COMPUTER SYSTEM FOR DIGITIZING,
ANALYZING AND PLOTTING WELL LOG DATA
(A USER'S GUIDE TO WELLOG.REV.1)

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ABSTRACT

WELLOG is a system of programs developed at the Earth Science Laboratory to be used to digitize well logs and perform some analysis and plotting of the data. Multiple logs can be plotted side by side for correlation analysis and up to three logs can be plotted in a cross plot. Data entry and editing functions are also provided by the programs. This system of well log interpretation programs is presently operating on the University of Utah UNIVAC 1108 computer. Digitizing of well logs is accomplished by an old model CALMA (off-line) digitizer. Those parts of WELLOG that handle the digitized data tapes are extremely machine dependent. The parts of WELLOG that produce the plots and handle the data beyond the digitized data tape are more portable.

INTRODUCTION AND PURPOSE OF THE SYSTEM

A great number of geothermal well logs have been and will continue to be submitted as part of the data packages purchased by DOE/DGE through the Industry Coupled Case Study Program. Copies of the original logs may be obtained from Rocky Mountain Well Log Services, Denver, Colorado. Most of the well logs are digitized, plotted and studied at the Earth Science Laboratory (ESL), University of Utah Research Institute, Salt Lake City, Utah. The well log analyses are important to the various geothermal case studies conducted at ESL. In order to perform the log analyses, several computer programs were written to digitize and plot the well log data. Many of the features incorporated into the computer programs are traditional log analysis techniques such as density and neutron cross plots and Schlumberger's (1974) MN plot. The programs contain several useful features that allow the user to recognize and correct digitizing errors and to modify data for special plots or terminal displays. The program described here is the first version, Rev 1, of ESL's well log digitizing, plotting and analysis system. Further changes are currently being made and future changes are anticipated. Additional updates of the system will be released at appropriate times.

SYSTEM DESCRIPTION

Programs

The well log digitizing, plotting and analysis system is comprised of four separate main programs and numerous subroutines. The system has been designed in modular form to facilitate program modifications and additions. Four main programs operate in more-or-less four distinct areas.

WELLOG is a main program with numerous options which accesses a number of subprograms with additional options and is the first program utilized in the processing of well log data. This program manages the digitized data, mass storage files, data input of various kinds, and data corrections and manipulations.

DATCAL is a smaller program that is used for simple, special data manipulations. PDATF and PDAT are complementary programs used to create a plot parameter file, PDATF, and to plot the well log data, PDAT, versus depth. The plots are drawn by a CALCOMP plotter. A column is generated on the right-hand side to accommodate a litholog. The user has options to control log and depth scales, overlay logs, and use solid or dashed traces and three pen colors.

CRSPLT is a major program which can be used in many ways to generate a variety of log data plots. Conventional well log interpretation cross plots found in the well log literature can be generated with this program, including Z-plots and MN plots (Schlumberger, 1974). Linear, semi-log, log-log, and square root scales are available plot options. The CRSPLT program includes options to average and modify data before plotting. Many of the plots can be made on a hard copy terminal for quick evaluations.

Detailed descriptions of the various programs and their options, and a sample run are given in later sections of this guide.

Data Files

Three data files are used by the WELLOG program. Two direct access files

are used by WELLOG and one sequential file is used by the log plotting program. One of the direct access files is a small work file that holds well log header information and is used to provide header and parameter information for the WELLOG system. The header information can be entered, edited, and listed from within the WELLOG program. The other direct access file is a merge file that contains individual log and header data. The merge file is composed of subfiles, each of which contains a well log header and digitized data. The sequential file is used to set plot parameters that the plotting program uses.

The header work file is an unformatted direct access file. It is two records long with 500 words per record. The format of the 500 word header is shown in Table C1, Appendix C. At present, record #2 of the work file is not used. It is available for future header manipulation.

The merge file is an unformatted direct access file. It is 2060 records long with 500 words per record. The merge file contains multiple logs each with their own 500 word header as the first record, followed by data records. Each log is contained in a subfile. The format of the merge file is described in Table C2, Appendix C. A single log can be broken into segments and stored as separate subfiles if desired. The plotting program is able to merge data from several subfiles.

The plotting parameter file is a formatted alphanumeric sequential access file. It contains plot parameter information that the plot program uses to read the merge file and plot the data records at various scales and positions. The program PDATA solicits user response concerning a plot to be generated and

then writes the sequential file. The sequential file can be modified by using a text editor. The plot program PDAT reads the sequential file and uses the information to generate plots.

Program Flow and Data Flow

The following is a short description of program and data flow in the WELLOG system. Most processing jobs will begin with the digitizing of several well logs. The digitized data are written to tape by the CALMA digitizer (Appendix A). The tape is then submitted to the UNIVAC 1108 computer for processing. The WELLOG system is activated by the user and the digitized tape is processed by entering log header information into the work file and then processing a tape file. The process continues by entering or modifying the header information for each tape file and then processing the file. Each tape file is stored as a merged subfile. After data have been processed into the merge file, they can be plotted in cross plots using the CRSPLT program or plotted in correlation plots using the PDATF and PDAT programs. PDATF solicits user input to define a correlation plot. The parameters describing position, scaling, and subfile numbers are written to a sequential file. PDAT reads the sequential file and uses the parameters to read the merge file and to plot the data in a correlation plot. Additional data can be digitized and processed into the merge file without modifying the data subfiles already stored in the merge file.

WELLOG OPTION SYSTEM

Introduction

The WELLOG program permits the user to perform certain desired operations

through the use of an option system. Related options have been placed in groups, which are connected together in a structured hierarchy. By selecting a specific option, the user may move up or down in the hierarchy.

When an option selection is to be made, the program will print out:

XXXXXXOPTION# (I) =

(XXXXXX represents a six character option name). If the user does not know the choice of options, the user may print the list of options by inputting a 0 (zero) or any other number that is known to be out of the option number range. To move up to the next highest level in the hierarchy the user inputs a 1 (one). Any number greater than one, and less than or equal to the highest option number available, will result in either the execution of an option or the step down to a lower group of options.

Master Options

In the main well log program, WELLOG, there are 8 master options available:

WELL--OPTION# (I) =

1. TERMINATE WELLOG	
2. HEADER INPUT	(See HOPT--OPTION)
3. MAG TAPE INPUT OF DATA	(See MODE--OPTION)
4. TERMINAL INPUT OF DATA	(See INPT--OPTION)
5. WRITE SUBFILE TO MRGFILE	
6. READ MERGEFILE	(See RDOPT--OPTION)
7. POSITION DIGITIZED TAPE	(See POST-T--OPTION)
8. XQT FMAIN	(See FM--OPTION)

Except for options 1 and 5, all options direct the program to a subprogram which may contain several additional options; the option name in each case is noted in parenthesis above and is discussed below. A description of the Master OPTIONS follows:

Master Options Description---

1. TERMINATE WELLOG: Terminates the WELLOG program.
2. HEADER INPUT: Creates a header that contains all pertinent description information for drill hole and log data--details shown in APPENDIX B.
3. MAG TAPE INPUT OF DATA: Reads data from the digitized tape and converts it to equally spaced absolute data values using the parameters in the header.
4. TERMINAL INPUT OF DATA: Allows the user to input discrete log data from the terminal.
5. WRITE SUBFILE TO MRGFILE: Writes the newly created header and data to the merge file.
6. READ MERGEFILE: Reads a specified subfile from the merge file.
7. POSITION DIGITIZED TAPE: Allows the user to assign a digitized tape and position the tape to the beginning of the desired tape file.
8. XQT FMAIN: Passes control to the file maintenance program.

A listing and brief description of each of the subset options follows.

Subprogram Options

Header Input Options-Master Option 2

Listing---

- ```
HOPT--OPTION# (1)=
1. RETURN TO PROGRAM
2. INPUT NEW HEADER
3. EDIT PREV HEAD BY LINE #
4. EDIT ALL HEAD BELOW LINE
5. PRINT HEADER
```

##### Description---

1. RETURN TO PROGRAM: Returns control back to the calling program.
2. INPUT NEW HEADER: Allows the input of a completely new header.
3. EDIT PREV HEAD BY LINE #: Allows the user to edit the header which was last used and placed in the work file. This saves time when a series of headers is needed where only a few lines are different.

4. EDIT ALL HEAD BELOW LINE: Allows the user to input all new information below the specified line of the previously used header.

5. PRINT HEADER: Prints the header for inspection on the terminal.

#### Mag Tape Input of Data Options-Master Option 3

Listing---

MODE OPTION# (I)=

1. SET DATA MODE
2. SET MOVE MODE

Description---

1. SET DATA MODE: Initially sets the data test flag to the data mode.
2. SET MOVE MODE: Initially sets the data test flag to the non-data mode. The flag is then set to the data mode when a B-ENTER is encountered on the digitized tape.

The digitizing system is described in Appendix A. In the process of digitizing, certain control characters are inserted into the data string to note the start of the log. If these characters are omitted, MODE option 1 is used; if these characters are present, MODE option 2 is used. If MODE option 1 is required to read the digitized data tape, more care should be taken in checking for digitizing errors.

#### Terminal Input of Data Options-Master Option 4

Listing---

INPT--OPTION# (I)=

1. RETURN TO WELLOG
2. EQUALLY SPACED DATA
3. RANDOM SPACED DATA

#### Description---

Options 2 and 3 are self-evident; the operator simply inputs whether the log data is equally spaced, option 2, or randomly spaced, option 3. If the data are randomly spaced, the footages are also part of the required data input. Option 1 simply returns the operator to the main, WELLOG, program.

#### Write Subfile to MRGEFILE-Master Option 5

There are no options here. The program simply writes the newly created header and data file to the merge file. The program automatically determines the next empty subfile and outputs to the terminal the subfile number where the data were written, the length of the subfile, and the number of data contained in the subfile.

#### Read Mergefile-Master Option 6

##### Listing---

```
RDOPT-OPTION# (I)=
 1. RETURN TO WELLOG
 2. READ HEADER
 3. READ HEADER AND DATA
 4. EDIT HEADER (See HOPT--OPTION)
 5. EDIT DATA
```

Description---

1. RETURN TO WELLOG: Returns control to the WELLOG program.
2. READ HEADER: Reads the subfile Header only.
3. READ HEADER AND DATA: Reads the entire subfile.
4. EDIT HEADER: Allows the user to edit the previously read header.
5. EDIT DATA: Allows the user to edit the previously read data.

This subprogram is very useful for editing all headers or editing discrete data files. Digitized data from the CALMA can be edited here but are best edited through options in FMAIN described below.

Position Digitized Tape-Master Option 7

Listing---

```
POS-T-OPTION# (I)=
 1. RETURN FROM POSTAP
 2. REWIND TAPE (ITP)
 3. ADVANCE TAPE N FILES
 4. BACKUP TAPE N FILES
 5. FREE OC TAPE (ITP)
 6. ASSIGN OC TAPE (ITP)
 7. CHECK TAPE FOR ERRORS
```

Description---

1. RETURN FROM POSTAP: Returns control to the WELLOG program.
2. REWIND TAPE (ITP): Rewinds the digitized tape to the first file.
3. ADVANCE TAPE N FILES: Allows the user to skip the specified number of tape files.
4. BACKUP TAPE N FILES: Allows the user to back up the specified number of tape files.
5. FREE OC TAPE (ITP): Rewinds and unassigns the tape drive.
6. ASSIGN OC TAPE (ITP): Assigns the tape drive and specifies the tape number to be mounted.
7. CHECK TAPE FOR ERRORS: Allows the user to check the tape for parity errors.

XQT FMAIN-Master Option 8

Listing---

```
FM----OPTION# (I)=
 1. XQT WELLOG PROGRAM
 2. DIRECTORY (SHORT)
 3. DIRECTORY (LONG)
 4. CHECK PLOT
 5. DELETE & PACK
 6. SET FILE LIMITS
```

7. INITIAL WORKFILE
8. READ SUBFILE DATA
9. EDIT SUBFILE HEADER (See HOPT--OPTION)
10. Edit SUBFILE DATA
11. FIX SUBFILE DATA (See FIX-D-OPTION)
12. PRINT SUBFILE DATA
13. TERMINATE FMAIN

Description---

1. XQT WELLOG PROGRAM: Returns control to the WELLOG program.
2. DIRECTORY (SHORT): Prints a short directory of the merge file on the terminal.
3. DIRECTORY (LONG): Prints a long directory consisting of the complete headers of each subfile. The directory is sent to the line printer.
4. CHECK PLOT>: Allows the user to create small check plots for the specified subfiles.
5. DELETE & PACK: Allows the user to delete obsolete subfiles from the merge file.
6. SET FILE LIMITS: Initializes a newly created merge file.
7. INITIAL WORKFILE: Initializes a newly created work file.
8. READ SUBFILE DATA: Allows the user to look at desired intervals of data in a specified subfile.
9. EDIT SUBFILE HEADER: Allows the user to edit a subfile header.
10. EDIT SUBFILE DATA: Allows the user to edit the data in a subfile point by point.
11. FIX SUBFILE DATA: Allows the user to modify the entire subfile or specified intervals within a subfile.
12. PRINT SUBFILE DATA: Prints the entire subfile on the terminal.
13. TERMINATE FMAIN: Stops execution of the program without returning control to the WELLOG program.

Fix Subfile Data-FMAIN Option 11

Listing---

FIX-D-OPTION# (I)=

1. TERMINATE FIXDAT
2. SELECT FOOTAGE INT

3. ADD TO DATA
4. SUBTRACT FROM DATA
5. MULTIPLY DATA
6. DIVIDE DATA
7. SHIFT START FTG

Description---

Data Fixing Options: (FIX-D-OPTION)

1. TERMINATE FIXDAT: Returns control to the FMAIN program.
2. SELECT FOOTAGE INT: Allows the user to specify the interval of data to be modified. A default gives the entire subfile.
3. ADD TO DATA: Adds the specified value to all data values within the selected interval.
4. SUBTRACT FROM DATA: Subtracts the specified value from all data values within the selected interval.
5. MULTIPLY DATA: Multiplies all data values within the selected interval by the specified value.
6. DIVIDE DATA: Divides all data values within the selected interval by the specified value.
7. SHIFT START FTG: Allows the user to shift the start and end footages by the specified value.

DATCAL OPTION SYSTEM

Introduction

The DATCAL program permits the user to average the well log data over specified footage increments from selected footage intervals and to modify the log data by using the formula $(X-A)/B$ where X is the log data and both A and B are constants. The option system operates in the same manner as described earlier for the WELLOG Option system. The DATCAL master options and subprogram options are described below.

Master Options

Listing---

```
DCAL--OPTION# (I)=
 1. TERMINATE DATCAL
 2. READ SUBFILE FROM MRGFILE
 3. WRITE SUBFILE TO MRGFILE
 4. CALCULATE AVERAGE
 5. PRINT ORIGINAL DATA (See PRT---OPTION)
 6. PRINT CALCULATED DATA (See PRT---OPTION)
 7. PRINT ORIGINAL HEADER
 8. PRINT CALCULATED HEADER
 9. CALCULATE (X-A)/B
```

Description---

1. TERMINATE DATCAL: Terminates the DATCAL program.
2. READ SUBFILE FROM MRGFILE: Reads the selected subfile from the merge file into the arrays for modification.
3. WRITE SUBFILE TO MRGFILE: Writes the modified subfile into a new subfile in the merge file.
4. CALCULATE AVERAGE: Averages the data over the specified intervals.
5. PRINT ORIGINAL DATA: Prints the data which were read from the merge file.

6. PRINT CALCULATED DATA: Prints the data which were created by averaging or calculated using the formula $(X-A)/B$.
7. PRINT ORIGINAL HEADER: Prints the header which was read from the merge file.
8. PRINT CALCULATED HEADER: Prints the header which was modified for use with the calculated data.
9. CALCULATE $(X-A)/B$: Creates the new data by modifying the data from the merge file by the formula $(X-A)/B$. A and B are specified by the user.

Subprogram Options

Only master options 5 and 6 use subprograms with additional options. In fact, both options use a single subprogram and the options are identical.

Listing---

```
PRT---OPTION# (I)=
 1. RETURN TO DATCAL
 2. PRINT ENTIRE FILE
 3. PRINT ONLY PART OF FILE
```

Description---

1. RETURN TO DATCAL: Returns control to the DATCAL program.
2. PRINT ENTIRE FILE: Prints the entire subfile on the terminal.
3. PRINT ONLY PART OF FILE: Prints the data contained in the user specified intervals only.

CRSPLT OPTION SYSTEM

Introduction

The CRSPLT option system allows the user to plot the well log data in several formats including most conventional cross plot formats found in the well log literature. Using data modifying systems in DATCAL prior to implementing CRSPLT or using a more limited data modifying option in CRSPLT, the user may construct a large variety of log data plots utilizing the many

basic plot options available in CRSPLT. The CRSPLT program can operate on only three data subfiles at one time. The CRSPLT option system operates in the same manner described earlier for the WELLOG option system.

Master Options

Listing---

```
CSPT--OPTION# (I)=
 1. TERMINATE CROSS PLOT PRG
 2. SELECT FILE #S TO PLOT
 3. SELECT PLOT FOOTAGES
 4. SELECT PLOT SIZE PARAM
 5. LINEAR-LINEAR PLOT
 6. LINEAR-LOG PLOT
 7. LOG-LOG PLOT
 8. LINEAR-SQUARE ROOT PLOT
 9. Z LINEAR PLOT (CALCOMP)
 0. XY LINEAR PLOT (TERMINAL)
 1. DATA VS FOOTAGE PLOT
 2. M & N PLOT
```

Description---

1. TERMINATE CROSS PLOT PRG: Terminates the CRSPLT program.
2. SELECT FILE #S TO PLOT: Allows the user to specify the subfiles to be cross plotted.
3. SELECT PLOT FOOTAGES: Allows the user to specify the start and end footages, and also the footage interval, of the data to be plotted.
4. SELECT PLOT SIZE PARAM: Allows the user to select the axis lengths for the plot.
5. LINEAR-LINEAR PLOT: Plots the data on a linear vs linear plot.
6. LINEAR-LOG PLOT: Plots the data on a semi-log plot. The user specifies which axis is to be the log axis.
7. LOG-LOG PLOT: Plots the data on a log vs log plot.
8. LINEAR-SQUARE ROOT PLOT: Plots the data on a linear vs square-root plot. The user specifies which axis is to be the square-root axis.

9. Z LINEAR PLOT (CALCOMP): Plots the data on a linear vs linear plot. The third data file is plotted by the use of symbols representing data intervals. These symbols and their corresponding intervals are plotted on a separate page.
10. XY LINEAR PLOT (TERMINAL): Plots the data on a linear vs linear plot on the user terminal. The number of values falling within the plot interval is printed rather than a symbol.
11. DATA VS FOOTAGE PLOT: Plots the data vs the footage--not implemented in Rev 1. Currently available in Rev 2 which is not ready for release. This plot can be made in PDAT which is described in the next section.
12. MODIFY PLOT DATA: Allows the user to modify the plot data via (X-A)/B and to average the data over specified increments.
13. M & N PLOT: Plots the data on a M & N (Schlumberger, 1974) plot. The user specifies which files the bulk density and neutron porosity are contained in. The user also specifies the fluid density and fluid travel time.

Subprogram Options

Listing---

```
AXOP--OPTION# (I)=
 1. NORMAL PLOT (Y VS X)
 2. PLOT X VS Y
 3. PLOT Z VS X
 4. PLOT X VS Z
 5. PLOT Y VS Z
 6. PLOT Z VS Y
```

Description---

1. NORMAL PLOT (Y VS X): Plots the data in the second file on the Y axis and the data in the first file on the X axis.
2. PLOT X VS Y: Plots the data in the first file on the Y axis and the data in the second file on the X axis.
3. PLOT Z VS X: Plots the data in the third file on the Y axis.
4. PLOT X VS Z: Plots the data in the third file on the X axis.
5. PLOT Y VS Z: Plots the data in the first file on the Y axis.
6. PLOT Z VS Y: Plots the data in the first file on the X axis.

Listing---

MDFY--OPTION# (I)=
1. RETURN TO PROGRAM
2. AVERAGE DATA
3. $(X-A)/B$

Descriptions---

1. RETURN TO PROGRAM: Returns control to the CRSPLT program.
2. AVERAGE DATA: Averages all three data files to the user specified interval.
3. $(X-A)/B$: Modifies the data in the specified file using the formula $(X-A)/B$. A and B are specified by the user.

DATA VERSUS FOOTAGE PLOT SYSTEM

Introduction

Two complementary programs are used to generate log data versus depth plots. The log data may be plotted on one or more axes set in a side-by-side fashion and every plot contains a blank column for lithology. PDATF is the first program utilized and it creates a plot parameter file that contains all the user information concerning which merge file, subfiles, log types, log scales, pen colors, and formats are to be used in the plot. PDAT is then executed and generates the plot using the information stored in the file created by PDATF and the log data in the designated merge file. Only PDATF has a set of options which are listed and described below.

PDATF Options

Listing---

1. # OF FIELDS
2. X AXIS START FOOTAGE
3. X AXIS END FOOTAGE
4. FEET/INCH SCALE
5. # OF SUBFILES
6. SUBFILE INDEX #
7. START AND END FOOTAGE
8. Y AXIS MINIMUM VALUE
9. Y AXIS MAXIMUM VALUE
10. Y AXIS LENGTH
11. Y AXIS UNITS
12. # OF DATA PLOTS
13. PEN SELECT #
14. LINE CODE AND INCREMENT
15. RELATIVE OR ABSOLUTE
16. Y AXIS TITLE
17. WELL NAME

Description---

The PDATF options, rather than being program control options, are I/O

commands. The above list contains instructions for the required input needed to allow PDAT to generate the desired plot. The detailed description of each option follows:

1. # OF FIELDS - Input the number of separate X-Y log data plots needed.
2. X AXIS START FOOTAGE - Input the depth start footage plot which need not be the same as the start footage for the digitized data.
3. X AXIS END FOOTAGE - Input end depth footage of plot which need not be the same as the end footage of the digitized data.
4. FEET/INCH SCALE - Input depth scale for the plot in feet/inch; e.g., an input of 20 would generate a 20 feet/inch plot.
5. # OF SUBFILES - One log may be stored in more than one subfile; therefore, all subfiles containing the data to be plotted are input, see option 6. This option indicates how many of these subfiles are needed.
6. SUBFILE INDEX # - Input an index number for as many subfiles as are needed and input in 5.
7. START AND END FOOTAGE - Input the actual start and end footage of the digitized data to be plotted. These footages must lie within the bounds established in 2 and 3 above but need not be the same.
8. Y AXIS MINIMUM VALUE - Input start point for Y axis.
9. Y AXIS MAXIMUM VALUE - Input end value of Y axis.
10. Y AXIS LENGTH - Input length of Y axis in inches; the program automatically scales 8 and 9 to fit 10.
11. Y AXIS UNITS - Input name for Y axis units; e.g., gm/cc.
12. # OF DATA PLOTS - Input number of different logs to be plotted on the same X-Y field; e.g., user can place several resistivity logs in one field or three porosity logs in one field.
13. PEN SELECT # - The user can specify what pen he wishes the plotter to use (see pen choices in Table below).
14. LINE CODE AND INCREMENT - The user can specify solid or dashed lines and dash spacing (see line choices in Table below).

15. RELATIVE OR ABSOLUTE - Input R for relative scales such as used on SP logs and A for absolute scales used on most log.
16. Y AXIS TITLE - Input name of log.
17. WELL NAME - Input drill hole name.

PEN SELECTIONS

PEN #	DESCRIPTION
1	Black #4 Fountain Pen
2	Red #4 Fountain Pen
3	Blue #4 Fountain Pen

LINE CODE SELECTIONS

LINE CODE #	DESCRIPTION
<1 or >5	Continuous line
2	---
3	---
4	---
5	---

Increment is variable and is in plot inches. A typical value would be .01.

PROGRAM CONVERSION TO OTHER HARDWARE SYSTEMS

The WELLOG system of programs is not extremely portable to other computer systems. The software system is operational on a UNIVAC 1108 computer at the University of Utah. The conversion of the FORTRAN code for WELLOG to other computer systems will have a few problems associated with the conversion of the 1108's I/O functions and the internal representation of alphanumeric data. The major problem in conversion will be that of providing an equivalent digitizing function and plotting functions for the system. Other conversion problems are associated with program chaining and disk file incompatibilities.

WELLOG is a group of programs that are chained together to form a system on the University of Utah's UNIVAC 1108 computer using a UNIVAC system routine called CONTRL. Chaining is the operation of stopping execution on one main program and passing control to another main program under software control. The operation of chaining is not the same as overlaying programs because no common memory locations exist between two programs that are chained together. Most systems have the ability to chain main programs, but conversion will require a modification of WELLOG's code where calls to CONTRL are located. An assembly language source for CONTRL is provided with the WELLOG system code for use on other UNIVAC 1100 systems.

The UNIVAC 1108 has a 36 bit word. No single program in the WELLOG system uses more than 65K words of memory. The 1108 uses a field data code that is six bits in length to represent alphanumeric characters internally. Thus each 1108 word can hold six characters. Most other systems have word lengths that are a power of two and are character codes that are eight bits in

length. Thus most other systems can store four, eight, or twelve characters per word. The WELLOG system of programs that is implemented on the 1108 has numerous references to A6 formatting fields which may have to be modified in other systems. WELLOG also uses ENCODE and DECODE statements to handle some of the alphanumeric manipulation. Any system that WELLOG is implemented on would require ENCODE and DECODE in the FORTRAN language.

WELLOG uses direct access files in its operation. The direct access READ and WRITE statements are equivalent to the IBM direct access syntax. If WELLOG is to be developed on a system that does not have direct access file capability, then it would be difficult to make modifications that would accomodate the substitution of another file type such as a sequential file.

WELLOG uses a plotting library on the UNIVAC 1108 that is similar to a standard CALCOMP subroutine package. There are a few differences in the calling arguments of some of the higher level routines. The source code of the plotting library is unobtainable because it contains information about the University of Utah UNIVAC accounting system. However, any computer system that has a plotting capability similar to a Calcomp plotter will be able to provide the necessary plotting functions that WELLOG requires. The code will probably require some modification but it should not be an extensive task. We are working to eliminate this problem in Rev 2 of WELLOG by providing FORTRAN code for a general purpose plotting library.

The major problem encountered in converting WELLOG to another system will be that of duplicating the digitizing functions of the CALMA digitizer and the digitized tape input routine. The WELLOG system uses an old model CALMA

digitizer to write a 7 track digitized tape. The magnetic tape is mounted on a tape drive on the 1108. The tape input routine of WELLOG reads the digitized tape, sums the digitizing increments, corrects for multiple "Y" points, removes negative "X" points, scales the data, equally spaces the data in the "X" direction, and writes the data to a merge file. All of the above operations are machine dependent. If WELLOG is to be implemented on another system the digitizing process and the input routines would have to be redone. We are working toward a solution of this problem in Rev 2 of WELLOG by using a digitizing process implemented on a TEKTRONIX 4014 terminal with a digitizing tablet. This system will not solve all the problems but it does eliminate the dependence on an extremely outdated CALMA digitizer.

The WELLOG system of programs can be transferred to another computer system if the person who is doing the implementation has the time and means of rewriting the digitizing portions of the program. WELLOG Rev 2 contains a more portable FORTRAN code. However, at present there is no estimated release time for Rev 2.

PROPOSED FUTURE CHANGES IN SYSTEM

This document is a user's guide to the first development level of a well log digitizing, plotting, and analysis system at ESL. The system has been designed in modular form to facilitate modifications and additions. The system described here was developed for use on the University of Utah UNIVAC 1108 computer, CALMA digitizer and CALCOMP plotter. This version of the system, Rev 1, is only occasionally used at ESL since the system has been converted to use on the University of Utah Research Institute PRIME 400 computer. The Rev 1 version described here was largely unchanged in the conversion. However, a few major changes subsequently have taken place and further system modifications are currently being made or are scheduled for implementation early in 1980. When the system development has reached a logical level for release, an appendix to this document or a new user's guide will be written and released and will be noted as Rev 2.

The single biggest change is in the digitizing system. A preliminary, operational system has been developed using a TEKTRONIX 4014 terminal and TEKTRONIX 4954 Graphics Tablet. Eventually the system will use a TEKTRONIX 4081 system. The digitized data are input onto the PRIME 400 computer disk storage and/or plotted directly on a VARIAN STATOS 42 plotter. The interfacing is all handled by the WELLOG system.

Other changes in progress or already implemented in Rev 2 are largely in CRSPLT and DATCAL:

1. Capability to plot random data such as geochemical data with well log data and with other random data.

2. Generate Dresser Atlas (1979) AK plot.
3. Compute other data modifications such as $B/X-A$, $X1/X2$, $X=A+ B \log X$ and $X = A10^{BX}$.
4. Incorporate a temperature gradient subprogram TGRAD currently used as a separate program.
5. Incorporate capability to process data in both English or MKS units.

REFERENCES

Dresser Atlas, 1979, Log interpretation charts; Dresser Atlas, Inc., Houston, Texas.

Schlumberger, 1974, Log interpretation, vol. II, Applications; Schlumberger Limited, N.Y., N.Y.

APPENDIX A
USER'S GUIDE TO THE CALMA DIGITIZER

DIGITIZING ON THE CALMA DIGITIZER A USERS GUIDE

INTRODUCTION:

The Calma digitizer is located at the University of Utah Computer Center (UUCC) located in the Merrill Engineering Building on the U of U Campus. The Digitizer is in the Users Room which is room number 3105 located on the third floor at the north-east end of the Building.

The digitizer is used to convert data from a continuous well log into a set of points that can be read from tape by the computer. The digitizer does this by recording movement in the X and Y direction. Each log is digitized in a different tape file. The WELLOG program then converts the data from the digitized tape (in inches) to the absolute values of the real data. These new data are stored in a merge file and used for future plotting and calculations.

PREPARATION:

Before actually digitizing there are several things to be done. The program is only able to read the data in small blocks. To divide the data into these smaller blocks it is necessary to place inter-record gaps after every six to ten inches of data. These IRG locations should be marked in pencil directly on the log before digitizing (see Figure A1). If the log is smooth, ten-inch intervals should be sufficient, but if there is any relief, shorter intervals should be used. It is easiest if the IRGs correspond to footage lines on the log. Most logs are measured off in inches so it is only a matter of deciding how many inches to space the IRGs. It is not necessary for the IRGs to be the same distance apart because some logs may be smooth in parts and not smooth in others.

Heading information sheets (see Figures A2 and A3) should be filled out for every tape file that is generated. The tape number starting footage and ending footage should be filled in during the digitizing process to avoid error. If there are scale changes on any of the logs, obtain enough scale change sheets for each tape file containing scale changes (see Figure A4). It would also help to mark the scale changes on the log in pencil.

When this is done obtain a digitizing tape and go to the digitizer. Use only a tape which has been cleared for reuse, as the digitizing process will destroy all previously digitized data on the tape.

DIGITIZER START-UP:

The first thing to do is to sign the log sheet at the digitizer listing the date, your name, the company name, the UUCC account number and the starting time.

Schlumberger

COMPENSATED NEUTRON LOG

COUNTY FIELD or LOCATION WELL COMPANY	BEAVER	COMPANY	UNION OIL OF CALIFORNIA
	WILDCAT	WELL	COVE FORT-SULPHURDALE UNIT NO. 42-7
	CFS 42-7	FIELD	WILDCAT
	UNION OIL OF CALIF	COUNTY	BEAVER STATE UTAH
Location:		Other Services:	
Sec. 7 Twp. 26S Rge. 6W		DIL HRT	

Permanent Datum:	GL	Elev.: 6422
Log Measured From	KB	20 Ft. Above Perm. Datum
Drilling Measured From	KB	Elev.: K.B. 6442
		D.F.
		G.I. 6422

Date	2/1/78				
Run No.	ONE				
Depth-Driller	3448				
Depth-Logger	3445				
Btm. Log Interval	3428				
Top Log Interval	50				
Casing-Driller	13-3/8	1552	@	@	@
Casing-Logger	1442				
Bit Size	12-1/4				
Type Fluid in Hole	FRESH FOAMED MUD				
Fluid Level	1320				
Dens.	8.4	28			
pH	11.5	---	ml	ml	ml
Source of Sample	FLOWLINE				
Rm @ Meas. Temp.	1.25 @ 61 °F	@	°F	@	°F
Rmf @ Meas. Temp.	1.32 @ 61 °F	@	°F	@	°F
Rmc @ Meas. Temp.	1.9 @ 61 °F	@	°F	@	°F
Source: Rmf	MEAS				
Rmc	CALC				
Rm @ BHT	NA	@	°F	@	°F
Time Since Circ.	4 HRS.				
Max. Rec. Temp.			°F		°F
Equip.	7761	FARM			
Recorded By	BECL				
Witnessed By	MR. STEVE MAI ONE				

Note:
Each
Company
Will Have
Its Own
Form which
Will Vary
From this
One.

FIGURE A2

WELL LOG DATA SHEET

TAPE # 0CC575 FILE# 3
 DATE DIGITIZED 6/12/79 BY WHOM John W. Atwood
 DATE PLACED IN I/O _____ DATE RETRIEVED _____
 DATE PLOTTED _____ DID DATA PLOT CORRECTLY _____
 CAN TAPE BE OVERWRITTEN _____ DATE OVERWRITTEN _____
 DRILLING COMPANY (2) Union Oil of California
 DRILL HOLE NAME (3) Cove Fort - Sulphurdale Unit #42-7
 AREA (4): FIELD Wildcat COUNTY Beaver STATE Utah
 PROJECT NAME (5) Cove
 LOCATION (6): LONGITUDE SECTION 7 LATITUDE TOWNSHIP 26S RANGE 6W
 LOGGING COMPANY (7) Schlumberger
 LOG NAME (8) Compsted Neutron LOG DATE (9) 2/1/78
 DATA TYPE (10) Gamma Ray DATA UNITS (11) API
 Y-ORIGIN (12) 0.0 Y-UNITS PER INCH (13) 80.0
 DATA STARTING FOOTAGE (14) 82 ENDING FOOTAGE (15) 3422
 DRILLING MEASURED FROM (16) KB ELEVATION (ABOVE P.D.) (17) 20
 LOG MEASURED FROM (18) KB ELEVATION (ABOVE P.D.) (19) 20
 PERMANENT DATUM (20) GL ELEVATION (21) 6422
 CASING DEPTH (22): DRILLER 1552 BIT SIZE (23) 12 1/4
 LOGGER 1442
 FLUID TYPE IN HOLE (24) Fresh Foamed Mud TIME SINCE CIRCULATION (25) 4 Hrs.
 MAXIMUM RECORDED TEMPERATURE (26) —

COMMENTS (27):

Example

Figure A3

SCALE CHANGES

TOTAL 1	2.0	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	32	33	34
35	36	37	38	39	40	41
42	43	44	45	46	47	48
49	50	51	52	53	54	55
56	57	58	59	60	61	62
63	64	65	66	67	68	69
70	71	72	73	74	75	76
77	78	79	80	81	82	83
84	85	86	87	88	89	90
91	92	93	94	95	96	97
98	99	100	101	102	103	104
105	106	107	108	109	110	111
112	113	114	115	116	117	118
119	120	121	122	123	124	125
126	127	128	129	130	131	132
133	134	135	136	137	138	139

FIGURE 4

The digitizer is kept unplugged and should be plugged in at this time. Turn on the power switch and then press the following buttons: "Clear", "8", "4", then "Enter" (see Figure A5). The record error light should stop flashing. If it does not, press the buttons again.

Mount the tape by removing the cover band and placing the tape on the left spindle so that the clear side of the reel faces out. The tape should unwind in a clockwise direction. Do not press the sides of the reel but press only in the center. Tighten the knob on the spindle to hold the reel. Thread the tape through the heads and on to the take-up reel so that it winds in a clockwise direction. (!! Warning, tape must be threaded this way or tape damage will result!!) A good rule to remember is that if there is only one post or pulley, the tape should go under it; If there are two pulleys, the tape goes between them (see Figure A6).

Manually wind the tape onto the take-up reel until the load point (the shiny metal strip) is located just in front of the tape heads (see Figure A7).

Turn on the tape drive motor and press the "Forward Load" button until the load point enters between the heads. Release the button and the tape should continue to advance, then stop. The tape should be ready.

Tape down the log to the digitizing table so that the baseline on the log exactly superimposes one of the horizontal lines on the digitizer (see Figure A8). The beginning of the log goes to the left side of the digitizer. It is very important that the baseline on the log always corresponds exactly to the line on the digitizer. If it does not, serious error will result in the data.

STARTING THE DIGITIZING PROCESS:

Mark the start of the log by circling the origin at the proper footage (see Figure A9). Record the footage and the Y origin on the heading sheet. The Y origin is usually, but does not have to be, the baseline, but it must be recorded accurately. Place the cross-hairs of the cursor on this point and press the "TRACE" button. Move the cursor up or down to the start of the data and press "B", then "ENTER" (see Figure A9). If it is necessary at any time to stop digitizing, press the "TRACE" button then mark the exact location where the digitizing was stopped.

DIGITIZING THE LOG:

All movement of the cursor while in trace mode is recorded, so when pressing buttons, keep the cursor securely in place. Trace over the data until the cursor corresponds to the first marked IRG. Carefully reach up with one hand and press the IRG button once only. Then trace to each consecutive IRG, again pressing the IRG button at each one until the last one before the log goes off the table. Do not put in an IRG at this last one, but press "TRACE" instead. Mark this IRG to distinguish it from the others, then move the log to the left, placing the location of the stopping point on the left side of the table. Again make sure that the baseline coincides with the

Figure A5
Digitizer Top Panel

Figure A6
Digitizer Tape Drive

Figure A7
Load Point Position

Figure A8
Digitizer Table and Cursor

employees. These interpretations are also subject to Clause of our General terms and Conditions as set out in our current Price Schedule.

horizontal lines of the digitizer. Tape it securely then move the cursor to the stopping point and press "TRACE." Do not place an IRG before or after the "TRACE." When entering trace, an IRG is automatically inserted and to do so will write an empty record to the tape. Continue digitizing as before until the end of the log is reached.

MISTAKES & SPEED ERRORS:

If an error is made or if the Speed Error warning comes on, press "TRACE", then "CLEAR", "4", "8", and "ENTER." Move the cursor to the point of the last inserted IRG and press "TRACE." Continue digitizing.

ORIGIN SHIFTS:

Often the data on the log will exceed the range of the log. When this occurs two things may be done. One is to shift the origin, the other is to change the scale. An origin shift occurs where the baseline receives a new value, usually the value at or near the point it went off the scale. The number of units per inch however remains the same. To digitize these, simply digitize up to the point of change, then press "TRACE." Move the cursor along the exact footage to where the data corresponding to the new origin starts, then press "TRACE" again (see Figure A10).

SCALE CHANGES:

To correct off-scale data a scale change may be made. In this case the origin may or may not retain its value, but the number of units per inch changes. To digitize these trace to the last point as before and press "TRACE." Press "A", then "ENTER" (see Figure A11) and write the ratio value of the change on the scale change sheet. The ratio is the value that you multiply the original units per inch by to get the new units per inch. For example, if the the original value is 10/inch and the change is 100/inch, the ratio is 10. If the log returns to its original scale the ratio is 1.

After recording the ratio, move the cursor to the start of the newly scaled data and press "TRACE."

OTHER PROBLEMS:

If part of the data are missing or if there is a discrepancy between two runs of the log, (see Figures A12 and A13), treat the end of the data as an end of log and start the next section of data as a new log.

FINISHING THE LOG:

At the end of the log, do not insert an IRG but just press "TRACE" (see Figure A14). Circle this point and record the footage on the heading sheet. Press the "File Gap" button on the tape drive. If another log is to be digitized, start over from "Starting the digitizing process" using a new heading sheet and scale change sheet for the new log. Write down the OC tape

+ Sil 1500 Origin Shift 1600

Casing

WELLCOVE FORT-SULPHURDALE 42-7
COMPANY UNION OIL
LOCATION BEAVER CO., UTAH

LEGEND
TCL TRIP CHLORIDES
NB NEW BIT
NCB NEW CORE BIT
DST DRILL STEM TEST
TG TRIP GAS
SAND
SHALE
LIMESTONE
DOLOMITE
NR NO RETURNS
EL ELECTRIC LOG
CO CIRCULATE OUT RETURNS
CKF CHECK FOR FLOW
WE INFORM SYSTEM ENGINE
147 10

Figure A12

41

4100

Data Discrepancy

4200

End Log

Start new File

Figure A13

42

Stopping at End
3400

FR
3

Ending Footage 3422 feet

SCHL
I.D.

Circle Stop

Digitize Figure A14
to end of
data, Press "Tracer".
then Press "File Gap"

REPEAT SECTION

1500

number and the number of the tape file where the log is digitized on the heading sheet.

If no other logs are to be digitized, press the "File Gap" button a second time. Press "REWIND", and the tape will rewind to the load point. Press "REWIND" again and then remove the tape from the machine. Pull the tape off from the back part of the reel, not the clear front part.

CONCLUSION:

Turn off the power to the tape drive and also the main power switch. Unplug the digitizer and record the finishing time on the digitizer log sheet. Fill out the accounting slip and turn it into the Business office across the hall in room 3116 (see Figure A15).

MISCELLANEOUS CHARGES

Transaction type A (1)

Account No. 9000 (6-9)

Subaccount 00 (11-12)

Charge code _____ (13-15)

Date 06/14/79 (16-21)

Units _____

or _____

Amount _____

(22-29)

Time off 3:10

Time on 8:20

L-only _____ (30) Rate class _____ (31) Not-to-used-amt _____ (32) Source code _____ (33)

Sequence No. _____ (34-37)

UCC agent _____ (38-43)

(44-72)

Item _____

Quantity _____ (73-78)

Signature John W. Wood

Their initials _____ (79-80)

Figure A15

APPENDIX B

SAMPLE COMPUTER SESSION

APPENDIX B

The following pages consist of a sample run demonstrating the use of the WELLOG System. Only a few of the options have been demonstrated because of limited space, but enough have been shown to help familiarize the user with the system.

The reader will notice that on several pages some of the numbers on the right hand side of the page have been cut off because of the necessity to provide space on the opposite side for binding. The numbers were data values that were a part of the test file and are not essential to understanding the program.

SUMMARY OF STEPS:

1. Mark the IRGs, scale changes, and other problems in pencil on the log.
2. Sign digitizer log sheet.
3. Plug in digitizer.
4. Turn on digitizer.
5. Clear - 8 - 4 Enter.
6. Mount Tape: 1 under, 2 between.
7. Move tape to load point.
8. Turn tape drive on.
9. Forward Load.
10. Tape down log.
11. Mark origin and record on heading sheet.
12. Move cursor to origin.
13. Trace.
14. Move cursor to start of data.
15. B - Enter.
16. Trace to IRGs.
17. Press IRG.
18. At last IRG on table press Trace.
19. Tape down log in new position.
20. Press Trace.
21. Continue.
22. At end of log press Trace.
23. Press File Gap.
24. If last log press 2nd File Gap.

25. REWIND.

26. Remove Tape.

27. Shut down Digitizer.

28. Record finishing time on Digitizer log.

29. Fill out and turn in accounting slip.

30. Complete heading sheets and turn them in with the tapes to John Atwood.

```

@RUN ATWOOD,905600/
#####OVE,10
DATE: 012280 L: 11 TIME: 112646
>@ASG,UP WELLOG-D10.
Ready
>@USE 10,WELLOG-D10
Ready
>@ASG,UP PROGTEST.,///600
Ready
>@USE 1,PROGTEST
Ready
>@XQT GEOPHY*WELLOG.FMAIN
FM----OPTION# (I)=
>0

```

```

OPTION
1 XQT WELLOG PROGRAM
2 DIRECTORY (SHORT)
3 DIRECTORY (LONG)
4 CHECK PLOT
5 DELETE & PACK
6 SET FILE LIMITS
7 INITIAL WORKFILE
8 READ SUBFILE DATA
9 EDIT SUBFILE HEADR
10 EDIT SUBFILE DATA
11 FIX SUBFILE DATA
12 PRINT SUBFILE DATA
13 TERMINATE FMAIN
FM----OPTION# (I)=

```

```

>7 :
WORKFILE INITIALIZED
FM----OPTION# (I)=
>6
PASSWORD=
>PLEASE
FILE DESCRIPTION (72 A) =
>WELLOG PROGRAM DEMONSTRATION FILE
FM----OPTION# (I)=
>13

```

NORMAL EXIT.   TIME: 368 MILLISECONDS.

```

>@FREE 10
Ready
>@ADD GEOPHY*WELLOG.XQT
Ready
Ready
Ready
Ready
Ready

```

```

WELL LOG DATA MANIPULATION PROGRAM
WELL--OPTION# (I)=

```

```

>0
OPTION
1 TERMINATE WELLOG
2 HEADER INPUT
3 MAG TAPE INPUT OF DATA
4 TERMINAL INPUT OF DATA

```

UNIVAC 1108
SYSTEM CONTROL
STATEMENTS - all
@ STATEMENTS

```

5 WRITE SUBFILE TO MRGFILE
6 READ MERGEFILE
7 POSTION DIGITIZED TAPE
8 XQT FMAIN
WELL--OPTION# (I)=
>2
*****HEADING INPUT*****

HOPT--OPTION# (I)=
>0
OPTION
1 RETURN TO PROGRAM
2 INPUT NEW HEADER
3 EDIT PREV HEAD BY LINE #
4 EDIT ALL HEAD BELOW LINE
5 PRINT HEADER
HOPT--OPTION# (I)=
>2
DRILLING COMPANY NAME IS:
>EARTH SCIENCE LAB
DRILL HOLE NAME IS:
>TEST-1
AREA IS: FIELD:
>U 000F
U OF U
COUNTY:
>SALT LAKE
STATE:
>UTAH
PROJECT NAME IS:
>WELLOG
LOCATION IS GIVEN BY:
1= SECTION, TOWNSHIP, RANGE
2= LATITUDE, LONGITUDE
INPUT 1 OR 2 :
>1
SECTION IS:
>36
TOWNSHIP IS:
>1N
RANGE IS:
>1E
LOGGING COMPANY IS:
>EARTH SCIENCE LAB
LOG NAME IS:
>BULK DENSITY
LOG DATE IS:
>1/22/80
DATA TYPE IS:
>BULK DENSITY
UNITS ARE:
>GRAMS/CC
Y ORIGIN IS AT VALUE (FLOAT):
>1.5
UNITS PER INCH (FLOAT):
>0
DATA STARTING FOOTAGE IS (FLOAT):
>0
DATA ENDING FOOTAGE IS (FLOAT):
>1000

```

DRILLING WAS MEASURED FROM:
 >KB
 ELEVATION ABOVE PERMANENT DATUM IS (FLOAT):
 >20
 LOG WAS MEASURED FROM:
 >KB
 ELEVATION ABOVE PERMANENT DATUM IS (FLOAT):
 >20
 PERMANENT DATUM IS:
 >GL
 ELEVATION IS (ELOAT):
 >5200
 CASING DEPTH IS:
 >100
 BIT SIZE IS:
 >8.25
 FLUID TYPE IN HOLE IS:
 >WATER
 TIME SINCE CIRCULATION IS:
 >2 HRS
 MAXIMUM RECORDED TEMPERATURE IS (INDICATE F OR C):
 >100 DEG F
 INPUT 12 LINES OF COMMENTS, 60 CHARACTERS PER LINE INCLUDING SPACES.
 (WRITE '*EXIT*' TO SKIP REMAINING LINES):
 >WELLOG DEMONSTRATION 01/22/80
 >*EXIT*
 INPUT THE NUMBER OF SCALE CHANGES (INT):
 >0
 HOPT--OPTION# (I)=
 >5
 DRILL HOLE NAME: TEST-1
 FIELD: U OF U COUNTY: SALT LAKE
 STATE: UTAH
 DRILLING COMPANY: EARTH SCIENCE LAB
 PROJECT: UURI,ESL,WELLOG

LOCATION: SEC 36 TWP 1N RGE 1E
 LOG NAME: BULK DENSITY
 LOGGING COMPANY: EARTH SCIENCE LAB
 LOG DATE: 1/22/80

DATA TYPE: BULK DENSITY UNITS: GRAMS/CC
 Y ORIGIN: 1.50 UNITS PER INCH: .00
 DATA STARTING FOOTAGE: .00 FEET
 DATA ENDING FOOTAGE: 1000.00 FEET
 PERMANENT DATUM: GL
 ELEVATION: 5200.00 FEET ABOVE SEA LEVEL
 DRILLING MEASURED FROM: KB
 ELEVATION: 20.00 FEET ABOVE PERMANENT DATUM
 LOG MEASURED FROM: KB
 ELEVATION: 20.00 FEET ABOVE PERMANENT DATUM

CASING DEPTH: 100
BIT SIZE: 8.25
FLUID TYPE IN HOLE: WATER
TIME SINCE CIRCULATION: 2 HRS
MAXIMUM RECORDED TEMPERATURE: 100 DEG F

*****
COMMENTS:
WELLOG DEMONSTRATION 01/22/80
*****
*****
HOPT--OPTION# (I)=

>3
WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):

>0
1= EXIT FROM EDIT MODE
2= DRILLING COMPANY NAME
3= DRILL HOLE NAME
4= AREA
5= PROJECT NAME
6= LOCATION
7= LOGGING COMPANY NAME
8= LOG NAME
9= LOG DATE
10= DATA TYPE
11= DATA UNITS
12= Y ORIGIN
13= UNITS PER INCH
14= STARTING FOOTAGE
15= ENDING FOOTAGE
16= DRILLING MEASURED FROM
17= ELEVATION ABOVE PERMANENT DATUM
18= LOG MEASURED FROM
19= ELEVATION ABOVE PERMANENT DATUM
20= PERMANENT DATUM
21= ELEVATION
22= CASING DEPTH
23= BIT SIZE
24= FLUID TYPE
25= TIME SINCE CIRCULATION
26= MAXIMUM RECORDED TEMPERATURE
27= COMMENTS
28= SCALE CHANGES

WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):

>12
Y ORIGIN IS AT VALUE (FLOAT):

>0.0
WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):

>1
HOPT--OPTION# (I)=

>1
WELL--OPTION# (I)=

>4
INPT--OPTION# (I)=

>0
OPTION
1 RETURN TO WELLOG
2 EQUALLY SPACED DATA
3 RANDM SPACED DATA

INPT--OPTION# (I)=

>2
STARTING FOOTAGE IS (F):
>0
ENDING FOOTAGE IS (F):
>1000
FOOTAGE INCREMENT IS (F):
>20
VALUE AT .00 FT IS (F):
>2.5
VALUE AT 20.00 FT IS (F):
>2.5
VALUE AT 40.00 FT IS (F):
>2.54
VALUE AT 60.00 FT IS (F):
>2.61
VALUE AT 80.00 FT IS (F):
>2.5
VALUE AT 100.00 FT IS (F):
>2.67
VALUE AT 120.00 FT IS (F):
>2.68
VALUE AT 140.00 FT IS (F):

>2.65
VALUE AT 160.00 FT IS (F):
>2.6
VALUE AT 180.00 FT IS (F):
>2.63
VALUE AT 200.00 FT IS (F):
>2.63
VALUE AT 220.00 FT IS (F):
>2.63
VALUE AT 240.00 FT IS (F):
>2.64
VALUE AT 260.00 FT IS (F):
>2.68
VALUE AT 280.00 FT IS (F):
>2.65
VALUE AT 300.00 FT IS (F):
>2.62
VALUE AT 320.00 FT IS (F):
>2.54
VALUE AT 340.00 FT IS (F):
>2.5
VALUE AT 360.00 FT IS (F):
>2.56
VALUE AT 380.00 FT IS (F):
>2.52
VALUE AT 400.00 FT IS (F):
>2.5
VALUE AT 420.00 FT IS (F):
>2.49
VALUE AT 440.00 FT IS (F):
>2.57
VALUE AT 460.00 FT IS (F):
>2.64
VALUE AT 480.00 FT IS (F):
>2.66
VALUE AT 500.00 FT IS (F):
>2.63

VALUE AT	520.00 FT IS (F):
>2.68	
VALUE AT	540.00 FT IS (F):
>2.6	
VALUE AT	560.00 FT IS (F):
>2.61	
VALUE AT	580.00 FT IS (F):
>2.59	
VALUE AT	600.00 FT IS (F):
>2.63	
VALUE AT	620.00 FT IS (F):
>2.67	
VALUE AT	640.00 FT IS (F):
>2.65	
VALUE AT	660.00 FT IS (F):
>2.65	
VALUE AT	680.00 FT IS (F):
>2.3	
VALUE AT	700.00 FT IS (F):
>2.44	
VALUE AT	720.00 FT IS (F):
>2.45	
VALUE AT	740.00 FT IS (F):
>2.6	
VALUE AT	760.00 FT IS (F):
>2.65	
VALUE AT	780.00 FT IS (F):
>2.63	
VALUE AT	800.00 FT IS (F):
>2.59	
VALUE AT	820.00 FT IS (F):
>2.62	
VALUE AT	840.00 FT IS (F):
>2.63	
VALUE AT	860.00 FT IS (F):
>2.61	
VALUE AT	880.00 FT IS (F):
>2.68	
VALUE AT	900.00 FT IS (F):
>2.66	
VALUE AT	920.00 FT IS (F):
>2.64	
VALUE AT	940.00 FT IS (F):
>2.68	
VALUE AT	960.00 FT IS (F):
>2.69	
VALUE AT	980.00 FT IS (F):
>2.65	
VALUE AT	1000.00 FT IS (F):
>2.67	
DO YOU WANT DATA PRINTED ?	
>Y	
THERE ARE	51 VALUES ! DO YOU WANT TO PRINT?
>Y	
SUBFILE #:	0

BULK DENSITY

GRAMS/CC

.00FT= 2.5000000+00	20.00FT= 2.5000000+00	40.00FT= 2.540
60.00FT= 2.6100000+00	80.00FT= 2.5000000+00	100.00FT= 2.670
120.00FT= 2.6800000+00	140.00FT= 2.6500000+00	160.00FT= 2.600
180.00FT= 2.6300000+00	200.00FT= 2.6300000+00	220.00FT= 2.630
240.00FT= 2.6400000+00	260.00FT= 2.6800000+00	280.00FT= 2.650
300.00FT= 2.6200000+00	320.00FT= 2.5400000+00	340.00FT= 2.500
360.00FT= 2.5600000+00	380.00FT= 2.5200000+00	400.00FT= 2.500
420.00FT= 2.4900000+00	440.00FT= 2.5700000+00	460.00FT= 2.640
480.00FT= 2.6600000+00	500.00FT= 2.6300000+00	520.00FT= 2.680
540.00FT= 2.6000000+00	560.00FT= 2.6100000+00	580.00FT= 2.590
600.00FT= 2.6300000+00	620.00FT= 2.6700000+00	640.00FT= 2.000
660.00FT= 2.6500000+00	680.00FT= 2.0000000+00	700.00FT= 2.440
720.00FT= 2.4500000+00	740.00FT= 2.6000000+00	760.00FT= 2.650
780.00FT= 2.6300000+00	800.00FT= 2.5900000+00	820.00FT= 2.620
840.00FT= 2.6300000+00	860.00FT= 2.6100000+00	880.00FT= 2.680
900.00FT= 2.6600000+00	920.00FT= 2.6400000+00	940.00FT= 2.680
960.00FT= 2.6900000+00	980.00FT= 2.6500000+00	1000.00FT= 2.6700

DO YOU WANT TO EDIT ?

>Y

EDIT DATA AT FOOTAGE (-1.0 TO EXIT) (F):

>680

680.00 FT = 2.00000000000000+00

DATA AT 680.00 = (F)

>2.6

EDIT DATA AT FOOTAGE (-1.0 TO EXIT) (F):

>640

640.00 FT = 2.00000000000000+00

DATA AT 640.00 = (F)

>2.65

EDIT DATA AT FOOTAGE (-1.0 TO EXIT) (F):

>-1

DO YOU WANT DATA PRINTED ?

>N

DO YOU WANT TO EDIT ?

>N

WELL--OPTION# (I)=

>5

NUMBER OF RECORDS WRITTEN = 2

DATA WRITTEN ON MASTER FILE # 1

WELL--OPTION# (I)=

>8

NORMAL EXIT. TIME: 1773 MILLISECONDS.

FM----OPTION# (I)=

>11

SUBFILE # (I)=

>1

SUBFILE #: 1

IS IT OK TO CHANGE SUBFILE ?

>Y

FIX-D-OPTION# (I)=

>0

OPTION

1 TERMINATE FIXDAT

2 SELECT FOOTAGE INT

3 ADD TO DATA

4 SUBTRACT FROM DATA

5 MULTIPLY DATA

6 DIVIDE DATA

7 SHIFT START FTG

```

 FIX-D-OPTION# (I)=
>7
 OLD STARTING FOOTAGE = .00
 NEW STARTING FOOTAGE (F):
>10
 FIX-D-OPTION# (I)=
>3
 ADD (F):
>.01
 FIX-D-OPTION# (I)=
>1
 IS IT OK TO REPLACE SUBFILE ?
>Y
 FM----OPTION# (I)=
>12
 SUBFILE # (I)=
>1
 THERE ARE 51 VALUES ! DO YOU WANT TO PRINT?
>Y
 SUBFILE #: 1

```

BULK DENSITY

GRAMS/CC

10.00FT= 2.5100000+00	30.00FT= 2.5100000+00	50.00FT= 2.5500
70.00FT= 2.6200000+00	90.00FT= 2.5100000+00	110.00FT= 2.6800
130.00FT= 2.6900000+00	150.00FT= 2.6600000+00	170.00FT= 2.6100
190.00FT= 2.6400000+00	210.00FT= 2.6400000+00	230.00FT= 2.6400
250.00FT= 2.6500000+00	270.00FT= 2.6900000+00	290.00FT= 2.6600
310.00FT= 2.6300000+00	330.00FT= 2.5500000+00	350.00FT= 2.5100
370.00FT= 2.5700000+00	390.00FT= 2.5300000+00	410.00FT= 2.5100
430.00FT= 2.5000000+00	450.00FT= 2.5800000+00	470.00FT= 2.6500
490.00FT= 2.6700000+00	510.00FT= 2.6400000+00	530.00FT= 2.6900
550.00FT= 2.6100000+00	570.00FT= 2.6200000+00	590.00FT= 2.6000
610.00FT= 2.6400000+00	630.00FT= 2.6800000+00	650.00FT= 2.6600
670.00FT= 2.6600000+00	690.00FT= 2.6100000+00	710.00FT= 2.4500
730.00FT= 2.4600000+00	750.00FT= 2.6100000+00	770.00FT= 2.6600
790.00FT= 2.6400000+00	810.00FT= 2.6000000+00	830.00FT= 2.6300
850.00FT= 2.6400000+00	870.00FT= 2.6200000+00	890.00FT= 2.6900
910.00FT= 2.6700000+00	930.00FT= 2.6500000+00	950.00FT= 2.6900
970.00FT= 2.7000000+00	990.00FT= 2.6600000+00	1010.00FT= 2.6800

```

 FM----OPTION# (I)=
>2

```

WELLOG PROGRAM DEMONSTRATION FILE

```

 LR = 500 NRP = 2060 NT = 2000 NFW = 1

```

```

FILE # 1
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT = 1
EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

```

```

 FM----OPTION# (I)=
>1

```

NORMAL EXIT. TIME: 1365 MILLISECONDS.

WELL LOG DATA MANIPULATION PROGRAM

```

 WELL--OPTION# (I)=

```

```

>6
 SUBFILE # (I)=

```

```

>1 RDOPT-OPTION# (I)=
>0 # OPTION
 1 RETURN TO WELLOG
 2 READ HEADER
 3 READ HEADER AND DATA
 4 EDIT HEADER
 5 EDIT DATA
 RDOPT-OPTION# (I)=
>3 NUMBER OF RECORDS READ = 2
 RDOPT-OPTION# (I)=
>1 WELL--OPTION# (I)=
>5 NUMBER OF RECORDS WRITTEN = 2
 DATA WRITTEN ON MASTER FILE # 2
 WELL--OPTION# (I)=
>6 SUBFILE # (I)=
>1 RDOPT-OPTION# (I)=
>3 NUMBER OF RECORDS READ = 2
 RDOPT-OPTION# (I)=
>1 WELL--OPTION# (I)=
>5 NUMBER OF RECORDS WRITTEN = 2
 DATA WRITTEN ON MASTER FILE # 3
 WELL--OPTION# (I)=
>6 SUBFILE # (I)=
>3 RDOPT-OPTION# (I)=
>3 NUMBER OF RECORDS READ = 2
 RDOPT-OPTION# (I)=
>1 WELL--OPTION# (I)=
>5 NUMBER OF RECORDS WRITTEN = 2
 DATA WRITTEN ON MASTER FILE # 4
 WELL--OPTION# (I)=
>8
NORMAL EXIT. TIME: 2555 MILLISECONDS.
 FM----OPTION# (I)=
>5 PASSWORD=
>PLEASE
 DELETE AND PACK
 TYPE Y FOR SUBFILE DELETION
 # OF SELECTIONS= 4
 1234
> Y
 FM----OPTION# (I)=
>2

```

WELLOG PROGRAM DEMONSTRATION FILE

LR = 500 NRP = 2060 NT = 2000 NFW = 3

FILE # 1
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FILE # 2
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FILE # 3
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FM----OPTION# (I)=

>1

NORMAL EXIT. TIME: 1196 MILLISECONDS.
WELL LOG DATA MANIPULATION PROGRAM
WELL--OPTION# (I)=

>1

NORMAL EXIT. TIME: 37 MILLISECONDS.
>EQ?@XQT GEOPHY*WELLOG.DATCAL
03 ILLEGAL CHARACTER ?
>@XQT GEOPHY*WELLOG.DATCAL
DCAL--OPTION# (I)=

>0

- # OPTION
- 1 TERMINATE DATCAL
- 2 READ SUBFILE FROM MRGFLE
- 3 WRITE SUBFILE TO MRGFILE
- 4 CALCULATE AVERAGE
- 5 PRINT ORIGINAL DATA
- 6 PRINT CALCULATED DATA
- 7 PRINT ORIGINAL HEADER
- 8 PRINT CALCULATED HEADER
- 9 CALCULATE (X - A) / B

DCAL--OPTION# (I)=

>2

SUBFILE # (I)=

>1

DCAL--OPTION# (I)=

>4

*****DATA AVERAGING ROUTINE*****
FILE # : 1

BULK DENSITY GRAMS/CC

STARTING FOOTAGE = 10.00
ENDING FOOTAGE = 1010.00
EQUALLY SPACED INTERVAL = 20.00

INPUT START AND END FOOTAGES (F),(F) :
>10,1010

INPUT AVERAGING INTERVAL (F) :
>100

AVERAGING PARAMETERS ARE :

STARTING FOOTAGE = 10.00
ENDING FOOTAGE = 1010.00
EQUALLY SPACED INTERVAL = 100.00

DO YOU WANT TO CHANGE THEM ? :

>N

DCAL--OPTION# (I)=

>3

NUMBER OF RECORDS WRITTEN = 2

DATA WRITTEN ON MASTER FILE # 4

DCAL--OPTION# (I)=

>2

SUBFILE # (I)=

>2

DCAL--OPTION# (I)=

>9

INPUT VALUES OF A AND B (F,F):

>1,3

DCAL--OPTION# (I)=

>3

NUMBER OF RECORDS WRITTEN = 2

DATA WRITTEN ON MASTER FILE # 5

DCAL--OPTION# (I)=

>2

SUBFILE # (I)=

>3

DCAL--OPTION# (I)=

>9

INPUT VALUES OF A AND B (F,F):

>0,.01

DCAL--OPTION# (I)=

>1

WARNING !!! UNSAVED DATA IN FILE
DO YOU WANT IT SAVED?

>Y

NUMBER OF RECORDS WRITTEN = 2

DATA WRITTEN ON MASTER FILE # 6

NORMAL EXIT. TIME: 2678 MILLISECONDS.

>@XQT GEOPHY*WELLOG.WELLOG

WELL LOG DATA MANIPULATION PROGRAM

WELL--OPTION# (I)=

>8

NORMAL EXIT. TIME: 43 MILLISECONDS.

FM----OPTION# (I)=

>9

SUBFILE # (I)=

>4

5.

*****HEADING EDIT*****

SUBFILE #: 5

HOPT--OPTION# (I)=

>3

WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >10
 DATA TYPE IS:
 >NEUTRON POR
 WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >11
 UNITS ARE:
 >PERCENT
 WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >1
 HOPT--OPTION# (I)=
 >1
 IS IT OK TO REPLACE SUBFILE ?
 >Y
 FM----OPTION# (I)=
 >9
 SUBFILE # (I)=
 >6
 *****HEADING EDIT*****

SUBFILE #: 6
 HOPT--OPTION# (I)=
 >10
 # OPTION
 1 RETURN TO PROGRAM
 2 INPUT NEW HEADER
 3 EDIT PREV HEAD BY LINE #
 4 EDIT ALL HEAD BELOW LINE
 5 PRINT HEADER
 HOPT--OPTION# (I)=
 >3
 WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >10
 DATA TYPE IS:
 >TRAVEL TIME
 WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >11
 UNITS ARE:
 >MICROSEC/FT
 WHAT DO YOU WANT TO CHANGE? (INPUT 0 FOR INDEX):
 >1
 HOPT--OPTION# (I)=
 >1
 IS IT OK TO REPLACE SUBFILE ?
 >Y
 FM----OPTION# (I)=
 >2

WELLOG PROGRAM DEMONSTRATION FILE

LR = 500 NRP = 2060 NT = 2000 NFW = 6

FILE # 1
 BULK DENSITY EARTH SCIENCE LAB 1/22/80
 N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT = 1
 EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FILE # 2
 BULK DENSITY EARTH SCIENCE LAB 1/22/80
 N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT = 1

EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FILE # 3
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 2.4499999881+00 MAX = 2.6999999881+00

FILE # 4
BULK DENSITY EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 10. N PTS = 10. ST FT = 60.00 EN FT =
EQUAL SP INT = 100.00 MIN = -2.7017129710+17 MAX = 2.4155964638-05

FILE # 5
NEUTRON POR EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 5.0333333015-01 MAX = 5.0333333015-01

FILE # 6
TRAVEL TIME EARTH SCIENCE LAB 1/22/80
N REC = 1. PT LST REC = 51. N PTS = 51. ST FT = 10.00 EN FT =
EQUAL SP INT = 20.00 MIN = 2.5099999809+02 MAX = 2.5099999809+02

FM----OPTION# (I)=

>5

PASSWORD=

>PLEASE

DELETE AND PACK

TYPE Y FOR SUBFILE DELETION

OF SELECTIONS= 6

123456

> YYY

FM----OPTION# (I)=

>1

NORMAL EXIT. TIME: 2207 MILLISECONDS.

1

WAIT-Last input ignored

WELL LOG DATA MANIPULATION PROGRAM

WELL--OPTION# (I)=

>1

NORMAL EXIT. TIME: 47 MILLISECONDS.

>@XQT GEOPHY*WELLOG.CRSPLT

*****INPUT DRILL HOLE NAME*****

INPUT UP TO 24 LETTERS (A) :

>TEST-1

1,2, OR 3 FILES ? (I):

>3

*****SELECT FILE FOR X AXIS*****

SUBFILE # (I)=

>1

TITLE (A):

INPUT UP TO 24 LETTERS (A) :

>BULK DENSITY

UNITS (A):

INPUT UP TO 24 LETTERS (A) :

>GRAMS/CC

*****SELECT FILE FOR Y AXIS*****

2

SUBFILE # (I)=

>NEUTRON POR

TITLE (A):

INPUT UP TO 24 LETTERS (A) :

>PERCENT

UNITS (A):

INPUT UP TO 24 LETTERS (A) :

>

*****SELECT FILE FOR Z AXIS*****

SUBFILE # (I)=

>3

TITLE (A):

INPUT UP TO 24 LETTERS (A) :

>TRAV TIME

UNITS (A):

INPUT UP TO 24 LETTERS (A) :

>MICROSEC/FT

BULK DENSITY

GRAMS/CC

FILE #: 1

STARTING FOOTAGE : 10.00 ENDING FOOTAGE : 1010.00

EQUALLY SPACED INTERVAL : 20.00

NEUTRON POR

PERCENT

FILE #: 2

STARTING FOOTAGE : 10.00 ENDING FOOTAGE : 1010.00

EQUALLY SPACED INTERVAL : 20.00

TRAV TIME

MICROSEC/FT

FILE #: 3

STARTING FOOTAGE : 10.00 ENDING FOOTAGE : 1010.00

EQUALLY SPACED INTERVAL : 20.00

MINIMUM FOOTAGE : 10.00 MAXIMUM FOOTAGE : 1010.00

MINIMUM FOOTAGE INCREMENT : 20.00

MAXIMUM FOOTAGE INCREMENT : 1000.00

INPUT START AND END FOOTAGES (F,F):

>10,1010

INPUT FOOTAGE INTERVAL (F):

>20

PRESENT PLOT FOOTAGES :

START FOOTAGE : 10.00 END FOOTAGE : 1010.00

FOOTAGE INTERVAL : 20.00

OK TO CONTINUE ?

>Y

FILE # 1 MIN = 2.4500000+00 MAX = 2.7000000+00

FILE # 2 MIN = 0.0000000 MAX = 2.6750000+00

FILE # 3 MIN = 0.0000000 MAX = 2.5100000+02

NUMBER OF DATA POINTS = 51

DO YOU WANT AN 8 1/2 X 11 PLOT ?

>Y

DO YOU WANT 11 INCH SIDE TO BE THE X AXIS ? :

>N

INPUT AXIS MIN AND UNITS/INCH FOR FILE 1 (F,F):

>2,.2

INPUT AXIS MIN AND UNITS/INCH FOR FILE 2 (F,F):
>0,.5

INPUT AXIS MIN AND UNITS/INCH FOR FILE 3 (F,F):
>0,50

OK TO CONTINUE ? :

>Y

CSPT--OPTION# (I)=

>0

OPTION

- 1 TERMINATE CROSS PLOT PRG
- 2 SELECT FILE #S TO PLOT
- 3 SELECT PLOT FOOTAGES
- 4 SELECT PLOT SIZE PARAM
- 5 LINEAR-LINEAR PLOT
- 6 LINEAR-LOG PLOT
- 7 LOG-LOG PLOT
- 8 LINEAR-SQUARE ROOT PLOT
- 9 Z LINEAR PLOT (CALCOMP)
- 10 XY LINEAR PLOT(TERMINAL)
- 11 DATA VS FOOTAGE PLOT
- 12 MODIFY PLOT DATA
- 13 M & N PLOT

CSPT--OPTION# (I)=

>10

AXOP--OPTION# (I)=

>0

OPTION

- 1 NORMAL PLOT (Y VS X)
- 2 PLOT X VS Y
- 3 PLOT Z VS X
- 4 PLOT X VS Z
- 5 PLOT Y VS Z
- 6 PLOT Z VS Y

AXOP--OPTION# (I)=

>1

DO YOU WANT A CONTINUOUS LINE GRAPH ? :

>N

NEUTRON POR VS BULK DENSITY

OK TO CONTINUE ?

>Y

NEUTRON POR VS BULK DENSITY

TEST-1

10.00 - 1010.00 FEET
AT 20.00 FOOT INTERVALS

CSPT--OPTION# (I)=
>1

THERE WERE 0 PLOTS MADE

NORMAL EXIT. TIME: 1944 MILLISECONDS.

>@FIN

RUNID: ATWOOD ACCOUNT: 905600 EXEC-ID: 33R3A-PROD11
PROJECT: COVE OPTS: N P/R: H/T10013
\I/O TIME: 00:01:01.668 ER TIME: 00:00:15.477
\CPU TIME: 00:00:14.225 KILO-CORE-SECS: 4749.297
\TOT UNITS: 00:01:31.370

BILLING INFORMATION 1108 UNITS : 98.95 CONNECT HOURS : 1.30

CARDS-IN: 260, OUT: 0 PAGES: 15 TAPES - LIB/OC:00/00

**EST. COST: \$10.52 SUB-USED: \$1.18 SUB-AMT. LEFT: [REDACTED]

ACCT-BAL [REDACTED] AT 00:39 JAN 22, 1980

OP/RP/TYPE M/H/DEMAND ABOVE COST DOES NOT INCLUDE PAGES, CARDS, OR PLOTS

INITIATION TIME 11:26:46 JAN 22, 1980

TERMINATION TIME 12:44:36 JAN 22, 1980

Terminal Inactive

APPENDIX C

FILE FORMAT TABLES

TABLE C1
WORK FILE FORMAT DESCRIPTION

<u>1108 WORDS</u>	<u>DESCRIPTION</u>
1-10	Drilling Co. Name (alphanumeric A6)
11-20	Drill hole Name (alphanumeric A6)
21-23	Field (alphanumeric A6)
24-26	County (alphanumeric A6)
27-29	State (alphanumeric A6)
30	Not used
31-40	Project Name (alphanumeric A6)
41	1.0 - Section, Township, Range (F.P.) or 2.0 - Latitude, Longitude (F.P.)
42-43	Section (alphanumeric A6)
44-45	Township (alphanumeric A6)
46-47	Range (alphanumeric A6)
or	
42-44	Latitude (alphanumeric A6)
45-47	Longitude (alphanumeric A6)
51-60	Log Name (alphanumeric A6)
61-70	Logging Company (alphanumeric A6)
71-80	Log Date (alphanumeric A6)
81-83	Data type (alphanumeric A6)
84-86	Data type Units (alphanumeric A6)
89	Y origin in data units (F.P.)
90	Units/inch in Y direction (F.P.)

<u>1108 WORDS</u>	<u>DESCRIPTION</u>
91	Start footage (F.P.)
92-100	Not used
101	End footage (F.P.)
111-116	Drilling reference (alphanumeric A6)
117-119	Not used
120	Elevation above Permanent Datum (F.P.)
121-126	Log reference (alphanumeric A6)
127-129	Not used
130	Elevation above Permanent Datum (F.P.)
131-136	Permanent Datum (alphanumeric A6)
137-140	Not used
141-150	Casing depth (alphanumeric A6)
151-160	Bit size (alphanumeric A6)
161-170	Fluid type (alphanumeric A6)
171-180	Time since circulation (alphanumeric A6)
181-190	Maximum recorded temperature (alphanumeric A6)
191-310	Comments (alphanumeric A6)
311	# of scale changes (F.P.)
312-450	Scale change ratios (F.P.)
451	# of records (F.P.)
452	# of points in last record (F.P.)
453	Total # of points (F.P.)
454	Starting footage (F.P.)
455	End footage (F.P.)
456	Delta X footage (F.P.)
457	Minimum Y value (F.P.)

1108 WORDS

DESCRIPTIONS

458

Maximum Y value (F.P.)

459-500

Not used

TABLE C2

MERGE FILE FORMAT DESCRIPTION

<u>RECORD #</u>	<u>DESCRIPTION</u>
1-5	Merge file header information and subfile pointers
	record #1
	word #1 record length (I)
	word #2 total records permitted (I)
	word #3 total subfiles permitted (I)
	word #4 total subfiles written (I)
	word #5-16 title (alphanumeric A6)
	record #2
	subfile start record pointers (I)
	record #3
	subfile start record pointers cont. (I)
	record #4
	subfile end record pointers (I)
	record #5
	subfile end record pointers cont. (I)
6	Header of first subfile
7	First data record of first subfile (F.P.)
.	
.	
.	
N	Last data record of subfile #1 (F.P.)
	(Note: The first subfile start pointer has the value of 6, and the first subfile end pointer has a value of N)
N+1	Header record of second subfile.
N+2	First data record of subfile #2 (F.P.)
.	
.	
.	
N+J	Last data record of subfile #2 (F.P.)
etc.	