Appendix A

Interactive Input Developer for HEC-1 (HEC1IN)

Introduction

Overview of the HEC1IN Program

This program was designed to aid beginning and first-time users in developing the correct sequence of records for an HEC-1 input file. Currently the program is limited to the basic rainfall-runoff processes available in the HEC-1 program. The use of this program consists of filling out a series of tables that describe the watershed and the type of hydrologic techniques that will be used to analyze the basin. Once all of the necessary information is entered, a skeleton HEC-1 input file can be created. The skeleton file will contain all of the data records needed to simulate the rainfall-runoff process for the user's watershed, but not all of the actual data. The file will contain the two-character alphabetic codes in columns one and two for each line of input. It is the users responsibility to edit the file (using COED or any other text editor) and fill in the necessary data associated with each record. Review section 10 and Appendix A of the HEC-1 User's Manual for details about the input structure and specific data requirements for each record.

Computer Requirements

The HEC1IN program was developed for IBM-compatible computers with the MS DOS operating system. The following is required in order to execute the program:

- **MS DOS 2.1 (or later)**
- **512 Kb of RAM (300 Kb free)**
- **One 360 Kb floppy-disk drive (or 1.2 Mb)**
- **10 Megabyte or larger hard-disk**

The HEC1IN program is included in the HEC-1 package of software. Installation is accomplished through the use of the HEC-1 install program. For further information on installing the HEC1IN program, review the HEC-1 package installation instructions.

Acknowledgements

This program was designed by Mr. Gary W. Brunner and Mr. Arlen D. Feldman of the Hydrologic Engineering Center. The computer program was written in FORTRAN and assembly language by Gary W. Brunner, Denise Nakaji, and Tracy Colwell.

Executing the HEC1IN Program

Running From The HEC-1 Menu System (MENU1)

Executing the HEC1IN program can be accomplished through the HEC-1 menu system (MENU1). As shown in Figure A.1, while option three of the menu is highlighted, press the space bar to change the program execution to HEC1IN. Then press the <ENTER> key to execute the HEC1IN program.

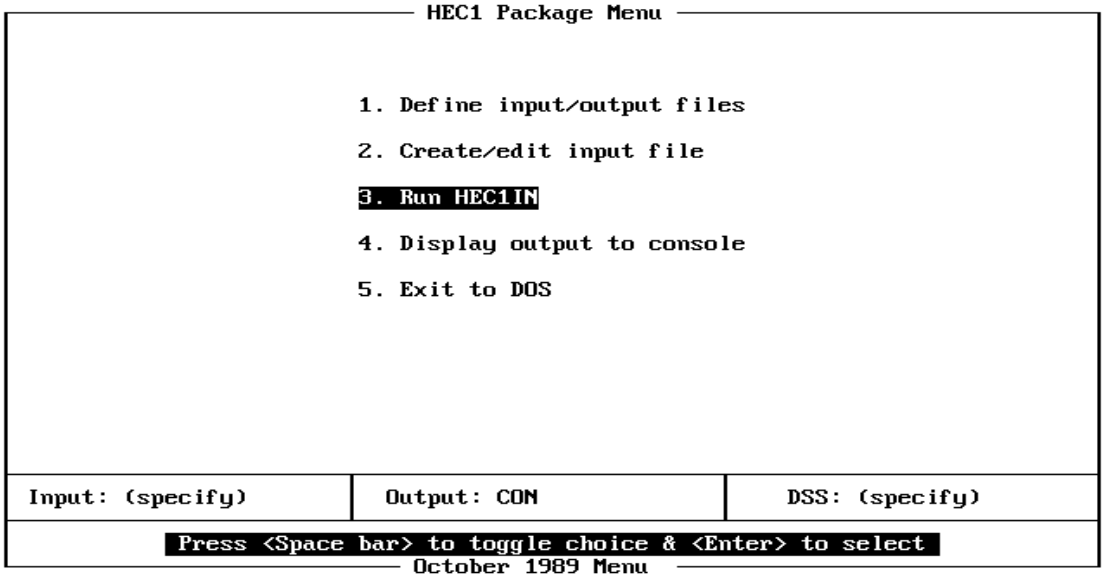


Figure A-1. HEC-1 Menu System

Files Associated With The HEC1IN Program

The HEC1IN program uses three files during execution:

1. HEC1IN.TXT - Text file containing HEC1IN screens.
2. filename - User-specified name for the HEC-1 input file.
3. filename.INT - File containing information entered into HEC1IN tables.

The HEC1IN.TXT file should be placed in the \HECEXE\SUP directory. This file contains all of the screens that come up in the HEC1IN program. The user-specified HEC-1 input file is identified while in the MENU1 program. The third file (filename.INT) is used to store all of the information that the user enters during the HEC1IN session. This file is given the same name as the user-specified HEC-1 input file, but the extension ".INT" is attached. The ".INT" file is preserved so the user can exit the HEC1IN session at any time and return to it as necessary.

WARNING: data should not be added to the HEC-1 input file until the user is completely finished building the skeleton file with HEC1IN. The HEC1IN program re-writes the skeleton HEC-1 input file and will not preserve data added by using COED.

Creating an Input Data File

General Philosophy of the Program

In general, this program operates by filling out a series of formatted screens and tables that describe the rainfall-runoff process that is trying to simulate. The river basin shown in Figure A.2 will be used in the following demonstration of HEC1IN.

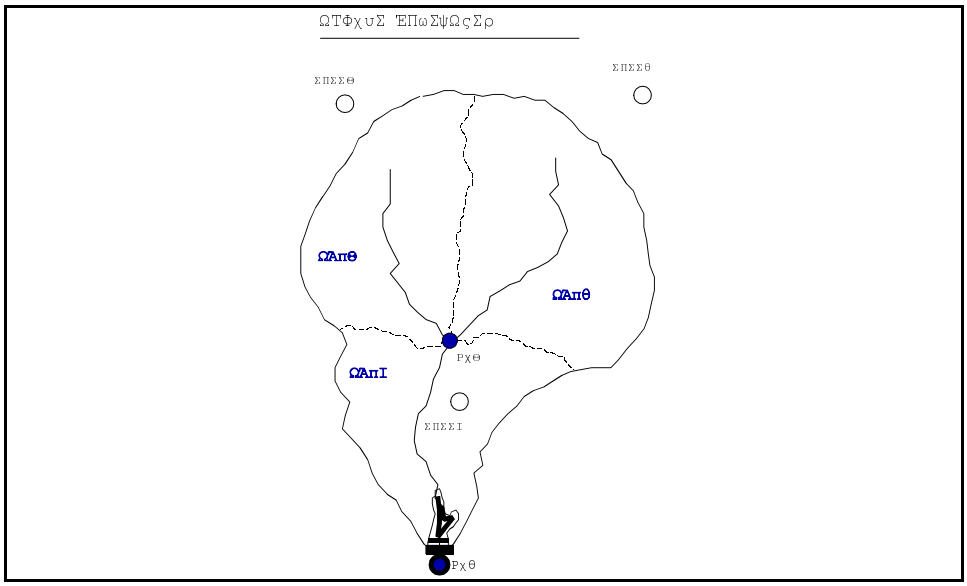


Figure A-2. Example Watershed

When HEC1IN is executed, the first screen to be filled out by the user is shown in Figure A.3. This Job Initialization screen is used to enter job title information and time specifications. In the job title information section, the user should enter comments that describes the rainfall-runoff process that is being simulated. Under the time specifications section, the user is required to enter a computation interval, simulation starting date and time, and the number of hydrograph ordinates to be computed. The computation interval is one of the most important parameters required by the model. The length of the computation interval is dependent on the size of the smallest subbasins and routing reaches within your watershed. A general rule of thumb is that the computation interval should be less than one fifth (1/5) of the smallest subbasin's time of concentration (Tc). The total simulation time for the job is the number of ordinates multiplied by the computation interval. Remember, the total simulation time should equal or exceed the duration of the precipitation event being analyzed.

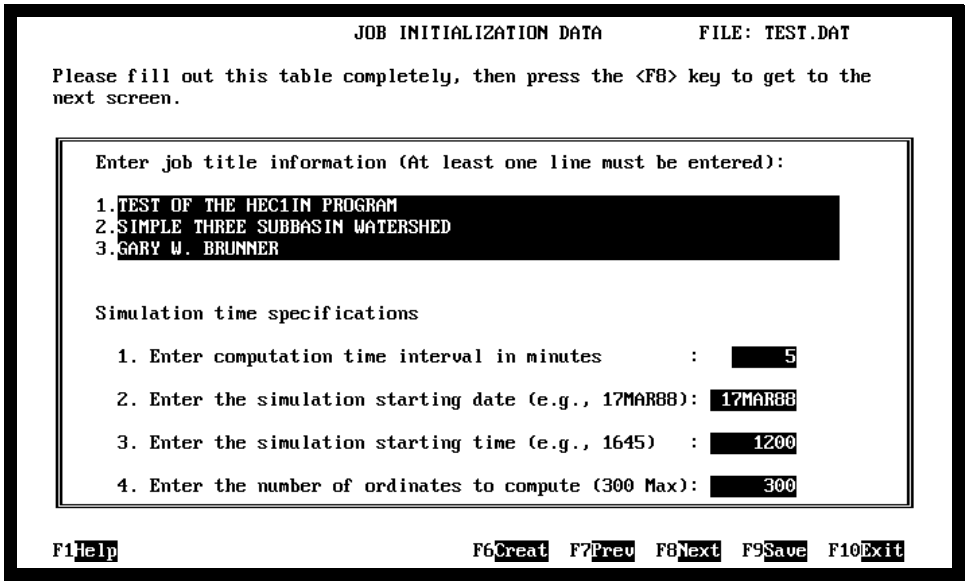
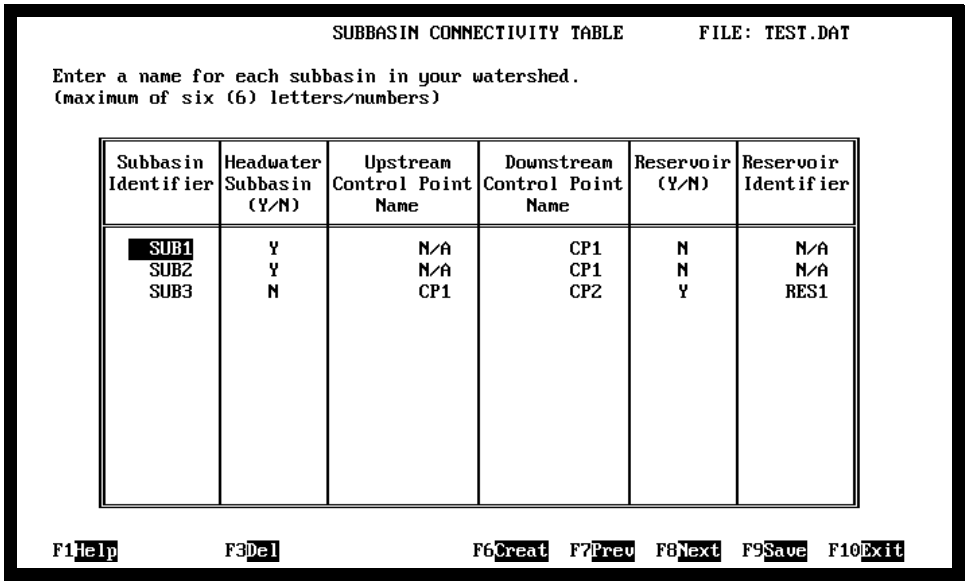


Figure A-3. Job Initialization Data

The next screen that the user must fill out is shown in Figure A.4. The subbasin connectivity table is used to enter a name for each of the subbasins in the watershed and to describe how these subbasins fit together. The term "Headwater Subbasin" is used for those subbasins where a stream initiates. Every subbasin that is entered in the table must be assigned a downstream control point name. For those subbasins that are not headwater subbasins, an upstream control point name must also be provided. This control point name must be the same as the downstream control point name of the subbasin immediately upstream.



Subbasin Identifier	Headwater Subbasin (Y/N)	Upstream Control Point Name	Downstream Control Point Name	Reservoir (Y/N)	Reservoir Identifier
SUB1	Y	N/A	CP1	N	N/A
SUB2	Y	N/A	CP1	N	N/A
SUB3	N	CP1	CP2	Y	RES1

Figure A-4. Subbasin Connectivity Table

After the user has completely filled out the subbasin connectivity table for all of the subbasins within the watershed, simply press the F8 function key to go to the next screen. The third screen, which is titled "Subbasin Runoff Table," is shown in Figure A.5. The subbasin runoff table is used to identify the methodologies that will be used in developing a runoff hydrograph for each subbasin. The information

required consists of: basin area; the type of precipitation data that will be used; a loss rate function; rainfall excess to runoff transformation (unit hydrograph or kinematic wave); and whether or not baseflow will be added to the direct runoff. The available choices for each column are shown in a menu at the top of the screen. The <TAB> key is used to move through the menu choices and the <ENTER> key is used to make a selection from the menu. Selecting a specific hydrologic method will depend upon the amount of historical data available; the experience of the user; and the characteristics of the watershed to which the method will be applied. Detailed explanations of the techniques listed in the menus are found in chapter three of the HEC-1 User's Manual.

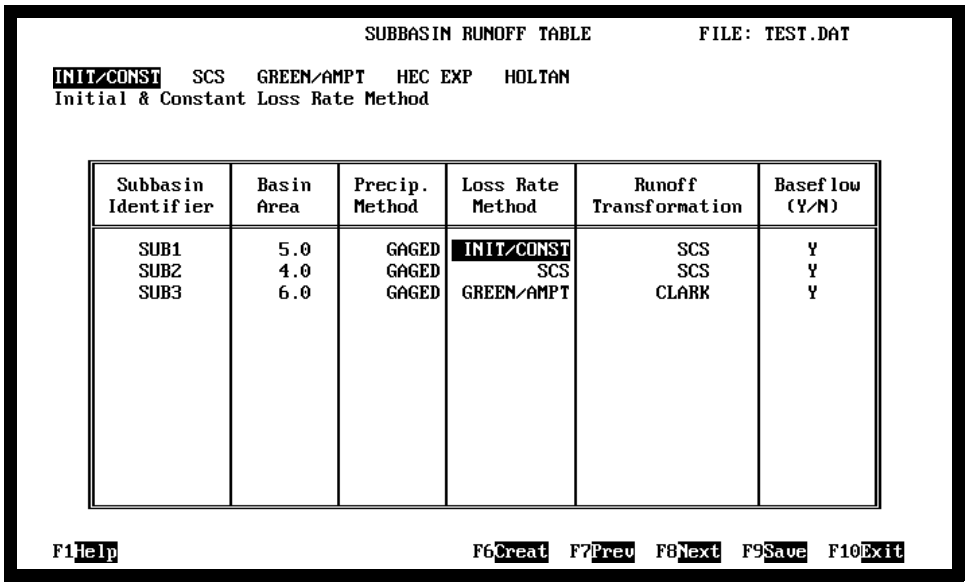


Figure A-5. Subbasin Runoff Table

The next screen will depend upon what was entered into the subbasin runoff table for precipitation. If the user had entered "Gaged" or "Basin Average" precipitation, then a precipitation table will come up to get more information. Otherwise, the program will go straight to the channel routing table. Shown in Figure A.6 is the gaged precipitation table.

The gaged precipitation table is used to identify all of the gages (recording and non-recording) that will be used in developing rainfall hyetographs for the watershed. The user is required to enter a name for each gage; whether the gage is recording or non-recording; and if the data will be entered incrementally or cumulatively. If the "Basin Average" precipitation method had been chosen by the user, the program will only ask if the data is going to be entered incrementally or cumulatively. When using the basin average precipitation method, the user must compute the basin average precipitation for each subbasin outside of the model and enter it directly. Computing the basin average precipitation can be accomplished by using Thiesson polygon or isohyetal averaging techniques.

If hydrograph routing is required, the next screen will be the channel routing table. The channel routing table, shown in Figure A.7, is used to define which routing techniques will be used to route hydrographs from upstream to downstream control points. The Hec1IN program will automatically

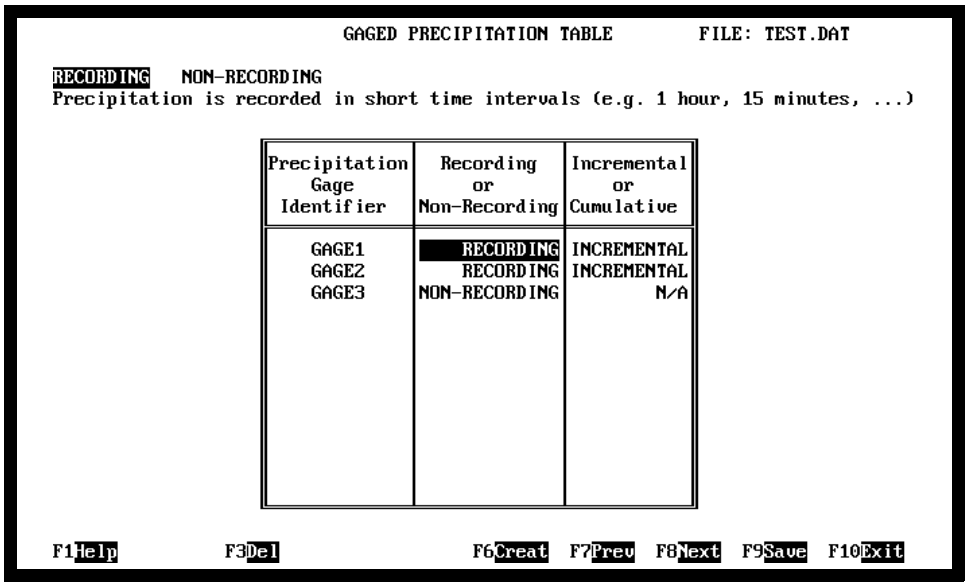


Figure A-6. Gaged Precipitation Table

determine the number of routing reaches are required. The upstream and downstream control points for each routing reach will be displayed in the table. The user is required to enter a name that will uniquely identify each routing reach, and then select the type of routing technique that will be used for that particular reach. The selection of a routing methodology is dependent upon the available data, the physical characteristics of the channel, and the nature of the flood wave to be routed. To learn more about a specific routing technique, please review chapter 3 of the HEC-1 user's manual.

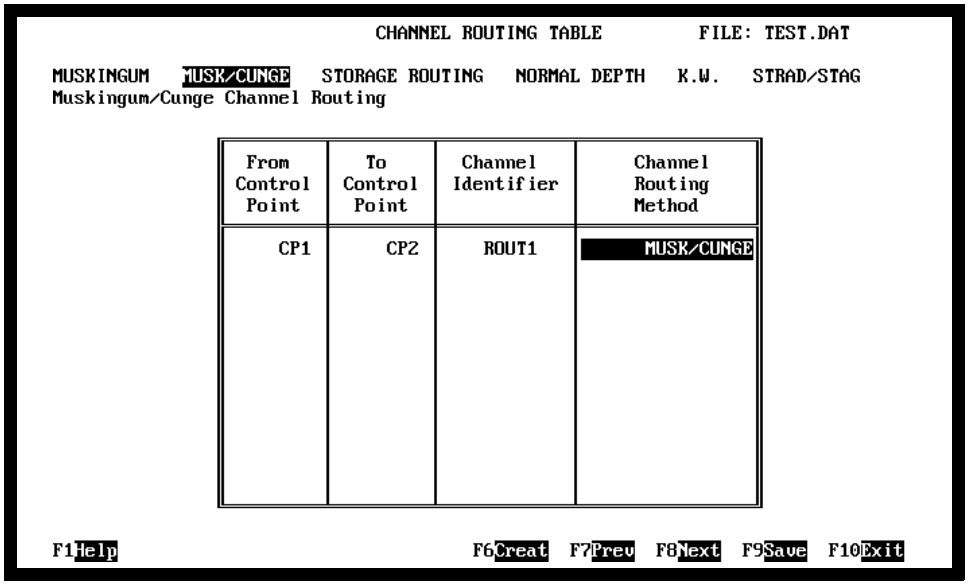


Figure A-7. Channel Routing Table

The last screen that may appear is used for reservoir routing. The reservoir routing table, shown in Figure A.8, will only come up if the user has specified that a reservoir is located in at least one of the subbasins. The reservoir routing table is used to identify how the elevation versus volume and elevation versus outflow relationships will be defined in the model. The user can define the storage behind the dam by entering elevation versus volume directly, or elevation versus surface area, and the HEC-1 program will calculate the volumes. To describe the outflow from the dam, the user can enter a single rating curve (which is a composite of all outflow mechanisms) or explicitly describe the physical dimensions of each outflow mechanism. The model also has the capability to simulate a dam breach, or flow going over top of the dam.

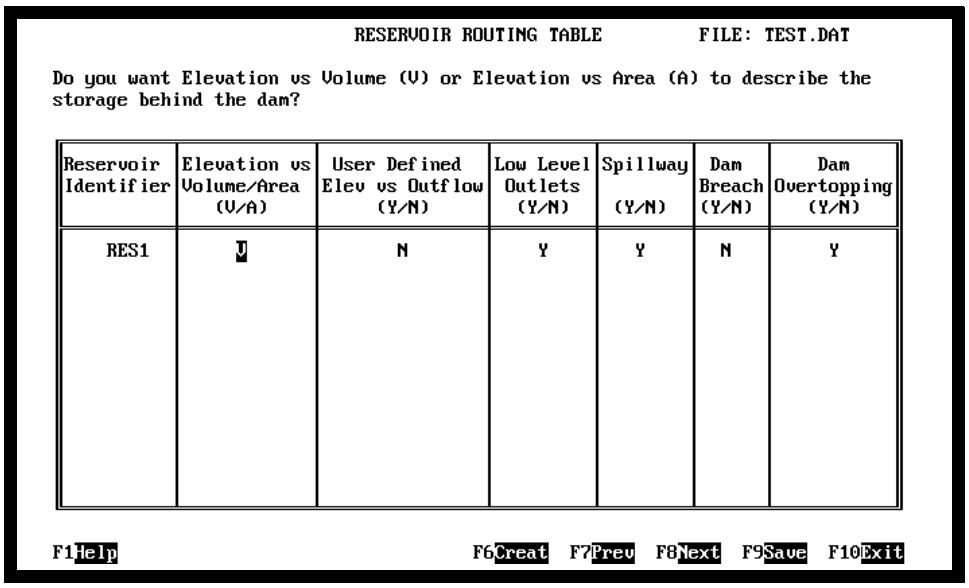


Figure A.8 Reservoir Routing Table

After all of the tables have been filled out completely, the HEC-1 input file can be created by simply pressing the F6 function key. The HEC-1 input file generated for this example is shown in Table A.1. **Remember**, the HEC-1 input file will only contain the two character identification codes for each record required for the rainfall-runoff simulation. It is the user's responsibility to edit the file and fill in all of the necessary data for each record.

WARNING: data should not be added to the HEC-1 input file until the user is completely finished building the skeleton file with HEC1IN. The HEC1IN program re-writes the skeleton HEC-1 input file and will not preserve data added by using COED.

Help System

Help within the HEC1IN program is available by pressing the F1 function key. The first two screens of the help system deal with editing and function keys, while the third screen is specific to the HEC1IN tables. The first screen of the help system lists all of the available function keys and their corresponding capabilities. The second help screen describes how the key pad, <TAB> key, and <ENTER> key can be

used to enter and edit information. The third help screen is always specific to the table the user was working in when the F1 key was pressed. Therefore, if the user is working on the subbasin connectivity table when the F1 key is pressed, the third help screen will describe what information is required for that specific table. Moving through the help screens is accomplished by pressing any key. After the third screen is viewed, pressing any key will return the user back to the table being used when help was requested.

Table A-1

HEC-1 Input File for Example Watershed

```
ID TEST OF THE HEC1IN PROGRAM
ID SIMPLE THREE SUBBASIN WATERSHED
ID GARY W. BRUNNER
IT     5 17MAR88    1200     300
IO
PG GAGE1
PI
PG GAGE2
PI
PG GAGE3
* **********
KK  SUB1
KM Basin runoff calculation for   SUB1
BA   5.0
BF
PT
PW
PR
PW
LU
UD
* **********
KK  SUB2
KM Basin runoff calculation for   SUB2
BA   4.0
BF
PT
PW
PR
PW
LS
UD
* **********
KK  SUB2
```

```
KM Combining two hydrographs at control point      CP1
HC     2
* **********
KK ROUT1
KM Muskingum-Cunge channel routing from      CP1 to CP2
```

```
RD
* **********
KK  SUB3
KM Basin runoff calculation for   SUB3
BA   6.0
BF
PT
PW
PR
PW
LG
UC
* **********
KK  SUB3
KM Combining two hydrographs at control point      CP2
HC     2
* **********
KK  RES1
KM Reservoir routing operation
RS
SV
SE
SL
SS
ST
* **********
ZZ
```