FORTRAN COMPUTER PROGRAMS TO PLOT AND PROCESS AQUIFER PRESSURE AND TEMPERATURE DATA

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CONVERSION FACTORS

Multiply inch-pound unit	By	To obtain SI unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
pound per square inch (PSI)	8947.6	pascal (Pa)
pound (lb)	453.59	gram (g)

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ABSTRACT

Two FORTRAN computer programs have been written to process water-well temperature and pressure data recorded automatically on magnetic tape by a datalogger. These programs process the data into tabular and graphical form. Both programs are presented with documentation. Sample plots of temperature versus time, water levels versus time, aquifer pressure versus log time, log drawdown versus log 1/time, and log drawdown versus log time/ radius squared are presented and are obtained using standard CALCOM directives. Drawdown plots may be used directly to obtain aquifer transmissivities and storage coefficients as well as leakance coefficients.

INTRODUCTION

Hydrologists often handle large amounts of data. Computers have become indispensible in making these tasks more manageable by automatically processing these data into useable forms (for example, tables, graphs, and so forth).

In this report, two programs have been developed for use in managing data derived from an aquifer thermal-energy storage (ATES) project being done by the University of Minnesota. Data are generated from temperature and pressure measuring devices that are read automatically by a datalogger. Up to 100 channels can be scanned every 10 seconds and recorded on magnetic tape or printed as paper output. Time periods of up to several years of data may be represented on a single tape.

These programs are written in FORTRAN computer language and were developed on a Control Data Corporation[1/] (CDC) Model 730 computer. Use of these programs on machines other than CDC equipment will require the user to make some minor changes to both programs to insure satisfactory operation.

One of the objectives of the U.S. Geological Survey's participation in the ATES project is to aid in the collection of hydraulic and thermal data during injection/ withdrawal tests and to design a data-processing system that will facilitate entry of the data into computer storage. The programs presented in this report achieve the second part of this objective and go beyond the simple storage of data to produce usable data represented in tabular and graphical form.

[1/]The use of brand names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

DATALOGGER-DATA STRUCTURE

The machine used to record pressure and temperature data is an Acurex Ten/5 datalogger. This machine is capable of recording various types of voltage or current data and converting these data to the appropriate pressure or temperature units (that is, PSI and ^{o}C). The machine is programmable, allowing the user many options for displaying and recording data. An example of the type of data output by the datalogger is shown in figure 1. Figure 2 shows the data fields used to hold the various data components that are output by the datalogger.

Although the data-reduction program presented here was originally designed for use on automatically generated data, there is no reason why manually produced data could not be used. These data could be stored in the form of cards, magnetic-tape fixed-block-length-records, or card images on disk, as long as the basic format is maintained.

The interrelationships between the two programs, APROMPT and USGSTAP, is shown in the flow chart in figure 3. User input is supplied to program APROMPT by way of interactive prompting. These data are stored in a file (ATEDATA) and are used as input data to drive program USGSTAP. The recorded pressure and temperature data are stored on magnetic tape (RAWDATA), which is assigned to logical unit 4 in program USGSTAP. Program USGSTAP processes the magnetic tape data according to the directives given in ATEDATA. The processed data ultimately appear in the form of tabulated values (ATEOUT) or graphical output (CALCOM PLOTS).

PROGRAM OPERATION

Program APROMPT

APROMPT (Appendix A) is an interactive program that automatically prompts the user for data: the user is asked a question which is followed on the next line by a "?". The user's response is entered directly after the "?" and ended with a carriage return (CR). Most responses are echoed back to allow the user the chance to change unintentional entries. Correct entries are then written to an output file assigned to logical unit 7 (for example, TAPE7 on CDC systems).

The program contains site-specific channel information related to the University of Minnesota's Aquifer Thermal-Energy Storage (ATES) project. This information (hole name, instrument depth, geologic formation, and instrument type) may be changed to fit the desired application by simply changing the appropriate DATA statements in APROMPT and USGSTAP.

A sample computer terminal session of APROMPT begins with a request for a starting time and date to begin listing data, and an ending date. The terminal prints:

```
ENTER STARTING TIME AND DATE AND ENDING DATE AS IN THIS
EXAMPLE:

HR:MN:SC,JUN01,1981,AUG03,1982

FORMAT: 3(A2,1X),A3,I2,1X,I4,1X,A3,I2,1X,I4

?  12:45:21,APR01,1981,AUG02,1982
```

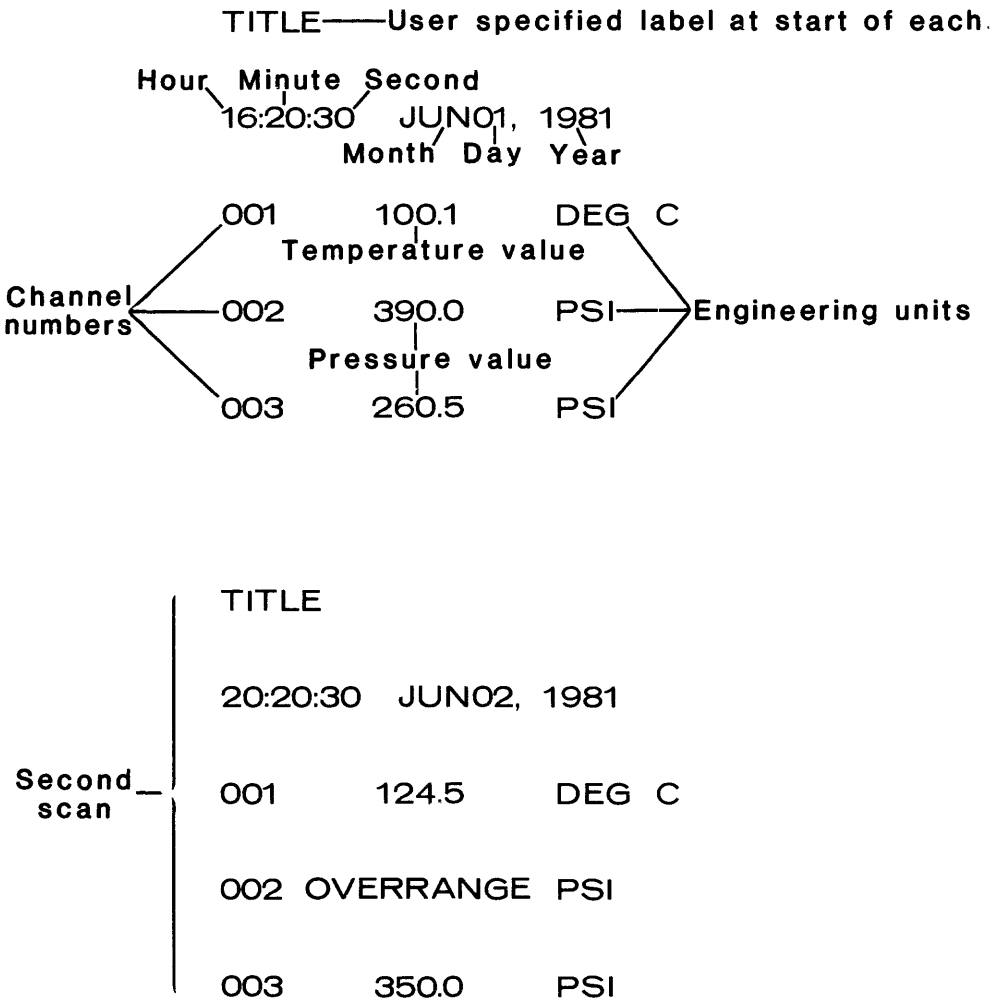

Figure 1.--Sample of data output to magnetic tape or printer by the Acurex Ten/5 datalogger

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	Column number
P U M P I N G T E S T	Scan label
0 6 : 1 5 : 3 5 M A Y 2 5 , 1 9 8 0	Time
0 0 1 1 1 . 5 C	Temperature, in degrees Celsius
0 0 2 1 0 . 6 C	Temperature, in degrees Celsius
0 0 3 1 1 5 . 0 P S I	Pressure, in pounds per square inch
0 0 4 0 . 2 4 5 0 M V	Pressure, in millivolts

Figure 2.--Data fields for data produced by the Acurex Autodata Ten/5 datalogger showing column location of integer, real, and character data (Acurex Autodata, 1980)

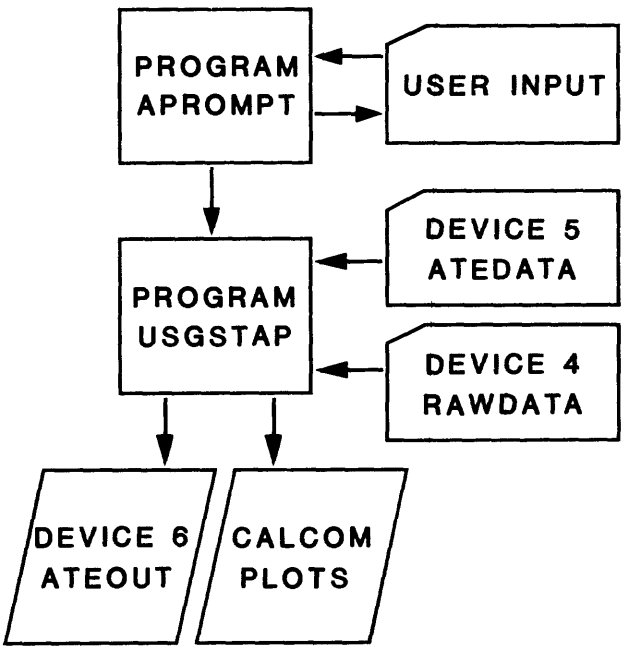

Figure 3.--Flow chart of programs APROMPT and USGSTAP with input and output devices

12 45 21 APR 1 1981 AUG 2 1982

IS THIS WHAT YOU WANT TO ENTER? (Y OR N)

? Y

The starting time entered acts as a reference point from which the elapsed time for other scans is calculated. The first scan selected as output will correspond to a time equal to or greater than the starting date and time; the last scan selected will be one with a time less than or equal to the ending date (for example, the search ends when a date greater than the ending date is found). Prior knowledge of the time period during which data were collected is necessary.

The minimum date allowed for a starting date is January 1, 1981, and the maximum ending date is December 31, 1988, in the present program. These restrictions may be adjusted as necessary.

The next queries by the program are:

HOW MANY TEMPERATURE CHANNELS ARE THERE (TOTAL) ?

? 69

HOW MANY PRESSURE CHANNELS ARE THERE ?

? 23

HOW MANY TIME INTERVALS AFTER THE START OF THE TAPE ARE REQUIRED TO INCLUDE THE DESIRED DATA?

? 540

YOU WANT 540 TIME SCANS, RIGHT? (Y OR N)

? Y

It is necessary to specify 69 temperature channels and 23 pressure channels for the current version of this program. That is, the number of channels is reflected by the number of labels used to designate the hole name, hole depth, and formation name. The number of time scans should be set equal to or greater than the number of scans expected between the start of the tape and the ending date.

If the user sets the number of time scans to a value greater than the number of scans between the start of the tape and the desired starting scan of the desired time interval (point A, fig. 4), but less than the number of time scans between the start of the tape and the desired ending time scan (point B, fig. 4), then the search for data occurring between the specified starting and ending dates will be terminated before the ending date has been encountered. Currently, the program is dimensioned to store 300 scans of 69 temperature and 23 pressure channels found between points A and B (fig. 4) on the magnetic tape. However, by using the time-step skipping increment (discussed later) consecutive scans need not be used, allowing one to plot data over a larger period of time, but at the expense of showing greater detail.

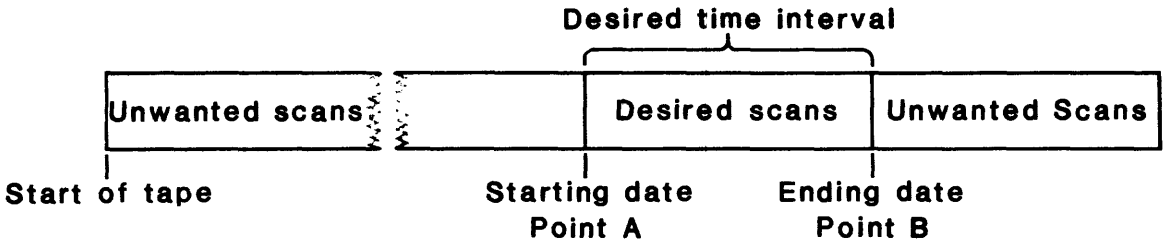

Figure 4.--Arrangement of data in desired time interval with respect to total data stored on magnetic tape

The next entry involves the type of plotting desired for pressure data:

ENTER THE NUMBER FOR THE TYPE OF PLOT DESIRED FOR PRESSURE DATA:

-1 - WATER LEVEL IN FEET VS. TIME (SEMILOG OR CARTESIAN)

0 - PRESSURE VS. LOG TIME (SEMILOG OR CARTESIAN)

1 - LOG DRAWDOWN VS. LOG TIME/RADIUS**2

2 - LOG DRAWDOWN VS. LOG 1/TIME

3 - DRAWDOWN VS. LOG TIME (SEMILOG OR CARTESIAN)

Examples of these types of plots appear in Appendix F. In choosing either "0" or "3", the time axis may also be specified as to whether or not it is logarithmic and as to the time units used. Selecting "1" produces a log-log plot of drawdown (in feet) versus t/r^2 (in day per square foot) with a grid identical to the one used in the type curves in plate 3 of Lohman (1979) or figure 4.2 of Reed (1980). Selecting "2" produces a log-log plot of drawdown (in feet) versus 1/time ($days^{-1}$) with a grid identical to that used in the type curves in plate 1 of Wenzel and Fishel (1942).

The raw data, as previously mentioned, can be output in either tabular and (or) graphical form. The next questions pertain to the printing of tabular results:

DO YOU WANT TEMPERATURE PRINTED OUT IN TABULAR
FORM FOR EACH TIME SCAN? (Y/N)

? Y

DO YOU WANT PRESSURES PRINTED OUT IN TABULAR
FORM FOR EACH TIME SCAN? (Y/N)

? Y

The next series of questions involve modifications in the types of plots produced and in the reading of the data:

LOGARITHMIC TIME AXIS? (Y/N)

? Y

READ A TITLE AT START OF EACH SCAN? (Y/N)

? Y

ENTER TIME-STEP SKIPPING INCREMENT:

? 25

ENTER THE NUMBER FOR THE TYPE OF UNITS DESIRED TO REPRESENT TIME:

0 OR 1 - TIME IN SECONDS

2 - TIME IN MINUTES

3 - TIME IN HOURS

4 - TIME IN DAYS

5 - TIME IN YEARS

? 4 (This entry and message omitted for plot-types 1 and 2 is shown here for illustration purposes only).

DO YOU WANT A TIME-AXIS WITH A LENGTH DIFFERENT THAN 10 INCHES? (Y/N)

? Y

ENTER THE TIME-AXIS LENGTH IN INCHES:

15.

The logarithmic time-axis question when answered "yes" will set up a logarithmic axis with a scale dependent on the time units selected. When answered "no", a Cartesian, linear axis will be used. The "title" question pertains to whether an optional title exists at the start of each scan (fig. 1).

The time-step skipping increment is the number of time-steps to skip while plotting. The larger this number is, the greater is the period of time that can be plotted, but at the expense of detail. This may be desirable for showing long-term temperature or pressure changes. The first data point plotted will be the first 25 points found in the time period; subsequent points will be skipped according to the time-step skipping increment.

The designation of time units only affects plots involving pressure, water level, temperature, or semilog drawdown. The length of the time-axis affects only these plots as well.

The following entries pertain to the initial pressures in observation wells used in drawdown plots:

ENTER 23 INITIAL PRESSURE VALUES CORRESPONDING TO THE ORDER OF PRESSURE CHANNELS:

ENTER PRESSURE NO. 1

? 225.

ENTER PRESSURE NO. 2

? 354.

ENTER PRESSURE NO. 3

? 430.

ENTER PRESSURE NO. 4

? 562.

ENTER PRESSURE NO. 5

? 976.

ENTER PRESSURE NO. 6

? 654.

.

.

.

ENTER PRESSURE NO. 21

? 568.

ENTER PRESSURE NO. 22

? 145.

ENTER PRESSURE NO. 23

? 654.

The above entries for initial pressure are omitted if pressure or water level plots are desired rather than drawdown.

Finally, the last set of questions pertains to the actual channels to be plotted. The user is first asked:

WOULD YOU LIKE A LISTING OF ALL THE POSSIBLE CHANNELS WITH THEIR CORRESPONDING FORMATIONS AND DEPTHS? (Y OR N)

A "Y" reply causes a listing equivalent to the one given in table 1 to be written to logical unit 6 (TAPE6). An "N" reply omits this list and is followed by questions pertaining to channel selection:

NOW, DO YOU WISH TO SEE ALL OF THESE CHANNELS PLOTTED ? IF SO TYPE IN 'Y'; IF NOT, TYPE 'N'.

? N

OK THEN, WHICH TEMPERATURE CHANNELS DO YOU WANT PLOTS FOR ? ENTER EACH CHANNEL SEPARATELY ON A SEPARATE LINE ENDING WITH A FINAL ENTRY OF '999'. IF NO TEMPERATURE CHANNELS ARE DESIRED ENTER '999'.

CHANNEL:

? 5

CHANNEL 5 RIGHT? Y/N

? Y

CHANNEL:

? 13

CHANNEL 13 RIGHT? Y/N

? Y

CHANNEL:

? 9

CHANNEL 9 RIGHT? Y/N

? Y

CHANNEL:

? 999

Table 1.--Channel data printed by program APROMPT

DATA LOGGER CHANNEL NO.	HOLE NAME	DEPTH FEET	GEOLOGIC FORMATION	TYPE
1	AM1	810.0	EAU CLAIRE	TEMPERATUR
2	AM1	788.0	GALESVILLE	TEMPERATUR
3	AM1	766.0	IRONTON	TEMPERATUR
4	AM1	744.0	IRONTON	TEMPERATUR
5	AM1	695.0	FRANCONIA	TEMPERATUR
6	AM1	670.0	FRANCONIA	TEMPERATUR
7	AM1	645.0	FRANCONIA	TEMPERATUR
8	AM1	630.0	FRANCONIA	TEMPERATUR
9	AM1	593.0	ST.LAWRENC	TEMPERATUR
10	AM1	575.0	ST.LAWRENC	TEMPERATUR
11	AM2	810.0	EAU CLAIRE	TEMPERATUR
12	AM2	788.0	GALESVILLE	TEMPERATUR
13	AM2	766.0	IRONTON	TEMPERATUR
14	AM2	744.0	IRONTON	TEMPERATUR
15	AM2	720.0	FRANCONIA	TEMPERATUR
16	AM2	695.0	FRANCONIA	TEMPERATUR
17	AM2	670.0	FRANCONIA	TEMPERATUR
18	AM2	645.0	FRANCONIA	TEMPERATUR
19	AM2	630.0	FRANCONIA	TEMPERATUR
20	AM2	610.0	FRANCONIA	TEMPERATUR
21	AM2	593.0	ST.LAWRENC	TEMPERATUR
22	AM2	575.0	ST.LAWRENC	TEMPERATUR
23	AM3	810.0	EAU CLAIRE	TEMPERATUR
24	AM3	788.0	GALESVILLE	TEMPERATUR
25	AM3	766.0	IRONTON	TEMPERATUR
26	AM3	744.0	IRONTON	TEMPERATUR
27	AM3	720.0	FRANCONIA	TEMPERATUR
28	AM3	695.0	FRANCONIA	TEMPERATUR
29	AM3	670.0	FRANCONIA	TEMPERATUR
30	AM3	645.0	FRANCONIA	TEMPERATUR
31	AM3	630.0	FRANCONIA	TEMPERATUR
32	AM3	610.0	FRANCONIA	TEMPERATUR
33	AM3	593.0	ST.LAWRENC	TEMPERATUR
34	AM3	575.0	ST.LAWRENC	TEMPERATUR
35	AS1	810.0	EAU CLAIRE	TEMPERATUR
36	AS1	788.0	GALESVILLE	TEMPERATUR
37	AS1	766.0	IRONTON	TEMPERATUR
38	AS1	744.0	IRONTON	TEMPERATUR
39	AS1	720.0	FRANCONIA	TEMPERATUR
40	AS1	695.0	FRANCONIA	TEMPERATUR
41	AS1	670.0	FRANCONIA	TEMPERATUR
42	AS1	645.0	FRANCONIA	TEMPERATUR
43	AS1	630.0	FRANCONIA	TEMPERATUR
44	AS1	610.0	FRANCONIA	TEMPERATUR

Table 1.--Channel data printed by program APROMPT—Continued

45	AS1	593.0	ST.LAWRENC	TEMPERATUR
46	AS1	575.0	ST.LAWRENC	TEMPERATUR
47	A-WELL	800.0	PRODUCTION	TEMPERATUR
48	B-WELL	800.0	PRODUCTION	TEMPERATUR
49	B-WELL	800.0	PRODUCTION	TEMPERATUR
100	BC1	864.0	MT. SIMON	TEMPERATUR
101	BC1	789.0	EAU CLAIRE	TEMPERATUR
102	BC1	749.0	IRONTON	TEMPERATUR
103	BS1	712.0	IRONTON	TEMPERATUR
104	BS1	633.0	FRANCONIA	TEMPERATUR
105	BS1	580.0	FRANCONIA	TEMPERATUR
106	BS1	553.0	FRANCONIA	TEMPERATUR
107	BS1	520.0	JORDAN	TEMPERATUR
108	CM1	740.0	IRONTON	TEMPERATUR
109	CM1	587.0	FRANCONIA	TEMPERATUR
110	RESERVE	0	RESERVE	TEMPERATUR
111	RESERVE	0	RESERVE	TEMPERATUR
112	RESERVE	0	RESERVE	TEMPERATUR
113	RESERVE	0	RESERVE	TEMPERATUR
114	RESERVE	0	RESERVE	TEMPERATUR
115	RESERVE	0	RESERVE	TEMPERATUR
116	RESERVE	0	RESERVE	TEMPERATUR
117	RESERVE	0	RESERVE	TEMPERATUR
118	RESERVE	0	RESERVE	TEMPERATUR
119	RESERVE	0	RESERVE	TEMPERATUR
120	AM1	826.0	EAU CLAIRE	PRESSUR
121	AM1	580.0	ST.LAWRENC	PRESSUR
122	AM2	710.0	IRONTON	PRESSUR
123	AM2	695.0	FRANCONIA	PRESSUR
124	AM2	627.0	FRANCONIA	PRESSUR
125	AM3	770.0	IRONTON	PRESSUR
126	AM3	695.0	FRANCONIA	PRESSUR
127	AM3	627.0	FRANCONIA	PRESSUR
128	AS1	904.0	MT.SIMON	PRESSUR
129	AS1	557.0	JORDAN	PRESSUR
130	AC1	904.0	MT.SIMON	PRESSUR
131	AC1	826.0	EAU CLAIRE	PRESSUR
132	AC1	772.0	IRONTON	PRESSUR
133	BC1	871.0	MT.SIMON	PRESSUR
134	BC1	789.0	EAU CLAIRE	PRESSUR
135	BC1	749.0	IRONTON	PRESSUR
136	BS1	712.0	IRONTON	PRESSUR
137	BS1	633.0	FRANCONIA	PRESSUR
138	BS1	580.0	FRANCONIA	PRESSUR
139	BS1	553.0	ST.LAWRENC	PRESSUR
140	BS1	520.0	JORDAN	PRESSUR
141	A-WELL	800.0	PRODUCTION	PRESSUR
142	B-WELL	800.0	PRODUCTION	PRESSUR

```
 OK THEN, WHICH PRESSURE CHANNELS DO YOU WANT PLOTS FOR ? ENTER
 EACH CHANNEL SEPARATELY ON A SEPARATE LINE ENDING WITH A FINAL
 ENTRY OF '999'. IF NO PRESSURE CHANNELS ARE DESIRED ENTER '999'.

 CHANNEL:

?  72

 CHANNEL    72 RIGHT? Y/N

?  Y

 CHANNEL:

?  84

 CHANNEL    84 RIGHT? Y/N

?  Y

 CHANNEL:

?  89

 CHANNEL    89 RIGHT? Y/N

?  Y

 CHANNEL:

?  999
```

The first of these questions if answered "Y" will result in all 92 data-collection points being plotted (which could be quite costly). This will rarely be the desired case. If answered "N", individual channels should be entered but need not be in ascending order. If a mistake is made, corrections can be performed by typing "N" after the incorrect channel is echoed back. Both temperature and pressure entries are terminated with a "999" entry. These are the last data requested by the program.

The net result of running program APROMPT is the creation of a file that was assigned to logical unit 7 (that is, TAPE7). The file generated from the previous example terminal session would contain the following data:

```
12 45 21 APR 1 1981 AUG 2 1982

 69  23 540   1   1   1   1   1   25   1   1

 15.0000

 225.0000

 354.0000
```

430.0000

562.0000

976.0000

654.0000

562.0000

876.0000

251.0000

252.0000

252.0000

768.0000

765.0000

923.0000

151.0000

543.0000

654.0000

543.0000

654.0000

254.0000

568.0000

145.0000

654.0000

5

13

9

999

72

84

89

999

This file is now ready to be used as input to program USGSTAP. At this point, the user need not worry about further terminal-data input.

Program USGSTAP

MAIN program

Now that the input data for program USGSTAP (Appendix B) have been assembled using program APROMPT, it can be assigned to logical unit 5 to be read in by USGSTAP. USGSTAP writes tabular output to logical unit 6 (which for current applications is a line printer) and writes CALCOM plotter instructions to a file named CALCOM. USGSTAP may be executed with data supplied from program APROMPT or with a user-supplied data deck. Card deck input documentation for program USGSTAP is provided in Appendix C.

The starting and ending dates are the first data read in by USGSTAP. The number of days between each of these dates and a base-reference date of January 1, 1981, is calculated by calling subroutine CONVRT.

The next parameters read in are the number of temperature and pressure channels (NTC and NPC); the number of scans starting from the beginning of the tape (NT); the type of pressure plots desired (IDRAW); controls for printing temperature and pressure data in tabular form (IWT and IWP); the type of time-axis to use (ILOGAX); a switch to control whether an optional title card is read at the start of each scan (ITITLE); a time-step skipping increment (ITH); the type of time units to use (ITIME); and a switch to control reading in a different time-axis length in inches (IAX). If IAX is set to anything other than 0, then the next value read is the length of the time-axis (AXLENG).

If IDRAW is set equal to -1, water levels are calculated using the relationship

$$w = w_i - (p - p_i) * 2.3$$

where

w is the current water level in feet,

w_i is the water level in the well at the time of pressure transducer installation,

p is the current water pressure on the pressure transducer in pounds per square inch, and

p_i is the pressure transducer reading at the time of installation.

Values for w_i and p_i are kept in arrays WLEVEL and PTR, respectively, and may be changed by changing appropriate values in the DATA statements in MAIN program of USGSTAP.

If IDRAW is greater than zero, then initial pressures (PINIT) prior to pumping or prior to recovery are read in for drawdown plots. Initial pressures are required for all pressure channels for which drawdown plots are desired. Pressures and associated wells are echoed back as output to logical unit 6.

Drawdown (in feet) is calculated as

$$s = (p_i - p) * 2.3$$

where:

p_i is the initial pressure (in pounds per square inch), and

p is the current pressure.

Drawdown/recovery plots are intended for use with pumping-test data from withdrawal wells or injection wells (see subroutine SKETCH). Since the absolute value of drawdown is calculated, the same shape drawdown curve should be obtained for a given well for a constant injection or withdrawal rate.

The program now searches through the temperature and pressure tape data assigned to logical unit 4 (Appendix D) until it has found all the scans between the starting and ending dates. The difference in time between the starting date and the current scan is calculated in seconds and stored in the TIME array for plotting purposes. When the temperature and pressure data (fig. 1) are read, the program checks to see if an OVERRANGE has occurred (for example, a break in a thermocouple or pressure transducer will result in the data-logger writing out the word "OVERRANGE"). If an OVERRANGE is read, the program assigns a value of 1.999 for that pressure or temperature channel. This is done so that plotting may be performed over a complete scan search despite the presence of gaps in the data.

Temperature and pressure data are stored after each selected scan in two arrays, TBIG and PBIG, respectively; the net result is the formation of two mixed arrays (for example, every NTC element in TBIG corresponds to a specific channel, as does every NPC element in PBIG). Associated with arrays TBIG and PBIG are two time arrays, TIMET and TIMEP. The size of these arrays are dimensioned at 20700 and 6900, respectively in Appendix B. The number of array elements needed is equal to the number of temperature or pressure channels (NTC or NPC) times the number of scans that conform to the range specified by the starting and ending time and date, divided by the time-step-skipping increment (ITH).

In terms of an equation

Number of elements in TBIG or TIMET =

$$\frac{\text{NTC} * (\text{No. of scans in desired time period})}{\text{ITH}}$$

and

Number of elements in PBIG or TIMEP =

$$\frac{\text{NPC} * (\text{No. of scans in desired time period})}{\text{ITH}}$$

This calculation should be made prior to running the program, so that a check can be made to see if the array sizes should be increased (requiring editing and recompiling of the source code) or a larger ITH value used (resulting in potentially less-detailed plots).

After USGSTAP has chosen and stored the correct data, it writes the data out to unit 6 starting with temperature data, followed by pressure or water-level data for each scan period (Appendix E). A warning is printed if the temperature is less than $3^{\circ}C$ or greater than $200^{\circ}C$. Similarly, if the pressure for any channel is less than 3.0 PSI or greater than 500.0 PSI, a warning is printed. These warnings are also issued for any OVERRANGE condition.

After the temperature and pressure data have been printed, the program reads the channel numbers to be plotted (IPLOT). If IPLOT = 888, all the temperature channels are plotted; if IPLOT = 888 again, then all the pressure channels are plotted. When IPLOT $\neq$ 888, the program reads each temperature channel to be plotted until it reads a "999". Then it reads each pressure channel to be plotted until a "999" is read. Plotting is performed in Subroutine SKETCH.

Subroutine SKETCH

Subroutine SKETCH uses CALCOM software subroutines to make plots of temperature versus log time, pressure versus log time, log drawdown versus log t/r^2, and log drawdown versus log 1/t as well as Cartesian plots of pressure, temperature, and drawdown versus time. The following CALCOM subroutines are called by SKETCH:

PLOTS

PLOT

LGAXS

AXIS

LGLIN

SYMBOL

NUMBER

Temperature versus log-time plots are made on a grid of 6.5 by 10 inches with a temperature range of 0.0° to $162.5^{\circ}C$ ($25^{\circ}C$/inch) and a default time range of 1 to 10^9 seconds (1 log cycle/inch). Pressure and water level versus log-time plots have the same grid size as for temperature versus log time. The range in pressure is from 0.0 to 487.5 PSI (75 PSI/inch) and from 100.0 to 275.0 feet for water levels. The time axis has a default range of 1 to 10^9 seconds. Plots of drawdown versus log time are made on a grid of 10 by 10 inches with a drawdown range of 0 to 100 feet (10 feet/inch). All of these semilogarithmic plots may also be plotted as arithmetic Cartesian plots. The length of the time-axis for either the logarithmic or arithmetic axis may be specified by reading AXLENG. In addition, the time units may be changed from seconds to minutes, hours, days, or years. The default time axis length is 10 inches; the default time unit is seconds. By changing the time units, a 10-inch time axis may have different time ranges as shown in table 2. Example plots appear in Appendix F.

Table 2.--Range of time values for a 10-inch time axis using different time units in program USGSTAP

Time units	Logarithmic Axis			Arithmetic Axis		
	Starting value	Log cycles per inch	Value at 10 inch	Starting value	Units per inch	Value at 10 inch
Seconds	1.	1.	10^{10}	0.	10000.	10^5
Minutes	0.1	0.2991	98	0.	120.	1200.
Hours	0.01	0.5	1000	0.	10.	100.
Days	0.001	0.5	100	0.	10.	100.
Years	0.0001	0.5	10	0.	0.25	2.5

Log-log plots of drawdown versus t/r^2 are the same scale as that used in the type curves of Lohman (1979, pl. 3) and Reed (1980, fig. 4.2). This is extremely helpful in the analysis of aquifer-test data because the computer plots may be directly used with the type curves given in Lohman to obtain values of transmissivity, storage coefficient, and leakage coefficient for a confined aquifer system.

An additional log-log plot of drawdown versus 1/time can be generated and used in conjunction with the type curves of Wenzel and Fishel (1942) to obtain the aquifer transmissivity and storage coefficient.

In addition to plotting data on labeled axes, subroutine SKETCH prints out the starting date and time, channel number, well name, formation name, and instrument depth. The starting date corresponds to the start of the time axis and plotted times are the differences between the time of the scan and the designated starting time.

Subroutine CONVRT

Called by the main program in USGSTAP, subroutine CONVRT calculates the number of days between a base date of January 1, 1981, and a date supplied by the MAIN program. The date supplied by MAIN is broken up into MONTH, IDAY, IYEAR. The MONTH (a three character Hollerith string) is compared against a 12 element array of three character Hollerith strings representing the 12 months of the year. When a match is found, a monthly index is set (MINDX) and used to calculate the number of days up to but not including that month (NDAYS) for the current year.

Next, IYEAR is compared to an eight element array containing the values 1981 to 1988. When IYEAR is matched, a yearly index is set and the number of days for the years preceding IYEAR is calculated (IYRDAY).

Finally, the total number of days is calculated as

NDAYS = NDAYS + IDAY + IYRDAY

This value is passed back to MAIN and used to calculate the number of seconds since the starting time and date.

System Dependent Program Statements

Since it may be desirable to run these programs on systems other than CDC systems, mention is made here of certain statements within program USGSTAP, which may be non-standard on other systems. The first of these statements is the PROGRAM statement, which begins both programs and is used on CDC systems to designate input and output devices used by the program. In subroutine SKETCH, two CALCOM library functions may cause problems on other machines. These functions are:

CALL PLOTS ( )

and

CALL LGLIN ( )

PLOTS is used to initialize plotting parameters such as describing the type of plotter, paper width, pen type, etc. These may vary in the manner in which they are described. LGLIN is the logarithmic counterpart to LINE, and may not be available in all plotting libraries.

SUMMARY

Two FORTRAN computer programs have been presented that can be used for processing automatically or manually generated aquifer pressure and temperature data into tabular or graphical output. Program APROMPT prompts the user for information concerning the number and type of data to be processed into tables and plots. This information is then used by program USGSTAP that reads aquifer-temperature and aquifer-pressure data from either magnetic-tape or disk-storage devices and generates a table of all pressures and temperatures for each time period requested. Plots are made using CALCOMP software subroutines. Plots of pressure versus log time, temperature versus log time, and log drawdown versus log time/radius^2, log drawdown versus log 1/time, and Cartesian plots of pressure, temperature, and drawdown versus time. The time axis can be adjusted to accommodate longer periods of time by adjusting the physical length or changing the units used to denote time. The log-log plots can be used in conjunction with type curves to determine confined aquifer transmissivity, storativity, and the confining-bed leakance coefficient.

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Acurex Autodata Corp., 1980, Autodata Ten/5 calculating data logger: Operation and installation manual, p. 5-3.

Lohman, S. W., 1979, Ground-water hydraulics: U.S. Geological Survey Professional Paper 708, 70 p.

Reed, J. E., 1980, Type curves for selected problems of flow to wells in confined aquifers: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter B3, 106 p.

Wenzel, L. K. and Fishel, V. C., 1942, Methods for determining permeability of water-bearing materials with special reference to discharging-well methods: U.S. Geological Survey Water-Supply Paper 887, 192 p.

APPENDIX A.--Program APROMPT

```
      PROGRAM APROMPT (INPUT,OUTPUT,TAPE6,TAPE5=INPUT,TAPE7)                    10
C     PROGRAM TO QUERY USER ON APPROPRIATE DATA RETRIEVAL PARAMETERS            20
C     USED IN CONJUNCTION WITH AUTOMATICALLY GENERATED DATA.                    30
C     PROGRAMMED BY JOHN B. CZARNECKI, USGS WRD, MINNESOTA DISTRICT             35
      DIMENSION FORM(92), HOLE(92), DEPTH(92), TYPE(92)                         40
      DATA TYPE/69*"TEMPERATUR",23*"PRESSUR "/                                  50
      DATA HOLE/10*"AM1",12*"AM2",12*"AM3",12*"AS1","A-WELL",2*"B-WELL",        180
     13*"BC1",5*"BS1",2*"CM1",10*"RESERVE ",2*"AM1",3*"AM2",3*"AM3",2*"A        190
     2S1",3*"AC1",3*"BC1",5*"BS1","A-WELL","B-WELL"/                            200
      DATA DEPTH/810.,788.,766.,744.,695.,670.,645.,630.,593.,575.,810.,        210
     1788.,766.,744.,720.,695.,670.,645.,630.,610.,593.,575.,810.,788.,7       220
     266.,744.,720.,695.,670.,645.,630.,610.,593.,575.,810.,788.,766.,74       230
     34.,720.,695.,670.,645.,630.,610.,593.,575.,800.,800.,800.,864.,789       240
     4.,749.,712.,633.,580.,553.,520.,740.,587.,10*0.,826.,580.,710.,695       250
     5.,627.,770.,695.,627.,904.,557.,904.,826.,772.,871.,789.,749.,712.       260
     6,633.,580.,553.,520.,800.,800./                                          270
      DATA FORM/"EAU CLAIRE","GALESVILLE",2*"IRONTON",4*"FRANCONIA",2*"S        280
     1T.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2*"       290
     2ST.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2*       300
     3"ST.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2       310
     4*"ST.LAWRENC",3*"PRODUCTION","MT. SIMON","EAU CLAIRE",2*"IRONTON",       320
     53*"FRANCONIA","JORDAN","IRONTON","FRANCONIA",10*"RESERVE ","EAU CL       330
     6AIRE","ST.LAWRENC","IRONTON",2*"FRANCONIA","IRONTON","FRANCONIA","       340
     7FRANCONIA","MT.SIMON","JORDAN","MT.SIMON","EAU CLAIRE","IRONTON","       350
     8MT.SIMON","EAU CLAIRE","IRONTON","IRONTON",2*"FRANCONIA","ST.LAWRE       360
     9NC","JORDAN",2*"PRODUCTION"/                                             370
C                                                                              380
C                                                                             260
 20   PRINT 370                                                               270
      READ (5,380,END=20) IHR,MIN,ISEC,MON1,IDAY1,IYR1,MON2,IDAY2,IYR         280
      PRINT 380, IHR,MIN,ISEC,MON1,IDAY1,IYR1,MON2,IDAY2,IYR                  290
 22   PRINT 390                                                               300
      READ (5,215,END=22) IYN                                                 310
      IF (IYN.NE."Y") GO TO 20                                                320
      WRITE (7,380) IHR,MIN,ISEC,MON1,IDAY1,IYR1,MON2,IDAY2,IYR               330
      PRINT 400                                                               340
 11   READ (5,*,END=11) NTC                                                   350
      PRINT 410                                                               360
 12   READ (5,*,END=12) NPC                                                   370
 30   PRINT 420                                                               380
      READ (5,*,END=30)NT                                                     390
 32   PRINT 430, NT                                                           400
      READ (5,215,END=32) IYN                                                 410
      IF (IYN.NE."Y") GO TO 30                                                420
      PRINT 220                                                               430
 21   READ(5,*,END=21)IDRAW                                                   440
 23   PRINT 350                                                               450
      READ (5,215,END=23) IYN                                                 460
      IWT=1                                                                   470
      IF (IYN.NE."Y") IWT=0                                                   480
 24   PRINT 360                                                               490
      READ (5,215,END=24) IYN                                                 500
      IWP=1                                                                   510
      IF (IYN.NE."Y") IWP=0                                                   520
 25   PRINT 230                                                               530
      READ(5,215,END=25)IYN                                                   540
      ILOGAX=1                                                                550
      IF (IYN.NE."Y") ILOGAX=0                                                560
 26   PRINT 240                                                               570
      READ(5,215,END=26)IYN                                                   580
      ITITLE=1                                                                590
      IF (IYN.NE."Y") ITITLE=0                                                600
 37   PRINT 250                                                               610
      READ (5,*,END=37) ITH                                                   620
      IF (IDRAW.EQ.1.OR.IDRAW.EQ.2) GO TO 40                                  630
      PRINT 260                                                               640
 27   READ (5,*,END=27) ITIME                                                 650
 40   CONTINUE                                                                660
      IF (IDRAW.EQ.1.OR.IDRAW.EQ.2) ITIME=1                                   670
      PRINT 270                                                               680
      IAX=0                                                                   690
```

```
 28   READ(5,215,END=28)IYN                                                  700
      IF (IYN.NE."Y") GO TO 50                                               710
      IAX=1                                                                  720
      PRINT 280                                                              730
 29   READ(5,*,END=29) AXLENG                                                740
 50   CONTINUE                                                               750
C     WRITE OUT DATA TO UNIT 7:                                              760
      WRITE (7,440) NTC,NPC,NT,IDRAW,IWT,IWP,ILOGAX,ITITLE,ITH,ITIME,IAX     770
      IF (IAX.GT.0) WRITE (7,450) AXLENG                                     780
      IF(IDRAW.LE.0) GO TO 100
      PRINT 320, NPC                                                         910
      DO 90 I=1,NPC                                                          920
        PRINT 330, I                                                         930
 64   READ(5,*,END=64) PINIT                                                 940
        WRITE (7,450)        PINIT                                           960
 90     CONTINUE                                                            970
 100  CONTINUE                                                               980
C      READ IN DESIRED CHANNELS TO BE PLOTTED                                990
 65   PRINT 460                                                             1000
      READ (5,215,END=65) IYN                                               1010
      IF (IYN.NE."Y") GO TO 120                                             1020
      WRITE (6,470)                                                         1030
      DO 110 I=1,92,1                                                       1040
        II=I                                                                1050
        IF (I.GE.50) II=I+50                                                1060
 110    WRITE (6,480) II,HOLE(I),DEPTH(I),FORM(I),TYPE(I)                   1070
      PRINT 340                                                             1080
 120  CONTINUE                                                              1090
      PRINT 490                                                             1100
 66   READ (5,215,END=66) IYN                                               1110
      IF (IYN.NE."Y") GO TO 130                                             1120
      IPLOT=888                                                             1130
      WRITE (7,440) IPLOT                                                   1140
      WRITE (7,440) IPLOT                                                   1150
      GO TO 210                                                             1160
 130  CONTINUE                                                              1170
      IF (NTC.EQ.0) GO TO 170                                               1180
      PRINT 500                                                             1190
      DO 160 J=1,1000                                                       1200
 140    PRINT 510                                                           1210
      READ (5,*,END=140)IPL                                                 1220
        IF (IPL.EQ.999) GO TO 150                                           1230
        PRINT 520, IPL                                                      1240
 67   READ (5,215,END=67) IYN                                               1250
        IF (IYN.NE."Y") PRINT 530                                           1260
        IF (IYN.NE."Y") GO TO 140                                           1270
 150    WRITE (7,440) IPL                                                   1280
        IF (IPL.EQ.999) GO TO 170                                           1290
 160    CONTINUE                                                            1300
 170  PRINT 540                                                             1310
      DO 200 J=1,100                                                        1320
 180    PRINT 550                                                           1330
      READ (5,*,END=180)IPL                                                 1340
        IF (IPL.EQ.999) GO TO 190                                           1350
 185    PRINT 560, IPL                                                      1360
      READ (5,215,END=185) IYN                                              1370
        IF (IYN.NE."Y") PRINT 570                                           1380
        IF (IYN.NE."Y") GO TO 180                                           1390
 190    WRITE (7,440) IPL                                                   1400
        IF (IPL.EQ.999) GO TO 210                                           1410
 200    CONTINUE                                                            1420
 210  CONTINUE                                                              1430
      STOP                                                                  1440
C                                                                           1450
C                                                                           1460
C                                                                           1470
 215  FORMAT (A1)
 220  FORMAT (/2X,"ENTER THE NUMBER FOR THE TYPE OF PLOT DESIRED FOR","     1480
     1PRESSURE DATA:"/" -1 - WATER LEVEL VS. TIME (SEMILOG OR CARTESIAN)   1490
     1              "/"  0 - PRESSURE VS. LOG TIME (SEMILOG OR CARTESIAN    1490
     2)"/41H  1 - LOG DRAWDOWN VS. LOG TIME/RADIUS""2/"  2 - LOG DRAWDOW    1500
     3N VS. LOG 1/TIME"/"  3 - DRAWDOWN VS. LOG TIME (SEMILOG OR CARTESI    1510
     4AN)"/)                                                                1520
```

```
230  FORMAT (/2X,"LOGARITHMIC TIME AXIS? (Y/N)")                          1530
240  FORMAT (/2X,"READ A TITLE AT START OF EACH SCAN? (Y/N)")              1540
250  FORMAT (/2X,"ENTER TIME STEP SKIPPING INCREMENT:")                    1550
260  FORMAT (/2X,"ENTER THE NUMBER FOR THE TYPE OF UNITS DESIRED TO","    1560
     1REPRESENT TIME:"/"  0 OR 1 - TIME IN SECONDS"/"     2   - TIME IN   1570
     2MINUTES"/"     3   - TIME IN HOURS "/"     4   - TIME IN DAYS "/"   1580
     3    5   - TIME IN YEARS "/)                                         1590
270  FORMAT (/2X,"DO YOU WANT A TIME-AXIS WITH A LENGTH DIFFERENT THAN"    1600
     1," 10 INCHES? (Y/N)")                                               1610
280  FORMAT (/2X,"ENTER THE TIME-AXIS LENGTH IN INCHES:")                  1620
320  FORMAT (/2X,"ENTER",I3," INITIAL PRESSURE VALUES",/2X,"CORRESPONDI    1720
     1NG TO THE ORDER OF PRESSURE CHANNELS:")                             1730
330  FORMAT (2X,"ENTER PRESSURE NO.",I2)                                  1740
340  FORMAT (/2X,"A COMPLETE LISTING OF THE CHANNELS WITH ",/2X,"CORRES    1750
     1PONDING WELL INFORMATION IS NOW CONTAINED IN ",/2X,"LOCAL FILE TAP   1760
     2E6, WHICH MAY BE ROUTED TO THE LINE PRINTER.")                      1770
350  FORMAT (/2X,"DO YOU WANT TEMPERATURES PRINTED OUT IN TABULAR"/2X,"    1780
     1FORM FOR EACH TIME SCAN? (Y/N)")                                    1790
360  FORMAT (/2X,"DO YOU WANT PRESSURES PRINTED OUT IN TABULAR"/2X,"FOR    1800
     1M FOR EACH TIME SCAN? (Y,N)")                                       1810
370  FORMAT (/2X,"ENTER STARTING TIME AND DATE AND ENDING DATE AS IN","    1820
     1 THIS EXAMPLE:"/"  HR:MN:SC,JUNO1,1981,AUG03,1982 "//2X,"FORMAT: 3   1830
     2(A2,1X),A3,I2,1X,I4,1X,A3,I2,1X,I4")                                1840
380  FORMAT (3(A2,1X),A3,I2,1X,I4,1X,A3,I2,1X,I4)                         1850
390  FORMAT (/2X,"IS THIS WHAT YOU WANT TO ENTER? (Y OR N)")              1860
400  FORMAT (/2X,"HOW MANY TEMPERATURE CHANNELS ARE THERE (TOTAL)? ")     1870
410  FORMAT (/2X,"HOW MANY PRESSURE CHANNELS ARE THERE ?")                1880
420  FORMAT (/2X,"HOW MANY TIME SCANS AFTER THE START OF THE TAPE",/" A    1890
     1RE REQUIRED TO INCLUDE THE DESIRED DATA? ")                         1900
430  FORMAT (/2X,"YOU WANT ",I5," TIME SCANS, RIGHT? (Y OR N)")           1910
440  FORMAT (16I5)                                                        1920
450  FORMAT (8F10.2)                                                      1930
460  FORMAT (/2X,"WOULD YOU LIKE A LISTING OF ALL THE POSSIBLE CHANNELS    1940
     1 WITH THEIR"/2X," CORRESPONDING FORMATIONS AND DEPTHS ? (Y OR N)")   1950
470  FORMAT (1H1///////10X,"DATA LOGGER",5X,"HOLE",5X,"DEPTH",5X,"GEOLO    1960
     1GIC"/10X,"CHANNEL NO.",5X,"NAME",5X,"FEET ",5X,"FORMATION"11X,"TYP   1970
     2E"/10X,11("-"),5X,4("-"),5X,5("-"),5X,9("-"),11X,4("-")/)           1980
480  FORMAT (10X,I5,11X,A8,1X,F5.1,5X,A10,8X,A10)                         1990
490  FORMAT (/2X,"NOW, DO YOU WISH TO SEE ALL OF THESE CHANNELS "/2X,"P    2000
     1LOTTED ? IF SO TYPE IN 'Y'; IF NOT, TYPE 'N'.")                     2010
500  FORMAT (/2X,"OK THEN. WHICH TEMPERATURE CHANNELS DO YOU WANT PLOTS    2020
     1"/2X," FOR ? ENTER EACH CHANNEL SEPARATELY ON A  SEPERATE LINE "/2   2030
     2X," ENDING WITH A FINAL ENTRY OF '999'."/2X,"IF NO TEMPERATURE CHA   2040
     3NNELS ARE DESIRED ENTER '999'.")                                    2050
510  FORMAT (/2X,"CHANNEL:")                                              2060
520  FORMAT (/2X,"CHANNEL",I5," RIGHT? Y/N")                              2070
530  FORMAT (/2X,"TRY AGAIN!")                                            2080
540  FORMAT (/2X,"OK THEN. WHICH PRESSURE CHANNELS DO YOU WANT PLOTS"/2    2090
     1X," FOR ? ENTER EACH CHANNEL SEPARATELY ON A  SEPERATE LINE "/2X,"   2100
     2 ENDING WITH A FINAL ENTRY OF '999'."/2X,"IF NO PRESSURE CHANNELS    2110
     3ARE DESIRED ENTER '999'.")                                          2120
550  FORMAT (/2X,"CHANNEL:")                                              2130
560  FORMAT (/2X,"CHANNEL",I5," RIGHT? Y/N")                              2140
570  FORMAT (/2X,"TRY AGAIN!")                                            2150
     END                                                                  2160
```

APPENDIX B.--Program USGSTAP

```
      PROGRAM USGSTAP (INPUT,OUTPUT,TAPE4,TAPE5=INPUT,TAPE6=OUTPUT,CALCO      10
     1M)                                                                      20
C     A PROGRAM TO PROCESS AQUIFER TEMPERATURE AND PRESSURE DATA              30
C     INTO TABULAR AND GRAPHICAL OUTPUT.                                      40
C     PROGRAMMED BY: JOHN B. CZARNECKI, USGS WRD ST.PAUL,MN                   50
C                                                                             60
      INTEGER PDUMMY,TDUMMY                                                   70
      DIMENSION PRES(23), TEMP(99), RADIUS(23), PINIT(23), PDUMMY(2), TD      80
     1UMMY(2), MONCHK(12), MDAYS(12)                                          90
      DIMENSION IC(100), KC(100), IPCHAN(23), WLEVEL(23), PTR(23)            100
      DIMENSION TITLE(5), FORM(92), HOLE(92), DEPTH(92), IBCD(5)             110
      COMMON /T1/ TBIG(20700)                                                120
      COMMON /T2/ PBIG(6900)                                                 130
      COMMON /T3/ TIMET(20700)                                               140
      COMMON /T4/ TIMEP(6900)                                                150
      DATA IBCD/"TIME (SEC)","TIME (MIN)","TIME (HRS)","TIME (DAY)","TIM     160
     1E (YRS)"/                                                              170
      DATA HOLE/10*"AM1",12*"AM2",12*"AM3",12*"AS1","A-WELL",2*"B-WELL",     180
     13*"BC1",5*"BS1",2*"CM1",10*"RESERVE ",2*"AM1",3*"AM2",3*"AM3",2*"A     190
     2S1",3*"AC1",3*"BC1",5*"BS1","A-WELL","B-WELL"/                         200
      DATA DEPTH/810.,788.,766.,744.,695.,670.,645.,630.,593.,575.,810.,     210
     1788.,766.,744.,720.,695.,670.,645.,630.,610.,593.,575.,810.,788.,7    220
     266.,744.,720.,695.,670.,645.,630.,610.,593.,575.,810.,788.,766.,74    230
     34.,720.,695.,670.,645.,630.,610.,593.,575.,800.,800.,800.,864.,789    240
     4.,749.,712.,633.,580.,553.,520.,740.,587.,10*0.,826.,580.,710.,695    250
     5.,627.,770.,695.,627.,904.,557.,904.,826.,772.,871.,789.,749.,712.    260
     6,633.,580.,553.,520.,800.,800./                                        270
      DATA FORM/"EAU CLAIRE","GALESVILLE",2*"IRONTON",4*"FRANCONIA",2*"S     280
     1T.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2*"    290
     2ST.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2*    300
     3"ST.LAWRENC","EAU CLAIRE","GALESVILLE",2*"IRONTON",6*"FRANCONIA",2    310
     4*"ST.LAWRENC",3*"PRODUCTION","MT. SIMON","EAU CLAIRE",2*"IRONTON",    320
     53*"FRANCONIA","JORDAN","IRONTON","FRANCONIA",10*"RESERVE ","EAU CL    330
     6AIRE","ST.LAWRENC","IRONTON",2*"FRANCONIA","IRONTON","FRANCONIA","    340
     7FRANCONIA","MT.SIMON","JORDAN","MT.SIMON","EAU CLAIRE","IRONTON","    350
     8MT.SIMON","EAU CLAIRE","IRONTON","IRONTON",2*"FRANCONIA","ST.LAWRE    360
     9NC","JORDAN",2*"PRODUCTION"/                                           370
C                                                                            380
      DATA MONCHK/"JAN","FEB","MAR","APR","MAY","JUN","JUL","AUG","SEP",     390
     1"OCT","NOV","DEC"/                                                     400
      DATA MDAYS/31,28,31,30,31,30,31,31,30,31,30,31/                        410
      DATA RADIUS/30.,30.,45.,46.9,46.9,56.2,54.2,52.5,34.8,28.7,3*10.,8     420
     1*800.,2*1000./                                                         430
      DATA IPCHAN/120,121,122,123,124,125,126,127,128,129,130,131,132,13     440
     13,134,135,136,137,138,139,140,141,142/                                 450
C      WATER LEVELS AT TIME OF PRESSURE TRANSDUCER INSTALLATION:             460
      DATA WLEVEL/214.95,176.34,187.21,185.11,181.96,178.98,186.87,-127.     470
     10,260.24,178.5,-130.,-131,-132,-133,-134,143.59,-136,-137,-138,-13     480
     29,-140,68.72,-142/                                                     490
C                                                                            500
C      PRESSURE TRANSDUCER PRESSURES AT TIME OF INSTALLATION:                510
      DATA PTR/25.02,24.983,24.88,26.017,26.086,25.998,23.77,127.,25.81,     520
     125.46,130.,131.,132.,133.,134.,96.70,136.,137.,138.,139.,140.,176.     530
     237,142./                                                               540
C                                                                            550
C     ************************************************************           560
C     READ DATE OF INTEREST FROM UNIT 5 (INPUT FILE):                        570
      READ (5,380) IHRS1,IMIN1,ISEC1,MONTH1,IDAY1,IYEAR1,MONTH2,IDAY2,IY     580
     1EAR2                                                                   590
      WRITE (6,440)                                                          600
      WRITE (6,390) IHRS1,IMIN1,ISEC1,MONTH1,IDAY1,IYEAR1,MONTH2,IDAY2,I     610
     1YEAR2                                                                  620
C      CONVERT DATE TO THE DAY OF THE YEAR                                   630
      CALL CONVRT (MONTH1,IDAY1,NDAYS1,IYEAR1)                               640
      CALL CONVRT (MONTH2,IDAY2,NDAYS2,IYEAR2)                               650
C                                                                            660
C     READ IN THE FOLLOWING PARAMETERS ON UNIT 5:                            670
C                                                                            680
C     NTC = NO. OF TEMPERATURE CHANNELS ON DATA LOGGER                       690
C     NPC = NO. OF PRESSURE CHANNELS                                         700
C     NT  = NO. OF TIME INTERVALS (MAXIMUM) ON TAPE                          710
```

```
C     IDRAW =-1, PLOT WATER LEVELS VS. TIME (SEMILOG OR CARTESIAN)                720
C           = 0, PLOT PRESSURE VS. LOG TIME (SEMILOG OR CARTESIAN)                730
C           = 1, PLOT LOG DRAWDOWN VS. LOG TIME/RADIUS**2                         740
C           = 2, PLOT LOG DRAWDOWN VS. LOG 1/TIME                                 750
C           = 3, PLOT DRAWDOWN VS. LOG TIME (SEMILOG OR CARTESIAN)                760
C     IWT = 1, PRINT OUT TEMPERATURE VALUES                                       770
C     IWT = 0, DO NOT PRINT OUT TEMPERATURE VALUES                                780
C     IWP = 1, PRINT OUT PRESSURE VALUES                                          790
C     IWP = 0, DO NOT PRINT OUT PRESSURE VALUES                                   800
C     ILOGAX = 1, LOGARITHMIC TIME AXIS IS USED IN TEMPERATURE AND                810
C                 PRESSURE PLOTS (UP TO 1E9 SECONDS)                            820
C            = 0, LINEAR TIME AXIS IS USED IN TEMPERATURE AND PRESSURE          830
C                 PLOTS (UP TO 9E4 SECONDS, I.E. ONE DAY)                       840
C     ITITLE = 1, READ A TITLE AS THE FIRST RECORD OF DATA FOR EACH SCAN          850
C            = 0, NO TITLE READ.                                                  860
C     ITH = NO. OF SCANS TO SKIP BETWEEN EACH READ.                               870
C          (I.E. ITH = 5 WILL PRODUCE EVERY FIFTH SCAN)                           880
C     ITIME = 1 (DEFAULT) TIME PLOTTED IN SECONDS                                 890
C           = 2, TIME CONVERTED TO MINUTES                                        900
C           = 3, TIME CONVERTED TO HOURS                                          910
C           = 4, TIME CONVERTED TO DAYS                                           920
C           = 5, TIME CONVERTED TO YEARS                                          930
C      IAX = 1 READ IN TIME AXIS LENGTH                                           940
C          = 0 DO NOT READ AXIS LENGTH. DEFAULT = 10. INCHES.                     950
C                                                                                 960
      READ (5,470) NTC,NPC,NT,IDRAW,IWT,IWP,ILOGAX,ITITLE,ITH,ITIME,IAX          970
      WRITE (6,400) NTC,NPC,NT,IDRAW,IWT,IWP,ILOGAX,ITITLE,ITH,IBCD(ITIM         980
     1E),IAX                                                                     990
      IF (IAX.NE.0) READ (5,410) AXLENG                                         1000
C      SET DEFAULT TIME AXIS LENGTH:                                            1010
      IF (IAX.EQ.0) AXLENG=10.                                                  1020
      WRITE (6,310) AXLENG                                                      1030
C      SET DEFAULT TIME CONVERSION TO SECONDS:                                  1040
      IF (ITIME.EQ.0) ITIME=1                                                   1050
C                                                                               1060
      IF (IDRAW.LE.0) GO TO 40                                                  1070
      DO 20 IR=1,NPC                                                            1080
 20   PINIT(IR)=1.0                                                             1090
C                                                                               1100
C     READ THE INITIAL PRESSURES AT THE OBSERVATION WELLS:                      1110
C     (CONDITIONAL READ, IF IDRAW > 0)                                          1120
      WRITE (6,320)                                                             1130
      DO 30 IR=1,NPC                                                            1140
      READ (5,410) PINIT(IR)                                                    1150
      WRITE (6,330) IR,IPCHAN(IR),RADIUS(IR),PINIT(IR)                          1160
 30   CONTINUE                                                                  1170
 40   CONTINUE                                                                  1180
C                                                                               1190
C                                                                               1200
      IF (ITH.LE.0) ITH=1                                                       1210
      ITHT=ITH                                                                  1220
      IF (ITH.EQ.1) ITHT=1                                                      1230
      KOUNT=0                                                                   1240
      NSEC=0                                                                    1250
      KOUNP=0                                                                   1260
      ISCAN=0                                                                   1270
C     NTAPE = UNIT NO. ASSIGNED TO MAGNETIC TAPE CONTAINING DATA                1280
      NTAPE=4                                                                   1290
      NTCNTP=NTC+NPC                                                            1300
C     NORMALIZATION TIME FACTOR, NSEC1:                                         1310
      NSEC1=3600*IHRS1+60*IMIN1+ISEC1                                           1320
C                                                                               1330
C     START SEARCH                                                              1340
      DO 230 I=1,NT                                                             1350
      IF (ITITLE.EQ.1) READ (4,420) TITLE                                       1360
C                                                                               1370
      READ(4,365,END=7)IHRS,IMIN,ISEC,MONTH,IDAY,IYEAR                          1380
      NSEC=3600*IHRS+60*IMIN+ISEC                                               1390
C     CONVERT MONTH TO A NUMBER:                                                1400
      CALL CONVRT (MONTH,IDAY,NDAY,IYEAR)                                       1410
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C     CHECK TO SEE IF DATE FALLS IN RIGHT RANGE                                 1420
      IF (IYEAR1.LT.1981.OR.IYEAR1.GT.1988) STOP 1                              1430
      IF (IYEAR.LT.IYEAR1) GO TO 210                                            1440
      IF (NDAY.LT.NDAYS1) GO TO 210                                             1450
      IF (NSEC.LT.NSEC1.AND.NDAY.EQ.NDAYS1) GO TO 210                           1460
      IF (NDAY.GT.NDAYS2.AND.I.EQ.1) WRITE (6,300)                              1470
      IF (NDAY.GT.NDAYS2.AND.I.EQ.1) GO TO 290                                  1480
      IF (NDAY.LE.NDAYS2) GO TO 50                                              1490
      GO TO 240                                                                 1500
 7    WRITE (6,415)                                                             1510
      IF (NDAY.LT.NDAYS1) WRITE (6,300)                                         1520
      IF (NDAY.LT.NDAYS1) GO TO 290                                             1530
      GO TO 240                                                                 1540
C     READ TEMPERATURE DATA FROM CHANNELS 001 TO 059                            1550
 50   CONTINUE                                                                  1560
      ISCAN=ISCAN+1                                                             1570
      TIME=NSEC-NSEC1+(NDAY-NDAYS1)*86400                                       1580
      TIMET2=TIME                                                               1590
      IF (TIME.LE.0.) TIME=1.                                                   1600
      IF (NTC.LE.0) GO TO 110                                                   1610
      DO 100 J=1,NTC                                                            1620
      READ (4,450) IC(J),TDUMMY,UNITS                                           1630
      IF (TDUMMY(1).NE.1OH OVERRANGE.AND.TDUMMY(1).NE.1OH  OVERRANG) GO         1640
     1TO 60                                                                     1650
      TEMP(J)=1.999                                                             1660
      GO TO 70                                                                  1670
 60   CONTINUE                                                                  1680
      DECODE (20,460,TDUMMY) TEMP(J)                                            1690
 70   CONTINUE                                                                  1700
      IF (ISCAN.LT.25) GO TO 80                                                 1710
      IF (MOD(I,ITHT).NE.0) GO TO 90                                            1720
 80   KOUNT=KOUNT+1                                                             1730
      TIMET1=TIME                                                               1740
      IF (ITIME.EQ.4) TIMET1=TIME/86400.                                        1750
      IF (ITIME.EQ.5) TIMET1=TIME/(365.*86400.)                                 1760
      IF (ITIME.EQ.3) TIMET1=TIME/3600.                                         1770
      IF (ITIME.EQ.2) TIMET1=TIME/60.                                           1780
      TIMET(KOUNT)=TIMET1                                                       1790
      TBIG(KOUNT)=TEMP(J)                                                       1800
 90   CONTINUE                                                                  1810
 100  CONTINUE                                                                  1820
 110  CONTINUE                                                                  1830
C                                                                              1840
C     READ PRESSURE DATA                                                        1850
      IF (NPC.LE.0) GO TO 170                                                   1860
      DO 160 J=1,NPC                                                            1870
      READ (4,450) KC(J),PDUMMY,UNITS                                           1880
      IF (PDUMMY(1).NE.1OH OVERRANGE.AND.PDUMMY(1).NE.1OH  OVERRANG) GO         1890
     1TO 120                                                                    1900
      PRES(J)=1.999                                                             1910
      GO TO 130                                                                 1920
 120  CONTINUE                                                                  1930
      DECODE (20,460,PDUMMY) PRES(J)                                            1940
 130  CONTINUE                                                                  1950
      IF (ISCAN.LT.25) GO TO 140                                                1960
      IF (MOD(I,ITH).NE.0) GO TO 150                                            1970
 140  KOUNP=KOUNP+1                                                             1980
      IF (IDRAW.EQ.1) TIMET2=TIME/RADIUS(J)**2./86400.                          1990
      IF (TIME.LE.0) TIMET2=1E-10                                               2000
      IF (IDRAW.EQ.2) TIMET2=1./(TIME/86400.)                                   2010
      IF (IDRAW.EQ.2.AND.TIMET2.LT.1.) TIMET2=1.                                2020
      IF (ITIME.EQ.4) TIMET2=TIME/86400.                                        2030
      IF (ITIME.EQ.5) TIMET2=TIME/(365.*86400.)                                 2040
      IF (ITIME.EQ.3) TIMET2=TIME/3600.                                         2050
      IF (ITIME.EQ.2) TIMET2=TIME/60.                                           2060
      TIMEP(KOUNP)=TIMET2                                                       2070
      PBIG(KOUNP)=PRES(J)                                                       2080
      IF (IDRAW.EQ.-1) PBIG(KOUNP)=WLEVEL(J)-(PRES(J)-PTR(J))*2.3               2090
      IF (IDRAW.EQ.-1) PRES(J)=PBIG(KOUNP)                                      2100
      IF (IDRAW.GT.0) PBIG(KOUNP)=ABS(PINIT(J)-PBIG(KOUNP))*2.3                 2110
      IF (IDRAW.GT.0.AND.PBIG(KOUNP).LT.0.1) PBIG(KOUNP)=0.11                   2120
      IF (IDRAW.EQ.2.AND.PBIG(KOUNP).GT.60.) PBIG(KOUNP)=60.                    2130
      IF (IDRAW.EQ.2.AND.PBIG(KOUNP).LT.1.) PBIG(KOUNP)=1.                      2140
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  150  CONTINUE                                                              2150
  160  CONTINUE                                                              2160
  170  CONTINUE                                                              2170
C                                                                           2180
C                                                                           2190
C     WRITE TIME AND DATE                                                   2200
      IF (IWT.EQ.0.AND.IWP.EQ.0) GO TO 230                                  2210
      IF (MOD(I,ITH).NE.0) GO TO 230                                        2220
      WRITE (6,480) IHRS,IMIN,ISEC,MONTH,IDAY,IYEAR                         2230
      WRITE (6,490) NDAY                                                    2240
      WRITE (6,500) TIMET1,TIMET2                                           2250
C     WRITE CHANNEL HEADER                                                  2260
      IF (IDRAW.GE.0) WRITE (6,530)                                         2270
      IF (IDRAW.EQ.-1) WRITE (6,540)                                        2280
C     WRITE TEMPERATURE DATA                                                2290
      IF (NTC.EQ.0.OR.IWT.EQ.0) GO TO 190                                   2300
      DO 180 J=1,NTC                                                        2310
      JC=IC(J)                                                              2320
      IF (IC(J).GE.100) JC=IC(J)-50                                         2330
      WRITE (6,550) IC(J),HOLE(JC),DEPTH(JC),FORM(JC),TEMP(J)               2340
  180 IF (TEMP(J).LE.3..OR.TEMP(J).GT.200.) WRITE (6,510)                   2350
  190 CONTINUE                                                              2360
C                                                                           2370
C     WRITE PRESSURE DATA                                                   2380
      IF (NPC.EQ.0.OR.IWP.EQ.0) GO TO 230                                   2390
      DO 200 IJ=1,NPC                                                       2400
      IJC=KC(IJ)                                                            2410
      IF (KC(IJ).GE.100) IJC=KC(IJ)-50                                      2420
      WRITE (6,560) KC(IJ),HOLE(IJC),DEPTH(IJC),FORM(IJC),PRES(IJ)          2430
      IF (IDRAW.GE.0.AND.PRES(IJ).LE.3..OR.PRES(IJ).GT.500.AND.IDRAW.GE.    2440
     10) WRITE (6,520)                                                      2450
  200 CONTINUE                                                              2460
      GO TO 230                                                             2470
  210 CONTINUE                                                              2480
C     DUMMY READ USED WHEN TIME DOES NOT CORRESPOND TO DESIRED INTERVAL     2490
      DO 220 IDUM=1,NTCNTP                                                  2500
      READ (4,450) IDUM1,DUM2,DUM3,DUM4                                     2510
  220 CONTINUE                                                              2520
C                                                                           2530
  230 CONTINUE                                                              2540
  240 CONTINUE                                                              2550
C                                                                           2560
      DAY1=IDAY1                                                            2570
      YEAR1=IYEAR1                                                          2580
      HRS1=IHRS1                                                            2590
      RMIN1=IMIN1                                                           2600
      NPPTS=KOUNP+2+NPC                                                     2610
      NTPTS=KOUNT+2+NTC                                                     2620
      WRITE (6,570)                                                         2630
      IF (NTC.EQ.0) GO TO 260                                               2640
C     THIS LOOP PLOTS ALL THE CHANNEL DATA                                  2650
C     CHANNEL DATA IS ENTERED IN THE FOLLOWING SEQUENCE:                    2660
C     1) TEMPERATURE CHANNELS 1-69;                                         2670
C     2) '999' TO END TEMPERATURE CHANNEL INPUT;                            2680
C     3) PRESSURE CHANNELS STARTING WITH AT LEAST 69 + 1;                   2690
C     4) '999' TO END PRESSURE CHANNEL INPUT.                               2700
C                                                                           2710
      READ (5,470) IPLOT                                                    2720
      WRITE (6,340) IPLOT                                                   2730
      DO 250 II=1,NTC                                                       2740
C     CHANNELS ARE READ IN FROM FILE ASSIGNED TO UNIT 5.                    2750
      IF (IPLOT.EQ.888) I=II                                                2760
      IF (IPLOT.NE.888) I=IPLOT                                             2770
      IF (IPLOT.NE.888.AND.IPLOT.GT.100) I=IPLOT-50                         2780
      IF (IPLOT.EQ.999) GO TO 270                                           2790
      IT=IC(I)                                                              2800
      IF (IT.GE.100) IT=IT-50                                               2810
      CHANL=IC(I)                                                           2820
      WRITE (6,360) IC(I)                                                   2830
      CALL SKETCH (TIMET(I),TBIG(I),NTPTS,MONTH1,DAY1,YEAR1,HOLE(IT),FOR    2840
     1M(IT),DEPTH(IT),NTC,0,HRS1,RMIN1,1,ILOGAX,CHANL,ITIME,AXLENG)         2850
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C                                                                       2860
      IF (IPLOT.NE.888) READ (5,470) IPLOT                              2870
      WRITE (6,340) IPLOT                                               2880
  250 CONTINUE                                                          2890
  260 CONTINUE                                                          2900
  270 CONTINUE                                                          2910
      IF (NPC.EQ.0) GO TO 290                                           2920
C     READ IN PRESSURE CHANNELS TO BE PLOTTED                           2930
      READ (5,470) IPLOT                                                2940
C                                                                       2950
      DO 280 IP=1,NPC                                                   2960
      IF (IPLOT.EQ.999) GO TO 290                                       2970
      WRITE (6,340) IPLOT                                               2980
      IF (IPLOT.EQ.888) I=IP                                            2990
      IF (IPLOT.GE.50.AND.IPLOT.LE.99) IPLOT=IPLOT+50                   3000
      IF (IPLOT.NE.888) I=IPLOT-NTC                                     3010
      IF (IPLOT.GE.100.AND.IPLOT.NE.888) I=IPLOT-NTC-50                 3020
      WRITE (6,350) I                                                   3030
      WRITE (6,370) KC(I)                                               3040
      IT2=KC(I)                                                         3050
      IF (IT2.GE.100) IT2=IT2-50                                        3060
      CHANL=KC(I)                                                       3070
      CALL SKETCH (TIMEP(I),PBIG(I),NPPTS,MONTH1,DAY1,YEAR1,HOLE(IT2),FO 3080
     1RM(IT2),DEPTH(IT2),NPC,IDRAW,HRS1,RMIN1,0,ILOGAX,CHANL,ITIME,AXLEN 3090
     2G)                                                                3100
      IF (IPLOT.NE.888) READ (5,470) IPLOT                              3110
  280 CONTINUE                                                          3120
  290 CONTINUE                                                          3130
      WRITE (6,430)                                                     3140
C                                                                       3150
      STOP 2                                                            3160
C                                                                       3170
C                                                                       3180
  365 FORMAT (I2,1X,I2,1X,I2,1X,A3,I2,1X,I4,5X)                         3190
C                                                                       3200
C                                                                       3210
  415  FORMAT (/10X,"END OF DATA ENCOUNTERED"/10X,23(1H*)/)              3220
C                                                                       3230
  300 FORMAT (/10X,"NO SCANS WERE FOUND THAT MATCHED DESIRED TIME"," INT 3240
     1ERVAL."/)                                                         3250
  310 FORMAT (/10X,"THE LENGTH OF THE TIME AXIS IS:",F10.1//)           3260
  320 FORMAT (/10X,"WELL",5X,"CHANNEL",5X,"RADIAL DISTANCE",5X,"INITIAL 3270
     1PRESSURE"/10X,4("-"),5X,7("-"),5X,15("-"),5X,16("-")/)            3280
  330 FORMAT (10X,I3,7X,I3,10X,F8.2,10X,F8.2)                           3290
  340 FORMAT (/10X,"IPLOT = ",I5)                                       3300
  350 FORMAT (/10X,"I = ",I3)                                           3310
  360 FORMAT (10X,"CHANNEL",I4,2X,"PLOTTED FOR TEMPERATURE.")           3320
  370 FORMAT (10X,"CHANNEL",I4,2X,"PLOTTED FOR PRESSURE.")              3330
  380 FORMAT (3(I2,1X),A3,I2,1X,I4,1X,A3,I2,1X,I4)                      3340
  390 FORMAT (10X,I2,":",I2,":",I2,2X,A3,1X,I2,",",1X,I4,1X,A3,1X,I2,"," 3350
     1,1X,I4)                                                           3360
  400 FORMAT (/10X,"THE NUMBER OF TEMPERATURE CHANNELS IS: ",I5/10X,"THE 3370
     1 NUMBER OF PRESSURE CHANNELS IS: ",I5/10X,"THE NUMBER OF CHANNEL S 3380
     2CANS (TIME STEPS) IS: ",I5/10X,"THE CODE FOR PLOTTING DRAWDOWN IS: 3390
     3 ",I3/10X,"THE CODE FOR PRINTING TEMPERATURE IS:",I3/10X,"THE CODE 3400
     4 FOR PRINTING PRESSURES IS:",I3/10X,"THE CODE FOR PLOTTING   WITH  3410
     5 LOGARITHMIC X-AXIS IS:",I3/10X,"THE CODE FOR READING A TITLE AS", 3420
     6" THE FIRST LINE OF DATA IS:",I3/10X,"ITH (SCAN INCREMENT =",I5/10 3430
     7X,"TIME IS DENOTED AS ",A10//10X,"CODE FOR CHANGING TIME-AXIS LENG 3440
     8TH:",I2///)                                                       3450
  410 FORMAT (8F10.4)                                                   3460
  420 FORMAT (5A5)                                                      3470
  430 FORMAT ("1"/10X,"THIS RUN IS FINISHED"/10X,20(1H*))               3480
  440 FORMAT ("1"/10X,"ATES PRESSURE AND TEMPERATURE DATA"/10X,34(1H*)/) 3490
  450 FORMAT (I3,A10,A2,1X,A5)                                          3500
  460 FORMAT (F12.4)                                                    3510
  470 FORMAT (16I5)                                                     3520
  480 FORMAT ("1"/10X,"TIME",10X,"DATE"/10X,4("-"),10X,4("-")/10X,2(I2," 3530
     1:"),I2,5X,A3,I2,",  ",I4/)                                      3540
  490 FORMAT (/10X,"NO. OF DAYS SINCE JAN. 1, 1982: ",I5)               3550
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  500  FORMAT (10X,"ACCUMULATED TIME =",E13.7/10X,"TIME USED IN PRESSURE      3560
     1(OR DRAWDOWN) PLOT =",E13.7/)                                          3570
  510  FORMAT (10X,10(1H*)," WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS.     3580
     1"," CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.")                    3590
  520  FORMAT (10X,10(1H*),"WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.","     3600
     1CHECK DATA LOGGER OR PRESSURE TRANSDUCER.")                            3610
  530  FORMAT (10X,"DATA LOGGER",5X,"HOLE",5X,"DEPTH",5X,"GEOLOGIC",10X,"     3620
     1TEMPERATURE",5X,"PRESSURE"/10X,"CHANNEL NO.",5X,"NAME",5X,"FEET ",     3630
     25X,"FORMATION",9X,"(CELSIUS)  ",5X,"(PSI)  "/10X,11("-"),5X,4("-")     3640
     3,5X,5("-"),5X,9("-"),9X,11("-"),5X,8("-")/)                            3650
  540  FORMAT (10X,"DATA LOGGER",5X,"HOLE",5X,"DEPTH",5X,"GEOLOGIC",10X,"     3660
     1TEMPERATURE",5X,"WATER LEVEL"/10X,"CHANNEL NO.",5X,"NAME",5X,"FEET     3670
     2 ",5X,"FORMATION",9X,"(CELSIUS)  ",5X,"(FEET) "/10X,11("-"),5X,4("     3680
     3-"),5X,5("-"),5X,9("-"),9X,11("-"),5X,11("-")/)                        3690
  550  FORMAT (10X,I5,11X,A8,1X,F5.1,5X,A10,8X,F7.2,9X,"   --   ")           3700
  560  FORMAT (10X,I5,11X,A8,1X,F5.1,5X,A10,8X,"   ---   ",5X,F8.3)         3710
  570  FORMAT ("1")                                                          3720
       END                                                                   3730
       SUBROUTINE SKETCH (XARRAY,YARRAY,NPTS,MONTH,DAY,YEAR,WELL,FORM,DEP SK   10
     1TH,INC,IDRAW,HRS,RMIN,ITYPE,ILOGAX,CHANL,ITIME,AXLEN)               SK   20
       DIMENSION IBCD(5), TIMLDV(5), TIMLFV(5), TIMEDV(5)                 SK   30
       DIMENSION XARRAY(NPTS), YARRAY(NPTS)                               SK   40
       DATA IBCD/"TIME (SEC)","TIME (MIN)","TIME (HRS)","TIME (DAY)","TIM SK   50
     1E (YRS)"/                                                           SK   60
       DATA TIMLFV/1.,0.1,0.01,0.001,0.0001/                              SK   70
       DATA TIMEDV/10000.,120.,10.,10.,0.25/                              SK   80
       DATA TIMLDV/1.,0.2991,0.5,0.5,0.5/                                 SK   90
       WRITE (6,160) XARRAY(1)                                            SK  100
       MPTS=(NPTS-2-INC)/INC                                              SK  110
       MPTSFV=MPTS*INC+1                                                  SK  120
       MPTSDV=MPTS*INC+INC+1                                              SK  130
C       FOR ITYPE = 1, PLOT TEMPERATURE;                                  SK  140
C                 = 0, PLOT PRESSURE;                                     SK  150
C       FOR IDRAW = 1, PLOT DRAWDOWN;                                     SK  160
C      INITIALIZE PLOT                                                    SK  170
       CALL PLOTS (6HEQUIPT,.01,14.)                                      SK  180
       CALL PLOTS (1,2,12HAQUIFER PLOT,24.0,7HAQUIFER)                    SK  190
       CALL PLOTS (6HNOCHEK)                                              SK  200
C      MOVE PEN AWAY FROM INITIAL ORIGIN AND SET NEW REFERENCE ORIGIN TO   SK  210
       CALL PLOT (1.0,0.0,-3)                                             SK  220
       IF (IDRAW.EQ.0.OR.ITYPE.EQ.1) GO TO 60                             SK  230
       IF (IDRAW.EQ.-1) GO TO 20                                          SK  240
       GO TO (30,40,50), IDRAW                                            SK  250
C      PLOT THE X-AXIS                                                    SK  260
C      PUT SCALING FACTORS INTO THE XARRAY AND YARRAY:                    SK  270
C      NOTE: THESE ARE THE SAME SCALING FACTORS AS THOSE USED IN AXIS     SK  280
C            AND LGAXS.                                                  SK  290
  20   CONTINUE                                                           SK  300
C       PLOT WATER LEVELS AXES                                            SK  310
       YARRAY(MPTSFV)=100.                                                SK  320
       YARRAY(MPTSDV)=25.                                                 SK  330
       CALL AXIS (0.,0.,37HWATER LEVEL (FEET BELOW LAND SURFACE),37,6.5,9 SK  340
     10.,100.,25.)                                                        SK  350
       GO TO 60                                                           SK  360
  30   XARRAY(MPTSFV)=1.E-10                                              SK  370
       XARRAY(MPTSDV)=0.5423728814                                        SK  380
       YARRAY(MPTSFV)=0.1                                                 SK  390
       YARRAY(MPTSDV)=0.5423728814                                        SK  400
       CALL LGAXS (0.,0.,28HT/R**2 (DAY PER SQUARE FOOT),-28,12.90625,0., SK  410
     11.E-10,.5423728814)                                                 SK  420
C      PLOT Y-AXIS                                                        SK  430
       CALL LGAXS (0.,0.,20HDRAWDOWN (S) IN FEET,20,7.375,90.,.1,0.542372 SK  440
     18814)                                                               SK  450
       GO TO 130                                                          SK  460
  40   CONTINUE                                                           SK  470
       XARRAY(MPTSFV)=1.                                                  SK  480
       XARRAY(MPTSDV)=0.2                                                 SK  490
       YARRAY(MPTSFV)=1.                                                  SK  500
       YARRAY(MPTSDV)=0.2                                                 SK  510
       CALL LGAXS (0.,0.,18H1/T (INVERSE DAYS),-18,20.,0.,1.,0.2)         SK  520
       CALL LGAXS (0.,0.,20HDRAWDOWN (S) IN FEET,20,10.,90.,1.,0.2)       SK  530
       GO TO 130                                                          SK  540
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 50   CONTINUE                                                          SK  550
C     PLOT NORMAL AXIS DRAWDOWN                                         SK  560
      YARRAY(MPTSFV)=0.0                                                SK  570
      YARRAY(MPTSDV)=10.                                                SK  580
      CALL AXIS (0.,0.,20HDRAWDOWN (S) IN FEET,20,6.5,90.,0.,10.)       SK  590
 60   CONTINUE                                                          SK  600
C     X - AXIS DESIGNATION                                              SK  610
      IF (ILOGAX.NE.1) GO TO 70                                         SK  620
      CALL LGAXS (0.,0.,IBCD(ITIME),-10,AXLEN,0.,TIMLFV(ITIME),TIMLDV(IT SK  630
     1IME))                                                             SK  640
      XARRAY(MPTSFV)=TIMLFV(ITIME)                                      SK  650
      XARRAY(MPTSDV)=TIMLDV(ITIME)                                      SK  660
      GO TO 80                                                          SK  670
 70   CALL AXIS (0.,0.,IBCD(ITIME),-10,AXLEN,0.,0.,TIMEDV(ITIME))      SK  680
      XARRAY(MPTSFV)=0.                                                 SK  690
      XARRAY(MPTSDV)=TIMEDV(ITIME)                                      SK  700
 80   IF (IDRAW.GT.0.AND.ILOGAX.EQ.1) GO TO 130                         SK  710
      IF (IDRAW.GT.0.AND.ILOGAX.NE.1) GO TO 100                         SK  720
      IF (ITYPE.EQ.0.AND.IDRAW.EQ.0) CALL AXIS (0.,0.,14HPRESSURE (PSI), SK  730
     114,6.5,90.,0.,30.)                                                SK  740
      IF (ITYPE.EQ.1) CALL AXIS (0.0,0.,15HTEMPERATURE (C),15,6.5,90.,0. SK  750
     1,25.)                                                             SK  760
C     SCALE DATA BY AXIS LENGTH                                         SK  770
C     PLOT DATA:                                                        SK  780
C     PUT SCALING FACTORS INTO XARRAY,YARRAY                            SK  790
      IF (IDRAW.EQ.-1) GO TO 90                                         SK  800
      YARRAY(MPTSFV)=0.                                                 SK  810
      IF (ITYPE.EQ.0) YARRAY(MPTSDV)=30.                                SK  820
      IF (ITYPE.EQ.1) YARRAY(MPTSDV)=25.                                SK  830
 90   IF (ILOGAX.EQ.1) CALL LGLIN (XARRAY,YARRAY,MPTS,INC,0,11,-1)      SK  840
 100  IF (ILOGAX.NE.1) CALL LINE (XARRAY,YARRAY,MPTS,INC,0,11)          SK  850
C     LABEL PLOT                                                        SK  860
      IF (ILOGAX.NE.1.OR.IDRAW.NE.0) GO TO 110                          SK  870
      IF (ITYPE.EQ.0) CALL SYMBOL (.5,7.5,.1,26HATES PRESSURE VS. LOG TI SK  880
     1ME,0.,26)                                                         SK  890
      IF (ITYPE.EQ.1) CALL SYMBOL (.5,7.5,.1,29HATES TEMPERATURE VS. LOG SK  900
     1 TIME,0.,29)                                                      SK  910
 110  CONTINUE                                                          SK  920
      IF (ILOGAX.EQ.1) GO TO 120                                        SK  930
      IF (ITYPE.EQ.0) CALL SYMBOL (.5,7.5,.1,22HATES PRESSURE VS. TIME,0 SK  940
     1.,22)                                                             SK  950
      IF (ITYPE.EQ.1) CALL SYMBOL (.5,7.5,.1,25HATES TEMPERATURE VS. TIM SK  960
     1E,0.,25)                                                          SK  970
 120  CONTINUE                                                          SK  980
      CALL SYMBOL (.5,7.0,.1,5HWELL:,0.,5)                              SK  990
      CALL SYMBOL (2.5,7.,.1,10HFORMATION:,0.,10)                       SK 1000
      CALL SYMBOL (4.5,7.0,.1,13HDEPTH (FEET):,0.,13)                   SK 1010
      CALL SYMBOL (.5,6.950,.1,5H_____,0.,5)                            SK 1020
      CALL SYMBOL (2.5,6.95,.1,10H__________,0.,10)                     SK 1030
      CALL SYMBOL (4.5,6.95,.1,13H_____________,0.,13)                  SK 1040
      CALL SYMBOL (.5,6.8,.1,WELL,0.,10)                                SK 1050
      CALL SYMBOL (2.5,6.8,.1,FORM,0.,10)                               SK 1060
      CALL NUMBER (4.5,6.8,.1,DEPTH,0.,1)                               SK 1070
      CALL SYMBOL (6.5,7.0,.10,12HCHANNEL NO.:,0.,12)                   SK 1080
      CALL SYMBOL (6.5,6.95,.1,12H____________,0.,12)                   SK 1090
      CALL NUMBER (6.5,6.8,.10,CHANL,-1)                                SK 1100
      GO TO 140                                                         SK 1110
C     SCALE DATA BY AXIS LENGTH:                                        SK 1120
 130  CONTINUE                                                          SK 1130
C     PLOT THE DATA                                                     SK 1140
      LTYPE=0                                                           SK 1150
      IF (IDRAW.EQ.3) LTYPE=-1                                          SK 1160
      CALL LGLIN (XARRAY,YARRAY,MPTS,INC,0,0,LTYPE)                     SK 1170
C     LABEL THIS PLOT:                                                  SK 1180
      CALL SYMBOL (0.5,11.8,.10,5HWELL:,0.,5)                           SK 1190
      CALL SYMBOL (3.5,11.8,.10,10HFORMATION:,0.,10)                    SK 1200
      CALL SYMBOL (6.5,11.8,.10,13HDEPTH (FEET):,0.,13)                 SK 1210
      CALL SYMBOL (0.5,11.5,.10,WELL,0.,10)                             SK 1220
      CALL SYMBOL (3.5,11.5,.10,FORM,0.,10)                             SK 1230
      CALL NUMBER (6.5,11.5,.10,DEPTH,0.,1)                             SK 1240
```

```
      CALL SYMBOL (8.5,11.8,.10,12HCHANNEL NO.:,0.,12)                  SK 1250
      CALL NUMBER (8.5,11.5,.10,CHANL,-1)                               SK 1260
      CALL SYMBOL (0.5,11.20,.1,14HSTARTING DATE:,0.,14)                SK 1270
      CALL SYMBOL (2.0,11.20,.1,MONTH,0.,5)                             SK 1280
      CALL NUMBER (2.50,11.20,.1,DAY,0.,-1)                             SK 1290
      CALL SYMBOL (2.7,11.2,.1,1H,,0.,1)                                SK 1300
      CALL NUMBER (2.80,11.2,.1,YEAR,0.,-1)                             SK 1310
      CALL SYMBOL (3.4,11.2,.1,4H AT ,0.,4)                             SK 1320
      CALL NUMBER (3.8,11.20,.1,HRS,0.,-1)                              SK 1330
      CALL SYMBOL (4.0,11.20,.1,1H:,0.,1)                               SK 1340
      CALL NUMBER (4.1,11.20,.1,RMIN,0.,-1)                             SK 1350
      GO TO 150                                                         SK 1360
C                                                                       SK 1370
 140  CONTINUE                                                          SK 1380
      CALL SYMBOL (0.5,7.30,.1,14HSTARTING DATE:,0.,14)                 SK 1390
      CALL SYMBOL (2.0,7.30,.1,MONTH,0.,5)                              SK 1400
      CALL NUMBER (2.50,7.30,.1,DAY,0.,-1)                              SK 1410
      CALL SYMBOL (2.7,7.3,.1,1H,,0.,1)                                 SK 1420
      CALL NUMBER (2.80,7.3,.1,YEAR,0.,-1)                              SK 1430
      CALL SYMBOL (3.4,7.3,.1,4H AT ,0.,4)                              SK 1440
      CALL NUMBER (3.8,7.30,.1,HRS,0.,-1)                               SK 1450
      CALL SYMBOL (4.0,7.30,.1,1H:,0.,1)                                SK 1460
      CALL NUMBER (4.1,7.30,.1,RMIN,0.,-1)                              SK 1470
C     END PLOTTING                                                      SK 1480
 150  CONTINUE                                                          SK 1490
C                                                                       SK 1500
      CALL PLOTS (-1)                                                   SK 1510
      RETURN                                                            SK 1520
C                                                                       SK 1530
C                                                                       SK 1540
C                                                                       SK 1550
 160  FORMAT (/10X,"STARTING TIME OF PLOT:",E12.5)                      SK 1560
      END                                                               SK 1570
      SUBROUTINE CONVRT (MONTH,IDAY,NDAYS,IYEAR)                        CV   10
      DIMENSION MONCHK(12), MDAYS(12), IYRCHK(8), IYDAYS(8)             CV   20
      DATA IYRCHK/1981,1982,1983,1984,1985,1986,1987,1988/              CV   30
      DATA IYDAYS/365,365,365,366,365,365,365,366/                      CV   40
      DATA MONCHK/"JAN","FEB","MAR","APR","MAY","JUN","JUL","AUG","SEP", CV   50
     1"OCT","NOV","DEC"/                                                CV   60
      DATA MDAYS/31,28,31,30,31,30,31,31,30,31,30,31/                   CV   70
      DO 20 KI=1,12                                                     CV   80
      IF (MONTH.EQ.MONCHK(KI)) MINDX=KI                                 CV   90
      IF (MONTH.EQ.MONCHK(KI)) GO TO 30                                 CV  100
 20   CONTINUE                                                          CV  110
 30   CONTINUE                                                          CV  120
      DO 40 KJ=1,8                                                      CV  130
      IF (IYEAR.EQ.IYRCHK(KJ)) IYRNDX=KJ                                CV  140
      IF (IYEAR.EQ.IYRCHK(KJ)) GO TO 50                                 CV  150
 40   CONTINUE                                                          CV  160
 50   IYRDAY=0                                                          CV  170
      NDAYS=0                                                           CV  180
      IF (MINDX.EQ.1) GO TO 70                                          CV  190
      MINDX1=MINDX-1                                                    CV  200
      DO 60 I=1,MINDX1                                                  CV  210
 60   NDAYS=NDAYS+MDAYS(I)                                              CV  220
 70   CONTINUE                                                          CV  230
      IF (IYRNDX.EQ.1) GO TO 90                                         CV  240
      IYNDX1=IYRNDX-1                                                   CV  250
      DO 80 KK=1,IYNDX1                                                 CV  260
 80   IYRDAY=IYRDAY+IYDAYS(KK)                                          CV  270
 90   CONTINUE                                                          CV  280
      NDAYS=NDAYS+IDAY+IYRDAY                                           CV  290
      RETURN                                                            CV  300
      END                                                               CV  310
```

APPENDIX C.--Input for program USGSTAP

Columns	Format	Name	Description
	Card 1 - Starting time and date; ending date		
1-2	I2,1X	IHRS1	Hour of desired time to begin data retrieval from tape.
4-5	I2,1X	IMIN1	Minute of desired time to begin data retrieval from tape.
7-8	I2,1X	ISEC1	Second of desired time to begin data retrieval from tape.
10-12	A3	MONTH1	Month of desired date to begin data retrieval from tape.
13-14	I2,1X	IDAY1	Day of desired date to begin data retrieval from tape.
16-19	I4,1X	IYEAR1	Year of desired date to begin data retrieval from tape.
21-23	A3	MONTH2	Month of desired date to end data retrieval from tape.
24-25	I2,1X	IDAY2	Day of desired date to end data retrieval from tape.
27-30	I4	IYEAR2	Year of desired date to end data retrieval from tape.
	Card 2 - Output control parameters		
1-5	I5	NTC	Number of temperature channels.
6-10	I5	NPC	Number of pressure channels.
11-15	I5	NT	Number of time scans from the beginning to end of tape.

APPENDIX C.--Input for program USGSTAP--Continued

Columns	Format	Name	Description
		Card 2 - Output control parameters--Continued	
16-20	I5	IDRAW	Code for type of pressure plot to produce = -1, Plot water levels in feet vs. time = 0, Plot pressure vs. time (semilog or Cartesian) = 1, Plot log drawdown vs. log t/r^2 = 2, Plot log drawdown vs. log 1/time = 3, Plot drawdown vs. time (semilog or Castesian)
21-25	I5	IWT	= 1, Print out temperatures in tabular form = 0, Do not print temperature
21-30	I5	IWP	= 1, Print out pressures in tabular form = 0, Do not print pressures
31-35	I5	ILOGAX	= 1, Logarithmic time axis is used in temperature and pressure plots = 0, Cartesian time axis used
36-40	I5	ITITLE	= 1, Read a title as the first record of data for each scan = 0, No title read
41-45	I5	ITH	Number of scans to skip between each read (for example, ITH=5 will produce every fifth scan)
46-50	I5	ITIME	= 1, (Default) Time plotted in seconds = 2, Time converted to minutes = 3, Time converted to hours = 4, Time converted to days = 5, Time converted to years

APPENDIX C.--Input for program USGSTAP--Continued

Columns	Format	Name	Description
	Card 2 - Output control parameters--Continued		
51-55	I5	IAX	= 1, Read in a time-axis length = 0, Default length used (10 inches)
	Card 3 - Axis length (Conditional read; skip if IAX = 0)		
1-10	F10.0	AXLENG	Time-axis length in inches
	Data Set 1 - Initial pressure (Conditional read; skip if IDRAW is less than 1)		
1-10	F10.4	PINIT(I)	Initial wellhead pressures prior to start of pumping test in pounds per square inch. Read NPC values, one per card.
	Data Set 2 - Temperature channels to be plotted		
1-5	I5	IPLOT	Number of temperature channels to be plotted. End with "999". If no plots desired, enter "999" only. If plots of all temperature channels are desired, enter "888" only.
	Data Set 3 - Pressure channels to be plotted		
1-5	I5	IPLOT	Number of pressure channels to be plotted. End with "999". If no plots are desired, enter "999" only. If all pressure channels are to be plotted, enter "888" only.

APPENDIX C.--Input for program USGSTAP--Continued

```
12 32 31 MAY10 1982 MAY25 1982
   69   23 8888    1    0    0    0    0    1    1    0
      1.00
      1.00
      2.00
      1.00
      1.00
    126.19
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
      1.00
  999
  125
  999
```

APPENDIX D.--Example of raw tape data

```
09:05:45 MAY10,1982
001     12.4      DEG C
002     20.4      DEG C
003     12.7      DEG C
004     12.0      DEG C
005     11.5      DEG C
006     12.0      DEG C
007     12.1      DEG C
008     15.1      DEG C
009     11.6      DEG C
010      5.9      DEG C
011      6.7      DEG C
012      6.6      DEG C
013      6.9      DEG C
014      6.7      DEG C
015      6.3      DEG C
016      6.2      DEG C
017      6.1      DEG C
018      6.3      DEG C
019      5.9      DEG C
020      8.4      DEG C
021      8.4      DEG C
022      8.3      DEG C
023 OVERRANGE     DEG C
024      9.0      DEG C
025      8.7      DEG C
026      9.2      DEG C
027      8.5      DEG C
028      8.7      DEG C
029      8.8      DEG C
030     10.0      DEG C
031      9.9      DEG C
032      9.8      DEG C
033      9.7      DEG C
034      9.3      DEG C
035     10.2      DEG C
036     10.7      DEG C
037     10.9      DEG C
038     11.0      DEG C
039     10.4      DEG C
040     10.6      DEG C
041     10.4      DEG C
042     10.5      DEG C
043     10.7      DEG C
044     10.0      DEG C
045      9.8      DEG C
046      9.7      DEG C
047 OVERRANGE     DEG C
048 OVERRANGE     DEG C
049 OVERRANGE     DEG C
```

100	8.43959	DEG C
101	9.47865	DEG C
102	8.84815	DEG C
103	200.000	DEG C
104	5.77132	DEG C
105	7.40053	DEG C
106	OVERRANGE	DEG C
107	OVERRANGE	DEG C
108	0.00000	DEG C
109	0.00000	DEG C
110	0.00000	DEG C
111	0.00000	DEG C
112	0.00000	DEG C
113	0.00000	DEG C
114	0.00000	DEG C
115	0.00000	DEG C
116	0.00000	DEG C
117	0.00000	DEG C
118	0.00000	DEG C
119	0.00000	DEG C
120	60.6488	PSI
121	114.216	PSI
122	122.911	PSI
123	120.338	PSI
124	111.316	PSI
125	126.145	PSI
126	122.885	PSI
127	0.00000	PSI
128	142.317	PSI
129	76.3356	PSI
130	0.00000	PSI
131	0.00000	PSI
132	158.962	PSI
133	78.2965	PSI
134	OVERRANGE	PSI
135	84.2484	PSI
136	0.00000	PSI
137	78.1136	PSI
138	79.0594	PSI
139	0.00000	PSI
140	0.00000	PSI
141	108.623	PSI
142	0.00000	PSI

APPENDIX E.--Output from USGSTAP

```
ATES PRESSURE AND TEMPERATURE DATA
**********************************

12: 0: 0  MAY 10, 1982 MAY 25, 1982

THE NUMBER OF TEMPERATURE CHANNELS IS:     69
THE NUMBER OF PRESSURE CHANNELS IS:     23
THE NUMBER OF CHANNEL SCANS (TIME STEPS) IS:  8888
THE CODE FOR PLOTTING DRAWDOWN IS:   0
THE CODE FOR PRINTING TEMPERATURE IS:  0
THE CODE FOR PRINTING PRESSURES IS:  0
THE CODE FOR PLOTTING   WITH  LOGARITHMIC X-AXIS IS:  0
THE CODE FOR READING A TITLE AS THE FIRST LINE OF DATA IS:  0
ITH (SCAN INCREMENT =    1
TIME IS DENOTED AS TIME (SEC)

CODE FOR CHANGING TIME-AXIS LENGTH: 0



THE LENGTH OF THE TIME AXIS IS:       10.0


END OF DATA ENCOUNTERED
***********************
1


IPLOT =    30
CHANNEL  30  PLOTTED FOR TEMPERATURE.

STARTING TIME OF PLOT:   .34500E+03
***PLOTPAC  ACCOUNTING RECORD FRAME:      1= 000001      10 WORDS  (ACCOUNTING)
***PLOTPAC              .9FT     FRAME:      2= 000002     490 WORDS (AQUIFER    )    1 TIME(S)  [NORMAL ]    FILE: CALCOM

IPLOT =    38
CHANNEL  38  PLOTTED FOR TEMPERATURE.

STARTING TIME OF PLOT:   .34500E+03
***PLOTPAC              .9FT     FRAME:      3= 000003     481 WORDS (AQUIFER    )    1 TIME(S)  [NORMAL ]    FILE: CALCOM

IPLOT =   999

IPLOT =   125

I =   6
CHANNEL 125  PLOTTED FOR PRESSURE.

STARTING TIME OF PLOT:   .34500E+03
***PLOTPAC              .9FT     FRAME:      4= 000004     479 WORDS (AQUIFER    )    1 TIME(S)  [NORMAL ]    FILE: CALCOM
1
THIS RUN IS FINISHED
********************
```

EXAMPLE OF TABULAR OUTPUT WRITTEN TO DEVICE 6:

ATES PRESSURE AND TEMPERATURE DATA
****

0: 0: 0 MAY 10, 1982 MAY 25, 1982

THE NUMBER OF TEMPERATURE CHANNELS IS: 69
THE NUMBER OF PRESSURE CHANNELS IS: 23
THE NUMBER OF CHANNEL SCANS (TIME STEPS) IS: 2
THE CODE FOR PLOTTING DRAWDOWN IS: 1
THE CODE FOR PRINTING TEMPERATURE IS: 1
THE CODE FOR PRINTING PRESSURES IS: 1
THE CODE FOR PLOTTING WITH LOGARITHMIC X-AXIS IS: 0
THE CODE FOR READING A TITLE AS THE FIRST LINE OF DATA IS: 0
ITH (SCAN INCREMENT = 1
TIME IS DENOTED AS TIME (SEC)

CODE FOR CHANGING TIME-AXIS LENGTH: 0

THE LENGTH OF THE TIME AXIS IS: 10.0

WELL	CHANNEL	RADIAL DISTANCE	INITIAL PRESSURE
1	120	30.00	1.00
2	121	30.00	1.00
3	122	45.00	2.00
4	123	46.90	1.00
5	124	46.90	1.00
6	125	56.20	126.19
7	126	54.20	1.00
8	127	52.50	1.00
9	128	34.80	1.00
10	129	28.70	1.00
11	130	10.00	1.00
12	131	10.00	1.00
13	132	10.00	1.00
14	133	800.00	1.00
15	134	800.00	1.00
16	135	800.00	1.00
17	136	800.00	1.00
18	137	800.00	1.00
19	138	800.00	1.00
20	139	800.00	1.00
21	140	800.00	1.00
22	141	1000.00	1.00
23	142	1000.00	1.00

TIME 9: 5:45 DATE MAY 10, 1982

NO. OF DAYS SINCE JAN. 1, 1982: 495
ACCUMULATED TIME = .3274500E+05
TIME USED IN PRESSURE (OR DRAWDOWN) PLOT = .3789931E-06

DATA LOGGER CHANNEL NO.	HOLE NAME	DEPTH FEET	GEOLOGIC FORMATION	TEMPERATURE (CELSIUS)	PRESSURE (PSI)	
1	AM1	810.0	EAU CLAIRE	12.40	--	
2	AM1	788.0	GALESVILLE	20.40	--	
3	AM1	766.0	IRONTON	12.70	--	
4	AM1	744.0	IRONTON	12.00	--	
5	AM1	695.0	FRANCONIA	11.50	--	
6	AM1	670.0	FRANCONIA	12.00	--	
7	AM1	645.0	FRANCONIA	12.10	--	
8	AM1	630.0	FRANCONIA	15.10	--	
9	AM1	593.0	ST.LAWRENC	11.60	--	
10	AM1	575.0	ST.LAWRENC	5.90	--	
11	AM2	810.0	EAU CLAIRE	6.70	--	
12	AM2	788.0	GALESVILLE	6.60	--	
13	AM2	766.0	IRONTON	6.90	--	
14	AM2	744.0	IRONTON	6.70	--	
15	AM2	720.0	FRANCONIA	6.30	--	
16	AM2	695.0	FRANCONIA	6.20	--	
17	AM2	670.0	FRANCONIA	6.10	--	
18	AM2	645.0	FRANCONIA	6.30	--	
19	AM2	630.0	FRANCONIA	5.90	--	
20	AM2	610.0	FRANCONIA	8.40	--	
21	AM2	593.0	ST.LAWRENC	8.40	--	
22	AM2	575.0	ST.LAWRENC	8.30	--	
23	AM3	810.0	EAU CLAIRE	2.00	--	
**********	WARNING:	TEMPERATURE	EXCEEDS PROJECT LIMITS.	CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.		
24	AM3	788.0	GALESVILLE	9.00	--	
25	AM3	766.0	IRONTON	8.70	--	
26	AM3	744.0	IRONTON	9.20	--	
27	AM3	720.0	FRANCONIA	8.50	--	
28	AM3	695.0	FRANCONIA	8.70	--	
29	AM3	670.0	FRANCONIA	8.80	--	
30	AM3	645.0	FRANCONIA	10.00	--	
31	AM3	630.0	FRANCONIA	9.90	--	
32	AM3	610.0	FRANCONIA	9.80	--	
33	AM3	593.0	ST.LAWRENC	9.70	--	
34	AM3	575.0	ST.LAWRENC	9.30	--	
35	AS1	810.0	EAU CLAIRE	10.20	--	
36	AS1	788.0	GALESVILLE	10.70	--	
37	AS1	766.0	IRONTON	10.90	--	
38	AS1	744.0	IRONTON	11.00	--	
39	AS1	720.0	FRANCONIA	10.40	--	
40	AS1	695.0	FRANCONIA	10.60	--	
41	AS1	670.0	FRANCONIA	10.40	--	
42	AS1	645.0	FRANCONIA	10.50	--	
43	AS1	630.0	FRANCONIA	10.70	--	
44	AS1	610.0	FRANCONIA	10.00	--	
45	AS1	593.0	ST.LAWRENC	9.80	--	
46	AS1	575.0	ST.LAWRENC	9.70	--	
47	AC1	904.0	MT.SIMON	2.00	--	
**********	WARNING:	TEMPERATURE	EXCEEDS PROJECT LIMITS.	CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.		
48	AC1	826.0	EAU CLAIRE	2.00	--	
**********	WARNING:	TEMPERATURE	EXCEEDS PROJECT LIMITS.	CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.		
49	AC1	772.0	IRONTON	2.00	--	
**********	WARNING:	TEMPERATURE	EXCEEDS PROJECT LIMITS.	CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.		
100	BC1	864.0	MT. SIMON	8.44	--	
101	BC1	789.0	EAU CLAIRE	9.48	--	
102	BC1	749.0	IRONTON	8.85	--	
103	BS1	712.0	IRONTON	200.00	--	
104	BS1	633.0	FRANCONIA	5.77	--	
105	BS1	580.0	FRANCONIA	7.40	--	
106	BS1	553.0	FRANCONIA	2.00	--	

```
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  107          BS1       520.0     JORDAN                2.00          --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  108          CM1       740.0     IRONTON                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  109          CM1       587.0     FRANCONIA              0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  110       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  111       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  112       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  113       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  114       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  115       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  116       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  117       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  118       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  119       RESERVE        0       RESERVE                0            --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  120          AM2       610.0     FRANCONIA             ---          60.649
  121          AM2       593.0     ST.LAWRENC            ---         114.216
  122          AM2       575.0     ST.LAWRENC            ---         122.911
  123          AM3       810.0     EAU CLAIRE            ---         120.338
  124          AM3       788.0     GALESVILLE            ---         111.316
  125          AM3       766.0     IRONTON               ---         126.145
  126          AM3       744.0     IRONTON               ---         122.885
  127          AM3       720.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  128          AM3       695.0     FRANCONIA             ---         142.317
  129          AM3       670.0     FRANCONIA             ---          76.336
  130          AM3       645.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  131          AM3       630.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  132          AM3       610.0     FRANCONIA             ---         158.962
  133          AM3       593.0     ST.LAWRENC            ---          78.296
  134          AM3       575.0     ST.LAWRENC            ---           1.999
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  135          AS1       810.0     EAU CLAIRE            ---          84.248
  136          AS1       788.0     GALESVILLE            ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  137          AS1       766.0     IRONTON               ---          78.114
  138          AS1       744.0     IRONTON               ---          79.059
  139          AS1       720.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  140          AS1       695.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  141          AS1       670.0     FRANCONIA             ---         108.623
  142          AS1       645.0     FRANCONIA             ---               0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
```

TIME	DATE
9:35:45	MAY 10, 1982

NO. OF DAYS SINCE JAN. 1, 1982: 495
ACCUMULATED TIME = .3454500E+05
TIME USED IN PRESSURE (OR DRAWDOWN) PLOT = .3998264E-06

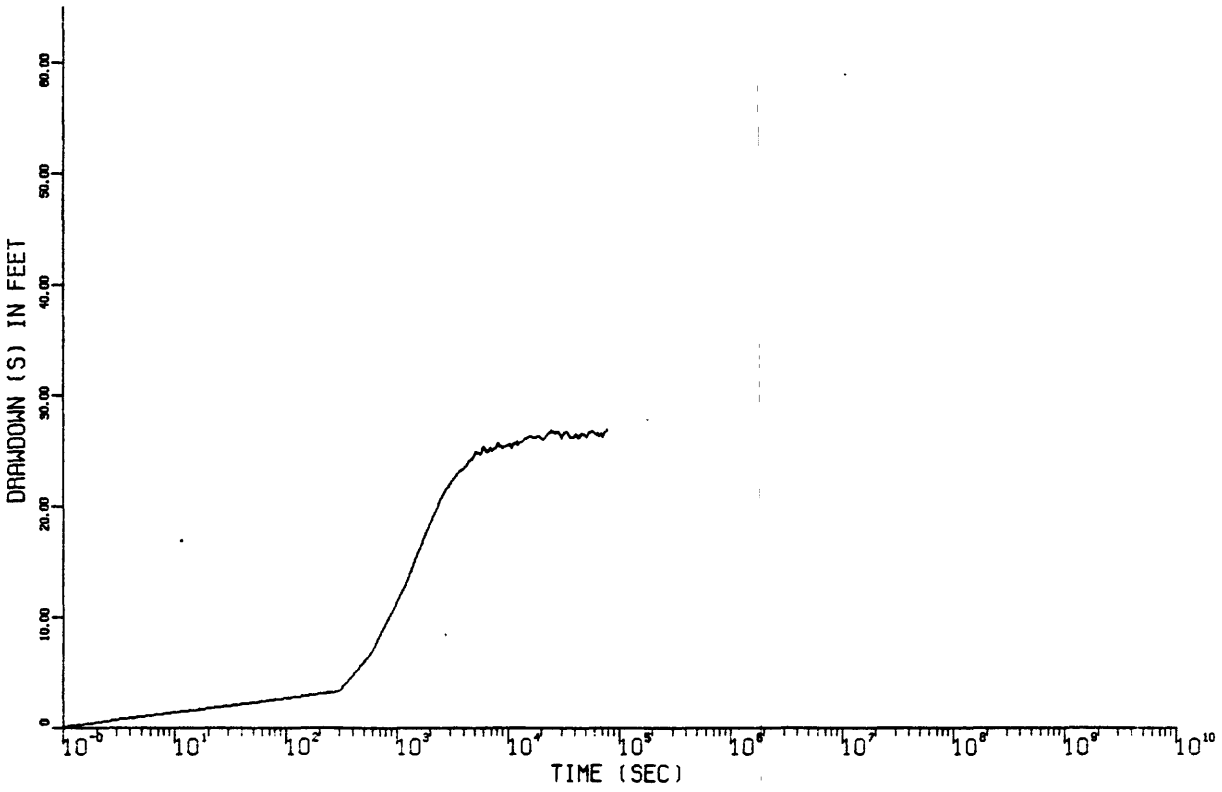
DATA LOGGER CHANNEL NO.	HOLE NAME	DEPTH FEET	GEOLOGIC FORMATION	TEMPERATURE (CELSIUS)	PRESSURE (PSI)	
1	AM1	810.0	EAU CLAIRE	12.40	--	
2	AM1	788.0	GALESVILLE	21.40	--	
3	AM1	766.0	IRONTON	12.70	--	
4	AM1	744.0	IRONTON	12.00	--	
5	AM1	695.0	FRANCONIA	11.50	--	
6	AM1	670.0	FRANCONIA	11.90	--	
7	AM1	645.0	FRANCONIA	12.10	--	
8	AM1	630.0	FRANCONIA	15.10	--	
9	AM1	593.0	ST.LAWRENC	11.60	--	
10	AM1	575.0	ST.LAWRENC	5.40	--	
11	AM2	810.0	EAU CLAIRE	6.20	--	
12	AM2	788.0	GALESVILLE	6.00	--	
13	AM2	766.0	IRONTON	6.30	--	
14	AM2	744.0	IRONTON	6.20	--	
15	AM2	720.0	FRANCONIA	5.90	--	
16	AM2	695.0	FRANCONIA	5.70	--	
17	AM2	670.0	FRANCONIA	5.60	--	
18	AM2	645.0	FRANCONIA	5.80	--	
19	AM2	630.0	FRANCONIA	5.40	--	
20	AM2	610.0	FRANCONIA	8.30	--	
21	AM2	593.0	ST.LAWRENC	8.20	--	
22	AM2	575.0	ST.LAWRENC	8.20	--	
23	AM3	810.0	EAU CLAIRE	2.00	--	
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.						
24	AM3	788.0	GALESVILLE	8.90	--	
25	AM3	766.0	IRONTON	8.60	--	
26	AM3	744.0	IRONTON	9.00	--	
27	AM3	720.0	FRANCONIA	8.50	--	
28	AM3	695.0	FRANCONIA	8.60	--	
29	AM3	670.0	FRANCONIA	8.70	--	
30	AM3	645.0	FRANCONIA	10.10	--	
31	AM3	630.0	FRANCONIA	9.90	--	
32	AM3	610.0	FRANCONIA	9.90	--	
33	AM3	593.0	ST.LAWRENC	9.80	--	
34	AM3	575.0	ST.LAWRENC	9.40	--	
35	AS1	810.0	EAU CLAIRE	10.30	--	
36	AS1	788.0	GALESVILLE	10.80	--	
37	AS1	766.0	IRONTON	11.00	--	
38	AS1	744.0	IRONTON	11.00	--	
39	AS1	720.0	FRANCONIA	10.50	--	
40	AS1	695.0	FRANCONIA	10.60	--	
41	AS1	670.0	FRANCONIA	10.40	--	
42	AS1	645.0	FRANCONIA	10.50	--	
43	AS1	630.0	FRANCONIA	10.70	--	
44	AS1	610.0	FRANCONIA	10.00	--	
45	AS1	593.0	ST.LAWRENC	9.70	--	
46	AS1	575.0	ST.LAWRENC	9.60	--	
47	AC1	904.0	MT.SIMON	2.00	--	
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.						
48	AC1	826.0	EAU CLAIRE	2.00	--	
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.						
49	AC1	772.0	IRONTON	2.00	--	
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.						
100	BC1	864.0	MT. SIMON	8.42	--	
101	BC1	789.0	EAU CLAIRE	9.44	--	
102	BC1	749.0	IRONTON	8.85	--	
103	BS1	712.0	IRONTON	200.00	--	
104	BS1	633.0	FRANCONIA	5.74	--	
105	BS1	580.0	FRANCONIA	7.40	--	
106	BS1	553.0	FRANCONIA	2.00	--	

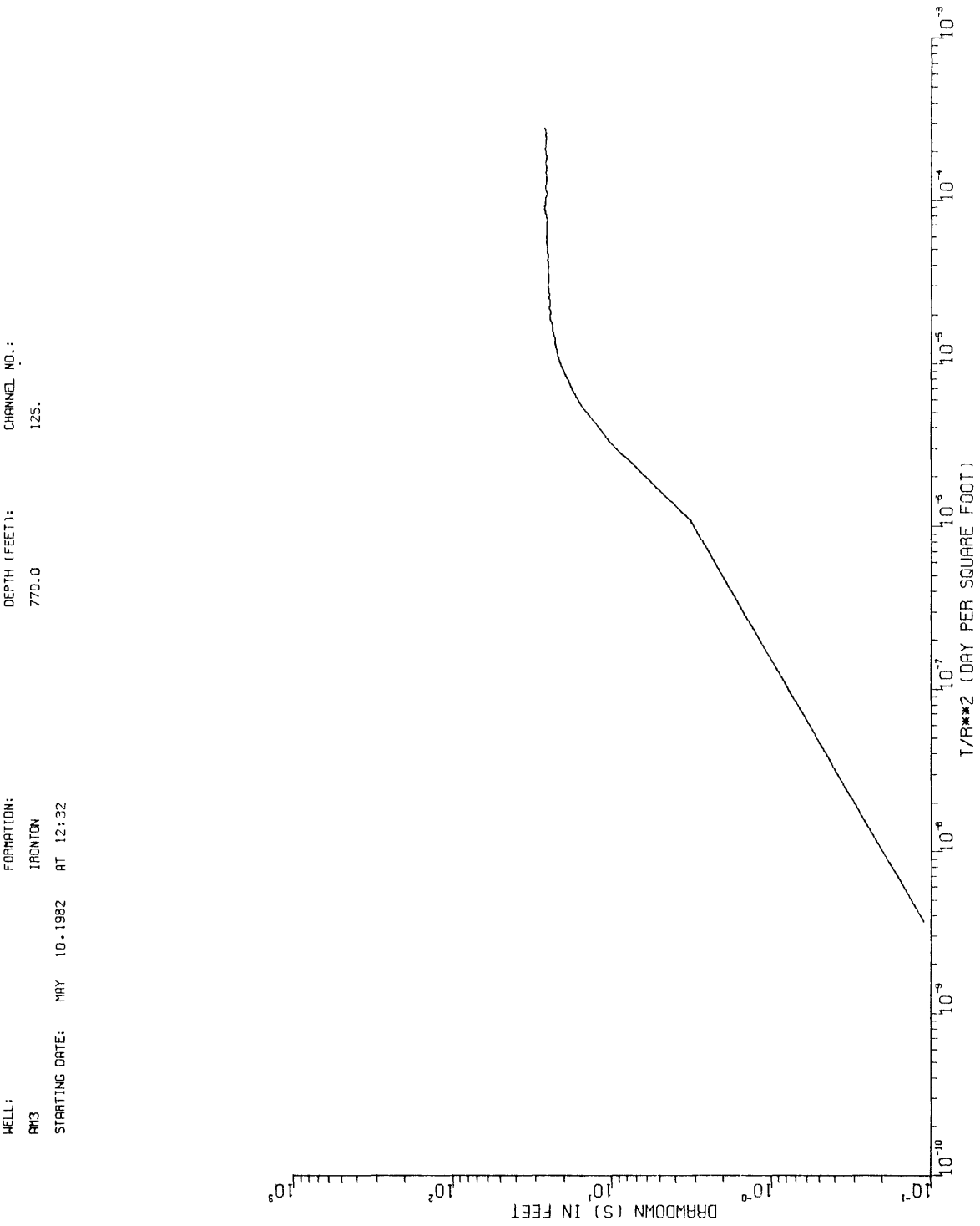
```
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  107          BS1       520.0     JORDAN                2.00          --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  108          CM1       740.0     IRONTON               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  109          CM1       587.0     FRANCONIA             0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  110          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  111          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  112          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  113          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  114          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  115          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  116          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  117          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  118          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  119          RESERVE   0         RESERVE               0             --
********** WARNING: TEMPERATURE EXCEEDS PROJECT LIMITS. CHECK DATA LOGGER AND THERMOCOUPLE OPERATION.
  120          AM2       610.0     FRANCONIA             ---           60.590
  121          AM2       593.0     ST.LAWRENC            ---          114.212
  122          AM2       575.0     ST.LAWRENC            ---          122.907
  123          AM3       810.0     EAU CLAIRE            ---          120.297
  124          AM3       788.0     GALESVILLE            ---          111.293
  125          AM3       766.0     IRONTON               ---          126.116
  126          AM3       744.0     IRONTON               ---          122.800
  127          AM3       720.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  128          AM3       695.0     FRANCONIA             ---          142.124
  129          AM3       670.0     FRANCONIA             ---           76.301
  130          AM3       645.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  131          AM3       630.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  132          AM3       610.0     FRANCONIA             ---          165.294
  133          AM3       593.0     ST.LAWRENC            ---           78.218
  134          AM3       575.0     ST.LAWRENC            ---            1.999
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  135          AS1       810.0     EAU CLAIRE            ---           84.201
  136          AS1       788.0     GALESVILLE            ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  137          AS1       766.0     IRONTON               ---           78.029
  138          AS1       744.0     IRONTON               ---           79.025
  139          AS1       720.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  140          AS1       695.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.
  141          AS1       670.0     FRANCONIA             ---          108.563
  142          AS1       645.0     FRANCONIA             ---              0
**********WARNING:  PRESSURE EXCEEDS PROJECT LIMITS.CHECK DATA LOGGER OR PRESSURE TRANSDUCER.


IPLOT =   999


THIS RUN IS FINISHED
********************
```

APPENDIX F.--Example plots

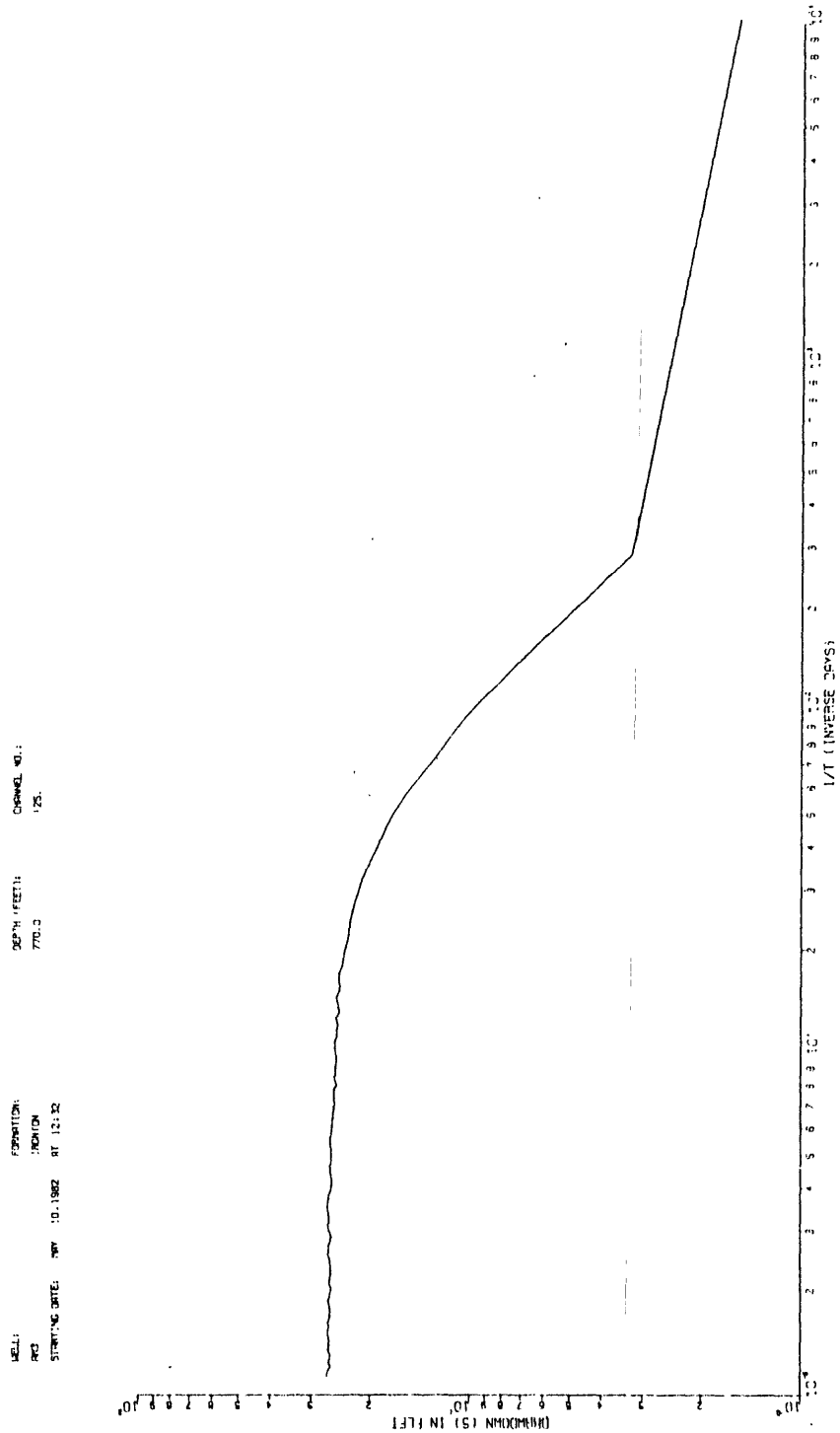
WELL:	FORMATION:	DEPTH (FEET):	CHANNEL NO.:
AM3	IRONTON	770.0	125.

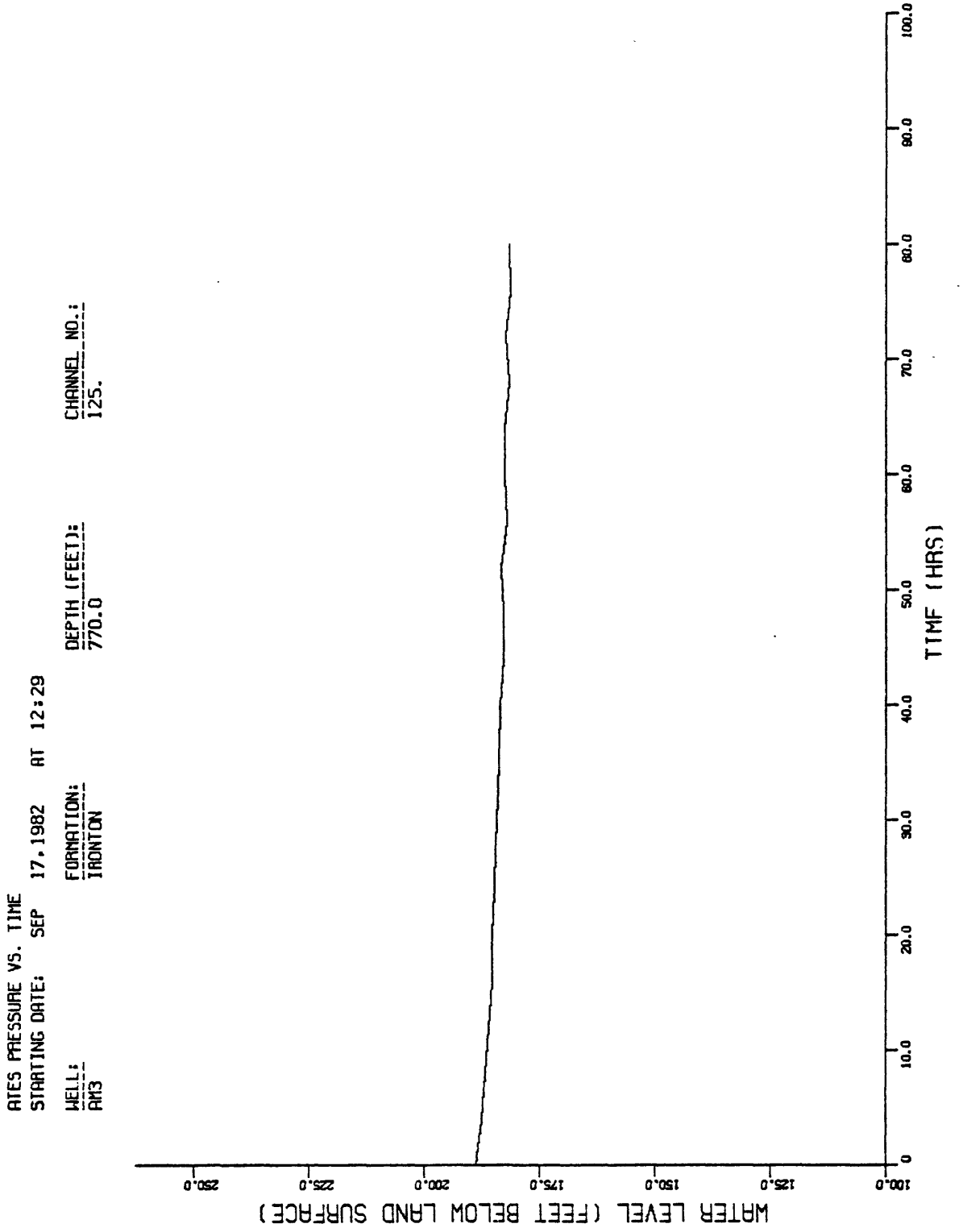
STARTING DATE: MAY 10.1982 AT 12:32

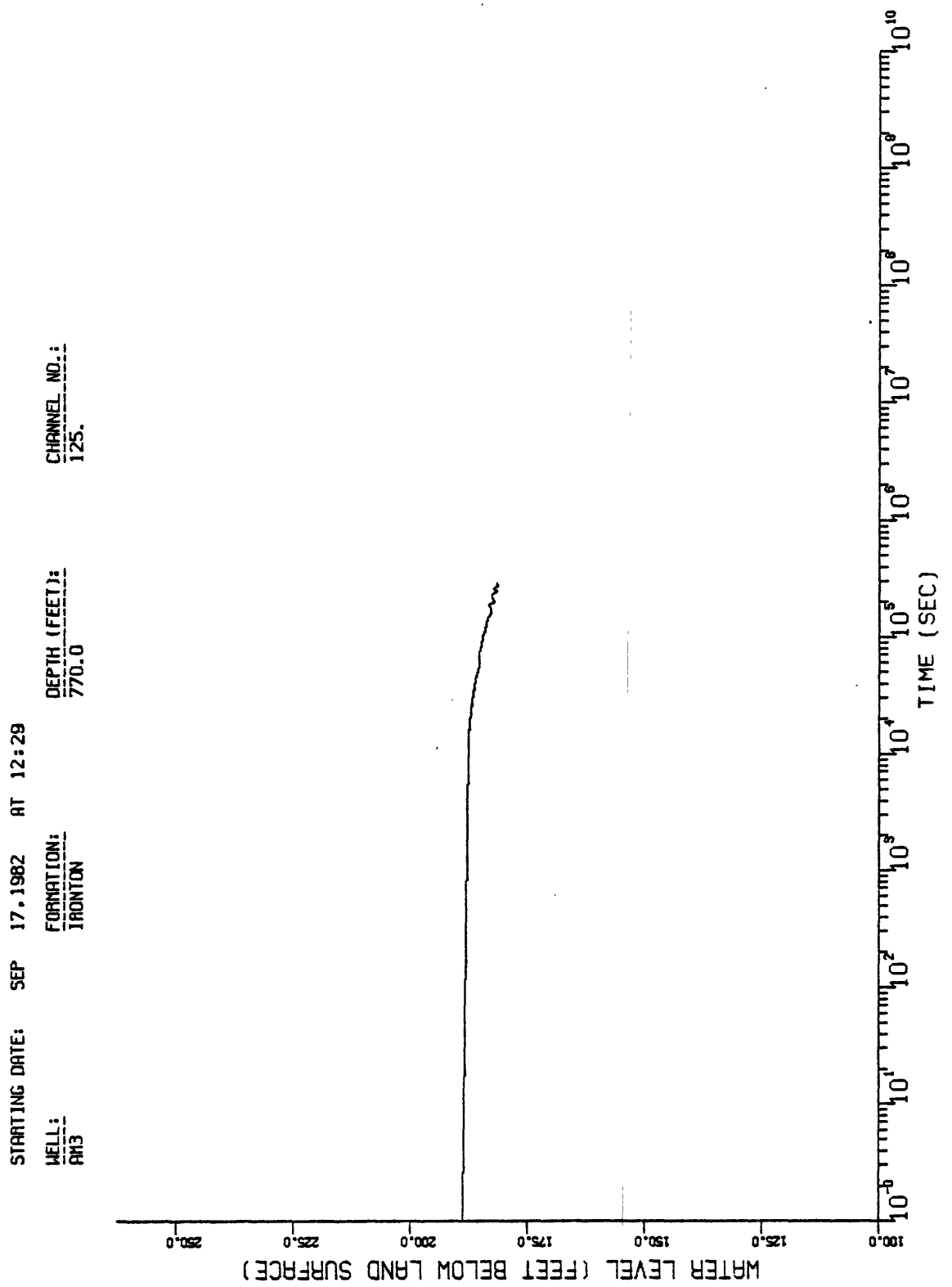


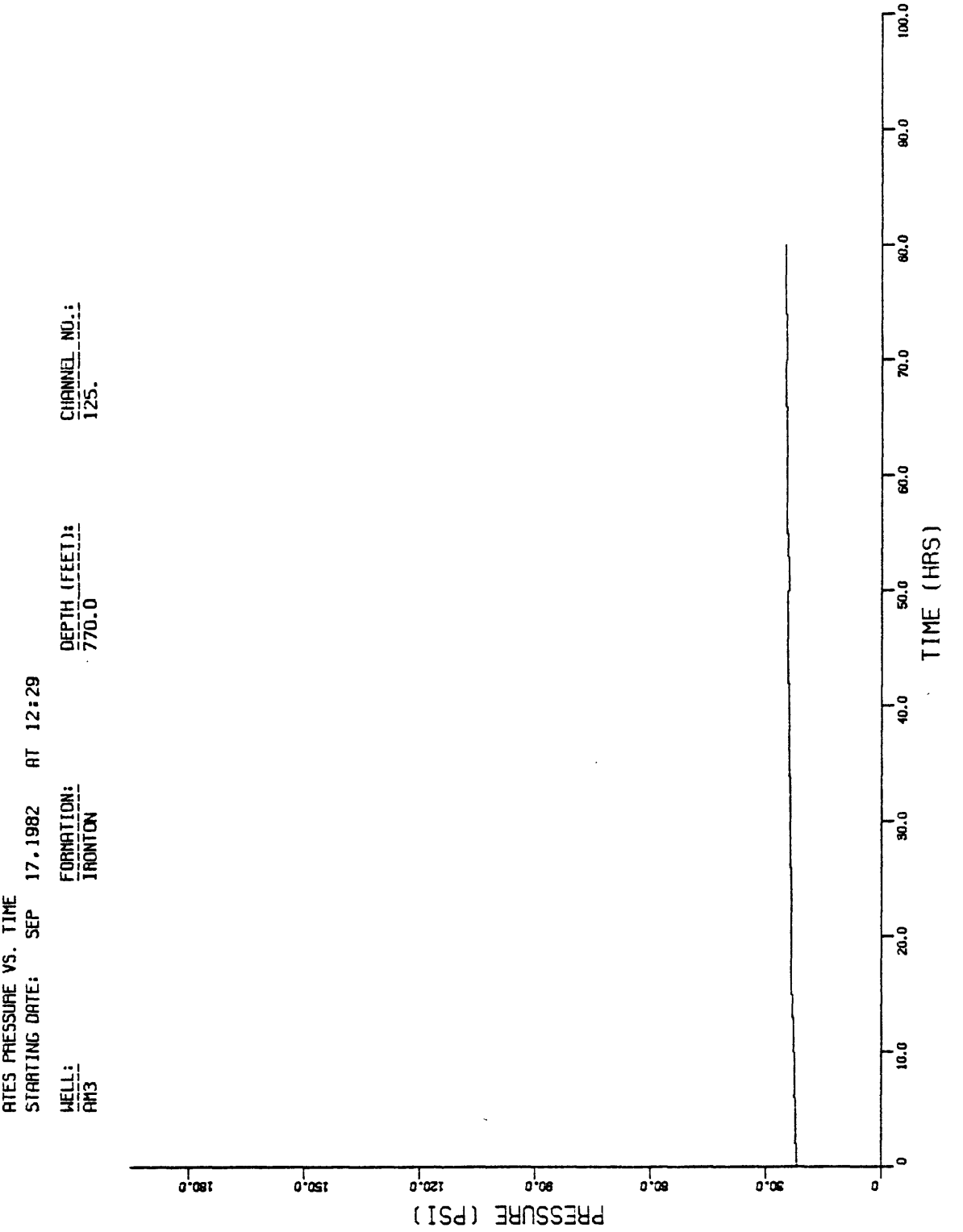

WELL:
AM3
STARTING DATE: MAY 10,1982 AT 12:32
FORMATION:
IRONTON
DEPTH (FEET):
770.0
CHANNEL NO.:
125.
DRAWDOWN (S) IN FEET
T/R**2 (DAY PER SQUARE FOOT)

APPENDIX F.--Example plots--Continued

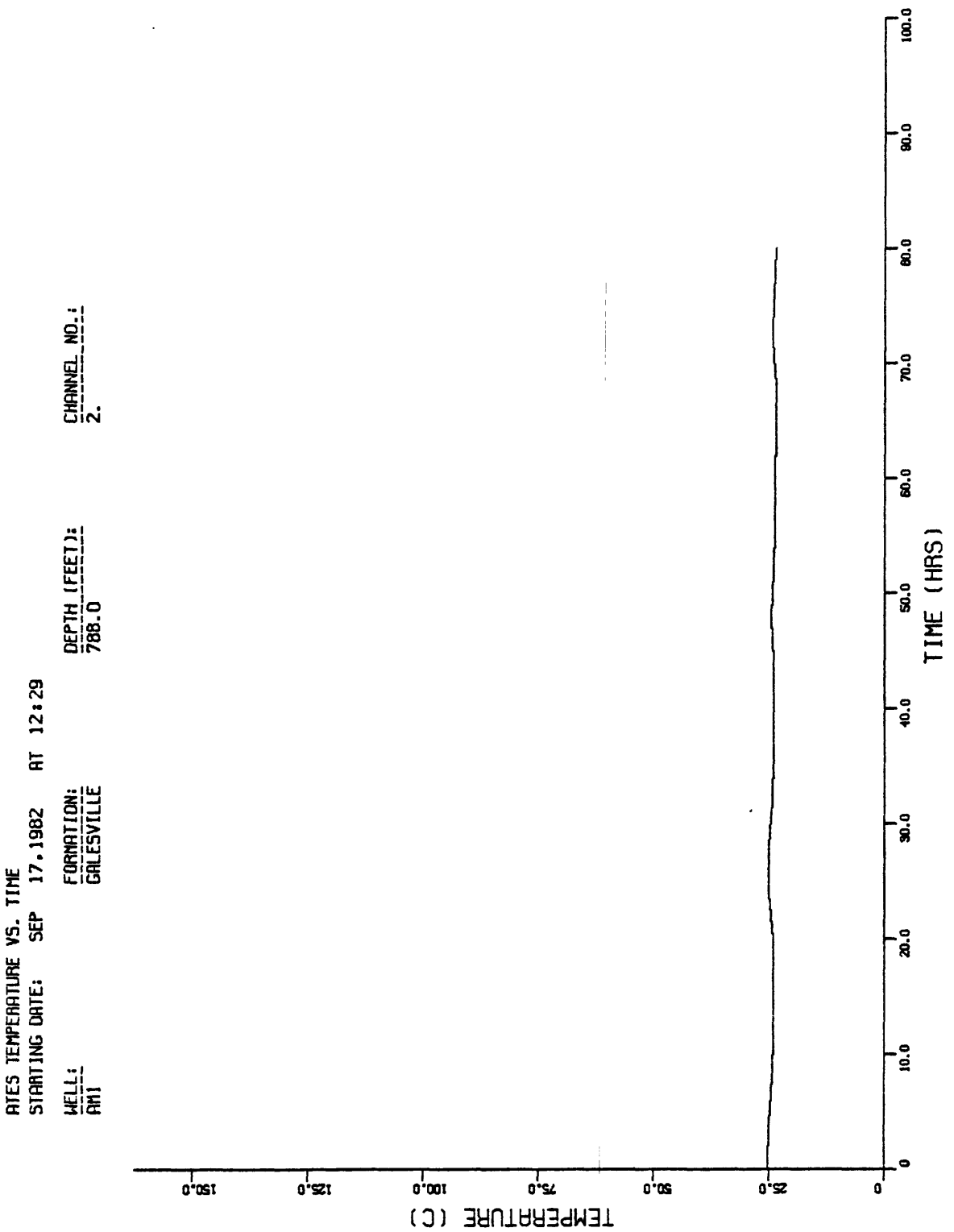


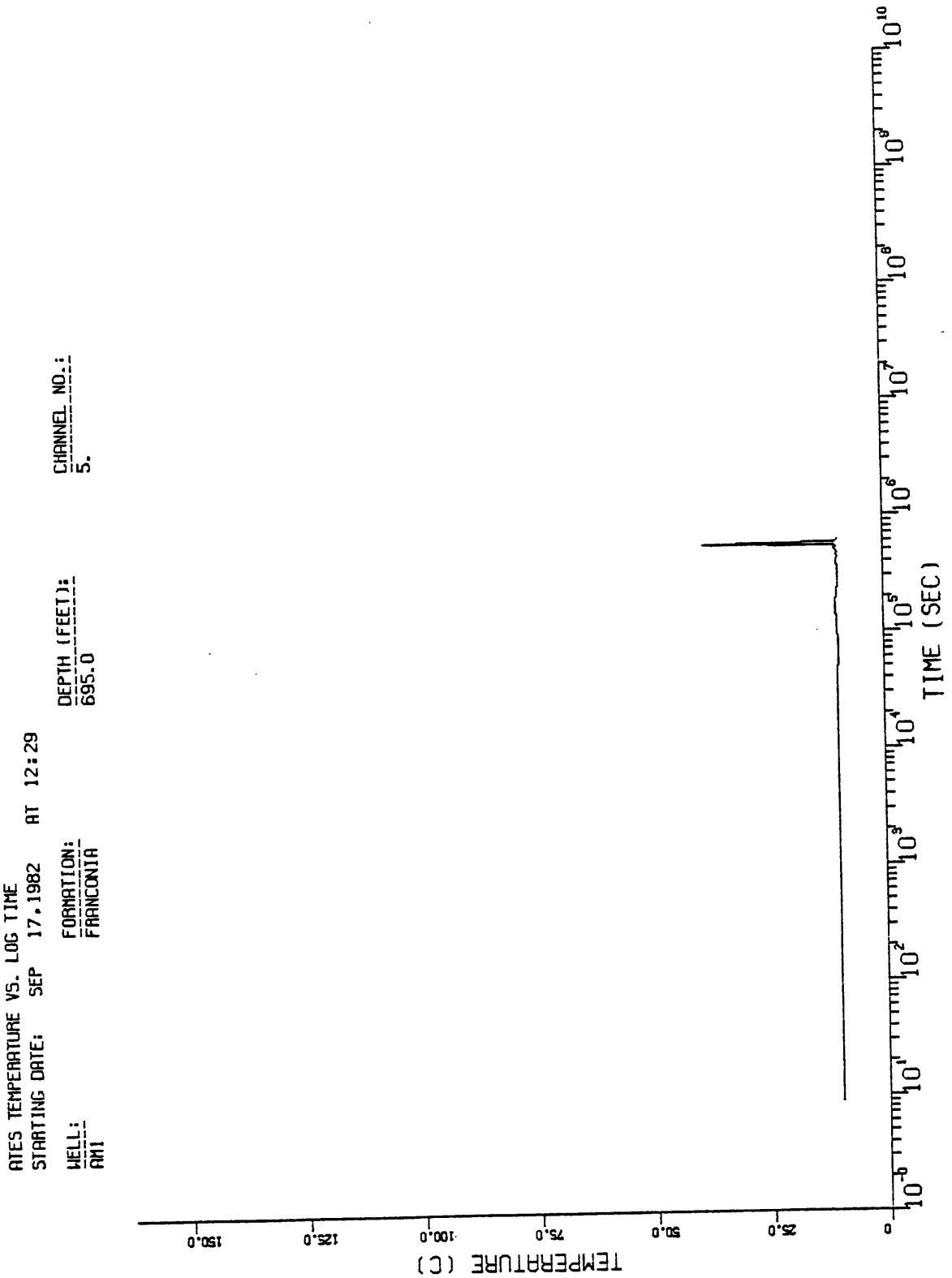

AIES PRESSURE VS. TIME
STARTING DATE: SEP 17,1982 AT 12:29
WELL:
AM3
FORMATION:
IRONTON
DEPTH (FEET):
770.0
CHANNEL NO.:
125.
WATER LEVEL (FEET BELOW LAND SURFACE)
TIME (HRS)
250.0
225.0
200.0
175.0
150.0
125.0
100.0
0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0


STARTING DATE: SEP 17, 1982 AT 12:29
WELL: AM3
FORMATION: IRONTON
DEPTH (FEET): 770.0
CHANNEL NO.: 125.
WATER LEVEL (FEET BELOW LAND SURFACE)
TIME (SEC)
100.0
125.0
150.0
175.0
200.0
225.0
250.0
10^{-6}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
10^{7}
10^{8}
10^{9}
10^{10}


ATES PRESSURE VS. TIME
STARTING DATE: SEP 17,1982 AT 12:29
WELL:
AM3
FORMATION:
IRONTON
DEPTH (FEET):
770.0
CHANNEL NO.:
125.
PRESSURE (PSI)
180.0
150.0
120.0
90.0
60.0
30.0
0
TIME (HRS)
0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0

APPENDIX F.--Example plots--Continued




ATES TEMPERATURE VS. LOG TIME
STARTING DATE: SEP 17,1982 AT 12:29
WELL:
AM1
FORMATION:
FRANCONIA
DEPTH (FEET):
695.0
CHANNEL NO.:
5.
TEMPERATURE (C)
0
25.0
50.0
75.0
100.0
125.0
150.0
TIME (SEC)
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{6}
10^{7}
10^{8}
10^{9}
10^{10}

APPENDIX F.--Example plots--Continued