GL02975-5

COMPLETION REPORT:
RAFT RIVER
GEOTHERMAL PRODUCTION WELL FIVE
(RRGP-5)

February 1979

L. G. Miller
EG&G Idaho, Inc.

and

S. M. Prestwich
DOE-ID

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APPROVED:

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ABSTRACT

The Raft River Geothermal Production Well Five (RRGP-5) is a production well in the Raft River KGRA (Known Geothermal Resource Area). The plan for this well included three barefoot legs. Due to technical and funding problems, two legs were drilled; only one leg is a producing leg.

This report describes the entire drilling operation. This report includes daily drilling reports, drill bit records, casing records, and descriptions of cementing, logging, coring, and containment techniques.

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COMPLETION REPORT:
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I. INTRODUCTION

This report describes the drilling and completion of Raft River Geothermal Production Well Five (RRGP-5). This well will provide fluid for the 5-MW power plant which is currently under construction.

The site (see Figures 1 and 2) for RRGP-5 was recommended by the U.S. Geological Survey (USGS) in the area chosen for production wells, which is considered adjacent to the suggested Narrows Geologic Structure. The location of RRGP-5 is NE-1/4, SW-1/4, Section 22, T-15-S, R-26-E in Cassia County, Idaho (see Figure 2). Drilling operations began on May 7, 1978. On July 8, after the drilling of the initial wellbore, and prior to setting the 24-cm (9-5/8-in.) liner, the decision was made to move the rig to Site Seven. After the drilling of RRGI-7, the rig was moved back to RRGP-5 and the well completed. Later operations in completing this well (after August 3, 1978) were under the direction of the Department of Energy - Idaho Operations (DOE-ID).

Colorado Well Service performed the drilling and completion of RRGP-5. The drilling supervision, subcontracted by EG&G, was conducted by an independent company - Energy Drilling Specialists of Denver, Colorado. Technical direction was supplied to the drilling subcontractor through the drilling supervisor. DOE-ID provided funding for the drilling operation, and EG&G provided budgeting and procurement administration.

II. DRILLING SUMMARY

The drill site, 76- x 76-m (250- x 250-ft), was prepared by EG&G Idaho, Inc. Preparation included: site leveling and grading, excavation of a reserve pit, drilling a 91-cm (36-in.) conductor hole to 18 m (60 ft), and setting and cementing of the 66-cm (26-in.) conductor pipe (see Figure 3). A temporary pipeline from RRGE-1 was laid to provide drilling water.

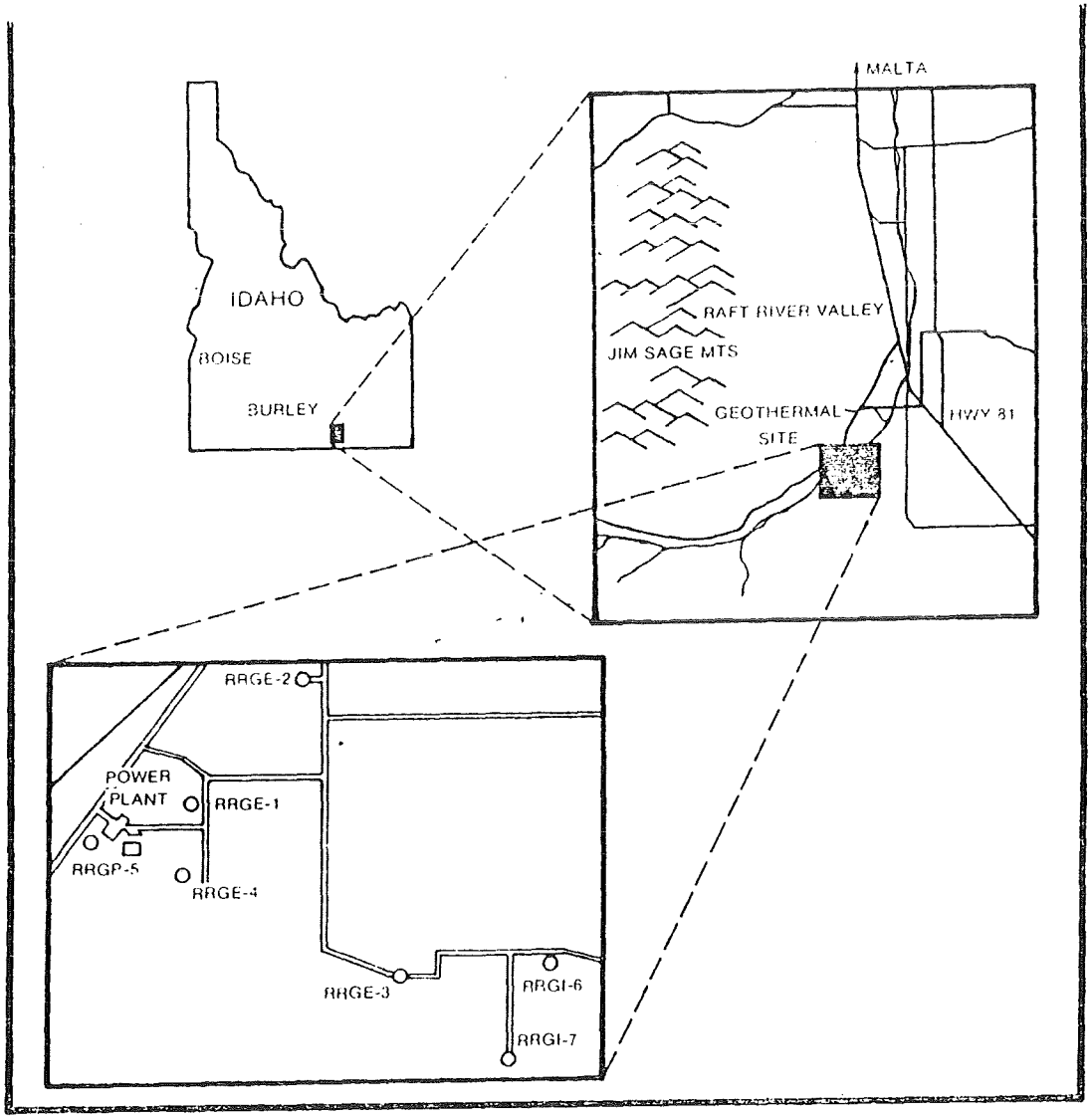

Fig. 1 Raft River Geothermal site and location of wells.

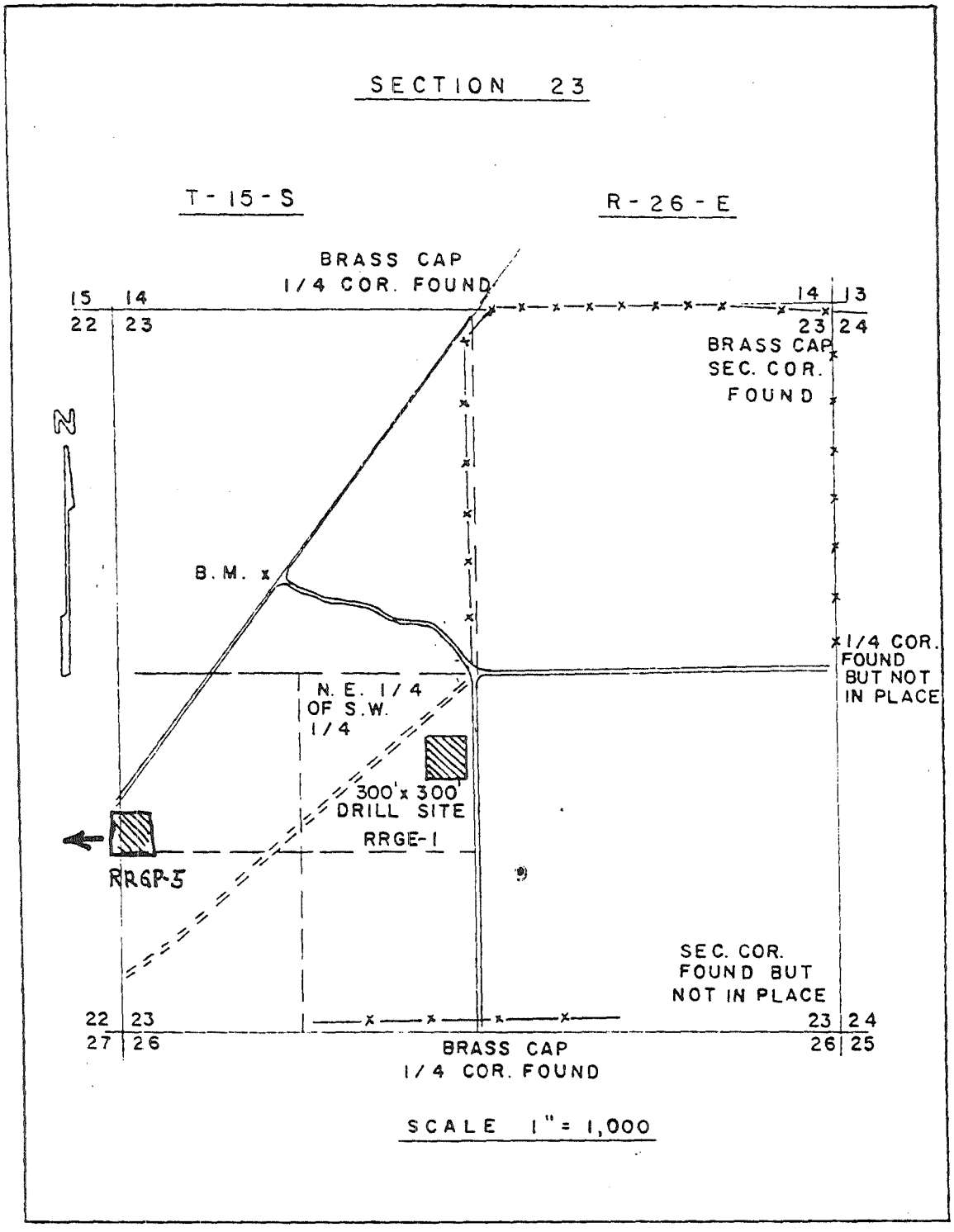

Figure 3. Location survey and continuation.

#5

N 0° 56' 34.4" W, 1430.65 ft from the south east of section 23. (22?) on NE 1/4 SW 1/4 Sec 22 T15S R26E

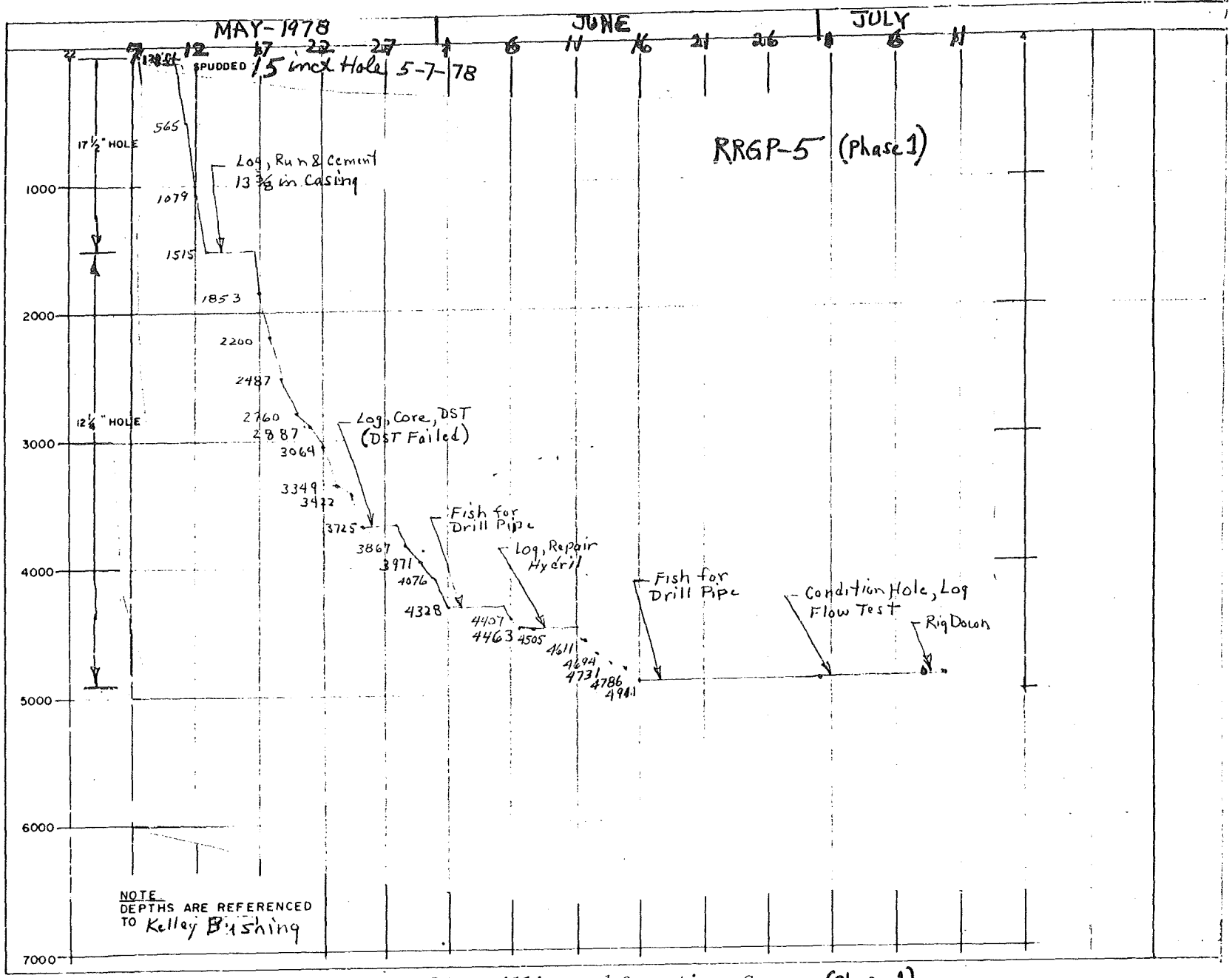

Figure 3. Drilling and Operations Summary (Phase 1)*

On May 7, 1978, drilling began on RRGP-5. At 55 m (180 ft), the hole was reamed to 64 cm (25 in.), and 52 m (172 ft) of 51-cm (20-in.) casing was cemented in place.[a] The BOP for the 44-cm (17-1/2-in.) hole was nippled up.

A 44-cm (17-1/2-in.) hole was drilled to 462 m (1515 ft). The hole was logged. Then, 34-cm (13-3/8-in.) K-55, 81.1-kg/m (54.4-lb/ft) casing was run and cemented to 460 m (1510 ft). BOP was nippled up and pressure tested.

After testing the casing, drilling of the 31-cm (12-1/4-in.) hole began. Due to low bottom hole temperatures, the decision was made to continue drilling past the planned casing point until adequate temperature was found. A temperature log at 1135 m (3725 ft) showed 135°C (274°F).

After logging, drilling continued to 1319 m (4328 ft). At this point the drill pipe twisted off on the 57th stand below the tool joint [56 stands and one piece 0.5-m (1-1/2-ft) long was pulled out]. The well was flowing at a rate of 2.5 L/sec (40 gpm) of 82°C (180°F) water at the wellhead. Fishing operations began after the well was killed with cold water. The next day, 29 stands of the fish were recovered, and in two more days, the rest of the fish was pulled out of the hole.

Drilling operations continued to 1373 m (4505 ft), when a temperature long showed 135°C (275°F) and when the well was flowing at approximately 63 L/sec (1000 gpm). Drilling continued,but water disposal created delays. An additional reserve pit was dug.

At 1497 m (4911 ft), the drill pipe twisted off again. A concentrated solution of salt (NaCl) was mixed and used to kill the well. Cold water pumped down the hole would not kill the well. On the third day the fish was stabbed. On the way out the pipe met an obstruction at 244 m (800 ft). Thirteen joints of the fish were recovered, but the remainder of the pipe fell down hole. The eighth day, a 33-joint section of the fish was recovered. On the twelfth day, the rest of the fish was recovered. The hole was washed, reamed, and circulated.

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[a] All depths are referenced from the Kelly Bushing, 4.2 m (14 ft) above ground level, unless otherwise noted.

A flow test and air lift was conducted. The flow test lasted 2 days. An attempt to air lift from 914 m (3000 ft) failed. Finally, air lifting began at 430 m (1430 ft) down hole. The hole was logged, and rigging down operations began. The drilling was temporarily suspended on July 8, 1978.

During the period of time the drill rig was off the hole, a small work-over rig was brought in to set a cement plug (see Figure 4). The top of cement plug was at 1121 m (3735 ft). The cement plug allowed testing of the upper portion of the hole and casing.

Tests were initiated to determine the extent of the salt intrusion in the geothermal aquifer around the 488-m (1600-ft) depth. Airlift tests on the upper portion were conducted, but very little salt solution was recovered. The majority of the solution had been recovered during the initial test period prior to July 8, 1978.

The drilling rig was moved back over the hole, and drilling started on August 23, 1978. The hole was cleaned and conditioned. A 25-cm (9-5/8-in.) casing was hung from the liner hanger at 391 m (1284 ft) to a depth of 1039 m (3408 ft) and cemented. The cement did not come up to the casing hanger, so two remedial cement squeeze jobs were required to complete the casing cementing.

An attempt to drill out the cement shoe and cement plug at 1138 m (3735 ft) was made with a 22-cm (8-3/4-in.) bit. However, the bit deviated off the plug and a new hole was drilled from about 1097 m (3600 ft) to T.D. as seen in Figure 5. Drilling on this leg was terminated at 1500 m (4925 ft) in the quartz monzonite formation.

III. SURFACE AND CONTAINMENT EQUIPMENT AND SERVICES

1. CONTAINMENT EQUIPMENT - SURFACE HOLE

A 51-cm (20-in.) single-gate Shaffer blowout preventer (BOP) was bolted between the 51-cm (20-in.) casing head and the drilling nipple for drilling the 44-cm (17-1/2-in.) hole to 462 m (1515 ft).

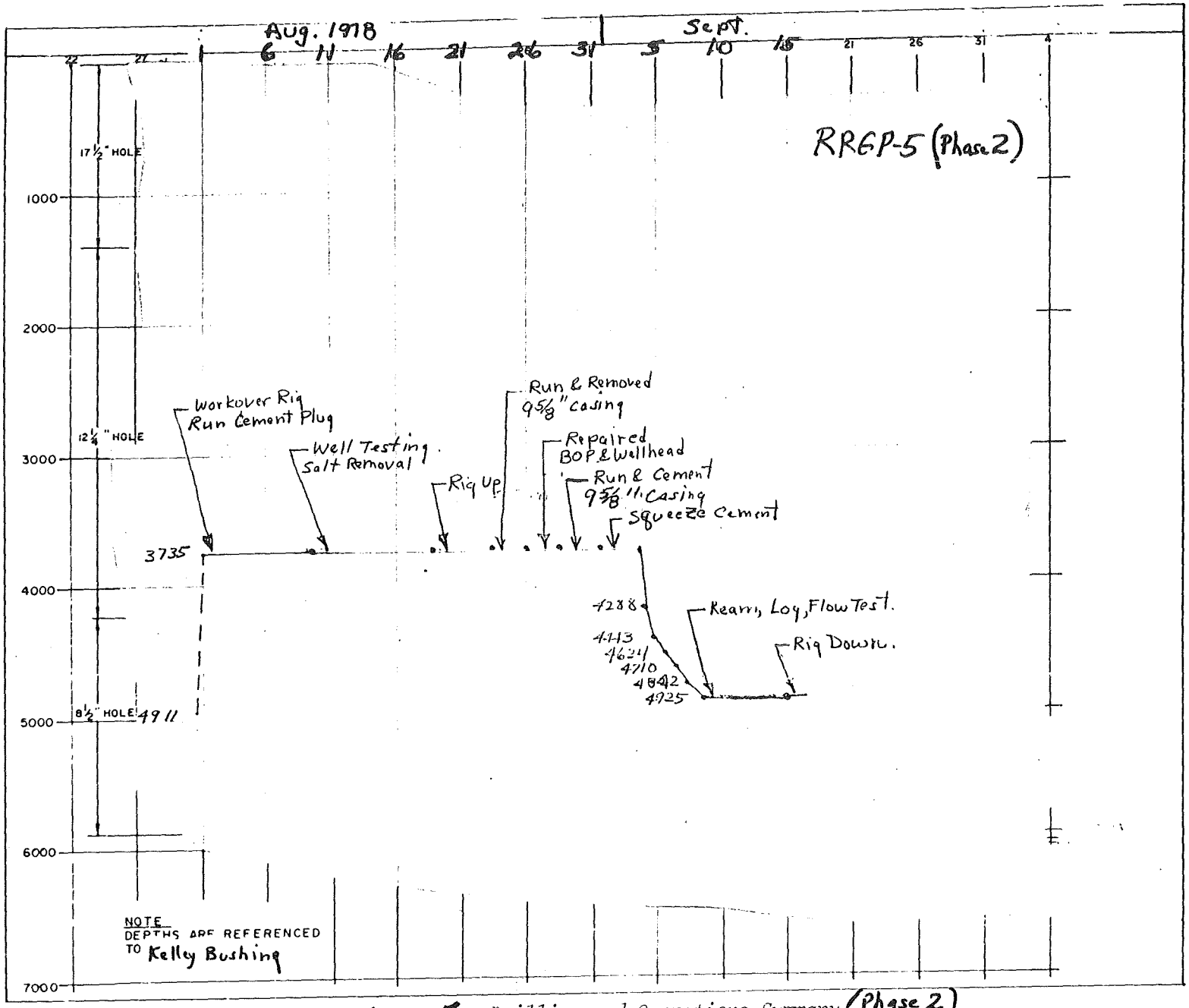


Figure 4 Drilling and Operations Summary (Phase 2)

RRGP-5

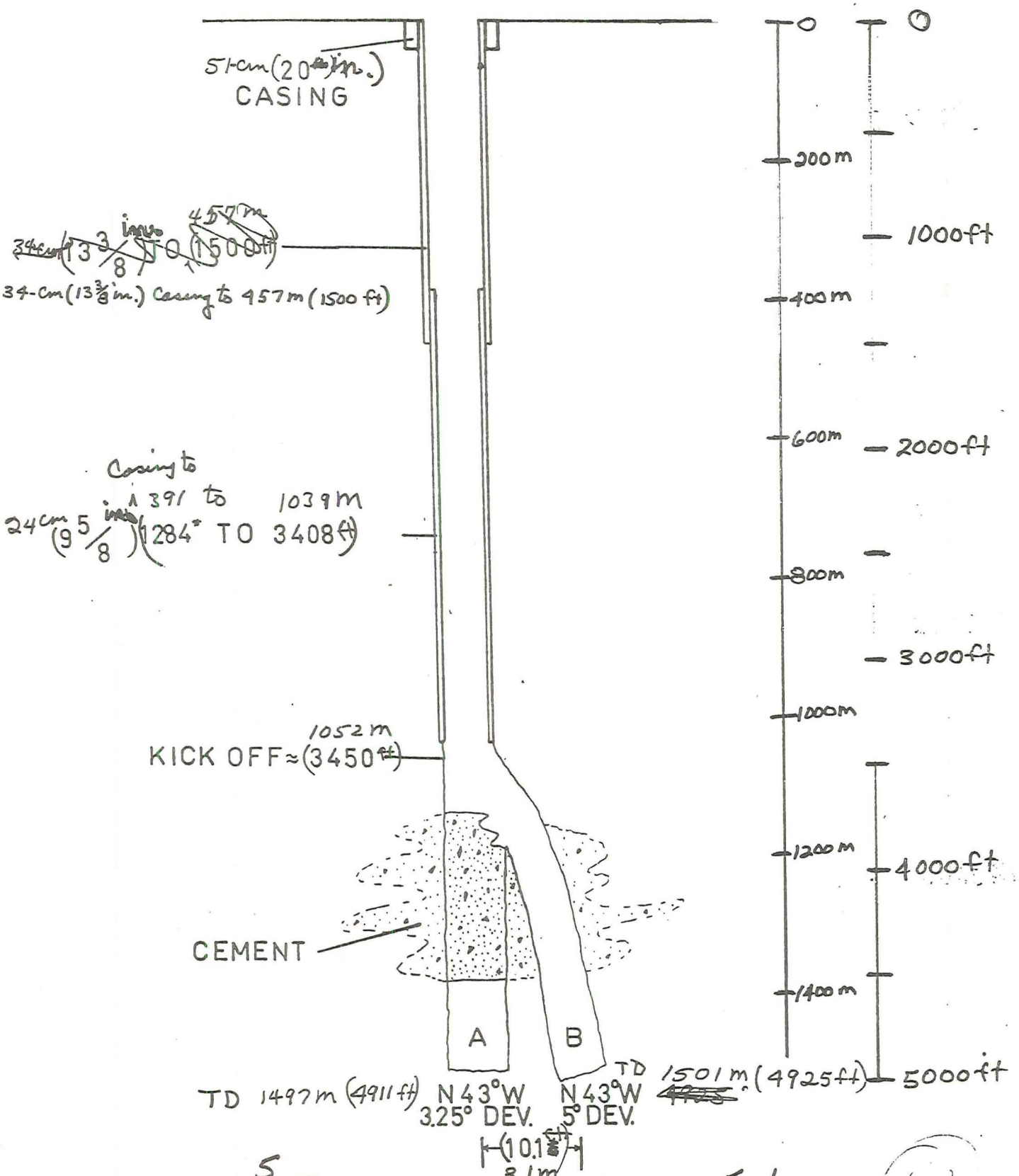


Figure 5 Subsurface Well Status.

2. CONTAINMENT EQUIPMENT - PRODUCTION HOLE

After setting the 34-cm (13-3/8-in.) casing at 460 m (1510 ft), the following containment stack, listed in order of position above the casing head, was used (see Figure 6).

(1) WKM 51- x 30-cm (20- x 12-in.) expansion spool

(2) WKM 30-cm (12-in.) master valve

(3) Hanger spool

(4) Shaffer double-gate 30-cm (12-in.) BOP

(5) Hydril Type-GK 30-cm (12-in.) BOP

(6) Grant 30-cm (12-in.) rotating head.

3. CELLAR

A subcontractor constructed a 2.4- x 3- x 2.4-m (8- x 10- x 8-ft) reinforced-concrete cellar to accommodate the BOP stack.

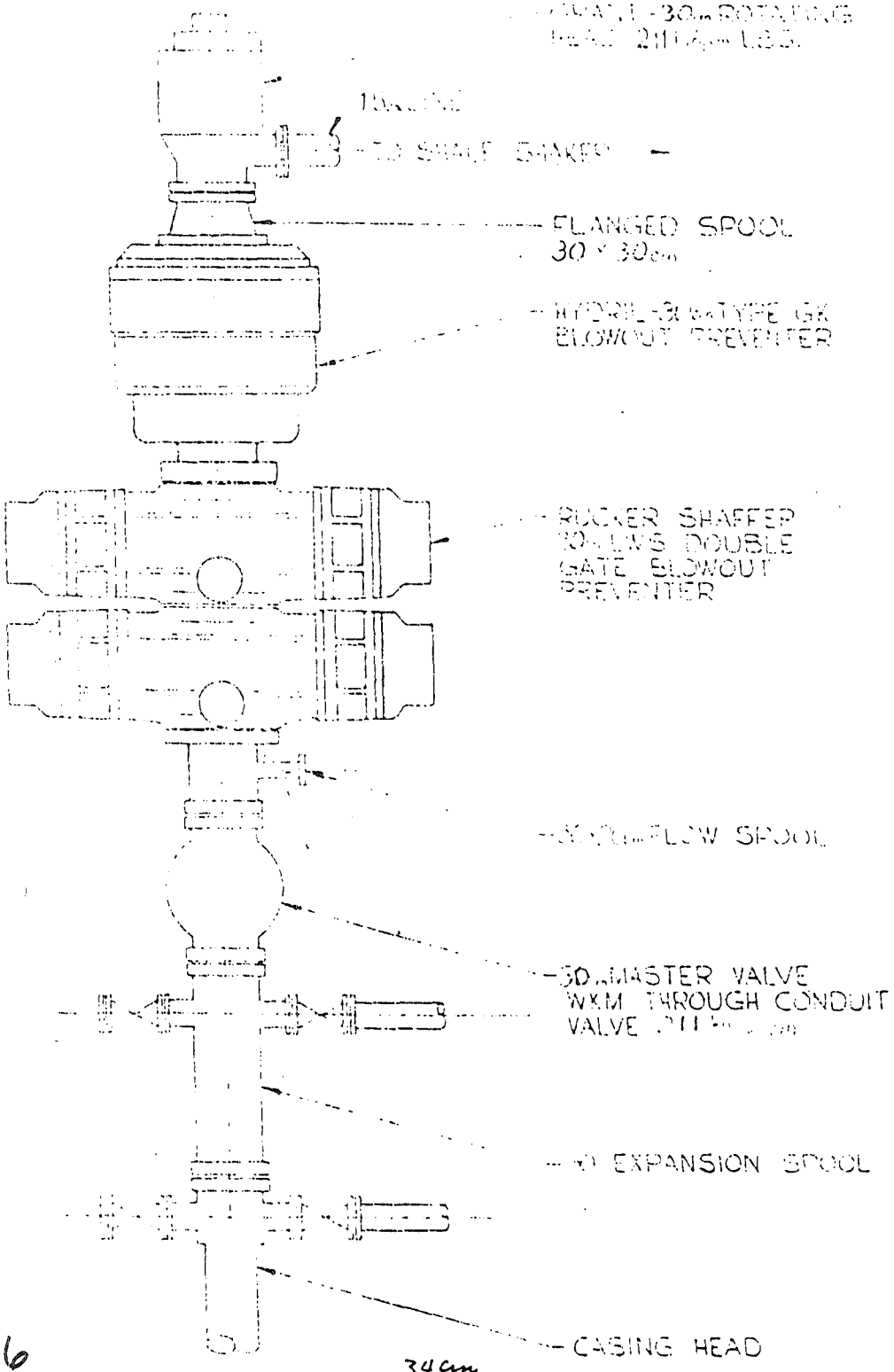
4. DRILLING RECORDER

While drilling, a six-pen recorder charted weight on derrick, drilling rate, rotary torque, standpipe pressure, and pump strokes on pumps one and two.

5. WELLHEAD

The permanent wellhead on this well consists of a standard WKM wellhead system. The casing head, with its 51-cm (20-in.) 141-kg/cm^2 (2000-psi) API flange, is welded directly to the 51-cm (20-in.) well casing. The expansion spool mates to the 51-cm (20-in.), 141-kg/cm^2 (2000-psi) API casing head flange on the bottom and the 30-cm (12-in.), 28-kg/cm^2 (400-psi) ANSI flanged master gate valve on the top. Both sides of the expansion spool contain 7.5-cm (3-in.) valved outlets with 7.5-cm (3-in.), 141-kg/cm^2 (2000-psi) API flanges.

A hanger spool mates with the master valve on the bottom, with a 20-cm (8-in.), 42-kg/cm^2 (600-psi) ANSI flanged power-seal gate valve on top. Above the power-seal gate valve is a 20-cm (8-in.), 42-kg/cm^2 (600-psi) ANSI tee (or cross).



6
Blowout preventer

34cm
(13-3/8 in) casing shoe.

For logging access into the well, a double-studded 20-cm (8-in.), 42-kg/cm^2 (600-psi) ANSI to 10-cm (4-in.), 21-kg/cm^2 (300-psi) ANSI flanged gate valve is mounted above the double-studded flange. Figure 7 is a schematic diagram of a completed wellhead system showing the expansion capabilities for the production casing and the packoff system. The packoff system is designed to be repacked under pressure.

IV. DOWNHOLE EQUIPMENT AND SERVICES

1. CONDUCTOR PIPE

There were 18 m (60 ft) of 66-cm (26-in.) conductor pipe set and cemented in a 91-cm (36-in.) hole.

2. SURFACE CASING

Five joints of 51-cm (20-in.) H-40 casing were set and cemented to 52 m (172 ft) with 225 sacks of Class-G cement.

3. INTERMEDIATE CASING

Thirty-eight joints of 34-cm (13-3/8-in.), 81.1-kg/m (54.5-lb/ft), K-55 casing, guide shoe, and float collar were run, set, and cemented to 460 m (1510 ft) with 850 sacks of Class-G thixotropic cement.

4. LINER HANGER

The liner hanger for the 25-cm (9-5/8-in.) production liner was a Baash-Ross plain type (from Otis Engineering) with fluted cones and circulation ports. The ports were designed to facilitate a remedial cement job if required. The liner hanger was set in the 34-m (13-3/8-in.) casing at 391 m (1284 ft).

5. PRODUCTION CASING

Fifty-two joints of 25-cm (9-5/8-in.) K-55 buttress-threaded. Range 3 casing were run and cemented with 1200 sacks of Class-G 1:1 Perlite cement. Two additional cement squeeze jobs were required to complete cementing.

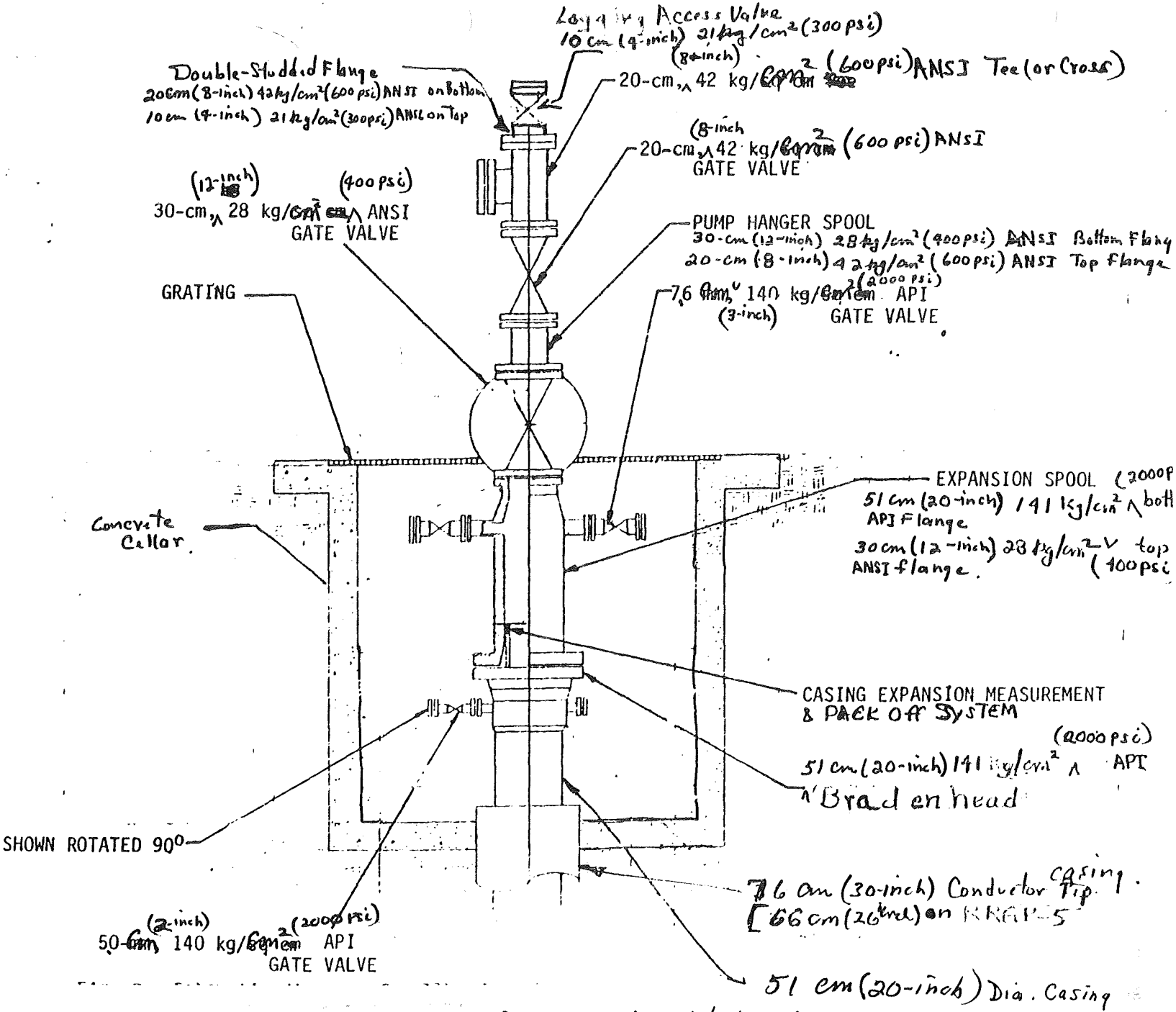


Figure 7 Schematic Diagram of Completed Wellhead.

6. DRILL BIT SUMMARY

A dry hole digger drilled 18 m (60 ft) of the 91-cm (36-in.) hole to set the 66-cm (26-in.) conductor pipe.

To set the 51-cm (20-in.) surface casing, the hole was drilled with a 31-cm (12-1/4-in.) bit and then reamed with a hole opener. A Smith 31-cm (12-1/4-in.) SVH-Jet bit drilled to 55 m (180 ft) in 8-1/2 hours. A Security 64-cm (25-in.) hole opener reamed the hole in 10-1/2 hours. The 51-cm (20-in.) H-40 casing was then set and cemented.

Two 44-cm (17-1/2-in.) bits were used to drill to 462 m (1515 ft). The first one, an OSCIG-Jet, drilled to 329 m (1079 ft) in 35-1/2 hours. The second one, an OWV-Jet, drilled from 329 to 462 m (1079 to 1515 ft) in 16 hours. This completed the 44-cm (17-1/2-in.) hole.

Thirteen 31-cm (12-1/4-in.) bits were used to drill from 462 to 1497 m (1515 to 4911 ft). The first bit used was a rerun of the bit used to drill the initial pilot hole for the 51-cm (20-in.) surface casing. It drilled from 21 to 483 m (70 to 1584 ft) in 3 hours. The next three 31-cm (12-1/4-in.) bits used were also Smith SVH-Jet bits, and they drilled from 483 to 885 m (1584 to 2904 ft), a total of 402 m (1320 ft), in 66 hours. Next, a Hughes OWV-Jet was used. It drilled from 885 to 959 m (2904 to 3147 ft) in 18 hours, a little slower than the Smith bits. Two more Smith SVH-Jet bits followed the Hughes bit,and they drilled to 1141 m (3743 ft) in 34 hours. Following the Smith bits, 2 Hughes OWV-Jets were used. They drilled 1141 to 1319 m (3743 to 4328 ft) in 58-1/2 hours. The rock encountered became much harder, and drilling noticeably slowed. Two more Smith SVH-Jets were tried. Those bits made only 53 m (175 ft) to 1373 m (4505 ft) in 37 hours. Due to the hard formation, 2 Hughes 31-cm (12-1/4-in.) J-77 bits were procured. These two bits made 124 m (406 ft) in 95 hours, bringing the total depth to 1497 m (4911 ft). This completed the 31-cm (12-1/4-in.) hole.

In the second phase of drilling, two Hughes J-7, 22 cm (8-3/4-in.) bits were used to drill out shoe and cement plug down to 1305 m (4430 ft) in 47 hours. The drilling deviated out of the original hole during this period. Two Security H-100F, 22-cm (8-3/4-in.) bits were used to complete the second leg to TD, 1501 m (4925 ft). Two additional Hughes bits were used in drilling out several bridges and cleaning the hole. These were a J-7 and an XV Type 22-cm (8-3/4-in.) size.

7. DRILLING FLUID

The 66-cm (26-in.) hole was drilled with gelled water. The 44-cm (17-1/2-in.) hole was drilled with a series of mud systems. The drilling started with a flocculated gel, with a weight of 1.1 kg/L (9.2 lb/gal), viscosity of 39 sec/1000 cm^3, plastic viscosity of 10, yield point of 26, and 6% solids. This changed to a Drispak system, with a weight of 1.11 kg/L (9.3 lb/gal), viscosity of 38 sec/1000 cm^3, plastic viscosity of 6, and a yield point of 21. The final system, a dispersed polymer, had an average weight of 1.11 kg/L (9.3 lb/gal), viscosity of 38 sec/1000 cm^3, plastic viscosity of 5, yield point of 29, and 5.7% solids.

The cement from the 34-cm (13-3/8-in.) casing operation was drilled with clear water.

The 31-cm (12-1/4-in.) hole was drilled with two mud systems. The clear water used to drill the cement gradually became a dispersed polymer. The dispersed polymer mud had properties averaging as follows: mud weight of 1.1 kg/L (9.2 lb/gal), viscosity of 33 sec/1000 cm^3, plastic viscosity of 6, yield point of 17, and solids of 6%. This system was used to 1242 m (4076 ft), where drilling with water began. A temporary line from RRGE-1 served as the source of water to the RRGP-5 site.

8. SAMPLES AND MUD LOGGING SERVICE

A mud logging service of monitoring drilling fluid and cutting returns was utilized throughout all drilling below the conductor pipe. This service monitored fluid temperatures (in and out) and hydrogen sulfide and hydrocarbon concentrations. Lithologic characteristics were determined by analyzing recovered drill cuttings every 6 m (20 ft).

9. CEMENTING

Conductor Pipe -- The 66-cm (26-in.) conductor pipe was cemented from 18 m (60 ft) to ground level using plant mix concrete.

Surface Casing -- The 51-cm (20-in.) casing was cemented with 210 sacks of Class-G cement, with 2% $CaCl_2$, 3% NaCl, and 11.5 kg/sack (25 lb/sack) of D-29. The cementing began with a 7950 L (50 bbl) water preflush. Slurry weight was 1.9 kg/L (15.8 lb/gal).

Intermediate Casing -- Thirty-four-cm (13-3/8-in.) casing was run in the 44-cm (17-1/2-in.) hole on RRGP-5. Drilled depth of the hole was 462 m (1515 ft). Casing was landed at 460 m (1510 ft), and wellhead slips were set. Cementing began using Dowell thixotropic RFC cement. A caliper had been run prior to running casing showing an in-gauge hole of 46 to 47 cm (18 to 18-1/2 in.) with the bottom 15 m (50 ft) being 44 cm (17-1/2 in.). The necessary cement volume was calculated for perfect hole volume plus 50% excess. EG&G also ordered an additional 100 sacks to compensate for a washout; a total of 850 sacks of cement. The cementing began by running 7900 L (50 bbl) of water ahead of the cement to preflush the hole. Returns were good throughout cementing; however, returns did not indicate cement returns at the surface. Indications were that the preflush was being returned as the cement was in place. This indicated that there might be no cement in the upper 30 m (100 ft) of casing. Petrolog ran a temperature and cement-bond log to locate the cement top for evaluation of remedial procedures. The cement-bond log was run 12 hours after cement was in place. Since the cement was not set up, the bond log showed only approximately 75% bonding through the greater portion of the log, which would improve as cement hardened. At 30 m (100 ft) to the bottom of the cellar, the log showed 25 to 30% bonding. About 50% of the area between the 51-cm (20-in.) and 34-cm (13-3/8-in.) casings was well cemented.

10. DRILLING PROBLEMS

Initial Fish Job -- On June 1, 1978, the drill pipe twisted off 15 joints above the drill collars. Fishing began on June 2, 1978. The fish was caught, but while being pulled out, hung up in the hole. Dialog was called to run a free-point location survey. The pipe stuck at 674 m (2212 ft) at the top of the 20-cm (8-in.) drill collars. A string shot was run at 666 m (2185 ft) with no results. A second attempt allowed the string to be backed off at 666 m (2185 ft). The string was pulled out of the hole and run back in with jars, a bumper sub, an accelerator, and eighteen 16-cm (6-1/4-in.) drill collars, with the 11.4-cm (4-1/2-in.) full-hole pin down. It screwed into the fish. They bumped down on the fish. The fish came free and was recovered. During this fishing job, the Derrick man incurred severe steam burns even though the flashing hot-water flow was relatively small. Flashing was reduced by injecting cold water into the hot water, below the Grant rotating head.

Second Fish Job -- On June 16, 1978, while drilling at a depth of 1497 m (4911 ft), the drill string twisted off leaving 792 m (2600 ft) of drill pipe in the bottom of the wellbore. The drill string consisted of 51 joints or 469 m (1540 ft) of 11.4-cm (4-1/2-in.) drill pipe; six joints or 55 m (180 ft) of 16-cm (6-1/4-in.) OD drill collars; and eight joints or 73 m (240 ft) of 20-cm (8-in.) OD drill collars and bit. The top of the drill string was calculated to be at 699 m (2292 ft).

Because of the extreme scalding danger from the flow of high-temperature water experienced on the first fishing job, it was decided to kill the well with a concentrated solution of salt water. Salt was ordered along with fishing tools. EG&G contacted Colorado Well Service and requested new drill pipe. Delivery of the 762 m (2500 ft) of new pipe was set for June 19. Fishing began June 18. June 19, the fish was caught. While tripping out, the drill collars stuck; while working to free the pipe, the drill pipe again parted 247 m (809 ft) below the surface.

The stuck pipe fell to the bottom of the hole, and fishing began again. The top of the pipe was calculated to be at 1006 m (3299 ft). At this point, Colorado Well Service was again contacted to request sufficient new drill pipe to complete a drill string of 1615 m (5300 ft). Fishing proceeded for two days, and the fish could not be located. Dresser-Atlas was called to run induction and caliper logs to determine the top of the drill pipe.

The induction log showed the top of the fish at 994 m (3262 ft). The caliper showed a 48-cm (19-in.) washout at the top of the fish. The well began flowing during logging, and it became necessary to pump in more salt water to contain the well. Fishing continued, and the drillers were unable to locate the fish or grab it until June 25. On June 26, 34 of the remaining 38 joints were fished out of the wellbore.

A skirted mill was rented to attempt to mill and catch the remaining portion of the fish. On June 29, a stub and 7 drill collars were pulled out of the hole. On June 30, the rest of the fish was caught. The milling had been successful.

11. CORING

One 5.5-m (18-ft) core from 1121 to 1130 m (3775 to 3743 ft) was cut using a 20- x 8.9-cm (7-7/8- x 3-1/2-in.) diamond core bit. One hundred percent recovery was obtained. The drilling fluid was water.

12. LOGGING

Various logs were run in the RRGP-5 well in order to determine the condition of the hole at different stages of the drilling operations. A listing of the logs, the intervals, and the lengths is shown in the following tables.

TABLE I

LOG RECORD, 0 TO 457 METERS (0 TO 1500 FEET)

Date	Type	Depth (m)	Depth (ft)	Company
5-15-78	Temperature	15-443	50-1453	Petro Log
5-13-78	Temperature	12-461	40-1514	Schlumberger
5-15-78	Cement Bend	15-443	50-1453	Petro Log
5-13-78	Caliper	37-461	120-1514	Schlumberger

TABLE II

LOG RECORD, 380 TO 1160 METERS (1250 TO 3800 FEET)

Date	Type	Depth (m)	Depth (ft)	Company
5-28-78	Dual Induction Focused	460-1141	1510-3743	Dresser-Atlas
6-27-78	Dual Inductinn	963-1012	3160-3320	Dresser-Atlas
6-22-78	Differential Temperature	21-1027	70-3370	Dresser-Atlas
5-29-78	Densilog-Neutron	460-1141	1508-3744	Dresser-Atlas
5-28-78	Caliper	460-1140	1509-3742	Dresser-Atlas
5-28-78	Densilog	460-1140	1508-3742	Dresser-Atlas
5-29-78	Acoustilog	460-1141	1508-3744	Dresser Atlas
9-2-78	Gamma	381-594	1250-1950	McCullough
8-30-78	Gamma	381-1021	1250-3350	McCullough
5-28-78	Differential Temperature	3-1140	10-3740	Dresser-Atlas

TABLE II (cont.)

LOG RECORD, 380 TO 1160 METERS (1250 TO 3800 FEET)

Date	Type	Depth (m)	Depth (ft)	Company
5-28-78	Dual Induction Focused	460-1141	1510-3743	Dresser-Atlas
6-2-78	Epilog	457-1143	1500-3750	Dresser-Atlas
5-28-78	Differential Temperature	10-1140	10-3740	Dresser-Atlas
5-28-78	Differential Temperature	8-1140	26-3740	Dresser-Atlas
5-29-78	Differential Temperature	23-1140	74-3740	Dresser-Atlas
6-2-78	Library Tape Most Logs[a]	460-1143	1508-3750	Dresser-Atlas

[a]Computer processed interpretation

TABLE III

LOG RECORD, 1030 TO 1509 METERS (3380 TO 4950 FEET)

Date	Type	Depth (m)	Depth (ft)	Company
5-10-78 to 6-22-78	Mudlog	21-1497	70-4911	Rocky Mountain Geo-Engineering
9-13-78	BGT Caliper	1043-1501	3394-4924	Schlumberger
9-14-78	High Resolution Temperature	9-1504	30-4934	Schlumberger
11-14-78	High Resolution Temperature	1006-1504	3300-4935	Schlumberger
7-6-78	Caliper	457-1496	1500-4908	Gebhart-Owens
7-8-78	Full Bore Spinner	405-1494	1330-4900	Schlumberger
9-14-78	Full Bore Spinner	1030-1504	3380-4936	Schlumberger
7-30-78	High Resolution Temperature Engineering Production Log[a]	24-1496	80-4908	Schlumberger
7-8-78	Temperature	91-1498	300-4916	Schlumberger

[a]Computer processed interpretation

TABLE III (cont.)

LOG RECORD, 1030 TO 1509 METERS (3380 TO 4950 FEET)

Date	Type	Depth (m)	Depth (ft)	Company
9-13-78	Dual Induction	1024-1503	3360-4930	Schlumberger
9-13-78	Compensated Sonic	1027-1504	3370-4934	Schlumberger
9-15-78	Compensated Neutron Formation Density	1035-1504	3396-4934	Schlumberger
7-7-78	Dual Induction	461-1499	1513-4919	Schlumberger
7-7-78	Compensated Nuetron Formation Density	461-1499	1513-4919	Schlumberger
7-8-78	Compensation Sonic	885-1499	2903-4919	Schlumberger
7-23-78	Dual Induction Focused	462-1499	1515-4920	Dresser-Atlas
5-10-78 to 6-22-78	Mudlog	21-1497	70-4911	Rocky Mountain Geo-Engineering
11-14-78	High Resolution Temperature	1006-1504	3300-4936	Schlumberger
7-6-78	Temperature	457-1496	1500-4908	Gebhart-Owens
	Multi-Shot Deviation Survey	1036-1501	3400-4924	Eastman Whipstock
7-6-78	X-Y Caliper	457-1496	1500-4908	Gebhart-Owens
5-19-78	Absolute Temperature	460-TD	1510-TD	EG&G

APPENDIX A

DAILY DRILLING REPORTS

The following table contains excerpts from the notes recorded in the driller's IADC "Daily Drilling Report."

COMPLETION REPORT
RRGP5, 1979
IDO-10082

TABLE A-I

DAILY DRILLING REPORTS

May 7, 1978	Spudded in at 2:00 P.M. Drilled from 17 m (55 ft) to 37 m (131 ft). Mud - gel/lime: wt. - 1.03 kg/L (8.6 ppg) vis. - 38 sec/1000 cm^3. Bottom hole assembly: Nonrotating stabilizer 9-m (30 ft) drill collar Shock sub. Nonrotating stabilizer 31-cm (13-1/4-in.) Smith SVH-Jet bit.
May 8, 1978	Changed out bottom hole assembly. Reamed hole. Started to run 51-cm (20-in.) casing. Hit a bridge at 20 m (66 ft). Pulled out of hole and reamed again. Started to run casing. Mud - gel/lime: vis. - 37 sec/1000 cm^3. Bottom hole assembly: Shock sub 64-cm (25-in.) hole opener - security.
May 9, 1978	Ran 51-cm (20-in.) casing to 52 m (172 ft). Cemented with 225 sacks Class G cement with 2% calcium, 3% salt, and 11.4 kg/sack (0.25 lbs/sack) cellophane flakes per sack of cement. Cement in place at 5:30 A.M. Wait on cement.
May 10, 1978	Nippled up BOP. Picked up tools and bit. Drilled cement to 52 m (170 ft). Cleaned the shale shaker and second mud pit. Mixed mud. Mud - floculated gel: wt. - 1.1 kg/L (9.2 ppg) vis. - 39 sec/1000 cm^3. Bottom hole assembly: Two nonrotating stabilizers 9-m (30 ft) drill collar Shock sub 6-point reamer 44-cm (17-1/2-in.) Hughes bit - OSCIG-Jet.

TABLE A-I (Cont'd)

May 11, 1978	Drilled to 172 m (565 ft). Mixed mud. Ran a deviation survey at 145 m (475 ft) which showed a 1-degree deflection. Mud - Drispak: wt. - 1.1 kg/L (9.3 ppg) vis. - 38 sec/1000 cm^3. Bottom hole assembly: Two nonrotating stabilizers 9-m (30 ft) drill collar Shock sub 6-point reamer 44-cm (17-1/2-in.) Hughes bit OSCIG-Jet.
May 12, 1978	Drilled to 329 m (1079 ft). Serviced rig. Ran a deviation survey at 298 m (977 ft) which showed a 2% deflection. Circulated for a trip and started to pull out of hole. Mud-Dispersed polymer: wt. - 1.09 kg/L (9.1 ppg) vis. - 38 sec/1000 cm^3. Bottom hole assembly: Two nonrotating stabilizers 9-m (30 ft) drill collar Shock sub 6-point reamer 44-cm (17-1/2-in.) Hughes bit OSCIG-Jet.
May 13, 1978	Finished trip for a new bit. Drilled to 462 m (1515 ft). Serviced rig. A deviation survey at 453 m (1485 ft) showed a 1-3/4 degree deflection. Started tripping out. Mud-Dispersed polymer: wt. - 1.12 kg/L (9.4 ppg) vis. - 38 sec/1000 cm^3. Bottom hole assembly: Two nonrotating stabilizers 9-m (30 ft) drill collar Shock sub 6-point reamer 44-cm (17-1/2-in.) Hughes bit OWV-Jet.

TABLE A-I (Cont'd)

May 14, 1978	Finished trip out and waited for loggers. Rigged up loggers and ran logs. Rigged down loggers. Started back in hole to circulate in preparation to run casing. Circulated and started running 34-cm (13-3/8-in.) casing.
May 15, 1978	Completed the running of casing to 460 m (1510 ft). Rigged up cementers and cemented with 850 sacks Class G cement, 8% RFC, 20% D-66, and 11.4 kg kolite/sack (25 lb/sack) of cement. Cement in place at 5:00 A.M. No cement returns with a 50% excess. Waited on cement. Rigged up loggers and ran a bond log. It showed cement within 6 m (20 ft) of the surface.
May 16, 1978	Nippled up BOP. Ran back in hole. Pressure tested to 2800 kPa (400 psi) for 30 minutes. Waited on cement.
May 17, 1978	Waited on cement. Drilled cement and shoe from 445 m (1459 ft) to 462 m (1515 ft). Drilled to 483 m (1584 ft). Tripped for a new bit. Serviced rig. Drilled to 565 m (1853 ft). Drilling fluid - water gel: wt. - 1.06 kg/L (8.9 ppg) vis. - 34 sec/1000 cm^3. Bottom Hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 18, 1978	Drilled to 614 m (2014 ft). Serviced rig. Ran a deviation survey at 602 m (1974 ft) which showed a 1 degree deflection. Tripped for a new bit. Changed rotating rubber. Drilled to 671 m (2200 ft). Mud - light dispersed polymer: wt. - 1.06 kg/L (8.9 ppg) vis. - 35 sec/1000 cm^3.

TABLE A-I (Cont'd)

May 18, 1978 (Cont'd)	Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 19, 1978	Drilled to 750 m (2487 ft). Serviced rig. A deviation survey at 750 m (2487 ft) showed a 1 degree deflection. Cleaned cellar. Prepared and started logging. Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 35 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 20, 1978	Finished commercial logging. Serviced rig. Tripped and drilled to 841 m (2760 ft). Mud - dispersed polymer: wt. - 1.09 kg/L (9.1 ppg) vis. - 33 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 21, 1978	Drilled to 885 m (2904 ft). A deviation survey at 880 m (2887 ft) showed a 2-1/4 degree deflection. Serviced and repaired rig. Tripped out of hole Rigged up and ran a temperature log-maximum temperature 180 degree at 758 m (2487 ft) after 2-1/2 hours on bottom. Started in hole with a new bit.

TABLE A-I (Cont'd)

May 21, 1978 (Cont'd)	Mud - dispersed polymer: wt. - 1.09 kg/L (9.1 ppg) vis. - 33 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bits: 1-SVH Jet; 1-OWV Jet.
May 22, 1978	Finished trip with new bit. Drilled to 949 m (3147 ft). The deviation survey at 934 m (3064 ft) showed a 3-1/3 degree deflection. Started tripping out for new bit. Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 32 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit OWV-Jet.
May 23, 1978	Finished trip with a new bit. Drilled to 1040 m (3411 ft). Serviced rig. A deviation survey at 1041 m (3349 ft) showed a 3-3/4 degree deflection. Worked on pump. Started to trip out. Mud - dispersed polymer; wt. - 1.1. kg/L (9.3 ppg) vis. - 33 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.

TABLE A-I (Cont'd)

May 24, 1978	Finished trip out of hole. Waited on pump parts. Serviced rig. Ran a temperature log. Repaired pump. Tripped in with a new bit. Drilled to 1043 m (3422 ft). Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 32 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 25, 1978	Drilled to 1135 m (3725 ft). Serviced rig. Ran a temperature log. A deviation survey at 1106 m (3627 ft) showed a 4-degree deviation and a 3-1/2-degree deviation at 1128 m (3700 ft). Tripped out for a new bit. Started to run a temperature log. Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 33 sec/1000 cm^3. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVA-Jet.
May 26, 1978	Completed temperature log. Tripped in hole. Repaired rig. Preapred to run a D.S.T. Packers would not hold when attempted to set between 1050 and 1089 m (3444 and 3572 ft). Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 33 sec/1000 cm^3.

TABLE A-I (Cont'd)

May 26, 1978 (Cont'd)

Bottom hole assembly:

Rib stabilizer
9-m (30 ft) drill collar
3-point stabilizer
9-m (30 ft) drill collar
Shock sub
6-point reamer
31-cm (12-1/4-in.) Smith bit SVH-Jet.

Packer assembly:

DC1P sampler
Hydro spring Big John Jars
Safety joints

Two 29-cm (11-1/4-in.) NR2 Packers
Anchor pipes
Safety joint
6 m (20 ft) of perforated anchor.

May 27, 1978

Prepared to core. Tripped in with core barrel. Cored 5-m (18 ft) at 1135 m (3725 ft), recovered 100%. Pulled out with the core barrel and ran in drill.

Mud - dispersed polymer:

wt. - 1.1 kg/L (9.3 ppg)
vis. - 34 sec/1000 cm^3.

Bottom hole assembly:

Rib stabilizer
9-m (30 ft) drill collar
3-point stabilizer
9-m (30 ft) drill collar
Shock sub
6-point reamer
31-cm (12-1/4-in.) Smith bit SVH-Jet.

May 28, 1978

Reamed and conditioned hole. Rigged up loggers. Began running logs.

Mud - dispersed polymer:

wt. - 1.1 kg/L (9.3 ppg)
vis. - 34 sec/1000 cm^3.

TABLE A-I (Cont'd)

May 28, 1978 (Cont'd)	Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Smith bit SVH-Jet.
May 29, 1978	Completed logging. Ran in hole and drilled to 1179 m (3867 ft). Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 33 sec/1000 cm^3 Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Hughes bit OWV-Jet.
May 30, 1978	Drilled to 1210 m (3971 ft). Serviced rig. Ran a temperature log. A deviation survey at 1198 m (3931 ft) showed a 5-degree deflection. Tripped out and chenged out bottom hole assembly. Ran a temperature log. Cleaned mud tanks and changed screen on shale shaker. Mud - dispersed polymer: wt. - 1.1 kg/L (9.2 ppg) vis. - 32 sec/1000 cm^2. Bottom hole assembly: Rib stabilizer 9-m (30 ft) drill collar 3-point stabilizer 9-m (30 ft) drill collar Shock sub 6-point reamer 31-cm (12-1/4-in.) Hughes bit OWV-Jet Blade stabilizer Two 9-m (30 ft) drill collars Shock sub 31-cm (12-1/4-in.) Hughes bit OWV-Jet.

TABLE A-I (Cont'd)

May 31, 1978	Logged. Tripped in and drilled to 1242 m (4076 ft). Cleaned mud pits. Worked on pump. Drilling fluid - water. Bottom hole assembly: Blade stabilizer Two 9-m (30-ft) drill collars Shock sub 6-point reamer 31-cm (12-1/4-in) Hughes bit OWV-Jet.
June 1, 1978	Drilled to 1319 m (4328 ft). Serviced rig. A deviation survey at 1289 m (4230 ft) showed a 3-degree deflection. At 9:30 P.M., the drill pipe twisted off. Fifty-six full stands and one partial stand (consisting of 1-1/2 lengths) were pulled out of the hole. The well was flowing. Cleaned the mud tanks. Drilling fluid - water. Bottom hole assembly: Blade stabilizer Two 9-m (30-ft) drill collars Shock sub 31-cm (12-1/4-in) Hughes bit OWV-Jet.
June 2, 1978	Measured flow at 2.5 L/sec (40 gpm) at 82°C (180°F). Picked up fishing tools, jars, bumper sub, and 23-cm x 11-cm (9-1/8- x 4-1/4-in) overshot and ran in hole. Caught fish but while attempting to pull out of the hole, the pipe became stuck. Waited on loggers to run a free point survey. Killing the well with cold water. Shut well in at 5:00 P.M. - 280 kPa (40 psi) at the wellhead. At 7:00 P.M. it was 360 kPa (65 psi). Fishing tool assembly: Assembly jars Bumper sub Overshot.
June 3, 1978	Waited on loggers. On evening tour, the derrick man was burned by steam while tripping out of hole.

TABLE A-I (Cont'd)

June 4, 1978	Ran in hole with new fishing tool assembly. Screwed into the fish and pulled it out. Checked breaks on 20-cm (8-in) drill collars. Laid down drill collars and fish. Ran 5 drill collar and 3 joints of drill pipe and blew out drill pipe. Attached Kelly and circulated to cool. Fishing tool assembly: Jars Bumper sub Accelerator Eighteen 16-cm (6-1/4-in) drill collars with F.H. pin down.
June 5, 1978	Tripped in hole. Broke circulation to cool water. Drilled and circulated out 21 m (70 ft) of fill. Pulled out of hole and tallied pipe. Sixty-six stands and single. Cleaned mud pits. Ran a temperature log while shut in and flowing. It showed a maximum temperature of 135°C (275°F) A flow test showed a flow rate of 11 L/sec (170 gpm). Water was flashing over the shale shaker. Drilling fluid - water Bit: 31-cm (12-1/4-in) Smith bit SVH-Jet.
June 6, 1978	Picked up pipe and ran in hole. Drilled to 1343 m (4407 ft). Serviced rig. Drilling fluid - water. Bit: 31-cm (12-1/4-in) Smith bit SVH-Jet.
June 7, 1978	While drilling, lost 1800 kPa (200 psi) pump pressure. Pulled out of hole and found 3 holes in 60th joint. Started tripping in with new bit. Ran in 40 stands, then circulated; ran in 30 more stands and circulated again. Finished tripping in hole. Drilled to 1366 m (4463 ft). Drilling fluid - water.

TABLE A-I (Cont'd)

June 7, 1978 (Cont'd)	Bits: Two 31-cm (12-1/4-in) Smith bits SVH-Jet.
June 8, 1978	Drilled to 1373 m (4505 ft). Serviced rig. Constructed a bleed off line on the flow nipple. Well was blowing in. Circulated and started out of hole. Prepared for a temperature log. Shut in well pressure was 900 kPa (130 psi). Drilling fluid - water. Bit: 31-cm (12-1/4-in) Smith bit SVH-Jet.
June 9, 1978	Ran temperature log 135°C (275°F) at 1373 m (4505 ft). Changed rubber pack-off in hydril. It still would not hold pressure. Ordered out a different hydril. Drilling fluid - water.
June 10, 1978	Waited on hydril. Replaced old hydril with new one. Ran a flow test with results showing a flow over 63 L/sec (1000 gpm). Tripped in hole with bottom hole assembly and a new bit. Washed and reamed to bottom. Drilled to 1377 m (4518 ft). Pumped excess water to RRGE-1 reserve pit. Drilling fluid - water. Bottom hole assembly: Shock sub Junk basket 31-cm (12-1/4-in) Hughes bit J-77.
June 11, 1978	Changed seal in rotating head. Alternately drilled and pumped out reserve pit to control water. Drilled to a depth of 1400 m (4593 ft). Drilling fluid - water. Bottom hole assembly: Junk basket Shock sub 31-cm (12-1/4-in) Hughes bit J-77.

TABLE A-I (Cont'd)

June 12, 1978	Alternately drilled and pumped out reserve pit to control water. A deviation at 1405 m (4611 ft) survey showed a 4-3/4-degree deflection. Drilled to 1405 m (4611 ft). Drilling fluid - water. Bottom hole assembly: Junk basket Shock sub 31-cm (12-1/4-in) Hughes bit J-77.
June 13, 1978	Pumped out reserve pit twice. Serviced rig. Drilled to 1431 m (4694 ft). Start an additional reserve pit. Drilling fluid - water. Bottom hole assembly: Junk basket Shock sub 31-cm (12-1/4-in) Hughes bit J-77.
June 14, 1978	New reserve pit completed and in use. Drilled to 1442 m (4731 ft) and then lost 135 kg (300 lbs) pump pressure. Pulled out of hole and found shock sub leaking. Tripped in with a new bit. At 1422 m (4665 ft), hole out of gauge. A deviation survey showed 4-degrees. Ran a temperature log. Drilling fluid - water. Bottom hole assembly: Junk basket Shock sub 31-cm (12-1/4-in) Hughes bit J-77.
June 15, 1978	Reamed from 1422 m (4665 ft) to 1442 m (4731 ft). Serviced rig and swivel. Drilled to 1459 m (4786 ft). Drilling fluid - water. Bottom hole assembly: Junk basket 31-cm (12-1/4-in) Hughes bit J-77.

TABLE A-I (Cont'd)

June 16, 1978	Drilled to 1497 m (4910 ft). Serviced rig. Drilling fluid - water. Bottom hole assembly: Junk basket 31-cm (12-1/4-in) Hughes bit J-77.
June 17, 1978	At 12:15 A.M. after drilling 0.3 m (1 ft) to 1497 m (4911 ft), the drill pipe twisted off. Due to the flow and danger to personnel, the decision was to mix a salt brine and pump it downhole. The suction end of the mud tank was modified for this purpose. Three hundred sacks of salt and 3330 L (300 bbl) of water were mixed and pumped downhole. Four stands of pipe were pulled and the well started flowing again out the drill pipe. The Kelly was attached and the crew attempted to kill the well by circulation. It was not successful. Sixty-four 23-kg (50-lb) sacks of salt were mixed and pumped. Waited on salt shipment. Salt mixed 300 - 45-kg (100-lb) sacks 64 - 23-kg (50-lb) sacks.
June 18, 1978	Mixed 350 - 45-kg (100-lbs) sacks and 531 - 23-kg (50-lb) sacks of salt over 12-1/2 hours to kill the well. Serviced rig. Chained out of hole. Made up fishing tool assembly. Ran in but could not find top of fish. Tripped out and put a bent joint between bent sub and overshot. Tried to work over fish. Mixed and pumped 150 - 23-kg (50-lb) sacks of salt. Salt mixed 350 - 45-kg (100-lb) sacks 681 - 23-kg (50-lb) sacks. Fishing tool assembly: Bumper sub Overshot.
June 19, 1978	Worked pipe to get fish. Pulled out 2 stands and the pipe got stuck. Worked stuck pipe until it was freed. Resumed fishing. Pulled out of hole. Worked on fishing tools. Ran back in hole. Worked over top of fish and began pulling out.

TABLE A-I (Cont'd)

June 19, 1978 (Cont'd)	Salt mixed 120 - 23-kg (50-lb) sacks 350 - 36-kg (80-lb) sacks. Fishing tool assembly: Bent joint Over shot Wall hook.
June 20, 1978	While pulling out of hole, fish stuck at approximately 244 m (800 ft). Pulled out with fishing tools. Ran back in hole. Fish had dropped back down hole. Pulled out of hole to replace old drill pipe. Ran back in hole and tagged a bridge at 723 m (2371 ft). Picked up Kelly and worked through. Salt mixed 250 - 23-kg (50-lb) sacks. Fishing tool assembly: Accelerator Jars Bumper sub Overshot.
June 21, 1978	Trying to find fish. Pulled out 25 stands of pipe and fishing tools. Worked through tight hole. Fishing tool assembly. Accelerator Drill collars Jars Bumper sub Overshot.
June 22, 1978	Waited on loggers. Rigged up and ran an induction and caliper log. Fish was at 994 m (3262 ft) in a 56-cm (22-in) hole. Well started flowing. Shut well in. Mixed and pumped salt to kill well. Rigged down loggers. Salt mixed 330 - 45-kg (100-lb) sacks 200 - 23-kg (50-lb) sacks.

TABLE A-I (Cont'd)

June 23, 1978	Picked up fishing tools and started to run in hole. Service and repaired rig. Mixed salt. Fishing tools hung up in hole. Worked loose and finished tripping in attempt to find fish. Pulled out of hole, broke down tools, and rebent fishing tools. Started back in hole. Salt mixed 400 - 23-kg (50-lb) sacks. Fishing tool assembly: Accelerator Drill collars Jars Bumper sub Bent sub Overshot.
June 24, 1978	Ran in hole with fishing tools and worked through tight hole at 686 m (2250 ft). Mixed salt. Attempted to find fish. Pulled out of hole working the pipe through the tight section. Changed out fishing tools. Mixed salt. Changed rubber seals on pipe and blind rams. Salt mixed 366 - 23-kg (50-lb) sacks 200 - 45-kg (100-lb) sacks. Fishing tool assembly: Accelerator Drill collars Jars Bumper sub Bent joint Knuckle joint Overshot.
June 25, 1978	Waited on fishing tools. Serviced rig. Picked up and ran in hole with tools. Attempted to work over the fish. Caught the fish at 1069 m (3490 ft). Started pulling out of hole and working past tight hole at 686 m (2250 ft). Salt mixed 300 - 45-kg (100-lb) sacks. Fishing tool assembly: Accelerators Drill collars Jars Knuckle joint Wall hook.

TABLE A-I (Cont'd)

June 26, 1978	Pulled out of hole. Recovered 33 joints and 2 pieces of the fish. Serviced rig. Ran back in hole with fishing tools. Attempted to work over the fish. Pulled out of the hole. Picked up a skirted mill and started running back in hole. Salt mixed 907 kg (2000 lb) bulk. Fishing tool assembly: Accelerator Jars Overshot Skirted mill Wall hook.
June 27, 1978	Finished running in hole. Milled over fish. Pulled out of hole and inspected mill. Serviced rig. Ran back in hole and milled fish again. Pulled out and ran back in with an overshot. Attempted to work over fish. Mixed salt. Salt mixed 280 - 45-kg (100-lb) sacks. Fishing tool assembly: Bumper sub Jars Overshot Skirted mill.
June 28, 1978	Tried to work over fish with overshot. Pulled out of hole and broke down fishing tools. Mixed salt. Repaired rig. Ran in hole with fishing tools. Mixed salt. Salt mixed 552 - 45-kg (100-lb) sacks. Fishing tool assembly: Grapple Overshot.
June 29, 1978	Milled fish. Tripped out and broke down tools. Made up fishing tools and ran in hole. Caught fish and jarred it loose. Weight on the string increased 5443 kg (12,000 lb). Pulled out of the hole and recovered a stub of drill pipe and seven 16-cm (6-1/4-in) drill collars.

TABLE A-I (Cont'd)

June 29, 1978 (Cont'd)	Salt mixed 330 - 45-kg (100-lb) sack. Fishing tool assembly: Skirted mill Bumper sub Jars Extension Grapple Overshot.
June 30, 1978	Ran in the hole with the fishing tools. Worked over the fish and jarred it loose. Pulled out of hole. Serviced rig. Laid down one 16-cm (6-1/4-in) drill collar, five 20-cm (8-in) drill collars, and the rest of the fish. Broke down the fishing tools and laid them down. Changed rotating head seal. Picked up a 31-cm (12-1/4-in) bit and ran in the hole. Cleaned the mud tank and filled it with fresh water. Fishing tool assembly: Bumper sub Jars Overshot.
July 1, 1978	Washed and reamed from 1433 to 1494 m (4700 to 4900 ft). Circulated with 2 pumps at 44 L/sec (700 gpm). Flowed the well. Circulated salt from the hole. Cleaned location. Rigged up 57 L/sec (900 gpm) compressor for an air lift.
July 2, 1978	Air lifted from 61 m (200 ft).
July 3, 1978	Air lifted from 61 m (200 ft). Flow was 25 L/sec (400 gpm) with 121°C (251°F) temperature. Started rigging up two 76-L/sec (1200-cfm) compressors and a booster.
July 4, 1978	Completed rigging up compressors. Tripped in to 914 m (3000 ft) but could not air lift at that depth. Pulled up to 616 m (2000 ft), and tried again. Pulled up to 436 m (1430 ft) and successfully began air lift with 3500 kPa (500 psi) air pressure flowing at 123 L/sec (1950 gpm).

TABLE A-I (Cont'd)

July 5, 1978	Air lifted from 436 m (1430 ft) at 9:45 A.M. Shut-in well. Wellhead pressure was 600 kPa (86 psi). Free flowed well at 24 L/sec (380 gpm). Pulled out of hole. Changed rotating head seal. Prepared to log.
July 6, 1978	Rigged up loggers. Ran temperature, caliper, and flow logs.
July 7, 1978	Logged hole.
July 8, 1978	Began rigging down operations.
July 9 to 31, 1978	No drilling action during this period.
August 1, 1978	Brought in workover rig to set cement plug for testing formation (rigging up).
August 2, 1978	Rigging up.
August 3, 1978	Started in hole with 7-cm (2-7/8-in) tubing but the Otis plug blew out at 27 m (90 ft).
August 4, 1978	Because of failure on several attempts to use the Otis plug, Otis Engineering was released and a float sub and float were ordered.
August 5, 1978	Tripped into hole with float sub and tubing to 1120 m (3730 ft). Pumped 4600 L (30 bbl) water followed by 230 sacks of cement containing 4 kg (10 lb) sand per sack of cement, 25% silica flour, friction reducer and retarder.
August 6, 1978	Tripped into hole to tag cement. No tag located. Pulled up 35 stands of tubing and waited on cement.
August 7, 1978	Went back in hole to 1120 m (3730 ft). Mixed and pumped through the tubing 800 sacks Class G cement with 10% sand, 0.2% D-8, 0.75% D-65 producing 2.1 kg/L (16.5 lb/gal). Pulled tubing and float out of the hole.
August 8, 1978	Went into the hole and tagged cement at 1121 m (3735 ft) depth. Set 15,900-kg (35,000-lb) weight on the plug. Tripped out of hole and tripped in with 131 m (435 ft) of tubing for testing. Layed down remaining tubing.
August 9, 1978	Rig released and left for Rangely, Colorado.

TABLE A-I (Cont'd)

August 10 to 18, 1978	Well testing was carriedout on portion of well above the cement plug.
August 19, 1978	Tubing was removed from the well.
August 20 to 22, 1978	Rig moved from RRGI-7 back to RRGP-5.
August 23, 1978	Tripped into hole to cement plug and circulated. Hit a bridge on the way in from 700 to 790 m (2300 to 2600 ft).
August 24, 1978	Tripped out of hole and ran 52 joints of 25-cm (9-5/8-in) casing. Liner hanger hung up in braden-head. Worked casing hanger free. Lowered casing and hanger into the well 383 m (1277 ft). Could not set hanger. Pulled drill pipe out of hole. Slips were torn off casing hanger.
August 25, 1978	Pulled casing and laid down.
August 26, 1978	Finished pulling casing. Picked up 31-cm (12-1/4-in) mill but could not get through master valve. Laid mill down and waited on Lyons Inflatable Packer. The 28-cm (11-in) Lyons Packer arrived on site.
August 27, 1978	Set packer at 18 m (60 ft) and pulled BOP equipment off the hole. Ground the 34-cm (13-3/8-in) casing off and beveled for ease of entry. Reinstalled BOP equipment. Released Lyons Packer. Checked hanger by going into hole to 18 m (60 ft). Called out casing crew.
August 28, 1978	Rigged up casing crew. Ran in casing and set liner hanger at 391 m (1284 ft) with centralizers on 12 top joints. Waited on cement truck.
August 29, 1978	Circulated hole, rigged up cementers. Cemented casing with 1200 sacks Class G cement with 2% get, 40% silica flour, 1.0% Perlile, 0.5% CFR-2, and 0.8% Halad 22A. Lost returns of 13310 L (87 bbl) and recovered after 12 minutes.
August 30, 1978	Waited on cement. Went in hole and tagged cement at 360 m (1180 ft). Drilled 30 m (100 ft) of cement above casing hanger. Pulled out of hole and layed down 20-cm (8-in) drill collars. Picked up 15-cm (6-in) drill collars and went into hole with 22-cm (8-3/4-in) bit and drilled cement. Continued into hole and tagged cement at 1021 m (3350 ft). Pulled out of hole and waited for loggers. Rigged up loggers.

TABLE A-I (Cont'd)

August 31, 1978	Cement bond log showed no cement 390 m (1280 ft) to 549 m (1800 ft). Waited on cement truck. Made up Halliburton 34-cm (13-3/8-in) RTTS packer. Went into hole and set packer at 360 m (1182 ft).
September 1, 1978	Rigged up cement trucks and squeeze cemented down through casing hanger. Pressure went to zero in 30 minutes. Tripped out of hole slowly. Layed down packer and W.O.C. Tripped in hole 22 stands, circulated and tripped out. Tripped in with Packer and 19 stands. Rigged up cement truck and pressured up on squeeze to 15,000 kPa (2200 psi) but would not take any fluid. Bled off pressure and tripped out of hole.
September 2, 1978	Waited on loggers. Rigged up loggers and run CBL from 390 to 594 m (1280 to 1950 ft). Perforated casing at 411 m (1350 ft) with four 9.5-mm (3/8-in) shots. Run packer in 20 stands and set. Rigged up cementers and squeezed with 11,700 kPa (1700 psi) at 230 L (1-1/2 bbl) per minute cement - 100 sacks Class G cement with 40% silica flour, 0.75% CFR-2, 1% Perlile for a density of 2 kg/L (16 lb/gal). Tripped out of hole and layed down packer. Waited on cement. Ran in hole and circulated. Pulled out of hole and waited on cement.
September 3, 1978	Rigged up and ran log. Rigged down logger and tripped in hole. Pressured up to 2070 kPa (300 psi). System held pressure for 30 minutes. Started drilling cement to 1174 m (3851 ft).
September 4, 1978	Drilled through cement to 1289 m (4230 ft). Tripped out of hole and changed bits. Replaced the Hughes J7 bit with another J7 bit. Drilled cement to 1308 m (4288 ft).
September 5, 1978	Drilled cement to 1354 m (4443 ft). Tripped out of hole, changed bits and tripped back in hole and reamed to bottom.
September 6, 1978	Drilled shale and quartz to 1410 m (4624 ft).
September 7, 1978	Drilled mica and quartz to 1430 m (4689 ft). Tripped out to change bits. Layed down bottom hole collar Picked up shock sub and a Security H-100F bit. Tripped in hole washing and reaming 34 m (110 ft) to bottom. Drilled to 1435 m (4710 ft).
September 8, 1978	Drilled quartz to 1476 m (4842 ft).
September 9, 1978	Drilled quartz to 1500 m (4925 ft). Circulated hole for logging. Tripped out of hole. Flowed well while waiting for loggers.

TABLE A-I (Cont'd)

September 10, 1978	Flowed well while waiting on loggers. Run logs to a bridge at 1070 m (3515 ft). Removed logger and started to trip into hole with bit.
September 11, 1978	Reamed bridge from 1070 m (3515 ft) to 1100 m (3615 ft). Washed and reamed to bottom. Circulated and pulled out of hole. Rigged up loggers. Logged hole to 1088 m (3569 ft) at a bridge.
September 12, 1978	Rigged down loggers and ran in hole with bit. Reamed from 1067 m (3500 ft) to 1122 m (3680 ft). Cleaned hole to bottom. Rigged up loggers. Logged to bridge again at 1122 m (3680 ft). Started in hole with bit and reamer.
September 13, 1978	Reamed and circulated hole. Tripped out of hole and rigged up loggers. Started to log well.
September 14, 1978	Logged well.
September 15, 1978	Started rig down for move to RRGP-4.

APPENDIX B

BIT RECORD

The following table provides a performance record for each of the bits used to drill RRGP-5. This information was also obtained from the IADC "Daily Drilling Report."

TABLE B-I
BIT RECORD

BIT	MAKE	SIZE	TYPE	SERIAL NO.	JETS	DEPTH OUT(KB)	LENGTH DRILLED	HOURS	WT 100 KG (1000 LBS)	RPM	PUMP PRESS.	SPM	DULL CONDITION T/B/G	FORMATION REMARKS
1	Smith	31cm (12-1/4 in)	SVH-Jet	594KN	Open	49m (160 ft)	49m (160 ft)	8-1/2	-	65	300	65	Good	Drilled with dispersed polymer to 1242m (4076ft at that point the drilling fluid was changed to water.
2	Security	64cm (25 in H.O.)	Hole Opener Milltooth	B-20	-	55m (180 ft)	37m (120 ft)	10-1/2	45 (10)	60	300	65		
3	Hughes	44.5cm (17-1/2 in)	OSCIG-Jet	CC 143	28/32	329m (1079 ft)	276m (907 ft)	35-1/2	45 (10)	65	500	68	4/1/0	
4	Hughes	44.5cm (17-1/2 in)	OWV-Jet	AA 423	28/32	462m (1515 ft)	133m (436 ft)	16	45 (10)	65	500	68	2/1/0	
5	Smith	31cm (12-1/4 in)	SVH-Jet	594KN	14/32	483m (1584 ft)	21m (70 ft)	3	23-45 (5-10)	65	500	70	5/0/0	
6	Smith	31cm (12-1/4 in)	SVH-Jet	301EZ	20/32	614m (2014 ft)	131m (430 ft)	17-1/2	45 (10)	65	600	70	5/1/0	
7	Smith	31cm (12-1/4 in)	SVH-Jet	356KN	20/32	758m (2487 ft)	144m (473 ft)	25-3/4	54 (12)	65	600	70	5/0-1/8	
8	Smith	31cm (12-1/4 in)	SVH-Jet	627FJ	20/32	885m (2904 ft)	127m (417 ft)	23	54-68 (12-15)	65-70	600-650	70	5/1-1/8	
9	Hughes	31cm (12-1/4 in)	OWV-Jet	DA219	20/32	959m (3147 ft)	74m (243 ft)	17-3/4	91 (20)	70-75	650	70	4/1-1/8	
10	Smith	31cm (12-1/4 in)	SVH-Jet	431EX	20/32	1040m (3411 ft)	80m (264 ft)	16-1/2	45-91 (10-20)	75-80	650	70	2/0/0	
11	Smith	31cm (12-1/4 in)	SVH-Jet	221FB	20/32	1141m (3743 ft)	123m (402 ft)	17-1/2	45-91 (10-20)	70-75	650	70-80	4/0-1/8	
12	Hughes	31cm (12-1/4 in)	OWV-Jet	E0689	20/32	1210m (3971 ft)	69m (228 ft)	23	45-91 (10-20)	75	650	70	4/2/0	
13	Hughes	31cm (12-1/4 in)	OWV-Jet	DA560	20/32	1319m (4328 ft)	108m (354 ft)	33-1/2	45-91 (10-20)	75	650	70	5/4-1/8	
14	Smith	31cm (12-1/4 in)	SVH-Jet	355KN	Open	1352m (4437 ft)	33m (109 ft)	24	68-91 (15-20)	75	800-850	50	8/6-1/8	

TABLE B-I

BIT	MAKE	SIZE	TYPE	SERIAL NO.	JETS	DEPTH OUT(KB)	LENGTH DRILLED	HOURS	WT 100 KG (1000 LBS)	RPM	PUMP PRESS.	SPM	DULL CONDITION T/B/G	FORMATION REMARKS
15	Smith	31cm (12-1/4 in)	SVH-Jet	368KN	Open	1373m (4505 ft)	20m (66 ft)	13	68 (15)	75	850	50	8/6-1/8	
16	Hughes	31cm (12-1/4 in)	J-77	JU680	Open	1442m (4731 ft)	69m (226 ft)	60-1/2	68-91 (15-20)	45	850	50	4/4-1/2	
17	Hughes	31cm (12-1/4 in)	J-77	HX134	Open	1497m (4911 ft)	55m (180 ft)	34-3/4	91 (20)	50	900	48	Good	
	Hughes	22cm (8-3/4 in)	J-7	BH027	-	1307m (4288 ft)	225m (738 ft)	32-3/4	82 (18)	60-70	650	48/32	-	Drilling cement and shoe
19	Hughes	22cm (8-3/4 in)	J-7	BF568	-	1350m (4430 ft)	44m (143 ft)	14	82 (18)	60	700	48/32	-	Drilling cement
20	Security	22cm (8-3/4 in)	H-100F	641133	-	1430m (4689 ft)	79m (259 ft)	35-1/2	91-113 (20-25)	45	800	48/32	-	
21	Security	22cm (8-3/4 in)	H-100F	712015	-	1500m (4925 ft)	72m (236 ft)	39-1/4	91-113 (20-25)	40	800	45	-	
22	Hughes	22cm (8-3/4 in)	J-7	BF561	-	-	-	-	-	-	-	-	-	Cleaning and reaming hole
23	Hughes	22cm (8-3/4 in)	XV	DB252	-	-	-	-	-	-	-	-	-	Cleaning and reaming hole

APPENDIX C

DIRECTIONAL DRILLING SURVEY SUMMARY

The following tables and figure contain excerpts from the Eastman Whipstock Multiple-Shot Survey records for both legs of well RRGP-5.

TABLE C-I

DIRECTIONAL DRILLING SURVEY SUMMARY, RRGP-5A

Measured[a] Depth [m(ft)]	Drift Angle (degrees)	Drift Direction (degrees)	Rectangular Coordinates [m (ft)] North	South	East	West
488 (1600)	1-1/4	S 86 E	-	0.04 (0.14)	0.60 (1.96)	-
518 (1700)	1-1/4	S 88 E	-	0.07 (0.22)	1.26 (4.14)	-
549 (1800)	1-1/4	N 52 E	0.34 (1.12)	-	1.79 (5.86)	-
579 (1900)	1	N 34 E	0.78 (2.57)	-	2.08 (6.84)	-
610 (2000)	1	N 25 E	1.27 (4.16)	-	2.31 (7.58)	-
640 (2100)	1	N 25 E	1.75 (5.75)	-	2.54 (8.32)	-
671 (2200)	3/4	N 20 E	2.83 (6.98)	-	2.40 (7.87)	-
701 (2300)	1	N 10 E	2.65 (8.70)	-	2.49 (8.17)	-
732 (2400	1	N 30 E	3.12 (10.22)	-	2.76 (9.05)	-
762 (2500)	1-1/4	N 44 W	3.59 (11.79)	-	2.30 (7.54)	-
792 (2600)	1-1/2	N 60 W	3.99 (13.10)	-	1.61 (5.27)	-
823 (2700)	2	N 61 W	4.51 (14.79)	-	0.68 (2.22)	-
853 (2800)	2-3/4	N 61 W	5.22 (17.12)	-	-	0.60 (1.98)
884 (2900)	3	N 65 W	5.67 (18.59)	-	-	1.57 (5.14)
914 (3000)	3-3/4	N 63 W	6.57 (21.56)	-	-	3.34 (10.97)
945 (3100)	3-3/4	N 60 W	7.57 (24.83)	-	-	5.07 (16.63)
975 (3200)	3-3/4	N 60 W	8.56 (28.10)	-	-	6.79 (22.29)
1006 (3300)	4-1/4	N 48 W	10.08 (33.06)	-	-	8.47 (27.80)
1036 (3400)	4	N 52 W	11.39 (37.36)	-	-	10.15 (33.30)
1067 (3500)	4	N 47 W	12.80 (41.98)	-	-	11.66 (38.26)
1097 (3600)	4	N 44 W	14.28 (46.86)	-	-	13.10 (42.97)
1128 (3700)	4-1/2	N 48 W	15.88 (52.11)	-	-	14.87 (48.80)
1158 (3800)	4-1/4	N 49 W	17.36 (56.97)	-	-	16.58 (54.39)
1189 (3900)	4-1/2	N 46 W	19.03 (62.43)	-	-	18.30 (60.04)
1219 (4000)	4-1/4	N 47 W	20.57 (67.48)	-	-	19.95 (65.46)
1250 (4100)	4-1/4	N 40 W	22.30 (73.16)	-	-	21.40 (70.22)
1280 (4200)	4	N 42 W	23.84 (78.20)	-	-	22.79 (74.76)
1311 (4300)	3-3/4	N 40 W	25.36 (83.21)	-	-	24.07 (78.96)
1341 (4400)	3-1/4	N 42 W	26.65 (87.42)	-	-	25.22 (82.75)

[a] Hole is assumed to be vertical from 0 to 460 m (1510 ft).

Table C-I (Cont.)

Measured[a] Depth [m (ft)]	Drift Angle (degrees)	Drift Direction (degrees)	Rectangular Coordinates [m (ft)] North	South	East	West
1372 (4500)	3-3/4	N 45 W	28.05 (92.04)	-	-	26.63 (87.37)
1402 (4600)	3-3/4	N 40 W	29.58 (97.05)	-	-	27.91 (91.57)
1433 (4700)	3-1/4	N 29 W	31.09 (102.01)	-	-	28.75 (94.32)
1463 (4800)	2-3/4	N 45 W	32.13 (105.40)	-	-	29.78 (97.71)
1489 (4884)	3-1/4	N 50 W	33.06 (108.46)	-	-	30.89 (101.36

[a] Hole is assumed to be vertical from 0 to 460 m (1510 ft).

TABLE C-II

DIRECTIONAL DRILLING SURVEY SUMMARY, RRGP-5B

Measured Depth [m (ft)]	Drift Angle (degrees)	Drift Direction (degrees)	Rectangular Coordinates [m (ft)] North	South	East	West
1036 (3400)	4	N 43 W	12.16 (39.91)	-	-	10.88 (35.68)
1067 (3500)	4	N 44 W	12.93 (42.42)	-	-	11.61 (38.10)
1097 (3600)	4	N 48 W	14.35 (47.09)	-	-	13.19 (43.29)
1128 (3700)	3-1/4	N 64 W	15.11 (49.58)	-	-	14.75 (48.39)
1158 (3800)	3	N 58 W	15.96 (52.35)	-	-	16.10 (52.83)
1189 (3900)	3-1/2	N 58 W	16.94 (55.58)	-	-	17.68 (58.00)
1219 (4000)	3-1/2	N 64 W	17.75 (58.25)	-	-	19.35 (63.48)
1250 (4100)	3-1/4	N 62 W	18.57 (60.91)	-	-	20.88 (68.49)
1280 (4200)	3-3/4	N 52 W	19.79 (64.94)	-	-	22.45 (73.64)
1311 (4300)	3	N 52 W	20.78 (68.16)	-	-	23.70 (77.76)
1341 (4400)	3	N 51 W	21.78 (71.45)	-	-	24.94 (81.82)
1372 (4500)	4	N 41 W	23.38 (76.72)	-	-	26.33 (86.40)
1402 (4600)	5-1/4	N 59 W	24.82 (81.43)	-	-	28.72 (94.24)
1433 (4700)	5	N 56 W	26.31 (86.31)	-	-	30.93 (101.47)
1463 (4800)	5-1/4	N 52 W	28.02 (91.94)	-	-	33.31 (108.68)
1494 (4900)	4-3/4	N 51 W	29.61 (97.15)	-	-	35.09 (115.11)
1501 (4924)	5	N 72 W	29.81 (97.80)	-	-	35.69 (117.10)

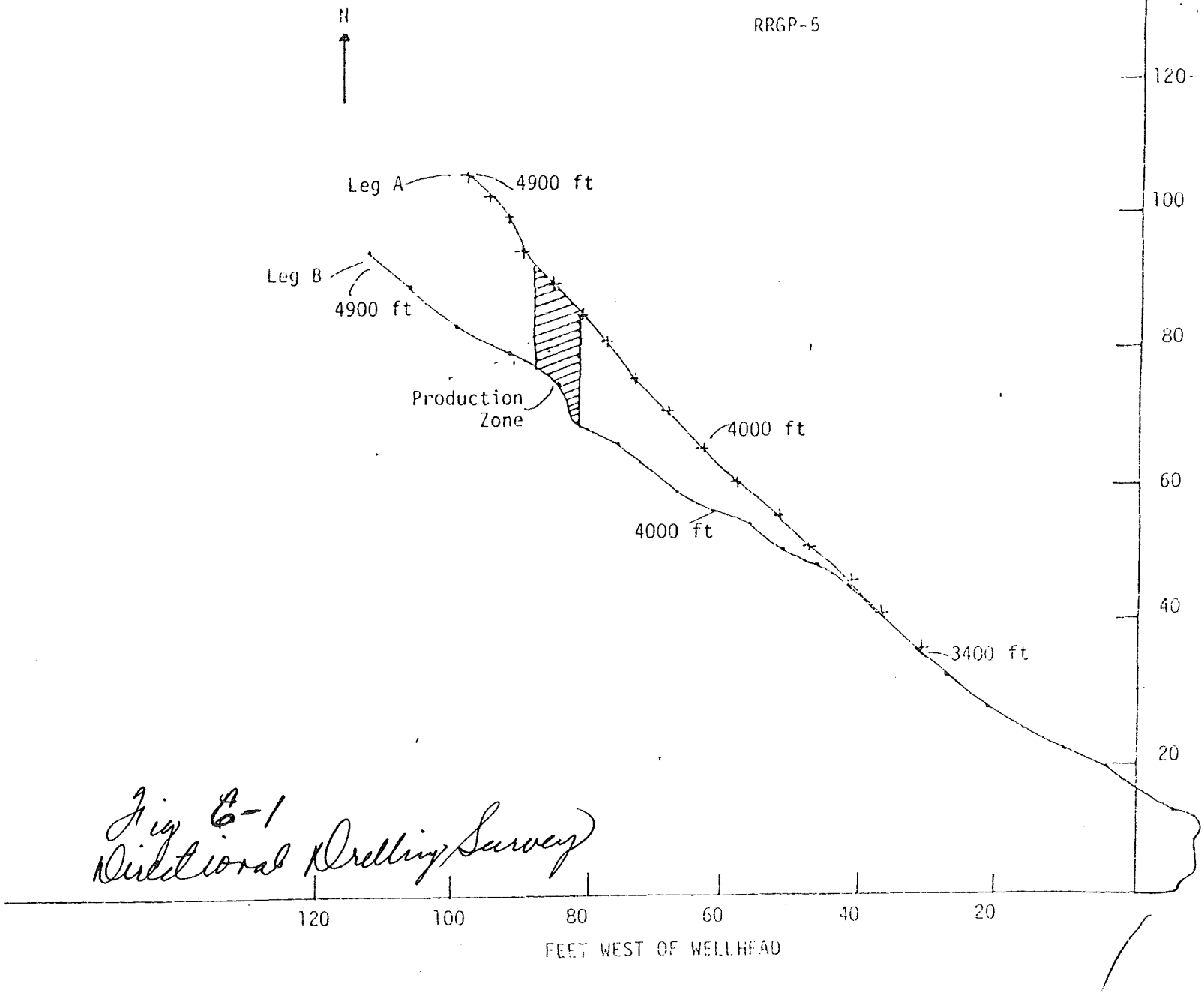


Fig C-1
Directional Drilling Survey

APPENDIX D

CASING SUMMARY

The following tables contain excerpts from notes recorded in the drilling superintendent's casing record notebook.

TABLE D-I

SURFACE CASING SCHEDULE

Joint[a]	Length [m (ft)]	Accumulated Length [m (ft)]
1	12.95 (42.48)	12.95 (42.48)
2	12.74 (41.80)	35.69 (84.28)
3	13.08 (42.90)	38.76 (127.18)
4	13.09 (42.93)	51.85 (170.11)
5	13.06 (42.82)	64.90 (212.93)

[a] All casing 51 cm (20 in.), K-55, ST&C, 140 k/m (94 lb/ft), Range-3. Casing was set at 52 m (170 ft) in a 55 m (180 ft) deep hole.

TABLE D-II

INTERMEDIATE CASING SCHEDULE

Joint [a]	Length [m (ft)]	Accumulated Length [m (ft)]
1	12.77 (41.90)	12.77 (41.90)
2	12.08 (39.63)	24.85 (81.53)
3	12.39 (40.64)	37.24 (122.17)
4	13.21 (43.35)	50.45 (165.52)
5	12.90 (42.33)	63.35 (207.85)
6	13.04 (42.79)	76.40 (250.64)
7	12.86 (42.20)	89.26 (292.84)
8	13.09 (42.95)	102.35 (335.79)
9	12.01 (39.40)	114.36 (375.19)
10	13.12 (43.06)	127.48 (418.25)
11	12.29 (40.31)	139.77 (458.56)
12	13.23 (43.42)	153.00 (501.98)
13	13.05 (42.80)	166.05 (544.78)
14	13.08 (42.90)	179.12 (587.68)
15	12.77 (41.90)	191.90 (629.58)
16	13.03 (42.75)	204.93 (672.33)
17	12.30 (40.37)	217.23 (712.70)
18	13.07 (42.87)	230.30 (755.57)
19	12.02 (39.43)	242.32 (795.00)
20	12.38 (40.62)	254.70 (835.62)
21	12.80 (41.98)	267.49 (877.60)
22	12.61 (41.37)	280.10 (918.97)
23	12.51 (41.03)	292.61 (960.00)
24	12.71 (41.70)	305.32 (1001.70)
25	13.18 (43.23)	318.49 (1044.93)
26	13.53 (44.38)	332.02 (1089.31)
27	12.82 (42.05)	344.84 (1131.36)
28	11.68 (38.33)	356.52 (1169.69)
29	13.25 (43.47)	369.77 (1213.16)
30	12.95 (42.50)	382.73 (1255.66)
31	13.15 (43.14)	395.87 (1298.80)
32	12.93 (42.42)	408.80 (1341.22)
33	12.68 (41.61)	421.49 (1382.83)
34	13.15 (43.15)	434.64 (1425.98)
35	13.12 (43.05)	447.76 (1469.03)
36	12.68 (41.60)	460.44 (1510.63)

[a] All casing 34 cm (13-3/8 in.), K-55, ST&C, 81.3 kg/m (54.5 lb/ft) Range -3. Casing was set at 460 m (1510 ft).

TABLE D-III

PRODUCTION CASING SCHEDULE

Joint[a]	Length [m (ft)]	Accumulated Length [m (ft)]
1	12.71 (41.71)	12.71 (41.71)
2	12.84 (42.11)	25.55 (83.82)
3	12.63 (41.45)	38.18 (125.27)
4	12.39 (40.65)	50.57 (165.92)
5	12.37 (40.60)	62.95 (206.52)
6	12.71 (41.71)	75.66 (248.23)
7	12.21 (40.05)	87.87 (288.28)
8	11.98 (39.30)	99.85 (327.58)
9	12.44 (40.80)	112.28 (368.38)
10	12.76 (41.85)	125.04 (410.23)
11	12.54 (41.15)	137.58 (451.38)
12	12.50 (41.00)	150.08 (492.38)
13	11.87 (38.95)	161.95 (531.33)
14	12.44 (40.80)	174.39 (572.13)
15	12.51 (41.05)	186.90 (613.18)
16	12.57 (41.25)	199.47 (654.43)
17	12.74 (41.80)	212.21 (696.23)
18	12.77 (41.90)	224.98 (738.13)
19	12.28 (40.30)	237.27 (778.43)
20	12.29 (40.31)	249.55 (818.74)
21	12.54 (41.15)	262.09 (859.89)
22	11.99 (39.35)	274.09 (899.24)
23	12.07 (39.60)	286.16 (938.84)
24	11.40 (37.40)	297.56 (976.24)
25	11.98 (39.30)	309.54 (1015.54)
26	12.66 (41.55)	322.20 (1057.09)
27	13.01 (42.70)	335.22 (1099.79)
28	12.68 (41.60)	347.90 (1141.39)
29	12.71 (41.69)	360.60 (1183.08)
30	12.23 (40.11)	372.83 (1223.19)
31	12.13 (39.80)	384.96 (1262.99)
32	12.60 (41.35)	397.56 (1304.34)
33	12.15 (39.85)	409.71 (1344.19)
34	11.19 (36.70)	420.90 (1380.89)
35	12.39 (40.65)	430.54 (1421.54)
36	12.47 (40.90)	445.75 (1462.44)
37	12.73 (41.75)	458.48 (1504.19)
38	12.50 (41.01)	270.98 (1545.20)
39	12.36 (40.55)	483.34 (1585.75)
40	12.04 (39.50)	495.38 (1625.25)
41	12.69 (41.64)	508.07 (1666.89)
42	12.30 (40.34)	520.36 (1707.23)
43	12.15 (39.85)	532.51 (1747.08)
44	12.86 (42.19)	545.37 (1789.27)
45	12.84 (42.11)	558.20 (1831.38)
46	12.55 (41.19)	570.76 (1872.57)
47	12.66 (41.55)	583.42 (1914.12)
48	12.57 (41.25)	596.00 (1955.37)
49	12.51 (41.05)	608.51 (1996.42)

TABLE D-III (cont.)

PRODUCTION CASING SCHEDULE

Joint [a]	Length [m (ft)]	Accumulated Length [m (ft)]
50	12.87 (42.22)	621.38 (2038.64)
51	12.79 (41.95)	634.16 (2080.59)
52	12.33 (40.45)	646.49 (2121.04)

[a] All casing 24 cm (9-5/8 in.), K-55, buttress thread, 54 kg/m (36 lb/ft), Range-3. Casing was set at 1039 (3408 ft) and liner hanger at 389 m (1277 ft).

ROCKY MOUNTAIN GEO-ENGINEERING COMPANY

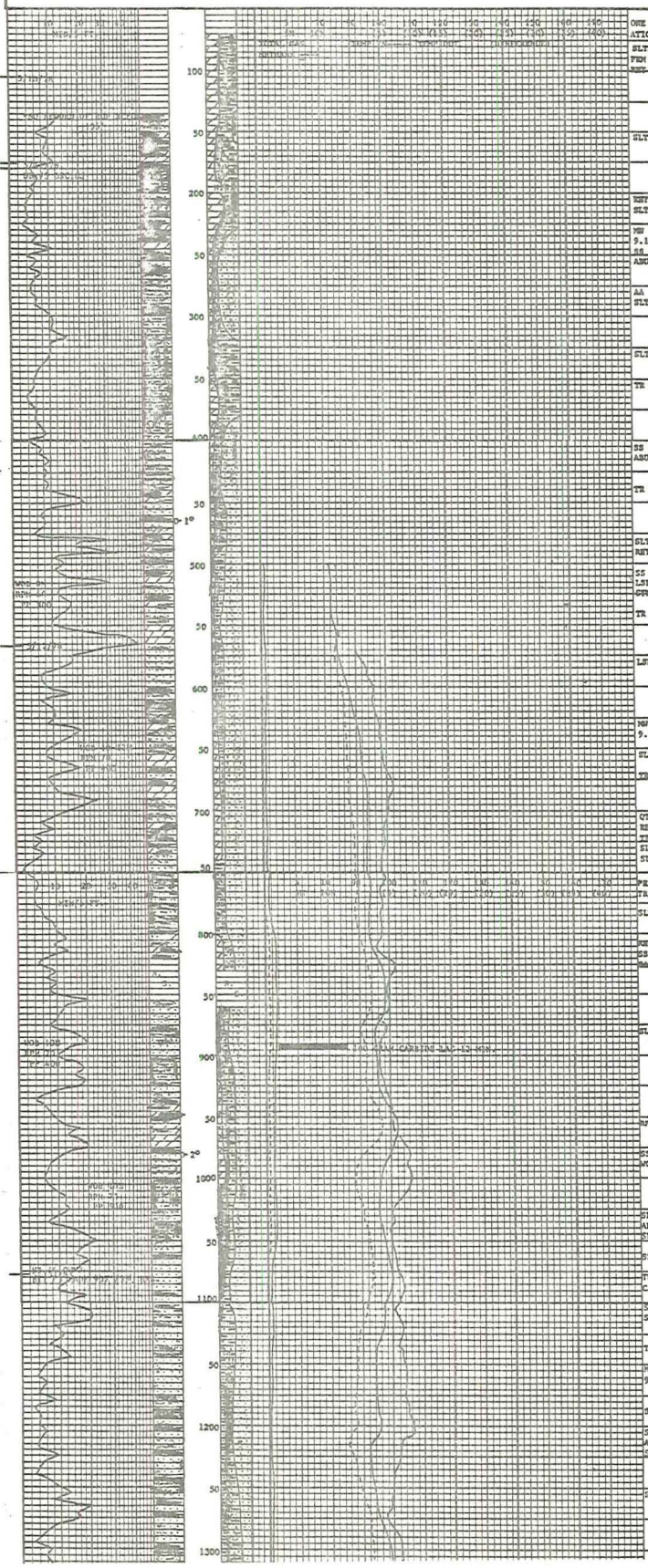
Grand Junction, Colorado

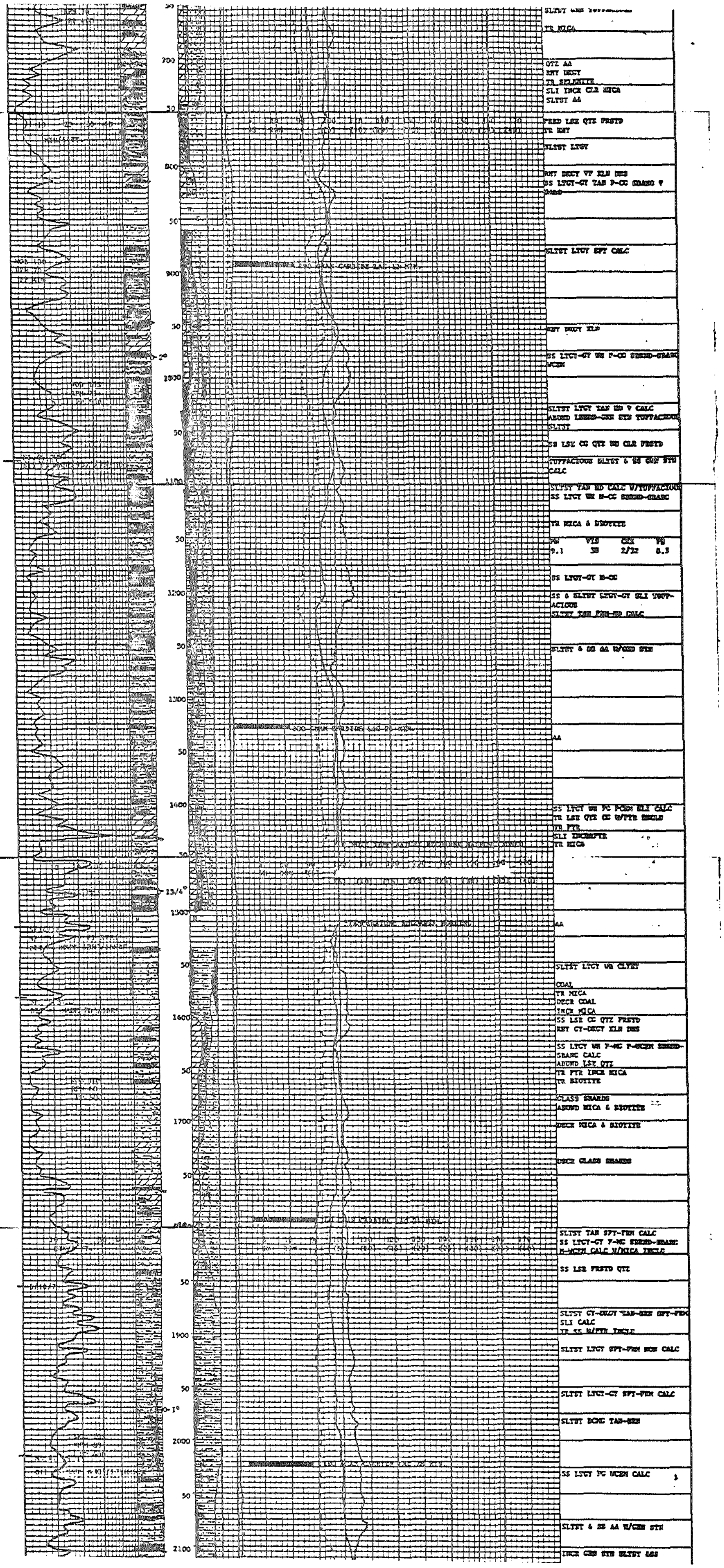
				FROM	TO
COMPANY	EG&G IDAHO INC.	LOCATION	NESW SEC 22 TWP15S R25E	DEPTH LOGGED	70'	4911'
WELL	RMGP #5	COUNTY	CASSIA	DATE LOGGED	5/10/78	6/22/78
FIELD	RAFT RIVER	STATE	IDAHO			
ELEVATION	G.L. 4988' K.B. 5004'	DRILLING FLUID	MUD & WATER	ENGINEERS	BLAIK COPELAND	

SHALE
SANDSTONE
SILTSTONE
TUFF
SCHIST
QUARTZ
QUARTZ MONZONITE
CONGLOMERATE
RHYOLITE
CORE NO.
DST NO.
DEVIATION

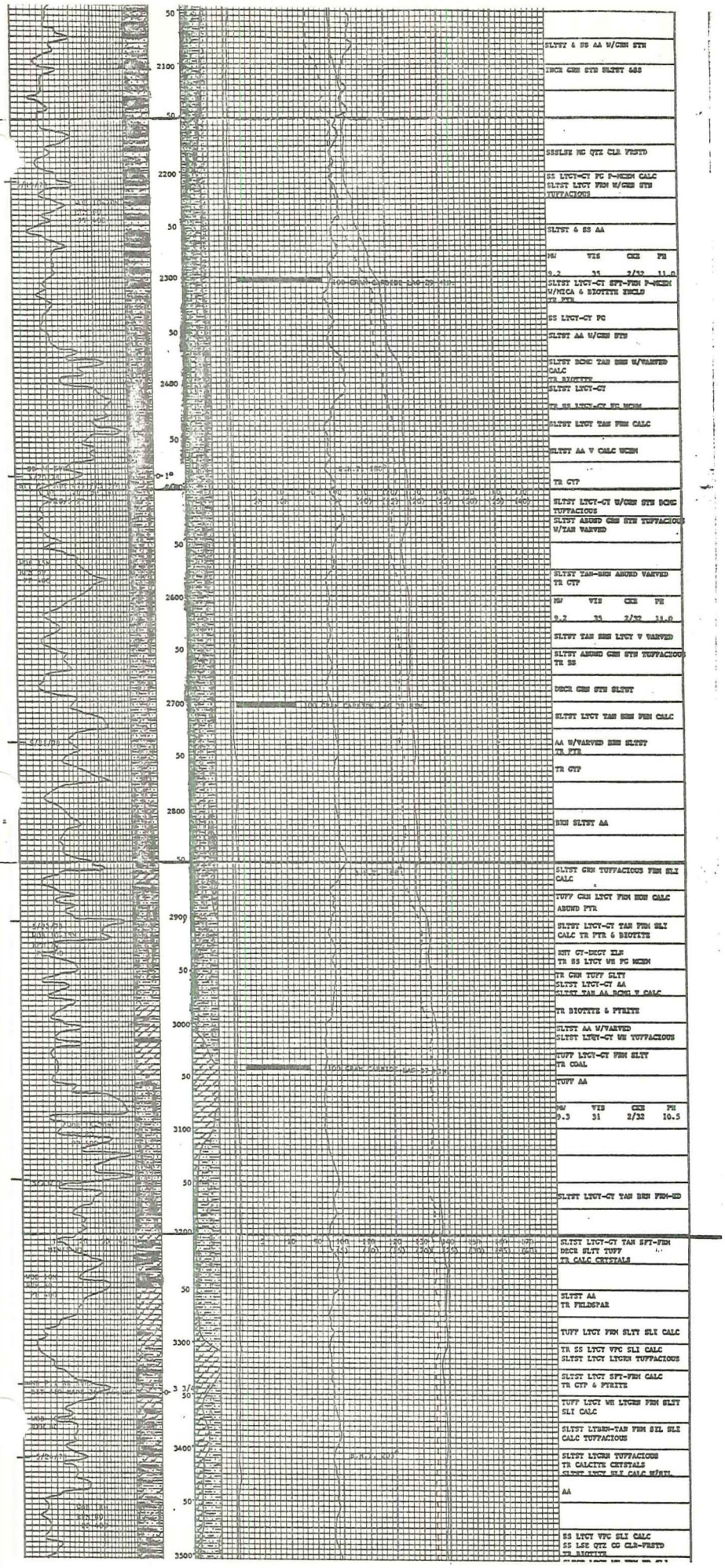
NB - NEW BIT
NR - NO RETURNS
CO - CIRCULATE OUT
NS - NO SAMPLE
TG - TRIP GAS

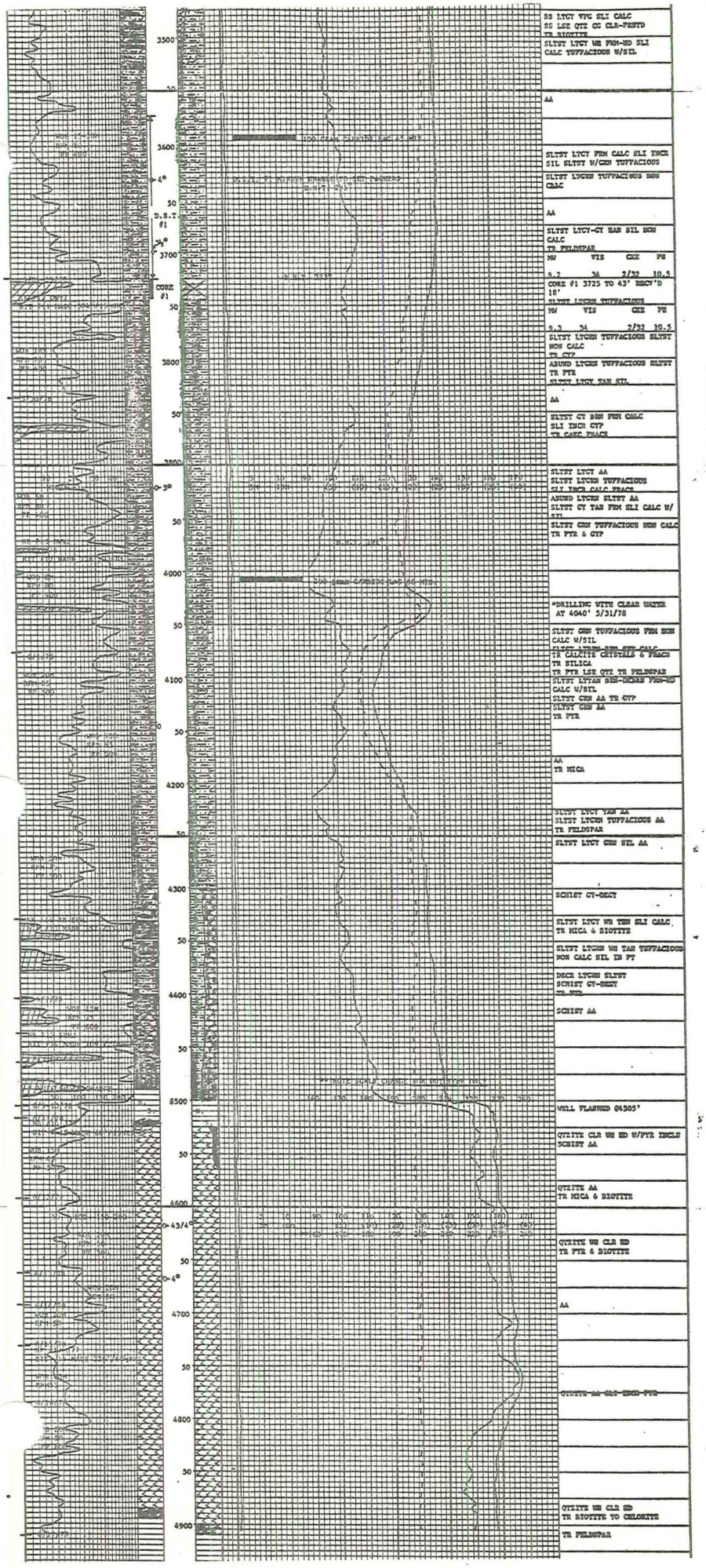
ONE MAN LOGGING UNIT ON LOCATION @ 7:00 PM 5/10/78
SLTST LTGY-GY WH TAN SFT-H FRM SLI CALC
SLTST AA W/CLYST
VRY AA
SLTST WH SFT CLYST
MW 9.1 VIS 41.5 CHK 3/32 PH 12
SS LTGY-GY FG ABUND LSE QTZ CLR WH FRSTD
AA
SLTST BCMS MORE CALC
SLTST WH SFT CLYST V CALC
TR LSE QTZ
SS WH LTGY F-MG WCHN V CALC ABUND LSE QTZ AA
TR MICA
SLTST PEBBLES LTGY-GY SFT-MD RRY DKISH GY VV ILM
SS LTGY TAN F-CG SFT-MD CALC LSE QTZ CLR WH FRSTD W/CHT GTY
TR BIOTITE & MICA
LSE QTZ CLR FRSTD WH
MW 9.3 VIS 38 CHK 2/32 PH 12
SLTST GRN TUFFACEOUS
TR MICA
QTZ AA
RRY DKGY
TR SPLINTER
SLI INCR CLR MICA
SLTST AA
FRED LSE QTZ FRSTD
TR RRY
SLTST LTGY
RRY DKGY VF ILM BRS
SS LTGY-GY TAN F-CG SBANG V BASC
SLTST LTGY SFT CALC
RRY DKGY ILM
SS LTGY-GY WH F-CG SBRND-SBANG WCHN
SLTST LTGY TAN MD V CALC ABUND LSERD-GRN STR TUFFACIOUS SLTST
SS LSE CG QTZ WH CLR FRSTD
TUFFACIOUS SLTST & SS GRN STR CALC
SLTST TAN MD CALC W/TUFFACIOUS SS LTGY WH M-CG SBRND-SBANG
TR MICA & BIOTITE
MW 9.1 VIS 38 CHK 2/32 PH 8.5
SC LTGY-GY M-CG
SS & SLTST LTGY-GY SLI TUFFACIOUS
SLTST TAN FRM-MD CALC
SLTST & SS AA W/GRN STR





700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1900
2000
2100
TR MICA
QTZ AA
SLI INCR CLR MICA
SLTST AA
FRED LSE QTZ FRSTD
SLTST LTGY
SLTST LTGY SFT CALC
SS LTGY-GY WH F-CC SBRND-SBANG
SLTST LTGY TAN HD V CALC
SS LSE CG QTZ WH CLR FRSTD
TR MICA & BIOTITE
MW VIS CKE PH
9.1 38 2/32 8.5
SS LTGY-GY M-CG
SLTST & SS AA W/GRN STN
AA
SS LTGY WH FG PCEM SLI CALC
TR LSE QTZ CG W/PYR INCLD
TR PYR
SLI INCR PYR
TR MICA
AA
SLTST LTGY WH CLYST
COAL
TR MICA
DECR COAL
INCR MICA
SS LSE CG QTZ FRSTD
SS LTGY WH F-MG F-WCEM SBRND-SBANG CALC
ABUND LSE QTZ
TR PYR INCR MICA
TR BIOTITE
GLASS SHARDS
ABUND MICA & BIOTITE
DECR MICA & BIOTITE
DECR GLASS SHARDS
SLTST TAN SFT-FRM CALC
SS LTGY-GY F-MG SBRND-SBANG
SS LSE FRSTD QTZ
SLI CALC
SLTST LTGY SFT-FRM NON CALC
SLTST LTGY-GY SFT-FRM CALC
SLTST BCMG TAN-BRN
SS LTGY FG WCEM CALC
SLTST & SS AA W/GRN STN
INCR GRN STN SLTST AAS


SLTST & SS AA W/GRN STR
DKCR GRN STR SLTST &SS
SSSLSE MC QTZ CLR FRSTD
SS LTCY-GY FG P-MDEM CALC
SLTST LTCY FRM W/GRN STR
TUFFACIOUS
SLTST & SS AA
MD VIS CKE FR
9.2 35 2/32 11.0
SLTST LTCY-GY SFT-FRM P-MDEM
W/MICA & BIOTITE INCLD
TR PYR
SS LTCY-GY FG
SLTST AA W/GRN STR
SLTST DCMC TAN BRN W/VARVED
CALC
TR BIOTITE
SLTST LTCY-GY
TR SS LTCY-GY FG MDEM
SLTST LTCY TAN FRM CALC
SLTST AA V CALC MDEM
TR CYP
SLTST LTCY-GY W/GRN STR DCMC
TUFFACIOUS
SLTST ABUND GRN STR TUFFACIOUS
W/TAN VARVED
SLTST TAN-BRN ABUND VARVED
TR CYP
MD VIS CKE FR
9.2 35 2/32 11.0
SLTST TAN BRN LTCY V VARVED
SLTST ABUND GRN STR TUFFACIOUS
TR SS
DKCR GRN STR SLTST
SLTST LTCY TAN BRN FRM CALC
AA W/VARVED BRN SLTST
TR PYR
TR CYP
BRN SLTST AA
SLTST GRN TUFFACIOUS FRM SLI
CALC
TUFF GRN LTCY FRM NOM CALC
ABUND PYR
SLTST LTCY-GY TAN FRM SLI
CALC TR PYR & BIOTITE
MDY GY-DKGY ZLN
TR SS LTCY WH FG MDEM
TR GRN TUFF SLTY
SLTST LTCY-GY AA
SLTST TAN AA DCMC V CALC
TR BIOTITE & PYRITE
SLTST AA W/VARVED
SLTST LTGY-GY WH TUFFACIOUS
TUFF LTCY-GY FRM SLTY
TR COAL
TUFF AA
MD VIS CKE FR
9.3 31 2/32 10.5
SLTST LTCY-GY TAN BRN FRM-MD
SLTST LTCY-GY TAN SFT-FRM
DECR SLTY TUFF
TR CALC CRYSTALS
SLTST AA
TR FELDSPAR
TUFF LTCY FRM SLTY SLI CALC
TR SS LTCY VFG SLI CALC
SLTST LTCY LTGRN TUFFACIOUS
SLTST LTCY SFT-FRM CALC
TR CYP & PYRITE
TUFF LTCY WH LTGRN FRM SLTY
SLI CALC
SLTST LYBRN-TAN FRM SIL SLI
CALC TUFFACIOUS
SLTST LTGRN TUFFACIOUS
TR CALCITE CRYSTALS
SLTST LTCY SLI CALC MICA
AA
SS LTCY VFG SLI CALC
SS LSE QTZ CG CLR-FRSTD
TR BIOTITE


3500
3600
3700
3800
4000
4100
4200
4300
4400
4500
4600
4700
4800
4900
CORE #1
D.S.T. #1
SS LTGY VFG SLI CALC
SS LSE QTZ CC CLR-FRSTD
TR BIOTITE
SLTST LTGY WH FRM-HD SLI
CALC TUFFACEOUS W/SIL
AA
SLTST LTGY FRM CALC SLI INCR
SIL SLTST W/GRN TUFFACIOUS
SLTST LTGRN TUFFACIOUS NON
CALC
AA
SLTST LTGY-GY HAR SIL NON
CALC
TR FELDSPAR
MW VIS CHK PH
9.7 34 2/32 10.5
CORE #1 3725 TO 43' RECV'D
18'
SLTST LTGRN TUFFACIOUS
MW VIS CHK PH
9.3 34 2/32 10.5
SLTST LTGRN TUFFACIOUS SLTST
NON CALC
TR GYP
ABUND LTGRN TUFFACIOUS SLTST
TR PYR
SLTST LTGY TAN SIL
AA
SLTST GY BRN FRM CALC
SLI INCR GYP
TR CARC FRAGS
SLTST LTGY AA
SLTST LTGRN TUFFACIOUS
SLI INCR CALC FRAGS
ABUND LTGRN SLTST AA
SLTST GY TAN FRM SLI CALC W/
SIL
SLTST GRN TUFFACIOUS NON CALC
TR PYR & GYP
*DRILLING WITH CLEAR WATER
AT 4040' 3/31/78
SLTST GRN TUFFACIOUS FRM NON
CALC W/SIL
TR CALCITE CRYSTALS & FRAGS
TR SILICA
TR PYR LSE QTZ TR FELDSPAR
SLTST LTTAN BRN-DKBRN FRM-HD
CALC W/SIL
SLTST GRN AA TR GYP
SLTST GRN AA
TR PYR
AA
TR MICA
SLTST LTGY TAN AA
SLTST LTGRN TUFFACIOUS AA
TR FELDSPAR
SLTST LTGY GRN SIL AA
SCHIST GY-BRGY
SLTST LTGY WH TRN SLI CALC
TR MICA & BIOTITE
SLTST LTGRN WH TAN TUFFACIOUS
NON CALC SIL IN PT
DKGR LTGRN SLTST
SCHIST GY-BRGY
TR PYR
SCHIST AA
WELL FLASHED @4505'
QTZITE CLR WH RD W/PYR INCLS
SCHIST AA
QTZITE AA
TR MICA & BIOTITE
QTZITE WH CLR RD
TR PYR & BIOTITE
AA
QTZITE WH CLR RD
TR BIOTITE TO CHLORITE
TR FELDSPAR