mg/l	me/l
SiO_2	104+		HCO_3	193	
Al			CO_3		
Fe			OH^3		
Mn					
			SO_4	34	
			Cl	3180	
As			F	5.3	
			Br		
Ca	12.2		I		
Mg	0.28		NO_2		
Sr	1.20		NO_3		
Ba			PO_4		
Na	2000		B	27.2	
K	400				
Li	15.0				
NH_4					
Cation totals:			Anion totals:		

SO_4^{-2} by Ba^{+2} Turbimetric

Dissolved solids:
Calculated (mg/l) 5868
Residue (180°C) (mg/l)
Hardness as $CaCO_3$ (mg/l) 316
N. C. Hardness as $CaCO_3$ (mg/l) 64.6

Specific conductance (micromhos at 25°C)
pH 7.72 ; Density at 20°C (g/ml)
Sulfides as H_2S (mg/l)

(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

RECEIVED
NOV 28 1977

ANALYTICAL STATEMENT

Source: Roosevelt #2 Condensate

Lab. No. R07-77-4

TPC

Location:
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll:

Disch. _____, Temp. (°F.) _____
Date of coll.: _____
Collected by: Truesdell
WBF:

Analyst: _____
Date completed: _____
Checked by: _____

	mg/l	me/l		mg/l	me/l
SiO_2	104+		HCO_3	134	
Al			CO_3		
Fe			OH		
Mn					
			SO_4	25	
			Cl	2330	
			F	3.8	
As			Br		
			I		
Ca	8.2		NO_2		
Mg	0.23		NO_3		
Sr	1.06		PO_4		
Ba			B	183	
Na	1350				
K	290				
Li	12.0				
NH_4					

SO_4 by Ba Turbimetric

Cation totals: 6835

Anion totals:

Dissolved solids:
Calculated (mg/l) 4277
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) 220
N. C. Hardness as $CaCO_3$ (mg/l) 48.4

Specific conductance (micromhos at 25°C) _____
pH 7.91 ; Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

RECEIVED
NOV 28 1977

ANALYTICAL STATEMENT

Source: Roosevelt #1 (Water)

Lab. No. R07-77-1

Location:

_____ ¼ Sec. _____, T. _____, R. _____

Point of coll:

Disch. _____, Temp. (°F.) _____

Date of coll.: _____

Collected by: Truesdell

WBF:

Analyst: _____

Date completed: 28 Oct 77

Checked by: _____

	mg/l	me/l		mg/l TPC	me/l
SiO_2	521		HCO_3	181	
Al			CO_3		
Fe			OH		
Mn					
			SO_4	32	
			Cl	3260	
			F	5.3	
As			Br		
			I		
Ca	12.20		NO_2		
Mg	0.29		NO_3		
Sr	1.20		PO_4		
Ba			B	27.2	
Na	2000				
K	400				
Li	16.0				
NH_4					

SO_4 By Ba^{+2} Turbimetric

Cation totals: Anion totals:

Dissolved solids:
Calculated (mg/l) 6444
Residue (180°C) (mg/l) _____

Hardness as $CaCO_3$ (mg/l) 297

N. C. Hardness as $CaCO_3$ (mg/l) 64.6

Specific conductance (micromhos at 25°C) _____

pH 7.53 ; Density at 20°C (g/ml) _____

Sulfides as H_2S (mg/l) _____

(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

Utah State Well 14-2 ML-27536
Roosevelt KGRA, Utah
Core #1

Interval 2600'-12' cut 12' Rec 10' (83%). Core in summary is granodiorite with about 5 thin (1") zones of quartz filled fractures cutting core at high angles. Near top of core a 1.5' zone of predominate quartz is noted.

Fractures are not open. Core is not in reservoir. Local green alteration zones of chlorite after biotite, also a tan material after hornblende. Some red staining. Trace pyrite.

Cut 12' in 5 hours with new 6½" Christensen diamond core head. Core head wornout at end of run.

14-2
FILE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Geologic Division
Branch of Experimental Geochemistry and Mineralogy
345 Middlefield Road, Menlo Park, California 94025

March 21, 1977

RECEIVED
MAR 22 1977
TPC

Jake Rudisill
Thermal Power Co.
601 California Street
San Francisco, CA 94108

Dear Jake,

Here are the chemical analyses of the Utah State 14-2 well fluids. The tritium, deuterium, H_2S, and SO_4 sulfur isotopes and SO_4 oxygen isotopes will be a few months more. The small cyclone separator worked well - only 1-2 ppm Cl in the steam condensate and a liquid-vapor ^{18}O fractionation of 2.5°/₀₀ vs. 2.6°/₀₀ from experiments. Earlier collections with a large separator showed steam in the water and water in the steam. The special port for the calorimeter collected a fluid with $\delta^{18}O = -13.5$ indicating that it contained almost all water ($\delta^{18}O = -13.27, -13.46$) and little steam ($\delta^{18}O = -15.82, -15.87$).

It appears now that Emanuel Mazor and John Bowman will come along for the collection on March 30. We will drive down from SLC on the 29th and connect our separator before you open up on the 30th. If we can sample upstream and downstream of your orifice plate we would like to do so. This would allow us to make an independent estimate of the total fluid enthalpy. For this we would need valves on both sampling points with ½" (or some other agreed upon size) female NPT connections.

Keep me informed of your plans as they develop.

Best wishes,

ALFRED H. TRUESDELL

Enclosure

cc: Stan Ward

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Branch of Experimental Geochemistry and Mineralogy
345 Middlefield Road, Menlo Park, California 94025

August 15,1977

Jake Rudisill
Thermal Power Company
601 California St
San Francisco, CA 94108

Dear Jake:

The following tritium analyses have been completed on the Utah State 14-2 well at Roosevelt Hot Springs, Utah.

Sample #	Type	Date Collected	TU±1σ
ROT-76-18	Brine	16 Nov 76	0.2±0.2
ROT-76-20	Brine	17 Nov 76	0.4±0.2
ROT-76-21	Steam Condensate	17 Nov 76	7.6±0.4

Analyses were done by F.J. Pearson, Jr. of the USGS in Reston, VA.

Sincerely,

Nancy Nehring

Nancy Nehring

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -13.46$

ANALYTICAL STATEMENT

Source: Thermal Power Company Well
ROT-76-18 Roosevelt, Utah

Lab. No. GT293AT76

Location:
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll: Water separate after 2 1/2 hours; 374°F.

WHP 177 psia, Collection Temp. 14°C
Date of coll.: November 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by:
Field Filter: None.
Lab Filter: 0.1 µm.
1:10 silica field dilution
F denotes field determination.

	mg/l	me/l		mg/l	me/l
SiO_2	640		HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	3.0		SO_4	78	
			Cl	3650	
			F	5.2	
			Br		
			I		
Ca	9.2		NO_2		
Mg	0.6		NO_3		
Sr			PO_4		
Ba			B	29	
Na	2150				
K	390				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l) _____
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) _____
N.C. Hardness as $CaCO_3$ (mg/l) _____

Specific conductance (micromhos at 25°C) 9900
FpH 5.9 (paper); Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 850-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -13.27$

ANALYTICAL STATEMENT

Source: Utah State Well #14-2
ROT-76-20
Location: Roosevelt, Utah
____ ¼ Sec. ____, T. ____, R. ____

Point of coll: Water separate.

Collection
WHP 177 psia, Temp. 9°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by:
Field Filter: None.
Acid: HCl, HNO_3.
1:10 silica field dilution.
F denotes field determination.
Lab Filter: 0.1 µm.

Lab. No. GT295AT76

	mg/l	me/l		mg/l	me/l
SiO_2	820		HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	2.2		SO_4	60	
			Cl	3650	
			F	4.8	
			Br		
			I		
Ca	6.9		NO_2		
Mg	0.08		NO_3		
Sr			PO_4		
Ba			B	28	
Na	2200				
K	410				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l)
Residue (180°C) (mg/l)
Hardness as $CaCO_3$ (mg/l)
N. C. Hardness as $CaCO_3$ (mg/l)

Specific conductance (micromhos at 25°C) 10,000
F_{pH} 6.2 (paper); Density at 20°C (g/ml)
Sulfides as H_2S (mg/l)
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -15.87$

ANALYTICAL STATEMENT

Source: Utah State Well #14-2
ROT-76-21
Location: Roosevelt, Utah
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll: Steam condensate

Collection
_____, Temp. 9°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by: _____
Field Filter: None.
Acid: HCl, HNO_3.
Lab Filter: 0.1 µm.
F denotes field determination.

Lab. No. GT296AT76

	mg/l	me/l		mg/l	me/l
SiO_2	<1	---	HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	<0.01		SO_4	3	
			Cl	2	
			F	<0.1	
			Br		
			I		
Ca	6.6		NO_2		
Mg	<0.05		NO_3		
Sr			PO_4		
Ba			B	0.55	---
Na	<0.5				
K	<0.1				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l) _____
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) _____
N. C. Hardness as $CaCO_3$ (mg/l) _____

Specific conductance (micromhos at 25°C) 185
F pH 6.5 (paper); Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 800-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -15.82$ ‰

ANALYTICAL STATEMENT

Source: Thermal Power Company Well
ROT-76-19 Roosevelt, Utah

Lab. No. GT294AT76

Location:
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll: Steam condensate.

Collection
_____, Temp. 15°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by: _____
Field Filter. None. Acid: HCl, HNO_3.
Lab Filter: 0.1 µm.
F denotes field determination.

	mg/l	me/l		mg/l	me/l
SiO_2	<1	---	HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	0.02		SO_4	2	
			Cl	1	
			F	<0.1	
			Br		
			I		
Ca	52		NO_2		
Mg	<0.05		NO_3		
Sr			PO_4		
Ba			B	0.6	---
Na	<1				
K	<0.1				
Li					
NH_4					

Cation totals: Anion totals:

Dissolved solids:
Calculated (mg/l) _____
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) _____
N. C. Hardness as $CaCO_3$ (mg/l) _____

Specific conductance (micromhos at 25°C) 220
F pH 4.9 (paper); Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

HISTORICAL SYNOPSIS OF THE ROOSEVELT HOT SPRINGS GEOTHERMAL FIELD, UTAH

Ronald J. Forrest

Phillips Petroleum Co.
P.O. Box 858
Milford, Utah 84751

The discovery and development of the Roosevelt Hot Springs Thermal area has involved many individuals, companies, institutions, and organizations. A search of literature reveals that a limited number of investigations were performed at the Roosevelt Hot Springs site prior to 1970.

In the late 1880's and early 1900's, the area was known as McKeans Hot Springs. In 1902, it was developed into a hot springs resort with operation continuing into the 1920's. The site of Roosevelt Hot Springs is now dry, emitting only some water vapor and gases as active fumaroles.

W. T. Lee published the first scientific information about the hot springs in 1908. He reported sodium-sulfate chloride water flowing from the largest spring at a rate of 10 gallons per minute (gpm) with a temperature of 190°F. In November, 1950, the Roosevelt Hot Springs were described by the U.S. Geological Survey. They reported the water as a sodium chloride type flowing at a rate of 1 gpm at 185°F. The dissolved mineral content was 7,040 parts per million (ppm), of which 405 ppm was silica. In September, 1957, the U. S. Geological Survey again classified the hot springs water as sodium chloride water containing 7,800 ppm of total dissolved solids. The flow rate was small with a temperature of 131°F. In May, 1966, the hot spring was "dry", with indications that it had been dry for possibly two years (Mundorff, 1970).

During the 1960's, exploration gave an indication of the importance of the Roosevelt Hot Springs area as a potential geothermal energy resource. In December, 1967, Mr. A. L. McDonald and Dr. E. Davie jointly drilled an 80' hole in the Roosevelt Hot Springs area (T26S, R9W, Sec. 16). It was eventually plugged because it encountered boiling hot water at shallow depths. A second drill hole, located about 300' to the east of the first hole, reached a depth of 165' before encountering hot water flashing to steam. This hole was temporarily abandoned until April, 1968, when it was deepened to about 270'. At this depth, the 270°F water flashed into steam. The well flowed out of control for approximately two months. It is this well that is generally described as the "discovery well" for the Roosevelt Hot Springs Thermal Area (Personal observations by Mr. A. L. McDonald).

In December, 1970, the U.S. Congress passed the Geothermal Steam Act. In 1971, the U.S. Geological Survey created the eight-section KGRA (Known Geothermal Resource Area) at Roosevelt Hot Springs. In 1972, Phillips Petroleum Company initiated their geothermal exploration program in the area. Competition between Phillips and other companies resulted in the expansion of the KGRA to 36.5 sections in January, 1974. At the lease sale in July, 1974, Phillips was the successful bidder on nine of the 12 tracts (18,871 acres); Getty Oil Company acquired one tract of 1,920 acres; Union Oil Company leased one tract of 1,600 acres; and Mr. A. L. McDonald acquired one tract of 40 acres. After the leases were issued in October, 1974, Phillips' exploration activities shifted to deep test drilling.

The deep test program began in February, 1975. During that year, six deep tests and two stratigraphic tests were drilled. In late April, 1975, Phillips' second deep test (#3-1) was drilled and this well is considered to be their discovery well.

In April, 1976, Phillips Petroleum Company gained the approval of the United States government to unitize the Roosevelt Hot Springs reservoir, thus allowing the field to be developed in the most efficient and economical manner. This unit (Figure 1) was the first to be approved in the United States. During 1976, Phillips also sought to better understand the geothermal system by performing flow tests and conducting a number of geophysical and geochemical surveys.

During 1977, Phillips drilled three stratigraphic test holes to obtain additional information on the dimensions of the reservoir. In October, 1977, their longest flow test and reinjection operation began, lasting 236 days. The main objective of this test was to determine the capacity of the geothermal reservoir.

Early in 1978, Phillips completed several stratigraphic test holes in the Roosevelt Hot Springs thermal area. Additional information on the geometry of the reservoir was gathered.

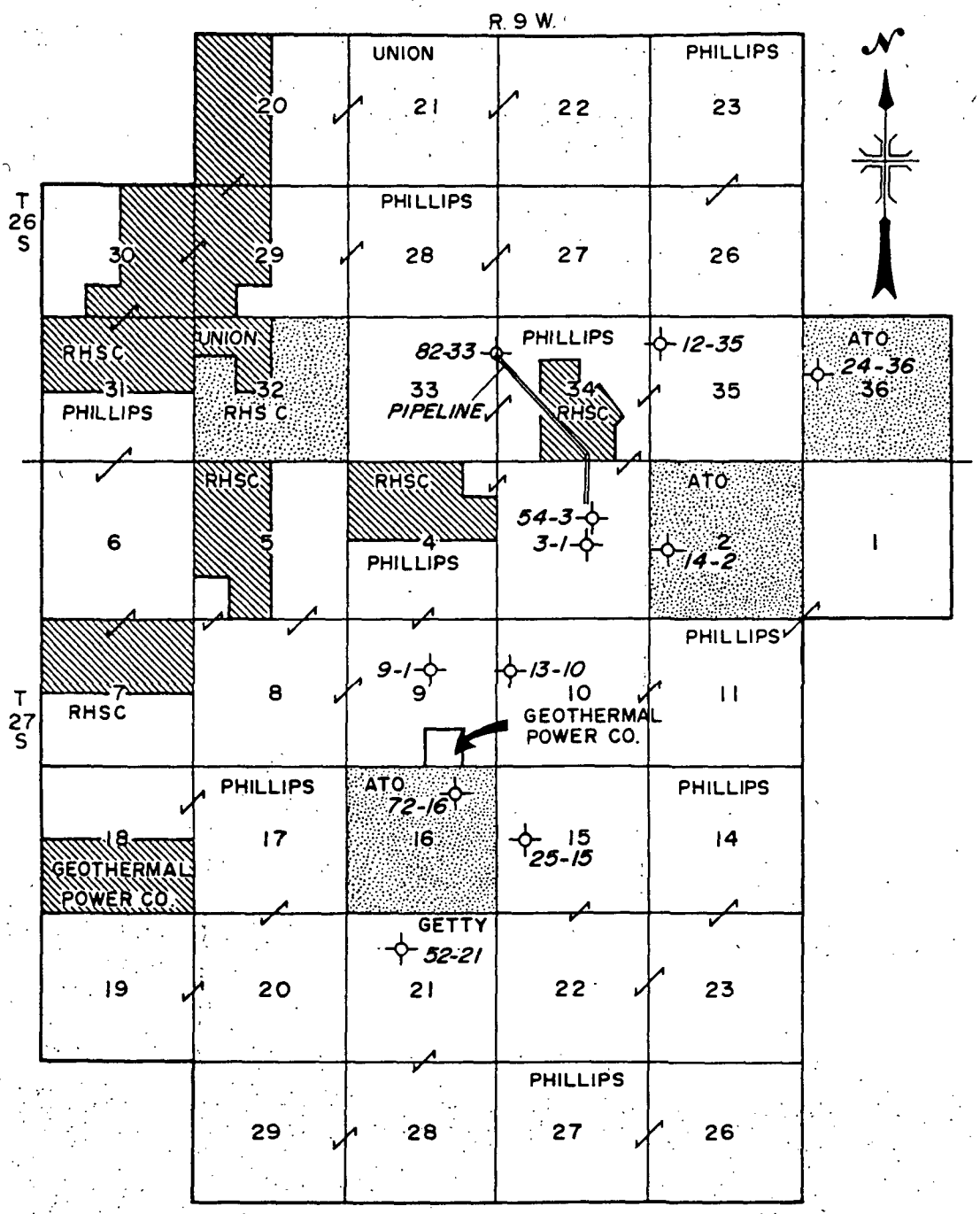


Figure 1

ROOSEVELT HOT SPRINGS UNIT
LAND STATUS MAP

RHSC - ROOSEVELT HOT SPRINGS CORPORATION
ATO - AMAX THERMAL POWER -O'BRIEN

In 1979, Phillips' main interest was to obtain still more information by conducting another major flow - reinjection test. Their goal is the eventual development of the field. Under the regulations of the Roosevelt Hot Springs Unit, Phillips plans further development, culminating in the generation of electrical power by using the geothermal energy -- possibly as early as 1983.

The case history of the Roosevelt Hot Springs Thermal Area, Utah, would not be complete without documentation of all party accomplishments. The historical synopsis highlights only the key events pertaining to this field. Activities of Phillips Petroleum Company were emphasized because that company has proven since 1972 to be the most active operator influencing the geothermal development of this field. The passing of the Geothermal Steam Act in 1970 by the U.S. government resulted in a veritable "explosion" of information from surveys performed at Roosevelt Hot Springs thermal area.

The amount of information released to the public domain indicates this to be one of the most extensively researched geothermal fields in the United States. Numerous energy-seeking industries have performed exploratory activities. The academic community, particularly the University of Utah Department of Geology and Geophysics, has completed a vast collection of reports on this geothermal field.

One approach to list all these accomplishments at Roosevelt Hot Springs was to organize the information into two separate tables: Table A is a chronologic listing of the known history and developments by all parties except Phillips Petroleum Company. Table B is a complete listing of the historical development at Roosevelt Hot Springs thermal area by Phillips Petroleum Company.

As of February, 1979, 11 geothermal test wells had been drilled within the Unit. Six of the wells are considered capable of producing fluid in commercial quantities: Phillips #3-1, #54-3, #13-10, and #25-15; Amax-Thermal Power-O'Brien (ATO) #14-2 and #72-16. Phillips well #12-35 is productive but presently not commercial. Four wells have not encountered the geothermal reservoir: #9-1 and #82-33; Getty Oil Co. #52-21; and ATO #24-36.

In addition to the deep tests, eight observation holes ranging in depth from 1760 to 2317 feet have been drilled in the area, of which seven are within the unit.

In May 1980, Phillips Petroleum Co. and Utah Power and Light Co. announced a 90-day negotiation period focussed on intentions to reach an agreement for the commercial electrical development of the Roosevelt Hot Springs Unit. If a contract agreement is reached, initial construction of the first of three power plants would likely begin in late 1980. The first plant, a 20 megawatt, would be completed by early 1983. This would be followed by two additional 50 megawatt plants also located at the geothermal site. They are projected for completion in 1985 and 1986. At this time, commercial output of this geothermal field is set at 120 megawatts of electrical power, sufficient for the needs of about 120,000 people. This would rank the Roosevelt Hot Springs Unit thermal area in the top three in the United States for generating electrical power from a geothermal reservoir system.

TABLE A
EARLY HISTORY AND DEVELOPMENT
OF THE ROOSEVELT HOT SPRINGS THERMAL AREA
BY ALL PARTIES (EXCLUDING PHILLIPS PETROLEUM COMPANY)

Late	1880's	The Roosevelt Hot Springs site, then known as McKeans was discovered.
Early	1900's	Roosevelt Hot Springs was turned into a hot spring resort or spa. (Petersen, 1975)
	1908	The first recorded scientific information on Roosevelt Hot Springs was reported by Lee. He identified the water type as a sodium sulfate-chloride, the largest spring flowing 10 gpm at 190°F. (Lee, 1908)
November	1950	The hot spring site was examined by the U.S. Geological Survey. The water was classified as a sodium chloride type and had a flow of 1 gpm at 185°F (Mundorff, 1970).
	1957	The U.S. Geological Survey re-examined the hot spring and classified it as sodium chloride type. The spring had a small flow at a temperature of 131°F (Mundorff, 1970).
May	1966	The U.S.G.S. visited the hot spring and it was "dry". It appeared to have been dry for possibly two years (Mundorff, 1970).
During	1960's	Mr. A.L. McDonald obtained a mineral lease from the state of Utah on Sec. 16, T27N, R9W, and staked claims on adjacent

		federal land to extract and mine opal.
December	1967	Mr. A. L. McDonald, (a Union Pacific engineer and resident of Milford) and Dr. E.V. Davie, a Milford physician, joined together to drill an 80' deep hole in Mr. McDonald's main opal pit and encountered boiling water.
December	1967	Mr. A. L. McDonald and Dr. E. Davie jointly drilled a second hole in the same area to a depth of 165'. The hole was plugged and abandoned after encountering hot water which flashed to steam.
April	1968	Dr. E. Davie re-entered the second hole and drilled to a depth of about 270'. Hot water (270°F) in the well flashed to steam and it took nearly two months to plug and abandon the well.
May	1968	Mr. A. L. McDonald applied to drill six geothermal wells on his mining claims.
May 5	1969	Mr. A. L. McDonald applied for the geothermal rights and other minerals (potassium) on his mining claims. This application led the U.S. government to eventually designate Sections 3, 4, 9, 10, 15, and 16 in T27S, R9W, and Sections 34 and 35 in T26S, R9W, as first "KGRA" (Known Geothermal Resource Area).
October	1970	Mr. McDonald's application rejected.
December 26	1970	"Steam Act" went into effect.
June 26	1971	Mr. McDonald planned for 120 acres (40 acres applicable to federal land).
	1971	The Roosevelt area was designated as KGRA.
January	1972	Dr. E. Davie organized Thermal Power Company of Utah.
Summer	1972	Carol Peterson, University of Utah, initiated geologic mapping project of the Roosevelt Hot Springs thermal area as Master's thesis and supported project by UG&MS Report completed in Fall, 1975 (Vol. 2, No. 2).
Mid	1973	Dr. E. Davie and Jack Von Hoene joined together to form the DAVON Company.
Summer	1973	Thermal Power Company drilled a number of temperature gradient holes in the Roosevelt Hot Springs KGRA.
		Getty Oil Co. was high bidder on a 3 square mile federal tract in southern part of Roosevelt Hot Springs KGRA.
		Mr. A. L. McDonald exercised his grandfather's rights on a 40 acre tract of federal land near the center of the Roosevelt Hot Springs KGRA.
Mid	1974	University of Utah Department of Geology and Geophysics began detailed geological, geophysical, and geochemical studies of the Roosevelt Hot Springs thermal area. These studies continue at the present time. Funding has been by grants from National Science Foundation (NSF), Energy Research and Development Administration (ERDA), and Department of Energy/Division of Geothermal Energy (DOE/DGE).
June	1976	Electrical Survey by Senturion Science.
July	1976	Geotronics performed electrical survey for Getty Oil Co.
September	1976	Thermal Power Co. spudded Utah State #14-2.

Forrest

October	1975	Thermal Power Co. spudded Utah State #72-16.
June - Aug.	1977	Geothermal Power Corp. drilled 15 temperature gradient holes in the Roosevelt area.
June	1977	Getty Oil Co. submitted a plan of operations to drill up to eight + 7500' deep geothermal wells.
July	1977	City of Bountiful purchased Mr. A. L. McDonald's 40-acre tract. (For $125,000.)
November	1977	Thermal Power Co. spudded Utah State #24-36.
February	1978	Getty Oil Co. spudded R.H.S.U. #52-21.
April	1978	Getty Oil Co. ran a second electrical survey.
July	1978	Geothermal Power Corp. spudded Observation Hole GPC #15.
August 29	1978	Colorado School of Mines performed electrical and seismic surveys.
November	1978	Thermogenics spudded Observation Hole #5, located about 2 miles south of Roosevelt Hot Springs Unit's southern boundary line.
December	1978	Thermogenics spudded Observation Hole #9, about 3 miles south of the southern R.H.S.U. boundary.
Late	1978	Earth Science Lab/University of Utah Research Institute initiated their research and reports.
Jan. - Feb.	1979	Beaver County Commission attended hearings at State Capitol for Power Development Interest at R.H.S.U.
March	1979	McCulloch Geothermal Inc. spudded deep test, Acord #1-26, about 1.7 miles west of R.H.S.U.'s western boundary.
April 30	1979	Thermal Power Co. flow tested Utah State #14-2 for a period of five days.

TABLE B

HISTORY OF DEVELOPMENT
ROOSEVELT HOT SPRINGS THERMAL AREA, UTAH
BY PHILLIPS PETROLEUM COMPANY

Late	1972	Literature Survey and Field Reconnaissance
February	1973	Reconnaissance Geochemical Survey
March	1973	Gravity Survey
May	1973	Geochemical Survey (Continuing)
June	1973	Bipole-Dipole Survey
June	1973	Groundnoise Survey
July	1973	Temperature Gradient Survey (Continuing)
October	1973	Magnetotelluric Survey
July 30	1974	Competitive Lease Sale (+ 18,871 acres; cost $798,860)
October	1974	Leases Issued
December	1974	Reflection Seismic Survey
February	1975	Spudded Observation Hole #2
March	1975	Spudded Observation Hole #1
March	1975	Spudded Roosevelt KGRA #9-1
April	1975	Ground Level Magnetic Survey
April	1975	Discovery well #3-1
May	1975	Magnetotelluric Survey
June	1975	Petrologic Studies
July	1975	Spudded Roosevelt KGRA #54-3
August	1975	Spudded Roosevelt KGRA #12-35
October	1975	Spudded Roosevelt KGRA #13-10
November	1975	Spudded Roosevelt KGRA #82-33
December 29	1975	Submitted proposed plan

		of operations to drill 16 deep test wells on federal leases at Roosevelt KGRA
January	1976	Water Observation System
February	1976	Magnetotelluric Survey
February	1976	Most Significant Flow Test (#54-3)
March	1976	Isotopic Studies
April	1976	Unit Approved (Unitization of Roosevelt KGRA)
April	1976	Water Application Hearing
April	1976	Flow Tested #13-10
May	1976	Helium Survey
August	1976	Spudded Roosevelt Hot Springs Unit #25-15
October	1976	Microearthquake and Groundnoise Surveys
October	1976	Spontaneous Potential Survey
October 22	1976	Submitted proposed plan to drill 6 deep test wells on federal leases at Roosevelt Hot Springs Unit
November	1976	High Resolution Seismic Survey
December	1976	Landsat Imagery Study
February	1977	Spudded Observation Hole #4
March	1977	Spudded Observation Hole #5
April	1977	Spudded Observation Hole #3
August	1977	Five Air quality Monitoring Stations set up; also, Phillips' upgrading of baseline water survey
August	1977	Initiated construction of 1.4 mile reinjection pipeline
October	1977	Started one-year environmental baseline study by Woodward-Clyde Consultants with support from the Environmental Monitoring and Support Laboratory at Las Vegas and of the Environmental Protection Agency and the University of Utah.
October	1977	Flow Test - Reinjection Operation (Flowed from #54-3, reinjected into #82-33. Test lasted 236 days.)
October	1977	Phillips granted permission to Hydrothermal Power Co. and Jet Propulsion Laboratory for the construction and active operation of a 1 megawatt unit at Phillips Pad Site #54-3
November	1977	Reseeding program of all Phillips pad sites except #54-3 and #82-33
July	1978	Spudded Observation Hole #8
September	1978	Spudded Observation Hole #7
October	1978	Three-day operation (October 13, 14, 15) for removal of calcite scale by workover rig on well #54-3
June	1979	Initiated the second long-term Flow - Reinjection Test. A damaged lower massive valve aborted the test.
August	1979	Flow Test - Reinjection operation (flowed from #54-3, reinjected into #82-33). Test lasted 88 days.
November	1979	Phillips Petroleum Company, Thermal Power, Amax, O'Brien agreed to develop the Roosevelt Hot Springs geothermal reservoir.
May	1980	Phillips Petroleum Co. and Utah Power and Light Co. agreed to a 90-day negotiation period to seek a contract agreement for commercial development of the Roosevelt Hot Springs Unit thermal area.

REFERENCES

Lee, W. T., 1908, Water Resources of Beaver Valley, Utah, U.S.G.S. Water Supply Paper 217, p. 57.

Mundorff, J. C., 1970, Major Thermal Springs of Utah: Utah Geol. and Min. Survey Water Resources Bulletin #13, p. 60.

Petersen, C. A., 1975, Geology of the Roosevelt Hot Springs area, Beaver County, Utah: Utah Geology, v. 2, no. 2, p. 109-116.

OFR
UT/RHS/TPC-1

14-2 file
Production & Reservoir Data
OFR Jan 22-23, 1978

THERMAL POWER COMPANY

Geothermal Well: Utah State 14-2 ML-27536
Roosevelt Field, Beaver County, Utah

48-Hour Flow Test, November 16, 1976 to November 18, 1976

CONTENTS

Jacob M. Rudisill
November 24th, 1976

DESCRIPTION OF TEST

Agnew and Sweet arrived on site at 2330 hrs. 11/15/76. They were rigged up and ready to run Pressure-Temperature survey at 0130 hr. 11/16. Pressure tool used was for 4000 psi maximum (normal pressured conditions): temperature tool was for 60°F to 600°F service. 12 hr. clocks for the 20 ft./min. survey were pre-zeroed and calibrated. Survey was completed at ∿ 0730 hrs. as scheduled without incident. Pressure clock stopped at 4900', 1796 psig. Temperature survey was completed (see Appendix for data).

Phillips personnel (Cecil Clements and Lee Peiffer) arrived at ∿ 0830 hrs. and began setting up pressure regulator air supply and miscellaneous. Clark Howard arrived at 0930 hrs. and began building up southwest side of sump to provide enough volume for 48-hour test. Roustabouts placed tarp on west side of sump opposite pipe mouth to prevent bank erosion. Tarp was held by dirt and stakes. Barbed wire fence was moved behind tarp.

Well opened at 1120 hrs. 11/16 to ∿ 15% open. Pressure regulator was about ∿ 50% open at 1144 hrs. when seals on pressure regulator began to leak. Well shut-in, regulator flanges tightend, well re-opened at 1155 hrs. Well fully opened at 1245 hrs., without incident. Tarp uprooted from stakes on inner side of sump, blown over barb wire behind it, and torn.

At 1400 hrs. 11/16 the #2 WKM 10" valve's pop-off pressure relief valve's port began to make water through relief hole (1/8" diameter). Flow diminished during test (only a few drops/minute at most) due to lower wellhead pressures and chemical deposits plugging the hole.*

Al Truesdale of the USGS and Dr. Stan Ward took water and steam samples for oxygen isotopes, radon, CH_4, H_2S, CO_2, etc. starting at 1430 hrs., ending at 1700 hrs., 11/16/76.

Upon my arrival at site at 0830 hrs., 11/17/76, streams of condensate were running down sump bank and across Section 2 into Section 3. Howard Construction was called and on the scene at 1230 hrs. Dirt moving started at 1300 hrs. to (1) shore up the WNW side of sump, which was eroded badly, and (2) form a drainage ditch to divert most of the condensate to the road leading to Well 54-3's sump, and thus minimize erosion of Federal land. Dirt moving completed at 1700 hrs., and successful.

*Sug Roberts said this phenomenon is entirely normal.

SUMMARY

The well surveys for Pressure and Temperature as well as the 48-hour flow test proceeded without major incident to successful conclusions. A rock throttled flow during the last nine (9) hours of the test, but managed only to change some specific values of enthalpy, and not the overall test results.

The average mass flow $\dot{m}p$ during the stabilized time of flow (1400 hrs. 11/16 to 0100 hrs. 11/18) was 495,000 lbm./hr. as calculated according to P.P. Co.'s methods. (Correcting for a misplaced pressure tap might bring that figure down to $\dot{m}_T$ = 483,000.) Average enthalpy during that time was 444.5 BTU/lbm. which would produce at 70 psig about 17.8% flash, or 88,300 lbm./hr. of 70 psig steam. This would be roughly enough steam to generate 4.5MW of electricity at a heat rate of 19,620 lbm./hr.MW.

Thermometer was broken at ∿ 0900 hrs., 11/17/76, replaced for 1300 hrs. reading. Temperature data from 0700-1200 hrs. consequently unrecorded.

I personally remained on site from 2000 hrs. to the test's end at 1130 hrs., 11/18/76 to (1) insure sump did not overfill, causing spillage onto Section 3, and (2) periodically inspect backside of sump to shut-off test should erosion be too great. Test was completed with almost one (1) foot of sump depth margin.

Agnew and Sweet began rigging up for a repeat P-T survey, 20 ft./min. at 1020 hrs., 11/18/76. Rigging up was completed at 1130 hrs., well was shut-in, and survey commenced. Obstruction was encountered at 130 feet, preventing entry into wellbore. Obstruction was overcome; consequently, the decision was made to survey from bottom to top. Obstruction encountered at 4387' - not overcome. Surveyed out of hole. P&T surveys both good from 4387'. Ran back in hole with sinker bar and knocked out obstructions at 4400' and on to T.D.

Ran back in hole with P-T instruments and one (1) section sinker bar, surveying going down. Obstruction encountered at 4870'. Survey stopped; tool worked. Obstruction overcome, tool lowered to T.D. (6084'). Surveyed out of hole to 4800', tripped back to surface. Wellhead restored to original 3/32" bleed line at 0400 hrs. Surveys read from 0430 hrs. to 0800 hrs., 11/19/76. Agnew and Sweet released at 0830 hrs.

The afternoon of 11/19/76 was spent (1-hr.) with Charles Marris of Phillips doing one (1) example of data reduction.

SPECIAL COMMENTS ON ROCK-THROTTLING AND SURGING

During the preliminary 2-hour clean-out flow test (10/29/76) of Well 14-2, quite a bit of surging of the flow at the pipe's end was noted, even when the Fisher globe-valve pressure regualtor was 90% open. I conjectured then that this surging appeared to be caused by flashing occurring upstream of the lip of the pipe (where the flow reverts from flow pressure to atmospheric). The 48-hour flow test has confirmed this conjecture by two means:

1. 14-2 surged until the Fisher pressure regulator was opened >90% to 100% open. That little bit of reduction in the pressure drop prevented the pre-lip flashing from becoming large enough to surge, and 14-2 flowed fairly uniformly until 0145 hrs. at 11/18/76.

2. At 0145 hrs., 11/18/76 14-2 made a large rock which became lodged in the pressure regulator. This obstruction throttled the flow, causing increases in wellhead pressure and temperature and a decrease in measured enthalpy (and thus ↓ in flow rate). Additionally, the well began to surge again due to the pressure loss caused by the throttling. (See time graphs.)

From these two (2) occurrences I feel confident that the well surges when flow obstructions cause major in-pipe flashing.

Flow Rate

$$G_T = \frac{10{,}450}{y0.063} \cdot \frac{p0.96}{h\ 1.102} \quad \text{if } y \leq 0.3 \text{ or } G_p = 11{,}400 \cdot \frac{p0.96}{h\ 1.102} \text{ if } y = 0.25$$

since G = lbm./ft.^{2} sec, $\dot{m} = \frac{\pi}{4} \left(\frac{dc}{12}\right)^2 \cdot 3600 \cdot G$ lbm./hr.

here, $d_c = 8.0"$

(1a.) $\dot{m}_T = 13{,}968{,}8{,}899.23 \cdot \frac{p0.96}{h\ 1.102}$ (1b.) $\dot{m}_p = 14{,}325{,}662.50 \frac{p0.96}{h\ 1.102}$

$$\dot{m}_T \cdot 1{,}0255 = \dot{m}_p$$

Enthalpy Determination

From James' "Metering of Steam-Water Two-Phase Flow by Sharp-Edged Orifices", Institute of M. E. Proceedings 1965-1966, Volume 180 Part 1, p. 563

$$\text{Eq (15)} \quad h_o^{1.102} = 1450 \frac{P_c^{0.96}}{Y_{TP}} \left(\frac{dc}{dm}\right)^2 \sqrt{1-B^4} \times \frac{\sqrt{\frac{(h_o-h_p)^{1.5}}{L}(\nu_g-\nu_f)+(\nu_f)}}{\emptyset_{TP}} \quad (2)$$

P_c = critical lip pressure (psia)

Y_{TP} = Expansion factor for two-phase flow, from Fig. 14, p. 565

D = diameter of pipe in orifice

d_c = diameter (in) where critical flow occurs

d_m = diameter (in) of metering orifice

B = $dm/\emptyset D$

h_o = specific stagnation enthalpy (Btu/lbm.)

h_p = specific enthalpy of saturated liquid (Btu/lbm.)

L = specific latent heat (Btu/lbm.) defined by State

νg = specific volume of dry saturated vapor (ft.^{3}/lbm.)

νf = specific volume of saturated liquid (ft.^{3}/lbm.)

$\emptyset_{TP}$ = Meter differential, mmH_g under water.

Constants and Conversion Factors

$D = 10.02"$

$d_c = 8.00"$

$d_m = 7.5"$

$\therefore B = \frac{d_m}{D} = \frac{7.5}{10.02} = 0.7485 \Rightarrow B^2 = 0.5603,\ B^4 = 0.3139$

Reduction of Meter Data

There are two readings on the meter: Downstream pressure R_D
Differential pressure R_Δ

Downstream Pressure $= P_D = R_D^2 \times 10$ in psig (3)

Differential Pressure $= P_\Delta = R_\Delta^2 \times 6.966$ in inches of H_2O (4)

since 13.61" H_2O = 1" of H_g = 25.4 mmH_g
1 psi = 51.71 mmH_g

then P_Δ (in H_2O) $\times \frac{25.4\ mmHg}{13.61\ in\ H_2O} = \emptyset_{TP}$ (mmH_g)

Substituting Eq(4) $R_\Delta^2 \times \frac{6.966}{13.61} \times 2.54 = \emptyset_{TP}$

$$\boxed{\emptyset_{TP} = 13.0005 \cdot R_\Delta^2\ mmH_g} \quad (5)$$

To determine Y_{TP}, P_1 is needed

Upstream Pressure $= P_1 = R_D^2 \times 10 + \emptyset_{TP} + Patm$ (6)

$$P_1 = R_D^2 \times 10 + \frac{13.005}{51.71} \times R_\Delta^2 + Patm$$

$$P_1 = R_D^2 \times 10 + 0.25141 \times R_\Delta^2 + Patm$$

Patm = (Barometric Pressure - elevation correction) conversion.

Airport is located at 5040 ft. (within 30').

Wellsite is located at 6240 ft.

Correction 0.875" H_g per 1000' ft. elevation at 5000-6000' range.

$$\text{Patm} = (\text{Barometric Pressure} - (6240\text{-}5040') \cdot \frac{0.875 \text{ in.}}{1000 \text{ ft.}} \times \frac{1 \text{ psi}}{2.036 \text{ in } H_g}$$

$$\text{Patm} = (\text{BP} - 1.05") \frac{1}{2.036} \text{ psia} \qquad (7)$$

Thus one has

$$\boxed{P_1 = R_D^2 \times 10 + 0.25141 R_\Delta^2 + \text{Patm} \quad \text{psia}} \qquad (8)$$

where Patm is defined by E_q (7)

Similarly

$$\boxed{P = P_L + \text{Patm}} \qquad (9)$$

The remaining variables in E_q (2) are determined by the State properties of water at P_1, and calculations on Figure 14, p. 565.

For Y_{TP}, $\frac{\phi_{TP}}{55.8 \times P_1} \times 100 = \text{abs.}$

$$B = 0.56$$

To get % flash at 82 psia (70 psig), E_q (10) is employed.

$$\% \text{ flash} = \frac{h_o - h_f \text{ @ 82 psia}}{h_{fg} \text{ @ 82 psia}} \times 100 = \frac{h_o - 283.98 \times 100}{900.1} \qquad (10)$$

Example Calculation @ 0100 hrs., 11/17/76

Data: $R_\Delta = 4.95$ $T = 362$ BP = 25.34

$R_D = 3.8$ $P_L = 20.25$ psig

Reduction

From Eq (7)

$$Patm = (.25.34" - 1.05") \frac{1}{2.036} = 11.930 \text{ psia}$$

$$\emptyset_{TP} = 318.55" \text{ Hg}$$

From Eq (8)

$$P_i = \frac{(3.8)^2}{144.4} \times 10 + 0.25141 \times (4.95)^2 + 11.930 + 6.1602$$

$P_i = 162.49$ psia ←←←← this sets the State for h_o calculation.

On Fig. 14, $\frac{\emptyset_{TP}}{55.8} \cdot 162.49 \times 100 = \text{absica} = 3.513$, $B^2 = 0.56$ $Y_{TP} = 0.97$

From Eq (9)

$P = P_L + Pam = 20.5 + 11.93 = 32.43$ psia $= P$

From Eq (2)

$$h_o^{1.102} = \frac{1450\ (32.43)}{0.97\ \sqrt{318.55}}^{0.96} \left(\frac{8.0}{7.5}\right)^2 \sqrt{1-0.3139}\ \sqrt{\ }$$

$$h_o^{1.102} = 2227.24\ \sqrt{f(h_o)}$$

From $P_1 = 162.5$ psia, and K&K tables

$\nu g = 2.794$ ft.^{3}/lbm.
$\nu f = 0.018168$ ft.^{3}/lbm.
$h_p = 337.48$ Btu/lbm.
$L = 858.7$ Btu/lbm.

Now perform converging - approximation - solution for h_o

Guess $h_o = 475$ Btu/lbm.

$$(475)^{1.102} \stackrel{?}{=} 2227.24 \sqrt{\frac{(475-337.48)^{1.5}\ (2.794-0.01868)+.018168}{858.7}}$$

$890.7 \stackrel{?}{=} 986.225$ NO

Guess h_o = 442, seeking $\Delta \sim 0$, ($|\Delta| \leq 0.1$ is convergence criteria)

$$\Delta = 2227.24 \sqrt{f(442)} - (442)^{1.102}$$

$$\Delta = 1.2167$$

h_o = 442.4, = 0.005

So h_o = 442.4 Btu/lbm.

Substituting into Eqs (1)

$\dot{m}_P$ = 490,800 lbm./hr.

$\dot{m}_T$ = 479,000 lbm./hr.

@ 0100 hrs., 11/17/76

h_o = 442.4 Btu/lbm.
corresponding to saturated fluids @

To get % flash at 82 psia (70 psig), E_q (10) is employed

$$\% = \frac{442.4-283.98}{900.1} \times 100 = \underline{17.6\%}$$

JMR/tti-11/24/76

CALCULATION TABLES

Day	Time Hrs.	P_L psig	R_D	R_Δ	BP "H_g	Patm psia	ϕ_{TP} mmH_g R_7	P_i psia	Ab	Y_{rp} R_o	P psia R_2	h_f Btu/lbm. R_3	L Btu/lbm. R_4	ν_g lbm./ft.^{2} R_5	ν_f lbm./ft.^{3} R_6
11/16	1205	13.2	5.6	2.3	25.270	11.90	68.77	326.83	.377	.997	25.1	414.9	790.3	1.2667	0.019198
	1215	20.2	5.4	3.0	"		117.00	305.76	.686	.990	32.1	396.0	808.07	1.5160	0.018923
	1230	24.5	4.6	4.25	"		234.82	228.04	1.85	.985	36.4	367.6	833.4	2.0169	0.018539
	1245	25.75	4.1	5.4	"		379.09	187.33	3.63	.965	37.65	349.79	848.6	2.4384	0.018315
	1300	23.3	4.0	5.2	"		351.53	178.70	3.53	.970	35.2	345.65	852.02	2.5512	0.018265
	1315	22.4	3.9	5.05	"		331.55	170.41	3.49	.970	34.3	341.54	855.42	2.6699	0.018216
	1330	22.2	3.9	"	"		"	170.41	3.49	.970	34.1	"	"	"	"
	1345	22.05	3.9	"	"		"	170.41	3.49	.970	33.95	"	"	"	"
	1400	21.80	3.9	"	"		"	170.41	3.49	.970	33.70	"	"	"	"
	1500	21.53	3.9	5.0	"		325.01	170.29	3.42	.971	33.43	"	"	"	"
	1600	21.42	3.9	"	"		"	170.29	3.42	.971	33.32	"	"	"	"
	1700	21.28	3.85	"	"		"	166.41	3.50	.970	33.18	339.50	857.04	2.7316	0.018191
	1800	21.13	3.85	"	"		"	166.41	3.50	.970	33.03	"	"	"	"
	1900	20.82	3.85	4.95	25.30	11.91	318.54	166.30	3.43	.971	32.73	"	"	"	"
	2000	20.7	3.83	"	"		"	164.76	3.46	.970	32.61	338.59	857.81	2.7598	0.018181
	2100	20.45	3.81	4.90	"		312.14	163.92	3.41	.971	32.36	339.29	857.2	2.770	0.018177
	2200	20.65	3.83	"	"		"	164.64	3.40	.971	32.56	338.49	857.78	2.7598	0.018181
	2300	20.8	3.82	4.95	25.34	11.93	318.54	164.01	3.48	.970	32.73	339.29	857.2	2.770	0.018177
	2400	20.5	3.82	4.9	"		312.14	163.89	3.41	.971	32.43	"	"	"	"
11/17	0100	20.5	3.80	4.95	"		318.54	162.49	3.51	.97	32.43	337.47	858.7	2.7942	0.018168
	0200	20.45	3.80	4.95	"		318.54	162.49	3.51	.97	32.38	"	"	"	"
	0300	20.55	3.80	4.95	"		318.54	162.49	3.51	.97	32.48	"	"	"	"
	0400	20.6	3.80	4.95	"		318.54	162.49	3.51	.97	32.53	"	"	"	"
	0500	20.6	3.80	4.90	"		312.14	162.37	3.51	.97	32.53	337.41	858.75	2.7961	0.018167
	0600	20.58	3.80	4.90	"		312.14	162.37	3.51	.97	32.51	"	"	"	"
	0700	20.60	3.75	4.95	"		318.54	158.72	3.60	.969	32.53	335.48	860.38	2.8578	0.018144
	0900	21.10	3.80	4.95	25.33	11.93	318.54	162.49	3.51	.97	33.03	337.47	858.7	2.7942	0.018168
	1100	21.54	3.90	5.04	25.28	11.90	330.23	170.39	3.47	.97	33.44	341.54	855.42	2.6699	0.018216

CALCULATION TABLES

Day	Time Hr.	PL psig	R_D	R_Δ	BP "Hg	Patm psia	ϕ_{TP} mmHg R_7	P_i psia	Ytp R_o	P psia R_2	hf Btu/lbm. R_3	L Btu/lbm. R_4	vg lbm./ft.³ R_5	vf lbm./ft.³ R_6
11/17	1300	21.65	3.9	5.05	25.28	11.89	331.55	170.40	.97 3.49	33.54	341.54	855.42	2.6699	0.018216
	1500	21.35	3.85	5.05	25.23	11.88	331.55	166.52	.968 3.57	33.23	339.50	857.04	2.7316	0.018191
	1700	21.42	3.85	5.05	25.21	11.87	331.55	166.51	.968 3.56	33.29	"	"	"	"
	1900	21.2	3.85	5.05	25.21	11.87	331.55	166.51	.968 3.56	33.07	"	"	"	"
	2100	21.3	3.85	5.0	25.20	11.86	325.01	166.39	.968 3.57	33.16	"	"	"	"
	2300	20.96	3.85	5.0	25.18	11.85	325.01	166.38	.968 3.57	32.81	"	"	"	"
11/18 →	0100 rock	21.2	3.85	5.0	25.17	11.85	325.01	166.38	.968 3.57	33.05	"	"	"	"
	0300	20.75	4.05	4.35	25.15	11.84	246	180.62	.976 2.44	32.59	346.59	851.25	2.5249	0.018277
	0500	20.15	4.05	4.3	25.14	11.83	240.38	180.50	.977 2.39	31.98	345.53	851.30	2.5265	0.018276
	0700	20.45	4.05	4.25	25.13	11.83	234.82	180.40	.977 2.33	32.28	346.48	851.34	2.5278	0.018275
	0900	20.40	4.0	4.2	25.15	11.84	229.33	176.27	.977 2.33	32.24	344.46	852.99	2.5852	0.018251
	1100	20.30	3.9	4.3	25.11	11.82	240.38	168.57	.975 2.56	32.12	340.61	856.17	2.6982	0.018205

VALUE TABLE

14-2

ROUNDED TO NEAREST 100

Day	Time (hrs.)	h_o (Btu/lbm.)	lip press. P (psia)	% flash @82 psia	$\dot{m}_p$ (lbm./hr.)	$\dot{m}_T$ (lbm./hr.)	Steam @70 psig based on $\dot{m}_p$
11/16	1205	507.1	25.1	24.8	330,200	322,000	81.9
	1215	471.0	32.1	20.8	453,600	442,300	94.3
	1230	457.9	36.4	19.3	528,000	514,800	101.9
	1245	460.2	37.65	19.6	542,400	528,800	106.3
	1300	457.6	35.2	19.3	511,600	498,900	98.7
	1315	444.7	34.3	17.9	515,000	502,200	92.2
	1330	446.2	34.1	18.0	510,200	497,500	91.8
	1345	447.3	33.95	18.1	506,700	494,100	91.7
	1400	449.3	33.70	18.4	500,700	488,200	92.1
	1500	449.0	33.43	18.3	497,200	484,800	91.0
	1600	449.8	33.32	18.4	494,600	482,300	91.0
	1700	444.9	33.18	17.9	498,600	486,200	89.3
	1800	446.05	33.03	18.0	495,000	482,700	89.1
	1900	446.0	32.73	18.0	490,800	478,600	88.3
	2000	444.1	32.61	17.8	491,400	479,100	87.5
	2100	444.2	32.36	17.8	487,600	475,500	86.8
	2200	441.85	32.56	17.5	493,400	481,100	86.4
	2300	443.75	32.73	17.8	493,500	481,200	87.8
	2400	443.65	32.43	17.7	489,300	477,100	86.6
11/17	0100	442.4	32.43	17.6	490,800	478,600	86.4
	0200	442.8	32.38	17.6	489,600	477,500	86.2
	0300	442.0	32.48	17.6	492,000	479,800	86.6

VALUE TABLES

ROUNDED TO NEAREST 100

Day	Time	h_o (Btu/lbm.)	lip press. P (psia)	% flash @82 psia	$\dot{m}p$ (lbm./hr.)	$\dot{m}_T$ (lbm./hr.)	Steam @ 70 psig based on $\dot{m}p$
11/17	0400	441.6	32.53	17.5	493,300	481,000	86.3
	0500	438.75	32.53	17.2	496,800	484,400	85.5
	0600	438.9	32.51	17.2	496,300	484,000	85.4
	0700	435.8	32.53	16.9	500,500	488,000	84.6
	0900	437.75	33.03	17.1	505,400	492,800	86.4
	1100	450.8	33.44	18.5	495,100	482,800	91.6
	1300	450.6	33.54	18.5	496,800	484,400	91.9
	1500	446.6	33.23	18.1	497,200	484,900	90.0
	1700	446.15	33.29	18.0	498,700	486,200	89.8
	1900	447.9	33.07	18.2	493,400	481,100	89.8
	2100	444.45	33.16	17.8	498,900	486,500	88.8
	2300	447.25	32.81	18.1	490,500	478,200	88.8
11/18 →	0100 rock	445.3	33.05	17.9	496,300	483,900	88.8
	0300	434.85	32.59	16.8	502,600	490,100	84.4
	0500	436.4	31.98	16.9	491,600	479,400	83.1
	0700	431.7	32.28	16.4	502,000	489,500	82.3
	0900	424.7	32.24	15.6	510,500	497,800	79.6
40 days pts	1100	420.85	32.12	15.2	513,800	501,000	78.1

Average Values

During the stabilized period (from 1400 hrs., 11/16/76 to 0100 hrs., 11/18/76)

$\bar{\dot{m}}_p$ = 495,000 lbm./hr. [s = 4,100, n = 27]

$\bar{\dot{s}team}_p$ = 88,300 lbm./hr. (weighted average) at 70 psig flash [s = 2,150, n = 27]

$\bar{h}_o$ = 444.5 Btu/lbm. [s = 3.9, n = 27]

$\bar{\%}$ flash = 17.8% at 70 psig

During the period of rock-throttled flow (0100 hrs., 11/18/76 to 1130 hrs., 11/18/76)

$\bar{\dot{m}}_p$ = 504,100 lbm./hr. [s = 8,600, n = 5]

$\bar{\dot{s}team}_p$ = 81,500 lbm./hr. [s = 2,600, n = 5]

$\bar{h}_o$ = 429.7 Btu/lbm. [s = 6.68, n = 5]

% flash at 70 psig = 16.2%

Company: FERMAL POWER Lease: UTAH STATE Well No. 1-2

25# BELLOWS 1000 PSI SPRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE W.H. Psig	WORKING PRESSURE L.P. Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-16-76									Bar. Pressure				
11 20	PM				( )²x10	( )²x6.966							Start Flow
11 40													Shut in to repair leaks
11 55													Start Flow
12 05		340	13.2	414	5.6	2.3			25,270				
12 15		308	20.2	412	5.4	3							Increase flow
12 30		248	24.5	391	4.6	4.25							" "
12 45		200	25.75	373	4.1	5.4							" " Wide Open
1 00		185	23.3	368	4.0	5.2							
1 15		181	22.4	366	3.9	5.05							
1 30		180	22.2	365	3.9	5.05							
1 45		180	22.05	364	3.9	5.05							
2:00		178	21.80	365	3.9	5.05							
3:00		177	21.55	364	3.9	5.0							PINHOLE IN POP BODY 2ND VALVE
4:00		176	21.42	364	3.9	5.0							
5:00		175	21.28	363	3.85	5.0							
6:00		175	21.13	363	3.85	5.0							

PAGE NO. 2

Company [illegible]rmal Power Lease Utah State 2 Well No. 14-2

25# Bellows \ 1000# SPRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE W H Psig	WORKING PRESSURE L P Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-16-76									Bar. Pressure (Airport)				
6:00	PM	175	21.13	363	3.85	5.0							
7:00		175	20.82	363	3.85	4.95							
8:00		173	20.7	362	3.83	4.95							
9:00		173	20.45	362	3.81	4.9							
10:00		175	20.65	362	3.83	4.9							
11:00		175	20.8	362	3.82	4.95			25.34				
12:00		176	20.5	362	3.82	4.9			25.34				
1:00		173	20.5	362	3.8	4.95			25.34				
2:00		174	20.45	362	3.8	4.95			25.34				
3:00		174	20.55	362	3.8	4.95			25.34				
4		174	20.6	362	3.8	4.95			25.34				
5:00		174	20.6	362	3.8	4.9			25.34				
6:00		175	20.58	362	3.8	4.9			25.34				
7:00		174	20.60	363	3.75	4.95			25.34				
9:00		176	21.10	—	3.8	4.95							THERMOMETER BROKEN

18123

Company Z RMAL POWER Lease UTAH STATE Well No. 1 [illegible]

25 # BELLOWS 1000 # SPRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE WH Psig	WORKING PRESSURE ΔP Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-17-76									Barometric Pressure	(Airport			
9:00 AM		176	21.10	—	3.8	4.95							THERMOMETER BROKEN
11:00 AM		178	21.54	—	3.9	5.04			25.33				
1:00 P		179	21.65	365	3.9	5.05			25.28				
3:00		176	21.35	365	3.85	5.05			25.23				
5:00		178	21.42	365	3.85	5.05			25.21				
7 [illegible]		178	21.2	364	3.85	5.05			25.21				
9 [illegible]		178	21.3	364	3.85	5.0			25.20				
11 [illegible]		176	20.96	364	3.85	5.0			25.18				
1 [illegible]		176	21.2	364	3.85	5.0			25.17				
3 [illegible]		191	20.75	371	4.05	4.35							
5 [illegible]		189	20.15	370	4.05	4.3			25.14				
7 [illegible]		189	20.45	370	4.05	4.25			25.13				
9:00		187	20.40	370	4.0	4.2			25.15				
11:00		188	20.30	370	3.9	4.3			25.11				SHUT IN AT 11:30 AM

19/23

Production Specialists

AGNEW and SWEET
3914 Gilmore Avenue
Bakersfield, California 93308
24-Hour Phone: 327-2267

SUBSURFACE SURVEY

Field Work Sheet

PRE-FLOW

OWNER Thermal Power FIELD Roosevelt WELL NAME 14-2

CASING ELEV. DATE: 11-15-76

LINER DESCRIPTION: ZERO POINT

DEPTH

TUBING DETAIL: ZONE

PUMP SHOE GAS ANCHOR INTAKE

PURPOSE

REMARKS:

ELEMENT 90-660 SERIAL NO. 10008 CLOCK 12 hr 15 TURN

ENGAGE STYLUS DISENGAGE STYLUS

OBS. TBG. PRESS. OBS. CSG. PRESS.

COR. TBG. PRESS. COR. CSG. PRESS.

PICKUP @ TIME ON BOTTOM: MAX. °F

WELL STATUS

SHUT IN: ON PRODUCTION:

STABILIZATION PERIOD

GROSS OIL RATE B/D

NET OIL RATE B/D

FORMATION GAS MCF/D

GOR CFT/BBL.

CIRCULATED GAS MCF/D

OIL DRY GRAVITY °API

BEAN SIZE

TIME	DEPTH	DEFL.	P—T	GRAD.	/D	TIME	DEPTH	DEFL.	P—T	GRAD.	/D	TIME	DEPTH	DEFL.	P—T	GRAD.	/D
	0	.003	91°				2500	1.084	418°				5000	1.333	486°		
	100	.003	91°				2600	1.095	421°				5100	1.334	486°		
	200	.003	91°				2700	1.098	422°				5200	1.335	487°		
	300	.003	91°				2800	1102	423°				5300	1.336	487°		
	400	.003	91°				2900	1.106	424°				5400	1.337	487°		
	500	.003	91°				3000	1.112	426°				5500	1.339	488°		
	600	.003	91°				3100	1.118	427°				5600	1.343	489°		
	700	.050	106°				3200	1.124	429°				5700	1.347	490°		
	800	.345	198°				3300	1.136	432°				5800	1.359	493°		
	900	.369	205°				3400	1.145	435°				5900	1.369	496°		
	1000	.440	227°				3500	1.150	436°				6000	1.403	505°		
	1100	.470	236°				3600	1.156	438°				6091	1443	516°		
	1200	.524	253°				3700	1164	440°								
	1300	.563	265°				3800	1.275	470°								
	1400	599	276°				3900	1.297	476°								
	1500	.653	292°				4000	1.311	480°								
	1600	.705	308°				4100	1.318	482°								
	1700	.735	317°				4200	1.319	482°								
	1800	.778	330°				4300	1.321	483°								
	1900	840	349°				4400	1.322	483°								
	2000	.908	369°				4500	1.324	484°								
	2100	.955	383°				4600	1.326	484°								
	2200	1.002	396°				4700	1.327	484°								
	2300	1.034	404°				4800	1.330	485°								
	2400	1.065	413°				4900	1.331	485°								

COMMENTS:

1796 lbs. at 4900'.
Clock stopped.

BY:

POST-FLOW

Temp. Profile 20'/min., Element: 90-660, Serial #10008, 12hr. clock, 15 turn

Depth	Temp.
0	90°
100	280°
200	302°
300	310°
400	282°
500	237°
600	354°
700	364°
800	372°
900	384°
1000	393°
1100	404°
1200	421°
1300	437°
1400	443°
1500	447°
1600	450°
1700	451°
1800	456°
1900	459°
2000	463°
2100	468°
2200	472°
2300	475°
2400	480°
2500	486°
2600	500°
2700	500°
2800	499°
2900	497°
3000	496°
3100	496°
3200	495°
3300	496°
3400	496°
3500	496°
3600	496°
3700	496°
3800	496°
3900	496°
4000	496°
4100	496°
4200	496°
4300	496°
4400	496°
4500	496°
4600	496°
4700	496°
4800	496°
4900	496°
5000	497°
5100	498°
5200	498°
5300	499°
5400	501°
5500	502°
5600	504°
5700	505°
5800	513°
5900	
6000	519.4°
6084	

Depth	Press. (Psi)
0	85
500	204
1000	423
1500	629
2000	885
2500	1174
3000	1390
3500	1531
4000	1695
4500	1829
4800	1851
5000	1963 → 2083.3
5500	2143
6000	2386
6084	2401

HP-25 Program Form

JACOB (JAKE) M. RUDISILL

Title Enthalpy determination from orifice measurements

Switch to PRGM mode, press [f] [PRGM], then key in the program.

DISPLAY LINE	DISPLAY CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00			h_o	h_o			
01		STO 1	STO 1				
02		1	1				
03		.	.				
04		3	3				
05		6	6				
06		6	6				
07		5	5				
08			4231				
09			EEX 3				
10			R2				
11			-				
12			9				
13			6				
14			X				
15			Y^x times				
16			R0				
17			÷				
18			R7				
19			√				
20			÷				
21			R1				
22			R3				
23			-				
24			R4				
25			÷				
26			1.5				
27			Y^x				
28			1/x				
29			R5				
30			-				
31			X				
32			R6				
33			+				
34			√				
35			X times				
36			R4				
37			1				
38			.				
39			1				
40			0				
41			2				
42			Y^x				
43			-				
44			GO TO				
45							
46							
47							
48							
49							

REGISTERS	
R_0	T_{rp}
R_1	h_o
R_2	ρ (liq)
R_3	h_f
R_4	L
R_5	v_g
R_6	v_f
R_7	θ_{rp}

} at P_1

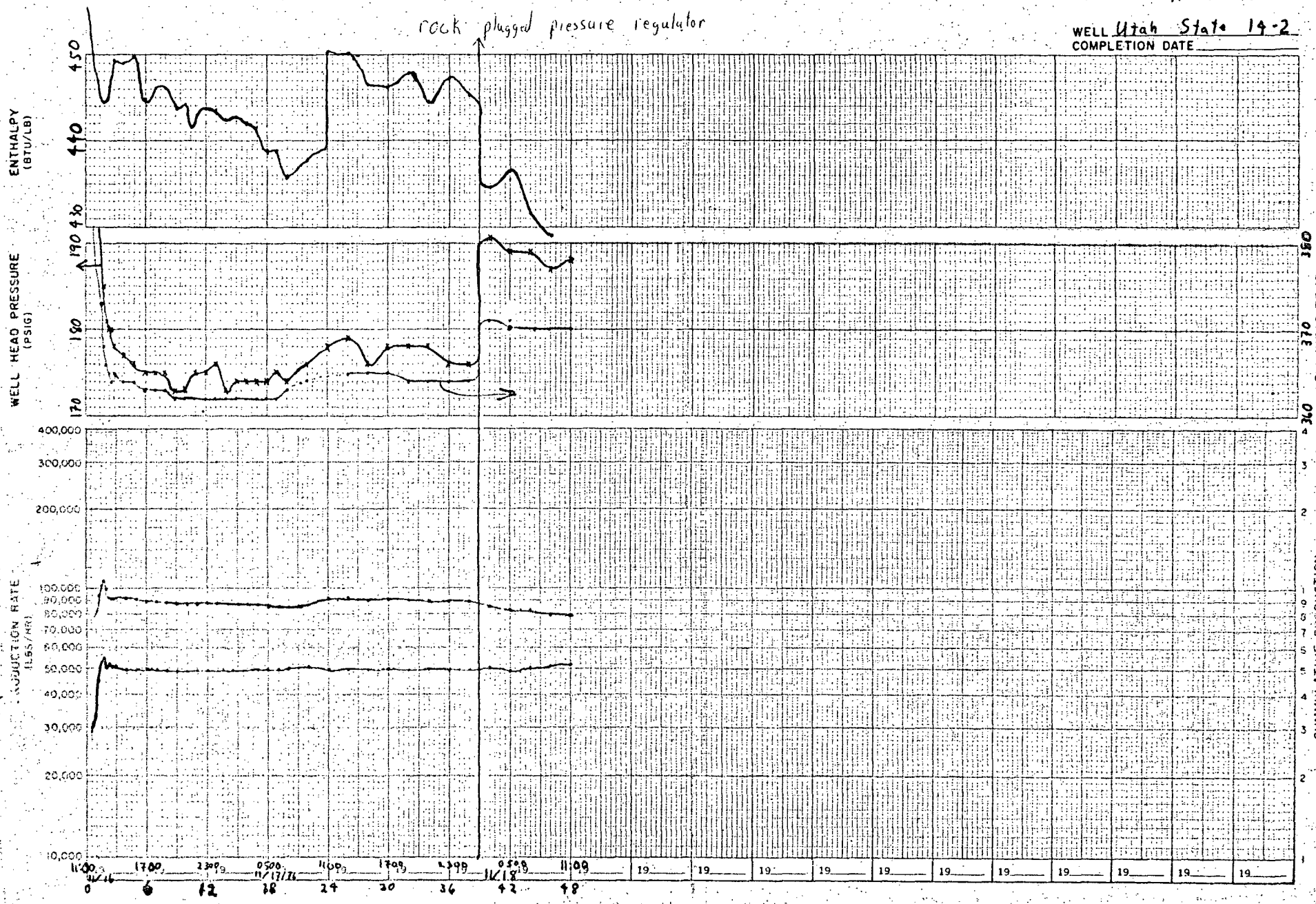
if h_o is too high, $\Delta > 0$
too low, $\Delta < 0$

$|\Delta| \leq 0.1$ is convergence criteria.

JACOB (JAKE) M. RUDISILL
11/23/76

rock plugged pressure regulator

WELL Utah State 14-2
COMPLETION DATE



OFR
UT/RHS/TPC-2

72-16 file 2

OFR Jan 22-29 1978

THERMAL POWER COMPANY

Geothermal Well: Utah State 72-16 ML-25128
Roosevelt Field, Beaver County, Utah

24-Hour Flow Test, April 4, 1977 - April 6, 1977

CONTENTS

14.66 / 55.8 / 4.2856 / 1200 / .001

SUMMARY

Test

The pre-test safety checks of the wellhead proved to be of great value. Only minor leaks (a seal pot and a flange) were incurred.

Even with two reserve pits only one day's worth of production could be stored. An injection well would be required for long term testing of this well.

The instruments and control valves of the pipeline operated satisfactorily.

Well Production Capacity

The well's flow rate failed to stabilize. Wellhead pressure and flow rate dropped throughout a 16-hour portion of the test while the valve opening was constant. The total mass flow rate as measured by James' method was 1,309,000 lbm./hr. @ T_w = 416°F, P_w = 294 psia @ 800 hrs. on 4/5/77. A Pressure versus Flow Rate plot suggests the well's maximum production rate to be in excess of 1.4×10^6 lbm./hr. A longer flow period is required to determine the significance of the decline - whether it shall continue to depletion or stabilization.

Measurements

The James' method of determining the flow rate of a two-phase flow continues to be less than satisfactory. Separation of steam and water would provide sorely needed, accurate production data and provide a standard against which the James' method might be quantified or improved.

Improved reservoir information is dependent on longer flow tests.

Utah State 72-16

TEST DESCRIPTION

April 3, 1977

1500 hrs.: AAA welding arrived at location and checked the annulus and kill-line valves, the kill-line, and the bolts on the wellhead as per their checklist. The other duties on the checklist had been performed only two days previously and were not repeated. The pipeline was repressured and checked for leaks. It was then unpressured via the ball valve. The 12" wing valve was audibly leaking and was shut with a 36" wrench.

April 4, 1977

0730 hrs.: Pressure, temperature and flow measurement devices were installed.

0900 hrs.: Well ready to be opened. Waited for WKM personnel (Sug Roberts) to arrive.

0930 hrs.: 12" wing valve opened and line pressured.

0945 hrs.: 8" ball valve opened to indicated 25% opening.

0947 hrs.: Differential pressure meter engaged in order to monitor flow rate. Well surging because of throttling across ball valve.

0955 hrs.: Water started dripping from annulus pipe.

1000 hrs.: Took water sample.

1004 hrs.: Opened 8" ball valve to 50% indicated opening.

1025 hrs.: Opened 8" ball valve to 75% indicated opening.

1029 hrs.: Throttled well back by closing ball valve to 50% indicated opening because of excessive vibration of meter run and wellhead. Sent for railroad ties to chock pipe @ meter run and at 45° angle at wellhead.

April 4, 1977 cont'd

1100 hrs.: Opened ball valve to 70% indicated opening after line chocked.

1115 hrs.: Opened ball valve to 75% indicated opening.

1130 hrs.: Closed ball valvue to 60% indicated opening momentarily. Re-opened almost immediately back to 75% indicated opening.

1145 hrs.: Opened ball valve to 80% indicated opening.

1215 hrs.: Broke and replaced thermometer.

1600 hrs.: H_2O sample grabbed. Opened ball valve to 87% indicated opening because of decreases in lip and differential pressure readings.

1800 hrs.: USGS (Al Truesdale) arrived to gather water and steam samples.

2200 hrs.: H_2O sample grabbed.

2230 hrs.: USGS finished sampling.

April 5, 1977

0200 hrs.: H_2O sample gathered. Winds shifted from East to light Southerly. Sump condition tenuous.

0500 hrs.: About 4' capacity remaining in Sump #2.

0600 hrs.: H_2O sample grabbed.

0829 hrs.: 8" ball valve started leaking at seal flanges. Shut-in well via wing valve and tightened ball valve flange with hammer wrench. Opened 12" wing balve completely, 8" ball valve to 25% indicated opening. Sump #2 filled to within 1-foot of bottom of culvert, so decision made to have Agnew and Sweet Production Specialists (A&S) set-up for build-up pressure run immediately.

0845 hrs.: USGS arrived to begin second sampling.

ADDITION TO TEST DESCRIPTION

4.5.77

0823 hrs.:	Well cut back to 0.17×10^6 lbm./hr. - for 2 min.
0825 hrs.:	Shut-in completely - for 5 min.
0830 hrs.:	Turned on to 0.17×10^6 lbm./hr. - for 25 min.
0855 hrs.:	Shut-in for 20 min.
0915 hrs.:	Re-opened to 170,000 lbm./hr. for 65 min.
1020 hrs.:	Shut-in.

Totals for	0823 - 1020 hrs.
Shut-in	170,000 lbm./hr.
25 min.	1 hr. 32 min.

April 5, 1977

0855 hrs.: Seal pot @ Location 1 developed leak. Well shut-in at master valve to weld seal pot.

0915 hrs.: Well re-opened to 25% indicated opening.

1020 hrs.: Well shut-in. Wellhead pressure 350 psig. Sump water ≈ 87°F. A&S immediately started "feeler" run with sinker bar and maximum reading thermometer (MRT).

1027 hrs.: Sinker bar on bottom @ 1248'.

1035 hrs.: Retrieved sinker bar and MRT. MRT reading 467°F.

1100 hrs.: Dual 0-1600 pressure tools with a second MRT made up on wireline.

1113 hrs.: Tools hung 1-foot off bottom @ 1247'. 7.5" orifice inspected and found bowed 1/32" from complete flatness. Silica deposits on bottom of orifice suggest separated flow with water flowing on bottom of pipe and steam and gas above occurring at some time during test. This flow regime probably occurred during high pressure, low flow rate conditions. The 12" wing valve had a slight leak.

April 6, 1977

1130 hrs.: A&S retrieved all tools. MRT and one pressure instrument failed. One more MRT survey was run, yielding a temperature of 456°F (note that this is 24-hours after flow had ended!).

1300 hrs.: A&S released after doing a field reduction of the one good instrument's data. 12" valve shut tightly with 36" cheater.

April 7, 1977

12" valve leaking once again, so no decision made to have repaired.

Stainless steel sampler at Location 1 inspected and found to have no signs of abrasions or impact.

DATA REDUCTION METHODS

From James' "Metering of Steam-Water Two-Phase Flow By Sharp-Edged Orifices," Institute of Mechanical Engineering Proceedings 1965-1966, Volume 180, Part 1.

Nomenclature

b_p = state at back pressure.

D = diameter of pipe in meter run (inches).

d_c = diameter of pipe where critical flow occurs (inches).

d_m = diameter of primary metering device, or in this case, the orifice (inches).

G = mass velocity (lbm./ft.^{2} sec.).

h_f = specific enthalpy of saturated liquid (BTU/lbm.).

h_{fbp} = specific enthalpy of saturated liquid at a given back pressure (BTU/lbm.).

h_{fgbp} = specific enthalpy of vaporization at a given back pressure (BTU/lbm.).

h_o = specific stagnation enthalpy (BTU/lbm.).

$L=h_{fg}$ = specific latent heat defined by state of flow by P_o. (BTU/lbm.).

m = mass flow rate (lbm./hr.).

Patm = atmospheric pressure (psia).

P_c = critical lip pressure (psia). $P_c = P_L$ + Patm.

P_L = critical lip pressure (psig).

P_o = line pressure upstream of orifice (psia) $P_o = R^2 \times 5$ + Patm.

R = static pressure reading upstream of orifice (red).

ΔR = differential pressure reading across orifice (blue).

ν_f = specific volume of saturated liquid @ P_o (ft.^{3}/lbm.).

ν_g = specific volume of saturated vapor @ P_o (ft.^{3}/lbm.).

y = centerline distance of ¼" npt tap from discharge pipe lip.

Y_{TP} = expansion factor for two-phase flow from Figure 14.

β = d_m/D.

$\emptyset_{TP}$ = meter differential (mmHg).

Conversion Factors and Equations

$P_o = R^2 \times 5 + Patm$ (1)

$\emptyset_{TP} = (\Delta R)^2 \times 15.5145$ (2)

$\emptyset_{TP}$ in psid $= (\Delta R)^2 \times 0.3$

Patm is corrected from the barometric pressure from the Milford airport to that at the well's location.

Flow Rate Determination

$$G = 10450 \div y^{0.063} \times P_c^{0.96} \div h_o^{1.102} \quad \text{if } y \leq 0.3 \text{ in.} \tag{3}$$

$$\dot{m} = \tau \div 4 \left(\frac{dc}{12}\right)^2 \times 3600 \times G \tag{4}$$

$$\dot{m} = \tau \div 4 \left(\frac{dc}{12}\right)^2 \times 3600 \times 10450 \div y^{0.063} \times P_c^{0.96} \div h_o^{1.102}$$

$$\dot{m} = 205{,}185.27 \frac{dc^2}{y^{0.063}} \times \frac{P_c^{0.96}}{h_o^{1.102}} \tag{5}$$

$\dot{m}_{1/4"} = 1.013\dot{m}$ ($\dot{m}_{1/4}$ used on Utah State 14-2 test)

Enthalpy Determination

$$h_o^{1.102} = 1450 \frac{P_c^{0.96}}{Y_{TP}} \left(\frac{dc}{dm}\right)^2 \sqrt{1-B^4} \sqrt{\frac{\left(\frac{h_o - h_f}{L}\right)^{1.5} (\nu g - \nu f) + \nu f}{\emptyset_{TP}}} \tag{6}$$

From Eq. (6), squaring both sides, and gathering terms,

$$h_o^{2.204} = (1450)^2 \frac{P_c^{1.92}}{Y_{TP}^2} \left(\frac{dc}{dm}\right)^4 (1-B^4) \frac{\left[\left(\frac{h_o - h_f}{L}\right)^{1.5} (\nu g - \nu f) + \nu f\right]}{\emptyset_{TP}}$$

$$\frac{h_o^{2.204} \cdot Y_{TP}^2 \times \emptyset_{TP}}{(1450)^2 P_c^{1.92} \left(\frac{dc}{dm}\right)^4 (1-B^4)} = \left(\frac{h_o - h_f}{L}\right)^{1.5} (\nu g - \nu f) + \nu f$$

Flow Rate Determination

$$h_o^{2.204}\left[\frac{Y_{TP}^2\,\phi_{TP}\,dm^4}{1450\,P_c^{1.92}\,d_c^4\,(1-B^4)\,(\nu g-\nu f)}\right]-\left(\frac{h_o-h_f}{L}\right)^{1.5}-\frac{\nu f}{\nu g-\nu f}=0 \quad (7)$$

$$\text{let } A=\frac{Y_{TP}\,\phi_{TP}\,dm^4}{1450\,P_c^{1.92}\,dc^4\,(1-B^4)\,(\nu g-\nu f)} \quad (8)$$

$$C=\frac{\nu f}{\nu g-\nu f} \quad (9)$$

Then Eq. (7) becomes:

$$f(h_o)=A\,h_o^{2.204}-\left(\frac{h_o-h_f}{L}\right)^{1.5}-C=0 \quad (10)$$

$$\text{and } f^1(h_o)=2.204\,A\,h_o^{1.204}-\frac{1.5\,(h_o-hf)^{0.5}}{L^{1.5}} \quad (11)$$

Applying the Newton-Raphson method for solving the roots of the equation (10), $f=\phi(h_o)$,

$$\delta nrl=\frac{f(h_o^n)}{f'(h_o^n)}, \qquad h_o(n+1)=h_o^n+\delta^{ntl}$$

and the computer stops when $\delta^{ntl}\leq\varepsilon$, ε being a predetermined accuracy for h_o.

A computer program complete with appropriate logic to provide the necessary exits was thus designed to solve for h_o. Once h_o was found, the mass flow ($\dot{m}$) was calculated through equation (5). Then percent flash proportions for back pressures of 70, 80 and 125 psig were calculated through the equation.

$$\%\ \text{flash}=100\times\frac{h_o-h_{fbp}}{h_{fgbp}} \quad (12)$$

Variable Assignments

A = COF1

C = un *

D = D

d_c = DC

d_m = DM

G = un

h_p = HF

L = HFG

$\dot{m}$ = MF

Patm = un

P_c = PC

% flash @ 70 psig = PF70

% flash @ 80 psig = PF80

% flash @ 125 psig = PF125

P_L = un

P_o = PO

R = un

ΔR = un

ν_p = UF

ν_g = UG

Y = Y

Y_{TP} = YTP

ϕ_{TP} = PHI

B = un

E = EPSI

δ = DEL

Patm, Po, ϕ_{TP}, ν_f, ν_g, h_f, and hfg must be hand calculated for this program. See the example problem that follows.

* = Unused.

SAMPLE CALCULATION

Data

For this particular test, the physical parameters were:

D = 10.02"

dc = 7.625"

dm = 7.500" ± 0.0001"

y = 5/16"

At 0800 hrs. on April 5, 1977, the following data was gathered:

R = 7.30	T_1 = 414°F	P_2 = 211 psig	BP = 25.180" Hg
ΔR = 9.57	P_W = 282 psig	T_2 = 391°F	P_L = 95.6 psig
P_1 = 266 psig	T_W = 416°F		

Patm = (25.180 - 0.73) ÷ 0.4911 = 12.01 psia = Patm

0.73 is a correction for altitude from the airport to the site.

0.4911 converts "of H_g to psia.

From Eq. (1) $P_o = (7.30)^2 \times 5 + 12.01 = 266.5 + 12.01 =$ 278.5 psia = P_o

From Eq. (2) $\phi_{TP} = (9.57)^2 \times 15.5145 =$ 1420.9 $mmH_g = \phi_{TP}$ (27.5 psid)

Since P_o, and using the Steam Tables generated by the USGS for this particular brine:

ν_g = 1.6608 $ft.^3/lbm.$ h_f = 381.4 BTU/lbm.

ν_f = 0.018794 $ft.^3/lbm.$ h_g = 813.9 BTU/lbm.

From Figure 14 in James' paper, the line for the value of the expansion factor Y_{TP} for $B^2 = 0.56$ follows the equation:

$$Y_{TP} = 1 - .01555 \frac{(\phi_{TP})}{P_o}$$

so $Y_{TP} = 1 - .01555 \frac{(1420.9)}{278.5} =$ 0.921 = Y_{TP}

$P_C = P_L + Patm = 95.6 + 12.01 =$ 107.61 psia = P_C

Inputting the date, time, ϕ_{TP}, Y_{TP}, P_o, P_c, νf, νg, h_r and hfg into the program yields:

4/5 800 hours

h_o = 467.4 BTU/lbm.

T_w = 416°F, P_w = 294 psia — saturation P for Rat T

$\dot{m}$ = 1,309,000 lbm./hr. + 15%

which, when flashed at 80 psig, would yield 263,100 lbm./hr. of steam, or roughly enough steam to sprovide 12.5MW of electrical generation capacity at a heat rate of 21,000 lbm./steam MW.

DISCUSSION OF TEST RESULTS

Flow Rate

From Graph 1, it is apparent that a gradual throttling up of flow rate was performed during the first three hours. A slow decline during the flowing four hours caused the well to be opened up slightly more at 1600 hours. From 1600 hours to 0830 hours the following day the throttle was not disturbed. During that time flow rate fell from about $1.35 \times 10^6 \pm 15\%$ lbm./hr. to about $1.31 \times 10^3 \pm 15\%$ lbm./hr., or a decline of 3%. This decline is highlighted in Graph 2. The 3% decline in mass flow rate, in wellhead pressure, P_W, upstream-of-orifice static pressure, P_o location 1 pressure, P^1, as well as a reduction in calculated h_o are clearly evident. The changes in the calculated values of h_o and $\dot{m}$ could be possibly attributed to many other variable changes had not the pressures declined so uniformly. The decline in flow rate at 2550 lbm./hr., if linearly extrapolated, would indicate that the well's flow would drop from 1.35×10^6 lbm./hr., to zero in only 22 days, with a commensurate drop in wellhead pressure to atmosphere. Of course, this extrapolation should under no circumstances be taken literally. An increase in flow rate and pressure occurred at 0800 hours just before the well was shut-in, and could suggest that a leveling out of the flow rate might have been starting. What the decline does dictate is the absolute necessity of a much longer (> 30 days) flow test to more completely determine the well's production capacity and delineate the characteristics of the reservoir from which it is producing before commitments to generate power are made.

Flow Rate versus Wellhead Pressure

Graph 3 depicts the relationship of $\dot{m}$ as a function of P_W for early times during the test such that the production potential of the reservoir in its initial state is represented. The curve suggests that the well's maximum flow rate would probably be in excess of 1.4×10^6 lbm./hr. $\pm$ 15% as measured by the James method.

The points labeled 1-4 are data points gleaned at later times during the flow test. Disturbingly, they suggest that the curve delineated at the initial time is shifting progressively downward to the left with time, indicative of a decline in the producing capacity of the well.

Measurement Accuracy

Enthalpy (h_o) and Flow Rate ($\dot{m}$)

Enthalpy measurements (h_o) for the time of somewhat stable flow (1600 hrs. to 0830 hrs., or region 8 of Graph 1) varied less than 1% from an average and median value of 469.6 BTU/lbm. However, the temperature of the saturated water in the reservoir (from the pre-test temperature survey and the MRT run immediately after the flow) is only 468°F, which means the water has an enthalpy of only 444.7 BTU/lbm. By the first law of thermodynamics, the water at the surface, regardless of its percentage of flash, cannot have an enthalpy greater than that of the water in the reservoir. (Measurements at Utah State 14-2 indicated a reservoir enthalpy of about 480 BTU/lbm. with a surface enthalpy of 445 BTU/lbm. - a reasonable and rational amount of difference due to losses incurred from the water "pumping" itself several thousand feet to the surface, turbulence, and drag.) This serious descrepancy, then, of the calculated surface enthalpy (h_o) being greater than that associated with the reservoir deserves an exploration of its effects and causes.

First, the 5.5% over-estimate in h_o can have a significant result on the flow rate calculation of total mass and steam. For example if one recalculates the 0800 hrs. flow rate with h_o = 440 BTU/lbm. as opposed to 467.4 BTU/lbm. (a 5.9% decrease in h_o) then the flow rate increases from 1.309×10^6 lbm./hr. to 1.399×10^6 lbm./hr. (a 6.9% increase in $\dot{m}$). However, the substitution of the more accurate value of h_o causes a decrease in the % of flash (for example, from 20.1% to 17.1% at 80 psig). The end result is a significant decrease in the calculated amount of steam producible at a given back pressure (from 263,600 lbm./hr. to 238,700 lbm./hr. in this case, or a 9.5% drop!). Since this is the quantity we look at for power generation purposes, the evaluation of enthalpy becomes important. It causes changes in the calculation of $\dot{m}$ and of % flashes (in the James method) and thus flavors the evaluation of the well.

Essentially, several elements of the testing equipment and operation vary outside of the limits of the method as declared by Russell James. These variances include, in suspected order of degree of effect:

1) The equipment effect that flange taps were used for measuring $\emptyset_{TP}$ as opposed to James' use of vena contracta taps (tap at a diameter upstream, ½ diameter downstream). (This is a result of blindly following again the footsteps of our predecessor in the field, and not setting up precisely as the literature states.) The effect of this misplacement is rather large, causing $\emptyset_{TP}$ and thus h_o to be too large.

2) The operational fact that h_o in this test was calculated with $\emptyset_{TP}$ of over 800mm H_g for most of the test, and of > 1400mm for the entire "decline" period. James' has only measured extensively in the range of $15 < \emptyset_{TP} < 780$ mm H_g. This effect is minor.

In the future, then, larger orifices with D and ½ D taps should be employed when using the James' method in an effort to get a true h_o calculation.

Alternatively, the long learning process for measuring two-phase flow could be avoided by separating the phases and measuring them separately.

Pressure and Temperature on Flow-line

Pressure measurements at the wellhead and lip were very satisfactorily and accurately measured with precision gauges. Needle valves effectively damped flow pulsations. The combination pressure-temperature measurements at the wellhead Location 1, and Location 2 will prove very helpful in determining pressure drop along the pipeline as a function of flow rate, the percentages of flash of the various locations, and even whether significant thermodynamics properties of the fluid are different from those of regular water. For example, a precursory comparison of wellhead pressure and temperature to those for water under the same saturated conditions suggested that the fluid indeed acts differently from pure water. Consequently, a USGS-produced table for the thermodynamic properties of the fluid of Utah State 14-2 was used in reducing the data for Utah State 72-16. Use of the regular Steam Table's values produced $\dot{m}$'s 2% lower than the geothermal fluid's values.

Wellbore Pressure

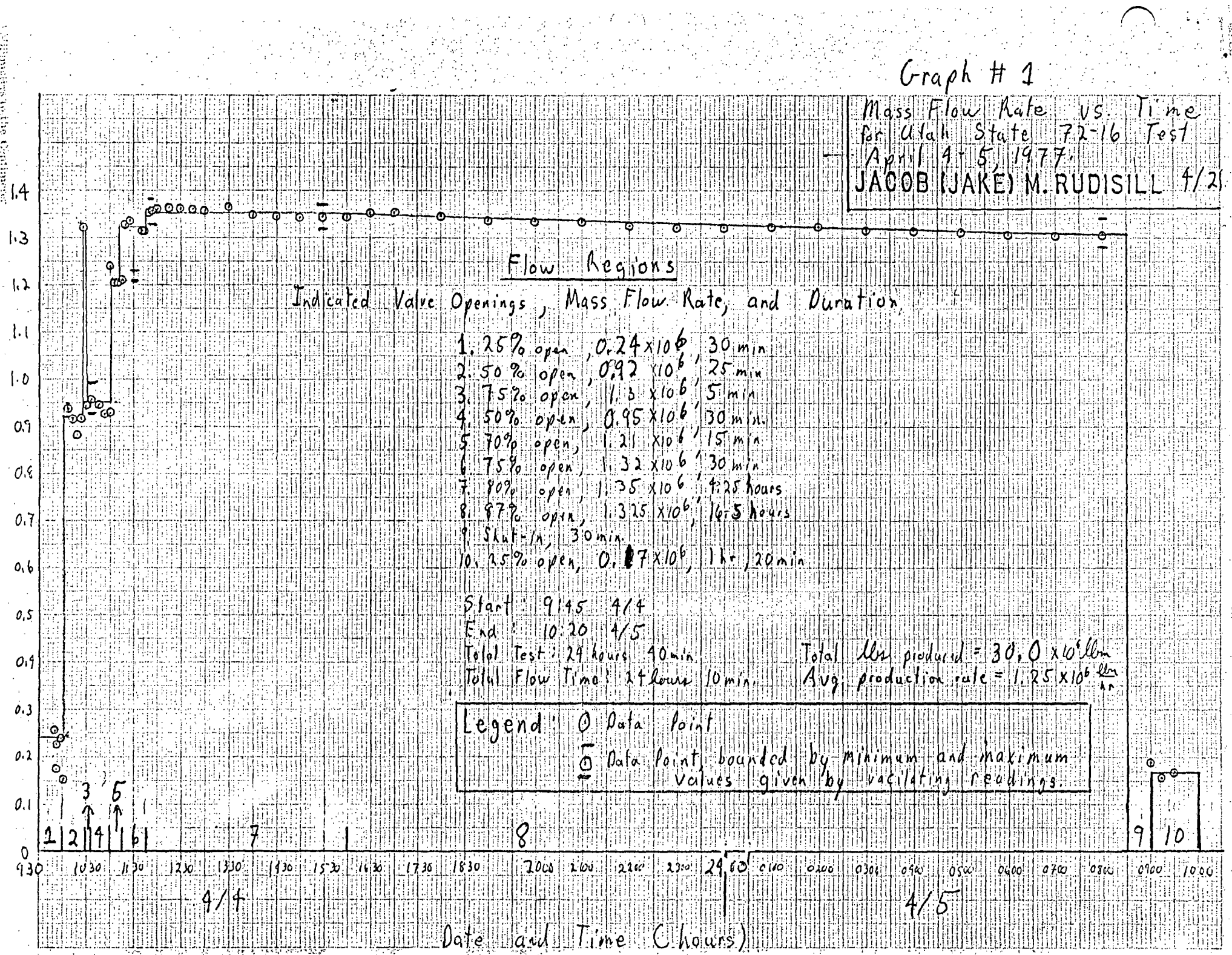
Enough build-up data was probably not gathered due to the desire to check the wellbore for any obstructions with a "feeler" run before lowering the tools. Since no real problems were encountered with obstruction or the well producing any rocks, I suggest future build-up runs to be done as soon after shut-in as possible.

I also suggest we attempt to use another contractor in an effort to get better repeatability in pressure surveys, better tool performance and lower cost.

JRM/tti-4/27/77

Graph # 1

Mass Flow Rate vs. Time
for Utah State 72-16 Test
April 4-5 1977.
JACOB (JAKE) M. RUDISILL 4/21



Flow Regions

Indicated Valve Openings, Mass Flow Rate, and Duration

1. 25% open, 0.24×10^6, 30 min
2. 50% open, 0.92×10^6, 25 min
3. 75% open, 1.3×10^6, 5 min
4. 50% open, 0.95×10^6, 30 min.
5. 70% open, 1.21×10^6, 15 min
6. 75% open, 1.32×10^6, 30 min
7. 80% open, 1.35×10^6, 4.25 hours
8. 87% open, 1.325×10^6, 16.5 hours
9. Shut-in, 30 min.
10. 25% open, 0.17×10^6, 1hr, 20 min

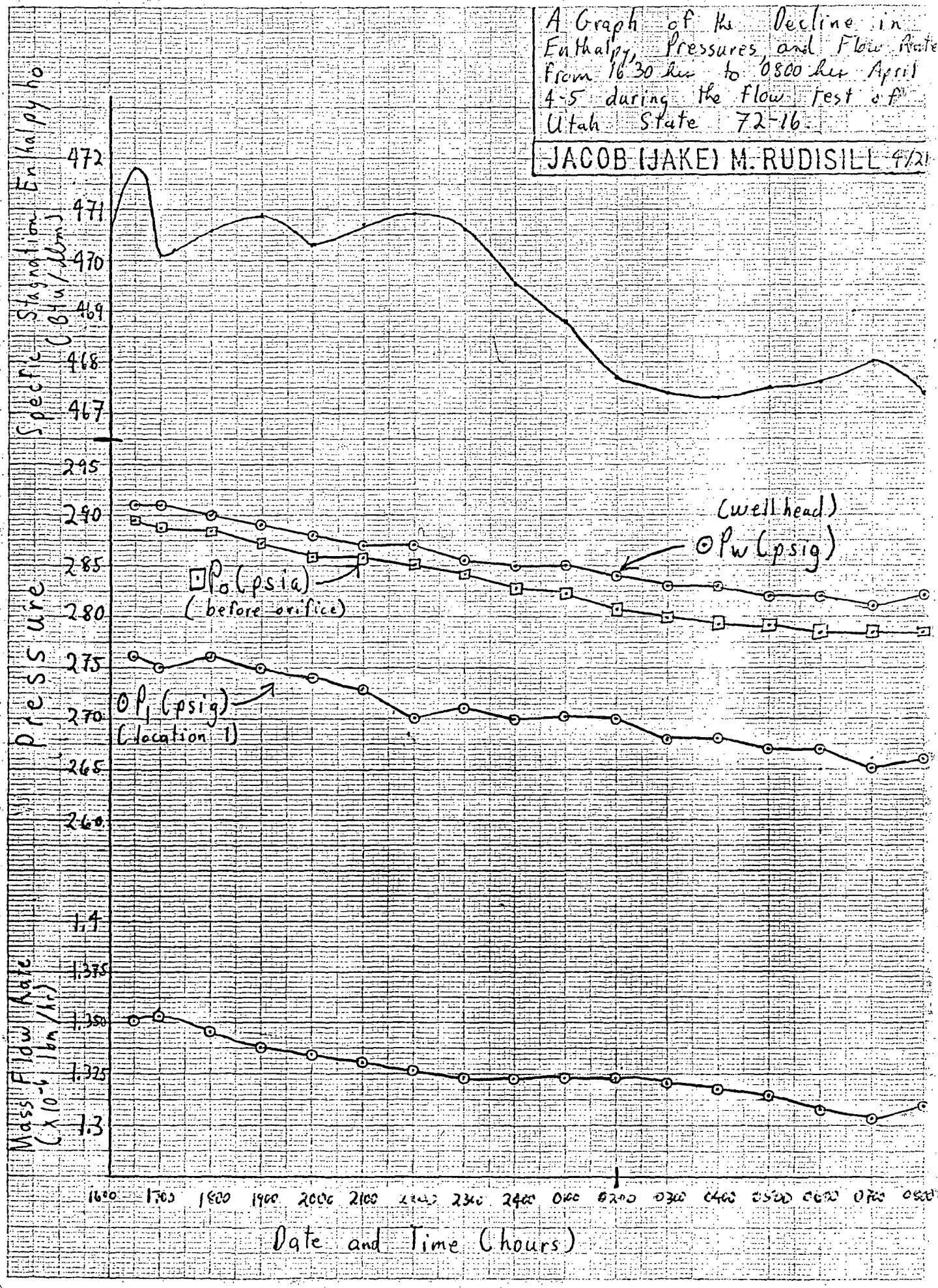
Start: 9145 4/4
End: 10:20 4/5
Total Test: 29 hours 40 min
Total Flow Time: 24 hours 10 min.

Total lbm produced = 30.0×10^6 lbm
Avg. production rate = 1.25×10^6 lbm/hr

Legend: ○ Data point
⊡ Data point, bounded by minimum and maximum values given by vacilating readings.

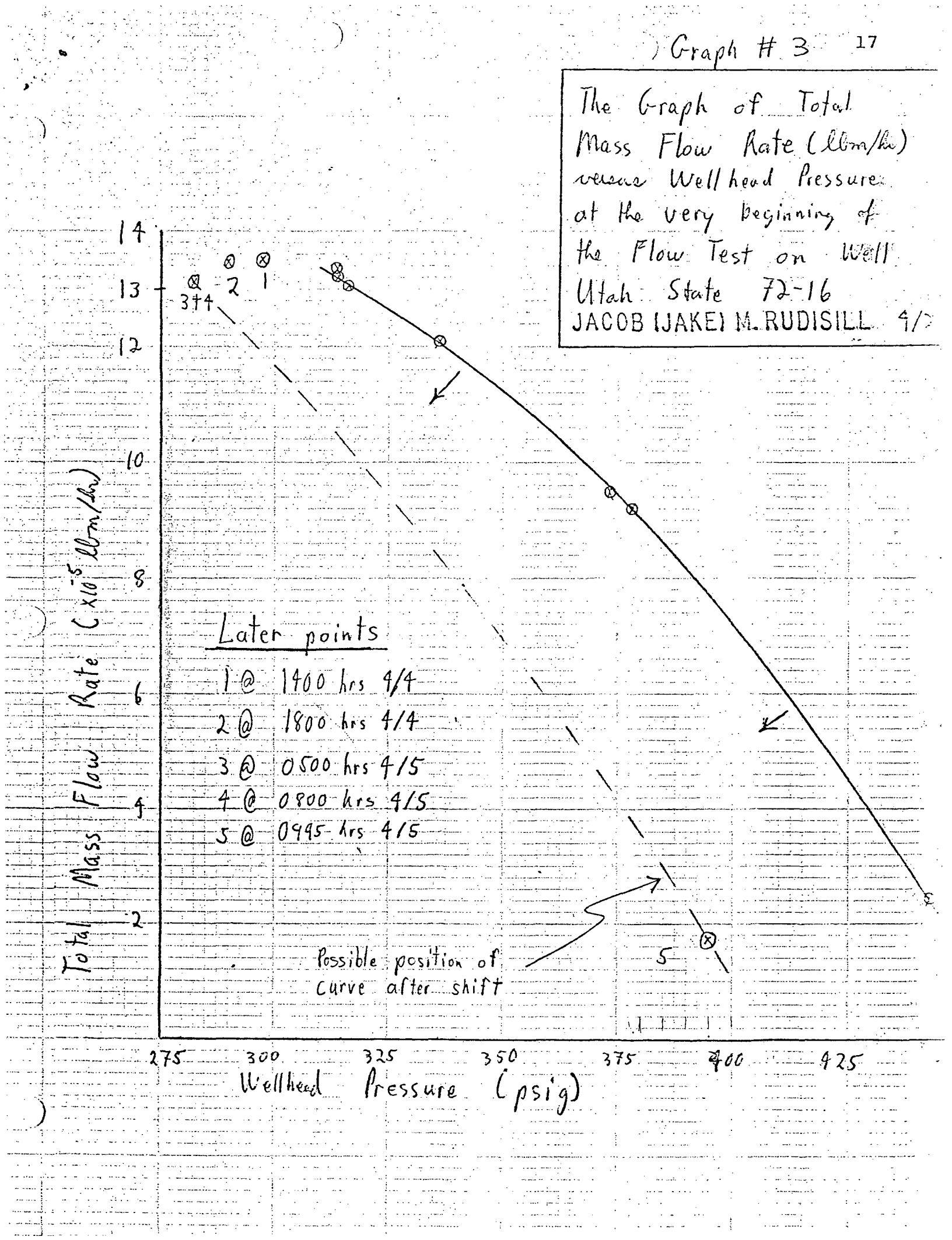
A Graph of the Decline in Enthalpy, Pressures, and Flow Rate From 1630 hrs to 0800 hrs April 4-5 during the Flow Test of Utah State 72-16.

JACOB (JAKE) M. RUDISILL 4/21



Graph # 3

The Graph of Total Mass Flow Rate (lbm/hr) versus Wellhead Pressure at the very beginning of the Flow Test on Well Utah State 72-16
JACOB (JAKE) M. RUDISILL 4/?



Utah State 72-16 24 hour Test 4/4/77 - 4/5/77

$\frac{\phi_{TP} \times 100}{55.8 P_o}$

Day	Time hr	BP in.Hg	P_{atm} psia	P_L psig	R	ΔR	ϕ_{TP} mm.Hg	P_o psia	P_c psig	h_f Btu/lbm	L Btu/lbm	v_g lbm/ft³	v_f lbm/ft³	$\frac{\phi_{TP} \times 100}{55.8 P_o}$	Y_{TP}	Remarks
4/4	0945	25.173	12.00	–	7.05	–	–	260.5	–	–	–	–	–	–	–	Ball valve opened 25%.
	0946	"	"	–	7.05	–	–	260.5	–	–	–	–	–	–	–	
	0947	"	"	–	7.05	–	–	260.5	–	–	–	–	–	–	–	
	0948	"	"	9.0	7.05	–	–	260.5	13.0	–	–	–	–	–	–	Bellows engaged
	0950	"	"	7.5	8.8	1.2	22.3	399.2	19.5	418.4	779.2	1.1644	0.019337	0.10	.999	
	0951	"	"	7.5	9.8	1.5	34.9	399.2	19.5	418.4	779.2	1.1644	0.019337	0.157	.999	
	0953	25.174	12.00	5.0	8.9	1.5	34.9	408.11	17.0	420.9	776.83	1.1391	0.019374	0.153	.999	
	0959	25.174	12.00	7.0	8.95	1.2	22.3	412.5	19.0	422.0	775.7	1.1270	0.019393	0.0969	.999	High
25%	1003	25.175	12.00	2.5	9.0	1.2	22.3	417	14.5	423.2	774.5	1.1148	0.019411	0.096	.999	Low for 0955-1005
	Avg	25.175	12.00	4.75	8.95	1.2	22.3	412.5	16.75	420.9	775.7	1.1270	0.019393	0.097	.999	Avg
	1005	25.175	12.00	60.0	8.8	3.2	158.9	399.2	72.0	418.4	779.2	1.1644	0.019337	0.713	.994	Opened well to 50%
	1007	25.176	12.01	62.0	8.65	4.3	286.9	386.1	74.0	414.8	782.7	1.2038	0.019281	1.33	.988	
50%	1013	25.178	12.01	62.0	8.65	4.5	314.2	386.1	74.0	414.8	782.7	1.2038	0.019281	1.46	.987	Avg figure for 50%
	1017	25.179	12.01	62.0	8.65	4.9	372.5	386.1	74	414.8	782.7	1.2038	0.019281	1.73	.985	High for 1005-1025
	1025	25.179	12.01	62	8.65	4.5	314.2	386.1	74	414.8	782.7	1.2038	0.019281	1.46	.987	
75%	1027	25.179	12.01	98	7.78	8.7	1174.3	314.6	110	393.4	802.9	1.4741	0.018964	6.69	.942	Valve opened to 75%
	1029	25.180	12.01	61	7.8	5.0	387.9	316.2	73	393.9	802.4	1.4668	0.018972	2.20	.981	Valve returned to 50%
50%	1031	25.180	12.01	64	8.60	4.65	335.5	381.8	76	413.6	783.8	1.2173	0.019263	1.58	.986	Well stabilized
	1034	25.181	12.01	65	8.60	4.70	342.7	381.8	77	413.6	783.8	1.2173	0.019263	1.61	.986	Averaged flow
	High		12.01	65	8.67	4.95	380.1	387.9	77	415.3	782.2	1.1982	0.019289	1.76	.985	High
	Low		12.01	65	8.52	4.40	300.4	375	77	411.7	785.7	1.2393	0.019234	1.44	.988	Low
	1046	25.183	12.01	64	8.60	4.65	335.5	381.8	76	413.6	783.8	1.2173	0.019263	1.57	.986	
	1052	25.184	12.01	63	8.60	4.63	332.6	381.8	75	413.6	783.8	1.2173	0.019263	1.56	.986	
	1058	25.185	12.01	63	8.60	4.62	331.1	381.8	75	413.6	783.8	1.2173	0.019263	1.55	.987	Last reading @ 50%.

$15.5145(\Delta R)^2$

$5R^2 + P_{atm}$

$P_L + P_{atm}$

Calculation Table

Utah State 72-16 24 hour test 4/4 - 4/5/77

Day 4/4	Time hr	BP in. Hg	P_{atm} psia	P_L psig	R	ΔR	ϕ_{TP} mm Hg	P_o psia	P_c psig	h_f Btu/lbm	L Btu/lbm	v_g lbm/ft³	v_f lbm/ft³	$\phi_{TP}^{55.8}/100$	Y_{TP}	Remarks
70%	1100	25.185	12.01	90	8.075	7.3	826.8	338	102	400.8	796.0	1.3735	0.019070	4.38	.962	Well opened to 70%
	1105	"	"	88	"	"	826.8	338	100	400.8	796.0	1.3735	0.019070	4.38	.962	
	1108	25.185	12.01	89	8.075	7.3	826.8	338	101	400.8	796.0	1.3735	0.019070	4.38	.962	average flow
	high			90	8.15	7.5	872.7	344.1	102	402.6	794.3	1.3495	0.019097	4.55	.961	for 1100 - 1115
	low			88	8.00	7.1	782.1	332	100	399.0	797.7	1.3971	0.019043	4.22	.963	
	1115	25.184	12.01	88.5	8.075	7.3	826.8	338	100.5	400.8	796.0	1.3735	0.019070	4.38	.962	
75%	1120	25.183	12.01	99.0	7.8	8.8	1201.9	316.2	111	393.9	802.4	1.4668	0.018972	6.8	.941	75% open
	1125	25.183	12.01	98.5	7.7	8.8	1201.9	308.5	110.5	391.5	804.7	1.5026	0.018936	7.0	.939	
	1140	25.182	12.01	97.5	7.8	8.65	1160.8	316.2	109.5	393.9	802.4	1.4668	0.018972	6.6	.943	
	1145	25.181	12.01	97.5	7.8	8.65	1160.8	316.2	109.5	393.9	802.4	1.4668	0.018972	6.6	.943	
80%	1149	25.181	12.01	102	7.60	9.75	1474	300.8	114	389.0	807.0	1.5403	0.018900	8.8	.924	Well opened to 80% after 1145
	1154	25.180	12.01	102	7.59	9.72	1466	300.1	114	388.7	807.2	1.5437	0.018896	8.8	.924	
	1159	25.180	12.01	102	7.59	9.70	1460	300.1	114	388.7	807.2	1.5437	0.018896	8.7	.924	
	1215	25.177	12.01	102	7.58	9.70	1460	299.3	114	388.4	807.4	1.5478	0.018893	8.7	.924	
	high		12.01	102	7.68	9.90	1521	306.9	114	391.0	805.1	1.5105	0.018928	8.9	.923	
	Low		12.01	102	7.50	9.50	1400	293.3	114	388.4	807.4	1.5788	0.018865	8.6	.925	
	1230	25.175	12.00	102	7.58	9.70	1460	299.3	114	388.4	807.4	1.5478	0.018893	8.6	.925	
	1245	25.172	12.00	"	"	"	1460	299.3	114	388.4	807.4	1.5478	0.018893	8.6	.925	
	1300	25.170	12.00	101.7	7.57	9.70	1460	298.5	113.7	388.2	807.7	1.5519	0.018889	8.8	.924	
	1330	25.165	12.00	101.8	7.55	9.67	1451	297	113.8	387.7	808.1	1.5596	0.018882	8.8	.924	
	1400	25.160	12.00	100.5	7.53	9.65	1445	295.5	112.5	387.2	808.6	1.5672	0.018875	8.8	.924	
	1430	25.155	12.00	100.2	7.52	9.65	1445	294.8	112.2	386.9	808.8	1.5709	0.018872	8.8	.924	
	1500	25.150	11.99	99.7	7.52	9.55	1415	294.7	111.7	386.9	808.9	1.5714	0.018872	8.6	.925	

Calculation Table

Day	Time hr	BP in. Hg	P_{atm} psia	P_L psig	R	ΔR	ϕ_{TP} mm Hg	P_o psia	P_c psig	h_f Btu/lbm	L Btu/lbm	v_g lbm/ft³	v_f lbm/ft³	$\sigma_{T_1 55.8}/100$	γ_{TP}	Remarks
4/4																
80%	high		12.00	102	7.68	9.85	1505	306.9	114.0	391.0	805.1	1.5105	0.018928	8.8	.924	T ≈ 12:00
	Low		12.00	102	7.50	9.55	1415	293.2	114	386.4	809.3	1.5793	0.018864	8.6	.925	
	high		11.99	99.7	7.60	9.70	1960	300.8	111.7	389.0	807.0	1.5403	0.018900	8.7	.924	≈ 1530
	Low		11.99	99.7	7.42	9.45	1385	287.3	111.7	384.4	811.1	1.6111	0.018836	8.6	.925	
	1530	25.142	11.99	99.7	7.51	9.62	1406	294	111.7	386.6	809.1	1.5751	0.018868	8.6	.925	
	1600	25.135	11.99	99.5	7.50	9.52	1406	293.2	111.5	386.4	809.3	1.5793	0.018864	8.6	.925	after this reading opened to 87%
87%	1630	25.127	11.98	100.4	7.45	9.76	1478	289.5	112.4	385.1	810.5	1.5990	0.018847	9.1	.921	
	1700	25.120	11.98	100.1	7.44	9.75	1475	288.7	112.1	384.8	810.7	1.6034	0.018843	9.2	.920	
	high		11.98	100.1	7.51	9.90	1520	294	112.1	386.6	809.1	1.5751	0.018868	9.3	.919	
	Low		11.98	100.1	7.36	9.60	1430	282.8	112.1	382.8	812.5	1.6362	0.018814	9.1	.921	
	1800	25.126	11.98	99.6	7.43	9.75	1475	288.0	111.6	384.6	810.9	1.6073	0.018839	9.2	.920	
	1900	25.115	11.98	99.0	7.42	9.73	1469	287.3	111.0	384.4	811.1	1.6111	0.018836	9.2	.920	
	2000	25.120	11.98	98.6	7.40	9.72	1466	285.8	110.6	383.9	811.6	1.6193	0.018829	9.2	.920	
	2100	25.125	11.98	98.4	7.40	9.72	1466	285.8	110.4	383.9	811.6	1.6193	0.018829	9.2	.920	
	2200	25.130	11.98	97.9	7.39	9.71	1463	285.0	109.9	383.6	811.8	1.6237	0.018825	9.2	.920	
	2300	25.130	11.98	97.6	7.38	9.70	1460	284.3	109.6	383.3	812.1	1.6277	0.018822	9.2	.920	
	2400	25.135	11.99	97.2	7.36	9.67	1451	282.8	109.2	382.8	812.5	1.6362	0.018814	9.2	.920	
4/5/77	0100	25.140	11.99	97.1	7.35	9.65	1445	282.1	109.1	382.6	812.7	1.6401	0.018811	9.2	.920	
	0200	25.140	11.99	96.8	7.33	9.63	1439	280.6	108.8	382.1	813.2	1.6486	0.018804	9.2	.920	
	0300	25.135	11.99	96.4	7.32	9.61	1433	279.9	108.4	381.8	813.4	1.6526	0.018801	9.2	.920	
	0400	25.135	11.99	96.1	7.31	9.60	1430	279.2	108.1	381.6	813.6	1.6567	0.018797	9.2	.920	
	0500	25.140	11.99	95.9	7.31	9.59	1427	279.2	107.9	381.6	813.6	1.6567	0.018797	9.2	.920	
	0600	25.145	11.99	95.5	7.30	9.58	1424	278.5	107.5	381.4	813.9	1.6608	0.018794	9.2	.920	

Day	Time hr	BP in. Hg	P_{atm} psia	P_L psig	R	ΔR	$\emptyset_{TP}$ mm Hg	P_o p.s.i.a.	P_c psig	h_f Btu/lbm	L Btu/lbm	v_g lbm/ft³	v_f lbm/ft³	$\rho_{T_1 55.6}$ / 100	Y_{TP}	Remarks
	0700	25.165	12.00	95.3	7.30	9.57	1421	278.5	107.3	381.4	813.9	1.6608	0.018794	9.1	.921	
	0800	25.180	12.01	95.6	7.30	9.57	1421	278.5	107.6	381.4	813.9	1.6608	0.018794	9.1	.921	
	high		12.01	95.6	7.47	9.70	1460	285.8	107.6	383.9	811.6	1.6193	0.018829	9.2	.920	
	Low		12.01	95.6	7.23	9.42	1377	271.2	107.6	378.8	816.2	1.7044	0.018758	9.1	.921	
	0830	—	12.01	—	—	—										Well cut back to 25#
	0900	25.180	12.01	4.5	8.82	1.3	26.22	401.0	16.5	418.9	778.7	1.1592	0.019344	0.12	.999	
	0930		12.01													Closed re-opened well
	0945		12.01	1.75	8.85	1.1	18.77	403.6	13.75	419.7	778.0	1.1518	0.019355	0.08	.999	
	1000	25.185	12.01	1.8	8.85	1.0	15.5	403.6	13.8	419.7	778.0	1.1518	0.019355	0.069	.999	
	1020	—	—	—	—	—	—	—	—	—	—	—	—	—	—	well shut-in
	MRT	read	467°	@	1035	hrs										
	Pressure	tools	hung		@ 1113											

```
OLD:JAMOD

WHAT?
OLD:JAMOD

READY
:L
00010C THIS IS A ROUTINE TO TAKE THE SEMI-REDUCED DATA FROM A TEST OF A GEOTHERMAL WELL BY THE JAMES METHOD AND
00020C THUS DETERMINE THE SPECFIC STAGNATION ENTHALPY,HO, THE TOTAL MASS FLOW,M, AND THE % FLASH OF THE FLOW TO STEAM
00030C AT VARIOUS BACK PRESSURES FOR GIVEN TIMES DURING THE TEST.
00040C
00050C THIS PROGRAM WILL BE MODIFIED TO DO TOTAL DATA REDUCTION IN THE NEAR FUTURE!
00070   COMMON HEAD(16),HO,IDAY,IME,PC,PO,PHI,YTP,HF,HFG,VG,VF,D,DM,DC,H1,EPSI,ADATE(2)
00080   REAL HF,PF70,PF80,PF125
00090   REAL*8 DATAF
00100   FPLAIN(H1)=(COF1*(H1**2.204))-(((H1-HF)/HFG)**1.5)-(VF/(VG-VF))
00110   FPRIME(H1)=(2.204*COF1*(H1**1.204))-((1.5/HFG)*(((H1-HF)/HFG)**0.5))
00130   PRINT 10
00140   10 FORMAT("ENTER THE NAME OF THE DATA FILE TO BE USED")
00150   READ(16,20)DATAF
00160   OPENF(5,DATAF)
00170   20 FORMAT(A6)
00180   READ (5,30)HEADING
00190   30 FORMAT(24A5)
00200   READ(5,*) H1,EPSI
00210   READ(5,*) D,DM,DC
00220   CALL DATE(ADATE)
00230   PRINT 40
00240   40 FORMAT(" SET PAPER--HIT C/R")
00250   READ(16,*)DUMB
00260   PRINT 900,HEAD,(ADATE(I),I=1,2)
00270 900FORMAT(16A5/1X,2A5//)
00280 PRINT 905,D,DM,DC
00290   905 FORMAT( "THE METER RUN'S INSIDE PIPE DIAMETER=",F6.3," INCHES,THE ORIFICE'S DIAMETER=",F6.3,
00295&" INCHES, AND",/,"THE DISCHARGE PIPE'S INSIDE DIAMETER= ",F6.3," INCHES.",//)
00310 PRINT 910
00320 910FORMAT( 4X,"DAY",7X,"TIME",11X,"MASS FLOW",18X,"SPECIFIC STAGNATION ENTHALPY",10X,"% FLASH @",1X/14X,
00330&"(HOURS)",7X,"(LBM/HOUR)",24X,"(BTU/LBM)",16X,"70 PSIG",4X,"80 PSIG",4X,"125 PSIG",///)
00335 49 READ(5,*,END=100),HO,IDAY,IME,PHI,PO,PC,HF,HFG,VG,VF,YTP
00340 NI=0
00345 51 IF(NI.EQ.1) H1=470.
00355 COF1=PHI*(YTP**2.)/(2102500.*(1.-(DM/D)**4.)*((DC/DM)**4.)*(PC**1.92)*(VG-VF))
00375 N=0
00385 50 DEL=FPLAIN(H1)/-(FPRIME(H1))
00395   H1=DEL+H1
00405 N=N+1
00415 IF (ABS(DEL).LT. EPSI) GO TO 90
00425 IF (N.GT.10) GO TO 99
00435 GO TO 50
00460 90 PF70=(H1-279.8)/8.9644
00470 PF80=(H1-288.11)/8.9028
00480 PF125=(H1-318.53)/8.6687
00500 MF=((205185.2*(DC**2.))*(PC**.96))/(((5./16.)**.063)*(H1**1.102))
00520 PRINT 915,HO,IDAY,IME,MF,H1,PF70,PF80,PF125
00530 915  FORMAT(3X,I2,"/",I2,7X,I4,12X,F8.0,24X,F5.1,20X,F4.1,7X,F4.1,9X,F4.1)
00550 GO TO 49
00554 99 NI=NI+1
00555 IF(NI.EQ.1) GO TO 51
00556 PRINT 996,IME
00557 996 FORMAT("  ENTHALPY CALCULATION FAILED TO CONVERGE FOR THE TIME ",I4)
00558 GO TO 49
00590 100 PRINT 999
00595 999 FORMAT(//"ALL DATA HAS BEEN REDUCED")
00600 END
```

define functions need #1

FPLAIN = 0 FOR PROPER H_1

$$FPRIME = \frac{\partial}{\partial H_1} FPLAIN$$

STD IN MACHINE DATEOPRUN

INPUT

$$DEL = \frac{F(x)}{-F'(x)}$$

(1450)

= 230835.54

OUTPUT

```
OLD:UT7216

READY
:L
00010 24-HOUR TEST OF THE WELL UTAH STATE 72-16 ON APRIL 4-5,1977
00020 470,.03
00030 10.02,7.5000,7.625
00040 4,4,0950,22.3,399.2,19.5,418.4,779.2,1.1644,.019337,.999
00050 4,4,0951,34.9,399.2,19.5,418.4,779.22,1.1644,.019337,.999
00060 4,4,0953,34.9,408.1,17.,420.9,776.83,1.1391,.019374,.999
00070 4,4,0959,22.3,412.5,19.,422.,775.7,1.127,.019393,.999
00080 4,4,1003,22.3,417,14.5,423.2,774.5,1.1148,.019411,.999
00090 4,4,0000,22.3,412.5,16.75,420.9,775.7,1.127,.019393,.999
00100 4,4,1005,158.9,399.2,72.,418.4,779.2,1.1644,.019337,.994
00110 4,4,1007,286.9,386.1,74.,414.8,782.7,1.2038,.019281,.988
00120 4,4,1013,314.2,386.1,74.,414.8,782.7,1.2038,.019281,.987
00130 4,4,1017,372.5,386.1,74.,414.8,782.7,1.2038,.019281,.985
00140 4,4,1025,314.2,386.1,74.,414.8,782.7,1.2038,.019281,.987
00150 4,4,1027,1174.3,314.6,110.,393.4,802.9,1.4741,.018964,.942
00160 4,4,1029,387.9,316.2,73.,393.9,802.4,1.4668,.018972,.981
00170 4,4,1031,335.5,381.8,76.,413.6,783.8,1.2173,.019263,.986
00180 4,4,1034,342.7,381.8,77.,413.6,783.8,1.2173,.019263,.986
00190 4,4,9999,380.1,387.9,77.,415.3,782.2,1.1982,.019289,.985
00200 4,4,0,300.4,375.,77.,411.7,785.7,1.2393,.019234,.988
00210 4,4,1046,335.5,381.8,76.,413.6,783.8,1.2173,.019263,.986
00220 4,4,1052,332.6,381.8,75.,413.6,783.8,1.2173,.019263,.986
00230 4,4,1058,331.1,381.8,75.,413.6,783.8,1.2173,.019263,.987
00240 4,4,1100,826.8,338.,102.,400.8,796.,1.3735,.019070,.962
00250 4,4,1105,826.8,338.,100.,400.8,796.,1.3735,.019070,.962
00260 4,4,1108,826.8,338.,100.,400.8,796.,1.3735,.01907,.962
00270 4,4,70,872.7,344.1,102.,402.6,794.3,1.3495,.019097,.961
00280 4,4,7,782.1,332.,100.,399.,797.7,1.3979,.019043,.963,
00290 4,4,1115,826.8,338.,100.5,400.8,796.,1.3735,.019070,.962
00300 4,4,1120,1201.4,316.2,111.,393.9,802.4,1.4668,.018972,.941
00310 4,4,1125,1201.4,308.5,110.5,391.5,804.7,1.5026,.018936,.939
00320 4,4,1140,1160.8,316.2,109.5,393.9,802.4,1.4668,.018972,.943
00330 4,4,1145,1160.8,316.2,109.5,393.9,802.4,1.4668,.018972,.943
00340 4,4,1149,1474.,300.8,114.,389.,807.,1.5403,.0189,.924
00350 4,4,1154,1466.,300.1,114.,388.7,807.2,1.5437,.018896,.924
00360 4,4,1159,1460.,300.1,114.,388.7,807.2,1.5437,.018896,.924
00370 4,4,1215,1460.,299.3,114.,388.4,807.4,1.5478,.018893,.924
00380 4,4,0080,1521.,306.9,114.,391.,805.1,1.5105,.018928,.923
00390 4,4,8,1400.,293.3,114.,386.4,807.4,1.5786,.018865,.925
00400 4,4,1230,1460.,299.3,114.,388.4,807.4,1.5478,.018893,.925
00410 4,4,1245,1460.,299.3,114.,388.4,807.4,1.5478,.018893,.925
00420 4,4,1300,1460.,298.5,113.7,388.2,807.7,1.5519,.018889,.924
00430 4,4,1330,1451.,297.,113.8,387.7,808.1,1.5596,.018882,.924
00440 4,4,1400,1449.,295.5,112.5,387.2,808.6,1.5672,.018875,.924
00450 4,4,1430,1445.,294.8,112.2,386.9,808.8,1.5709,.018872,.924
00460 4,4,1500,1415.,294.7,111.7,386.9,808.9,1.5714,.018872,.925
00470 4,4,8012,1505.,306.9,114.,391.,805.1,1.5105,.018928,.924
00480 4,4,812,1415.,293.2,114.,386.4,809.3,1.5793,.018864,.925
00490 4,4,8053,1460.,300.8,111.7,389.,807.,1.5403,.018900,.924
00500 4,4,853,1385.,287.3,111.7,384.4,811.1,1.6111,.018836,.925
00510 4,4,1530,1406.,294.,111.7,386.6,809.1,1.5751,.018868,.925
00520 4,4,1600,1406.,293.2,111.5,386.4,809.3,1.5793,.018864,.925
00530 4,4,1630,1478.,289.5,112.4,385.1,817.5,1.599,.018847,.921
00540 4,4,1700,1475.,288.7,112.1,384.8,810.7,1.6034,.018843,.92
00550 4,4,8717,1520.,294.,112.1,386.6,809.1,1.5751,.018868,.919
00560 4,4,8710,1430.,282.8,112.1,382.8,82.5,1.6362,.018814,.921
00570 4,4,1800,1475.,288.,111.6,384.6,810.9,1.6073,.018839,.92
00580 4,4,1900,1469.,287.3,111.,384.4,811.1,1.6111,.018836,.92
00590 4,4,2000,1466.,285.8,110.6,383.9,811.6,1.6193,.018829,.92
00600 4,4,2100,1466.,285.8,110.4,383.9,811.6,1.6193,.018829,.92
```

INPUT data

```
00610 4,4,2200,1463.,285.,109.9,383.6,811.8,1.6237,.018825,.92
00620 4,4,2300,1460.,284.3,109.6,383.3,812.1,1.6277,.018822,.92
00630 4,4,2400,1451.,282.8,109.2,382.8,812.5,1.6362,.018814,.92
00640 4,5,100,1445.,282.1,109.1,382.6,812.7,1.6401,.018811,.92
00650 4,5,200,1439.,280.6,108.8,382.1,813.2,1.6486,.018804,.92
00660 4,5,300,1433.,297.9,108.4,381.8,813.4,1.6526,.018801,.92
00670 4,5,400,1430.,279.2,108.1,381.6,813.6,1.6567,.018797,.92
00680 4,5,500,1427.,279.2,107.9,381.6,813.6,1.6567,.018797,.92
00690 4,5,600,1424.,278.5,107.5,381.4,813.9,1.6608,.018794,.92
00700 4,5,700,1421.,278.5,107.3,381.4,813.9,1.6608,.018794,.921
00710 4,5,800,1421.,278.5,107.6,381.4,813.9,1.6608,.018794,.921
00720 4,5,8780,1460,285.8,107.6,383.9,811.6,1.6193,.018829,.92
00730 4,5,8708,1377.,271.2,107.6,378.8,816.2,1.7044,.018758,.921
00740 4,5,900,26.22,401.,16.5,418.9,778.7,1.1592,.019384,.999
00750 4,5,945,18.77,403.6,13.75,419.7,778.,1.1518,.019355,.999
00760 4,5,1000,15.5,403.6,13.8,419.7,778.,1.1518,.019355,.999

READY
RUN: JAMOD

JAMOD  17:53  RDS11  APR 20 77 WED

ENTER THE NAME OF THE DATA FILE TO BE USED ?UT7216

SET PAPER--HIT C/R ?
```

24-HOUR TEST OF THE WELL UTAH STATE 72-16 ON APRIL 4-5,1977
20-Apr-77

THE METER RUN'S INSIDE PIPE DIAMETER=10.020 INCHES,THE ORIFICE'S DIAMETER= 7.500 INCHES, AND
THE DISCHARGE PIPE'S INSIDE DIAMETER= 7.625 INCHES.

DAY	TIME (HOURS)	MASS FLOW (LBM/HOUR)	SPECIFIC STAGNATION ENTHALPY (BTU/LBM)	% FLASH @ 70 PSIG	80 PSIG	125 PSIG
4/ 4	950	254864.	466.0	20.8	20.0	17.0
4/ 4	951	226111.	519.5	26.7	26.0	23.2
4/ 4	953	177052.	575.5	33.0	32.3	29.6
4/ 4	959	241949.	477.6	22.1	21.3	18.4
4/ 4	1003	158951.	552.6	30.4	29.7	27.0
4/ 4	C	201970.	504.1	25.0	24.3	21.4
ENTHALPY CALCULATION FAILED TO CONVERGE FOR THE TIME 1005						
4/ 4	1007	936861.	457.0	19.8	19.0	16.0
4/ 4	1013	917934.	465.6	20.7	19.9	17.0
4/ 4	1017	881526.	483.0	22.7	21.9	19.0
4/ 4	1025	917934.	465.6	20.7	19.9	17.0
4/ 4	1027	1322075.	472.2	21.5	20.7	17.7
4/ 4	1029	943522.	448.7	18.8	18.0	15.0
4/ 4	1031	943878.	464.6	20.6	19.8	16.8
4/ 4	1034	956656.	464.2	20.6	19.8	16.8
4/ 4	9999 50% min	926751.	477.8	22.1	21.3	18.4
4/ 4	0 open max	992601.	448.9	18.9	18.1	15.0
4/ 4	1046	943878.	464.6	20.6	19.8	16.8
4/ 4	1052	928314.	466.2	20.8	20.0	17.0
4/ 4	1058	928857.	466.0	20.8	20.0	17.0
4/ 4	1100	1237524.	469.5	21.2	20.4	17.4
4/ 4	1105	1202511.	473.7	21.6	20.8	17.9
4/ 4	1106	1202511.	473.7	21.6	20.8	17.9

			479.0	22.2	21.4	16.5
		max 1229342.	464.3	20.6	19.8	16.8
		1211268.	472.6	21.5	20.7	17.8
	1120	1329046.	473.7	21.6	20.6	17.9
4/ 4	1125	1338038.	469.0	21.1	20.3	17.4
4/ 4	1140	1313220.	473.3	21.6	20.8	17.8
4/ 4	1145	1313220.	473.3	21.6	20.8	17.8
4/ 4	1149	1354224.	476.7	22.0	21.2	18.2
4/ 4	1154	1358320.	475.4	21.8	21.0	18.1
4/ 4	1159	1359900.	474.9	21.8	21.0	18.0
4/ 4	1215	1362024.	474.2	21.7	20.9	18.0
4/ 4	80 80%	min 1328316.	485.1	22.9	22.1	19.2
4/ 4	8 open	max 1382328.	467.9	21.0	20.2	17.2
4/ 4	1230	1361192.	474.4	21.7	20.9	18.0
4/ 4	1245	1361192.	474.4	21.7	20.9	18.0
4/ 4	1300	1358210.	474.3	21.7	20.9	18.0
4/ 4	1330	1366014.	472.2	21.5	20.7	17.7
4/ 4	1400	1347778.	473.2	21.6	20.8	17.8
4/ 4	1430	1344401.	473.2	21.6	20.8	17.8
4/ 4	1500	1342554.	472.0	21.4	20.7	17.7
4/ 4	8012 80% 12:00	min 1331665.	484.0	22.8	22.0	19.1
4/ 4	812 open	max 1387553.	466.3	20.8	20.0	17.0
4/ 4	8053 80% 1530	min 1316627.	480.4	22.4	21.6	18.7
4/ 4	853 open	max 1368418.	463.9	20.5	19.7	16.8
4/ 4	1530	1346954.	470.6	21.3	20.5	17.5
4/ 4	1600	1344950.	470.5	21.3	20.5	17.5
4/ 4	1630	1351144.	471.8	21.4	20.6	17.7
4/ 4	1700	1353134.	470.1	21.2	20.4	17.5
4/ 4	8717 87%	min 1329338.	477.7	22.1	21.3	18.4
4/ 4	8710 open	max 1670468.	388.3	12.1	11.3	8.0
4/ 4	1800	1345642.	470.6	21.3	20.5	17.5
4/ 4	1900	1337858.	470.9	21.3	20.5	17.6
4/ 4	2000	1334984.	470.3	21.3	20.5	17.5
4/ 4	2100	— 1331354. —	— 470.7 —	21.3	20.5	17.6
4/ 4	2200	1325164.	470.9	21.3	20.5	17.6
4/ 4	2300	1322477.	470.6	21.3	20.5	17.5
4/ 4	2400	1321193.	469.5	21.2	20.4	17.4
4/ 5	100	1322452.	466.8	21.1	20.3	17.3
4/ 5	200	1322135.	467.7	21.0	20.2	17.2
4/ 5	300	1318415.	467.4	20.9	20.1	17.2
4/ 5	400	1315260.	467.3	20.9	20.1	17.2
4/ 5	500	1312387.	467.5	20.9	20.1	17.2
4/ 5	600	1307351.	467.6	21.0	20.2	17.2
4/ 5	700	1303674.	466.0	21.0	20.2	17.2
4/ 5	800	1309154.	467.4	20.9	20.1	17.2
4/ 5	8780 87%	min 1281983.	476.4	21.9	21.1	18.2
4/ 5	8708 open	max 1338981.	457.9	19.9	19.1	16.1
4/ 5	900	189953.	526.1	27.5	26.7	23.9
4/ 5	945	157968.	530.6	26.0	27.2	24.5
4/ 5	1000	168526.	501.9	24.8	24.0	21.2

ALL DATA HAS BEEN REDUCED

USED: 38.6 UNITS

READY

24-HOUR TEST OF THE WELL UTAH STATE 72-16 ON APRIL 4-5,1977
22-Apr-77

THE METER RUN'S INSIDE PIPE DIAMETER=10.020 INCHES,THE ORIFICE'S DIAMETER= 7.500 INCHES, AND
THE DISCHARGE PIPE'S INSIDE DIAMETER= 7.625 INCHES.

DAY	TIME (HOURS)	MASS FLOW (LBM/HOUR)	SPECIFIC STAGNATION ENTHALPY (BTU/LBM)	% FLASH @ 70 PSIG	80 PSIG	125 PSIG
4/ 4	1245	1361192.	474.4	21.7	20.9	18.0
4/ 4	1300	1358210.	474.3	21.7	20.9	18.0
4/ 4	1330	1366014.	472.2	21.5	20.7	17.7
4/ 4	1400	1347778.	473.2	21.6	20.8	17.8
4/ 4	1430	1344401.	473.2	21.6	20.8	17.8
4/ 4	1500	1342554.	472.0	21.4	20.7	17.7
4/ 4	1530	1346954.	470.6	21.3	20.5	17.5
4/ 4	1600	1344950.	470.5	21.3	20.5	17.5
4/ 4	1630	1351144.	471.8	21.4	20.6	17.7
4/ 4	1700	1353134.	470.1	21.2	20.4	17.5
4/ 4	1800	1345642.	470.6	21.3	20.5	17.5
4/ 4	1900	1337858.	470.9	21.3	20.5	17.6
4/ 4	2000	1334984.	470.3	21.3	20.5	17.5
4/ 4	2100	1331354.	470.7	21.3	20.5	17.6
4/ 4	2200	1325164.	470.9	21.3	20.5	17.6
4/ 4	2300	1322477.	470.6	21.3	20.5	17.5
4/ 4	2400	1321193.	469.5	21.2	20.4	17.4
4/ 5	100	1322452.	468.8	21.1	20.3	17.3
4/ 5	200	1322135.	467.7	21.0	20.2	17.2
4/ 5	300	1318415.	467.4	20.9	20.1	17.2
4/ 5	400	1315260.	467.3	20.9	20.1	17.2
4/ 5	500	1312387.	467.5	20.9	20.1	17.2
4/ 5	600	1307351.	467.6	21.0	20.2	17.2
4/ 5	700	1303674.	468.0	21.0	20.2	17.2
4/ 5	800	1309154.	467.4	20.9	20.1	17.2
4/ 5	900	169953.	526.1	27.5	26.7	23.9
4/ 5	945	157968.	530.6	28.0	27.2	24.5
4/ 5	1000	168528.	501.9	24.8	24.0	21.2

ALL DATA HAS BEEN REDUCED

USED: 23.7 UNITS

READY

Production Specialists

AGNEW and SWEET
3914 Gilmore Avenue
Bakersfield, California 93308
24-Hour Phone: 327-2267

SUBSURFACE SURVEY

Field Work Sheet
PRE-FLOW

OWNER Thermal Power FIELD Rosedale WELL NAME 14-2
CASING ELEV. DATE: 11-15-76
LINER DESCRIPTION: ZERO POINT
DEPTH
TUBING DETAIL: ZONE

PUMP SHOE GAS ANCHOR INTAKE
PURPOSE
REMARKS:

ELEMENT 90-660 SERIAL NO. 10008 CLOCK 12 hr 15 TURN STABILIZATION PERIOD
ENGAGE STYLUS DISENGAGE STYLUS GROSS OIL RATE B/D
OBS. TBG. PRESS. OBS. CSG. PRESS. NET OIL RATE B/D
COR. TBG. PRESS. COR. CSG. PRESS. FORMATION GAS MCF/D
PICKUP @ TIME ON BOTTOM MAX. °F GOR CFT/BBL.
WELL STATUS CIRCULATED GAS MCF/D
SHUT IN: ON PRODUCTION: OIL DRY GRAVITY °API
BEAN SIZE

TIME	DEPTH	DEFL.	P—T	GRAD.	/D	TIME	DEPTH	DEFL.	P—T	GRAD.	/D	TIME	DEPTH	DEFL.	P—T	GRAD.	/D
	0	.003	91°				2500	1.084	418°				5000	1.333	486°		
	100	.003	91°				2600	1.095	421°				5100	1.334	486°		
	200	.003	91°				2700	1.098	422°				5200	1.335	487°		
	300	.003	91°				2800	1.102	423°				5300	1.336	487°		
	400	.003	91°				2900	1.106	424°				5400	1.337	487°		
	500	.003	91°				3000	1.112	426°				5500	1.339	488°		
	600	.003	91°				3100	1.119	427°				5600	1.343	489°		
	700	.050	106°				3200	1.124	429°				5700	1.347	490°		
	800	.395	198°				3300	1.136	432°				5800	1.359	493°		
	900	.369	205°				3400	1.145	435°				5900	1.369	496°		
	1000	.440	227°				3500	1.150	436°				6000	1.403	505°		
	1100	.470	226°				3600	1.156	438°				6091	1.443	516°		
	1200	.524	253°				3700	1.164	440°								
	1300	.563	265°				3800	1.275	470°								
	1400	.599	276°				3900	1.297	476°								
	1500	.653	292°				4000	1.311	480°								
	1600	.705	308°				4100	1.319	482°								
	1700	.735	317°				4200	1.319	482°								
	1800	.778	330°				4300	1.321	483°								
	1900	.840	349°				4400	1.322	483°								
	2000	.908	369°				4500	1.324	484°								
	2100	.955	383°				4600	1.326	484°								
	2200	1.002	396°				4700	1.327	484°								
	2300	1.034	404°				4800	1.330	485°								
	2400	1.065	413°				4900	1.331	485°								

COMMENTS:

1796 lbs. at 4900'.
Clock stopped.

BY:

THERMAL POWER
COMPANY

Utah State 14-2 ML-27536

Location: 2310' south and 350' east from the northwest corner Section 2, T 27S, R 9W, Beaver County, Utah.
Elevation:

Take all measurements from top KB.
Keep hole full at all times.
Check operation of BOE each round trip or daily, whichever first occurs.

Drilling Program

1. Drill 26" or 27½" hole to 40'+ to fit 20" casing. Cement with Class B cement treated with 2% $CaCl_2$ to fill annulus to cellar floor. Use 2 centralizers. Drill rat hole.
2. Drill 17½" hole to 650' to fit 13-3/8" casing.
3. Cement 13-3/8", 54.5#, K-55, buttress casing at 650' with 400 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel and 40% silica flour. (100% excess). Run guide shoe with insert fillup. Tack weld and Bakerlok bottom 4 collars, weld shoe solid. Use top rubber plug only, plug holding head. Bump plug on shoe. Use 3 centralizers.
4. After 4 hours (or cement is firm), land 13-3/8" casing. Weld on 12" Series 900 WKM geothermal wellhead. Test weld with 1000 psig. Install 12" Series 900 Shaffer double hydraulic control gate and Hydril GK. All blowout preventers on this well to have high temperature packing elements. Test each preventer, casing, kelly cock, valves and check valve in kill line and blow down line valves to 1000 psig. for five minutes. Notify Utah Division of Water Rights to witness preventer tests 3 days in advance of testing (801-586-4231, Cedar City, Gerald Stoker). Enter test results on tour sheet.
5. Drill 12¼" hole to 1820' to fit 9-5/8" casing. One or more cores may be taken. Run Schlumberger Induction, FDC/CNL and Sonic logs at 1820'.
6. Cement 9-5/8", 40#, K-55, buttress casing at 1820' with 350 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel, 40% silica flour and 0.3-0.4% HLX-C214 retarder (% retarder to be determined by maximum thermometers). (40% excess). Run fillup shoe and fillup collar on shoe joint. Tack weld top and bottom, bottom 4 collars, weld shoe solid. Use top and bottom rubber plug and plug holding head. Centralize 40' above shoe and every 5th joint above shoe. Have WKM (505-327-3359, Farmington, Sug Roberts) install centralizing elements in 12" head prior to cementing.

Utah State 14-2 ML-27536
Drilling Program

7. Land 9-5/8" casing. WKM install 12" Series 900 by 10" Series 600 14" stroke casing spool. Test pack off with 1000 psig. Install 10" gate valve, two double hydraulic Shaffer control gates, Hydril GK and Grant rotating head. All equipment to have high temperature packing elements. Test all blowout preventers, casing and valving as before with 1000 psig. for 5 minutes each. Notify Utah DWR to witness preventer tests. Enter test results on tour sheets.

8. Drill $8\frac{1}{2}$" hole to total depth, estimated at 6000'. One or more cores may be taken. Run Schlumberger logs as ordered. Complete or abandon. 7" casing may be run as protection or production casing if required.

9. Survey hole angle every 2-300', on dull bits. Drillable wing stabilizers are to be run in $12\frac{1}{4}$" and $8\frac{1}{2}$" holes, and $17\frac{1}{2}$" hole if required. A multi-shot or wireline angle survey may be run if hole angle exceeds 5^{o} over several thousand feet. Run drill pipe float valve in $8\frac{1}{2}$" hole and have "wet plug" with valve in open position on floor at all times.

10. Install ABC mud logging service at shoe of 20" conductor. Record continuous mud in and out temperature, H_2S, CH_4, lithology, drilling rate. Have pit level indicator and intercom to drillers station. Take two sets W&D samples every 10' above 1800' and every 5' below 1800'. Mail daily copies of the mud log to:

    Thermal Power Co. (3 copies)
    601 California Street
    San Francisco, CA 94108
    W. L. D'Olier

    Hathaway Engineering (1 copy)
    3382 El Camino, Suite 37
    Sacramento, Ca 95821

    Keep 3 copies up to date and spliced in trailer

11. Mud Program. American Mud Company 505-327-2525

    Surface-650'. Water and gel, 8.3-9.0 ppg.
    650'- TD Milford city water, add sodium chloride if req.

    Have lost circulation material on location.

12. Run and record maximum recording thermometers on each Totco run.

13. Telephone numbers:

Thermal Power Company	415-981-5700
W. L. D'Olier	415-982-5630 Nites
	805-833-8313 Weekend
W. N. Hathaway	916-489-1206 Office
	916-944-3884 Home
H. E. Wheeler	916-485-2715

September 9, 1976

WELL SUMMARY REPORT

Operator THERMAL POWER COMPANY Well No. Utah State 14-2, ML-27536

Sec. 2, T. 27S, R. 9W, SL B. & M. Roosevelt KGRA Field Beaver County

Location 2510' south and 350' east from the northwest corner Section 2
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level 6240 feet USGS

All depth measurements taken from top of kelly bushing which is 21 feet above ground
(Derrick Floor, Rotary Table or Kelly Bushing)

The information given herewith is a complete and correct record of the prese condition of the well and all work done thereon, so far as can be determined from all available records.

Date October 26, 1976 Signed W. L. D'Olier

Hathaway Engineering (Engineer) (Superintendent) Title Vice-President (President, Secretary or Agent)

Commenced drilling September 11, 1976

Completed drilling October 14, 1976

Total depth 6100' Plugged depth None

Junk

GEOLOGICAL MARKERS	DEPTH
Alluvium	0'-200'
Granite	200'-6100'
See attached lithology log	

Geologic age at total depth: Est. 9-15 mybp

Commenced producing (Date) Flowing/gas lift/pumping (Cross out unnecessary words) Name of producing zone Granite

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Ca Pre
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of if through
20"	79'	Surface	94#	N	S	H-40	26"	200	
13-5/8"	645'	Surface	54#	N	S	K-55	17½"	400	
9-5/8"	1805'	Surface	40#	N	S	K-55	12¼"	400	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

None. Well completed barefoot.

Was the well directionally drilled? No Electrical Log Depths 645'-6100' (Attach Copy of Log

Δ OSP

HISTORY OF GEOTHERMAL WELL

Operator THERMAL POWER COMPANY Field or County Beaver County Roosevelt KGRA

Well name and No. Utah State 14-2, ML-27536, Sec. 2, T 27S, R 9W, SL B. & M.

A.P.I. well No. ..... Name W. L. D'Olier (Person submitting report) Title V-President (President, Secretary or Agent)

Date October 26, 1976

Signature W. L. D'Olier

601 California Street
San Francisco, CA 94108 (Address)

415-981-5700 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date	
976	
-11	Moved in Loffland Brothers Company, Rig No. 5. Drilled 12¼" hole and opened to 26" to 79'. Cemented 20" OD, 94#, H-40 conductor casing @ 79' with 200 sacks neat cement treated with 2% CaCl2.
-12	Landed 20" casing. Installed 20" Hydril GK. Drilled 17½" hole to 290'. Installed Alpha-Beta-Gamma mud logging service @ 79'.
-13	Depth 552'. Mud 8.7 ppg.
-14	Depth 650'. Mud 8.8 ppg.
	13-3/8" casing @ 645'. Ran 16 joints 13-3/8" OD, 54#, K-55, buttress, new, smls. USS casing including float shoe and 1 centralizer on each of bottom 3 joints and second joint from top. Cemented shoe @ 645' with 400 sacks Class B cement premixed with 1:1 expanded perlite, 2% gel and 40% silica flour. Had good cement returns to surface.
-15	Landed 13-3/8" casing. Installed 12" Series 900 Shaffer double hydraulic control head and Hydril GK. Installed Grant rotating head. Tested CSO and pipe rams, kill line, blowdown line with 1000 psig. Tested Hydril with 600 psig.
-16	Drilled 12¼" hole to 1285'. Mud-water.
-17	Depth 1557'. Mud-water.
-18	Depth 1625'. Mud 9.2 ppg + LCM. Well kicked while drilling @ 1625'.
-19	Depth 1805'. Mud 9.5 ppg.
-20	Ran Schlumberger Induction-Electrical, Compensated Neutron-Formation Density, Borehole Compensated Sonic-Gamma Ray and Temperature logs.
-21	9-5/8" casing @ 1805'. Ran 44 joints of 9-5/8" OD, 40#, K-55, buttress, new, smls. USS casing including float shoe and float collar @ 1762'. Placed centralizers @ 1785' and over collars of second and every fifth joint to 77'. Cemented shoe @ 1805' with 400 sacks Class B cement premixed with 1:1 expanded perlite, 2% gel and 40% silica flour with 0.3% HR-5 & 0.5% CFR-2. Had good returns to surface during job but no cement returns. Tested casing with 2000 psig.
	Ran Wilson temperature survey. Located top cement @ 150'.
22	Landed 9-5/8" casing. Installed WKM thermal expansion head. Installed 2-10" Series 900 Shaffer double hydraulic control gates, Hydril GK and Grant rotating head.
23	Tested CSO rams, 3 sets pipe rams, kill line, blowdown manifold and Hydril with 1000 psig.
	Drilled 8½" hole to 1863'. Mud-water.

HISTORY OF GEOTHERMAL WELL

Operator THERMAL POWER COMPANY Field or County Roosevelt KGRA, Beaver County

Well name and No. Utah State 14-2, ML-27536, Sec. 2, T 27S, R 9W, SL B. & M

A.P.I. well No. ..... Name W. L. D'Olier (Person submitting report) Title V-President (President, Secretary or Agent)

Date October 26, 1976

Signature W. L. D'Olier

601 California Street
San Francisco, CA 94108 (Address)

415-981-5700 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date 1976	
9-24	Depth 2233'. Mud-water.
9-25	Depth 2558'. Mud-water.
9-26	Depth 2612'. Mud-water. Cut core 2600'-2612'. Recovered 10'6".
9-27	Depth 2890'. Mud-water.
9-28	Depth 3255'. Mud-water.
9-29	Depth 3653'. Mud 8.7 ppg. with LCM.
9-30	Depth 3696'. Mud 8.8 with LCM.
10- 1	Depth 3701'. Mud 8.6 ppg. with LCM. Ran Eastman single shots: 3200' 3-3/4° N10W. 3696' 5-1/4° N 15W.
10- 2	Depth 3929'. Mud-salt water with LCM.
10- 3	Depth 4184'. Mud-salt water.
10- 4	Depth 4358'. Mud-salt water with LCM.
10- 5	Depth 4535'. Mud 8.6 ppg. with LCM.
10- 6	Depth 4675'. Mud-salt water.
10- 7	Depth 4891'. Mud-salt water.
10- 8	Depth 5138'. Mud-salt water.
10- 9	Depth 5294'. Mud-salt water.
10-10	Depth 5519'. Mud-salt water.
10-11	Depth 5678'. Mud-salt water.
10-12	Depth 5803'. Displaced hole with cold water. Ran Eastman Multi-shot 1805'-5800'. At 5800' MD, 5774.59' TVD, 395.38'N, 120.19'W. Well attempted to flow. Killed well.
10-13	Depth 5980'. Mud-salt water.
10-14	Total depth 6100'. Mud-salt water.
10-15	Ran Schlumberger Induction-Electrical, Borehole Compensated Sonic, Compensated Neutron-Formation Density and Temperature logs.
10-16	Ran Agnew & Sweet temperature survey. Attempted to test well but volume exceeded capacity of 4" flow line.
10-17	Laid down drill pipe. Tore out BOE. Installed 10" wellhead. Released rig to Utah State 72-16.

BIT RECORD

COMPANY	CONTRACTOR	COUNTY	STATE
Thermal Power Company	Loffland Rig No. 5	Beaver	Utah

LEASE	WELL NO.	SEC	TOWNSHIP	RANGE	BLOCK	FIELD
Utah State	14-2	2	27S	9W	SLB&M	Roosevelt KRA

TOOL PUSHER	DRILL PIPE	DRAW-WORKS	
Buddy Bowden	$4\frac{1}{2}$"	Ideco Hydrair H-1000	Spud 9-11-76

DRILLER	TOOL JOINT MAKE / SIZE / TYPE	POWER	UNDER SURF
		2-GMC 12V-71N H.P. 868	

MORNING DRILLER	DRILL COLLAR NO / O.D. / I.D. / LENGTH	PUMP NO. 1 MAKE / MODEL / STROKE	INT. DATE
		Emsco D-500	

EVENING DRILLER	DRILL COLLAR NO / O.D / I D / LENGTH	PUMP NO. 2 MAKE / MODEL / STROKE	T.D. DATE
		Emsco D-500	10-14-76

NO.	BIT SIZE	BIT MFGR.	BIT TYPE	SERIAL NO. OF BIT	JET SIZE 1	2	3	DEPTH OUT	FTGE.	HOURS RUN	ACC. HOURS	FT/HR	WEIGHT 1000 LBS.	ROTARY R.P.M.	VERT. DEV.	PUMP PRESS	PUMPS No.	Liner	SPM	MUD Wt	Vis	DULL. CODE T	B	G	REMARKS FORMATION, CIRC. FLUID, ETC.	DATE
	12¼	HTC	OSC1	RR	12	12	-	79	79	1½		53														
	17½	HTC	OSC3	RR	12	12	-	206	127	7½		17	20	50	½	700										
	17½	SM	3JS	RR	16	16	16	650	444	38		12	35	60	½	600										
	12¼	RD	S62	RR	20	20	20	1304	654	25½		26	40	50	½	600										
	12¼	HTC	X44	RR	20	20	20	1805	501	34½		15	35	60		500										
	8½	HTC	OWV	BP172	12	12	12	1895	90	4½		20	30	55		1000										
	8½	HTC	J55	XE022	12	12	12	2600	705	44½		16	20	60	4½	1000										
	8½	HTC	J55	XC302	15	15	15	3696	1096	70¾		15	30	60	5¾	600										
	8½	RD	FP63	22-1679	15	15	15	4270	574	53¾		11	20	60	6½	600										
	8½	SM	F5	AC-304	14	14	16	4675	405	57		7	18	60	7½	650										
	8½	HTC	J44	RA-987	15	15	15	5170	495	51		10	20	60	10½	650										
	8½	HTC	J44	EB463	15	15	15	5678	508	55		9	22	60	11¾	650										
	8½	SM	F4	201DD	16	16	14	5983	305	36½		8	20	60	11½	650										
	8½	SM	F5	445ES	16	16	14	6100	117	13	493	9	20	60	-	650										
	6½	CNR	C.H.	65-39754				2612	12'	1½																

REPRESENTATIVE _____ PHONE _____

Compliments of SMITH TOOL

P.O. BOX C19511 • IRVINE, CALIF. 92713

Utah State Well 14-2 ML-27536
Roosevelt KGRA, Utah
Core #1

Interval 2600'-12' cut 12' Rec 10' (83%). Core in summary is granodiorite with about 5 thin (1") zones of quartz filled fractures cutting core at high angles. Near top of core a 1.5' zone of predominate quartz is noted.

Fractures are not open. Core is not in reservoir. Local green alteration zones of chlorite after biotite, also a tan material after hornblende. Some red staining. Trace pyrite.

Cut 12' in 5 hours with new 6½" Christensen diamond core head. Core head wornout at end of run.

THERMAL POWER COMPANY
UTAH STATE 14-2 - ROOSEVELT HOT SPRINGS, UTAH
Flow Test 11/16-18/76 (48-hrs.)

(Sample 1 through 6)

Constituent (ppm)	1 1630* 11/16	2 2230* 11/16	3 0630* 11/17	4 1430* 11/17	5 0030* 11/18	6 0630* 11/18	Avg.	Std. Dev.
Sodium	2100.	2100.	2200.	2100.	2100.	2100.	2116	40.8
Potassium	410.	410.	420.	410.	410.	400.	410	6.3
Calcium	8.1	7.6	8.5	7.2	48.	7.1	7.7	.6
Magnesium	0.06	0.06	0.07	0.05	0.13	0.05	0.07	.03
Chloride	3600.	3500.	3500.	3600.	3500.	3600.	3550	55
Bicarbonate	385.	384.	403.	394.	612.	379.	426	91
Carbonate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Sulfate	75.	74.	76.	75.	73.	74.	74.5	1
Boron	26.	26.	26.	25.	25.	25.	25.5	.6
Nitrate (NO_3)	<.02	<.02	<.02	<.02	<.02	<.02	<0.02	
Ammonium (NH_4)	6.	5.	5.	5.	4.	5.	5	.63
Arsenic	3.2	2.6	2.2	3.6	0.79	3.1	2.6	1
pH	6.1	6.1	6.2	6.2	6.4	6.2	6.2	0.11
TDS (ppm)	6500.	6400.	6700.	6300.	6600.	6700.	6533	163
Conductivity $[\frac{mho}{cm} \times 10^{-3}]$	9.18	9.18	9.18	9.18	9.10	9.38	9.2	.09

9×10^{-3} mho/cm

$\frac{1000}{9}$ ohm-cm $= \frac{10}{9}$ ohm-m

*Time

CWM/JRM/tti 12/14/76

GEOTHERMAL POWER CORP.
WELL NO. 15
SEC. 18, T27S, R9W
BEAVER COUNTY, UTAH

Prepared by:

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.
860 Anaconda Tower - 555 Seventeenth Street
Denver, Colorado 80202

September 5, 1978

Helton Engineering & Geological Services, Inc.

WELL DATA SUMMARY

WELL NAME:	Geothermal Power Corporation #15
LOCATION:	Sec. 18, T27S, R9W, Beaver County, Utah
OPERATOR:	Geothermal Power Corporation
ELEVATION:	5544.5 ft. KB; 5539 ft. GL
TOTAL DEPTH:	1890 ft.
STATUS:	Completed as geothermal observation well
SPUD DATE:	Not Known
RIG RELEASED:	11:00 AM 7/20/78
HOLE SIZE:	6-1/2" to 1890 ft.
OBSERVATION CASING:	Ran 90 joints of 1-1/2" Black Pipe (Total of 1890 ft.). Landed at 1890 ft. KB, cemented with 10 sacks construction cement.
LOGS:	Induction, Density, Sonic, Bottom Hole Temperature.
DRILLING CONTRACTOR:	Darrah Drilling Corporation
DRILLING FOREMAN:	C. R. McKay, Helton Engineering & Geological Services, Inc.
ADDITIONAL INFORMATION:	The Helton drilling foreman was called out after the well was spudded, so the first few daily drilling reports are not available.

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. _____ DATE 7/16/78

DEPTH 650 FEET MADE _____ HRS. ON BOTTOM _____

OPERATION W.O.P. Tripping

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 0

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 2-7/8/3½ DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT _____ VIS _____ WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping 1
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing 1/2
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

Took United Airlines to Salt Lake City. Arrived approximately 7:15 AM. Took Sky West to Cedar City. Arrived at 9:15 AM. Drove to Milford, Utah. On location approximately 12:00 PM. Rig down - mud pump to recycle mud to main tank out.

Located centrifugal pump - hauled out to location to use until parts arrive from California for pump. Installed same. Owner of rig had let personnel off.

Waited for crews to return.

6:30 AM - 8:00 AM Hooked up centrifugal pump and tripped in hole.

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. _____ °F _____ Supervisor: _____

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 2 DATE 7/17/78

DEPTH 870 FEET MADE 210 HRS. ON BOTTOM 14

OPERATION Drilling

SURVEYS

LAST PIPE TALLY ____ BOARD ____ CORRECTION: YES ____ NO ____

WT OF STRING M LBS. ____ WT ON BIT M LBS ____ ROTARY RPM ____

PUMP No. 1 5 x 10 GD IN USE ____ LINERS 5" SPM 50 PRESS 0

PUMP No. 2 ____ IN USE ____ LINERS ____ SPM ____ PRESS ____

DRILL PIPE OD 3½/4½ THD 2-7/8/3½ DRILL COLLARS OD 5" THD ____ No. IN HOLE ____

BOTTOM HOLE ASSEMBLY

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
2	6-1/2	Hughes J33	650			14	None				Used
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD
WT. 9 VIS 40 WL ____ GEL ____ FC ____
PH ____ APP VIS ____ PLAS VIS ____ YLD. PT. ____
WATER ____ OIL ____ CL- ____ PPM
SOLIDS ____ SAND ____ CA++ ____ PPM
AV ____ NV ____ d-exp ____ Pore Press ____
MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER	14			LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED ____ bbl
OUTPUT ____ cfm Press. ____ psig
MAKE RATING

RIG TIME

1. Drilling	14	6. Surveying		11. Coring		16.	3-1/2 hrs. Cleaned pits
2. Tripping	2-1/2	7. Circulating		12. Testing		17.	and mud tank went
3. Service & BOPs		8. Clean to Btm		13. Logging		18.	thru mud pump (circ.
4. Reaming		9. Cond. Mud		14. Casing		19.	sand & granite) 12#
5. Slip & Cutline		10. Repairing	4	15. WOC		20.	mud.

OTHERS (SPECIFY)

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM	Tripped in hole. Stuck pipe at 180'. Pulled loose. Reamed same spot several times. No problems going to bottom.
10:30 - 8:30 PM	Drilled.
8:30 - 12:00PM	Dumped pits - mixed new mud. Circulated too much sand & granite. Drilled.
12:00 - 4:00AM	Centrifugal pump out. Trip to town - found another one. Tripped in hole w/8 stands.
4:00 - 8:00 AM	Drilled - worked on pump.

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. 100 °F Hot Supervisor: C. R. McKay

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 3 DATE 7/18/78

DEPTH 890 FEET MADE 20 HRS. ON BOTTOM 2

OPERATION Drilling - WO parts.

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. 18 WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 0

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 2-7/8/3½ DRILL COLLARS OD 5" THD _____ No. IN HOLE ___

BOTTOM HOLE ASSEMBLY

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
2	6-1/2	133	650	890	240	16	None	3	2	2	Used Bit
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT 9 VIS 50 WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling 2
2. Tripping 2
3. Service & BOPs
4. Reaming
5. Slip & Cutline
6. Surveying
7. Circulating
8. Clean to Btm
9. Cond. Mud
10. Repairing
11. Coring
12. Testing
13. Logging
14. Casing
15. WOC

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 10:00 Drilling.

10:00 AM 2:00 Centrifugal pump motor went out. Shut rig down until rig equipment repaired. Tripped out - put pipe on bank - waited on parts.

2:00 PM - 8:00 AM Waited on parts.

Note: Formation change approximately 860' - some clay and fine sand.

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. _____ °F _____ Supervisor: C. R. McKay

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 4 DATE 7/19/78

DEPTH 890 FEET MADE 0 HRS. ON BOTTOM 0

OPERATION Shut down - tripping.

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD _____ THD _____ DRILL COLLARS OD _____ THD _____ No. IN HOLE ____

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT _____ VIS _____ WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping 2
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 9:00 PM Waited on parts for pump. Should arrive on plane at 7:00 PM.

Crew off - start up in morning.

6:00 AM - 8:00 AM Laid down 4½" drill pipe - picked up 3½" drill pipe.

Well Costs	$
Daily	
Cumulative	

Flow line temperature 80°

WEATHER: TEMP. _____ °F _____ Supervisor: C. R. McKay

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 5 DATE 7/20/78

DEPTH 1090 FEET MADE 200 HRS. ON BOTTOM 10

OPERATION Shut down, waiting on repairs to water truck.

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. 28 WT ON BIT M LBS 20 ROTARY RPM 80

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 300

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 3½/2-7/8IF DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
3	6-1/2	Varel V2	390		200	10					
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD
WT 11/9 VIS 40 WL _____ GEL _____ FC _____
PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____
WATER _____ OIL _____ CL- _____ PPM
SOLIDS _____ SAND _____ CA++ _____ PPM
AV _____ NV _____ d-exp _____ Pore Press _____
MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER	10			LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl
OUTPUT _____ cfm Press. _____ psig
MAKE RATING

RIG TIME

1. Drilling 10
2. Tripping 4½
3. Service & BOPs
4. Reaming
5. Slip & Cutline
6. Surveying
7. Circulating
8. Clean to Btm
9. Cond. Mud 2½
10. Repairing truck 7
11. Coring
12. Testing
13. Logging
14. Casing
15. WOC

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 12:30 PM Tripped in hole - regained circulation - conditioned mud.
12:30 PM - 6:30 PM Drilled.
6:30 PM - 9:00 PM Cleaned tanks - put new head in 5 x 10 mud pump - mixed mud.
9:00 PM - 1:00 AM Drilled. Unable to keep up with samples (too fine). Now catching 15 foot samples.
1:00 AM - 8:00 AM Rear end of water truck torn out on bad roads. Shut rig down. No Water. Contractor to furnish same.

Well Costs	$
Daily	
Cumulative	

Flowline temperature 85°

WEATHER: TEMP. _____ °F _____ Supervisor: C. R. McKay

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 6 DATE 7/11/78

DEPTH 1320 FEET MADE 230 HRS. ON BOTTOM 8

OPERATION Mixing Mud.

SURVEYS								

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. 23 WT ON BIT M LBS 20 ROTARY RPM 80

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 300

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 3½/2-7/8 DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
3	6-1/2	Varel V2	890		450	18					
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD
WT 9 VIS 38 WL _____ GEL _____ FC _____
PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____
WATER _____ OIL _____ CL- _____ PPM
SOLIDS _____ SAND _____ CA++ _____ PPM
AV _____ NV _____ d-exp _____ Pore Press _____
MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER	8			LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl
OUTPUT _____ cfm Press. _____ psig
MAKE RATING

RIG TIME

1. Drilling 8
2. Tripping 5
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud 1
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. Water Truck Down 4 hrs.
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 12:00 PM Down. No Water. Contractor to furnish water.
12:00 AM - 1:00 PM Conditioned mud with chemical and water.
1:00 PM - 9:00 PM Drilled
9:00 PM 12:00 AM Blew manifold gasket on compressor. Shut rig down. Pulled 4½" pipe to be replaced by 3½" pipe. Rig down at 12:00 AM. Transferred water to tanks.
12:00 AM - 6:00 AM Rig down.
6:00 AM - 8:00 AM Mixed mud.

Well Costs	$
Daily	
Cumulative	

Flowline temperature 92o

WEATHER: TEMP. 105 °F Hot Supervisor: C. R. McKay

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 7 DATE 7/22/78

DEPTH 405 FEET MADE 85 HRS. ON BOTTOM 6-1/2

OPERATION Drilling - Repairing Air Compressor

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. 26 WT ON BIT M LBS 20 ROTARY RPM 60/80

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 300

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 3½/2-7/8 DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
3	6-1/2	Varel V2	890	1405	515	24½		8	4	8	
Ream Bit No.											
Core No.							FEET CUT		FEET REC.		

MUD

WT 9 VIS 40 WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER	6-1/2			LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling 6-1/2
2. Tripping 9
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing 3-1/2
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. Shut Down 5 hrs.
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 11:00 AM Picked up 3-1/2" IF Drill Pipe. Put 500' in hole to replace 4-1/2" pipe.

11:00 AM 2:30 PM Repaired air compressor.

2:30 PM 9:00 PM Drilled

9:00 PM 3:00 AM Made 1/2 trip. Laid down 20 joints - balance in derrick - Shut down for night.

3:00 AM 8:00 AM Rig down.

Well Costs	$
Daily	
Cumulative	

Flowline temperature 96°

WEATHER: TEMP. 105 °F Hot Supervisor: Supervisor

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 8 DATE 7/23/78

DEPTH 1405 FEET MADE 0 HRS. ON BOTTOM 0

OPERATION Rig shut down.

SURVEYS							

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD _____ THD _____ DRILL COLLARS OD _____ THD _____ No. IN HOLE ____

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT _____ VIS _____ WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping _____
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. 24 hrs. down time.
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM to 8:00 AM — Rig down (on bank). Since arrival have had driller, two rough necks, pusher to relieve driller. (Rest badly needed).

1/2 hr. crew unloaded 1-1/2" casing.

Flowline temperature 100°

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. _____ °F _____ Supervisor: _____

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 9 DATE 7/24/78

DEPTH 1690 FEET MADE 285 HRS. ON BOTTOM 13-1/2

OPERATION Drilling

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. 29 WT ON BIT M LBS 25 - 20 ROTARY RPM 80/60

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 300

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4½ THD 2-7/8/3½ DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
4	6-1/2	Hughes J33	1405		285	13½	14 14 14				Used bit - re-run from this hole - had been used before that.
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD
WT 9.3 VIS 40 WL _____ GEL _____ FC _____
PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____
WATER _____ OIL _____ CL- _____ PPM
SOLIDS _____ SAND _____ CA++ _____ PPM
AV _____ NV _____ d-exp _____ Pore Press _____
MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER	13½			LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl
OUTPUT _____ cfm Press. _____ psig
MAKE RATING

RIG TIME

1. Drilling 13½
2. Tripping 4½
3. Service & BOPs
4. Reaming
5. Slip & Cutline
6. Surveying
7. Circulating
8. Clean to Btm
9. Cond. Mud
10. Repairing 3½
11. Coring
12. Testing
13. Logging
14. Casing
15. WOC

OTHERS (SPECIFY)

16. 2½ down.
17.
18.
19.
20.

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 10:30 AM Down.
10:30 AM - 3:00 PM Tripped in hole - mixed mud.
3:00 PM - 7:00 PM Drilled - 1480' Reamed.
7:00 PM - 10:30 PM Down - repaired air compressor clutch.
10:30 PM - 8:00 AM Drilled to 1680'.

Well Costs	$
Daily	
Cumulative	

Flowline temperature 102° F

WEATHER: TEMP. ____ °F Supervisor: _____

Form HE-D1

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 10 DATE 7/25/78

DEPTH 1890 FEET MADE 200 HRS. ON BOTTOM 16

OPERATION Drilling - Waiting on Schlumberger

SURVEYS							

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 5 x 10 GD IN USE _____ LINERS 5" SPM 50 PRESS 300

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD 3½/4-½ THD 2-7/8"/3½ DRILL COLLARS OD 5" THD 3½ IF No. IN HOLE 3

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds			COND T	COND B	COND G	REMARKS
4	6-1/2	Hughes	1405	1890	485	29½	10	10	10				Used bit -
		J33											Welded in jets
Ream Bit No.													
Core No.							FEET CUT			FEET REC.			

MUD

WT _____ VIS _____ WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER	16			LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling 16
2. Tripping _____
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. 8 hrs. W.O. Schlumberger
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 12:00 PM Drilled 1690 - 1890'.

12:00 PM - 8:00 AM Waited on Schlumberger - Mixed mud, conditioned hole.

Schlumberger came out of Grand Junction.

Bit is dull - believed to be in granite.

Mud Logging Unit Released: 12:00 Midnight.

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. _____ °F _____ Supervisor: C. R. McKay

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power Corp. #15 DAY NO. 11 DATE 7/26/78

DEPTH 1890' T.D. FEET MADE 0 HRS. ON BOTTOM 0

OPERATION Laying down drill pipe - rigging up Schlumberger - running logs.

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD _____ THD _____ DRILL COLLARS OD _____ THD _____ No. IN HOLE ____

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds			COND T	COND B	COND G	REMARKS
4	6-1/2	Hughes J33	1405	1890	485	29½	10	10	10	6	5	4	
Ream Bit No.													
Core No.							FEET CUT			FEET REC.			

MUD

WT 9 VIS 60 WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping 8
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging 9-1/2
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 10:30 PM Broke out and laid down 4½ and 3½" drill pipe. Torqued up - heated each joint to break out.

10:30 PM - 8:00 AM Rigged up Schlumberger - Induction Log tool broken - ran logs.

Well Costs	$
Daily	-
Cumulative	

Flowline temperature 102° F.

WEATHER: TEMP. 104 °F Hot Supervisor: C. R. McKay

HELTON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Power #15 DAY NO. 12 DATE 7/27/78

DEPTH 1890' T.D. FEET MADE 0 HRS. ON BOTTOM 0

OPERATION Running 1-1/2" casing

SURVEYS

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD _____ THD _____ DRILL COLLARS OD _____ THD _____ No. IN HOLE ____

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT 9 VIS 60 WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- _____ PPM

SOLIDS _____ SAND _____ CA++ _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping _____
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 3:00 PM Finished running logs. Ran Induction, Density, GR Caliper Sonic, Bottom Hole Temperature.

3:00 PM 12:00 AM Ran 1-1/2" pipe. 90 joints - 1890' KB. (regular black malleable pipe.). Cemented with 10 sacks cement, 18' depth - cut off conductor pipe.

Bottom Hole Temp.: #1 - 144°F
#2 - 146°F
#3 - 148°F

Well Costs	$
Daily	
Cumulative	

WEATHER: TEMP. 104 °F Hot Supervisor: C. R. McKay

Helton Engineering & Geological Services, Inc.

DRILLING TIME LOG

Formation	Start Drlg.	Depth	Finish Drlg.	Depth
Soft	12:40	895	12:50	910
Soft, medium	12:57	910	1:21	925
Soft	1:28	925	1:48	940
"	1:58	940	2:23	955
"	2:29	955	2:55	970
"	3:01	970	3:27	985
"	3:33	985	3:54	1000
"	4:06	1000	4:27	1015
"	4:36	1015	4:57	1030
"	5:06	1030	5:27	1045
"	5:12	1045	5:30	1060
Very fast, soft	5:40	1060	6:00	1075
	6:08	1075	6:30	1090
6:45 - made mud, cleaned mud pump, tightened brakes - 9:00	9:00	1090	9:20	1105
Soft, w/boulders	9:38	1105	10:00	1120
	10:15	1120	10:38	1135
	10:50	1135	11:25	1150
	11:35	1150	12:05	1165
	12:12	1165	12:50	1180
New Day - 7/20/78	1:25	1180	1:45	1195
	1:57	1195	2:20	1210
Soft clay & sands	2:27	1210	2:50	1225
Made mud, tight hole	2:58	1225	3:35	1240
	3:55	1240	4:30	1255
	4:38	1255	5:05	1270
	5:15	1270	6:15	1285
	6:31	1285	7:12	1300
Shut down for lube	7:30	1300	8:20	1315
	8:40	1315		
Worked on compressor				
New Day - 7/21/78	2:30	1315	3:00	1330
	3:20	1330	4:15	1345
	4:35	1345	5:20	1360
	5:35	1360	6:25	1375
Sands, boulders	6:30	1375	7:15	1390
	7:25	1390	8:28	1405
Tripped 9:00				

Helton Engineering & Geological Services, Inc.

DRILLING TIME LOG
(Continued)

Formation	Temp.	Start Drlg.	Depth	Finish Drlg.	Depth
New Day 7/23/78	89 F.	3:00	1405	3:34	1420
	91	3:51	1420	4:15	1435
	92	4:20	1435	4:50	1450
	93	4:58	1450	5:25	1465
	96	5:31	1465	6:00	1480
	97	6:07	1480	6:40	1495
Air Comp. Trouble 7:00 - 11:00 down for lube.		6:46	1495	11:10	1510
New Day 7/24/78		11:35	1510	12:20	1525
	98	12:26	1525	1:05	1540
Few boulders and sand	98	1:10	1540	1:45	1555
Disc. staying the	99	1:55	1555	2:30	1570
same - 37 sec.	99	2:35	1570	3:05	1585
	100	3:13	1585	3:47	1600
Harder	100	3:55	1600	4:40	1615
	100	4:50	1615	5:25	1630
Change towers	100	5:35	1630	6:12	1645
	100	6:25	1645	7:00	1660
	98	7:11	1600	7:43	1675
Hard spots	96	7:50	1675	8:15	1690
Boulders about	98	8:25	1690	9:31	1705
5 ft. apart 2" thick	100	9:40	1705	10:07	1720
	100	10:45	1720	11:25	1735
	100	11:35	1735	12:10	1750
	95	12:20	1750	12:40	1765
	95	1:30	1765	1:55	1780
Changed rotary speed to save bit	95	2:05	1780	3:05	1795
	98	3:15	1795	4:00	1810
	100	4:10	1810	4:50	1825
	100	4:55	1825	5:45	1840
6:00-6:45 Lubed rig -	100	6:45	1840	7:57	1855
cleaned desanders	102	8:07	1855	11:08	1870
Chert & granite 1865-70					
		11:17	1870		1885
Out of water					
			1885		1900
Drillers			1900		1915

T.D. 1880 @ 2:00AM

12:00 discontinued drilling, bit worn out. Mixed mud - began conditioning hole. Waited for Well Loggers.

HEL TON ENGINEERING & GEOLOGICAL SERVICES, INC.

DAILY DRILLING REPORT

(AS OF 8 AM)

WELL Geothermal Powe Corp. #15 DAY NO. 13 DATE 7/28/78

DEPTH 1890 FEET MADE _____ HRS. ON BOTTOM _____

OPERATION _____

SURVEYS							

LAST PIPE TALLY _____ BOARD _____ CORRECTION: YES ___ NO ___

WT OF STRING M LBS. _____ WT ON BIT M LBS _____ ROTARY RPM _____

PUMP No. 1 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

PUMP No. 2 _____ IN USE _____ LINERS _____ SPM _____ PRESS _____

DRILL PIPE OD _____ TH D _____ DRILL COLLARS OD _____ THD _____ No. IN HOLE ___

BOTTOM HOLE ASSEMBLY _____

BIT NO.	SIZE	TYPE	DEPTH IN	DEPTH OUT	FT. MADE	TOTAL HRS. RUN	JET SIZE IN 32nds	COND T	COND B	COND G	REMARKS
Ream Bit No.											
Core No.							FEET CUT	FEET REC.			

MUD

WT _____ VIS _____ WL _____ GEL _____ FC _____

PH _____ APP VIS _____ PLAS VIS _____ YLD. PT. _____

WATER _____ OIL _____ CL- - _____ PPM

SOLIDS _____ SAND _____ CA + + _____ PPM

AV _____ NV _____ d-exp _____ Pore Press _____

MUD ADDED

DAILY MUD COST

	Hrs. Run	IN	OUT	
DESILTER				LB/GAL
DESANDER				LB/GAL
DEGASSER				LB/GAL

COMPRESSOR DATA MUD DUMPED _____ bbl

OUTPUT _____ cfm Press. _____ psig

MAKE RATING

RIG TIME

1. Drilling _____
2. Tripping _____
3. Service & BOPs _____
4. Reaming _____
5. Slip & Cutline _____
6. Surveying _____
7. Circulating _____
8. Clean to Btm _____
9. Cond. Mud _____
10. Repairing _____
11. Coring _____
12. Testing _____
13. Logging _____
14. Casing _____
15. WOC _____

OTHERS (SPECIFY)

16. _____
17. _____
18. _____
19. _____
20. _____

DRILLING & GEOLOGICAL REMARKS (Time & Sequence of Operations to be inserted below)

8:00 AM - 11:00 AM Laid down balance of 3-1/2" drill pipe in derrick. Tore down to move out. Welded lock cap on 1-1/2" pipe.

RIG RELEASED: 11:00 AM.

Trip back to Denver.

	Well Costs	$
	Daily	
	Cumulative	

WEATHER: TEMP. 105 °F Hot Supervisor: C. R. McKay

FINAL 1"=2000' MAPPING (RICHFIELD QUAD)
COVE FORT REGIONAL GRAVITY

After Adjustments REPORT #8

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

DOD PLUS UNION STATIONS. Airport Datum minus 200 mgals

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
1	38.1917	112.9233	5698.1	1463.36	2020.36	1.48	-535.75	174.50	0.0	0.0	0.0	7.88	1	2599
1	38.2183	112.9967	5399.9	1486.30	2023.19	1.45	-507.72	165.37	0.0	0.0	0.0	6.01	1	1083
1	38.6031	112.5100	6700.0	1431.20	2056.92	1.52	-629.90	205.18	0.0	0.0	0.0	-2.58	1	1 U.O.C.
2	38.6016	112.5234	6510.0	1445.32	2056.85	1.51	-612.04	199.36	0.0	0.0	0.0	-0.16	2	1
2	38.2233	112.9133	5307.7	1503.90	2023.63	1.44	-499.06	162.54	0.0	0.0	0.0	12.34	2	1083
2	38.1250	112.9717	5227.0	1493.15	2021.15	1.44	-491.47	160.07	0.0	0.0	0.0	1.97	2	2599
3	38.2150	112.9233	5272.0	1500.73	2022.90	1.44	-495.70	161.45	0.0	0.0	0.0	10.64	3	2078
3	38.2033	112.9317	5345.1	1492.61	2021.84	1.45	-502.57	163.69	0.0	0.0	0.0	8.17	3	2599
3	38.6039	112.5469	6265.0	1463.29	2057.05	1.51	-589.02	191.86	0.0	0.0	0.0	1.89	3	1
3	38.5533	112.7750	5541.0	1463.80	2026.70	1.46	-520.98	169.69	0.0	0.0	0.0	-13.07	3	1083
3	38.2733	112.6633	5891.1	1430.34	2028.02	1.49	-553.83	180.41	0.0	0.0	0.0	-19.69	3	3685
4	38.2583	112.6417	5891.1	1435.48	2026.70	1.49	-553.83	180.41	0.0	0.0	0.0	-19.24	4	2078
4	38.0167	112.7150	5821.1	1420.98	2009.53	1.49	-547.50	178.35	0.0	0.0	0.0	-16.86	4	3507
4	38.3233	112.9467	7408.1	1377.10	2032.40	1.50	-696.44	226.87	0.0	0.0	0.0	12.77	4	2599
4	38.5994	112.5276	6620.0	1437.11	2056.22	1.52	-622.38	202.73	0.0	0.0	0.0	-0.97	4	1
4	38.4283	112.4470	7875.0	1303.32	2041.18	1.48	-740.30	241.16	0.0	0.0	0.0	-35.20	4	5131
4	38.2667	112.6917	5297.6	1504.70	2026.99	1.44	-498.10	162.23	0.0	0.0	0.0	12.13	4	1083
4	38.7717	112.3333	5344.3	1495.34	2071.61	1.45	-502.54	163.68	0.0	0.0	0.0	-39.06	4	3685
5	38.5800	112.2967	5725.0	1464.72	2054.95	1.48	-538.28	175.32	0.0	0.0	0.0	-28.75	5	2078
5	38.2350	112.2200	6001.0	1413.44	2024.66	1.50	-564.21	183.77	0.0	0.0	0.0	-32.27	5	2381
5	38.3950	113.0100	4957.3	1526.17	2038.69	1.41	-466.12	151.81	0.0	0.0	0.0	0.33	5	3817
5	38.5203	112.4803	8339.9	1321.53	2049.75	1.44	-783.93	255.40	0.0	0.0	0.0	-1.08	5	5131
5	38.5997	112.5618	6120.0	1472.14	2056.68	1.50	-575.39	187.42	0.0	0.0	0.0	1.94	5	1
5	38.5483	112.6733	6534.1	1433.20	2034.60	1.51	-614.31	200.10	0.0	0.0	0.0	17.30	5	2599
5	38.2553	112.7459	5667.3	1499.10	2027.14	1.47	-532.65	173.56	0.0	0.0	0.0	-23.22	5	1083
5	38.1417	112.6150	6404.8	1397.96	2016.48	1.51	-602.17	196.14	0.0	0.0	0.0	-24.08	5	3507
6	38.6014	112.5767	6024.0	1477.58	2056.83	1.50	-566.37	184.48	0.0	0.0	0.0	1.15	6	1
6	38.3950	112.4967	6068.3	1464.37	2035.18	1.50	-570.59	185.85	0.0	0.0	0.0	12.45	6	2599
6	38.5833	112.4650	6725.0	1420.04	2055.68	1.52	-632.25	205.95	0.0	0.0	0.0	-10.85	6	2078
6	38.2750	112.6400	5891.1	1457.30	2028.16	1.49	-553.83	180.41	0.0	0.0	0.0	-18.88	6	1083
6	38.2133	112.9250	5314.9	1499.53	2022.76	1.44	-499.74	162.76	0.0	0.0	0.0	12.35	6	3507
6	38.5663	112.2567	5592.5	1472.44	2053.92	1.47	-525.82	171.26	0.0	0.0	0.0	-26.00	6	2381
6	38.5537	112.0002	9464.9	1235.10	2050.61	1.28	-889.66	289.85	0.0	0.0	0.0	-16.99	6	5131
7	38.6267	112.1083	5250.0	1484.49	2059.05	1.44	-493.63	160.78	0.0	0.0	0.0	-43.15	7	2078
7	38.3600	112.9033	5813.0	1477.83	2035.62	1.46	-546.54	178.02	0.0	0.0	0.0	9.30	7	2599
7	38.3200	112.9700	5135.8	1519.70	2032.11	1.43	-482.90	157.28	0.0	0.0	0.0	11.78	7	1083
7	38.2367	112.3783	9545.9	1201.18	2024.80	1.27	-897.29	292.33	0.0	0.0	0.0	-19.95	7	3507
7	38.7545	112.5008	5918.0	1519.42	2070.30	1.49	-556.50	181.26	0.0	0.0	0.0	22.86	7	5131
7	38.5759	112.5606	5997.0	1474.08	2056.45	1.50	-563.83	183.65	0.0	0.0	0.0	-3.58	7	1
8	38.5549	112.5647	5980.0	1466.71	2055.38	1.49	-562.24	183.13	0.0	0.0	0.0	-11.06	8	1
8	38.3567	112.5400	6118.4	1421.70	2035.33	1.50	-575.25	187.37	0.0	0.0	0.0	-27.25	8	1083
8	38.8548	112.7097	4762.1	1581.60	2080.02	1.38	-447.77	145.84	0.0	0.0	0.0	2.13	8	5131
8	38.2583	112.7900	5487.3	1467.38	2026.70	1.46	-515.99	168.06	0.0	0.0	0.0	-12.86	8	3507
8	38.3717	112.9467	5263.0	1504.65	2036.64	1.44	-495.42	161.36	0.0	0.0	0.0	0.63	8	2599
9	38.3833	112.9750	5038.0	1515.35	2037.67	1.42	-473.71	154.28	0.0	0.0	0.0	-4.31	9	2599
9	38.4367	112.6400	6375.0	1413.00	2039.72	1.51	-599.56	195.23	0.0	0.0	0.0	-24.1	9	1083
9	38.5703	112.5908	6050.0	1461.14	2054.10	1.50	-568.82	185.28	0.0	0.0	0.0	-10.91	9	1
9	38.9035	112.4959	4084.0	1614.81	2083.43	1.37	-440.80	143.56	0.0	0.0	0.0	27.24	9	5131
10	38.4967	112.6300	6325.4	1416.10	2043.23	1.51	-594.70	193.71	0.0	0.0	0.0	-27.65	10	1083
10	38.5390	112.6042	6072.0	1450.06	2051.34	1.50	-570.88	185.95	0.0	0.0	0.0	-17.85	10	1
10	38.3750	113.0100	4957.3	1526.12	2038.69	1.41	-466.12	151.81	0.0	0.0	0.0	0.33	10	3685
10	38.3333	112.9917	4934.9	1519.67	2037.67	1.41	-468.71	152.66	0.0	0.0	0.0	-3.45	10	2599
11	38.4633	112.9900	4967.8	1525.26	2044.70	1.41	-467.11	152.13	0.0	0.0	0.0	-5.87	11	2599
11	38.4950	112.6133	6311.3	1426.60	2047.48	1.51	-593.38	193.26	0.0	0.0	0.0	-22.29	11	1083

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
11	38.5433	112.5936	6092.0	1457.35	2053.48	1.50	-572.76	186.56	0.0	0.0	0.0	-11.43	11	1
12	38.5450	112.6017	6066.9	1452.30	2051.87	1.50	-570.41	185.79	0.0	0.0	0.0	-16.46	12	1083
12	38.5493	112.5996	6068.0	1452.13	2052.25	1.50	-570.51	185.83	0.0	0.0	0.0	-16.94	12	1
12	38.4650	112.9733	5011.1	1519.90	2044.34	1.41	-471.13	153.46	0.0	0.0	0.0	-8.64	12	2599
12	38.3967	113.0082	4957.3	1525.64	2038.84	1.41	-466.12	151.81	0.0	0.0	0.0	-0.30	12	2381
13	38.4667	112.9567	5090.9	1513.27	2044.79	1.42	-478.67	155.90	0.0	0.0	0.0	-10.37	13	2599
13	38.5271	112.6047	6110.0	1445.01	2050.30	1.50	-574.46	187.11	0.0	0.0	0.0	-19.45	13	1
13	38.5767	112.3590	5897.3	1453.50	2054.66	1.49	-554.46	180.60	0.0	0.0	0.0	-28.78	13	1083
14	38.5170	112.6047	6160.0	1440.01	2049.41	1.50	-579.15	188.64	0.0	0.0	0.0	-20.40	14	1
14	38.5417	112.4500	6536.7	1427.70	2055.10	1.51	-614.55	200.18	0.0	0.0	0.0	-14.54	14	1083
14	38.4683	112.9350	5198.1	1507.01	2045.13	1.43	-488.76	159.19	0.0	0.0	0.0	-7.99	14	2599
15	38.4717	112.9167	5332.0	1504.17	2045.43	1.45	-501.34	163.29	0.0	0.0	0.0	-4.65	15	2599
15	38.3950	113.0033	4957.0	1525.98	2038.69	1.41	-466.09	151.80	0.0	0.0	0.0	0.17	15	3507
15	38.5850	112.4067	6180.4	1447.60	2055.39	1.50	-581.07	189.27	0.0	0.0	0.0	-17.49	15	1083
15	38.5015	112.6099	6245.0	1450.48	2048.05	1.51	-587.14	191.25	0.0	0.0	0.0	-23.18	15	1
15	38.1167	112.3367	6270.0	1384.89	2014.29	1.51	-589.50	192.01	0.0	0.0	0.0	-33.42	15	3598
15	38.1733	112.2750	6061.0	1401.79	2019.25	1.50	-569.86	185.61	0.0	0.0	0.0	-34.72	16	3598
16	38.5517	112.2650	5661.7	1469.50	2055.98	1.47	-532.33	173.38	0.0	0.0	0.0	-29.01	16	1083
16	38.5083	112.6045	6260.0	1434.25	2046.67	1.51	-588.55	191.71	0.0	0.0	0.0	-19.09	16	1
16	38.4733	112.8917	5527.9	1498.34	2045.57	1.46	-519.75	169.29	0.0	0.0	0.0	1.76	16	2599
17	38.4033	112.8500	6057.1	1475.27	2046.45	1.50	-569.48	185.49	0.0	0.0	0.0	11.31	17	2599
17	38.6107	112.5991	5939.3	1479.40	2057.65	1.49	-558.38	181.88	0.0	0.0	0.0	-3.24	17	1
17	38.5933	112.4983	7230.9	1394.00	2056.12	1.51	-679.79	221.44	0.0	0.0	0.0	-5.28	17	1083
17	38.4500	112.2283	5827.1	1427.49	2049.52	1.49	-547.87	178.45	0.0	0.0	0.0	-48.10	17	3598
17	38.0850	113.2292	5171.9	1491.61	2011.51	1.43	-486.29	158.38	0.0	0.0	0.0	6.58	17	3816
18	38.6633	112.1533	5323.1	1485.79	2064.04	1.45	-500.50	163.02	0.0	0.0	0.0	-42.21	18	3598
18	38.6000	112.5067	6901.9	1417.40	2056.71	1.52	-648.87	211.36	0.0	0.0	0.0	-3.32	18	1083
18	38.6148	112.5233	5891.0	1498.16	2058.01	1.49	-553.87	180.41	0.0	0.0	0.0	2.13	18	1
18	38.4967	112.7967	7262.1	1392.17	2047.62	1.51	-682.72	222.39	0.0	0.0	0.0	3.36	18	2599
18	38.0705	112.6877	5912.7	1421.00	2010.24	1.49	-555.92	181.07	0.0	0.0	0.0	-15.89	18	4099
19	38.2392	112.6462	5913.9	1436.11	2025.02	1.49	-556.50	181.26	0.0	0.0	0.0	-15.16	19	4099
19	38.6226	112.6367	5875.0	1492.18	2058.70	1.49	-552.37	179.92	0.0	0.0	0.0	4.45	19	1
19	38.6017	112.5233	6590.5	1440.40	2056.85	1.52	-619.61	201.83	0.0	0.0	0.0	-0.19	19	1083
19	38.2625	112.1203	7944.9	1302.16	2027.07	1.47	-746.87	243.30	0.0	0.0	0.0	-22.81	19	5165
19	38.7700	112.0850	5294.9	1492.19	2071.67	1.44	-497.85	162.15	0.0	0.0	0.0	-45.22	19	3598
19	38.1500	113.0850	5369.1	1490.60	2017.21	1.45	-504.83	164.42	0.0	0.0	0.0	12.35	19	2599
20	38.2658	112.0642	8964.9	1240.13	2027.36	1.36	-842.70	274.54	0.0	0.0	0.0	-20.44	20	5165
20	38.6033	112.5533	6195.5	1467.60	2057.00	1.50	-582.47	189.73	0.0	0.0	0.0	1.85	20	1083
20	38.5655	112.5762	6558.0	1448.54	2053.67	1.51	-595.88	194.09	0.0	0.0	0.0	-4.86	20	1
20	38.3542	112.6383	6118.7	1422.25	2035.11	1.50	-575.28	187.38	0.0	0.0	0.0	-26.46	20	4099
20	38.1500	113.1300	5591.8	1471.02	2017.21	1.47	-525.76	171.29	0.0	0.0	0.0	6.86	20	2599
21	38.1550	113.1417	5240.1	1494.62	2017.65	1.44	-492.71	160.47	0.0	0.0	0.0	7.77	21	2599
21	38.6033	112.5817	5998.0	1476.10	2057.00	1.50	-563.93	183.68	0.0	0.0	0.0	-2.15	21	1083
21	38.5083	112.6042	6259.8	1434.31	2048.65	1.51	-588.53	191.70	0.0	0.0	0.0	-19.01	21	4099
21	38.5583	112.5637	6646.0	1426.86	2053.02	1.52	-624.62	203.53	0.0	0.0	0.0	-6.38	21	1
21	38.3087	112.1500	6682.1	1377.46	2031.12	1.52	-628.22	204.62	0.0	0.0	0.0	-31.59	21	5165
22	38.6267	112.2000	5410.7	1486.50	2059.05	1.45	-508.74	165.70	0.0	0.0	0.0	-30.97	22	1083
22	38.3117	112.3333	11165.0	1092.93	2031.38	0.89	-1049.34	341.92	0.0	0.0	0.0	-31.92	22	5165
22	38.5497	112.5652	6735.0	1418.69	2052.29	1.52	-633.19	206.25	0.0	0.0	0.0	-8.18	22	1
22	38.6017	112.5808	5997.7	1476.29	2056.85	1.50	-563.90	183.67	0.0	0.0	0.0	-1.83	22	4099
22	38.1567	113.2050	5047.9	1503.16	2017.79	1.42	-474.64	154.59	0.0	0.0	0.0	4.00	22	2599
22	38.1567	113.2050	5047.9	1503.51	2017.79	1.42	-474.64	154.59	0.0	0.0	0.0	4.35	22	3816
23	38.5413	112.5645	6920.0	1407.70	2051.55	1.52	-650.57	211.92	0.0	0.0	0.0	-6.71	23	1
23	38.7675	112.5408	4947.8	1582.18	2071.45	1.40	-465.22	151.52	0.0	0.0	0.0	23.03	23	4099

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	******** CORRECTIONS ******** LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ---- INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
23	38.3703	112.0525	9686.0	1203.98	2036.57	1.24	-910.43	296.62	0.0	0.0	0.0	-20.02	23	5165
23	38.1583	113.0800	5268.0	1495.95	2017.94	1.44	-495.33	161.33	0.0	0.0	0.0	10.57	23	2599
24	38.4025	112.0975	8567.9	1272.39	2039.35	1.41	-805.40	262.38	0.0	0.0	0.0	-25.36	24	5165
24	38.7383	112.0933	5269.0	1492.70	2068.83	1.44	-495.32	161.33	0.0	0.0	0.0	-43.63	24	1083
24	38.5320	112.5613	7189.0	1386.49	2050.73	1.51	-675.85	220.16	0.0	0.0	0.0	-10.06	24	1
24	38.8400	112.4258	4855.0	1599.15	2077.83	1.39	-456.50	148.68	0.0	0.0	0.0	27.74	24	4099
24	38.1633	113.1117	5120.1	1503.36	2018.33	1.42	-481.42	156.80	0.0	0.0	0.0	8.18	24	2599
25	38.1667	113.1400	5133.8	1501.49	2018.67	1.43	-482.72	157.22	0.0	0.0	0.0	6.90	25	2599
25	38.5215	112.5625	7140.0	1387.56	2049.81	1.51	-671.24	218.66	0.0	0.0	0.0	-11.17	25	1
25	38.7733	112.0850	5337.2	1496.30	2071.96	1.45	-502.01	163.51	0.0	0.0	0.0	-38.61	25	1083
25	38.4508	112.0533	9436.0	1225.59	2043.60	1.29	-886.95	288.97	0.0	0.0	0.0	-21.31	25	5165
25	38.9675	112.3228	5134.3	1593.27	2089.07	1.43	-482.80	157.25	0.0	0.0	0.0	28.32	25	4099
26	38.7967	112.0317	5277.2	1501.70	2074.02	1.44	-496.18	161.61	0.0	0.0	0.0	-39.18	26	1083
26	38.5113	112.5649	7290.0	1376.61	2048.91	1.51	-685.34	223.25	0.0	0.0	0.0	-11.72	26	1
26	38.4608	112.4000	11305.1	1085.67	2044.48	0.85	-1062.49	346.21	0.0	0.0	0.0	-43.37	26	5165
26	38.1667	113.1733	5075.1	1503.51	2018.67	1.42	-477.20	155.42	0.0	0.0	0.0	5.20	26	2599
27	38.5926	112.5676	6880.0	1398.01	2048.14	1.52	-646.81	210.69	0.0	0.0	0.0	-15.53	27	1
27	38.4887	112.8432	6178.1	1467.23	2046.92	1.50	-580.86	189.20	0.0	0.0	0.0	10.46	27	5165
27	38.1717	113.0800	5143.0	1504.49	2019.10	1.43	-483.58	157.50	0.0	0.0	0.0	10.04	27	2599
27	38.3967	113.0133	4957.3	1527.10	2036.84	1.41	-466.12	151.81	0.0	0.0	0.0	1.16	27	1083
28	38.4183	113.0583	5152.2	1529.50	2040.74	1.43	-484.44	157.78	0.0	0.0	0.0	13.99	28	1083
28	38.6717	112.5608	5806.1	1505.46	2063.01	1.48	-545.89	177.81	0.0	0.0	0.0	9.05	28	5165
28	38.5037	112.5828	6640.0	1412.63	2048.24	1.52	-624.26	203.34	0.0	0.0	0.0	-16.21	28	1
28	38.1733	113.2033	5037.1	1504.00	2019.25	1.41	-473.62	154.25	0.0	0.0	0.0	2.70	28	2599
29	38.5077	112.5962	6400.0	1427.52	2048.59	1.51	-601.71	195.99	0.0	0.0	0.0	-16.88	29	1
29	38.6717	112.6920	5724.1	1507.92	2063.01	1.48	-538.18	175.29	0.0	0.0	0.0	6.32	29	5165
29	38.1783	113.0250	5151.9	1505.42	2019.69	1.43	-484.41	157.77	0.0	0.0	0.0	10.94	29	2599
30	38.1783	113.0550	5138.1	1507.92	2019.69	1.43	-483.12	157.35	0.0	0.0	0.0	12.57	30	2599
30	38.5216	112.5830	6580.0	1420.79	2049.81	1.52	-618.62	201.51	0.0	0.0	0.0	-13.42	30	1
30	38.7867	112.3225	8148.9	1373.42	2073.13	1.46	-766.03	249.55	0.0	0.0	0.0	15.31	30	5165
31	38.5264	112.5945	6280.0	1437.43	2050.24	1.51	-590.43	192.32	0.0	0.0	0.0	-16.21	31	1
31	38.8317	112.3960	5076.1	1581.89	2077.10	1.42	-477.28	155.45	0.0	0.0	0.0	25.20	31	5165
31	38.0023	112.9438	6110.9	1422.00	2004.28	1.50	-574.54	187.14	0.0	0.0	0.0	3.63	31	5118
31	38.1400	113.2167	5045.9	1501.30	2015.83	1.42	-474.54	154.56	0.0	0.0	0.0	0.04	31	2599
31	38.4617	113.1283	5555.4	1515.90	2044.55	1.47	-522.34	170.13	0.0	0.0	0.0	22.09	31	1083
32	38.1950	113.1400	5028.9	1509.93	2021.15	1.41	-472.85	154.00	0.0	0.0	0.0	6.21	32	2599
32	38.4683	113.1950	5993.7	1478.90	2045.13	1.50	-563.53	183.55	0.0	0.0	0.0	12.25	32	1083
32	38.9550	112.6020	4667.0	1604.46	2087.97	1.37	-438.82	142.92	0.0	0.0	0.0	11.03	32	5165
32	38.6140	112.5803	6033.0	1477.11	2057.94	1.50	-567.22	184.75	0.0	0.0	0.0	0.13	32	1
32	38.0030	112.8172	6122.7	1416.57	2004.77	1.50	-575.65	187.50	0.0	0.0	0.0	-1.55	32	5118
33	38.0408	112.3565	6765.4	1383.33	2007.65	1.52	-636.05	207.18	0.0	0.0	0.0	3.04	33	5118
33	38.6313	112.5728	6160.0	1473.84	2059.46	1.50	-579.15	188.64	0.0	0.0	0.0	3.39	33	1
33	38.2183	113.1683	5035.1	1513.37	2023.19	1.41	-473.43	154.19	0.0	0.0	0.0	8.00	33	2599
33	38.9633	112.2325	7043.9	1468.01	2088.71	1.51	-662.67	215.86	0.0	0.0	0.0	24.60	33	5165
34	38.9792	112.2730	5597.1	1567.94	2090.10	1.47	-526.43	171.47	0.0	0.0	0.0	31.33	34	5165
34	38.6375	112.5579	6360.0	1465.11	2060.00	1.51	-597.95	194.77	0.0	0.0	0.0	6.78	34	1
34	38.0410	112.9912	6301.5	1413.20	2007.66	1.51	-592.46	192.96	0.0	0.0	0.0	3.51	34	5118
34	38.2217	113.1017	5035.1	1513.91	2023.49	1.41	-473.43	154.19	0.0	0.0	0.0	8.25	34	2599
35	38.0623	112.9185	6402.9	1408.05	2009.53	1.51	-601.98	196.08	0.0	0.0	0.0	2.91	35	5118
35	38.6238	112.5906	6060.0	1474.95	2058.60	1.50	-569.75	185.58	0.0	0.0	0.0	-1.17	35	1
35	38.2217	113.1400	5019.0	1513.47	2023.49	1.41	-471.92	153.70	0.0	0.0	0.0	6.79	35	2599
35	38.2217	113.1950	5078.1	1505.52	2023.49	1.42	-477.47	155.51	0.0	0.0	0.0	2.58	36	2599
36	38.6361	112.5969	6190.0	1470.58	2059.88	1.50	-581.97	189.56	0.0	0.0	0.0	1.61	36	1
36	38.0752	112.9577	6510.1	1401.29	2010.65	1.51	-612.07	199.37	0.0	0.0	0.0	1.82	36	5118
37	38.0841	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	****** CORRECTIONS ****** *LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ----* INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
37	38.6465	112.5945	5900.0	1493.02	2060.80	1.49	-554.72	180.68	0.0	0.0	0.0	4.76	37	1
37	38.2217	113.2233	5214.9	1500.02	2023.49	1.43	-490.33	159.70	0.0	0.0	0.0	5.73	37	2599
38	38.6589	112.5906	5750.0	1506.52	2061.89	1.48	-540.62	176.09	0.0	0.0	0.0	7.68	38	1
38	38.2367	113.0083	5122.0	1507.63	2024.80	1.42	-481.61	156.86	0.0	0.0	0.0	6.15	38	2599
*38	38.3133	112.0542	8791.0	1262.37	2031.53	1.35	-826.36	269.21	0.0	0.0	0.0	-13.40	38	5118
39	38.2367	113.0467	5073.1	1513.76	2024.80	1.42	-477.01	155.36	0.0	0.0	0.0	9.19	39	2599
39	38.6591	112.5730	5787.0	1503.99	2061.91	1.48	-544.10	177.22	0.0	0.0	0.0	7.48	39	1
39	38.3533	112.3922	10172.9	1172.80	2035.04	1.14	-956.16	311.53	0.0	0.0	0.0	-18.75	39	5118
40	38.6139	112.5432	6414.0	1454.66	2057.93	1.51	-603.02	196.42	0.0	0.0	0.0	1.82	40	1
40	38.2367	113.0833	5039.0	1512.73	2024.80	1.42	-473.80	154.32	0.0	0.0	0.0	6.00	40	2599
40	38.3697	112.2223	6166.0	1407.02	2036.47	1.50	-579.72	188.83	0.0	0.0	0.0	-40.06	40	5118
41	38.4175	112.3197	7663.0	1317.07	2040.67	1.49	-720.85	234.82	0.0	0.0	0.0	-39.06	41	5118
41	38.6212	112.5410	6520.0	1443.40	2058.58	1.51	-612.98	199.67	0.0	0.0	0.0	1.63	41	1
41	38.2400	113.2417	5665.0	1472.64	2025.09	1.47	-532.64	173.49	0.0	0.0	0.0	5.22	41	2599
42	38.6183	112.5591	6425.0	1457.82	2058.32	1.51	-604.06	196.76	0.0	0.0	0.0	5.29	42	1
42	38.4498	112.2215	5827.1	1429.31	2043.51	1.49	-547.87	178.45	0.0	0.0	0.0	-46.27	42	5118
42	38.2517	113.0650	5044.9	1512.19	2026.12	1.42	-474.36	154.50	0.0	0.0	0.0	4.52	42	2599
43	38.5203	112.3803	8272.0	1295.28	2049.70	1.45	-777.60	253.32	0.0	0.0	0.0	-31.59	43	5118
43	38.5960	112.5408	6410.0	1452.15	2056.53	1.51	-602.65	196.30	0.0	0.0	0.0	0.45	43	1
43	38.2553	113.2447	5503.9	1488.23	2026.44	1.46	-517.50	168.55	0.0	0.0	0.0	9.28	43	2599
44	38.2583	113.2257	5567.9	1484.89	2026.70	1.47	-523.51	170.51	0.0	0.0	0.0	9.72	44	2599
44	38.5942	112.5500	6500.0	1444.08	2056.20	1.51	-611.10	199.06	0.0	0.0	0.0	-1.58	44	1
44	38.5413	112.2658	5751.0	1454.42	2051.55	1.48	-540.71	176.12	0.0	0.0	0.0	-34.02	44	5118
45	38.5452	112.0900	9377.9	1231.50	2051.89	1.30	-881.49	287.19	0.0	0.0	0.0	-27.38	45	5118
45	38.5988	112.5645	6280.0	1459.42	2055.72	1.51	-590.43	192.32	0.0	0.0	0.0	-0.70	45	1
46	38.5756	112.5708	6325.0	1450.99	2054.56	1.51	-594.75	193.73	0.0	0.0	0.0	-4.06	46	1
46	38.6183	112.7208	5621.0	1510.26	2058.32	1.47	-528.50	172.14	0.0	0.0	0.0	6.83	46	5118
47	38.5513	112.5815	6320.0	1442.22	2052.42	1.51	-594.19	193.54	0.0	0.0	0.0	-11.07	47	1
47	38.6227	112.0393	9209.9	1243.38	2058.70	1.33	-865.71	282.04	0.0	0.0	0.0	-27.98	47	5118
47	38.2650	113.0567	5042.0	1512.88	2027.29	1.42	-474.08	154.41	0.0	0.0	0.0	3.85	47	2599
48	38.2650	113.0750	5028.9	1515.87	2027.29	1.41	-472.85	154.00	0.0	0.0	0.0	6.01	48	2599
48	38.5379	112.6196	6060.0	1449.67	2051.25	1.50	-569.76	185.58	0.0	0.0	0.0	-18.90	48	1
48	38.6737	112.4330	7164.0	1416.70	2063.19	1.51	-673.50	219.39	0.0	0.0	0.0	6.11	48	5118
49	38.5300	112.6372	6095.0	1446.30	2050.55	1.50	-573.05	186.65	0.0	0.0	0.0	-19.36	49	1
49	38.6877	112.2847	8325.1	1324.64	2064.42	1.44	-782.59	254.95	0.0	0.0	0.0	-13.58	49	5118
49	38.2650	113.1150	5014.1	1523.83	2027.29	1.41	-471.46	153.55	0.0	0.0	0.0	13.04	49	2599
50	38.2650	113.1833	5337.9	1498.60	2027.29	1.45	-501.90	163.47	0.0	0.0	0.0	8.29	50	2599
50	38.5162	112.6235	6140.0	1440.35	2049.34	1.50	-577.27	188.03	0.0	0.0	0.0	-21.25	50	1
51	38.7325	112.6312	5204.1	1541.07	2068.37	1.43	-489.31	159.37	0.0	0.0	0.0	1.21	51	5118
51	38.5947	112.6060	5945.0	1475.76	2056.25	1.49	-558.95	182.06	0.0	0.0	0.0	-5.09	51	1
51	38.2652	113.1017	5015.1	1522.01	2027.30	1.41	-471.55	153.58	0.0	0.0	0.0	11.27	51	2599
52	38.6755	112.5898	5694.0	1513.91	2063.35	1.48	-535.36	174.37	0.0	0.0	0.0	10.07	52	1
52	38.2652	113.1680	5275.9	1507.52	2027.30	1.44	-496.07	161.57	0.0	0.0	0.0	13.28	52	2599
52	38.7408	112.2127	7975.0	1363.82	2069.10	1.47	-749.70	244.23	0.0	0.0	0.0	-1.28	52	5118
53	38.6870	112.5874	5735.0	1516.52	2064.36	1.48	-539.21	175.63	0.0	0.0	0.0	14.26	53	1
53	38.7425	112.6003	5087.9	1555.41	2069.25	1.42	-478.39	155.81	0.0	0.0	0.0	7.32	53	5118
53	38.2653	113.0833	5025.9	1517.39	2027.32	1.41	-472.57	153.91	0.0	0.0	0.0	7.32	53	2599
54	38.6755	112.5698	5757.0	1511.87	2063.35	1.48	-541.28	176.30	0.0	0.0	0.0	12.01	54	1
54	38.7453	112.5743	5028.9	1571.16	2069.50	1.41	-472.84	154.00	0.0	0.0	0.0	19.09	54	5118
54	38.2653	113.1290	5051.3	1520.39	2027.32	1.42	-475.01	154.71	0.0	0.0	0.0	11.96	54	2599
55	38.6752	112.5505	5918.0	1500.24	2063.32	1.49	-556.41	181.23	0.0	0.0	0.0	10.60	55	1
55	38.2655	113.0650	5037.1	1514.00	2027.33	1.41	-473.62	154.25	0.0	0.0	0.0	4.62	55	2599
55	38.7543	112.3675	5575.1	1532.18	2070.29	1.47	-524.18	170.73	0.0	0.0	0.0	13.88	55	5118
56	38.6731	112.5217	6200.0	1479.59	2063.14	1.51	-582.91	189.87	0.0	0.0	0.0	7.99	56	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	157.41	0.0	0.0	0.0	0.67	56	5118

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ---- INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
56	38.2655	113.1940	5387.1	1493.53	2027.33	1.45	-506.52	164.98	0.0	0.0	0.0	6.29	56	2599
57	38.6778	112.5359	6040.0	1492.12	2063.55	1.50	-567.87	184.97	0.0	0.0	0.0	9.97	57	1
57	38.7593	112.6025	5054.1	1564.34	2070.73	1.42	-475.22	154.78	0.0	0.0	0.0	12.63	57	5118
57	38.2657	113.0463	5053.1	1512.29	2027.34	1.42	-475.13	154.75	0.0	0.0	0.0	3.91	57	2599
58	38.2653	113.0392	5095.1	1512.37	2027.36	1.42	-479.08	156.03	0.0	0.0	0.0	7.13	58	2599
58	38.6530	112.5527	5180.0	1485.09	2061.37	1.50	-581.03	189.26	0.0	0.0	0.0	13.99	58	1
58	38.8015	112.4367	5015.1	1582.91	2074.44	1.41	-471.55	153.58	0.0	0.0	0.0	25.02	58	5118
59	38.6623	112.5625	5830.0	1503.59	2062.19	1.49	-548.14	178.54	0.0	0.0	0.0	9.52	59	1
59	38.8152	112.6548	4862.8	1573.15	2075.65	1.39	-457.24	148.92	0.0	0.0	0.0	4.43	59	5118
59	38.2658	113.0200	5088.9	1512.24	2027.36	1.42	-478.49	155.84	0.0	0.0	0.0	6.11	59	2599
60	38.6420	112.6604	5912.0	1495.48	2060.40	1.49	-555.85	181.05	0.0	0.0	0.0	8.39	60	1
60	38.8342	112.2685	10087.9	1253.56	2077.42	1.16	-948.17	308.93	0.0	0.0	0.0	14.32	60	5118
61	38.8387	112.0060	5334.0	1503.13	2077.72	1.45	-501.52	163.35	0.0	0.0	0.0	-35.86	61	5118
61	38.6563	112.6411	5945.0	1499.57	2061.66	1.49	-558.95	182.06	0.0	0.0	0.0	12.30	61	1
62	38.6629	112.6467	5992.0	1496.69	2062.24	1.50	-563.36	183.50	0.0	0.0	0.0	12.82	62	1
62	38.8492	112.5500	4693.9	1604.47	2078.55	1.37	-441.35	143.75	0.0	0.0	0.0	22.15	62	5118
63	38.6799	112.6289	6100.0	1494.25	2063.74	1.50	-573.51	186.81	0.0	0.0	0.0	15.72	63	1
63	38.8700	112.1953	9265.1	1313.31	2080.48	1.32	-870.88	283.73	0.0	0.0	0.0	19.16	63	5118
63	38.2800	113.0283	5053.1	1515.14	2028.60	1.42	-475.13	154.75	0.0	0.0	0.0	5.50	63	2599
64	38.2800	113.0467	5034.1	1516.26	2028.60	1.41	-473.34	154.16	0.0	0.0	0.0	5.42	64	2599
64	38.6795	112.6072	6080.0	1493.67	2063.35	1.50	-571.63	186.19	0.0	0.0	0.0	14.26	64	1
64	38.8773	112.4113	4621.8	1604.47	2081.12	1.39	-463.38	147.66	0.0	0.0	0.0	27.68	64	5118
65	38.6579	112.6138	6120.0	1485.85	2061.80	1.50	-575.39	187.42	0.0	0.0	0.0	10.52	65	1
65	38.9053	112.6350	4785.1	1589.32	2083.64	1.38	-449.93	146.54	0.0	0.0	0.0	7.69	65	5118
65	38.2800	113.0567	5023.9	1518.08	2028.60	1.41	-472.38	153.85	0.0	0.0	0.0	6.60	65	2599
66	38.2800	113.0650	5022.9	1519.65	2028.60	1.41	-472.29	153.82	0.0	0.0	0.0	8.10	66	2599
66	38.6360	112.6096	6156.0	1477.60	2059.89	1.50	-578.78	188.52	0.0	0.0	0.0	6.47	66	1
66	38.9215	112.2368	5980.1	1534.47	2083.00	1.50	-563.09	183.41	0.0	0.0	0.0	27.65	66	5118
67	38.5327	112.5933	5995.0	1467.86	2055.19	1.50	-563.65	183.59	0.0	0.0	0.0	-8.76	67	1
67	38.9612	112.5345	4671.9	1613.23	2088.75	1.37	-439.29	143.07	0.0	0.0	0.0	21.53	67	5118
67	38.2800	113.1050	5001.0	1525.30	2028.60	1.41	-470.23	153.15	0.0	0.0	0.0	13.36	67	2599
68	38.2800	113.1900	5482.9	1492.27	2028.60	1.46	-515.52	167.91	0.0	0.0	0.0	9.82	68	2599
68	38.5491	112.6035	6030.0	1459.14	2053.99	1.50	-566.94	184.66	0.0	0.0	0.0	-14.07	68	1
68	38.9455	112.1327	9390.1	1313.59	2087.13	1.30	-882.62	287.56	0.0	0.0	0.0	20.22	68	5118
69	38.4493	112.0208	6698.1	1464.74	2087.47	1.52	-629.72	205.12	0.0	0.0	0.0	0.34	69	5118
69	38.5450	112.6077	6050.0	1452.27	2051.87	1.50	-568.82	185.28	0.0	0.0	0.0	-17.56	69	1
70	38.5815	112.6030	6040.0	1464.75	2055.08	1.50	-567.88	184.97	0.0	0.0	0.0	-8.93	70	1
70	38.9643	112.4465	4670.9	1623.32	2088.79	1.37	-439.19	143.04	0.0	0.0	0.0	29.31	70	5118
70	38.2505	113.0092	5071.8	1514.99	2026.65	1.42	-476.89	155.32	0.0	0.0	0.0	6.49	70	2599
71	38.6072	112.5900	5942.0	1473.35	2057.34	1.49	-558.67	181.97	0.0	0.0	0.0	-3.79	71	1
71	38.9713	112.3518	4989.2	1604.32	2089.41	1.41	-469.11	152.79	0.0	0.0	0.0	29.82	71	5118
71	38.2825	113.1507	5203.1	1516.51	2028.82	1.43	-489.22	159.34	0.0	0.0	0.0	16.14	71	2599
72	38.9942	112.1367	10072.1	1270.39	2091.43	1.17	-946.69	308.45	0.0	0.0	0.0	16.04	72	5118
72	38.6306	112.6589	5844.0	1498.57	2059.40	1.49	-549.46	178.97	0.0	0.0	0.0	8.17	72	1
72	38.2833	113.0283	5044.9	1516.26	2029.33	1.42	-474.36	154.50	0.0	0.0	0.0	5.37	72	2599
73	38.2917	113.0550	4998.9	1523.97	2029.63	1.41	-469.95	153.06	0.0	0.0	0.0	9.82	73	2599
73	38.6262	112.6877	5749.0	1502.63	2059.01	1.48	-540.53	176.06	0.0	0.0	0.0	6.61	73	1
74	38.6185	112.7207	5621.0	1510.25	2058.34	1.47	-528.50	172.14	0.0	0.0	0.0	6.81	74	1
74	38.2950	113.0092	5054.1	1517.34	2029.92	1.42	-475.22	154.78	0.0	0.0	0.0	6.45	74	2599
75	38.2950	113.0283	5036.1	1517.74	2029.92	1.41	-473.53	154.22	0.0	0.0	0.0	5.71	75	2599
75	38.6350	112.7034	5698.0	1506.96	2059.78	1.48	-535.73	174.50	0.0	0.0	0.0	6.96	75	1
76	38.6555	112.6970	5774.0	1504.62	2061.59	1.48	-542.88	176.82	0.0	0.0	0.0	7.61	76	1
76	38.2950	113.0467	5019.0	1520.58	2029.92	1.41	-471.92	153.70	0.0	0.0	0.0	7.47	76	2599
77	38.2950	113.0567	5018.0	1522.15	2029.92	1.41	-471.83	153.67	0.0	0.0	0.0	8.97	77	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY +	********** CORRECTIONS ********** *LATITUDE −	CURV −	FREE AIR +	BOUG −	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0 +	STA #	MAP #
78	38.6911	112.6919	5700.0	1503.51	2064.72	1.48	-535.92	174.56	0.0	0.0	0.0	3.67	78	1
78	38.2983	113.0863	5003.9	1527.94	2030.21	1.41	-470.50	153.24	0.0	0.0	0.0	13.58	78	2599
79	38.3017	113.0467	5007.9	1522.94	2030.50	1.41	-470.87	153.36	0.0	0.0	0.0	8.54	79	2599
79	38.6954	112.7043	5781.0	1503.44	2065.10	1.48	-543.53	177.04	0.0	0.0	0.0	3.36	79	1
80	38.7109	112.7039	5621.0	1514.14	2066.39	1.47	-528.50	172.14	0.0	0.0	0.0	2.64	80	1
81	38.7090	112.7290	5860.0	1500.40	2056.30	1.49	-550.96	179.46	0.0	0.0	0.0	4.11	81	1
82	38.7229	112.7197	5696.0	1510.54	2057.44	1.48	-535.54	174.45	0.0	0.0	0.0	2.78	82	1
83	38.7370	112.7444	5580.0	1517.21	2068.76	1.47	-524.64	170.88	0.0	0.0	0.0	0.75	83	1
84	38.7192	112.6938	5455.0	1525.50	2067.19	1.46	-512.89	167.05	0.0	0.0	0.0	2.69	84	1
84	38.3067	113.1150	5083.0	1526.67	2030.94	1.42	-477.93	155.66	0.0	0.0	0.0	16.58	84	2599
85	38.3083	113.2333	6126.9	1462.19	2031.09	1.50	-576.05	187.63	0.0	0.0	0.0	18.02	85	2599
85	38.7323	112.6812	5204.0	1541.08	2068.39	1.43	-489.30	159.37	0.0	0.0	0.0	1.19	85	1
86	38.7176	112.6479	5497.0	1530.51	2067.05	1.46	-516.84	168.34	0.0	0.0	0.0	10.50	86	1
86	38.3093	113.0092	5029.8	1519.45	2031.22	1.41	-472.94	154.03	0.0	0.0	0.0	6.12	86	2599
87	38.3100	113.0183	5032.1	1519.85	2031.23	1.41	-473.15	154.10	0.0	0.0	0.0	6.25	87	2599
87	38.7029	112.6553	5700.0	1516.06	2065.77	1.48	-535.92	174.56	0.0	0.0	0.0	10.18	87	1
88	38.6913	112.6667	5835.0	1503.76	2064.74	1.49	-548.61	178.69	0.0	0.0	0.0	7.45	88	1
88	38.3100	113.0283	5022.9	1521.02	2031.23	1.41	-472.29	153.82	0.0	0.0	0.0	6.84	88	2599
89	38.3100	113.0367	5018.0	1522.50	2031.23	1.41	-471.83	153.67	0.0	0.0	0.0	8.01	89	2599
89	38.6748	112.6604	6030.0	1493.50	2063.29	1.50	-566.00	184.36	0.0	0.0	0.0	10.36	89	1
90	38.5280	112.6563	6091.0	1451.78	2050.37	1.50	-572.67	186.53	0.0	0.0	0.0	-13.95	90	1
90	38.3100	113.0467	5007.8	1524.41	2031.23	1.41	-471.06	153.42	0.0	0.0	0.0	9.40	90	2599
91	38.5286	112.6914	6026.0	1463.13	2050.43	1.50	-566.56	184.54	0.0	0.0	0.0	-6.77	91	1
91	38.3117	113.2150	5921.8	1477.74	2031.38	1.49	-547.38	178.29	0.0	0.0	0.0	13.96	91	2599
92	38.3133	113.2117	5837.6	1476.36	2031.53	1.49	-548.86	178.77	0.0	0.0	0.0	13.93	92	2599
92	38.5377	112.7122	5851.0	1478.20	2051.23	1.49	-550.11	179.18	0.0	0.0	0.0	-3.59	92	1
93	38.5385	112.7258	5830.0	1479.24	2051.30	1.49	-548.14	178.54	0.0	0.0	0.0	-3.95	93	1
93	38.3150	113.2050	5811.7	1478.04	2031.67	1.48	-546.42	177.98	0.0	0.0	0.0	13.33	93	2599
94	38.3150	113.2083	5815.0	1472.35	2031.67	1.49	-554.34	180.56	0.0	0.0	0.0	12.97	94	2599
94	38.5247	112.7393	5996.0	1467.38	2050.09	1.50	-563.74	183.62	0.0	0.0	0.0	-4.09	94	1
95	38.5069	112.7492	6285.0	1451.53	2048.52	1.51	-590.90	192.47	0.0	0.0	0.0	-0.07	95	1
95	38.3167	113.2017	5771.0	1479.75	2031.82	1.48	-542.60	176.73	0.0	0.0	0.0	12.32	95	2599
96	38.5456	112.7366	5750.0	1489.95	2051.93	1.43	-540.62	176.09	0.0	0.0	0.0	-2.93	96	1
97	38.5582	112.7466	5668.0	1494.73	2053.03	1.47	-532.92	173.58	0.0	0.0	0.0	-0.44	97	1
98	38.6047	112.7463	5550.0	1514.17	2057.12	1.47	-521.82	169.96	0.0	0.0	0.0	7.45	98	1
99	38.5945	112.7310	5580.0	1507.71	2056.22	1.47	-524.64	170.88	0.0	0.0	0.0	3.78	99	1
99	38.3133	113.1967	5478.9	1471.81	2031.97	1.49	-552.74	180.04	0.0	0.0	0.0	11.06	99	2599
100	38.5807	112.7036	5805.0	1489.39	2055.01	1.48	-545.79	177.77	0.0	0.0	0.0	0.92	100	1
101	38.5386	112.6839	5865.0	1489.85	2055.70	1.49	-550.96	179.48	0.0	0.0	0.0	4.10	101	1
101	38.3200	113.0467	4998.0	1527.16	2032.11	1.41	-469.95	153.06	0.0	0.0	0.0	10.53	101	2599
102	38.3200	113.0700	4991.1	1530.94	2032.11	1.41	-469.30	152.85	0.0	0.0	0.0	13.87	102	2599
102	38.5723	112.6951	5815.0	1485.78	2054.27	1.49	-546.73	178.08	0.0	0.0	0.0	-1.33	102	1
103	38.5875	112.6632	5970.0	1479.21	2055.61	1.49	-561.30	182.83	0.0	0.0	0.0	0.58	103	1
103	38.3200	113.1917	5955.4	1467.15	2032.11	1.49	-559.93	182.38	0.0	0.0	0.0	11.09	103	2599
104	38.3217	113.1867	5919.3	1470.68	2032.26	1.49	-556.53	181.27	0.0	0.0	0.0	12.19	104	2599
104	38.5991	112.6528	5959.0	1482.95	2056.63	1.49	-560.26	182.49	0.0	0.0	0.0	2.60	104	1
105	38.6132	112.6453	5865.0	1494.97	2057.87	1.49	-551.43	179.61	0.0	0.0	0.0	7.43	105	1
105	38.5814	112.6169	6147.0	1460.10	2055.07	1.50	-576.99	187.94	0.0	0.0	0.0	-7.42	106	1
106	38.3233	113.1833	5984.2	1467.15	2032.40	1.50	-562.64	183.26	0.0	0.0	0.0	12.63	106	2599
107	38.3240	113.1020	5085.9	1530.69	2032.46	1.42	-478.21	155.75	0.0	0.0	0.0	19.27	107	2599
107	38.5726	112.6384	6500.0	1435.75	2054.30	1.51	-611.10	199.06	0.0	0.0	0.0	-8.02	107	1
108	38.5798	112.6309	6350.0	1448.94	2054.94	1.51	-597.01	194.46	0.0	0.0	0.0	-4.96	108	1
108	38.3242	113.0092	5014.1	1522.15	2032.48	1.41	-471.46	153.55	0.0	0.0	0.0	6.17	108	2599
109	38.3250	113.0283	5004.9	1524.16	2032.55	1.41	-470.60	153.27	0.0	0.0	0.0	7.52	109	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	CORRECTIONS *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
110	38.7054	112.5049	5537.0	1538.38	2065.98	1.46	-520.60	169.57	0.0	0.0	0.0	21.97	110	1
110	38.3250	113.0367	5001.9	1525.69	2032.55	1.41	-470.32	153.18	0.0	0.0	0.0	8.87	110	2599
111	38.3250	113.0833	4991.1	1534.12	2032.55	1.41	-469.30	152.85	0.0	0.0	0.0	16.61	111	2599
112	38.3250	113.1750	6015.7	1467.00	2032.55	1.50	-565.69	184.26	0.0	0.0	0.0	14.39	112	2599
113	38.3250	113.1767	5957.3	1472.76	2032.55	1.49	-560.11	182.44	0.0	0.0	0.0	16.39	113	2599
114	38.7201	112.5615	5275.0	1551.49	2067.28	1.44	-495.98	161.54	0.0	0.0	0.0	17.21	114	1
115	38.6992	112.5905	5540.0	1530.78	2065.44	1.46	-520.88	169.66	0.0	0.0	0.0	15.11	115	1
115	38.3267	113.1700	5816.9	1482.65	2032.70	1.49	-546.91	178.14	0.0	0.0	0.0	17.24	115	2599
116	38.3267	113.1717	5791.3	1483.75	2032.70	1.48	-544.51	177.35	0.0	0.0	0.0	16.71	116	2599
116	38.7293	112.5844	5125.0	1558.54	2068.09	1.42	-481.88	156.95	0.0	0.0	0.0	13.97	116	1
117	38.7427	112.5771	5030.0	1570.59	2069.26	1.41	-472.95	154.04	0.0	0.0	0.0	18.82	117	1
118	38.7500	112.5681	5015.0	1576.17	2069.91	1.41	-471.54	153.58	0.0	0.0	0.0	22.80	118	1
118	38.3317	113.0917	5029.8	1534.12	2033.14	1.41	-472.94	154.03	0.0	0.0	0.0	18.48	118	2599
119	38.7434	112.5903	5088.0	1564.02	2069.36	1.42	-478.40	155.81	0.0	0.0	0.0	15.82	119	1
119	38.3334	113.1250	5425.8	1509.29	2033.28	1.45	-510.16	166.16	0.0	0.0	0.0	18.55	119	2599
120	38.7378	112.6157	5250.0	1547.97	2068.83	1.44	-493.63	160.78	0.0	0.0	0.0	10.56	120	1
121	38.7412	112.6377	5260.0	1543.61	2069.13	1.44	-494.57	161.08	0.0	0.0	0.0	6.53	121	1
121	38.3383	113.0283	4988.8	1526.96	2033.72	1.41	-469.08	152.78	0.0	0.0	0.0	8.14	121	2599
122	38.3383	113.0367	4983.9	1529.07	2033.72	1.41	-468.62	152.63	0.0	0.0	0.0	9.93	122	2599
122	38.7398	112.6482	5256.0	1544.49	2069.01	1.44	-494.19	160.96	0.0	0.0	0.0	7.27	122	1
123	38.7431	112.6890	5163.0	1554.57	2069.30	1.43	-485.64	158.17	0.0	0.0	0.0	1.30	123	1
123	38.3383	113.0467	4981.7	1530.89	2033.72	1.41	-468.44	152.57	0.0	0.0	0.0	11.63	123	2599
124	38.3367	113.0092	4991.1	1529.31	2033.75	1.41	-469.30	152.85	0.0	0.0	0.0	5.60	124	2599
124	38.7357	112.6633	5195.0	1544.00	2068.65	1.43	-488.46	159.09	0.0	0.0	0.0	3.28	124	1
125	38.7205	112.6370	5472.0	1533.20	2067.31	1.46	-514.49	167.57	0.0	0.0	0.0	11.34	125	1
126	38.7263	112.6139	5377.0	1540.06	2067.82	1.45	-505.56	164.67	0.0	0.0	0.0	11.68	126	1
127	38.6433	112.7319	5765.0	1505.50	2060.52	1.48	-542.03	176.55	0.0	0.0	0.0	8.98	127	1
127	38.0140	113.1410	5562.0	1459.58	2005.30	1.47	-522.96	170.33	0.0	0.0	0.0	5.44	127	5118
128	38.0217	113.1712	5460.3	1462.18	2005.97	1.46	-513.40	167.22	0.0	0.0	0.0	0.94	128	5118
128	38.6623	112.7244	5950.0	1493.95	2062.23	1.49	-559.42	182.21	0.0	0.0	0.0	7.43	128	1
129	38.6754	112.7129	6050.0	1485.08	2063.34	1.50	-568.81	185.28	0.0	0.0	0.0	3.78	129	1
129	38.0278	113.2327	5157.1	1486.34	2006.51	1.43	-484.91	157.93	0.0	0.0	0.0	5.38	129	5118
129	38.3418	113.0997	5074.1	1532.95	2034.03	1.42	-477.10	155.39	0.0	0.0	0.0	19.22	129	2599
130	38.0280	113.2100	5302.1	1476.53	2006.52	1.44	-498.54	162.37	0.0	0.0	0.0	6.73	130	5118
130	38.6924	112.7317	5930.0	1496.00	2064.84	1.49	-557.54	181.60	0.0	0.0	0.0	5.61	130	1
131	38.7036	112.7424	5940.0	1498.13	2065.82	1.49	-558.48	181.91	0.0	0.0	0.0	7.39	131	1
131	38.0315	113.3992	5897.3	1443.12	2006.83	1.49	-554.47	180.60	0.0	0.0	0.0	8.67	131	5118
131	38.3467	113.0283	4981.0	1528.29	2034.45	1.41	-468.34	152.54	0.0	0.0	0.0	8.24	131	2599
132	38.3467	113.0733	5013.1	1535.92	2034.45	1.41	-471.37	153.52	0.0	0.0	0.0	17.90	132	2599
132	38.7258	112.5745	5120.0	1561.03	2067.78	1.42	-481.41	156.79	0.0	0.0	0.0	16.44	132	1
132	38.0348	113.1397	5544.9	1459.94	2007.12	1.47	-521.36	169.81	0.0	0.0	0.0	2.90	132	5118
133	38.7151	112.5537	5460.0	1542.20	2066.84	1.46	-513.36	167.21	0.0	0.0	0.0	20.06	133	1
134	38.7232	112.5408	5503.0	1540.34	2067.55	1.46	-517.41	168.52	0.0	0.0	0.0	20.21	134	1
134	38.0387	113.2258	5263.1	1484.66	2009.21	1.44	-494.87	161.18	0.0	0.0	0.0	7.70	134	5118
135	38.0622	113.1058	5955.0	1438.34	2009.51	1.49	-559.90	182.37	0.0	0.0	0.0	4.86	135	5118
135	38.7381	112.5313	5400.0	1552.04	2068.86	1.45	-507.73	165.37	0.0	0.0	0.0	24.08	135	1
136	38.7483	112.5383	5220.0	1563.75	2069.80	1.44	-490.81	159.86	0.0	0.0	0.0	23.46	136	1
136	38.3533	113.0092	4981.9	1525.10	2035.04	1.41	-468.44	152.57	0.0	0.0	0.0	4.52	136	2599
137	38.3533	113.0283	4976.0	1524.88	2035.04	1.41	-467.88	152.39	0.0	0.0	0.0	1.93	137	2599
137	38.5953	112.6631	5850.0	+1481.68	-2056.34	-1.49	+550.02	-179.15	0.0	0.0	0.0	2.94	137	1
137	38.0657	113.1092	5996.0	1437.83	2009.82	1.50	-563.75	183.62	0.0	0.0	0.0	6.64	137	5118
138	38.5725	112.5702	6110.0	1464.93	2054.29	1.50	-574.45	187.11	0.0	0.0	0.0	-3.47	138	1
139	38.6086	112.6096	5920.0	1481.26	2057.46	1.49	-556.60	181.29	0.0	0.0	0.0	-2.39	139	1
139	38.3542	113.2408	6253.9	1459.56	2035.11	1.51	-587.98	191.52	0.0	0.0	0.0	19.41	139	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
140	38.3550	113.0317	5108.9	1531.27	2035.18	1.42	-480.37	156.46	0.0	0.0	0.0	18.58	140	2599
140	38.0925	113.2408	5093.5	1496.18	2012.17	1.42	-478.92	155.98	0.0	0.0	0.0	5.53	140	5118
140	38.5531	112.6858	5979.0	1467.69	2052.58	1.49	-502.14	183.10	0.0	0.0	0.0	-7.35	140	1
141	38.5115	112.6917	6242.0	1451.00	2048.93	1.51	-586.86	191.15	0.0	0.0	0.0	-3.73	141	1
141	38.3550	113.1017	6457.0	1447.22	2035.18	1.51	-605.19	197.83	0.0	0.0	0.0	18.58	141	2599
141	38.0947	113.0663	6125.6	1428.58	2012.36	1.50	-575.93	187.59	0.0	0.0	0.0	3.06	141	5118
142	38.3567	113.1043	5715.9	1494.08	2035.33	1.48	-537.42	175.04	0.0	0.0	0.0	19.65	142	2599
142	38.5173	112.6736	6144.0	1451.07	2049.44	1.50	-577.65	188.15	0.0	0.0	0.0	-10.38	142	1
143	38.6238	112.7338	5590.0	1517.06	2058.80	1.47	-525.58	171.19	0.0	0.0	0.0	11.19	143	1
144	38.6277	112.7490	5573.0	1520.90	2059.15	1.47	-523.99	170.67	0.0	0.0	0.0	13.60	144	1
144	38.1042	113.1125	5857.2	1468.98	2013.19	1.49	-550.89	179.43	0.0	0.0	0.0	5.76	144	5118
145	38.6197	112.7107	5635.0	1507.54	2058.44	1.47	-529.81	172.57	0.0	0.0	0.0	6.87	145	1
145	38.3610	113.0358	4969.1	1530.69	2035.71	1.41	-467.23	152.18	0.0	0.0	0.0	8.63	145	2599
146	38.3617	113.0583	4980.0	1534.83	2035.77	1.41	-468.25	152.51	0.0	0.0	0.0	13.40	146	2599
146	38.6234	112.6965	5735.0	1503.40	2058.77	1.48	-539.21	175.63	0.0	0.0	0.0	6.74	146	1
14	38.1147	113.2429	5076.1	1496.13	2014.11	1.42	-477.29	155.45	0.0	0.0	0.0	2.44	146	5118
147	38.6232	112.6609	5800.0	1500.95	2059.13	1.48	-545.32	177.62	0.0	0.0	0.0	7.98	147	1
147	38.3617	113.0700	5016.1	1535.02	2035.77	1.41	-471.64	153.61	0.0	0.0	0.0	15.87	147	2599
148	38.6241	112.6499	5870.0	1496.10	2059.18	1.49	-551.90	179.76	0.0	0.0	0.0	7.57	148	1
149	38.6169	112.6294	5900.0	1490.90	2058.19	1.49	-554.72	180.68	0.0	0.0	0.0	5.25	149	1
149	38.3633	113.0517	4978.0	1533.55	2035.92	1.41	-468.07	152.45	0.0	0.0	0.0	11.85	149	2599
149	38.1283	113.2147	5082.0	1498.04	2015.35	1.42	-477.84	155.63	0.0	0.0	0.0	3.48	149	5118
150	38.1290	113.1417	5465.2	1482.51	2015.37	1.46	-513.86	167.37	0.0	0.0	0.0	12.18	150	5118
151	38.3647	113.2453	6144.0	1463.33	2036.03	1.50	-581.41	189.38	0.0	0.0	0.0	17.83	151	2599
153	38.3683	113.0092	4969.1	1525.10	2036.35	1.41	-467.23	152.18	0.0	0.0	0.0	2.40	153	2599
154	38.3683	113.0233	4967.8	1528.97	2036.35	1.41	-467.11	152.15	0.0	0.0	0.0	6.19	154	2599
155	38.3683	113.0650	5022.9	1535.06	2036.35	1.41	-472.29	153.82	0.0	0.0	0.0	15.76	155	2599
157	38.3717	113.1817	6165.0	1462.67	2036.64	1.50	-579.63	188.80	0.0	0.0	0.0	15.35	157	2599
158	38.3750	113.0833	5231.9	1524.21	2036.94	1.44	-491.93	160.22	0.0	0.0	0.0	17.55	158	2599
160	38.3767	113.2367	6079.0	1472.02	2037.08	1.50	-571.55	186.16	0.0	0.0	0.0	10.82	160	2599
163	38.3850	113.2083	5964.9	1480.00	2037.82	1.49	-560.82	182.67	0.0	0.0	0.0	18.84	163	2599
164	38.3883	113.0433	5042.0	1529.85	2038.11	1.42	-474.09	154.41	0.0	0.0	0.0	10.00	164	2599
165	38.3933	113.0669	5083.0	1533.39	2038.11	1.42	-477.93	155.66	0.0	0.0	0.0	16.63	165	2599
166	38.3867	113.0383	5032.1	1528.43	2038.14	1.41	-473.15	154.10	0.0	0.0	0.0	8.33	166	2599
167	38.3900	113.0850	5179.9	1532.41	2038.26	1.43	-486.20	158.35	0.0	0.0	0.0	20.57	167	2599
168	38.3917	113.0950	5352.0	1522.22	2038.40	1.45	-503.22	163.90	0.0	0.0	0.0	21.69	168	2599
168	38.1667	113.1730	5075.0	1504.53	2018.07	1.42	-477.19	155.42	0.0	0.0	0.0	6.21	168	2
169	38.1566	113.2050	5048.0	1504.20	2017.79	1.42	-474.65	154.59	0.0	0.0	0.0	5.05	169	2
170	38.1728	113.2028	5037.0	1504.98	2019.21	1.41	-473.61	154.25	0.0	0.0	0.0	3.72	170	2
170	38.3925	113.0950	5352.0	1522.20	2038.47	1.45	-503.22	163.90	0.0	0.0	0.0	21.60	170	2599
175	38.3983	113.0275	5044.9	1526.08	2038.99	1.42	-474.36	154.50	0.0	0.0	0.0	5.54	175	2599
176	38.3983	113.0650	5121.0	1529.62	2038.99	1.42	-481.51	156.85	0.0	0.0	0.0	13.89	176	2599
180	38.4017	113.2350	6002.3	1478.19	2039.28	1.50	-564.33	183.81	0.0	0.0	0.0	17.93	180	2599
181	38.4017	113.2400	6030.2	1476.47	2039.28	1.50	-566.95	184.67	0.0	0.0	0.0	17.98	181	2599
182	38.4017	113.2433	6044.9	1475.59	2039.28	1.50	-568.34	185.12	0.0	0.0	0.0	18.03	182	2599
183	38.4017	113.2467	6154.2	1468.47	2039.28	1.50	-578.61	188.47	0.0	0.0	0.0	17.83	183	2599
184	38.4033	113.2150	5894.0	1484.76	2039.43	1.49	-554.16	180.50	0.0	0.0	0.0	17.50	184	2599
185	38.4033	113.2183	5907.8	1483.93	2039.43	1.49	-555.45	180.92	0.0	0.0	0.0	17.55	185	2599
186	38.4033	113.2233	5984.6	1478.73	2039.43	1.50	-562.67	183.27	0.0	0.0	0.0	17.26	186	2599
187	38.4033	113.2300	5973.7	1479.61	2039.43	1.49	-561.65	182.94	0.0	0.0	0.0	17.40	187	2599
189	38.4050	113.0083	4992.1	1524.12	2039.57	1.41	-469.39	152.88	0.0	0.0	0.0	-0.35	189	2599
190	38.4050	113.1900	5920.9	1477.11	2039.57	1.49	-556.69	181.32	0.0	0.0	0.0	11.41	190	2599
191	38.4050	113.1933	5886.5	1480.15	2039.57	1.49	-553.45	180.27	0.0	0.0	0.0	12.27	191	2599
192	38.4050	113.1983	5872.0	1482.20	2039.57	1.49	-552.09	179.82	0.0	0.0	0.0	13.47	192	2599
193	38.4050	113.2017	5819.2	1486.48	2039.57	1.49	-547.13	178.21	0.0	0.0	0.0	14.34	193	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ----* INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
194	38.4050	113.2067	5849.7	1485.35	2039.57	1.49	-550.00	179.14	0.0	0.0	0.0	15.34	194	2599
195	38.4050	113.2067	5850.0	1485.42	2039.57	1.49	-550.03	179.15	0.0	0.0	0.0	15.23	195	2599
196	38.4050	113.2100	5865.3	1485.40	2039.57	1.49	-551.51	179.65	0.0	0.0	0.0	16.21	196	2599
197	38.4067	113.1700	5927.1	1477.11	2039.72	1.49	-557.27	181.51	0.0	0.0	0.0	11.66	197	2599
197	38.7657	112.0762	5294.9	1493.58	2071.29	1.44	-497.85	162.15	0.0	0.0	0.0	-43.45	197	5176
198	38.7762	112.0627	5281.1	1495.11	2072.21	1.44	-496.55	161.73	0.0	0.0	0.0	-43.72	198	5176
198	38.4067	113.1733	5965.9	1474.70	2039.72	1.49	-560.91	182.70	0.0	0.0	0.0	11.70	198	2599
199	38.4067	113.1400	5974.4	1473.48	2039.72	1.49	-561.71	182.96	0.0	0.0	0.0	11.02	199	2599
199	38.7823	112.0332	5246.0	1499.29	2072.75	1.44	-493.44	160.72	0.0	0.0	0.0	-42.18	199	5176
200	38.8117	112.0147	5251.0	1505.11	2075.34	1.44	-493.72	160.81	0.0	0.0	0.0	-38.76	200	5176
200	38.4067	113.1350	5959.0	1474.41	2039.72	1.49	-560.17	182.46	0.0	0.0	0.0	10.91	200	2599
201	38.1717	113.1692	5056.0	1504.93	2019.10	1.42	-475.40	154.83	0.0	0.0	0.0	3.97	201	2
202	38.1733	113.1773	5047.0	1505.52	2019.25	1.42	-474.55	154.56	0.0	0.0	0.0	4.85	202	2
202	38.4083	113.0900	5284.1	1528.90	2039.86	1.44	-496.84	161.82	0.0	0.0	0.0	22.61	202	2599
203	38.1723	113.1862	5040.0	1507.43	2019.16	1.42	-473.90	154.34	0.0	0.0	0.0	6.40	203	2
203	38.4033	113.1633	5104.0	1465.33	2039.86	1.50	-573.89	186.93	0.0	0.0	0.0	10.98	203	2599
204	38.1710	113.1947	5029.0	1508.50	2019.05	1.41	-472.49	153.89	0.0	0.0	0.0	6.64	204	2
204	38.4033	113.1650	5006.2	1472.15	2039.86	1.50	-564.70	183.93	0.0	0.0	0.0	11.56	204	2599
205	38.1660	113.1815	5082.0	1505.59	2018.43	1.42	-477.84	155.63	0.0	0.0	0.0	7.95	205	2
205	38.4108	113.0655	5198.1	1525.88	2040.04	1.43	-488.76	159.19	0.0	0.0	0.0	13.93	205	2599
206	38.1613	113.1898	5082.0	1505.33	2018.20	1.42	-477.84	155.63	0.0	0.0	0.0	7.92	206	2
207	38.1585	113.1935	5062.0	1504.80	2017.95	1.42	-475.96	155.02	0.0	0.0	0.0	6.38	207	2
207	38.4117	113.0650	5198.1	1525.97	2040.16	1.43	-488.76	159.19	0.0	0.0	0.0	13.95	207	2599
208	38.1542	113.2133	5048.0	1502.43	2017.57	1.42	-474.65	154.59	0.0	0.0	0.0	3.50	208	2
209	38.1517	113.2216	5053.0	1501.83	2017.35	1.42	-475.12	154.74	0.0	0.0	0.0	3.43	209	2
210	38.1483	113.2342	5058.0	1501.97	2017.06	1.42	-475.59	154.90	0.0	0.0	0.0	4.18	210	2
210	38.4142	113.0540	5151.9	1528.14	2040.38	1.43	-484.41	157.77	0.0	-0.0	0.0	12.97	210	2599
211	38.5000	112.9917	4969.0	1531.87	2047.92	1.41	-467.22	152.17	0.0	0.0	0.0	-2.41	211	2
211	38.4150	113.1483	5751.9	1490.90	2040.45	1.48	-540.81	176.15	0.0	0.0	0.0	13.63	211	2599
212	38.4167	113.1308	5622.0	1501.42	2040.77	1.47	-528.60	172.17	0.0	0.0	0.0	15.61	212	2599
212	38.5317	112.9917	4922.0	1541.94	2050.70	1.40	-462.80	150.73	0.0	0.0	0.0	1.91	212	2
213	38.5533	112.9666	4928.0	1546.94	2052.60	1.40	-463.36	150.92	0.0	0.0	0.0	5.38	213	2
213	38.4200	113.0300	5102.0	1525.83	2040.89	1.42	-479.72	156.24	0.0	0.0	0.0	7.00	213	2599
214	38.5350	112.9866	4910.0	1553.57	2055.39	1.40	-461.67	150.36	0.0	0.0	0.0	8.09	214	2
214	38.4200	113.0983	5374.0	1524.12	2040.89	1.45	-505.29	164.57	0.0	0.0	0.0	22.49	214	2599
215	38.7183	112.9700	4843.0	1592.47	2067.12	1.39	-455.37	148.31	0.0	0.0	0.0	31.02	215	2
215	38.4200	113.1333	5070.1	1479.31	2040.89	1.49	-551.91	179.76	0.0	0.0	0.0	9.07	215	2599
216	38.6850	112.9900	4889.0	1580.75	2064.18	1.40	-459.70	149.72	0.0	0.0	0.0	25.14	216	2
217	38.6933	112.9833	4895.0	1570.42	2061.40	1.40	-460.26	149.90	0.0	0.0	0.0	17.98	217	2
217	38.4250	113.1143	5486.9	1519.99	2041.33	1.46	-515.89	168.03	0.0	0.0	0.0	25.06	217	2599
218	38.6183	112.9150	4858.0	1562.09	2058.32	1.39	-456.78	148.77	0.0	0.0	0.0	10.39	218	2
219	38.7433	112.9550	4841.0	1599.00	2069.76	1.39	-455.18	148.25	0.0	0.0	0.0	34.78	219	2
219	38.4267	113.0283	5085.9	1526.42	2041.46	1.42	-478.21	155.75	0.0	0.0	0.0	5.98	219	2599
220	38.7759	112.9317	4910.0	1596.24	2072.11	1.40	-461.67	150.36	0.0	0.0	0.0	34.04	220	2
220	38.4333	113.0100	5015.1	1524.66	2042.06	1.41	-471.55	153.58	0.0	0.0	0.0	-0.84	220	2599
221	38.8017	112.8967	4867.0	1594.35	2074.46	1.39	-457.63	149.05	0.0	0.0	0.0	27.08	221	2
222	38.8350	112.8483	4872.0	1593.07	2077.39	1.40	-459.10	149.20	0.0	0.0	0.0	23.18	222	2
222	38.4350	113.1383	5555.1	1503.46	2042.21	1.47	-522.31	170.12	0.0	0.0	0.0	11.97	222	2599
223	38.6917	112.9467	4955.0	1575.93	2064.77	1.41	-465.90	151.74	0.0	0.0	0.0	23.91	223	2
224	38.6750	112.9133	4999.0	1563.77	2063.30	1.41	-470.04	153.09	0.0	0.0	0.0	21.00	224	2
224	38.4383	113.0772	5303.1	1526.33	2042.32	1.44	-498.62	162.40	0.0	0.0	0.0	18.78	224	2599
225	38.4367	113.1317	5546.4	1505.76	2042.35	1.46	-520.55	169.55	0.0	0.0	0.0	12.94	225	2599
225	38.6550	112.8700	5080.0	1561.84	2061.55	1.42	-477.65	155.57	0.0	0.0	0.0	20.95	225	2
226	38.6467	112.8316	5410.0	1541.47	2060.81	1.45	-508.67	165.68	0.0	0.0	0.0	22.19	226	2
226	38.4367	113.1350	5544.1	1504.64	2042.35	1.47	-521.29	169.79	0.0	0.0	0.0	12.33	226	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
227	38.4333	113.1293	5447.8	1512.09	2042.50	1.46	-512.22	166.83	0.0	0.0	0.0	13.52	227	2599
227	38.6250	112.9350	5875.0	1493.64	2058.91	1.49	-552.37	179.92	0.0	0.0	0.0	5.70	227	2
228	38.6283	112.6800	5789.0	1500.85	2059.20	1.48	-544.29	177.28	0.0	0.0	0.0	7.17	228	2
228	38.4390	113.0492	5353.9	1521.96	2042.56	1.45	-503.87	164.11	0.0	0.0	0.0	17.71	228	2599
229	38.6200	112.7200	5621.0	1510.46	2058.46	1.47	-528.50	172.14	0.0	0.0	0.0	6.88	229	2
230	38.6333	112.7600	5573.0	1522.47	2059.64	1.47	-523.70	170.58	0.0	0.0	0.0	14.49	230	2
230	38.4400	113.1250	5434.0	1513.57	2042.64	1.46	-510.93	166.41	0.0	0.0	0.0	13.99	230	2599
231	38.4400	113.1533	5353.1	1503.16	2042.64	1.47	-522.12	170.06	0.0	0.0	0.0	11.11	231	2599
231	38.6450	112.7967	5429.0	1532.36	2060.67	1.46	-510.45	166.26	0.0	0.0	0.0	14.43	231	2
232	38.6817	112.8483	5190.0	1556.07	2063.89	1.43	-487.99	158.94	0.0	0.0	0.0	19.80	232	2
233	38.7017	112.8183	5273.0	1543.79	2065.65	1.44	-495.79	161.48	0.0	0.0	0.0	11.00	233	2
233	38.4417	113.0283	5369.9	1528.14	2042.79	1.42	-478.70	155.26	0.0	0.0	0.0	5.37	233	2599
234	38.7300	112.7967	5187.0	1551.36	2068.15	1.43	-487.71	158.85	0.0	0.0	0.0	10.64	234	2
234	38.4417	113.1183	5414.0	1516.07	2042.79	1.45	-508.95	165.77	0.0	0.0	0.0	15.01	234	2599
235	38.4417	113.1217	5421.9	1514.74	2042.79	1.45	-509.79	166.04	0.0	0.0	0.0	14.24	235	2599
235	38.6217	112.8733	5094.0	1550.40	2058.61	1.42	-478.97	156.00	0.0	0.0	0.0	13.33	235	2
236	38.6117	112.9000	5035.0	1546.45	2057.73	1.41	-473.42	154.19	0.0	0.0	0.0	8.54	236	2
236	38.4417	113.1577	5698.1	1493.44	2042.79	1.48	-535.75	174.50	0.0	0.0	0.0	10.42	236	2599
237	38.4425	113.2313	6139.1	1471.69	2042.87	1.50	-577.19	188.00	0.0	0.0	0.0	16.51	237	2599
237	38.5533	112.9433	5025.0	1541.02	2052.60	1.41	-472.48	153.89	0.0	0.0	0.0	5.60	237	2
237	38.6100	112.9433	4957.0	1551.41	2057.59	1.41	-466.09	151.80	0.0	0.0	0.0	6.71	237	2
238	38.5000	112.9633	5023.0	1529.00	2047.92	1.41	-472.29	153.82	0.0	0.0	0.0	-1.86	238	2
239	38.4433	113.0433	5120.9	1531.18	2042.94	1.43	-482.34	157.10	0.0	0.0	0.0	12.06	239	2599
239	38.1967	113.2717	5168.0	1494.24	2021.30	1.43	-485.93	158.26	0.0	0.0	0.0	3.18	239	2
240	38.1950	113.3033	5162.0	1494.42	2021.15	1.43	-485.36	158.08	0.0	0.0	0.0	3.12	240	2
240	38.4433	113.1133	5473.1	1514.79	2042.94	1.46	-514.60	167.61	0.0	0.0	0.0	17.38	240	2599
241	38.4433	113.1167	5474.1	1513.17	2042.94	1.46	-514.69	167.64	0.0	0.0	0.0	15.82	241	2599
241	38.1950	113.3333	5202.0	1491.48	2021.15	1.43	-489.12	159.31	0.0	0.0	0.0	-1.29	241	2
242	38.1800	113.3067	5123.0	1497.64	2019.83	1.42	-481.70	156.89	0.0	0.0	0.0	1.19	242	2
242	38.4450	113.1100	5460.6	1517.44	2043.09	1.46	-513.43	167.23	0.0	0.0	0.0	19.10	242	2599
243	38.4467	113.1033	5435.3	1520.93	2043.23	1.46	-511.05	166.45	0.0	0.0	0.0	20.74	243	2599
243	38.1800	113.2683	5094.0	1500.14	2019.83	1.42	-478.97	156.00	0.0	0.0	0.0	1.86	243	2
244	38.1800	113.2600	5072.0	1501.53	2019.83	1.42	-476.90	155.32	0.0	0.0	0.0	1.86	244	2
244	38.4467	113.1067	5447.8	1519.11	2043.23	1.46	-512.22	166.83	0.0	0.0	0.0	19.81	244	2599
245	38.1650	113.3033	5088.0	1497.15	2018.52	1.42	-478.41	155.81	0.0	0.0	0.0	-0.20	245	2
246	38.1650	113.2800	5052.0	1500.94	2018.52	1.42	-475.02	154.71	0.0	0.0	0.0	1.31	246	2
246	38.4483	113.0983	5406.5	1521.76	2043.38	1.45	-508.34	165.57	0.0	0.0	0.0	19.70	246	2599
247	38.4483	113.1008	5419.0	1521.96	2043.38	1.45	-509.42	165.92	0.0	0.0	0.0	20.63	247	2599
247	38.1650	113.2500	5043.0	1502.32	2018.52	1.42	-474.18	154.44	0.0	0.0	0.0	2.12	247	2
248	38.1650	113.3350	5104.0	1494.91	2018.52	1.42	-479.91	156.30	0.0	0.0	0.0	-1.43	248	2
248	38.4483	113.1017	5696.8	1493.89	2043.38	1.48	-535.63	174.46	0.0	0.0	0.0	10.20	248	2599
249	38.1367	113.3300	5072.0	1489.63	2016.04	1.42	-476.90	155.32	0.0	0.0	0.0	-6.25	249	2
249	38.4500	113.0967	5373.7	1522.05	2043.52	1.45	-507.14	165.18	0.0	0.0	0.0	19.03	249	2599
250	38.4517	113.0900	5368.4	1524.46	2043.67	1.45	-504.76	164.40	0.0	0.0	0.0	19.70	250	2599
250	38.1300	113.2933	5059.0	1491.17	2015.45	1.42	-475.68	154.93	0.0	0.0	0.0	-4.95	250	2
251	38.1300	113.2817	5062.0	1496.21	2015.45	1.42	-475.96	155.02	0.0	0.0	0.0	0.28	251	2
251	38.4517	113.0933	5380.9	1522.44	2043.67	1.45	-505.93	164.79	0.0	0.0	0.0	18.87	251	2599
252	38.1200	113.3466	5113.0	1486.03	2014.58	1.42	-480.76	156.58	0.0	0.0	0.0	-5.80	252	2
253	38.1167	113.3833	5355.0	1483.28	2014.29	1.45	-503.50	163.99	0.0	0.0	0.0	7.06	253	2
253	38.4533	113.0483	5095.1	1537.46	2043.82	1.42	-479.07	156.03	0.0	0.0	0.0	15.26	253	2599
254	38.4533	113.0867	5353.1	1526.38	2043.82	1.45	-503.34	163.94	0.0	0.0	0.0	20.22	254	2599
254	38.1017	113.4183	5470.0	1476.75	2012.97	1.46	-514.31	167.51	0.0	0.0	0.0	9.12	254	2
255	38.1233	113.4267	5554.0	1475.54	2014.87	1.47	-522.21	170.09	0.0	0.0	0.0	11.32	255	2
255	38.4533	113.2033	5995.0	1478.13	2043.82	1.50	-563.75	183.62	0.0	0.0	0.0	12.94	255	2599
256	38.1617	113.4383	5782.0	1456.68	2018.23	1.48	-543.64	177.07	0.0	0.0	0.0			

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
256	38.4550	113.0833	5377.9	1526.23	2043.96	1.45	-505.65	164.69	0.0	0.0	0.0	21.78	256	2599
257	38.0700	113.4467	5268.0	1487.23	2010.20	1.44	-495.33	161.33	0.0	0.0	0.0	9.59	257	2
258	38.0433	113.4450	5114.0	1490.29	2007.87	1.42	-480.85	156.61	0.0	0.0	0.0	5.24	258	2
258	38.4567	113.0083	4957.0	1530.05	2044.11	1.41	-466.09	151.80	0.0	0.0	0.0	-1.18	258	2599
259	38.4567	113.0783	5440.3	1522.10	2044.11	1.46	-511.51	166.60	0.0	0.0	0.0	21.44	259	2599
259	38.0050	113.4333	5081.0	1473.81	2004.51	1.42	-477.75	155.60	0.0	0.0	0.0	-9.97	259	2
260	38.4567	113.0300	5426.5	1523.53	2044.11	1.46	-510.22	166.18	0.0	0.0	0.0	22.00	260	2599
260	38.0050	113.4583	5086.0	1481.28	2004.51	1.42	-478.22	155.75	0.0	0.0	0.0	-2.18	260	2
261	38.0000	113.4933	5305.0	1480.49	2004.07	1.44	-498.61	162.46	0.0	0.0	0.0	11.32	261	2
261	38.4567	113.1600	5721.1	1494.82	2044.11	1.48	-537.91	175.20	0.0	0.0	0.0	11.94	261	2599
262	38.0283	113.4050	5083.0	1473.11	2006.53	1.42	-477.94	155.66	0.0	0.0	0.0	-12.58	262	2
263	38.0267	113.2550	5096.0	1474.30	2006.41	1.42	-479.16	156.06	0.0	0.0	0.0	-10.43	263	2
263	38.4617	113.2325	6287.1	1467.81	2044.20	1.51	-591.09	192.53	0.0	0.0	0.0	20.66	263	2599
264	38.0267	113.3300	5116.0	1477.18	2006.41	1.42	-481.04	156.67	0.0	0.0	0.0	-6.28	264	2
264	38.4617	113.1242	5556.1	1514.64	2044.37	1.47	-522.40	170.15	0.0	0.0	0.0	21.05	264	2599
265	38.0567	113.3300	5095.0	1480.85	2009.03	1.42	-479.07	156.03	0.0	0.0	0.0	-6.57	265	2
265	38.4600	113.0283	5018.0	1533.44	2044.40	1.41	-471.83	153.67	0.0	0.0	0.0	5.78	265	2599
266	38.4600	113.1017	5437.0	1520.78	2044.40	1.46	-511.21	166.50	0.0	0.0	0.0	19.62	266	2599
266	38.3098	112.8802	7430.0	1373.56	2031.22	1.50	-699.50	227.54	0.0	0.0	0.0	11.80	266	2
267	38.1150	113.2933	5063.0	1492.69	2014.14	1.42	-476.06	155.05	0.0	0.0	0.0	-1.86	267	2
268	38.1000	113.3133	5074.0	1489.13	2012.83	1.42	-477.09	155.39	0.0	0.0	0.0	-3.41	268	2
268	38.4633	113.1583	5717.3	1496.34	2044.70	1.48	-537.60	175.10	0.0	0.0	0.0	12.66	268	2599
269	38.1000	113.2717	5081.0	1493.97	2012.83	1.42	-477.75	155.60	0.0	0.0	0.0	1.87	269	2
270	38.0783	113.3417	5107.0	1482.09	2010.93	1.42	-480.19	156.40	0.0	0.0	0.0	-6.46	270	2
270	38.4683	113.1908	5993.1	1477.78	2045.16	1.50	-563.47	183.53	0.0	0.0	0.0	11.06	270	2599
271	38.0567	113.3667	5086.0	1476.78	2009.03	1.42	-478.22	155.75	0.0	0.0	0.0	-11.21	271	2
271	38.4700	113.0600	5179.1	1536.73	2045.28	1.43	-486.97	158.61	0.0	0.0	0.0	18.38	271	2599
272	38.0550	113.2933	5100.0	1483.44	2008.89	1.42	-479.54	156.18	0.0	0.0	0.0	-3.52	272	2
272	38.4700	113.2183	6303.1	1462.63	2045.28	1.51	-592.61	193.03	0.0	0.0	0.0	15.42	272	2599
273	38.0550	113.2533	5113.0	1489.31	2008.89	1.42	-480.76	156.58	0.0	0.0	0.0	3.18	273	2
273	38.4703	113.1525	5729.0	1499.08	2045.31	1.48	-538.56	175.41	0.0	0.0	0.0	15.43	273	2599
274	38.4733	113.1367	5724.1	1502.57	2045.57	1.48	-538.19	175.29	0.0	0.0	0.0	18.41	274	2599
274	38.0563	113.2330	5212.0	1488.09	2009.00	1.43	-490.06	159.61	0.0	0.0	0.0	8.10	274	2
275	38.4767	113.1200	5668.0	1510.93	2045.87	1.47	-532.91	173.58	0.0	0.0	0.0	22.03	275	2599
275	38.0563	113.2143	5369.0	1478.93	2009.00	1.45	-504.82	164.42	0.0	0.0	0.0	8.93	275	2
276	38.0267	113.2983	5123.0	1479.80	2006.41	1.42	-481.70	156.89	0.0	0.0	0.0	-3.22	276	2
277	38.0267	113.2683	5137.0	1484.60	2006.41	1.43	-483.01	157.32	0.0	0.0	0.0	2.47	277	2
277	38.4793	113.1012	5430.1	1523.87	2046.01	1.46	-510.56	166.29	0.0	0.0	0.0	20.67	277	2599
278	38.0280	113.2330	5157.0	1486.91	2006.52	1.43	-484.89	157.93	0.0	0.0	0.0	5.92	278	2
279	38.0280	113.2102	5302.0	1478.81	2006.52	1.44	-498.52	162.37	0.0	0.0	0.0	7.00	279	2
280	38.0133	113.1778	5367.0	1465.26	2005.24	1.45	-504.63	164.36	0.0	0.0	0.0	-1.16	280	2
280	38.4683	113.0733	5193.9	1536.43	2046.45	1.43	-488.35	159.06	0.0	0.0	0.0	17.84	280	2599
281	38.4933	113.1433	5886.1	1497.27	2046.45	1.49	-553.42	180.26	0.0	0.0	0.0	22.49	281	2599
281	38.0350	113.1400	5557.0	1460.19	2007.14	1.47	-522.49	170.18	0.0	0.0	0.0	3.90	281	2
282	38.0650	113.1095	5995.0	1438.43	2009.84	1.50	-563.75	183.62	0.0	0.0	0.0	7.22	282	2
284	38.4867	113.2117	6253.9	1467.24	2046.75	1.51	-587.94	191.52	0.0	0.0	0.0	15.45	284	2599
285	38.4867	113.2450	6854.1	1437.46	2046.75	1.52	-645.69	210.33	0.0	0.0	0.0	24.56	285	2599
288	38.4975	113.1967	6150.9	1473.80	2047.70	1.50	-578.30	188.37	0.0	0.0	0.0	14.53	288	2599
290	38.4995	113.0940	5376.0	1530.54	2047.87	1.45	-505.47	164.63	0.0	0.0	0.0	22.05	290	2599
292	38.5033	113.0183	4906.8	1533.38	2048.21	1.41	-467.02	152.10	0.0	0.0	0.0	4.68	292	2599
293	38.5033	113.2383	6688.0	1448.83	2048.21	1.52	-628.77	204.81	0.0	0.0	0.0	23.06	293	2599
294	38.5033	113.2383	6688.0	1449.08	2048.21	1.52	-628.77	204.81	0.0	0.0	0.0	23.31	294	2599
295	38.5042	113.1350	6065.9	1480.33	2048.28	1.50	-570.31	185.76	0.0	0.0	0.0	15.10	295	2599
298	38.5090	113.0938	5503.9	1525.39	2048.71	1.46	-517.49	168.55	0.0	0.0	0.0	24.16	298	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

					******************** CORRECTIONS				********************					
STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	*LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ----* INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
301	38.3410	112.9170	5857.0	1478.19	2033.95	1.49	-550.68	179.36	0.0	0.0	0.0	14.06	301	2
302	38.5217	113.0083	5639.1	1519.85	2049.82	1.47	-530.20	172.69	0.0	0.0	0.0	26.06	302	2599
302	38.3387	112.8970	6436.0	1442.03	2033.75	1.51	-605.09	197.10	0.0	0.0	0.0	14.77	302	2
303	38.3297	112.8760	7300.0	1490.71	2032.96	1.51	-686.28	223.56	0.0	0.0	0.0	118.97	303	2
304	38.3500	112.9273	5588.0	1492.53	2034.74	1.47	-525.40	171.13	0.0	0.0	0.0	10.59	304	2
304	38.5250	113.1183	6295.9	1482.21	2050.11	1.51	-591.93	192.81	0.0	0.0	0.0	29.71	304	2599
305	38.5267	113.1567	6016.1	1495.79	2050.26	1.50	-565.63	184.24	0.0	0.0	0.0	25.42	305	2599
305	38.2795	112.9617	5220.0	1510.36	2028.56	1.44	-490.81	159.86	0.0	0.0	0.0	11.32	305	2
306	38.2900	112.9532	5309.0	1507.72	2028.60	1.44	-499.18	162.58	0.0	0.0	0.0	14.27	306	2
306	38.5267	113.1950	6118.1	1482.90	2050.26	1.50	-575.22	187.36	0.0	0.0	0.0	18.99	306	2599
307	38.2680	112.9180	5844.0	1476.47	2027.55	1.49	-549.65	179.03	0.0	0.0	0.0	18.05	307	2
308	38.2773	112.9148	6103.0	1460.14	2028.37	1.50	-574.27	187.05	0.0	0.0	0.0	17.49	308	2
309	38.2780	112.9048	6328.0	1447.71	2028.43	1.51	-594.95	193.79	0.0	0.0	0.0	18.93	309	2
310	38.5317	113.1817	5972.1	1495.12	2050.70	1.49	-561.49	182.89	0.0	0.0	0.0	21.53	310	2599
310	38.2905	112.8983	6667.0	1427.04	2029.52	1.52	-626.80	204.17	0.0	0.0	0.0	18.63	310	2
311	38.5378	113.1688	5832.0	1507.62	2051.24	1.49	-548.33	178.60	0.0	0.0	0.0	24.62	311	2599
311	38.2202	112.9232	5278.0	1502.02	2023.35	1.44	-496.27	161.63	0.0	0.0	0.0	11.86	311	2
312	38.2370	112.9103	5566.0	1487.27	2024.83	1.47	-523.33	170.45	0.0	0.0	0.0	13.85	312	2
313	38.2483	112.9032	5762.0	1479.19	2025.83	1.48	-541.75	176.46	0.0	0.0	0.0	17.18	313	2
314	38.2633	112.8952	6074.0	1461.53	2027.14	1.50	-571.08	186.01	0.0	0.0	0.0	17.95	314	2
315	38.2703	112.8865	6310.0	1446.33	2027.80	1.51	-593.25	193.24	0.0	0.0	0.0	17.04	315	2
316	38.2942	112.8515	7533.0	1366.18	2029.85	1.50	-703.18	230.69	0.0	0.0	0.0	12.32	316	2
317	38.2860	112.8667	6832.0	1412.38	2029.13	1.52	-642.31	209.22	0.0	0.0	0.0	14.82	317	2
317	38.5433	113.0133	4905.8	1548.55	2051.73	1.40	-461.28	150.24	0.0	0.0	0.0	6.47	317	2599
318	38.5433	113.0467	4924.9	1554.69	2051.73	1.40	-463.07	150.82	0.0	0.0	0.0	13.81	318	2599
318	38.2585	112.7492	5521.0	1468.76	2026.72	1.46	-519.10	169.08	0.0	0.0	0.0	-9.39	318	2
319	38.3013	112.7967	5891.0	1453.47	2030.47	1.49	-553.88	180.41	0.0	0.0	0.0	-0.02	319	2
319	38.5433	113.0650	5014.1	1555.77	2051.73	1.41	-471.46	153.55	0.0	0.0	0.0	20.54	319	2599
320	38.5433	113.0817	5214.9	1549.93	2051.73	1.43	-490.33	159.70	0.0	0.0	0.0	27.40	320	2599
320	38.3020	112.8315	6472.0	1433.83	2030.53	1.51	-608.48	198.20	0.0	0.0	0.0	12.06	320	2
321	38.3258	112.7853	6036.0	1455.19	2032.62	1.50	-567.50	184.85	0.0	0.0	0.0	3.73	321	2
322	38.2882	112.7750	5599.0	1465.11	2029.32	1.47	-526.43	171.45	0.0	0.0	0.0	-10.71	322	2
322	38.5500	113.1858	5961.9	1502.30	2052.31	1.49	-560.54	182.58	0.0	0.0	0.0	26.46	322	2599
323	38.3058	112.9215	6196.0	1456.83	2030.87	1.50	-582.54	189.75	0.0	0.0	0.0	17.25	323	2
324	38.3053	112.9040	6687.0	1423.80	2030.83	1.52	-628.68	204.78	0.0	0.0	0.0	15.36	324	2
324	38.5583	113.0233	4898.9	1551.89	2053.04	1.40	-460.63	150.02	0.0	0.0	0.0	8.06	324	2599
325	38.5583	113.1017	5274.9	1549.04	2053.04	1.44	-495.97	161.54	0.0	0.0	0.0	28.99	325	2599
325	38.3068	112.8380	7153.0	1396.33	2030.95	1.51	-672.94	219.21	0.0	0.0	0.0	17.59	325	2
326	38.2853	112.9368	5616.0	1493.18	2029.07	1.47	-528.03	171.98	0.0	0.0	0.0	18.68	326	2
327	38.3207	112.9365	5753.0	1484.91	2032.17	1.48	-540.91	176.18	0.0	0.0	0.0	15.99	327	2
327	38.5622	113.1537	5607.9	1531.87	2053.38	1.47	-527.27	171.74	0.0	0.0	0.0	32.55	327	2599
328	38.5633	113.0467	4919.9	1552.97	2053.48	1.40	-462.61	150.67	0.0	0.0	0.0	10.02	328	2599
328	38.6957	112.8983	5052.0	1570.17	2065.21	1.42	-475.02	154.71	0.0	0.0	0.0	29.85	328	2
329	38.7250	112.8983	5072.0	1581.00	2067.71	1.42	-476.90	155.32	0.0	0.0	0.0	33.45	329	2
329	38.5633	113.1233	5444.9	1539.80	2053.48	1.46	-511.94	166.74	0.0	0.0	0.0	30.06	329	2599
330	38.7617	112.8783	5072.0	1576.43	2070.93	1.42	-476.90	155.32	0.0	0.0	0.0	25.70	330	2
331	38.5643	113.1838	5887.1	1511.11	2053.57	1.49	-553.51	180.29	0.0	0.0	0.0	29.27	331	2599
337	38.5733	113.0833	5109.9	1549.18	2054.36	1.42	-480.46	156.49	0.0	0.0	0.0	17.37	337	2599
338	38.5735	113.2038	6239.0	1492.89	2054.33	1.51	-585.73	190.79	0.0	0.0	0.0	31.95	338	2599
339	38.5750	113.2257	6748.0	1463.33	2054.51	1.52	-634.41	206.65	0.0	0.0	0.0	35.06	339	2599
340	38.5757	113.1775	5841.3	1516.61	2054.57	1.49	-549.25	178.90	0.0	0.0	0.0	30.91	340	2599
342	38.5900	113.1533	5630.9	1530.78	2054.95	1.47	-529.43	172.44	0.0	0.0	0.0	31.35	342	2599
343	38.5900	113.1600	5630.9	1531.04	2054.95	1.47	-529.43	172.44	0.0	0.0	0.0	31.61	343	2599
347	38.5875	113.1195	5287.1	1548.23	2055.01	1.44	-497.11	161.91	0.0	0.0	0.0	26.38	347	2599
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.40	[illegible]	[illegible]	0.0	0.0	0.0	[illegible]	348	2599

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ----* INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
349	38.5883	113.0650	5025.9	1552.31	2055.68	1.41	-472.57	153.91	0.0	0.0	0.0	13.87	349	2599
352	38.5900	113.1022	5195.8	1549.95	2055.83	1.43	-488.54	159.12	0.0	0.0	0.0	22.11	352	2599
353	38.5933	113.1483	5448.1	1543.10	2056.12	1.46	-512.25	166.84	0.0	0.0	0.0	30.93	353	2599
354	38.5967	113.1833	5580.8	1538.17	2056.42	1.47	-524.65	170.88	0.0	0.0	0.0	34.05	354	2599
355	38.5967	113.1650	5532.0	1537.98	2056.42	1.47	-524.83	170.94	0.0	0.0	0.0	33.99	355	2599
356	38.6017	113.1950	5371.1	1514.97	2056.85	1.49	-561.40	182.86	0.0	0.0	0.0	35.16	356	2599
361	38.6067	113.1800	5756.9	1529.14	2057.29	1.48	-541.27	176.30	0.0	0.0	0.0	35.33	361	2599
363	38.5107	113.0970	5054.1	1559.11	2057.05	1.42	-475.22	154.78	0.0	0.0	0.0	20.49	363	2599
364	38.6117	113.1567	5513.1	1544.45	2057.73	1.46	-518.36	168.83	0.0	0.0	0.0	34.78	364	2599
365	38.6137	113.2025	6044.9	1511.27	2057.91	1.50	-563.34	185.12	0.0	0.0	0.0	35.08	365	2599
366	38.6167	113.1400	5341.3	1554.24	2056.17	1.45	-502.26	163.59	0.0	0.0	0.0	33.29	366	2599
368	38.6183	113.1450	5334.8	1552.83	2058.32	1.45	-506.30	164.90	0.0	0.0	0.0	34.45	368	2599
372	38.6317	113.0183	4660.9	1575.16	2059.49	1.39	-457.05	148.86	0.0	0.0	0.0	20.47	372	2599
373	38.6317	113.0467	4830.9	1576.31	2059.49	1.40	-458.94	149.47	0.0	0.0	0.0	25.38	373	2599
374	38.6317	113.0750	4956.0	1573.98	2059.49	1.41	-460.00	151.77	0.0	0.0	0.0	24.31	374	2599
375	38.6317	113.1617	6012.1	1515.87	2059.49	1.50	-565.26	184.12	0.0	0.0	0.0	36.02	375	2599
377	38.6360	113.2047	5622.0	1535.10	2059.87	1.47	-528.59	172.17	0.0	0.0	0.0	30.18	377	2599
384	38.6457	113.0653	4893.0	1580.23	2060.72	1.40	-460.08	149.84	0.0	0.0	0.0	28.34	384	2599
385	38.6467	113.1017	5042.0	1576.08	2060.31	1.42	-474.08	154.41	0.0	0.0	0.0	33.52	385	2599
386	38.6483	113.1767	5431.1	1553.26	2060.96	1.46	-510.65	166.32	0.0	0.0	0.0	35.17	386	2599
387	38.6490	113.2220	5361.9	1550.54	2061.02	1.45	-504.14	164.20	0.0	0.0	0.0	28.01	387	2599
390	38.6633	113.2250	5140.1	1565.91	2062.23	1.43	-483.30	157.41	0.0	0.0	0.0	28.09	390	2599
391	38.6650	113.1717	5116.1	1569.51	2062.43	1.42	-481.04	156.68	0.0	0.0	0.0	30.03	391	2599
392	38.6650	113.1967	5099.1	1564.49	2062.43	1.42	-479.44	156.15	0.0	0.0	0.0	23.93	392	2599
393	38.6650	113.2067	5118.1	1564.94	2062.43	1.42	-481.23	156.74	0.0	0.0	0.0	25.58	393	2599
396	38.6642	113.0527	4863.3	1590.88	2062.70	1.39	-457.33	148.95	0.0	0.0	0.0	35.16	396	2599
397	38.6683	113.2200	5078.1	1569.46	2062.72	1.42	-477.47	155.51	0.0	0.0	0.0	27.28	397	2599
400	38.6750	113.0933	5020.0	1582.46	2063.30	1.41	-472.01	153.73	0.0	0.0	0.0	35.92	400	2599
405	38.6827	113.0413	4883.8	1591.27	2063.98	1.40	-459.21	149.56	0.0	0.0	0.0	35.54	405	2599
408	38.6947	113.2310	4730.0	1593.73	2065.04	1.38	-444.75	144.85	0.0	0.0	0.0	27.22	408	2599
409	38.6950	113.2317	4730.0	1593.91	2065.06	1.38	-444.75	144.85	0.0	0.0	0.0	27.37	409	2599
410	38.6957	113.1667	4734.9	1590.73	2065.12	1.38	-445.21	145.00	0.0	0.0	0.0	24.44	410	2599
411	38.6963	113.2048	4751.9	1591.71	2065.18	1.38	-446.81	145.52	0.0	0.0	0.0	26.44	411	2599
412	38.6967	113.2050	4752.9	1591.78	2065.21	1.38	-446.91	145.55	0.0	0.0	0.0	26.54	412	2599
413	38.6968	113.1533	4750.0	1592.74	2065.23	1.38	-446.63	145.46	0.0	0.0	0.0	27.30	413	2599
414	38.6970	113.1158	5069.9	1582.48	2065.24	1.42	-476.70	155.26	0.0	0.0	0.0	37.26	414	2599
415	38.6977	113.1342	4827.1	1592.94	2065.30	1.39	-453.88	147.82	0.0	0.0	0.0	32.30	415	2599
418	38.6988	113.0888	5212.9	1573.35	2065.40	1.43	-490.14	159.64	0.0	0.0	0.0	37.02	418	2599
421	38.7020	113.0627	5070.8	1582.34	2065.68	1.42	-476.79	155.29	0.0	0.0	0.0	36.74	421	2599
423	38.7060	113.0428	4987.3	1587.88	2066.03	1.41	-468.99	152.75	0.0	0.0	0.0	36.68	423	2599
424	38.7067	113.1167	4896.0	1594.14	2066.09	1.40	-460.35	149.93	0.0	0.0	0.0	37.07	424	2599
425	38.7080	113.2117	4661.1	1598.97	2066.21	1.37	-438.27	142.74	0.0	0.0	0.0	26.93	425	2599
426	38.7117	113.0283	4921.9	1591.49	2066.53	1.40	-462.77	150.73	0.0	0.0	0.0	35.62	426	2599
427	38.7117	113.2433	4596.1	1598.98	2066.53	1.36	-432.17	140.75	0.0	0.0	0.0	22.50	427	2599
429	38.7150	113.0117	4855.0	1595.12	2066.83	1.39	-456.59	148.71	0.0	0.0	0.0	34.78	429	2599
434	38.7233	113.1333	4642.0	1600.57	2067.56	1.36	-436.48	142.16	0.0	0.0	0.0	25.97	434	2599
435	38.7250	113.1017	4976.0	1591.69	2067.71	1.41	-467.88	152.39	0.0	0.0	0.0	38.07	435	2599
436	38.7250	113.2135	4523.9	1605.93	2067.71	1.35	-425.84	138.69	0.0	0.0	0.0	24.03	436	2599
438	38.7325	113.1952	4523.9	1605.73	2068.37	1.35	-425.38	138.54	0.0	0.0	0.0	22.86	438	2599
439	38.7325	113.2138	4523.9	1604.40	2068.37	1.35	-425.38	138.54	0.0	0.0	0.0	21.53	439	2599
440	38.7383	113.1250	4644.0	1599.93	2068.88	1.36	-436.67	142.22	0.0	0.0	0.0	24.14	440	2599
442	38.7433	113.0950	4855.0	1600.42	2069.32	1.39	-456.50	148.68	0.0	0.0	0.0	37.53	442	2599
444	38.7467	113.0583	5047.9	1589.08	2069.61	1.42	-474.63	154.59	0.0	0.0	0.0	38.09	444	2599
1001	38.3242	112.9908	5021.0	1522.03	2032.48	1.41	-472.11	153.76	0.0	0.0	0.0	6.48	1001	2
1002	38.3233	112.9716	5096.0	1521.12	2032.41	1.42	-479.35	156.12	0.0	0.0	0.0	12.51	1002	2

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
BOUGUER DENSITY = 2.40 GM/CC, TERRAIN DENSITY MULTIPLIER = 1.00, NO TERRAIN CORRECTIONS APPLIED

STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	---- TERRAIN ----* INNER	OUTER	TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
1003	38.3233	112.9533	5304.0	1510.47	2032.41	1.44	-498.71	162.43	0.0	0.0	0.0	12.90	1003	2
1004	38.3383	112.9350	5531.0	1496.49	2033.72	1.46	-520.04	169.38	0.0	0.0	0.0	11.97	1004	2
1005	38.3383	112.9533	5233.0	1511.88	2033.72	1.44	-492.03	160.26	0.0	0.0	0.0	8.50	1005	2
1006	38.3533	112.9533	5244.0	1509.26	2035.04	1.44	-493.07	160.59	0.0	0.0	0.0	5.26	1006	2
1007	38.3683	112.9716	5074.0	1515.47	2036.35	1.42	-477.09	155.39	0.0	0.0	0.0	0.40	1007	2
1008	38.3967	112.9900	4955.0	1522.56	2038.84	1.41	-465.90	151.74	0.0	0.0	0.0	-3.52	1008	2
1009	38.4117	112.9533	5119.0	1510.63	2040.16	1.42	-481.32	156.76	0.0	0.0	0.0	-6.40	1009	2
1010	38.3967	112.9533	5131.0	1511.11	2038.84	1.43	-482.45	157.13	0.0	0.0	0.0	-3.84	1010	2
1011	38.3817	112.9533	5164.0	1510.74	2037.52	1.43	-485.55	158.14	0.0	0.0	0.0	-0.81	1011	2
1012	38.3817	112.9400	5273.0	1504.34	2037.52	1.44	-496.26	161.63	0.0	0.0	0.0	0.00	1012	2
1013	38.4142	112.9242	5364.0	1499.77	2040.38	1.45	-504.85	164.27	0.0	0.0	0.0	-1.98	1013	2
1014	38.4333	112.9000	5604.0	1488.42	2042.06	1.47	-526.90	171.62	0.0	0.0	0.0	0.18	1014	2
1015	38.4333	112.8833	5775.0	1480.07	2042.06	1.48	-542.97	176.85	0.0	0.0	0.0	2.65	1015	2
1016	38.4158	112.8325	6511.0	1452.34	2040.52	1.51	-612.14	199.39	0.0	0.0	0.0	3.05	1016	2
1017	38.3883	112.8375	6334.0	1447.05	2038.11	1.51	-595.51	193.97	0.0	0.0	0.0	8.97	1017	2
1018	38.4325	112.9175	5450.0	1495.66	2041.99	1.46	-512.43	166.90	0.0	0.0	0.0	-2.26	1018	2
1019	38.4308	112.9308	5316.0	1501.68	2041.84	1.44	-499.83	162.80	0.0	0.0	0.0	-4.57	1019	2
1020	38.4417	112.9533	5104.0	1510.91	2042.79	1.42	-479.91	156.30	0.0	0.0	0.0	-9.70	1020	2
1021	38.4550	112.9733	5033.0	1518.11	2043.96	1.41	-473.23	154.13	0.0	0.0	0.0	-8.16	1021	2
1022	38.4417	112.9716	5004.0	1519.23	2042.79	1.41	-470.51	153.24	0.0	0.0	0.0	-7.71	1022	2
1023	38.4300	112.9883	4957.0	1523.98	2041.77	1.41	-466.09	151.80	0.0	0.0	0.0	-4.90	1023	2
1024	38.4275	112.9716	5033.0	1519.99	2041.55	1.42	-473.80	154.31	0.0	0.0	0.0	-7.49	1024	2
1025	38.5000	112.9350	5076.0	1523.60	2047.92	1.42	-477.28	155.45	0.0	0.0	0.0	-3.91	1025	2
1026	38.5183	112.9267	5130.0	1524.13	2049.53	1.43	-482.35	157.10	0.0	0.0	0.0	-1.57	1026	2
1027	38.5433	112.9000	5187.0	1520.69	2051.73	1.43	-487.71	158.85	0.0	0.0	0.0	6.39	1027	2
1028	38.5533	112.8792	5339.0	1520.25	2052.60	1.45	-501.99	163.50	0.0	0.0	0.0	14.69	1028	2
1029	38.5533	112.8500	5764.0	1516.61	2052.60	1.48	-541.94	176.52	0.0	0.0	0.0	27.94	1029	2
1030	38.5542	112.8250	6379.0	1475.93	2052.68	1.51	-599.73	195.35	0.0	0.0	0.0	26.12	1030	2
1031	38.3392	112.9908	5005.0	1522.71	2033.79	1.41	-470.60	153.27	0.0	0.0	0.0	4.84	1031	2
1032	38.3458	112.9803	5030.0	1520.99	2034.38	1.41	-472.95	154.04	0.0	0.0	0.0	4.11	1032	2
1033	38.3625	112.9908	4992.0	1521.63	2035.84	1.41	-469.38	152.87	0.0	0.0	0.0	0.89	1033	2
1034	38.3100	112.9908	5043.0	1520.60	2031.23	1.42	-474.18	154.44	0.0	0.0	0.0	7.69	1034	2
1035	38.2875	112.9904	5078.0	1516.51	2029.26	1.42	-477.47	155.51	0.0	0.0	0.0	7.79	1035	2
1036	38.2800	112.9725	5143.0	1513.28	2028.60	1.43	-483.53	157.50	0.0	0.0	0.0	9.33	1036	2
1037	38.2975	112.9675	5198.0	1513.92	2030.14	1.43	-488.75	159.18	0.0	0.0	0.0	11.91	1037	2
1038	38.2650	112.9350	5526.0	1495.30	2027.29	1.46	-519.57	169.23	0.0	0.0	0.0	16.90	1038	2
1039	38.3017	112.9417	5738.0	1486.41	2030.50	1.48	-539.50	175.72	0.0	0.0	0.0	18.20	1039	2
1040	38.3058	112.9117	6481.0	1442.77	2030.87	1.51	-609.32	198.47	0.0	0.0	0.0	21.24	1040	2
1041	38.2658	112.9583	5298.0	1504.52	2027.46	1.44	-498.14	162.25	0.0	0.0	0.0	11.62	1041	2
1042	38.2625	112.9767	5123.0	1511.52	2027.07	1.42	-481.70	156.89	0.0	0.0	0.0	1.84	1042	2
1043	38.2367	113.0650	5050.0	1513.39	2024.80	1.42	-474.83	154.65	0.0	0.0	0.0	7.35	1043	2
1044	38.2216	113.0833	5042.0	1512.95	2023.49	1.42	-474.08	154.41	0.0	0.0	0.0	7.73	1044	2
1045	38.2225	113.0650	5059.0	1514.57	2023.56	1.42	-475.68	154.93	0.0	0.0	0.0	10.35	1045	2
1046	38.2250	113.0458	5082.0	1515.96	2023.78	1.42	-477.84	155.63	0.0	0.0	0.0	12.97	1046	2
1047	38.2250	113.0283	5105.0	1511.98	2023.78	1.42	-480.00	156.34	0.0	0.0	0.0	10.45	1047	2
1048	38.2225	113.0092	5128.0	1508.05	2023.56	1.43	-482.17	157.04	0.0	0.0	0.0	8.19	1048	2
1049	38.2216	112.9592	5208.0	1500.30	2023.49	1.43	-489.69	159.49	0.0	0.0	0.0	5.58	1049	2
1050	38.2142	112.9783	5343.0	1501.90	2022.83	1.45	-502.37	163.62	0.0	0.0	0.0	16.37	1050	2
1051	38.2017	112.9450	5397.0	1487.03	2021.73	1.45	-507.45	165.28	0.0	0.0	0.0	6.02	1051	2
1052	38.2216	112.9142	5308.0	1501.92	2023.49	1.44	-499.08	162.55	0.0	0.0	0.0	13.52	1052	2
1053	38.2358	112.9358	5320.0	1502.02	2024.73	1.45	-500.21	162.92	0.0	0.0	0.0	13.14	1053	2
1054	38.2358	112.9733	5178.0	1504.69	2024.73	1.43	-486.87	158.57	0.0	0.0	0.0	6.82	1054	2
1055	38.2125	112.9583	5219.0	1497.35	2022.68	1.43	-490.72	159.83	0.0	0.0	0.0	4.12	1055	2
1056	38.1925	112.9917	5188.0	1497.82	2020.93	1.43	-487.81	158.88	0.0	0.0	0.0	4.39	1056	2
1057	38.2066	112.9917	5160.0	1500.41	2022.17	1.43	-485.17	158.02	0.0	0.0	0.0	4.16	1057	2

BASIC GRAVITY CORRECTIONS FOR LATITUDE, CURVATURE, FREE AIR, BOUGUER, AND TERRAIN
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STA #	LAT	LONG	ELEV	OBSERVED GRAVITY	********** CORRECTIONS ********** *LATITUDE	CURV	FREE AIR	BOUG	TERRAIN INNER	TERRAIN OUTER	TERRAIN TOTAL	BOUG ANOMALY + 200.0	STA #	MAP #
1058	38.1833	112.9425	5470.0	1482.69	2020.13	1.46	-514.31	167.51	0.0	0.0	0.0	7.90	1058	2
1059	38.1675	112.9233	5820.0	1464.23	2018.74	1.49	-547.21	178.23	0.0	0.0	0.0	12.98	1059	2
1060	38.1592	112.9067	6048.0	1452.38	2018.01	1.50	-568.63	185.21	0.0	0.0	0.0	16.29	1060	2
1061	38.1625	112.9550	5527.0	1478.62	2018.30	1.46	-519.67	169.26	0.0	0.0	0.0	9.26	1061	2
1062	38.1483	112.9592	5577.0	1472.17	2017.06	1.47	-524.37	170.79	0.0	0.0	0.0	7.22	1062	2
1063	38.1308	112.9758	5803.0	1460.02	2015.53	1.48	-545.61	177.71	0.0	0.0	0.0	10.91	1063	2
1064	38.1317	112.9942	5844.0	1456.38	2015.60	1.49	-553.60	180.31	0.0	0.0	0.0	12.57	1064	2
1065	38.1783	112.9733	5320.0	1490.45	2019.69	1.45	-500.21	162.92	0.0	0.0	0.0	6.61	1065	2
1066	38.1550	113.0350	5399.0	1488.81	2017.65	1.45	-507.64	165.34	0.0	0.0	0.0	12.01	1066	2
1067	38.1292	113.1417	5459.0	1483.02	2015.38	1.46	-513.28	167.18	0.0	0.0	0.0	12.28	1067	2
1068	38.1925	113.1583	5028.0	1509.99	2020.93	1.41	-472.77	153.98	0.0	0.0	0.0	6.44	1068	2
1069	38.2066	113.1592	5021.0	1513.17	2022.17	1.41	-472.11	153.76	0.0	0.0	0.0	7.93	1069	2
1070	38.2066	113.1400	5022.0	1513.87	2022.17	1.41	-472.20	153.79	0.0	0.0	0.0	8.69	1070	2
1071	38.2066	113.1017	5041.0	1513.18	2022.17	1.42	-473.99	154.38	0.0	0.0	0.0	9.21	1071	2
1072	38.1925	113.1025	5045.0	1513.34	2020.93	1.42	-474.37	154.50	0.0	0.0	0.0	10.86	1072	2
1073	38.1783	113.1025	5064.0	1509.46	2019.69	1.42	-476.15	155.08	0.0	0.0	0.0	9.43	1073	2
1074	38.2066	113.0467	5084.0	1515.25	2022.17	1.42	-478.03	155.69	0.0	0.0	0.0	14.00	1074	2
1075	38.1925	113.0467	5093.0	1513.69	2020.93	1.42	-478.88	155.97	0.0	0.0	0.0	14.25	1075	2
1076	38.2066	113.1203	5032.0	1515.67	2022.17	1.41	-473.14	154.10	0.0	0.0	0.0	11.13	1076	2
1077	38.2216	113.1208	5022.0	1516.20	2023.49	1.41	-472.20	153.79	0.0	0.0	0.0	9.71	1077	2
1078	38.2259	113.1583	5047.0	1513.43	2023.85	1.42	-474.55	154.56	0.0	0.0	0.0	8.55	1078	2
1079	38.1925	113.1950	5038.0	1508.33	2020.93	1.42	-473.71	154.26	0.0	0.0	0.0	5.41	1079	2
1080	38.2208	113.1000	5047.0	1514.45	2023.42	1.42	-474.55	154.56	0.0	0.0	0.0	9.61	1080	2
1081	38.2367	113.1575	5095.0	1512.03	2024.80	1.42	-479.06	156.03	0.0	0.0	0.0	8.84	1081	2
1082	38.2517	113.1575	5151.0	1512.79	2026.12	1.43	-484.33	157.74	0.0	0.0	0.0	11.83	1082	2
1083	38.2066	113.1950	5046.0	1507.48	2022.17	1.42	-474.46	154.53	0.0	0.0	0.0	3.82	1083	2
1084	38.2066	113.2450	5198.0	1499.96	2022.17	1.43	-488.75	159.18	0.0	0.0	0.0	5.92	1084	2
1085	38.2133	113.2708	5268.0	1493.83	2022.76	1.44	-495.33	161.33	0.0	0.0	0.0	3.63	1085	2
1086	38.2250	113.3033	5320.0	1492.70	2023.78	1.45	-500.21	162.92	0.0	0.0	0.0	4.77	1086	2
1087	38.2375	113.3367	5426.0	1489.21	2024.88	1.46	-510.18	166.17	0.0	0.0	0.0	6.89	1087	2
1088	38.2333	113.3633	5514.0	1474.79	2024.51	1.46	-518.45	168.86	0.0	0.0	0.0	-1.60	1088	2
1089	38.2267	113.3983	5722.0	1466.77	2023.93	1.48	-537.99	175.23	0.0	0.0	0.0	6.13	1089	2
1090	38.1967	113.4300	6204.0	1438.37	2021.30	1.51	-583.29	139.99	0.0	0.0	0.0	8.87	1090	2
1091	38.2133	113.2250	5102.0	1501.17	2022.76	1.42	-479.72	156.24	0.0	0.0	0.0	0.47	1091	2
1092	38.1925	113.2500	5139.0	1501.19	2020.93	1.43	-483.20	157.38	0.0	0.0	0.0	4.66	1092	2
1093	38.1783	113.2500	5077.0	1502.00	2019.69	1.42	-477.37	155.48	0.0	0.0	0.0	2.79	1093	2
1095	38.1292	113.2142	5082.0	1497.77	2015.38	1.42	-477.84	155.63	0.0	0.0	0.0	3.38	1095	2
1096	38.1183	113.2133	5107.0	1493.73	2014.43	1.42	-480.19	156.40	0.0	0.0	0.0	1.67	1096	2
1097	38.0858	113.2300	5172.0	1491.91	2011.59	1.43	-486.30	158.39	0.0	0.0	0.0	6.81	1097	2
1098	38.1150	113.2417	5076.0	1497.08	2014.14	1.42	-477.28	155.45	0.0	0.0	0.0	3.35	1098	2
1099	38.1333	113.2417	5065.0	1497.52	2015.75	1.42	-476.25	155.11	0.0	0.0	0.0	1.49	1099	2
1100	38.1408	113.2483	5063.0	1499.03	2016.40	1.42	-476.06	155.05	0.0	0.0	0.0	2.22	1100	2
1101	38.2508	113.1017	5025.0	1518.31	2026.04	1.41	-472.48	153.89	0.0	0.0	0.0	9.45	1101	2
1102	38.2508	113.0833	5030.0	1514.98	2026.04	1.41	-472.96	154.04	0.0	0.0	0.0	6.44	1102	2
1103	38.5000	113.0275	4984.0	1541.09	2047.92	1.41	-468.63	152.63	0.0	0.0	0.0	7.76	1103	2
1104	38.5000	113.0458	5030.0	1544.32	2047.92	1.41	-472.95	154.04	0.0	0.0	0.0	13.90	1104	2
1105	38.4850	113.0458	5030.0	1542.23	2046.60	1.41	-472.95	154.04	0.0	0.0	0.0	13.13	1105	2
1106	38.4708	113.0458	5031.0	1541.86	2045.35	1.41	-473.05	154.07	0.0	0.0	0.0	14.07	1106	2
1107	38.4708	113.0275	4991.0	1536.54	2045.35	1.41	-469.29	152.84	0.0	0.0	0.0	6.22	1107	2
1184	38.1867	113.1400	5135.0	1502.33	2018.67	1.43	-482.83	157.25	0.0	0.0	0.0	7.81	1184	2
1389	38.3833	112.9917	4985.0	1520.57	2037.07	1.41	-468.72	152.66	0.0	0.0	0.0	-2.45	1389	2

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IEF285I   VOL SER NOS= OSYST4.
IEF285I   SYS74311.T124952.RV000.GRDSPOTM.S0000010        SYSIN
IEF285I   VOL SER NOS= OSYST2.
IEF285I   SYS74311.T124952.RV000.GRDSPOTM.S0000010        DELETED
IEF285I   VOL SER NOS= OSYST2.
IEF285I   SYS74311.T124952.SV000.GRDSPOTM.R0000013        SYSOUT
IEF285I   VOL SER NOS= OSYST2.
IEF285I   SYS74311.T124952.RV000.GRDSPOTM.R0000014        DELETED
IEF285I   VOL SER NOS= OSYST5.
IEF285I   PLOT22                                          KEPT
IEF285I   VOL SER NOS= PLOT22.
IEF285I   SYS74311.T124952.RV000.GRDSPOTM.R0000015        KEPT
IEF285I   VOL SER NOS= COVE  .
IEF208E K 284,COVE  ,GRDSPOTM,GO
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COVE FORT DATA SOURCE

AUTHOR-INDEX FILE SELECT/PRINT PROGRAM

PROGRAM NUMBER ULB052-01

10/24/73

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5118 GEODETIC SURVEY SQUADRON, 1ST
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5119 THERE IS NO INFORMATION AVAILABLE FOR THIS POINT.

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5176 GEODETIC SURVEY SQUADRON, 1ST
UTAH REGIONAL GRAVITY SURVEY
1ST GSS, 1972, 490 PTS.

THIS JOB WAS BEEN SUCCESSFULLY COMPLETED.

90 DATA SETS WERE PRINTED.
DATA IGNORED - IN CONTROL MODE

FIN

SEISMIC EMISSIONS STUDY

ROOSEVELT HOT SPRINGS

MILFORD, UTAH

Prepared for:

Getty Oil Company

By:

Seismic Exploration Inc.
Salt Lake City, Utah

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SEISMIC EMISSIONS STUDY, ROOSEVELT HOT SPRINGS
MILFORD, UTAH

Introduction

At the request of Getty Oil Company, a Seismic Emissions Study was performed at Roosevelt Hot Springs, Milford, Utah (27 S., R.9 W). The areal extent of this survey was approximately 16 square miles. Five 5 geophone arrays were used to collect seismic emission data over this region for the purpose of delineating fault and fracture zones.

Data Acquisition

Five Sprengnether MEQ-800 microearthquake recording systems, together with Datamagnetics digital tape recorders, were used for field data acquisition. Hall Sears HS-1 (1 Hz) geophones with calibration coils were used as sensors. The digital tape recorders feature high dynamic range and low system noise recording. The MEQ-800 offers smoked paper records for field monitoring of the data. Geophones were spaced approximately 2000 feet apart. Individual recording systems were hard wired together so that absolute relative timing could be obtained by broadcasting time marks every hour. The crystal clocks supplied by the manufacturer in the MEQ-800's are temperature dependent causing drifts greater than 20 msecs. These drifts are not linear and therefore cannot be scaled by a correction factor. Stations were occupied

from one to three days, depending on the quality of data observed on the paper records.

Data Processing

Field data were first edited by picking quiet sections from the smoked paper records. These sections were stripped out and re-edited. Data from four stations were chosen for processing. For each station, four depth arrays (20 x 20) of possible source locations were chosen at 1,100 foot intervals. That is, four 22,000 x 22,000 foot horizontal maps were generated at depths of 2000, 4000, 6000, and 8000 feet. Ray tracing algorithms were used to determine delay times from each source location to the geophones at each station. Geophone arrays were focused on each location by shifting traces by appropriate delay times and then stochastically correlating traces. Five hours of array processing time per station was required (6800 correlations). A listing of individual delay times, correlation values, and graphic plots were produced.

Data Analysis

Maximum correlation values were found to be approximately .0275. With the exception of station 2, the background noise level is about .090. That is, any correlation value above .090 is not random and therefore has some sort of structural significance.

Caution must be taken when interpreting the computer plots. These plots were created as a visual aid by scaling correlation values between zero and one hundred for each station set. The maximum correlation value was scaled to one hundred. Therefore, plot intensities

may represent different values at different stations and it is possible that a high correlation value could distort the entire plot.

Maps showing locations of correlation values greater than 50% and 90% of maximum have been made for stations 1, 2, 4, and 5. These should be examined in conjunction with the computer plots to reduce the possibility of misinterpretation. That is, by examining these together, lateral extent and thickness of anomalies will be more obvious.

Data Interpretation

The purpose of this survey was to map locations of seismic emissions (groundnoise) as a means of delineating zones of permeability (faults and fractures). Inferred faults (dashes and dots) and associated fracture zones (solid or dashed lines) mapped using seismic emissions are shown on the composite map enclosed. As can be seen from this map a complicated fault pattern emerges.

An east-west emissions zone (Anomaly A) through station 2 is a prominent feature consistently appearing at all stations. This may be related to an east-west fault described by Ward and Sill (1976) in this area. Anomaly B, is a north-south emissions trend believed to be associated with the Dome Fault. It is seen primarily on station 4. Another probable north-south trend (Anomaly C) is located at the western portion of sections 18 and 19. Secondary, emissions zones and faulting are seen associated with the mouths of Little and Big Cedar Cove. Although less apparent, an east-west emissions trend may run along Ranch Canyon Road in the southern portion of the survey. Ward and Sill (1976) make mention of an inferred fault in this

region.

Conclusions and Explanations

In general, emission source locations agree with zones of production and known faulting (Dome). Questions arise with regard to some differences seen at each station. These questions can be answered by examining the position of the stations relatives to the emission locations. For example, at station 4, Anomaly B is seen on the contour map to be broad with a nose directed toward the station. This can result from smearing or blurring effects as you focus on points further from the station. This may be caused by two factors. First, as you go further away from the array, differences in travel times between geophones decrease (become similar). Secondly, higher frequencies attenuate with distance and the correlation is performed over a narrower frequency band.

Another reason for some dissimilarities is that high noise regions close to the stations may overshadow more distant sources. Such is probably the case with stations 1, 2, and 5. They are closer to Anomaly A than station 4 and, thus, see it more distinctly than they do other anomalies.

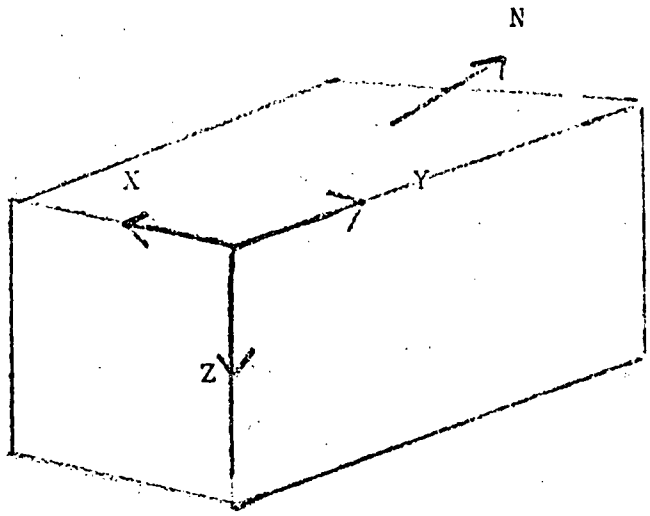
References

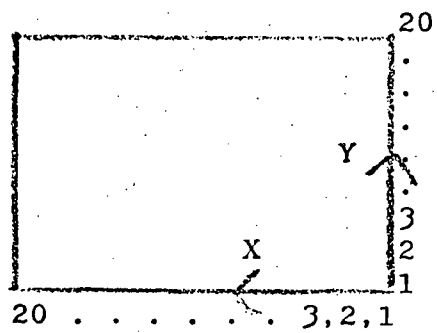
Ward, S. H. and W. R. Sill (1976). Dipole-Dipole resistivity delineation of the near-surface zone at the Roosevelt Hot Springs area, Technical Report, Vol 76-1, ERDA, University of Utah.

APPENDIX A

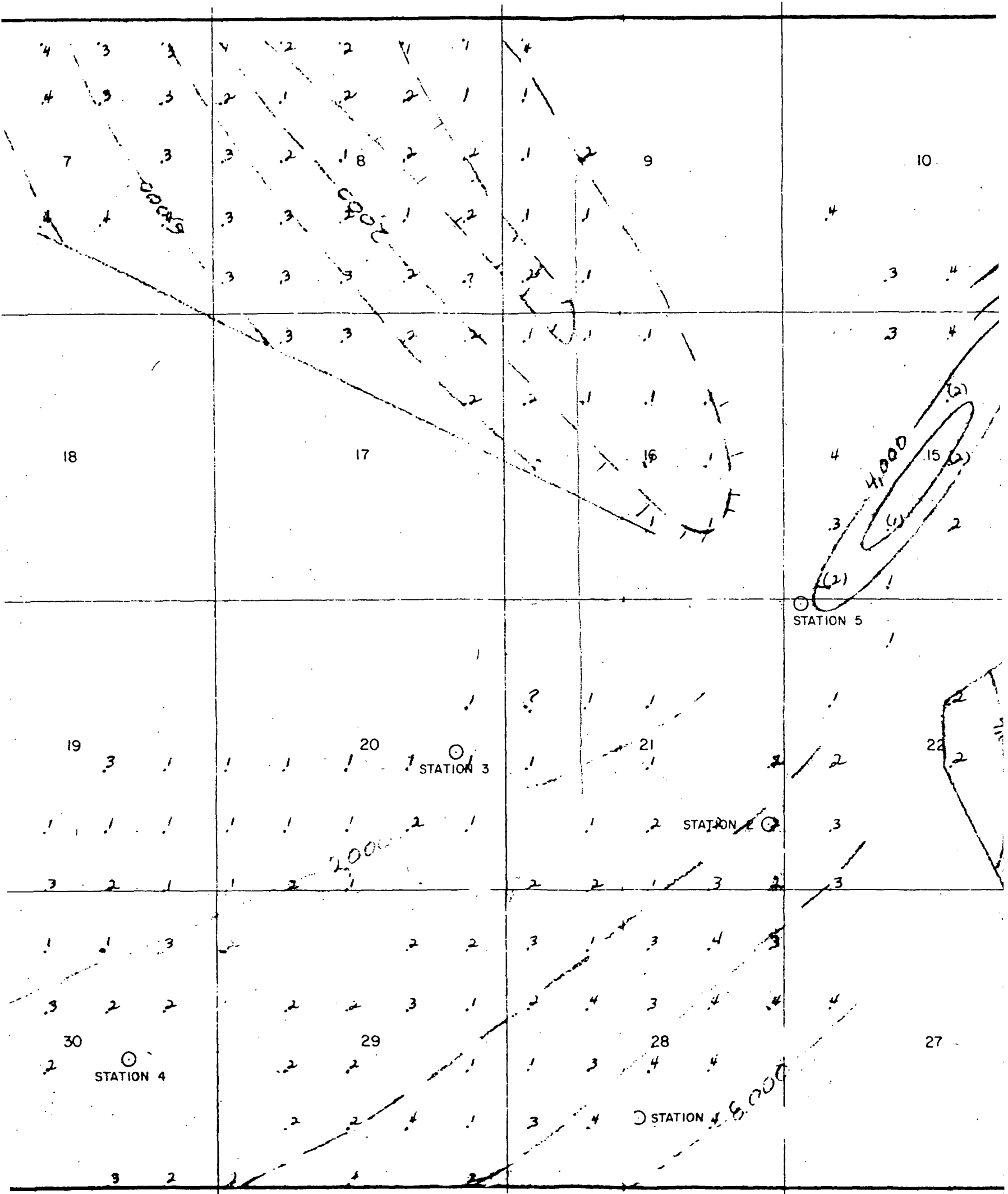
Data Format

X-Y computer plots are read from the lower right hand corner (east) as point (1,1,1) [X,Y,Z]. Going from right to left across the bottom points are (1,1,1), (2,1,1), (3,1,1). . . . Similarly, the second horizontal row is labeled from right to left (1,2,1), (2,2,1), (3,2,1). . . . The center Y value indicates the horizontal row and the end Z value the depth. Each iteration is 1100 feet except for the Z values which are 2000 feet. Z values 1, 2, 3, 4, and 5 correspond to depths of 2000, 4000, 6000, 8000, 10,000 feet, respectively.





Numbering is east to west and surface downward.



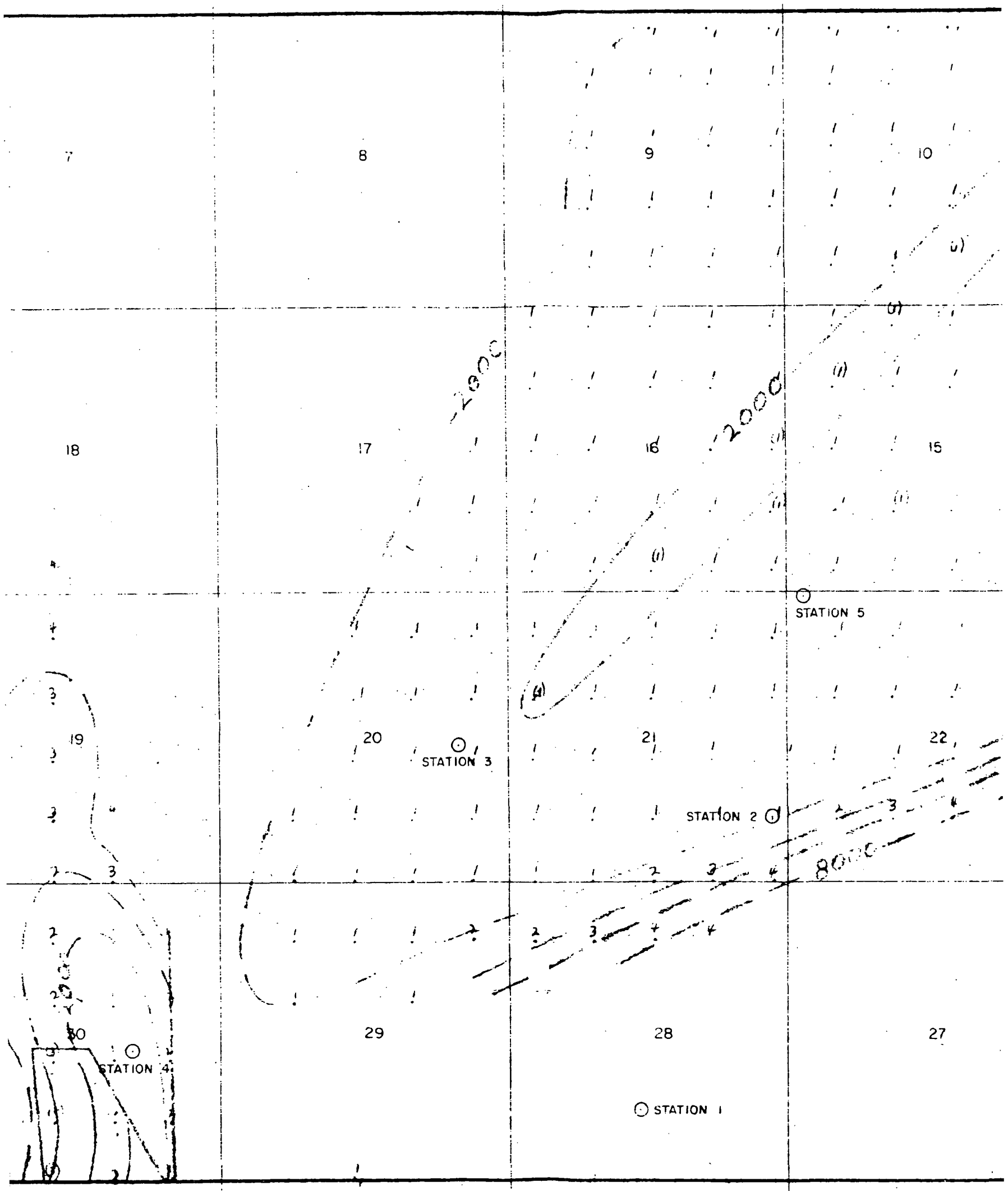
LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 5
PREPARED FOR:
GETTY OIL COMPANY



LEGEND

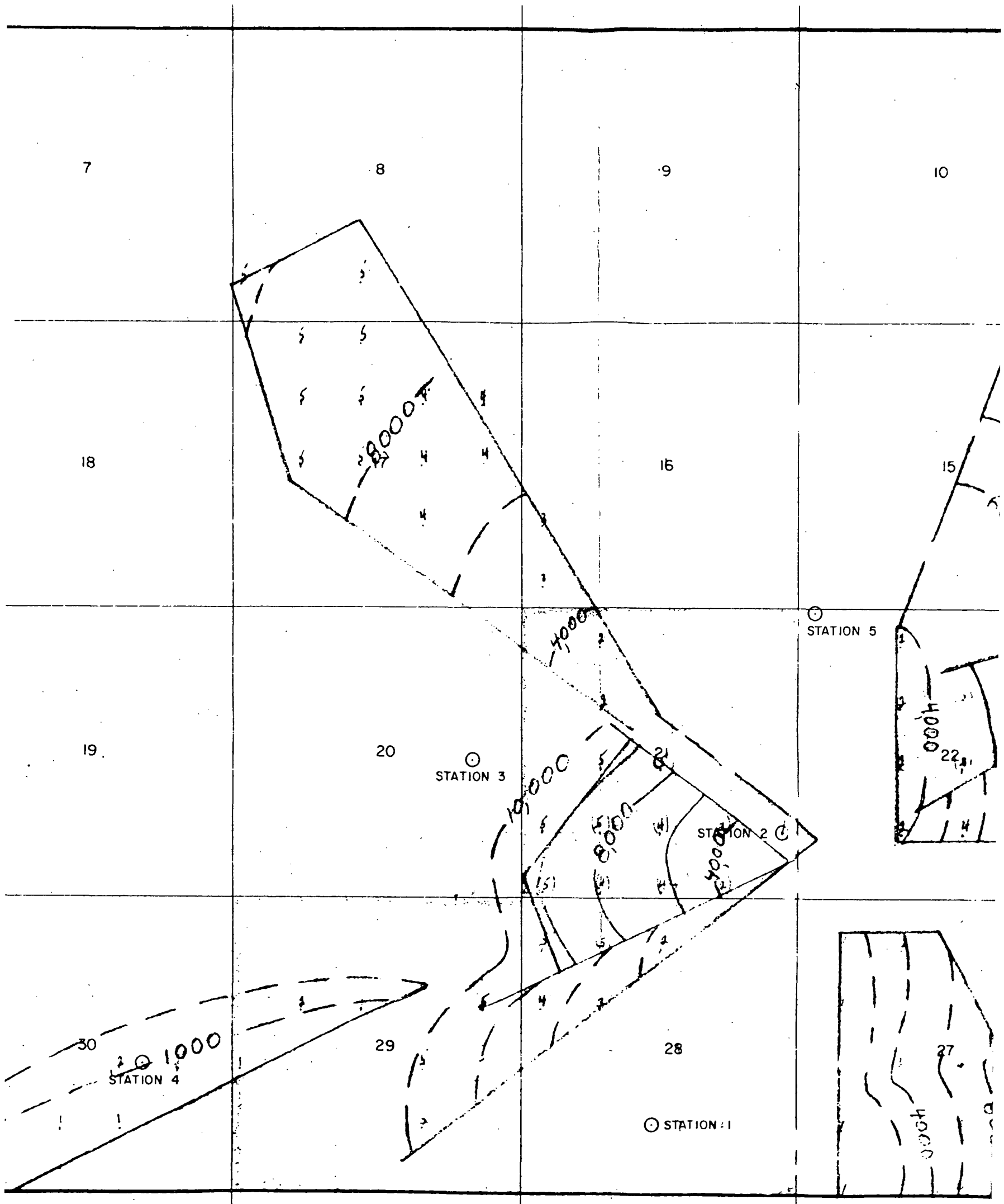
UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 4

PREPARED FOR:
GETTY OIL COMPANY



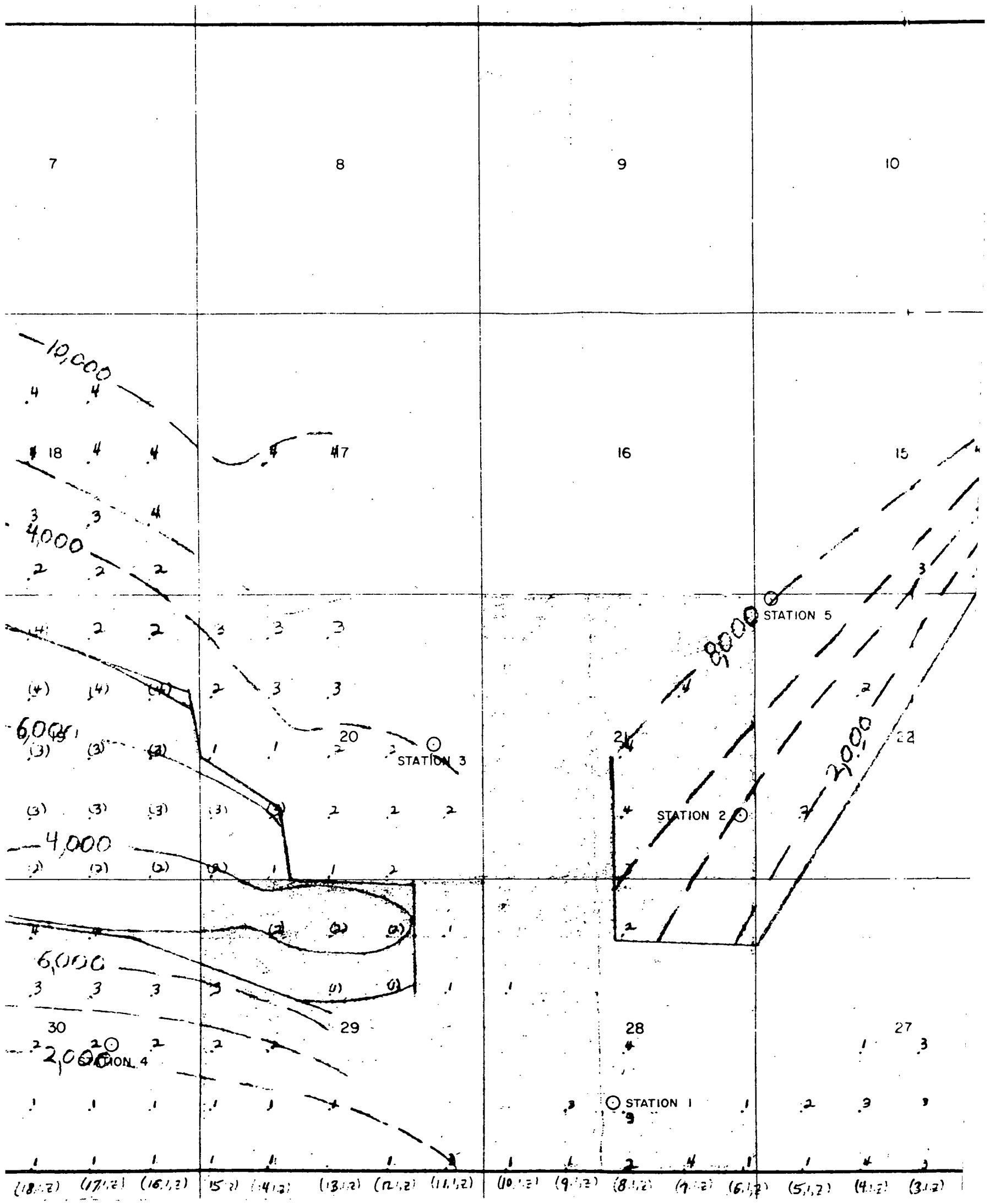
LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ——————

50% - 90% OF MAXIMUM CORRELATION VALUES — — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 2
PREPARED FOR:
GETTY OIL COMPANY



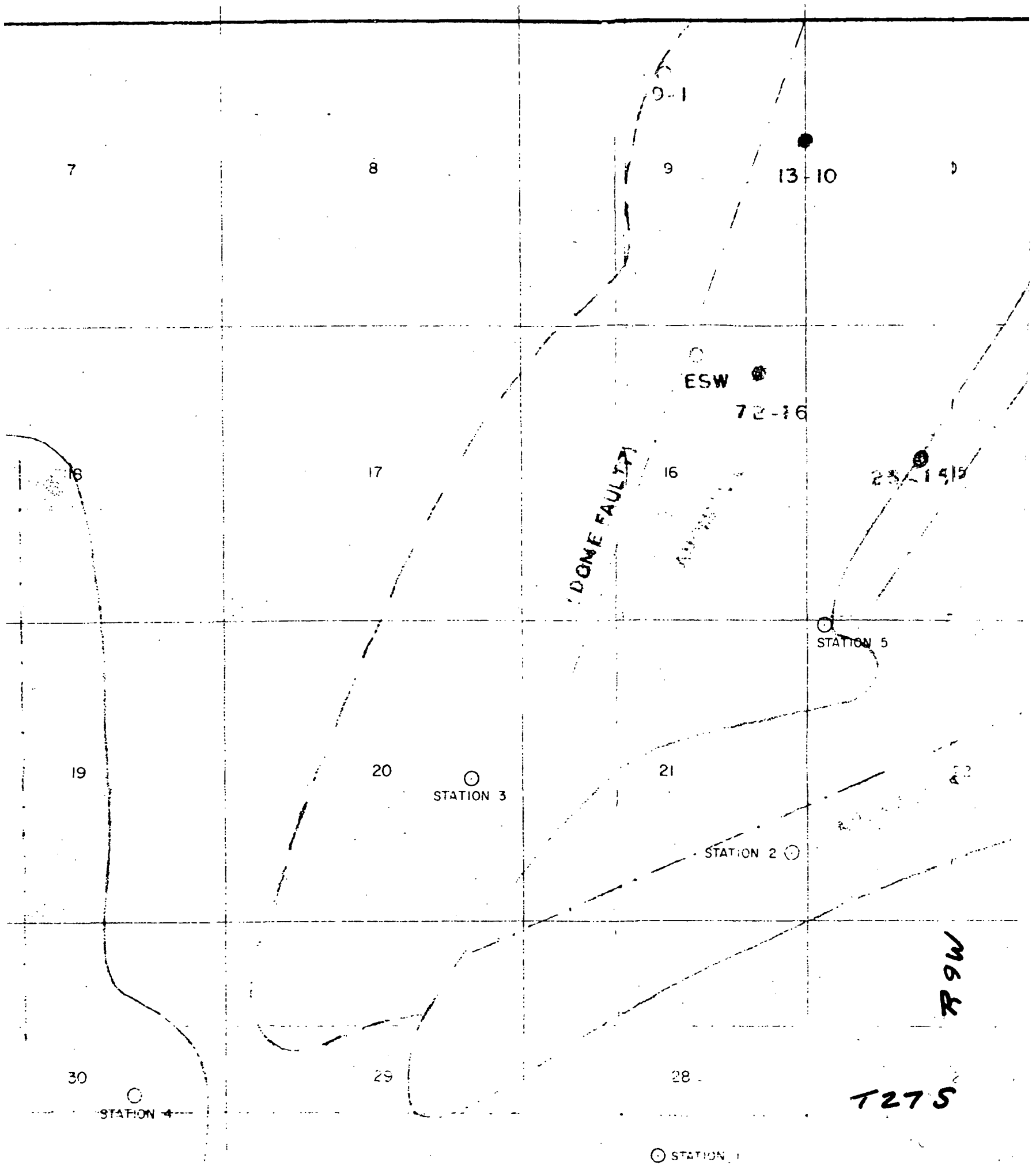
LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 1
PREPARED FOR:
GETTY OIL COMPANY



LEGEND

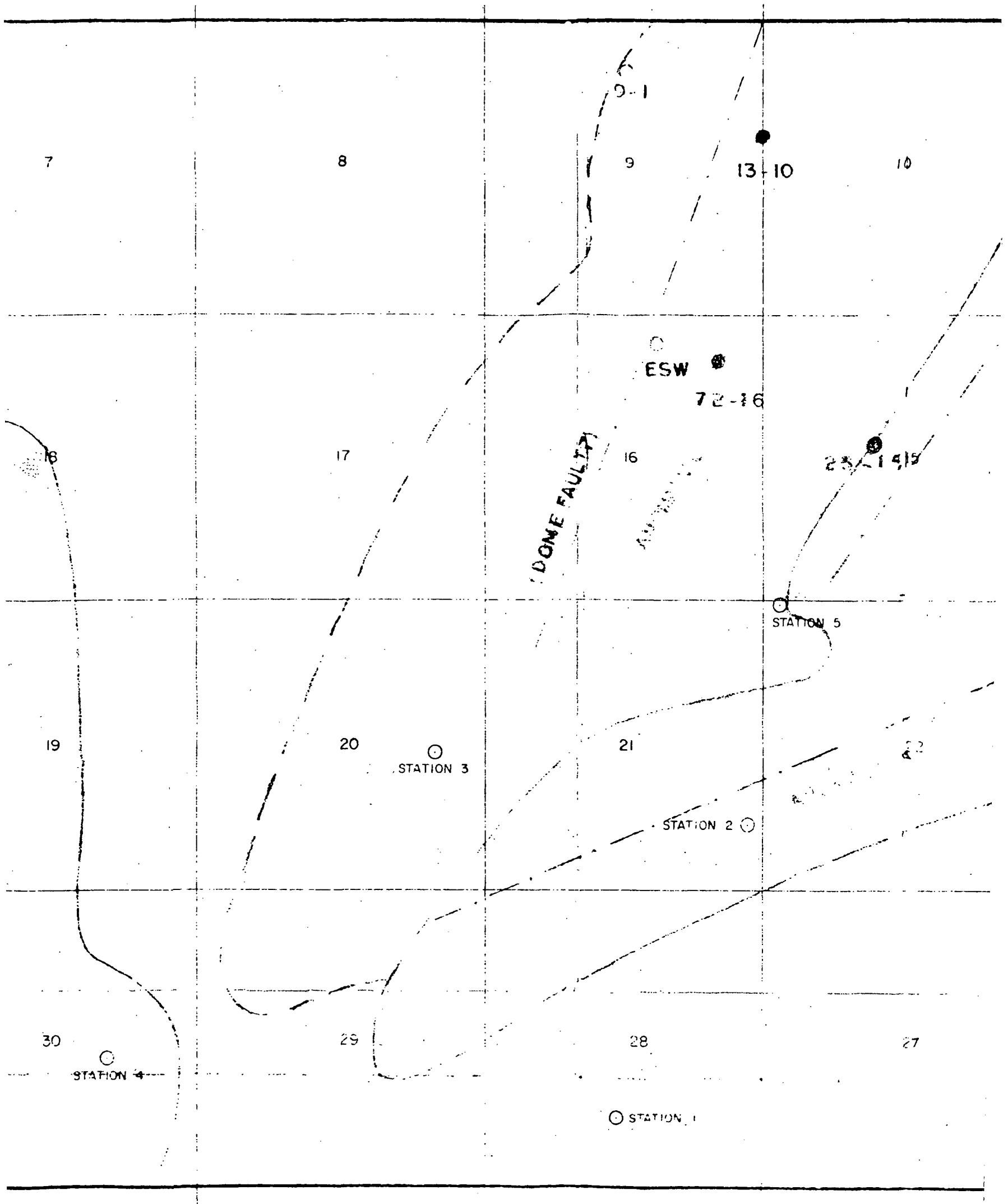
FRACTURED ZONE ?

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH

COMPOSITE MAP
TOP OF SEISMIC EMISSIONS
ANOMALY

PREPARED FOR:
GETTY OIL COMPANY



LEGEND

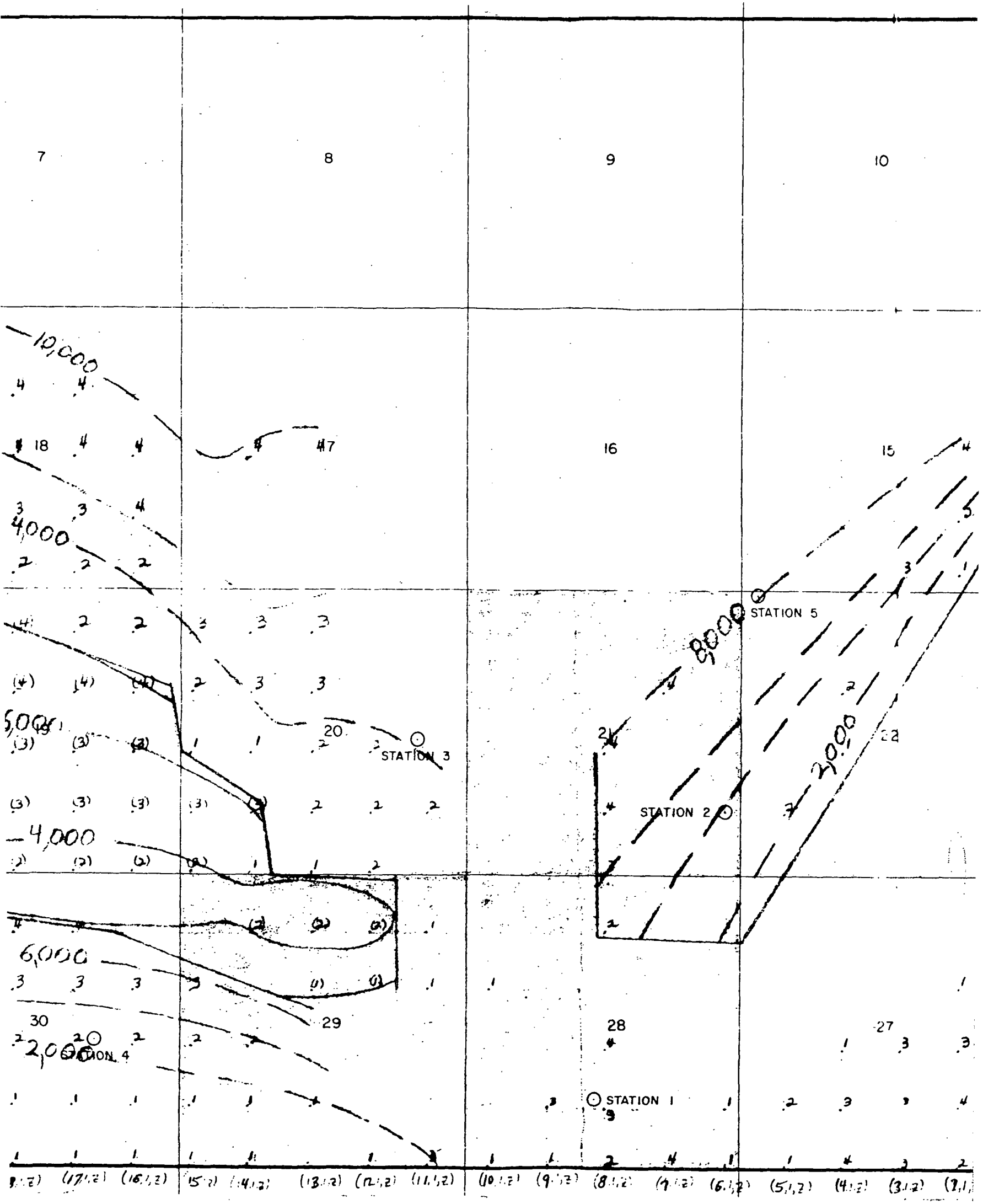
FRACTURED ZONE ?

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH

COMPOSITE MAP
TOP OF SEISMIC EMISSIONS
ANOMALY

PREPARED FOR:
GETTY OIL COMPANY



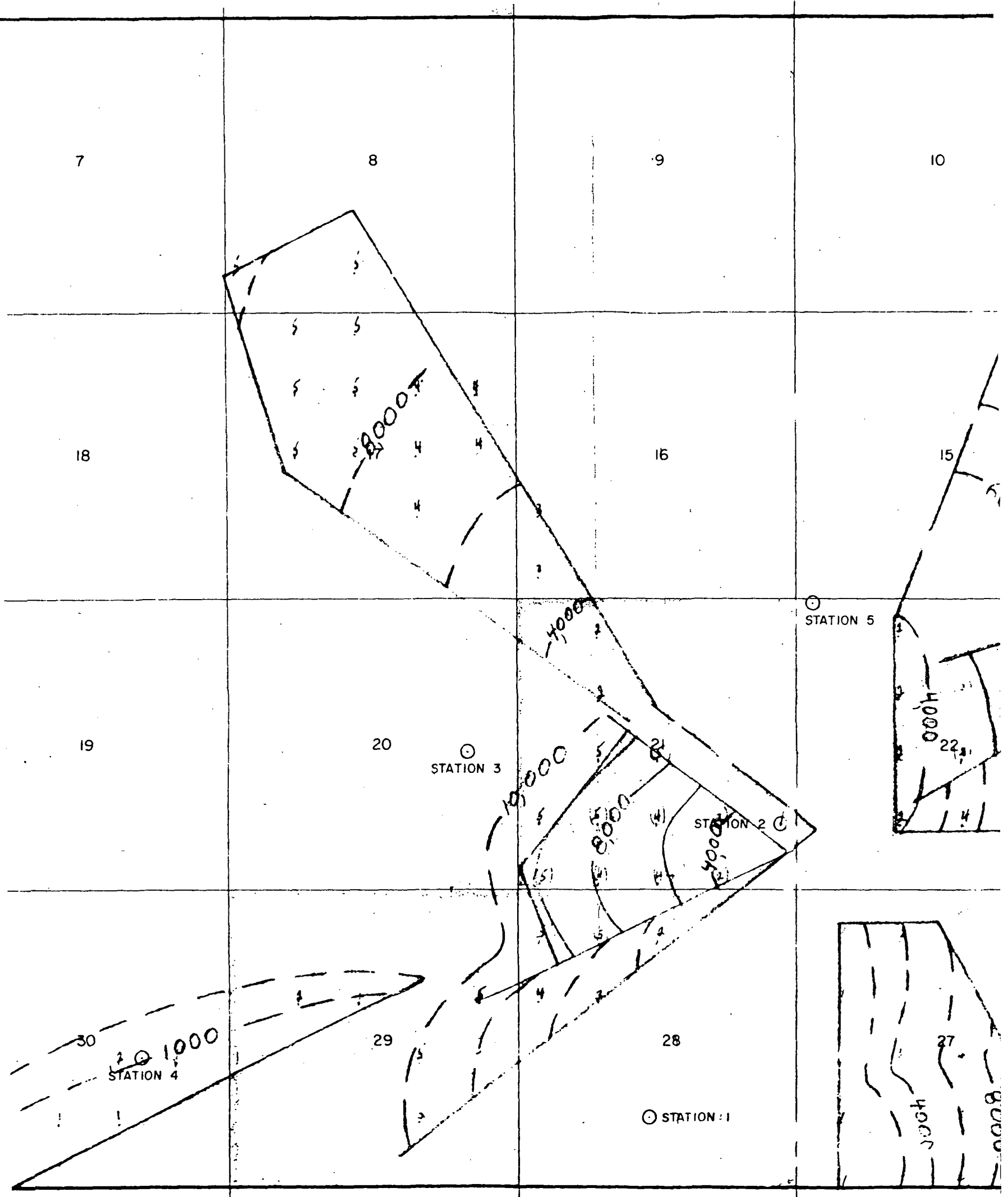
LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 1
PREPARED FOR:
GETTY OIL COMPANY



LEGEND

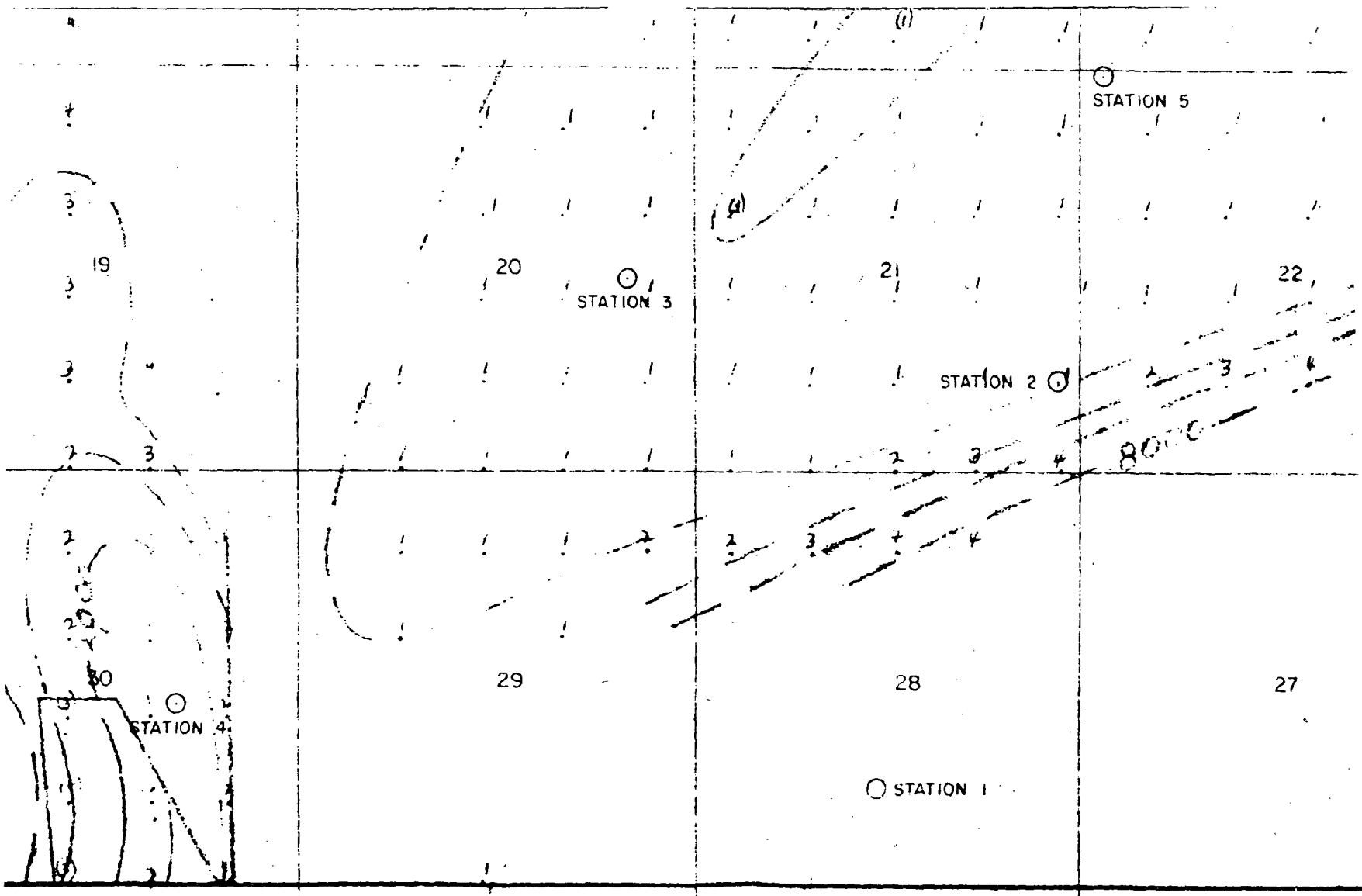
UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 2

PREPARED FOR:
GETTY OIL COMPANY



LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

SEISMIC EXPLORATION INC.
SALT LAKE CITY, UTAH 84101

LOCATION:
ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 4
PREPARED FOR:
GETTY OIL COMPANY

LEGEND

UPPER 10% OF MAXIMUM CORRELATION VALUES ———

50% - 90% OF MAXIMUM CORRELATION VALUES — — —

ROOSEVELT HOT SPRINGS - MILLFORD, UTAH
CONTOUR DEPTH MAP
TOP OF SEISMIC EMISSIONS
ANOMALY
STATION: 5
PREPARED FOR:
GETTY OIL COMPANY