INFORMATION STORAGE AND RETRIEVAL
SYSTEM FOR WELL HYDROGRAPH DATA
USER'S MANUAL

Battelle

Pacific Northwest Laboratories
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by

D. R. Friedrichs

Water and Land Resources Department

1972

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SUMMARY

This document describes a collection of programs used in storage and retrieval of well hydrograph data. The programs are used on either a UNIVAC 1108 computer or a PDP-9 computer, depending upon their function. The UNIVAC 1108 computer programs are transmitted from the PDP-9 to the 1108 via a data communication link for execution. The computations are returned to the PDP-9 via the data link and manipulated by the PDP-9 computer programs to provide the required output options.

Certain preliminary programs perform preparatory functions prior to the execution of the main PDP-9 computer program DSWELL, which is the actual data retrieval and display program. The function of each of the programs is described in detail.

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INFORMATION STORAGE AND RETRIEVAL SYSTEM
FOR WELL HYDROGRAPH DATA
USER'S MANUAL

INTRODUCTION

The data retrieval and display program (DSWELL) described in this report was developed to retrieve hydrograph data and produce a visual display on a UNIVAC 1558 graphics display unit. This program, written for the PDP-9 computer, performs this function for all of the wells on the Hanford Reservation, using field measurements and/or calculations from the Variable Thickness Transient Groundwater Flow Model as input data.¹

The program provides a quick method of retrieving, displaying, and outputting hydrograph data in hard copy on an INFO-MAX printer/plotter. The program also provides an efficient method for eliminating errors and discrepancies in the data. Once these errors have been detected they may be quickly corrected on the permanent magnetic tape data file. The program is also valuable in VTT model verification runs since it provides an efficient method for comparing field data with model calculations.

HYDROGRAPH DISPLAY PROGRAM

Figure 1 shows the initial CRT display immediately after program execution. This display includes the Hanford boundary map with all wells currently being used. Each well is represented by a star which is light pen interactive. In the upper right hand corner of the CRT display are light pen interactive options available to the users. An explanation of these options follows.

To select a well, the star is activated with the light pen causing the designation and casing elevation of the selected well to appear in the lower left hand corner of the display (Figure 1). To obtain the well hydrograph on the CRT, the light button CHART is activated with the light pen. The hydrograph is displayed as depicted in Figure 2 (water level elevation in feet above mean sea level as a function of time in years). To obtain a hard copy of the hydrograph, the light button PLOT is activated and an electro-static plotter/printer produces a plot of the hydrograph.

The user has the option of changing either or both of the vertical and horizontal scales of the plots to provide more detail. The vertical and horizontal scales of the hydrograph shown in Figure 2 were expanded to produce the enlarged portion shown in Figure 3A. Figure 3B shows an expansion in the vertical scale while Figure 3C shows an expansion in the horizontal direction.

This program can also request hydrographs produced by VTT model simulations at any well location. To do so, a well is selected from the display screen with the light pen and a key is depressed. The PDP-9 program stores the well name and coordinates. When all the wells have been selected in this manner, an 1108 program converts the results into VTT model coordinates and initiates a search of VTT generated potentials for the appropriate time planes existing in the UNIVAC 1108 files. The potential for each well site at each time plane is obtained by spatial interpolation and the information is returned to the PDP-9. The results may then be displayed as overlays on the original measured well hydrographs for rapid visual comparisons.

Figure 4 shows some wells used with the VTT data. These labels are light pen interactive and when the light button OVERLAY is selected the corresponding hydrographs with overlaid VTT data, Figure 5, are produced.

FIGURE 1. Hanford Base Map with Wells

FIGURE 2. Hydrograph for Well 699-32-77

FIGURE 3A. Expanded Scale for Well Shown in Figure 2

FIGURE 3B. Expanded Y Scale for Well 699-32-77

FIGURE 3C. Expanded X Scale for Well 699-32-77

FIGURE 4. Labels of Wells Used in the VTT Model

For areas which contain a high concentration of wells, a procedure has been devised for enlarging a selected subregion to permit easier well selection with the light pen. The subregion is selected on the display screen as shown in Figure 6. The size of the area to be enlarged is determined with the light pen and the tracking cross. To expand the subregion to full scale on the display screen, the light button REGION is selected and the designated area is enlarged as shown in Figure 7. All the wells that fall within the subregion are represented by light pen interactive stars. Using the procedure described previously, a hydrograph of any well in the subregion can be produced as shown in Figure 8. The well number and casing elevation appears on the graph for ready reference. The solid line shows the available data for the well. The user may recall the base map by activating the light button MAP or the expanded region by activating the light button REGION to select other wells. He may return to the base map to define another region for enlargement. The user may also return to the last selected graph by activating the light button CHART.

FIGURE 5. Well Hydrograph with VTT Overlay

FIGURE 6. Base Map Showing Selected Subregion for Enlargement

FIGURE 7. Enlarged Display of Subregion Shown in Figure 6

FIGURE 8. Hydrograph of Well Within Expanded Subregion

PROGRAM OPERATION

Prior to program operation it is necessary to transfer programs and hydrograph data from tape to the disc in the following manner.

- 1) Mount tape labeled VTT HYDROGRAPH SAVE onto DEC tape unit 1.
- 2) Using the DOS (disc operating system) SAVE routine, transfer from DEC tape 1 to disc unit 1.
- 3) Return control to the monitor and begin display program operation by typing the following message after the \$:

\$ G 1 DSWELL

- 4) A display of the Hanford base map with wells will then appear on the CRT. The operation of the program from this point on is described in detail in Program Operation - DSWELL.

- 5) If other operations such as updating well data or retrieval of VTT data are required, the operator must obtain the appropriate program which is stored on the DEC tape labeled SOURCES HYDROGRAPH. A brief description of each program is listed below, and more complete information will be found under the appropriate program headings on the following pages.

Program Set

- a) DSWELL - display program (SAVE tape)
- b) COMBIN - 1108 program for combining new and old well data
- c) HYDRO - 1108 program for retrieving well data from the master well tape and formatting data for the display
- d) WLLDSK- PDP-9 program for setting up disc files from the well data returned by HYDRO
- e) VTT - 1108 program for retrieving VTT generated data for wells selected using DSWELL.

Program Operation - DSWELL

This program has several options which facilitate the retrieval and display of well hydrographs. These options are activated through the use of the CRT display light pen and keyboard.

Light Pen Interrupts:

- 1) Wells may be selected with the light pen
- 2) Tracking cross-used with function keys α and β to define a box for expanded region
- 3) Light buttons

MAP--return to map display

REGION--display expanded subregion defined by box

CLEAR BOX--remove subregion from display

CHART--display chart and selected well hydrograph

EXPAND Y--expand vertical scale - see keyboard interrupts No. 4

EXPAND X--expand horizontal scale - see keyboard interrupts No. 4

PLOT--plot current display on printer/plotter

OVERLAYS--display observed and VTT model generated hydrographs for the selected well

- 4) Wells that have been requested from VTT potential surfaces appear on the screen after the light button OVERLAYS has been activated (see Figure 4). When one of these designations has been activated by the light pen, the chart and graph for the selected well are displayed along with the corresponding overlaid VTT data.

Keyboard Interrupts:

- 1) α - inputs present position of tracking cross as start of box
- 2) β - inputs present position of tracking cross as end of box
- 3) P - punches selected well on paper tape for VTT request
- 4) Keys 0 through 9 -- used to input a three digit number as a minimum and another three digit number as a maximum for expanded scale; both numbers are terminated with a carriage return after which the user activates the light button CHART with the light pen; the expanded graph is then displayed using the input minimum and maximum values. This procedure is used to expand the scale in either the horizontal or vertical direction or both
- 5) Track keys -- move the tracking cross incrementally:
 - ↑ -- move up
 - ↓ -- move down
 - -- move right
 - ← -- move left

Appendix A shows the load map of the DSWELL program. When the program has been loaded, a map of the Hanford Reservation appears on the display screen with small stars indicating individual well locations. The tracking cross and several tags (light buttons) which are used for option selections also appear on the initial display, as shown in Figure 1.

To define a subregion, the operator moves the tracking cross with the light pen or track keys to the bottom left portion of a region to be expanded and strikes the α key on the CRT keyboard. Moving the tracking cross again causes a box to appear on the screen. This box is adjusted to define the limits of the subregion desired (Figure 6); when this is completed the user strikes the β key and the program searches the disc files and retrieves the wells which lie within this box. At this point activating the light button REGION will expand the defined subregion, producing the new display on the CRT (Figure 7).

The hydrograph scale can be changed so that fine detail may be more closely studied by inputting on the CRT keyboard a three digit number for a minimum ordinate value, followed by a RETURN. The maximum ordinate value is then input as a three digit number followed by a RETURN. Activating the light button CHART now displays the expanded hydrograph. This operation may be repeated any number of times.

When a hard copy of a hydrograph is desired the user first turns on the printer/plotter, then activates the light button PLOT. This produces a plot as shown in Figure 9.

See Appendix A for load map and program listing. Four other routines are required when loading: HANFRD, CHART, MOVER and DDECIM. HANFRD and CHART are display files while MOVER and DDECIM are subroutines.

Program Operation - COMBIN

COMBIN is a UNIVAC 1108 program used to update the original well hydrograph data stored on magnetic tape. Water elevation data collected after 1956 and stored on a second magnetic tape is combined with the original data and output to a third magnetic tape which now becomes the permanent master well file.

This program uses a number of unique data handling techniques, including manipulation of several magnetic tapes, continual swapping between drum locations, and outputting results to tape, cards, and printer. These capabilities are useful when large amounts of data must be manipulated and combined or appended. The program is on cards and is input at either a 1004 terminal or at the 1108. A complete listing of the Program and Control Cards is given in Appendix B.

WELL HYDROGRAPHS

FIGURE 9. Hydrograph Plot

Program Operation - HYDRO

HYDRO is a UNIVAC 1108 computer program which is used to re-format and transfer the permanent well hydrograph data from an 1108 magnetic tape to the PDP-9 computer. This program is used each time the data files are changed on the permanent magnetic tape. The data is stored on the permanent tape as it appears on page C-4; page C-5 shows how the data appears when received at the PDP-9.

The program reads each well in consecutive order from the tape and converts Richland coordinates to plant coordinates if they are not already in that form. The following equations are used to make this conversion.

$$N_p = -79566.87 + .9999298968N_r + .0118409201E_r$$

$$W_p = 892.88 + .0118409201N_r + .9999298968E_r$$

The PDP-9 uses the plant coordinate system with the origin shifted to $N_p = 35,000$ and $W_p = 109,000$. Therefore, these values are used to adjust the well coordinates in the following manner:

$$Y = N_p - 35,000$$

$$X = W_p - 109,000$$

These new coordinates are then converted to display units (IY and IX) for use on the CRT display

$$IY = (Y*1023.)/144,000$$

$$IX = (X*1023.)/144,000$$

where 1023 is the maximum number of display units for full screen display and 144,000 is the total number of feet at the widest part of the Hanford base map.

The information for each well is then transferred via data link to the PDP-9 computer; when all wells are transferred the results appear as shown on page C-3. This data is edited at the PDP-9 to eliminate the unnecessary data link header and all of the information immediately following the data (see page C-3). After editing, the well data file is transferred to DECTAPE as WELLS SRC.

The data returned from the 1108 is stored on DEC tape 2 by program HYDRO as follows:

<u>FILE Name</u>	<u>EXT.</u>
WELLS	SRC

This is the input to program WLLDSK.

Program Operation - WLLDSK

WLLDSK is a computer program used to set up the PDP-9 disc files of well hydrograph data for the DSWELL program. This program reformats the data contained in the file wells SRC and transfers the data to disc in an optimum form in order to conserve disc space. These files are stored on disc 1.

There are four possible disc files that may be internally set up on the disc by the program WLLDSK. The size of each file is determined by the number of SUBFILES (wells) it contains. Each file has a predetermined maximum number of points per subfile, as shown in Table 1.

TABLE 1. DISC FILE SETUP FOR WELL DATA

<u>FILE NAME</u>	<u>FILE EXT.</u>	<u>SUBFILE SIZE</u>	<u>DISC SECTORS PER SUBFILE</u>
WELLS	FL1	51	1
WELLS	FL2	107	2
WELLS	FL3	163	3
WELLS	FL4	216	4

For example, WELLS FL1 contains all wells with 51 or fewer data points; WELLS FL2 contains wells 52 - 107 data points, and so on.

The following table shows the configuration in which each subfile stores the hydrograph data.

TABLE 2. FORMAT OF INDIVIDUAL WELLS STORED ON DISC

<u>LOCATION</u>	<u>CONTENTS</u>
INDX(1)	NO. OF POINTS
INDX(2)	X COORDINATE
INDX(3)	Y COORDINATE
INDX(4)	CASING ELEVATION
INDX(5)	WELL DESIGNATION ↓
INDX(6)	
INDX(7)	
INDX(8)	
INDX(9)	
INDX(10)	POTENTIALS ↓
INDX(11)	
↓	
INDX (N)	
INDX (N+1)	
↓	ELEVATIONS
INDX (M)	

Table 3 shows a sample disc map. Assuming all four files are being utilized,

File 1 contains 5 wells
 File 2 contains 3 wells
 File 3 contains 4 wells
 File 4 contains 3 wells

TABLE 3. SAMPLE DISC MAP

<u>FILE NAME</u>	<u>FILE EXT.</u>		<u>START DISC ADDRESS</u>
WELLS	FL1	Subfile 1	1
		2	2
		3	3
		4	4
		5	5
WELLS	FL2	Subfile 1	6
		2	8
		3	10
WELLS	FL3	Subfile 1	12
		2	15
		3	18
		4	21
WELLS	FL4	Subfile 1	24
		2	28
		3	32

Page D-1 shows the loading procedure for WLLDSK and the resulting output to the teletype after the program has searched the well tape and determined the number of wells in each disc file.

Program Operation - VTT

VTT is a UNIVAC 1108 program used to retrieve VTT model predicted potential data at selected well locations. It utilizes input well coordinate data obtained from the DS WELL display program and potential surfaces from the VTT model simulations.

The well coordinates punched at the PDP-9 by program DS WELL are placed in a data file following the VTT program. One line with a two-word header is placed immediately preceding this data in a 2I5 format (page E-2). The first word is the number of wells in the file and the second word is the number of time planes to be calculated for each well. This input data is also used later by the display program; the

procedure for its use is described in the following pages.

The VTT program with appended well data is transmitted via data link to the UNIVAC 1108 where it is processed. The following method is used to determine the hydrograph of the well within the VTT model potential matrix system.

The matrix is set up on a 2000 foot grid system and the well coordinates are input in feet. The first step is to determine the four surrounding points I, J, K, and L with the following configuration.

Where I, J, K, and L are the node numbers within the array. TK is the percentage of distance of point P between I and J and TI is the percentage of distance of point P between I and K.

The following equations are now used to determine the potential at point P.

$$\theta_1 = \theta(I) + \frac{\theta(J) - \theta(I)}{TK}$$

$$\theta_2 = \theta(K) + \frac{\theta(L) - \theta(K)}{TK}$$

$$\theta_3 = \theta(I) + \frac{\theta(K) - \theta(I)}{TI}$$

$$\theta_4 = \theta(J) + \frac{\theta(L) - \theta(J)}{TI}$$

$$\theta_P = \frac{\theta_1 + \theta_2 + \theta_3 + \theta_4}{4}$$

θ_P is the potential at point P. The process is repeated for this well point for each time plane that has been generated by the VTT model.

Upon program completion the resulting potential values for each well location are transmitted back to the PDP-9 computer via data link in a 10F7.2 format. This information must then be edited to delete the data link header and trailer information which is received with each return transmission. Page E-3 shows a typical return transmission of data as well as the edited data which is labeled OVERLAY SRC and transferred to disc 2. The input data labeled HEADR SRC (page E-2) is also transferred to disc 2 for use by program DSWELL. The DSWELL program can now be used to display both observed and predicted hydrographs.

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APPENDIX A

PROGRAM DSWELL

APPENDIX A

↑C

\$ A DSA 3/DKC1 -4/DKD1 10/DKD2 7
\$ GLOAD

LOADER

>P,C-DSWELL,HANFRD,MOVER,DDECIM

P	DSWELL	01743
C	.XX	33004
C	SCREEN	31370
C	DATA	31167
C	VDATA	30607
P	HANFRD	07663
P	MOVER	10643
P	DDECIM	10660
P	PPA.	10745
P	DSA.	11536
P	WRDFL	11763
P	DUMP	12227
P	DMPFIL	12312
P	RASAVE	12456
P	RATRA	12644
P	RAFILE	12755
P	NDKS	13167
P	IARYSZ	13217
P	EQUIV	13233
P	IMEM	13257
P	TRACK	13275
P	DFHOL	13535
P	DFILE	13641
P	DELAY	15446
P	IFLD	15553
P	IOCT	15620
P	GFNAM.	15677
P	.DAI	15771
P	DKD.	16034
P	FILE	20020
P	FLOAT	17567
P	IFIX	17600
P	.DA	17613
P	BCDIO	20356
P	.SS	17671
P	GOTO	24251
P	STOP	17760
P	SPMSG	24277
P	FIOPS	24372
P	INTEAZ	25215
P	RELEAZ	25351
P	OTSER	26462
P	.CB	26672

USE ↑Q

↑Q

DKAD 13500

\$ ENTER 13500 I DSWELL
\$ G I DSWELL


```

C   DISPLAY PROGRAM "DSWELL" FOR HANFORD WELL DATA
C   D.R. FRIEDRICHS
C   3/14/72
      INTEGER F1,GRAPH,OUT,BOX,TRK
      LOGICAL TRKSW,REGSW,SWTCH
      EXTERNAL HANFRD,TRAK
      DIMENSION MEM(1),F1(1),TRK(1),MM1(730),MM2(129),MM3(120)
      DIMENSION WELLS1(2),WELLS2(2),WELLS3(2),WELLS4(2)
      DIMENSION DEFDOT(2),TMP(2),DFL(2),HDR(2),OVR(2)

C
      COMMON INDX(448),LPWELL(2000),LRUT(80)
      COMMON/SCREEN/ BOX(30),LPBOX(150),GRAPH(500),OUT(100)
      COMMON/DATA/ NWELL,ITC,TRKSW,REGSW,SWTCH,I1,I2,I3,I4,
1          LABL1(30),LABL2(30),LABL3(30),LABL4(30)
      COMMON/VDATA/ ELEV(45),B1(25),B2(25),B3(25)

C
      EQUIVALENCE(BOX(1),MM1(1)),(NWELL,MM2(1)),(ELEV(1),MM3(1))

C
      DATA WELLS1(1),WELLS1(2)/5HWELLS,4H FL1/
      DATA WELLS2(1),WELLS2(2)/5HWELLS,4H FL2/
      DATA WELLS3(1),WELLS3(2)/5HWELLS,4H FL3/
      DATA WELLS4(1),WELLS4(2)/5HWELLS,4H FL4/

C
      DATA DEFDOT(1),DEFDOT(2)/5HDEFDOT,4H DMP/
      DATA TMP(1), TMP(2) /5HDSWELL,4H L TMP/
      DATA DFL(1), DFL(2) /5HDSWELL,4H L DFL/
      DATA HDR(1), HDR(2) /5HHEADR,4H SRC/
      DATA OVR(1), OVR(2) /5HOVRIA,4HYSRC/

C
      CALL INEM(MEM)
      CALL EQUIV(TRK,TRAK)
      CALL DFIN(BOX,1)

C   LOGICAL SWITCHES
C   TRKSW: FOR TRACKING CROSS
C   REGSW: TO DETECT IF IN REGION
C   SWTCH: TO DETECT IF IN VTI OVERLAY MODE
      CALL DFIN(LPBOX,1)
      TRKSW=.TRUE.
      REGSW=.TRUE.
      SWTCH=.FALSE.

C
      J1=302
      J2=65
      J3=22
      J4=2

C
      KEYM=1
C   SETUP BOUNDARY FILE
      CALL EQUIV(F1,HANFRD)
C   SETUP WELL FILE----LP INTERACTIVE
      CALL RAFILE(1,WELLS1,J1,KDA1)
      CALL RAFILE(1,WELLS2,J2*2,KDA2)
      CALL RAFILE(1,WELLS3,J3*3,KDA3)
      CALL RAFILE(1,WELLS4,J4*4,KDA4)
      MAX=J1+J2+J3+J4
      CALL DFIN(LPWELL,1)
      CALL DFPAR(2,0,0,0)

```

```

DO 14 J=1,MAX
IF(J.GT.J1) GO TO 10
IND=J-1
CALL RATRAN(KDA1+IND,0,INDX,112)
GO TO 13
10 IF(J.GT.J1+J2) GO TO 11
IND=J-1-J1
CALL RATRAN(KDA2+(IND*2),0,INDX,224)
GO TO 13
11 IF(J.GT.J1+J2+J3) GO TO 12
IND=J-1-J1-J2
CALL RATRAN(KDA3+(IND*3),0,INDX,336)
GO TO 13
12 IND=J-1-J1-J2-J3
CALL RATRAN(KDA4+(IND*4),0,INDX,448)
13 X=FLOAT(INDX(2))/100.
Y=FLOAT(INDX(3))/100.
IX=IFIX(X)
IY=IFIX(Y)
CALL DFID(J)
CALL ABSV(IX,IY)
CALL DFCHR(IOCT(153))
14 CONTINUE
C SETUP LIGHT BUTTONS
321 FORMAT(' MAP ')
322 FORMAT(' REGION ')
323 FORMAT(' CLEAR BOX ')
324 FORMAT(' CHART ')
325 FORMAT(' EXPAND Y ')
326 FORMAT(' EXPAND X ')
327 FORMAT(' OVERLAYS ')
328 FORMAT(' PLOT ')
CALL DFIN(LBUT,1)
CALL DFPAR(2,0,0,0)
DO 1450 J=1,8
CALL DFID(1000+J)
CALL ABSV(910,1010-J*30)
IF(J.EQ.1) WRITE(3,321)
IF(J.EQ.2) WRITE(3,322)
IF(J.EQ.3) WRITE(3,323)
IF(J.EQ.4) WRITE(3,324)
IF(J.EQ.5) WRITE(3,325)
IF(J.EQ.6) WRITE(3,326)
IF(J.EQ.7) WRITE(3,327)
IF(J.EQ.8) WRITE(3,328)
1450 CONTINUE
C GENERATE DMP FILE
CALL DUMP(IARG)
C
C COMES HERE WHEN PROGRAM LOADED
C OR WHEN RETURNING FROM DFDOT
15 IF(IARG.NE.0) GO TO 3000
16 CALL DFHIT(LPWELL,LBUT)
CALL DFSTRT(F1)
C
C
C *****DISPLAY INTERRUPTS*****

```

```

C          ITC=0
19          CALL DSKEY(1,750,10)
20          IF(TRKSW) CALL TRACK(ITCX,ITCY,5)
21          CALL DSINP(I,J,K,L)
            GO TO (20,22,23,24),I
C ***CHARACTER KEYS***
22          IF(J.NE.IOCT(120)) GO TO 21
C          PUNCH PRESENT WELL INFO FOR VIT INPUT.---CHARACTER P
            WRITE(4,400) A1,A2,A3,XCOORD,YCOORD
400          FORMAT(1X,3A4,1PZE12.9)
            GO TO 19
C
C ***FUNCTION KEYS***
23          IF(J.EQ.IOCT(161)) GO TO 2310
            IF(J.EQ.IOCT(162)) GO TO 2320
            IF(J.NE.IOCT(013)) GO TO 21
C          INPUT MIN & MAX Y OR X VALUES FOR CHART SCALE
            READ(3,303) MMY
303          FORMAT(I3)
            IF(KEYM.EQ.2) GO TO 2305
            MINXY=MMY
            KEYM=2
            GO TO 19
2305         MAXXY=MMY
            KEYM=1
            GO TO 19
C          SETUP START OF BOX
2310         NX1=ITCX
            NY1=ITCY
            X1=FLOAT(NX1)
            Y1=FLOAT(NY1)
            CALL DFIN(BOX,1)
            ITC=1
            GO TO 19
C          DEFINE END POINT OF BOX
2320         NX2=ITCX
            NY2=ITCY
            X2=FLOAT(NX2)
            Y2=FLOAT(NY2)
            CALL DFIN(LPBOX,1)
            ITC=0
            GO TO 55
C ***LIGHT PEN INTERRUPTS***
24          ID=IFLD(7,11,MEM(L))
            IF(ID.EQ.1920) GO TO 26
            IF(ITC.EQ.1) GO TO 20
            IF(ID.GE.500) GO TO 2401
C          LP STRIKE ON WELL ON LARGE MAP
            NWELL=ID
            GO TO 28
2401         IF(ID.GE.1000) GO TO 25
C          LP STRIKE ON WELL WITHIN BOX
            ID=ID-500
            IF(ID.GT.11) GO TO 2402
            NWELL=LABL1(ID)
            GO TO 28

```

```

2402     IF(ID.GT.11+I2) GO TO 2403
        III=ID-I1
        NWELL=LABL2(III)
        GO TO 28
2403     IF(ID.GT.11+I2+I3) GO TO 2404
        III=ID-I1-I2
        NWELL=LABL3(III)
        GO TO 28
2404     III=ID-I1-I2-I3
        NWELL=LABL4(III)
        GO TO 28
C      LP STRIKE ON LIGHT BUTTON
25     IF(ID.NE.1001) GO TO 2502
C      DISPLAY MAP
        CALL DFSTOP(LPBOX)
        CALL DFHIT(LPWELL,TRK)
        CALL DFSTRT(BOX,F1)
        TRKSW=.TRUE.
        SWITCH=.FALSE.
2501     CALL DFSTOP(GRAPH)
        GO TO 999
2502     IF(ID.NE.1002) GO TO 2503
C      DISPLAY REGION
        IF(REGSW) GO TO 999
        CALL DFSTOP(LPWELL,BOX,F1,TRK)
        TRKSW=.FALSE.
        CALL DFHIT(LPBOX)
        GO TO 2501
C
2503     IF(ID.NE.1003) GO TO 2504
C      CLEAR BOX
        CALL DFIN(BOX,1)
        CALL DFIN(LPBOX,1)
        ITC=0
        GO TO 999
C
2504     IF(ID.NE.1004) GO TO 2505
C      DISPLAY CHART & GRAPH
        MINY=300
        MAXY=500
        INCY=10
        MINX=48
        MAXX=73
2594     CALL DFSTOP(BOX,LPBOX,LPWELL,F1,TRK)
        TRKSW=.FALSE.
        GO TO 36
2505     IF(ID.NE.1005) GO TO 2506
C      CHANGE SCALE IN Y DIRECTION
        IF(MINXY.LT.300) GO TO 2594
        INCY=2
        IF((MAXXY-MINXY).GT.40) INCY=10
        MINY=MINXY
        MAXY=MAXXY
        GO TO 2594
2506     IF(ID.NE.1006) GO TO 2507
C      CHANGE SCALE IN X DIRECTION
        IF(MINXY.LT.45.OR.MINXY.GT.85) GO TO 2594

```

```

        MINX=MINXY
        MAXX=MAXXY
        GO TO 2594
2587      IF(ID.NE.1007) GO TO 2508
C      DISPLAY WELLS USED IN VTT MODEL
        CALL CLOSE(7)
        CALL SEEK(7,HDR)
        READ(7,700) NW,NTP
260      FORMAT(215)
        CALL DFIN(GRAPH,1)
        CALL DPAR(2,0,0,0)
        CALL ABSV(200,900)
        WRITE(3,302)
261      FORMAT(25H WELLS USED WITH VTT DATA      )
        IV=800
        DO 2597 J=1,NW
        READ(7,701) B1(J),B2(J),B3(J)
261      FORMAT(304)
        IDD=1500+J
        CALL DFIG(IDD)
        CALL ABSV(300,IV)
        CALL DFIG(4,B1(J))
        CALL DFIG(4,B2(J))
        CALL DFIG(4,B3(J))
        IV=IV+30
263      CONTINUE
        TRKSW= .FALSE.
        CALL DFIG(4,TRKSW)
        CALL DFIG(4,TRKSW)
        GO TO 20
266      IF(ID.NE.1008) GO TO 949
C      READ RESULTS
        CALL DESTOP(LBU1)
        GO TO 2000
268      CALL DELAY(0.75)
        GO TO 20
C      DRAW BOX ON SCREEN
26      IF(ITC.EQ.0) GO TO 20
        CALL DFIG(BOX,1)
        CALL DPAR(1,0,0,0)
        CALL ABSV(NX1,NY1)
        CALL VEC(1,ITCX,NY1)
        CALL VEC(1,ITCX,ITCY)
        CALL VEC(NX1,ITCY)
        CALL VEC(NX1,NY1)
        CALL DESTRT(BOX)
        GO TO 20
C      GET LP INFO FOR OVERLAY
2600      IWELL=ID-1500
        SWITCH=.TRUE.
C
C *****
C
C      READ WELL DATA AFTER SELECTING POINT
C
28      IF(.NOT.SWITCH) GO TO 2800
        NWELL=I

```

```

2800      IF(NWELL.GT.J1) GO TO 30
          IND=NWELL-1
          CALL RATRAN(KDA1+IND,0,INDX,112)
          GO TO 35
30        IF(NWELL.GT.J1+J2) GO TO 31
          IND=NWELL-1-J1
          CALL RATRAN(KDA2+(IND*2),0,INDX,224)
          GO TO 35
31        IF(NWELL.GT.J1+J2+J3) GO TO 32
          IND=NWELL-1-J1-J2
          CALL RATRAN(KDA3+(IND*3),0,INDX,336)
          GO TO 35
32        IND=NWELL-1-J1-J2-J3
          CALL RATRAN(KDA4+(IND*4),0,INDX,448)
C
C      DISPLAY WELL DESIG. & ELEVATION
35      NPTS=INDX(1)
C      GET X & Y DIST FROM MATRIX ORIGIN FOR VTT
          XCOORD=FLOAT(INDX(2))*144000./102300.
          YCOORD=FLOAT(INDX(3))*144000./102300.+34000.
          CASEL=FLOAT(INDX(4))/100.
          CALL MOVER(INDX(5),A1)
          CALL MOVER(INDX(7),A2)
          CALL MOVER(INDX(9),A3)
          IF(.NOT.SWCH) GO TO 3500
          I=IWELL
          IF(A1.EQ.B1(I).AND.A2.EQ.B2(I).AND.A3.EQ.B3(I)) GO TO 3500
          IF(NWELL.EQ.MAX) GO TO 3500
          NWELL=NWELL+1
          GO TO 2800
3500     CALL DFIN(OUT,1)
          CALL DFPAR(2,0,0,0)
          CALL ABSV(10,50)
          WRITE(3,300) A1,A2,A3
360     FORMAT(13H WELL NUMBER ,3A4)
          CALL ABSV(10,10)
          WRITE(3,301) CASEL
361     FORMAT(19H CASING ELEVATION = ,F7.2)
          CALL DFSTR(OUT)
          IF(.NOT.SWCH) GO TO 999
C
C
C      CALCULATE GRAPH---ELEVATIONS VS DATE
C*****DEFINE CHART****
36      CALL DFIN(GRAPH,1)
          CALL DFPAR(2,0,0,0)
          DO 3601 J=1,3
              CALL ABSV(99+J,99+J)
              CALL VECT(899+J,99+J)
              CALL VECT(899+J,899+J)
              CALL VECT(99+J,899+J)
              CALL VECT(99+J,99+J)
3601     CONTINUE
          CALL DFPAR(2,0,1,0)
          CALL ABSV(350,25)
          WRITE(3,351)
351     FORMAT(' CALENDER YEAR ')

```

```

      CALL ABSV(315,944)
      WRITE(3,352)
352  FORMAT(' WELL HYDROGRAPHS ')
      CALL DEPAR(2,0,1,1)
      CALL ABSV(35,285)
      WRITE(3,353)
353  FORMAT(' WELL ELEVATION (FT) ')
      CALL DEPAR(2,0,0,0)
      NDIF=MAXY-MINY
      YSCALE=800./FLOAT(NDIF)
C    DRAW Y LINES FOR CHART
      NN=MINY
      JDD=1
      NDIF=NDIF/INCY+1
      DO 3604 JD=1,NDIF
      IY=FLOAT(NN-MINY)*YSCALE+100.
      IF(JDD.NE.1) GO TO 3602
      CALL ABSV(100,IY)
      CALL VECT(900,IY)
      CALL ABSV(65,IY)
      CALL DDECIM(NN)
      GO TO 3603
3602  CALL ABSV(94,IY)
      CALL VECT(100,IY)
3603  JDD=JDD+1
      IF(JDD.EQ.6) JDD=1
      NN=NN+INCY
3604  CONTINUE
C    DRAW X LINES FOR CHART
3610  NDIF=(MAXX-MINX)
      XSCALE=800./FLOAT(NDIF)*365.
      CALL DEPAR(2,1,0,0)
      NTOP=NDIF+1
      JDD=1
      DO 3650 JD=1,NTOP
      XD=FLOAT(JD)*365.-365.
      IX=XD*XSCALE+100.
      CALL ABSV(IX,100)
      CALL VECT(IX,900)
      IF(JDD.NE.1) GO TO 3620
      CALL ABSV(IX,10,30)
      NN=IFIX(XD)/365 + MINX
      CALL DDECIM(NN)
      JDD=2
      GO TO 3650
3620  JDD=1
3650  CONTINUE
      CALL DESTRT(GRAPH)
      CALL DEPAR(2,0,0,0)
      NABSV=0
C
C*****RETRIEVE DATA & GRAPH****
      IPLACE=0
37  DO 40 JK=1,NPTS
      IF(IPLACE.EQ.0) GO TO 3701
      IYR=IYR
      MO=MO+1

```

```

        IDA=IDA
        IF(MO.EQ.13) IYR=IYR+1
        IF(MO.EQ.13) MO=1
        Y=ELEV(JK)
        GO TO 38
3701      IND1=JK+10
        Y=FLOAT(INDX(IND1))/100.
        IND1=IND1+NPTS
        IYR=IFLD(9,9,INDX(IND1))
        MO= IFID(9,4,INDX(IND1))
        IDA=IFID(13,5,INDX(IND1))
38      DAYS=(FLOAT(IYR-MINX)*365. + FLOAT(MO-1)*30.4 + FLOAT(IDA))
        IX=IFIX(DAYS*XSCALE)+100
        IY=IFIX((Y-FLOAT(MINY))*YSCALE)+100
C      CHECK FOR POINT WITHIN REGION
        IF(IX.LT.100.OR.IX.GT.900) GO TO 40
        IF(IY.GE.100.AND.IY.LE.900) GO TO 39
        NBLANK=1
        GO TO 40
C      GOOD VALUE--CALCULATE VECTOR
39      CALL DFIN(GRAPH)
        IF(NABSV.EQ.1) GO TO 3900
        NABSV=1
        CALL ABSV(IX,IY)
        GO TO 3901
C      IF LAST VALUE OUTSIDE REGION DRAW BLANK VECTOR
3900     IF(NBLANK.EQ.1) CALL VECT(IX,IY,1)
        IF(NBLANK.EQ.0) CALL VECT(IX,IY)
        NBLANK=0
3901     CALL DFSTR1(GRAPH)
40      CONTINUE
        IF(.NOT.SWITCH) GO TO 45
        IF(IPLACE.EQ.1) GO TO 45
C      CALCULATE GRAPH---OVERLAY FROM VTT
        CALL CLOSE(7)
        CALL SEEK(7,OVR)
        DO 42 J=1,IWELL
        READ(7,702) (ELEV(I),I=1,NTP)
702     FORMAT(10F7.0)
42      CONTINUE
        IYR=68
        MO=2
        IDA=1
        IPLACE=1
        NPTS=NTP
        NABSV=0
        NBLANK=0
        GO TO 37
45      CALL DFSTR1(GRAPH)
        GO TO 999
C
C
C      ENTERED FROM FUNCTION KEY---BETA--
C      FIND WELLS WITHIN BOX
C      STORE THEIR NO.'S IN LABL1, LABL2, LABL3 & LABL4
55      I1=0
        I2=0

```



```

      I3=0
      I4=0
      II=0
      CALL DESTOP(LBUT)
      DSMAX=(X2-X1)
      IF((Y2-Y1).GT.DSMAX) DSMAX=Y2-Y1
C     DRAW BOX
      IX=(X2-X1)*800./DSMAX
      IY=(Y2-Y1)*800./DSMAX
      CALL DEIN(LPBOX,1)
      CALL DEPAR(1,0,0,0)
      CALL ARSV(50,100)
      CALL VECT(IX+50,100)
      CALL VECT(IX+50,IY+100)
      CALL VECT(50,IY+100)
      CALL VECT(50,100)
      CALL DEPAR(2,0,1,0)
      DO 60 JJ=1,MAX
      IF(JJ.GT.J1) GO TO 57
      IND=JJ-1
      CALL RATRAN(KDA1+IND,0,INDX,112)
      GO TO 58
59     IF(JJ.GT.J1+J2) GO TO 5701
      IND=JJ-1-J1
      CALL RATRAN(KDA2+(IND*2),0,INDX,224)
      GO TO 58
5701   IF(JJ.GT.J1+J2+J3) GO TO 5702
      IND=JJ-1-J1-J2
      CALL RATRAN(KDA3+(IND*3),0,INDX,336)
      GO TO 58
5702   IND=JJ-1-J1-J2-J3
      CALL RATRAN(KDA4+(IND*4),0,INDX,448)
58     X=FLOAT(INDX(2))/100.
      Y=FLOAT(INDX(3))/100.
      IF(X.LT.X1. OR .X.GT.X2) GO TO 60
      IF(Y.LT.Y1. OR .Y.GT.Y2) GO TO 60
      IX=(X-X1)*800./DSMAX
      IY=(Y-Y1)*800./DSMAX
C     FOUND A POINT WITHIN BOX
      IF(JJ.GT.J1) GO TO 59
C     J1=NO. OF WELLS IN FILE1
      I1=I1+1
      LABL1(I1)=JJ
      GO TO 5907
59     IF(JJ.GT.J1+J2) GO TO 5901
C     J2=NO. OF WELLS IN FILE2
      I2=I2+1
      LABL2(I2)=JJ
      GO TO 5907
5901   IF(JJ.GT.J1+J2+J3) GO TO 5902
C     J3=NO. OF WELLS IN FILE3
      I3=I3+1
      LABL3(I3)=JJ
      GO TO 5907
C     J4=NO. OF WELLS IN FILE4
5902   I4=I4+1
      LABL4(I4)=JJ

```

```

        CALL DFID(11+500)
        CALL ABSV(TX+50, TX+100)
        CALL DFCHR(10CT(153))
60      CONTINUE
        CALL DFHIT(LBUT)
        REGSW=.FALSE.
        GO TO 19

C
C
C
2000    CALL RASAVE(1,TMP,1,MM1,MM2,MM3)
        CALL DLRE(8,DFL,ISW)
        CALL WRDFL(1,DFL)
        CALL DMPF11(4,DFDOT,10CT(16061))
        STOP
3000    CALL RASAVE(1,TMP,0,MM1,MM2,MM3)
        CALL DFHIT(LBUT)
        CALL DFSTRT(GRAPH)
        CALL DFSTPT(OUT)
        GO TO 19
        STOP
        END

```

APPENDIX B

PROGRAM COMBIN

APPENDIX B

```

00 RUN: 0 8, CUB620, , 3600, 9000/1000      FRIEDRICHS*DATA*  PS2  EX 2413
0X ASG      D=U4136(WELLS)
0X ASG      E=U1988(WELLS)
0X ASG, W   A=U2992(WELLS)
@ XQT CUR
IN D
TRI D
DEL WELLS/V1
@H1E UPD,*  WELLS/V2,WELLS/V2
-513, 514
@ XQT CUR
IN E
TRI E
TOC
0M PR5  COMBIN, COMBIN
C  PROGRAM TO INPUT NEW WELL DATA FROM TAPE AND COMBINE WITH ORIGINAL
C  DATA THEN OUTPUT TO ANOTHER TAPE
C  MANIPULATIONS ARE DONE ON DRUM
C  D. R. FRIEDRICHS
C  BATTELLE NW
      INTEGER YCOORD, XCOORD, ELEV, WLDES1, WLDES2
      INTEGER POT, DATE
      DIMENSION ITAB(14), M(3), MM(9), POT(500), DATE(500)
      DIMENSION DTB(14), JTAB(7)
      LOGICAL MATCH, SWITCH
C
      CALL SETDAR(7, 1, DTB)
      CALL SETDAR(10, 2, DTB(8))
      CALL OPDARC(9, 5HWELLS, 2HV6, JTAB)
C
      CALL SETDR(1, 300000, 300000, ITAB)
      CALL SETDR(2, 600000, 300000, ITAB(8))
C
      CALL SETEOF($500)
      NWELLS=0
C  READ DATA TAPE D AND TRANSFER TO DISC.
1    READ(7, 91) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
      WRITE(1) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
91   FORMAT(15, 7X, 2A1, I6, 3X, A1, I6, 4X, I6, 3X, 2A6)
      NWELLS=NWELLS+1
      READ(7, 92) (POT(J), J=1, NPOINT)
      WRITE(1) (POT(J), J=1, NPOINT)
      READ(7, 92) (DATE(J), J=1, NPOINT)
      WRITE(1) (DATE(J), J=1, NPOINT)
92   FORMAT(12I6)
      GO TO 1
C
500  REWIND 1
      CALL SETEOF($501)
      LU1=1
      LU2=2
C  READ A TITLE CARD FROM THE NEW TAPE E
      SWITCH=. TRUE.
10   READ(10, 91) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
      WRITE(6, 81) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
      MATCH=. FALSE.
C  SEARCH DRUM FILE FOR MATCH
      N=0
11   READ(LU1) (MM(J), J=1, 9)
      N=N+1
      NTOP=MM(1)
      READ(LU1) (POT(J), J=1, NTOP)
      READ(LU1) (DATE(J), J=1, NTOP)
12   IF(WLDES1.NE.MM(8)) GO TO 15
      IF(WLDES2.NE.MM(9)) GO TO 15
C  FOUND A MATCH---APPEND NEW DATA ON TAPE E TO OLD
      NBOT=NTOP+1
      NTOP=NTOP+NPOINT

```

```

      READ(10,92) (POT(J), J=NBOT, NTOP)
      READ(10,92) (DATE(J), J=NBOT, NTOP)
      MM(1)=NTOP
      SWITCH=.TRUE.
C   WRITE TO SECOND DRUM FILE
15   WRITE(LU2) (MM(J), J=1, 9)
      WRITE(LU2) (POT(J), J=1, NTOP)
      WRITE(LU2) (DATE(J), J=1, NTOP)
30   IF (N NEWELLS) GO TO 11
      IF (MATCH) GO TO 35
C
C
C   OUTPUT TO PRINTER AND CARDS IF WELL IS NEW
      READ(10,92) (POT(J), J=1, NPOINT)
      READ(10,92) (DATE(J), J=1, NPOINT)
      WRITE(6,81) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
81   FORMAT(1X, I5, 7X, 2A1, I6, 3X, A1, I6, 4X, I6, 3X, 2A5)
      WRITE(6,82) (POT(J), J=1, NPOINT)
      WRITE(6,82) (DATE(J), J=1, NPOINT)
82   FORMAT(1X, 12I6)
      PUNCH 91, (NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2)
      PUNCH 92, (POT(J), J=1, NPOINT)
      PUNCH 92, (DATE(J), J=1, NPOINT)
C
35   REWIND LU1
      REWIND LU2
      IF (SWITCH) GO TO 40
      LU1=1
      LU2=2
      SWITCH=.TRUE.
      GO TO 10
40   LU1=2
      LU2=1
      SWITCH=.FALSE.
      GO TO 10
C
C
C   ALL TRANSFERS COMPLETE, WRITE RESULTS TO TAPE A
C
501  DO 50 J=1, NWELLS
      READ(LU2) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
      WRITE(9,91) NPOINT, M(1), M(2), YCOORD, M(3), XCOORD, ELEV, WLDES1, WLDES2
      READ(LU2) (POT(K), K=1, NPOINT)
      WRITE(9,92) (POT(K), K=1, NPOINT)
      READ(LU2) (DATE(K), K=1, NPOINT)
      WRITE(9,92) (DATE(K), K=1, NPOINT)
50   CONTINUE
      CALL CLDAMF(9)
      WRITE(6,960) NWELLS
960  FORMAT(' ALL FILES COMPLETE. ', I3, ' WELLS ON TAPE' )
      STOP
      END
@ DAT  WELLS/V2,1
@ DAT  WELLS/V5,2
@ XOT COMBIN
@ XOT CUR
@CL COMBIN
DEL COMBIN/CODE
DEL WELLS/V2
DEL WELLS/V5
OUT A
TRI A
TOC
LIST WELLS/V6
@ FIN

```

X

APPENDIX C

PROGRAM HYDRO

APPENDIX C

```

@O RUN,0  @DF2,CUB620,,,200,7100/3000          FRIEDRICHS*HYDRO*
@PRL TEL CUB700
@X ASG D=U4804(WELLS)
@ XQT CUR
IN D
TRI D
TOC
@E UPD,* WELLS/V6,WELLS/V6
-1932,1934
-1941
      5          PN 54203      W 44506          49429      699  54  45
39580 30655 30579 39618 39655
711118720119720202720308720411
@ FR5  HYDRO
      INTEGER EAST,RICH,POT,ELEV,DATE,WLDES1,WLDES2
      INTEGER X,Y
      REAL NS
      DIMENSION M(3),POT(300),DATE(300)
      DIMENSION DTB(7)
      DATA NORTH,EAST,RICH/6HN      ,6HE      ,6HR      /

C
C
      CALL SETDAR(7,1,DTB)
      CALL SETEOF($500)
      EW=100000.
      NS=35000.
2      READ(7,91) NPOINT,M(1),M(2),Y,M(3),X,ELEV,WLDES1,WLDES2
91      FORMAT(15,7X,2A1,I6,3X,A1,I6,4X,I6,3X,2A6)
      READ(7,92) (POT(J),J=1,NPOINT)
      READ(7,92) (DATE(J),J=1,NPOINT)
92      FORMAT(12I6)
C
8      IF(M(1).NE.RICH) GO TO 108
      PLANTY=-79566.87+.9999299*FLOAT(Y)+.01184092*FLOAT(X)
      GO TO 208
108     IF(M(2).NE.NORTH) Y=-Y
      PLANTY=FLOAT(Y)
208     YCOORD=NS+PLANTY
C
9      IF(M(1).NE.RICH) GO TO 109
      PLANTX=892.88+.01184092*FLOAT(Y)-.9999299*FLOAT(X)
      GO TO 209
109     IF(M(3).NE.EAST) X=-X
      PLANTX=FLOAT(X)
209     XCOORD=EW+PLANTX
C
C  CONVERT TO DISPLAY UNITS * 100
      IX=XCOORD*102300./144000.
      IY=YCOORD*102300./144000.
C  ELIMINATE WELLS WITH NO COORDINATES OR OUTSIDE REGION
      IF(IY.LE.0.OR.IX.LE.0) GO TO 2
      PUNCH 11,(NPOINT,IX,IY,ELEV,WLDES1,WLDES2)
11      FORMAT(4I6,2A6)
      PUNCH 92,(POT(J),J=1,NPOINT)
      PUNCH 92,(DATE(J),J=1,NPOINT)
      GO TO 2

```

C
500 STOP
END
@ DAT WELLS/V6,1.
@ XOT HYDRO
@ FIN

Well Data Output from HYDRO

LNK header (delete)

Hydrograph data--WELLS SRC

LNK trailer (delete)

29 NOV 72 AT 12:49:27 INQUIRE REPORT FOR @FROM TEL CUB626

SITE ID RUN ID PROJECT ID LOGNUM STATUS PR

CUB626 CUB620 9DF2 COMPLETE S

@0 RUN,S 9DF2,CUB620,,200,7100/3000 FRIEDRICHS*LIST* PS2 EX 25

25 10820 75872 43979 199 B3 I
40993 41207 40899 40914 40904 40924 40912 40458 40424 40685 40733 40242
40939 40937 40849 40992 40964 41174 40937 41579 41839 41801 40121 41851
39651
641229650713650716650818650921651019651027660303660413660518660727661229
670328670922670927671012671019671027671109671115671117671129671204671211
710900

2 65902 1960 373973099 47 18B

33335 33310
500927501011

17 88256 3279 401753099 49 E16

34364 34006 34118 34070 40529 40513 40519 40515 40500 40510 40500 40482

40537 40630 40664 40533 40523

650817650920651018651228660105660303660411660519660705661018661227670328

671019680315690424700511710900

06201172 CUB620 9DF2 100 4241 61 2801 14012 549 1 00 FRIEDRS

9876543210-+9876543210-+9876543210-+9876543210-+9876543210

WAITING FOR OUTPUT

WAITING FOR OUTPUT

Well Data Format on Master Tape (UPDATE File)

Number of data points for this well																			
X coordinate					Y coordinate					casing elevation in feet x 100					Well designation				

Well Data Format when Returned to PDP-9

No. of data points for this well	X coord. in display units*100	Y coord. in display units*100	Casing elevation in feet*100	Well designation	Water elevation of this point in feet*100	Date of this point YR/MO/DAY
1 20341 73867 47155 199 B4 4						
40405						
641229						
24 19181 74593 45556 199 B5 1						
40536 40831 40761 40616 40578 40502 40398 40278 40314 40559 40391 40278						
40419 40534 40529 40507 40486 40484 40519 40577 40536 40622 40791 40089						
641229650716650818650921651018651227660303660413660518660727661020661229						
670407670922670927671012671019671027671109671120671127671204671211710900						
22 20629 72817 47948 199 B9 1						
40948 40733 40620 40562 40505 40385 40269 40307 40555 40413 40309 40403						
40574 40552 40531 40525 40515 40547 40575 40582 40678 40819						
641229650816650923651018651227660303660413660518660727661020661229670407						
670925670927671012671019671027671109671127671204671211						

APPENDIX D

PROGRAM WLLDSK

APPENDIX D

↑C

\$ A DKC2 -4/DKD2 6/TT 2
\$ GLOAD

LOADER

>P, G-WLLDSK, MOVER

P	WLLDSK	01743
P	MOVER	05507
P	RATRAM	05524
P	RAFILE	05635
P	SFLD	06047
P	GENAM.	06126
P	.DAI	06220
P	DKA.	06263
P	DKD.	10577
P	FILE	12332
P	.DA	12670
P	PCDIO	12746
P	.SS	16641
P	STOP	16730
P	SPMSG	16743
P	FIOPS	17036
P	INTEAE	20020
P	RELEASE	20154
P	OTSER	21265
P	.CP	17661

NO. OF WELLS IN FILE 1	=	207
NO. OF WELLS IN FILE 2	=	67
NO. OF WELLS IN FILE 3	=	25
NO. OF WELLS IN FILE 4	=	2

STOP 000000

↑

```

C PROGRAM TO SETUP DISC FILES FOR WELL DATA
  DIMENSION TAPE(2),INDX(448),IYR(216),MO(216),IDA(216)
  DIMENSION WELLS1(2),WELLS2(2),WELLS3(2),WELLS4(2)
  DATA TAPE(1),TAPE(2)/5HWELLS,4H SRC/
  DATA WELLS1(1),WELLS1(2)/5HWELLS,4H FL1/
  DATA WELLS2(1),WELLS2(2)/5HWELLS,4H FL2/
  DATA WELLS3(1),WELLS3(2)/5HWELLS,4H FL3/
  DATA WELLS4(1),WELLS4(2)/5HWELLS,4H FL4/

C
  NWEL1=0
  NWEL2=0
  NWEL3=0
  NWEL4=0
  CALL SPEK(6,TAPE)
C FIND THE NUMBER OF WELLS TO BE STORED IN EA. DISC FILE.
  DO 13 J=1,600
    READ(6,600,END=15) NPOINT,IDUM1,IDUM2,IDUM3,A1,A2,A3
    NSAVE=NPOINT/12
    IC=0
    IF(NSAVE*12.NE.NPOINT) IC=1
    NLINE=(NSAVE+IC)*2
    DO 9 I=1,NLINE
      READ(6,601,END=15)
9     CONTINUE
      IF(NPOINT.GT.51) GO TO 10
      NWEL1=NWEL1+1
      GO TO 13
10    IF(NPOINT.GT.107) GO TO 11
      NWEL2=NWEL2+1
      GO TO 13
11    IF(NPOINT.GT.163) GO TO 12
      NWEL3=NWEL3+1
      GO TO 13
12    IF(NPOINT.GT.216) GO TO 98
      NWEL4=NWEL4+1
13    CONTINUE
C
C SETUP 4 DISC FILES ACCORDING TO # OF WELLS IN. EA. FILE.
C ONE SECTOR/WELL
15    IF(NWEL1.EQ.0) NWEL1=1
      CALL RNFIL(1,WELLS1,NWEL1,KDA1)
C TWO SECTORS/WELL
      IF(NWEL2.EQ.0) NWEL2=1
      NSECT=NWEL2*2
      CALL RNFIL(1,WELLS2,NSECT,KDA2)
C THREE SECTORS/WELL
      IF(NWEL3.EQ.0) NWEL3=1
      NSECT=NWEL3*3
      CALL RNFIL(1,WELLS3,NSECT,KDA3)
C FOUR SECTORS/WELL
      IF(NWEL4.EQ.0) NWEL4=1
      NSECT=NWEL4*4
      CALL RNFIL(1,WELLS4,NSECT,KDA4)
C
C
C
C INPUT WELL DATA FROM TAPE UNIT 2

```

```

      T1=3
      J2=0
      J3=0
      J4=0
      CALL SPEK(6,TAPE)
      DO 30 J1=1,600
        READ(6,600,END=51) (INDX(I),I=1,4),A1,A2,A3
600    FORMAT(4I6,3H4)
        CALL MOVER(A1,INDX(5))
        CALL MOVER(A2,INDX(7))
        CALL MOVER(A3,INDX(9))
      C   INPUT POTENTIALS
        NTOP=INDX(1)+10
        READ(6,601,END=51) (INDX(I),I=11,NTOP)
601    FORMAT(12I6)
      C   INPUT DATE
        NTP1=INDX(1)
        READ(6,602,END=51) (IYR(I),MO(I),IDA(I),I=1,NTP1)
602    FORMAT(36I2)
        NBOT=NTOP+1
        NTOP=NBOT+INDX(1)-1
        T=0
        DO 20 K=NBOT,NTOP
          J=J+1
          CALL SFLD(INDX(K),IDA(J),13,5)
          CALL SFLD(INDX(K),MO(J),9,4)
          CALL SFLD(INDX(K),IYR(J),0,9)
20      CONTINUE
          IF (NTOP.GT.112) GO TO 30
          J1=J1+1
          IND1=J1-1
          CALL RATRAN(KDA1+IND1,1,INDX,112)
          GO TO 50
30      IF (NTOP.GT.224) GO TO 31
          J2=J2+1
          IND2=J2-1
          CALL RATRAN(KDA2+(IND2*2),1,INDX,224)
          GO TO 50
31      IF (NTOP.GT.336) GO TO 32
          J3=J3+1
          IND3=J3-1
          CALL RATRAN(KDA3+(IND3*3),1,INDX,336)
          GO TO 50
32      J4=J4+1
          IND4=J4-1
          CALL RATRAN(KDA4+(IND4*4),1,INDX,448)
50      CONTINUE
51      T=1
          WRITE(1,100) I,J1
          T=2
          WRITE(1,100) I,J2
          T=3
          WRITE(1,100) I,J3
          T=4
          WRITE(1,100) I,J4
100     FORMAT(21H NO. OF WELLS IN FILE,I2,3H = ,I3)
          GO TO 200

```

```
C
C  TOO MANY POINTS
98      WRITE(1,104) A1,A2,A3,NPOINT
104     FORMAT(///10H1*****//9H WELL NO.,3A5,9X,I5,6HPPOINTS)
200     CALL CLOSE(6)
        STOP
        END
```


APPENDIX E

PROGRAM VTT

APPENDIX E

```

@O RUN,S  @DF1,CUB620,,,600,7100/1000      FRIEDRICHS*VTT*
@X  ASG  D=U0621(WDM)
@EN FR5 VTT
      REAL J4,J5
      DIMENSION FTP(100,50),A1(30),A2(30)
      DIMENSION JIM(100),J1(100),J2(100),J3(100),J4(100),J5(100)
      COMMON JTP,PHI(5916)

C
      MAXK=68
C  MM=NO. OF WELLS.      N=NO. OF TIME PLANES.
      READ(5,1) MM, N
      1  FORMAT(14I5)
      DO 350 J=1,MM
          READ(5,2) A1(J),A2(J),XCOORD,YCOORD
      2  FORMAT(2A6,2F12.0)
C
C  WELL LOCATION IS NOW LOCATED IN DISTANCE FROM MATRIX ORIGIN
C  FIND LOCATION IN MATRIX CO-ORDINATES
C
      KX=XCOORD/2000.+1.01
      IY=YCOORD/2000.+1.01
      JIM(J)=MAXK*(IY-1)+KX
      J1(J)=JIM(J)+1
      J2(J)=JIM(J)+MAXK
      J3(J)=JIM(J)+MAXK+1
      J4(J)=(XCOORD-(KX-1)*2000.)/2000.
      J5(J)=(YCOORD-(IY-1)*2000.)/2000.
      350  CONTINUE
      DO 450 I=1,N
          CALL NTRAN(7,2,5917,JTP,JT)
      500  IF(JT.EQ.-1) GO TO 500
          IF(JT.NE.5917) GO TO 600
              DO 400 K=1,MM
                  JAM=JIM(K)
                  IJ1=J1(K)
                  I1J=J2(K)
                  I1J1=J3(K)
                  TK=J4(K)
                  TI=J5(K)
                  F1=PHI(JAM)+(PHI(IJ1)-PHI(JAM))*TK
                  F2=PHI(I1J)+(PHI(I1J1)-PHI(I1J))*TK
                  F3=PHI(JAM)+(PHI(I1J)-PHI(JAM))*TI
                  F4=PHI(IJ1)+(PHI(I1J1)-PHI(IJ1))*TI
                  FTP(K,I)=(F1+F2+F3+F4)/4.
      400  CONTINUE
      450  CONTINUE
C
C  INTERPOLATION HAS NOW BEEN MADE AND DATA IS NOW READY TO BE
C  SENT BACK TO PDP-9 FOR DISPLAY
C
      GO TO 700
      600  WRITE(6,5) JT
      5  FORMAT(' NTRAN READ ERROR JT=',I5)
      700  CONTINUE
      DO 20 K=1,MM
          PUNCH 10,(FTP(K,I),I=1,N)
      10  FORMAT(10F7.2)

```

```

20  CONTINUE
    CALL EXIT
    END

```

```

@ XQT VTT

```

```

20  46

```

```

699  S6 E14 1.23211E+05 6.25640E+04
699  17  5 1.04499E+05 8.64495E+04
699  2   3 1.05675E+05 7.08995E+04
699  9  E2 1.11323E+05 7.75758E+04
699  1  18 9.14069E+04 7.04195E+04
699  15 15 9.40364E+04 8.38144E+04
699  26 15 9.44558E+04 9.46644E+04
699  24 33 7.56638E+04 9.28077E+04
699  40  1 1.08429E+05 1.08848E+05
699  42 12 9.72739E+04 1.11473E+05
699  30 31 7.83216E+04 9.95066E+04
699  40 33 7.55740E+04 1.09404E+05
699  42 42 6.69368E+04 1.10993E+05
699  45 42 6.69002E+04 1.14273E+05
299  E25  2 6.18088E+04 1.10269E+05
299  E19  1 5.29760E+04 1.07084E+05
699  50 30 7.91662E+04 1.19298E+05
699  53 47 6.15357E+04 1.21518E+05
699  63 25 8.30231E+04 1.32459E+05
699  69 45 6.39991E+04 1.38000E+05

```

VTT input

Also transferred to
Disc 2 as HEADR SRC
for display program

```

@ FIN

```

22 SEP 72 AT 13:29:11 INQUIRE REPORT FOR @FROM TEL CUB626

SITE ID	RUN ID	PROJECT ID	LOGNUM	STATUS	PR
CUB626	CUB620		9DF1	COMPLETE	S
CUB626	CUB620		9DF1	COMPLETE	S

LINK header (delete)

@0 RUN,S 9DF1,CUB620,,,600,7100/1000 FRIEDRICHS*LIST* PS2 EX

346.51	346.28	347.04	350.74	349.71	346.86	346.25	345.80	345.84	346.21
346.62	347.03	346.68	348.80	350.08	350.25	349.09	346.77	346.04	346.23
346.43	346.64	346.36	346.04	346.29	346.48	347.53	348.90	347.43	346.80
346.10	346.35	346.54	346.13	345.93	346.55	347.64	347.35	351.06	351.99
349.90	349.37	346.33	346.24	346.54	347.05				
383.43	383.51	383.59	383.65	383.72	383.78	383.83	383.88	383.92	383.96
384.00	384.03	384.07	384.10	384.13	384.16	384.18	384.21	384.24	384.27
384.29	384.32	384.35	384.37	384.40	384.43	384.46	384.48	384.51	384.54
384.57	384.60	384.63	384.66	384.70	384.72	384.76	384.79	384.82	384.85
384.89	384.92	384.95	384.98	385.02	385.05				

OVERLAY SRC

VTT output data

LINK trailer (delete)

399.14 397.74 396.70 395.90 395.22 394.65 394.16 393.70 393.29 392.88
392.49 392.16 391.80 391.48 391.18 390.94 390.72 390.54 390.37 390.18
390.00 389.81 389.63 389.48 389.40 389.40 389.49 389.62 389.80 390.00
390.19 390.38 390.55 390.72 390.87 390.95 390.92 390.74 390.44 390.11
389.75 389.30 389.06 388.72 388.39 388.05
06220972 CUB620 9DF1 100 2083 81 101 80132846 1 00

9876543210-+9876543210-+9876543210-+9876543210-+9876543210-+9876543210

CSCX RLC83J 22 SEP 72 13:28:46 USER CUB620 9DF1

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