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Assessment of Effectiveness of Geologic Isolation Systems

VARIABLE THICKNESS TRANSIENT GROUND-WATER FLOW MODEL

VOLUME 2. USERS' MANUAL

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DOE Richland, WA

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FOREWORD

The Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) Program is developing and applying the methodology for assessing the far-field, long-term post-closure safety of deep geologic nuclear waste repositories. AEGIS is being performed by Pacific Northwest Laboratory (PNL) under contract with the Office of Nuclear Waste Isolation (ONWI) for the Department of Energy (DOE). One task within AEGIS is the development of methodology for analysis of the consequences (water pathway) from loss of repository containment as defined by various release scenarios.

Analysis of the long-term, far-field consequences of release scenarios requires the application of numerical codes which simulate the hydrologic systems, model the transport of released radionuclides through the hydrologic systems to the biosphere, and, where applicable, assess the radiological dose to humans.

Essentially three modeling technologies are involved in assessing the water pathway release consequence. These models are: 1) hydrologic models that define the groundwater flow field and provide water flow paths and travel times, 2) transport models that describe the movement and concentrations of the radionuclides in the flow field, and 3) dose models that determine the resultant radiation doses to individuals and/or populations. Figure i is a schematic flow diagram for the release consequence analysis.

The various input parameters required in the analysis are compiled in data systems. The data are organized and prepared by various input subroutines for use by the hydrologic and transport codes. The hydrologic models simulate the groundwater flow systems and provide water flow directions, rates, and velocities as inputs to the transport models. Outputs from the transport models are basically graphs of radionuclide concentration in the groundwater plotted against time. After dilution in the receiving surface-water body (e.g., lake, river, bay), these data are the input source terms for the dose models, if dose assessments are required. The dose models calculate radiation dose to individuals and populations.

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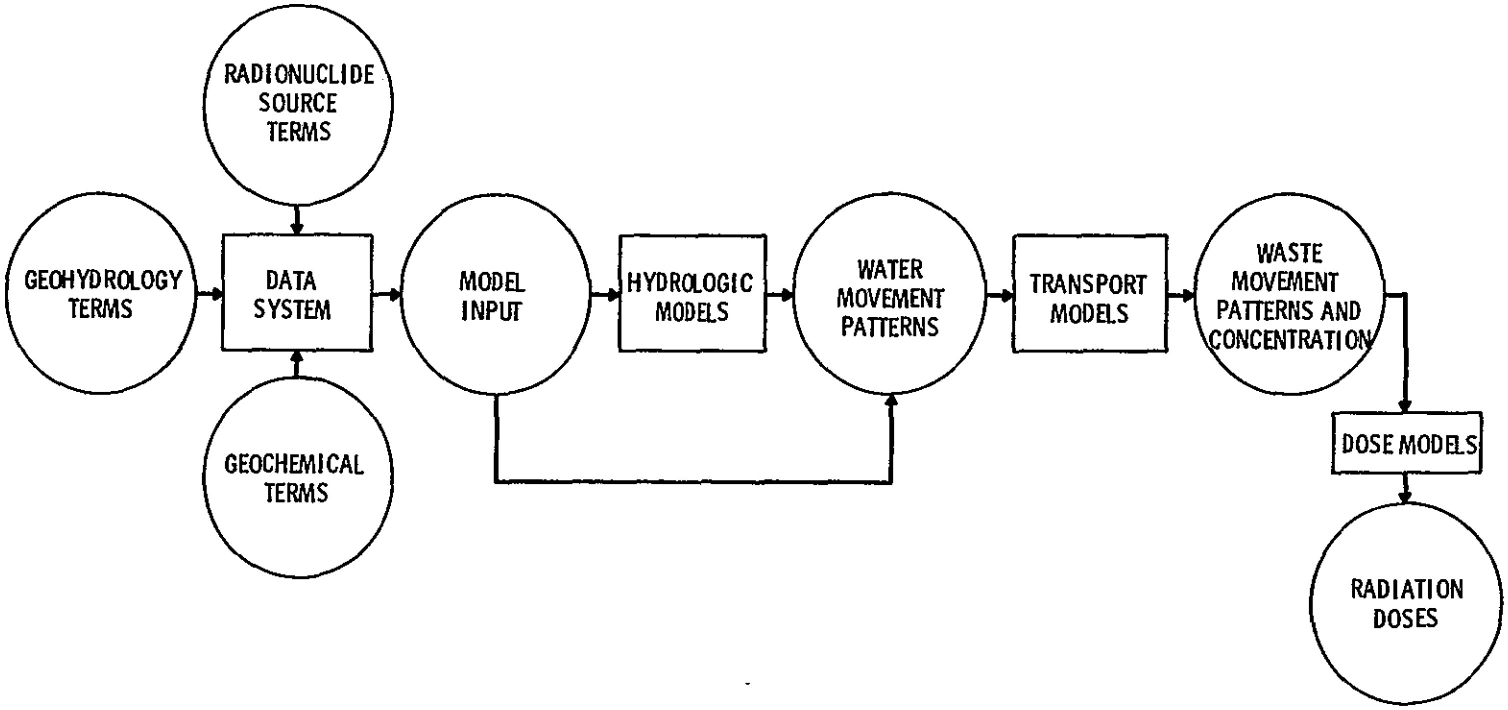

FIGURE i. Schematic Diagram of Consequence Analysis

Hydrologic and transport models are available at several levels of complexity or sophistication. Model selection and use are determined by the quantity and quality of input data. Model development under AEGIS and related programs provides three levels of hydrologic models, two levels of transport models, and one level of dose models (with several separate models). The models and data systems are documented as follows:

- HYDROLOGIC MODELS:

PNL-3162 PATHS Groundwater Hydrologic Model - first level (simplest) idealized hybrid analytical/numerical model for two-dimensional, saturated groundwater flow and single component transport; homogeneous geology.

PNL-3160 VTT (Variable Thickness Transient) Groundwater Hydrologic Model - second level (intermediate complexity) two-dimensional saturated groundwater flow, Boussinesq approximation, finite difference approach; two-dimensional (quasi three-dimensional) multiaquifer capability; heterogeneous geology.

PNL-2939 FE3DGW (Finite Element, Three-Dimensional Groundwater) Hydrologic Model - third level (high complexity) three-dimensional, finite element approach (Galerkin formulation) for saturated groundwater flow; heterogeneous geology.

- TRANSPORT MODELS:

PNL-2970 GETOUT Transport Model - first level one-dimensional analytical solution considering radioactive chain decay with capability for only simple release and hydrologic functions; single speciation, constant flow rate, dispersion and sorption three-member straight delay chains.

PNL-3179 MMT (Multicomponent Mass Transport) Model - second level, one-dimensional numerical, discrete parcel random walk (DPRW) algorithm; chain decay, single speciation, equilibrium sorption, time-variant leach rate and dispersion, n-membered straight or branched decay chains.

- DOSE MODELS:

PNL-3180	ARRRG - drinking water, external exposure to aquatic food, water and shorelines, and FOOD - terrestrial food.
PNL-3209	PABLM - Combination of ARRRG and FOOD with additional features related to chronic releases.
BNWL-B-264	KRONIC - chronic external dose from air pathways.
BNWL-B-351	SUBDOSA - acute external dose from air pathways.
BNWL-B-389	DACRIN - chronic or acute inhalation dose from air pathways.

- DATA SYSTEMS:

PNL-3139	SIRS (Sorption Information Retrieval System) - storage and retrieval system for experimental data on sorption/desorption analyses for a wide variety of radionuclides, groundwater compositions, and rocks and minerals.
PNL-3161	CIRMIS (Comprehensive Information Retrieval and Model Input Sequence) Data System - storage and retrieval system for model input and output data, including graphical interpretation and display.

This is the second of 3 volumes of the description of the VTT hydrologic model.

Return of the form on the last page of this report is required in order to remain on the Distribution List for future revisions of the model.

ACKNOWLEDGMENT

This research was supported by the Waste Isolation Safety Assessment Program (WISAP) conducted by Pacific Northwest Laboratory. The program was sponsored by the Office of Nuclear Waste Isolation, managed by Battelle Memorial Institute for the Department of Energy under Contract EY-76-C-06-1830. On 1 October 1979, WISAP became the Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) program and the Waste/Rock Interactions Technology (WRIT) program. This report was issued by AEGIS.

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INTRODUCTION

Through many years of ground-water modeling experience, Pacific Northwest Laboratory (PNL) has developed a system of computer codes to aid in the preparation and evaluation of ground-water model input, as well as in the computer codes and auxillary programs developed and adapted for use in modeling major ground-water aquifers. Volume 1 of this series explains the variable thickness transient ground-water flow model formulation and programs listings. Volume 3 of this series contains the computer listings for these programs.

The ground-water model is interactive, rather than a batch-type model. Interactive models have been demonstrated to be superior to batch in the ground-water field. For example, looking through reams of numerical lists can be avoided with the much superior graphical output forms or summary type numerical output.

The system of computer codes permits the flexibility to develop rapidly the model-required data files from engineering data and geologic maps, as well as efficiently manipulating the voluminous data generated. Central to these codes is the Ground-water Model, which given the boundary value problem, produces either the steady-state or transient time plane solutions. A sizable part of the codes available provide rapid evaluation of the results. Besides contouring the new water potentials, the model allows graphical review of streamlines of flow, travel times, and detailed comparisons of surfaces or points at designated wells. Use of the graphics scopes provide immediate, but temporary displays which can be used for evaluation of input and output and which can be reproduced easily on hard copy devices, such as a line printer, Calcomp plotter and image photographs.

Before going into detail about the system of codes we will first discuss computers, computer jargon and the RSX-11D operating system for the PDP 11/45 computer. This should help the user better understand the material presented in this manual.

BRIEF DISCUSSION OF BASIC COMPUTER TERMINOLOGY AND OPERATING PROCEDURES

The PNL computer system uses a RSX-11D operating system, with most computer codes being written in FORTRAN IV-PLUS. The system is interactive, as opposed to the batch type computer system most users are familiar with.

A batch system typically requires the user to punch control and/or data cards and submit them to a computer center. The cards are then read into the computer via some operator and processed at some time depending on the computer load. The operators collect the output and collate it. The user is then called to pick up the output.

On an interactive type of computer system, the user operates the computer directly through an interactive terminal. There is no need for control cards, as normally used on a batch system, since commands are issued directly to the computer via the terminal. Data cards and the card reader are also used differently; initial entry of large data sets is made with cards, but subsequent use and modifications are made with a powerful interactive editor.

All commands to the basic operating system are made through the primary system program, called the Monitor Console Routine (MCR). The basic request to the system to start the MCR is by typing control C. The system responds by printing a MCR > at the terminal. At this point, user programs can be started; the user can log onto or off of the computer, or can start any of the basic system programs. These procedures are covered in the Digital Equipment Corporation PDP 11 Reference Manuals. The interactive sequence for each of the modeling programs is presented in the individual sections of this document.

There are two basic data types (file types) with which the user must be familiar: Binary and ASCII (files or data). An ASCII file consists of the byte codes, which cause a teletype or lineprinter to print the appropriate characters, whereas binary files consist of the machine-dependent representation of a number. For example, on the PDP 11/45 the ASCII file containing the integer numbers: 1, 2, 3, 4, 5, 6, 12 would consist of:

061	(base 8)	byte	1
054			2
062			3
054			4
063			5
054			6
064			7
054			8
065			9
015			10
012			11
066			12
054			13
060			13
062			15
054			16
015			17
012			18

The binary file would contain:

0000000000000001 (base 2	byte 1, 2
0000000000000010	byte 3, 4
0000000000000011	byte 5, 6
0000000000000100	byte 7, 8
0000000000000101	byte 9, 10
End of record indicator	byte 11
0000000000000110	byte 12, 13
0000000000001010	byte 14, 15
End of record	byte 16

The main difference between ASCII and binary files is that ASCII files may be created and listed directly with system programs like the Editor and PIP, while binary files can only be generated and listed via user programs. Binary files in general are considerably smaller and easier to use than ASCII files. Binary files are generally used in the ground-water modeling programs to store matrix data. Each record normally consists of the value of the matrix at each column position from 1 to the number of columns. The binary file has NLINE records, were NLINE = the number of lines in the matrix. Record 1 corresponds to line 1, record 1 to line 2, and so on.

BASIC STRUCTURE OF GROUND-WATER MODELS

The Variable Thickness Transient (VTT) Ground-water Modeling System can be classified into the components illustrated in Figure 1.

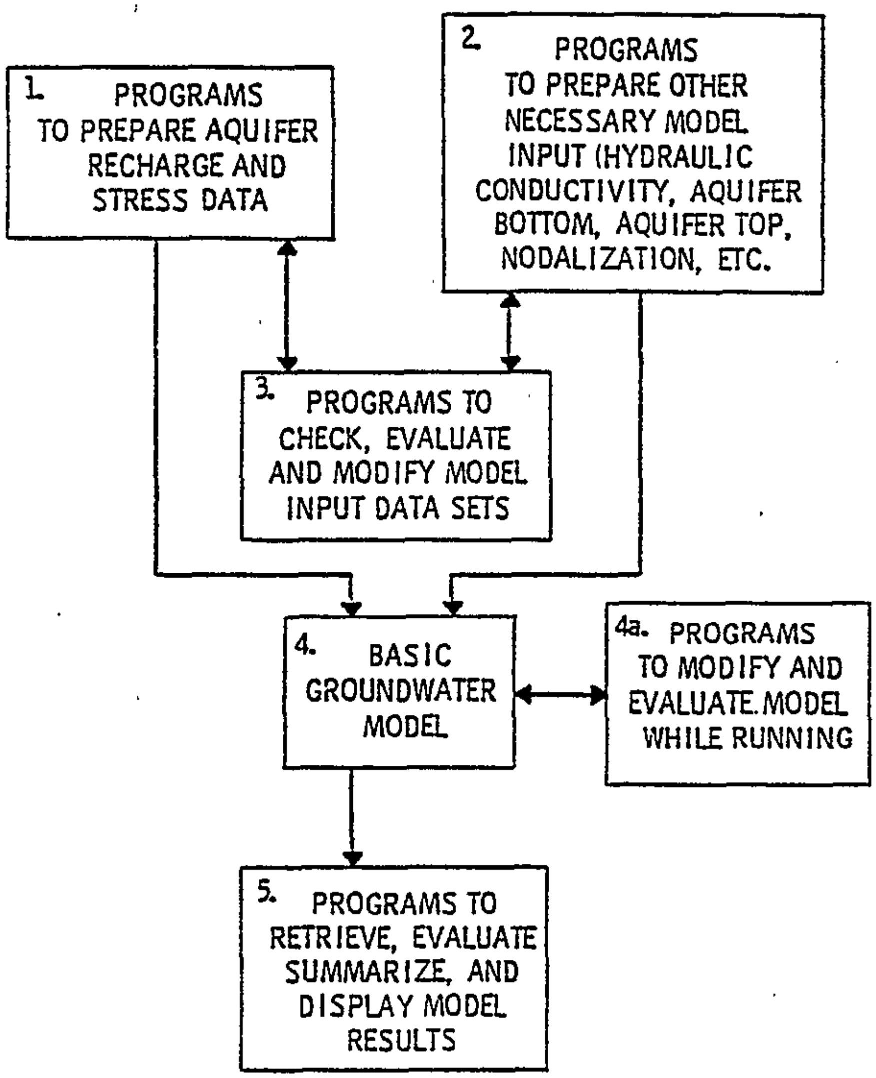


FIGURE 1. Diagram of the Essential Components of the Ground-water Modeling System

This user's manual will be organized into five sections according to the block diagram of Figure 1 as follows:

1) aquifer stress and recharge calculations
2) programs to aid in preparation of primary input data
3) programs to evaluate and display model input streams
4) basic ground-water model codes
5) programs to retrieve, evaluate, display and summarize model results
6) programs to establish, run subregion model

Each of these five sections will contain a description of the function of the codes and a description of the use of these codes. The last section of the report will contain a brief description of the basic RSX11 system procedures necessary to build, edit, and manipulate files and run these programs.

Briefly, the ground-water model requires the following in order to be run:

- A matrix of total stress or recharge at each model node. (This binary file is calculated from the programs in Section 1 above.)
- A node type map, which describes the aquifer's lateral extent and boundary conditions. (This ASCII file is generated via the Editor from the hydrologist's interpretation of the ground-water system and is checked out via the CALTYP program of Section 3 above.)
- Matrix files which define:
    1) aquifer top elevation
    2) aquifer bottom elevation
    3) initial aquifer potential
    4) aquifer storage coefficient
    5) interaquifer transfer coefficient
    6) aquifer hydraulic conductivity (or transmissivity)

  at each model node. (These binary files are prepared with the CIRMIS programs of Section 2 above from the hydrologist's interpretation of these values.) These files can then be checked as the programs of Section 2 above.
- An ASCII input file for the VTT ground-water model, which relates to the ground-water model, the nodalization, and the names of the binary data files that have been prepared. (This file is prepared via the interactive editor.)

Once the above input files have been prepared, the ground-water model can be run. The majority of the input data files will not need to be prepared again. Generally, model runs can be made by making only minor changes in the existing model input files. New input files would only be prepared when building a completely new model. Most model runs will involve changing the aquifer recharge-stress file to include the effects of new or proposed pumping and/or land use patterns.

Once the input files have been altered to account for the proposed changes, the ground-water model is run and the solution is generated. The solution generated is the new spatial variation of potential throughout the aquifers. However, from this new potential distribution in conjunction with other input data, the following information can be calculated:

- ground-water velocities
- ground-water flowpaths
- travel times
- new recharge discharge relationships along streams and rivers.

Typical types of model output that can be produced with the programs of Blocks 3, 4a, and 5 of Figure 1 include:

- contour maps of:
  - equal potential
  - equal drawdown
  - equal transmissivity
- three-dimensional projection plots of:
  - potential
  - drawdown
  - transmissivity
- cross section plots showing aquifer top, aquifer bottom and aquifer potential
- flow path plots with associated listings of travel times
- numerical listings of the input data or calculated potentials
- difference maps showing the node by node predictions of potential changes.

As with the model input, the basic control files for producing final model output have already been created, so that normally only minor alteration of these basic files is necessary in order to produce new model output.

This brief overview is intended to give the model user a look at the modeling system as a whole. The details of the specific programs will be covered in the sections that follow.

VTT GROUND-WATER MODEL

Function:

Simulation of Saturated Ground-water Flow

Input Requirements:

Data	INTERPRETATION PREPARED FOR THE MODEL
Geologic	Aquifer Boundaries - Map base and top of aquifer units - Define boundary conditions
Ground-water Elevations	Aquifer Potential Maps - Interaquifer transfer
Well Pumping Tests	Aquifer Transmissivity Distributions - Storage coefficients
Recharge and Stress - Precipitation - Evapotranspiration - Well stress - Irrigation	Recharge and Stress File

Output:

Time-Dependent Ground-water
- Potentials
- Velocities
- Flow paths
- Flow velocities
- Travel times

Stream Flow Effects

Data Formats
- Contour maps
- Cross section plots
- Difference maps
- Flow path plots
- Data listings

9 2 1 2 7 3 1 2 3

I. AQUIFER STRESS AND RECHARGE CALCULATIONS

A computer code is developed to define the amount of water recharged or withdrawn from each aquifer or distributed in appropriate quantities to each model segment or node. This stress is treated independently from the other input data. Generally, it is necessary to tailor the aquifer recharge code to the specific problem to maintain flexibility in matching the model requirements to large volumes of specific data. Data garnered from a wide variety of records are used to calculate stress and recharge; e.g., from irrigation water permits, application rates, well pumping records, electrical power usage of pumps, well permits, actual evapotranspiration (AET) and potential evapotranspiration (PET) curves, rainfall records, isohyetal maps, soil type, slope, watershed, Landsat photos, base flow analysis, and various combinations of these and other data. Combining these with the diverse record keeping methods and map coordinate reference problems, necessitates tailoring this program for each simulation.

The final product of the Aquifer Stress and Recharge Code is a file combining all the data into values which describe the external stress applied at each model node during the time of simulation. In the case of a transient simulation, the stress is also transient.

An example of such a program code is included.

9 2 1 2 5 7 3 1 2 5 9

PREPARING INPUT Q-FILE FOR VTT MODEL - PROGRAM OPRG

The VTT model requires a flux input file of monthly variations in nodal recharge stress. The steady state version requires the average daily flux or stress at each node. This file is prepared from a set of input data cards which describe the applicable items such as the P.E.T., A.E.T., rainfall, surface diversions, runoff and wells for the area being simulated. WIQPG is a PDP-11/45 code which prepares the VTT input data file as well as a report on the aquifer stress at each stress point in each of the aquifers. WIOPG uses the column of change option, specifying with one card the start and stop line where the flux, Q, is applied and the number of changes on those lines. The second card of the pair specifies the column and the Q applied in each of the changes. Several pair of cards are needed to fill the matrix.

9 2 1 2 5 7 3 1 5 7 0

II. PREPARATION OF PRIMARY INPUT DATA

PROGRAMS TO AID IN THE PREPARATION OF PRIMARY INPUT DATA FILES

As discussed in the section on Basic Model Structure in the Introduction, there are many kinds of primary data files which must be prepared in order to run the ground-water model. The user normally only needs to modify these files slightly in order to make a given model run. Many times this can be done with the system editor program when the file is of ASCII (or formatted) type. Binary files usually require the use of a special program or some of the basic CIRMIS programs for manipulating model input files. Since we are going to discuss preparation of all the various kinds of model input files in this section, we need to organize the presentation so as to reduce the confusion which might arise. The following is a list of the files required to run the VTT ground-water model and produce an estimation of potentials throughout the aquifers.

- A binary matrix file, which specifies the total stress of recharge at each model node for each aquifer. This file is the main input to the WISAPQ program, which sets up the Q file for the VTT program.
- An ASCII (or formatted) input control file for the main VTT input program VTTINP. This file contains pointers to other files as well as information on nodalization, time steps, numerical simulation parameters, and number of aquifers. This file normally contains the file names for:
  - an ASCII node type map file which describes the aquifers' lateral extent and boundary conditions (WISAP.TYP).
  - various binary (or unformatted) matrix type files which represent the hydrogeologist's interpretation for:
    1) aquifer top elevations
    2) aquifer bottom elevations

3) initial aquifer potential
4) aquifer storage coefficient
5) interaquifer transfer coefficient
6) aquifer hydraulic conductivity.

The previous section discussed the preparation of the stress-recharge file. The main VTT input file for the VTTINP program is prepared via the interactive editor, and its structure will be discussed in one of the following subsections of this section. Construction of the calculation type map will be discussed in this same subsection with the VTTINP file. The binary matrix files for aquifer bottom, top potential, etc., are prepared with the CIRMIS program from the hydrologist's contour maps.

Other kinds of files needed for this ground-water model include:

- base boundary maps for contour plotting difference maps
- average annual precipitation matrix files
- well stress data files.

The boundary map files, and binary unformatted files, such as average annual precipitation, are prepared via CIRMIS programs. Other ASCII (or formatted) files are prepared via the interactive editor.

9 2 1 2 3 1 2 7 2

MAIN VTT INPUT FILE FOR VTTINP PROGRAM

As previously mentioned, two programs must be run to set up the disk for running the Ground-water Model. The first program is WISAPQ, which requires the binary (or formatted) matrix file of total stress-recharge at each model node for each aquifer. The second program is VTTINP, which requires an ASCII (or formatted) file that describes all the physical and numerical parameters required by the ground-water model. Both WISAPQ and VTTINP simply set up the data on the File-Q data disk on which the ground-water model operates.

The structure of the VTTINP input file which is created with the system editor program is as follows:

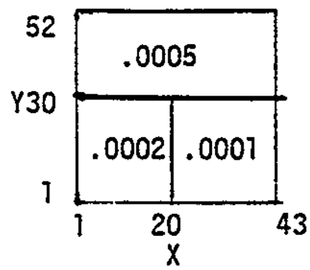
STRUCTURE OF THE VTTINP FILE

Line	Description of the Input Stream
1	Title for the run (80A1)
2	Name of merged potential files (matrix binary) or NONE for column of change input
3	Name of merged aquifer bottom files (matrix binary) or NONE for column of change input
4	Name of merged aquifer top files (matrix binary) or NONE for column of change input
5	Name of merged aquifer hydraulic conductivity or transmissivity for column of change input
6	Name of the calculational type file (ASCII file)
7	Name of the merged storage coefficient file (matrix binary) or NONE for column of change input
8	Name of the merged interaquifer transfer coefficient (matrix binary) or NONE for column of change input
9	Name of the merged ocean transfer coefficient (matrix binary) or NONE for column of change input
10	Number of aquifers (I5), nodes in X direction (I5), nodes in the y direction (I5), switch for normal or totally confined (Y = yes, N = confined) (A1) switch for leaky artesian aquifer (Y = yes, N = no) (A1), rotation switch (0 = normal, 1 = rotated) (I1). Bias elevation in feet (F10.0), Delta X and Delta Y node spacing in feet (2F10.0), storage coefficient multiplier used when aquifer goes unconfined (F10.0).
11	Coordinates for the lower left corner model node X, Y (2F10.0)

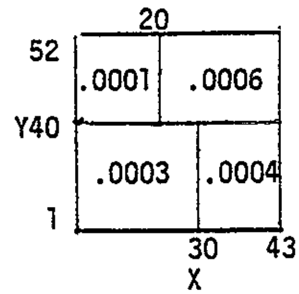
Line	Description of the Input Stream
12	Mean sea level, leakage coefficient, (only applies when a unmodeled leaky artesian aquifer is being simulated and when the model has an ocean boundary) (2F10.0).
13	Transient or steady-state switch (0 = transient, 1 = steady state) (I5), ocean transfer switch (0 = none, 1 = ocean transfer (I5), automatic or manual operation switch (1 = automatic, 0 = manual) (I5), number of iterations for steady-state model (I5), maximum number of iterations for any transient model time step (I5), convergence criterion for the transient model (normally 7.0×10^{-3}) (F10.0), overrelation coefficient for the transient model (normally 1.25 (F10.0).
14	Starting time (5I5) (year, month, day, hour, minute)
15	Ending time (5I5) (year, month, day, hour, minute)
16	Kind of time input switch (0 = manual, 1 = automatic) (I5), a number of time planes (I5), when automatic time input, input total number of days (I10), and initial delta time in minutes (I10).
17 to 17+number of time planes	Time when first time place is to be stored, ratio, and number of steps to be used in getting to this point in time from the first or initial time plane. (Year, month, day, hour, minute, ratio, number of days.) (5I5, F10.0, I5) second time plane data, third time plane data, etc.
17	Number of steps to be used between time planes, one entry per time plane (20I3) automatic.

The next lines in the VTTINP file are only required when the NONE option is used in lines 2 through 9 above. The order of the columns of change input is determined from the order of the NONE's in lines 2 through 9 above. Typically, most models do not have storage coefficient definitions nor are they ocean transfer type aquifers. Therefore a NONE would have been entered on Lines 7 and 9 so that first storage coefficients would be input via column of change for all the aquifers followed by the ocean transfer coefficient for all of the aquifers. Column of change works as follows:

Support that we have a node system NX = 43 by NY = 52 and that we wish to define the storage coefficient as pictured:



Aquifer 1



Aquifer 2

The column of change input cards would be:

1, 29, 2, Aquifer 1 storage (starting line, ending line, number of changes)

1, 0.0002, 20, 0.0001, (col, value, col, value)

number of change pairs

30, 52 1,

1, 0.0005,

1, 39, 2, Aquifer 2 storage (3I3)

1, 0.0003, 30, 0.0004 5 (I5, F10.0)

40, 52, 2

1, 0.0001, 20, 0.0006

A typical ground-water basin VTTINP input file is as follows:

LISTING OF VTT TEST INPUT FILE

```
WISAP DATA= HANFORD DATA
DP1:WISAP.AQ1                  POTENTIAL FILE
DP1:WISAP.BOT                  AQUIFER BOTTOM FILE
DP1:TOP.AQ1                    AQUIFER TOP FILE
DP1:WIASP.HYC                  HYDRAULIC CONDUCTIVITY FILE
DP1:WISAP.TYP                  CALCULATION TYPE FILE
NONE                           STORAGE COEFFICIENT
NONE                           INTERAQUIFER TRANSFER COEF.
NONE                           OCEAN TRANSFER COEF.
1,58,25,YN1,0.0,3000.,1.0,
0,0,0,0,
0,0,0,0,
0,0,1,50,50,7.E-3,1,25
1975,1,1,0,0,0,
1975,1,1,0,0,0,
0,2,0,0,
1975,1,1,0,0,0,
1975,1,2,0,0,0,
1,25,1,                       COLUMN OF CHANGE INPUT
1,.1                          (STORAGE COEFFICIENT)
1,25,1,
1,0.0                         (INTERAQUIFER TRANSFER)
1,25,1,
1,0.0                         (OCEAN TRANSFER)
```

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PREPARATION OF THE CALCULATIONAL TYPE FILE

The calculational type file WISAP.TYP (page 16) (an ASCII or formatted file) is a column of change type of file that is prepared from the hydrologist's interpretation of the aquifer. The hydrologist prepares a line drawing map on a base map, which has model node locations plotted and other surface features for reference. The lines drawn by the hydrologist represent the aquifer-bedrock outcrop impermeable boundaries and the river, lake and stream boundaries which act as known potential boundaries for the aquifer. The modeler now attempts to match these boundaries with the node types of Figure 2.

There are basically four kinds of nodal types, and the rest simply arise to handle the various shapes and orientations of the impermeable or outcrop boundaries.

-  is a potential boundary, i.e., $h = H(x,y,t$.
-  is an external node outside of the aquifer.
-  is an internal, i.e., a nonboundary node which lies within the aquifer.
-  These basic shapes, with all their possible rotations, are used to represent the 24 kinds and shapes of impermeable boundary nodes. The <u>heavy</u> lines represent the impermeable boundary.

The basic format of the column of change input is (3I3) for the starting and stopping line and the number of changes, and 14(I3,02) for the number of change pairs. To illustrate the column of change input, the following listing is the column of change input file required to produce the node type map (Figure 2). The calculational file should not need updating unless field observations prove that the hydrologist's interpretation of the ground water systems needs to be updated.

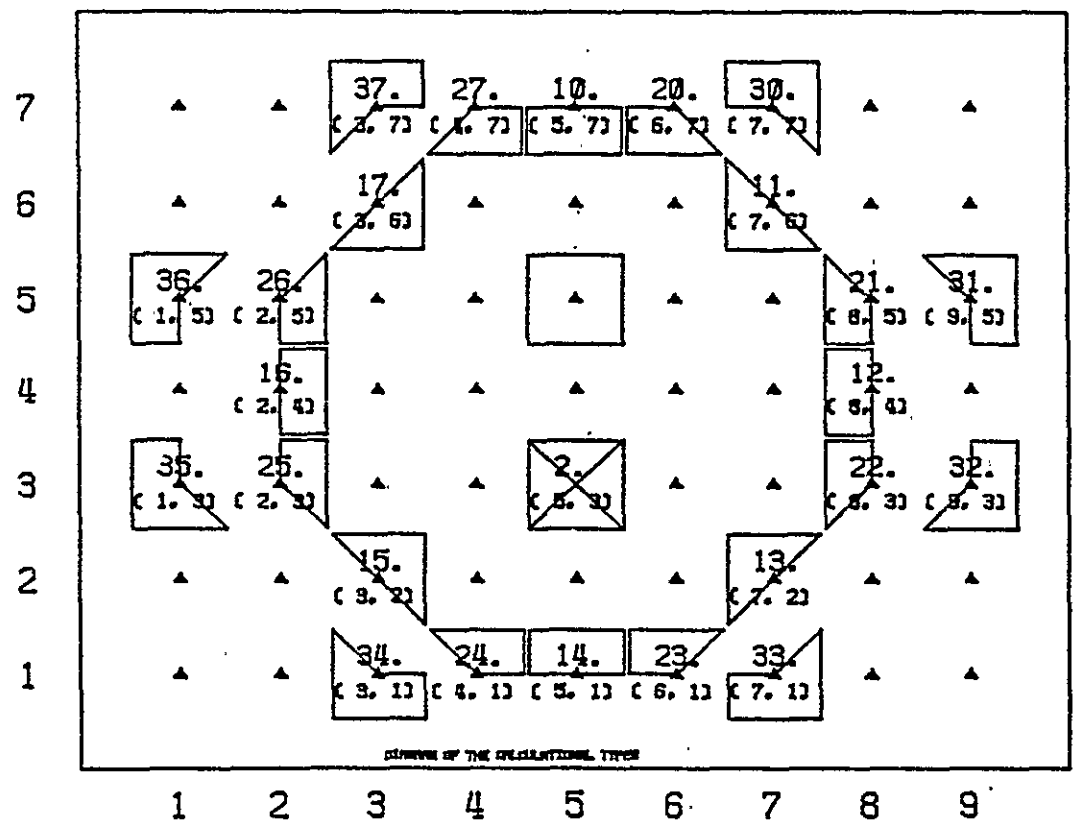


FIGURE 2. Illustration of the 27 Boundary Types Used by the VTT Code

LISTING OF A WISAP.TYP INPUT FILE

```
  58   25    1
0.1237
WISAP AQUIFER 1 (NODE SPACING 3000.*)
1,1,5
  101 3324 3414 4102 4401
2,2,7,
  101 3024 3114 3230 3300 4302 4401
3,3,11,
  101  824  914 1223 1301 2915 3000 4302 4401 4802 5101
4,4,11,
  101  715  800 1313 1401 2815 2900 4402 4800 5102 5401
5,5,11,
  101  424  514  630  700 1437 1514 2730 2800 5302 5401
6,6,6
  101  224  330  400 5202 5301
7,7,4,
  125  200 5202 5301
8,9,4,
  116  200 5102 5201
10,10,4,
  126  200 5002 5101
11,11,5,
  101  217  300 5002 5101
12,12,5,
  101  332  400 4902 5001
13,13,5,
  101  331  400 4902 5001
14,14,5,
  101  215  300 4902 5001
15,15,5,
  101  202  300 4902 5001
16,16,8,
  101  302  434  510  933 1000 4802 4901
17,17,7,
  101 1027 1110 1233 1300 4702 4801
18,18,5,
  101 1317 1400 4602 4801
19,19,5,
  101 1402 1500 4602 4701
20,20,5,
  101 1502 1600 4502 4601
21,21,8,
  101 1602 1734 1810 2333 2400 4402 4501
22,22,7,
  101 2427 2510 2633 2700 4002 4401
23,23,5,
  101 2717 2800 3802 4001
24,24,5,
  101 2802 3100 3402 3801
25,25,3,
  101 3102 3401
```


9 2 1 2 7 9 1 2 7 9

COMPREHENSIVE INFORMATION RETRIEVAL AND MODEL* INPUT SYSTEM

The Comprehensive Information Retrieval and Model Input System (CIRMIS)* was originally developed to increase data storage and retrieval capabilities and ground-water model control for the Hanford site. The overall configuration, however, was designed to be flexible for use in other areas. This development was sponsored by the Environmental Research and Development Administration (ERDA, now DOE).

Expansion of this system has continued for several years, and CIRMIS has proven to be an invaluable tool by furnishing rapid access to data as well as rapid input of boundary maps or isopleth surfaces and interactive control of ground-water models.

CIRMIS was used with the WISAP ground water study to provide: 1) preparation of matrix files for aquifer potential surfaces, aquifer bottom, etc., which are necessary input to the ground-water models, and 2) the preparation of map files, such as the WISAP background maps which are ultimately plotted on one of the plotting devices or displayed on an interactive scope for use with the CIRMIS Special Applications Programs.

* See Volume 1 of Part VII - Data Systems of this document set (PNL-3161-1).

CIRMIS PREPARATION OF MATRIX FILES

The generation, modification and smoothing of matrix files can be accomplished very rapidly using the CIRMIS system. Maps containing isopleths, whether they be topographic contours, isopotential lines, or any other data of this type, can be easily digitized and automatically interpolated to form matrix data files that can be used by the ground water programs. Once digitized, they may be rapidly retrieved for plotting using the CONTUR program or viewing on an interactive scope using the CIRMIS system. Figure 3 shows a typical Calcomp plot of such a file. The dotted lines are iso-potential contours interpolated from the matrix file which was digitized from the original aquifer map. The Ahtanum-Moxee Basalt background map and labels were generated using the CIRMIS map generating programs.

The original contour maps containing the isopleths were placed on the digitized table, and digitized and manipulated as described in the CIRMIS User's Manual, which is included in Part VII- Data Systems, PNL-3161-1.

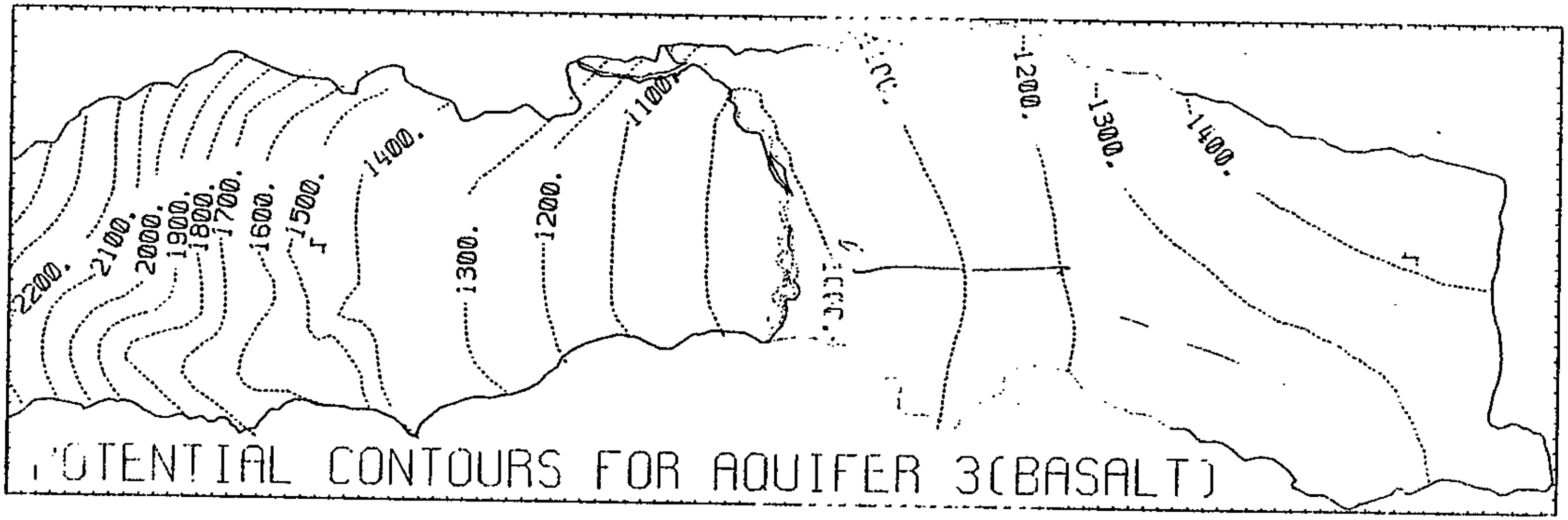


FIGURE 3. Contour Plot of a Matrix File Generated Using CIRMIS

III. EVALUATE, DISPLAY MODEL INPUT FILES, OUTPUT RESULTS

PROGRAMS TO EVALUATE AND DISPLAY MODEL INPUT STREAMS

Many of the input data files and output prediction files for the ground-water model are in the form of binary matrix files and complex formatted (ASCII) files. Debugging of these files, to ensure that they are free from data errors and are correct representation of the desired input, requires the use of many auxiliary codes. The auxiliary codes typically used for checking and displaying model input data fils as well as model output files include:

- CALTYP - a program for checking out the calculational type file via the use of computer graphics;
- LIST and LISTI - a program for listing a binary matrix file on the lineprinter (either real or integer);
- THREED - a program for producing a biased binary matrix file for use in preparing a three-dimensional plot via P3D;
- P3D - a program for producing a three-dimensional plot from a binary matrix file;
- CNT - a program for producing a contour map from a binary input file with a background map produced from a formatted background map file;
- DIFER - a program for comparing one binary matrix file with another and producing a lineprinter difference map and a binary matrix difference for contouring;
- WDIFER - a program for comparing a binary potential file with an ASCII (or formatted) file containing well locations and observed potential measurements.

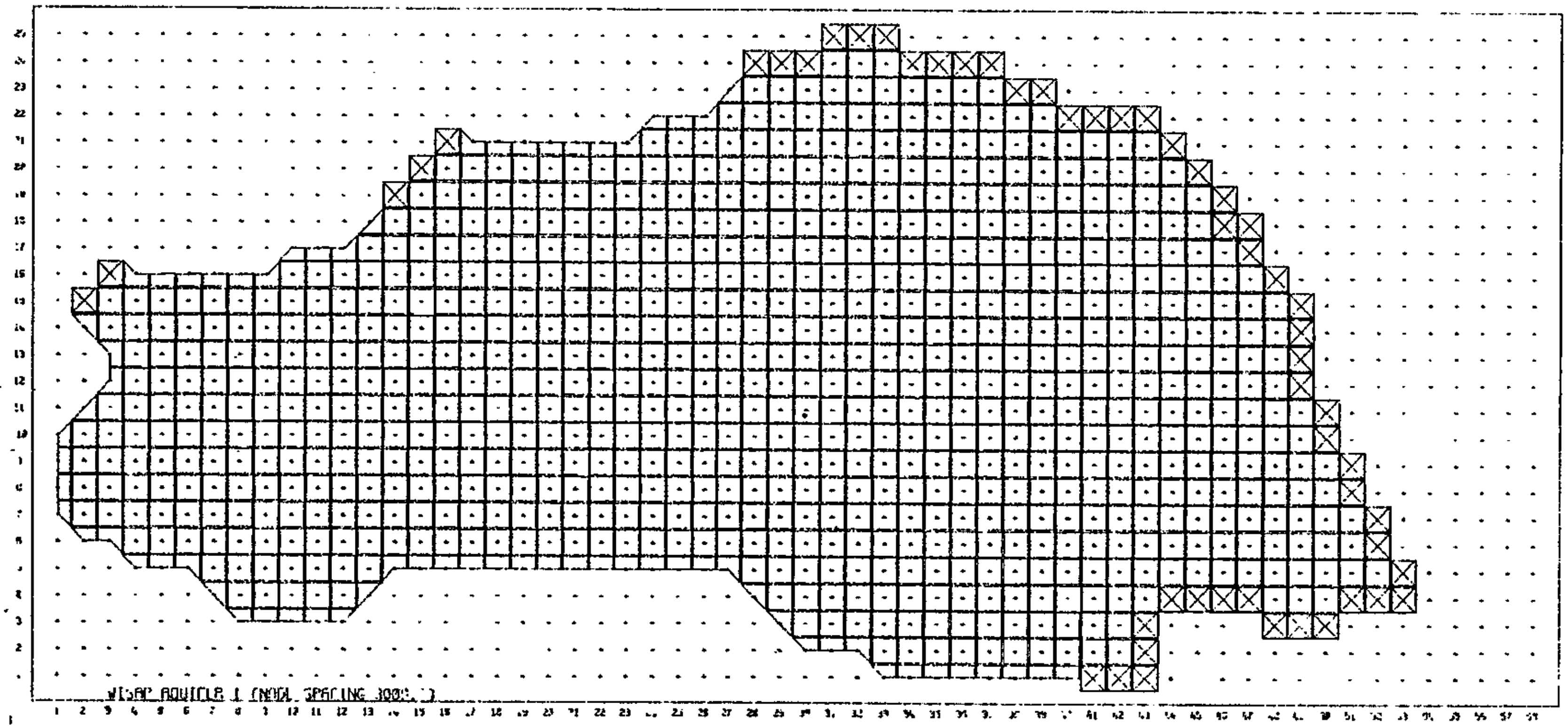
The following show the input trail needed to run the program and a sample of the output.

Program CALTYP

```
MCR>RUN DP2:CALTYP$
ENTER NAME OF CALCULATION TYPE FILE (7A4)
[213,3]WISAP.TYP
OUTPUT TO XY (X) , OUTPUT TO TG (T)
T
LABEL CALCULATIONAL TYPES (CR) , LABEL NODE NOS. (1)

CALTYP  --  STOP
```

Example of the interactive input stream for CALTYP. This program displays the calculational types from the calculative type input file so this input stream can be checked. This input file can be listed via PIP on the lineprinter. This listing is shown under Preparation of the Calculational Type File.



Calculational Type Plots

Program LIST

```
MCR>RUN DP2:LIST$
ENTER THE NAME OF THE FILE TO BE LISTED
ENTER NODESX NODESY
[213,3]NWISAP.POT
58,25
[213,3]NWISAP.POT
        58          25



LIST  --  STOP
```

Example of the interactive input required to run 'LIST'. 'LIST' is used to list on the lineprinter any binary format matrix input or output file from the VTT code which is in real number format.

SAMPLE OUTPUT FROM LIST

```
(213,3)N=ISAP,POT
     58       25
LINE=  1
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000      390.1      389.3      388.0      386.1      384.0      381.4      376.0      372.6
    363.9      360.4      356.7     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  2
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      394.3
    393.2      391.7      390.6      389.6      388.4      386.5      384.4      381.9      378.5      373.4
    365.3      360.6      355.1     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  3
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      495.9      500.8      504.0
    505.5      505.9     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      395.0      393.9
    393.0      392.8      391.4      390.7      389.6      388.2      386.2      383.9      381.0      377.1
    370.6      362.3      354.7     0.0000     0.0000     0.0000     0.0000      345.7      345.2      344.4
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  4
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      487.2      493.5      500.7      504.3
    505.9      506.0      504.8     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
   0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000      394.7      394.4      393.7
    393.0      392.3      391.8      391.3      390.6      389.5      387.9      385.8      383.2      379.9
    374.7      367.1      357.7      351.5      348.8      347.6      346.7      346.0      345.3      344.7
    344.4      344.4      344.4     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  5
   0.0000     0.0000     0.0000      471.5      472.4      476.4      482.6      492.2      500.9      504.9
    506.9      507.0      504.0      495.7      480.1      465.9      452.5      439.0      425.0      412.5
    403.3      398.5      397.0      396.5      396.2      395.9      395.4      394.9      394.4      393.8
    393.1      392.5      392.0      391.4      390.7      389.7      388.2      386.2      383.8      380.6
    376.2      370.1      362.7      356.0      351.7      349.3      347.7      346.7      345.7      345.1
    344.8      344.7      344.4     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  6
   0.0000      474.9      472.4      470.9      471.0      473.7      480.2      492.2      501.0      505.8
    509.0      510.4      507.7      495.1      479.7      464.8      450.7      436.1      421.0      409.1
    401.5      398.8      396.9      396.5      396.2      395.9      395.6      395.1      394.6      394.1
    393.5      392.8      392.2      391.5      390.7      389.6      388.1      385.9      383.4      380.3
    376.1      370.6      364.6      359.3      355.2      352.2      350.0      348.1      346.3      345.7
    345.6      345.9     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  7
    480.1      475.7      471.9      468.5      467.2      469.5      476.7      491.2      500.0      506.2
    512.3      519.3      523.4      498.0      478.3      460.7      444.1      427.8      411.3      402.4
    398.7      397.4      396.8      396.5      396.3      396.0      395.7      395.3      394.9      394.4
    393.9      393.3      392.6      391.7      390.7      389.4      387.7      385.3      382.4      379.8
    374.7      369.7      364.8      360.6      357.2      354.4      352.1      349.8      347.9      346.4
    345.9      345.9     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  8
    478.6      473.8      468.6      463.2      460.2      462.7      471.0      487.2      496.7      504.9
    515.2      536.6      536.4      498.3      472.9      451.4      430.7      410.2      401.4      398.8
    397.7      397.1      396.8      396.5      396.3      396.0      395.8      395.4      395.1      394.8
    394.3      393.7      393.0      391.9      390.6      389.1      387.0      384.1      380.8      377.0
    372.6      368.1      364.2      360.9      358.1      355.7      353.3      351.0      348.8      347.1
    346.2     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
LINE=  9
    476.3      470.2      463.8      455.0      450.6      453.1      462.3      479.8      489.9      499.3
    510.5      518.7      510.4      466.0      459.9      432.9      408.5      401.3      399.1      398.1
    397.5      397.1      396.7      396.5      396.3      396.1      395.9      395.6      395.3      395.0
```

9 2 1 2 7 3 1 2 3 3

394.0	394.0	393.2	392.0	390.4	388.5	385.9	382.3	378.8	375.1
371.1	366.9	363.5	360.7	358.4	356.1	353.9	351.6	349.2	347.1
346.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 10									
473.9	464.9	454.8	444.2	440.6	442.5	450.6	468.5	479.1	490.2
509.8	516.0	492.0	465.8	435.6	408.9	401.3	399.3	398.4	397.8
397.5	397.1	396.8	396.5	396.3	396.1	395.9	395.7	395.4	395.1
394.7	394.1	393.2	391.8	390.0	387.6	384.7	380.6	376.9	373.3
369.6	366.2	363.2	360.6	358.3	356.2	353.8	351.4	348.9	346.2
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 11									
0.0000	456.0	436.0	427.8	428.7	430.6	437.1	452.0	462.0	470.7
479.5	480.2	465.1	441.6	413.9	402.4	399.6	398.7	398.2	397.8
397.5	397.2	396.9	396.6	396.3	396.1	395.9	395.7	395.4	395.0
394.6	394.0	393.0	391.4	389.4	387.0	383.4	379.0	375.3	371.9
368.5	365.4	362.7	360.5	358.3	355.9	353.4	351.0	348.6	347.2
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 12									
0.0000	0.0000	487.4	469.4	413.7	415.8	420.0	431.3	441.7	449.9
454.0	453.2	442.1	423.5	404.3	400.2	399.2	398.7	398.2	397.9
397.7	397.4	397.0	396.6	396.3	396.1	395.8	395.5	395.2	394.8
394.4	393.6	392.5	390.8	388.7	386.0	381.8	377.5	374.0	370.8
367.5	364.7	362.3	360.1	357.9	355.5	353.1	350.6	347.5	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 13									
0.0000	0.0000	401.4	402.4	403.6	404.6	406.6	416.4	424.5	430.8
434.1	432.6	425.5	412.2	401.3	399.4	399.1	398.8	398.4	398.0
397.8	397.6	397.4	397.0	396.4	396.0	395.7	395.3	394.9	394.4
393.9	393.1	391.8	390.0	387.7	384.6	379.9	376.8	372.8	369.7
366.6	363.9	361.7	359.4	357.2	355.2	353.0	350.7	347.9	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 14									
0.0000	399.5	400.0	400.6	401.2	402.1	403.4	405.8	408.7	413.2
414.9	416.0	411.7	404.8	399.5	399.2	399.1	399.0	398.7	398.3
398.1	398.2	398.0	398.4	397.3	396.1	395.5	395.0	394.4	393.7
393.0	392.2	390.7	388.6	386.0	382.4	378.2	374.7	371.5	368.5
365.6	363.1	361.0	358.7	356.6	354.8	353.1	351.4	350.0	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 15									
0.0000	399.1	399.2	399.8	400.7	401.6	402.6	403.5	404.5	404.9
405.4	404.8	402.1	399.9	399.2	399.2	399.1	399.1	399.1	399.1
399.6	401.5	405.5	404.2	401.3	397.5	395.1	394.3	393.5	392.6
391.8	390.7	388.6	386.2	383.1	379.5	376.1	372.9	369.8	366.9
364.4	362.2	360.2	358.2	356.2	354.5	353.0	351.7	350.1	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 16									
0.0000	0.0000	397.7	399.1	400.4	401.5	402.6	403.4	404.0	404.1
403.8	402.6	400.6	399.5	399.2	399.1	399.1	399.2	399.2	399.5
401.5	406.4	423.2	415.7	407.2	398.9	393.5	392.3	391.6	390.8
389.6	387.8	385.4	382.4	379.4	376.3	373.6	370.7	367.9	365.3
363.2	361.3	359.4	357.6	355.9	354.3	353.0	352.3	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 17									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	403.9
403.3	401.6	399.8	399.2	399.1	399.1	399.1	399.2	399.3	399.5
408.8	409.1	480.6	429.4	406.8	394.5	388.0	387.3	387.5	387.0
385.1	382.8	380.6	378.2	375.6	373.3	371.1	368.6	366.2	363.9
362.0	360.3	358.6	357.0	355.4	353.8	352.5	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 18									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	399.3	399.0	398.9	399.0	399.1	399.3	399.5	399.3
397.9	396.4	395.0	390.5	388.0	386.1	384.1	381.8	380.1	378.8
377.6	376.3	375.5	374.1	372.3	370.5	368.6	366.5	364.4	362.5
360.8	359.2	357.8	356.4	354.8	352.8	352.6	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 1									

LINE= 19									
0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	398.7	398.7	398.7	399.0	399.6	400.2	399.9
396.9	394.6	392.3	389.7	387.7	385.9	383.7	380.6	377.0	374.6
373.2	372.1	371.5	370.7	369.3	367.7	366.1	364.3	362.5	360.8
359.3	358.1	357.0	355.9	354.8	354.1	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 20									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	398.2	398.2	398.7	400.1	401.9	399.3
396.2	393.5	391.1	389.0	387.3	385.5	383.0	379.5	375.9	373.2
371.3	370.0	369.1	368.3	366.8	365.2	363.5	361.6	360.0	358.9
357.0	357.0	356.2	355.3	354.5	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 21									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	397.1	397.9	399.7	401.1	399.0
395.9	392.9	390.2	388.5	386.9	384.8	381.6	377.7	374.2	371.5
369.5	368.3	367.4	365.7	364.4	362.8	361.0	359.3	358.0	356.6
356.1	355.7	355.1	354.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 22									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	388.0	386.5	383.3	379.0	374.8	371.5	369.0
367.6	366.6	365.4	363.4	362.2	360.4	358.7	357.0	355.6	354.1
354.2	354.2	354.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 23									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	374.9	370.2	367.1	365.7
365.3	364.6	362.9	360.7	359.1	357.8	356.4	353.9	354.1	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 24									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	362.0	360.7	366.7
362.4	362.3	360.4	356.4	356.4	355.5	355.3	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
LINE= 25									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
360.7	360.7	359.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		

MAXIMUM VALUE= 536.6163 MINIMUM VALUE= 344.3757

Program THREED

```
MCR>RUN THREED$
INPUT FILE NAME
[207,207]ELLEN.BIN
[207,207]ELLEN.BIN
NODESX,NODESY,NO. OF MATRICES TO SKIP,INVERT(0=NO,1=YES)
106,33,0,0
 106    33     0     0
ENTER OUTPUT FILE NAME
ELLEN3D.FIL
ELLEN3D.FIL
ENTER BACKGROUND SUBTRACTION FACTOR
900.
 900.0000
THREED  --  STOP
```

Example of the interactive input program for THREED. THREED is used to bias and/or invert binary matrix files so they might be used to make three-dimensional plots with P3D. The output from this program is an appropriately biased and/or inverted binary matrix file in real number format.

Program P3D

```
MCR>P3D

                    ***3-D PLOTTING ROUTINE***
SPECIFY THE CONTROL INPUT DEV:FILNAME>ELLEN.CNL
ENTER THE NUMBER OF DATA SETS TO BE READ>1
DO YOU WISH THE INPUT FILES TO BE ECHOED ON THE LP:>N
DO YOU WANT BASE LINES TO BE DRAWN?>Y
ENTER THE OUTPUT DEVICE NAME>XY:
WHICH DRIVE HOLDS THE FILE-Q DISK>1

....P3D  --  STOP
```

Example of the interactive input stream required to run P3D. P3D produces 3-D plots of matrix files for various viewing angles. The main input control stream format is shown on the following page.

```
1,106,33,1,106,1,33
7.,7.5,7.5
YY   -55.,20.,27000000.
500.,500.,0,0,
2
ELLEN30.FIL
YHANO DRAWN ELLENSBURG INTERPRETATION
1.5,8.,,150,0.
END
```

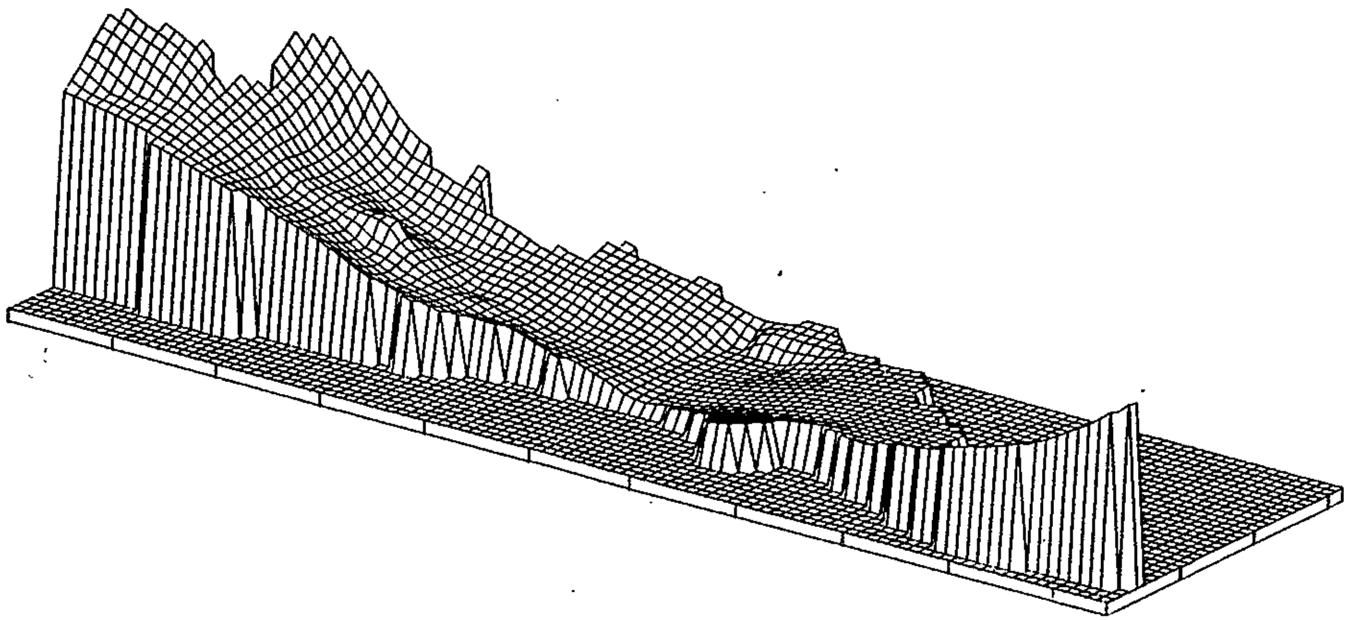
Sample of a P3D Input Control File
(ELLEN.CNL)

<u>Format for P3D Control File</u>

Line 1	Pen number for Title, Nodes X, Nodes Y, starting X node for plot, ending X node for plot (7I5)
Line 2	Exaggeration factor, maximum size of plot in the X direction, maximum size of plot in Y direction (3F10.0)
Line 3	(only the YY option works), angle of rotation around Z arises, angle of elevation from X-Y planes distance from (0,0) point from which the surface is viewed (2A1, 2X, 3F10.0)
Line 4	Delta X spacing between node points, Delta Y spacing between node points, (always 0, 0, 0). (2F10.0), 0, 0, 0.
Line 5	Type of file to be plotted } Same format as for CNS program data set 5 records 1 and 2
Line 6	Name of file to be plotted }
Line 7	Type of units for label location (Y = inches, N = data units), Label for the plot (A1, 79A1)
Line 8	X location for label, Y location for label, size of label (inches), angle that label is to be plotted on. (4F10.0)

9 2 1 2 5 7 8 1 2 9 3

HAND DRAWN ELLENSBURG INTERPRETATION



Sample 'P3D' Output

Program CNT

```
MCR>CNT$
          *** CONTOUR PLOTTING ROUTINE (V77.2) ***
ENTER THE CONTROL FILE SPECIFICATION (26A1)>WISAP.CNT
ENTER THE NUMBER OF DATA SETS TO BE READ (I5)>1
DO YOU WANT THE INPUT FILE ECHOED>N
ENTER OUTPUT DEVICE/FILE SPECIFICATION (26A1)>DP0:POT.PLT
                    *** CONTOUR FINISHED ***
```

Example of the interactive control stream required to run CNT, the contour plotting routing for plotting contour maps with background overlays. The format for the CNT input control file is documented on the following page.

9212731294

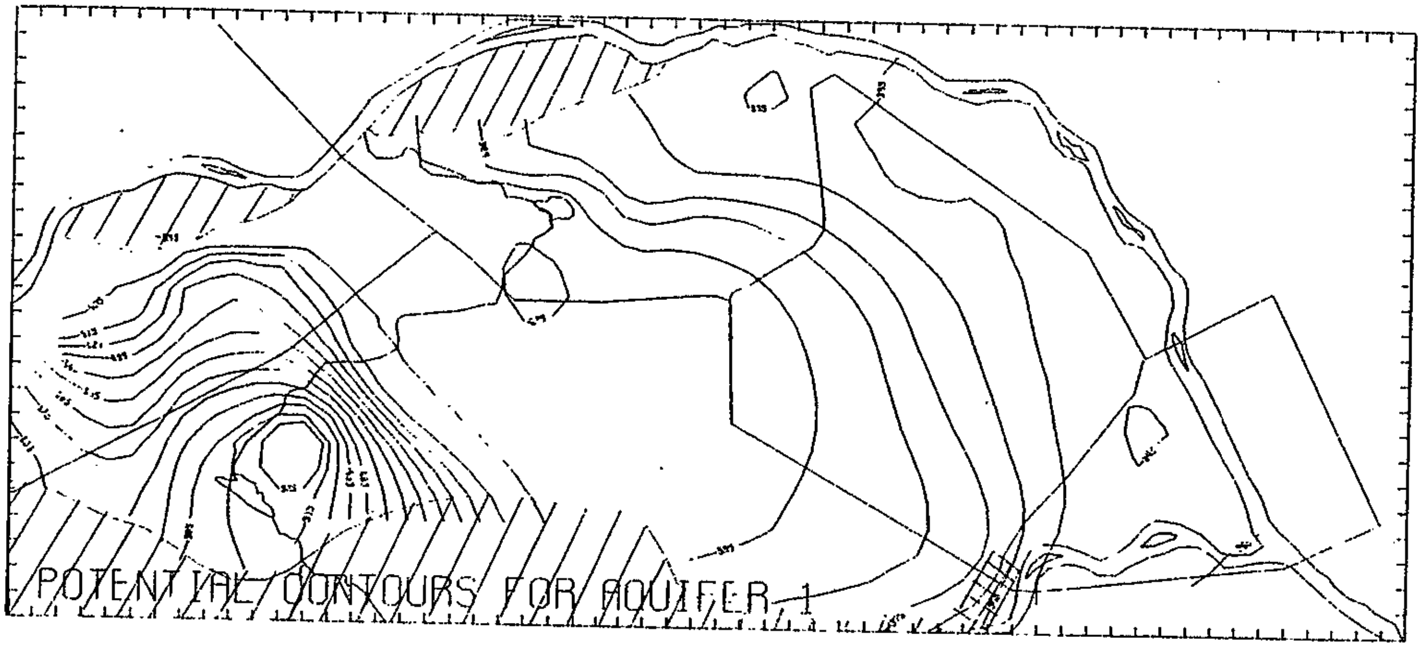
```
SIZING PARAMETERS.
0,1,58,25,1,58,1,25,0
BORDER SPECIFICATIONS.
.1,.1,1
SCALE FACTORS.
10962.,1.
PRIMARY GRID SIZES.
3000.,3000.,
MATRIX INPUT FILE SPECIFICATIONS.
2,0,
DP0:[213,3]HWISAP.A01
BACKGROUND FILE SPECIFICATIONS.
DP0:[213,3]WISAP.BND        (8F10.0)
CONTOUR LEVELS.
    1    Y .07         -1,1
345.,520.,10.,1,1
LABELS.
1POTENTIAL CONTOURS FOR AQUIFER 1
Y      4000.,2000.,-16,0.
END OF LABELS.
END OF DATA.
```

Sample of the CNT input control stream, BASALT.CNT. This is a lineprinter listing produced with PIP.

```
MCR>
PIP>XY:=BASALT.POT
```

Example of the method of transferring a disk type plot file to CALCOMP

9212 7 8 1 2 9 7



Sample of the 'CNT' Output for the Displayed Control Stream

ID: 2-3-2

COMPONENT: CNT--Contour Plotting Program

LOCATION: [11,1] CONTUR.TSK

DATE: June 1977

AUTHORS: S. W. Ahlstrom, S. E. Wise

SOURCE: FORTRAN 4 PLUS, MACRO 11

DESCRIPTION:

CNT is a general purpose graphic utility program designed to compute and draw contour lines for data surfaces of up to 256 x 256 nodes on any of the Device Independent Graphic System devices. It is an important auxiliary program allowing the user to present output matrices in a more comprehensible form. Depending on specified dimensions of the matrix area to be contoured, the program will operate in one of two modes: 1) all data will be memory resident, or 2) data will be segmented on a FILE-Q format data disk. This program accepts variable node spacing and negative as well as positive contour elevations. CNT also has provisions for plotting a background map for the contoured data, as well as various labels, reference marks and contour level labels if desired.

Two input streams are required. The first is an interactive conversation via a console device and is described in Section 1. The control input stream described in Section 2 is accessed from any file structured device as specified in the interactive stream.

1. OPERATING INSTRUCTIONS AND INTERACTIVE I/O

As previously mentioned, CNT determines from the control input stream whether or not a FILE-Q disk is required for the matrix about to be contoured. However, the user must also make this determination before running the program so that a disk can be properly mounted. A FILE-Q disk will be needed if the product of the number of columns and the number of rows in the matrix area to be contoured (that is, the total number of nodes) exceeds 3025.

After ensuring that all of the needed devices are properly mounted, the user can invoke the program by:

```
MCR>CNT<ALT>
```

After loading, the program will announce itself with the line:

```
*** CONTOUR PLOTTING ROUTINE (V77.1) ***
```

and begin soliciting information from the user. It will first want to know the location and name of the control input file:

```
ENTER THE CONTROL FILE SPECIFICATION (26A1) >
```

Any number of data sets can be included in the control input file:

```
ENTER THE NUMBER OF DATA SETS TO BE READ (I5) >
```

The user must specify the number of data sets to be processed sequentially starting with the first set. If more than one set is to be read, the user will be asked:

```
DO YOU WANT MULTIPLE PLOT FILES CREATED>
```

If the user answers "Y", the program will expect to read the plot file specification for each data set from the control input stream. The following questions will also be asked:

```
DO YOU WANT A PIP CONTROL FILE CREATED>
```

If the user chooses to use this option, the program will build a PIP indirect command file appending to it the name of the plot files as encountered in the control input stream. The program assumes that the plot files are to be transferred to XY:, but a simple editing session on the completed file can change the output device to whatever the user prefers. When the indirect file is eventually used, the files will be transferred in the same order they were written and with the proper paging between plots. The user must supply the name of the PIP command file:

```
ENTER NAME OF PIP CONTROL FILE (26A1) >
```

Specifying a file extension of "CMD" will simplify the PIP commands later on. A proper response might be "AVGPLTPIP.CMD".

Regardless of the number of data sets to be processed the program will ask the user which echo options are to be used. There is a primary echo option that allows the data sets from the control input stream to be echoed to the line printer device and a secondary option that will cause the matrix that is to be contoured to be listed. The primary option must be selected before the secondary option is offered:

```
DO YOU WANT THE INPUT FILE ECHOED>

DO YOU WANT THE INPUT MATRIX ECHOED>
```

When only a single data set is being processed, the name of the output device and/or file must be specified:

```
ENTER OUTPUT DEVICE/FILE SPECIFICATION (26A1) >
```

The plot file may be directed to a specific file (e.g., DP:PLOT1.PLT) or any of the Device Independent Graphics system devices by specifying only a device name. Devices currently allowed include disk (DP:, DB:, SY:), magnetic tape (MT:), Cal-Comp plotter (XY:), Tektronix 611 display scope (TG:), Gould 5100 electrostatic printer (GD:) and More Dicomed D-47 Color Film Recorder (DD:). If the specified device is file structured and no file name has been given, a default file name of PLOTDATA.TMP will be used. However, if the device is not file structured, the plot will output directly.

CNT will notify the user when it has finished processing all of the data sets with the line:

```
*** CONTOUR FINISHED ***
```

2. CONTROL INPUT STREAM FORMATS

The current input processing module has been designed to simplify the preparation of data sets while maintaining maximum flexibility. Consequently, the data that make up a control input stream have been grouped into 14 different data types or categories. Each data type has been assigned a keyword phrase identifier which must precede the data. While the additional keyword may seem like added work for the user, it offers many advantages regarding complex data sets. First, it makes individual data entries much easier to find when a correction or update is to be made. In addition, with a couple of exceptions, the user does not have to be concerned about the order of the sets within the control stream and is able to concentrate on specifying a single category correctly. Some of the data types are optional and can be left out of the control stream, and defaults values used.

As an introduction to the different data sets, all the keyword phrases are listed below with a short explanation of their usage and the data categories they precede. All keyword phrases are terminated with a period.

<u>BACKGROUND FILE SPECIFICATION</u>:

This optional data set is used when the user wishes to have the outlines of pertinent features of the contour area drawn on the plot.

<u>BORDER SPECIFICATION</u>:

This data sent must be included to specify the length to be used for the marks on the plot border. The marks are used to indicate nodal locations.

<u>CONTOUR LEVELS</u>:

This data set is used to tell the program which levels are to be contoured. This is an optional data set because it is permissible to draw only a background map without any contour lines.

9 2 1 7 9 3 2 2

END OF DATA:

It is possible to include any number of complete data sets within one control file and this phrase is used to signal the end of a data set and must be included.

LABELS:

This optional data type is used to specify labels for the plot.

MATRIX INPUT FILE SPECIFICATION:

This data set informs CNT of the name of the data file to be contoured and the format of the data within the file.

PLOT FILE SPECIFICATIONS:

The use of this optional data category allows the user to separate plots that are described in the same control input stream.

PRIMARY GRID SIZES:

This mandatory data set specifies the distances between nodes in both the X and Y-directions.

REFERENCE MARKS:

The Device Independent Graphics User's Guide describes about three dozen different reference marks that can be drawn on a contour plot. This optional data set allows the user to exercise this feature of the plotting software.

SCALING FACTORS:

This keyword is used to input the number of map units per plot inch and the overall scaling factor. This set should precede the CONTOUR LEVELS, LABELS and REFERENCE MARKS.

SIZING PARAMETERS:

The data items in this set include the matrix sizes and some program control options that must be specified. If the control set includes a title, this data type may be second in the control stream otherwise it must be first.

TITLE:

It sometimes is helpful to identify a control set and this data set provides a labeling mechanism. This optional data set must be placed first in the input stream.

X-IRREGULAR NODES:

Y-IRREGULAR NODES:

CNT has the capability of using an uneven grid system. These phrases are used to introduce variations in the X or Y-direction in the standard grid as defined by the PRIMARY GRID SIZES.

An explanation of each data type given below consists of the keyword phrase, a short description of the data, the record formats and sample data strings. The samples are given in both formatted and free field form. The free field format is easier to use because the data items are separated by commas. However, the user must be careful when entering alphanumeric data items. A complete data set example and the resulting plot is given on pages 35 and 36.

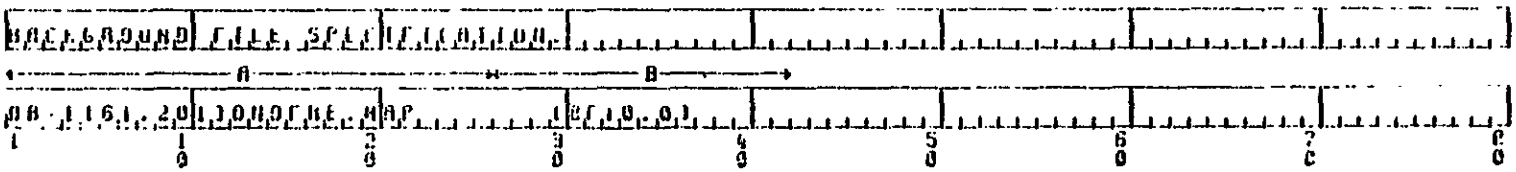
Keyword Phrase: BACKGROUND FILE SPECIFICATION.

This optional data set is included to outline the physical features of the area being contoured.

Format: 26A1,4A4

Columns	Contents	Description
1-26	BFILE	26 columns for the background map file descriptor
27-42	FMT1	16 columns for the format to be used when reading the background map file

Sample:



In the above sample, the name of the background map file is

a) DB:[161,201] ONOFRE.MAP and the format of the X-Y pairs is

b) 8F10.0. Note the presence of the parenthesis in the format specification.

Background map file format description: Two record types are used to describe a line on the map. The first type gives the number of X-Y pairs used in defining the line and the pen number to be used when drawing the line. This is followed by the X-Y pairs in the format given above. The combination of these two record types can be repeated as often as necessary.

Record Type 1 format: 2I5

Columns	Contents	Description
1-5	NPT	Number of X-Y coordinate pairs used to describe a line
6-10	NPN	Pen number to be used when drawing a line

Record Type 2: Contains the X-Y coordinate pairs defining the boundary line. The format of the lines is as specified in FMT1. However, the values will be expected to be in sequential X-Y pairs. A minus X coordinate will cause the pen to be raised before moving to the coordinate.

The sample below uses five X-Y pairs to draw a box counterclockwise. Pen number 1 is to be used when drawing the box. Only the free field format is shown.

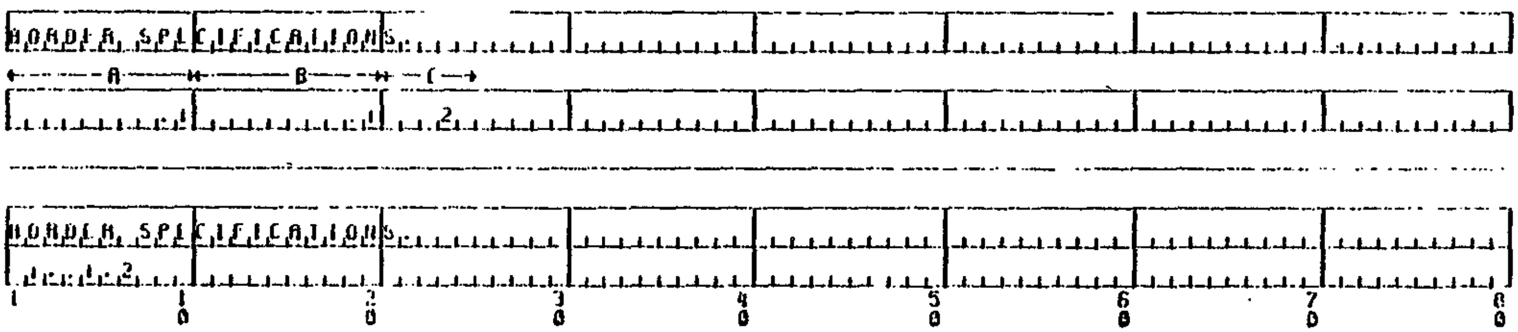
```
5,1
-10.,10.,20.,10.,20.,20.,20.,20.
10.,10.
```

Keyword Phrase: BORDER SPECIFICATIONS.

Format: 2F10.0,I5

Columns	Contents	Description
1-10	XTICLN	Length of the tic marks to be used on the bottom and top of the border box (inches)
11-20	YTICLN	Length of the tic marks to be used on the sides of the border box (inches)
21-25	NPNB	Pen number to use to draw the border box

Sample:



In the above sample, the length of the tic mark to be used on the bottom and top of the border box is

a) .1 in. The tic marks on the sides of the border box will also be the same

b) .1 in. The border box is to be drawn with pen number

c) 2.

Keyword Phrase: CONTOUR LEVELS

Important features of this data set include the two methods of inputting the contour levels and the labeling options. If the absolute size is to be used, the SCALING FACTORS must precede this data set.

Record type 1 format: I5,4X,A1,F10.0,2I5

Columns	Contents	Description
1-5	NCTYP	Type of contour level specification =1; read starting level, ending level and increment. The intermediate levels are then calculated (see record type 2) =2; read each level to be contoured (see record types 3 and 4)
10	CLAB	Primary contour label control =N; no labels =Y; label each contour line
11-20	SZ	Contour label height (inches). Inputting this value as a minus number will cause CNT to disregard the overall scaling factor and use the absolute value.
21-25	LABDEC	Number of digits after the decimal point in the contour level labels. To have integers printed, input a minus number.
26-30	LABALL	Secondary label control; CNT looks for room along the contour line to place the label. If there is not enough room a label will not be printed unless LABALL is input as 1. In which case every contour line will be labeled even if some labels are overwritten. Of course, if CLAB=N, no labels at all will be printed.

Record type 2 (to be used when NCTYP=1) format: 3F10.0,3I5

Columns	Contents	Description
1-10	CSTRT	Starting contour level (must be less than CEND)
11-20	CEND	Ending contour level (must be greater than CSTRT)
21-30	CINC	Contour level increment

9 2 1 2 3 7 3 1 3 3 9

Columns	Contents	Description
31-35	NLIN	Primary contour line type =0; solid line =1; dashed line =2; dash-dot line =3; solid line with triangle symbols
36-40	NINC	Spacing of the secondary contour lines. Every NINCth contour line regardless of value, will have the line type specified by NLIN1.
41-45	NLIN1	Secondary contour line type (same as NLIN)

Record type 3 and 4 are used when NCTYP=2.

Record type 3 format: I5

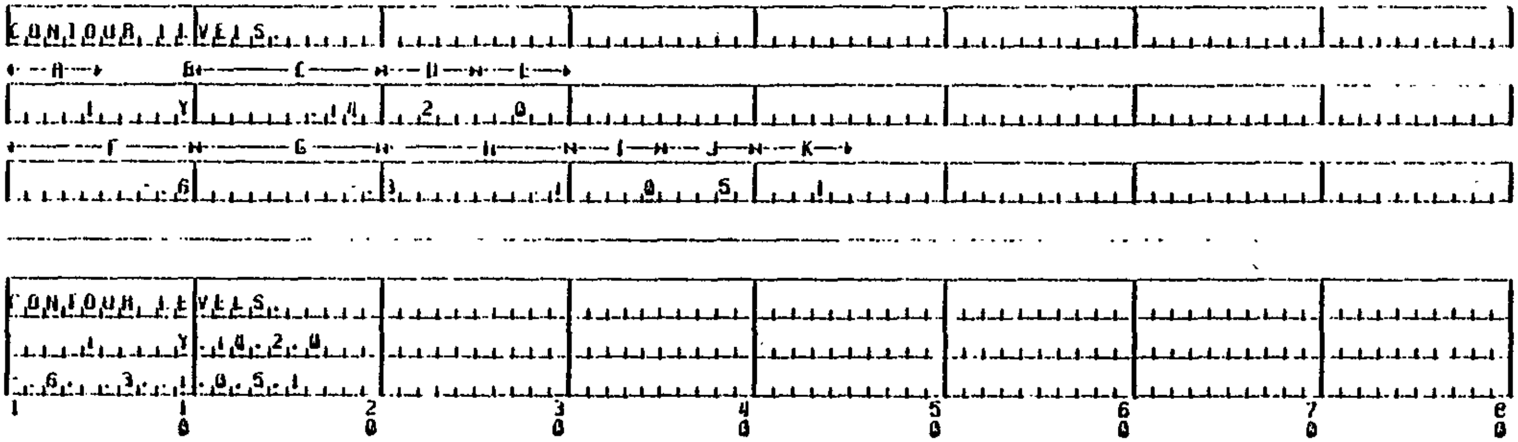
Column	Contents	Description
1-5	NLEV	Number of contour levels to be read (maximum of 50)

Record type 4 format: F10.0,I5 - NLEV records are read

Column	Contents	Description
1-10	CLEV(I)	Contour level I
11-15	ACNT(I)	Contour line type for level I (same as NLIN; record type 2)

9 2 1 2 5 7 3 1 3 1 0

Sample 1



In the above sample, CNT will

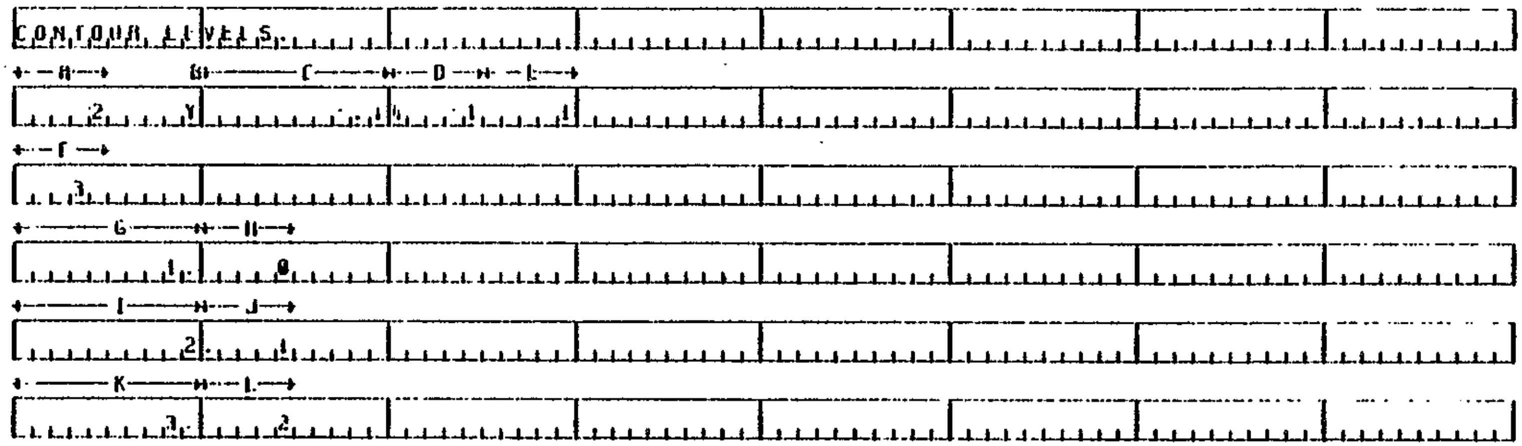
a) read record type 1,
b) label the contour lines with a label height of
c) .14 in. and output
d) 2 digits to the right of the decimal point
e) The lines will be labeled only when there is room with no overlapping of labels.

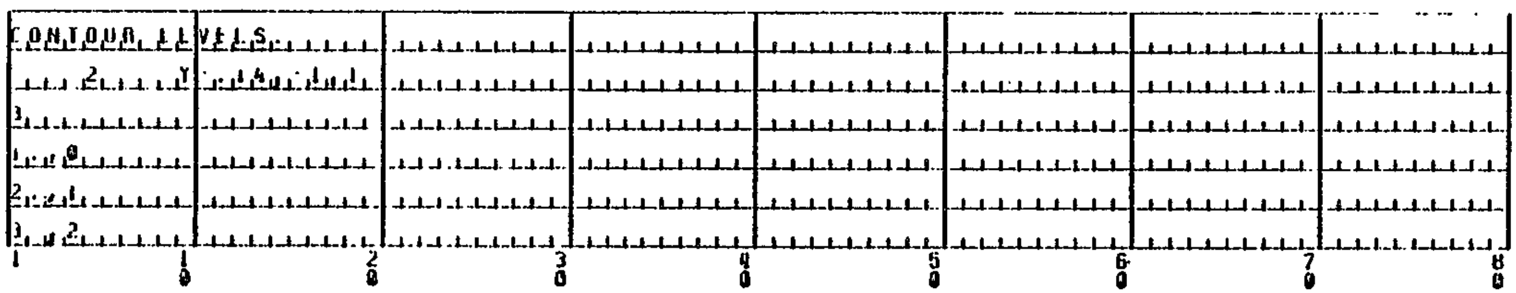
Record type 2 tells CNT that the starting level is

f) -.6, the ending level is
g) -.3 and the increment is
h) .1. This will yield 4 contour levels of -.6, -.5, -.4 and -.3. The primary line type is
i) a solid line and every
j) 5th line will be a
k) dashed line.

9 2 1 2 5 7 3 1 3

Sample 2:





In Sample 2, the user is going to

a) Specify each level. The lines are
b) to be labeled with a label height of
c) .14 in. The overall scale factor is to be ignored. The labels will
d) have no decimal point and
e) all of the lines are to be labeled without regard to overlapping.
f) 3 levels are to be contoured. The first level is
g) 1.0 and will be drawn using a
h) solid line. The second level is
i) 2.0 and it will be drawn with a
j) dashed line. The final level is
k) 3.0 and a
l) dash-dot line will be used.

9 2 1 2 3 7 3 1 3 1 2

Keyword Phrase: END OF DATA

This keyword phrase announces to CNT the end of one control data set and the beginning of the next. It must be present in all control data sets or the program will not function properly.

Sample:

```
END OF DATA
1        10        20        30        40        50        60        70        80
```

9 2 1 2 5 7 8 1 3 1 3

Keyword Phrase: LABELS

This data set allows the user to supply labels that will be drawn on the plot. The set consists of two record types that can be repeated as many times as required. The set is terminated with the phrase "END OF LABELS".

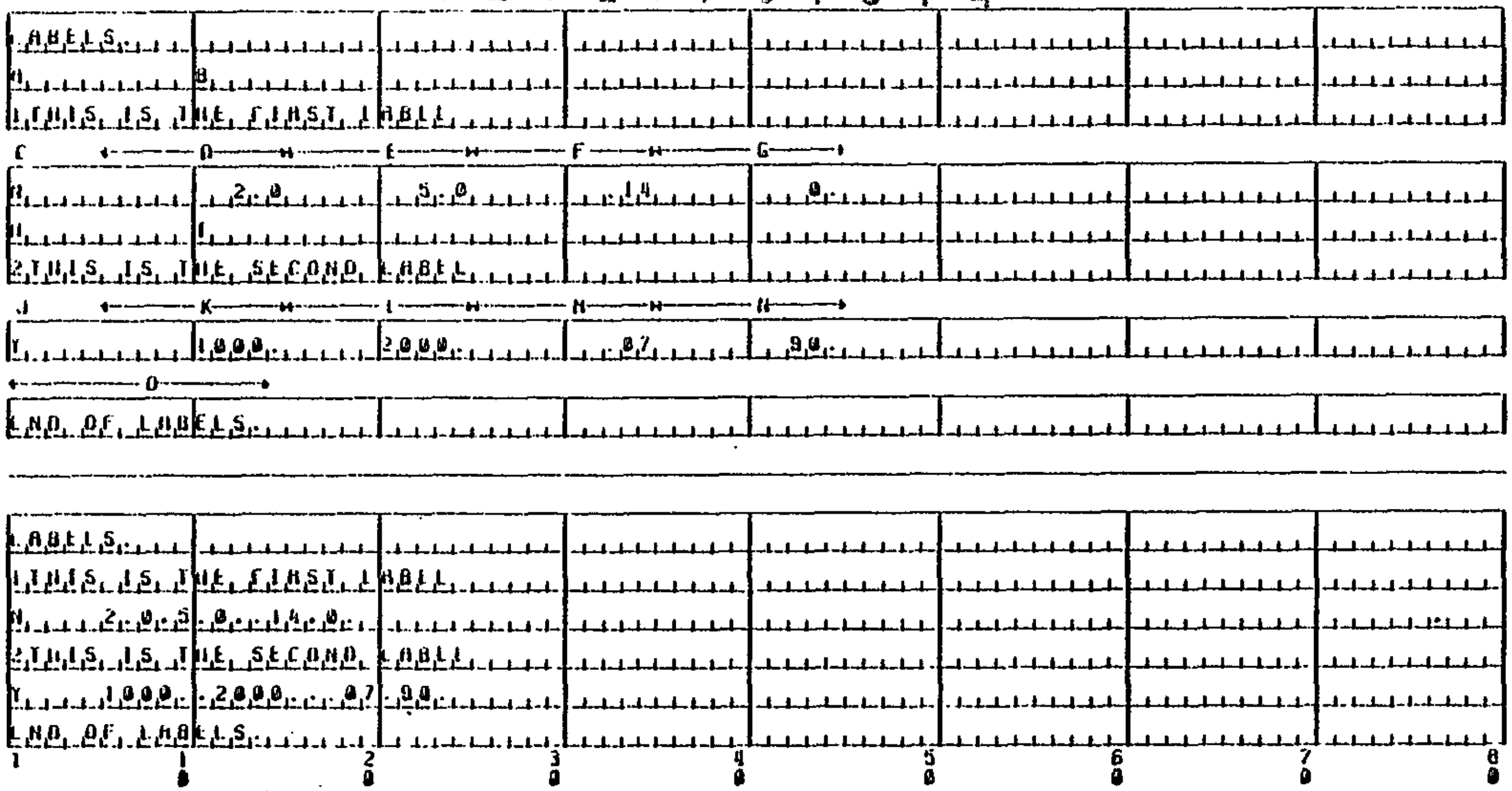
Record type 1 format: I1,77A1

Column	Contents	Description
1	NPNA	Pen number to be used when writing this label
2-78	LAB	77 columns to hold the alphanumeric label text

Record type 2 format: A1,4X,4F10.0

Column	Contents	Description
1	DTYP	Label coordinate units indicator =N; coordinates expressed in inches =Y; coordinates expressed in map units
6-15	XLAB	X-direction coordinate of label
16-25	YLAB	Y-direction coordinate of label
26-35	HLAB	Height of the label in inches. Inputting this value as a minus number will cause CNT to ignore the overall scaling factor when writing the label. If this option is used, SCALING FACTORS must precede this data set.
36-45	ALAB	Angle of the label. An angle of 0° will cause the label to be plotted parallel to the X-axis. If ALAB = 90°, it will be plotted parallel to the Y-axis. For further information, consult the Device Independent Graphics User's Guide.

921273131 4



There are two labels in the above sample. The first will be drawn using

a) pen number 1 and its text is
b) "THIS IS THE FIRST LABEL". The coordinates are given in
c) inches and the X-coordinate is
d) 2.0 in. and the Y-coordinate is
e) 5.0 in. The characters will have a height of
f) .14 in. and will be drawn
g) parallel to the X-axis. The second label will be drawn with
h) pen number 2 and its text is
i) "THIS IS THE SECOND LABEL". The coordinates of the second label are given in
j) map units with the X-coordinate at
k) 1000. and the Y-coordinate at
l) 2000. The label will have a height of
m) .07 inches and CNT is to ignore the overall scaling factor when writing the label at an angle of
n) 90° which is parallel to the Y-axis.

9 2 1 2 5 7 3 F 3 1 5

Keyword Phrase: MATRIX INPUT FILE SPECIFICATION.

CNT is capable of reading the input matrix from four different types of data files: formatted, unformatted, FILE-11 random access and FILE-Q random access. This data set identifies the type of file and provides the program with the file name.

Record type 1 format: 2I5

Column	Contents	Description
1-5	MTYP	Data file type =1; formatted ASCII (record type 2) =2; unformatted sequential binary (record type 3) =3; unformatted random access binary, FILE-11 structured (record type 4) =4; unformatted random access binary, FILE-Q structured (record type 5)
5-10	NMATX	Number of matrices within the file that are to be skipped. The first matrix to be read will be the (NMATX +1)th matrix in the file.

Record type 2 format: 26A1,4A4 - read when MTYP = 1

Column	Contents	Description
1-26	ANAME	26 columns for the data matrix file name
27-42	FMT	Data matrix ASCII format specification (16 columns)

Record type 3 format: 26A1 - read when MTYP = 2

Column	Contents	Description
1-26	ANAME	26 columns for the data matrix file name

Record type 4 format: 26A1,2I5 - read when MTYP = 3

Column	Contents	Description
1-26	ANAME	26 columns for the data matrix file name
27-31	NBLK	Number of records in the file
32-36	IBSZ	Number of real words per data record

Record type 5 format: A2,I1,1X,9A1 - read when MTYP = 4

Column	Contents	Description
1-2	DVICE	FILE-Q device containing the data matrix file
3	IDRV	Drive number of the File-Q device
4	Not Used	
5-13	ANAME	9 character data matrix file name

Sample 1: formatted ASCII file; note the presence of the parenthesis

```
MATRIX INPUT FILE SPECIFICATION.
    1    0
MT1:AVGDATA.DAT           (8F10.0)
```

Sample 2: unformatted sequential binary file; 1 matrix is to be skipped. Processing begins with the second matrix.

```
MATRIX INPUT FILE SPECIFICATION.
    2    1
LI60.2101AVGTEMP.DAT
```

Sample 3: unformatted random access binary FILE-11 structured file

```
MATRIX INPUT FILE SPECIFICATION.
    3    0
DV:CASE10008.SHO
```

Sample 4: unformatted random access binary FILE-Q structured file

```
MATRIX INPUT FILE SPECIFICATION.
    4    0
DV0:BOTTOMFIL
```

Keyword Phrase: PLOT FILE SPECIFICATION.

When using multiple control data sets, this data set allows the user to separate the plots into individual files. However, this keyword phrase is only active if the user specifies during the interactive I/O session that multiple plot files are to be created.

Format: 26A1

Columns	Contents	Description
1-26	MULFIL	26 columns for the plot file specification

Sample:

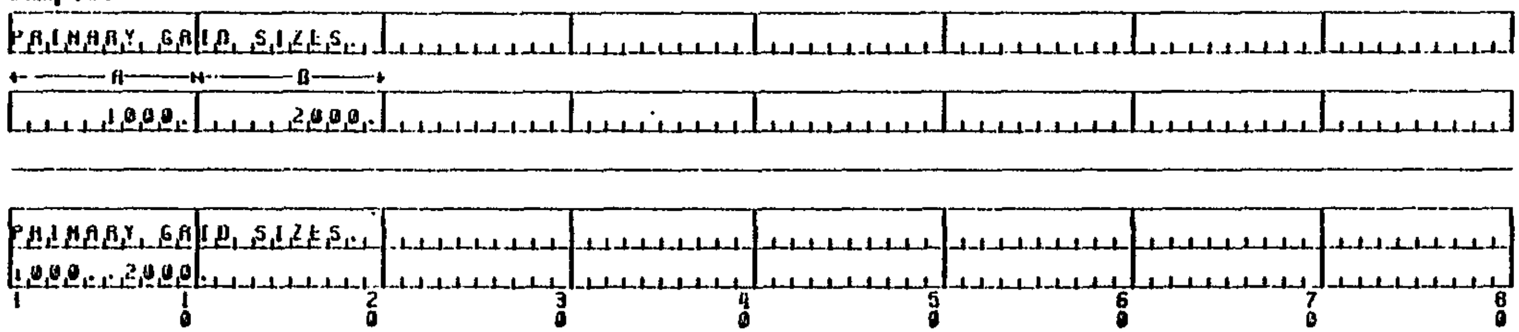
```
PLOT FILE SPECIFICATION.
MT0.PLOT01.PLT
1        10        20        30        40        50        60        70        80
```

Keyword Phrase: PRIMARY GRID SIZES.

Format: 2F10.0

Column	Contents	Description
1-10	XINCP	Standard node spacing in the X-direction (map units)
11-20	YINCP	Standard node spacing in the Y-direction (map units)

Sample:



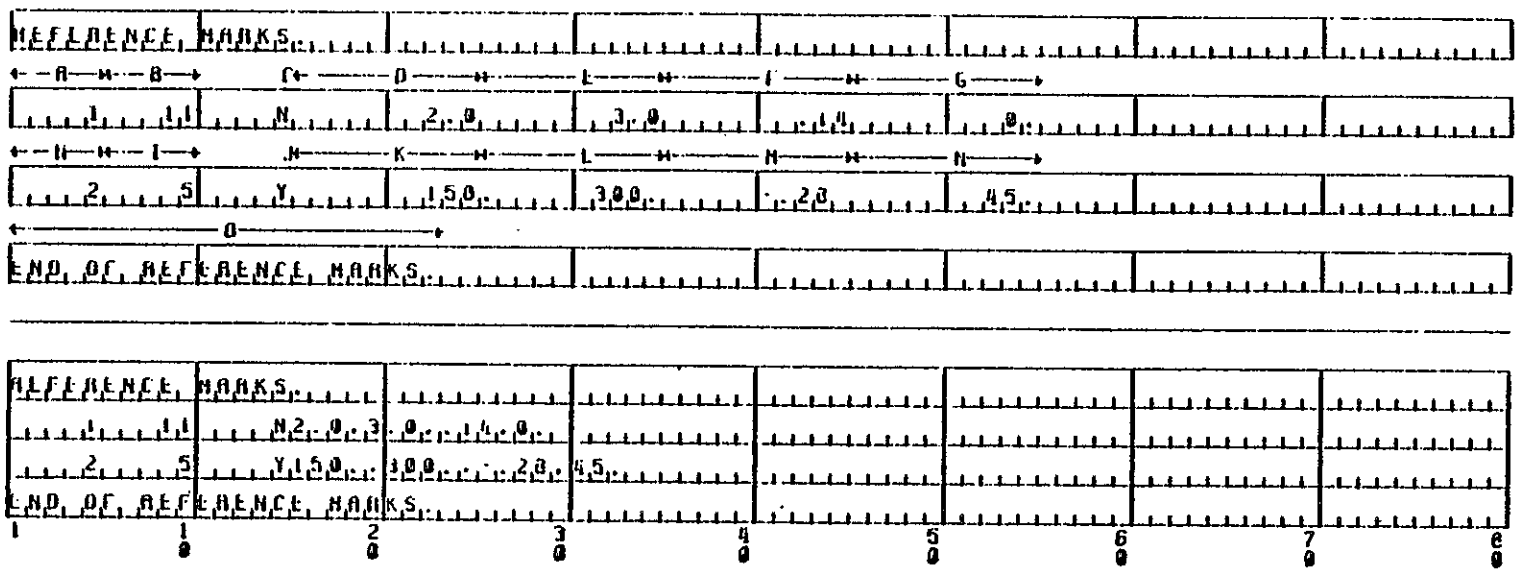
The above example shows a standard node spacing in the X-direction of
a) 1000. map units and in the Y-direction of
b) 2000. map units.

Keyword Phrase: REFERENCE MARKS.

This data type allows any of the symbols available from the Device Independent Graphics package to be drawn at specified locations. The data can be repeated as often as the user wishes and is terminated with the phrase "END OF REFERENCE MARKS".

Format: 2I5,4X,A1,4F10.0

Column	Contents	Description
1-5	NPNA	Pen number with which to draw the reference mark
5-10	IRF	Number of one of the available symbols (refer to the Device Independent Graphics User's Manual for the available symbols)
11-14	Not used	
15	DTYP	Label coordinate units indicator =N; coordinates expressed in inches =Y; coordinates expressed in map units
16-25	XLAB	X-direction coordinate of the reference mark
26-35	YLAB	Y-direction coordinate of the reference mark
36-45	HLAB	Size of the reference mark in inches. Inputting this value as a minus number will tell CNT to ignore the overall scaling factor when drawing the symbol. If this option is used, the SCALING FACTORS must precede this data set.
46-55	ALAB	Angle of the reference mark. An angle of 0° will cause the symbol to be drawn parallel to the X-axis and a 90° angle will cause the symbol to be drawn parallel to the Y-axis.



There are two reference marks in the above sample. The first will be drawn with

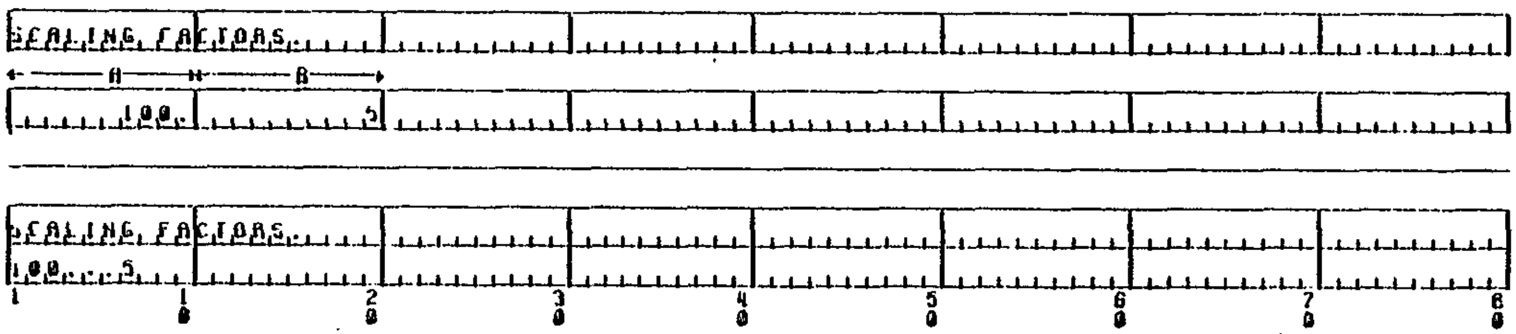
a) pen number 1 and number of the symbol is
b) 11. The location coordinate are expressed in
c) inches with the X-coordinate at
d) 2. in. and the Y-coordinate is
e) 3. in. from the origin. The symbol is to be drawn
f) .14 in. high with
g) no rotation. The second reference mark is to be drawn with
h) pen number 2 and the symbol to be used is
i) number 5. The location coordinates are expressed in
j) map units with the X-coordinate at
k) 150. map units and the Y-coordinate at
l) 300. map units. The size of the symbol is
m) .28 in. and CNT is directed to ignore the overall scaling factor when drawing the symbol with a counterclockwise rotation of
n) 45°.
o) End of the reference marks for the control data set.

Keyword Phrase: SCALING FACTORS.

Format 2F10.0

Columns	Contents	Description
1-10	DSCALE	Data scale factor (map units/inch)
11-20	FSCALE	Overall scale factor that modifies the size of the entire plot. This parameter is used as the argument to the D.I.G. FACTOR subroutine

Sample:



In the above sample, the number of map units/inch is

a) 100., and the overall scale factor is
b) .5 which reduces all vectors and sizes by half.

9 2 1 2 3 7 8 1 3 2 3

Keyword Phrase: SIZING PARAMETERS.

This must be either the first or second data set. It can be preceded only by the TITLE.

Format: 9I5

Column	Contents	Description
1-5	IOVR	Paging control variable. This variable can have two functions. When multiple control data sets are being processed, the value of the data item determines the placement of the pen and establishment of each plot's origin before it is drawn. If this is the last control data set being processed, it determines the placement of the pen after the plot has been drawn. =0; this is the most frequently used value. If multiple sets are being processed, a new origin is established before the plot is drawn and if this is the last data set, the pen is moved bottom right after the plot is drawn. Plot files created with this option can be transferred to the plotting device by using a wild card PIP command or with an indirect PIP command file without the user manually moving the pen to keep the plots from being drawn on top of one another. =1; this is the overlay option. If multiple sets are being processed and this is not the first set, a new origin will not be established before drawing the plot and no border, background map, labels or reference marks marks will be drawn. However, if this option is used in the first data set, the border, background map, labels and reference marks will be drawn. When used with the last data set, the pen will be moved bottom right after the plot has been drawn. =2; reserved for future enhancements =3; used for drawing only the border, background map, labels and reference marks. If multiple sets are being processed and this is not the first set, a new origin is determined before drawing proceeds. When this option is used in the last data set, the pen is returned to the plot's origin after the plot is completed.

Column	Contents	Description
	IOVR (contd)	
		=4; this is the zero-zero option. If multiple sets are being processed and this is not the first set, the plot will be drawn using the last established origin of the previous plot for its starting point. And, if this is the last set processed, the pen will be returned to the plot's origin after the plot is finished.
6-10	NPNC	Pen number with which the contour lines are to be drawn
11-15	NX	Number of data nodes in the X-direction (256 is maximum)
16-20	NY	Number of data nodes in the Y-direction (256 is maximum)
21-25	NCXF	Starting X-direction node for the plot area
26-30	NCXL	Ending X-direction node for the plot area
31-35	NCYF	Starting Y-direction node for the plot area
36-40	NCYL	Ending Y-direction node for the plot area
		Note: If ((NCXL-NCXF)+1) * ((NCYL-NCYF)+1) is greater than 3025, the matrix is too large to be kept core resident and a FILE-Q disk will be needed for temporary data storage.
41-45	CELCEN	Cell centered data (i.e., DPRW Transport Model output) - INTEGER =0; no offset =1; background map will be displaced 1/2 of the first node spacing increment in both the X and Y-directions.

Sample:

```
SIZING PARAMETERS
<-A-><-B-><-C-><-D-><-E-><-F-><-G-><-H-><-I->
    0    1  150  100    1   50   25   75    0
-----------------------------------------------
SIZING PARAMETERS
0,1,150,100,1,50,25,75,0
1        1         2         3         4         5         6         7         8
         0         0         0         0         0         0         0         0
```

In the above sample,

a) normal paging will be done and the contour lines will be drawn with
b) pen number 1. There are
c) 150 nodes in the X-direction and
d) 100 nodes in the Y-direction for a total matrix size of 15,000 nodes. The starting X-direction node for this plot is
e) 1 and the ending X-node is
f) 50 for a total number of X-direction nodes of 50. The beginning Y-direction node is
g) 25 and the ending Y-node is
h) 75 which yields a total number of Y-direction nodes of 50. The ultimate matrix size of the plot area is 2500 nodes and this plot will not require a FILE-Q structured disk. The data in the matrix is
i) not cell centered.

Keyword Phrase: TITLE.

The title is for identification purposes and is used only when the line printer echo option is selected. It should be the first set in the control data set followed by the SIZING PARAMETERS.

Format: 80A1

Column	Contents	Description
1-80	TITLE	80 columns for the title text

Sample:

```
TITLE.
CONTROL DATA SET FOR CONTOUR SURFACE TEMPERATURE OF 9/27/74
1        10        20        30        40        50        60        70        80
```

9 2 1 2 5 7 9 3 3 2 7

Keyword Phrase: X-IRREGULAR NODES.

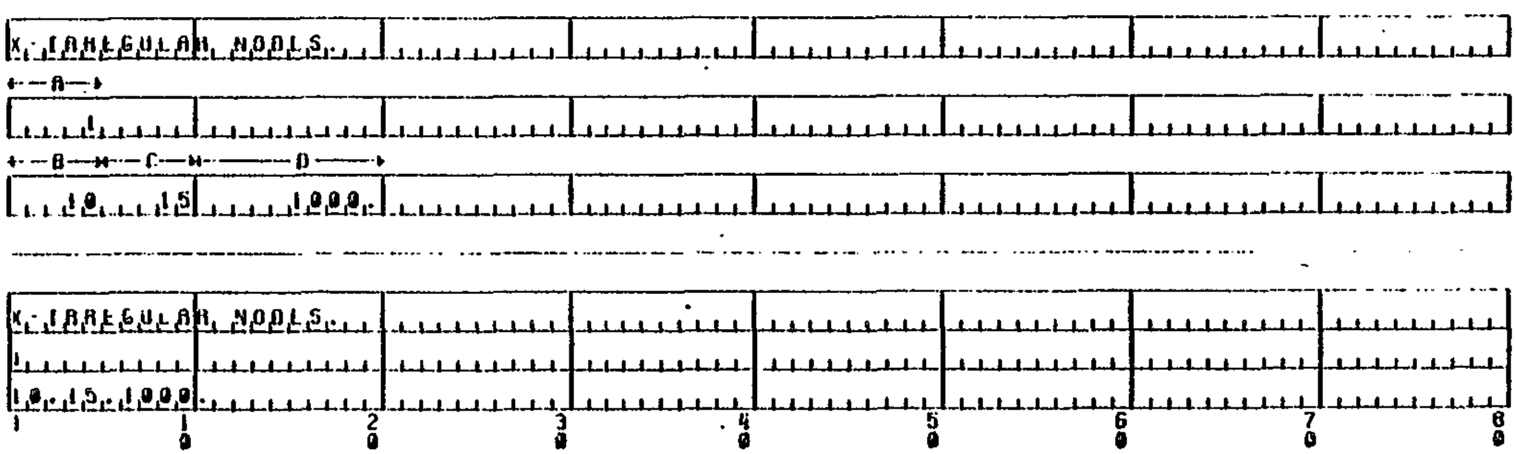
CNT is capable of contouring a surface with an irregular grid system and this data set is used to introduce irregularities in the X-direction. It consists of two record types.

Record type 1 format: I5

Columns	Contents	Description
1-5	NEX	Number of intervals in the X-direction that the node spacing differs from the standard.

Record type 2 format: 2I5,F10.0 - NEX records are required

Columns	Contents	Description
1-5	NSX	Starting node interval in the X-direction for the nonstandard grid system
6-10	NFX	Ending node interval in the X-direction for the nonstandard grid system
11-20	XDIF	Grid spacing to be used for this variation interval.



In the above sample, there is

a) one variation in the X-direction and it begins with node interval
b) 10 and ends with node interval
c) 15 (inclusive). The intervals for nodes 10-15 will be
d) 1000. units.

Keyword Phrase: Y-IRREGULAR NODES.

For an explanation of this data set, read the description of X-IRREGULAR NODES and substitute a Y for each X.

3.3 RUN TIME ERROR MESSAGES

CNT performs some internal data consistency checks and will produce some run time error messages. All of these are fatal errors in that processing of the control set will be suspended, but only one error will stop execution immediately without reading the rest of the control stream. The run time errors are listed below with a short explanation.

FILE NOT ON DEVICE XXY FILENAME IN DATA SET ZZZZZ

The user has specified a FILE-Q structured file as the matrix input file and the file could not be found. Processing will continue with the next control data set if appropriate.

XX - FILE-Q structured device

Y - FILE-Q device drive number

FILENAME - FILE-Q file name

ZZZZZ - control data set number where the error was encountered

----

IMPROPER FILE-Q DEVICE OR DRIVE NO. XXY IN DATA SET ZZZZZ

The user has specified a FILE-Q structured file as the matrix input file and either the specified device or drive number is in error. Has the device been properly mounted? Processing will continue with the next control data set if appropriate.

XX - FILE-Q structured device

Y - FILE-Q device drive number

ZZZZZ - control data set number where the error was encountered

----

INVALID CONTOUR INPUT SPECIFICATION TYPE XXXXX IN DATA SET YYYYY

Check the CONTOUR LEVELS data set because the type of contour specification is in error. Processing will continue with the next control data set if appropriate.

XXXXX - contour type specification as input

YYYYY - control data set number where the error was encountered

----

NO VALID KEY IN ABOVE RECORD

The line that is written prior to the error message contains the buffer that was being scanned for a keyword phrase when none was recognized. This error will suspend any further processing.

ONLY THE TITLE MAY PRECEDE THE MATRIX SIZING PARAMETERS IN DATA SET XXXXX

The SIZING PARAMETERS must be either the first or second data set and only the title can precede them. Processing will continue with the next control data set if appropriate.

XXXXX - control data set number where the error was encountered

----

THE CONTOUR LEVELS ARE OUTSIDE THE DATA RANGE IN DATA SET XXXXX

The user has specified contour levels that are not present in the input data matrix. A line printer echo listing will provide the minimum and maximum values found in the matrix. Processing will continue with the next control data set if appropriate.

XXXXX - control data set number where the error was encountered

----

TOO MANY IRREGULAR NODE SPECIFICATIONS (50 MAX.) IN DATA SET XXXXX

Either the number of X or Y-irregular node variations has exceeded the maximum allowable of 50. Processing will continue with the next control data set if appropriate.

XXXXX - control data set number where the error was encountered

----

TOO MANY LEVELS SPECIFIED XXXXX (50 IS MAXIMUM) IN DATA SET YYYYY

CNT can only contour 50 levels at one pass through the data matrix. If more levels are required, a second pass can be set up with another control set using the proper paging options to draw the lines on the same plot. Processing will continue with the next control data set if appropriated.

XXXXX - the number of levels specified

YYYYY - control data set number where the error was encountered

----

TOO MANY NODES (256 MAX.) XXXXX YYYYY IN DATA SET ZZZZZ

The maximum matrix size that can be contoured in 256 x 256. Processing will continue with the next control data set if appropriate.

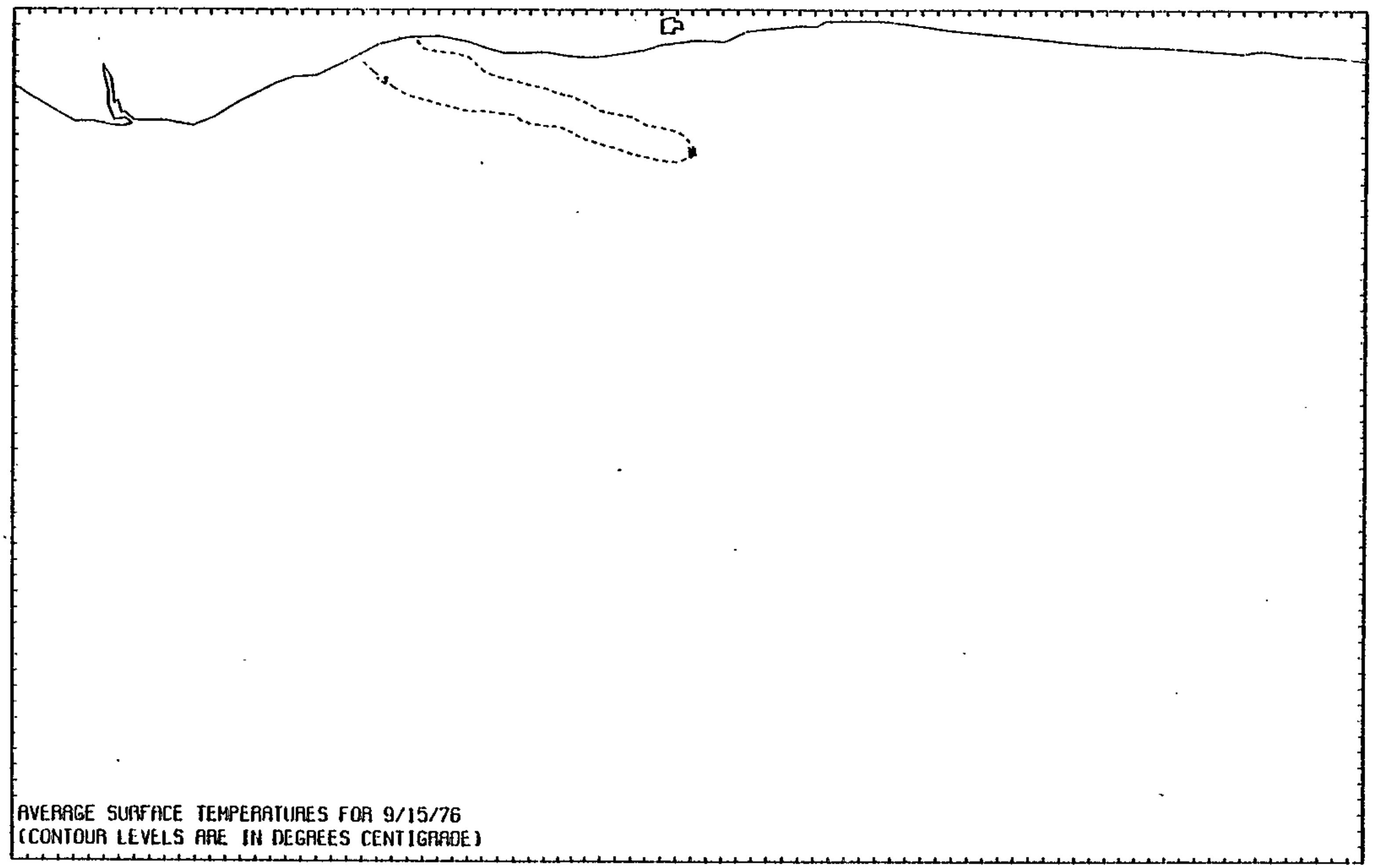
XXXXX - number of nodes in the X-direction as input

YYYYY - number of nodes in the Y-direction as input

ZZZZZ - control data set number where the error was encountered

```
SIZING PARAMETERS.
0,1,90,55,1,90,1,55,1
BORDER SPECIFICATIONS.
.1,.1,1
SCALING FACTORS.
304.76,.5
PRIMARY GRID SIZES.
100.,100.
CONTOUR LEVELS.
     2     Y.14,1
3,
.5,1
1.,1
2.,1
BACKGROUND FILE SPECIFICATION.
DP0:[100,210]BGNDFRE.MAP  (8F10.0)
MATRIX INPUT FILE SPECIFICATION.
2,0
DP0:CASE13915.AVG
LABELS.
1AVERAGE SURFACE TEMPERATURES FOR 9/13/76
Y    100.,300.,.28,0.
1(CONTOUR LEVELS ARE IN DEGREES CENTIGRADE)
Y    100.,150.,.28,0.
END OF LABELS.
REFERENCE MARKS.
     1   11    Y4550.,4550.,.28,0.2
END OF REFERENCE MARKS.
END OF DATA.
```

SAMPLE CONTROL FILE



SUBSEQUENT PLOT

Program DIFFER

```
MCR>RUN DB0:DIFER$
 PROGRAM DIFER TO MAKE DIFFERENCE MAPS
 WHICH DISK UNIT 1,2, 3=DB0:
3
 ENTER THE BASE FILE NAME
 THEN NEW FILE NAME
 THEN DIFFERENCE FILE NAME
 THEN MODULO NUMBER,NODES-X,NODES-Y
[213,3]HWISAP.BOT
[213,3]NWISAP.POT
TOSS.TMO\O\P
1.,58,25,
[213,3]HWISAP.BOT
[213,3]NWISAP.POT
TOSS.TMP
       1.          58          25
MAX-MIN-RMS DIFFERENCE
   0.29834E+03    0.57340E+00    0.12291E+03
 ENTER A TITLE FOR THE PRINTOUT
AQUIFER THICKNESS MAP
AQUIFER THICKNESS MAP
 ENTER THE NUMBER OF DIFFERENCE MAPS TO BE PREPARED
1
 NUMBER OF COPIES=       1
 ENTER 6 ONE CHARACTER PLOTTING SYMBOLS FOLLOWED BY
 SIX UPPER LIMITS ON THE RANGES (IF THE FIRST
 PLOTTING CHARACTER IS AN (E) NO SYMBOL DIFFERENCE
 MAP WILL BE MADE
ABCDEF50.,100.,150.,200.,250.,300.,350.,
        A          B          C          D          E          F
    50.00     100.00     150.00     200.00     250.00     300.00

 ENTER THE BASE FILE NAME
 THEN NEW FILE NAME
 THEN DIFFERENCE FILE NAME
 THEN MODULO NUMBER,NODES-X,NODES-Y
^Z

DIFER  --  STOP
```

DIFER is a program for making lineprinter differences maps of two kinds and a binary difference file for plotting purposes. Input can be from the File-Q disk if the user wants to look at difference maps only between time planes or from binary files to look at differences between any two binary files. This interactive input stream differences between a binary stress potential file and a binary potential file for the no stress case so that the resulting difference may represents drawdown between the stress and no stress cases for the Basalt aquifer.

LINE \ COLUMN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
25*																									
24*																									
23*																									
22*																								38	55
21*																37	31	26	28	29	29	30	29	34	49
20*															64	43	37	40	43	44	41	41	37	41	54
19*														97	75	55	43	29	30	26	35	41	42	42	48
18*													103	99	77	54	23	19	21	17	27	35	40	43	46
17*										108	104	100	102	91	56	61	32	30	29	21	25	40	117	73	55
16*			135	122	144	96	98	97	90	71	59	57	69	89	85	73	45	54	37	16	16	26	45	42	41
15*		137	117	96	85	65	47	27	32	22	26	29	29	41	78	91	72	49	11	6	6	10	19	25	31
14*		132	130	128	114	98	78	64	54	49	46	48	42	30	25	38	34	10	5	6	5	6	14	23	32
13*			109	110	114	122	143	160	158	117	96	96	94	62	33	24	21	11	13	25	40	28	29	36	45
12*			20	39	75	116	168	197	199	188	177	171	149	103	53	34	25	20	30	53	71	47	45	58	72
11*		15	1	17	50	105	173	210	210	205	203	199	172	130	76	39	23	26	40	62	74	61	80	97	109
10*	23	18	19	18	54	110	176	221	225	220	232	234	205	164	112	55	34	36	49	70	100	109	122	140	156
9*	25	20	16	16	51	125	168	231	241	241	244	252	245	205	153	97	57	57	76	88	109	131	154	181	195
8*	28	23	18	20	50	130	195	236	249	256	263	287	298	252	195	139	107	90	85	94	115	137	173	197	201
7*	29	25	22	22	53	124	194	234	252	260	269	281	290	260	222	175	148	111	89	83	91	111	146	184	187
6*		24	22	24	51	94	187	223	249	258	264	268	266	246	206	165	125	95	71	59	52	57	72	97	114
5*				20	40	77	158	237	220	239	243	245	236	211	162	113	75	53	31	19	9	12	19	32	44
4*							105	169	197	206	205	201	188												
3*								120	153	170	174	167													
2*																									
1*																									

AQUIFER THICKNESS MAP
MAX= 0.2963E+03 MIN= 0.3750E+00 RMS= 0.1229E+03 PLUS MEANS OFA IS HIGHER
AVG= 0.105E+03 # ACTIVE NODES= 683 AVG POS= 104.5648 # POS= 683 AVG NEG= 0.0000 # NEG= 0
BASE FILE NAME [213,3]HWISAP,001 NEW FILE NAME[213,3]HWISAP,POT

LINE \ COLUMN	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
25*						55	55	42																	
24*			53	55	55	57	57	35	29	29	43	48													
23*		69	64	62	66	70	57	27	35	47	47	75	89	84											
22*	71	71	68	67	67	74	61	38	36	52	50	89	87	86	126	209	209	209							
21*	65	69	68	65	63	66	58	40	49	54	93	91	90	122	211	210	210	209	209						
20*	59	56	54	55	52	48	44	40	48	63	66	109	127	177	213	212	212	210	211	211					
19*	43	34	32	29	32	36	38	41	48	63	84	109	156	208	215	214	213	210	211	208	207				
18*	47	43	38	33	32	35	37	42	48	61	86	120	162	210	221	218	214	211	209	202	196	193			
17*	47	42	46	48	45	42	41	43	48	60	102	136	178	216	221	218	213	210	201	194	192	191			
16*	39	33	43	52	54	50	47	45	47	60	89	145	191	219	221	217	212	202	197	195	193	192	187		
15*	35	39	45	55	59	57	54	51	50	61	80	147	201	221	221	216	208	197	186	183	182	178	157	155	
14*	39	45	57	63	65	62	59	57	58	66	85	150	204	222	221	215	202	190	181	166	161	158	157	150	
13*	54	66	74	74	76	66	63	61	62	68	79	138	194	216	217	207	191	179	171	163	159	150	143	138	
12*	81	84	85	85	76	72	67	64	63	68	77	113	172	190	195	187	176	167	161	157	149	142	140	137	
11*	112	109	101	93	80	82	74	67	64	66	76	101	147	165	171	166	160	155	151	149	145	142	140	138	127
10*	157	149	136	121	105	92	84	75	67	68	76	95	132	148	153	151	147	143	142	139	138	140	123	87	84
9*	196	193	176	161	143	122	102	86	76	73	78	89	119	136	140	138	134	130	128	128	127	127	91	87	85
8*	202	199	196	191	170	160	137	107	86	80	81	89	111	131	135	132	127	119	113	114	113	105	89	87	85
7*	191	194	192	196	195	190	173	143	102	85	83	91	107	122	132	131	125	117	108	103	100	90	80	77	87
6*	124	126	133	151	174	183	192	172	130	90	88	95	106	113	125	129	125	117	108	97	85	72	66	80	91
5*	55	68	75	82	69	137	133	155	141	108	98	102	105	108	114	124	122	116	108	99	87	77	82	87	90
4*			45	54	50	67	77	91	105	106	103	102	103	103	103	106	111	109	103	100	96	90	89	93	96
3*				37	30	44	55	66	77	86	93	96	97	96	93	87	83	89					98	103	105
2*					25	27	37	47	59	69	77	83	88	86	84	76	70	60							
1*								36	45	56	65	72	78	81	79	73	65	58							

9 2 1 2 3 7 8 1 3 5 7

COLUMN / LINE	51	52	53	54	55	56	57	58
25*								
24*								
23*								
22*								
21*								
20*								
19*								
18*								
17*								
16*								
15*								
14*								
13*								
12*								
11*								
10*								
9*	84							
8*	84							
7*	91	91						
6*	90	91						
5*	91	100	105					
4*	105	105	105					
3*								
2*								
1*								

9 2 1 2 1 7 0 1 3 3 3

```
AQUIFER THICKNESS MAP
 MAX=  0.2465E+03 MIN=  0.5734E+03 RMS= 0.1229E+03 PLUS MEANS NEW IS HIGHER
 AVG=   0.1095E+03 , ACTIVE NODES=  883 AVG POS=  109.5648 # POS=  883 AVG NEG=    0.0000 # NEG=    0
   BASE FILE NAME [213,3]HWISAP.OUT                       NEW FILE NAME[213,3]NWISAP.PUT

COLUMN  ****************************************************************************************************

                           1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 4 4 4 4 4 4 4 4 4 4 5
         1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
LINE    ****************************************************************************************************
    25*                                                             B B A
    24*                                                       B B B B B A A A A A
    23*                                                     B B B B B B A A A A B B B
    22*                                               A B B B B B B B B A A B B B B B C E E E
    21*                               A A A A A A A A A A B B B B B B A A B U B B C E E E E E
    20*                             d A A A A A A A A A B B B h B B A A A A B B C C D E E E E E E
    19*                           u B H A A A A A A A A A A A A A A A A A A A B B C D E E E E E E E
    18*                         C B B U A A A A A A A A A A A A A A A A A A B B C D E E E E E E E D D
    17*                   C C B C H d H A A A A A A C B B A A A A A A A A A B C C D E E E E E E D D D
    16*     C C C B n b d B d U U B U d A U A A A A A A A A A A B B U A A A B B C U E E E E E D D D D D
    15*   C C B B H A A A A A A A B d b A A A A A A A A A A A A A B U U B d B B U C E E E E E D D D D D D
    14*   C C C C B H b d A A A A A A A A A A A A A A A A A A A B B H B d d B B B U E E E E E D D D D D D
    13*     C C C C C U U C B B H A A A A A A A A A A A A U B B B B H H U U B B C D E E E D D D D D D C C
    12*     A A B C H U H U D D C C B A A A A B B A A B B B U U B B B B B B B B C D D D D D D D D C C C C
    11*   A A A B C D E E E E D D C B A A A A B B B B B C C C C B B B B B B B B C C D D D D D D C C C C C C
    10* A A A A A C D E E E E E E D C B A A A B C C C C D D C C C C U B B B B B C C U D C C C C C C C C D B
     9* A A A A H C D E E E E F E E D B B B B B C C D D D D D D D C C C B B B B C C C C C C C C C C C B B B
     8* A A A A H C D E E F F F F F D C C H B B C C D D E E D D D D C C B B B B C C C C C C C C C C C B B B
     7* A A A A H C D E F F F F F F E D C C B B B C C D D D D D D D D C C B B B B C C C C C C C C C B B B H
     6*   A A A H H D E E F F F F E E D C B B B B B B C C C C D D D D D C B B B C C C C C C C C C B B B B B
     5*       A A D D E E E E E E E D C B B A A A A A A A B B B B B C C D C C B C C C C C C C C C B B B B B
     4*             C D D E E E D                             A B B B B C C C C C C C C C C C C C B B B B B
     3*               C D D D D                                 A A A B B B B B B B B B B B B         B C C
     2*                                                           A A A A B B B B B B B B B B
     1*                                                                 A A B B B B B B B B B
```

9212378133 9

```
COLUMN   ****************************************************************************************************

          5 5 5 5 5 5 5 5
          1 2 3 4 5 6 7 8
LINE     ****************************************************************************************************
      25*
      24*
      23*
      22*
      21*
      20*
      19*
      18*
      17*
      16*
      15*
      14*
      13*
      12*
      11*
      10*
       9* B
       8* B
       7* B B
       6* B B
       5* B B C
       4* C C C
       3*
       2*
       1*
```

AQUIFER THICKNESS MAP
MAX= 0.2993E+03 MIN= 0.5754E+01 RMS= 0.12291E+03 PLUS MEANS NEW IS HIGHER

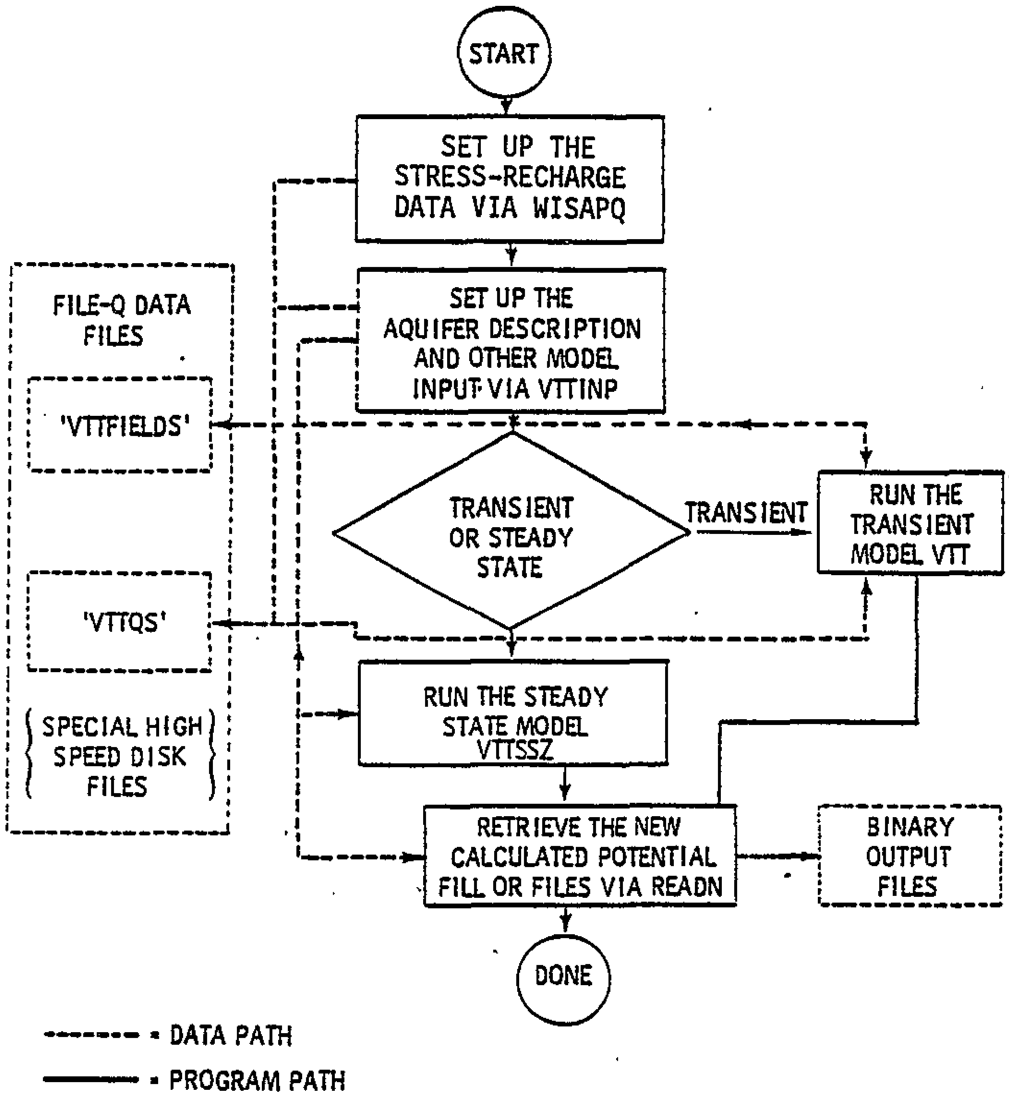
RANGE	VALUE		ABS DIFF	% OF NODES	POS DIFF	% OF NODES	NEG DIFF	% OF NODES
A	0.000*	50.000	208	23.556	208	23.556	0	0.000
B	50.000*	100.000	288	32.616	288	32.616	0	0.000
C	100.000*	150.000	168	19.026	168	19.026	0	0.000
D	150.000*	200.000	114	12.911	114	12.911	0	0.000
E	200.000*	250.000	89	10.079	89	10.079	0	0.000
F	250.000*	300.000	16	1.812	16	1.812	0	0.000
TOTALS			883		883	100.000	0	0.000

FIVE MAXIMUM NODES

	ROW	COLUMN	DATA	MODEL	DIFFERENCE
1	6	13	0.23607E+03	0.53641E+03	0.29834E+03
2	7	13	0.23298E+03	0.52344E+03	0.29046E+03
3	6	12	0.24980E+03	0.53662E+03	0.28681E+03
4	7	12	0.23846E+03	0.51927E+03	0.28081E+03
5	7	11	0.24362E+03	0.51228E+03	0.26867E+03

BASIC GROUND-WATER MODEL CODES

Once all the input files have been prepared and checked out the procedure for setting up the model input, running the model and retrieving the newly calculated potential files is rather simple, as illustrated below:



In addition to the WISAPQ, VTTINP, VTT or VTTSSZ and READN programs used to set up the model input, run the model, and retrieve the model results, other useful programs will also be presented in this section. These programs include:

- ACHECK for printing out the model data files currently set up for the ground-water model on the FILE-Q disk.
- VTTPNT for summarizing and printing out model results as they currently exist on the model's data files on the FILE-Q disk.
- MXED for examining and/or modifying the model data files that exist on the FILE-Q disk.

These programs can be used to further check and/or list model input, and the MXED program can be used to make various simple changes in model input for certain kinds of modeling studies.

The program in this section will always ask which FILE-Q disk and whether the user is working with the large or small field. One must be consistent as to the File-Q disk he specifies. The small field option has to do with obtaining a higher resolution potential field within some small region of the base nodal (large region) system. If in the future there is a need to use this high resolution feature, the additional operating procedures and program documentation can be found under programs SUBGEN and BCTRN.

Program WIQPG

```
MCR>RUN DB0:WIQPG$
 THE WISAP FILE Q MUST BE SETUP
 WHICH FILE Q DISK?  1,2,OR DB0:=3
3
 ENTER NAME OF BILE
[213,3]QOUT.DAT

WIQPG  --  STOP
```

Sample of the interactive input stream required to run WIQPG, which utilizes the intermediate Q-File supplied by WISAPQ to prepare the VTTQS File-Q file for a VTT model run.

Main Model Input, VTTNP

VTTINP is the main ground-water model input code. It is used to prepare all the control and matrix data on the File-Q disk except for the Q data file VTTQS. VTTINP should be run after the Q data have been prepared, checked out and WISAPQ has been run. All the input data matrices and the calculational type files can be checked out as indicated in the previous pages.

92127334

```
MCR>RUN DP2:VTTINP$
WHICH FILE Q DISK 1,2,3
2
HAVE YOU RUN QPRG WITH THE PROPER ROTATION????
ENTER INPUT FILE NAME
WISAP2.CRD
WISAP2.CRD
TIME VARING BOUNDARY NODES (0=NO, 1=YES)
0
IS A SMALL REGION SIMULATION TO BE RUN (0=NO 1=YES)
0
ENTER NAME OF INITIAL CONDITION FILE(OR NONE)
NONE


VTTINP  --  STOP
```

Example of the interactive control streams necessary to run VTTINP

```
WISAP DATA= HANFORD DATA
DP1:WISAP.AQ1                    POTENTIAL FILE
DP1:WISAP.BOT                    AQUIFER BOTTOM FILE
DP1:TOP.AQ1                      AQUIFER TOP FILE
DP1:WIASP.HYC                    HYDRAULIC CONDUCTIVITY FILE
DP1:WISAP.TYP                    CALCULATION TYPE FILE
NONE                             STORAGE COEFFICIENT
NONE                             INTERAQUIFER TRANSFER COEF.
NONE                             OCEAN TRANSFER COEF.
1,58,25,YN1,0.0,3000.,1.0,
0.0,0.0,
0.0,0.0,
0,0,1,50,50,7.E-3,1.25
1975,1,1,0,0,0,
1975,1,1,0,0,0,
0,2,0,0,
1975,1,1,0,0,0,
1975,1,2,0,0,0,
1,25,1,                        COLUMN OF CHANGE INPUT
1,.1                           (STORAGE COEFFICIENT)
1,25,1,
1,0.0                          (INTERAQUIFER TRANSFER)
1,25,1,
1,0.0                          (OCEAN TRANSFER)
```

Example of Main Input Control Stream for VTTINP

9212781316

Steady State Models VTTSSZ

```
MCR>RUN DP2:VTTSSZ*
 WHICH FILE Q DISK 1,2,3
 2
 LARGE OR SMALL FIELD ? :CR=LG,1=SM
 0
  TTY HEADER INPUT ?
 0
 START OF ITERATION  1
 PRINT ?
 0
 START OF ITERATION  2
 PRINT ?
 1
 PRINT MATRIX ?
 0
 SOLUTION ,THICKNESS ,SOL -BIAS
   1           2          3
 0
 Q -CAL ,  INT. AQUIFER TRANS. ,Q -MAG. ,Q -RATIO
  1              2              3         4
 0
 TRANSMISSIVITY MAP ?:(1) =FT**2/DAY ;(2) =GAL/DAY/FT
 0


 VTTSSZ  --  STOP
```

Example of the Interactive Input Stream required to run VTTSSZ. The solution at the end of each iteration is stored in the VTTFIELDS (large field) File-Q file. There are print options available like VTTPNT has. These print options can be utilized at the start of each iteration. Typically, five iterations are required to obtain the solution to an unconfined aquifer problem. Conversely, only one is required for a confined aquifer.

Program ACHEK

```
MCR>RUN DP1:ACHEK$
 WHICH DISK UNIT 1,2, 3=DB0:
1
LARGE OR SMALL FIELD ? :CR=LG,1=SM

HEADER OUTPUT ,PRINT B. C. LIST
     1                2
1
       N         M          LINES      ICOL       NIT        ITCT
       929        23         58         25         50          0

START LINE ,STOP LINE :2I4
1,39
WHICH ARRAYS ?  H     BTM  K   Q   NTP   NNO   TOP   TRN   OCN   OPT   STO   Q2
                1      2   3   4    5     6     7     8     9    10    11    12
1,2,3,4,5,7,
       N         M          LINES      ICOL       NIT        ITCT
       929        23         58         25         50          0

START LINE ,STOP LINE :2I4
21,25,
WHICH ARRAYS ?  H     BTM  K   Q   NTP   NNO   TOP   TRN   OCN   OPT   STO   Q2
                1      2   3   4    5     6     7     8     9    10    11    12
1,4,5
       N         M          LINES      ICOL       NIT        ITCT
       929        23         58         25         50          0

START LINE ,STOP LINE :2I4
^Z

ACHEK  --  STOP
```

ACHEK is a program for producing line printer listings of the matrices stored on the File-Q files VTTFIELDS. These listings can be used to obtain matrix information as well as the main VTT and VTTSSZ control information. This is an example of the interactive control stream required to run ACHEK.

EXAMPLE HEADER OUTPUT FROM ACHEK

```
                                                   WISAP DATA- HANFORD DATA

NO. OF UNKNOWNS                          829
HALF BANDWIDTH                            23
NO. OF LINES                              58
NO. OF COLUMNS                            25
NO. OF ITTERATIONS                        50
ITTERATION COUNT                           0
CONVERGENCE LIMIT                          0.0070
ELEVATION BIAS                               0.00
NO. OF AQUIFERS                            1
OCEAN TRANS. 1=YES, 0=NO                   0
ROTATION 1=YES, 0=NO                       1
MAX NO. OF ITTERATIONS                    50
NODE SPACING                            3000.00
AUTO OPERATION 1=YES ,0 =NO                1
OVER RELAXATION FACTOR                  1.25
NO. OF SAVED TIME PLANES                   2
NO. OF G-TIMES                             0
TRANSIENT OR STST.                         0
AQUIFER WIDTH                             25
DAYS SINCE START OF TEST    .                  0.
STARTING TIME                                  0.
ENDING TIME                                    0.
STARTING DATE:/Y/M/D/H/M/          /1975/ 1/ 1/ 0/ 0/
ENDING DATE:/Y/M/D/H/M/            /1975/ 1/ 1/ 0/ 0/
X -NODES                                  58
Y -NODES                                  25
NO. OF AQUIFERS                            1
NO. OF UNCONFINED NODES                    0
DOIT(1) =N      DOIT(2) =     0
STORAGE MULT.                                1.0
LEAKAGE COFF.                               0.00
MEAN SEALEVEL                               0.00
LEAKAGE OFFSET                              0.00
TIME VARING NODES (1=Y,0=N)                0
FIELD :(0=LARGE ,1=SMALL)                  0
STORE B.C. FOR SMALL FIELD (1=Y,0          1
X COORDINATE OF L.L.C.(FT.)                  0.0
Y COORDINATE OF L.L.C.(FT.)                  0.0
SUBLEVEL (0=STARTING FIELD)                0
MAGNIFICATION FACTOR                       0
```

9 2 1 2 5 7 8 1 3 5 0

N	M	LINES	ICOL	NII	ITCT
829	23	58	25	58	0

LINE NO. = 58

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,061	354,061	352,660	352,538	352,538	352,010	350,116	350,116	348,940	347,474	347,474	346,756
BOTTOM =	146,893	146,893	156,300	161,391	161,391	168,642	194,644	194,644	208,077	210,890	210,890	238,931
HYD. COND.=	16,363	16,383	19,159	20,779	20,779	34,770	84,942	84,942	77,935	83,407	83,407	115,371
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	377,119	377,119	365,214	365,214	365,214	370,267	316,666	316,666	321,736	321,736	330,419	330,419
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	346,171	346,171	346,171	345,876	345,876	345,876	344,376	344,376	344,466	344,466	344,466	344,466
BOTTOM =	261,791	261,791	261,791	255,141	255,141	255,141	239,492	239,491	252,271	252,271	252,271	252,271
HYD. COND.=	141,428	141,428	141,428	426,740	426,740	426,740	1459,357	1459,418	1582,703	1582,703	1582,703	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	330,419	330,419	330,419	337,677	337,677	337,677	327,143	327,142	327,142	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 57

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,107	354,061	353,497	352,564	352,538	352,538	350,116	350,116	349,914	347,474	347,474	347,474
BOTTOM =	146,540	146,893	151,320	160,713	161,391	161,391	194,644	194,644	204,191	210,890	210,890	210,890
HYD. COND.=	14,527	16,383	17,686	20,563	20,779	20,779	84,942	84,942	76,417	83,407	83,407	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	379,997	377,119	381,044	365,214	365,214	365,214	316,666	316,666	320,812	321,736	326,905	330,419
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	346,171	346,171	346,171	346,012	345,876	345,876	344,817	344,376	344,419	344,466	344,466	344,466
BOTTOM =	261,791	261,791	261,791	258,204	255,141	255,141	244,096	239,491	245,668	252,271	252,271	252,271
HYD. COND.=	141,428	141,428	141,428	295,312	426,740	426,740	1155,516	1459,418	1519,012	1582,703	1582,703	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	330,419	330,419	330,419	334,353	337,677	337,677	330,242	327,142	327,142	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0

EXAMPLE MATRIX OUTPUT FROM ACHEK

LINE NO. = 56

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,198	354,061	354,061	352,788	352,538	352,538	351,392	350,116	350,054	348,337	347,474	347,474
BOTTOM =	145,857	146,893	146,893	157,670	161,391	161,391	177,131	194,644	197,574	209,244	210,890	210,890
HYD. COND.=	10,935	16,383	16,383	19,595	20,779	20,779	51,150	84,942	82,326	80,205	83,407	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	385,567	377,119	377,119	385,214	385,214	385,214	352,767	316,666	317,938	321,736	321,984	330,419
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	346,425	346,171	346,171	346,171	345,876	345,876	345,668	344,376	344,376	344,466	344,466	344,466
BOTTOM =	251,925	261,791	261,791	261,791	255,141	255,141	252,966	239,491	239,491	252,271	252,271	252,271
HYD. COND.=	130,183	141,428	141,428	141,428	426,740	426,740	570,283	1459,378	1459,418	1582,703	1582,703	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	330,419	330,419	330,419	330,419	337,677	337,677	336,212	327,142	327,142	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 55

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,067	354,061	353,200	352,538	352,538	352,538	350,116	350,116	349,694	347,474	347,474
BOTTOM =	145,680	146,848	146,893	153,650	161,391	161,391	161,391	194,644	194,644	206,653	210,890	210,890
HYD. COND.=	10,044	16,145	16,383	18,372	20,779	20,779	20,779	84,942	84,942	75,166	83,407	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	386,948	377,487	377,119	383,111	385,214	385,214	385,214	316,666	316,666	321,736	321,736	329,122
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,162	346,171	346,171	346,171	345,937	345,876	345,876	344,434	344,376	344,442	344,466	344,466
BOTTOM =	223,077	261,791	261,791	261,791	256,507	255,141	255,141	240,101	239,491	240,931	252,271	252,271
HYD. COND.=	97,299	141,428	141,428	141,428	368,148	426,740	426,740	1419,118	1459,418	1550,445	1582,703	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	330,419	330,419	330,419	330,419	336,186	337,677	337,677	327,553	327,142	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 54

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12

POTENTIAL =	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BOTTOM =	145,688	146,165	146,893	148,476	159,041	161,391	161,391	185,620	194,644	200,555	210,411	210,890
HYD. COND.=	10,044	12,553	16,383	16,849	20,031	20,779	20,779	67,530	84,942	79,664	82,474	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	386,948	383,058	377,119	378,523	385,214	385,214	385,214	335,268	316,666	319,232	321,736	324,201
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,474	346,171	346,171	346,171	346,104	345,876	345,876	345,285	344,376	344,391	344,466	344,466
BOTTOM =	210,890	261,791	261,791	261,791	260,275	255,141	255,141	248,971	239,491	241,688	252,271	252,271
HYD. COND.=	83,407	141,428	141,428	141,428	206,444	426,740	426,740	833,885	1459,480	1460,611	1582,703	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	330,419	330,419	330,419	330,419	332,073	337,677	337,677	333,523	327,142	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 53

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,061	354,061	352,984	352,538	352,538	352,146	350,116	350,116	349,083	347,474
BOTTOM =	145,688	145,688	146,893	146,893	155,981	161,391	161,391	166,774	194,644	194,644	207,820	210,890
HYD. COND.=	10,044	10,044	16,383	16,383	19,058	20,779	20,779	31,165	84,942	84,942	77,436	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	386,948	386,948	377,119	377,119	385,177	385,214	385,214	374,119	316,666	316,666	321,736	321,736
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,474	346,829	346,171	346,171	346,171	345,876	345,876	345,876	344,376	344,376	344,466	344,466
BOTTOM =	210,890	236,071	261,791	261,791	261,791	255,141	255,141	255,141	239,492	239,491	252,193	252,271
HYD. COND.=	83,407	112,110	141,428	141,428	141,428	426,740	426,740	426,740	1459,352	1459,418	1581,958	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	2	2	1	1
TOP OF AQF=	330,419	330,419	330,419	330,419	330,419	337,677	337,677	337,677	327,143	327,142	327,142	0,000
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 52

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,116	354,061	353,562	352,604	352,538	352,538	350,155	350,116	349,928	347,474
BOTTOM =	145,688	145,688	146,472	146,893	150,847	160,412	161,391	161,391	194,189	194,644	203,535	210,890
HYD. COND.=	10,044	10,044	14,171	16,383	17,535	20,467	20,779	20,779	83,909	84,942	77,003	83,407
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOP OF AQF=	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,474	347,474	346,171	346,171	346,171	346,028	345,876	345,876	344,733	344,376	344,414	344,466
BOTTOM =	210,890	210,890	261,791	261,791	261,791	258,578	255,141	255,141	244,976	239,491	244,950	252,271
HYD. COND.=	83,407	83,407	141,428	141,428	141,428	279,260	426,740	426,740	1097,489	1459,418	1512,084	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	829	0	0	0
NODE TYPES=	1	1	1	1	1	1	2	2	0	2	1	1
TOP OF AQF=	326,417	330,419	330,419	330,419	330,419	333,926	337,677	337,677	330,834	327,142	327,142	0,000

COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 51

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,207	354,061	354,061	352,808	352,538	352,538	351,528	350,116	350,068	348,472
BOTTOM =	145,688	145,688	145,789	146,893	146,893	157,369	161,391	161,391	175,263	194,644	196,918	208,987
HYD. COND.=	10,044	10,044	10,579	16,383	16,383	19,499	20,779	20,779	47,544	84,942	82,911	79,705
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	386,948	386,948	386,120	377,119	377,119	385,214	385,214	385,214	356,619	316,666	317,653	321,736

COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,474	347,474	346,497	346,171	346,171	346,171	345,945	345,569	344,810	344,376	344,376	344,466
BOTTOM =	210,890	210,890	249,065	261,791	261,791	261,791	255,141	255,141	253,845	239,491	239,491	252,271
HYD. COND.=	83,407	83,407	126,922	141,428	141,428	141,428	426,740	426,740	512,257	1459,374	1459,418	1582,703
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	826	827	828	0	0	0
NODE TYPES=	1	1	1	1	2	2	0	0	0	2	1	1
TOP OF AQF=	321,736	330,419	330,419	330,419	330,419	330,419	337,677	337,677	336,804	327,142	327,142	0,000

COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344,466	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	252,271	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1582,703	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 50

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,220	354,076	354,061	353,266	352,538	352,538	352,538	350,116	350,116	349,829
BOTTOM =	145,688	145,688	145,688	146,780	146,893	153,137	161,391	161,391	161,391	194,644	194,604	206,396
HYD. COND.=	10,044	10,044	10,044	15,769	16,383	18,221	20,779	20,779	23,779	84,942	84,942	74,666
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	1	1
TOP OF AQF=	386,948	386,948	386,948	378,040	377,119	382,656	385,214	385,214	385,214	316,666	316,666	321,736

COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347,474	347,474	347,236	346,171	347,144	347,079	346,377	345,724	345,141	344,661	344,376	344,222
BOTTOM =	210,890	210,890	224,217	261,791	261,791	261,791	259,834	255,141	255,141	248,362	239,491	239,906
HYD. COND.=	83,407	83,407	94,038	141,428	141,428	141,428	178,466	426,740	426,740	593,554	1459,418	1614,832
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

NODE #S =	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NODE TYPES=	1	1	2	2	0	0	0	0	0	0	2	1
TOP OF AQF=	321.736	0.000	330.419	330.419	330.419	330.419	336.142	337.677	337.677	335.718	327.142	324.801
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344.466	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BOTTOM =	252.271	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HYD. COND.=	1582.703	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

LINE NO. = 49

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354.220	354.220	354.220	354.166	354.061	353.925	352.716	352.538	352.538	350.909	350.116	350.005
BOTTOM =	145.688	145.688	145.688	146.097	146.893	147.963	158.739	161.391	161.391	183.752	194.644	199.899
HYD. COND.=	10.044	10.044	10.044	12.197	16.383	16.698	19.935	20.779	20.779	63.924	84.942	80.250
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	1	1	1	1	1	1	1	1	1	2	2
TOP OF AQF=	386.948	386.948	386.948	383.610	377.119	378.068	385.214	385.214	385.214	339.120	316.666	318.948
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	347.060	347.474	348.649	348.932	349.155	348.764	347.896	346.289	345.678	345.315	345.209	344.350
BOTTOM =	210.154	210.890	210.890	261.791	261.791	261.791	270.783	266.416	258.996	252.616	242.572	239.561
HYD. COND.=	81.975	83.407	83.407	141.428	141.428	141.428	172.705	4.561	180.024	489.070	895.389	1485.768
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	812	813	814	815	816	817	818	819	0	0
NODE TYPES=	2	2	0	0	0	0	0	0	0	0	2	1
TOP OF AQF=	321.736	325.871	330.419	330.419	330.419	330.419	331.590	336.369	335.225	336.945	331.337	326.745
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	344.112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BOTTOM =	249.346	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HYD. COND.=	1661.558	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	328.979	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

LINE NO. = 48

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354.220	354.220	354.220	354.220	354.061	354.061	352.969	352.538	352.538	352.282	351.657	351.387
BOTTOM =	145.688	145.688	145.688	145.688	146.893	146.893	155.468	161.391	161.391	164.905	194.644	194.644
HYD. COND.=	10.044	10.044	10.044	10.044	16.383	16.383	18.987	20.779	20.779	27.559	84.942	84.942
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	800	801
NODE TYPES=	1	1	1	1	1	1	1	1	1	2	0	0
TOP OF AQF=	386.948	386.948	386.948	386.948	377.119	377.119	384.722	385.214	385.214	377.970	316.666	316.666
COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	350.720	350.550	350.961	351.378	351.579	350.963	349.824	348.082	346.716	346.042	345.719	345.690
BOTTOM =	207.563	210.890	210.890	228.632	261.050	261.791	269.788	281.927	264.839	256.917	247.927	249.899
HYD. COND.=	76.936	83.407	83.407	123.126	161.308	141.428	136.893	139.886	304.777	403.839	729.587	1346.324
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	802	803	804	805	806	807	808	809	810	811	0	0
NODE TYPES=	0	0	0	0	0	0	0	0	0	0	2	1
TOP OF AQF=	321.736	324.271	330.419	332.071	331.127	330.419	331.256	324.636	338.905	330.048	340.063	342.732
COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	345.977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BOTTOM =	268.121	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HYD. COND.=	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HYD. COND.=	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	348,586	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 47

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,220	354,220	354,125	354,061	353,628	352,624	352,538	353,025	353,041	353,060
BOTTOM =	145,688	145,688	145,688	145,688	146,405	146,893	150,294	160,110	161,391	161,391	175,232	194,644
HYD. COND.=	10,044	10,044	10,044	10,044	13,815	16,383	17,384	20,371	20,779	20,779	56,841	64,942
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	788	789	790
NODE TYPES=	1	1	1	1	1	1	1	2	2	0	0	0
TOP OF AQF=	386,948	386,948	386,948	386,948	381,101	377,119	380,135	385,214	385,214	385,214	347,085	316,666

COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	353,044	353,083	353,383	353,005	353,054	353,323	352,092	349,991	347,709	346,734	346,676	346,804
BOTTOM =	202,879	210,890	210,890	214,295	226,965	248,034	262,295	277,522	270,067	256,362	250,180	251,535
HYD. COND.=	77,589	83,407	83,407	123,059	176,058	173,044	141,142	128,074	184,789	416,719	730,788	1472,435
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	791	792	793	794	795	796	797	798	799	0	0	0
NODE TYPES=	0	0	0	0	0	0	0	0	0	2	1	1
TOP OF AQF=	328,242	322,369	312,378	309,972	334,318	315,296	338,472	334,120	345,015	354,591	359,815	368,247

COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	347,159	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	282,322	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1778,380	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	375,058	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

LINE NO. = 46

COLL. POS.=	1	2	3	4	5	6	7	8	9	10	11	12
POTENTIAL =	354,220	354,220	354,220	354,220	354,216	354,061	354,061	352,828	353,777	354,331	354,506	354,809
BOTTOM =	145,688	145,688	145,688	145,688	145,722	146,893	146,893	157,867	161,391	161,391	172,919	193,999
HYD. COND.=	10,044	10,044	10,044	10,044	10,223	16,383	16,383	19,403	20,779	20,779	50,401	90,468
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	775	776	777	778
NODE TYPES=	1	1	1	1	1	1	2	2	0	0	0	0
TOP OF AQF=	386,948	386,948	386,948	386,948	386,672	377,119	377,119	385,214	385,214	385,214	354,349	302,929

COLL. POS.=	13	14	15	16	17	18	19	20	21	22	23	24
POTENTIAL =	355,153	355,481	355,911	356,162	356,112	355,675	354,423	352,242	349,254	347,559	347,476	347,659
BOTTOM =	196,262	204,120	210,507	217,734	228,680	243,162	254,518	267,418	261,837	251,698	248,712	258,132
HYD. COND.=	83,497	74,227	82,662	140,630	183,094	155,621	131,321	113,661	119,485	277,215	541,032	1097,389
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	779	780	781	782	783	784	785	786	787	0	0	0
NODE TYPES=	0	0	0	0	0	0	0	0	0	2	1	1
TOP OF AQF=	317,368	321,736	306,183	334,753	334,546	333,259	345,112	354,809	365,187	381,422	388,463	394,898

COLL. POS.=	25	26	27	28	29	30	31	32	33	34	35	36
POTENTIAL =	348,263	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BOTTOM =	290,256	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HYD. COND.=	1560,546	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Q-SOURCE =	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NODE #S =	0	0	0	0	0	0	0	0	0	0	0	0
NODE TYPES=	1	0	0	0	0	0	0	0	0	0	0	0
TOP OF AQF=	390,351	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Program VTTPNT

```
MCR>RUN DP1:VTTPNT$
 WHICH DISK UNIT 1, 2, 3=DB0:
1
LARGE OR SMALL FIELD ? :CR=LG,1=SM
0
 TTY HEADER INPUT ?
0
 TRIDENT-TYPE LEAKY AQUIFER 0=NO, 1=YES
0
 WHICH KIND OF SOLUTION 0=CHOLESKY, 1=NEWTON
1
PRINT ?
1
PRINT MATRIX ?
1
START LINE, STOP LINE
13,20
START LINE, STOP LINE

SOLUTION ,THICKNESS ,SOL -BIAS, STRESS
  1            2           3         4

Q -CAL , INT. AQUIFER TRANS. ,Q -MAG. ,Q -RATIO ,OCEAN LEAKAGE
 1              2                3         4          5

TRANSMISSIVITY MAP ?:(1) =FT**2/DAY ;(2) =GAL/DAY/FT
1
VTTPNT  --  STOP
```

VTTPNT is a printing program which can be used to list specific matrix output which must be calculated from the VTTFIELDS File-Q files. This example shows the interactive input stream required to run VTTPNT.

TRANSMISSIVITY

FT**2/DAY

	1	2	3	4	5	6	7	8	9	10	11	12
58	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	10365.	9554.
48	0.	0.	0.	0.	0.	0.	0.	0.	0.	5164.	10365.	10365.
47	0.	0.	0.	0.	0.	0.	0.	3922.	3972.	3982.	9768.	10365.
46	0.	0.	0.	0.	0.	0.	3394.	3798.	3998.	4009.	9144.	9855.
45	0.	0.	0.	0.	0.	2605.	3407.	3654.	4031.	4042.	5281.	9104.
44	0.	0.	0.	0.	2095.	2539.	3317.	3457.	3831.	4041.	5255.	5353.
43	0.	0.	0.	2095.	2104.	3095.	3419.	3455.	3611.	3945.	4665.	6176.
42	0.	0.	0.	2095.	2109.	3251.	3363.	3381.	3547.	3731.	4194.	5124.
41	0.	0.	0.	2095.	2115.	2130.	2146.	3230.	3275.	3344.	3643.	4266.
40	0.	0.	0.	4598.	1712.	2142.	2168.	2462.	2792.	2732.	2958.	3830.
39	0.	0.	4426.	4516.	4747.	3473.	1982.	2504.	2436.	1961.	2250.	3760.
38	0.	0.	4246.	4578.	4699.	2764.	2953.	2740.	2748.	1999.	1769.	2859.
37	0.	6059.	4841.	4669.	4790.	3555.	3548.	3256.	3007.	2626.	2300.	2495.
36	0.	7123.	4483.	4731.	4883.	4997.	4395.	3906.	3916.	2840.	2209.	2145.
35	0.	19073.	7341.	4984.	5106.	4938.	4512.	3983.	3474.	3095.	3246.	3863.
34	0.	19073.	21955.	23738.	4960.	5144.	4398.	4069.	3667.	3301.	3824.	5768.
33	26030.	25792.	25315.	24998.	26730.	14481.	6385.	4744.	4362.	4353.	5776.	8327.
32	19600.	20170.	43796.	61034.	63376.	33026.	14329.	5895.	6068.	8500.	11984.	15417.
31	19600.	20213.	28934.	47639.	49960.	40306.	14071.	6783.	6491.	17187.	34189.	45034.
30	0.	19600.	24144.	25424.	35310.	38854.	11476.	2987.	5253.	17197.	39150.	68226.
29	0.	19600.	21875.	25056.	32747.	38174.	8936.	1791.	2826.	6823.	21481.	64593.
28	0.	18024.	19438.	25350.	31247.	36779.	11419.	1322.	782.	1292.	5597.	38488.
27	0.	0.	16212.	24776.	35971.	68570.	22356.	2498.	518.	492.	1018.	7617.
26	0.	0.	0.	26971.	52771.	115059.	46829.	998.	558.	498.	479.	3333.
25	0.	0.	0.	33838.	81340.	141034.	75943.	553.	689.	886.	1447.	3396.
24	0.	0.	0.	35562.	78641.	118925.	70300.	478.	1001.	2159.	2916.	6403.
23	0.	0.	0.	0.	45283.	87799.	69735.	487.	1712.	3201.	4515.	10679.
22	0.	0.	0.	0.	16692.	59201.	81094.	9887.	654.	3187.	7261.	12683.
21	0.	0.	0.	0.	8685.	33976.	68569.	18100.	2328.	10535.	9627.	22271.
20	0.	0.	0.	0.	8365.	27143.	44975.	29012.	30134.	31453.	25526.	35062.
19	0.	0.	0.	0.	9006.	20444.	46540.	50845.	121645.	229321.	79205.	40619.
18	0.	0.	0.	0.	9821.	19081.	29236.	45010.	135633.	438176.	527843.	135900.
17	0.	0.	0.	0.	19973.	19912.	34530.	41495.	122000.	309640.	781979.	415836.
16	0.	0.	0.	0.	46279.	57546.	89298.	156032.	230064.	234111.	213044.	89933.
15	0.	0.	0.	0.	0.	126529.	281192.	278189.	132722.	78198.	24877.	2944.
14	0.	0.	0.	0.	0.	0.	256121.	211004.	78520.	29962.	3827.	1211.
13	0.	0.	0.	0.	0.	0.	0.	107293.	34105.	17175.	2094.	1086.
12	0.	0.	0.	0.	0.	0.	0.	0.	28800.	17540.	2168.	1770.
11	0.	0.	0.	0.	0.	0.	0.	0.	38464.	33377.	5724.	1887.
10	0.	0.	0.	0.	0.	0.	0.	0.	72014.	75281.	6623.	2043.
9	0.	0.	0.	0.	0.	0.	0.	0.	0.	124276.	21097.	2401.
8	0.	0.	0.	0.	0.	0.	0.	0.	0.	108935.	30669.	2945.
7	0.	0.	0.	0.	0.	0.	0.	0.	0.	91412.	64884.	21117.
6	0.	0.	0.	0.	0.	0.	0.	0.	0.	78923.	79805.	16857.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.	91605.	116984.	50628.
4	0.	0.	0.	0.	0.	0.	0.	0.	0.	115987.	155570.	106585.
3	0.	0.	0.	0.	0.	0.	0.	0.	0.	132796.	219067.	200205.
2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	242285.	273374.
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SAMPLE OF OUTPUT PRODUCED BY VTTPNT

9 2 1 2 7 9 1 3 3 3

TRANSMISSIVITY FT**2/DAY

	13	14	15	16	17	18	19	20	21	22	23	24
58	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
53	0.	0.	0.	0.	0.	0.	0.	0.	127914.	127920.	0.	0.
52	0.	0.	0.	0.	0.	0.	35221.	35221.	94229.	127920.	0.	0.
51	0.	0.	0.	0.	9706.	9706.	35221.	35221.	42496.	127916.	0.	0.
50	0.	0.	10363.	9706.	9706.	9706.	13618.	35221.	35221.	51639.	127920.	0.
49	9147.	9590.	9978.	9706.	9706.	9706.	10582.	319.	13723.	41243.	79480.	0.
48	8784.	9457.	9970.	12736.	11304.	9706.	8415.	5974.	22574.	32764.	61222.	0.
47	9106.	9369.	8465.	11774.	18908.	11639.	9623.	7249.	13844.	37660.	0.	0.
46	10112.	8502.	7909.	16456.	19383.	14021.	11897.	9641.	10445.	26574.	0.	0.
45	10365.	9045.	9814.	17642.	24488.	17612.	11734.	7873.	6204.	11649.	0.	0.
44	7054.	12226.	12850.	15321.	22318.	17305.	10445.	6907.	4044.	5296.	0.	0.
43	7917.	10297.	12798.	12421.	16881.	18003.	10298.	6870.	3364.	1644.	2108.	1386.
42	6071.	8898.	9484.	11887.	9928.	14295.	11331.	8051.	4226.	1574.	1216.	1445.
41	5382.	6616.	7342.	9483.	8636.	10787.	14214.	13070.	6913.	1895.	1204.	1616.
40	4776.	5759.	6647.	7775.	18798.	9905.	18758.	22904.	12022.	3151.	2298.	2047.
39	5067.	5365.	5786.	6514.	8843.	9900.	22991.	39301.	22381.	6103.	3724.	5831.
38	4525.	4560.	4526.	5281.	5961.	10283.	22221.	51399.	36836.	7738.	5218.	7958.
37	2576.	3210.	3889.	4579.	5903.	10316.	26610.	67036.	61286.	12710.	7311.	10804.
36	2899.	4986.	6192.	7790.	9046.	15230.	35889.	102516.	104202.	14905.	8842.	9477.
35	5323.	7478.	8466.	9409.	11293.	16742.	43866.	141672.	174780.	35735.	8773.	11681.
34	7861.	9542.	10582.	11497.	13609.	28436.	51266.	174284.	315941.	53376.	9982.	16259.
33	10516.	12688.	15795.	19013.	23592.	35791.	83679.	249692.	339740.	38630.	8287.	14618.
32	18640.	22913.	30436.	42413.	56639.	84015.	160098.	250824.	119710.	14617.	5637.	12528.
31	40695.	41419.	54509.	74908.	119072.	178552.	253875.	188530.	31276.	6996.	4203.	7631.
30	88341.	85882.	98342.	156363.	296887.	411758.	274196.	68214.	10260.	4666.	3200.	5392.
29	132528.	167405.	194162.	324798.	587718.	521258.	127638.	20350.	6360.	3112.	2610.	0.
28	174637.	253497.	338962.	537411.	747184.	394438.	44492.	11708.	3792.	2117.	0.	0.
27	112513.	315853.	477621.	772985.	868292.	285533.	30434.	8326.	2947.	0.	0.	0.
26	43840.	333495.	597411.	1558247.	974013.	122520.	24818.	7105.	2072.	0.	0.	0.
25	24940.	238332.	679277.	1643361.	835060.	91958.	23576.	5891.	1516.	0.	0.	0.
24	31657.	116316.	678285.	1370406.	575920.	83118.	20623.	4682.	1025.	0.	0.	0.
23	46268.	151548.	625063.	981334.	337676.	55892.	15910.	3021.	546.	0.	0.	0.
22	116719.	288228.	541998.	660535.	163701.	36970.	8347.	1791.	342.	0.	0.	0.
21	256260.	579562.	703652.	532834.	116118.	21207.	4439.	1482.	299.	0.	0.	0.
20	199152.	493195.	496630.	267025.	69787.	11992.	2844.	1742.	770.	0.	0.	0.
19	125779.	242391.	216816.	130116.	45984.	6067.	2768.	2183.	1366.	0.	0.	0.
18	149891.	164512.	91050.	46856.	13047.	2982.	3801.	3094.	2638.	0.	0.	0.
17	168810.	91898.	28410.	10061.	2049.	3087.	4771.	5032.	3937.	0.	0.	0.
16	25085.	24027.	6984.	1637.	1360.	3229.	5716.	6884.	5142.	0.	0.	0.
15	3139.	2295.	1581.	1110.	1220.	2883.	6087.	7069.	5249.	0.	0.	0.
14	1416.	1388.	1249.	1383.	1579.	2255.	5899.	7067.	4838.	0.	0.	0.
13	1548.	1556.	1395.	1611.	1960.	2453.	4801.	6856.	5405.	2661.	0.	0.
12	1836.	1952.	1845.	2313.	2564.	3065.	4466.	6435.	5757.	2946.	1512.	0.
11	2055.	2661.	2782.	3277.	3636.	4759.	5976.	5884.	4767.	2696.	1518.	0.
10	2793.	3150.	3184.	3449.	3897.	4496.	4964.	4439.	3393.	1930.	1067.	0.
9	4030.	2640.	2545.	2810.	3089.	3100.	2826.	1977.	1406.	861.	584.	0.
8	3027.	1037.	1013.	1033.	1177.	1051.	1036.	928.	826.	633.	381.	0.
7	1969.	767.	777.	858.	813.	869.	890.	1064.	1303.	1167.	0.	0.
6	3567.	1731.	2599.	2927.	2411.	2281.	2512.	2510.	2746.	0.	0.	0.
5	12956.	5546.	10374.	9025.	5423.	3372.	3294.	3317.	3171.	0.	0.	0.
4	38994.	10173.	6874.	7712.	5650.	4044.	2918.	2581.	1900.	0.	0.	0.
3	79585.	7582.	251.	7068.	8404.	7825.	6218.	4622.	0.	0.	0.	0.
2	0.	0.	6882.	9244.	11886.	13086.	12107.	9552.	0.	0.	0.	0.
1	0.	0.	0.	12810.	16248.	18618.	18316.	0.	0.	0.	0.	0.

9212731359

TRANSMISSIVITY
FT**2/DAY

	25	26	27	28	29	30	31	32	33	34	35	36
58	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
57	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
56	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
55	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
54	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
53	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
52	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
46	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
45	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
44	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
43	12492.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
42	18742.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
41	21595.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
40	33313.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
39	44950.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
38	60337.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
37	60232.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
36	54498.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
35	52026.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
34	42445.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
33	33386.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
32	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
31	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

9 2 1 2 5 7 9 1 3 5 0

	1	2	3	4	5	6	7	8	9	10	11	12
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	13	14	15	16	17	18	19	20	21	22	23	24
10	0.	0.	0.	0.	0.	17949.	0.	0.	111.	632.	14452.	-31661.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	11179.	-10708.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-803719.
13	0.	0.	0.	235804.	0.	0.	0.	0.	0.	0.	288108.	-571338.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	137758.	-185948.
15	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	19489.	-26805.
16	0.	12532.	11349.	6108.	3260.	1774.	587.	0.	0.	0.	-6962.	-23555.
17	0.	13477.	7253.	3871.	2107.	697.	0.	0.	0.	0.	-5421.	-31063.
18	0.	14426.	6896.	3531.	1168.	0.	0.	0.	0.	-227.	3987.	-28971.
19	0.	13362.	6033.	1996.	0.	0.	0.	0.	-83.	120.	6191.	-25552.
20	0.	11018.	3646.	0.	0.	0.	0.	-38.	55.	460.	7300.	-19782.
21	0.	4014.	0.	0.	0.	0.	-11.	16.	130.	473.	6516.	-9137.
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-312048.
23	186144.	48844.	12058.	1484.	902.	545.	283.	175.	116.	59.	135072.	-482344.
24	152496.	37622.	4633.	2016.	1700.	883.	546.	363.	184.	0.	145407.	-341774.
25	11081.	3598.	1297.	649.	75.	133.	179.	272.	444.	1006.	12927.	-139718.
26	9339.	2848.	1266.	46.	80.	106.	154.	235.	486.	993.	10773.	-40698.
27	6856.	2688.	20.	34.	45.	64.	94.	183.	347.	481.	8347.	-25357.
28	18391.	15.	26.	34.	40.	69.	132.	240.	311.	532.	15456.	-27589.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	27874.	-21035.
30	0.	0.	0.	10162.	4011.	1864.	877.	447.	192.	161.	69.	-15237.

	25	26	27	28	29	30	31	32	33	34	35	36
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
16	-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
27	-1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

9212378 1353

	37	38	39	40	41	42	43	44	45	46	47	48
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	476.
11	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	475.
12	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	399.
13	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	400.
14	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	401.
15	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	407.
16	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	436.
17	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	455.
18	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	463.
19	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	469.
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	472.
21	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	472.
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	399.
23	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	400.
24	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	401.
25	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	402.
26	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	409.
27	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	428.
28	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	444.
29	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	455.
30	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	463.

Program MXED

```
MCR>RUN DP1:MXED$
 WHICH DISK UNIT 1,2, 3=DB0:
1
LARGE OR SMALL FIR=LG,1=SM

SPECIFY ARRAY (CR =SAME)
H  BTM  K  Q  NNO  NTP  TOP  TRN  OCN  OLDH  STO  Q2
 *** LP0 NOT READY
1   2   3  4   5    6    7    8    9    10    11   12
4
LINE NO.  , COLUMN,CR=SAME)
12,19,

LINE NO.                      Q-SOURCE (CFD)

  13                   0.0      19353.6          0.0
  12                   0.0          0.0          0.0
  11                   0.0          0.0          0.0

                        17          18            19
                                 COLUMN NO.

CHANGE VALUE ? (CR =NO, 1 =YES)
1
NEW VALUE =
200000.

LINE NO.                      Q-SOURCE (CFD)

  13                   0.0      19353.6          0.0
  12                   0.0     200000.0          0.0
  11                   0.0          0.0          0.0

                        17          18            19
                                 COLUMN NO.

EXIT ? (CR=NO,1=YES)
1
MXED  --  STOP
```

MXED is a VTTFIELD editing program for looking at matrix values and/or changing them. It can be used to input new wells, change node types, etc. This example illustrates the interactive stream required to use MXED.

Program DIFER1

```
MCR>RUN DP1:DIFER1$
 WHICH DISK UNIT 1,2, 3=DB0:
1
LARGE OR SMALL REGION 0 OR 1
0
ENTER 2 DIFFERENCE INDICES,AQUIFER #
MODULO NUMBER
1=POT,2=BOT OR THK,7=TOP,10=OLD POT,13=BOTTOM,14=NULL
2,1,1
1..
   2     1     1
 1.00
DIFER1  --  ERROR 73
FLOATING ZERO DIVIDE
AT PC = 026704
  IN    ".MAIN." AT OR AFTER 00094


MAX-MIN-RMS DIFFERENCE
   0.29834E+03    0.57330E+00    0.12291E+03
ENTER TITLE FOR THE PRINTOUT
NISAP TRIAL CASE
NISAP TRIAL CASE
DIFER1  --  STOP
```

Example of the interactive stream necessary to run DIFER1 the File-Q based version of DIFER.

EXAMPLE OF THE OUTPUT PRODUCED BY DIFER1

LINE \ COLUMN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
58*																									
57*																									
56*																									
55*																									
54*																									
53*																					105	105			
52*																			91	91	100	105			
51*																	84	84	91	90	91	105			
50*															127	84	85	85	87	91	98	96	105		
49*											155	150	138	137	138	87	87	87	77	80	87	93	103		
48*										187	157	157	143	140	140	123	91	89	80	66	82	89	98		
47*								193	191	192	178	158	150	142	142	140	127	105	90	72	77	98			
46*							207	196	192	193	182	161	159	149	145	138	127	113	100	85	87	96			
45*						211	208	202	194	195	183	166	163	157	149	139	128	114	103	97	99	100			
44*					209	211	211	249	201	197	186	181	171	161	151	142	128	113	108	100	108	103			
43*				209	209	210	218	211	210	202	197	190	179	167	155	143	130	119	117	117	116	109	89	60	58
42*				209	210	212	213	214	213	212	208	202	191	176	160	147	134	127	125	125	122	111	83	70	65
41*				209	210	212	214	218	218	217	216	215	207	187	166	151	138	132	131	129	124	106	87	76	73
40*				126	211	213	215	221	221	221	221	221	217	195	171	153	140	135	132	125	114	103	93	84	79
39*			84	86	122	177	208	210	216	219	221	222	216	190	165	148	136	131	122	113	108	103	96	86	81
38*			89	87	90	127	156	162	178	191	201	204	194	172	147	132	119	111	107	106	105	105	97	88	78
37*		40	75	89	91	109	109	120	136	145	147	150	138	113	101	95	89	89	91	95	102	102	96	83	72
36*		43	47	50	93	86	84	86	102	89	80	85	79	77	76	76	70	81	83	88	98	103	93	77	65
35*		29	47	52	54	63	63	61	60	60	61	66	68	68	66	68	73	80	85	90	108	106	86	69	56
34*		29	33	36	49	48	48	48	48	47	50	58	62	63	64	67	76	86	102	130	141	105	77	59	45

33*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32*	55	57	57	61	58	44	38	37	41	47	54	59	65	67	74	84	102	137	173	192	133	77	55	37	
31*	55	57	70	74	66	48	36	35	42	50	57	62	66	72	82	92	122	160	190	183	107	67	44	27	
30*		55	66	67	63	52	32	32	45	54	59	63	70	78	88	105	143	178	195	170	89	58	38	25	
29*		55	62	67	65	53	29	33	48	52	55	63	74	63	93	121	161	191	196	151	82	50	37		
28*		53	64	68	68	54	32	38	46	43	45	57	74	85	101	156	176	196	192	133	75	45			
27*			69	71	69	56	34	43	42	38	39	45	66	84	108	149	190	199	198	126	68				
26*				71	65	59	43	47	47	39	35	39	54	81	112	157	196	242	191	124	55				
25*				55	49	54	48	46	55	41	31	32	45	72	109	156	195	201	187	114	44				
24*				30	34	41	42	43	73	42	25	23	36	50	97	140	181	197	184	97	32				
23*					29	37	42	40	117	45	19	14	29	45	80	122	154	173	146	72	19				
22*					30	41	41	35	40	26	10	6	28	47	61	109	131	137	111	57	12				
21*					29	41	35	27	25	18	6	5	40	71	74	100	109	115	91	52	9				
20*					29	44	26	17	21	16	6	6	25	53	62	70	88	94	83	59	19				
19*					28	43	30	21	29	37	11	5	13	30	40	49	76	85	89	71	31				
18*					26	40	29	19	30	54	49	10	11	20	26	36	57	90	111	95	53				
17*					31	37	43	23	32	45	72	34	21	25	23	34	57	107	148	125	75				
16*					37	43	55	54	61	73	91	38	24	34	39	55	97	139	175	165	113				
15*						64	75	77	56	85	78	25	33	53	76	112	153	195	222	206	162				
14*							97	99	91	89	41	30	62	103	130	164	205	252	260	246	211				
13*								143	102	69	29	42	94	149	172	205	245	298	290	266	236	188			
12*									100	57	29	48	96	171	199	234	252	287	281	268	245	201	167		
11*									104	59	26	46	96	177	203	232	244	263	269	264	243	205	174		
10*									108	71	22	49	117	188	205	220	241	256	260	258	239	206	170		
9*										90	32	54	158	199	210	225	241	249	252	249	228	197	153		
8*										97	27	64	160	197	210	221	231	236	234	223	207	169	120		
7*										98	47	78	143	168	173	176	188	195	194	187	158	105			
6*										96	65	98	122	116	105	118	125	130	124	94	77				
5*										104	83	114	114	75	56	50	51	58	53	51	40				
4*										122	96	120	118	39	17	18	16	20	22	24	20				
3*										135	117	130	104	20	1	14	16	18	22	22					
2*											137	132			15	18	20	23	25	24					
1*																23	25	28	29						

V. RETRIEVE, EVALUATE, DISPLAY, SUMMARIZE MODEL RESULTS

PROGRAMS TO RETRIEVE, EVALUATE, DISPLAY AND SUMMARIZE MODEL RESULTS

As was the case with model input files, programs are needed which allow the user to examine and display the output model results in a meaningful manner and consequently evaluate what the model results are indicating. The typical large computer generated numerical lists are not necessarily the best means to evaluate these results. Graphical or summary methods are usually superior. The same evaluation and display programs discussed in the section on model input can also be used for model output files:

- CNT
- THREED - P3D
- LIST
- DIFER
- WDIFER

When the VTT model has been run and the steady-state solution or the transient solutions calculated, the results reside on the File-Q disk. They must be retrieved and put into binary (unformatted) files for permanent storage and for use with many of the evaluation programs. The program READN serves this function. READN allows the user to retrieve/or restore solutions from/or to the File-Q disk.

As stated earlier, when the ground-water model is run, it only calculates the new steady-state potential distribution, or the transient potential distributions through the modeled aquifers. From these new predictions for potential, one can predict new streamlines or flow paths and new estimates of travel times. The program for calculating these streamlines is MXPLOT. MXPLOT also allows the user to produce contour plots and cross section plots. Since MXPLOT requires most of the other model input files to run it, it runs off of the File-Q disk.

Program READN

```
MCR>RUN DP1:READN$
 PROGRAM READN
 WHICH DISK UNIT 1,2, 3=DB0:
1
LARGE FIELD OR SMALL (CR OR 1)
                    LARGE FIELD
WISAP DATA- HANFORD DATA
(2)   SAVE CALCULATED TIME PLANES' AND DRAWDOWN FILES
(1)   RETRIVE CURRENT SURFACE AND SAVE IT
(0)   RESTORE A STARTING SURFACE
(-1)  EDIT THE HEADER BLOCK
1
WHICH SURFACE DO TO RETRIVE?
POT=1,BOT=2,TOP=3,TRN=4,CAL=5,STO=6,TRCF=7,OTRCF=8,QS=9
1
ENTER INPUT FILE NAME FOR EACH AQUIFER EXCEPT' FOR CAL=5
[213,3]NWISAP.POT
EXIT (0) CONTINUE (1)

READN  --  STOP
```

Example of the interactive control stream for READN. READN is a VTT input/output/editing program. READN can be used to edit a limited number of variables in the File-Q header block, and restore or retrieve matrices from binary matrix files to the File-Q disk or the reverse. READN can also prepare drawdown files. READN produces user labeled binary files when used in modes (2) (1) but simply formats data on the File-Q disk in modes (0) (-1).

Program MXPLOT

```
MCR>RUN DP1:MXPLT          $
 WHICH DISK UNIT 1,2, 3=DB0:
1
LARGE OR SMALL FIELD ? :CR=LG,1=SM
9
WHICH OUTPUT DEVICE?
SCOPE=CR  XY:=1  DISK=2
1
CROSS SECTION PLOTS ? :1=Y,CR=N

 NODE AND/OR CONTOUR PLOTS AND STREAMLINES AND/OR TRAVEL TIMES
 MANUAL OPERATION =CR   AUTOMATIC =1

 THIS IS A       1  AQUIFER SYSTEM
 EACH AQUIFER IS      25  COLUMNS
                 BY      58  LINES
 DO YOU WISH TO DISPLAY EVERYTHING CR=YES, 1=NO
9
SCALE FACTOR ,:F4.
1.\.1\.5
ROTATION :0,1 ?
1
*** CALCOMP NOT READY
NODE TYPE PLOT ?
1
EXT  BNDY  HELD  INT  ND.NOS.
 1    2     3     4    5
1,3
CONTOUR PLOT ?
1
 H  K  TOP  BOT  DIFF
 1  2   3    4    5
1
BOT LVL ,TOP LVL ,SPAC :3F6
350.,550.,20.,
CONTOUR PLOT ?

 STREAMLINES AND TRAVEL TIMES 1=YES  CR=NO
1
 DO YOU DESIRE TRAVEL TIMES 1=YES CR=JUST STREAMLINES
1
 ENTER POROSITY :F6.0
.1
 TO SET MAX. TRAVEL TIME ENTER A 1 FOR NONE A CR
```

Sample of iterative input stream of MXPLOT for online model output evaluation. This interactive stream produces:

1) a node and contour plot,
2) streamlines on this contour plot, and
3) a cross-section potential plot.

9 2 1 2 7 3 1 3 7 9

```
 MORE STREAMLINES OR TRAVEL TIMES 1=YES CR=NO
1
INPUT MODE SELECTION :I1
(1) SINGLE STREAMLINE
(2) MULTIPLE STREAMLINE
2
INPUT AQUIFER NUMBER AND END POINTS OF LINE SEGMENT.
AQ. # ,X1 ,Y1 ,X2 ,Y2 ,NLINES :4F4.0,I2
1,12.,12.,19.,15.,6
UP GRAD ,DOWN GRAD :1,-1 F4.
-1.
 AQUIFER       1
TRAVEL TIME(YEARS) =     36.41     DISTANCE(FEET) =    22500.
 AQUIFER       1
TRAVEL TIME(YEARS) =     75.91     DISTANCE(FEET) =    27900.
 AQUIFER       1
TRAVEL TIME(YEARS) =    580.36     DISTANCE(FEET) =   111600.
 AQUIFER       1
TRAVEL TIME(YEARS) =    473.20     DISTANCE(FEET) =   111600.
 AQUIFER       1
TRAVEL TIME(YEARS) =    112.62     DISTANCE(FEET) =   109800.
 AQUIFER       1
TRAVEL TIME(YEARS) =    132.41     DISTANCE(FEET) =    92700.
PRINT DATA ON STREAMLINES ? :1=YES
1
 MORE STREAMLINES OR TRAVEL TIMES 1=YES CR=NO
0
 CROSSECTION PLOTS NOW CR=NO 1=YES
0
MXPLT  --  STOP
```

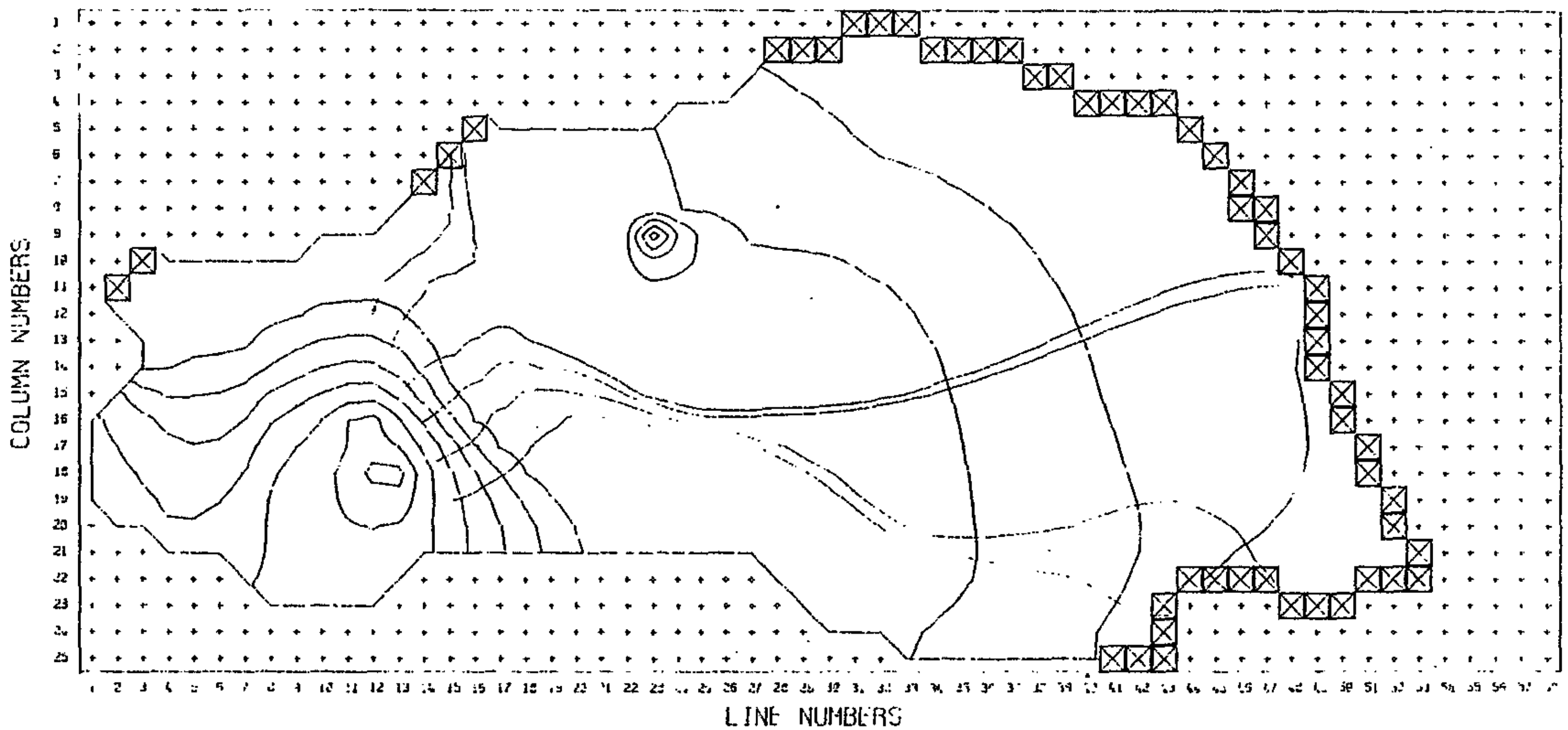

9 2 1 2 7 8 1 3 7

```
MCR>PIP
PIP>XY:=MXPLT.DAT
PIP>^Z

MCR>
```

Example of the PIP command necessary to transfer the contour-streamline plot produced by MXPLOT to the CALCOMP.

9212731372

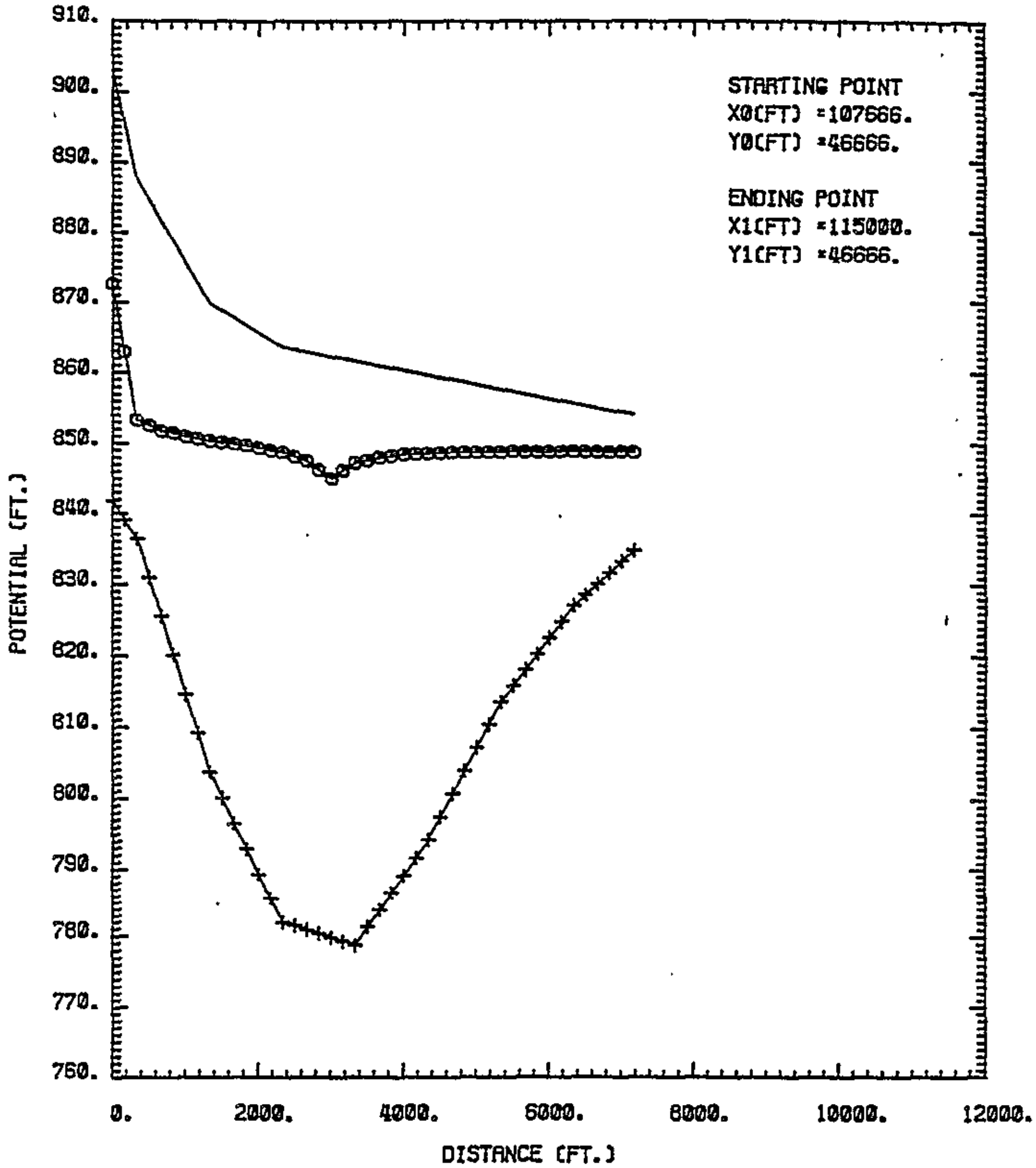


Example of the Node Type Contour and Streamline Plot Produced by MXPLOT on the Large Region

```
MCR>RUN DP2:MXPLOT$
WHICH FILE Q DISK 1,2,3
2
LARGE OR SMALL FIELD ? :CR=LG,1=SM
0
WHICH OUTPUT DEVICE?
SCOPE=CR  XY:=1  DISK=2
2
CROSS SECTION PLOTS ? :1=Y,CR=N
1
MANUAL = CR OR AUTOMATIC =1
0
CROSS SECTION OPTIONS
(1) PLOT POTENTIAL
(2) PLOT POT. ,TOP ,BOT.  :PENS 1,2,3
1
SCALE FACTOR , :F4.
.5
INPUT POINT PAIR
COLL-0 ,LINE0 ,COLL-1 ,LINE1 :4I3
18,40,18,70
NEW GRAPH SCALE ? :1=Y,CR=2000(FT/IN)
1
NEW SCALE (FT/IN) :F6
4000.
MORE PROFILES ? :1=Y,CR=NO
0
MXPLOT  --  STOP
```

Cross section plot example control commands

9212731374



CROSS SECTION PLOT

VERTICAL EXAGGERATION = 100.0

9 2 1 2 3 7 9 1 3 7 5

VI. ESTABLISH, RUN SUBREGION MODEL

PROGRAMS TO ESTABLISH AND RUN SUBREGION MODEL

The generation of a subregion within the large grid requires several programs to be run and requires two new data files. The data files are: a list of well pumpage to occur in the small region with their x,y location in the large model in feet from x=0, y=0, and a file of calculation types for the small subregion boundaries. The latter must be generated by the modular by way of the system editor.

The sequence of program runs to establish the subregions is as follows:

1) remove all well pumpage from the large region model FILE-Q disk files,
2) run SUBGEN to establish the subregional grid,
3) run READN to load the calculation type file into the subregion,
4) run BCTRN to load the well pumpage into the small grid,
5) run ACHEK to create a listing of all the subregion data,
6) check to make sure data are filled in on all held boundaries,
7) if data are not complete, load missing data with MXED, and
8) run MXED to re-number the nodes in their proper sequence.

Model of subregion is then ready to run VTTSS3, the primary ground water modeling program on the subregion.

9212731376

PROGRAM BCTRN

```
MCR>HEL [5,4]
MCR>RUN BCTRN$
WHICH FILE Q DISK 1,2,3
2
TRANSFER SMALL TO LARGE REGION ? :1=Y,CR=NO

TRANSFER POTENTIAL TO SMALL REGION ? :1=YES,CR=NO

WELL QS IO ? :1=Y
1
PRINT OUT WELLS AND LOCATIONS ?: 1=Y
1
CR= STOP ,1= SET QS ,2= CLEAR QS :I2
1
LARGE OR SMALL REG. ?:CR=LG,1=SM
1
TRANSFER SMALL TO LARGE REGION ? :1=Y,CR=NO

TRANSFER POTENTIAL TO SMALL REGION ? :1=YES,CR=NO
WELL QS IO ? :1=Y

CHANGE LEAKAGE COFF. ? CR=NO,1=YES

BCTRN  --  STOP
```

9 2 1 2 7 3 1 3 7 7

PROGRAM SUBGEN

```
MCR>RUN SUBGEN$
WHICH FILE Q DISK 1,2,3
2
INPUT UNROTATED COORDINATES OF SUBREGION
X0-COLL ,X1-COLL ,Y0-LINE ,Y1-LINE ,MAG :5I3
74,87,48,62,3
SUBGEN  --  STOP
```

SUBGEN will generate a subregion model from the large region from the grid x,y specifications

VII. BASIC RSX11 SYSTEM PROCEDURES

The operating system on the PDP 11/45 used in conjunction with the ground water model is the DEC (Digital Equipment Corporation) RSX-11D system. All user interaction between the machine and the user is through the RSX-11D operating system. This system can facilitate either batch or interactive control. The ground water model is operated via interactive control. The user's guide for the RSX-11D operating system can be used in addition to this User's Manual for reference purposes. The following sections are included to provide a more user specific reference of areas covered in more general terms in the RSX-11D User's Guide.

MCR COMMANDS

All initial interaction between the user and the Ground-water Model programs or any other RSX-11D system programs is through the Monitor Console Routines, (MCR). The MCR provides an interface between the user and the system. The MCR is used to start system or user programs, to log on, to obtain information about the system status etc. Typical MCR commands required by the ground-water model user include:

ABORT (abort a program)
ACTIVE TASK LIST (obtain an active task list)
BYE (log off the computer)
HELLO (log on the computer)
MOUNT (mount a disk, magnetic tape etc.)
RUN (run a program)
TIME (obtain system time)
SYS (obtain information on the system)
WHO (determine who is logged on what terminal)

Typical system programs that the ground water modeler will need to use include:

EDITOR
Peipheral Interchange Program (PIP)
FORTRAN COMPILER (F4P)
Task Builder (TKB)

The use of the above MCR commands and system programs will be discussed in this and the following sections by example.

Before proceeding with the discussion of the MCR commands, we need to discuss the teletype or terminal input structure. The MCR, system and user input from the terminal is always in a line by line mode. Until the line terminator is typed, the user may modify the input on a given line to correct errors. The other feature of the terminal input system is that up to eighty characters may be typed ahead, and they are remembered and sent to the programs on a first-in-first-out (FIFO) basis. An example of this will be shown later. The only input character that violates this FIFO relationship is the CTRL C character. When a CTRL C is typed, it migrates immediately to the head to the FIFO que. The special characters and their function with respect to terminal input are as listed in the following table from the RSX-11D User's Guide.

RSX-11D CONVENTIONS

Table 3-5
Terminal Control Conventions

KEYS	FUNCTION
CTRL C	Causes MCR to be activated. The system prints the prompt characters, MCR>. NOTE Typing CTRL C does not affect the execution of any tasks currently running.
CTRL Z	Logical end-of-file; when typed in response to a prompt from most system programs, causes that program to exit.
RETURN	Terminates the current line and causes the system to print the prompt for the next command. All lines are terminated using RETURN unless otherwise noted in the documentation.
RUBOUT	Causes the most recently typed character to be deleted from the command string. RUBOUT echoes as a backslash (\). Successive typing of RUBOUT causes the most recently typed characters to be deleted. One character is deleted for each successive pressing of RUBOUT.
ALT	Terminates MCR. Normally used when requesting a program (user or system) that is to interact with the operator after the command is executed (e.g., RUN ...MAC <ALT>). NOTE On some keyboards, the ALT key is labeled "ESC".
CTRL I	Causes a horizontal tab. Tab stops are set, by the software, at every eighth character position (e.g., 9, 17, 25, 33).
CTRL K	Causes a vertical tab of one line.
CTRL L	Causes a form feed to the top of the next page.

Table 3-5 (Cont.)
Terminal Control Conventions

KEYS	FUNCTION
CTRL O	Interrupts system output to the terminal. Successive pressings of CTRL O cause output to start and stop. For example, it directory listing on the terminal is requested and the first few lines present the desired information, CTRL O can suppress the printing of the rest of the directory. (Large TTY Handler only)*
CTRL R	Causes the system to print the current terminal line. When errors make the line difficult to read, pressing CTRL R produces a clear copy. Input can continue on the newly-printed line (large TTY handler only).
CTRL U	Cancels the current input line. The prompt (e.g., MCR> or PIP>) is not printed on the next line, but the system is ready for the typing of a new command.
CTRL X	Causes a user-written program named TTYNnn to execute; nn is the two digit unit number of the terminal with which the program is to interact during execution.
CTRL S and CTRL Q	These two keys correspond to XON and XOFF respectively. (Pressing CTRL Q (XOFF) stops output to the terminal until CTRL S (XON) is pressed. Unlike CTRL O, the XON/XOFF function stops and starts output without any loss of characters. The silo of the VT05 terminal generates XON/XOFF automatically. (Large TTY Handler only)*

The RUBOUT or Delete key cannot be used to delete a RETURN (CR) or ALT (esc) or any CONTROL character that has been entered into the 80 character input buffer. The RUBOUT only deletes characters on a given line. An example will be shown in the following paragraphs.

The monitor console routine is requested by depressing the CTRL C key and striking the C key. The system will envoke the MCR and the terminal will response with MCR >. The format for an MCR command is MCR > Command Name {command string}, where the command string in pointed brackets is an optional input. We will utilize this convection of putting optional input in pointed brackets throughout the other parts of this section.

HELLO Command

To log on the system the user can type CTRL CHEL UIC RETURN. Here UIC stands for the user identification code assigned to the system user. It consists of two up to 3 digit octal numbers separated by a comma. A typical UIC is [73, 710]. For a user to log on under this UIC he would type CTRL C HEL [73, 710]RETURN. The computer would echo this input string as follows:

MCR>HEL [73, 710]

MCR>

If the ALT (or esc) key were used for a line terminator instead of the RETURN, the computer would echo the input strings as follows:

MCR HEL [73, 710]$

Note that the dollar sign is typed for the ALT (esc) and that the control is not returned to the MCR. Once a user has logged on, he does not have to specify a UIC for files which reside on his UIC. The following illustrates the use of the other MCR commands with a simple description of their function. The detailed description of these MCR commands and their use is contained in the RSX-11D User's Guide.

```
MCR>HEL [6,3]                   <—— HELLO to Log on
MCR>BYE                         <—— BYE  to Log off
MCR>ABO
 -- PLEASE LOGON WITH "[UIC]"
HEL>[6,3]
MCR>PIP
PIP>LP:=/LI                     <—— ABORT to abort a running program
MCR>ABO ...PIP

TASK "...PIP" TERMINATED
ABORTED VIA DIRECTIVE (OR MCR)
AND WITH PENDING I/O REQUESTS
  PC=167764
  PS=174004
  R0=004772
  R1=013660
  R2=000000
  R3=006003
  R4=000040
  R5=014036
  SP=000240
MCR>ACT                         <—— ACT to determine the active tasks on your terminal
DP.... W0 TT00
TT.... W0 TT00
LP.... W0 TT00
MT.... W0 TT00
CR.... W0 TT00
DL.... W0 TT00
...ACT RN TT00
F11ACP SU TT00
MTAACP W0 TT00
MO.... W0 TT00
XY.... W0 TT00
TG.... W0 TT00                  <—— DMO to dismount a device
MCR>DMO DP1:
DMO -- DP1: ** DISMOUNT COMPLETE **
MCR>MOU DP1:/CHA=[FOR,ATCH]
MOUNT-**VOLUME INFORMATION**    <—— MOU to mount a FILE-Q disk
        DEVICE   =DP1
        CLASS    =FOREIGN
        UIC      =[1,1]
        ACCESS   =[RWED,RWED,RWED,RWED]
        CHARAC   =[FOR,ATCH,DCF]
MCR>DMO DP2:
F11ACP --  DP2: ** DISMOUNT COMPLETE **
MCR>MOU DP2.FCRSAV
MOUNT-**VOLUME INFORMATION**    <—— MOU to mount an RSXII disk
```

```
        DEVICE  =DP2
        CLASS   =FILE 11
        LABEL   =FCRSAY
        UIC     =[1,1]
        ACCESS  =[RWED,RWED,RWED,RWED]
        CHARAC  =[]
MCR>RUN EXAM$                               ←RUN to run a user program
 ENTER THE FILE-Q DISK UNIT
^Z

MCR>RUN ...PIP$                             ←RUN to run an MCR program
PIP>^Z

MCR>TIM                                     ←TIM to determine time
 05/24/77 13:32:09
MCR>SYS                                     ←SYS to determine system status

ATL:

DP....  TT....  LP....  MT....  CR....  DL....  F11ACP  MTAACP  ...SYS

MO....  ...EDI  ...PIP  XY....  TG....

MRL:

NO ENTRIES


CKQ:

TT....

MCR>WHO                                     ←WHO to determine who is logged on
TT0  [6,3] PRIVLEGED
TL0  NOT LOGGED ON
TT5  NOT LOGGED ON
TT4  NOT LOGGED ON
TT3  NOT LOGGED ON
TT2  [166,215]
TT1  [130,131]
MCR>^Z
```

FILE NAMING CONVENTIONS

Using the ground-water model and the RSC-11D system requires that the user be aware of file naming conventions. A complete file name has the following word form with the optional parts in pointed brackets. The device when not specified is the system disk DPØ:

{device descriptor} {UIC} (up to 9 character name)
(up to 3 character extension {octal version number}

Other typical devices are DP (n): or MT (N):. The UIC when not specified is the UIC that the terminal is logged under. The up to 9 character name is any combination of numers and letters. The extension is any combination o up to 3 letters and numbers. Version number is optional. When not specified the default is the latest version number. Files are stored according to UIC. The directory of files that belong to any user's UIC can be listed with PIP as shown in the following section on PIP usage.

9212738315

USE OF THE SYSTEM EDITOR

In this and the following sections an example will be presented in order to illustrate the use of these programs. A simple FORTRAN program and the required input files will be created with the editor, listed with PIP, compiled with F4P, built into a task with TKB, and run with the MCR RUN command. This example will use the File-Q disk, an RSX-11 type disk other than the system disk, and a magnetic tape. This will serve to make the user aware of the various input and output options available.

The program chosen for this example will take binary (unformatted) aquifer bottom and aquifer potential files and copy them to the FILE-Q disk. The program will then read a formatted or (ASCII) input file that requests the saturated aquifer thickness to be printed for certain random lines. The following is a list of the FORTRAN Coding form upon which the program was created.

The following is the teletype stream produced when this program and ASCII input file were created with the system editor. It illustrates the use of many of the editor commands.

USE OF PIP

The following teletype trail illustrates the use of Peripheral Interchange Procedure (PIP) to obtain a directory listing of the UIC and of the program and input file created with the EDITOR. This trail also illustrates the procedure for mounting a FILE-Q disk, a RSX-11 type disk, and a magnetic tape, and the procedure for getting a directory listing from the magnetic tape. Detailed usage of PIP is contained in the Utility Programs Procedure Manual for the PDP-11 series computer available from Digital Equipment Corporation.

EXAMPLE OF THE LINEPRINTER LISTING OBTAINED WITH PIP

```
MCR>PIP
PIP>LP:=\\\\TI.=/LI^R
TI:=/LI


DIRECTORY DP0:[6,3]
24-MAY-77 12:32

EXAM.FTN;1              4.          24-MAY-77 12:10
EXAMPLE.INP;1           1.          24-MAY-77 12:31

        TOTAL OF 5. BLOCKS IN 2. FILES



PIP>LP:=EXAM.FTN
PIP>TI:=EXAMPLE.INP
EXAMPLE FORTRAN PROGRAM TO CALCULATE SPECIFIED SATURATED THICKNESS'S
43,52,   NODESX,NODESY
20,20
18,25,
16,16
15,19,
PIP>^Z
MCR>INI MT0:EXAMPL
MCR>MOU MT0:EXAMPL
MOUNT-**VOLUME INFORMATION**
        DEVICE  =MT0
        CLASS   =FILE 11
        LABEL   =EXAMPL
        UIC     =[1,1]
        ACCESS  =[RWED,RWED,RE,R]
        CHARAC  =[ ]
MCR>MOU DP2:FCRSAV
MOUNT-**VOLUME INFORMATION**
        DEVICE  =DP2
        CLASS   =FILE 11
        LABEL   =FCRSAV
        UIC     =[1,1]
        ACCESS  =[RWED,RWED,RWED,RWED]
        CHARAC  =[ ]
MCR>MOU DP1:/CHA=[FOR,ATCH]
MOUNT-**VOLUME INFORMATION**
        DEVICE  =DP1
        CLASS   =FOREIGN
        UIC     =[1,1]
        ACCESS  =[RWED,RWED,RWED,RWED]
        CHARAC  =[FOR,ATCH,DCF]
MCR>PIP
PIP>DP2:[6,5]*.AB1/LI
```

```
DIRECTORY DP2:[6,5]
24-MAY-77 12:52

CC0575.A81;1          19.      C  09-FEB-77 13:56

        TOTAL OF 19. BLOCKS IN 1. FILE


PIP>MT0:=DP2:[6,5]CC0576.A81
PIP>DP2:[6,5]*.PT1/LI


DIRECTORY DP2:[6,5]
24-MAY-77 12:53

CLKDAMSIC.PT1;1       19.      C  09-FEB-77 13:54
CC0576.PT1;1          19.      C  09-FEB-77 13:56

        TOTAL OF 38. BLOCKS IN 2. FILES


PIP>^Z

MCR>^Z
```

9 2 1 2 7 3 1 3 9 0

```
C      EXAMLE PROGRAM TO ILLUSTRATE RSX11-D USE
C
C        ********EXAM.FTN**********
       DIMENSION TRANS(60),FILE(7),FIL2(7),FIL1(7),SNOPCT(60),SNOTHK(60)
1234   FORMAT(7A4)
       WRITE(5,*)' ENTER NAME OF SAND THICKNESS FILE'
       READ (5,1234) FIL1
       N=ICHR(FIL1)
       OPEN(UNIT=2,NAME=FIL1,TYPE='OLD',FORM='UNFORMATTED',READONLY)
       WRITE(5,*)' ENTER OUTPUT BIN FILE NAME'
       READ(5,1234)FIL2
       N=ICHR(FIL2)
       OPEN(UNIT=3,NAME=FIL2,TYPE='NEW',FORM='UNFORMATTED')
       WRITE(5,*) ' ENTER THE PERMEABILITY FACTOR'
       READ (5,*) PMBLTY
C ZERO THE MATRIX
       DO 32758 J=1,65
       DO 32757 I=1,60
       TRANS(I)=0.
32757  CONTINUE
       READ (2) (SNOTHK(I),I=1,60)
       DO 32756 I=1,60
       TRANS(I)=SNOTHK(I)*PMBLTY
32756  CONTINUE
       WRITE(3) (TRANS(I),I=1,60)
32758  CONTINUE
20     CLOSE (UNIT=3)
       CLOSE (UNIT=2)
       STOP
       END
```

USE OF THE FORTRAN COMPILER

The following teletype trail illustrates how to compile our example program and obtain a compilation listing and object module for task building purposes. See the Fortran IV Plus User's Guide (Digital Equipment Corporation) for complete details on the F4P compiler usage.

```
MCR>F4P
F4P>EXAM,LP=EXAM/TR/CK
F4P>^Z

MCR>
```

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RUNNING A PROGRAM

Now that our program has been edited, compiled, and task built, we are ready to run the program. Previously we have prepared the ASCII input file and have mounted the FILE-Q disk, RSX-11 type disk, and magnetic tape so that we can now run our program. The following teletype trail illustrates the procedure along with the lineprinter output produced.

```
MCR>RUN EXAM$
  ENTER NAME OF SAND THICKNESS FILE
HNETSAND.THK
  ENTER OUTPUT BIN FILE NAME
SANDTRANS.TRN
  ENTER THE PERMEABILITY FACTOR
50.0
EXAM  --  STOP
```


9 2 1 2 7 3 3 3 7

EXAMPLE OF THE LINEPRINTER TASK BUILD MAP
OF EXAM PRODUCED BY TKB

```
FILE EXAM.TSK;1 MEMORY ALLOCATION MAP
THIS ALLOCATION WAS DONE ON 30-MAY-79
AT 10:59 BY TASK BUILDER VERSION R10


*** ROOT SEGMENT: EXAM


R/W MEM  LIMITS: 000000 055247 055250
STACK    LIMITS: 000000 000777 001000
DISK BLK LIMITS: 000003 000061 000057
IDENTIFICATION : 30MAY
PRG XFR ADDRESS: 020320
TASK ATTRIBUTES: FP,NF,TA


PROGRAM SECTION ALLOCATION SYNOPSIS:

<. BLK.>: 001000 020317 017320
<$CODE1>: 020320 021353 001034
<$IDATA>: 021354 021533 000160
<$PDATA>: 021534 021673 000140
<$VARS >: 021674 023351 001456
<$$AOTS>: 023352 024351 001000
<$$DEVT>: 024352 025561 001210
<$$DEVU>: 025562 025562 000000
<$$FIOC>: 025562 032251 004470
<$$FIOD>: 032252 032557 000306
<$$FIOI>: 032560 033263 000504
<$$FIOL>: 033264 033371 000106
<$$FIOR>: 033372 035523 002132
<$$FIO2>: 035524 035561 000036
<$$FSR1>: 035562 041661 004100
<$$FSR2>: 041662 041765 000104
<$$IOB1>: 041766 042171 000204
<$$IOB2>: 042172 042172 000000
<$$OBF1>: 042172 042271 000100
<$$OBF2>: 042272 042272 000000
<$$OTSD>: 042272 043057 000566
<$$OTSI>: 043060 054365 011306
<$$RESL>: 054366 055245 000660
<. ABS.>: 000000 000000 000000
```

EXAMPLE OF THE LINEPRINTER LISTING OF
EXAM.FTN PRODUCED BY THE F4P COMPILER

```
FORTRAN IV-PLUS V02-51D          10:56:43    30-MAY-79           PAGE 1
EXAM.FTN           /CK/TR:ALL/WR

        C       EXAMLE PROGRAM TO ILLUSTRATE RSX11-D USE
        C
        C         ********EXAM.FTN**********
0001            DIMENSION TRANS(60),FILE(7),FIL2(7),FIL1(7),SNDPCT(60),SNDTHK(60)
0002    1234    FORMAT(7A4)
0003            WRITE(5,*)' ENTER NAME OF SAND THICKNESS FILE'
0004            READ (5,1234) FIL1
0005            N=ICHR(FIL1)
0006            OPEN(UNIT=2,NAME=FIL1,TYPE='OLD',FORM='UNFORMATTED',READONLY)
0007            WRITE(5,*)' ENTER OUTPUT BIN FILE NAME'
0008            READ(5,1234)FIL2
0009            N=ICHR(FIL2)
0010            OPEN(UNIT=3,NAME=FIL2,TYPE='NEW',FORM='UNFORMATTED')
0011            WRITE(5,*) ' ENTER THE PERMEABILITY FACTOR'
0012            READ (5,*) PMBLTY
        C ZERO THE MATRIX
0013            DO 32758 J=1,65
0014            DO 32757 I=1,60
0015            TRANS(I)=0.
0016    32757 CONTINUE
0017            READ (2) (SNDTHK(I),I=1,60)
0018            DO 32756 I=1,60
0019            TRANS(I)=SNDTHK(I)*PMBLTY
0020    32756 CONTINUE
0021            WRITE(3) (TRANS(I),I=1,60)
0022    32758 CONTINUE
0023    20      CLOSE (UNIT=3)
0024            CLOSE (UNIT=2)
0025            STOP
0026            END

PROGRAM SECTIONS

 NAME       SIZE                 ATTRIBUTES

$CODE1  001034   270             RW,I,CON,LCL
$PDATA  000140    48             RW,D,CON,LCL
$IDATA  000160    56             RW,D,CON,LCL
$VARS   001456   407             RW,D,CON,LCL

TOTAL SPACE ALLOCATED = 003032   781

EXAM,LP:=EXAM/CK/TR
```

USE OF THE TASK BUILDER

Once the user's program has been compiled error free and an object module prepared with the compiler, the task file can be prepared. The function of the task builder is to line the user's object module with existing system and library programs to create a core-ready disk version of the user's task. The following trail illustrates the procedure required to build our compiled example program into a core ready task. See the Task Builder Reference Manual (Digital Equipment Corporation) for complete details on the task builder usage.

```
MCR>TKB
TKB>EXAM,LP:/SH=EXAM,[1,1]BNWLIB/LB
TKB>/
ENTER OPTIONS:
TKB>ASG=TI:5,DP0:2:3
TKB>/
```

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