From: Jack Gentry

ENERGY SERVICES
INCORPORATED
A Forsgren-Perkins Engineering Subsidiary
Energy Engineering and Development
Airport Plaza #2 1084 North Skyline Drive
Idaho Falls, Idaho 83401
(208) 529-3064

AREA
ID
Twin Falls
Kimb

September 13, 1979

Mr. Jack Gentry
J. H. Henry Produce Company
Box H
Kimberly, Idaho 83341

Subject: Second Geothermal Well Evaluation Report - RCS-56-79

Dear Mr. Gentry:

Attached is the Second Evaluation Report concerning your geothermal well south of Kimberly, Idaho. I can recommend a drilling site based on the information contained in the report. However, a geophysical survey to accurately locate the faults would result in a more precise location. The geophysical survey would cost approximately $800.00 or less.

If I can be of further assistance to you, do not hesitate to call.

Respectfully,

Roger Stoker

Roger C. Stoker, P.G.
Mgr., Geological & Reservoir Engr.

cc: Jay F. Kunze
Joseph R. Winkelmaier

enc.

/vl

A MARLEY COMPANY

LAYNE PUMPS, Inc.

VERTICAL TURBINE PUMPS

PHONE 733-3284 P. O. BOX 640

TWIN FALLS, IDAHO 83301

WELL TESTING REPORT AND AGREEMENT

NAME Bill Davis-Henry Produce LOCATION Well So. of Kimberly

I. D. WELL 12" WELL DEPTH 870' WATER TEMP. _____ STATIC WATER LEVEL 870'-23'

ORIFICE SIZE _____ DISCHARGE PIPE _____ COLUMN & LENGTH 8" x 400' AIRLINE _____

TIME	WATER LEVEL FT. FROM TOP	R. P. M.	ORIFICE READING	G. P. M.	REMARKS: SAND? CASCADING WATER? etc.
10/7 11:06	77			340	Very Muddy
11:16	57			380	Very Muddy w/Sand
11:32	61			408	Less Color w/Sand
11:54	72			463	Light Color w/Sand
12:05	73			476	Med Color w/Sand
12:17	86			533	Med Color w/Sand
12:35	89			533	Light Color w/Sand
12:45	89			533	Clearing
12:57	95			618	Color & Sand up and down
1:20	95			618	Clearing
1:30	108			672	Med Color w/Sand
1:51	121	90° Water		735	Med Color w/Sand
2:15	119.5	92° Water		735	Med Color w/Sand
2:22	119.5			735	Clearing
2:40	133			791	Med Color w/Sand
2:47	129			798	Very Dirty at Times
3:00	129			798	Clearing
3:05	145	97° Water		851	Med Color w/ coarse Sand
3:15	146	1400 RPM		851	" "
3:45	142			844	" "
4:00	141			844	Some Clearing
4:30	141			844	Less Color & Sand
4:33	156	1500 RPM		901	Med Color w/ coarse Sand
5:30	157			901	Light Color - coarse Sand
6:00	157			901	Cloudy w/coarse sand
6:05	120	1300 RPM		768	" "

RECOVERY TIME: FT. 1 MINUTE FT. 2 MINUTES FT. 3 MINUTES

APPROVED BY:

(LAYNE & BOWLER, INC.) (OWNER OF WELL)

A MARLEY COMPANY

LAYNE PUMPS, Inc.

VERTICAL TURBINE PUMPS

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TWIN FALLS, IDAHO 83301

WELL TESTING REPORT AND AGREEMENT

NAME Bill Davis - Henry Produce LOCATION

I. D. WELL WELL DEPTH WATER TEMP. STATIC WATER LEVEL

ORIFICE SIZE DISCHARGE PIPE COLUMN & LENGTH AIRLINE

TIME	WATER LEVEL FT. FROM TOP	R. P. M.	ORIFICE READING	G. P. M.	REMARKS: SAND? CASCADING WATER? etc.
8:25	63			508	Cloudy - Less Sand
8:30	Shut down				
-1/2 8:35	Well Flowing				
/20/7 8:45	Start Test - Well Flowing				
9:00	39			433	Clear - Trace coarse sand
10:00	65			578	" "
10:09	83			663	Cloudy - Increase in Sand
10:18	96			744	Increase color & Sand
10:23	100			744	Clearing
10:30	?			818	Med Color/ coarse sand
10:45	?			818	Clearing
10:48	?	1500 RPM		889	Light Color - increased sand
11:30	145			882	Some Clearing
11:43	165			949	Med Color w/coarse sand
12:25	165			949	Some Clearing
12:40	196			1062	Med Color w/coarse sand
1:10	207	No RPM Change		1145	Color Dark to Cloudy up & down
1:25	204	" "			Sand Plunging Tube
1:32	181		93° Water	1045	Less Color & Sand
1:45	179	" "		1029	Cloudy w/coarse sand
2:15	178	" "		1023	Almost Clear w/less sand
2:20	191	RPM Open		1084	Cloudy w/coarse sand
2:30	193		93° Water	1078	" "
2:40	193			1029	Cloudy - Some clearing
2:45	Shut Down				
2:51	Well Flowing				

RECOVERY TIME: FT. 1 MINUTE FT. 2 MINUTES FT. 3 MINUTES

APPROVED BY:

(LAYNE & BOWLER, INC.) (OWNER OF WELL)

rm 238-7
78

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name C. H. Davis

Address Kimberly Idaho

Owner's Permit No. _____

2. NATURE OF WORK

☐ New well ☑ Deepened ☐ Replacement
☐ Abandoned (describe method of abandoning) _____

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☐ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☑ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
___ inches	16 inches + 2	___ feet	450 feet
___ inches	___ inches	___ feet	___ feet
___ inches	___ inches	___ feet	___ feet
___ inches	___ inches	___ feet	___ feet

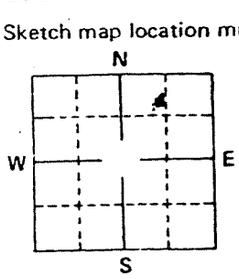
Was casing drive shoe used? ☑ Yes ☐ No
Was a packer or seal used? ☑ Yes ☐ No
Perforated? ☐ Yes ☑ No
How perforated? ☐ Factory ☐ Knife ☐ Torch
Size of perforation ___ inches by ___ inches

Number	From	To
___ perforations	___ feet	___ feet
___ perforations	___ feet	___ feet
___ perforations	___ feet	___ feet

Well screen installed? ☐ Yes ☐ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☐ Yes ☑ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth ___ Material used in seal: ☐ Cement grout ☐ Puddling clay ☐ Well cuttings
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing ☐ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld ☐ Cemented between strata
Describe access port _____

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____

Lot No. 2 Block No. _____

County _____

7. WATER LEVEL

Static water level _____ feet below land surface.
Flowing? ☑ Yes ☐ No G.P.M. flow 1700
Artesian closed-in pressure 60 p.s.i.
Controlled by: ☑ Valve ☐ Cap ☐ Plug
Temperature 56 °F. Quality _____

8. WELL TEST DATA

☑ Pump ☐ Bailer ☐ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
1700	325'	10

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
16	375	464	Rd Rhyolite		✓
12	464	473	Blk "		✓
"	473	485	Rd "	✓	
8	485	570	Blk Shale		✓
	570	575	Br Clay		✓
	575	602	Rd Rhyolite		✓
	602	670	" " Strips of Clay		✓
	670	770	Sm Clay Layers RD Rhyolite		✓
	770	860	Loose Rock & Gravel Clean Cutting		✓

10.

Work started 6/10/72 finished 6/17/72

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Chuck Tool Firm No. 24

Address Kimberly Date 6/17/72

Signed by (Firm Official) C. Chuck

and

(Operator) _____

Based on the data and information contained herein, it appears that there is a strong possibility of encountering hotter water by drilling deeper in this well. The geothermometers are very encouraging and the formation (sand & loose broken rock) in the bottom of the hole would indicate a possible fault zone intersection (probably not the major east-west fault however). If the recommendations (or a version of them) were not options that are open to you, we would be inclined to deepen the well at least 350 feet. It's a trade-off and capital risk either way. The decision must be weighed against the possible benefits.

The best course of action (for the highest probability of geothermal success) would be to accurately locate the surface expression of the faults through a geophysical survey (EM-16 and magnetometer) and then site a well to intersect the fault or faults at depth. The mouth of Rock Creek Canyon is the best area but the current study area is also excellent. Water temperature and production rates might be reduced somewhat in the study area as compared to what might be available in the Red Rock Canyon Area.

G. RECOMMENDATIONS

1. Conduct a geophysical survey to pinpoint the exact location of the east-west fault in the vicinity of the well under study.

2. A well study of some area wells (including temperature, depth and water level) would also be worthwhile especially in the Rock Creek Canyon Area. This study would help determine the correlation between ground water temperature and faulting and would also provide some basic hydrological information.

3. The chemistry of selected known hot water wells and springs in the area should be compared with this well.

4. A temperature survey should be conducted in this well following a minimum two-month shut-in period and compared to the present surveys.

5. The well drilling log should be examined for any additional information and area drillers contacted for other pertinent data.

F. CONCLUSION

Two conclusions can be drawn from the data available, depending on the structural control of the area. The most probable source of the geothermal water is from fault zones extending out from the mountains to the south. The geothermal water likely moves down these faults in a northernly direction. Whenever the water encounters other permeable faults or aquifers, it will also move along or within these features.

A second possibility is that the geothermal water originates in the permeable red rhyolite layer and moves horizontally within that zone. Whenever a fault is encountered by the geothermal water within the rhyolite, the fault provides a permeable zone for the water to move upward and laterally.

In either case, it appears that certain permeable fault zones constitute excellent geothermal targets in this area. That is, the hottest water should be encountered (at a given depth) within the area fault zones. However, not all fault zones will carry geothermal water and the target faults whould be selected with a geological knowledge of the area.

E. AREA WELLS

Several warm wells and springs exist in the area although very little specific information has been gathered on them. Of particular interest is a 1,500 foot well located a little over a mile to the east of the J. H. Henry Produce Well. The reported temperature is 110°F and it's location relative to the fault is similar to the Henry Produce Well. The maximum downhole temperature could be much higher, depending on the amount of dilution from the cold water aquifers.

The area wells generally reflect the influence that the faults have on the water temperature of the wells versus the depth. It appears that the hottest geothermal resource occurs in selected faults for a given depth.

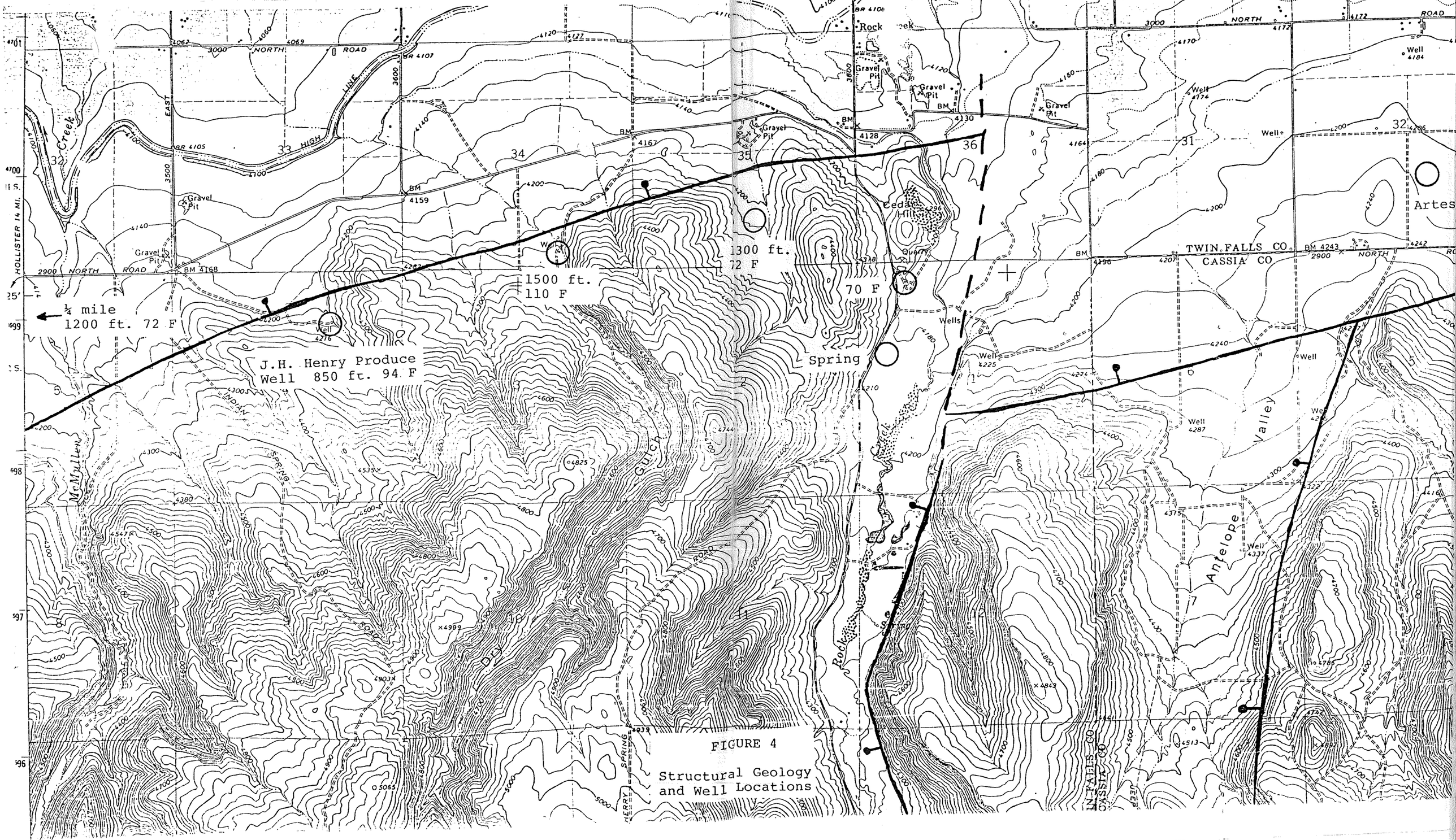


FIGURE 4

Structural Geology
and Well Locations

D. AERIAL RECONNAISSANCE

From the flight over the area on August 30 several major faults were mapped along the edge of the Snake River Plain to the south of Kimberly. See Figure 4. Determining the precise location of the fault is not possible without further geophysical surveys. From the land surface the major E-W fault appears to be located just north of the well site. This fault dips to the north and thus the wellbore probably does not intersect the fault zone at depth. North-south trending faults were mapped extending down some of the gulleys out of the hills to the south. The nearest north-south fault that is discernable from the surface features runs down Rock Creek Gulch approximately 2½ miles east of the well site. This right-lateral fault has offset the E-W fault in the vicinity of Rock Creek Canyon.

The mouth of Rock Creek Canyon is the best geothermal prospect in the immediate area. The J. H. Henry Produce Property is an excellent prospect area if the well is sited to intersect the E-W fault at depth.

The bicarbonate ($CaCo_3$), calcium, and hardness concentrations would indicate that calcium carbonate deposits will not be a major problem in heating systems and not much of one in steam systems. Steam system application should be analyzed further however. Sulfide and thus hydrogen sulfide (rotten egg gas) does not appear to present a problem, even a minor one. The rest of the analyzed constituents are relatively minor in amounts and shouldn't constitute any concern.

Based on this limited analysis, the water would be considered very good culinary water, especially for a geothermal resource. In fact, fluoride and other elements are normally much higher in geothermal water. A fluoride content of 4-8 ppm is not unusual, and some waters in Idaho go as high as 15-20 ppm (Raft River) and 14-24 ppm fluoride (Boise). However, the well water concentration (4-8 ppm) of fluoride is slightly above the EPA standard of 2 ppm.

TABLE 1

J.H. Henry Produce
Well Sample Analysis
August 3, 1979
Sec. 4, T12S, R18 E

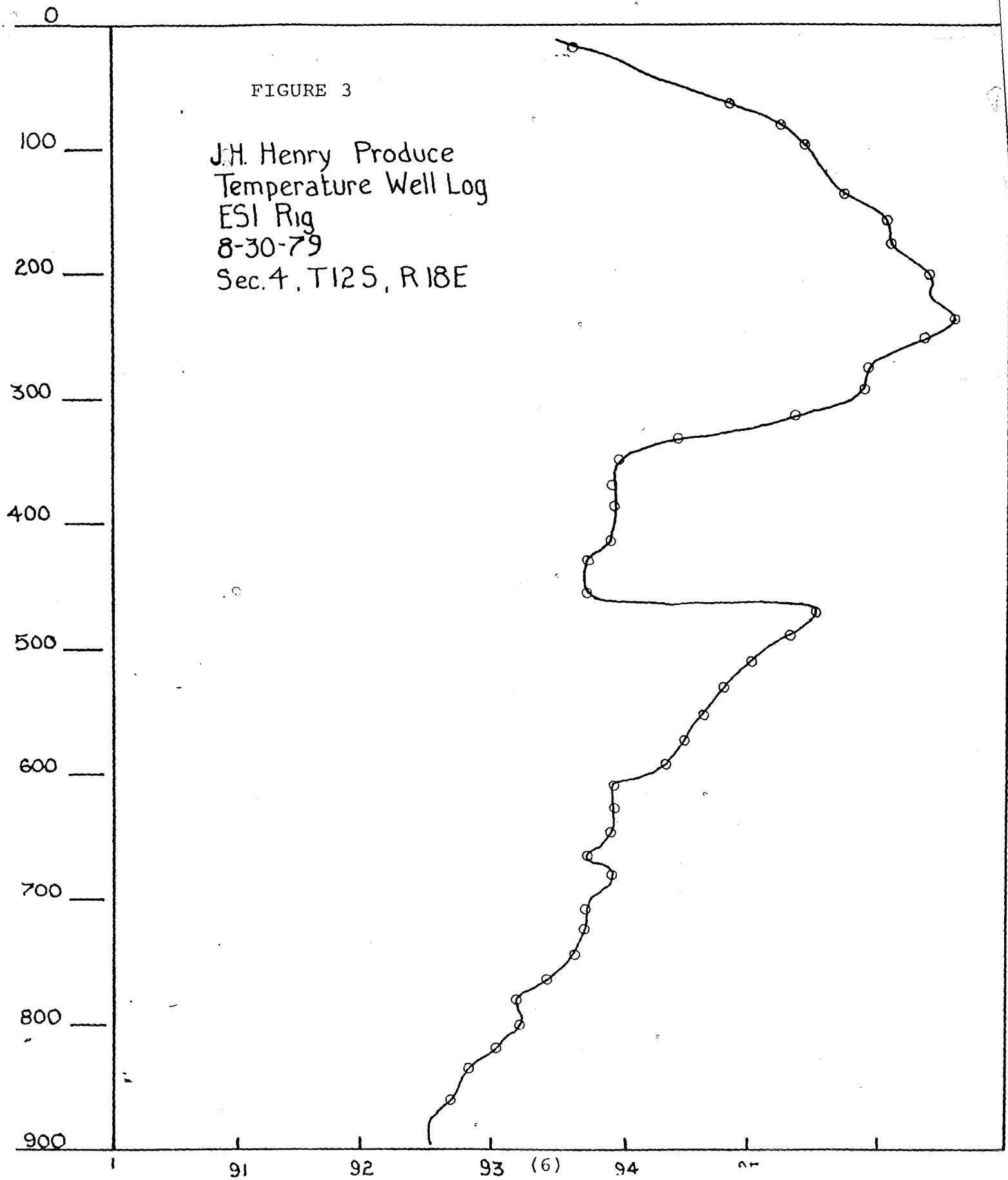
Compound or Element	Units (ppm or as shown)
Bicarbonate (HCO_3)	44
Bicarbonate ($CaCo_3$)	72
Calcium (Ca)	17
Chloride (Cl)	7.7
Flouride (F)	0.7
Potassium (K)	8.3
Silica (SiO_2)	49
Sodium (Na)	14
Sulfate (SO_4)	6.5
Sulfide (S)	<0.5
Hardness ($CaCo_3$)	39
Conductivity (taken in field)	210 microhms/cm
Total Dissolved Solids (TDS)	181
PH (taken in field)	6.5

C. GEOCHEMICAL ANALYSIS

Some indication of the maximum geothermal reservoir temperature can be gained from an analysis of certain elements in solution with the discharge water. The chemical analysis of the water sample taken at the study well is shown in Table 1.

Assuming no dilution of the geothermal resource from cold ground water, it is estimated by silica geothermometry that a reservoir temperature of at least 212°F exists somewhere at depth. Assuming a 70/30 dilution (a conservative estimate) of the geothermal water with normal temperature ground water containing 10 ppm of SiO_2, the geochemistry indicates a reservoir temperature of 234°F. Using the Na/Ca/k method, which is not normally as reliable as the silica geochemistry in the volcanic regions of Idaho, a reservoir temperature of 460°F was obtained. However, for various reasons, neither method should be relied upon solely as they can give erroneous indications.

FIGURE 3


J.H. Henry Produce
Temperature Well Log
ESI Rig
8-30-79
Sec. 4, T12S, R18E
0
100
200
300
400
500
600
700
800
900
91
92
93
94

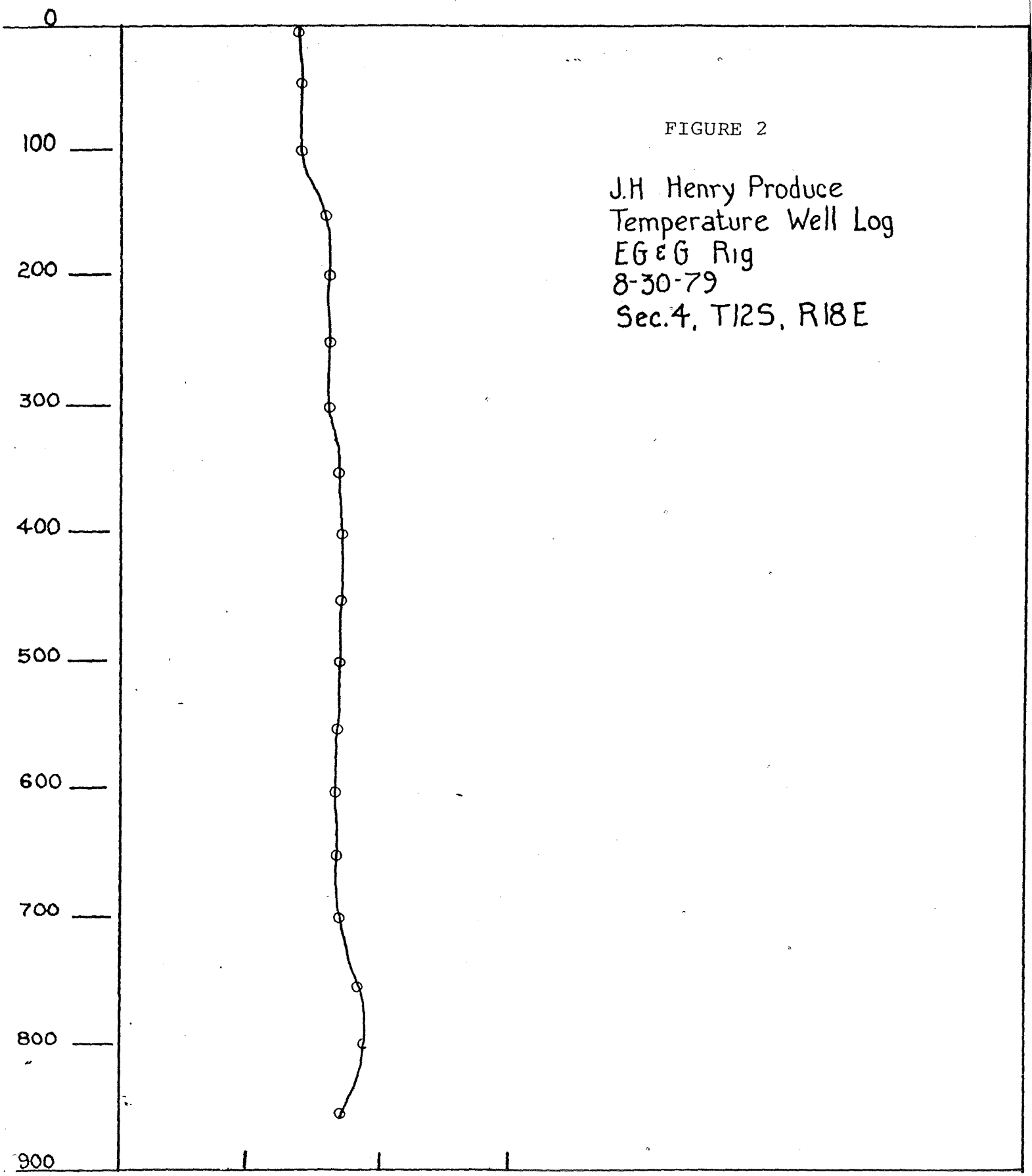
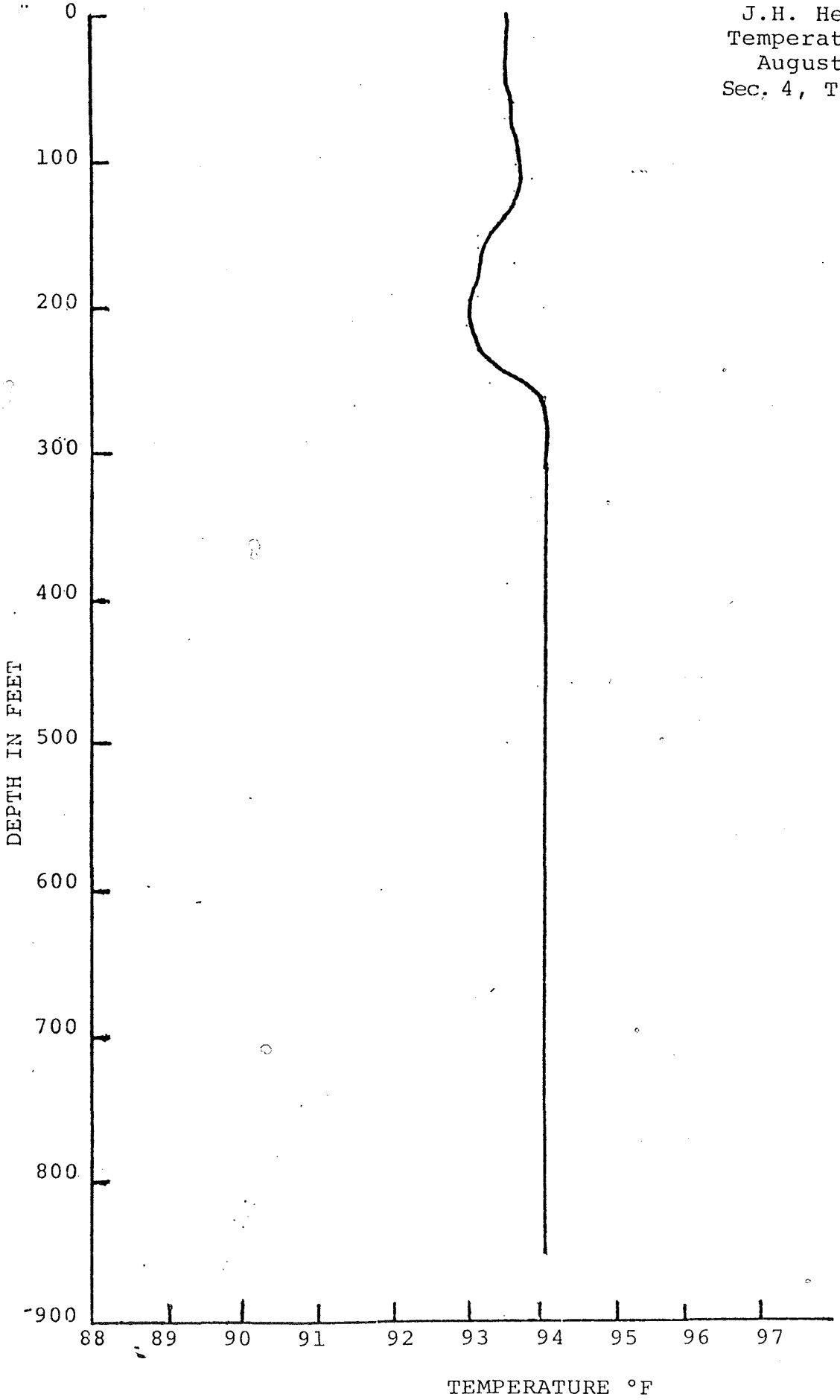


FIGURE 2

J.H Henry Produce
Temperature Well Log
EG&G Rig
8-30-79
Sec.4, T12S, R18E

FIGURE 1
J.H. Henry Produce
Temperature Well Log
August 3, 1979
Sec. 4, T12S, R18 E



The temperature profiles that were plotted from the data taken during the temperature surveys of August 30 are shown in Figures 2 and 3. The temperatures recorded from the EG&G Rig (Figure 2) confirmed the profile and data interpretation obtained on August 3; the profile obtained from the Energy Services, Inc. Rig (Figure 3) on August 30 is questionable due to the abnormal recorded variation of temperature inside the unperforated casing. Referring to the Figure 2 temperature profile, a total difference of only .5°F (93.4 and 93.9) was recorded between the high and low temperature readings. A miximum difference of 4°F was recorded from the Energy Services, Inc. Rig on the way down although there was no variance in temperature on the way back up. A probe response check was made at the surface and both probes were found to be working properly.

The evaluation of all three temperature profiles indicates that the warmest water production is coming from the bottom portion of the well in the loose rock and gravel encountered at 770 feet.

B. TEMPERATURE SURVEY AND PROFILE

The temperature profile that was plotted from the data taken during the August 3rd temperature survey is shown in Figure 1. It indicates that the resource water is coming into the well from the bottom and flowing upward with no temperature drop (isothermal). The magnitude of the difference between the high and low temperature readings (93.0 & 94.1°F) is only 1.1°F and constitutes no real difference at all. The other alternatives that can account for the shape of the profile is that either, 1) the temperature probe was not working or 2) the probe "hung up" in the wellbore at about the 260-foot depth or deeper on the way down. Subsequently the probe was caught at approximately the 450-foot depth and pulled off the cable during the trip out. Thus, a probe response check and relogging of the wellbore was not possible after the failure. This questionable data dictated that additional temperature surveys of the well would be necessary.

SECOND
EVALUATION REPORT
OF THE
J. H. HENRY PRODUCE COMPANY
GEOTHERMAL WELL

A INTRODUCTION

The J. H. Henry Produce Company owns a 860-foot deep geothermal well that produces free-flowing water at approximately 94°F and 160 gpm. This well is located in the northeastern quarter of Section 4, T12S, R18E, approximately 8 miles south of Kimberly, Idaho. Energy Services, Inc. was engaged to obtain a temperature profile of the well, collect a well water sample, analyze the sample, conduct an aerial reconnaissance and evaluate the resulting data.

On August 3, 1979, a field trip was made to the well in order to conduct a temperature survey of the well and collect a well water sample. The field trip was only partially successful as the temperature profile revealed very little information about the well or the hot water feeding the well.

On August 30, 1979 a second field trip was made to the J. H. Henry Produce Well in order to conduct a second temperature survey of the well, measure the flow, and conduct a geological aerial reconnaissance of the area.

This report combines the information and evaluation presented in an earlier (August 21, 1979) report with the information obtained during the second field trip.

RCS-56-79

GL02728

SECOND

EVALUATION REPORT

OF THE

J. H. HENRY PRODUCE COMPANY

GEOTHERMAL WELL

prepared by:

ENERGY SERVICES, INC.

Two Airport Plaza

1084 N Skyline Drive

Idaho Falls, Idaho 83401

REGISTERED PROFESSIONAL GEOLOGIST
ROGER C. STOKER
NO. 460
STATE OF IDAHO

Roger C. Stoker, P.G.
Mgr., Geological & Reservoir Engr.

Joseph R. Winkelmaier
Student Geologist
University of Idaho

September 13, 1979

for the:

J. H. Henry Produce Company
Box H
Kimberly, Idaho 83341