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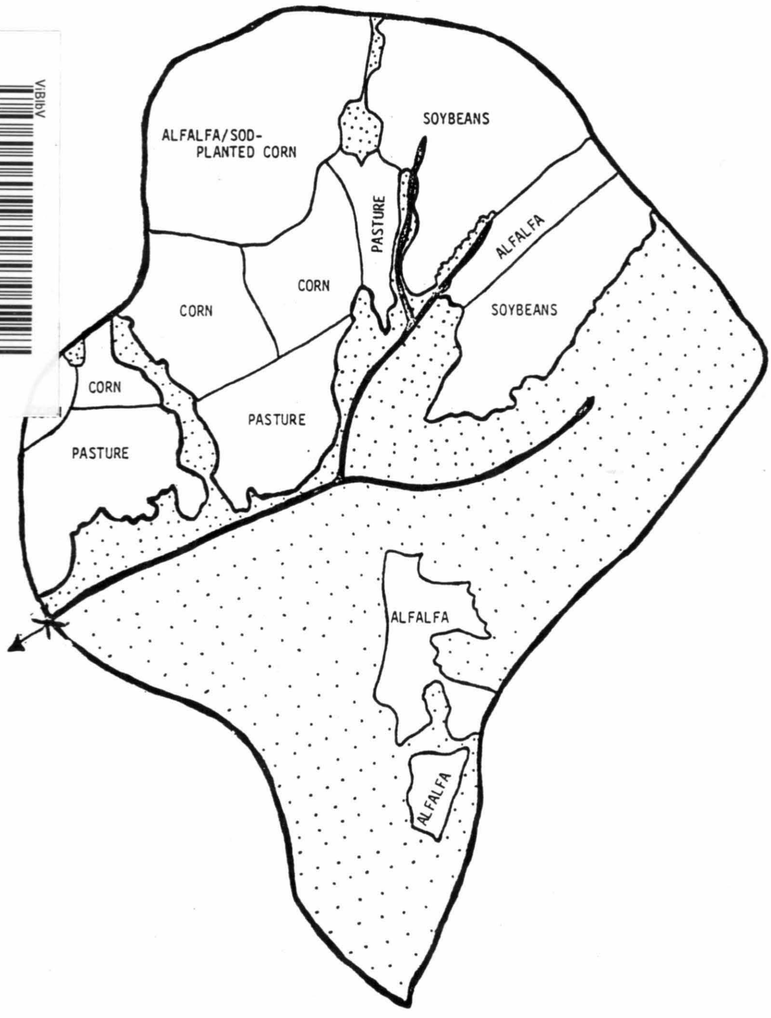
Finite Element
n Hydrograph Model
Users Guide

M.D. Smolen, B.B. Ross, T.M. Younos, and W.J. Sydor



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The Virginia Agricultural and Mechanical College came into being in 1872 upon acceptance by the Commonwealth of the provisions of the Morrill Act of 1862 "to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." Research and investigations were first authorized at Virginia's land-grant college when the Virginia Agricultural Experiment Station was established by the Virginia General Assembly in 1886.

The Virginia Agricultural Experiment Station received its first allotment upon passage of the Hatch Act by the United States Congress in 1887. Other related Acts followed, and all were consolidated in 1955 under the Amended Hatch Act which states "It shall be the object and duty of the State agricultural experiment stations . . . to conduct original and other researches, investigations and experiments bearing directly on and contributing to the establishment and maintenance of a permanent and effective agricultural industry of the United States, including the researches basic to the problems of agriculture and its broadest aspects and such investigations as have for their purpose the development and improvement of the rural home and rural life and the maximum contributions by agriculture to the welfare of the consumer . . . "

In 1962, Congress passed the McIntire-Stennis Cooperative Forestry Research Act to encourage and assist the states in carrying on a program of forestry research, including reforestation, land management, watershed management, rangeland management, wildlife habitat improvement, outdoor recreation, harvesting and marketing of forest products, and "such other studies as may be necessary to obtain the fullest and most effective use of forest resources."

In 1966, the Virginia General Assembly "established within the Virginia Polytechnic Institute a division to be known as the Research Division . . . which shall encompass the now existing Virginia Agricultural Experiment Station . . . "

THE FINITE ELEMENT STORM HYDROGRAPH MODEL

USERS GUIDE

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Abstract

The users guide presented herein provides a documentation of the Finite Element Storm Hydrograph Model (FESHM). FESHM is a distributed parameter watershed model structured to simulate the hydrology of flood-type events. A brief theory of the hydrologic model is outlined, and detailed instructions are provided for input data collection and preparation, model execution, and interpretation of results. Illustrative examples are presented to aid in proper use of the model.

Acknowledgments

Several agencies and many individuals have contributed toward the development of FESHM to date. The preparation of this users guide was financed with funds provided by the Virginia State Water Control Board. Appreciation is extended to those individuals who assisted in the development and critical review of this manuscript. Special acknowledgment is made to T. A. Dillaha, V. O. Shanholtz, and the techical staff of the Virginia State Water Control Board.

Disclaimer

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1. INTRODUCTION

This manual is intended as a guide to the use of the Finite Element Storm Hydrograph Model (FESHM). The procedure outlined herein consists of a series of interface programs and editing procedures to prepare input data for FESHM. Input to a distributed parameter model, such as FESHM, is necessarily complex because, in addition to time series data such as rainfall and evaporation, parameter values at a large number of different points across the surface of the watershed are required. The interface routines described provide a step by step procedure for setting up and checking data sets to be certain the watershed and storm descriptors can be correctly read and interpreted by the model.

The interface programs discussed are written in FORTRAN IV, and should, therefore, be useable on most computers. To facilitate running these programs at VPI&SU, two EXEC programs were written. These execs are not necessary for implementing the interface, but are included for users at installations where the EXEC2 language is available. At other installations, these EXECs can be replaced by whatever system-specific commands are needed to define the necessary input and output data files.

All of the data formatting required by FESHM is satisfied by the interface routines provided in this package. Most of the data set is built by the input programs; however, some procedures require the use of an editor. Although these editing functions are most easily performed on a full screen editor, such as XEDIT, a line editor would be adequate.

2. BACKGROUND

A basic problem facing modelers of natural watershed systems is that of accounting for the heterogeneities which are generally present. It has long been recognized that such factors as soil, land cover, management practice, and slope contribute to the variability in the runoff response from one drainage basin to another.

Computer-based mathematical models that predict the runoff response of a watershed system have been the subject of much research in recent years. Research efforts have focused on the development of hydrologic models that have the capability of simulating the flow response when a drainage area is subjected to some rainfall distribution. Many of these hydrologic models are lumped-parameter models in which non-uniform parameters--such as rainfall, soils, landuse and topographic characteristics--are weighted to obtain representative values for the entire drainage basin. These models are relatively easy to use when the necessary data requirements are available, but they are not readily adaptable to situations where spatial variations must be considered or where insufficient information for calibration exists.

The most significant advantage of a spatially responsive modeling concept is its ability to incorporate many facets of the natural watershed system to answer specific questions about the system's response to perturbation. Properly constructed, the modeling system can be used with data at varying degrees of resolution. However, when using very large units, the concept approaches that of a lumped model. Thus, the system may economically be used to analyze single land units, entire basins, or the effect of a single land unit on a larger watershed.

A model which integrates the spatial variability of soils, landuse, topography and rainfall, and minimizes the aggregation of those watershed-related properties that inherently can have tremendous spatial variability, should be capable of reproducing streamflows in the ungaged context. Investigators have for many years attempted to develop a hydrologic model with a reasonable degree of reliability in its output when applied to ungaged watersheds without prior optimization of model parameters. A model with this capability would have obvious benefits for application to watersheds which have not been monitored for streamflow. For a model to have this capability, it appears logical that the incorporation of spatiotemporal variations should improve the probability of successful quantity and related quality simulations.

The early development of FESHM in meeting the above goals was begun by Judah et al. (1). Later, Li et al. (2) and Ross et al. (3) developed the basic component relationships which comprise the current model. Subsequent modifications have occurred since then as well as substantial testing and application. An earlier users guide was prepared by Ross et al. (4).

Today's version of FESHM was constructed with the two main attributes discussed above given primary consideration, i.e., the spatial responsiveness capability in evaluating the effects of land treatment alternatives and reliability in applying the model to ungaged watersheds. FESHM is a distributed parameter hydrologic model, designed to simulate runoff and streamflow from a single rainfall event. It is based upon physical principles and uses a flexible distributed parameter structure to account for the spatial variability of watershed characteristics.

The fundamental concept of FESHM is that the complex watershed system can be subdivided, or discretized, into less complex subsets. These may then be analyzed independently, such that the response of the independent subsets can be assembled to simulate the overall system response.

3. THE HYDROLOGIC MODEL

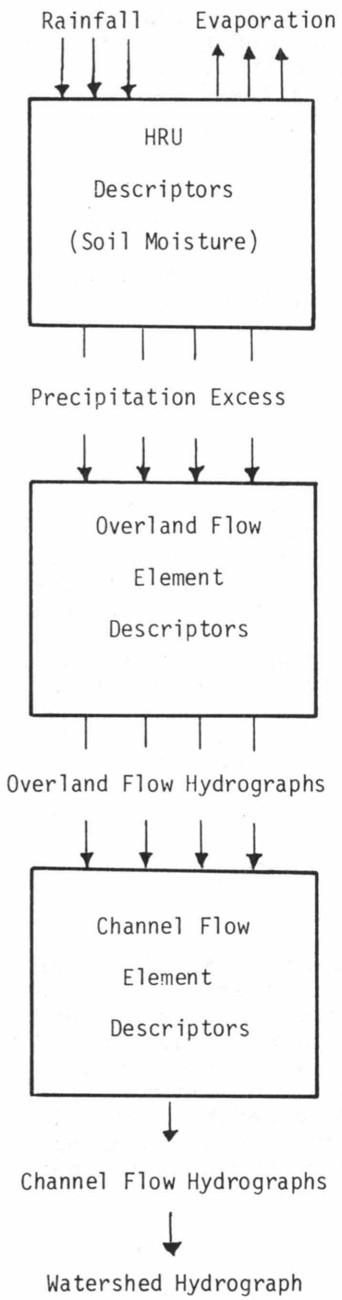
FESHM consists of three distinct submodels as shown in Figure 1. The first submodel computes infiltration and precipitation excess for each hydrologic response unit (HRU) in the watershed. The HRUs are defined by unique combinations of landuse and soil type. Precipitation excess from each HRU is passed to the overland flow submodel, which consists of a series of flow strips, each consisting of one or more overland flow elements. Flow equations are solved simultaneously for all elements of a flow strip, and the computed overland flow is passed to the channel flow submodel. The channel flow submodel also consists of a linear sequence of elements, to route flows to the watershed outlet.

3.1 INFILTRATION SUBMODEL

Incoming rainfall is partitioned between infiltration and precipitation excess by the Holtan infiltration equation [Holtan (5)]. This empirical model is used in lieu of more detailed solutions of the partial differential equations of unsaturated flow. The Holtan equation was selected from among many possible relationships because the equation parameters correspond to the criteria used to define HRUs. In addition to the successful use of this equation in FESHM applications, Shanholtz and Lillard (6) and Holtan and Lopez (7) have documented its applicability.

This model may be written as

FA = GINDEX*AFLU*STO**CEXP + FC (1)



<u>DATA NEEDS</u>

Land Use: Holtan's AFLU depression storage

Soil Characteristics: available water, slope class, final infiltration rate; C and K factors (USLE), precipitation, antecedent moisture conditions.

HRU Distribution
flow element area, length
relief,
average roughness (Manning's N)
and width

flow element length, relief
roughness (Manning's N) and
crossectional geometry

Figure 1. Structure and data needs for FESHM.

where FA is infiltration rate (in/hr),

GINDEX is a monthly growth index,

AFLU is a landuse cover factor,

STO is the available moisture capacity of the soil (in), and is a function of potential storage, STOMAX,

CEXP is a function of soil texture defined below,

FC is the final infiltration rate under prolonged wetting (in/hr).

The exponent CEXP is estimated from the following relationship

$$CEXP = FGW/FAW \qquad (2)$$

where FGW is the moisture capacity that is drainable by gravity, and

FAW is the plant available water capacity (moisture capacity between field capacity and wilting point).

Although this relationship is strictly empirical, it appears to work well within the range of parameter values specified by Holtan et al. (8) and Ross et al. (4).

Equation (1) relates the maximum infiltration rate or infiltration capacity for a given available moisture storage within a prescribed soil depth. If, however, infiltration occurs over a period of time, some of the storage capacity would be exhausted during that time, and the infiltration capacity at the end of the time interval would be lower than at the start. An iterative procedure, described by Holtan et al. (9), is used in the current version of FESHM to estimate the actual infiltration amount for each rainfall interval. At the conclusion of a rainfall interval, the soil moisture capacity is reduced by the amount of water that has infiltrated, and any drainable water is removed at the rate FC, if moisture content exceeds field capacity. The Holtan infiltration submodel accounts for the effect of vegetation on infiltration rate by parameter GINDEX*AFLU and for the effect of soil texture on the rate of filling the soil storage by parameters CEXP and STO. It also allows for recovery of infiltration capacity with parameter FC, as indicated in Figure 2.

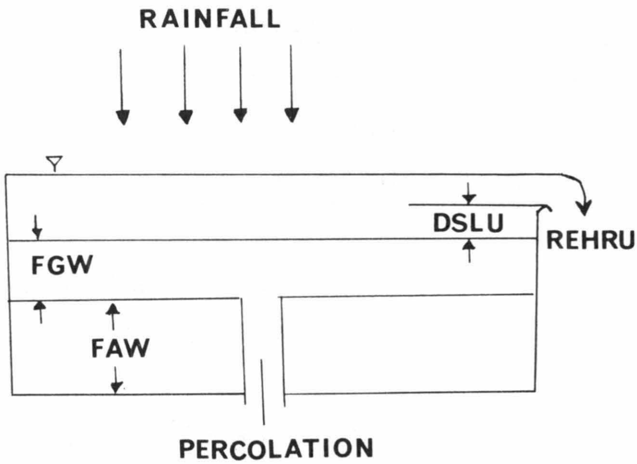


Figure 2. Schematic representation of the Holtan infiltration submodel.

FESHM requires rainfall data presented as amounts of rain during regular time intervals. Infiltration and percolation are computed for each time interval, and, as shown in Figure 2, any precipitation that does not infiltrate during the time step enters depression storage. When depression storage (DSLU) is satisfied, any remaining precipitation excess becomes runoff. On subsequent rainfall time intervals, water in depression storage may be depleted by infiltration. Evapotranspiration during storm events is not considered in the current version of FESHM.

3.2 COMPUTATION OF ANTECEDENT SOIL MOISTURE CONTENT

The soil moisture at the beginning of a storm event must be known in order to estimate the initial infiltration capacity using the Holtan submodel. This initial moisture may be entered by the model user, or it may be estimated internally as a percentage of the potential storage, STOMAX. In this latter case, an estimate of the mean daily evapotranspiration (EVP) for the month in which the storm event occurs and a record of daily precipitation (DAILPC) for the 30 days preceding the event are required. A simplified daily moisture accounting scheme is used to estimate the available moisture storage capacity (SMCWS) for each HRU during the 30-day antecedent period. This moisture accounting procedure is used only when the model user is attempting to simulate a historical storm. In a design mode, initial moisture is generally assumed to be 50 percent of field capacity. A wet weather storm, however, might have an initial soil moisture at or near field capacity.

3.3 OVERLAND FLOW SUBMODEL

To use the overland-flow submodel, the user describes the watershed as a series of flow strips that extend from the watershed boundary to a channel or channels. As shown in Figure 3, an overland-flow strip may consist of one or more overland-flow elements. Each element is considered to be a plane with a flow path, length, area, and a uniform slope. The width of the element is defined only at the downslope boundary (the lower node). Precipitation excess from HRUs appears uniformly along the length of each element during each computational time step.

For convenience and efficiency, overland-flow strips often consist of single elements. If, however, there are significant variations in slope or landuse across a strip, the distinct properties can be placed in separate elements.

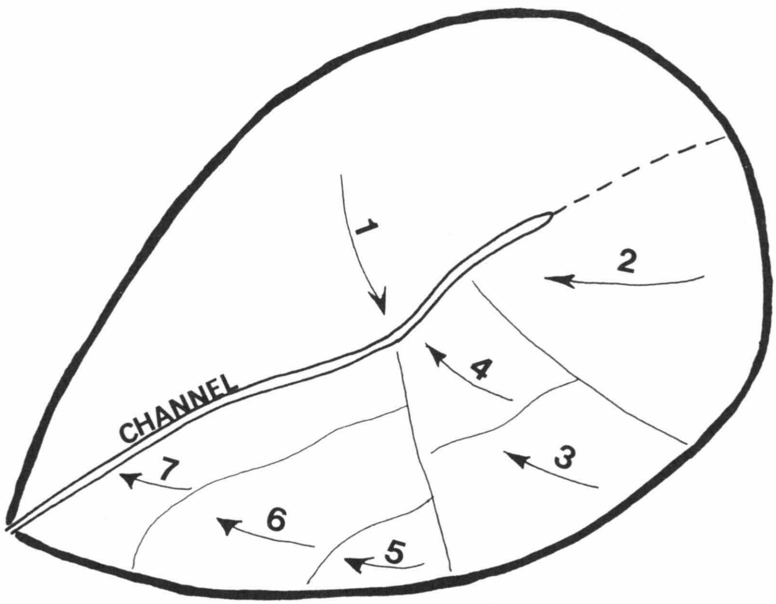


Figure 3. Example of watershed with four overland-flow strips and seven overland-flow elements. Arrows indicate general direction of flow.

A hydrograph can be obtained at the lower node of any flow element in the flow strip.

If there is more than one element in a flow strip, the overland flows at all nodes in the flow strip are computed simultaneously during each time step. Flow discharges from the lower element nodes of each flow strip for each computational time step are stored for later use as lateral input to the channel flow system.

The rainfall time interval must be an integer multiple of the overland flow computational time step. The selection of an overland-flow time step is generally a function of the length of the shortest overland-flow element and estimated maximum velocity of flow. In the event that very short element lengths result from a watershed discretization, elements should be combined whenever practical. Guidance in the selection of a computational time step for overland flow is provided in Section 5.2.8.1.

The finite element numerical procedure is used to solve the one-dimensional, unsteady partial differential equations of continuity and momentum. The well-known hydrodynamic equations applicable to both overland and channel flow, originally published by Saint-Venant in 1871, were selected. The kinematic wave approximation (KWA) is used to simplify these computations. Although some limitations are introduced by using the KWA, these limitations do not affect model results significantly except at very mild slopes. A warning is issued by the interface programs when KWA assumptions are violated by mild slope conditions. The finite-element solution technique is documented by Ross and Shanholtz (10) and Ross et al. (11).

3.4 CHANNEL FLOW SUBMODEL

The channel flow submodel is analogous to the overland-flow submodel. Whereas lateral input to the overland-flow submodel comes from HRUs, lateral input to the channel flow submodel comes from the downstream nodes of overland-flow strips. Because channel flow velocities are higher than overland flow velocities, a shorter computational time step is required for this submodel. The computational time step for the overland-flow submodel must be an integer multiple of the channel flow time step. Guidance for selecting a time step for the channel flow submodel is provided in Section 5.2.8.1.

Channel element lengths are equal to the widths of overland-flow elements adjacent to the channel, as shown in Figure 4. Four channel elements are described in Figure 4. A channel cross-section description must be provided at each channel element node. A general trapezoidal shape is assumed. This shape becomes triangular if the base is set to zero, and it becomes rectangular if the channel's base and topwidth are equal. A triangular cross-section is generally applicable to mountain streams or grassed waterways, and a rectangular channel may be appropriate for deeply incised channels that occur in large rivers or highly erodible soils. The depth parameter in the channel cross-section description is used to indicate the depth to full bank flow.

3.5 FLOW NETWORK DESCRIPTION

The channel system of most watersheds is best described as a "tree" structure, as shown in Figure 5. Each tributary defines a distinct subwatershed (or subshed) having only one channel. The uppermost node of a channel may be the wateshed boundary (a zero flow condition), the outlet of another subshed or the confluence of two or more subsheds. The interface program allows the user to assign names to the subsheds when defining the tree structure, e.g., subsheds ONE, TWO, THREE, FOUR, and FIVE in Figure 5.

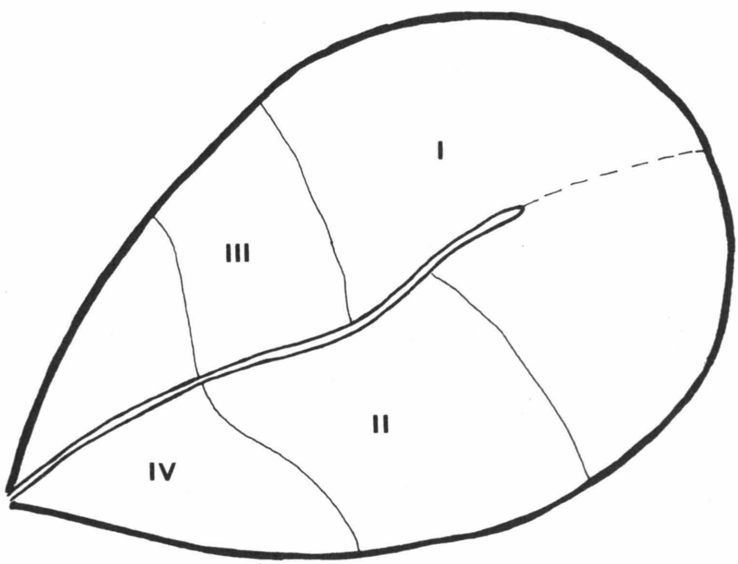


Figure 4. Channel flow submodel showing a channel with four elements.

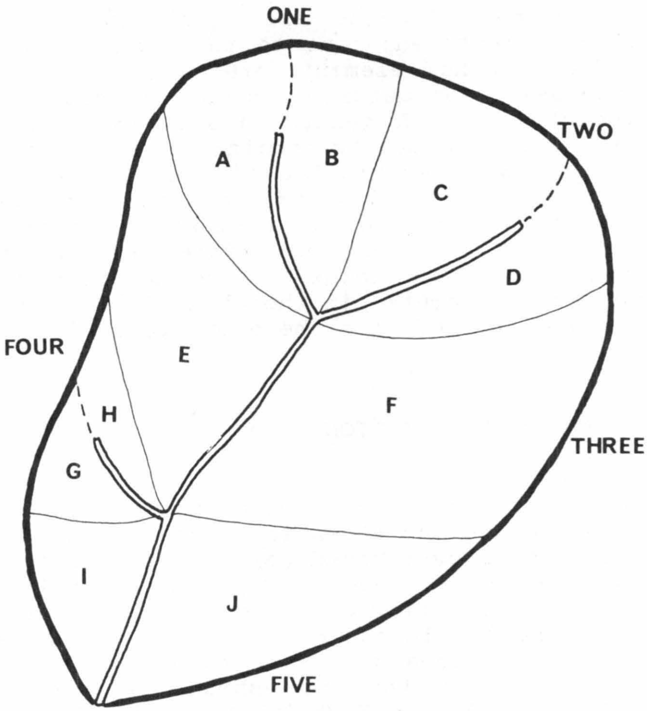


Figure 5. Discretization of flow network by defining subsheds ONE through FIVE. The uppermost channel nodes of subsheds ONE, TWO and FOUR receive no flow. The uppermost channel node of subshed THREE receives the combined outflow from subsheds ONE and TWO while the uppermost channel node of subshed FIVE receives the combined outflow from subsheds THREE and FOUR.

3.6 SPATIAL DESCRIPTION OF THE WATERSHED

A model watershed description for FESHM consists of at least one subshed, designated by name. A subshed always contains a channel and at least one overland flow strip. The overland-flow strips are designated by uppercase letters, A-Z (Figure 5). The numbering scheme for subsheds is arbitrary because the ordering of subsheds is defined by the tree structure pattern. The numbering scheme for overland-flow strips begins from the farthest upstream flow strip on the left side of the channel looking upstream for a given subshed. Flow strip input sequencing proceeds down the left side of the channel and then downstream along the right side of the channel. This numbering scheme is continued for the flow strips in the next subshed. A flow strip may be subdivided into overland-flow elements, each designated by Arabic numerals (Figure 3). Finally, the subshed channels consist of one or more channel flow elements, each designated by a Roman numeral (Figure 4).

3.7 IMAGINARY SUBSHEDS

When a tree structure is defined with a tributary confluence a short distance upstream from the watershed outlet, it is generally inconvenient to define a small subshed below the confluence. Instead, the outlet hydrograph is constructed by combining the hydrographs of the two lower subshed outlets. When the outlet hydrograph is formed in this way, without routing through the last channel segment, an imaginary channel is created which simply sums the hydrographs at the confluence.

4. SEDIMENT MODELING

4.1 GENERAL CONSIDERATIONS

Distributed parameter models are aptly suited to the simulation of erosion and sediment transport on a watershed scale. The FESHM sediment algorithm assigns rainfall detachment processes to HRUs such that detached soil particles are passed to the overland-flow routing submodel along with precipitation excess. Detachment or deposition of soil particles may occur in flow strips based on the amount of energy available in overland-flow. In FESHM, however, only sheet erosion is considered, and deposited sediment is not distinguished from the original bulk soil. Soil particles carried in overland-flow are routed to the channel where they are transported by channel flow. The model does not simulate gully erosion, channel scouring, or bed load transport. The simulation process follows the approach specified by Beasley et al. (12).

4.2 UPLAND PHASE

Detachment by raindrop impact is estimated by the following relationship:

$$DETRAI = 4702 * ECUSLE * EKUSLE * AREA * R^2 \quad (3)$$

where DETRAI is the rainfall impact detachment rate (kg/sec),

ECUSLE is the element cropping and management factor from the Universal Soil Loss Equation (USLE),

EKUSLE is the element soil erosivity factor from the USLE, in tons/acre/EI unit,

R is the rainfall intensity (in/hr).

Detachment due to overland-flow is expressed as

$$DETOFL = 338.4 * ECUSLE * EKUSLE * SLOPE * QPW \quad (4)$$

where DETOFL is detachment due to overland-flow (kg/sec),

SLOPE is surface gradient, and

QPW is the discharge per unit width (cfs/ft).

The total soil detached at any given time, DETSED, is:

$$DETSED = DETRAI + DETOFL. \quad (5)$$

A detached soil particle is transported from its overland-flow element if there is sufficient energy in the overland-flow. Otherwise, it is deposited in the element. The following transport functions presented by Beasley et al. (12) are used in FESHM to estimate transport capacity in laminar and turbulent flow:

$$TRNSPT=1.931*SLOPE*QPW^{0.5} \text{ when } QPW<0.00825 \text{ cfs/ft} \quad (6)$$

$$TRNSPT=2576*SLOPE*QPW^{2} \text{ when } QPW>0.00825 \text{ cfs/ft}$$

where TRNSPT is potential transport energy.

In each computational time step, total detached soil, DETSED, is compared with potential transport rate, TRNSPT. If DETSED is greater than TRNSPT, deposition occurs in the overland-flow element; otherwise all of the detached sediment is transported to the downstream element or the channel.

4.3 CHANNEL PHASE

The channel sediment routing process was derived from the approach given by Chen et al. (13) using a model referred to as the sediment continuity equation. This equation is solved using finite element procedures as outlined for the channel flow routing submodel and described in Ross et al.(11).

5. DATA NEEDS FOR FESHM

5.1 GENERAL REQUIREMENTS

A considerable volume of data must be obtained to create an accurate model description of a natural watershed. With a lumped parameter model, characteristics of subwatershed areas are averaged to estimate parameter values, and only a small number of parameters describe the entire watershed. With a distributed parameter model such as FESHM, however, each identifiable watershed characteristic can be assigned directly to the subwatershed area from which it was evaluated or measured. FESHM has an additional feature in that it uses an irregular grid that may represent a watershed in greater or lesser detail. Therefore, if ample data are available, the watershed may be represented with high resolution by FESHM, but if detailed data are not available, FESHM can still be used with resolution characteristic of a lumped parameter model.

5.2 SPATIAL DATA

5.2.1 Hydrologic Response Units (HRUs)

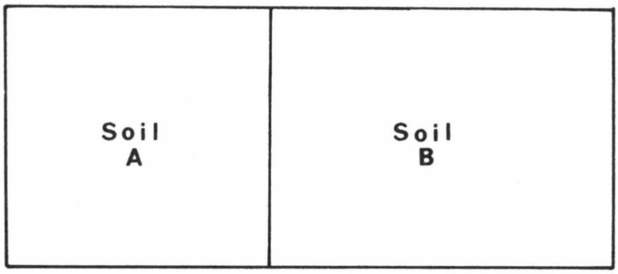
Hydrologic response units are delineated by overlaying a soil survey map and a landuse map as shown in Figure 6. Landuse characteristics are used to define the cover factor (AFLU), depression storage (DSLU), and roughness coefficient (RCLU). Guidance for selection of AFLU and RCLU for specific landuse types may be found in Ross et al. (4) and in Table 1. Potential depression storage (DSLU) values are given and are further modified internally depending on slope class of the soil combining with land use to form a given HRU. For sediment simulation, the cropping and management factor (ECUSLE) from the USLE [SCS-USDA (14)] must be defined for each landuse present in the watershed.

The soils information required are a description of the soil profile in terms of texture, bulk density, and information on the soil's water-holding capacity at various moisture tensions. Also necessary is the slope classification and, for sediment simulation, the soil erosivity factor from the USLE (14). The soil profile description is used to es-

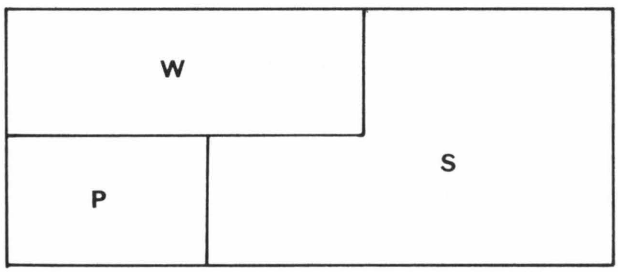
Table 1. Estimates for AFLU (Holtan Equation), RCLU and DSLU for selected landuse categories [Ross et al.(4)].

Land-use Index Code	Land-use	AFLU	RCLU	DSLU
1	Small Grain	0.30	0.08	0.15
2	Corn	0.20	0.08	0.15
3	Hay	0.70	0.25	0.30
4	Pasture	0.60	0.15	0.40
5	Tobacco	0.20	0.08	0.10
6	Dense Woods	1.00	0.45	0.50
7	Idle Land	0.70	0.25	0.30
8	Impervious (Roads)	0.00	0.02	0.05
9	Soybeans	0.40	0.08	0.15
10	Cotton	0.40	0.08	0.15
11	Sorghum	0.20	0.08	0.15
12	Fallowed	0.20	0.05	0.80
13	Light Woods	0.80	0.35	0.50
14	Homestead	0.50	0.15	0.40
15	Cemetery	0.80	0.15	0.40
16	Building and Lot	0.50	0.03	0.02
17	Pond	0.00	0.01	10.00

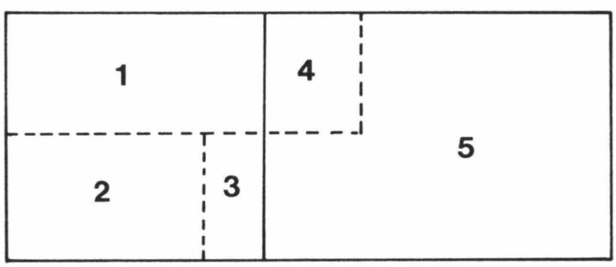
timate the thickness of the soil layer that controls the rate of infiltration. The control depth, while sometimes taken as the depth of the A horizon, may extend beyond the plow layer until some nonhomogeneity is observed. The description of the soil profile in terms of root penetration and color when available is particularly relevant because the absence of roots or the appearance of strong colors or mottling may indicate a restrictive layer.



Soils Map



Land Use Map



Overlay of Soils and Land Use Maps

Figure 6. Schematic illustration of the process for determining Hydrologic Response Units (HRUs).

Potential storage capacity, STOMAX, is selected as the amount of water a soil profile can contain between zero bars (saturation) and 15 bars (wilting point) tension. It may be estimated as:

$$TP = (1 - \frac{BD}{2.65}) * DEPTH \qquad (9)$$

where TP is total porosity,

BD is bulk density, and

DEPTH is control depth (in).

Total porosity may be used as an estimate of STOMAX.

Available water capacity, FAW, is defined as the moisture capacity in soil between tensions at field capacity (1/3 bar) and wilting point (15 bar). An estimate of this value is generally provided in the soil series description. Guidance in estimating this parameter from soil texture is provided in Ross et al. (4) and in Table 2.

Table 2. Estimates by texture of the water storage capacity of a soil [Ross et al. (4)].

Soil Texture	Gravitational Water Storage	Available Water Storage	Total Storage
	(in/in)	(in/in)	(in/in)
coarse sand	0.177	0.067	0.244
coarse sand loam	0.153	0.087	0.245
sand	0.190	0.133	0.323
loamy sand	0.269	0.101	0.370
loamy fine sand	0.272	0.054	0.326
sandy loam	0.186	0.123	0.309
fine sandy loam	0.235	0.131	0.366
very fine sandy loam	0.210	0.117	0.327
loam	0.144	0.156	0.300
silty loam	0.114	0.199	0.313
sandy clay loam	0.134	0.119	0.253
clay loam	0.130	0.127	0.257
silty clay loam	0.084	0.149	0.233
sandy clay	0.116	0.078	0.194
silty clay	0.091	0.123	0.214
clay	0.073	0.115	0.188

Gravitational water, FGW, is the moisture capacity between full saturation and field capacity. As implied by its name, water contained in this storage is assumed to drain by gravity. Guidance for estimating this parameter from soil texture is also provided in Ross et al. (4) and in Table 2. These moisture capacity relationships are represented schematically in Figure 7.

The final infiltration rate, FC, is generally estimated as the saturated hydraulic conductivity of the restrictive layer below the control depth. It may be estimated from the low end of the range of infiltration capacities specified in a soil series description. Alternatively, it may be estimated from the hydrologic groups shown in Table 3 [Li et al. (15)]. Soil assignments to hydrologic groups may be found in Chow (16) and SCS (17).

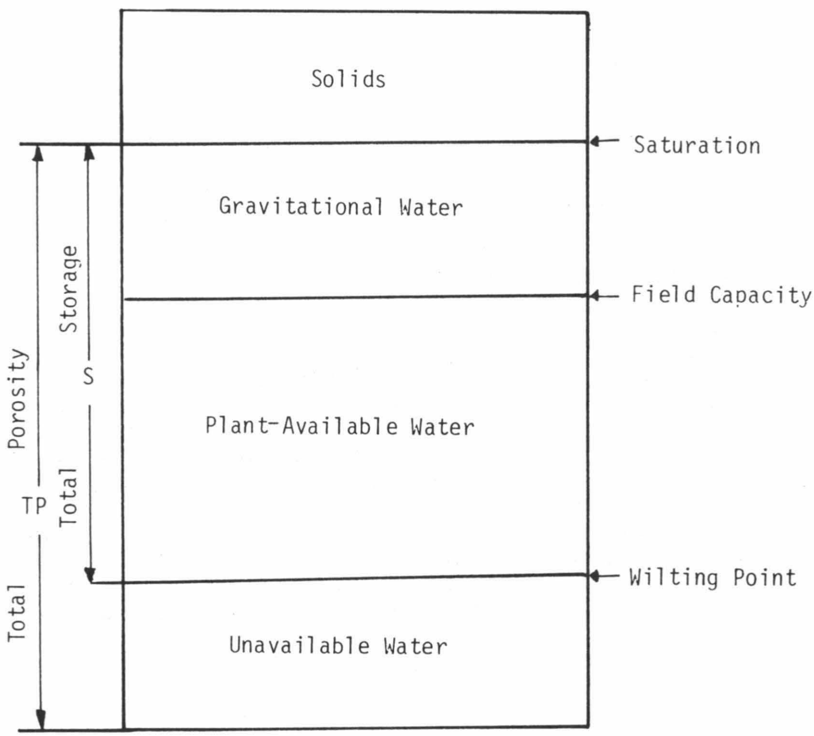


Figure 7. Schematic representation of the volume composition of soil.

Table 3. Estimates by soil hydrologic group of final infiltration rate [Li et al. (15)].

Hydrology Group	SFC
	(in./hr.)
A^+	0.450
A	0.400
A^-	0.350
B^+	0.300
B	0.250
B^-	0.200
C^+	0.150
C	0.100
C^-	0.075
D^+	0.050
D	0.025
D^-	0.000
Impervious	0.000

5.2.2 Subshed Definition

The first step in preparing watershed discretization data is to divide the watershed into subsheds. Although a watershed may be modeled as a single subshed, accuracy is generally improved by delineating subsheds for all main tributary drainage areas. Regardless of watershed size, it is possible to introduce a tremendous amount of complexity by modeling every defined drainage path as a channel. Such complexity is generally not warranted, however, and the short flow paths introduced cause an increase in computer time and storage requirements. As a rule-of-thumb, it is generally sufficient to include two levels of stream order in the model description, i.e., when modeling a third order watershed, second-order subsheds would represent the finest delineation.

5.2.3 Flow Strip Definition

Conceptually, flow strip boundaries are used to isolate the flow from adjacent overland-flow areas within the same subshed. Each flow strip is assumed to be homogeneous across its width. Although flow across a flow strip is seldom truly a uniform overland flow, flow through a large number of small channels behaves similarly to overland-flow. Therefore, land areas in the model for which no channel description exists and areas that are not of primary interest are generally modeled as overland-flow.

Flow strip boundaries need not be parallel and are generally placed on land features that appear to separate flow from adjacent strips. These boundaries may follow true ridge lines in the upper areas of the subshed. As they approach the stream channel, however, they do not converge as true divides would. Instead they meet the channel with a perpendicular intersection, thereby defining channel element nodes.

5.2.4 Overland Flow Elements

All overland-flow strips consist of one or more overland-flow elements. Element boundaries within a flow strip are defined to separate areas that have significantly different flow characteristics across their lengths, such as slope, relief, landuse, or different soil erodibilities. Element boundaries are generally placed along topographic contour lines. The actual length of the lower boundary of an element is taken as the element width. Slope of an element is computed internally from an estimate of relief, which is the difference between the upstream and downstream boundary elements.

An average flow path length must be provided for each element. When an element is highly irregular (Figure 8), the estimation of a proper flow path length can be difficult. Williams and Berndt (18) have described many techniques for estimating overland-flow path length. Satisfactory results have been obtained by measuring the longest flow path and adjusting this value by a factor of 2/3. Alternatively, a series of distinct flow paths may be averaged, as indicated in Figure 8.

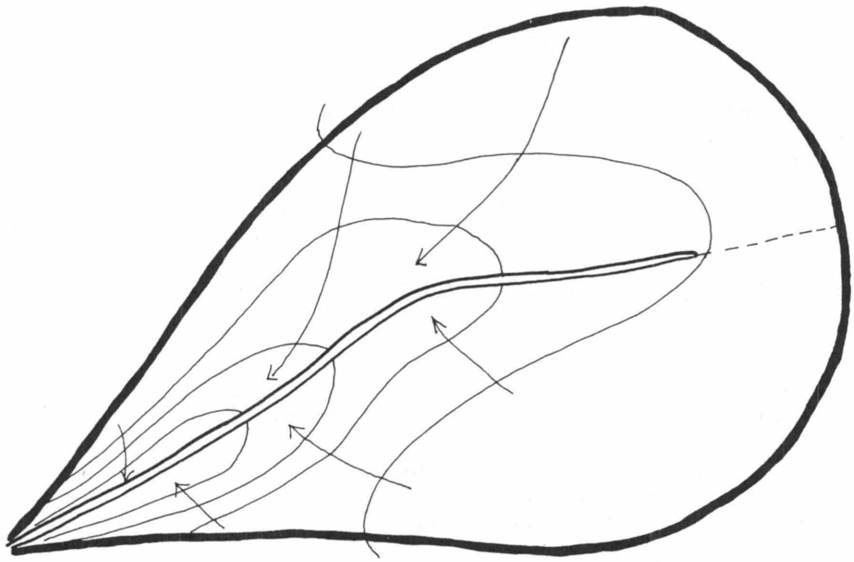


Figure 8. Overland-flowpaths in a hypothetical two-element subshed.

5.2.5 Assignment of HRUs to Overland Flow Elements

The characteristics of HRUs are listed in the input data set, and each HRU is given an index number. The description of each overland-flow element contains a list of HRUs with the fractional area of each HRU indicated. To obtain these data, the user must measure the area of each element, then determine the percentage of the element occupied by each HRU. These fractional areas are the basis for a weighting function to compute the amount of precipitation excess to be passed to the overland-flow element. The areal weighting function is also used to compute an average roughness coefficient for each overland-flow element for use in flow routing.

5.2.6 Channel Description

Channels are divided into one or more elements as determined by intersections with overland-flow strip boundaries. Although flow strip boundaries from opposite sides of the channel need not meet at the same channel node, care should be taken to avoid small offsets that introduce short linking channels. Short channel element lengths may require very small computational time steps that increase the cost of running FESHM.

Channel element description includes the channel length and relief between nodes, an estimate of channel roughness coefficient, and a description of channel cross-section geometry at the downstream node. Length is measured as the actual distance in feet following the path of the channel. The total length of channel elements in a subshed must equal the sum of the adjacent flow strip widths on each side of the channel. Guidance for selection of roughness for stream channels can be obtained in Chow (19). Channel geometry is described as a trapezoid where the user supplies base and top widths and the depth. As a default, for triangular cross-sections, the base width and depth are set to zero and the top width for a 2-foot depth must be given. The channel flow routing algorithm will also accept a rectangular cross-section when the user specifies the same dimensions for base and top width. The depth estimate provided by the user is assumed to be the depth for full bank flow. If this depth is exceeded during simulation, flow velocities may be higher than those which actually occur. The model issues a warning when this condition occurs.

5.2.7 Precipitation and Evapotranspiration Data

FESHM requires equal interval rainfall data, presented as inches of rain per time interval. Many sources of precipitation data are possible, such as the National Weather Service (NWS), the Virginia Water Resources Research Center (HISARS), and others. If data are obtained from NWS or HISARS, it is likely to be hourly or daily rainfall. Some distributional assumptions should be made to break these rainfall data down to reasonable estimates for shorter intervals, particularly for smaller watersheds. As a rule-of-thumb, it is recommended that the rainfall time interval be shorter than the watershed's time of concentration.

FESHM allows the user to enter different rainfall patterns for each overland-flow element by an indexing scheme. A rainfall sequence must be entered for each raingage in the watershed. (A common rainfall time interval must be used.) If the antecedent moisture accounting algorithm is used, a 30-day history of daily rainfall must also be provided for each raingage. Generally raingages are assigned to elements using a Thiessen polygon procedure described in hydrology texts.

5.2.8 Other Considerations for Spatial Data

5.2.8.1 Selection of Computational Time Step

The computational time step must be small enough to ensure proper solution of the equations of flow. When time steps are too large, oscillations and instabilities may occur in the simulated hydrograph. As a general rule, a conservative estimate of time step, T, is:

$$T = 0.2 * \text{minimum element length/maximum flow velocity} \quad (8)$$

As a rule-of-thumb, maximum overland-flow velocity is often estimated as 0.25 ft/sec. Therefore, an element length of 200-ft would result in a time step of 160 sec or less. Maximum channel flow velocity is often estimated as 10 ft/sec. Therefore, a 200-ft channel element would require a time step of 4 seconds or less. The channel flow time step (DTC) should be determined using the shortest channel element length in the watershed discretization. Likewise, the overland-flow time step (DTO) should be determined using the shortest overland-flow element length. The overland-flow computational time step should be an integer multiple of the channel flow time step. Likewise, the rainfall time interval should be an integer multiple of the overland-flow time step. Similarly, the print time interval for model output should be an integer multiple of the corresponding time series (overland-flow or channel flow) that is to be printed.

5.2.8.2 Data Resolution and Detail of Simulation

If FESHM were used to simulate watershed runoff processes at the level of detail it is capable of, data requirements and very large computer resources would be required. As in any modeling study, the model should be used to examine a clearly identified problem such that only relevant parameters and processes are considered. For example, to investigate the runoff or sediment load from an area in one-third of the watershed, it may be sufficient to use a detailed simulation of that area, and eliminate or lump the remainder of the watershed. Short, small area flow strips or channel elements should be combined with adjacent elements whenever they are not the focus of the modeling study or significant nonhomogenieties do not exist. Increases in simulation efficiency could easily justify the resulting loss of accuracy. In general, the level of data resolution and modeling detail should match the requirements of the study.

6. DATA PREPARATION ROUTINES

The FESHM interface package consists of four FORTRAN programs which prepare and check data sets for use in FESHM. The complete procedure for preparing an input data set for FESHM and modifying the data set for different analyses is summarized in Table 4. The first of these programs, RAINFALL, converts breakpoint rainfall records into rainfall increments received per time interval. The second, SETUP, consists of an interactive terminal session by which the user inputs fundamental watershed information and program descriptors; this input is used by the program to prepare input tables for detailed data entry. After the tables have been completed by manual editing of the data file, it is used as input to the third program, INTERFACE, which prepares a FESHM-compatible data set. The last program, DATATEST, is employed to check input formats for the model and identify parameter values which might present problems during a model run.

Two of these programs, INTERFACE and DATATEST, require no user inputs once the program and corresponding data files have been loaded into the computer. The source of the input data is specified by the file definition associated with IUNIT4 in the BLOCK DATA sections of the program. The two programs RAINFALL and SETUP require that the user input data at the terminal (terminal file definition is indicated by IUNIT5 for input and IUNIT6 for output); the RAINFALL program also requires an input data specified by the file definition associated with IUNIT4, and the format for the input data to be specified in IUNIT3 if the data are not in standard VPI format.

6.1 GENERAL GUIDELINES FOR USING THE INTERACTIVE PROGRAMS

1. Entering QUIT will terminate the program and will return the user to the computer operating system.

2. Except for the question regarding the name of the first subshed, an ENTER or CARRIAGE RETURN may be entered in response to any question. In most cases

Table 4. Data input procedure using the FESHM interface package.

STEP	ACTION	PROGRAM
1.	Prepare equal interval rainfall data set from break point data. Examine output graphically.	RAINFALL
2.	Describe watershed and storm event: a) Assign names to subsheds and land use categories. b) Designate number of channel elements, flow strips, elements, and HRUs. c) Specify duration of storm and number of raingages.	SETUP
3.	Generate physical description of watershed: a) Sequence the processing of subsheds and flow strips. b) Assign elements to flow strips, HRUs to elements, and raingages to HRUs.	INTERFACE
4.	Complete FESHM input data set; make changes or corrections. Add rainfall data to data set.	editor*
5.	Check FESHM input data set for errors.	DATATEST
6.	Run the model to simulate storm event runoff.	FESHM
7.	Examine model output. Return to Step 4 to make corrections or to modify input parameters.	

*any text editor

this action will invoke default parameter values; however, if the question is repeated, the CARRIAGE RETURN is not an acceptable response and at least one numerical value must be entered. The word HELP may be entered in such cases to obtain more information regarding the type of response required.

6.2 RAINFALL PREPARATION PROGRAM

The RAINFALL program is used to transform breakpoint rainfall data into equal interval precipitation data. In the current version of the program, the given breakpoint rainfall intensity is for the time period prior to the indicated time as presently generated by VPI digitizer programs.

The program has the capability of analyzing the data from a single storm or from a sequence of storms. In addition to preparing data for use in FESHM, the program also produces a graph of the storm intensity and total accumulation vs. time interval. If a sequence of storms is entered for analysis, a separate set of inputs compatible with FESHM is prepared. A storm is considered to be complete when a user-defined time interval has elapsed without any input rainfall. As a default, the program uses a time interval of two hours or more of no rainfall to distinguish between storms.

To run the program, you will need to check the format of the input data. If your data are not in the standard VPI breakpoint precipitation data format -- (9X, 3I2, 1X, 2I2, 45X, F10.5, 10X, F10.5) for month, day, year, hour, minute, rainfall intensity and accumulated rainfall, respectively -- the format of the data must be specified as the first record in the input file specified by IUNIT3. The breakpoint data are read from IUNIT4, the output FESHM-compatible data sets are written to IPUNCH, and the output graphs are written to IUNIT7.

When execution of the RAINFALL program begins, the first lines to appear on the screen are:

WELCOME TO THE V.P.I. EQUAL INTERVAL RAINFALL PROGRAM.
ENTER THE FIRST TITLE LINE FOR OUTPUT HEADINGS.

If you enter QUIT, the program will terminate and you will be returned to the computer's operating system. If you enter HELP, a message will be printed indicating that any input entered other than HELP or QUIT will be considered as a title to be printed as the heading line for the output data sets. A CARRIAGE RETURN will be interpreted as a blank title line.

In response to the question:

ENTER THE SECOND TITLE LINE FOR OUTPUT HEADINGS

Enter another line to be used as a title for output. If you wish to enter more than two title lines, you can do so by preceding the desired input title by '*** ' (3 asterisks and a blank) as a response to any of the questions which follow. The initial question will be repeated. If a single asterisk, 2 asterisks, or four asterisks are entered, whatever follows on the line will be considered as a comment line and the following line will appear on your screen:

COMMENT RECEIVED

You will now be requested to enter information regarding the storm characteristics and the format for the output graph(s).

ENTER THE RAINFALL INTERVAL IN MINUTES

Valid responses are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60. If you enter any other numerical value, an error message will appear indicating that the input value is incompatible with the program; a list of the acceptable values will be printed. If a CARRIAGE RETURN is input, the question is repeated. If an acceptable value and any other digit or combination of digits is input, program defaults will be invoked for all remaining parameters and you will be informed that data entry has been completed. Otherwise the following request will appear on the screen:

WILL THE DATA FILE CONTAIN MORE THAN ONE STORM? (Y/N/QUIT/HELP)

The default answer is YES and will be invoked if any response other than QUIT, HELP, or N as the first input character is entered. No problem will occur if YES is entered and there is data for only one storm. If, however, there is data for more than one storm, and two of the storms are widely spaced in time, you may receive a voluminous output with little significant content. If you wish to change the time interval of zero rainfall input used to distinguish between two storms, enter the number of hours of zero rainfall on the same line and following the YES response to this question.

You will then be asked if you would like to have a graph of the data prepared:

DO YOU WISH TO HAVE A GRAPH OF THE PRECIPITATION DATA?

The default answer is YES; in most cases you would like to compare the hydrograph output with the original storm data so that you can verify that the watershed and storm data were correctly interpreted by the model. If, however, the data set is large and contains several storms, you may not wish to see a graph of each storm. Under such circumstances, a NO answer would be appropriate. If you would like to have a graph but wish to change the scale used on the graph, enter the maximum desired graph scale for rainfall intensity and the maximum desired graph scale for accumulated rainfall on the same line and following a YES response to this question.

The next question to appear on the screen will be:

IS YOUR INPUT DATA IN THE STANDARD VPI FORMAT? (Y/N/QUIT/HELP)

The standard VPI format requires that your data not only fit the specified format given above, but also that the input be given in units of inches per hour and that the given rainfall intensity is for the time period prior to the indicated time. The standard VPI format is incorporated as a data (integer) input in the BLOCK DATA section of the program. You will be prompted to give a conversion factor if your data is not in the units of the standard VPI format. The format for data entry will be read from IUNIT3. If the rainfall intensity is not for the period prior to the indicated time, the current version of the RAINFALL program will be unable to process your data correctly.

You have now completed entry of the program control parameters. Graphs for each storm will appear in output IUNIT7 and FESHM-compatible data sets will appear in output IUNIT8.

6.3 SETUP PROGRAM

The setup program is used to prepare tables of input data which will be checked by the INTERFACE program. After the SETUP program has been run, you will edit the output to add details to the input data, change program-generated default values, and correct any errors which may have been identified.

Once the FORTRAN program has been compiled and loaded, the following lines will appear on the terminal screen:

WELCOME TO THE V.P.I. FESHM INTERFACE PROGRAM.
ENTER TITLE LINE FOR THE WATERSHED CHARACTERISTICS DATA SET:

Any entry, except QUIT, will be considered as an input title and will be written as the first line of the output data set generated by SETUP. Entering QUIT will terminate the program and no output data set will be generated.

After your input title has been accepted, you will be requested to input information regarding names of subsheds and the relationships of subsheds to one another. Subshed names are assigned in the ordering convention described in Section 3.5. In response to the question:

ENTER THE NAME OF THE FIRST SUBSHED.

you are to enter the name of the farthest upstream subshed.

In response to the question:

ENTER THE NAME OF THE SECOND SUBSHED AND ITS TRIBUTARY SUBSHEDS:

you are to enter the name of the second subshed in your subshed ordering convention.

This question is repeated for the third, fourth, etc., subsheds. The SETUP program will accept up to 32 subsheds even though some versions of FESHM may not be dimensioned for more than 10 subsheds. If the given subshed receives its inflow from the confluence of two or three subsheds (in FESHM no subshed can have an upstream flow boundary formed by the confluence of more than than three subsheds), also enter the names of the subsheds which are immediately above it (i.e., subsheds which provide tributary inputs to downstream subshed channel flow). If two or three subsheds join at the outlet of the watershed and do not flow through another subshed before leaving the watershed, enter a colon (:) as the name of the subshed and enter the names of the tributary subsheds. This is the imaginary subshed description referred to in Section 3.7. After the last subshed has been entered, enter a CARRIAGE RETURN to terminate the input of additional subshed names. The input of subshed name descriptors and drainage relationships is now complete.

NOTE: The name of a tributary subshed should be the name of one of the previously assigned subshed names. A subshed should not be a tributary subshed to more than one downstream subshed. With the exception of the outlet subshed, each subshed should be a tributary to a downstream subshed. If any of these conditions is violated, possibly due to a spelling error during data input, a warning message will be printed in the output data set.

You will now be asked to enter the number of overland-flow elements in the total watershed. If a CARRIAGE RETURN or a number less than the number of subsheds is entered, the program will continue to the next step but a warning message will be written to the output file indicating that the input value for the number of elements was less than the number of subsheds (NTSS) and that NTSS was entered as the value for the total number of elements.

You will next enter information describing the overland and channel flow characteristics for each of the subsheds previously defined. The following statement will appear on your terminal:

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, AND NUMBER OF FLOW STRIPS ON THE LEFT SIDE OF THE CHANNEL FOR
SUBSHED "XXX".,

where "XXX" is the name of the first subshed entered. In response to this question you should respond with 3 positive integers, corresponding to the number of channel elements in subshed "XXX," the number of overland-flow strips it contains, and the number of flow strips on the left side of the channel looking upstream. A CARRIAGE RETURN will result in the question being asked again. The number of channel elements must be greater than or equal to one and cannot exceed the number of flow strips. The number of flow strips on the left side of the channel may be as few as zero, in which case the number of flow strips on the right side of the channel must be equal to the total number of flow strips in the subshed. Likewise, the number of flow strips on the left side of the channel may be equal to the total number of flow strips in the subshed, resulting in no flow strips on the right side of the channel.

After these values have been correctly entered, the terminal will respond with:

ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED "XXX".

Enter one positive integer value corresponding to each flow strip in subshed "XXX."

The overland and channel flow counters have now been entered. The preceding two steps will be repeated at the terminal for each of the remaining subsheds, with "XXX" being replaced by the appropriate subshed name. The program now generates tables in the output data set which contain the flow strip alphabetic indicators and channel flow element Roman numeral indicators for each subshed.

You will next be directed to enter information regarding landuse descriptors for the complete watershed:

ENTER THE NAMES TO BE USED FOR EACH LANDUSE CATEGORY:

For each landuse in the watershed, enter an eight-character, or shorter, descriptor. You may also input values unique to each landuse corresponding to cover factor (AFLU), depression storage (DSLU), and roughness coefficient (RCLU). If one or more of these values are entered, you should insure that the first number does not begin until column nine of the input record; the first eight characters, including blanks, are assumed to be the landuse name. Alternatively, you may enter a CARRIAGE RETURN and enter the landuse descriptors at a later time during the manual editing session.

You will now be requested to input a value which describes soil moisture conditions prior to the onset of the storm:

ENTER THE ANTECEDENT SOIL MOISTURE:

If you wish to use a particular value for the antecedent soil moisture (SMCWS) throughout the watershed, enter its value, as a fraction of plant-available water, at this time. Otherwise enter a CARRIAGE RETURN or zero.

It is now time to enter the HRU descriptors:

ENTER THE TOTAL NUMBER OF UNIQUE HRUs:

If you wish to enter the HRU descriptors at another time, enter a CARRIAGE RETURN. Otherwise, enter the number of unique HRUs in the watershed. The program will now write HRU descriptor tables into the output data set.

You will now be asked to provide a title which will be used in the output from FESHM.

ENTER A TITLE LINE FOR THE COMBINED BASIN AND STORM DATA SETS:

As in the first title input request, entering QUIT will result in termination of the program; however, previous input will be retained in the output data set. Any other characters entered will be considered as a title for the output data set.

You will now be asked to provide information regarding the model output control descriptors:

ENTER THE NUMBER OF HOURS IN THE DISCHARGE RECORD:

In response to this question, enter the number of hours to be used for model calculations. If HELP, a value less than one, or a CARRIAGE RETURN is entered, the default value of 5 hours will be implemented. If HELP or a CARRIAGE RETURN is entered, the next two data input requests will be bypassed. If HELP is entered, a message will appear at the terminal screen indicating that default values were employed.

ENTER VALUES FOR THE OVERLAND FLOW PRINT FREQUENCY INDICATOR (SECONDS) AND THE OVERLAND FLOW CALCULATION INTERVAL:

Enter the values you wish to employ for parameters NOPRIN, the overland-flow printing interval, and DTO, the overland-flow time step. NOPRIN must be an integer multiple of DTP. Entering a value less than zero, HELP, or a CARRIAGE RETURN will invoke default values. If HELP or a CARRIAGE RETURN is entered, the next data input request will be bypassed.

ENTER VALUES FOR THE CHANNEL FLOW PRINT FREQUENCY INDICATOR (SECONDS) AND THE CHANNEL FLOW CALCULATION INTERVAL:

In response, you now enter the values you wish to use for parameters NCPRIN, the channel printing interval, and DTC, the computational time step. NCPRIN must be an integer multiple of DTC. Entering a value less than zero, HELP, or a CARRIAGE RETURN will invoke default values. The model control and output print designators will now be written to the output data set.

Your terminal will now request storm descriptive information:

ENTER THE NUMBER OF RAIN GAGES TO BE EMPLOYED:

You should enter a positive integer in response to this question. A value less than one, HELP, or a CARRIAGE RETURN will invoke the default value of one.

The SETUP data input program is now complete and you will be returned to the computer operating system. The output will be found in the file corresponding to the file definition associated with IUNIT7 in the program. This file is now available for correction and the addition of further data by manual editing. A line-by-line description of the contents of this file and how to prepare it as the input data set to the INTERFACE program is given in the section which follows.

6.4 INTERFACE PROGRAM

Before running the INTERFACE program, it is necessary to complete the input data set which had been initialized via the SETUP program. Upon editing the file, all lines beginning with an asterisk (*) are considered as user input comments and are ignored by the program. They may be deleted from the data set without affecting program output, but they are provided to make the input to INTERFACE easier to read and to provide identifiers for the parameters. Any line whose initial character is not an asterisk is an input data statement for the program, and the values or characters on these should be verified to correspond to the desired values of the input parameters.

The first line is the data set title and may contain up to 80 characters.

The next lines of input describe subshed names and relationships among subsheds. Each of these lines begins with the following statement:

TRIBUTARIES TO SUBSHED

The subshed names are eight characters long and begin in column 35. Each subshed which is upstream from another subshed is considered as a tributary subshed to the downstream subshed. Except for the farthest downstream subshed, each subshed must be a tributary subshed to another subshed or contribute directly to the watershed outlet. The watershed outlet is indicated by 8 blank spaces and a colon in columns 35-43. A subshed can be a tributary to only one downstream subshed. If the first of these two conditions is violated, the following warning message will have been generated by the SETUP program:

* ERROR: SUBSHED "XXX" HAS NOT BEEN ASSIGNED AS A TRIBUTARY SUBSHED NAME.

If the second condition is violated, the following warning message will appear:

ERROR: THE NAME 'XXX' HAS ALREADY BEEN ASSIGNED AS A SUBSHED NAME.

If either of these messages should occur, incorrect boundary condition codes will be assigned in the FESHM compatible data set and the model output will be invalid. If either message occurs, you should carefully check the spelling of subshed names and the relationships among subsheds. Correct any errors which occur here using the available text editor. The subshed name and relationship inputs are terminated by the words

END OF SUBSHED DESCRIPTOR INPUT

beginning after column 34.

The next input line is for the total number of elements (NTELES) in the watershed. Verify that the number in this line corresponds to the number of elements in the watershed. The setup program also produces a line indicating the number of subsheds present. This line begins with an asterisk and is given only to provide you with a tally of the number of subsheds.

You must next input the descriptors for overland and channel flow. The SETUP program generates tables of these parameters for each subshed. Using the text editor, you add values for overland flow length (XLEN), relief (RELIEF), element area (AREA), and width (TWIDTH) for each element in the flow strip. Similarly you add values of channel length (XLEN), relief (RELIEF), roughness coefficient (RCOEF), top width (TWIDTH), depth (HT), and the base width of the trapezoid (BASE) for each channel element. Verify that the number of channel elements, number of flow strips, and number of flow strips on the left side of the channel correspond to those present in each subshed.

The next section of the model input describes landuse characteristics. The first eight columns of each input record are reserved for a landuse name, and the next twelve columns are reserved for assignment of a landuse number. Thus, since the program uses a format-free input read through subroutine FREERE, the parameter values for cover factor (AFLU), depression storage (DSLU), and roughness coefficient (RCLU) may be entered in any columns following column 20, with each parameter value being separated from the next by at least one space. If the same landuse descriptors are to be used for different watersheds, the names and parameter values for landuse characteristics could be stored in a separate file and the file copied into each watershed file when needed. The end of the landuse descriptor input is indicated by a line containing the following phrase beginning after column 20:

END OF LANDUSE DESCRIPTORS

The next input line contains the value of SMCWS, the antecedent soil moisture for the watershed. If you wish the model to utilize antecedent rainfall and evapotranspiration characteristics to calculate this value for each HRU, this should be zero. Otherwise, verify that the correct value, as a fraction of plant-available water, has been entered.

Default values are assigned by SETUP for the growth index coefficients (GINDEX), and for the evaporation coefficients (EVP) if SMCWS equal zero. These values should be changed to correspond to the regional characteristics of the watershed under study.

You will now need to enter the HRU descriptors. If HRU information is available in a data file, this file may be copied directly into the watershed data set. Otherwise, enter the values of parameters corresponding to landuse number (defined by the index number associated with each landuse category defined previously), the slope class (SLOHRU), available water (FAW), gravitational water (FGW), final infiltration rate (FC), control depth (DEPTH), HRU cropping and management factor (CUSLE), and HRU soil erosivity factor (XKUSLE). NOTE: The value of slope class, an alphabetic character, must be adjusted to reflect the correct value in column 24. HRU input is terminated by the line:

END OF HRU DESCRIPTOR INPUT

The SETUP program writes a value of one as the number of HRUs in each watershed element. Correct this line of input data to reflect the actual number of HRUs per element. Then for each element enter the HRU number and fractional area for that HRU in each element. For each additional HRU present in any element, you will need to add lines containing the additional HRU identifying number (IHRU) and the fraction of the HRU it covers (FHRU). The sum of the fractional areas for each element should be 1.0. The values of IHRU may be entered in any column following column 35. This section of the data set is terminated by the line:

END OF ASSIGNMENT OF HRUs TO ELEMENTS

The next line of the data set is the title line which will be employed as the title for the FESHM output. Next, check that NHOURC corresponds to the number of hours you would like in the discharge record. The next two parameters, NTBLHS and NTBLPE, are set by defaults in the program and designate whether or not tabulated HRU and precipitation excess data, respectively, are to be printed as output. Verify that these values properly indicate the detail of output you require. The overland and channel flow calculation intervals are the time steps used in the model calculations (DTO and DTC, respectively). Verify that these are the values you wish to employ. NOPRIN and NCPRIN were input to the SETUP program and indicate the frequency at which outputs should be printed. Verify that these parameters are correctly entered.

The next lines provide the print codes for overland (NPOVER) and channel (NPCHAN) flow. As a default, these were set to zero by SETUP. A '1' code indicates that output will be printed for the corresponding flow regime. If you wish to use values other than zero for selected elements, enter the appropriate codes in the appropriate columns. If a '2' code is entered for one or more values of NPOVER, you will need to add an additional two lines for each '2' code entered to indicate the specific element notes in a flow strip at which overland flow output is desired.

Verify that the number of raingages is entered correctly. If the number of raingages is greater than one, check the raingage assignment to each overland flow element. The data should include a heading line indicating the date, starting time, duration in seconds, and number of hours of rainfall. For each raingage you will need to provide precipitation data and, if SMCWS is 0.0, daily rainfall data for the preceding 30-day period. The correct precipitation data format may be obtained for the storm event by inserting the RAINFALL-generated data set. Verify that you have copied the correct number of precipitation records based on the precipitation interval and the duration of the storm, e.g., if the precipitation interval was 5 minutes (300 seconds) you would need 1-1/2 lines of precipitation data for each hour of storm since these are eight values per line. The antecedent moisture is entered directly at the terminal with eight entries per line. The input data set is now complete.

The FESHM compatible data set is generated by running INTERFACE with the input data set read by IUNIT4. Two outputs are prepared:

1. Output to IUNIT8 is the FESHM compatible data set.

2. Output to IUNIT7 is a 133-characters-per-line file (including carriage control) and contains diagnostics from error checking functions as well as a copy of the input data. This data file should be checked for errors before submitting the contents of IUNIT8 for a FESHM model run.

6.5 WARNING MESSAGES & ERROR MESSAGES GENERATED BY THE INTERFACE PROGRAM

1. ERROR: TRIBUTARY SUBSHED XXX WAS NOT PREVIOUSLY DEFINED The name of each tributary subshed must be identical to one of the previously input subshed names. Check spelling carefully.

2. ERROR: THE NAME XXX HAS ALREADY BEEN ASSIGNED AS A SUBSHED NAME You have assigned the name 'XXX' as a tributary to two or more subsheds. This duplication is not allowed. Check the relationships among subsheds and eliminate the incorrect duplication.

3. ERROR: SUBSHED XXX WAS NOT ASSIGNED AS A TRIBUTARY SUBSHED Except for the farthest downstream subshed (or subsheds if they join at the outlet of the watershed), each subshed must be a tributary subshed to another watershed. Assign the name XXX as the tributary to the appropriate downstream subshed.

   NOTE:

   ERRORS 1-3 should not occur as they should have been detected and corrected during the execution of the SETUP program. This error checking is provided to verify that subshed relationships have indeed been entered correctly. Otherwise the FESHM outputs will be invalid.

4. WARNING: OVERLAND FLOW SLOPE MAY NOT BE SUFFICIENTLY STEEP TO YIELD VALID RESULTS. Check your input data for length and slope. This message does not necessarily mean that output will be invalid; however, you should check the model outputs carefully for oscillations and to verify that they follow a hydrographic pattern. A similar warning message may appear when channel flow slopes are too mild.

5. ERROR: THE SUM OF LEFT-HAND FLOWSTRIP TOPWIDTHS (#) SHOULD EQUAL THE SUM OF RIGHT-HAND FLOWSTRIP TOPWIDTHS (#). The sum of overland flowstrip topwidths on the left and right hand sides of the channel should be equal. Check the entered data values for each topwidth.

6. ERROR: THE SUM OF CHANNEL ELEMENTS SHOULD EQUAL THE SUM OF LEFT-HAND FLOWSTRIP TOPWIDTHS. Check the data entries and sums of channel element lengths and flowstrip topwidths.

7. THE SUM OF THE FRACTIONAL AREAS FOR ELEMENT 'J' IS 'nnn' AND SHOULD BE CLOSE TO ONE. CHECK THE ASSIGNMENT OF HRU's TO ELEMENTS AND THEN THE FRACTIONAL VALUE OF EACH HRU WITHIN THE ELEMENT. The error message will occur most frequently if the number of HRUs per element has not been correctly assigned. Verify that you have the same number of HRU's in each element as you had specified in the HRU to element assignment data input line. If these values match, check that you have correctly entered the values of fractional area for each HRU within the indicated element. This message will appear only for the first 5 occurrences of this error.

8. WARNING: THE TIME STEP FOR OVERLAND FLOW MAY NOT BE SUFFICIENTLY SMALL TO YIELD VALID RESULTS. AN ESTIMATED MINIMUM TIME STEP FOR OVERLAND FLOW IS 'xxx'

   If this warning message occurs, you may wish to reconsider the time step you had originally planned on using, but it does not necessarily mean that the model will produce invalid results with the original time steps; however, you should check the output carefully for oscillations and reasonableness of results.

6.6 DATATEST PROGRAM

This is a stand-alone program which may be used with either an INTERFACE-generated data set or with an independently-developed data set for FESHM. As input it requires only the data set (IUNIT4) which is to be checked for compatibility with FESHM. One data set is generated, which is an annotated listing of the input data and any warning diagnostics (IUNIT7). You should check any error or warning diagnostics. The messages produced are similar to those produced by INTERFACE (see Section 6.5). You should also check that parameter values match those of the watershed and that program control parameters are correct.

7. DEMONSTRATION OF FESHM USERS GUIDE

7.1 WATERSHED DESCRIPTION

The Cunningham Creek watershed was the prototype watershed selected for a demonstration of the FESHM Users Guide. Cunningham Creek (285.60 ac) is a part of the Bush River drainage basin which is located on the edge of the Piedmont physiographic province of Virginia.

Figure 9 shows a contour map of the Cunningham Creek watershed which was obtained from a 7.5 minute series topographic map. The watershed has an average slope of 2.5 to 10 percent. Some slopes on the lower part of the watershed approach 20 percent.

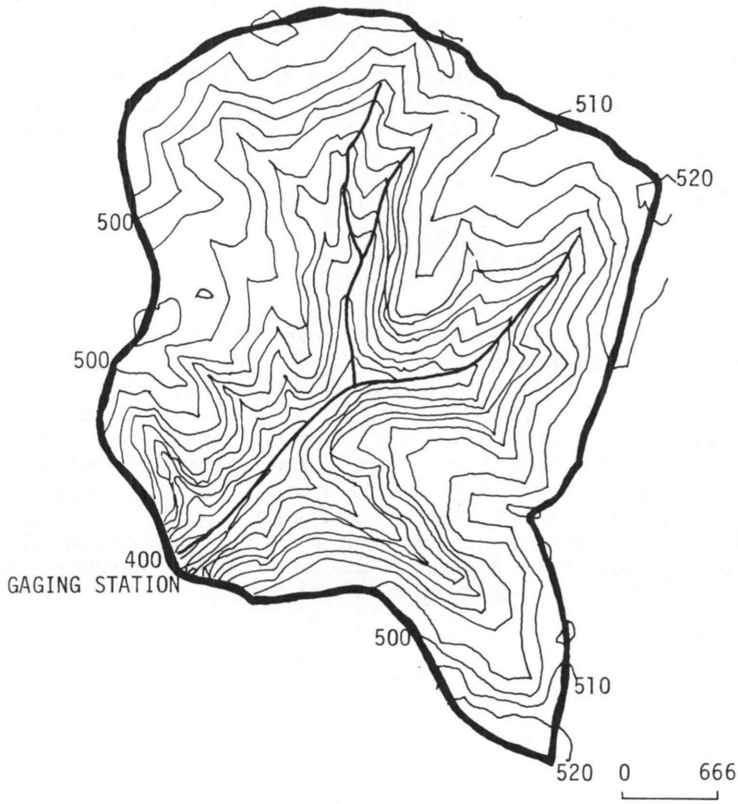
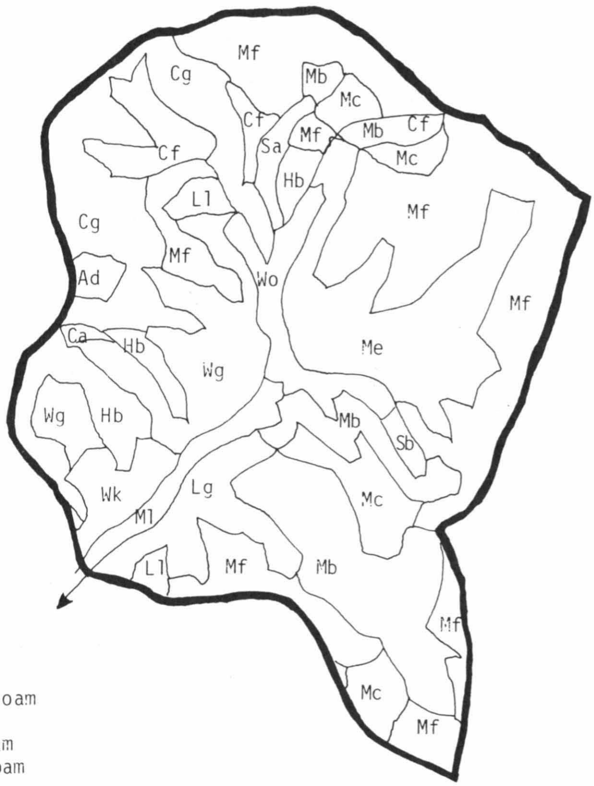


Figure 9. Topographic map of Cunningham Creek watershed.

Soil types of the Cunningham Creek watershed are typical of the lower Southeastern Piedmont watersheds. The cropped portion of the watershed contains Cecil fine sandy loam and Madison clay loam predominantly; the pasture includes Wilkes sandy loam and Helena fine sandy loam; the forested areas are primarily Madison fine sandy loam and clay loam; and the area along the stream consists of mixed alluvium and Worsham sandy loam. In addition, this watershed includes smaller scattered areas of Seneca fine sandy loam, Starr loam, Louisa fine sandy loam, Appling fine sandy loam, and Cecil clay loam. Figure 10 illustrates the distribution of these soil types.



Soil Types

Ad	Appling fine sandy loam
Ca	Cecil clay loam
Cf,Cg	Cecil fine sandy loam
Hb	Helena fine sandy loam
Ll,Lg	Louisa
Mb,Mc	Madison clay loam
Me,Mf	Madison fine sandy loam
Ml	Mixed alluvium
Sa	Seneca fine sandy loam
Sb	Starr loam
Wg,Wk	Wilkes sandy loam
Wo	Worsham sandy loam

Figure 10. Soil map of Cunningham Creek watershed.

The landuse in Cunningham Creek watershed is approximately half agricultural and half forested. Figure 11 shows landuse distribution throughout the watershed.

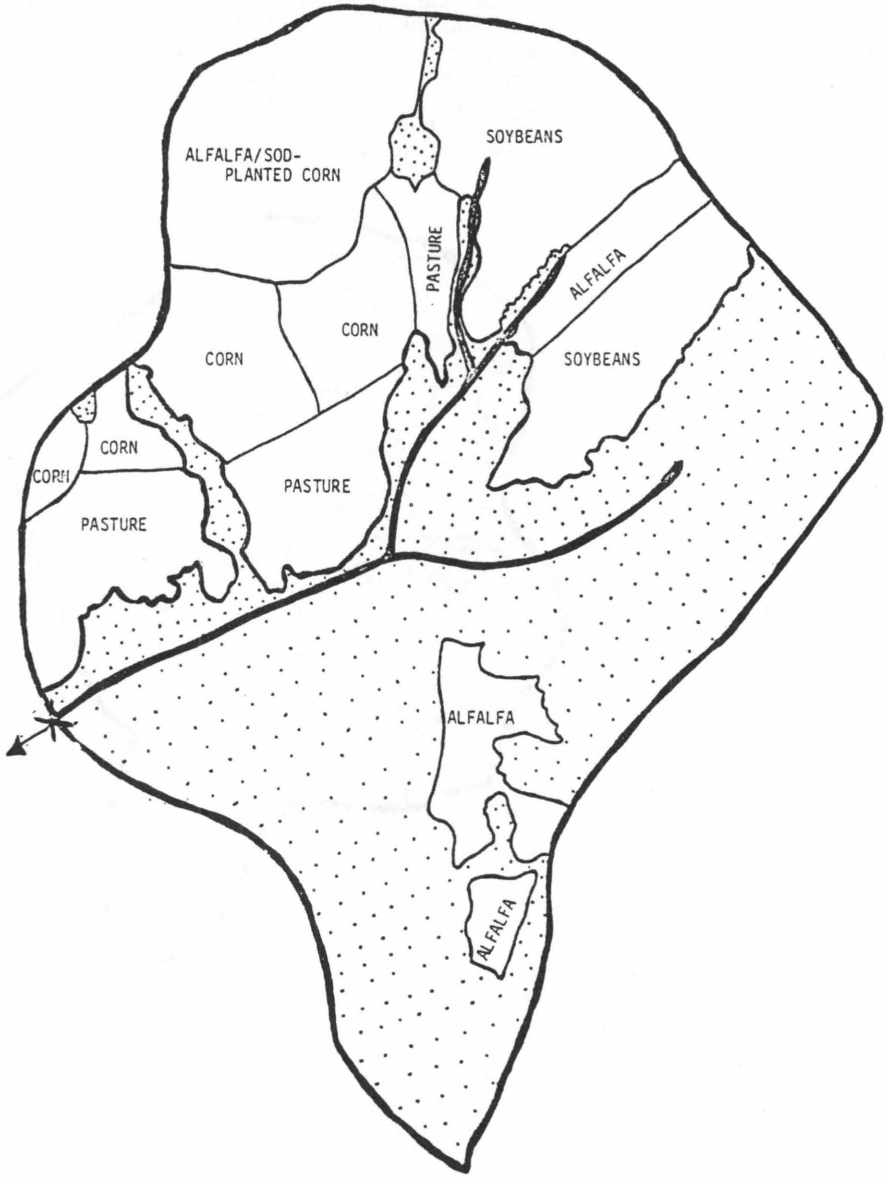


Figure 11. Landuse map of Cunningham Creek watershed.

The contour map defining the drainage system shown in Figure 9 was used to prepare the finite element grid map of the Cunningham Creek watershed shown in Figure 12. The procedure for the development of the finite element grid map included: 1) the division of the watershed into subsheds; 2) the separation of subsheds into unit-source drainage areas or flow strips; and 3) the separation of the flow strips into one or more sequential elements. The Cunningham Creek Watershed was divided into 5 subsheds with 22 overland flow elements, as shown in Figure 12.

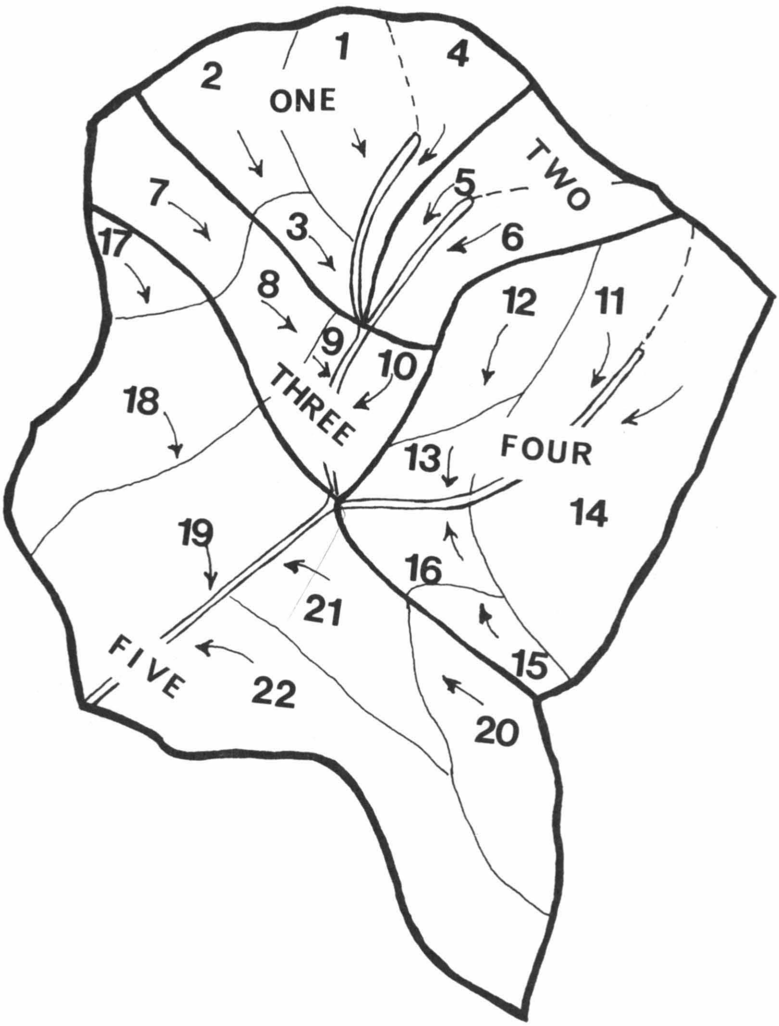


Figure 12. Finite element discretization of Cunningham Creek watershed.

The soil map (Figure 10) and the landuse map (Figure 11) were superimposed to obtain the HRU map, i.e., units of a single soil type and landuse combination. A total of 67 unique HRU's were obtained and each HRU was assigned an index number. As an illustration, the location of HRU's within overland flow element No.22 are shown in Figure 13.

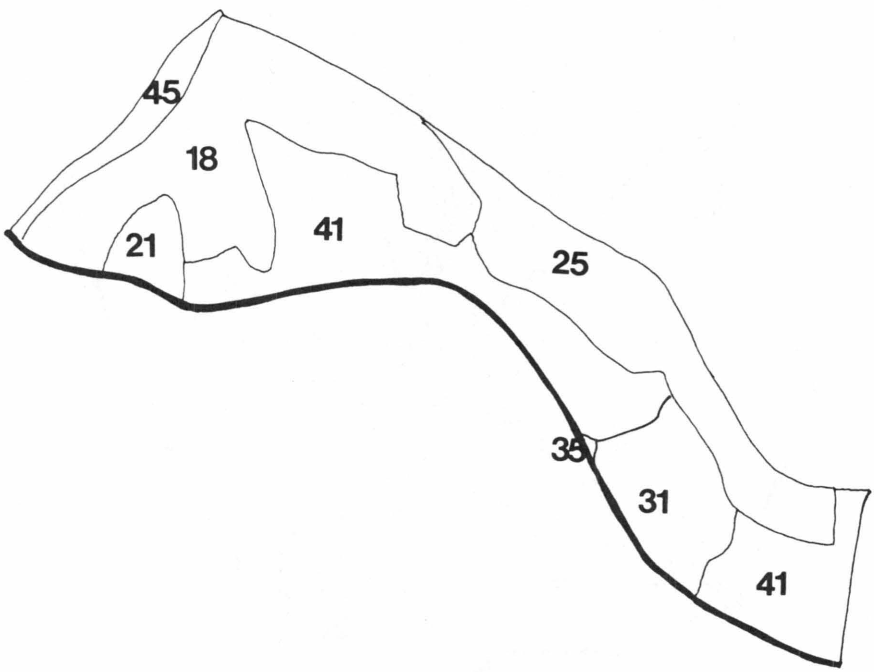


Figure 13. HRU distribution within element No. 22, (Figure 12), Cunningham Creek watershed.

7.2 DATA DEVELOPMENT AND MODEL RUN

7.2.1 Creation of FESHM data file

The procedure by which a FESHM compatible data file is obtained is outlined on the following pages. The setting up and checking of a FESHM compatible data set for Cunningham Creek watershed, previously defined, is presented from beginning to end.

Commencing with the steps given in Chapter 6, the user provides a data file of storm information for use in the program RAINFALL. In this case, the event file is named STORM1 DATA and is break-point data in the standard VPI format. This data file is shown on the next page, and the conversation invoked by the user at the console on the following page.

```
##### STORM1 DATA ##########################################################################################################################

T104 PM4  1 472 19 3 19.1500S
T104 PM4  1 472 19 9 19.1500S   5469  0.030      0.3667          0.3      0.030000  0.03000  0.03000  0.03000  0.03000 0    2
T104 PM4  1 472 1933 19.5500S   5493  0.110      0.4000          0.20000  0.080000  0.11000  0.11000  0.11000  0.11000 0    3
T104 PM4  1 472 1955 19.9167S   5515  0.200      0.3667          0.24545  0.090000  0.20000  0.20000  0.20000  0.20000 0    4
9999999999999999999
```

```
rainfall
TODAY'S DATE IS: 83/10/05                          THE CURRENT TIME IS: 11:19:56

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
storm1 data
DMSLIO740I EXECUTION BEGINS...

WELCOME TO THE V.P.I. EQUAL INTERVAL RAINFALL PROGRAM.

ENTER FIRST  TITLE LINE FOR OUTPUT HEADING:
rainfall data preparation for cunningham creek watershed
ENTER SECOND TITLE LINE FOR OUTPUT HEADING:
storm event of 01/04/72

ENTER THE RAINFALL INTERVAL (MINUTES):
5

WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?   (Y/N/QUIT/HELP):
y

DO YOU WISH TO HAVE A GRAPH OF THE PRECIPITATION DATA?   (Y/N/QUIT/HELP):
y

IS YOUR INPUT DATA IN THE STANDARD V.P.I. FORMAT?    (Y/N/QUIT/HELP):
y


ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.


      YOUR PROGRAM OUTPUTS ARE IN:

           A         LISTING  Z             FOR OUTPUT UNIT 7
                     &
           STORM1    DATABASE A             FOR OUTPUT UNIT 8

      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                 UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                      IT WILL BE LOST WHEN YOU LOGOFF !

R;
```

The two output files created during the execution of RAINFALL provide additional information about the storm event (A LISTING Z) and a data file to be inserted into the FESHM data file at a later time (STORM1 DATABASE). These output files are listed on the following pages.

```
#### A LISTING Z ########################################################################################################################

RAINFALL DATA PREPARATION FOR CUNNINGHAM CREEK WATERSHED
STORM EVENT OF 01/04/72


                                           CONVERSION  MAXIMUM   MAXIMUM
 NTITLE INTRVL SOURCE  GRAPH STORMS     FACTOR    ACCUM.  INTENSITY      LAMBDA   FORMAT

      2      5      0      0      5      1.00       0.0        0.0         120   (9X,3I2,1X, 2I2,45X,F10.5,10X,F10.5)


MONTH DAY     HOUR MIN     RAININ     GAGE ACCUM.

    1  4        19  0     0.0         0.0
                19  3     0.0         0.0
                19  9     0.300       0.030
                19 33     0.200       0.110
                19 55     0.245       0.200


TOTAL INPUT PRECIPITATION BEGINNING AT  19: 3  ON  JAN.  4   WAS      0.2000 INCH

  0.01000   0.02333   0.01667   0.01667   0.01667   0.01667   0.01818   0.02045
  0.02045   0.02045   0.02045   0.0
```

RAINFALL DATA PREPARATION FOR CUNNINGHAM CREEK WATERSHED
STORM EVENT OF 01/04/72

```
AMOUNT PER INTERVAL          0.0       2.33E-03  4.67E-03  7.00E-03  9.33E-03  1.17E-02  1.40E-02  1.63E-02  1.87E-02  2.10E-02     0.0
                             +|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-
ACCUMULATED PRECIPITATION    0.0       2.00E-02  4.00E-02  6.00E-02  8.00E-02  .100      .120      .140      .160      .180         0.2
                              +
AMOUNT PER   TOTAL     END    +
 INTERVAL    ACCUM.    TIME   +
                              +
    I          *              +
                              +
  1.00E-02   1.00E-02 1905    +     *                                     I
  2.33E-02   3.33E-02 1910    +                 *                                                                        I
  1.67E-02   5.00E-02 1915    +                         *                                             I
  1.67E-02   6.67E-02 1920    +                                 *                                     I
  1.67E-02   8.33E-02 1925    +                                          *                            I
  1.67E-02   .100     1930    +                                                  *                    I
  1.82E-02   .118     1935    +                                                           *                  I
  2.05E-02   .139     1940    +                                                                     *           I
  2.05E-02   .159     1945    +                                                                                *I
  2.05E-02   .180     1950    +                                                                                 I *
  2.05E-02   .200     1955    +                                                                                 I          *
  .0         .200     2000    +I                                                                                           *
                              +
                              +
AMOUNT PER INTERVAL          0.0       2.33E-03  4.67E-03  7.00E-03  9.33E-03  1.17E-02  1.40E-02  1.63E-02  1.87E-02  2.10E-02     0.0
                             +|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-
ACCUMULATED PRECIPITATION    0.0       2.00E-02  4.00E-02  6.00E-02  8.00E-02  .100      .120      .140      .160      .180         0.2
```

```
##### STORM1 DATABASE ##############################################################

*** RAINFALL DATA PREPARATION FOR CUNNINGHAM CREEK WATERSHED
*** STORM EVENT OF 01/04/72
$  1/ 4/72  19: 3   300      1     STORM BEGINNING AT 19: 3  ON  JAN.  4
   0.01000   0.02333   0.01667   0.01667   0.01667   0.01667   0.01818   0.02045
   0.02045   0.02045   0.02045   0.0
```

Execution of the SETUP program is the next step. This program constructs the initial framework of the FESHM data file with the exception of the storm data previously defined. Before initiating this program, the name of any existing data file must be available. The following conversation occurred at the console.

```
execute setup
TODAY'S DATE IS: 83/10/05                        THE CURRENT TIME IS: 11:35:24

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
cuncreek data
DMSLI0740I EXECUTION BEGINS...

WELCOME TO THE V.P.I. FESHM INTERFACE PROGRAM.

ENTER TITLE LINE FOR WATERSHED CHARACTERISTICS DATA SET:

cunningham creek watershed data set

ENTER  NAME OF FIRST  SUBSHED:
one
ENTER  NAME OF SECOND SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
two
ENTER  NAME OF THIRD  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
three one two
ENTER  NAME OF FOURTH SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
four
ENTER  NAME OF FIFTH  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
five four three
ENTER  NAME OF SIXTH  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:

                NAMES RECEIVED FOR      5  SUBSHEDS.

ENTER THE TOTAL NUMBER OF ELEMENTS IN THE COMPLETE WATERSHED:
22

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED      ONE:
2 3 2

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED      ONE:
1 2 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED      TWO:
1 2 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED      TWO:
1 1
```

```
ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED    THREE:
1 2 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED    THREE:
3 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED     FOUR:
2 4 2

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED     FOUR:
1 2 1 2

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED     FIVE:
2 3 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED     FIVE:
3 2 1


ENTER THE NAMES TO BE USED FOR EACH LANDUSE CATEGORY:
(ONE PER LINE):


ENTER THE ANTECEDENT SOIL MOISTURE:
0.0

ENTER THE TOTAL NUMBER OF UNIQUE HRUS:

67

ENTER A TITLE LINE FOR THE COMBINED BASIN AND STORM DATA SETS:
feshm model run for the cunningham creek watershed on  4 january 1974

ENTER THE NUMBER OF HOURS FOR THE DISCHARGE OUTPUT:

5

ENTER VALUES FOR THE OVERLAND FLOW PRINT FREQUENCY INDICATOR (SECONDS)  AND
      THE OVERLAND FLOW CALCULATION INTERVAL:
300  30


ENTER VALUES FOR THE CHANNEL FLOW PRINT FREQUENCY INDICATOR (SECONDS) AND
      THE OVERLAND FLOW CALCULATION INTERVAL:
300 10

ENTER THE NUMBER OF RAINGAGES TO BE EMPLOYED:
1


ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.


      YOUR PROGRAM OUTPUTS ARE IN:

           A        LISTING Z             FOR OUTPUT UNIT 7
                    &
           CUNCREEK DATABASE A            FOR OUTPUT UNIT 8

      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !

R;
```

For this particular run, there is not output on IUNIT7 as A LISTING Z. The FESHM compatible data base is contained in a file named CUNCREEK DATABASE. This file is listed below.

```
##### CUNCREEK DATABASE ##########################################################

CUNNINGHAM CREEK WATERSHED DATA SET
*
*
    TRIBUTARIES TO SUBSHED    1        ONE:
    TRIBUTARIES TO SUBSHED    2        TWO:
    TRIBUTARIES TO SUBSHED    3      THREE:        ONE      TWO
    TRIBUTARIES TO SUBSHED    4       FOUR:
    TRIBUTARIES TO SUBSHED    5       FIVE:       FOUR    THREE
*
*
                                     END OF SUBSHED DESCRIPTOR INPUT.
*
*
*
*
    TOTAL NUMBER OF ELEMENTS (NTELES):                                    22
*   NUMBER OF SUBSHEDS         (NTSS):                                     5
*
*
*------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:               ONE
*
   NUMBER OF FLOW STRIPS                             (NSTRPS):             3
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 2
   NUMBER OF CHANNEL ELEMENTS                        (NECHAN):             2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        1   2   1
*
*                       (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW     ELEM.     LENGTH     RELIEF    ELEMENT      TOP
*   STRIP     NOS.                             AREA      WIDTH
*
        A       1
        B       2
                3
        C       4
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)  (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
*      CHAN    LENGTH   RELIEF   ROUGHNESS      TOP     DEPTH     BASE OF
*       NO                         COEFF.      WIDTH             TRAPEZOID
*
      I  1
     II  2
*
*------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:               TWO
*
   NUMBER OF FLOW STRIPS                             (NSTRPS):             2
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 1
   NUMBER OF CHANNEL ELEMENTS                        (NECHAN):             1
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        1   1
```

```
*
*                           (XLEN)    (RELIEF)   (AREA)   (TWIDTH)
*   FLOW      ELEM.         LENGTH     RELIEF    ELEMENT    TOP
*   STRIP     NOS.                                 AREA     WIDTH
*
       A        5
       B        6
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*                 (XLEN)   (RELIEF)    (RCOEF)    (TWIDTH)   (HT)      (BASE)
*     CHAN        LENGTH    RELIEF   ROUGHNESS      TOP     DEPTH     BASE OF
*      NO                              COEFF.      WIDTH             TRAPEZOID
*
     1   3
*
*-----------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:            THREE
*
   NUMBER OF FLOW STRIPS                            (NSTRPS):              2
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 1
   NUMBER OF CHANNEL ELEMENTS                       (NECHAN):              1
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       3    1
*
*                           (XLEN)    (RELIEF)   (AREA)   (TWIDTH)
*   FLOW      ELEM.         LENGTH     RELIEF    ELEMENT    TOP
*   STRIP     NOS.                                 AREA     WIDTH
*
       A        7
                8
                9
       B       10
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*                 (XLEN)   (RELIEF)    (RCOEF)    (TWIDTH)   (HT)      (BASE)
*     CHAN        LENGTH    RELIEF   ROUGHNESS      TOP     DEPTH     BASE OF
*      NO                              COEFF.      WIDTH             TRAPEZOID
*
     1   4

*
*-----------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:             FOUR
*
   NUMBER OF FLOW STRIPS                            (NSTRPS):              4
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 2
   NUMBER OF CHANNEL ELEMENTS                       (NECHAN):              2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       1    2    1    2
*
*                           (XLEN)    (RELIEF)   (AREA)   (TWIDTH)
*   FLOW      ELEM.         LENGTH     RELIEF    ELEMENT    TOP
*   STRIP     NOS.                                 AREA     WIDTH
*
       A       11
       B       12
               13
       C       14
       D       15
               16
*
```

```
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)  (RELIEF)   (RCOEF)    (TWIDTH)   (HT)     (BASE)
*     CHAN      LENGTH   RELIEF   ROUGHNESS     TOP      DEPTH    BASE OF
*      NO                           COEFF.     WIDTH             TRAPEZOID
*
      I  5
     II  6
*
*-----------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:                 FIVE
*
   NUMBER OF FLOW STRIPS                            (NSTRPS):          3
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):            1
   NUMBER OF CHANNEL ELEMENTS                       (NECHAN):          2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       3   2   1
*
*                     (XLEN)   (RELIEF)   (AREA)   (TWIDTH)
*    FLOW     ELEM.   LENGTH    RELIEF   ELEMENT     TOP
*   STRIP     NOS.                         AREA     WIDTH
*
       A       17
               18
               19
       B       20
               21
       C       22
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)  (RELIEF)   (RCOEF)    (TWIDTH)   (HT)     (BASE)
*     CHAN      LENGTH   RELIEF   ROUGHNESS     TOP      DEPTH    BASE OF
*      NO                           COEFF.     WIDTH             TRAPEZOID
*
      I  7
     II  8
*
*-----------------------------------------------------------------------
*
*
*
** LAND USE DESCRIPTORS:
*
*                            (AFLU)          (DSLU)          (RCLU)
* LAND USE      NO.       HOLTAN'S A      DEPRESSION      MANNING'S
*                         COEFFICIENT       STORAGE       ROUGHNESS
*
*
                          END OF LANDUSE DESCRIPTORS
*
*
*-----------------------------------------------------------------------
*
*
*
** MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:
*
*
   THE VALUE OF SMCWS IS:        0.0
*
*
** GROWTH INDEX COEFFICIENTS  (GINDEX):
*
* JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.
 0.300 0.300 0.300 0.450 0.600 0.800 0.900 0.900 0.750 0.400 0.300 0.300
*
```

```
** EVAPORATION COEFFICIENTS      (EVP):
*
* JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.
 0.800 1.430 2.130 3.300 4.340 4.800 4.960 4.030 3.300 1.940 1.110 0.710
*
*
*
*
*------------------------------------------------------------------------
*
*
** HRU DESCRIPTORS:
*
*
*  TOTAL NUMBER OF HRU'S (NHRUS):                                      67
*
*                  (SLOHRU) (FAW)      (FGW)    (FC)
* HRU   LANDUSE     SLOPE   AVAIL.    GRAVITY  INFILT DEPTH  CUSLE  XKUSL
* NO.       NO.     CLASS   WATER      WATER    RATE  OF A
*
    1                 A
    2                 A
    3                 A
    4                 A
    5                 A
    6                 A
    7                 A
    8                 A
    9                 A
   10                 A
   11                 A
   12                 A
   13                 A
   14                 A
   15                 A
   16                 A
   17                 A
   18                 A
   19                 A
   20                 A
   21                 A
   22                 A
   23                 A
   24                 A
   25                 A
   26                 A
   27                 A
   28                 A
   29                 A
   30                 A
   31                 A
   32                 A
   33                 A
   34                 A
   35                 A
   36                 A
   37                 A
   38                 A
   39                 A
   40                 A
   41                 A
   42                 A
   43                 A
   44                 A
   45                 A
   46                 A
   47                 A
   48                 A
   49                 A
   50                 A
   51                 A
   52                 A
   53                 A
   54                 A
   55                 A
   56                 A
   57                 A
```

```
   58                  A
   59                  A
   60                  A
   61                  A
   62                  A
   63                  A
   64                  A
   65                  A
   66                  A
   67                  A
*
                                      END OF HRU DESCRIPTOR INPUT
*
*
*
*   NUMBER OF HRUS IN EACH ELEMENT (NHRU):
*
*    ELEMENT:   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
      # HRUS:  67  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
*
*    ELEMENT:  21 22
      # HRUS:  67  0
*
*
*
*  ASSIGNMENT OF HRUS TO ELEMENTS
*
*
*                                        (IHRU)      (FHRU)
* SUBSHED      FLOW            ELEM.      HRU      FRACTION OF
*    NAME     STRIP    NO.      NO.     NUMBER     ELEMENT AREA
*
      ONE        A       1       1
                 B       1       2
                         2       3
                 C       1       4
*
      TWO        A       1       5
                 B       1       6
*
    THREE        A       1       7
                         2       8
                         3       9
                 B       1      10
*
     FOUR        A       1      11
                 B       1      12
                         2      13
                 C       1      14
                 D       1      15
                         2      16
*
     FIVE        A       1      17
                         2      18
                         3      19
                 B       1      20
                         2      21
                 C       1      22
*
*
                                      END OF ASSIGNMENT OF HRUS TO ELEMENTS
*
*
*
*------------------------------------------------------------------------
*
*
```

```
*
**** OUTPUT TITLE, TIME STEPS, AND PROGRAM CONTROL PARAMETERS:
*
FESHM MODEL RUN FOR CUNNINGHAM CREEK WATERSHED ON 4 JANUARY 1974
*
*
*
   HRU TABLE OUTPUT PRINT INDICATOR                 (NTBLHS):            0
   PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR      (NTBLPE):            0
   NUMBER OF HOURS FOR THE DISCHARGE RECORD         (NHOURC):            5
*
*
*
** FLOW CALCULATION INTERVALS (SECONDS):
*
   OVERLAND FLOW CALCULATION INTERVAL  (DTO):                          30.
   CHANNEL  FLOW CALCULATION INTERVAL  (DTC):                          10.
*
*
*
*
** PRINT FREQUENCY INDICATORS (SECONDS):
*
    OVERLAND FLOW PRINT FREQUENCY INDICATOR  (NOPRIN):                300
    CHANNEL  FLOW PRINT FREQUENCY INDICATOR  (NCPRIN):                300
*
*
** SUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER):
*
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
** PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF SELECTED STRIPS
*   (TWO LINES FOR EACH  '2'  ENTERED IN THE PREVIOUS LINE):
*
*
*
** SUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS (NPCHAN):
*
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
*-----------------------------------------------------------------------
*
*
    NUMBER OF RAINGAGES  (NGAGES):                                       1
*
*
*
*
*
** INPUT STORM DATA (PRECIP) FOR RAINGAGE:                               1
*
*     DATE    TIME INTPCS NHOURR
*

*
** THIRTY DAY ANTECEDENT PRECIPITATION (DAILPC) RAIN GAGE:               1
*
```

At this stage, the user is required to manually edit the file, CUNCREEK DATABASE, for the purpose of completing data entry describing the watershed. The result of this exercise is shown below: the blanks have been filled in, some values altered, and the rainfall distribution, STORM1 DATABASE, added to the FESHM data file. The file was renamed CCKFESHM DATA.

```
##### CCKFESHM DATA ###############################################################

CUNNINGHAM CREEK WATERSHED DATA SET:
*
*
    TRIBUTARIES TO SUBSHED     1         ONE:
    TRIBUTARIES TO SUBSHED     2         TWO:
    TRIBUTARIES TO SUBSHED     3       THREE:          ONE        TWO
    TRIBUTARIES TO SUBSHED     4        FOUR:
    TRIBUTARIES TO SUBSHED     5        FIVE:         FOUR      THREE
*
*
                                            END OF SUBSHED DESCRIPTOR INPUT.
*
*
*
*
    TOTAL NUMBER OF ELEMENTS (NTELES):                                            22
*   NUMBER OF SUBSHEDS          (NTSS):                                            5
*
*
*-------------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:                  ONE
*
   NUMBER OF FLOW STRIPS                                (NSTRPS):                  3
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                         2
   NUMBER OF CHANNEL ELEMENTS                           (NECHAN):                  2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       1   2   1
*
*                        (XLEN)     (RELIEF)    (AREA)     (TWIDTH)
*    FLOW      ELEM.     LENGTH      RELIEF     ELEMENT       TOP
*    STRIP     NOS.                               AREA       WIDTH
*
       A         1       882.10       62.0     12.3655     796.67
       B         2       907.98       57.0     10.2634     520.82
                 3       651.58       38.0      4.5356     425.38
       C         4       875.12       54.0      9.3310    1222.05
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)   (RELIEF)    (RCOEF)      (TWIDTH)    (HT)       (BASE)
*     CHAN      LENGTH    RELIEF    ROUGHNESS       TOP      DEPTH      BASE OF
*      NO                            COEFF.        WIDTH                TRAPEZOID
*
     I  1   796.67       40.0       0.040          10.0
    II  2   425.38       12.0       0.035          10.0
*
*-------------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:                  TWO
*
   NUMBER OF FLOW STRIPS                                (NSTRPS):                  2
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                         1
   NUMBER OF CHANNEL ELEMENTS                           (NECHAN):                  1
```

```
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       1    1
*
*                          (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.       LENGTH     RELIEF   ELEMENT      TOP
*   STRIP      NOS.                              AREA      WIDTH
*
        A        5         804.34       44.0    7.7618     967.76
        B        6        1324.32       48.0   12.8383     967.76
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)    (HT)      (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS      TOP      DEPTH     BASE OF
*      NO                           COEFF.      WIDTH               TRAPEZOID
*
      I  3     967.76      52.0      0.040      10.00
*
*-----------------------------------------------------------------------------
*
*
*   OVERLAND FLOW DESCRIPTORS FOR SUBSHED:              THREE
*
    NUMBER OF FLOW STRIPS                               (NSTRPS):               2
    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                     1
    NUMBER OF CHANNEL ELEMENTS                          (NECHAN):               1
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       3    1
*
*                          (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.       LENGTH     RELIEF   ELEMENT      TOP
*   STRIP      NOS.                              AREA      WIDTH
*
        A        7          994.86      36.0   13.0751     578.40
                 8          588.43      35.0    7.5171     717.13
                 9          418.40      30.0    6.1864     979.20
        B       10          771.33      70.0    6.6512     979.20
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)    (HT)      (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS      TOP      DEPTH     BASE OF
*      NO                           COEFF.      WIDTH               TRAPEZOID
*
      I  4     979.20      20.0      0.035      18.00

*
*-----------------------------------------------------------------------------
*
*
*   OVERLAND FLOW DESCRIPTORS FOR SUBSHED:              FOUR
*
    NUMBER OF FLOW STRIPS                               (NSTRPS):               4
    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                     2
    NUMBER OF CHANNEL ELEMENTS                          (NECHAN):               2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       1    2    1    2
*
*                          (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.       LENGTH     RELIEF   ELEMENT      TOP
*   STRIP      NOS.                              AREA      WIDTH
*
        A       11         937.40      60.0   10.9879    1335.03
        B       12        1318.22      30.0   11.3658     928.41
                13        1094.03      54.0    6.1423     634.49
        C       14         748.15      61.0   31.4758    1256.93
        D       15         704.86      37.0    6.6460     704.05
                16         501.01      61.0    7.4368     712.59
*
```

```
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)   (HT)       (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS      TOP      DEPTH      BASE OF
*      NO                           COEFF.      WIDTH               TRAPEZOID
*
      I  5     1335.03      61.0     0.040      20.00
     II  6      634.49      10.0     0.040      16.00
*
*-----------------------------------------------------------------------------
*
*
*   OVERLAND FLOW DESCRIPTORS FOR SUBSHED:                 FIVE
*
    NUMBER OF FLOW STRIPS                             (NSTRPS):             3
    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                1
    NUMBER OF CHANNEL ELEMENTS                        (NECHAN):             2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
      3   2   1
*
*                        (XLEN)     (RELIEF)   (AREA)     (TWIDTH)
*     FLOW      ELEM.    LENGTH      RELIEF    ELEMENT      TOP
*    STRIP      NOS.                            AREA       WIDTH
*
        A        17      719.93       29.0     5.9462     659.03
                 18      619.68       30.0    21.5265    1683.17
                 19      821.24       77.0    27.2798    1839.52
        B        20      616.60       36.0    14.8364    1173.09
                 21     1220.11       80.0    16.1303     844.80
        C        22     1629.14      104.0    35.3006     994.72
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)   (HT)       (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS      TOP      DEPTH      BASE OF
*      NO                           COEFF.      WIDTH               TRAPEZOID
*
      I  7      844.80      10.0     0.045      14.00       1.5        3.00
     II  8      994.72      20.0     0.045      14.00       1.5        6.50
*
*-----------------------------------------------------------------------------
*
*
*
** LAND USE DESCRIPTORS:
*
*                          (AFLU)          (DSLU)           (RCLU)
*  LAND USE     NO.      HOLTAN'S A      DEPRESSION       MANNING'S
*                        COEFFICIENT       STORAGE        ROUGHNESS
*
                 1          .267             .2              .2
                 2          .107             .105            .08
                 3          .133             .11             .08
                 4          .900             .25             .2
                 5          .800             .18             .15
                 6          .500             .16             .1
                 7          .900             .32             .25
                 8          .700             .24             .25
                 9          .000             .05             .02
                10          .000             .00             .02
                11          .160             .11             .08
*
                       END OF LANDUSE DESCRIPTORS
*
*
*-----------------------------------------------------------------------------
*
*
```

*
** MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:
*
*
THE VALUE OF SMCWS IS: 0.0
*
*
** GROWTH INDEX COEFFICIENTS (GINDEX):
*

* JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.
0.300	0.300	0.300	0.450	0.600	0.800	0.900	0.900	0.750	0.400	0.300	0.300

*
** EVAPORATION COEFFICIENTS (EVP):
*

* JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.
0.800	1.430	2.130	3.300	4.340	4.800	4.960	4.030	3.300	1.940	1.110	0.710

*
*
*
*
*--
*
*
** HRU DESCRIPTORS:
*
*
* TOTAL NUMBER OF HRU'S (NHRUS): 67
*
*

* HRU NO.	LANDUSE NO.	(SLOHRU) SLOPE CLASS	(FAW) AVAIL. WATER	(FGW) GRAVITY WATER	(FC) INFILT RATE	DEPTH OF A	CUSLE	XKUSL
1	2	B	0.120	0.190	0.139	10.0	0.6100	0.240
2	2	C	0.127	0.130	0.250	5.0	0.6100	0.280
3	4	C	0.127	0.130	0.250	5.0	0.0001	0.280
4	11	C	0.082	0.267	0.047	10.0	0.1100	0.280
5	7	C	0.082	0.267	0.047	10.0	0.0050	0.280
6	3	C	0.082	0.267	0.047	10.0	0.1700	0.280
7	6	C	0.082	0.267	0.047	10.0	0.0100	0.280
8	11	B	0.082	0.267	0.047	11.0	0.1100	0.280
9	7	B	0.082	0.267	0.047	11.0	0.0050	0.280
10	3	B	0.082	0.267	0.047	11.0	0.1700	0.280
11	6	B	0.082	0.267	0.047	11.0	0.0100	0.280
12	4	B	0.082	0.267	0.047	11.0	0.0001	0.280
13	2	B	0.082	0.267	0.047	11.0	0.6100	0.280
14	11	B	0.131	0.235	0.230	12.0	0.1100	0.280
15	2	B	0.131	0.235	0.230	12.0	0.6100	0.280
16	4	B	0.131	0.235	0.230	12.0	0.0001	0.280
17	6	B	0.131	0.235	0.230	12.0	0.0100	0.280
18	4	D	0.131	0.235	0.230	3.0	0.0001	0.430
19	3	B	0.131	0.235	0.230	4.0	0.1700	0.280
20	2	B	0.131	0.235	0.230	4.0	0.6100	0.280
21	4	B	0.131	0.235	0.230	4.0	0.0001	0.280
22	11	C	0.127	0.130	0.180	5.0	0.1100	0.320
23	1	C	0.127	0.130	0.180	5.0	0.0200	0.320
24	5	C	0.127	0.130	0.180	5.0	0.0090	0.320
25	4	C	0.127	0.130	0.180	5.0	0.0001	0.320
26	7	C	0.127	0.130	0.180	5.0	0.0050	0.320
27	8	C	0.127	0.130	0.180	5.0	0.0060	0.320
28	11	B	0.127	0.130	0.180	5.0	0.1100	0.280
29	1	B	0.127	0.130	0.180	5.0	0.0200	0.280
30	5	B	0.127	0.130	0.180	5.0	0.0090	0.280
31	4	B	0.127	0.130	0.180	5.0	0.0001	0.280
32	5	C	0.158	0.113	0.230	7.0	0.0090	0.320
33	11	C	0.158	0.113	0.230	7.0	0.1100	0.320
34	1	C	0.158	0.113	0.230	7.0	0.0200	0.320
35	4	C	0.158	0.113	0.230	7.0	0.0001	0.320
36	11	B	0.158	0.113	0.230	7.0	0.1100	0.280
37	1	B	0.158	0.113	0.230	7.0	0.0200	0.280
38	3	B	0.158	0.113	0.230	7.0	0.1700	0.280
39	7	B	0.158	0.113	0.230	7.0	0.0050	0.280
40	6	B	0.158	0.113	0.230	7.0	0.0100	0.280
41	4	B	0.158	0.113	0.230	7.0	0.0001	0.280
42	2	B	0.158	0.113	0.230	7.0	0.6100	0.280
43	5	B	0.158	0.113	0.230	7.0	0.0090	0.280

44	8	B	0.158	0.113	0.230	7.0	0.0060	0.280
45	4	A	0.119	0.134	0.025	6.0	0.0001	0.240
46	6	A	0.119	0.134	0.025	6.0	0.0100	0.240
47	11	B	0.131	0.190	0.150	8.0	0.1100	0.240
48	4	B	0.131	0.190	0.150	8.0	0.0001	0.240
49	6	B	0.131	0.190	0.150	8.0	0.0100	0.240
50	1	B	0.131	0.190	0.150	8.0	0.0200	0.240
51	5	B	0.158	0.113	0.230	6.0	0.0090	0.000
52	4	B	0.158	0.113	0.230	6.0	0.0001	0.000
53	1	B	0.158	0.113	0.230	6.0	0.0200	0.000
54	2	C	0.123	0.186	0.100	3.0	0.6100	0.320
55	6	C	0.123	0.186	0.100	3.0	0.0100	0.320
56	4	C	0.123	0.186	0.100	3.0	0.0001	0.320
57	6	C	0.123	0.186	0.100	2.0	0.0100	0.430
58	5	B	0.087	0.153	0.380	8.0	0.0090	0.000
59	4	B	0.087	0.153	0.380	8.0	0.0001	0.000
60	11	B	0.087	0.153	0.380	8.0	0.1100	0.000
61	1	B	0.087	0.153	0.380	8.0	0.0200	0.000
62	2	B	0.087	0.153	0.380	8.0	0.6100	0.000
63	6	B	0.087	0.153	0.380	8.0	0.0100	0.000
64	4	D	0.123	0.186	0.100	2.0	0.0001	0.430
65	6	D	0.123	0.186	0.100	2.0	0.0100	0.430
66	10	B	0.000	0.000	0.000	0.0	0.0000	0.000
67	9	B	0.000	0.000	0.000	0.0	0.0020	0.320

*

END OF HRU DESCRIPTOR INPUT

*
*
*
* NUMBER OF HRUS IN EACH ELEMENT (NHRU):
*

ELEMENT:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
# HRUS:	9	8	7	8	11	15	6	5	7	4	4	4	3	7	9	5	2	11	10	14

ELEMENT:	21	22
# HRUS:	6	7

*
*
*
* ASSIGNMENT OF HRUS TO ELEMENTS
*
*
*

SUBSHED NAME	FLOW STRIP	NO.	ELEM. NO.	(IHRU) HRU NUMBER	(FHRU) FRACTION OF ELEMENT AREA
ONE	A	1	1	36	.6019
				4	.1262
				8	.1054
				47	.0995
				22	.0212
				48	.0207
				9	.0090
				67	.0058
				66	.0103
	B	1	2	38	.0634
				10	.4635
				67	.0069
				66	.0192
				9	.0772
				5	.0208
				6	.3273
				8	.0217
		2	3	7	.1462
				11	.6518
				49	.0949
				48	.0345
				59	.0296
				12	.0160
				42	.0270
	C	1	4	48	.0269
				36	.4512
				66	.0192
				47	.0842
				22	.1264

					28	.1304
					14	.1381
					60	.0236
*	TWO	A	1	5	36	.1753
					66	.0186
					37	.1251
					22	.0641
					23	.0828
					4	.0414
					29	.0261
					28	.1147
					14	.1219
					33	.1022
					60	.1278
		B	1	6	38	.2867
					39	.0661
					40	.0191
					66	.0087
					41	.0485
					4	.0272
					22	.0317
					23	.0371
					28	.1669
					29	.0153
					37	.0725
					34	.1563
					61	.0089
					35	.0288
					59	.0262
*	THREE	A	1	7	10	.5335
					66	.0076
					6	.2609
					38	.1407
					19	.0540
					67	.0033
			2	8	42	.3344
					20	.1882
					54	.3452
					62	.0985
					63	.0337
			3	9	40	.0272
					55	.4991
					56	.0941
					63	.0668
					46	.0177
					59	.2394
					11	.0557
		B	1	10	36	.0707
					41	.0966
					35	.5303
					59	.3024
*	FOUR	A	1	11	39	.0087
					40	.0555
					43	.3696
					32	.5662
		B	1	12	36	.5116
					41	.1652
					33	.2884
					35	.0348
			2	13	41	.1036
					35	.7322
					59	.1642
		C	1	14	43	.5843
					32	.3526
					58	.0048
					51	.0126
					24	.0285
					67	.0125
					40	.0047
		D	1	15	43	.0712
					30	.0208
					31	.1049
					41	.0824

					25	.1357
					52	.0387
					53	.0290
					23	.2031
					29	.3142
			2	16	25	.5268
					31	.0807
					52	.1066
					59	.2765
					45	.0094
*						
	FIVE	A	1	17	10	.9754
					67	.0246
			2	18	13	.2913
					67	.0053
					1	.0951
					42	.0335
					54	.2108
					15	.2465
					2	.0145
					12	.0052
					3	.0221
					16	.0059
					56	.0698
			3	19	55	.3570
					11	.0047
					17	.2444
					46	.0201
					16	.0094
					56	.0532
					45	.0581
					64	.1247
					65	.1204
					57	.0080
		B	1	20	30	.0179
					31	.0076
					29	.1713
					50	.0136
					41	.0451
					66	.0033
					43	.0080
					23	.3146
					26	.0064
					39	.0150
					37	.0416
					44	.1140
					25	.2290
					27	.0126
			2	21	25	.6388
					18	.1670
					31	.0642
					45	.0959
					46	.0282
					23	.0059
		C	1	22	41	.3337
					25	.1821
					31	.1063
					35	.0045
					21	.0352
					18	.2925
					45	.0457
*						
*						

END OF ASSIGNMENT OF HRUS TO ELEMENTS

```
*
*
*
*-------------------------------------------------------------------
*
*
*
**** OUTPUT TITLE, TIME STEPS, AND PROGRAM CONTROL PARAMETERS:
*
FESHM MODEL RUN FOR THE CUNNINGHAM WATERSHED ON  4 JANUARY 1972.
*
*
*
   HRU TABLE OUTPUT PRINT INDICATOR                (NTBLHS):          1
   PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR     (NTBLPE):          1
   NUMBER OF HOURS FOR THE DISCHARGE RECORD        (NHOURC):          5
*
*
*
** FLOW CALCULATION INTERVALS (SECONDS):
*
   OVERLAND FLOW CALCULATION INTERVAL  (DTO):                        30.
   CHANNEL  FLOW CALCULATION INTERVAL  (DTC):                        10.
*
*
*
*
** PRINT FREQUENCY INDICATORS (SECONDS):
*
    OVERLAND FLOW PRINT FREQUENCY INDICATOR  (NOPRIN):              300
    CHANNEL  FLOW PRINT FREQUENCY INDICATOR  (NCPRIN):              300
*
*
** SUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER):
*
 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
** PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF SELECTED STRIPS
*   (TWO LINES FOR EACH '2'  ENTERED IN THE PREVIOUS LINE):
*
*
*
** SUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS (NPCHAN):
*
 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
*-------------------------------------------------------------------
*
*
    NUMBER OF RAINGAGES  (NGAGES):                                    1
*
*
*
*
*
** INPUT STORM DATA (PRECIP) FOR RAINGAGE:                            1
*
*     DATE   TIME INTPCS NHOURR
*
*** RAINFALL DATA PREPARATION FOR CUNNINGHAM CREEK WATERSHED
*** STORM EVENT OF 01/04/72
$  1/ 4/72  19: 3    300       1      STORM BEGINNING AT 19: 3  ON  JAN.  4
   0.01000   0.02333   0.01667   0.01667   0.01667   0.01667   0.01818   0.02045
   0.02045   0.02045   0.02045   0.0

*
** THIRTY DAY ANTECEDENT PRECIPITATION (DAILPC) RAIN GAGE:             1
*
0     0    0    .01     .1    0    1.2      0
  2.0    .2    0   0 0   0  0  0
   0 0 0 0 0 .4 0 0
.1 .3 1.0 0 .8  .2
```

The next step, as described in Chapter 6, is the execution of INTERFACE to scan the program and the user-prepared data file (CCKFESHM DATA) for errors and to rewrite the data into a form compatible with FESHM requirements. Two output files are received: A LISTING Z and CCKFESHM DATABASE, which is in a format for running FESHM. The INTERFACE console conversation and the two resultant output files are shown on the following pages.

```
execute interface
TODAY'S DATE IS: 83/10/05                          THE CURRENT TIME IS: 23:34:05

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
cckfeshm data
DMSLIO740I EXECUTION BEGINS...

      YOUR PROGRAM OUTPUTS ARE IN:

           A          LISTING  Z              FOR OUTPUT UNIT 7
                      &
           CCKFESHM DATABASE A                FOR OUTPUT UNIT 8


      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                 UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                      IT WILL BE LOST WHEN YOU LOGOFF !

R;


#### A LISTING Z ##################################################################


   TRIBUTARIES TO SUBSHED     1       ONE:
   TRIBUTARIES TO SUBSHED     2       TWO:
   TRIBUTARIES TO SUBSHED     3     THREE:        ONE      TWO
   TRIBUTARIES TO SUBSHED     4      FOUR:
   TRIBUTARIES TO SUBSHED     5      FIVE:       FOUR     THREE


BOUNDARY DESCRIPTION CODES FOR EACH SUBSHED:


   0    0    1    0    1


TRIBUTARY IDENTIFIERS:


SUBSHED    CODE          TRIB 1     TRIB 2     TRIB 3

      3       1              1         2
      5       1              4         3


    TOTAL NUMBER OF ELEMENTS (NTELES):   22
    NUMBER OF SUBSHEDS          (NTSS):    5
```

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: ONE

NUMBER OF FLOW STRIPS	(NSTRPS):	3
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	2
NUMBER OF CHANNEL ELEMENTS	(NECHAN):	2

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
1 2 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	882.0999	62.0000	12.3655	796.6699
B	2	907.9800	57.0000	10.2634	520.8198
	3	651.5798	38.0000	4.5356	425.3799
C	4	875.1199	54.0000	9.3310	1222.0498

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO		(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I	1	796.67	40.00	0.04	10.00	2.00	0.0
II	2	425.38	12.00	0.03	10.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: TWO

NUMBER OF FLOW STRIPS	(NSTRPS):	2
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1
NUMBER OF CHANNEL ELEMENTS	(NECHAN):	1

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
1 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	804.3398	44.0000	7.7618	967.7598
B	2	1324.3198	48.0000	12.8383	967.7598

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO		(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I	1	967.76	52.00	0.04	10.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: THREE

NUMBER OF FLOW STRIPS	(NSTRPS):	2
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1
NUMBER OF CHANNEL ELEMENTS	(NECHAN):	1

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
3 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	994.8599	36.0000	13.0751	578.3999
	2	588.4299	35.0000	7.5171	717.1299
	3	418.3999	30.0000	6.1864	979.2000
B	4	771.3298	70.0000	6.6512	979.2000

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO		(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I	1	979.20	20.00	0.03	18.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: FOUR

NUMBER OF FLOW STRIPS (NSTRPS): 4
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 2
NUMBER OF CHANNEL ELEMENTS (NECHAN): 2

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
1 2 1 2

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	937.3999	60.0000	10.9879	1335.0298
B	2	1318.2200	30.0000	11.3658	928.4099
	3	1094.0298	54.0000	6.1423	634.4900
C	4	748.1499	61.0000	31.4758	1256.9299
D	5	704.8599	37.0000	6.6460	704.0498
	6	501.0098	61.0000	7.4368	712.5898

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO		(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I	1	1335.03	61.00	0.04	20.00	2.00	0.0
II	2	634.49	10.00	0.04	16.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: FIVE

NUMBER OF FLOW STRIPS (NSTRPS): 3
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 1
NUMBER OF CHANNEL ELEMENTS (NECHAN): 2

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
3 2 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	719.9299	29.0000	5.9462	659.0298
	2	619.6799	30.0000	21.5265	1683.1699
	3	821.2400	77.0000	27.2798	1839.5198
B	4	616.5999	36.0000	14.8364	1173.0898
	5	1220.1099	80.0000	16.1303	844.7998
C	6	1629.1399	104.0000	35.3006	994.7200

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO		(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I	1	844.80	10.00	0.04	14.00	1.50	3.00
II	2	994.72	20.00	0.04	14.00	1.50	6.50

LAND USE DESCRIPTORS:

NO.	(AFLU) HOLTAN'S A COEFFICIENT	(DSLU) DEPRESSION STORAGE	(RCLU) MANNING'S ROUGHNESS
1	0.26700	0.20000	0.20000
2	0.10700	0.10500	0.08000
3	0.13300	0.11000	0.08000
4	0.90000	0.25000	0.20000
5	0.80000	0.18000	0.15000
6	0.50000	0.16000	0.10000
7	0.90000	0.32000	0.25000
8	0.70000	0.24000	0.25000
9	0.0	0.05000	0.02000
10	0.0	0.0	0.02000
11	0.16000	0.11000	0.08000

MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:

THE VALUE OF SMCWS IS: 0.0

GROWTH INDEX COEFFICIENTS (GINDEX):

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.
0.300	0.300	0.300	0.450	0.600	0.800	0.900	0.900	0.750	0.400	0.300	0.300

EVAPORATION COEFFICIENTS (EVP):

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT.	NOV.	DEC.
0.800	1.430	2.130	3.300	4.340	4.800	4.960	4.030	3.300	1.940	1.110	0.710

HRU DESCRIPTORS:

HRU NO.	LANDUSE NO.	(SLOHRU) SLOPE CLASS	(FAW) AVAIL WATER	(FGW) GRAVITY WATER	(FC) INFILT. RATE	CONTROL OF A	CUSLE	XKUSL	SMCHRU	NSOIL
1	2	B	0.1200	0.1900	0.1390	10.0000	0.6100	0.2400	0.0	0
2	2	C	0.1270	0.1300	0.2500	5.0000	0.6100	0.2800	0.0	0
3	4	C	0.1270	0.1300	0.2500	5.0000	0.0001	0.2800	0.0	0
4	11	C	0.0820	0.2670	0.0470	10.0000	0.1100	0.2800	0.0	0
5	7	C	0.0820	0.2670	0.0470	10.0000	0.0050	0.2800	0.0	0
6	3	C	0.0820	0.2670	0.0470	10.0000	0.1700	0.2800	0.0	0
7	6	C	0.0820	0.2670	0.0470	10.0000	0.0100	0.2800	0.0	0
8	11	B	0.0820	0.2670	0.0470	11.0000	0.1100	0.2800	0.0	0
9	7	B	0.0820	0.2670	0.0470	11.0000	0.0050	0.2800	0.0	0
10	3	B	0.0820	0.2670	0.0470	11.0000	0.1700	0.2800	0.0	0
11	6	B	0.0820	0.2670	0.0470	11.0000	0.0100	0.2800	0.0	0
12	4	B	0.0820	0.2670	0.0470	11.0000	0.0001	0.2800	0.0	0
13	2	B	0.0820	0.2670	0.0470	11.0000	0.6100	0.2800	0.0	0
14	11	B	0.1310	0.2350	0.2300	12.0000	0.1100	0.2800	0.0	0
15	2	B	0.1310	0.2350	0.2300	12.0000	0.6100	0.2800	0.0	0
16	4	B	0.1310	0.2350	0.2300	12.0000	0.0001	0.2800	0.0	0
17	6	B	0.1310	0.2350	0.2300	12.0000	0.0100	0.2800	0.0	0
18	4	D	0.1310	0.2350	0.2300	3.0000	0.0001	0.4300	0.0	0
19	3	B	0.1310	0.2350	0.2300	4.0000	0.1700	0.2800	0.0	0
20	2	B	0.1310	0.2350	0.2300	4.0000	0.6100	0.2800	0.0	0
21	4	B	0.1310	0.2350	0.2300	4.0000	0.0001	0.2800	0.0	0
22	11	C	0.1270	0.1300	0.1800	5.0000	0.1100	0.3200	0.0	0
23	1	C	0.1270	0.1300	0.1800	5.0000	0.0200	0.3200	0.0	0
24	5	C	0.1270	0.1300	0.1800	5.0000	0.0090	0.3200	0.0	0
25	4	C	0.1270	0.1300	0.1800	5.0000	0.0001	0.3200	0.0	0
26	7	C	0.1270	0.1300	0.1800	5.0000	0.0050	0.3200	0.0	0
27	8	C	0.1270	0.1300	0.1800	5.0000	0.0060	0.3200	0.0	0
28	11	B	0.1270	0.1300	0.1800	5.0000	0.1100	0.2800	0.0	0
29	1	B	0.1270	0.1300	0.1800	5.0000	0.0200	0.2800	0.0	0
30	5	B	0.1270	0.1300	0.1800	5.0000	0.0090	0.2800	0.0	0
31	4	B	0.1270	0.1300	0.1800	5.0000	0.0001	0.2800	0.0	0
32	5	C	0.1580	0.1130	0.2300	7.0000	0.0090	0.3200	0.0	0
33	11	C	0.1580	0.1130	0.2300	7.0000	0.1100	0.3200	0.0	0
34	1	C	0.1580	0.1130	0.2300	7.0000	0.0200	0.3200	0.0	0
35	4	C	0.1580	0.1130	0.2300	7.0000	0.0001	0.3200	0.0	0
36	11	B	0.1580	0.1130	0.2300	7.0000	0.1100	0.2800	0.0	0
37	1	B	0.1580	0.1130	0.2300	7.0000	0.0200	0.2800	0.0	0
38	3	B	0.1580	0.1130	0.2300	7.0000	0.1700	0.2800	0.0	0
39	7	B	0.1580	0.1130	0.2300	7.0000	0.0050	0.2800	0.0	0
40	6	B	0.1580	0.1130	0.2300	7.0000	0.0100	0.2800	0.0	0
41	4	B	0.1580	0.1130	0.2300	7.0000	0.0001	0.2800	0.0	0
42	2	B	0.1580	0.1130	0.2300	7.0000	0.6100	0.2800	0.0	0
43	5	B	0.1580	0.1130	0.2300	7.0000	0.0090	0.2800	0.0	0
44	8	B	0.1580	0.1130	0.2300	7.0000	0.0060	0.2800	0.0	0

45	4	A	0.1190	0.1340	0.0250	6.0000	0.0001	0.2400	0.0	0
46	6	A	0.1190	0.1340	0.0250	6.0000	0.0100	0.2400	0.0	0
47	11	B	0.1310	0.1900	0.1500	8.0000	0.1100	0.2400	0.0	0
48	4	B	0.1310	0.1900	0.1500	8.0000	0.0001	0.2400	0.0	0
49	6	B	0.1310	0.1900	0.1500	8.0000	0.0100	0.2400	0.0	0
50	1	B	0.1310	0.1900	0.1500	8.0000	0.0200	0.2400	0.0	0
51	5	B	0.1580	0.1130	0.2300	6.0000	0.0090	0.0	0.0	0
52	4	B	0.1580	0.1130	0.2300	6.0000	0.0001	0.0	0.0	0
53	1	B	0.1580	0.1130	0.2300	6.0000	0.0200	0.0	0.0	0
54	2	C	0.1230	0.1860	0.1000	3.0000	0.6100	0.3200	0.0	0
55	6	C	0.1230	0.1860	0.1000	3.0000	0.0100	0.3200	0.0	0
56	4	C	0.1230	0.1860	0.1000	3.0000	0.0001	0.3200	0.0	0
57	6	C	0.1230	0.1860	0.1000	2.0000	0.0100	0.4300	0.0	0
58	5	B	0.0870	0.1530	0.3800	8.0000	0.0090	0.0	0.0	0
59	4	B	0.0870	0.1530	0.3800	8.0000	0.0001	0.0	0.0	0
60	11	B	0.0870	0.1530	0.3800	8.0000	0.1100	0.0	0.0	0
61	1	B	0.0870	0.1530	0.3800	8.0000	0.0200	0.0	0.0	0
62	2	B	0.0870	0.1530	0.3800	8.0000	0.6100	0.0	0.0	0
63	6	B	0.0870	0.1530	0.3800	8.0000	0.0100	0.0	0.0	0
64	4	D	0.1230	0.1860	0.1000	2.0000	0.0001	0.4300	0.0	0
65	6	D	0.1230	0.1860	0.1000	2.0000	0.0100	0.4300	0.0	0
66	10	B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
67	9	B	0.0	0.0	0.0	0.0	0.0020	0.3200	0.0	0

*
* NUMBER OF HRUS IN EACH ELEMENT (NHRU):

ELEMENT:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
# HRUS:	9	8	7	8	11	15	6	5	7	4	4	4	3	7	9	5	2	11	10	14

*
* NUMBER OF HRUS IN EACH ELEMENT (NHRU):

ELEMENT:	21	22
# HRUS:	6	7

ASSIGNMENT OF HRUS TO ELEMENTS:

I	J	IHRU	FHRU
1	1	36	0.60190
	2	4	0.12620
	3	8	0.10540
	4	47	0.09950
	5	22	0.02120
	6	48	0.02070
	7	9	0.00900
	8	67	0.00580
	9	66	0.01030
2	1	38	0.06340
	2	10	0.46350
	3	67	0.00690
	4	66	0.01920
	5	9	0.07720
	6	5	0.02080
	7	6	0.32730
	8	8	0.02170
3	1	7	0.14620
	2	11	0.65180
	3	49	0.09490
	4	48	0.03450
	5	59	0.02960
	6	12	0.01600
	7	42	0.02700
4	1	48	0.02690
	2	36	0.45120
	3	66	0.01920
	4	47	0.08420
	5	22	0.12640
	6	28	0.13040
	7	14	0.13810
	8	60	0.02360
5	1	36	0.17530
	2	66	0.01860
	3	37	0.12510
	4	22	0.06410
	5	23	0.08280
	6	4	0.04140
	7	29	0.02610
	8	28	0.11470
	9	14	0.12190
	10	33	0.10220
	11	60	0.12780
6	1	38	0.28670
	2	39	0.06610
	3	40	0.01910
	4	66	0.00870
	5	41	0.04850
	6	4	0.02720
	7	22	0.03170
	8	23	0.03710
	9	28	0.16690
	10	29	0.01530
	11	37	0.07250
	12	34	0.15630

	13	61	0.00890
	14	35	0.02880
	15	59	0.02620
7	1	10	0.53350
	2	66	0.00760
	3	6	0.26090
	4	38	0.14070
	5	19	0.05400
	6	67	0.00330
8	1	42	0.33440
	2	20	0.18820
	3	54	0.34520
	4	62	0.09850
	5	63	0.03370
9	1	40	0.02720
	2	55	0.49910
	3	56	0.09410
	4	63	0.06680
	5	46	0.01770
	6	59	0.23940
	7	11	0.05570
10	1	36	0.07070
	2	41	0.09660
	3	35	0.53030
	4	59	0.30240
11	1	39	0.00870
	2	40	0.05550
	3	43	0.36960
	4	32	0.56620
12	1	36	0.51160
	2	41	0.16520
	3	33	0.28840
	4	35	0.03480
13	1	41	0.10360
	2	35	0.73220
	3	59	0.16420
14	1	43	0.58430
	2	32	0.35260
	3	58	0.00480
	4	51	0.01260
	5	24	0.02850
	6	67	0.01250
	7	40	0.00470
15	1	43	0.07120
	2	30	0.02080
	3	31	0.10490
	4	41	0.08240
	5	25	0.13570
	6	52	0.03870
	7	53	0.02900
	8	23	0.20310
	9	29	0.31420
16	1	25	0.52680
	2	31	0.08070
	3	52	0.10660
	4	59	0.27650
	5	45	0.00940
17	1	10	0.97540
	2	67	0.02460
18	1	13	0.29130
	2	67	0.00530
	3	1	0.09510
	4	42	0.03350

	5	54	0.21080
	6	15	0.24650
	7	2	0.01450
	8	12	0.00520
	9	3	0.02210
	10	16	0.00590
	11	56	0.06980
19	1	55	0.35700
	2	11	0.00470
	3	17	0.24440
	4	46	0.02010
	5	16	0.00940
	6	56	0.05320
	7	45	0.05810
	8	64	0.12470
	9	65	0.12040
	10	57	0.00800
20	1	30	0.01790
	2	31	0.00760
	3	29	0.17130
	4	50	0.01360
	5	41	0.04510
	6	66	0.00330
	7	43	0.00800
	8	23	0.31460
	9	26	0.00640
	10	39	0.01500
	11	37	0.04160
	12	44	0.11400
	13	25	0.22900
	14	27	0.01260
21	1	25	0.63880
	2	18	0.16700
	3	31	0.06420
	4	45	0.09590
	5	46	0.02820
	6	23	0.00590
22	1	41	0.33370
	2	25	0.18210
	3	31	0.10630
	4	35	0.00450
	5	21	0.03520
	6	18	0.29250
	7	45	0.04570

OUTPUT PRINT CONTROL DESIGNATORS:

HRU TABLE OUTPUT PRINT INDICATOR	(NTBLHS):	1
PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR	(NTBLPE):	1
NUMBER OF HOURS FOR THE DISCHARGE RECORD	(NHOURC):	5

FLOW CALCULATION INTERVALS (SECONDS):

OVERLAND FLOW CALCULATION INTERVAL (DTO):	30.
CHANNEL FLOW CALCULATION INTERVAL (DTC):	10.

PRINT FREQUENCY INDICATORS (SECONDS):

OVERLAND FLOW PRINT FREQUENCY INDICATOR	(NOPRIN):	300
CHANNEL FLOW PRINT FREQUENCY INDICATOR	(NCPRIN):	300

```
SUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER):

 SUBSHED:  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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
  NPOVER:  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0


SUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS (NPCHAN):

 SUBSHED:  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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
  NPCHAN:  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0


STORM DESCRIPTIVE INFORMATION:

  NUMBER OF RAIN GAGES IN THE WATERSHED:                             1
  NUMBER OF HOURS IN THE OUTPUT DISCHARGE RECORD:                    5
  STARTING HOUR OF THE STORM:                                       19
  STARTING DATE OF THE STORM:                                   1  4 72
  NUMBER OF HOURS IN THE INPUT  RAINFALL  RECORD:                    1
  TIME INTERVAL OF PRECIPITATION RECORDS (SECONDS):                300
  ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD
        CAPACITY FOR THE ENTIRE WATERSHED:                          0.


RAINGAGE NUMBER CORRESSESPONDING TO EACH ELEMENT (NRGAGE):

  ELEMENT:  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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
   NRGAGE:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1


  ELEMENT: 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
   NRGAGE:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

INPUT PRECIPITATION FOR RAINGAGE   1


            0.01000   0.02333   0.01667   0.01667   0.01667   0.01667   0.01818   0.02045
            0.02045   0.02045   0.02045   0.0


ANTECEDENT PRECIPITATION FOR THE PRECEDING 30 DAYS AT RAINGAGE:   1

            0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
            0.0         0.0         0.0         0.01000     0.10000     0.0         1.20000     0.0
            2.00000     0.20000     0.0         0.0         0.0         0.0         0.0         0.0
            0.0         0.0         0.0         0.0         0.0         0.40000
```

REQUIRED DIMENSIONS FOR AN FESHM MODEL RUN:

```
THE NUMBER OF RAINGAGES                            (NGAGES):      1
THE NUMBER OF RAINFALL INCREMENTS                  (NPCINT):     12

THE NUMBER OF SUBSHEDS                             (NTSS  ):      5
THE NUMBER OF LANDUSE TYPES                        (NLANUS):     11
THE NUMBER OF HRUS                                 (NDHRUS):     67
THE TOTAL NUMBER OF ELEMENTS                       (NTELES):     22

THE MAXIMUM NUMBER OF HRUS IN AN ELEMENT           (MHRU  ):     15
THE MAXIMUM NUMBER OF FLOWSTRIPS IN A SUBSHED      (MSTRPS):      4
THE MAXIMUM NUMBER OF ELEMENTS IN A FLOWSTRIP      (MESTRP):      3
THE MAXIMUM NUMBER OF NODES IN A FLOWSTRIP         (MNSTRP):      4
THE MAXIMUM NUMBER OF CHANNEL ELEMENTS             (MECHAN):      2
THE MAXIMUM NUMBER OF NODES IN A CHANNEL REACH     (MNCHAN):      3

THE MAXIMUM NUMBER OF OVERLAND TIME STEPS          (NOSTEP):    600
THE MAXIMUM NUMBER OF CHANNEL  TIME STEPS          (NCSTEP):   1800
```

```
##### CCKFESHM DATABASE ############################################################

FESHM MODEL RUN FOR THE CUNNINGHAM WATERSHED ON  4 JANUARY 1972.
    1    1          300           300
 1 0 0 0 0
 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
         1          1          5        300      19     1     4    720.0
   0.01000    0.02333    0.01667    0.01667    0.01667    0.01667    0.01818    0.02045
   0.02045    0.02045    0.02045    0.0
  0.30  0.30  0.30  0.45  0.60  0.80  0.90  0.90  0.75  0.40  0.30  0.30
  0.80  1.43  2.13  3.30  4.34  4.80  4.96  4.03  3.30  1.94  1.11  0.71
   0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
   0.0        0.0        0.0        0.01000    0.10000    0.0        1.20000    0.0
   2.00000    0.20000    0.0        0.0        0.0        0.0        0.0        0.0
   0.0        0.0        0.0        0.0        0.0        0.40000
         5         22         67         11
         9
       36         4         8        47        22        48         9        67        66
   0.6019   0.1262   0.1054   0.0995   0.0212   0.0207   0.0090   0.0058   0.0103
         8
       38        10        67        66         9         5         6         8
   0.0634   0.4635   0.0069   0.0192   0.0772   0.0208   0.3273   0.0217
         7
        7        11        49        48        59        12        42
   0.1462   0.6518   0.0949   0.0345   0.0296   0.0160   0.0270
         8
       48        36        66        47        22        28        14        60
   0.0269   0.4512   0.0192   0.0842   0.1264   0.1304   0.1381   0.0236
        11
       36        66        37        22        23         4        29        28        14        33
       60
   0.1753   0.0186   0.1251   0.0641   0.0828   0.0414   0.0261   0.1147   0.1219   0.1022
   0.1278
        15
       38        39        40        66        41         4        22        23        28        29
       37        34        61        35        59
   0.2867   0.0661   0.0191   0.0087   0.0485   0.0272   0.0317   0.0371   0.1669   0.0153
   0.0725   0.1563   0.0089   0.0288   0.0262
         6
       10        66         6        38        19        67
   0.5335   0.0076   0.2609   0.1407   0.0540   0.0033
         5
       42        20        54        62        63
   0.3344   0.1882   0.3452   0.0985   0.0337
         7
       40        55        56        63        46        59        11
   0.0272   0.4991   0.0941   0.0668   0.0177   0.2394   0.0557
         4
       36        41        35        59
   0.0707   0.0966   0.5303   0.3024
         4
```

```
    39        40        43        32
0.0087    0.0555    0.3696    0.5662
     4
    36        41        33        35
0.5116    0.1652    0.2884    0.0348
     3
    41        35        59
0.1036    0.7322    0.1642
     7
    43        32        58        51        24        67        40
0.5843    0.3526    0.0048    0.0126    0.0285    0.0125    0.0047
     9
    43        30        31        41        25        52        53        23        29
0.0712    0.0208    0.1049    0.0824    0.1357    0.0387    0.0290    0.2031    0.3142
     5
    25        31        52        59        45
0.5268    0.0807    0.1066    0.2765    0.0094
     2
    10        67
0.9754    0.0246
    11
    13        67         1        42        54        15         2        12         3        16
    56
0.2913    0.0053    0.0951    0.0335    0.2108    0.2465    0.0145    0.0052    0.0221    0.0059
0.0698
    10
    55        11        17        46        16        56        45        64        65        57
0.3570    0.0047    0.2444    0.0201    0.0094    0.0532    0.0581    0.1247    0.1204    0.0080
    14
    30        31        29        50        41        66        43        23        26        39
    37        44        25        27
0.0179    0.0076    0.1713    0.0136    0.0451    0.0033    0.0080    0.3146    0.0064    0.0150
0.0416    0.1140    0.2290    0.0126
     6
    25        18        31        45        46        23
0.6388    0.1670    0.0642    0.0959    0.0282    0.0059
     7
    41        25        31        35        21        18        45
0.3337    0.1821    0.1063    0.0045    0.0352    0.2925    0.0457
     0.27         0.11          0.13          0.90          0.80          0.50          0.90          0.70
     0.0          0.0           0.16
     0.20         0.10          0.11          0.25          0.18          0.16          0.32          0.24
     0.05         0.0           0.11
     0.20         0.08          0.08          0.20          0.15          0.10          0.25          0.25
     0.02         0.02          0.08
        2       0.120         0.190         0.139           10.           B         0.610         0.240
        2       0.127         0.130         0.250            5.           C         0.610         0.280
        4       0.127         0.130         0.250            5.           C         0.000         0.280
       11       0.082         0.267         0.047           10.           C         0.110         0.280
        7       0.082         0.267         0.047           10.           C         0.005         0.280
        3       0.082         0.267         0.047           10.           C         0.170         0.280
        6       0.082         0.267         0.047           10.           C         0.010         0.280
       11       0.082         0.267         0.047           11.           B         0.110         0.280
        7       0.082         0.267         0.047           11.           B         0.005         0.280
        3       0.082         0.267         0.047           11.           B         0.170         0.280
        6       0.082         0.267         0.047           11.           B         0.010         0.280
        4       0.082         0.267         0.047           11.           B         0.000         0.280
        2       0.082         0.267         0.047           11.           B         0.610         0.280
       11       0.131         0.235         0.230           12.           B         0.110         0.280
        2       0.131         0.235         0.230           12.           B         0.610         0.280
        4       0.131         0.235         0.230           12.           B         0.000         0.280
        6       0.131         0.235         0.230           12.           B         0.010         0.280
        4       0.131         0.235         0.230            3.           D         0.000         0.430
        3       0.131         0.235         0.230            4.           B         0.170         0.280
        2       0.131         0.235         0.230            4.           B         0.610         0.280
        4       0.131         0.235         0.230            4.           B         0.000         0.280
       11       0.127         0.130         0.180            5.           C         0.110         0.320
        1       0.127         0.130         0.180            5.           C         0.020         0.320
        5       0.127         0.130         0.180            5.           C         0.009         0.320
        4       0.127         0.130         0.180            5.           C         0.000         0.320
        7       0.127         0.130         0.180            5.           C         0.005         0.320
        8       0.127         0.130         0.180            5.           C         0.006         0.320
       11       0.127         0.130         0.180            5.           B         0.110         0.280
        1       0.127         0.130         0.180            5.           B         0.020         0.280
        5       0.127         0.130         0.180            5.           B         0.009         0.280
```

4	0.127	0.130	0.180	5.	B	0.000	0.280
5	0.158	0.113	0.230	7.	C	0.009	0.320
11	0.158	0.113	0.230	7.	C	0.110	0.320
1	0.158	0.113	0.230	7.	C	0.020	0.320
4	0.158	0.113	0.230	7.	C	0.000	0.320
11	0.158	0.113	0.230	7.	B	0.110	0.280
1	0.158	0.113	0.230	7.	B	0.020	0.280
3	0.158	0.113	0.230	7.	B	0.170	0.280
7	0.158	0.113	0.230	7.	B	0.005	0.280
6	0.158	0.113	0.230	7.	B	0.010	0.280
4	0.158	0.113	0.230	7.	B	0.000	0.280
2	0.158	0.113	0.230	7.	B	0.610	0.280
5	0.158	0.113	0.230	7.	B	0.009	0.280
8	0.158	0.113	0.230	7.	B	0.006	0.280
4	0.119	0.134	0.025	6.	A	0.000	0.240
6	0.119	0.134	0.025	6.	A	0.010	0.240
11	0.131	0.190	0.150	8.	B	0.110	0.240
4	0.131	0.190	0.150	8.	B	0.000	0.240
6	0.131	0.190	0.150	8.	B	0.010	0.240
1	0.131	0.190	0.150	8.	B	0.020	0.240
5	0.158	0.113	0.230	6.	B	0.009	0.0
4	0.158	0.113	0.230	6.	B	0.000	0.0
1	0.158	0.113	0.230	6.	B	0.020	0.0
2	0.123	0.186	0.100	3.	C	0.610	0.320
6	0.123	0.186	0.100	3.	C	0.010	0.320
4	0.123	0.186	0.100	3.	C	0.000	0.320
6	0.123	0.186	0.100	2.	C	0.010	0.430
5	0.087	0.153	0.380	8.	B	0.009	0.0
4	0.087	0.153	0.380	8.	B	0.000	0.0
11	0.087	0.153	0.380	8.	B	0.110	0.0
1	0.087	0.153	0.380	8.	B	0.020	0.0
2	0.087	0.153	0.380	8.	B	0.610	0.0
6	0.087	0.153	0.380	8.	B	0.010	0.0
4	0.123	0.186	0.100	2.	D	0.000	0.430
6	0.123	0.186	0.100	2.	D	0.010	0.430
10	0.0	0.0	0.0	0.	B	0.0	0.0
9	0.0	0.0	0.0	0.	B	0.002	0.320
30.	10.						

0	0	1	0	1	0
1	2				
4	3				
3	2	2			
1	2	1			
882.10	62.00	12.3655	796.67		
907.98	57.00	10.2634	520.82		
651.58	38.00	4.5356	425.38		
875.12	54.00	9.3310	1222.05		
796.6699	40.0000	0.0400	10.0000	2.0000	0.0
425.3799	12.0000	0.0350	10.0000	2.0000	0.0
2	1	1			
1	1				
804.34	44.00	7.7618	967.76		
1324.32	48.00	12.8383	967.76		
967.7598	52.0000	0.0400	10.0000	2.0000	0.0
2	1	1			
3	1				
994.86	36.00	13.0751	578.40		
588.43	35.00	7.5171	717.13		
418.40	30.00	6.1864	979.20		
771.33	70.00	6.6512	979.20		
979.2000	20.0000	0.0350	18.0000	2.0000	0.0
4	2	2			
1	2	1	2		
937.40	60.00	10.9879	1335.03		
1318.22	30.00	11.3658	928.41		
1094.03	54.00	6.1423	634.49		
748.15	61.00	31.4758	1256.93		
704.86	37.00	6.6460	704.05		
501.01	61.00	7.4368	712.59		
1335.0298	61.0000	0.0400	20.0000	2.0000	0.0
634.4900	10.0000	0.0400	16.0000	2.0000	0.0

```
   3     1     2
   3     2     1
 719.93     29.00     5.9462    659.03
 619.68     30.00    21.5265   1683.17
 821.24     77.00    27.2798   1839.52
 616.60     36.00    14.8364   1173.09
1220.11     80.00    16.1303    844.80
1629.14    104.00    35.3006    994.72
844.7998   10.0000    0.0450   14.0000    1.5000    3.0000
994.7200   20.0000    0.0450   14.0000    1.5000    6.5000
```

DATATEST is the stand-alone program described in Chapter 6 that can be used with an INTERFACE-generated or independently-developed data set for FESHM. The DATATEST conversation and resultant file, A LISTING Z, are shown on the following pages. No output is received on IUNIT8.

```
execute datatest
TODAY'S DATE IS: 83/10/05                         THE CURRENT TIME IS: 24:05:34

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
cckfeshm database
DMSLIO740I EXECUTION BEGINS...

      YOUR PROGRAM OUTPUTS ARE IN:

           A        LISTING  Z                FOR OUTPUT UNIT 7
                    &
           CCKFESHM DATABASE A                FOR OUTPUT UNIT 8


      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !

R;
```

```
#### A LISTING Z ##########################################################################################################

FESHM MODEL RUN FOR THE CUNNINGHAM WATERSHED ON  4 JANUARY 1972.

OUTPUT PRINT CONTROL DESIGNATORS:

  HRU TABLE OUTPUT PRINT INDICATOR             (NTBLHS):              1
  PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR  (NTBLPE):              1

  PRINT FREQUENCY INDICATORS (SECONDS):

      OVERLAND FLOW PRINT FREQUENCY INDICATOR  (NOPRIN):            300
      CHANNEL  FLOW PRINT FREQUENCY INDICATOR  (NCPRIN):            300


SUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER):

  SUBSHED:   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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
   NPOVER:   1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0


SUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS     (NPCHAN):

  SUBSHED:   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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
   NPCHAN:   1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0


STORM DESCRIPTIVE INFORMATION:

   NUMBER OF RAIN GAGES IN THE WATERSHED:                             1
   NUMBER OF HOURS IN THE OUTPUT DISCHARGE RECORD:                    5
   STARTING HOUR OF THE STORM:                                       19
   STARTING DATE OF THE STORM:                                   1  4 72
   NUMBER OF HOURS IN THE INPUT  RAINFALL  RECORD:                    1
   TIME INTERVAL OF PRECIPITATION RECORDS (SECONDS):                300
   ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD
         CAPACITY FOR THE ENTIRE WATERSHED:                         0.0
```

```
INPUT PRECIPITATION FOR RAIN GAGE    1

  0.01000    0.02333    0.01667    0.01667    0.01667    0.01667    0.01818    0.02045
  0.02045    0.02045    0.02045    0.0


   THE SUM OF RAINFALL FOR RAINGAGE    1   IS:         0.1971

RAINGAGE NUMBER CORRESSESPONDING TO EACH ELEMENT (NRGAGE):

  ELEMENT:  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 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
   NRGAGE:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

  ELEMENT: 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
   NRGAGE:  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:

  GROWTH INDEX COEFFICIENTS  (GINDEX):

     JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.

     0.300 0.300 0.300 0.450 0.600 0.800 0.900 0.900 0.750 0.400 0.300 0.300

  EVAPORATION COEFFICIENTS   (EVP):

     JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.

     0.800 1.430 2.130 3.300 4.340 4.800 4.960 4.030 3.300 1.940 1.110 0.710


ANTECEDENT PRECIPITATION FOR THE PRECEDING 30 DAYS AT RAINGAGE:          1

  0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0        0.0        0.0        0.01000    0.10000    0.0        1.20000    0.0
  2.00000    0.20000    0.0        0.0        0.0        0.0        0.0        0.0
  0.0        0.0        0.0        0.0        0.0        0.40000

   THE SUM OF ANTECEDENT RAINFALL FOR RAINGAGE    1  IS:          3.9100
```

INDEXING OF HRUS WITHIN SUBSHEDS:

NUMBER OF SUBSHEDS =	5
TOTAL NUMBER OF ELEMENTS =	22
NUMBER OF DIFFERENT HRUS =	67
NUMBER OF LAND USES =	11

ELEMENT NUMBER	NHRU	J	(IHRU) HRU NUMBER	(FHRU) FRACTION OF ELEMENT AREA
1	9	1	36	0.601900
		2	4	0.126200
		3	8	0.105400
		4	47	0.099500
		5	22	0.021200
		6	48	0.020700
		7	9	0.009000
		8	67	0.005800
		9	66	0.010300
2	8	1	38	0.063400
		2	10	0.463500
		3	67	0.006900
		4	66	0.019200
		5	9	0.077200
		6	5	0.020800
		7	6	0.327300
		8	8	0.021700
3	7	1	7	0.146200
		2	11	0.651800
		3	49	0.094900
		4	48	0.034500
		5	59	0.029600
		6	12	0.016000
		7	42	0.027000
4	8	1	48	0.026900
		2	36	0.451200
		3	66	0.019200
		4	47	0.084200
		5	22	0.126400
		6	28	0.130400
		7	14	0.138100
		8	60	0.023600
5	11	1	36	0.175300
		2	66	0.018600
		3	37	0.125100
		4	22	0.064100
		5	23	0.082800
		6	4	0.041400
		7	29	0.026100
		8	28	0.114700
		9	14	0.121900
		10	33	0.102200
		11	60	0.127800
6	15	1	38	0.286700
		2	39	0.066100
		3	40	0.019100
		4	66	0.008700
		5	41	0.048500
		6	4	0.027200
		7	22	0.031700
		8	23	0.037100
		9	28	0.166900
		10	29	0.015300
		11	37	0.072500

		12	34	0.156300
		13	61	0.008900
		14	35	0.028800
		15	59	0.026200
7	6	1	10	0.533500
		2	66	0.007600
		3	6	0.260900
		4	38	0.140700
		5	19	0.054000
		6	67	0.003300
8	5	1	42	0.334400
		2	20	0.188200
		3	54	0.345200
		4	62	0.098500
		5	63	0.033700
9	7	1	40	0.027200
		2	55	0.499100
		3	56	0.094100
		4	63	0.066800
		5	46	0.017700
		6	59	0.239400
		7	11	0.055700
10	4	1	36	0.070700
		2	41	0.096600
		3	35	0.530300
		4	59	0.302400
11	4	1	39	0.008700
		2	40	0.055500
		3	43	0.369600
		4	32	0.566200
12	4	1	36	0.511600
		2	41	0.165200
		3	33	0.288400
		4	35	0.034800
13	3	1	41	0.103600
		2	35	0.732200
		3	59	0.164200
14	7	1	43	0.584300
		2	32	0.352600
		3	58	0.004800
		4	51	0.012600
		5	24	0.028500
		6	67	0.012500
		7	40	0.004700
15	9	1	43	0.071200
		2	30	0.020800
		3	31	0.104900
		4	41	0.082400
		5	25	0.135700
		6	52	0.038700
		7	53	0.029000
		8	23	0.203100
		9	29	0.314200
16	5	1	25	0.526800
		2	31	0.080700
		3	52	0.106600
		4	59	0.276500
		5	45	0.009400
17	2	1	10	0.975400
		2	67	0.024600
18	11	1	13	0.291300
		2	67	0.005300
		3	1	0.095100

		4	42	0.033500
		5	54	0.210800
		6	15	0.246500
		7	2	0.014500
		8	12	0.005200
		9	3	0.022100
		10	16	0.005900
		11	56	0.069800
19	10	1	55	0.357000
		2	11	0.004700
		3	17	0.244400
		4	46	0.020100
		5	16	0.009400
		6	56	0.053200
		7	45	0.058100
		8	64	0.124700
		9	65	0.120400
		10	57	0.008000
20	14	1	30	0.017900
		2	31	0.007600
		3	29	0.171300
		4	50	0.013600
		5	41	0.045100
		6	66	0.003300
		7	43	0.008000
		8	23	0.314600
		9	26	0.006400
		10	39	0.015000
		11	37	0.041600
		12	44	0.114000
		13	25	0.229000
		14	27	0.012600
21	6	1	25	0.638800
		2	18	0.167000
		3	31	0.064200
		4	45	0.095900
		5	46	0.028200
		6	23	0.005900
22	7	1	41	0.333700
		2	25	0.182100
		3	31	0.106300
		4	35	0.004500
		5	21	0.035200
		6	18	0.292500
		7	45	0.045700

LAND USE DESCRIPTORS:

NO.	(AFLU) HOLTAN'S A COEFFICIENT	(DSLU) DEPRESSION STORAGE	(RCLU) MANNING'S ROUGHNESS
1	0.27000	0.20000	0.20000
2	0.11000	0.10000	0.08000
3	0.13000	0.11000	0.08000
4	0.90000	0.25000	0.20000
5	0.80000	0.18000	0.15000
6	0.50000	0.16000	0.10000
7	0.90000	0.32000	0.25000
8	0.70000	0.24000	0.25000
9	0.0	0.05000	0.02000
10	0.0	0.0	0.02000
11	0.16000	0.11000	0.08000

HRU DESCRIPTORS:

HRU NO.	LANDUSE	(SLOHRU) SLOPE CLASS	(FAW) AVAIL WATER	(FGW) GRAVITY WATER	(FC) INFILT. RATE	CONTROL DEPTH	CUSLE	XKUSL
1	2	B	0.120	0.190	0.139	10.000	0.610	0.240
2	2	C	0.127	0.130	0.250	5.000	0.610	0.280
3	4	C	0.127	0.130	0.250	5.000	0.0	0.280
4	11	C	0.082	0.267	0.047	10.000	0.110	0.280
5	7	C	0.082	0.267	0.047	10.000	0.005	0.280
6	3	C	0.082	0.267	0.047	10.000	0.170	0.280
7	6	C	0.082	0.267	0.047	10.000	0.010	0.280
8	11	B	0.082	0.267	0.047	11.000	0.110	0.280
9	7	B	0.082	0.267	0.047	11.000	0.005	0.280
10	3	B	0.082	0.267	0.047	11.000	0.170	0.280
11	6	B	0.082	0.267	0.047	11.000	0.010	0.280
12	4	B	0.082	0.267	0.047	11.000	0.0	0.280
13	2	B	0.082	0.267	0.047	11.000	0.610	0.280
14	11	B	0.131	0.235	0.230	12.000	0.110	0.280
15	2	B	0.131	0.235	0.230	12.000	0.610	0.280
16	4	B	0.131	0.235	0.230	12.000	0.0	0.280
17	6	B	0.131	0.235	0.230	12.000	0.010	0.280
18	4	D	0.131	0.235	0.230	3.000	0.0	0.430
19	3	B	0.131	0.235	0.230	4.000	0.170	0.280
20	2	B	0.131	0.235	0.230	4.000	0.610	0.280
21	4	B	0.131	0.235	0.230	4.000	0.0	0.280
22	11	C	0.127	0.130	0.180	5.000	0.110	0.320
23	1	C	0.127	0.130	0.180	5.000	0.020	0.320
24	5	C	0.127	0.130	0.180	5.000	0.009	0.320
25	4	C	0.127	0.130	0.180	5.000	0.0	0.320
26	7	C	0.127	0.130	0.180	5.000	0.005	0.320
27	8	C	0.127	0.130	0.180	5.000	0.006	0.320
28	11	B	0.127	0.130	0.180	5.000	0.110	0.280
29	1	B	0.127	0.130	0.180	5.000	0.020	0.280
30	5	B	0.127	0.130	0.180	5.000	0.009	0.280
31	4	B	0.127	0.130	0.180	5.000	0.0	0.280
32	5	C	0.158	0.113	0.230	7.000	0.009	0.320
33	11	C	0.158	0.113	0.230	7.000	0.110	0.320
34	1	C	0.158	0.113	0.230	7.000	0.020	0.320
35	4	C	0.158	0.113	0.230	7.000	0.0	0.320
36	11	B	0.158	0.113	0.230	7.000	0.110	0.280
37	1	B	0.158	0.113	0.230	7.000	0.020	0.280
38	3	B	0.158	0.113	0.230	7.000	0.170	0.280
39	7	B	0.158	0.113	0.230	7.000	0.005	0.280
40	6	B	0.158	0.113	0.230	7.000	0.010	0.280
41	4	B	0.158	0.113	0.230	7.000	0.0	0.280
42	2	B	0.158	0.113	0.230	7.000	0.610	0.280
43	5	B	0.158	0.113	0.230	7.000	0.009	0.280
44	8	B	0.158	0.113	0.230	7.000	0.006	0.280
45	4	A	0.119	0.134	0.025	6.000	0.0	0.240
46	6	A	0.119	0.134	0.025	6.000	0.010	0.240
47	11	B	0.131	0.190	0.150	8.000	0.110	0.240
48	4	B	0.131	0.190	0.150	8.000	0.0	0.240
49	6	B	0.131	0.190	0.150	8.000	0.010	0.240
50	1	B	0.131	0.190	0.150	8.000	0.020	0.240
51	5	B	0.158	0.113	0.230	6.000	0.009	0.0
52	4	B	0.158	0.113	0.230	6.000	0.0	0.0
53	1	B	0.158	0.113	0.230	6.000	0.020	0.0
54	2	C	0.123	0.186	0.100	3.000	0.610	0.320
55	6	C	0.123	0.186	0.100	3.000	0.010	0.320
56	4	C	0.123	0.186	0.100	3.000	0.0	0.320
57	6	C	0.123	0.186	0.100	2.000	0.010	0.430
58	5	B	0.087	0.153	0.380	8.000	0.009	0.0
59	4	B	0.087	0.153	0.380	8.000	0.0	0.0
60	11	B	0.087	0.153	0.380	8.000	0.110	0.0
61	1	B	0.087	0.153	0.380	8.000	0.020	0.0
62	2	B	0.087	0.153	0.380	8.000	0.610	0.0
63	6	B	0.087	0.153	0.380	8.000	0.010	0.0
64	4	D	0.123	0.186	0.100	2.000	0.0	0.430
65	6	D	0.123	0.186	0.100	2.000	0.010	0.430
66	10	B	0.0	0.0	0.0	0.0	0.0	0.0
67	9	B	0.0	0.0	0.0	0.0	0.002	0.320

TIME INCREMENTS:

TIME INCREMENT FOR OVERLAND FLOW = 30.
TIME INCREMENT FOR CHANNEL FLOW = 10.

OVERLAND AND CHANNEL FLOW DESCRIPTORS:

BOUNDARY CONDITION CODES AND CHANNEL ORDERING

```
0   0   1   0   1   0
1   2
4   3
```

OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR SUB-BASIN 1

NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE (NSTRPS): 3
NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 2
NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED (NECHAN): 2
NUMBER OF ELEMENTS IN EACH FLOWSTRIP (NESTRP): 1 2 1

OVERLAND FLOW ELEMENT DESRCIPTORS:

ELEM. NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
1	882.10	62.00	12.37	796.67
1	907.98	57.00	10.26	520.82
2	651.58	38.00	4.54	425.38
1	875.12	54.00	9.33	1222.05

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
1	796.6699	40.0000	0.0400	10.0000	2.0000	0.0
2	425.3799	12.0000	0.0350	10.0000	2.0000	0.0

OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR SUB-BASIN 2

NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE (NSTRPS): 2
NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 1
NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED (NECHAN): 1
NUMBER OF ELEMENTS IN EACH FLOWSTRIP (NESTRP): 1 1

OVERLAND FLOW ELEMENT DESRCIPTORS:

ELEM. NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH	
1	804.34	44.00	7.76	967.76	
1	1324.32	48.00	12.84	967.76	0

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
1	967.7598	52.0000	0.0400	10.0000	2.0000	0.0

OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR SUB-BASIN 3

NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE	(NSTRPS):	2		
NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1		
NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED	(NECHAN):	1		
NUMBER OF ELEMENTS IN EACH FLOWSTRIP	(NESTRP):	3	1	

OVERLAND FLOW ELEMENT DESRCIPTORS:

ELEM. NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
1	994.86	36.00	13.08	578.40
2	588.43	35.00	7.52	717.13
3	418.40	30.00	6.19	979.20
1	771.33	70.00	6.65	979.20

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
1	979.2000	20.0000	0.0350	18.0000	2.0000	0.0

OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR SUB-BASIN 4

NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE	(NSTRPS):	4			
NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	2			
NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED	(NECHAN):	2			
NUMBER OF ELEMENTS IN EACH FLOWSTRIP	(NESTRP):	1	2	1	2

OVERLAND FLOW ELEMENT DESRCIPTORS:

ELEM. NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
1	937.40	60.00	10.99	1335.03
1	1318.22	30.00	11.37	928.41
2	1094.03	54.00	6.14	634.49
1	748.15	61.00	31.48	1256.93
1	704.86	37.00	6.65	704.05
2	501.01	61.00	7.44	712.59

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
1	1335.0298	61.0000	0.0400	20.0000	2.0000	0.0
2	634.4900	10.0000	0.0400	16.0000	2.0000	0.0

OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR SUB-BASIN 5

NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE	(NSTRPS):	3
NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1
NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED	(NECHAN):	2
NUMBER OF ELEMENTS IN EACH FLOWSTRIP	(NESTRP):	3 2 1

OVERLAND FLOW ELEMENT DESRCIPTORS:

ELEM. NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
1	719.93	29.00	5.95	659.03
2	619.68	30.00	21.53	1683.17
3	821.24	77.00	27.28	1839.52
1	616.60	36.00	14.84	1173.09
2	1220.11	80.00	16.13	844.80
1	1629.14	104.00	35.30	994.72

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
1	844.7998	10.0000	0.0450	14.0000	1.5000	3.0000
2	994.7200	20.0000	0.0450	14.0000	1.5000	6.5000

REQUIRED DIMENSIONS FOR AN FESHM MODEL RUN:

THE NUMBER OF RAINGAGES	(NGAGES):	1
THE NUMBER OF RAINFALL INCREMENTS	(NPCINT):	12
THE NUMBER OF SUBSHEDS	(NTSS):	5
THE NUMBER OF LANDUSE TYPES	(NLANUS):	11
THE NUMBER OF HRUS	(NDHRUS):	67
THE TOTAL NUMBER OF ELEMENTS	(NTELES):	22
THE MAXIMUM NUMBER OF HRUS IN AN ELEMENT	(MHRU):	15
THE MAXIMUM NUMBER OF FLOWSTRIPS IN A SUBSHED	(MSTRPS):	4
THE MAXIMUM NUMBER OF ELEMENTS IN A FLOWSTRIP	(MESTRP):	3
THE MAXIMUM NUMBER OF NODES IN A FLOWSTRIP	(MNSTRP):	4
THE MAXIMUM NUMBER OF CHANNEL ELEMENTS	(MECHAN):	2
THE MAXIMUM NUMBER OF NODES IN A CHANNEL REACH	(MNCHAN):	3
THE MAXIMUM NUMBER OF OVERLAND TIME STEPS	(NOSTEP):	600
THE MAXIMUM NUMBER OF CHANNEL TIME STEPS	(NCSTEP):	1800

7.2.2 FESHM Generated Output

The following pages list the output file generated by FESHM utilizing the data file created above.

FESIM MODEL RUN FOR THE CUNNINGHAM CREEK WATERSHED ON 4 JANUARY 1972.
STORM EVENT-- 1/ 4/72
STARTING TIME--19:00
INITIAL MOISTURE CONDITION FOR THE WATERSHED-- DETERMINED INTERNALLY FOR EACH HRU

SUMMARY OF HYDROLOGIC RESPONSE UNITS

HRU NO	LANDUSE NO	SLOPE CLASS	MANNINGS N	DEPRESSION STORAGE	HOLTANS A	FRACTION OF AVAIL WATER	FRACTION OF GRAVITY WATER	EXPONENT C	FINAL INFIL-TRATION RATE	DEPTH OF THE A HORIZON	MAXIMUM STORAGE
1	2	B	0.080	0.080	0.110	0.120	0.190	1.583	0.139	10.00	3.10
2	2	C	0.080	0.060	0.110	0.127	0.130	1.024	0.250	5.00	1.28
3	4	C	0.200	0.150	0.900	0.127	0.130	1.024	0.250	5.00	1.28
4	11	C	0.080	0.066	0.160	0.082	0.267	3.256	0.047	10.00	3.49
5	7	C	0.250	0.192	0.900	0.082	0.267	3.256	0.047	10.00	3.49
6	3	C	0.080	0.066	0.130	0.082	0.267	3.256	0.047	10.00	3.49
7	6	C	0.100	0.096	0.500	0.082	0.267	3.256	0.047	10.00	3.49
8	11	B	0.080	0.088	0.160	0.082	0.267	3.256	0.047	11.00	3.84
9	7	B	0.250	0.256	0.900	0.082	0.267	3.256	0.047	11.00	3.84
10	3	B	0.080	0.088	0.130	0.082	0.267	3.256	0.047	11.00	3.84
11	6	B	0.100	0.128	0.500	0.082	0.267	3.256	0.047	11.00	3.84
12	4	B	0.200	0.200	0.900	0.082	0.267	3.256	0.047	11.00	3.84
13	2	B	0.080	0.080	0.110	0.082	0.267	3.256	0.047	11.00	3.84
14	11	B	0.080	0.088	0.160	0.131	0.235	1.794	0.230	12.00	4.39
15	2	B	0.080	0.080	0.110	0.131	0.235	1.794	0.230	12.00	4.39
16	4	B	0.200	0.200	0.900	0.131	0.235	1.794	0.230	12.00	4.39
17	6	B	0.100	0.128	0.500	0.131	0.235	1.794	0.230	12.00	4.39
18	4	D	0.200	0.100	0.900	0.131	0.235	1.794	0.230	3.00	1.10
19	3	B	0.080	0.088	0.130	0.131	0.235	1.794	0.230	4.00	1.46
20	2	B	0.080	0.080	0.110	0.131	0.235	1.794	0.230	4.00	1.46
21	4	B	0.200	0.200	0.900	0.131	0.235	1.794	0.230	4.00	1.46
22	11	C	0.080	0.066	0.160	0.127	0.130	1.024	0.180	5.00	1.28
23	1	C	0.200	0.120	0.270	0.127	0.130	1.024	0.180	5.00	1.28
24	5	C	0.150	0.108	0.800	0.127	0.130	1.024	0.180	5.00	1.28
25	4	C	0.200	0.150	0.900	0.127	0.130	1.024	0.180	5.00	1.28
26	7	C	0.250	0.192	0.900	0.127	0.130	1.024	0.180	5.00	1.28
27	8	C	0.250	0.144	0.700	0.127	0.130	1.024	0.180	5.00	1.28
28	11	B	0.080	0.088	0.160	0.127	0.130	1.024	0.180	5.00	1.28
29	1	B	0.200	0.160	0.270	0.127	0.130	1.024	0.180	5.00	1.28
30	5	B	0.150	0.144	0.800	0.127	0.130	1.024	0.180	5.00	1.28
31	4	B	0.200	0.200	0.900	0.127	0.130	1.024	0.180	5.00	1.28
32	5	C	0.150	0.108	0.800	0.158	0.113	0.715	0.230	7.00	1.90
33	11	C	0.080	0.066	0.160	0.158	0.113	0.715	0.230	7.00	1.90
34	1	C	0.200	0.120	0.270	0.158	0.113	0.715	0.230	7.00	1.90
35	4	C	0.200	0.150	0.900	0.158	0.113	0.715	0.230	7.00	1.90
36	11	B	0.080	0.088	0.160	0.158	0.113	0.715	0.230	7.00	1.90
37	1	B	0.200	0.160	0.270	0.158	0.113	0.715	0.230	7.00	1.90
38	3	B	0.080	0.088	0.130	0.158	0.113	0.715	0.230	7.00	1.90
39	7	B	0.250	0.256	0.900	0.158	0.113	0.715	0.230	7.00	1.90

40	6	B	0.100	0.128	0.500	0.158	0.113	0.715	0.230	7.00	1.90
41	4	B	0.200	0.200	0.900	0.158	0.113	0.715	0.230	7.00	1.90
42	2	B	0.080	0.080	0.110	0.158	0.113	0.715	0.230	7.00	1.90
43	5	B	0.150	0.144	0.800	0.158	0.113	0.715	0.230	7.00	1.90
44	8	B	0.250	0.192	0.700	0.158	0.113	0.715	0.230	7.00	1.90
45	4	A	0.200	0.250	0.900	0.119	0.134	1.126	0.025	6.00	1.52
46	6	A	0.100	0.160	0.500	0.119	0.134	1.126	0.025	6.00	1.52
47	11	B	0.080	0.088	0.160	0.131	0.190	1.450	0.150	8.00	2.57
48	4	B	0.200	0.200	0.900	0.131	0.190	1.450	0.150	8.00	2.57
49	6	B	0.100	0.128	0.500	0.131	0.190	1.450	0.150	8.00	2.57
50	1	B	0.200	0.160	0.270	0.131	0.190	1.450	0.150	8.00	2.57
51	5	B	0.150	0.144	0.800	0.158	0.113	0.715	0.230	6.00	1.63
52	4	B	0.200	0.200	0.900	0.158	0.113	0.715	0.230	6.00	1.63
53	1	B	0.200	0.160	0.270	0.158	0.113	0.715	0.230	6.00	1.63
54	2	C	0.080	0.060	0.110	0.123	0.186	1.512	0.100	3.00	0.93
55	6	C	0.100	0.096	0.500	0.123	0.186	1.512	0.100	3.00	0.93
56	4	C	0.200	0.150	0.900	0.123	0.186	1.512	0.100	3.00	0.93
57	6	C	0.100	0.096	0.500	0.123	0.186	1.512	0.100	2.00	0.62
58	5	B	0.150	0.144	0.800	0.087	0.153	1.759	0.380	8.00	1.92
59	4	B	0.200	0.200	0.900	0.087	0.153	1.759	0.380	8.00	1.92
60	11	B	0.080	0.088	0.160	0.087	0.153	1.759	0.380	8.00	1.92
61	1	B	0.200	0.160	0.270	0.087	0.153	1.759	0.380	8.00	1.92
62	2	B	0.080	0.080	0.110	0.087	0.153	1.759	0.380	8.00	1.92
63	6	B	0.100	0.128	0.500	0.087	0.153	1.759	0.380	8.00	1.92
64	4	D	0.200	0.100	0.900	0.123	0.186	1.512	0.100	2.00	0.62
65	6	D	0.100	0.064	0.500	0.123	0.186	1.512	0.100	2.00	0.62
66	10	B	0.020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67	9	B	0.020	0.040	0.0	0.0	0.0	0.0	0.0	0.0	0.0

HRU	SMC	CUSLE	XKUSLE
1	0.992	0.610	0.240
2	0.984	0.610	0.280
3	0.984	0.0	0.280
4	0.988	0.110	0.280
5	0.988	0.005	0.280
6	0.988	0.170	0.280
7	0.988	0.010	0.280
8	0.989	0.110	0.280
9	0.989	0.005	0.280
10	0.989	0.170	0.280
11	0.989	0.010	0.280
12	0.989	0.0	0.280
13	0.989	0.610	0.280
14	0.994	0.110	0.280
15	0.994	0.610	0.280
16	0.994	0.0	0.280
17	0.994	0.010	0.280
18	0.975	0.0	0.430
19	0.981	0.170	0.280
20	0.981	0.610	0.280
21	0.981	0.0	0.280

22	0.984	0.110	0.320
23	0.984	0.020	0.320
24	0.984	0.009	0.320
25	0.984	0.0	0.320
26	0.984	0.005	0.320
27	0.984	0.006	0.320
28	0.984	0.110	0.280
29	0.984	0.020	0.280
30	0.984	0.009	0.280
31	0.984	0.0	0.280
32	0.991	0.009	0.320
33	0.991	0.110	0.320
34	0.991	0.020	0.320
35	0.991	0.0	0.320
36	0.991	0.110	0.280
37	0.991	0.020	0.280
38	0.991	0.170	0.280
39	0.991	0.005	0.280
40	0.991	0.010	0.280
41	0.991	0.0	0.280
42	0.991	0.610	0.280
43	0.991	0.009	0.280
44	0.991	0.006	0.280
45	0.986	0.0	0.240
46	0.986	0.010	0.240
47	0.990	0.110	0.240
48	0.990	0.0	0.240
49	0.990	0.010	0.240
50	0.990	0.020	0.240
51	0.989	0.009	0.0
52	0.989	0.0	0.0
53	0.989	0.020	0.0
54	0.973	0.610	0.320
55	0.973	0.010	0.320
56	0.973	0.0	0.320
57	0.959	0.010	0.430
58	0.986	0.009	0.0
59	0.986	0.0	0.0
60	0.986	0.110	0.0
61	0.986	0.020	0.0
62	0.986	0.610	0.0
63	0.986	0.010	0.0
64	0.959	0.0	0.430
65	0.959	0.010	0.430

PRECIPITATION EXCESS FOR RAINGAGE NUMBER 1

HRU PRECIPITATION EXCESS FOR EACH 5-MINUTE INCREMENT OF THE STORM

PRECIPITATION INCREMENTS FROM THE BEGINNING OF THE STORM

HRU	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	HRU
PRECIPITATION	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0													
PRECIPITATION EXCESS																									
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													1
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													2
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													3
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													4
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													5
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													6
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													7
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													8
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													9
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													10
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													11
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													12
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													13
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													14
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													15
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													16
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													17
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													18
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													19
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													20
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													21
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													22
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													23
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													24
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													25
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													26
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													27
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													28
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													29
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													30
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													31
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													32
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													33
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													34
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													35
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													36
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													37

38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50
51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.01	0.01	0.0	54
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56
57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60
61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.01	0.0	65
66	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0	66
67	0.0	0.0	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0	67

ELEMENT PRECIPITATION EXCESS FOR EACH 5-MINUTE INCREMENT OF THE STORM

PRECIPITATION INCREMENTS FROM THE BEGINNING OF THE STORM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
PRECIPITATION																									
	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0													
ELE	PRECIPITATION EXCESS																								ELE
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													1
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													2
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													3
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													5
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													6
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0													7
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.0													8
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													9

10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13
14	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	14
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16
17	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	17
18	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	18
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.0	19
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	20
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22

ROUTING TIME INCREMENT FOR OVERLAND FLOW-- 30 SECONDS
ROUTING TIME INCREMENT FOR CHANNEL FLOW-- 10 SECONDS

OVERLAND FLOW INFORMATION FOR SUB-SHED NUMBER 1

OVERLAND FLOW STRIP NUMBER	ELEMENT NUMBER	ELEMENT AREA (ACRES)	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	NODE WIDTH
1	1	12.4	882.1	62.0	0.070	0.083	2	796.7

	NODE 1			NODE 2		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.00	0.0	0.0
0.17	0.0	0.0	0.0	0.00	0.006	0.0
0.25	0.0	0.0	0.0	0.00	0.014	0.0
0.33	0.0	0.0	0.0	0.00	0.019	0.0
0.42	0.0	0.0	0.0	0.00	0.025	0.0
0.50	0.0	0.0	0.0	0.00	0.030	0.0
0.58	0.0	0.0	0.0	0.00	0.036	0.0
0.67	0.0	0.0	0.0	0.00	0.044	0.0
0.75	0.0	0.0	0.0	0.00	0.052	0.0
0.83	0.0	0.0	0.0	0.00	0.061	0.1
0.92	0.0	0.0	0.0	0.00	0.069	0.1
1.00	0.0	0.0	0.0	0.00	0.073	0.1
1.08	0.0	0.0	0.0	0.00	0.073	0.1
1.17	0.0	0.0	0.0	0.00	0.073	0.1
1.25	0.0	0.0	0.0	0.00	0.073	0.2
1.33	0.0	0.0	0.0	0.00	0.073	0.2
1.42	0.0	0.0	0.0	0.00	0.073	0.2
1.50	0.0	0.0	0.0	0.00	0.073	0.2
1.58	0.0	0.0	0.0	0.00	0.073	0.2
1.67	0.0	0.0	0.0	0.00	0.073	0.3

1.75	0.0	0.0	0.0	0.00	0.073	0.3
1.83	0.0	0.0	0.0	0.00	0.073	0.3
1.92	0.0	0.0	0.0	0.00	0.073	0.3
2.00	0.0	0.0	0.0	0.00	0.073	0.3
2.08	0.0	0.0	0.0	0.00	0.073	0.4
2.17	0.0	0.0	0.0	0.00	0.073	0.4
2.25	0.0	0.0	0.0	0.00	0.073	0.4
2.33	0.0	0.0	0.0	0.00	0.073	0.4
2.42	0.0	0.0	0.0	0.00	0.073	0.5
2.50	0.0	0.0	0.0	0.00	0.073	0.5
2.58	0.0	0.0	0.0	0.00	0.073	0.5
2.67	0.0	0.0	0.0	0.00	0.073	0.5
2.75	0.0	0.0	0.0	0.00	0.073	0.5
2.83	0.0	0.0	0.0	0.00	0.073	0.6
2.92	0.0	0.0	0.0	0.00	0.073	0.6
3.00	0.0	0.0	0.0	0.00	0.073	0.6
3.08	0.0	0.0	0.0	0.00	0.073	0.6
3.17	0.0	0.0	0.0	0.00	0.073	0.6
3.25	0.0	0.0	0.0	0.00	0.073	0.7
3.33	0.0	0.0	0.0	0.00	0.073	0.7
3.42	0.0	0.0	0.0	0.00	0.073	0.7
3.50	0.0	0.0	0.0	0.00	0.073	0.7
3.58	0.0	0.0	0.0	0.00	0.073	0.7
3.67	0.0	0.0	0.0	0.00	0.073	0.8
3.75	0.0	0.0	0.0	0.00	0.073	0.8
3.83	0.0	0.0	0.0	0.00	0.073	0.8
3.92	0.0	0.0	0.0	0.00	0.073	0.8
4.00	0.0	0.0	0.0	0.00	0.073	0.9
4.08	0.0	0.0	0.0	0.00	0.073	0.9
4.17	0.0	0.0	0.0	0.00	0.074	0.9
4.25	0.0	0.0	0.0	0.00	0.074	0.9
4.33	0.0	0.0	0.0	0.00	0.074	0.9
4.42	0.0	0.0	0.0	0.00	0.074	1.0
4.50	0.0	0.0	0.0	0.00	0.074	1.0
4.58	0.0	0.0	0.0	0.00	0.074	1.0
4.67	0.0	0.0	0.0	0.00	0.074	1.0
4.75	0.0	0.0	0.0	0.00	0.074	1.0
4.83	0.0	0.0	0.0	0.00	0.074	1.1
4.92	0.0	0.0	0.0	0.00	0.074	1.1
5.00	0.0	0.0	0.0	0.00	0.074	1.1

OVERLAND FLOW STRIP NUMBER	ELEMENT NUMBER	ELEMENT AREA (ACRES)	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	NODE WIDTH
2	1	10.3	908.0	57.0	0.063	0.095	2	520.8
	2	4.5	651.6	38.0	0.058	0.107	3	425.4

	NODE 1			NODE 2			NODE 3		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.0	0.0	0.00	0.004	0.0	0.0	0.0	0.0
0.25	0.0	0.0	0.0	0.00	0.010	0.0	0.0	0.0	0.0

0.33	0.0	0.0	0.0	0.00	0.020	0.0	0.0	0.0	0.0
0.42	0.0	0.0	0.0	0.00	0.032	0.0	0.0	0.0	0.0
0.50	0.0	0.0	0.0	0.00	0.042	0.0	0.0	0.0	0.0
0.58	0.0	0.0	0.0	0.00	0.049	0.0	0.0	0.0	0.0
0.67	0.0	0.0	0.0	0.00	0.058	0.0	0.0	0.0	0.0
0.75	0.0	0.0	0.0	0.00	0.068	0.0	0.0	0.0	0.0
0.83	0.0	0.0	0.0	0.00	0.078	0.0	0.0	0.0	0.0
0.92	0.0	0.0	0.0	0.00	0.088	0.0	0.0	0.0	0.0
1.00	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.08	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.17	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.25	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.33	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.42	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.50	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.58	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.67	0.0	0.0	0.0	0.00	0.093	0.1	0.0	0.0	0.0
1.75	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
1.83	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
1.92	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.00	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.08	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.17	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.25	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.33	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.42	0.0	0.0	0.0	0.00	0.093	0.2	0.0	0.0	0.0
2.50	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
2.58	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
2.67	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
2.75	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
2.83	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
2.92	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
3.00	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
3.08	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
3.17	0.0	0.0	0.0	0.00	0.093	0.3	0.0	0.0	0.0
3.25	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.33	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.42	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.50	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.58	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.67	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.75	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.83	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
3.92	0.0	0.0	0.0	0.00	0.093	0.4	0.0	0.0	0.0
4.00	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.08	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.17	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.25	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.33	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.42	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.50	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0
4.58	0.0	0.0	0.0	0.00	0.093	0.5	0.0	0.0	0.0

4.67	0.0	0.0	0.0	0.00	0.093	0.6	0.0	0.0	0.0
4.75	0.0	0.0	0.0	0.00	0.093	0.6	0.0	0.0	0.0
4.83	0.0	0.0	0.0	0.00	0.093	0.6	0.0	0.0	0.0
4.92	0.0	0.0	0.0	0.00	0.093	0.6	0.0	0.0	0.0
5.00	0.0	0.0	0.0	0.00	0.093	0.6	0.0	0.0	0.0

OVERLAND FLOW STRIP NUMBER	ELEMENT NUMBER	ELEMENT AREA (ACRES)	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	NODE WIDTH
3	1	9.3	875.1	54.0	0.062	0.082	2	1222.1

	NODE 1			NODE 2		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.00	0.0	0.0
0.17	0.0	0.0	0.0	0.00	0.006	0.0
0.25	0.0	0.0	0.0	0.00	0.014	0.0
0.33	0.0	0.0	0.0	0.00	0.018	0.0
0.42	0.0	0.0	0.0	0.00	0.022	0.0
0.50	0.0	0.0	0.0	0.00	0.026	0.0
0.58	0.0	0.0	0.0	0.00	0.031	0.0
0.67	0.0	0.0	0.0	0.00	0.036	0.0
0.75	0.0	0.0	0.0	0.00	0.042	0.0
0.83	0.0	0.0	0.0	0.00	0.049	0.0
0.92	0.0	0.0	0.0	0.00	0.055	0.1
1.00	0.0	0.0	0.0	0.00	0.058	0.1
1.08	0.0	0.0	0.0	0.00	0.058	0.1
1.17	0.0	0.0	0.0	0.00	0.058	0.1
1.25	0.0	0.0	0.0	0.00	0.058	0.1
1.33	0.0	0.0	0.0	0.00	0.058	0.1
1.42	0.0	0.0	0.0	0.00	0.058	0.1
1.50	0.0	0.0	0.0	0.00	0.058	0.2
1.58	0.0	0.0	0.0	0.00	0.058	0.2
1.67	0.0	0.0	0.0	0.00	0.058	0.2
1.75	0.0	0.0	0.0	0.00	0.058	0.2
1.83	0.0	0.0	0.0	0.00	0.058	0.2
1.92	0.0	0.0	0.0	0.00	0.058	0.2
2.00	0.0	0.0	0.0	0.00	0.058	0.2
2.08	0.0	0.0	0.0	0.00	0.058	0.3
2.17	0.0	0.0	0.0	0.00	0.058	0.3
2.25	0.0	0.0	0.0	0.00	0.058	0.3
2.33	0.0	0.0	0.0	0.00	0.058	0.3
2.42	0.0	0.0	0.0	0.00	0.058	0.3
2.50	0.0	0.0	0.0	0.00	0.058	0.3
2.58	0.0	0.0	0.0	0.00	0.058	0.3
2.67	0.0	0.0	0.0	0.00	0.058	0.4
2.75	0.0	0.0	0.0	0.00	0.058	0.4
2.83	0.0	0.0	0.0	0.00	0.058	0.4
2.92	0.0	0.0	0.0	0.00	0.058	0.4
3.00	0.0	0.0	0.0	0.00	0.058	0.4
3.08	0.0	0.0	0.0	0.00	0.058	0.4
3.17	0.0	0.0	0.0	0.00	0.058	0.4
3.25	0.0	0.0	0.0	0.00	0.058	0.5

3.33	0.0	0.0	0.0	0.00	0.058	0.5
3.42	0.0	0.0	0.0	0.00	0.058	0.5
3.50	0.0	0.0	0.0	0.00	0.058	0.5
3.58	0.0	0.0	0.0	0.00	0.058	0.5
3.67	0.0	0.0	0.0	0.00	0.058	0.5
3.75	0.0	0.0	0.0	0.00	0.058	0.5
3.83	0.0	0.0	0.0	0.00	0.058	0.6
3.92	0.0	0.0	0.0	0.00	0.058	0.6
4.00	0.0	0.0	0.0	0.00	0.058	0.6
4.08	0.0	0.0	0.0	0.00	0.058	0.6
4.17	0.0	0.0	0.0	0.00	0.058	0.6
4.25	0.0	0.0	0.0	0.00	0.058	0.6
4.33	0.0	0.0	0.0	0.00	0.058	0.6
4.42	0.0	0.0	0.0	0.00	0.058	0.7
4.50	0.0	0.0	0.0	0.00	0.058	0.7
4.58	0.0	0.0	0.0	0.00	0.058	0.7
4.67	0.0	0.0	0.0	0.00	0.058	0.7
4.75	0.0	0.0	0.0	0.00	0.058	0.7
4.83	0.0	0.0	0.0	0.00	0.058	0.7
4.92	0.0	0.0	0.0	0.00	0.058	0.7
5.00	0.0	0.0	0.0	0.00	0.058	0.8

CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER 1

ELEMENT NUMBER	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	WIDTH	DEPTH	BASE
1	796.7	40.0	0.050	0.040	2	10.00	2.00	0.0
2	425.4	12.0	0.028	0.035	3	10.00	2.00	0.0

	NODE 1			NODE 2			NODE 3		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
0.17	0.0	0.0	0.0	0.00	0.000	0.0	0.00	0.000	0.0
0.25	0.0	0.0	0.0	0.00	0.001	0.0	0.00	0.000	0.0
0.33	0.0	0.0	0.0	0.00	0.002	0.0	0.00	0.001	0.0
0.42	0.0	0.0	0.0	0.00	0.005	0.0	0.00	0.001	0.0
0.50	0.0	0.0	0.0	0.00	0.008	0.0	0.00	0.003	0.0
0.58	0.0	0.0	0.0	0.00	0.013	0.0	0.00	0.005	0.0
0.67	0.0	0.0	0.0	0.00	0.019	0.0	0.00	0.009	0.0
0.75	0.0	0.0	0.0	0.00	0.027	0.0	0.00	0.014	0.0
0.83	0.0	0.0	0.0	0.00	0.037	0.0	0.00	0.022	0.0
0.92	0.0	0.0	0.0	0.00	0.050	0.0	0.00	0.032	0.0
1.00	0.0	0.0	0.0	0.00	0.063	0.0	0.00	0.044	0.0
1.08	0.0	0.0	0.0	0.00	0.075	0.1	0.00	0.058	0.0
1.17	0.0	0.0	0.0	0.00	0.086	0.1	0.00	0.072	0.1
1.25	0.0	0.0	0.0	0.00	0.095	0.1	0.00	0.086	0.1
1.33	0.0	0.0	0.0	0.00	0.102	0.1	0.00	0.098	0.1
1.42	0.0	0.0	0.0	0.00	0.108	0.2	0.00	0.109	0.1
1.50	0.0	0.0	0.0	0.00	0.112	0.2	0.00	0.117	0.2

1.58	0.0	0.0	0.0	0.00	0.115	0.2	0.00	0.124	0.2
1.67	0.0	0.0	0.0	0.00	0.116	0.3	0.00	0.128	0.3
1.75	0.0	0.0	0.0	0.00	0.117	0.3	0.00	0.132	0.3
1.83	0.0	0.0	0.0	0.00	0.117	0.3	0.00	0.134	0.3
1.92	0.0	0.0	0.0	0.00	0.117	0.4	0.00	0.135	0.4
2.00	0.0	0.0	0.0	0.00	0.117	0.4	0.00	0.136	0.4
2.08	0.0	0.0	0.0	0.00	0.117	0.4	0.00	0.136	0.4
2.17	0.0	0.0	0.0	0.00	0.117	0.5	0.00	0.137	0.5
2.25	0.0	0.0	0.0	0.00	0.117	0.5	0.00	0.137	0.5
2.33	0.0	0.0	0.0	0.00	0.117	0.5	0.00	0.137	0.5
2.42	0.0	0.0	0.0	0.00	0.117	0.6	0.00	0.137	0.6
2.50	0.0	0.0	0.0	0.00	0.117	0.6	0.00	0.137	0.6
2.58	0.0	0.0	0.0	0.00	0.117	0.6	0.00	0.137	0.7
2.67	0.0	0.0	0.0	0.00	0.117	0.6	0.00	0.137	0.7
2.75	0.0	0.0	0.0	0.00	0.117	0.7	0.00	0.137	0.7
2.83	0.0	0.0	0.0	0.00	0.117	0.7	0.00	0.137	0.8
2.92	0.0	0.0	0.0	0.00	0.117	0.7	0.00	0.137	0.8
3.00	0.0	0.0	0.0	0.00	0.117	0.8	0.00	0.137	0.8
3.08	0.0	0.0	0.0	0.00	0.117	0.8	0.00	0.137	0.9
3.17	0.0	0.0	0.0	0.00	0.117	0.8	0.00	0.137	0.9
3.25	0.0	0.0	0.0	0.00	0.117	0.9	0.00	0.137	0.9
3.33	0.0	0.0	0.0	0.00	0.117	0.9	0.00	0.137	1.0
3.42	0.0	0.0	0.0	0.00	0.117	0.9	0.00	0.137	1.0
3.50	0.0	0.0	0.0	0.00	0.117	1.0	0.00	0.137	1.0
3.58	0.0	0.0	0.0	0.00	0.117	1.0	0.00	0.137	1.1
3.67	0.0	0.0	0.0	0.00	0.117	1.0	0.00	0.137	1.1
3.75	0.0	0.0	0.0	0.00	0.117	1.0	0.00	0.137	1.2
3.83	0.0	0.0	0.0	0.00	0.117	1.1	0.00	0.137	1.2
3.92	0.0	0.0	0.0	0.00	0.117	1.1	0.00	0.137	1.2
4.00	0.0	0.0	0.0	0.00	0.117	1.1	0.00	0.137	1.3
4.08	0.0	0.0	0.0	0.00	0.117	1.2	0.00	0.137	1.3
4.17	0.0	0.0	0.0	0.00	0.117	1.2	0.00	0.137	1.3
4.25	0.0	0.0	0.0	0.00	0.117	1.2	0.00	0.137	1.4
4.33	0.0	0.0	0.0	0.00	0.117	1.3	0.00	0.137	1.4
4.42	0.0	0.0	0.0	0.00	0.117	1.3	0.00	0.137	1.4
4.50	0.0	0.0	0.0	0.00	0.117	1.3	0.00	0.137	1.5
4.58	0.0	0.0	0.0	0.00	0.117	1.3	0.00	0.137	1.5
4.67	0.0	0.0	0.0	0.00	0.117	1.4	0.00	0.137	1.5
4.75	0.0	0.0	0.0	0.00	0.117	1.4	0.00	0.137	1.6
4.83	0.0	0.0	0.0	0.00	0.117	1.4	0.00	0.137	1.6
4.92	0.0	0.0	0.0	0.00	0.117	1.5	0.00	0.137	1.6
5.00	0.0	0.0	0.0	0.00	0.117	1.5	0.00	0.137	1.7

CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER 2

ELEMENT NUMBER	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	WIDTH	DEPTH	BASE
1	967.8	52.0	0.054	0.040	2	10.00	2.00	0.0

	NODE 1			NODE 2		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.00	0.0	0.0
0.17	0.0	0.0	0.0	0.00	0.000	0.0
0.25	0.0	0.0	0.0	0.00	0.000	0.0
0.33	0.0	0.0	0.0	0.00	0.001	0.0
0.42	0.0	0.0	0.0	0.00	0.002	0.0
0.50	0.0	0.0	0.0	0.00	0.004	0.0
0.58	0.0	0.0	0.0	0.00	0.007	0.0
0.67	0.0	0.0	0.0	0.00	0.010	0.0
0.75	0.0	0.0	0.0	0.00	0.015	0.0
0.83	0.0	0.0	0.0	0.00	0.020	0.0
0.92	0.0	0.0	0.0	0.00	0.027	0.0
1.00	0.0	0.0	0.0	0.00	0.035	0.0
1.08	0.0	0.0	0.0	0.00	0.043	0.0
1.17	0.0	0.0	0.0	0.00	0.050	0.0
1.25	0.0	0.0	0.0	0.00	0.056	0.0
1.33	0.0	0.0	0.0	0.00	0.061	0.0
1.42	0.0	0.0	0.0	0.00	0.066	0.1
1.50	0.0	0.0	0.0	0.00	0.070	0.1
1.58	0.0	0.0	0.0	0.00	0.074	0.1
1.67	0.0	0.0	0.0	0.00	0.077	0.1
1.75	0.0	0.0	0.0	0.00	0.080	0.1
1.83	0.0	0.0	0.0	0.00	0.082	0.1
1.92	0.0	0.0	0.0	0.00	0.084	0.1
2.00	0.0	0.0	0.0	0.00	0.086	0.1
2.08	0.0	0.0	0.0	0.00	0.088	0.1
2.17	0.0	0.0	0.0	0.00	0.089	0.1
2.25	0.0	0.0	0.0	0.00	0.090	0.2
2.33	0.0	0.0	0.0	0.00	0.091	0.2
2.42	0.0	0.0	0.0	0.00	0.092	0.2
2.50	0.0	0.0	0.0	0.00	0.092	0.2
2.58	0.0	0.0	0.0	0.00	0.093	0.2
2.67	0.0	0.0	0.0	0.00	0.093	0.2
2.75	0.0	0.0	0.0	0.00	0.094	0.2
2.83	0.0	0.0	0.0	0.00	0.094	0.2
2.92	0.0	0.0	0.0	0.00	0.094	0.2
3.00	0.0	0.0	0.0	0.00	0.095	0.3
3.08	0.0	0.0	0.0	0.00	0.095	0.3
3.17	0.0	0.0	0.0	0.00	0.095	0.3
3.25	0.0	0.0	0.0	0.00	0.095	0.3
3.33	0.0	0.0	0.0	0.00	0.095	0.3
3.42	0.0	0.0	0.0	0.00	0.096	0.3
3.50	0.0	0.0	0.0	0.00	0.096	0.3
3.58	0.0	0.0	0.0	0.00	0.096	0.3

3.67	0.0	0.0	0.0	0.00	0.096	0.3
3.75	0.0	0.0	0.0	0.00	0.096	0.4
3.83	0.0	0.0	0.0	0.00	0.096	0.4
3.92	0.0	0.0	0.0	0.00	0.096	0.4
4.00	0.0	0.0	0.0	0.00	0.096	0.4
4.08	0.0	0.0	0.0	0.00	0.096	0.4
4.17	0.0	0.0	0.0	0.00	0.096	0.4
4.25	0.0	0.0	0.0	0.00	0.096	0.4
4.33	0.0	0.0	0.0	0.00	0.096	0.4
4.42	0.0	0.0	0.0	0.00	0.096	0.5
4.50	0.0	0.0	0.0	0.00	0.096	0.5
4.58	0.0	0.0	0.0	0.00	0.096	0.5
4.67	0.0	0.0	0.0	0.00	0.096	0.5
4.75	0.0	0.0	0.0	0.00	0.096	0.5
4.83	0.0	0.0	0.0	0.00	0.096	0.5
4.92	0.0	0.0	0.0	0.00	0.096	0.5
5.00	0.0	0.0	0.0	0.00	0.096	0.5

CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER 3

ELEMENT NUMBER	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	WIDTH	DEPTH	BASE
1	979.2	20.0	0.020	0.035	2	18.00	2.00	0.0

		NODE 1			NODE 2	
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.00	0.0	0.0	0.00	0.0	0.0
0.17	0.00	0.000	0.0	0.00	0.000	0.0
0.25	0.00	0.001	0.0	0.00	0.000	0.0
0.33	0.00	0.002	0.0	0.00	0.000	0.0
0.42	0.00	0.004	0.0	0.00	0.000	0.0
0.50	0.00	0.007	0.0	0.00	0.000	0.0
0.58	0.00	0.012	0.0	0.00	0.000	0.0
0.67	0.00	0.019	0.0	0.00	0.001	0.0
0.75	0.00	0.029	0.0	0.00	0.002	0.0
0.83	0.00	0.042	0.0	0.00	0.004	0.0
0.92	0.00	0.053	0.0	0.00	0.006	0.0
1.00	0.00	0.061	0.0	0.00	0.009	0.0
1.08	0.00	0.069	0.0	0.00	0.012	0.0
1.17	0.00	0.077	0.0	0.00	0.016	0.0
1.25	0.00	0.084	0.0	0.00	0.020	0.0
1.33	0.00	0.092	0.1	0.00	0.025	0.0
1.42	0.00	0.099	0.1	0.00	0.030	0.0
1.50	0.00	0.107	0.1	0.00	0.036	0.0
1.58	0.00	0.115	0.1	0.00	0.042	0.0
1.67	0.00	0.124	0.1	0.00	0.048	0.0
1.75	0.00	0.133	0.1	0.00	0.055	0.0
1.83	0.00	0.143	0.1	0.00	0.062	0.0
1.92	0.00	0.153	0.1	0.00	0.070	0.1

2.00	0.00	0.162	0.2	0.00	0.078	0.1
2.08	0.00	0.169	0.2	0.00	0.087	0.1
2.17	0.00	0.176	0.2	0.00	0.095	0.1
2.25	0.00	0.182	0.2	0.00	0.104	0.1
2.33	0.00	0.187	0.2	0.00	0.113	0.1
2.42	0.00	0.192	0.3	0.00	0.124	0.1
2.50	0.00	0.196	0.3	0.00	0.135	0.1
2.58	0.00	0.199	0.3	0.00	0.149	0.2
2.67	0.00	0.202	0.3	0.00	0.165	0.2
2.75	0.00	0.204	0.3	0.00	0.183	0.2
2.83	0.00	0.206	0.4	0.00	0.203	0.2
2.92	0.00	0.208	0.4	0.00	0.227	0.2
3.00	0.00	0.210	0.4	0.00	0.253	0.3
3.08	0.00	0.211	0.4	0.00	0.283	0.3
3.17	0.00	0.212	0.5	0.00	0.316	0.3
3.25	0.00	0.213	0.5	0.00	0.352	0.3
3.33	0.00	0.214	0.5	0.00	0.392	0.4
3.42	0.00	0.214	0.5	0.00	0.436	0.4
3.50	0.00	0.215	0.5	0.00	0.480	0.4
3.58	0.00	0.216	0.6	0.00	0.519	0.5
3.67	0.00	0.216	0.6	0.00	0.554	0.5
3.75	0.00	0.216	0.6	0.01	0.584	0.6
3.83	0.00	0.217	0.6	0.01	0.611	0.6
3.92	0.00	0.217	0.7	0.01	0.634	0.7
4.00	0.00	0.217	0.7	0.01	0.654	0.7
4.08	0.00	0.217	0.7	0.01	0.672	0.8
4.17	0.00	0.217	0.7	0.01	0.687	0.8
4.25	0.00	0.218	0.8	0.01	0.700	0.9
4.33	0.00	0.218	0.8	0.01	0.712	0.9
4.42	0.00	0.218	0.8	0.01	0.722	1.0
4.50	0.00	0.218	0.8	0.01	0.730	1.1
4.58	0.00	0.218	0.9	0.01	0.737	1.1
4.67	0.00	0.218	0.9	0.01	0.744	1.2
4.75	0.00	0.218	0.9	0.01	0.749	1.3
4.83	0.00	0.218	0.9	0.01	0.754	1.4
4.92	0.00	0.218	0.9	0.01	0.758	1.5
5.00	0.00	0.218	1.0	0.01	0.761	1.5

CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER 4

ELEMENT NUMBER	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	WIDTH	DEPTH	BASE
1	1335.0	61.0	0.046	0.040	2	20.00	2.00	0.0
2	634.5	10.0	0.016	0.040	3	16.00	2.00	0.0

	NODE 1			NODE 2			NODE 3		
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.25	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.33	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.42	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.58	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.67	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.75	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.83	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.92	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.08	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.17	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.25	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.33	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.42	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.50	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.58	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.67	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.75	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.83	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.92	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.00	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.08	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.17	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.25	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.33	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.42	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.50	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.58	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.67	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.75	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.83	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.92	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.08	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.17	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.25	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.33	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.42	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.50	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0

3.58	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.67	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.75	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.83	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.92	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.08	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.17	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.25	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.33	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.42	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.50	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.58	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.67	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.75	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.83	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.92	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00	0.0	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER 5

ELEMENT NUMBER	ELEMENT LENGTH	ELEMENT RELIEF	ELEMENT SLOPE	ELEMENT MANNING N	NODE NUMBER	WIDTH	DEPTH	BASE
1	844.8	10.0	0.012	0.045	2	14.00	1.50	3.00
2	994.7	20.0	0.020	0.045	3	14.00	1.50	6.50

		NODE 1			NODE 2			NODE 3	
TIME	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M	CFS	M.TONS	CU.M
0.08	0.00	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0
0.17	0.00	0.003	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.25	0.00	0.006	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.33	0.00	0.010	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.42	0.00	0.014	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.50	0.00	0.019	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.58	0.00	0.025	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.67	0.00	0.031	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.75	0.00	0.038	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.83	0.00	0.046	0.0	0.00	0.000	0.0	0.0	0.0	0.0
0.92	0.0	0.055	0.0	0.00	0.000	0.0	0.0	0.0	0.0
1.00	0.0	0.065	0.0	0.00	0.000	0.0	0.00	0.000	0.0
1.08	0.0	0.076	0.0	0.00	0.000	0.0	0.00	0.000	0.0
1.17	0.0	0.088	0.0	0.00	0.000	0.0	0.00	0.000	0.0
1.25	0.0	0.101	0.0	0.00	0.000	0.0	0.00	0.000	0.0
1.33	0.0	0.114	0.0	0.00	0.000	0.0	0.00	0.000	0.0
1.42	0.0	0.128	0.0	0.00	0.001	0.0	0.00	0.000	0.0
1.50	0.0	0.143	0.0	0.00	0.001	0.0	0.00	0.000	0.0
1.58	0.0	0.159	0.0	0.00	0.002	0.0	0.00	0.000	0.0
1.67	0.0	0.177	0.0	0.00	0.002	0.0	0.00	0.001	0.0
1.75	0.0	0.198	0.0	0.00	0.003	0.0	0.00	0.001	0.0

1.83	0.0	0.221	0.0	0.00	0.004	0.0	0.00	0.002	0.0
1.92	0.0	0.247	0.0	0.00	0.006	0.0	0.00	0.002	0.0
2.00	0.0	0.275	0.0	0.00	0.008	0.0	0.00	0.003	0.0
2.08	0.0	0.307	0.0	0.00	0.010	0.0	0.00	0.004	0.0
2.17	0.0	0.342	0.0	0.00	0.013	0.0	0.00	0.005	0.0
2.25	0.0	0.380	0.0	0.00	0.017	0.0	0.00	0.007	0.0
2.33	0.0	0.423	0.0	0.00	0.021	0.0	0.00	0.008	0.0
2.42	0.0	0.470	0.0	0.00	0.026	0.0	0.00	0.011	0.0
2.50	0.0	0.522	0.0	0.00	0.033	0.0	0.00	0.013	0.0
2.58	0.0	0.579	0.0	0.00	0.040	0.0	0.00	0.016	0.0
2.67	0.0	0.638	0.0	0.00	0.047	0.0	0.00	0.019	0.0
2.75	0.0	0.696	0.0	0.00	0.056	0.0	0.00	0.022	0.0
2.83	0.0	0.751	0.0	0.00	0.066	0.0	0.00	0.025	0.0
2.92	0.0	0.805	0.0	0.00	0.077	0.0	0.00	0.029	0.0
3.00	0.0	0.858	0.0	0.00	0.089	0.0	0.00	0.032	0.0
3.08	0.0	0.911	0.0	0.00	0.102	0.0	0.00	0.036	0.0
3.17	0.0	0.964	0.0	0.00	0.117	0.0	0.00	0.041	0.0
3.25	0.0	1.018	0.0	0.00	0.132	0.0	0.00	0.045	0.0
3.33	0.0	1.073	0.0	0.00	0.150	0.0	0.00	0.050	0.0
3.42	0.0	1.130	0.0	0.00	0.168	0.0	0.00	0.056	0.0
3.50	0.0	1.186	0.0	0.00	0.189	0.0	0.00	0.062	0.0
3.58	0.0	1.235	0.0	0.00	0.211	0.0	0.00	0.068	0.0
3.67	0.0	1.278	0.0	0.00	0.234	0.0	0.00	0.075	0.0
3.75	0.0	1.316	0.0	0.00	0.259	0.0	0.00	0.082	0.0
3.83	0.0	1.348	0.0	0.00	0.286	0.0	0.00	0.091	0.0
3.92	0.0	1.377	0.0	0.00	0.314	0.0	0.00	0.100	0.0
4.00	0.0	1.402	0.0	0.00	0.344	0.1	0.00	0.110	0.0
4.08	0.0	1.423	0.0	0.00	0.376	0.1	0.00	0.122	0.1
4.17	0.0	1.442	0.0	0.00	0.408	0.1	0.00	0.135	0.1
4.25	0.0	1.457	0.0	0.00	0.443	0.1	0.00	0.149	0.1
4.33	0.0	1.468	0.0	0.00	0.478	0.1	0.00	0.164	0.1
4.42	0.0	1.478	0.0	0.00	0.515	0.1	0.00	0.181	0.1
4.50	0.0	1.486	0.0	0.00	0.553	0.1	0.00	0.200	0.1
4.58	0.0	1.494	0.0	0.00	0.592	0.1	0.00	0.220	0.1
4.67	0.0	1.500	0.0	0.00	0.632	0.1	0.00	0.242	0.1
4.75	0.0	1.505	0.0	0.00	0.673	0.2	0.00	0.267	0.2
4.83	0.0	1.510	0.0	0.00	0.715	0.2	0.00	0.293	0.2
4.92	0.0	1.514	0.0	0.00	0.757	0.2	0.00	0.321	0.2
5.00	0.0	1.517	0.0	0.00	0.801	0.2	0.00	0.351	0.2

7.3 ILLUSTRATION OF HELPS AND ERROR MESSAGES

The following pages repeat some of the steps found in Section 7.2.1 while including some of the options available in replies to questions as well as demonstrating some of the specific error messages that may be found in creating a FESHM compatible data set.

Console conversations resulting from execution of RAINFALL and SETUP are shown initially. Error messages appearing in the output file (CUNCREEK DATABASE) generated by SETUP follow. The output file (A LISTING Z) resulting from the execution of INTERFACE is listed next.

```
rainfall
TODAY'S DATE IS: 83/10/11                              THE CURRENT TIME IS: 07:58:05

PLEASE-ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
help

          TO EXIT THE PROGRAM AT ANY TIME, ENTER QUIT.

          ENTER THE NAME OF THE DISK FILE WHICH CONTAINS THE DATA
                SET TO BE USED IN THE PROGRAM COMPUTATIONS.
          IF NO DATA IS REQUIRED BY THE PROGRAM, ENTER THE NAME OF
                ANY EXISTING FILE.

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
storm1 dataa

YOUR SPECIFIED DATA SET COULD NOT BE FOUND:
TO ATTACH ANOTHER DISK, ENTER: LDISK <USERID>

TO LEAVE THIS EXEC, ENTER: QUIT

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
storm1 data
DMSLIO740I EXECUTION BEGINS...

WELCOME TO THE V.P.I. EQUAL INTERVAL RAINFALL PROGRAM.

ENTER FIRST  TITLE LINE FOR OUTPUT HEADING:
help

TO EXIT FROM DATA ENTRY AT ANY TIME, ENTER:   QUIT

THE PROGRAM WILL AUTOMATICALLY READ IN THE FIRST 2 LINES AS TITLES.

ADDITIONAL TITLE LINES, UP TO A TOTAL OF 10, MAY BE ADDED
AS THE FIRST RESPONSE TO ANY QUESTION BY ENTERING  '*** ' IN THE
FIRST FOUR COLUMNS OF THE RESPONSE.

ENTER FIRST  TITLE LINE FOR OUTPUT HEADING:
rainfall preparation for cunningham creek watershed
ENTER SECOND TITLE LINE FOR OUTPUT HEADING:
storm event of 01/04/72

ENTER THE RAINFALL INTERVAL (MINUTES):
help

         THIS INTERVAL IS THE TIME DURATION OF THE INTERVALS
         TO BE USED IN THE FINITE ELEMENT MODEL CALCULATIONS.

    ACCEPTABLE VALUES ARE:    1, 2, 3, 4, 5, 6, 10, 12, 15, 30, OR 60
```

```
ENTER THE RAINFALL INTERVAL (MINUTES):
9

THE INPUT INTERVAL IS NOT COMPATIBLE WITH THIS PROGRAM.

    ACCEPTIBLE VALUES ARE:   1, 2, 3, 4, 5, 6, 10, 12, 15, 30, OR 60


ENTER THE RAINFALL INTERVAL (MINUTES):
5

WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?   (Y/N/QUIT/HELP):
help

                    ENTER YES TO THIS QUESTION.
        THE DEFAULT IN THE PROGRAM ASSUMES THAT THE INPUT RAINFALL
        RECORD MAY CONTAIN MORE THAN ONE STORM.  CONSULT THE USER'S
        GUIDE AT A LATER TIME FOR A DISCUSSION OF CIRCUMSTANCES
        WHEN A 'NO' RESPONSE WOULD BE APPROPRIATE.


WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?   (Y/N/QUIT/HELP):
* this is the first of two storms to be run

     COMMENT RECEIVED

WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?   (Y/N/QUIT/HELP):
*** first of a two day storm

     THIRD  TITLE LINE RECEIVED

WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?   (Y/N/QUIT/HELP):
n

DO YOU WISH TO HAVE A GRAPH OF THE PRECIPITATION DATA?   (Y/N/QUIT/HELP):
help

                THE DEFAULT ANSWER IS YES.
    NO IS AN APPROPRIATE RESPONSE IF YOU HAVE A LONG STORM
    AND ARE NOT INTERESTED IN EXAMINING AN OUTPUT GRAPH.

    TO CHANGE THE DEFAULT GRAPH SCALING FACTORS, ENTER THE
    MAXIMUM STORM INTENSITY AND MAXIMUM TOTAL ACCUMULATION
    FOLLOWING A YES RESPONSE TO THIS QUESTION.


DO YOU WISH TO HAVE A GRAPH OF THE PRECIPITATION DATA?   (Y/N/QUIT/HELP):
y

IS YOUR INPUT DATA IN THE STANDARD V.P.I. FORMAT?   (Y/N/QUIT/HELP):
help


         IF DATA IS NOT ENTERED IN THE STANDARD FORMAT CONTAINED
         AS A DEFAULT WITHIN THE PROGRAM, YOU WILL NEED TO SPECIFY
         THE INPUT DATA FORMAT AS THE FIRST RECORD OF INPUT ON UNIT 3.


IS YOUR INPUT DATA IN THE STANDARD V.P.I. FORMAT?   (Y/N/QUIT/HELP):
n

ENTER CONVERSION FACTOR FOR INCH/HOUR:
help


          THE CONVERSION FACTOR IS A MULTIPLIER USED TO TRANSFORM
          THE INPUT DATA INTO UNITS OF IN/HR.

          FOR EXAMPLE,  ENTER:   .393701   WHICH IS EQUAL TO  1/2.54
                                 TO CONVERT CM/HR TO IN/HR.

          IF THE ORIGINAL DATA IS GIVEN IN INCH/HOUR, ENTER  1.0
```

```
ENTER CONVERSION FACTOR FOR INCH/HOUR:
1.0


ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.


      YOUR PROGRAM OUTPUTS ARE IN:

           A        LISTING Z              FOR OUTPUT UNIT 7
                    &
           STORM1   DATABASE Z             FOR OUTPUT UNIT 8

      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !

R;


execute setup
TODAY'S DATE IS: 83/10/11                    THE CURRENT TIME IS: 08:15:32

PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
cuncreek data
DMSLIO740I EXECUTION BEGINS...

WELCOME TO THE V.P.I. FESHM INTERFACE PROGRAM.

ENTER TITLE LINE FOR WATERSHED CHARACTERISTICS DATA SET:

cunningham creek watershed data set

ENTER  NAME OF FIRST  SUBSHED:
help

       TO EXIT FROM DATA ENTRY AT ANY TIME, ENTER:   QUIT


       YOU WILL BE PROMPTED FOR THE NAME OF EACH SUBSHED.
    AFTER ENTERING THE NAME OF A SUBSHED, ENTER THE NAMES OF
    SUBSHEDS WHICH ARE TRIBUTARIES TO IT.  IF A SUBSHED HAS NO
    UPSTREAM TRIBUTARY SUBSHEDS, ENTER <RETURN> FOLLOWING THE
    NAME OF THE SUBSHED.  TO TERMINATE ENTRY OF SUBSHED NAMES
    ENTER <RETURN> OR A BLANK LINE FOLLOWED BY <RETURN> .


ENTER  NAME OF FIRST  SUBSHED:
one
ENTER  NAME OF SECOND SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
two
ENTER  NAME OF THIRD  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
three noe two
ENTER  NAME OF FOURTH SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
four
ENTER  NAME OF FIFTH  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
five four three
ENTER  NAME OF SIXTH  SUBSHED AND NAMES OF ITS TRIBUTARY SUBSHEDS:
                 NAMES RECEIVED FOR      5  SUBSHEDS.


ENTER THE TOTAL NUMBER OF ELEMENTS IN THE COMPLETE WATERSHED:
22

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED       ONE:
2 3 5
```

```
     ERROR:  THE NUMBER OF FLOWSTRIPS ON THE LEFT SIDE OF THE CHANNEL
  IS GREATER THAN THE TOTAL NUMBER OF  FLOWSTRIPS FOR THE SUBSHED.

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED      ONE:

2 3 2

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED      ONE:
1 2 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED      TWO:
1 2 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED      TWO:
1 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED    THREE:
4 2 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED    THREE:
3 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED     FOUR:
2 4 2

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED     FOUR:
1 2 1

ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW STRIPS, & NUMBER
     OF FLOW STRIPS ON LEFT SIDE OF THE CHANNEL FOR SUBSHED     FIVE:
2 3 1

     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP OF SUBSHED     FIVE:
3 2 1

ENTER THE NAMES TO BE USED FOR EACH LANDUSE CATEGORY:
(ONE PER LINE):
help

       ENTER A NAME FOR EACH LAND USE CATEGORY, ONE PER LINE.  NUMERIC
          VALUES ENTERED FOLLOWING THE LANDUSE NAME WILL BE CONSIDERED
          AS VALUES FOR THE LANDUSE PARAMETERS IN THE FOLLOWING ORDER:
          HOLTAN'S A, DEPRESSION STORAGE, AND MANNING'S ROUGHNESS COEFF.

       TO TERMINATE DATA ENTRY, ENTER A CARRIAGE RETURN.


ENTER THE NAMES TO BE USED FOR EACH LANDUSE CATEGORY:
(ONE PER LINE):

ENTER THE ANTECEDENT SOIL MOISTURE:
help

DEFAULT VALUES WERE EMPLOYED FOR EACH MODEL PARMETER.


ENTER THE TOTAL NUMBER OF UNIQUE HRUS:

help

ENTER A TITLE LINE FOR THE COMBINED BASIN AND STORM DATA SETS:
feshm model run for the cunningham creek watershed on 4 january 1974

ENTER THE NUMBER OF HOURS FOR THE DISCHARGE OUTPUT:

help

DEFAULT VALUES WERE EMPLOYED FOR EACH MODEL PARAMETER.
```

```
ENTER VALUES FOR THE OVERLAND FLOW PRINT FREQUENCY INDICATOR (SECONDS)  AND
      THE OVERLAND FLOW CALCULATION INTERVAL:
300 30


ENTER VALUES FOR THE CHANNEL FLOW PRINT FREQUENCY INDICATOR (SECONDS) AND
      THE OVERLAND FLOW CALCULATION INTERVAL:
300 10

ENTER THE NUMBER OF RAINGAGES TO BE EMPLOYED:
help

DEFAULT VALUES WERE EMPLOYED FOR EACH MODEL PARMETER.



ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.


      YOUR PROGRAM OUTPUTS ARE IN:

           A         LISTING  Z               FOR OUTPUT UNIT 7
                     &
           CUNCREEK DATABASE A               FOR OUTPUT UNIT 8


      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !

R;


##### CUNCREEK DATABASE #######################################################


CUNNINGHAM CREEK WATERSHED DATA SET
*
*
    TRIBUTARIES TO SUBSHED     1         ONE:
    TRIBUTARIES TO SUBSHED     2         TWO:
    TRIBUTARIES TO SUBSHED     3       THREE:         NOE       TWO
*
*  ERROR:  SUBSHED        NOE WAS NOT PREVIOUSLY DEFINED.
*
    TRIBUTARIES TO SUBSHED     4        FOUR:
    TRIBUTARIES TO SUBSHED     5        FIVE:        FOUR    THREE
*  ERROR:  SUBSHED        ONE HAS NOT BEEN ASSIGNED AS A TRIBUTARY SUBSHED.
*
*
                                   END OF SUBSHED DESCRIPTOR INPUT.
*
*
*
*
    TOTAL NUMBER OF ELEMENTS (NTELES):                                   22
*   NUMBER OF SUBSHEDS          (NTSS):                                   5
*
*
*-----------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:                ONE
*
   NUMBER OF FLOW STRIPS                      (NSTRPS):                    3
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 2
   NUMBER OF CHANNEL ELEMENTS                 (NECHAN):                    2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        1   2   1
```

```
*
*                            (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.         LENGTH     RELIEF    ELEMENT      TOP
*   STRIP      NOS.                                 AREA      WIDTH
*
        A        1
        B        2
                 3
        C        4
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
*     CHAN      LENGTH    RELIEF   ROUGHNESS       TOP     DEPTH     BASE OF
*      NO                             COEFF.      WIDTH              TRAPEZOID
*
     I  1
    II  2
*
*-------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:              TWO
*
   NUMBER OF FLOW STRIPS                          (NSTRPS):                2
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 1
   NUMBER OF CHANNEL ELEMENTS                     (NECHAN):                1
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        1    1
*
*                            (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.         LENGTH     RELIEF    ELEMENT      TOP
*   STRIP      NOS.                                 AREA      WIDTH
*
        A        5
        B        6
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
*     CHAN      LENGTH    RELIEF   ROUGHNESS       TOP     DEPTH     BASE OF
*      NO                             COEFF.      WIDTH              TRAPEZOID
*
     I  3
*
*-------------------------------------------------------------------------
*
*
*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:            THREE
*
   NUMBER OF FLOW STRIPS                          (NSTRPS):                2
   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                 1
   NUMBER OF CHANNEL ELEMENTS                     (NECHAN):                4
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        3    1
*
*                            (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*    FLOW      ELEM.         LENGTH     RELIEF    ELEMENT      TOP
*   STRIP      NOS.                                 AREA      WIDTH
*
        A        7
                 8
                 9
        B       10
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*               (XLEN)   (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
```

```
*     CHAN     LENGTH    RELIEF    ROUGHNESS       TOP     DEPTH      BASE OF
*       NO                           COEFF.      WIDTH               TRAPEZOID
*
       I  4
      II  5
     III  6
      IV  7
*
*-----------------------------------------------------------------------------
*
*
*   OVERLAND FLOW DESCRIPTORS FOR SUBSHED:              FOUR
*
    NUMBER OF FLOW STRIPS                        (NSTRPS):                    4
    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                   2
    NUMBER OF CHANNEL ELEMENTS                   (NECHAN):                    2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        1   2   1   0
*
*                          (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*     FLOW      ELEM.      LENGTH     RELIEF    ELEMENT      TOP
*    STRIP      NOS.                             AREA       WIDTH
*
         A       11
         B       12
                 13
         C       14
         D       15
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)  (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS       TOP     DEPTH     BASE OF
*       NO                          COEFF.      WIDTH               TRAPEZOID
*
       I  8
      II  9
*
*-----------------------------------------------------------------------------
*
*
*   OVERLAND FLOW DESCRIPTORS FOR SUBSHED:              FIVE
*
    NUMBER OF FLOW STRIPS                        (NSTRPS):                    3
    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):                   1
    NUMBER OF CHANNEL ELEMENTS                   (NECHAN):                    2
*
** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
        3   2   1
*
*                          (XLEN)    (RELIEF)   (AREA)    (TWIDTH)
*     FLOW      ELEM.      LENGTH     RELIEF    ELEMENT      TOP
*    STRIP      NOS.                             AREA       WIDTH
*
         A       16
                 17
                 18
         B       19
                 20
         C       21
*
*
** CHANNEL FLOW ELEMENT DESCRIPTORS:
*
*              (XLEN)  (RELIEF)   (RCOEF)     (TWIDTH)   (HT)      (BASE)
*     CHAN     LENGTH    RELIEF   ROUGHNESS       TOP     DEPTH     BASE OF
*       NO                          COEFF.      WIDTH               TRAPEZOID
*
       I 10
      II 11
*
*-----------------------------------------------------------------------------
*
```

```
*
*
** LAND USE DESCRIPTORS:
*
*                            (AFLU)         (DSLU)         (RCLU)
* LAND USE     NO.        HOLTAN'S A     DEPRESSION     MANNING'S
*                        COEFFICIENT       STORAGE      ROUGHNESS
*
*
                            END OF LANDUSE DESCRIPTORS
*
*
*----------------------------------------------------------------------
*
*
*
** MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:
*
*
  THE VALUE OF SMCWS IS:      0.0
*
*
** GROWTH INDEX COEFFICIENTS  (GINDEX):
*
* JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.
 0.300 0.300 0.300 0.450 0.600 0.800 0.900 0.900 0.750 0.400 0.300 0.300
*
** EVAPORATION COEFFICIENTS      (EVP):
*
* JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT  OCT.  NOV.  DEC.
 0.800 1.430 2.130 3.300 4.340 4.800 4.960 4.030 3.300 1.940 1.110 0.710
*
*
*
*
*----------------------------------------------------------------------
*
*
** HRU DESCRIPTORS:
*
*
*  TOTAL NUMBER OF HRU'S (NHRUS):                                      0
*
*               (SLOHRU)  (FAW)      (FGW)    (FC)
* HRU  LANDUSE    SLOPE   AVAIL.    GRAVITY  INFILT DEPTH  CUSLE  XKUSL
* NO.      NO.    CLASS   WATER      WATER    RATE   OF A
*
*
                                       END OF HRU DESCRIPTOR INPUT
*
*
*
*   NUMBER OF HRUS IN EACH ELEMENT (NHRU):
*
*    ELEMENT:   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
      # HRUS:   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
*
*    ELEMENT:  21 22
      # HRUS:   0  0
*
*
*
*  ASSIGNMENT OF HRUS TO ELEMENTS
*
*
*                                    (IHRU)      (FHRU)
* SUBSHED    FLOW           ELEM.     HRU      FRACTION OF
*    NAME   STRIP    NO.     NO.     NUMBER    ELEMENT AREA
*
     ONE       A      1       1
               B      1       2
                      2       3
               C      1       4
*
     TWO       A      1       5
               B      1       6
```

```
*
    THREE        A      1       7
                        2       8
                        3       9
                 B      1      10
*
     FOUR        A      1      11
                 B      1      12
                        2      13
                 C      1      14
                 D      1      15
*
     FIVE        A      1      16
                        2      17
                        3      18
                 B      1      19
                        2      20
                 C      1      21
*
*
                                                    END OF ASSIGNMENT OF HRUS TO ELEMENTS
*
*
*
*-----------------------------------------------------------------------
*
*
*
**** OUTPUT TITLE, TIME STEPS, AND PROGRAM CONTROL PARAMETERS:
*
FESHM MODEL RUN FOR THE CUNNINGHAM CREEK WATERSHED ON 4 JANUARY 1974
*
*
*
   HRU TABLE OUTPUT PRINT INDICATOR                (NTBLHS):              0
   PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR     (NTBLPE):              0
   NUMBER OF HOURS FOR THE DISCHARGE RECORD        (NHOURC):              5
*
*
*
** FLOW CALCULATION INTERVALS (SECONDS):
*
   OVERLAND FLOW CALCULATION INTERVAL  (DTO):                            30.
   CHANNEL  FLOW CALCULATION INTERVAL  (DTC):                            10.
*
*
*
*
** PRINT FREQUENCY INDICATORS (SECONDS):
*
    OVERLAND FLOW PRINT FREQUENCY INDICATOR  (NOPRIN):                  300
    CHANNEL  FLOW PRINT FREQUENCY INDICATOR  (NCPRIN):                  300
*
*
** SUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER):
*
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
** PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF SELECTED STRIPS
*   (TWO LINES FOR EACH  '2'  ENTERED IN THE PREVIOUS LINE):
*
*
*
** SUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS (NPCHAN):
*
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
*
*
*-----------------------------------------------------------------------
*
*
    NUMBER OF RAINGAGES  (NGAGES):                                        1
*
```

```
*
*
*
*
** INPUT STORM DATA (PRECIP) FOR RAINGAGE:                                 1
*
*     DATE    TIME INTPCS NHOURR
*

*
** THIRTY DAY ANTECEDENT PRECIPITATION (DAILPC) RAIN GAGE:                 1
*

#### A LISTING Z ###################################################################
```

```
   TRIBUTARIES TO SUBSHED    1        ONE:
   TRIBUTARIES TO SUBSHED    2        TWO:
   TRIBUTARIES TO SUBSHED    3      THREE:        ONE       TWO
   TRIBUTARIES TO SUBSHED    4       FOUR:
   TRIBUTARIES TO SUBSHED    5       FIVE:       FOUR     THREE
```

BOUNDARY DESCRIPTION CODES FOR EACH SUBSHED:

```
   0    0    1    0    1
```

TRIBUTARY IDENTIFIERS:

SUBSHED	CODE	TRIB 1	TRIB 2	TRIB 3
3	1	1	2	
5	1	4	3	

```
    TOTAL NUMBER OF ELEMENTS (NTELES):   22
    NUMBER OF SUBSHEDS          (NTSS):    5
```

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: ONE

```
  NUMBER OF FLOW STRIPS                           (NSTRPS):           3
  NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):            2
  NUMBER OF CHANNEL ELEMENTS                      (NECHAN):           2

  NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
       1   2   1
```

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	882.0999	62.0000	12.3655	796.6699
B	2	907.9800	57.0000	10.2634	520.8198
	3	651.5798	38.0000	4.5356	425.3799
C	4	875.1199	54.0000	9.3310	1222.0498

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I 1	896.67	40.00	0.04	10.00	2.00	0.0
II 2	425.38	12.00	0.03	10.00	2.00	0.0

```
**************************************************************************************
*                                                                                    *
*  ERROR:  THE SUM OF CHANNEL ELEMENTS                (      1322.05)  SHOULD EQUAL  *
*          THE SUM OF THE LEFT-HAND FLOWSTRIP TOPWIDTHS  (      1222.05).              *
*                                                                                    *
**************************************************************************************
```

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: TWO

NUMBER OF FLOW STRIPS	(NSTRPS):	2
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1
NUMBER OF CHANNEL ELEMENTS	(NECHAN):	1

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
1 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	804.3398	44.0000	7.7618	967.7598
B	2	1324.3198	48.0000	12.8383	967.7598

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I 1	967.76	52.00	0.04	10.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: THREE

NUMBER OF FLOW STRIPS	(NSTRPS):	2
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL	(LHSSPS):	1
NUMBER OF CHANNEL ELEMENTS	(NECHAN):	1

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
3 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	994.8599	36.0000	13.0751	578.3999
	2	588.4299	35.0000	7.5171	717.1299
	3	418.3999	30.0000	6.1864	679.2000
B	4	771.3298	70.0000	6.6512	979.2000

```
*********************************************************************************
*                                                                               *
* ERROR:  THE SUM OF THE  LEFT-HAND FLOWSTRIP TOPWIDTHS  (      679.20)  SHOULD EQUAL  *
*         THE SUM OF THE RIGHT-HAND FLOWSTRIP TOPWIDTHS  (      979.20 ).           *
*                                                                               *
*********************************************************************************
```

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I 1	979.20	20.00	0.03	18.00	2.00	0.0

```
*********************************************************************************
*                                                                               *
* ERROR:  THE SUM OF CHANNEL ELEMENTS                    (      979.20)  SHOULD EQUAL  *
*         THE SUM OF THE LEFT-HAND FLOWSTRIP TOPWIDTHS   (      679.20).            *
*                                                                               *
*********************************************************************************
```

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: FOUR

NUMBER OF FLOW STRIPS (NSTRPS): 4
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 2
NUMBER OF CHANNEL ELEMENTS (NECHAN): 2

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
1 2 1 2

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	937.3999	6.0000	10.9879	1335.0298
B	2	1318.2200	30.0000	11.3658	928.4099
	3	1094.0298	54.0000	6.1423	634.4900
C	4	748.1499	61.0000	31.4758	1256.9299
D	5	704.8599	37.0000	6.6460	704.0498
	6	501.0098	61.0000	7.4368	712.5898

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN NO	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS COEFF.	(TWIDTH) TOP WIDTH	(HT) DEPTH	(BASE) BASE OF TRAPEZOID
I 1	1335.03	61.00	0.04	20.00	2.00	0.0
II 2	634.49	10.00	0.04	16.00	2.00	0.0

OVERLAND FLOW DESCRIPTORS FOR SUBSHED: FIVE

NUMBER OF FLOW STRIPS (NSTRPS): 3
NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS): 1
NUMBER OF CHANNEL ELEMENTS (NECHAN): 2

NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):
3 2 1

FLOW STRIP	NOS.	(XLEN) LENGTH	(RELIEF) RELIEF	(AREA) ELEMENT AREA	(TWIDTH) TOP WIDTH
A	1	719.9299	29.0000	5.9462	659.0298
	2	619.6799	30.0000	21.5265	1683.1699
	3	821.2400	77.0000	27.2798	1839.5198
B	4	616.5999	36.0000	14.8364	1173.0898
	5	1220.1099	80.0000	16.1303	844.7998
C	6	1629.1399	104.0000	35.3006	994.7200

CHANNEL FLOW ELEMENT DESCRIPTORS:

CHAN	(XLEN) LENGTH	(RELIEF) RELIEF	(RCOEF) ROUGHNESS	(TWIDTH) TOP	(HT) DEPTH	(BASE) BASE OF

8. REFERENCES

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Appendix A.1 Listing of Program Statements for Data Preparation Routines

The following listings contain all main programs and subroutine listings used in the preparation of FESHM data. EXEC and FORTRAN main programs are listed first in the order that they are encountered. All external subroutines are listed next in alphabetical order.

RAINFALL EXEC

The RAINFALL EXEC routine is used to set up file definitions for the input and output (read/write) units used in the rainfall program. The RAINFALL program is self contained and does not need the exec routine in order to be run successfully. If the EXEC-2 language is not available at your installation, all you need to do is to define the input and output file definitions and run the compiled/linked program. The required file definitions are as follows:

IUNIT3: INPUT FORMAT - this data set contains only one line, the format of the input breakpoint precipitation data. This file is only needed if the data is not in standard VPI format (9X, 3I2, 1X, 2I2, 45X, F10.5, 10X for month, day, year, hour, minute, rainfall intensity, and accumulated rainfall, respectively).

IUNIT4: INPUT DATA - this file contains the input breakpoint precipitation data.

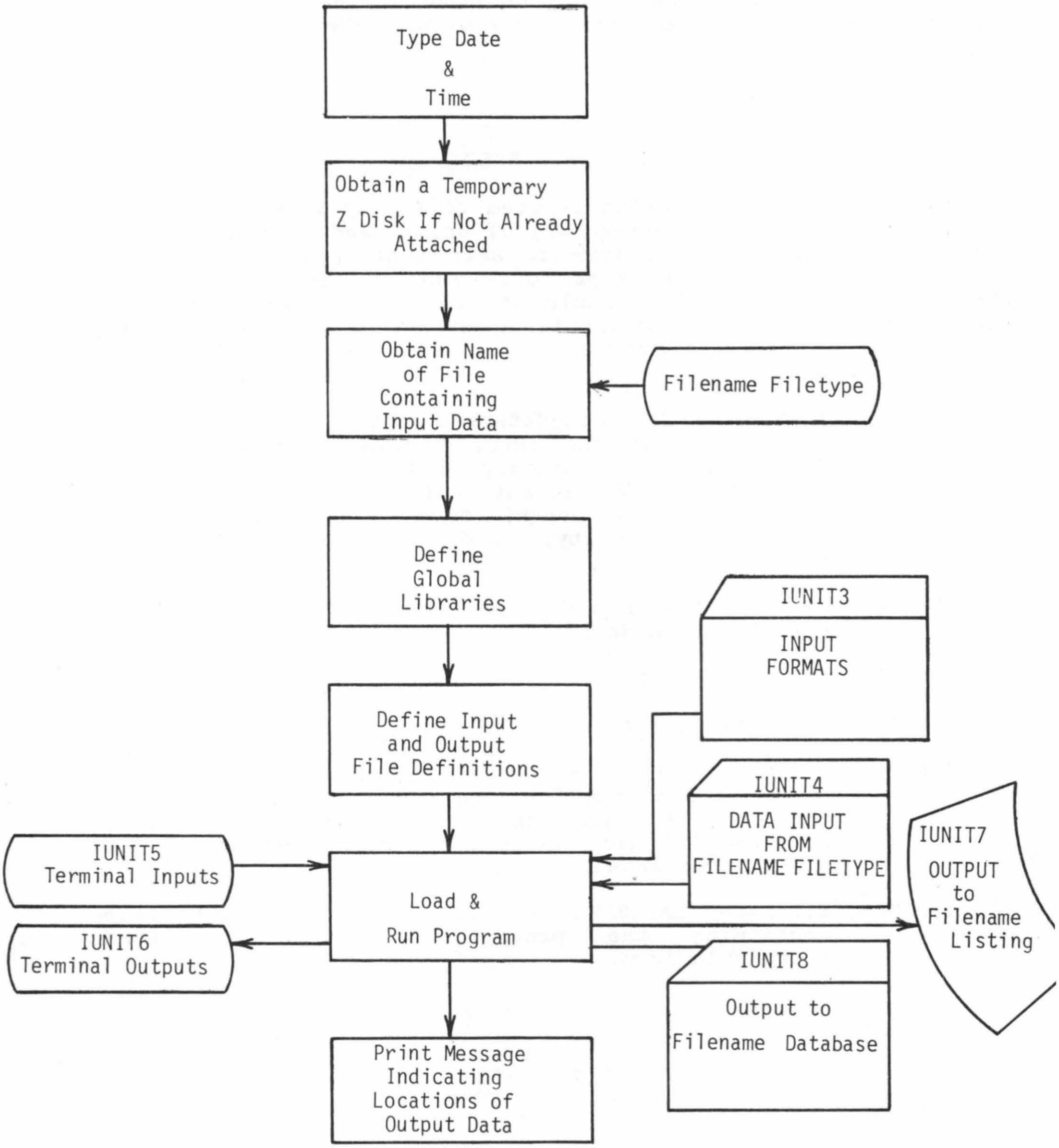
IUNIT5: Terminal Input

IUNIT6: Terminal Output to the Operator

IUNIT7: filename LISTING - this file contains the program output and a graph of the precipitation data. IN the exec routine, this is sent to a temporarily attached 'Z' disk so that the main disk space will not be overloaded.

IUNIT8: filename DATABASE - this is the output file containing the precipitation data in FESHM compatible form.

FLOWCHART
RAINFALL EXEC



```
      &TRACE
*
*     REVISION:  26 SEPTEMBER 1983
*
*---- THIS EXEC INVOKES THE EXISTING TEXTFILE RAINFALL TO OBTAIN EQUAL
*     INTERVAL RAINFALL FROM BREAKPOINT PRECIPITATION DATA:
*
*
*     THE PROGRAM INPUTS ARE ASSUMED TO BE:
*
*        DISK DATA FORMAT        ON  UNIT 3. (ONLY REQUIRED WHEN NON-
*                                             STANDARD FORMAT IS USED)
*        DISK DATA STORAGE       FOR UNIT 4.
*        TERMINAL                FOR UNIT 5.
*
*     THE PROGRAM OUTPUT WILL BE FOUND IN:
*
*        TERMINAL                FOR UNIT 6.
*        FILE   A  LISTING  Z    FOR UNIT 7 (PRINTER OUTPUT).
*           FILE   A  OUTPUT   A    FOR UNIT 8 (DATA STORAGE).
*
*
*       ENTER QUIT IF YOU DESIRE TO LEAVE THIS EXEC.
*
*---  INITIALIZE VARIABLE NAMES AND PRINT DATE & TIME.
*
      &DATEX = &RIGHT OF &DATE 10
      &DATEX = &LEFT  OF &DATE 30
      &TYPE    TODAY'S DATE IS: &DATEX THE CURRENT TIME IS: &TIME
      &TYPE
      &Q0   =  1
*
*---  ATTACH A TEMPORARY  'Z DISK'  IF NOT ALREADY AVAILABLE.
*
      STATE * * Z
      &IF &RC NE 36 &SKIP 2
      &TYPE PLEASE WAIT FOR LINK TO OBTAIN SPACE ON "Z" DISK.
      EXEC TDISK 2 Z
*
*
*-----  ENTER THE NAME OF THE FILE CONTAINING THE BREAKPOINT RAINFALL
*       DATA FROM WHICH EQUAL INTERVAL RAINFALL DATA IS TO BE COMPUTED:
*

-90
        &L     = -100
        &TEXT =  DATA
        &FSET =  SET
-100
        &TYPE PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
        &READ VARS &FN &FT &FM
          &IF .&FN NE .HELP  &GOTO -CONT

          &BEGTYPE 8

           TO EXIT THE PROGRAM AT ANY TIME, ENTER QUIT.

           ENTER THE NAME OF THE DISK FILE WHICH CONTAINS THE DATA
                 SET TO BE USED IN THE PROGRAM COMPUTATIONS.
           IF NO DATA IS REQUIRED BY THE PROGRAM, ENTER THE NAME OF
                 ANY EXISTING FILE.

          &GOTO  -100
-CONT
               &IF .&FN EQ .QUIT  &EXIT 100
               &IF .&FN EQ .      &GOTO -100
               &IF .&FT EQ .      &GOTO -100
               &IF .&FT NE .      &LKR = &FT
               &IF .&FN EQ .LDISK &GOTO -LINKR
```

```
          LISTFILE &FN &FT * ( STACK
               &IF &RC NE 0 &GOTO -MISSING
               &READ ARGS
               &FN  = &1
               &FT  = &2
               &FM  = &3
        STATE &FN &FT &FM
               &IF &RC NE 0 &GOTO -100
               &GO TO -200
*
*-----  THE OUTPUT FROM UNIT 7 IS WRITTEN TO A FILE CALLED A LISTING.
*       THIS FILE IS ERASED AND A NEW ONE GENERATED EACH TIME THIS
*       EXEC IS IMPLEMENTED.  IF YOU DESIRE TO SAVE THIS OUTPUT FILE,
*       RENAME 'A LISTING A' TO A NEW FILENAME BEFORE REUSING THIS EXEC.
*
-200
        GLOBAL TXTLIB FORTXLIB VPIUTIL CMSLIB
        FILEDEF 3 DISK INPUT FORMAT A
        FILEDEF 4 DISK &FN &FT &FM (LRECL 132 RECFM FB BLKSIZE 132
        FILEDEF 5 TERM (PERM
        FILEDEF 6 TERM (PERM
        FILEDEF 7 DISK A LISTING Z (LRECL 133 RECFM FB  BLKSIZE 133

*
*-----  THE OUTPUT FROM UNIT 8 IS WRITTEN TO A FILE CALLED 'A OUTPUT A'.
*       USING THE OPTION 'DIS MOD' THE OUTPUT FROM THIS JOB WILL BE
*       APPENDED TO THE OUTPUT CURRENTLY IN FILE 'A OUTPUT A'.
*
        FILEDEF 8 DISK &FN DATABASE  A (LRECL 80
*       FILEDEF 8 DISK &FN DATABASE  A (LRECL 80   DISP MOD
        SET BLIP OFF
*
*-----  THIS SECTION IMPLEMENTS EXECUTION OF THE EXISTING TEXT FILE:
*
        LOAD RAINFALL
        START

        SET BLIP RIVET...

*
*------ THE FOLLOWING LINES ISSUE A REMINDER INDICATING THE NAMES OF THE
*       OUTPUT FILES GENERATED DURING PROGRAM EXECUTION:
*
        &A = Z
        &A = &LEFT  OF &A    12
        &X = &LEFT  OF &FN    8
        &X = &RIGHT OF &X    19

        &BEGTYPE 5

      YOUR PROGRAM OUTPUTS ARE IN:

          A         LISTING  Z              FOR OUTPUT UNIT 7
                    &
       &TYPE &X DATABASE &A FOR OUTPUT UNIT 8
       &BEGTYPE 7


      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

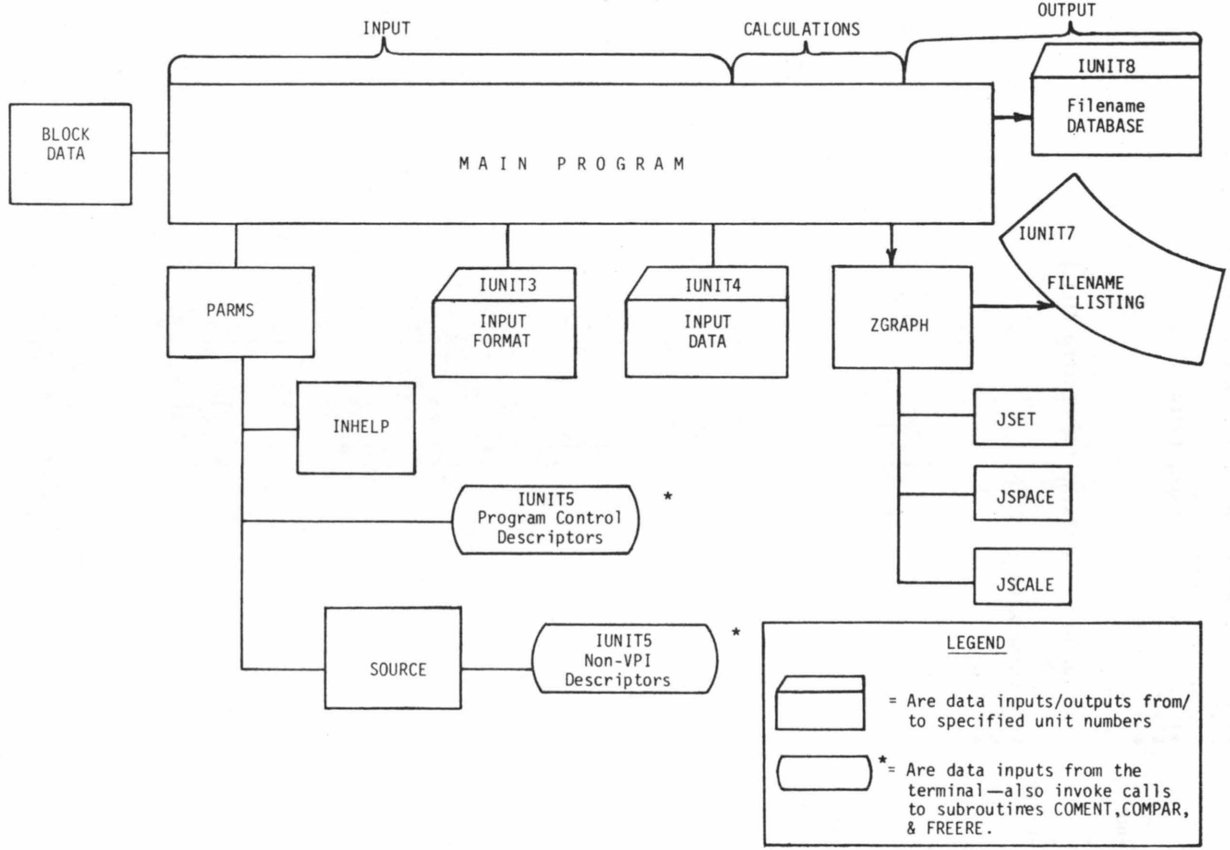
                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !


       &EXIT
*


*
*-----  THE FOLOWING LINES INFORM THE USER THAT THE SPECIFIED DATA SET
*       COULD NOT BE FOUND ON ANY LINKED DISK.  THE USER MAY LINK THE
*       APPROPRIATE DISK BY ENTERING LDISK USERID IF IT IS NOT ALREADY
*       ATTACHED.  OTHERWISE THE USER SHOULD VERIFY CORRECT SPELLING
*       OF THE FILE NAME.  THE USER WILL BE PROMPTED TO RE-ENTER THE
*       FILENAME CONTAINING THE INPUT DATA SET.
*
```

```
-MISSING
         &TYPE
         &TYPE YOUR SPECIFIED &TEXT &FSET COULD NOT BE FOUND:
         &TYPE TO ATTACH ANOTHER DISK, ENTER:   LDISK   <USERID>
         &TYPE
         &IF &Q0 GT 1 &GOTO -40
         &TYPE TO LEAVE THIS EXEC, ENTER: QUIT
         &TYPE
         &Q0 = &Q0 + 1
-40
         &GOTO &L
*
*        LINK THE DISK CONTAINING THE DESIRED FILE.
*
-LINKR
         EXEC LDISK &LKR
         &TYPE
         &GOTO &L
```

FLOWCHART
SUBROUTINE RELATIONSHIP IN RAINFALL FORTRAN



```
C***  28 SEPTEMBER 1983   **********    DO NOT ERASE   ******  W. J. SYDOR
C***********************************************************************
C
C
C
C                         RAINFALL  FORTRAN
C
C
C
C---- THIS FILE CONTAINS A PROGRAM FOR DERIVING THE AMOUNT OF RAINFALL
C     PER SPECIFIED INTERVAL GIVEN BREAKPOINT PRECIPITATION DATA.
C
C     IN ADDITION TO THE SUBROUTINES CONTAINED WITHIN THIS FILE (LISTED
C     ALPHABETICALLY), USE OF THIS PROGRAM REQUIRES AVAILABLILITY OF:
C
C                         SUBROUTINE   COMENT
C
C                         SUBROUTINE   COMPAR
C
C                         SUBROUTINE   FREERE
C
C
C     SUBROUTINES 'FILES' AND 'FILES2' ARE NOT REQUIRED. THESE COMMENTED
C     SUBROUTINE ENTRIES ARE PROVIDED TO CALL USER USER GENERATED
C     SUBROUTINES WHICH UTILIZE SYSTEM SPECIFIC ROUTINES WHICH ASSIGN
C     RUNTIME SPECIFICATION OF READ/WRITE UNIT NUMBERS.  AN EXAMPLE OF
C     SUCH A SYSTEM SPECIFIC ROUTINE IS 'SYSCAL' AT VPI.
C
C     THE BLOCK DATA SUBPROGRAM CONTAINED HEREIN IS FOR INTERACTIVE
C         USE OF THE RAINFALL PROGRAM.  COMMENTS ARE INDICATED       $$$$
C         WHICH DESCRIBE HOW THE BLOCK DATA SUB-PROGRAM SHOULD BE
C         MODIFIED FOR BATCH OPERATION.  NO OTHER MODIFICATIONS ARE
C         REQUIRED IN THE REMAINDER OF THE PROGRAM.
C
C     FOR BATCH MODE OPERATION (NO TERMINAL INTERACTION),
C         DEFINE IUNIT1=0.                                           $$$$
C
C     THE INPUT DATA SET IS READ FROM IUNIT4 (<FN> <FT> <FM>).
C         SET IUNIT4=5 FOR BATCH MODE OPERATION.                     $$$$
C
C     THE OUTPUT FILE FOR IUNIT7 (A LISTING) CONTAINS GRAPHIC
C         OUTPUT AND A COPY OF THE INPUT DATA.
C         SET IUNIT7=6 FOR BATCH MODE OPERATION.                     $$$$
C
C     THE OUTPUT FILE FOR IPUNCH (<FN> DATABASE) CONTAINS A
C         PROGRAM GENERATED FESHM COMPATIBLE DATA SET.
C         SET IPUNCH EQUAL TO THE OUTPUT UNIT NUMBER YOU WISH        $$$$
C         TO USE FOR CARD/DISK/TAPE STORAGE.
C
C     IF DATA IS TO BE READ FROM A DATA SET NOT IN STANDARD VPI
C         FORMAT, THE FORMAT TO BE USED IS READ FROM IUNIT3.
C         SET IUNIT3=5 FOR BATCH MODE OPERATION                      $$$$
C
C
                           BLOCK DATA
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKINTV/INTRVL,SOURC,GRAPH,STORMS,FACTOR,LAMBDA,XMAX1,XMAX2
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,NLINES,ITRANS,IPT
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      DOUBLE PRECISION ZN(15)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNHELP,NNQUIT,NNSTAR
C
      REAL     FACTOR        /1.0/
C
      INTEGER GRAPH          /0/
C
      INTEGER    IER         /'WARN','PRNT','DIAG','END','ERR ','DBUG'/
      INTEGER IFA01          /'(80A','1)  ',18*'    '/
      INTEGER IFA04          /'(20A','4)  ',18*'    '/
      INTEGER    IFO         /'(1H*',',80A','1)  ',17*'    '/
```

```
      INTEGER IFR08       /'(10*','F8.4',')   ',17*'    '/
      INTEGER IFR10       /'(8*F','10.4',')   ',17*'    '/
      INTEGER IFRMT       /'(9X,','3I2,','1X, ','2I2,','45X,','F10.',
     1                        '5,10','X,F1','0.5)',11*'    '/
      INTEGER IPUNCH      /8/
      INTEGER IUNIT1      /1/
      INTEGER IUNIT3      /3/
      INTEGER IUNIT4      /4/
      INTEGER IUNIT5      /5/
      INTEGER IUNIT6      /6/
      INTEGER IUNIT7      /7/
      INTEGER IZONE       /1,80/
C
      INTEGER LALPHA      /'A','B','C','D','E','F','G','H','I','J','K',
     1                     'L','M','N','O','P','Q','R','S','T','U','V',
     2                     'W','X','Y','Z'/
      INTEGER LAMBDA      /120/
      INTEGER LBLANK      /' '/
      INTEGER LDASH       /'-'/
      INTEGER LDIGIT      /'0','1','2','3','4','5','6','7','8','9','.',
     1                     '-','+'/
      INTEGER LDOT(1)     /'.'/
      INTEGER LPLUS(1)    /'+'/
      INTEGER LSTAR(1)    /'*'/
      INTEGER LTITLE      /800*' '/
C
      INTEGER MDM         /80/
      INTEGER MONTH       /'JAN.','FEB.','MAR.','APR.',' MAY','JUNE',
     1                     'JULY','AUG.','SEPT','OCT.','NOV.','DEC.'/
      INTEGER MTITLE      /2/
C
      INTEGER NLINES      /2/
      INTEGER NNBASE(1)   /'BASE'/
      INTEGER NNDATA(1)   /'DATA'/
      INTEGER NNDEFA(1)   /'DEFA'/
      INTEGER NNQUIT(1)   /'QUIT'/
      INTEGER NNSTAR(1)   /'*** '/
      INTEGER NTITLE      /0/
C
      INTEGER SOURC       /0/
      INTEGER STORMS      /5/
C
      REAL    XMAX1       /0.0/
      REAL    XMAX2       /0.0/
      REAL    XMIN        /0.0/
      DATA    ZN          /'FIRST ','SECOND','THIRD ','FOURTH','FIFTH ',
     1                      'SIXTH ','  7TH ','EIGHT ','NINTH ','TENTH ',
     2                      ' 11TH ',' 12TH ',' 13TH ',' 14TH ',' 15TH '/
      END
C
C
C***********************************************************************
C
C
C
C                              MAIN PROGRAM
C
C
C---- OUTPUT PARAMETER DEFINITIONS:
C
C     R(I)     IS THE AMOUNT OF RAINFALL FOR INTERVAL I.
C     ACCUM(I) IS THE ACCUMULATED RAINFALL THROUGH INTERVAL I.
C     MTIME(I) IS THE HOUR AND MINUTE INDICATOR FOR INTERVAL I.
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKINTV/INTRVL,SOURC,GRAPH,STORMS,FACTOR,LAMBDA,XMAX1,XMAX2
              INTEGER SOURC,GRAPH,STORMS
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,NLINES,ITRANS,IPT
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      DIMENSION R(1000),ACCUM(1000),MTIME(1000),XMAXM(3)
C
```

```
      INTEGER IEND        /0/
      INTEGER INDEX       /1/
      INTEGER JJ          /1/
C
C
C------------------------------------------------------------------------
C
C
C---- OBTAIN PROGRAM CONTROL DESCRIPTORS:
C
C*    CALL FILES
      CALL PARMS(IANSWR)
      IF(IANSWR.LT.-2) GO TO 9990
      WRITE(6,1)
    1 FORMAT(//'0ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.'
     1       //)
C
C
C------------------------------------------------------------------------
C
C
C---- INITIALIZE AND WRITE PROGRAM CONTROL DESCRIPTORS:
C
  409 IF(FACTOR.LE.0.0) FACTOR = 1.0
       DO 490 I=1,NTITLE
          IF(IPUNCH.GT.0)  WRITE(IPUNCH,492) (LTITLE(J,I),J=1,76)
  490     WRITE(IUNIT7,491) (LTITLE(J,I),J=1,76)
  491 FORMAT(1H ,76A1)
  492 FORMAT('*** ',76A1)
      CALL JSPACE(IUNIT7,2)
      WRITE(IUNIT7,500) NTITLE,INTRVL,SOURC,GRAPH,STORMS,FACTOR,XMAX1,
     1              XMAX2,LAMBDA,(IFRMT(I1),I1=1,11)
  500 FORMAT(//'0',35X,'CONVERSION  MAXIMUM   MAXIMUM'/
     1  '  NTITLE INTRVL SOURCE  GRAPH STORMS    FACTOR   ',
     2  'ACCUM. INTENSITY     LAMBDA    FORMAT'/'0',5I7,3F10.2,I10,
     3   3X,11A4)
      NCOUNT = 60/INTRVL
      REM = AMOD(FLOAT(LAMBDA),60.0)
      LAMBDA = 100*LAMBDA/60 + REM
C     WRITE(IUNIT7,510) NCOUNT,INTRVL,REM,LAMBDA
C 510 FORMAT(//'0   NCOUNT     INTRVL               REM    LAMBDA'//2I10,
C    1         E15.7,I10//)
C
C
C------------------------------------------------------------------------
C
C
C****                    MAIN CALCULATION SECTION:                  *****
C
C
C---- READ FIRST DATA ENTRY CARD:
C
C     NMONTH IS THE MONTH CORRESPONDING TO THE INPUT RAINFALL RECORD.
C     NDAY   IS THE DAY CORRESPONDING TO THE INPUT RAINFALL RECORD.
C     NYEAR  IS THE YEAR CORRESPONDING TO THE FIRST INPUT RECORD.
C     NHOUR  IS THE HOUR CORRESPONDING TO THE TIME OF THE BREAKPOINTS
C                   FOR THE INPUT RAINFALL RECORD.
C     NMIN   IS THE MINUTE CORRESPONDING TO THE TIME OF THE BREAKPOINTS
C                   FOR THE INPUT RAINFALL RECORD.
C     RAININ IS THE INPUT RAINFALL INTENSITY (ORIGINAL DATA UNITS).
C     RAIN   IS THE RAINFALL INTENSITY (INCHES/HOUR).  IF INPUT DATA
C                   IS GIVEN IN OTHER UNITS, ENTER THE VALUE OF THE
C                   MULTIPLIER NEEDED TO CONVERT TO INCHES/HOUR AS
C                   THE VALUE FOR "FACTOR".
C     TOTAL  IS THE ACCUMULATED RAINFALL RECORDED AT THE RAINGAGE.
C
C     NOTE:  THE ABOVE VALUES ARE UPDATED WITH EACH DATA READ;  THE
C            INITIAL VALUES OF THESE PARAMETERS ARE ASSIGNED TO
C            KDAY, KHOUR, KMIN, KMONTH, AND KYEAR RESPECTIVELY.
C
C---- PROGRAM GENERATED COUNTERS:
C
C     N      IS A COUNTER FOR THE NUMBER OF INTERVALS.
C     NNTRVL IS THE STORM DURATION IN HOURS.
C     NCOUNT IS THE NUMBER OF INTERVALS PER HOUR.
```

```
C
C
  900 READ(IUNIT4,IFRMT,END=8600) NMONTH,NDAY,NYEAR,NHOUR,NMIN,RAININ,
     1                             TOTAL
C
C---- INITIALIZATIONS:
C
  980 ICOUNT    = 0
      IIII      = 0
      IMIN      = 0
      KDAY      = NDAY
      KHOUR     = NHOUR
      KMIN      = NMIN
      KMONTH    = NMONTH
      KYEAR     = NYEAR
      N         = 0
      MHOUR     = KHOUR
      RAIN      = 0.0
      STRAIN    = 0.0
      XMAXM(2)  = 0.0
      ITIME     = 100     * KHOUR
      NTIME     = ITIME   + KMIN
      IF(JJ.GE.1) GO TO 995
      JJ =  JJ - 1
      DO 990 I=1,NTITLE
  990    WRITE(IUNIT7,491) (LTITLE(J,I),J=1,76)
  995 WRITE(IUNIT7,996) KMONTH,KDAY,KHOUR,N,RAININ,TOTAL
  996 FORMAT(//'0MONTH DAY    HOUR MIN     RAININ     GAGE ACCUM.'//I6,I3,
     1       4X,I5,I3,2F10.3)
C*    WRITE(IUNIT7,997)
C 997 FORMAT(/49X,'N ITIM NTIM NMIN  MIN       RAIN       RAININ     ',
C    1   'SRAIN'/)
      PTOTAL = TOTAL
C
C---- MAJOR LOOP:
C
 1000 DO 4000 MM=1,NCOUNT
         IF(IEND.GT.0) GO TO 4000
         N      = N + 1
         SRAIN = 0.0
         MIN    = INTRVL*(MM-1) + 100*MHOUR
         DO 3000 I=1,INTRVL
            IF(IEND.GT.0) GO TO 3000
            IMIN  = IMIN  + 1
            ITIME = ITIME + 1
C
C----       INCREMENT TO THE NEXT HOUR IF IMIN > 60.
C
            IF(IMIN.LT.60) GO TO 1005
            IMIN  = 0
            ITIME = ITIME + 40
 1005       MIN   = MIN + 1
C
C----       WRITE TIME AND INTENSITY AT EACH BREAKPOINT:
C
            IF(MIN.LE.NTIME) GO TO 2000
            WRITE(IUNIT7,1010) NHOUR,NMIN,RAININ,TOTAL
 1010       FORMAT (13X,I5,I3,2F10.3)
            NH2   = NHOUR
            IF(SOURC.GE.1) RAIN = RAININ * FACTOR
C
C----       INITIALIZE END OF STORM COUNTERS AND READ NEXT RECORD:
C
            LMONTH = NMONTH
            LDAY   = NDAY
            LHOUR  = NHOUR
            LMIN   = NMIN
C           INDEX  = 1
            READ(IUNIT4,IFRMT,END=2500) NMONTH,NDAY,NYEAR,NHOUR,NMIN,
     1             RAININ,TOTAL
C           RAININ = (PTOTAL-TOTAL) * 60/NMIN
C           PTOTAL = TOTAL
C           INDEX = 2
            IF(NHOUR.LT.NH2) ICOUNT = ICOUNT + 1
            NTIME = ICOUNT*2400 + 100*NHOUR + NMIN
```

```
             IF(SOURC.LT.1) RAIN = RAININ * FACTOR
 2000        SRAIN = SRAIN + RAIN
C*           WRITE(IUNIT7,2001) N,ITIME,NTIME,NMIN,MIN,RAIN,RAININ,SRAIN
C2001        FORMAT(45X,5I5,5F10.3)
             GO TO 3000
C
C----        WRITE ERROR DIAGNOSTICS IF END OF DATA ENCOUNTERED:
C
 2500        IEND = 1
             BACKSPACE IUNIT4
C*           WRITE(IUNIT6,2510)
C2510        FORMAT(/'0  END OF RECORD ENCOUNTERED ON IUNIT4;'/
C    1         '0  EXECUTION CONTINUING WITH DATA INPUT TO THIS POINT'/)
 3000     CONTINUE
C
          R(N)      = SRAIN/60.0
          XMAXM(2) = AMAX1(XMAXM(2),R(N))
          STRAIN    = STRAIN + R(N)
          ACCUM(N) = STRAIN
          MTIME(N) = ITIME
 4000 CONTINUE
C
C---- IF INPUT RAINFALL IS ZERO, READ THE NEXT DATA RECORD AND DETERMINE
C     WHETHER THERE IS A SUFFICIENT DURATION OF ZERO RAINFALL TO WARRANT
C     TERMINATION OF THE FIRST STORM AND INITIATION OF A SECOND.
C
      IF(IEND.GT.1) GO TO 9000
      MHOUR = MHOUR + 1
      IF(STORMS-1) 8500,8000,8000
 8000 IF(RAININ.GT.0.0) GO TO 1000
         IF(SOURC.GT.0) GO TO 8200
         IF(NMONTH.GT.LMONTH+1.OR.NMONTH.LE.0) GO TO 9000
C        IF(KDAY  .GT.LDAY  +1.OR.  NDAY.LE.0) GO TO 9000
         IF(NDAY.LE.0) GO TO 9000
         LTIME  = 100 * LHOUR + LMIN + LAMBDA
         LLTIME = 100 * NHOUR + NMIN
         IF(100*NHOUR+NMIN.GT.LAMBDA) GO TO 8100
         IF(NDAY.GT.LDAY) GO TO 9000
 8100    IF(LLTIME.GT.LTIME) GO TO 9000
C        WRITE(IUNIT7,8190) LMIN,LHOUR,LAMBDA,LTIME,NHOUR,NMIN,LLTIME
C8190    FORMAT(//'0       LMIN       LHOUR      LAMBDA        LTIME         ',
C    1         'NHOUR       NMIN     LLTIME'/4I10,5X,3I10)
         GO TO 1000
 8200    LMONTH = NMONTH
         LDAY   = KDAY
         LHOUR  = NHOUR
         LMIN   = NMIN
         READ(IUNIT4,IFRMT,END=8600) NMONTH,KDAY,NHOUR,NMIN,RAININ,TOTAL
         IF(NMONTH.GT.LMONTH+1) GO TO 9000
         IF(KDAY  .GT.LDAY  +1) GO TO 9000
         LTIME  = 100 * LHOUR + LMIN + LAMBDA
         LLTIME = 100 * NHOUR + NMIN
         IF(LLTIME.GT.LTIME) GO TO 9000
         GO TO 1000
 8500 IF(KDAY.GE.40.OR.KDAY.LE.0) GO TO 9000
         GO TO 980
C
 8600    IEND  = 1
         NMIN  = 100
         NHOUR = 100
         BACKSPACE IUNIT4
C*    WRITE(IUNIT6,2510)
C
C
C-----------------------------------------------------------------------
C
C
C---- WRITE PROGRAM OUTPUTS IN FINITE ELEMENT MODEL COMPATIBLE FORMAT:
C
C     NOTE:  THE TIME INTERVAL OF RAINFALL INPUT IS CONVERTED TO SECONDS
C
 9000 NNTRVL = N/NCOUNT
      IF(IPUNCH.LE.0) GO TO 9103
      IITRVL = 60 * INTRVL
      WRITE(IPUNCH,9102) KMONTH,KDAY,KYEAR,KHOUR,KMIN,IITRVL,NNTRVL,
```

```
     1                   KHOUR,KMIN,MONTH(KMONTH),KDAY
 9102 FORMAT('$ ',2(I2,'/'),I2,I4,':',I2,I7,I7,5X,'STORM BEGINNING AT ',
     1        I2,':',I2,' ON ',A4,I3)
      WRITE(IPUNCH,9107)  (R(I),I=1,N)
 9103 IF(GRAPH.EQ.0) WRITE(IUNIT7,9104) KHOUR,KMIN,MONTH(KMONTH),KDAY,
     1              STRAIN
 9104 FORMAT(////'OTOTAL INPUT PRECIPITATION BEGINNING'
     1       ,' AT',I4,':',I2,'  ON  ',A4,I3,'   WAS  ',F10.4,' INCH'//)
      WRITE(IUNIT7,9107) (R(I),I=1,N)
 9107 FORMAT(8F10.5)
C
C
C-----------------------------------------------------------------------
C
C
C---- PLOT GRAPH OF ACCUMULATED RAINFALL FOR COMPARISON TO STRIP CHARTS:
C
      IF(GRAPH.NE.0) GO TO 9910
      CALL JSPACE(IUNIT7,-1)
      DO 9400 I=1,NTITLE
 9400    WRITE(IUNIT7,491) (LTITLE(J,I),J=1,76)
      CALL JSPACE(IUNIT7,4)
      XMAXM(1) = STRAIN
      IF(XMAX1.GT.0) XMAXM(1) = XMAX1
      IF(XMAX2.GT.0) XMAXM(2) = XMAX2
      CALL JGRAPH(IUNIT7,1,1,0,ACCUM(1),R(1),XMAXM)
      DO 9500 I=1,N
         MTIME(I) = MOD(MTIME(I),2400)
 9500    CALL JGRAPH(IUNIT7,0,1,MTIME(I),ACCUM(I),R(I),XMAXM)
      CALL JGRAPH(IUNIT7,1,1,-1,ACCUM(1),R(1),XMAXM)
      CALL JSPACE(IUNIT7,5)
 9910 IF(NMONTH.GT.30.OR.IEND.GT.0.OR.NMONTH.LE.0) GOTO 9999
      IF(SOURC.LE.0) GO TO 980
      GO TO 900
C
C
C-----------------------------------------------------------------------
C
C
C---- TERMINATE PROGRAM INPUT IF USER SPECIFIED THE OPTION QUIT:
C
 9990 WRITE(IUNIT6,9991)
 9991 FORMAT(//'ODATA ENTRY TERMINATED AT YOUR REQUEST.'//'0YOU HAVE ',
     1 'NOW LEFT THE V. P. I. EQUAL INTERVAL RAINFALL PREPARATION ',
     2 'PROGRAM AND'/'      HAVE BEEN RETURNED TO YOUR COMPUTER''S ',
     3 'GENERAL OPERATING SYSTEM.')
 9999 CONTINUE
C     CALL FILES2
      STOP
      END
C
C
C
C***********************************************************************
C
C
      SUBROUTINE INHELP(IUNITI,IUNITO,INDEXX,IANSWR)
C
C---- THIS SUBROUTINE PRINTS DATA ENTRY ERROR DIAGNOSTICS:
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKINTV/INTRVL,SOURC,GRAPH,STORMS,FACTOR,LAMBDA,XMAX1,XMAX2
              INTEGER SOURC,GRAPH,STORMS
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,NLINES,ITRANS,IPT
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      DOUBLE PRECISION ZN(15)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNHELP,NNQUIT,NNSTAR
      DATA IERROR/0/
C
      IANSWR = 1
      INDEX = IABS(INDEXX)
```

```
      IF(INDEX.GE.0) GO TO 150
      IF(INDEXX.GT.0) WRITE(IUNITO,100)
  100 FORMAT(/'OINAPPROPRIATE DATA ENTRY.')
  150 IF(IERROR.LE.0) WRITE(IUNITO,200)
  200 FORMAT('OTO EXIT FROM DATA ENTRY AT ANY TIME, ENTER:   QUIT'/)
      IERROR = IERROR + 1
      INDEX  = MAXO(1,MINO(INDEX,8))
  900 GO TO (1000,2000,3000,4000,5000,6000,7000,9900), INDEX
C
 1000 WRITE(IUNITO,1001)
 1001 FORMAT(' THE PROGRAM WILL AUTOMATICALLY READ IN THE FIRST 2 ',
     1  'LINES AS TITLES.'//' ADDITIONAL TITLE LINES, UP TO A TOTAL OF '
     2  ,'10, MAY BE ADDED'/
     2  ' AS THE FIRST RESPONSE TO ANY QUESTION BY ENTERING',
     3  '  ''*** ''  IN THE '/' FIRST FOUR COLUMNS OF THE RESPONSE.'/)
C    3  ,' OF ANY INPUT READ CARD PRIOR TO THE VARIABLE FORMAT CARD.'/
C    3  ' WHATEVER APPEARS IN THE FIRST TWO INPUT LINES WILL BE ',
C    4  ' PRINTED EXACTLY AS WRITTEN ON THE OUTPUT LISTING.'//
C    5  '        THE ''*** '' WILL BE DELETED FROM THE THIRD AND ',
C    6  'SUCCEEDING TITLES WHEN THEY ARE PRINTED.'///
C    4  ' ANY CARD CONTAINING ''****'' IN THE FIRST FOUR COLUMNS WILL ',
C    5  'BE TREATED AS A COMMENT WITHIN THE INPUT DATA SET;'/'    I.E.',
C    6  ' IT WILL BE READ, BUT NOT ADDED TO THE LIST OF TITLE LINES.'
C    1  //' ANY TITLE LINES INPUT IN EXCESS OF 10 WILL BE CONDSIDERED ',
C    2  ' AS ADDITIONAL COMMENT STATEMENTS.')
      RETURN
C
 2000 IF(INDEXX.LT.0) WRITE(IUNITO,2001)
 2001 FORMAT('OTHE INPUT INTERVAL IS NOT COMPATIBLE WITH THIS PROGRAM.')
      IF(INDEXX.GT.0) WRITE(IUNITO,2002)
 2002 FORMAT(/10X,'THIS INTERVAL IS THE TIME DURATION OF THE INTERVALS'/
     1 10X,'TO BE USED IN THE FINITE ELEMENT MODEL CALCULATIONS.')
      WRITE(IUNITO,2100)
 2100 FORMAT(/5X,'ACCEPTIBLE VALUES ARE:  '
     2  ,' 1, 2, 3, 4, 5, 6, 10, 12, 15, 30, OR 60'/)
 3000 RETURN
C
 4000 WRITE(IUNITO,4100)
 4100 FORMAT(/9X,'              ENTER YES TO THIS QUESTION.'/
     1 9X,'THE DEFAULT IN THE PROGRAM ASSUMES THAT THE INPUT RAINFALL'/
     1 9X,'RECORD MAY CONTAIN MORE THAN ONE STORM.  CONSULT THE USER''S'
     2 /9X,'GUIDE AT A LATER TIME FOR A DISCUSSION OF CIRCUMSTANCES'/
     3 9X,'WHEN A ''NO'' RESPONSE WOULD BE APPROPRIATE.'/)
      IF(IUNITO.GT.0) RETURN
      WRITE(IUNITO,4200)
 4200 FORMAT(/'OAS A DEFAULT THE PROGRAM ASSUMES THAT THE INPUT RAIN',
     1  'FALL RECORD MAY CONTAIN MORE THAN ONE STORM.'/' EACH STORM ',
     2  'IS CONSIDERED TO BE OVER WHEN LAMBDA MINUTES OF ZERO INPUT ',
     3  'PRECIPITATION HAS OCCURED.'/' THE DEFAULT VALUE OF LAMBDA IS ',
     4  ' 120 MINUTES (2 HOURS).'/
     5  ' TO CHANGE THE VALUE OF LAMBDA EMPLOYED:'/
     6  '       ENTER A ''Y'' OR ''YES'' IN RESPONSE TO THIS QUESTION'/
     7  '       FOLLOWED BY YOUR DESIRED VALUE OF LAMBDA (MINUTES).'//
     8  ' IF YOU WISH YOUR COMPLETE DATA SET TO BE CONSIDERED AS ONE ',
     9  'STORM,'/'      ENTER A ''N'' OR ''NO'' RESPONSE TO THIS ',
     1  'QUESTION.')
      RETURN
C
 5000 WRITE(IUNITO,5100)
 5100 FORMAT(/16X,'THE DEFAULT ANSWER IS YES.'/
     1 5X,'NO IS AN APPROPRIATE RESPONSE IF YOU HAVE A LONG STORM'/
     2 5X,'AND ARE NOT INTERESTED IN EXAMINING AN OUTPUT GRAPH.'//
     3 5X,'TO CHANGE THE DEFAULT GRAPH SCALING FACTORS, ENTER THE '/
     4 5X,'MAXIMUM STORM INTENSITY AND MAXIMUM TOTAL ACCUMULATION'/
     5 5X,'FOLLOWING A YES RESPONSE TO THIS QUESTION.'//)
      RETURN
C
 6000 WRITE(IUNITO,6100)
 6100 FORMAT(//10X,'IF DATA IS NOT ENTERED IN THE STANDARD FORMAT ',
     1'CONTAINED '/10X,'AS A DEFAULT WITHIN THE PROGRAM, YOU WILL ',
     1    'NEED TO SPECIFY'/
     2 10X,'THE INPUT DATA FORMAT AS THE FIRST RECORD OF INPUT ON ',
     3    'UNIT 3.'/)
      RETURN
C
```

```
7000 WRITE(IUNITO,7100)
7100 FORMAT(//10X,'THE CONVERSION FACTOR IS A MULTIPLIER USED TO ',
    1 'TRANSFORM'/10X,'THE INPUT DATA INTO UNITS OF IN/HR.'//
    1 10X,'FOR EXAMPLE,   ENTER:    .393701    WHICH IS EQUAL TO   1/2.54'/
    2 10X,'                        TO CONVERT CM/HR TO IN/HR.'//
    3 10X,'IF THE ORIGINAL DATA IS GIVEN IN INCH/HOUR, ENTER  1.0'/)
 9900 RETURN
      END
C
C
C
C************************************************************************
C
C
      SUBROUTINE JGRAPH(IUNIT,IZERO,N,N2,C1,C2,XMAXM)
C
C---- THIS SUBROUTINE PLOTS 2 INPUT DATA VECTORS ALONG A VERTICAL AXIS..
C
C     C1 AND C2 ARE THE INPUT DATA VECTORS.
C     N  IS THE NUMBER OF INPUT VALUES TO BE PLOTTED.
C     N2 IS THE TIME-SCALE PRINT DESIGNATOR:
C        SET N2=0 IF N>1.
C        SET N2 EQUAL TO THE NUMERICAL DESIGNATOR FOR THE OUTPUT
C            VERTICAL GRAPH SCALE WHEN N<2.  TO PRINT THE SCALE AT THE
C            TOP OF THE GRAPH WHEN THE FIRST INPUT VALUE OF N2 IS NOT
C            EQUAL TO ONE, CALL THE SUBROUTINE WITH N=1, N2=1, AND
C            IZERO>0.  THEN, TO PRINT A SCALE AFTER GRAPHING THE LAST
C            VALUE, CALL THE SUBROUTINE WITH N2<0.
C
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,NLINES,ITRANS,IPT
      DIMENSION CHAR(102),CHARO(102),C1(N),C2(N),C(3),CC(3),IC(3),
     1          BA(10),BA2(10),XMAXM(3)
      REAL BLANK(1)/' '/,DASH(1)/'-'/,PLOTI(1)/'I'/,PLOT(2)/'*','I'/
C
C---- PRINT SCALE FOR OUTPUT GRAPH:
C
      IF(N2.LT.0) GO TO 8000
      IF(IZERO.LE.0) GO TO 900
      CALL JSET(1,102,CHARO,DASH(1))
      DO 500 I=1,102,10
  500 CHARO(I)=PLOTI(1)
      SF = 1.0
      SSF = (XMAXM(2)-XMIN)/100.0
      DO 700 I=1,10
  700 BA(I) = ((FLOAT(10*I)*SSF)+XMIN)
      WRITE(IUNIT,9001) XMIN,(BA(I),I=1,10)
      WRITE(IUNIT,9002) CHARO
      SSF = (XMAXM(1)-XMIN)/100.0
      DO 850 I=1,10
  850 BA2(I) = ((FLOAT(10*I)*SSF)+XMIN)
      WRITE(IUNIT,9004) XMIN,(BA2(I),I=1,10)
      WRITE(IUNIT,9005)
      WRITE(IUNIT,9003)
      IF(N.LE.1) RETURN
C
C---- GRAPH PRODUCTION LOOP:
C
  900 DO 5000 L=1,N
         LI=L
         IF(N2.GT.0) LI=N2
         CALL JSET(1,102,CHAR,BLANK(1))
         C(1) = C1(L)
         C(2) = C2(L)
C
C----    SCALE INPUT VECTORS AND PRINT EACH LINE OF THE GRAPH:
C
 2000    DO 3000 I=1,2
            J = 0
 2500       CC(I) = (100.0*C(I)/XMAXM(I))  -  100.0 * FLOAT(J)
            IF(CC(I).LE.100.5) GO TO 2700
            J = J + 1
            GO TO 2500
 2700       IC(I) = JSCALE(CC(I))
 3000       CHAR(IC(I)) = PLOT(I)
 5000    WRITE(IUNIT,9000) C2(L),C1(L),LI,CHAR
      RETURN
```

```
C
C---- PRINT SCALE AT THE BOTTOM OF THE GRAPH:
C
 8000 WRITE(IUNIT,9003)
      WRITE(IUNIT,9003)
      WRITE(IUNIT,9001) XMIN,(BA(I),I=1,10)
      WRITE(IUNIT,9002) CHARO
      WRITE(IUNIT,9004) XMIN,(BA2(I),I=1,10)
C
 9000 FORMAT(' ',1PG10.3,1X,G10.3,1X,I4,2X,1H+,102A1)
 9001 FORMAT(' AMOUNT PER INTERVAL         ',F3.1,5X,1PG9.3,8(1X,G9.3),
     1       0PF7.1)
 9002 FORMAT(' ',28X,1H+,102A1)
 9003 FORMAT(' ',28X,1H+)
 9004 FORMAT(' ACCUMULATED PRECIPITATION  ',F3.1,5X,1PG9.3,8(1X,G9.3),
     1       0PF7.1)
 9005 FORMAT(' ',28X,1H+/' AMOUNT PER   TOTAL    END    +'/
     1                    '  INTERVAL   ACCUM.   TIME   +'/
     2                    '                             +'/
     3                    '     I          *            +')
      RETURN
      END
C
C
C
C*********************************************************************
C
C
      FUNCTION JSCALE(VALUE)
C
C---- THIS FUNCTION SCALES THE INPUT VALUE FOR APPROPRIATE PLACEMENT ON
C     THE GRAPH.  DATA  VALUES WHICH WOULD BE TOO SMALL OR TOO LARGE TO
C     FIT ON THE GIVEN GRAPH SCALE ARE PRINTED AT THE BOTTOM OR THE TOP
C     OF THE GRAPH, RESPECTIVELY.  NOTE:  1.0 IS ADDED TO EACH INPUT
C     OF 'VALUE' TO PROVIDE A SPACE FOR PLOTTING VALUES LESS THAN OR
C     EQUAL TO XMIN.  AN ADDITIONAL .5 IS ADDED TO PROVIDE ROUNDING
C     OFF TO THE NEAREST INTEGER.
C
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,LINESP,ITRANS,IPT
      JSCALE = AMIN1(102.0,AMAX1(1.0,1.5+VALUE-XMIN))
      RETURN
      END
C
C
C
C*********************************************************************
C
C
      SUBROUTINE JSET(ILOWER,IUPPER,CHAR,PLOT)
C
C---- THIS SUBROUTINE SETS THE VALUE OF CHAR TO THE CHARACTER DESIGNATED
C     BY THE INPUT VALUE OF PLOT OVER THE RANGE ILOWER THROUGH IUPPER.
C
      DIMENSION CHAR(102)
      IF(ILOWER.GT.IUPPER) RETURN
      DO 1000 I=ILOWER,IUPPER
 1000 CHAR(I) = PLOT
      RETURN
      END
C
C
C
C*********************************************************************
C
C
      SUBROUTINE JSPACE(IUNIT,NUMBER)
C
C---- THIS SUBROUTINE SKIPS THE NUMBER OF LINES INDICATED BY THE INPUT
C     VALUE OF "NUMBER". IF NUMBER<1, SUBROUTINE SKIPS TO THE NEXT PAGE.
C
      IF(NUMBER.LE.0) GO TO 5000
      DO 1000 N=1,NUMBER
 1000 WRITE(IUNIT,1001)
 1001 FORMAT(' ')
      RETURN
```

```
C
 5000 WRITE(IUNIT,5001)
 5001 FORMAT('1')
      RETURN
      END
C
C
C
C***********************************************************************
C
C
      SUBROUTINE PARMS(IANSWR)
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKINTV/INTRVL,SOURC,GRAPH,STORMS,FACTOR,LAMBDA,XMAX1,XMAX2
              INTEGER SOURC,GRAPH,STORMS
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      DOUBLE PRECISION ZN(15)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNHELP,NNQUIT,NNSTAR
C
      INTEGER JJJ(12)  /1,2,3,4,5,6,10,12,15,20,30,60/
      INTEGER LSTAR1(1)/'*   '/,LSTAR2(1)/'**  '/,LSTAR3(1)/'*** '/,
     1        LSTAR4(1)/'****'/
C
C
C-----------------------------------------------------------------------
C
C
C---- OBTAIN BATCH MODE PROGRAM CONTROL DESCRIPTORS:
C
C     IF THE PROGRAM IS BEING RUN IN INTERACTIVE MODE, SKIP TO NEXT
C     SECTION, PROGRAM LINE 79.
C
      MSG = IER(1)
      IF(IUNIT1.GT.0) GO TO 79
      DO 10 I=1,MTITLE
   10    READ(IUNIT4,15) (LTITLE(J,I),J=1,76)
   15 FORMAT(76A1)
   20 CALL FREERE(IUNIT6,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-2) RETURN
      IF(IANSWR.EQ.-1) GO TO 20
      INTRVL = II(1)
      CALL COMPAR(0,GRAPH ,II(2),ZERO,ZERO)
      CALL COMPAR(0,STORMS,II(3),ZERO,ZERO)
      CALL COMPAR(0,LAMBDA,II(4),ZERO,ZERO)
      CALL COMPAR(0,SOURC ,II(5),ZERO,ZERO)
      CALL COMPAR(1,0     ,0    ,XMAX1 ,RR(6))
      CALL COMPAR(1,0     ,0    ,XMAX2 ,RR(7))
   40 READ(IUNIT3,IFA04) IFMT
      IF(IFMT(1).EQ.LBLANK.AND.IFMT(2).EQ.LBLANK) RETURN
      IF(IFMT(1).EQ.LSTAR1(1).OR.IFMT(1).EQ.LSTAR2(1).OR.
     1   IFMT(1).EQ.LSTAR3(1).OR.IFMT(1).EQ.LSTAR4(1)) GO TO 40
      DO 70 I=1,20
   70    IFRMT(I) = IFMT(I)
      RETURN
C
C
C-----------------------------------------------------------------------
C
C
C---- OBTAIN INTERACTIVE MODE PROGRAM CONTROL DESCRIPTORS;
C     IF THE PROGRAM IS BEING RUN IN BATCH MODE, RETURN TO MAIN PROGRAM.
C
C---- READ TWO INPUT TITLE LINES (UP TO 76 CHARACTERS PER LINE):
C
   79 WRITE(IUNIT6,80)
   80 FORMAT('OWELCOME TO THE V.P.I. EQUAL INTERVAL RAINFALL PROGRAM.'/)
   81 NTITLE = NTITLE + 1
      WRITE(IUNIT6,82) ZN(NTITLE)
   82 FORMAT (' ENTER ',A6,' TITLE LINE FOR OUTPUT HEADING: ')
```

```
      N = NTITLE
      READ(IUNIT5,15,END=89) (LTITLE(J,NTITLE),J=1,76)
      IF(LTITLE(1,N).EQ.LALPHA(17).AND.LTITLE(4,N).EQ.LALPHA(20))
     1   GO TO 390
      IF(LTITLE(1,N).EQ.LALPHA(08).AND.LTITLE(2,N).EQ.LALPHA(05).AND.
     1 LTITLE(3,N).EQ.LALPHA(12).AND.LTITLE(4,N).EQ.LALPHA(16)) GO TO 85
   84 IF(NTITLE.LT.MTITLE) GO TO 81
      GO TO 90
   85 CALL INHELP(IUNIT5,IUNIT6,0,IANSWR)
      IF(IANSWR.LT.-2) RETURN
      NTITLE = NTITLE - 1
      GO TO 81
   89 IF(IUNIT5.NE.IUNIT4.AND.IUNIT5.NE.IUNIT6) BACKSPACE IUNIT5
      GO TO 84
C
C---- REQUEST THE INTERVAL FOR FESHM MODEL RAINFALL INPUT:
C
C     INTRVL IS THE USER SPECIFIED TIME INTERVAL IN MINUTES.
C        INTRVL MUST BE A DIVISOR OF 60 THAT LEAVES NO REMAINDER;
C        ACCEPTIBLE VALUES ARE:  1, 2, 3, 4, 5, 6, 10, 12, 15, 20, OR 30
C
C     ENTERING A SECOND NUMERICAL VALUE INVOKES EXECUTION OF THE PROGRAM
C        WITHOUT REQUIRING FURTHER USER INPUTS.
C
   90 INDEX  = 2
      MTITLE = 10
   91 WRITE(IUNIT6,92)
   92 FORMAT('0ENTER THE RAINFALL INTERVAL (MINUTES):')
   94 MSG = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 91
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 104
      IF(IANSWR.EQ.-1) GO TO 91
      IFLAG  = 0
      INTRVL = II(1)
      DO 103 J=1,12
  103    IF(INTRVL.EQ.JJJ(J)) IFLAG = 1
      IF(IFLAG.GE.1) GO TO 110
      INDEX = -2
  104 CALL INHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      IF(IANSWR.LT.-2) RETURN
      GO TO 90
  110 IF(N.GT.1) RETURN
C
C---- DETERMINE WHETHER THE INPUT RECORD IS TO BE CONSIDERED AS A SINGLE
C     STORM OR A SEQUENCE OF STORMS.  (IF A SEQUENCE OF STORMS IS
C     ENTERED, AN INDIVIDUAL STORM IS TERMINATED BY LAMBDA/INTRVL INPUTS
C     OF ZEROS).  DATA ENTRY IS TERMINATED BY ENTERING A  VALUE OF
C     NMONTH GREATER THAN 30 OR WHEN THE END OF THE INPUT DATA SET IS
C     ENCOUNTERED.
C
C     SUBROUTINE FREERE IS USED TO READ THE NEXT INPUT DATA RECORD.
C     SUBROUTINE COMPAR IS USED TO ASSIGN A USER INPUT VALUE TO LAMBDA.
C
  111 WRITE(IUNIT6,112)
  112 FORMAT('0WILL THE DATA FILE CONTAIN MORE THAN ONE STORM?',
     1       '    (Y/N/QUIT/HELP):')
C
C          IF Y IS ENTERED, 'STORMS' IS LEFT GREATER THAN ONE.
C          IF N IS ENTERED, 'STORMS' IS SET  EQUAL TO ONE.
C
  115 INDEX = 4
      MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 120
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.GE. 0) GO TO  117
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 116
      IF(IANSWR.EQ.-1) GO TO 111
      INDEX = -4
  116 CALL INHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      GO TO 111
  117 IF(IANSWR.EQ. 0) STORMS = 1
```

```
      CALL COMPAR(0,LAMBDA,II(1),ZERO,ZERO)
C
C---- DETERMINE WHETHER THE USER WOULD LIKE A GRAPH OF THE RAINFALL
C     DATA'(IN INTERVALS) AND ENTER THE DESIRED CHANGES TO THE DEFAULTS:
C
C     XMAX1 IS THE MAXIMUM DIMENSION OF THE GRAPH SCALE FOR INTENSITY
C           PER INTERVAL.   DEFAULT SCALING IS USED IF RR(1) IS BLANK.
C
C     XMAX2 IS THE MAXIMUM DIMENSION OF THE GRAPH SCALE FOR ACCUM.
C           PRECIPITATION.  DEFAULT SCALING IS USED IF RR(2) IS BLANK.
C
  120 WRITE(IUNIT6,121)
  121 FORMAT('ODO YOU WISH TO HAVE A GRAPH OF THE PRECIPITATION DATA?',
     1       '     (Y/N/QUIT/HELP):')
C
C         IF Y IS ENTERED, GRAPH IS LEFT EQUAL TO ZERO.
C         IF N IS ENTERED, GRAPH IS SET  EQUAL TO ONE (NO GRAPH).
C
  122 MSG   = IER(1)
      INDEX = 5
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 130
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 124
      IF(IANSWR.GE. 0) GO TO 125
      IF(IANSWR.GE.-1) GO TO 120
      INDEX = -5
  124 CALL INHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      GO TO 120
  125 IF(IANSWR.EQ. 0) GRAPH = 1
      CALL COMPAR(1,0,0,XMAX1,RR(1))
      CALL COMPAR(1,0,0,XMAX2,RR(2))
C
C---- DETERMINE THE SOURCE OF THE DATA AND OBTAIN ADDITIONAL INFORMATION
C     REQUIRED TO PROCESS THE DATA.
C
C     IF Y IS ENTERED, THE PROGRAM ASSUMES THE RAINFALL INTENSITY IS FOR
C                      THE INTERVAL PREDEDING THE TIME INDICATED.
C
  130 WRITE(IUNIT6,131)
  131 FORMAT('OIS YOUR INPUT DATA IN THE STANDARD V.P.I. FORMAT? ',
     1       '     (Y/N/QUIT/HELP):')
  134 MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 400
      IF(IANSWR.EQ.-1) GO TO 130
      IF(IANSWR.EQ. 1) RETURN
      CALL SOURCE(IANSWR)
      IF(IANSWR.LE.-3) RETURN
C     CALL FRMATS(20,IFRMT,IANSWR)
      READ(IUNIT3,300,END=350) IFRMT
  300 FORMAT(20A4)
      RETURN
C
  350 WRITE(IUNIT6,351)
  351 FORMAT('0    NO FORMAT AVAILABLE FOR THE INPUT DATA,',
     1       '     E.G. IUNIT3 NOT DEFINED AS AN EXISTING DISK FILE.')
  390 IANSWR = -3
      RETURN
C
  400 CALL INHELP(IUNIT5,IUNIT6,6,IANSWR)
      GO TO 130
      END
C
C
```

```
C
C*********************************************************************
C
      SUBROUTINE SOURCE(IANSWR)
C
C---- THIS SUBROUTINE OBTAINS REQUIRED INFORMATION TO INTERPRET DATA
C     SETS WHICH ARE NOT IN THE STANDARDIZED V.P.I. FORMAT.
C
C     IF SOURC>1     THE PROGRAM ASSUMES THAT THE RAINFALL INTENSITY IS
C                    FOR THE PERIOD AFTER THE INPUT TIME AS GIVEN
C                    (E. G.  PURDUE DIGITIZED OUTPUT).
C                    THIS OPTION HAS NOT YET BEEN FULLY TESTED.
C
C     FACTOR IS THE CORRECTION FACTOR USED TO CONVERT THE INPUT DATA
C        FOR RAINFALL INTO UNITS OF INCH/HOUR;  FOR EXAMPLE IF THE
C        ORIGINAL DATA WERE GIVEN IN CM OF RAIN AT THE BREAKPOINTS,
C        FACTOR = .393701 = 1/2.54
C        A DEFAULT VALUE OF ONE IS ASSUMED IF THIS ENTRY IS BLANK.
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKINTV/INTRVL,SOURC,GRAPH,STORMS,FACTOR,LAMBDA,XMAX1,XMAX2
              INTEGER SOURC,GRAPH,STORMS
      COMMON/BKSCAL/SF,XMIN,XMAX,A(3),P(3),D(3),LNPLOT,NLINES,ITRANS,IPT
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      DOUBLE PRECISION ZN(15)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNHELP,NNQUIT,NNSTAR
      DIMENSION IVFMT(20)
C
  999 MSG   = IER(1)
      INDEX = 7
  980 WRITE(IUNIT6,1000)
 1000 FORMAT('0ENTER CONVERSION FACTOR FOR INCH/HOUR:')
 3000 CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-2) GO TO 3040
      IF(IANSWR.EQ.-1) GO TO 980
      GO TO 3050
 3040 CALL INHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      GO TO 999
 3050 CALL COMPAR(1,0,0,FACTOR,RR(1))
      CALL COMPAR(0,SOURC,II(1),ZERO,ZERO)
 9990 RETURN
      END
C
C
C
```

EXECUTE EXEC

The EXECUTE EXEC routine is used to set up file definitions and run a compiled FORTRAN program. The interface programs are self contained and do not need this exec in order to be run successfully. The EXECUTE EXEC is provided for users who do have the EXEC-2 language available in order to facilitate program implementation. If the EXEC-2 language is not available at your installation, all you need to do is define the appropriate input and output file definitions and then run the compiled program. The required file definitions are as follows:

IUNIT4: Input Data File

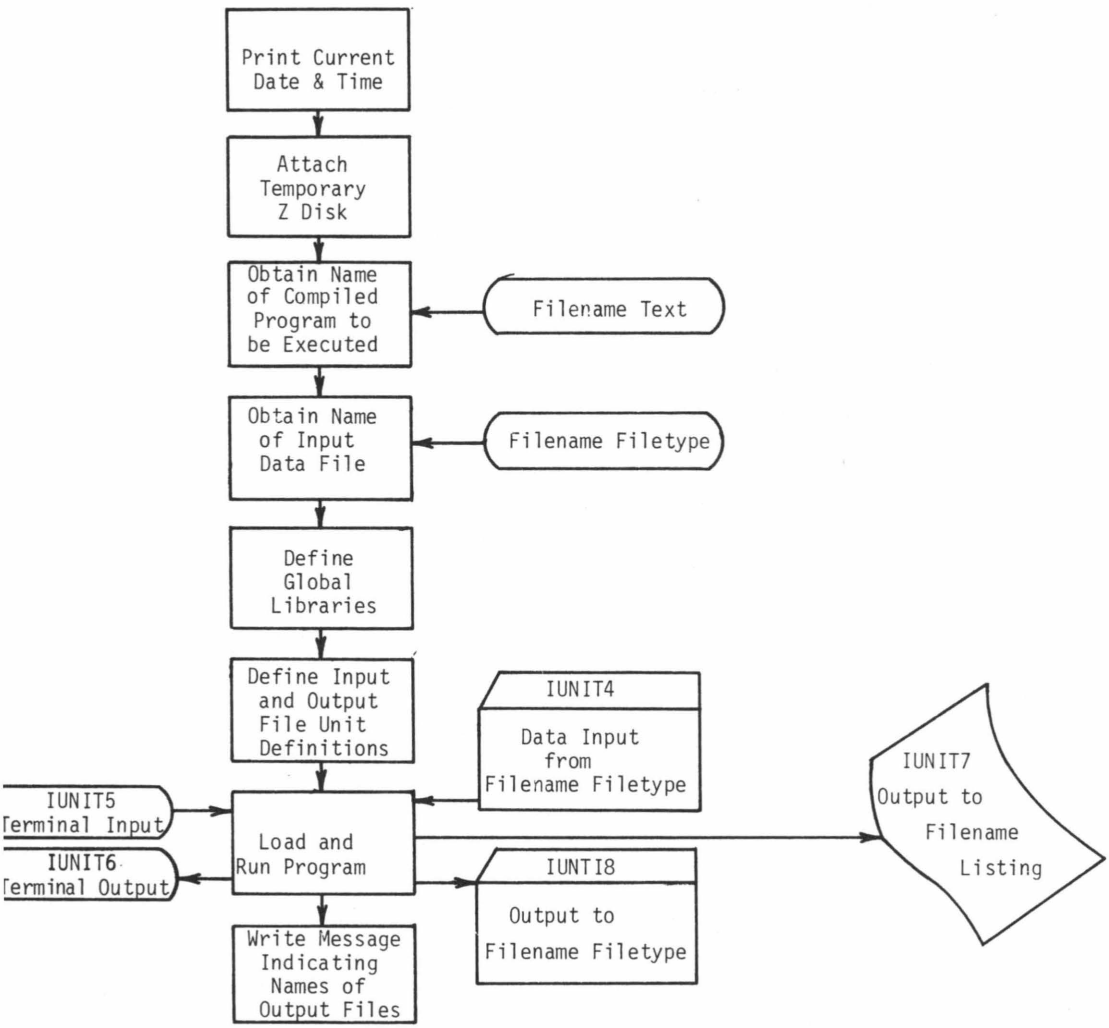
IUNIT5: Terminal Input

IUNIT6: Terminal Output to the Operator

IUNIT7: Printer Output (132 character logical record length)

IUNIT8: Data Storage Output (80 character logical record length); i.e. output which is used as input to later programs in the interface package.

FLOWCHART EXECUTE EXEC



```
      &TRACE
*
*     REVISION:  25 SEPTEMBER 1983
*
*---  INITIALIZE VARIABLE NAMES AND PRINT DATE & TIME.
*
      &DATEX = &RIGHT OF &DATE 10
      &DATEX = &LEFT  OF &DATE 30
      &TYPE    TODAY'S DATE IS: &DATEX THE CURRENT TIME IS: &TIME
      &TYPE
      &TEXT =  TEXT
      &FSET =  FILE
      &L    = -ASK2
      &QO   =  1
*
*---  ATTACH A TEMPORARY  'Z DISK'  IF NOT ALREADY AVAILABLE.
*
      STATE  *  *  Z
      &IF &RC NE 36 &SKIP 2
      &TYPE WAIT FOR LINK TO WORK SPACE ON "Z" DISK.
      EXEC TDISK 2 Z
*
*---- THIS EXEC IMPLEMENTS EXECUTION OF AN EXISTING TEXT FILE:
*
*
*     THE PROGRAM INPUTS ARE ASSUMED TO BE:
*
*                DISK DATA STORAGE       FOR UNIT 4.
*                TERMINAL                FOR UNIT 5.
*
*     THE PROGRAM OUTPUT WILL BE FOUND IN:
*
*                TERMINAL                  FOR UNIT 6.
*                FILE   A  LISTING   Z     FOR UNIT 7 (PRINTER OUTPUT).
*                FILE   A  DATABASE  A     FOR UNIT 8 (DATA STORAGE).
*
*     THE ERROR MESSAGES:   "NO FILENAME SPECIFIED"  MAY BE IGNORED.
*                           "UNKNOWN CMS COMMAND"    MAY BE IGNORED.
*
*
*
*
*
*****                       IMPLEMENTATION:                       *****
*
*
*     IF THIS FILE WAS JUST RECENTLY SENT TO YOU, DELETE ANY LINES
*        WHICH APPEAR ABOVE THE LINE CONTAINING    "  &TRACE ".
*
*     TO INACTIVATE (COMMENT OUT) SECTIONS OF THE PROGRAM, PLACE    *
*        IN COLUMN 1 OF THE PROGRAM LINES.
*
*--- 0.   IF A TEXT FILE ALREADY EXISTS, ON YOUR DISK OR ON A LINKED
*         DISK, SKIP TO 4.  THIS EXEC SEARCHES, ALPHABETICALLY, ATTACHED
*         DISKS AND WILL EMPLOY THE FIRST TEXT FILE CORRESPONDING TO
*         THE TEXT FILE NAME YOU SUPPLY.
*
*--- 1.   PREPARE A FORTRAN SOURCE PROGRAM; THE FILETYPE MUST BE FORTRAN.
*
*--- 2.   COMPILE THE PROGRAM (PREPARE A TEXT FILE):  E.G.  F FILENAME
*
*--- 3.   IF ERRORS ARE DETECTED, CORRECT THEM AND REPEAT 2.
*         THE FILE       FILENAME LISTING      CONTAINS A LISTING OF THE
*         SOURCE PROGRAM WITH ERROR DIAGNOSTICS.  ONCE THE PROGRAM HAS
*         BEEN COMPILED ERROR-FREE, THIS LISTING FILE MAY BE ERASED.
*
```

```
*--- 4.  ENTER          EXECUTE FILENAME
*
*        THE PROGRAM NOW COMPARES THE FILENAME WITH EXISTING TEXT FILES,
*        IF A FILENAME WAS NOT ENTERED OR IF NO TEXT FILE CORRESPONDING
*        TO THE INPUT FILENAME EXISTS ON ANY ATTACHED DISK, THE EXEC
*        WILL PROMPT YOU FOR THE NAME OF THE TEXT FILE TO BE EMPLOYED.
*        THE PROMPT MESSAGE WILL CONTINUE TO APPEAR UNTIL YOU SUPPLY THE
*        NAME OF AN EXISTING TEST FILE OR YOU ENTER QUIT.
*

-ASK
         &IF  &N  LE   0       &GOTO -ASK2
         &IF .&1  EQ  .QUIT    &EXIT  10
         &IF .&1  EQ  .LDISK   &GOTO -LINKR
         &IF .&1  EQ  .F       &GOTO -COMPL
         &TXTFL = &1
         STATE &TXTFL &TEXT A
         &IF &RC EQ 0 &GOTO -90
*
*---     CHECK ATTACHED DISKS TO OBTAIN THE FILEMODE IDENTITY.
*
         LISTFILE  &TXTFL &TEXT * ( STACK
              &IF &RC NE 0 &GOTO -MISSING
              &READ ARGS
              &FM = &3
              &FT = &TEXT
              &FN     = &1
              &TXTFL = &1
         STATE &TXTFL &TEXT &FM
         &IF &RC EQ 0 &GOTO -90
-MISSING
         &TYPE
         &TYPE YOUR SPECIFIED &TEXT &FSET COULD NOT BE FOUND:
         &TYPE TO ATTACH ANOTHER DISK, ENTER:   LDISK   <USERID>
         &TYPE
         &IF &Q0 GT 1 &GOTO -40
         &TYPE TO LEAVE THIS EXEC, ENTER: QUIT
         &TYPE
         &Q0 = &Q0 + 1
-40
         &GOTO &L
-ASK2
         &TYPE PLEASE ENTER NAME OF TEXT FILE TO BE EXECUTED:
         &READ ARGS
              &IF &N GT 1 &LKR = &2
              &GOTO -ASK
*
*---     COMPILE AN EXISITNG FORTRAN FILE IF THE CORRESPONDING TEXT FILE
*        HAS NOT YET BEEN CREATED.
*
-COMPL
         EXEC  F  &LKR
         &TYPE
         &GOTO &L
*
*        LINK THE DISK CONTAINING THE DESIRED FILE.
*
-LINKR
         EXEC LDISK &LKR
         &TYPE
         &GOTO &L

*
*--- 5. UNLESS THE THE FOLLOWING LINES ARE DEACTIVATED, YOU WILL NOW BE
*       ASKED TO SUPPLY THE NAME OF A FILE CONTAINING DATA TO BE USED
*       DURING EXECUTION OF YOUR PROGRAM (DISK STORAGE TO READ UNIT 4):
*
*       IF NO DATA IS NEEDED FOR THE IMPLEMENTATION OF YOUR PROGRAM, THE
*       NAME OF ANY EXISTING FILE MAY BE ENTERED;  THE FILENAME AND
*       FILETYPE MAY BE ANY CMS COMPATIBLE NAMES.
*       BOTH THE FILENAME AND FILETYPE MUST BE SPECIFIED.
*       THIS PROMPT WILL BE REPEATED UNTIL YOU ENTER AN ACCEPTIBLE NAME.
*
*       ENTER QUIT IF YOU DESIRE TO LEAVE THIS EXEC.
*
```

```
-90
        &L    = -100
        &TEXT =  DATA
        &FSET =  SET
-100
        &TYPE PLEASE ENTER FILE-ID FOR INPUT DATA SET (FN FT FM):
        &READ VARS &FN &FT &FM
          &IF .&FN NE .HELP  &GOTO -CONT

          &BEGTYPE 8

          TO EXIT THE PROGRAM AT ANY TIME, ENTER QUIT.

          ENTER THE NAME OF THE DISK FILE WHICH CONTAINS THE DATA
                SET TO BE USED IN THE PROGRAM COMPUTATIONS.
          IF NO DATA IS REQUIRED BY THE PROGRAM, ENTER THE NAME OF
                ANY EXISTING FILE.

         &GOTO  -100
-CONT
              &IF .&FN EQ .QUIT  &EXIT 100
              &IF .&FT NE .      &LKR = &FT
              &IF .&FN EQ .LDISK &GOTO -LINKR
              &IF .&FN EQ .      &GOTO -100
              &IF .&FT EQ .      &GOTO -100
*       STATE &FN &FT A
*             &IF &RC EQ 0 &GOTO -200
        LISTFILE &FN &FT * ( STACK
              &IF &RC NE 0 &GOTO -MISSING
              &READ ARGS
              &FN  = &1
              &FT  = &2
              &FM  = &3
        STATE &FN &FT &FM
              &IF &RC NE 0 &GOTO -100
*
*--- 6. IF A GLOBAL STATEMENT IS PROVIDED IN YOUR PROFILE EXEC, THE
*       GLOBAL PROVIDED HERE MAY BE COMMENTED OUT.
*
-200
        GLOBAL TXTLIB FORTXLIB          VPIUTIL CMSLIB
*       GLOBAL TXTLIB FORTXLIB VFORTLIB VPIUTIL CMSLIB
*       GLOBAL TXTLIB FORTXLIB VFORTLIB VPIUTIL CMSLIB SYDOR2
        GLOBAL MACLIB WATLIB
*
*--- 7. THE OUTPUT FROM UNIT 7 IS WRITTEN TO A FILE CALLED A LISTING.
*       THIS FILE IS ERASED AND A NEW ONE GENERATED EACH TIME THIS
*       EXEC IS IMPLEMENTED.  IF YOU DESIRE TO SAVE THIS OUTPUT FILE,
*       RENAME 'A LISTING A' TO A NEW FILENAME BEFORE REUSING THIS EXEC.
*
        FILEDEF 1 DISK FREERE JUNK  Z
        FILEDEF 3 DISK INPUT FORMAT A
        FILEDEF 4 DISK &FN &FT &FM
        FILEDEF 5 TERM (PERM
        FILEDEF 6 TERM (PERM
        FILEDEF 7 DISK A LISTING Z (LRECL 133 RECFM FB  BLKSIZE 133

*
*--- 8. THE OUTPUT FROM UNIT 8 IS WRITTEN TO A FILE CALLED 'FN DATABASE A'.
*       USING THE OPTION 'DIS MOD' THE OUTPUT FROM THIS JOB WILL BE
*       APPENDED TO THE OUTPUT CURRENTLY IN FILE 'A DATABASE A'.
*
        FILEDEF 8 DISK &FN DATABASE  A (LRECL 80
*       FILEDEF 8 DISK &FN DATABASE  A (LRECL 80   DISP MOD
*       &STACK  &FN
        SET BLIP OFF
*
*--  9. THIS SECTION IMPLEMENTS EXECUTION OF THE EXISTING TEXT FILE:
*
        LOAD &TXTFL
        START

        SET BLIP RIVET...
```

```
*
*-- 10. THE FOLLOWING LINES ISSUE A REMINDER INDICATING THE NAMES OF THE
*       OUTPUT FILES GENERATED DURING PROGRAM EXECUTION:
*

        &A = A
        &A = &LEFT  OF &A   12
        &X = &LEFT  OF &FN   8
        &X = &RIGHT OF &X   19

        &BEGTYPE 5

      YOUR PROGRAM OUTPUTS ARE IN:

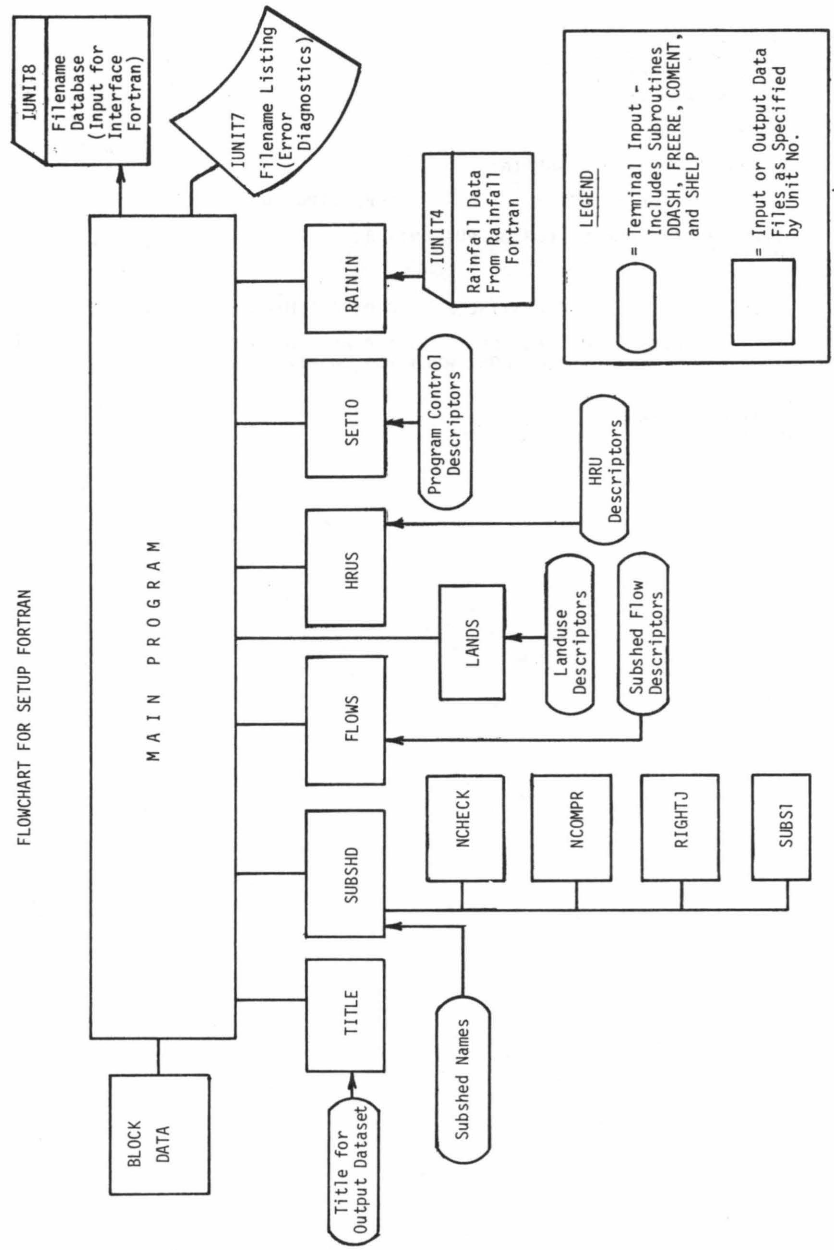
          A        LISTING  Z            FOR OUTPUT UNIT 7
                   &
       &TYPE &X DATABASE &A FOR OUTPUT UNIT 8
       &BEGTYPE 7

      WARNING:  THE FILE   A LISTING Z   IS ON A TEMPORARY DISK.

                UNLESS YOU TRANSFER IT TO A PERMANENT DISK,
                     IT WILL BE LOST WHEN YOU LOGOFF !

*      PRINT A LISTING Z
       &EXIT
```

FLOWCHART FOR SETUP FORTRAN



```
C***  29 SEPTEMBER 1983    **********    DO NOT ERASE   ******  W. J. SYDOR
C***********************************************************************
C
C
C                             SETUP FORTRAN
C
C
C---- THIS FILE CONTAINS THE SUBROUTINE USED TO GENERATE A USER
C     INTERPRETABLE DATA FILE TO BE USED WITH THE FINITE ELEMENT
C     STORM HYDROLOGIC MODEL INTERFACE.
C
C---- EXTERNAL SUBROUTINES REQUIRED ARE:
C
C                                  COMENT
C                                  COMPAR
C                                  FREERE
C                                  NCHECK
C                                  NCOMPR
C                                  RIGHTJ
C                                  SUBS1
C                                  TITLE
C
C
C---- PREFIX IDENTIFIERS USED WITH INTEGER COUNTERS:
C
C      I  =>  MAIN LOOP COUNTER
C      J  =>  SUB-LOOP COUNTER WITHIN LOOP OF I,
C             NUMBERED VALUES OF J ARE USED FOR DEEPER SUB-LOOPS.
C      M  =>  THE MAXIMUM DIMENSION OF THE VARIABLE CORRESPONDING TO THE
C             REMAINING FIVE LETTERS.
C      N  =>  THE ACTUAL DIMENSION USED BY THE PROGRAM CORRESPONDING TO
C             THE REMAINING FIVE LETTERS.
C             THE PREFIX NN IS USED TO INDICATE NAME VECTORS KEYED TO THE
C             VARIABLES CORRESPONDING TO THE REMAINING FOUR LETTERS.
C      K  =>  AN INDEX COUNTER WITH NEW DIMENSIONS CORRESPONDING TO THE
C             INDEX COUNTER CORRESPONDING TO THE REMAINING 5 LETTERS.
C
C
                                BLOCK DATA
C
C
C---- COMMON BLOCKS FROM THE FINITE ELEMENT STORM HYDROLOGIC MODEL:
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(50,120),NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1     ,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
C
C---- COMMON BLOCKS ADDED FROM MARY LEE WOLF THESIS:
C
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1        DIA(8,163),TYPE(8,163)
C*    COMMON/BK33/XKUSLE(163),CUSLE(163),PUSLE(163)
      COMMON/BK36/IELE,NGREAT,KDET,XI30(4)
      COMMON/BK38/INCLAS
C
C---- COMMON BLOCKS ADDED TO PROVIDE DIMENSIONS NOT GIVEN BY THE
C     FINITE ELEMENT MODEL FORMULATION:
C
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
```

```
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1       KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1       YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
C
C---- COMMON BLOCKS FOR TITLES, FORMATS, AND SYMBOLS:
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BKNUM/NUMBER(100)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      DOUBLE PRECISION ZN(32)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNQUIT,NNSTAR,LLFRMT(20)
C
      REAL      DTC       /30.0/
      REAL      DTO       /30.0/
      REAL      EVP       / 0.800, 1.430, 2.130, 3.300, 4.340, 4.800,
     1                      4.960, 4.030, 3.300, 1.940, 1.110, 0.710/
C
      REAL     GINDEX     / 0.300, 0.300, 0.300, 0.450, 0.600, 0.800,
     1                      0.900, 0.900, 0.750, 0.400, 0.300, 0.300/
C
      INTEGER   IER       /'WARN','PRNT','DIAG','END','ERR ','DBUG'/
      INTEGER IPUNCH      /8/
      INTEGER IUNIT1      /0/
      INTEGER IUNIT2      /2/
      INTEGER IUNIT4      /4/
      INTEGER IUNIT5      /5/
      INTEGER IUNIT6      /6/
      INTEGER IUNIT7      /0/
      INTEGER IZONE       /1,80/
C
      INTEGER KNECHA/32*1/
      INTEGER KNSTRP/32*1/
      INTEGER KLHSSP/32*1/
      INTEGER KNESTR/640*1/
C
      INTEGER LALPHA      /'A','B','C','D','E','F','G','H','I','J','K',
     1                     'L','M','N','O','P','Q','R','S','T','U','V',
     2                     'W','X','Y','Z'/
      INTEGER LBLANK(1) /' '/
      INTEGER LDASH(1)  /'-'/
      INTEGER LDIGIT      /'0','1','2','3','4','5','6','7','8','9','.',
     1                     '-','+'/
      INTEGER LDOT(1)     /'.'/
      INTEGER LLFRMT      /'(20I','1)  ',18*'    '/
      INTEGER LPLUS(1)    /'+'/
      INTEGER LSTAR(1)    /'*   '/
      INTEGER LTITLE      /800*' '/
C
      INTEGER MDM         /80/
      INTEGER LMONTH      /'JAN.','FEB.','MAR.','APR.','MAY ','JUNE',
     1                     'JULY','AUG.','SEPT','OCT.','NOV.','DEC.'/
      INTEGER MTITLE      /2/
C
      INTEGER NOPRIN      /300/
      INTEGER NCPRIN      /300/
      INTEGER NGAGES      /1/
      INTEGER NHOURC      /5/
      INTEGER NHRU        /50*1/
      INTEGER NNBASE(1) /'BASE'/
      INTEGER NNDATA(1) /'DATA'/
      INTEGER NNDEFA(1) /'DEFA'/
      INTEGER NNQUIT(1) /'QUIT'/
      INTEGER NPCHAN      /40*0/
      INTEGER NPOVER      /40*0/
      INTEGER NNSTAR(1) /'*** '/
      INTEGER NRGAGE      /80*1/
      INTEGER NSUBS       /0/
      INTEGER NTITLE      /0/
C     INTEGER NNSUBS      /'A','L','P','H','A',3*' ','B','E','T','A',4*' '
C    1 ,'G','A','M','M','A',' ',' ',' ','D','E','L','T','A',' ',' ',' ',
```

```
C     2  'E','P','S','I','L','O','N',' ','Z','E','T','A',' ',' ',' ',' ',
C     3  'E','T','A',' ',' ',' ',' ',' ','T','H','E','T','A',' ',' ',' ',
C     4  'I','O','T','A',' ',' ',' ',' ','K','A','P','P','A',' ',' ',' ',
C     5  'L','A','M','B','D','A',' ',' ','M','U',' ',' ',' ',' ',' ',' ',
C     6  'N','U',' ',' ',' ',' ',' ',' ','X','I',' ',' ',' ',' ',' ',' ',
C     7  'O','M','I','C','R','O','N',' ','P','I',' ',' ',' ',' ',' ',' ',
C     8  'R','H','O',' ',' ',' ',' ',' ','S','I','G','M','A',' ',' ',' ',
C     9  'T','A','U',' ',' ',' ',' ',' ','U','P','S','I','L','O','N',' ',
C     *  'P','H','I',' ',' ',' ',' ',' ','C','H','I',' ',' ',' ',' ',' ',
C     1  'P','S','I',' ',' ',' ',' ',' ','O','M','E','G','A',' ',' ',' ',
C     2   64*' '/
C
         DATA NUMBER/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
      1     21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,
      2     41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,
      3     61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,
      4     81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,07,98,99,100/
C
         REAL SMCWS/0.0/
C
         DATA ZN   /'FIRST ','SECOND','THIRD ','FOURTH','FIFTH ',
      1    'SIXTH ','  7TH ','EIGHTH','NINTH ','TENTH ',' 11TH ',
      2    ' 12TH ',' 13TH ',' 14TH ',' 15TH ',' 16TH ',' 17TH ',
      3    ' 18TH ',' 19TH ',' 20TH ',' 21ST ',' 22ND ',' 23RD ',
      4    ' 24TH ',8*'      '/
      END
C
C
C***********************************************************************
C
C
C                            MAIN   PROGRAM
C
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
C
      INTEGER IANSWR /0/
C
C---- READ A TITLE LINE TO BE ASSIGNED AS A HEADING FOR THE DATA SET:
C
      WRITE(IUNIT6,10)
   10 FORMAT('OWELCOME TO THE V.P.I. FESHM INTERFACE PROGRAM.'//
     1  ' ENTER TITLE LINE FOR WATERSHED CHARACTERISTICS DATA SET:'/)
      CALL TITLE(IANSWR,10,0)
      IF(IANSWR.LE.-3) GO TO 9990
C
C---- READ SUBSHED NAMES AND DETERMINE BOUNDARY CONDITION CODES:
C
      CALL SUBSHD(1,IANSWR,NTELES)
      IF(IANSWR.LE.-3) GO TO 9990
C
C---- OBTAIN THE CHANNEL & OVERLAND FLOW DESCRIPTORS FOR EACH SUBSHED:
C
      CALL FLOWS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9990
C
C---- OBTAIN LANDUSE AND HRU PARAMETERS:
C
      CALL LANDS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9990
      CALL HRUS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9990
C
C---- OBTAIN A TITLE LINE FOR THE COMBINED BASIN AND STORM DATA SET:
C
      WRITE(IPUNCH,7200)
 7200 FORMAT('*'/'**** OUTPUT TITLE, TIME STEPS, AND PROGRAM ',
     1       'CONTROL PARAMETERS:'/'*')
      WRITE(IUNIT6,7400)
 7400 FORMAT('OENTER A TITLE LINE FOR THE COMBINED BASIN AND STORM DATA'
     1      ,' SETS:')
      CALL TITLE(IANSWR,10,0)
      IF(IANSWR.LE.-3) GO TO 9990
```

```
C
C---- OBTAIN OUTPUT CONTROL DESCRIPTORS:
C
      CALL SETIO(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9990
C
C---- OBTAIN STORM DESCRIPTIVE INFORMATION:
C
      CALL RAININ(IANSWR)
      IF(IANSWR.GT.-3) GO TO 9999
C
C-----------------------------------------------------------------------
C
C---- TERMINATE PROGRAM INPUT IF USER SPECIFIED THE OPTION QUIT:
C
 9990 WRITE(IUNIT6,9991)
 9991 FORMAT(//'0DATA ENTRY TERMINATED AT YOUR REQUEST.'//'0YOU HAVE ',
     1  'NOW LEFT THE FESHM DATA PREPARATION PROGRAM AND'/'     HAVE ',
     2  'BEEN RETURNED TO YOUR COMPUTER''S GENERAL OPERATING SYSTEM.'/)
 9999 STOP
      END
C
C
C***********************************************************************
C
      SUBROUTINE DDASH(IUNIT,NUMBER)
C
C---- THIS SUBROUTINE WRITES THE SECTION BREAKS DURING EXECUTION
C     OF THE FESHM DATASET GENERATION PROGRAM.
C
      WRITE(IUNIT,1000)
 1000 FORMAT('*'/'*',71('-'))
      DO 2000 I=1,NUMBER
 2000    WRITE(IUNIT,3000)
 3000 FORMAT('*')
      RETURN
      END
C
C
C***********************************************************************
C
      SUBROUTINE FLOWS(IANSWR)
C
C---- THIS SUBROUTINE OBTAINS CHANNEL AND OVERLAND FLOW PARAMETERS:
C
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),MONTH(12)
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      INTEGER ICOUNT/0/
      INTEGER JCOUNT/0/
      INTEGER LROMAN(20)/'   I','  II',' III','  IV','   V','  VI',
     1       ' VII','VIII','  IX','   X','  XI',' XII','XIII',' XIV',
     2       '  XV',' XVI','XVII',' 18 ',' XIX','  XX'/
C
C---- OBTAIN THE NUMBER OF FLOWSTRIPS AND CHANNEL ELEMENTS:
C
      I = 0
 2000 I = I + 1
 2100 WRITE(IUNIT6,2101) (NNSUBS(J,I),J=1,8)
 2101 FORMAT(/' ENTER THE NUMBER OF CHANNEL ELEMENTS, NUMBER OF FLOW'
     1,' STRIPS, & NUMBER'/'      OF FLOW STRIPS ON LEFT SIDE OF THE ',
     2'CHANNEL FOR SUBSHED ',8A1,':')
 2400 INDEX = 3
      MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 2800
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.GE. 0) GO TO 2800
      IF(IANSWR.LE.-3) GO TO 9900
      IF(IANSWR.LE.-2) GO TO 2600
      IF(IANSWR.EQ.-1) GO TO 2100
```

```
 2500 INDEX = -3
 2600 CALL SHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      IF(INDEX.GT.0) GO TO 2400
      GO TO 2100
 2800 KNECHA(I) = II(1)
      KNSTRP(I) = II(2)
      KLHSSP(I) = II(3)
      IF(II(1).LE.0.OR.II(2).LE.0) GO TO 2500
      IF(II(3).LE.II(2)) GO TO 2900
      INDEX = -4
      CALL SHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      GO TO 2100
 2900 NSTRIP    = II(2)
      NCHANN    = II(1)
C
C---- OBTAIN THE NUMBER OF ELEMENTS IN EACH FLOWSTRIP OF THE SUBSHED:
C
 3000 WRITE(IUNIT6,3200) (NNSUBS(J,I),J=1,8)
 3200 FORMAT('0     ENTER THE NUMBER OF ELEMENTS IN EACH FLOW STRIP ',
     1   'OF SUBSHED ',8A1,':')
 3300 MSG    = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 3000
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) GO TO 9900
      IF(IANSWR.EQ.-1) GO TO 3000
 3380 J2 = 0
      DO 3400 J=1,NSTRIP
 3400    KNESTR(I,J) = II(J)
C
C---- PRINT THE OVERLAND FLOW DESCRIPTORS FOR EACH WATERSHED:
C
 4100 WRITE(IPUNCH,4200) (NNSUBS(J1,I),J1=1,8),KNSTRP(I),KLHSSP(I),
     1      KNECHA(I),(KNESTR(I,J),J=1,NSTRIP)
 4200 FORMAT('*  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:  ',6X,8A1/'*'/
     1 '    NUMBER OF FLOW STRIPS                          (NSTRPS):',I14/
     2 '    NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):',I14/
     3 '    NUMBER OF CHANNEL ELEMENTS                     (NECHAN):',I14/
     4 '*'/'** NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):'/
     5 '         ',20I4)
C
C---- PRINT THE OUTLINE FOR ELEMENT DATA INPUT:
C
      WRITE(IPUNCH,4400)
 4400 FORMAT('*'/'*                          (XLEN)   (RELIEF)   ',
     1  '(AREA)   (TWIDTH)'/
     2  '*     FLOW     ELEM.     LENGTH     RELIEF   ELEMENT',
     3  '       TOP'/
     4  '*    STRIP     NOS.',25X,'AREA       WIDTH'/'*')
C
      DO 4700 J=1,NSTRIP
         NELM = KNESTR(I,J)
         DO 4700 K=1,NELM
            ICOUNT = ICOUNT + 1
            IF(K.EQ.1) WRITE(IPUNCH,4702) LALPHA(J),ICOUNT
            IF(K.NE.1) WRITE(IPUNCH,4703)           ICOUNT
 4700 CONTINUE
 4702 FORMAT(8X,A2,4X,I3)
 4703 FORMAT(      14X,I3)
C
C---- PRINT THE OUTLINE FOR CHANNEL ELEMENT DATA INPUT:
C
      WRITE(IPUNCH,5100)
 5100 FORMAT('*'/'*'/'** CHANNEL FLOW ELEMENT DESCRIPTORS:'/'*'/
     1 '*',13X,'(XLEN)  (RELIEF)   (RCOEF)    (TWIDTH)    (HT)     ',
     2  ' (BASE)'/
     2 '*     CHAN     LENGTH   RELIEF   ROUGHNESS       TOP',
     3 '     DEPTH      BASE OF'/
     4 '*',7X,'NO',24X,'COEFF.       WIDTH             TRAPEZOID'/'*')
      DO 5700 JJ=1,NCHANN
         JCOUNT = JCOUNT + 1
 5600    WRITE(IPUNCH,5602)  LROMAN(JJ),JCOUNT
 5602    FORMAT(3X,A4,I3)
 5700 CONTINUE
      CALL DDASH(IPUNCH,2)
```

```
      IF(I.LT.NSUBS) GO TO 2000
 9900 RETURN
      END
C
C
C*********************************************************************
C
      SUBROUTINE HRUS(IANSWR)
C
C---- THIS SUBROUTINE OBTAINS THE HRU DESCRIPTORS:
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
C
C---- COMMON BLOCK ADDED FROM MARY LEE WOLF THESIS:
C
      COMMON/BK33/PUSLE(163)
C
C---- BLOCKS ADDED TO ENABLE FUNCTION OF THE INTERFACE PROGRAM:
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1        KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1        YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      COMMON/BKNUM/NUMBER(100)
C
      INTEGER N1111(20)/20*1/
C
 2000 WRITE(IUNIT6,2001)
 2001 FORMAT('OENTER THE TOTAL NUMBER OF DISTINCT HRUS:'/)
C2001 FORMAT('OENTER THE MAXIMUM NUMBER OF HRUS WITHIN AN ELEMENT ',
C    1 'AND THE TOTAL NUMBER OF HRUS:'/)
 2200 MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 2400
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-1) GO TO 2000
 2400 NHRUS = II(1)
 2900 WRITE(IPUNCH,3000) NHRUS
 3000 FORMAT('** HRU DESCRIPTORS:'/'*'/'*'/
     1    '*  TOTAL NUMBER OF HRU''S (NHRUS):   ',32X,I4/'*'/
     2    '*                 (SLOHRU)  (FAW)      (FGW)    (FC) '/
     4    '* HRU  LANDUSE     SLOPE   AVAIL.    GRAVITY  INFILT',
     5    ' DEPTH  CUSLE  XKUSL'/
     6    '* NO.       NO.      CLASS   WATER      WATER     RATE    OF A'
     7    /'*')
      IF(NHRUS.LE.0.OR.MSG.EQ.IER(4)) GO TO 3503
      DO 3500 I=1,NHRUS
 3500    WRITE(IPUNCH,3501) I,LALPHA(1)
 3501 FORMAT(I5,18X,1A1)
 3503 WRITE(IPUNCH,3505)
 3505 FORMAT('*'/40X,'END OF HRU DESCRIPTOR INPUT'/'*'/'*')
C
C---- OBTAIN THE NUMBER OF HRUS IN EACH ELEMENT:
C
      ICOUNT = 1
 3600 WRITE(IPUNCH.3601)
```

```
 3601 FORMAT('*'/'*    NUMBER OF HRUS IN EACH ELEMENT (NHRU): '/'*')      SET04520
 3610 CONTINUE                                                            SET04530
C     WRITE(IUNIT6,3611)                                                  SET04540
C3611 FORMAT('0ENTER THE NUMBER OF HRUS IN EACH OF THE FOLLOWING ',       SET04550
C    1        'ELEMENTS:'/)                                               SET04560
      JCOUNT = ICOUNT + 19                                                SET04570
C     WRITE(IUNIT6,3631) (NUMBER(III),III=ICOUNT,JCOUNT)                  SET04580
C3631 FORMAT(20I3)                                                        SET04590
C     INDEX = 13                                                          SET04600
C     MSG   = IER(1)                                                      SET04610
C     CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)                SET04620
C     IF(MSG.EQ.IER(4)) GO TO 4000                                        SET04630
C     CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE) SET04640
C     IF(IANSWR.GE. 0) GO TO  3650                                        SET04650
C     IF(IANSWR.LE.-3) RETURN                                             SET04660
C     IF(IANSWR.LE.-2) GO TO 3640                                         SET04670
C     IF(IANSWR.EQ.-1) GO TO 3610                                         SET04680
C     INDEX = -13                                                         SET04690
C3640 CALL SHELP(IUNIT5,IUNIT6,INDEX,IANSWR)                              SET04700
C     GO TO 3610                                                          SET04710
C3650 CONTINUE                                                            SET04720
      KCOUNT = ICOUNT - 1                                                 SET04730
      JJJJ   = MINO(JCOUNT,NTELES)                                        SET04740
      DO 3670 I=1,20                                                      SET04750
 3670    NHRU(KCOUNT+I) = II(I)                                           SET04760
      WRITE(IPUNCH,3800) (NUMBER(I),I=ICOUNT,JJJJ)                        SET04770
 3800 FORMAT('*     ELEMENT: ',20I3)                                      SET04780
      WRITE(IPUNCH,3900) (NHRU(I),I=ICOUNT,JJJJ)                          SET04790
C     WRITE(IPUNCH,3900) (N1111(I),I=1,JJJJ)                              SET04800
 3900 FORMAT('        # HRUS: ',20I3)                                     SET04810
      WRITE(IPUNCH,3950)                                                  SET04820
 3950 FORMAT('*')                                                         SET04830
      ICOUNT = ICOUNT + 20                                                SET04840
      IF(NTELES.GT.ICOUNT) GO TO 3610                                     SET04850
C                                                                         SET04860
4000  WRITE(IPUNCH,4100)                                                  SET04870
4100  FORMAT('*'/'*'/'*  ASSIGNMENT OF HRUS TO ELEMENTS'/'*'/'*'/         SET04880
     4 '*                                        (IHRU)      (FHRU)'/     SET04890
     5 '* SUBSHED    FLOW           ELEM.        HRU       FRACTION OF'/  SET04900
     6 '*    NAME   STRIP    NO.     NO.      NUMBER     ELEMENT AREA'/'*') SET04910
C                                                                         SET04920
      ICOUNT = 0                                                          SET04930
      DO 4700 I=1,NSUBS                                                   SET04940
         NSTRIP = KNSTRP(I)                                               SET04950
         DO 4600 J=1,NSTRIP                                               SET04960
            MM = KNESTR(I,J)                                              SET04970
            DO 4600 K=1,MM                                                SET04980
               ICOUNT = ICOUNT + 1                                        SET04990
               IF(K.EQ.1.AND.J.EQ.1) WRITE(IPUNCH,4602)                   SET05000
     1                   (NNSUBS(J1,I),J1=1,8),LALPHA(J),K,ICOUNT         SET05010
               IF(K.EQ.1.AND.J.NE.1) WRITE(IPUNCH,4603)                   SET05020
     1                   LALPHA(J),K,ICOUNT                               SET05030
 4600          IF(K.NE.1) WRITE(IPUNCH,4604) K,ICOUNT                     SET05040
 4602       FORMAT(1X,8A1,7X,A2,I5,3X,I4)                                 SET05050
 4603       FORMAT(       16X,A2,I5,3X,I4)                                SET05060
 4604       FORMAT(          18X,I5,3X,I4)                                SET05070
 4700 WRITE(IPUNCH,4701)                                                  SET05080
 4701 FORMAT('*')                                                         SET05090
C                                                                         SET05100
      WRITE(IPUNCH,4702)                                                  SET05110
 4702 FORMAT('*'/40X,'END OF ASSIGNMENT OF HRUS TO ELEMENTS'/'*'/'*')     SET05120
      CALL DDASH(IPUNCH,2)                                                SET05130
 9900 RETURN                                                              SET05140
      END                                                                 SET05150
C                                                                         SET05160
C                                                                         SET05170
C*************************************************************************SET05180
C                                                                         SET05190
      SUBROUTINE LANDS(IANSWR)                                            SET05200
C                                                                         SET05210
C---- THIS SUBROUTINE OBTAINS LAND-USE ASSOCIATED PARAMETERS:             SET05220
C                                                                         SET05230
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),       SET05240
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)    SET05250
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                                 SET05260
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      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &          KNDRDR,BRANCH,MESAGE
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      INTEGER NNLAND(8,30)
C
C---- PRINT HEADINGS FOR LANDUSE PARAMETER INPUTS:
C
      WRITE(IPUNCH,1000)
 1000 FORMAT('*'/'** LAND USE DESCRIPTORS:'/'*'/
     2'*',27X,'(AFLU)          (DSLU)          (RCLU)'/
     3'* LAND USE       NO.        HOLTAN''S A       DEPRESSION       ',
     3' MANNING''S'
     4/'*                          COEFFICIENT         STORAGE          ',
     5'ROUGHNESS'/'*')
C
C---- OBTAIN NAMES FOR EACH LAND USE CATEGORY AND ASSOCIATED PARAMETERS:
C
      I = 0
 8000 WRITE(IUNIT6,8100)
 8100 FORMAT(/'0ENTER THE NAMES TO BE USED FOR EACH LANDUSE CATEGORY:'/
     1       ' (ONE PER LINE):')
      IF(I.GT.0) GO TO 8310
 8300 I      = I + 1
 8310 INDEX = 6
      MSG    = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 8800
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.GE. 0)  GO TO 8380
      IF(IANSWR.LE.-3)  GO TO 9900
      IF(IANSWR.LE.-2)  GO TO 8350
      IF(IANSWR.EQ.-1)  GO TO 8000
      INDEX = -6
 8350 CALL SHELP(IUNIT5,IUNIT6,INDEX,IANSWR)
      GO TO 8000
 8380 DO 8390 J=1,8
 8390    NNLAND(J,I) = IALPHA(J)
      CALL RIGHTJ(MSG,NNLAND,8,I,I,LBLANK)
      AFLU(I) = RR(1)
      DSLU(I) = RR(2)
      RCLU(I) = RR(3)
      NLANUS   = I
 8600 WRITE(IPUNCH,8750) (NNLAND(J,I),J=1,8),I,AFLU(I),DSLU(I),RCLU(I)
 8750 FORMAT(2X,8A1,2X,I5,4X,F13.5,2(2X,F13.5))
      GO TO 8300
 8800 WRITE(IPUNCH,8801)
 8801 FORMAT('*'/25X,'END OF LANDUSE DESCRIPTORS'/'*')
      CALL DDASH(IPUNCH,2)
C
C---- OBTAIN THE VALUE OF SMCWS, ANTECEDENT SOIL MOISTURE AS A FRACTION
C     OF FIELD CAPACITY.  IF A VALUE IS INPUT WHICH IS LESS THAN OR
C     OR EQUAL TO ZERO, ANTECEDENT SOIL MOISUTE IS CALCULATED USING THE
C     ANTECEDENT PRECIPITATION FOR THE PRECEDING 30 DAYS.
C
      WRITE(IPUNCH,8805)
 8805 FORMAT('*'/'** MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:'
     1 /'*')
 8809 WRITE(IUNIT6,8810)
 8810 FORMAT('0ENTER THE ANTECEDENT SOIL MOISTURE:')
 8830 MSG    = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 8900
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-2) CALL SHELP(IUNIT5,IUNIT6,1,IANSWR)
```

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      IF(IANSWR.EQ.-1) GO TO 8809
      CALL COMPAR(1,NO,NO,SMCWS,RR(1))
 8900 WRITE(IPUNCH,8913) SMCWS
 8913 FORMAT('*'/'   THE VALUE OF SMCWS IS:  ',F12.6/'*')
C
C---- WRITE 'DEFAULT' VALUES FOR GROWTH INDICES AND EVAPORATION PARMS.
C
 9000 WRITE(IPUNCH,9100) (LMONTH(I),I=1,12),(GINDEX(J),J=1,12)
 9100 FORMAT('*'/'** GROWTH INDEX COEFFICIENTS  (GINDEX):'/'*'
     3      /'* ',A4,11(2X,A4)/12F6.3)
C
      IF(SMCWS.GT.0.0) GO TO 9800
      WRITE(IPUNCH,9200) (LMONTH(I),I=1,12),(EVP(J),J=1,12)
 9200 FORMAT('*'/'** EVAPORATION COEFFICIENTS      (EVP):'/'*'/
     1       '* ',A4,11(2X,A4)/12F6.3/'*')
 9800 WRITE(IPUNCH,9801)
 9801 FORMAT('*'/'*')
      CALL DDASH(IPUNCH,2)
 9900 RETURN
      END
C
C
C*********************************************************************
C
      SUBROUTINE SETIO(IANSWR)
C
C---- THIS SUBROUTINE OBTAINS THE INPUT-OUTPUT CONTROL DESCRIPTORS:
C
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
C
      INTEGER NZERO(50)/50*0/
C
C---- OBTAIN VALUES OF THE OUTPUT CONTROL DESCRIPTORS:
C
  100 WRITE(IUNIT6,110)
  110 FORMAT('0ENTER THE NUMBER OF HOURS FOR THE DISCHARGE OUTPUT:'/)
  200 MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 3000
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-2) CALL SHELP(IUNIT5,IUNIT6,1,IANSWR)
      IF(IANSWR.LE.-2) GO TO 3000
      IF(IANSWR.EQ.-1) GO TO  100
      IF(II(1).LT.1) II(1) = 0
      CALL COMPAR(0,NHOURC,II(1),0.0,0.0)
C
 1000 WRITE(IUNIT6,1100)
 1100 FORMAT('0ENTER VALUES FOR THE OVERLAND FLOW PRINT FREQUENCY ',
     1  'INDICATOR (SECONDS)  AND'
     2  /7X,'THE OVERLAND FLOW CALCULATION INTERVAL: ')
 1200 MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 3000
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-2) CALL SHELP(IUNIT5,IUNIT6,1,IANSWR)
      IF(IANSWR.LE.-2) GO TO 3000
      IF(IANSWR.EQ.-1) GO TO 1000
      IF(II(1).LT.1  ) II(1) = 0
      IF(RR(1).LT.1.0) RR(1) = 0.0
      CALL COMPAR(0,NOPRIN,II(1),0.0,0.0)
      CALL COMPAR(1,NO,NO,DTO,RR(2))
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```
C
 2000 WRITE(IUNIT6,2100)
 2100 FORMAT(/'0ENTER VALUES FOR THE CHANNEL FLOW PRINT FREQUENCY ',
     1  'INDICATOR (SECONDS) AND'/
     2    7X,'THE OVERLAND FLOW CALCULATION INTERVAL: ')
 2200 MSG   = IER(1)
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 3000
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.EQ.-2) CALL SHELP(IUNIT5,IUNIT6,1,IANSWR)
      IF(IANSWR.LE.-2) GO TO 3000
      IF(IANSWR.EQ.-1) GO TO 2000
      IF(II(1).LT.1   ) II(1) = 0
      IF(RR(1).LT.1.0) RR(1) = 0.0
      CALL COMPAR(0,NCPRIN,II(1),0.0,0.0)
      CALL COMPAR(1,NO,NO,DTC,RR(2))
C
C---- WRITE VALUES OF OUTPUT CONTROL DESCRIPTORS TO DISK DATA FILE:
C
 3000 WRITE(IPUNCH,3001) NTBLHS, NTBLPE, NHOURC
 3001 FORMAT('*'/'    HRU TABLE OUTPUT PRINT INDICATOR',
     1 '                   (NTBLHS): ',I12/
     2 '    PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR   (NTBLPE):',I13/
     3 '    NUMBER OF HOURS FOR THE DISCHARGE RECORD      (NHOURC):',I13)
      WRITE(IPUNCH,3100) DTO, DTC
 3100 FORMAT('*'/'*'/'*'/'** FLOW CALCULATION INTERVALS (SECONDS):'/'*'/
     1 '    OVERLAND FLOW CALCULATION INTERVAL  (DTO): ',F26.0/
     2 '    CHANNEL  FLOW CALCULATION INTERVAL  (DTC): ',F26.0/'*'/'*')
      WRITE(IPUNCH,3200) NOPRIN, NCPRIN
 3200 FORMAT('*'/'*'/'** PRINT FREQUENCY INDICATORS (SECONDS): '/'*'/
     1 '      OVERLAND FLOW PRINT FREQUENCY INDICATOR  (NOPRIN): ',I16/
     2 '      CHANNEL  FLOW PRINT FREQUENCY INDICATOR  (NCPRIN): ',I16)
      WRITE(IPUNCH,4100) (NPOVER(I),I=1,40)
 4100 FORMAT('*'/'*'/'** SUBSHED OVERLAND FLOW OUTPUT PRINT ',
     1     'INDICATORS (NPOVER):  '/'*'/(20I2))
      WRITE(IPUNCH,4200) (NPCHAN(I),I=1,40)
 4200 FORMAT('*'/'*'/'** PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF '
     1 ,'SELECTED STRIPS'/'*   (TWO LINES FOR EACH  ''2''  ENTERED IN ',
     2  'THE PREVIOUS LINE):'/'*'/
     3  '*'/'*'/'** SUBSHED CHANNEL  FLOW OUTPUT PRINT ',
     4  'INDICATORS (NPCHAN):  '/'*'/(20I2))
      WRITE(IPUNCH,4300)
 4300 FORMAT('*')
      CALL DDASH(IPUNCH,2)
 9900 RETURN
      END
C
C
C***********************************************************************
C
      SUBROUTINE SHELP(IUNITI,IUNITO,INDEX,IANSWR)
C
C---- THIS SUBROUTINE PRINTS DATA ENTRY ERROR DIAGNOSTICS FOR THE FESHM
C     MODEL DATA SET GENERATION PROGRAM.
C
      COMMON/NAMES/NNAME1(8),NNAME2(8)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      INTEGER IERROR/0/
C
      IANSWR = 1
      IF(IERROR.LE.0) WRITE(IUNITO,200)
  200 FORMAT(/8X,'TO EXIT FROM DATA ENTRY AT ANY TIME, ENTER:   QUIT'/)
      IERROR = IERROR + 1
      INDEXX = MAX0(1,MIN0(IABS(INDEX),9))
  900 GO TO (1000,2000,3000,4000,5000,6000,7000,8000,9000), INDEXX
 1000 WRITE(IUNITO,1001)
 1001 FORMAT(/' DEFAULT VALUES WERE EMPLOYED FOR EACH MODEL PARMETER.'/)
      RETURN
C
 2000 WRITE(IUNITO,2001)
 2001 FORMAT(/8X,'YOU WILL BE PROMPTED FOR THE NAME OF EACH SUBSHED.'/
     1 5X,'AFTER ENTERING THE NAME OF A SUBSHED, ENTER THE NAMES OF '/
     2 5X,'SUBSHEDS WHICH ARE TRIBUTARIES TO IT.  IF A SUBSHED HAS NO '/
     3 5X,'UPSTREAM TRIBUTARY SUBSHEDS, ENTER <RETURN> FOLLOWING THE'/
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    4 5X,'NAME OF THE SUBSHED.  TO TERMINATE ENTRY OF SUBSHED NAMES'/
    5 5X,'ENTER <RETURN> OR A BLANK LINE FOLLOWED BY <RETURN> .'//)
      RETURN
C
 3000 IF(INDEX.LT.0) GO TO 3200
      WRITE(IUNITO,3001)
 3001 FORMAT(/8X,'ENTER THREE INTEGER VALUES CORRESPONDING TO THE NUMBE'
    1 ,'R'/5X,'OF CHANNEL ELEMENTS, NUMBER OF FLOWSTRIPS, & NUMBER OF'/
    2 5X,'FLOWSTRIPS ON THE LEFT SIDE OF THE CHANNEL FOR THE SUBSHED:')
      RETURN
C
 3200 WRITE(IUNITO,3201)
 3201 FORMAT(/8X,'YOU MUST ENTER AT LEAST TWO NON-NEGATIVE INTEGER ',
    1        ' VALUES.'/)
      RETURN
C
 4000 WRITE(IUNITO,4001)
 4001 FORMAT(/8X,'ERROR:  THE NUMBER OF FLOWSTRIPS ON THE LEFT SIDE OF',
    1  ' THE CHANNEL'/3X,'IS GREATER THAT THE TOTAL NUMBER OF ',
    2  ' FLOWSTRIPS FOR THE SUBSHED.'/)
 5000 RETURN
C
 6000 IF(INDEX.LE.0) GO TO 6200
      WRITE(IUNITO,6100)
 6100 FORMAT(/8X,'ENTER A NAME FOR EACH LAND USE CATEGORY, ONE PER ',
    1     'LINE.  NUMERIC'/
    2 11X,'VALUES ENTERED FOLLOWING THE LANDUSE NAME WILL BE CONSID',
    2     'ERED '/
    3 11X,'AS VALUES FOR THE LANDUSE PARAMETERS IN THE FOLLOWING ',
    4     'ORDER:'/
    3 11X,'HOLTAN''S A,',
    4     ' DEPRESSION STORAGE, AND MANNING''S ROUGHNESS COEFF.'//
    5 8X,'TO TERMINATE DATA ENTRY, ENTER A CARRIAGE RETURN.'/)
      RETURN
C
 6200 WRITE(IUNITO,6201)
 6201 FORMAT(/8X,'DATA ENTRY ERROR IN READING THE LANDUSE NAME AND'/
    1 5X,'PARAMETERS LAST ENTERED.  CHECK PREVIOUS INPUT AND REENTER.')
 7000 RETURN
C
C
 8000 IF(INDEX.LE.0) GO TO  8200
      WRITE(IUNITO, 8001)
 8001 FORMAT(/8X,'THE ANTECEDENT SOIL MOISTURE IS GIVEN AS A FRACTION ',
    1    'OF FIELD CAPACITY.'/5X,'TO OBTAIN A COMPUTED VALUE OF THIS ',
    2    'PARAMETER BASED ON THE '/5X,'PRECIPITATION DURING THE ',
    3    'PRECEDING 30 DAYS, ENTER 0.0'/)
      RETURN
C
 8200 WRITE(IUNITO, 8201)
 8201 FORMAT(/8X,'ERROR IN READING THE VALUE OF THE ANTECEDENT SOIL ',
    1    'MOISTURE'/)
 9000 RETURN
      END
C
C
C**********************************************************************
C
      SUBROUTINE RAININ(IANSWR)
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(50,120),NRGAGE(80)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKNUM/NUMBER(100)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
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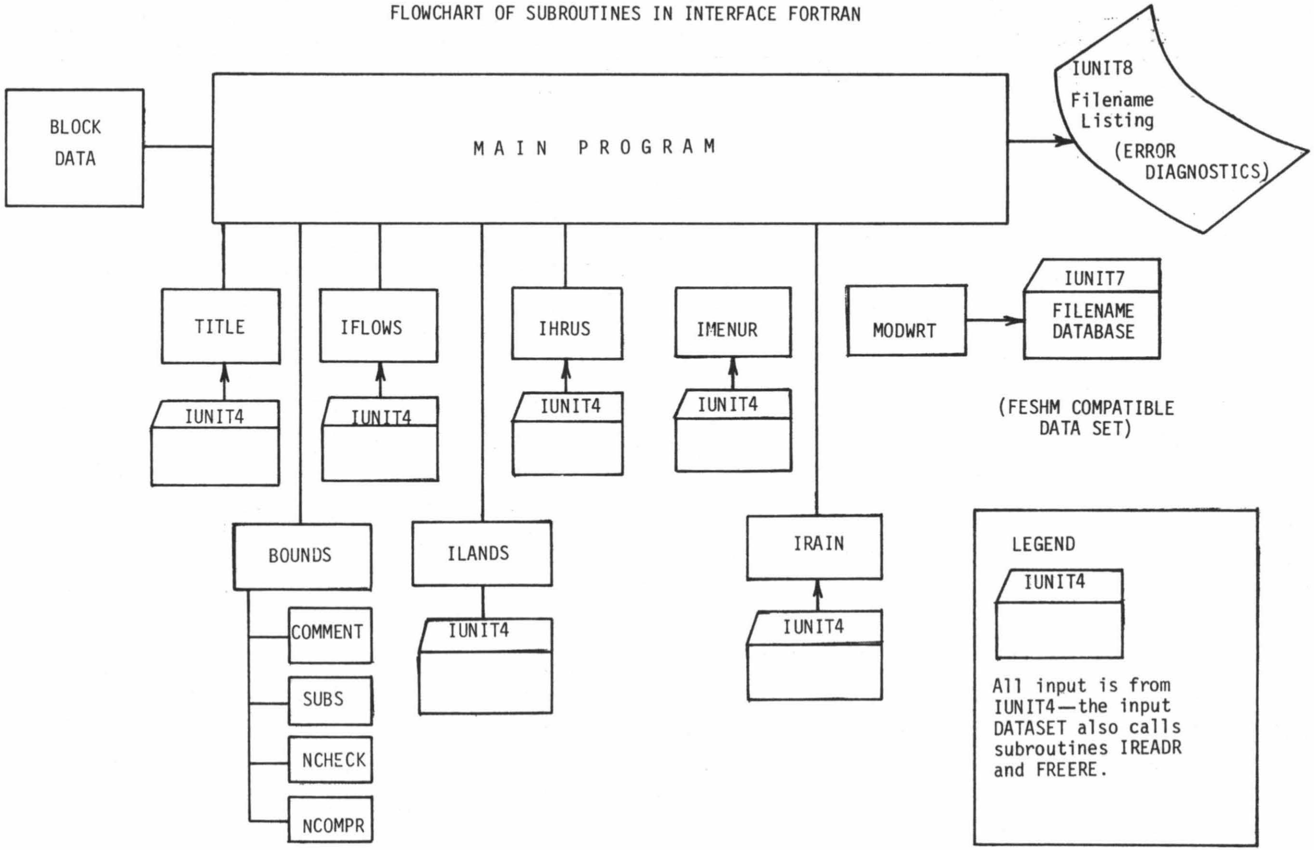
C                                                                       SET08260
C---- OBTAIN STORM DESCRIPTIVE INFORMATION:                             SET08270
C     (THE ACTUAL DATA FOR THE STORM IS OBTAINED AS A FILE GENERATED    SET08280
C      BY THE INTERVAL RAINFALL PROGRAM AND FROM A FILE CONTAINING      SET08290
C      THE THIRTY DAY ANTECEDENT MOISTURE.)                             SET08300
C                                                                       SET08310
      NGAGES = 1                                                        SET08320
 7000 WRITE(IUNIT6,7100)                                                SET08330
 7100 FORMAT('0ENTER THE NUMBER OF RAINGAGES TO BE EMPLOYED:')          SET08340
 7300 MSG    = IER(1)                                                   SET08350
      CALL FREERE(IUNIT5,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)              SET08360
      IF(MSG.EQ.IER(4)) GO TO 8000                                      SET08370
      CALL COMENT(IUNIT5,IUNIT6,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE) SET08380
      IF(IANSWR.LE.-3) RETURN                                           SET08390
      IF(IANSWR.EQ.-2) CALL SHELP(IUNIT5,IUNIT6,1,IANSWR)               SET08400
      IF(IANSWR.EQ.-1) GO TO 7000                                       SET08410
      IF(II(1).LT.1  ) II(1) = 0                                        SET08420
 7500 CALL COMPAR(NO,NGAGES,II(1),ZERO,ZERO)                            SET08430
C                                                                       SET08440
C---- PRINT THE RAINGAGE NUMBER CORRESPONDING TO EACH ELEMENT:          SET08450
C     (NOTE:  ASSIGNMENT OF RAINGAGES IS ONLY NECESSARY WHEN THERE IS   SET08460
C      DATA PROVIDED FOR MORE THAN ONE RAINGAGE IN THE WATERSHED).      SET08470
C                                                                       SET08480
 8000 WRITE(IPUNCH,8001) NGAGES                                         SET08490
 8001 FORMAT('    NUMBER OF RAINGAGES  (NGAGES): ',35X,I2/'*'/'*')      SET08500
      IF(NGAGES.EQ.1) GO TO 8640                                        SET08510
      WRITE(IPUNCH,8620) (NUMBER(I),I= 1,20),(NRGAGE(I),I=1,20)         SET08520
      WRITE(IPUNCH,8620) (NUMBER(I),I=21,40),(NRGAGE(I),I=21,40)        SET08530
      WRITE(IPUNCH,8620) (NUMBER(I),I=41,60),(NRGAGE(I),I=41,60)        SET08540
      WRITE(IPUNCH,8620) (NUMBER(I),I=61,80),(NRGAGE(I),I=61,80)        SET08550
 8620 FORMAT('*    ELEMENT:',20I3,/'        NRGAGE:',20I3/'*')          SET08560
C                                                                       SET08570
 8640 DO 8680 J=1,NGAGES                                                SET08580
         WRITE(IPUNCH,8650) J                                           SET08590
 8650    FORMAT('*'/'*'/'*'/'** INPUT STORM DATA (PRECIP) FOR RAINGAGE:'SET08600
     1          ,I30/'*'/'*      DATE   TIME INTPCS NHOURR'/'*'/)       SET08610
         IF(SMCWS.GT.0) GO TO 8680                                      SET08620
         WRITE(IPUNCH,8670) J                                           SET08630
 8670    FORMAT('*'/'** THIRTY DAY ANTECEDENT PRECIPITATION (DAILPC) ', SET08640
     1          'RAIN GAGE:  ',I12/'*'/)                                SET08650
 8680 CONTINUE                                                          SET08660
      WRITE(6,8681)                                                     SET08670
 8681 FORMAT(//'0ENTRY OF PROGRAM CONTROL DESCRIPTORS IS NOW COMPLETE.' SET08680
     1  //)                                                             SET08690
      RETURN                                                            SET08700
      END                                                               SET08710
C                                                                       SET08720
C                                                                       SET08730
C***********************************************************************SET08740
C                                                                       SET08750
      SUBROUTINE SUBSHD(IINDEX,IANSWR,IZOUT)                            SET08760
C                                                                       SET08770
C---- THIS SUBROUTINE READS THE NAMES OF SUBSHEDS AND PREPARES THE      SET08780
C     INDEXING CONTROL DESIGNATORS FOR HRUS.                            SET08790
C                                                                       SET08800
C                                                                       SET08810
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,SET08820
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,SET08830
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NO,N1,NCPRIN,NHOURC,NDSET08840
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF                         SET08850
C                                                                       SET08860
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,     SET08870
     &       KNDRDR,BRANCH,MESAGE                                       SET08880
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)SET08890
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)    SET08900
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR SET08910
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)SET08920
C                                                                       SET08930
      DOUBLE PRECISION ZN(32)                                           SET08940
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNQUIT,NNSTAR,LLFRMT(20)       SET08950
C                                                                       SET08960
      INTEGER IWORD(8,32)                                               SET08970
      INTEGER JJFLAG(100)/100*0/                                        SET08980
      INTEGER LCOLON(1)/':'/                                            SET08990
      INTEGER MSUBS/32/                                                 SET09000
```

```
C                                                                        SET09010
      INTEGER NA(1)/'A'/,NB(1)/'B'/,NC(1)/'C'/,ND(1)/'D'/,NE(1)/'E'/,    SET09020
     1        NF(1)/'F'/,NG(1)/'G'/,NH(1)/'H'/,NI(1)/'I'/,NJ(1)/'J'/,    SET09030
     2        NK(1)/'K'/,NL(1)/'L'/,NM(1)/'M'/,NN(1)/'N'/,NO(1)/'O'/,    SET09040
     3        NP(1)/'P'/,NQ(1)/'Q'/,NR(1)/'R'/,NS(1)/'S'/,NT(1)/'T'/,    SET09050
     4        NU(1)/'U'/,NV(1)/'V'/,NW(1)/'W'/,NX(1)/'X'/,NY(1)/'Y'/,    SET09060
     5        NZ(1)/'Z'/                                                 SET09070
C                                                                        SET09080
C---- READ SUBSHED NAMES:                                                SET09090
C                                                                        SET09100
      IF(IINDEX.GT.0) IREAD = IUNIT5                                     SET09110
      IF(IINDEX.LE.0) IREAD = IUNIT4                                     SET09120
 1000 INDEX = 2                                                          SET09130
 1010 IF(IINDEX.GT.0.AND.NSUBS.LT.1) WRITE(IUNIT6,1100) ZN(NSUBS+1)      SET09140
 1100 FORMAT ('0ENTER  NAME OF ',A6,' SUBSHED:')                         SET09150
      IF(IINDEX.GT.0.AND.NSUBS.GE.1) WRITE(IUNIT6,1101) ZN(NSUBS+1)      SET09160
 1101 FORMAT (' ENTER  NAME OF ',A6,' SUBSHED AND NAMES OF ITS TRIBUT',  SET09170
     1       'ARY SUBSHEDS:')                                            SET09180
      READ(IREAD, 800,END=3000) (IALPHA(I),I=1,80)                       SET09190
  800 FORMAT(80A1)                                                       SET09200
      CALL COMENT(IREAD,IPUNCH,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)   SET09210
      IF(IANSWR.LE.-3) RETURN                                            SET09220
      IF(IANSWR.LE.-2) GO TO 2000                                        SET09230
      IF(IANSWR.EQ.-1) GO TO 1010                                        SET09240
      IZONE1 = 1                                                         SET09250
      NSUBS  = NSUBS + 1                                                 SET09260
      CALL SUBS1(IPUNCH,IALPHA,NNSUBS,8,NSUBS,IZONE1)                    SET09270
      IF(NNSUBS(8,NSUBS).EQ.LBLANK) GO TO 3100                           SET09280
      CALL SUBS1(IPUNCH,IALPHA,NNT1  ,8,NSUBS,IZONE1)                    SET09290
      CALL SUBS1(IPUNCH,IALPHA,NNT2  ,8,NSUBS,IZONE1)                    SET09300
      CALL SUBS1(IPUNCH,IALPHA,NNT3  ,8,NSUBS,IZONE1)                    SET09310
C                                                                        SET09320
      WRITE(IPUNCH,1500) NSUBS,(NNSUBS(I,NSUBS),I=1,8),(NNT1(I,NSUBS),   SET09330
     1      I=1,8),(NNT2(I,NSUBS),I=1,8),(NNT3(I,NSUBS),I=1,8)           SET09340
C     WRITE(IUNIT7,1500) NSUBS,(NNSUBS(I,NSUBS),I=1,8),(NNT1(I,NSUBS),   SET09350
C    1      I=1,8),(NNT2(I,NSUBS),I=1,8),(NNT3(I,NSUBS),I=1,8)           SET09360
 1500 FORMAT('     TRIBUTARIES TO SUBSHED ',I4,3X,8A1,':',2X,3(1X,8A1))  SET09370
C                                                                        SET09380
C---- CHECK THAT A SUBSHED IS AT MOST A TRIBUTARY TO ONE OTHER SUBSHED:  SET09390
C                                                                        SET09400
      IF(NSUBS.LE.1) GO TO 1510                                          SET09410
      CALL NCHECK(8,NNSUBS,NSUBS-1,NNSUBS,NSUBS,IFLAG,JJFLAG)            SET09420
 1510 CALL NCHECK(8,NNSUBS,NSUBS  ,NNT1  ,NSUBS,IFLAG,JJFLAG)            SET09430
      CALL NCHECK(8,NNSUBS,NSUBS  ,NNT2  ,NSUBS,IFLAG,JJFLAG)            SET09440
      CALL NCHECK(8,NNSUBS,NSUBS  ,NNT3  ,NSUBS,IFLAG,JJFLAG)            SET09450
      N = NSUBS                                                          SET09460
      IF(IALPHA(N  ).EQ.NF(1).AND.IALPHA(N+1).EQ.NI(1).AND.              SET09470
     1   IALPHA(N+2).EQ.NN(1).AND.IALPHA(N+3).EQ.NI(1).AND.              SET09480
     2   IALPHA(N+4).EQ.NS(1).AND.IALPHA(N+5).EQ.NH(1).AND.              SET09490
     3   IALPHA(N+6).EQ.NE(1).AND.IALPHA(N+7).EQ.ND(1)) GO TO 3000       SET09500
      IF(IALPHA(N  ).EQ.NI(1).AND.IALPHA(N+1).EQ.NM(1).AND.              SET09510
     1   IALPHA(N+2).EQ.NA(1).AND.IALPHA(N+3).EQ.NG(1).AND.              SET09520
     2   IALPHA(N+4).EQ.NI(1).AND.IALPHA(N+5).EQ.NN(1).AND.              SET09530
     3   IALPHA(N+6).EQ.NA(1).AND.IALPHA(N+7).EQ.NR(1)) GO TO 3000       SET09540
      IF(NSUBS.LT.MSUBS) GO TO 1000                                      SET09550
      GO TO 3000                                                         SET09560
C                                                                        SET09570
C---- PRINT HELP/ERROR MESSAGES AS REQUESTED/REQUIRED:                   SET09580
C                                                                        SET09590
 2000 CALL SHELP(IREAD,IUNIT6,2,IANSWR)                                  SET09600
      GO TO 1010                                                         SET09610
C                                                                        SET09620
C---- PRINT MESSAGE INDICATING NUMBER OF SUBSHED NAMES RECEIVED AND      SET09630
C     CHECK THAT ALL BUT THE LAST SUBSHED IS A TRIBUTARY TO ANOTHER      SET09640
C     SUBSHED:                                                           SET09650
C                                                                        SET09660
 3000 BACKSPACE IREAD                                                    SET09670
      IF(NSUBS.LE.0) GO TO 9990                                          SET09680
 3100 IF(NNSUBS(8,NSUBS).EQ.LCOLON(1).OR.NNSUBS(8,NSUBS).EQ.LBLANK)      SET09690
     1    NSUBS = NSUBS - 1                                              SET09700
      WRITE(IUNIT6,3150)  NSUBS                                          SET09710
 3150 FORMAT(18X,'NAMES RECEIVED FOR ',I6,'  SUBSHEDS.'/)                SET09720
      IF(NSUBS.LE.1) GO TO 3250                                          SET09730
      NSUBM1 = NSUBS - 1                                                 SET09740
      DO 3200 I=1,NSUBM1                                                 SET09750
```

```
 3200     IF(JJFLAG(I).LT.1) WRITE(IPUNCH,3201) (NNSUBS(LL,I),LL=1,8)
 3201 FORMAT('*  ERROR:  SUBSHED ',8A1,' HAS NOT BEEN ASSIGNED AS ',
    1        'A TRIBUTARY SUBSHED.')
 3250 WRITE(IPUNCH,3251)
 3251 FORMAT('*'/'*'/36X,'END OF SUBSHED DESCRIPTOR INPUT.'/'*'/'*')
C
C---- OBTAIN THE NUMBER OF ELEMENTS IN THE WATERSHED:
C
 5000 IF(IINDEX.GT.0) WRITE(IUNIT6,5001)
 5001 FORMAT(/' ENTER THE TOTAL NUMBER OF ELEMENTS IN THE COMPLETE ',
    1        'WATERSHED:')
 5100 INDEX = 3
      MSG   = IER(1)
      CALL FREERE(IREAD,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 5400
      CALL COMENT(IREAD,IPUNCH,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.GE. 0) GO TO  5400
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO  5300
      IF(IANSWR.EQ.-1) GO TO  5000
      INDEX = -3
 5300 CALL SHELP(IREAD,IUNIT6,INDEX,IANSWR)
      GO TO  5000
 5400 CONTINUE
      NTSS   = NSUBS
      NTELES = MAX0(NSUBS,II(1))
      IF(IINDEX.GT.0) WRITE(IPUNCH,5500) NTELES,NTSS
 5500 FORMAT('*'/'*'/'     TOTAL NUMBER OF ELEMENTS (NTELES): ',29X,I4/
    1             '*   NUMBER OF SUBSHEDS              (NTSS): ',29X,I4/'*')
      IF(II(1).LT.NSUBS) WRITE(IPUNCH,5600) II(1)
 5600 FORMAT('*'/'*   WARNING:  THE SPECIFIED NUMBER FOR THE TOTAL'
     1,' NUMBER OF ELEMENTS WAS:',I4/
     2'*                WHICH IS LESS  THAN THE NUMBER OF SUBSHEDS.'/'*'/
     3'*                NTELES SET EQUAL TO THE NUMBER OF SUBSHEDS.'/'*')
      CALL DDASH(IPUNCH,2)
 9900 RETURN
C
 9990 IANSWR = -3
      RETURN
      END
C
C
```

FLOWCHART OF SUBROUTINES IN INTERFACE FORTRAN



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C***  29 SEPTEMBER 1983   **********   DO NOT ERASE  ******  W. J. SYDOR
C************************************************************************
C
C
C                           INTERFACE FORTRAN
C
C
C---- THIS PROGRAM IS THE SUBROUTINES FOR READING THE USER PREPARED
C     INTERFACE DATA SET.  AFTER READING THE INPUTS, THE DATA IS
C     WRITTEN TO A DISK FILE (UNIT 8) IN AN FESHM COMPATIBLE FORMAT
C     VIA SUBROUTINE MODWRT.
C
C     REQUIRED EXTERNAL SUBROUTINES ARE:
C
C                                   COMENT
C                                   COMPAR
C                                   FREERE
C                                   NCHECK
C                                   NCOMPR
C                                   RIGHTJ
C                                   SUBS1
C                                   TABLES
C                                   TITLE
C
C
C-----------------------------------------------------------------------
C
C
                              BLOCK DATA
C
C
C---- COMMON BLOCKS FROM THE FINITE ELEMENT STORM HYDROLOGIC MODEL:
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(50,120),NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
C
C---- COMMON BLOCKS ADDED FROM MARY LEE WOLF THESIS:
C
C     NOTE:  BLOCKS BK33, BK36, AND BK38 ARE NOT USED IN THIS PROGRAM.
C            PUSLE OF BLOCK BK33 IS INCORPORATED IN BLOCK BK43.
C
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1       DIA(8,163),TYPE(8,163)
C*    COMMON/BK33/XKUSLE(163),CUSLE(163),PUSLE(163)
C*           DIMENSION PUSLE(163)
      COMMON/BK36/IELE,NGREAT,KDET,XI30(4)
      COMMON/BK38/INCLAS
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1       PUSLE(163),SMCHRU(163)
C
C---- COMMON BLOCKS ADDED TO PROVIDE DIMENSIONS NOT GIVEN BY THE
C     FINITE ELEMENT MODEL FORMULATION:
C
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
         INTEGER KNECHA/32*2/
         INTEGER KNSTRP/32*2/
         INTEGER KLHSSP/32*2/
         INTEGER KNESTR/640*2/
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      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1       KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1       YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
C
C---- COMMON BLOCKS FOR TITLES, FORMATS, AND SYMBOLS:
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BKDELT/DTOMIN,DTCMIN,DSLOPE
      COMMON/BKNUM/NUMBER(100),LROMAN(17)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      DOUBLE PRECISION ZN(11)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNQUIT,NNSTAR,LLFRMT(20)
C
      REAL     DTOMIN     /1.0E9/
      REAL     DTCMIN     /1.0E9/
      REAL     DSLOPE     /0.002/
C
      INTEGER    IER      /'WARN','PRNT','DIAG','END','ERR ','DBUG'/
      INTEGER IPUNCH      /8/
      INTEGER IUNIT1      /1/
      INTEGER IUNIT3      /0/
      INTEGER IUNIT4      /4/
      INTEGER IUNIT5      /5/
      INTEGER IUNIT6      /6/
      INTEGER IUNIT7      /7/
      INTEGER IZONE       /1,80/
C
      INTEGER LALPHA      /'A','B','C','D','E','F','G','H','I','J','K',
     1                     'L','M','N','O','P','Q','R','S','T','U','V',
     2                     'W','X','Y','Z'/
      INTEGER LBLANK(1) /' '/
      INTEGER LDASH(1)  /'-'/
      INTEGER LDIGIT      /'0','1','2','3','4','5','6','7','8','9','.',
     1                     '-','+'/
      INTEGER LDOT(1)     /'.'/
      INTEGER LLFRMT      /'(20I','1)  ',18*'    '/
      INTEGER LPLUS(1)    /'+'/
      INTEGER LROMAN      /'   I','  II',' III','  IV','   V','  VI',
     1                     ' VII','VIII','  IX','   X','  XI',' XII',
     2                     'XIII',' XIV','  XV',' XVI','XVII'/
      INTEGER LSTAR(1)    /'*   '/
      INTEGER LTITLE      /800*' '/
C
      INTEGER MDM         /80/
      INTEGER LMONTH      /'JAN.','FEB.','MAR.','APR.','MAY ','JUNE',
     1                     'JULY','AUG.','SEPT','OCT.','NOV.','DEC.'/
      INTEGER MTITLE      /2/
      INTEGER MHRU        /1/
      INTEGER MSTRPS      /1/
      INTEGER MESTRP      /1/
      INTEGER MECHAN      /1/
C
      INTEGER NNBASE(1) /'BASE'/
      INTEGER NNDATA(1) /'DATA'/
      INTEGER NNDEFA(1) /'DEFA'/
      INTEGER NNQUIT(1) /'QUIT'/
      INTEGER NNSTAR(1) /'*** '/
      INTEGER NNT1        /256*' '/
      INTEGER NNT2        /256*' '/
      INTEGER NNT3        /256*' '/
      INTEGER NODE1       /10*0/
      INTEGER NCONF1      /10*0/
      INTEGER NCONF2      /10*0/
      INTEGER NCONF3      /10*0/
      INTEGER NSUBS       /0/
      INTEGER NTITLE      /0/
      INTEGER NNSUBS      /256*' '/
C     INTEGER NNSUBS      /'A','L','P','H','A',3*' ','B','E','T','A',4*' '
C    1 ,'G','A','M','M','A',' ',' ',' ','D','E','L','T','A',' ',' ',' ',
C    2 'E','P','S','I','L','O','N',' ','Z','E','T','A',' ',' ',' ',' ',
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```
C     3   'E','T','A',' ',' ',' ',' ',' ','T','H','E','T','A',' ',' ',' ',
C     4   'I','O','T','A',' ',' ',' ',' ','K','A','P','P','A',' ',' ',' ',
C     5   'L','A','M','B','D','A',' ',' ','M','U',' ',' ',' ',' ',' ',' ',
C     6   'N','U',' ',' ',' ',' ',' ',' ','X','I',' ',' ',' ',' ',' ',' ',
C     7   'O','M','I','C','R','O','N',' ','P','I',' ',' ',' ',' ',' ',' ',
C     8   'R','H','O',' ',' ',' ',' ',' ','S','I','G','M','A',' ',' ',' ',
C     9   'T','A','U',' ',' ',' ',' ',' ','U','P','S','I','L','O','N',' ',
C     *   'P','H','I',' ',' ',' ',' ',' ','C','H','I',' ',' ',' ',' ',' ',
C     1   'P','S','I',' ',' ',' ',' ',' ','O','M','E','G','A',' ',' ',' ',
C     2    64*' '/
C
          DATA NUMBER/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
     1      21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,
     2      41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,
     3      61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,
     4      81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,07,98,99,100/
C
          REAL SMCWS/0.0/
C
          DATA ZN   /6HFIRST ,6HSECOND,6HTHIRD ,6HFOURTH,6HFIFTH ,
     1      6HSIXTH ,6H  7TH ,6HEIGHT ,6HNINTH ,6HTENTH ,6H 11TH /
      END
C
C
C***********************************************************************
C
C
C                          MAIN    PROGRAM
C
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
C
C---- READ/PRINT INPUT TITLE FROM THE INTERFACE DATA SET:
C
      CALL TITLE(IANSWR,0,0)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN THE BOUNDARY CONDITION CODES FROM INPUT SUBSHED NAMES:
C
      CALL BOUNDS(IUNIT4,IANSWR)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN SUBSHED DESCRIPTIVE PARAMETERS:
C
      CALL IFLOWS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN LANDUSE PARAMETERS:
C
      CALL ILANDS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN HRU DESCRIPTIVE PARAMETERS:
C
      CALL IHRUS(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN THE TITLE OF THE COMBINED BASIN AND STORM DATA SET:
C
      CALL TITLE(IANSWR,1,0)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN AND WRITE VALUES OF OUTPUT CONTROL DESCRIPTORS:
C
      CALL IMENUR(IANSWR)
      IF(IANSWR.LE.-3) GO TO 9000
C
C---- OBTAIN DESCRIPTIVE INFORMATION FOR THE STORM:
C
      CALL IRAIN(IANSWR)
C
C---- WRITE THE MODEL PARAMETERS IN FESHM COMPATIBLE FORMAT:
C
 9000 CALL MODWRT
```

```
C
C---- TABULATE THE DIMENSIONS REQUIRED FOR A MODEL RUN:
C
      CALL TABLES
      STOP
      END
C
C
C***********************************************************************
C
      SUBROUTINE BOUNDS(IREAD,IANSWR)
C
C---- THIS SUBROUTINE ASSIGNS BOUNDARY CONDITION CODES TO EACH SUBSHED
C     BASED ON SUBSHED NAME ASSIGNMENTS INPUT FROM THE FESHM INTERFACE
C     PROGRAM.
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NME,NMN,NCPRIN,NHOURC,
     3NDAMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      DIMENSION NNS(9,32)
C
      INTEGER  JJFLAG(100) /100*0/
      INTEGER  LCOLON(1)   /':'/
      INTEGER  MSUBS       /32/
      INTEGER  NNBLAN(8)   /8*' '/
C
C---- READ SUBSHED AND TRIBUTARY SUBSHED NAMES:
C
C     NOTE: NCONF1(I), NCONF2(I), AND NCONF3(I) ARE ASSIGNED ZERO VALUES
C           IN THE COMMON BLOCK.
C
C---- READ THE NAME OF THE FIRST SUBSHED:
C
C     NOTE:   THE FIRST SUBSHED MAY HAVE NO TRIBUTARY SUBSHEDS.  ANY
C             CHARACTERS FOLLOWING IT ARE DISREGARDED.
C
      I = 1
      IANSWR = 0
   90 READ(IREAD,100,END=4900) (IALPHA(J),J=1,80)
  100 FORMAT(80A1)
      CALL COMENT(IREAD,0,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 2000
      IF(IANSWR.EQ.-1) GO TO 90
      IZONE1 = 1
      IF(IREAD.EQ.4) IZONE1 = 35
      CALL SUBS1(IUNIT7,IALPHA,NNS,9,I,IZONE1)
      IF(NNS(9,I).EQ.LCOLON(1)) GO TO 300
      DO 200 J=2,9
         K = 10-J
  200    NNSUBS(K,I) = NNS(K+1,I)
      GO TO 500
  300 DO 400 J=1,8
  400    NNSUBS(J,I) = NNS(J,I)
  500 CONTINUE
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,900) I,(NNSUBS(J,I),J=1,8),(NNT1(J,I)
C    1       ,J=1,8),(NNT2(J,I),J=1,8),(NNT3(J,I),J=1,8)
C 900 FORMAT(' TRIBUTARIES TO SUBSHED ',I4,3X,8A1,':',2X,3(1X,8A1))
C
C---- READ THE NAME OF THE SECOND AND SUCCEEDING SUBSHEDS:
C
 1000 IF(NNSUBS(8,I).EQ.LBLANK.OR.I.GT.MSUBS) GO TO 5000
      I = I + 1
 1100 READ(IREAD,100,END=4900) (IALPHA(J),J=1,80)
      CALL COMENT(IREAD,0,IALPHA,IANSWR,LTITLE,MDM,MTITLE,NTITLE)
      IF(IANSWR.LE.-3) RETURN
      IF(IANSWR.LE.-2) GO TO 2000
```

```
      IF(IANSWR.EQ.-1) GO TO 1100
      IZONE1 = 1
      IF(IREAD.EQ.4) IZONE1 = 35
      CALL SUBS1(8,IALPHA,NNS,9,I,IZONE1)
      IF(NNS(6,I).EQ.LALPHA(5).AND.NNS(7,I).EQ.LALPHA(14).AND.
     1   NNS(8,I).EQ.LALPHA(4).AND.NNS(5,I).EQ.LBLANK) GO TO 4900
      IF(NNS(7,I).EQ.LALPHA(5).AND.NNS(8,I).EQ.LALPHA(14).AND.
     1   NNS(9,I).EQ.LALPHA(4).AND.NNS(6,I).EQ.LBLANK) GO TO 4900
      IF(NNS(9,I).EQ.LBLANK) GO TO 4900
 1150 IF(NNS(9,I).EQ.LCOLON(1)) GO TO 1300
      DO 1200 J=2,9
         K = 10-J
 1200    NNSUBS(K-1,I) = NNS(K,I)
 1300 DO 1400 J=1,8
 1400    NNSUBS(J,I) = NNS(J,I)
 1500 CALL SUBS1(8,IALPHA,NNT1  ,8,I,IZONE1)
      CALL SUBS1(8,IALPHA,NNT2  ,8,I,IZONE1)
      CALL SUBS1(8,IALPHA,NNT3  ,8,I,IZONE1)
      IF(NNSUBS(8,I).EQ.LBLANK) GO TO 1507
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,900) I,(NNSUBS(J,I),J=1,8),
C    1      (NNT1(J,I),J=1,8),(NNT2(J,I),J=1,8),(NNT3(J,I),J=1,8)
 1507 NSUBS = I
      CALL NCHECK(8,NNSUBS,NSUBS-1,NNSUBS,NSUBS,LFLAG,JJFLAG)
C
C---- OBTAIN THE NAME OF THE FIRST TRIBUTARY SUBSHED:
C
      IF(NNT1(8,I).EQ.LBLANK) GO TO 1000
      CALL NCHECK(8,NNSUBS,NSUBS,NNT1,NSUBS,LFLAG,JJFLAG)
      J1 = 0
 1900 J1 = J1 + 1
      IF(J1.GE.I) GO TO 1950
      CALL NCOMPR(8,NNSUBS,J1,NNT1,I,IFLAG)
      IF(IFLAG)  2000, 2000, 1900
 1950 WRITE (IUNIT7,1951) (NNT1(J2,I),J2=1,8)
 1951 FORMAT(//'0ERROR:  TRIBUTARY SUBSHED  ',8A1,'  WAS NOT ',
     1          'PREVIOUSLY DEFINED.'//)
      GO TO 2010
 2000 JJFLAG(J1) = JJFLAG(J1) + 1
 2010 NCONF1(I) = J1
      NODE1(I)  = 3
C
C---- OBTAIN THE NAME OF THE SECOND TRIBUTARY:
C
      IF(NNT2(8,I).EQ.LBLANK) GO TO 1000
      CALL NCHECK(8,NNSUBS,NSUBS,NNT2,NSUBS,LFLAG,JJFLAG)
      J2 = 0
 2100 J2 = J2 + 1
      IF(J2.GE.I) GO TO 2450
 2400 CALL NCOMPR(8,NNSUBS,J2,NNT2,I,IFLAG)
      IF(IFLAG) 2500, 2500, 2100
 2450 WRITE (IUNIT7,1951) (NNT2(J2,NSUBS),J2=1,8)
      GO TO 2600
 2500 JJFLAG(J1) = JJFLAG(J1) + 1
 2600 NCONF2(I) = J2
      NODE1(I)  =  1
      IF(NNSUBS(8,I).EQ.LBLANK.OR.NNSUBS(8,I).EQ.LCOLON(1)) NODE1(I) = 2
C
C---- OBTAIN THE NAME OF THE THIRD TRIBUTARY:
C
      IF(NNT3(8,I).EQ.LBLANK) GO TO 1000
      CALL NCHECK(8,NNSUBS,NSUBS,NNT3,NSUBS,LFLAG,JJFLAG)
      J3 = 0
 3100 J3 = J3 + 1
      IF(J3.GE.I) GO TO 3450
 3400 CALL NCOMPR(8,NNSUBS,J3,NNT3,I,IFLAG)
      IF(IFLAG) 3500, 3500, 3100
 3450 WRITE (IUNIT7,1951) (NNT3(J2,NSUBS),J2=1,8)
      GO TO 3600
 3500 JJFLAG(J1) = JJFLAG(J1) + 1
 3600 NCONF3(I) = J3
      NODE1(I)  =  4
      IF(NNSUBS(8,I).EQ.LBLANK.OR.NNSUBS(8,I).EQ.LCOLON(1)) NODE1(I) = 5
      GO TO 1000
C
C---- WRITE THE TRIBUTARY SUBSHED NAMES TO IUNIT7:
```

```
C
 4900 IANSWR = 1
      NSUBS  = I - 1
C     IF(NNS(9,I).EQ.LCOLON(1).OR.NNSUBS(8,I).EQ.LCOLON(1)) NSUBS = I-1
      GO TO 5001
 5000 NSUBS  = I
 5001 IF(NSUBS.LE.0) GO TO 9000
      DO 5900 I=1,NSUBS
 5900    WRITE(IUNIT7,5911) I,(NNSUBS(L,I),L=1,8),(NNT1(L,I),
     1          L=1,8),(NNT2(L,I),L=1,8),(NNT3(L,I),L=1,8)
 5911 FORMAT('     TRIBUTARIES TO SUBSHED ',I4,3X,8A1,':',2X,3(1X,8A1))
      IP1 = NSUBS + 1
      IF(NODE1(I+1).EQ.2.OR.NODE1(I+1).EQ.5) WRITE(IUNIT7,5911) IP1,
     1  (NNBLAN(I+1),L=1,8),(NNT1(L,I+1),L=1,8),(NNT2(L,I+1),L=1,8),
     2  (NNT3(L,I+1),L=1,8)
C
C---- WRITE THE BOUNDARY CONDITION CODES IN FESHM COMPATIBLE FORMAT:
C
C*     WRITE(IPUNCH,6001) (NODE1(I),I=1,NSUBS)
C*6001 FORMAT(16I5)
      WRITE(IUNIT7,6010) (NODE1(I),I=1,NSUBS)
 6010 FORMAT(//'OBOUNDARY DESCRIPTION CODES FOR EACH SUBSHED:'///16I5)
      WRITE(IUNIT7,6020)
 6020 FORMAT(//'OTRIBUTARY IDENTIFIERS:'/
     1   /'OSUBSHED    CODE           TRIB 1     TRIB 2     TRIB 3'
     2   /'+_______    ____           ______     ______     ______'/)
      DO 6600 I=1,NSUBS
         IF(NODE1(I).EQ.0) GO TO 6600
         IF(NODE1(I).GE.4) GO TO 6500
         WRITE(IUNIT7,6601) I,NODE1(I),NCONF1(I),NCONF2(I)
C*          WRITE(IPUNCH,7002)             NCONF1(I),NCONF2(I)
         GO TO 6600
 6500    WRITE(IUNIT7,6601) I,NODE1(I),NCONF1(I),NCONF2(I),NCONF3(I)
C*          WRITE(IPUNCH,7002)             NCONF1(I),NCONF2(I),NCONF3(I)
      IF(NODE1(I+1).EQ.2) WRITE(IUNIT7,6601) IP1,NODE1(I),NCONF1(I+1),
     1                    NCONF2(I+1)
      IF(NODE1(I+1).EQ.5) WRITE(IUNIT7,6601) IP1,NODE1(I),NCONF2(I+1),
     1                    NCONF2(I+1),NCONF3(I+1)
 6600 CONTINUE
 6601 FORMAT(I8,I8,6X,3I10)
C* 7002 FORMAT(3I5)
      IF(NNSUBS(8,NSUBS).EQ.LBLANK.OR.NNSUBS(8,NSUBS).EQ.LCOLON(1))
     1                NSUBS = NSUBS - 1
C
C---- OBTAIN THE TOTAL NUMBER OF ELEMENTS IN THE WATERSHED:
C
      IZONE(1) = 1
      CALL IREADR(IREAD,MSG,I,II,RR,IALPHA,IF1,IF2,IZONE)
      NTELES = II(1)
      NTSS   = NSUBS
      WRITE(IUNIT7,6901) NTELES,NTSS
 6901 FORMAT(//'0     TOTAL NUMBER OF ELEMENTS (NTELES): ',I4/
     1         '      NUMBER OF SUBSHEDS          (NTSS): ',I4//)
C
C---- CHECK THAT ALL BUT THE LAST SUBSHED IS A TRIBUTARY TO ANOTHER
C     SUBSHED:
C
      IF(NSUBS.LE.1) RETURN
      NSUBM1 = MAX0(1,NSUBS-1)
      DO 8000 I=1,NSUBM1
 8000    IF(JJFLAG(I).LT.1) WRITE(IUNiT7,8001) (NNSUBS(LL,I),LL=1,8)
 8001 FORMAT(' *'/' *  ERROR:  SUBSHED ',8A1,' HAS NOT BEEN ASSIGNED ',
     1       'AS A TRIBUTARY SUBSHED.')
      RETURN
C
  9000 IANSWR = -3
       RETURN
       END
 C
 C
 C**********************************************************************
```

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C
      SUBROUTINE IFLOWS(IANSWR)
C
C---- THIS SUBROUTINE READS THE DATA FROM THE PROGRAM MENU INPUT AND
C     WRITES A COPY TO IUNIT7.
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKDELT/DTOMIN,DTCMIN,DSLOPE
      COMMON/BKNUM/NUMBER(100),LROMAN(17)
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1        KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1        YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1        PUSLE(163),SMCHRU(163)
C
      REAL V(2)   / 1.0, 10.0 /
      DOUBLE PRECISION ZNAME(2)
      DATA ZNAME  / 'OVERLAND',' CHANNEL'/
      REAL Z001   /.001/
C
      IANSWR = 0
      DO 8000  I=1,NSUBS
         IZONE(1)  = 1
         CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         KNSTRP(I) = II(1)
         NSTRPS    = II(1)
         MSTRPS    = MAX0(MSTRPS,NSTRPS)
        IF(N.LE.0) GO TO 8900
        CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
        IF(MSG.EQ.IER(4)) RETURN
        KLHSSP(I) = II(1)
        IF(N.LE.0) GO TO 8900
        CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
        IF(MSG.EQ.IER(4)) RETURN
        KNECHA(I) = II(1)
        NCHAN     = II(1)
        MECHAN    = MAX0(MECHAN,II(1))
        IF(N.LE.0) GO TO 8900
C
C----    OBTAIN THE NUMBER OF ELEMENTS PER FLOW STRIP:
C
        CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
C       IF(IUNIT1.GT.0) WRITE(IUNIT1,1000) (IALPHA(III),III=1,80)
C1000   FORMAT(/80A1///)
        IF(MSG.EQ.4) RETURN
        DO 1090 J=1,NSTRPS
           MESTRP      = MAX0(MESTRP,II(J))
 1090      KNESTR(I,J) = II(J)
C       IF(IUNIT1.GT.0) WRITE(IUNIT1,1091) (KNESTR(I,J),J=1,NSTRPS)
C1091   FORMAT(20I4//)
C
C----    PRINT THE OVERLAND FLOW DESCRIPTORS FOR EACH WATERSHED:
C
        WRITE(IUNIT7,1095) (NNSUBS(J1,I),J1=1,8),KNSTRP(I),KLHSSP(I),
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     1           KNECHA(I),(KNESTR(I,J),J=1,NSTRPS)
  1095  FORMAT(///'0  OVERLAND FLOW DESCRIPTORS FOR SUBSHED:  ',8A1//,
     1        '   NUMBER OF FLOW STRIPS                          (NSTRPS):'
     1        ,I14/
     2        '   NUMBER OF FLOW STRIPS ON LEFT SIDE OF CHANNEL (LHSSPS):'
     2        ,I14/
     3        '   NUMBER OF CHANNEL ELEMENTS                     (NECHAN):'
     3        ,I14/
     4        /'    NUMBER OF ELEMENTS IN EACH FLOW STRIP (NESTRP):'/
     5        '      ',20I4)
C
C----   WRITE WARNING MESSAGE IF KNESTR(I,J) LE 0.0:
C
        DO 1100  J=1,NSTRPS
           IF(KNESTR(I,J).GT.0) GO TO 1100
           KNESTR(I,J) = 1
           WRITE(IUNIT7,1101) J,I
  1100  CONTINUE
  1101  FORMAT(//'0FLOWSTRIP NUMBER   ',I3,'   IN SUBSHED   ',I3,
     1        '   WAS ASSIGNED A VALUE LESS THAN ONE.'/'      A VALUE OF ',
     2        'ONE WAS REASSIGNED TO THIS FLOWSTRIP.'//)
        IF(N.LE.0) GO TO 8900
C
C----     OBTAIN AND PRINT THE OVERLAND FLOWSTRIP PROPERTIES:
C
C         WRITE(IUNIT7,1590) I
C1590     FORMAT(//'0      I =',I5//)
          WRITE(IUNIT7,1310)
  1310    FORMAT(//'0                          (XLEN)      (RELIEF)',
     1       '       (AREA)     (TWIDTH)'/
     2       '       FLOW              LENGTH        RELIEF      ELEMENT   ',
     3       '       TOP'/
     4       '      STRIP  NOS.',30X,'AREA        WIDTH'/)
C
          ICOUNT   = 0
          IZONE(1) = 20
          SLOVER   = 0
          SROVER   = 0
          DO 1700 J=1,NSTRPS
             NELM = KNESTR(I,J)
             DO 1600 K=1,NELM
                ICOUNT = ICOUNT + 1
                L = ICOUNT
                CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
                IF(N.LE.0) GO TO 8900
C               IF(IUNIT1.GT.0) WRITE(IUNIT1,1000) (IALPHA(III),
C    1                          III=1,80)
                IF(MSG.EQ.4) RETURN
                ZXLEN(I,L)     = RR(1)
                ZRELIE(I,L)    = RR(2)
                ZAREA(I,L)     = RR(3)
                ZTWIDT(I,L)    = RR(4)
                KNDAMS(I)      = II(5)
                IF(K.EQ.1) WRITE(IUNIT7,1602) LALPHA(J),ICOUNT,ZXLEN(I
     1            ,L),ZRELIE(I,L),ZAREA(I,L),ZTWIDT(I,L)
                IF(K.NE.1) WRITE(IUNIT7,1603) ICOUNT,ZXLEN(I,L),
     1            ZRELIE(I,L),ZAREA(I,L),ZTWIDT(I,L)
                DTOMIN = AMIN1(DTOMIN,0.2*ZXLEN(I,J)/V(1))
                XSLOPE  = ZRELIE(I,J)/ZXLEN(I,J)
                IF(XSLOPE.LT.DSLOPE) WRITE(IUNIT7,1500) ZNAME(1)
  1500          FORMAT(//1X,120('*')/' *',118X,'*'/
     1             ' *     WARNING:  ',A8,' ELEMENT SLOPE MAY NOT BE ',
     2             'SUFFICIENTLY STEEP TO YIELD VALID RESUTLS.   ',25X,
     3             '*'/' *',118X,'*'/1X,120('*')//)
  1600       CONTINUE
  1602       FORMAT(8X,A1,2X,I3,4F12.4)
  1603       FORMAT(     11X,I3,4F12.4)
             IF(J.LE.KLHSSP(I)) SLOVER = SLOVER + ZTWIDT(I,ICOUNT)
  1700       IF(J.GT.KLHSSP(I)) SROVER = SROVER + ZTWIDT(I,ICOUNT)
           IF(SLOVER.LT.SROVER-1.0.OR.SLOVER.GT.SROVER+1.0)
     1     WRITE (IUNIT7,1701) SLOVER,SROVER
  1701     FORMAT(//' ',120('*')/' *',118X,'*'/' *     ERROR:  THE ',
     1        'SUM OF THE  LEFT-HAND FLOWSTRIP TOPWIDTHS  (',F12.2,
     2        ') SHOULD EQUAL  ',29X,'*'/
     3        ' *',12X,'THE SUM OF THE RIGHT-HAND FLOWSTRIP TOPWIDT',
     4        'HS  (',F12.2,' ).',43X,'*'/' *',118X,'*'/1X,120('*')/)
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C                                                                       INT05990
C----     OBTAIN AND PRINT THE CHANNEL FLOW DESCRIPTORS:                INT06000
C                                                                       INT06010
          WRITE(IUNIT7,2501)                                            INT06020
 2501     FORMAT(///'OCHANNEL FLOW ELEMENT DESCRIPTORS:'///             INT06030
     1      ,15X,'(XLEN)    (RELIEF)  (RCOEF)   (TWIDTH)      (HT)',    INT06040
     2      '    (BASE)'/                                               INT06050
     2      '       CHAN     LENGTH     RELIEF  ROUGHNESS       TOP',   INT06060
     3      '     DEPTH   BASE OF'/                                     INT06070
     4      9X,'NO',25X,'COEFF.     WIDTH              TRAPEZOID'/)     INT06080
C                                                                       INT06090
          M         =  0                                                INT06100
          IZONE(1) = 12                                                 INT06110
          SCHAN = 0.0                                                   INT06120
          DO 2600 J=1,NCHAN                                             INT06130
             M = M + KNESTR(I,J)                                        INT06140
             IF(N.LE.0) GO TO 8900                                      INT06150
             CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)       INT06160
             IF(N.LE.0) GO TO 8900                                      INT06170
C            IF(IUNIT1.GT.0) WRITE(IUNIT1,1000) (IALPHA(III),III=1,80)  INT06180
             IF(MSG.EQ.4) RETURN                                        INT06190
             YXLEN(I,J)  = RR(1)                                        INT06200
             YRELIE(I,J) = RR(2)                                        INT06210
             YRCOEF(I,J) = RR(3)                                        INT06220
             YTWIDT(I,J) = RR(4)                                        INT06230
             YHT(I,J)    = RR(5)                                        INT06240
             YBASE(I,J)  = RR(6)                                        INT06250
             KKNDAM(I)   = II(7)                                        INT06260
             SCHAN       = SCHAN + YXLEN(I,J)                           INT06270
             IF(YHT(I,J).LE.0.0) YHT(I,J) = 2.0                         INT06280
             WRITE(IUNIT7,2602) LROMAN(J),J,YXLEN(I,J),YRELIE(I,J),     INT06290
     1          YRCOEF(I,J),YTWIDT(I,J),YHT(I,J),YBASE(I,J)             INT06300
             DTCMIN = AMIN1(DTCMIN,0.2*YXLEN(I,J)/V(1))                 INT06310
             XSLOPE  = YRELIE(I,J)/YXLEN(I,J)                           INT06320
             IF(XSLOPE.LT.DSLOPE) WRITE(IUNIT7,1500) ZNAME(2)           INT06330
C            IF(ZTWIDT(I,M).GE.YXLEN(I,J)) GO TO 2600                   INT06340
 2600     CONTINUE                                                      INT06350
          IF(SLOVER.LT.SCHAN-1.0.OR.SLOVER.GT.SCHAN+.01)                INT06360
     1         WRITE (IUNIT7,2601) SCHAN,SLOVER                         INT06370
 2601     FORMAT(//' ',120('*')/' *',118X,'*'/' *    ERROR:  THE ',     INT06380
     1         'SUM OF CHANNEL ELEMENTS  ',17X,'(',F12.2,               INT06390
     2         ') SHOULD EQUAL ',31X,'*'/' *',12X,'THE ',               INT06400
     3         'SUM OF THE LEFT-HAND FLOWSTRIP TOPWIDTHS  (',F12.2,').' INT06410
     4         ,45X,'*'/' *',118X,'*'/1X,120('*')/)                     INT06420
 2602     FORMAT(4X,A4,I3,8F10.2)                                       INT06430
C                                                                       INT06440
C----    OBTAIN FLOOD DETENTION STRUCTURE PROPERITIES:                  INT06450
C                                                                       INT06460
C        IF(KNDAMS(I).LE.0) GO TO 1400                                  INT06470
C        NDAMS = KNDAMS(I)                                              INT06480
C        DO 1300 J=1,NDAMS                                              INT06490
C            IZONE(1) = 30                                              INT06500
C            CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)       INT06510
C            IF(N.LE.0) GO TO 8900                                      INT06520
C            IF(MSG.EQ.4) RETURN                                        INT06530
C            AREA(I,J)    = RR(1)                                       INT06540
C            NLEVELS(I,J) = II(2)                                       INT06550
C            VOLD(I,J)    = RR(3)                                       INT06560
C            QQD(I,J)      = RR(4)                                      INT06570
 8000 CONTINUE                                                          INT06580
      RETURN                                                            INT06590
C                                                                       INT06600
 8900 WRITE(IUNIT7,8901) I                                              INT06610
 8901 FORMAT(//'0',100('*')/'0ERROR: END OF FLOW INPUT DATA ENCOUNTER', INT06620
     1   'ED AFTER READING PARAMETERS FOR SUBSHED: ',I6/'0',100('*')/)  INT06630
      RETURN                                                            INT06640
      END                                                               INT06650
C                                                                       INT06660
C                                                                       INT06670
C***********************************************************************INT06680
C                                                                       INT06690
      SUBROUTINE IHRUS(IANSWR)                                          INT06700
C                                                                       INT06710
C---- THIS SUBROUTINE READS HRUS DESCRIPTIVE INFORMATION FROM THE MENU  INT06720
C     INPUT FORMAT AND WRITES A COPY TO IUNIT7.                         INT06730
```

```
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1        DIA(8,163),TYPE(8,163)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKNUM/NUMBER(100),LROMAN(17)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1        PUSLE(163),SMCHRU(163)
C
      INTEGER IRRR        /0/
      REAL    ZBLANK(1)   /' '/
C
C
C---- OBTAIN HRU DESCRIPTIVE PARAMETERS:
C
C---- LANDU  = LAND USE NUMBER FOR A PARTICULAR HRU.
C---- FAW    = AVAILABLE WATER POTENTIAL AS A FRACTION OF SOIL PROFILE.
C---- FGW    = GRAVITY WATER POTENTIAL AS A FRACTION OF SOIL PROFILE.
C---- FC     = FINAL INFILTRATION RATE.
C---- DEPTH  = DEPTH OF THE 'A' HORIZON.
C---- SLOHRU = SLOPE CLASS FOR EACH HRU.
CW--- SMCHRU = ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD CAPACITY
C              FOR EACH INDIVIDUAL HRU.
CW--- XKUSLE = ERODIBILITY FACTOR K FROM USLE EQUATION.
CW--- CUSLE  = CROPPING-MANAGEMENT FACTOR C FROM USLE EQUATION.
CW--- PUSLE  = CONTOURINT FACTOR P FROM USLE EQUATION.
CW--- NSOIL  = SOIL TYPE NUMBER FOE EACH HRU.
C
C---- NDHRUS = NUMBER OF DIFFERENT TYPES OF HRU'S IN THE WATERSHED.
C---- NHRU = NUMBER OF HRU'S IN A GIVEN ELEMENT.
C---- IHRU = IDENTIFYING NUMBER OF AN HRU FOR A GIVEN ELEMENT.
C---- FHRU = AREA OF AN HRU AS A FRACTION OF A GIVEN ELEMENT.
C
      WRITE(IUNIT7,100)
  100 FORMAT(///'OHRU DESCRIPTORS:'/'+',15('_')///
     1'                    (SLOHRU)  (FAW)     (FGW)      (FC) '/
     2'     HRU  LANDUSE   SLOPE    AVAIL   GRAVITY    INFILT.    ',
     3'CONTROL    CUSLE       XKUSL'/1X,
     4'     NO.       NO.   CLASS   WATER      WATER       RATE         OF A'/)
C
      NDHRUS   = 0
      IZONE(1) = 1
 1000 CALL IREAD2(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE,ZZ)
         IP1 = NDHRUS + 1
C        IF(IUNIT1.GT.0) WRITE(IUNIT1,1001) IP1,(IALPHA(III),III=1,80)
C1001    FORMAT(//'0DESCRIPTORS FOR HRU NO.: ',I5/80A1///)
         IF(MSG.EQ.IER(4)) RETURN
         IF(N.LE.0.OR.NDHRUS.GT.163.OR.ZZ.EQ.ZBLANK(1)) GO TO 2000
         NDHRUS            = NDHRUS + 1
C        CALL SUBS1(8,IALPHA,NNAME,8,1,1)
C        IF(NNAME(8,1).EQ.LBLANK) NNAME(8,1) = NA
C        SLOHRU(NDHRUS) = NNAME(8,1)
         SLOHRU(NDHRUS) = ZZ
         LANDU(NDHRUS)   = II(2)
         FAW(NDHRUS)     = RR(4)
         FGW(NDHRUS)     = RR(5)
```

```
         FC(NDHRUS)       = RR(6)
         DEPTH(NDHRUS)    = RR(7)
         CUSLE(NDHRUS)    = RR(8)
         XKUSLE(NDHRUS)   = RR(9)
         PUSLE(NDHRUS)    = RR(10)
         NSOIL(NDHRUS)    = II(11)
         WRITE(IUNIT7,1901) NDHRUS,LANDU(NDHRUS),SLOHRU(NDHRUS),
     1          FAW(NDHRUS),
     1          FGW(NDHRUS),FC(NDHRUS),DEPTH(NDHRUS),CUSLE(NDHRUS),
     2          XKUSLE(NDHRUS)
 1901    FORMAT(3X,I4,1X,6X,A1,6F10.4,I8)
         GO TO 1000
C
C---- OBTAIN THE NUMBER OF HRUS PER ELEMENT:
C
 2000 IZONE(1) = 1
      I = 0
 2100 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         IF(N.LE.0.OR.I.GT.163) GO TO 3000
         III = 1
         DO 2200 K=1,20
            I = I + 1
            IF(II(K).GT.0) III=I
 2200       NHRU(I) = II(K)
C
         L = I - 19
         WRITE(IUNIT7,2751) (NUMBER(J),J=L,III)
         WRITE(IUNIT7,2752) (NHRU(J)  ,J=L,III)
C        IF(IUNIT1.GT.0) WRITE(IUNIT1,2751) (NUMBER(J),J=L,III)
C        IF(IUNIT1.GT.0) WRITE(IUNIT1,2752) (NHRU(J)  ,J=L,III)
 2751    FORMAT(' *'/' *   NUMBER OF HRUS IN EACH ELEMENT (NHRU): '//
     1         '     ELEMENT: ',20I3)
 2752    FORMAT('      # HRUS: ',20I3/)
         IF(NTELES.GT.I) GO TO 2100
C
C---- OBTAIN THE ASSIGNMENT OF HRUS TO EACH ELEMENT I:
C
 3000 I = 0
      IZONE(1) = 35
      WRITE(IUNIT7,3001)
 3001 FORMAT(//'0 ASSIGNMENT OF HRUS TO ELEMENTS: '///11X,
     1   '   I     J        IHRU             FHRU'/)
 3100 J = 0
      I = I + 1
 3200 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         IF(N.LE.0.OR.I.GT.163) GO TO 4000
         IF(NHRU(I).LE.0) GO TO 3200
         J  = J + 1
         IHRU(I,J) = II(1)
         FHRU(I,J) = RR(2)
         IF(J.EQ.1) WRITE(IUNIT7,3401) I,J,IHRU(I,J),FHRU(I,J)
         IF(J.NE.1) WRITE(IUNIT7,3402)   J,IHRU(I,J),FHRU(I,J)
 3401    FORMAT(/10X,2I5,I10,5X,F10.5)
 3402    FORMAT( 10X,I10,I10,5X,F10.5)
         IF(J.LT.NHRU(I)) GO TO 3200
         MHRU = MAX0(MHRU,NHRU(I))
         SUM = 0.000
         DO 3600 JJ=1,J
 3600       SUM = SUM + FHRU(I,JJ)
         IF(SUM.GT.0.99.AND.SUM.LT.1.01) GO TO 3700
         IRRR = IRRR + 1
         IF(IRRR.GT.5) GO TO 3700
         WRITE(IUNIT7,3601) I,SUM
 3601    FORMAT(/' *',119('*')/' *',118X,'*'/
     *   ' *   THE SUM OF THE FRACTIONAL AREAS FOR ELEMENT ',I3,
     1    '  IS  ',F10.5,'  AND SHOULD BE CLOSE TO ONE.          ',13X,
     2    ' *'/' *    CHECK THE ASSIGNMENT OF HRUS TO ELEMENTS AND THEN '
     3    ,'THE FRACTRIONAL VALUE OF EACH HRU WITHIN THE ELEMENT.',12X,
     4     '*'/' *',118X,'*'/1X,120('*')/)
 3700    CONTINUE
         GO TO 3100
 4000 RETURN
      END
```

```
C
C
C***********************************************************************
C
      SUBROUTINE ILANDS(IANSWR)
C
C---- THIS SUBROUTINE READS THE DATA FROM THE PROGRAM MENU INPUT AND
C     WRITES A COPY TO IUNIT7.
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
C
C---- OBTAIN VALUES OF LAND USE DESCRIPTORS:
C
      IANSWR = 0
      WRITE(IUNIT7,100)
  100 FORMAT(///'OLAND USE DESCRIPTORS:'//
     2                 16X,'     (AFLU)           (DSLU)          (RCLU)'/
     3  '      NO.         HOLTAN''S A      DEPRESSION       MANNING''S'
     4   /'                COEFFICIENT        STORAGE       ROUGHNESS'/)
C
      I          =  0
      IZONE(1)   = 20
 1000 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) GO TO 9900
         IF(N.LE.0)  GO TO 3000
         IF(I.GT.40) GO TO 3000
         I       = I + 1
         AFLU(I) = RR(1)
         DSLU(I) = RR(2)
         RCLU(I) = RR(3)
         WRITE(IUNIT7,2001) I,AFLU(I),DSLU(I),RCLU(I)
 2001    FORMAT(2X,I5,5X,F13.5,2(2X,F13.5))
      GO TO 1000
C
C---- OBTAIN THE VALUE OF SMCWS:
C
 3000 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) IANSWR = -3
      SMCWS  = RR(1)
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,3005) SMCWS
      IF(IUNIT7.GT.0) WRITE(IUNIT7,3005) SMCWS
 3005 FORMAT(////'OMONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:'
     1        //'0 THE VALUE OF SMCWS IS:  ',F12.6//)
      IF(MSG.EQ.IER(4)) RETURN
C
C---- OBTAIN EVAPORATION AND GROWTH INDEX PARAMETERS FOR EACH MONTH:
C
      NLANUS   = I
      IZONE(1) = 1
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 9900
      DO 4600 I=1,12
 4600    GINDEX(I) = RR(I)
      WRITE(IUNIT7,4601) (LMONTH(III),III=1,12),(GINDEX(J),J=1,12)
 4601 FORMAT(///'        GROWTH INDEX COEFFICIENTS  (GINDEX):'//
     2        /'        ',A4,11(2X,A4)/5X,12F6.3)
      IF(SMCWS.GT.0.0) RETURN
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) GO TO 9900
      DO 4700 I=1,12
 4700    EVP(I) = RR(I)
      WRITE(IUNIT7,4701) (LMONTH(III),III=1,12),(EVP(J),J=1,12)
```

```
 4701 FORMAT(//'      EVAPORATION COEFFICIENTS   (EVP):'//
     1      '          ',A4,11(2X,A4)/5X,12F6.3//)
 5000 RETURN
C
 9900 IANSWR = -3
      RETURN
      END
C
C
C***********************************************************************
C
      SUBROUTINE IMENUR(IANSWR)
C
C---- THIS SUBROUTINE READS PROGRAM CONTROL PARAMETERS FROM THE MENU
C     PREPARED BY THE INTERFACE MENU PROGRAM:
C
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1       PUSLE(163),SMCHRU(163)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BKDELT/DTOMIN,DTCMIN,DSLOPE
      COMMON/BKNUM/NUMBER(100),LROMAN(17)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
C
      DOUBLE PRECISION ZNAME(2)
      DATA ZNAME / 'OVERLAND',' CHANNEL'/
C
C---- OBTAIN VALUES OF OUTPUT CONTROL DESCRIPTORS:
C
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NTBLHS = II(1)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NTBLPE = II(1)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NHOURC = II(1)
      WRITE(IUNIT7,100) NTBLHS, NTBLPE,NHOURC
  100 FORMAT(/////' OUTPUT PRINT CONTROL DESIGNATORS:'/'+',32('_')//
     * '   HRU TABLE OUTPUT PRINT INDICATOR                (NTBLHS):',I13/
     2 '   PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR     (NTBLPE):',I13/
     3 '   NUMBER OF HOURS FOR THE DISCHARGE RECORD        (NHOURC):',I13)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      DTO = RR(1)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      DTC = RR(1)
      WRITE(IUNIT7,200) DTO, DTC
  200 FORMAT(///'0FLOW CALCULATION INTERVALS (SECONDS):'/
     1       '+______________________________________'///
     1 '   OVERLAND FLOW CALCULATION INTERVAL  (DTO): ',F26.0/
     2 '   CHANNEL  FLOW CALCULATION INTERVAL  (DTC): ',F26.0/'*')
C
      IF(DTO.GT.DTOMIN) WRITE(IUNIT7,300) ZNAME(1),ZNAME(1),DTOMIN
      IF(DTC.GT.DTCMIN) WRITE(IUNIT7,300) ZNAME(2),ZNAME(2),DTCMIN
  300 FORMAT(//1X,120('*')/' *',118X,'*'/
     *   ' *    WARNING:  THE TIME STEP FOR ',A8,' FLOW MAY NOT ',
     1   'BE SUFFICIENTLY SMALL TO YIELD VALID RESULTS.',T121,'*'/
     2   ' *              AN ESTIMATED MINIMUM TIME STEP FOR ',A8,
     3   ' FLOW IS: ',F12.6,T121,'*'/' *',118X,'*'/1X,120('*')//)
```

```
C
C
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NOPRIN = II(1)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NCPRIN = II(1)
      WRITE(IUNIT7,1034) NOPRIN, NCPRIN
 1034 FORMAT(//'    PRINT FREQUENCY INDICATORS (SECONDS): '//
     1'         OVERLAND FLOW PRINT FREQUENCY INDICATOR   (NOPRIN): ',I12/
     2'         CHANNEL  FLOW PRINT FREQUENCY INDICATOR   (NCPRIN): ',I12)
C
C---- NPOVER = PRINT CODE CONTROLLING SUB-SHED OVERLAND FLOW OUTPUTS:
C              NPOVER=0; NO OUTPUT.
C                    =1; OUTPUT FOR BOTTOM NODES OF STRIPS ONLY.
C                    =2; OUTPUT AT ALL NODES OF SELECTED STRIPS.
C                        FOR WHICH ADDITIONAL CODES MUST BE READ.
C
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      IIFLAG = 0
      DO 1035 L=1,20
         IF(II(L).EQ.2) IIFLAG = IIFLAG + 1
 1035    NPOVER(L) = II(L)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      DO 1036 L=1,20
         IF(II(L).EQ.2) IIFLAG = IIFLAG + 1
 1036    NPOVER(L+20) = II(L)
      WRITE(IUNIT7,1037) (NUMBER(I),I=1,40), (NPOVER(K),K=1,40)
 1037 FORMAT(//'OSUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER)'
     1  ,':  '/'+',54('_')//'0  SUBSHED: ',40I3/'     NPOVER: ',40I3)
C
C----READING NPSTRP PRINT CONTROL DESIGNATORS (NPOVER>1 FOR ONE OF MORE
C    OF THE SUBSHEDS).
C
C    NPSTRP = PRINT CODE FOR OVERLAND FLOW AT NODES OF SELECTED STRIPS:
C             NPSTRP=0; NO OUTPUT FOR STRIP.
C                   =1; OUTPUT AT ALL NODES OF THE STRIP.
C
      IF(IIFLAG.LE.0) GO TO 1061
      WRITE(IUNIT7,1048) (NUMBER(I),I=1,40)
 1048 FORMAT(//' PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF ',
     1   'SELECTED STRIPS:'/'0       NODES:',40I3)
      DO 1060 K=1,40
         IF (NPOVER(K).NE.2) GO TO 1060
         CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         DO 1051 L=1,20
 1051       NPSTRP(K,L) = II(L)
         CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         DO 1052 L=1,20
 1052       NPSTRP(K,L+20) = II(L)
         WRITE(IUNIT7,1059) K,(NPSTRP(K,I),I=1,40)
 1059    FORMAT('     STRIP',I3,':',40I3)
 1060 CONTINUE
C
C---- NPCHAN = PRINT CODE CONTROLLING SUB-SHED CHANNEL FLOW OUTPUTS.
C              NPCHAN=0; NO OUTPUT.
C                    =1; OUTPUT FOR BOTTOM NODE OF CHANNEL ONLY.
C                    =2; OUTPUT AT ALL NODES OF THE CHANNEL.
C
 1061 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      DO 1065 L=1,20
 1065    NPCHAN(L) = II(L)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      DO 1066 L=1,20
 1066    NPCHAN(L+20) = II(L)
      WRITE(IUNIT7,1080) (NUMBER(I),I=1,40), (NPCHAN(K),K=1,40)
 1080 FORMAT(//'OSUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS ',
     1 '(NPCHAN):'/'+',54('_')/'0  SUBSHED: ',40I3/'     NPCHAN: ',40I3)
```

```
 9900 RETURN
      END
C
C
C*********************************************************************
C
      SUBROUTINE IRAIN(IANSWR)
C
C---- THIS SUBROUTINE READS PROGRAM CONTROL PARAMETERS FROM THE MENU
C     PREPARED BY THE INTERFACE MENU PROGRAM:
C
C
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(50,120),NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1        DIA(8,163),TYPE(8,163)
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1         PUSLE(163),SMCHRU(163)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKNUM/NUMBER(100),LROMAN(17)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
C
C**** PARAMETER DEFINITIONS:
C
C---- NGAGES = NUMBER OF RAIN GAGES IN THE WATERSHED.
C---- NHOURR = NUMBER OF HOURS OF RAINFALL.
C---- INTPCS = TIME INTERVAL OF PRECIPITATION RECORDS.
C---- SMCWS  = ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD CAPACITY
C              FOR THE ENTIRE WATERSHED.
C
C---- OBTAIN STORM DESCRIPTORS:
C
      IANSWR   = 0
      IZONE(1) = 1
 1000 CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      NGAGES = II(1)
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,1005) NGAGES
C1005 FORMAT(//'0 THE NUMBER OF RAINGAGES IS:  ',I6//)
      CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
      IF(MSG.EQ.IER(4)) RETURN
      MONTH  = II(1)
      NDAY   = II(2)
      NYEAR  = II(3)
      NSTART = II(4)
      INTPCS = II(6)
      NHOURR = II(7)
C
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,1001) NGAGES,NHOURC,NSTART,MONTH,NDAY
C    1                 ,NYEAR,NHOURR,INTPCS,SMCWS
      WRITE(IUNIT7,1001) NGAGES,NHOURC,NSTART,MONTH,NDAY,NYEAR,NHOURR,
     1                   INTPCS,SMCWS
 1001 FORMAT(//'0STORM DESCRIPTIVE INFORMATION:'/'+',29('_')//
     1 '        NUMBER OF RAIN GAGES IN THE WATERSHED:          ',I19/
```

```
     1         '    NUMBER OF HOURS IN THE OUTPUT DISCHARGE RECORD: ' ,I19/
     2         '    STARTING HOUR OF THE STORM:                     ' ,I19/
     2         '    STARTING DATE OF THE STORM:'              ,28X,I6,I3,I3/
     2         '    NUMBER OF HOURS IN THE INPUT  RAINFALL  RECORD: ' ,I19/
     3         '    TIME INTERVAL OF PRECIPITATION RECORDS (SECONDS):',I18/
     4         '    ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD'     /
     5         '           CAPACITY FOR THE ENTIRE WATERSHED:       ',F22.0/)
C
C---- NSTART = STARTING TIME OF STORM.
C---- MONTH  = MONTH IN WHICH STORM OCCURS.
C---- NDAY   = DAY IN WHICH STORM OCCURS.
C---- NYEAR  = YEAR IN WHICH STORM OCCURS.
C---- NSECR  = NUMBER OF SECONDS OF RAINFALL.
      NSECR  = 3600 * NHOURR
C---- NPCINT = NUMBER OF PRECIPITATION INTERVALS FOR THE STORM.
      NPCINT = NSECR/INTPCS
C---- INTPCM = PRECIPITATION TIME INTERVAL IN MINUTES.
      INTPCM = INTPCS/60
C---- PCINTH = PRECIPITATION TIME INTERVAL IN HOURS.
      PCINTH = INTPCM/60.0
      NSECC  = 3600*NHOURC
C
C---- NRGAGE  = NUMBER OF RAIN GAGE AFFECTING A GIVEN ELEMENT;
C               NOT NECESSARY WHEN NGAGES=1.
C
C     NOTE: WHEN MORE THAN ONE RAIN GAGE IS EMPLOYED, THERE CAN BE NO
C           MORE THAN 80 ELEMENTS.
C
      IF(NGAGES.EQ.1) GO TO 2600
      DO 2595 J=1,4
         CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         IF(MSG.EQ.IER(4)) RETURN
         DO 2590 L=1,20
            K = (20*(J-1)) + L
 2590       NRGAGE(K) = II(L)
 2595    CONTINUE
      GO TO 2625
C
 2600 DO 2620 L=1,80
 2620    NRGAGE(L) = 1
 2625 CONTINUE
C     IF(IUNIT1.LE.0) GO TO 2627
C     WRITE(IUNIT1,2630)
C     WRITE(IUNIT1,2639) (NUMBER(I),I=1,20),(NRGAGE(I),I=1,20)
C     WRITE(IUNIT1,2641)
C     WRITE(IUNIT1,2639) (NUMBER(I),I=21,40),(NRGAGE(I),I=21,40)
C     WRITE(IUNIT1,2641)
C     WRITE(IUNIT1,2639) (NUMBER(I),I=41,60),(NRGAGE(I),I=31,60)
C     WRITE(IUNIT1,2641)
C     WRITE(IUNIT1,2639) (NUMBER(I),I=61,80),(NRGAGE(I),I=61,80)
 2627 WRITE(IUNIT7,2630)
 2630 FORMAT(//'ORAINGAGE NUMBER CORRESSESPONDING TO ',
     1      'EACH ELEMENT (NRGAGE):'/)
      WRITE(IUNIT7,2640) (NUMBER(I),I=1,40),(NRGAGE(I),I=1,40)
C2639 FORMAT('     ELEMENT:',20I3,/'      NRGAGE:',20I3)
 2640 FORMAT('     ELEMENT:',40I3,/'      NRGAGE:',40I3)
      WRITE(IUNIT7,2641)
 2641 FORMAT(/)
      WRITE(IUNIT7,2640) (NUMBER(I),I=41,80),(NRGAGE(I),I=41,80)
C
C---- OBTAIN THE STORM DATA FOR EACH RAINGAGE:
C
C     PRECIP = PRECIPITATION RECORDS FOR EACH RAIN GAGE & TIME INTERVAL.
C
      IZONE(1) = 1
      DO 5000 IGAGE=1,NGAGES
         WRITE(IUNIT7,3001) IGAGE
 3001    FORMAT (////'0INPUT PRECIPITATION FOR RAINGAGE',I4,//)
         J = 0
 3100    CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
         DO 3200 III=1,8
 3200       PRECIP(IGAGE,J+III) = RR(III)
         JP1 = J + 1
         JP8 = J + 8
         WRITE(IUNIT7,4900) (PRECIP(IGAGE,JX),JX=JP1,JP8)
         IF(MSG.EQ.IER(4)) RETURN
```

```
         J = J + 8
         IF(J.LT.NPCINT) GO TO 3100
C
C----    READ PRECIPITATION FOR THE PRECEDING THIRTY DAYS IF ANTECEDENT
C        SOIL MOISTURE IS UNKNOWN.
C
         IF(SMCWS.GT.0.0) GO TO 5000
         WRITE(IUNIT7,4100) IGAGE
 4100    FORMAT (//'0ANTECEDENT PRECIPITATION FOR THE PRECEDING 30 ',
     1          'DAYS AT RAINGAGE: ',I3/)
         DO 4400 JJ=1,4
            CALL IREADR(IUNIT4,MSG,N,II,RR,IALPHA,IF1,IF2,IZONE)
            IF(MSG.EQ.IER(4)) RETURN
            DO 4400 III=1,8
 4400         DAILPC(IGAGE,III+8*(JJ-1)) = RR(III)
         WRITE(IUNIT7,4900) (DAILPC(IGAGE,III),III=1,30)
 4900    FORMAT(10X,8F12.5)
 5000 CONTINUE
 9900 RETURN
      END
C
C
C*********************************************************************
C
      SUBROUTINE IREADR(IUNIT,MSG,N,II,RR,IALPHA,F1,F2,IZONE)
C
C---- THIS SUBROUTINE READS A LINE OF TEXT AND COMPARES THE FIRST
C     CHARACTER WITH LSTAR;  IF THERE IS A MATCH, THEN THE NEXT LINE OF
C     OF DATA IS READ.  OTHERWISE, IALPHA IS PASSED TO FREERE TO EVLUATE
C     PARAMETERS.
C
C      IUNIT  IS THE READ UNIT DEVICE NUMBER.
C     MSG     IS AN ERROR DIAGNOSTICS CONTROLLER (SEE FREERE HANDOUT).
C     N       IS THE NUMBER OF NUMERICAL VALUES OBTAINED FROM IALPHA.
C     II      IS A VECTOR CONTAINING UP TO 20 INTEGER VALUES OBTAINED
C             FROM IALPHA.
C     RR      IS A VECTOR CONTAINING UP TO 20 REAL VALUES OBTAINED
C             FROM IALPHA.  NOTE:  II(1) CONTAINS THE INTEGER EQUIVALENT
C             OF RR(1)
C     IALPHA IS THE VECTOR OF INPUT CHARACTERS.  IF THE FIRST CHARACTER
C             IS AN ASTERIX, THE NEX LINE OF DATA IS READ. THE SUBROUTINE
C             RETURNS TO THE MAIN PROGRAM IF END OF FILE IS ENCOUNTERED.
C     IF1     IS A VECTOR CONTAINING THE STARTING COLUMN CORRESPONDING TO
C             EACH VALUE IN THE INPUT STRING.
C     IF2     IS A VECTOR CONTAINING THE LAST COLUMN CORRESPONDING TO
C             EACH VALUE IN THE INPUT STRING.
C     IZONE   AN INTEGER VECTOR CONTAINING THE FIRST AND LAST COLUMNS OF
C             IALPHA WHICH ARE TO BE SCANNED BY THE PROGRAM.
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,
     &        KNDRDR,BRANCH,MESAGE
C
      INTEGER F1(20)
      INTEGER F2(20)
      INTEGER IALPHA(80)
      INTEGER IERROR(6)  /'WARN','PRNT','DIAG','END ','ERR ','DBUG'/
      INTEGER II(20)
      INTEGER IZONE(2)
      INTEGER LSTAR(1)    /'*'/
      REAL    RR(20)
C
      MSG    = IERROR(1)
 1000 READ(IUNIT,2000,END=9000) (IALPHA(I),I=1,80)
 2000 FORMAT(80A1)
      IF(IALPHA(1).NE.LSTAR(1)) GO TO 3000
C     IF(IUNIT.EQ.IUNIT5) WRITE(IUNIT7,3001)
C3001 FORMAT('0          COMMENT RECEIVED          '//)
      GO TO 1000
 3000 CALL FREERE(0,MSG,N,II,RR,IALPHA,F1,F2,IZONE)
      RETURN
C
 9000 MSG = IERROR(4)
      BACKSPACE IUNIT
      WRITE(IUNIT7,9001)
 9001 FORMAT(//'0END OF FILE ENCOUNTERED ON INPUT DATA READ'/
```

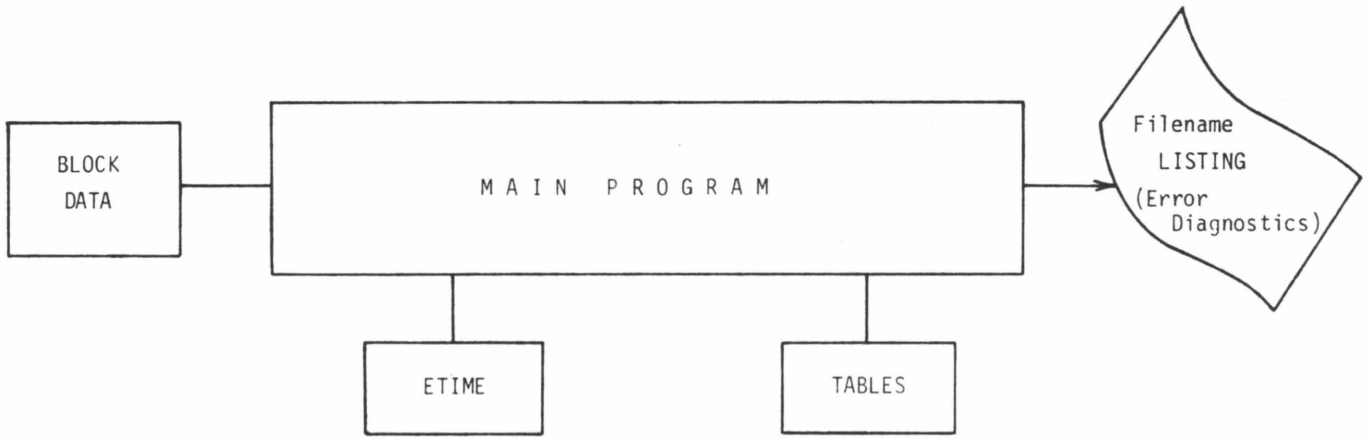
```
     1  'OPROGRAM PROCESSING TERMINATED AT THIS POINT.'//)
      RETURN
      END
C
C
C***********************************************************************
C
      SUBROUTINE IREAD2(IUNIT,MSG,N,II,RR,IALPHA,F1,F2,IZONE,ZZ)
C
C---- THIS SUBROUTINE READS A LINE OF TEXT AND COMPARES THE FIRST
C     CHARACTER WITH LSTAR;  IF THERE IS A MATCH, THEN THE NEXT LINE OF
C     OF DATA IS READ.  OTHERWISE, IALPHA IS PASSED TO FREERE TO EVLUATE
C     PARAMETERS.  (PARAMETERS ARE THE SAME AS DEFINED IN SUBROUTINE
C     IREADR, ABOVE).
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,
     &        KNDRDR,BRANCH,MESAGE
C
      INTEGER F1(20)
      INTEGER F2(20)
      INTEGER IALPHA(80)
      INTEGER  IBETA(80) /80*' '/
      INTEGER IERROR(6)  /'WARN','PRNT','DIAG','END ','ERR ','DBUG'/
      INTEGER II(20)
      INTEGER IZONE(2)
      INTEGER LSTAR(1)   /'*'/
      REAL    RR(20)
C
      MSG    = IERROR(1)
 1000 READ(IUNIT,2000,END=9000) (IALPHA(J),J=1,23),ZZ,(IBETA(I),I=25,80)
 2000 FORMAT(80A1)
      IF(IALPHA(1).EQ.LSTAR(1)) GO TO 1000
      DO 3000 I=25,80
 3000    IALPHA(I) = IBETA(I)
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,4000) (IALPHA(I),I=1,80)
C4000 FORMAT(///'0INPUT DATA TO SUBROUTINE IREAD2:'//80A1///)
      CALL FREERE(0,MSG,N,II,RR,IALPHA,F1,F2,IZONE)
      RETURN
C
 9000 MSG = IERROR(4)
      BACKSPACE IUNIT
      WRITE(IUNIT7,9001)
 9001 FORMAT(//'0END OF FILE ENCOUNTERED ON INPUT DATA READ'/
     1  'OPROGRAM PROCESSING TERMINATED AT THIS POINT.'//)
      RETURN
      END
C
C
C***********************************************************************
C
      SUBROUTINE MODWRT
C
C---- THIS FILE CONTAINS A PROGRAM FOR PRINTING "COMMON" INFORMATION
C     IN THE INPUT FORMAT REQUIRED BY THE FINITE ELEMENT STORM
C     HYDROLOGIC MODEL.
C
C     DATA SETS 1-5 ARE TAKEN DIRECTLY FROM THE INPUT SECTION OF FESHM.
C     SHOULD THE MODEL EVER BE REWRITTEN, THIS PROGRAM MAY BE UPDATED
C     BY COPYING THESE DATA SETS DIRECTLY FROM THE INPUT SUBROUTINE FOR
C     THE MODEL AND DELETING THE "GO TO 40" AND SIMILAR CONTROL
C     STATEMENTS.  DATA SETS 6-9, AS WRITTEN HERE, UTILIZE COMMON BLOCKS
C     40-41 AND WILL HAVE TO BE REWRITTEN IF SIGNIFICANT CHANGES ARE
C     MADE TO THEIR INPUT COMPONENTS.  (NOTE:  J+1  VALUES OF THE
C     SUBSCRIPTS OF MODEL OVERLAND AND CHANNEL FLOW PARAMETERS ARE
C     SIMPLIFIED HERE AS JUST J).
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(50,120),NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(50,100),LANDU(100),NHRU(50),IHRU(50,100)
     1,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
```

```
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      EQUIVALENCE (NSUBS,NTSS)
C
C---- COMMON BLOCKS ADDED FROM MARY LEE WOLF THESIS:
C
C     NOTE: THE COMMON BLOCKS IN THIS THESIS VARY BOTH IN DIMENSION AND
C           COMPONENTS FROM THE STSTANS VERSION OF THE MODEL.
C
C     NOTE: THE WOLF VERSION OF THE MODEL ALSO READS THE TITLE AFTER
C           DATA SET 1:  DESCRIPTION OF OUTPUT TABLES.
C
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1       DIA(8,163),TYPE(8,163)
C*    COMMON/BK33/XKUSLE(163),CUSLE(163),PUSLE(163)
      COMMON/BK36/IELE,NGREAT,KDET,XI30(4)
      COMMON/BK38/INCLAS
C
C---- COMMON BLOCKS ADDED TO PROVIDE ADDITIONAL DIMENSIONS FOR OVERLAND
C     AND CHANNEL FLOW PARAMETERS:
C
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1       KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1       YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
      COMMON/BK43/ITITLE(20),PUSLE(163),SMCHRU(163)
C
C---- COMMON BLOCK FOR READ/WRITE OF TITLE:
C
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      INTEGER IWOLF/0/
C
C**** DATA SET NUMBER 1:  INPUT TITLE AND DESCRIPTION OF OUTPUT TABLES
C
      IF(IWOLF.GT.0) GO TO 1000
      WRITE(8,101)  (LTITLE(I,1),I=1,80)
  101 FORMAT(80A1)
C
 1000 WRITE(8,1010) NTBLHS,NTBLPE,NOPRIN,NCPRIN
 1010 FORMAT(2I5,3I10)
      IF(IWOLF.LE.0) GO TO 1020
      WRITE(8,100)  (LTITLE(I,1),I=1,80)
1020  WRITE(8,100)   (NPOVER(K),K=1,NTSS)
100   FORMAT(40I2)
      DO 104 K=1,40
         IF (NPOVER(K).NE.2) GO TO 104
         WRITE(8,100)(NPSTRP(K,I),I=1,NTSS)
  104    CONTINUE
      WRITE(8,100)(NPCHAN(K),K=1,40)
C
C**** DATA SET NUMBER 2:  DESCRIPTION OF THE STORM EVENT
C
      IF(IWOLF.LT.1) GO TO 1900
      WRITE(8,1800) NGAGES,NHOURR,NHOURC,INTPCS,SMCWS
 1800 FORMAT(4I10,F10.2)
      WRITE(8,1850) NSTART,MONTH,NDAY,NYEAR
 1850 FORMAT(4I5)
      GO TO 2010
 1900 WRITE(8,2000) NGAGES,NHOURR,NHOURC,INTPCS,NSTART,MONTH,NDAY,
     1           NYEAR,SMCWS
 2000 FORMAT(4I10,4I5,F5.3)
 2010 CONTINUE
C
      DO 12 I=1,NGAGES
12       WRITE(8,9)(PRECIP(I,J),J=1,NPCINT)
9     FORMAT(8F10.5)
      IF(NGAGES.EQ.1)GO TO 50
```

```
      WRITE(8,8)(NRGAGE(L),L=1,80)
8     FORMAT(80I1)
      GO TO 52
50    DO 53 L=1,80
53       NRGAGE(L)=1
52    WRITE(8,55)(GINDEX(I),I=1,12)
      IF(SMCWS.GT.0.0)GO TO 54
      WRITE(8,55)(EVP(I),I=1,12)
55    FORMAT(12F6.2)
      DO 58 I=1,NGAGES
58       WRITE(8,56)(DAILPC(I,J),J=1,30)
56    FORMAT(8F10.5)
C
C**** DATA SET NUMBER 3:  INDEXING CONTROL FOR HRUS
C
54    WRITE(8,1)NTSS,NTELES,NDHRUS,NLANUS
1     FORMAT(4I10)
      DO 6 I=1,NTELES
         WRITE(8,3)NHRU(I)
3        FORMAT(I10)
         N=NHRU(I)
         WRITE(8,4)(IHRU(I,J),J=1,N)
4        FORMAT(10I8)
6        WRITE(8,5)(FHRU(I,J),J=1,N)
5     FORMAT(10F8.4)
C
C**** DATA SET NUMBER 4:  DESCRIPTION OF HRU PROPERTIES
C
      WRITE(8,33)(AFLU(I),I=1,NLANUS)
      WRITE(8,33)(DSLU(I),I=1,NLANUS)
      WRITE(8,33)(RCLU(I),I=1,NLANUS)
33    FORMAT(8F10.2)
C
      DO 4200 I=1,NDHRUS
         IF(IWOLF.GT.0) GO TO 4100
         WRITE(8,4240)  LANDU(I),FAW(I),FGW(I),FC(I),DEPTH(I),
     1                      SLOHRU(I),CUSLE(I),XKUSLE(I)
         GO TO 4200
 4100    WRITE(8,4241)  LANDU(I),FAW(I),FGW(I),FC(I),DEPTH(I),
     1          SLOHRU(I),SMCHRU(I),XKUSLE(I),CUSLE(I)
 4200 CONTINUE
 4240 FORMAT(I10,3F10.3,F10.0,9X,A1,2F10.3)
 4241 FORMAT(I5,4F8.3,5X,A1,3F8.3)
C
C
C**** DATA SET NUMBER 5:  TIME INCREMENTS AND ORDERING OF CHANNELS
C
      WRITE(8,51)DTO,DTC
51    FORMAT(2F10.0)
      IF(NTSS.EQ.1) GO TO 96
      NTSSX=NTSS+1
      WRITE(8,25)(NODE1(I),I=1,NTSSX)
25    FORMAT(16I5)
      DO 30 I=1,NTSSX
         IF(NODE1(I).EQ.0)GO TO 30
         IF(NODE1(I).GE.4)GO TO 31
         WRITE(8,35)NCONF1(I),NCONF2(I)
35       FORMAT(2I5)
         GO TO 30
31       WRITE(8,36)NCONF1(I),NCONF2(I),NCONF3(I)
36       FORMAT(3I5)
30    CONTINUE
C
C
C**** DATA SET NUMBER 6W:  VALUES OF SEDIMENT CALCULATIONS:
C
C     IF THE WOLF VERSION OF THE MODEL IS NOT BEING EMPLOYED, SKIP
C     THIS SECTION.
C
 5920 IF(IWOLF.LE.0) GO TO 6000
      WRITE(8,5930) NST
 5930 FORMAT(I5)
      DO 5980 I=1,NST
         WRITE(8,9530) NPART(I)
 9530    FORMAT(20I4)
         K = NPART(I)
```

```
          MPART = MAXO(MPART,K)
          DO 5940 J=1,K
 5940        WRITE(8,5950) DIA(I,J),SG(I,J),TYPE(I,J)
 5950        FORMAT(3F10.3)
 5980 CONTINUE
 6000 CONTINUE
C
C
C**** DATA SET NUMBER 6:  OVERLAND FLOW ELEMENT DESCRIPTORS
C
   96 DO 9000 I=1,NTSS
   98    WRITE(8,89) KNSTRP(I),KLHSSP(I),KNECHA(I)
   89    FORMAT(3I5)
         NSTRPS = KNSTRP(I)
         WRITE(8,92) (KNESTR(I,J),J=1,NSTRPS)
   92    FORMAT(16I5)
         J = 0
   97    DO 70 JJ=1,NSTRPS
            NELM = KNESTR(I,JJ)
            DO 70 K=1,NELM
               J = J + 1
   70          WRITE(8,75) ZXLEN(I,J),ZRELIE(I,J),ZAREA(I,J),
     1                     ZTWIDT(I,J)
   75    FORMAT(2F10.2,F10.4,F10.2)
         IF(KNDAMS(I).EQ.0)GO TO 120
C
C****    DATA SET NUMBER 7:  O-F FLOOD-DETENTION STRUCTURE PROPERTIES
C
         DO 110 J=1,NDAMS
            WRITE(8,111) AREDAM(J,1),NLEVLS(J)
  111       FORMAT(F10.1,I10)
            NLS = NLEVLS(J)
            WRITE(8,114) (VOLD(J,K),K=1,NLS)
  114       FORMAT(8F10.0)
            WRITE(8,114) (QQD(J,K),K=1,NLS)
  110    CONTINUE
C
```

FLOWCHART OF SUBROUTINES IN DATATEST FORTRAN



```
C***  29 SEPTEMBER 1983     *********    DO NOT ERASE  ******  W. J. SYDOR
C***********************************************************************
C
C
C                         DATATEST  FORTRAN
C
C
                              BLOCK DATA
C
C     THIS PROGRAM IS USED TO CHECK THE COMPATIBILITY OF AN INPUT DATA
C     SET WITH THE FINITE ELEMENT MODEL.
C
C     REQUIRED EXTERNAL SUBROUTINES ARE:
C
C                         TABLES
C
C
C     NOTE: IF THE WOLF VERSION OF THE MODEL IS TO BE CHECKED, INPUT A
C           VALUE GREATER THAN 1 FOR IWOLF:
C
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1      PUSLE(163),SMCHRU(163)
      INTEGER IWOLF/0/
C
C***********************************************************************
C
C--- THE MAXIMUM DIMENSIONS PROVIDED IN THIS VERSION OF THE PROGRAM ARE:
C
C     THE NUMBER OF RAINGAGES                         (NGAGES):      3
C     THE NUMBER OF RAINFALL INCREMENTS               (NPCINT):    120
C     THE NUMBER OF SUBSHEDS                          (NTSS  ):     32
C     THE NUMBER OF LANDUSE TYPES                     (NLANUS):     10
C     THE NUMBER OF HRUS                              (NDHRUS):    100
C     THE TOTAL   NUMBER OF ELEMENTS                  (NTELES):     80
C     THE MAXIMUM NUMBER OF HRUS IN AN ELEMENT        (MHRU  ):     10
C     THE MAXIMUM NUMBER OF FLOWSTRIPS IN A SUBSHED   (MSTRPS):     10
C     THE MAXIMUM NUMBER OF ELEMENTS IN A FLOWSTRIP   (MESTRP):     10
C     THE MAXIMUM NUMBER OF NODES IN A FLOWSTRIP      (MNSTRP):     11
C     THE MAXIMUM NUMBER OF CHANNEL ELEMENTS          (MECHAN):     10
C     THE MAXIMUM NUMBER OF NODES IN A CHANNEL REACH  (MNCHAN):     11
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(33,50),LANDU(100),NHRU(99),IHRU(33,50)
     1,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
C
C---- COMMON BLOCKS ADDED FROM MARY LEE WOLF THESIS:
C
C     NOTE: THE COMMON BLOCKS IN THIS THESIS VARY BOTH IN DIMENSION AND
C           COMPONENTS FROM THE STSTANS VERSION OF THE MODEL.
C
C     NOTE: THE WOLF VERSION OF THE MODEL ALSO READS THE TITLE AFTER
C           DATA SET 1:  DESCRIPTION OF OUTPUT TABLES.
C
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1      DIA(8,163),TYPE(8,163)
C*    COMMON/BK33/XKUSLE(163),CUSLE(163),PUSLE(163)
C*          DIMENSION PUSLE(163),SMCHRU(163)
      COMMON/BK36/IELE,NGREAT,KDET,XI30(4)
      COMMON/BK38/INCLAS
```

```
C
C---- COMMON BLOCKS TO PROVIDE ADDITIONAL DIMENSIONS NEEDED TO STORE
C     INPUTS FOR PRINTING BY SUBROUTINE MODWRT:
C
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1        KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1        YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
C
C---- COMMON BLOCK FOR READ/WRITE OF TITLE:
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BI/IFA04(20),IFA01(20),IFMT(20),IFO(20),IFR08(20),IFR10(20)
      COMMON/BKNUM/NUMBER(100)
      COMMON/BKS/NSUBS(8,32),NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      INTEGER LMONTH    /'JAN.','FEB.','MAR.','APR.','MAY ','JUNE',
     1                    'JULY','AUG.','SEPT','OCT.','NOV.','DEC.'/
      DOUBLE PRECISION ZN(11)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNQUIT,NNSTAR,LLFRMT(20)
      DIMENSION ITITLE(20)
      EQUIVALENCE (ITITLE(1),IFMT(1))
C
      INTEGER MHRU/1/,MPART/1/,MSTRPS/1/,MECHAN/1/,MESTRP/1/
      INTEGER IUNIT1/1/
      INTEGER IUNIT2/2/
      INTEGER IUNIT4/4/
      INTEGER IUNIT5/5/
      INTEGER IUNIT6/6/
      INTEGER IUNIT7/7/
      INTEGER IPUNCH/8/
C
      INTEGER NNSUBS     /'A','L','P','H','A',3*' ','B','E','T','A',4*' '
     1 ,'G','A','M','M','A',' ',' ',' ','D','E','L','T','A',' ',' ',' ',
     2  'E','P','S','I','L','O','N',' ','Z','E','T','A',' ',' ',' ',' ',
     3  'E','T','A',' ',' ',' ',' ',' ','T','H','E','T','A',' ',' ',' ',
     4  'I','O','T','A',' ',' ',' ',' ','K','A','P','P','A',' ',' ',' ',
     5  'L','A','M','B','D','A',' ',' ','M','U',' ',' ',' ',' ',' ',' ',
     6  'N','U',' ',' ',' ',' ',' ',' ','X','I',' ',' ',' ',' ',' ',' ',
     7  'O','M','I','C','R','O','N',' ','P','I',' ',' ',' ',' ',' ',' ',
     8  'R','H','O',' ',' ',' ',' ',' ','S','I','G','M','A',' ',' ',' ',
     9  'T','A','U',' ',' ',' ',' ',' ','U','P','S','I','L','O','N',' ',
     *  'P','H','I',' ',' ',' ',' ',' ','C','H','I',' ',' ',' ',' ',' ',
     1  'P','S','I',' ',' ',' ',' ',' ','O','M','E','G','A',' ',' ',' ',
     2   64*' '/
C
         DATA NUMBER/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
     1     21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,
     2     41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,
     3     61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,
     4     81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,07,98,99,100/
C
         DATA ZN   /6HFIRST ,6HSECOND,6HTHIRD ,6HFOURTH,6HFIFTH ,
     1     6HSIXTH ,6H  7TH ,6HEIGHT ,6HNINTH ,6HTENTH ,6H 11TH /
      END
C
C
C*********************************************************************
C
C
C                            MAIN   PROGRAM
C
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(30),FHRU(33,50),LANDU(100),NHRU(99),IHRU(33,50)
     1,DSLU(30)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
```

```
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(30)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      COMMON/BK31/NTYPE,NS,NSED,NPART(8),NSOIL(163),SG(8,163),
     1        DIA(8,163),TYPE(8,163)
C*    COMMON/BK33/XKUSLE(163),CUSLE(163),PUSLE(163)
C*            DIMENSION PUSLE(163),SMCHRU(163)
      COMMON/BK36/IELE,NGREAT,KDET,XI30(4)
      COMMON/BK38/INCLAS
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1        PUSLE(163),SMCHRU(163)
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/BK41/ZXLEN(32,20),ZRELIE(32,20),ZAREA(32,20),ZTWIDT(32,20),
     1        KNDAMS(20)
      COMMON/BK42/YXLEN(32,20),YRELIE(32,20),YTWIDT(32,20),YHT(32,20),
     1        YRCOEF(32,20),YBASE(32,20),KKNDAM(20)
C
      COMMON/CNTL/IUNIT1,IUNIT2,IREAD,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
      COMMON/BKNUM/NUMBER(100)
      COMMON/BKS/NSUBS,NNSUBS(8,32),NNT1(8,32),NNT2(8,32),NNT3(8,32)
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)
      COMMON/SYMBOL/LALPHA(26),LDIGIT(13),LBLANK,LDASH,LDOT,LPLUS,LSTAR
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      DOUBLE PRECISION ZN(11)
      COMMON/BKZ/ZN,NNBASE,NNDATA,NNDEFA,NNQUIT,NNSTAR,LLFRMT(20)
C
      DOUBLE PRECISION ZNAME(2)
      DATA ZNAME / 'OVERLAND',' CHANNEL'/
C
      REAL ZWIDTH(200)
C
      INTEGER ITITLE(80)   /80*' '/
      INTEGER IIFLAG       /0/
      INTEGER NZERO(100)   /100*0/
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C**** PUT ONE LINE TITLE AT TOP OF THE COMBINED DATA SET:
C
      IF(IWOLF.GT.0) GO TO 1000
      READ (IREAD,100)   ITITLE
  100 FORMAT(80A1)
      WRITE(IUNIT7,1022) ITITLE
C
C
C***********************************************************************
C
C**** DATA SET NUMBER 1:  DESCRIPTION OF OUTPUT TABLES
C
C---- IF NTBLHS=1 TABLE LISTING HRU'S AND DESCRIPTIVE CHARACTERISTICS
C                IS PRINTED; IF NTBLHS=0 IT IS NOT
C---- IF NTBLPE=1 TABLE LISTING PRECIPITATION AND PRECIPITATION
C                EXCESS FOR BOTH HRU'S AND ELEMENTS IS PRINTED;
C                IF NTBLPE=0   IT IS NOT.
C---- NOPRIN = TIME INTERVAL FOR OVERLAND FLOW OUTPUT DISPLAY (SECONDS).
C---- NCPRIN = TIME INTERVAL FOR CHANNEL  FLOW OUTPUT DISPLAY (SECONDS).
C---- NRAIN  = IS A DATA READ/WRITE CONTROL DESIGNATOR:
C             IF NRAIN>0, THE PROGRAM TERMINATES FOLLOWING READ/WRITE
C                         OF INPUT PRECIPITATION DATA.
C             IF NRAIN<1, THE PROGRAM PROCESSES A COMPLETE DATA SET.
C
 1000 READ(IREAD,1010) NTBLHS,NTBLPE,NOPRIN,NCPRIN,NRAIN
 1010 FORMAT(2I5,3I10)
      IF(IWOLF.LE.0) GO TO 1020
      READ (IREAD,100)   ITITLE
      WRITE(IUNIT7,1022) ITITLE
C
```

```
C---- OBTAIN VALUES OF OUTPUT CONTROL DESCRIPTORS:
C
 1020 WRITE(IUNIT7,1030) NTBLHS, NTBLPE
 1022 FORMAT('1',80A1)
 1030 FORMAT(//' OUTPUT PRINT CONTROL DESIGNATORS:'/'+',32('_')//
     * '   HRU TABLE OUTPUT PRINT INDICATOR              (NTBLHS):',I23/
     2 '   PRECIPITATION TABLE OUTPUT PRINT DESIGNATOR   (NTBLPE):',I23)
      WRITE(IUNIT7,1034) NOPRIN, NCPRIN
 1034 FORMAT(//'   PRINT FREQUENCY INDICATORS (SECONDS): '//
     1'        OVERLAND FLOW PRINT FREQUENCY INDICATOR   (NOPRIN): ',I22/
     2'        CHANNEL  FLOW PRINT FREQUENCY INDICATOR   (NCPRIN): ',I22)
C
C---- NPOVER = PRINT CODE CONTROLLING SUB-SHED OVERLAND FLOW OUTPUTS:
C             NPOVER=0; NO OUTPUT.
C                   =1; OUTPUT FOR BOTTOM NODES OF STRIPS ONLY.
C                   =2; OUTPUT AT ALL NODES OF SELECTED STRIPS.
C                       FOR WHICH ADDITIONAL CODES MUST BE READ.
C
      READ(IREAD,9982)    (NPOVER(K),K=1,40)
      DO 1035 K=1,40
 1035    IF(NPOVER(K).EQ.2) IIFLAG = IFLAG + 1
      WRITE(IUNIT7,1036) (NUMBER(I),I=1,40), (NPOVER(K),K=1,40)
 1036 FORMAT(//'OSUBSHED OVERLAND FLOW OUTPUT PRINT INDICATORS (NPOVER)'
     1  ,':   '/'+',54('_')//'0  SUBSHED: ',40I3/'     NPOVER: ',40I3)
C
C----READING NPSTRP PRINT CONTROL DESIGNATORS (NPOVER>1 FOR ONE OF MORE
C    OF THE SUBSHEDS).
C
C    NPSTRP = PRINT CODE FOR OVERLAND FLOW AT NODES OF SELECTED STRIPS:
C             NPSTRP=0; NO OUTPUT FOR STRIP.
C                   =1; OUTPUT AT ALL NODES OF THE STRIP.
C
      IF(IIFLAG.LE.0) GO TO 1061
      WRITE(IUNIT7,1048) (NUMBER(I),I=1,40)
 1048 FORMAT(//' PRINT CODES FOR OVERLAND FLOW AT ALL NODES OF ',
     1      'SELECTED STRIPS:'/'+',61('_')//'       NODES:',40I3//)
      DO 1060 K=1,40
         IF (NPOVER(K).NE.2) GO TO 1060
         READ(IREAD,9982) (NPSTRP(K,I),I=1,40)
         WRITE(IUNIT7,1050) K,(NPSTRP(K,I),I=1,40)
 1050    FORMAT('    STRIP',I3,':',40I3)
 1060 CONTINUE
 1061 CONTINUE
C
C---- NPCHAN = PRINT CODE CONTROLLING SUB-SHED CHANNEL FLOW OUTPUTS.
C             NPCHAN=0; NO OUTPUT.
C                   =1; OUTPUT FOR BOTTOM NODE OF CHANNEL ONLY.
C                   =2; OUTPUT AT ALL NODES OF THE CHANNEL.
C
C*    READ (IREAD,9975)(IALPHA(I).I=1.80)
      READ (IREAD,9982)  (NPCHAN(K),K=1,40)
      WRITE(IUNIT7,1080) (NUMBER(I),I=1,40), (NPOVER(K),K=1,40)
 1080 FORMAT(//'OSUBSHED CHANNEL  FLOW OUTPUT PRINT INDICATORS      ',
     1 '(NPCHAN):'/'+',59('_')/'0  SUBSHED: ',40I3/'     NPCHAN: ',40I3)
C
C*************************************************************************
C
C**** DATA SET NUMBER 2:  DESCRIPTION OF THE STORM EVENT:
C
C---- NGAGES = NUMBER OF RAIN GAGES IN THE WATERSHED.
C---- NHOURR = NUMBER OF HOURS OF RAINFALL.
C---- NHOURC = NUMBER OF HOURS IN THE OUTPUT DISCHARGE RECORD.
C---- INTPCS = TIME INTERVAL OF PRECIPITATION RECORDS.
C---- SMCWS  = ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD CAPACITY
C              FOR THE ENTIRE WATERSHED.
C
C
C     NOTE:  THE WOLF VERSION EMPLOYS TWO READ STATEMENTS TO OBTAIN THE
C            DESCRIPTIVE INFORMATION ABOUT THE STORM.
C
      IF(IWOLF.LT.1) GO TO 1900
      READ(IREAD,1800) NGAGES,NHOURR,NHOURC,INTPCS,SMCWS
 1800 FORMAT(4I10,F10.2)
      READ(IREAD,1850) NSTART,MONTH,NDAY,NYEAR
 1850 FORMAT(4I5)
```

```
      GO TO 2010
 1900 READ(IREAD,2000) NGAGES,NHOURR,NHOURC,INTPCS,NSTART,MONTH,NDAY,
     1                 NYEAR,SMCWS
 2000 FORMAT(4I10,4I5,F5.0)
C
      WRITE(IUNIT7,2103) NGAGES,NHOURC,NSTART,MONTH,NDAY,NYEAR,NHOURR,
     1          INTPCS,SMCWS
 2103 FORMAT(//'0STORM DESCRIPTIVE INFORMATION:'/'+',29('_')//
     6       '     NUMBER OF RAIN GAGES IN THE WATERSHED:            ',I29/
     1       '     NUMBER OF HOURS IN THE OUTPUT DISCHARGE RECORD: ',I29/
     2       '     STARTING HOUR OF THE STORM:                       ',I29/
     2       '     STARTING DATE OF THE STORM:'            ,38X,I6,I3,I3/
     2       '     NUMBER OF HOURS IN THE INPUT  RAINFALL  RECORD: ',I29/
     3       '     TIME INTERVAL OF PRECIPITATION RECORDS (SECONDS):',I28/
     4       '     ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD'      /
     5       '          CAPACITY FOR THE ENTIRE WATERSHED:',18X,F19.2/)
C
 2010 CONTINUE
C
C---- NSTART = STARTING TIME OF STORM.
C---- MONTH  = MONTH IN WHICH STORM OCCURS.
C---- NDAY   = DAY IN WHICH STORM OCCURS.
C---- NYEAR  = YEAR IN WHICH STORM OCCURS.
C---- NSECR  = NUMBER OF SECONDS OF RAINFALL.
      NSECR  = 3600 * NHOURR
C---- NPCINT = NUMBER OF PRECIPITATION INTERVALS FOR THE STORM.
      NPCINT = NSECR/INTPCS
C---- INTPCM = PRECIPITATION TIME INTERVAL IN MINUTES.
      INTPCM = INTPCS/60
C---- PCINTH = PRECIPITATION TIME INTERVAL IN HOURS.
      PCINTH = INTPCM/60.0
      NSECC  = 3600*NHOURC
C
C---- PRECIP = PRECIPITATION RECORDS FOR EACH RAIN GAGE & TIME INTERVAL.
C
      DO 2500 I=1,NGAGES
         WRITE(IUNIT7,2400) I
 2400    FORMAT (/'0INPUT PRECIPITATION FOR RAIN GAGE',I4/)
         READ (IREAD,9995)  (PRECIP(I,JX),JX=1,NPCINT)
 2500    WRITE(IUNIT7,2501) (PRECIP(I,JX),JX=1,NPCINT)
 2501 FORMAT(1X,8F10.5)
      DO 2560 I=1,NGAGES
         SRAINN  = 0.0
         DO 2550 III=1,NPCINT
 2550       SRAINN = SRAINN + PRECIP(I,III)
 2560    WRITE(IUNIT7,2561) I,SRAINN
 2561    FORMAT(//'0    THE SUM OF RAINFALL FOR RAINGAGE ',I3,'  IS: ',
     1          F15.4//)
C
C---- NRGAGE  = NUMBER OF RAIN GAGE AFFECTING A GIVEN ELEMENT;
C               NOT NECESSARY WHEN NGAGES=1.
C
C     NOTE: WHEN MORE THAN ONE RAIN GAGE IS EMPLOYED, THERE CAN BE NO
C           MORE THAN 80 ELEMENTS.
C
      IF(NGAGES.EQ.1) GO TO 2600
      READ(IREAD,9981) (NRGAGE(L),L=1,80)
      GO TO 2625
 2600 DO 2620 L=1,80
 2620    NRGAGE(L)=1
 2625 WRITE(IUNIT7,2630)
 2630 FORMAT(//'0RAINGAGE NUMBER CORRESSESPONDING TO ',
     1        'EACH ELEMENT (NRGAGE):'/)
      WRITE(IUNIT7,2640) (NUMBER(I),I=1,40),(NRGAGE(I),I=1,40)
 2640 FORMAT('     ELEMENT:',40I3,/'      NRGAGE:',40I3)
      WRITE(IUNIT7,2641)
 2641 FORMAT(/)
      WRITE(IUNIT7,2640) (NUMBER(I),I=41,80),(NRGAGE(I),I=41,80)
C
C---- READ GROWTH INDEX FOR EACH MONTH, I.E. THE SEASONAL ADJUSTMENT
C     FACTORS FOR INFILTRATION:
C
      READ (IREAD ,9999) (GINDEX(I),I=1,12)
      WRITE(IUNIT7,2650) (LMONTH(I),I=1,12),(GINDEX(J),J=1,12)
 2650 FORMAT(//' MONTHLY GROWTH INDEX AND EVAPORATION PARAMETERS:'/'+',
```

```
     1     47('_')///'    GROWTH INDEX COEFFICIENTS  (GINDEX):'//
     2           '               ',A4,11(2X,A4)//7X,12F6.3)
C
C---- READ EVAPORATION POTENTIAL FOR EACH MONTH IF ANTECEDENT SOIL
C     MOISTURE IS NOT KNOWN.  EVAP IS THE MONTHLY EVAPORATION.
C
      IF(SMCWS.GT.0.0) GO TO 2990
      READ (IREAD,9999)  (EVP(I),I=1,12)
      WRITE(IUNIT7,2670) (LMONTH(I),I=1,12),(EVP(J),J=1,12)
 2670 FORMAT(//'    EVAPORATION COEFFICIENTS   (EVP):'//
     1      '              ',A4,11(2X,A4)//7X,12F6.3//)
C
C---- READ PRECIPITATION FOR THE PRECEDING THIRTY DAYS IF ANTECEDENT
C     SOIL MOISTURE IS UNKNOWN.
C
C
      DO 2800 I=1,NGAGES
         WRITE(IUNIT7,2802) I
         READ (IREAD,9995)  (DAILPC(I,J),J=1,30)
 2800    WRITE(IUNIT7,2501) (DAILPC(I,J),J=1,30)
 2802    FORMAT (//'0ANTECEDENT PRECIPITATION FOR THE PRECEDING 30 ',
     1           'DAYS AT RAINGAGE: ',I12/)
C
      DO 2860 I=1,NGAGES
         SRAINN  = 0.0
         DO 2850 III=1,30
 2850       SRAINN = SRAINN + DAILPC(I,III)
 2860    WRITE(IUNIT7,2861) I,SRAINN
 2861    FORMAT(//'0    THE SUM OF ANTECEDENT RAINFALL FOR RAINGAGE ',
     1           I3,'  IS: ',F15.4//)
C
C
C**********************************************************************
C
C**** DATA SET NUMBER 3:  INDEXING CONTROL FOR HRUS:
C
C---- NTSS   = NUMBER OF SUB-SHEDS IN THE WATERSHED.
C---- NTELES = TOTAL NUMBER OF ELEMENTS IN THE WATERSHED.
C---- NDHRUS = NUMBER OF DIFFERENT TYPES OF HRU'S IN THE WATERSHED.
C---- NLANUS = NUMBER OF DIFFERENT TYPES OF LAND USES IN WATERSHED.
C
 2990 IF(NRAIN.GT.0) GO TO 9910
      WRITE(IUNIT7,3000)
 3000 FORMAT (///'0INDEXING OF HRUS WITHIN SUBSHEDS:'/'+',32('_')///)
 3300 READ (IREAD ,9989) NTSS,NTELES,NDHRUS,NLANUS
      WRITE(IUNIT7,3305) NTSS,NTELES,NDHRUS,NLANUS
 3305 FORMAT(10X,'       NUMBER OF SUBSHEDS =',I5/
     1        10X,'TOTAL NUMBER OF ELEMENTS =',I5/
     2        10X,'NUMBER OF DIFFERENT HRUS =',I5/
     3        10X,'      NUMBER OF LAND USES =',I5//)
C
C---- NHRU = NUMBER OF HRU'S IN A GIVEN ELEMENT.
C---- IHRU = IDENTIFYING NUMBER OF AN HRU FOR A GIVEN ELEMENT.
C---- FHRU = AREA OF AN HRU AS A FRACTION OF A GIVEN ELEMENT.
C
      IRR = 0
      WRITE(IUNIT7,3350)
 3350 FORMAT(//9X,'                         (IHRU)           (FHRU)'/
     1         9X,'  ELEMENT  NHRU   J         HRU           FRACTION OF'/
     2         9X,'   NUMBER                 NUMBER          ELEMENT AREA')
C
      DO 3700 I=1,NTELES
         READ(IREAD,9974)  NHRU(I)
         N    = NHRU(I)
         MHRU = MAX0(MHRU,N)
         READ(IREAD,9988) (IHRU(J,I),J=1,N)
         READ(IREAD,3701) (FHRU(J,I),J=1,N)
         DO 3500 J=1,N
            IF(J.NE.1) WRITE(IUNIT7,3502)     J,IHRU(J,I),FHRU(J,I)
 3500       IF(J.EQ.1) WRITE(IUNIT7,3501) I,N,J,IHRU(J,I),FHRU(J,I)
 3501    FORMAT(/11X,I8,I6,I4,I10,1X,F16.6)
 3502    FORMAT(         25X,I4,I10,1X,F16.6)
         SUM = 0.000
         DO 3600 J=1,N
 3600       SUM = SUM + FHRU(J,I)
```

```
      IF(SUM.GT.0.99.AND.SUM.LT.1.01) GO TO 3700
      IRR = IRR + 1
      IF(IRR.LE.5) WRITE(IUNIT7,3601) I,SUM
 3601 FORMAT(/' *',119('*')/' *',118X,'*'/
     *      ' *   THE SUM OF THE FRACTIONAL AREAS FOR ELEMENT ',I3,
     1      '  IS  ',F10.5,'  AND SHOULD BE CLOSE TO ONE.    ',19X,
     2      ' *'/' *',118X,'*'/' *',119('*')/)
 3700 CONTINUE
 3701 FORMAT(10F8.4)
C
C*************************************************************************
C
C**** DATA SET NUMBER 4:  DESCRIPTION OF HRU PROPERTIES:
C
C---- AFLU = VALUE OF 'A' IN HOLTAN'S EQUATION FOR A GIVEN LAND USE.
C---- DSLU = POTENTIAL DEPRESSION STORAGE FOR A GIVEN ELEMENT.
C---- RCLU = ROUGHNESS COEFFICIENT IN MANNING'S EQUATION FOR A GIVEN
C           LAND USE TYPE.
C
      WRITE(IUNIT7,3800)
 3800 FORMAT(/////'OLAND USE DESCRIPTORS:'/'+',20('_')///
     2' ',15X,'  (AFLU)         (DSLU)         (RCLU)'/
     3'      NO.           HOLTAN''S A     DEPRESSION     MANNING''S'
     4/'                     COEFFICIENT    STORAGE        ROUGHNESS'/
     5'  ')
      READ(IREAD,9992)  (AFLU(I),I=1,NLANUS)
      READ(IREAD,9992)  (DSLU(I),I=1,NLANUS)
      READ(IREAD,9992)  (RCLU(I),I=1,NLANUS)
      DO 3900 I=1,NLANUS
 3900    WRITE(IUNIT7,3901) I,AFLU(I),DSLU(I),RCLU(I)
 3901 FORMAT(2X,I5,5X,F13.5,2(2X,F13.5))
C
C**** NOTE: THE WOLF VERSION OF THE MODEL USES A DIFFERENT SET OF THESE
C          PARAMETERS.  TO CHECK THE WOLF VERSION, INPUT IWOLF>0.
C
C---- LANDU  = LAND USE NUMBER FOR A PARTICULAR HRU.
C---- FAW    = AVAILABLE WATER POTENTIAL AS A FRACTION OF SOIL PROFILE.
C---- FGW    = GRAVITY WATER POTENTIAL AS A FRACTION OF SOIL PROFILE.
C---- FC     = FINAL INFILTRATION RATE.
C---- DEPTH  = CONTROL DEPTH.
C---- SLOHRU = SLOPE CLASS FOR EACH HRU.
CW--- SMCHRU = ANTECEDENT SOIL MOISTURE AS A FRACTION OF FIELD CAPACITY
C              FOR EACH INDIVIDUAL HRU.
CW--- XKUSLE = ERODIBILITY FACTOR K FROM USLE EQUATION.
CW--- CUSLE  = CROPPING-MANAGEMENT FACTOR C FROM USLE EQUATION.
CW--- PUSLE  = CONTOURINT FACTOR P FROM USLE EQUATION.
CW--- NSOIL  = SOIL TYPE NUMBER FOE EACH HRU.
C
      WRITE(IUNIT7,4010)
 4010 FORMAT(///'OHRU DESCRIPTORS:'/'+',15('_')///
     2 '                    (SLOHRU)  (FAW)      (FGW)      (FC) '/
     4 '      HRU             SLOPE   AVAIL     GRAVITY    INFILT. CO',
     5 'NTROL     CUSLE       XKUSL'/
     6 '      NO.  LANDUSE  CLASS    WATER      WATER      RATE     DEPTH'/)
C
      DO 4200 I=1,NDHRUS
         IF(IWOLF.GT.0) GO TO 4100
         READ (IREAD,4240)  LANDU(I),FAW(I),FGW(I),FC(I),DEPTH(I),
     1                      SLOHRU(I),CUSLE(I),XKUSLE(I)
         WRITE(IUNIT7,4242) I,LANDU(I),SLOHRU(I),FAW(I),FGW(I),FC(I),
     1                      DEPTH(I),CUSLE(I),XKUSLE(I)
         GO TO 4200
 4100    READ (IREAD,4241)  LANDU(I),FAW(I),FGW(I),FC(I),DEPTH(I),
     1         SLOHRU(I),SMCHRU(I),XKUSLE(I),CUSLE(I),PUSLE(I),NSOIL(I)
         WRITE(IUNIT7,4242) I,LANDU(I),SLOHRU(I),FAW(I),FGW(I),FC(I),
     1          DEPTH(I),XKUSLE(I),CUSLE(I)
 4200 CONTINUE
 4240 FORMAT(I10,3F10.3,F10.0,9X,A1,2F10.3)
 4241 FORMAT(I5,4F8.3,5X,A1,4F8.3,I5)
 4242 FORMAT(3X,I4,I6,8X,A1,6F10.3)
C
C
C*************************************************************************
C
C**** DATA SET NUMBER 5:  TIME INCREMENTS AND ORDERING OF CHANNELS
```

```
C
C---- DTO = TIME INCREMENT FOR OVERLAND FLOW CALCULATIONS IN SECONDS.
C---- DTC = TIME INCREMENT FOR CHANNEL  FLOW CALCULATIONS IN SECONDS.
C
      READ (IREAD,9990)  DTO,DTC
      WRITE(IUNIT7,5100) DTO,DTC
 5100 FORMAT(////'0TIME INCREMENTS:'/'+',15('_')
     1      //'0      TIME INCREMENT FOR OVERLAND FLOW  = ',F39.0/
     2        '       TIME INCREMENT FOR  CHANNEL FLOW  = ',F39.0/////
     3        '0OVERLAND AND CHANNEL FLOW DESCRIPTORS:'/'+',37('_'))
C
C---- BOUNDARY CONDITION CODE FOR CHANNEL; NOT NECESSARY WHEN NTSS=1.
C
C     NOTE: THE WOLF VERSION OF THE MODEL ALLOWS FOR A MAXIMUM OF TWO
C           STREAM CONFLUENCES AT ANY ONE NODE.
C
C     NODE1=0; DISCHARGE IS ZERO AT UPSTREAM NODE OF CHANNEL.
C          =1; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A STREAM
C              CONFLUENCE OF TWO CHANNELS.
C          =2; TOTAL DISCHARGE FROM WATERSHED IS SUM OF DISCHARGE FROM
C              LAST TWO SUBSHEDS.
C          =3; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A SINGLE
C              CHANNEL (USED TO SUBDIVIDE AN EXISTING SUBSHED INTO
C              SMALLER SUBSHEDS).
C          =4; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A STREAM
C              CONFLUENCE OF THREE CHANNELS.
C          =5; TOTAL DISCHARGE FROM WATERSHED IS SUM OF DISCHARGE FROM
C              LAST THREE SUBSHEDS.
C
      IF(NTSS.EQ.1) GO TO 5920
      NTSSX=NTSS+1
      WRITE(IUNIT7,5200)
      READ (IREAD,9985)  (NODE1(I),I=1,NTSSX)
      WRITE(IUNIT7,9985) (NODE1(I),I=1,NTSSX)
 5200 FORMAT(///'0BOUNDARY CONDITION CODES AND CHANNEL ORDERING'/)
C
C---- NCONF1 = NUMBER OF FIRST CHANNEL ENTERING CONFLUENCE.
C---- NCONF2 = NUMBER OF SECOND CHANNEL ENTERING CONFLUENCE.
C---- NCONF3 = NUMBER OF THIRD CHANNEL ENTERING CONFLUENCE.
C
      DO 5800 I=1,NTSSX
         IF(NODE1(I).EQ.0) GO TO 5800
         IF(NODE1(I).GE.4) GO TO 5700
         READ (IREAD,9985)  NCONF1(I),NCONF2(I)
         WRITE(IUNIT7,9985) NCONF1(I),NCONF2(I)
         GO TO 5800
 5700    READ (IREAD,9985)  NCONF1(I),NCONF2(I),NCONF3(I)
         WRITE(IUNIT7,9985) NCONF1(I),NCONF2(I),NCONF3(I)
 5800    CONTINUE
C
C
C***********************************************************************
C
C**** DATA SET NUMBER 6W:  VALUES OF SEDIMENT CALCULATIONS:
C
C     NOTE: THIS DATA SET IS ONLY EMPLOYED WITH THE WOLF VERSION OF THE
C           MODEL; IF THIS VERSION IS EMPLOYED, THE DATA SET NUMBERS
C           OF EACH OF THE FOLLOWING SECTIONS SHOULD BE INCREMENTED BY
C           ONE TO CORRESPOND TO THE DATA SET NUMBERS GIVEN BY WOLF.
C
C           IF THE WOLF VERSION OF THE MODEL IS NOT BEING EMPLOYED, SKIP
C           THIS SECTION.
C
C---- NSED   = INDEX INDICATING IF SEDIMENT CALCULATIONS ARE DESIRED.
C              IF NSED=1, SEDIMENT CALCULATIONS ARE PERFORMED.
C---- NST    = NUMBER OF SOIL TYPES IN THE WATERSHED.
C---- NPART  = NUMBER OF PARTICLE TYPES IN A PARTICULAR SOIL.
C---- DIA    = DIAMETER OF PARTICULAR PARTICLE TYPE (MM).
C---- SG     = SPECIFIC GRAVITY OF A PARTICULAR PARTICLE TYPE.
C---- TYPE   = AMOUNT OF PARTICLE TYPE AS A FRACTION OF TOTAL AMOUNT OF
C              SOIL (EXPRESSED AS A DECIMAL).
C
 5920 IF(IWOLF.LE.0) GO TO 6000
      READ(IREAD,5930) NST
 5930 FORMAT(I5)
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```
      DO 5980 I=1,NST                                                   DAT06010
         READ(IREAD,9530) NPART(I)                                      DAT06020
 9530    FORMAT(20I4)                                                   DAT06030
         K = NPART(I)                                                   DAT06040
         MPART = MAX0(MPART,K)                                          DAT06050
         DO 5940 J=1,K                                                  DAT06060
 5940       READ(IREAD,5950) DIA(J,I),SG(J,I),TYPE(J,I)                 DAT06070
 5950       FORMAT(3F10.3)                                              DAT06080
 5980 CONTINUE                                                          DAT06090
C                                                                       DAT06100
C                                                                       DAT06110
C***********************************************************************DAT06120
C                                                                       DAT06130
C**** DATA SET NUMBER 6:  OVERLAND FLOW ELEMENT DESCRIPTORS:            DAT06140
C                                                                       DAT06150
C---- NSTRPS = NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE.         DAT06160
C---- LHSSPS = NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL.                DAT06170
C---- NECHAN = NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED.               DAT06180
C                                                                       DAT06190
C     NOTE:  THE WOLF VERSION OF THE MODEL DOES NOT READ THE NUMBER     DAT06200
C            OF CHANNEL ELEMENTS NOR THE NUMBER OF STRIPS ON THE LEFT   DAT06210
C            HAND SIDE OF THE CHANNEL.  IN ORDER TO BE IMPLEMENTED IN   DAT06220
C            ITS CURRENT FORM, THE WATERSED BEING MODELED MUST MEET     DAT06230
C            CERTAIN FLOW CONFIGURATIONS (SEE USER'S GUIDE).            DAT06240
C                                                                       DAT06250
 6000 WRITE(IUNIT7,9970)                                                DAT06260
      DTOMIN = 1000.0                                                   DAT06270
      DTCMIN = 1000.0                                                   DAT06280
      DO 9900 NBASIN=1,NTSS                                             DAT06290
         SLOVER = 0.0                                                   DAT06300
         SROVER = 0.0                                                   DAT06310
         READ (IREAD,9985)  NSTRPS,LHSSPS,NECHAN                        DAT06320
         READ (IREAD,9985)  (NESTRP(I),I=1,NSTRPS)                      DAT06330
         MSTRPS = MAX0(MSTRPS,NSTRPS)                                   DAT06340
         MECHAN = MAX0(MECHAN,NECHAN)                                   DAT06350
         WRITE(IUNIT7,6100) NBASIN,NSTRPS,LHSSPS,NECHAN,(NESTRP(I),     DAT06360
     1                      I=1,NSTRPS)                                 DAT06370
 6100    FORMAT(//' OVERLAND FLOW AND CHANNEL FLOW DESCRIPTORS FOR ',   DAT06380
     1          'SUB-BASIN ',16X,I5/                                    DAT06390
     1            '+___________________________________________',       DAT06400
     1          '__________',19X,'__'//                                 DAT06410
     2   5X,'NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE  (NSTRPS):',DAT06420
     3          12X,I4/                                                 DAT06430
     4   5X,'NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL         (LHSSPS):',DAT06440
     5          12X,I4/                                                 DAT06450
     6   5X,'NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED        (NECHAN):',DAT06460
     7          12X,I4/                                                 DAT06470
     8   5X,'NUMBER OF ELEMENTS IN EACH FLOWSTRIP             (NESTRP):',DAT06480
     9   12X,10I4/(74X,10I4))                                           DAT06490
C                                                                       DAT06500
C---- XLEN   = LENGTH OF THE ELEMENT IN A GIVEN STRIP.                  DAT06510
C---- RELIEF = RELIEF OF THE ELEMENT IN A GIVEN STRIP.                  DAT06520
C---- AREA   = AREA, IN ACRES, OF THE ELEMENT IN A GIVEN STRIP.         DAT06530
C---- TWIDTH = TOP WIDTH OF THE DOWNSTREAM NODE OF THE ELEMENT IN A     DAT06540
C              GIVEN STRIP.                                             DAT06550
C---- NDAMS  = NUMBER OF DAMS IN A GIVEN STRIP (SAME VALUE FOR EACH     DAT06560
C              ELEMENT IN THE STRIP).                                   DAT06570
C                                                                       DAT06580
         WRITE(IUNIT7,6448)                                             DAT06590
 6448    FORMAT(///' OVERLAND FLOW ELEMENT DESRCIPTORS:',//             DAT06600
     1  '                (XLEN)   (RELIEF)   (AREA)  (TWIDTH)    ',     DAT06610
     1                  '          '/                                   DAT06620
     2  '      ELEM.     LENGTH     RELIEF   ELEMENT        TOP    ',    DAT06630
     3                  '         '/                                    DAT06640
     4  '       NOS.                           AREA     WIDTH    ',     DAT06650
     5                  '          '/)                                  DAT06660
         DO 6550 K=1,NSTRPS                                             DAT06670
            NE     = NESTRP(K)                                          DAT06680
            MESTRP = MAX0(MESTRP,NE)                                    DAT06690
            DO 6500 I=1,NE                                              DAT06700
               READ (IREAD,6450)  XLEN(I),RELIEF(I),AREA(I),TWIDTH(I+1),DAT06710
     1                            NDAMS                                 DAT06720
               XXXX = TWIDTH(I+1)                                       DAT06730
 6450          FORMAT(2F10.2,F10.2,F10.2,I10)                           DAT06740
               WRITE(IUNIT7,6451) I,XLEN(I),RELIEF(I),AREA(I),          DAT06750
     1               TWIDTH(I+1)                                        DAT06760
```

```
 6451         FORMAT(5X,I5,2F10.2,F10.2,F10.2)
              CALL ETIME(IUNIT7,1,I,DTO,RELIEF(I),XLEN(I))
              DTOMIN = AMIN1(DTOMIN,DTO)
 6500     ZWIDTH(K) = XXXX + .01
          IF(K.LE.LHSSPS) SLOVER = SLOVER + TWIDTH(NE+1)
          IF(K.GT.LHSSPS) SROVER = SROVER + TWIDTH(NE+1)
 6550     CONTINUE
          IF(SLOVER.LT.SROVER-1.0.OR.SLOVER.GT.SROVER+1.0)
     1    WRITE (IUNIT7,1701) SLOVER,SROVER
 1701     FORMAT(//' ',120('*')/' *',118X,'*'/' *     ERROR:  THE ',
     1        'SUM OF THE  LEFT-HAND FLOWSTRIP TOPWIDTHS  (',F12.2,
     2        ')  SHOULD EQUAL  ',29X,'*'/
     3        ' *',12X,'THE SUM OF THE RIGHT-HAND FLOWSTRIP TOPWIDT',
     4        'HS  (',F12.2,'). ',43X,'*'/' *',118X,'*'/1X,120('*')/)
C
C
C***********************************************************************
C
C****     DATA SET NUMBER 7:  FLOOD-DETENTION STRUCTURE PROPERTIES:
C
C         NOTE: THE WOLF VERSION OF THE MODEL INCORPORATES ADDITIONAL
C               FLOOD DETENTION STRUCTURE DESCRIPTORS INDICATED BY
C               CW----     IN THE FOLLOWING LISTING:
C
C-----     AREDAM = AREA, IN ACRES, OF A FLOOD-DETENTION STRUCTURE
C                   DRAINAGE AREA LOCATED WITHIN A GIVEN ELEMENT.
CW----     XLENDM = LENGTH OF THE FLOOD-DETENTION STRUCTURE DRAINAGE
C                   ELEMENT.
CW----     RELDAM = RELIEF OF THE FLOOD-DETENTION STRUCTURE DRAINAGE
C                   ELEMENT.
CW---      TWDAM  = TOPWIDTH OF THE DOWNSTREAM NODE OF THE FLOOD-DETENTION
C                   STRUCTURE DRAINAGE ELEMENT.
C-----     NLEVLS = NUMBER OF VOLUME-DISCHARGE LEVELS DESCRIBING THE
C                   DISCHARGE HYDROGRAPH OF THE FLOOD-DETENTION STRUCTURE.
C
          IF(NDAMS.LE.0) GO TO 8000
          DO 7900 J=1,NDAMS
             READ(IREAD,7100) AREDAM(J,1),NLEVLS(J)
 7100        FORMAT(F10.1,I10)
C
C----        VOLD = VOLUME, IN ACRE-FEET, OF THE DETENTION POND FOR A
C                   GIVEN VOLUME-DISCHARGE LEVEL.
C
             NLS=NLEVLS(J)
             READ (IREAD,9990)  (VOLD(J,K),K=1,NLS)
             WRITE(IUNIT7,9990) (VOLD(J,K),K=1,NLS)
C
C----        QQD = DISCHARGE FROM THE FLOOD-DETENTION STRUCTURE FOR A
C                  GIVEN VOLUME-DISCHARGE LEVEL.
C
             READ (IREAD,9990)  (QQD(J,K),K=1,NLS)
 7900        WRITE(IUNIT7,9990) (QQD(J,K),K=1,NLS)
C
C
C***********************************************************************
C
C****     DATA SET NUMBER 8:  CHANNEL FLOW ELEMENT DESCRIPTORS:
C
C----      XLEN   = LENGTH OF THE ELEMENT IN THE CHANNEL.
C----      RELIEF = RELIEF OF THE ELEMENT IN THE CHANNEL.
C----      RCOEF  = ROUGHNESS COEFFICIENT OF THE ELEMENT IN THE CHANNEL.
C----      TWIDTH = TOP WIDTH OF THE DOWNSTREAM NODE OF THE ELEMENT IN THE
C                   CHANNEL FOR A 2-FOOT DEPTH (TRIANGULAR XSECTION).
C
C****      GENERALIZED TRAPEZOIDAL XSECTION    *** MDS 4/7/82
C
C          HT     = DEPTH FOR TOPWIDTH (DEFAULT IS 2.0 FEET)
C          BASE   = BASE OF TRAPEZOID (DEFAULT IS 0.0 FEET)
C
 8000     WRITE(IUNIT7,8001)
 8001     FORMAT(///'0CHANNEL FLOW ELEMENT DESCRIPTORS:'//
     1    14X,'(XLEN)    (RELIEF)  (RCOEF)  (TWIDTH)    (HT)      (BASE)'/
     2    '      CHAN     LENGTH     RELIEF ROUGHNESS         TOP ',
     3       ' DEPTH    BASE OF'/
     4    '       NO',24X,'COEFF.      WIDTH         TRAPEZOID'/)
           SCHAN = 0.0
```

```
          DO 9800 K=1,NECHAN
             READ (IREAD,9994) XLEN(K),RELIEF(K),RCOEF(K),TWIDTH(K+1)
     1                   ,HT(K+1),BASE(K+1)
             WRITE(IUNIT7,8101) K,XLEN(K),RELIEF(K),RCOEF(K),
     1                         TWIDTH(K+1),HT(K+1),BASE(K+1)
 8101        FORMAT(I10,6F10.4)
             CALL  ETIME(IUNIT7,2,K,DTC,RELIEF(K),XLEN(K))
             DTCMIN = AMIN1(DTCMIN,DTC)
             IF(HT(K+1).LE.0.0) HT(K+1)=2.0
             SCHAN        = SCHAN + XLEN(K)
C
 9860    CONTINUE
C
C
C************************************************************************
C
C****        DATA SET NUMBER 9: C-F FLOOD-DETENTION STRUCTURE PROPERTIES
C
C            ****     THIS SECTION REMOVED 4/7/82 MDS****
C
C            READ(IREAD,9989) NLEVLS(1)
C            NLS=NLEVLS(1)
C            READ(IREAD,9990)(VOLD(1,K),M=1,NLS)
C            READ(IREAD,9990)(QQD(1,K),M=1,NLS)
C
 9800        CONTINUE
             IF(SLOVER.LT.SCHAN-1.0.OR.SLOVER.GT.SCHAN+1.0)
     1       WRITE (IUNIT7,9801) SCHAN,SLOVER
 9801    FORMAT(//' ',120('*')/' *',118X,'*'/' *     ERROR:  THE ',
     1         'SUM OF CHANNEL ELEMENTS  ',17X,'(',F12.2,
     2         ')  SHOULD EQUAL ',31X,'*'/' *',12X,'THE ',
     3         'SUM OF THE LEFT-HAND FLOWSTRIP TOPWIDTHS  (',F12.2,').'
     4         ,45X,'*'/' *',118X,'*'/1X,120('*')/)
 9900    CONTINUE
 9910 CONTINUE
      IF(DTOMIN.LT.DTO-.01) WRITE(IUNIT7,9913)ZNAME(INDEX),ZNAME(INDEX),
     1                  DTOMIN
      IF(DTCMIN.LT.DTC-.01) WRITE(IUNIT7,9913)ZNAME(INDEX),ZNAME(INDEX),
     1                  DTCMIN
 9913 FORMAT(//1X,120('*')/' *',118X,'*'/
     *  ' *     WARNING:  THE TIME STEP FOR ',A8,' FLOW MAY NOT ',
     1  'BE SUFFICIENTLY SMALL TO YIELD VALID RESULTS.',T121,'*'/
     2  ' *              AN ESTIMATED MINIMUM TIME STEP FOR ',A8,
     3  ' FLOW IS: ',F12.6,T121,'*'/' *',118X,'*'/1X,120('*')//)
      WRITE(IUNIT7,9971)
      CALL TABLES
C
 9970 FORMAT('0')
 9971 FORMAT('1',20A4)
 9974 FORMAT(I10,7F10.5)
C9975 FORMAT(80A1)
C
 9981 FORMAT(80I1)
 9982 FORMAT(40I2)
C9984 FORMAT(20I4)
 9985 FORMAT(16I5)
 9988 FORMAT(10I8)
 9989 FORMAT(8I10)
C
 9990 FORMAT(8F10.0)
 9992 FORMAT(8F10.2)
 9994 FORMAT(8F10.4)
 9995 FORMAT(8F10.5)
 9999 FORMAT(12F6.2)
      STOP
      END
C
C
C
      SUBROUTINE ETIME(IUNIT,INDEX,NUMBER,DT,RELIEF,XLEN)
C
C---- THIS SUBROUTINE COMPARES THE VALUE OF THE TIME STEP DT AND THE
C     ELEMENT SLOPE TO A RULE OF THUMB.  ERROR MESSAGES ARE PRINTED IF
C     POTENTIALLY UNACCEPTABLE VALUES WERE INPUT.
C
```

```
      REAL DSLOPE / 0.002 /
      REAL V(2)   / .25, 10.0 /
      DOUBLE PRECISION ZNAME(2)
      DATA ZNAME / 'OVERLAND',' CHANNEL'/
C
      XTIME = 0.2*XLEN/V(INDEX)
      SLOPE = RELIEF/XLEN
      IF(SLOPE.GE.DSLOPE) RETURN
      WRITE(IUNIT,3000) ZNAME(INDEX)
 3000 FORMAT(//1X,120('*')/' *',118X,'*'/
     1 ' *    WARNING:  ',A8,' ELEMENT SLOPE MAY NOT BE ',
     2 'SUFFICIENTLY STEEP TO YIELD VALID RESULTS.',T121,'*'/
     3 ' *',118X,'*'/1X,120('*')//)
      RETURN
      END
C
C
```

```
C***  25 SEPTEMBER 1983    **********    DO NOT ERASE   ******  W. J. SYDOR
C************************************************************************
C
      SUBROUTINE COMENT(IUNITI,IUNITO,IALPHA,IANSWR,LTITLE,MDM,MTITLE,
     1                  NTITLE)
C
C---- THIS SUBROUTINE EXAMINES THE CONTENT OF THE VECTOR IALPHA;  IWORD
C     THE FIRST NON-BLANK CHARACTERS GENERATE A VALUE FOR IANSWR:
C
C         IANSWR = -3  IF FIRST FOUR NON-BLANK CHARACTERS ARE:  QUIT
C         IANSWR = -2  IF FIRST FOUR NON-BLANK CHARACTERS ARE:  HELP
C         IANSWR = -1  IF FIRST CHARACTER IS AN *.  IF THE FIRST FOUR
C                      COLUMNS ARE '*** ' THE LINE WILL BE CONSIDERED
C                      TO BE AN ADDITIONAL INPUT TITLE.  OTHERWISE THE
C                      LINE WILL BE MERELY CONSIDERED AS A COMMENT.
C         IANSWR =  0  IF THE RESPONSE IS COMPATIBLE WITH A NOANSWER
C                      (I.E. AN 'N' AS THE FIRST NON-BLANK CHARACTER).
C         IANSWR =  1  OTHERWISE.
C
C     IUNITI IS THE SUBROUTINE INPUT READ UNIT NUMBER.
C
C     IUNITO IS THE SUBROUTINE OUTPUT WRITE UNIT NUMBER.
C
C     LTITLE IS AN OUTPUT TITLE VECTOR CONTAINING NTITLE LINES.
C           (MDM IS AND MTITLE ARE THE DIMENSIONS OF THIS VECTOR)
C
      COMMON/CNTL/IUNIT1,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &        KNDRDR,BRANCH,MESAGE
C
      DIMENSION IALPHA(MDM),LTITLE(MDM,MTITLE)
      INTEGER NA(1)/'A'/,NB(1)/'B'/,NC(1)/'C'/,ND(1)/'D'/,NE(1)/'E'/,
     1        NF(1)/'F'/,NG(1)/'G'/,NH(1)/'H'/,NI(1)/'I'/,NJ(1)/'J'/,
     2        NK(1)/'K'/,NL(1)/'L'/,NM(1)/'M'/,NN(1)/'N'/,NO(1)/'O'/,
     3        NP(1)/'P'/,NQ(1)/'Q'/,NR(1)/'R'/,NS(1)/'S'/,NT(1)/'T'/,
     4        NU(1)/'U'/,NV(1)/'V'/,NW(1)/'W'/,NX(1)/'X'/,NY(1)/'Y'/,
     5        NZ(1)/'Z'/
      INTEGER  LBLANK(1)/' '/,LSTAR(1)/'*'/
C
      DOUBLE PRECISION ZN(10)
        DATA ZN/6HFIRST ,6HSECOND,6HTHIRD ,6HFOURTH,6HFIFTH ,
     1          6HSIXTH ,6H  7TH ,6HEIGHT ,6HNINTH ,6HTENTH /
C
      IANSWR = 1
      N = 0
 2000 N = N + 1
      IF(IALPHA(1).EQ.LSTAR(1))  GO TO 5000
      IF(IALPHA(N).NE.LBLANK(1)) GO TO 3000
      IF(N.LT.MDM-5) GO TO 2000
 3000 IF(IALPHA(N).EQ.NN(1)) IANSWR = 0
      IF(IALPHA(N).EQ.NH(1).AND.IALPHA(N+1).EQ.NE(1).AND.
     1   IALPHA(N+2).EQ.NL(1).AND.IALPHA(N+3).EQ.NP(1)) IANSWR = -2
      IF(IALPHA(N).EQ.NQ(1).AND.IALPHA(N+1).EQ.NU(1).AND.
     1   IALPHA(N+2).EQ.NI(1).AND.IALPHA(N+3).EQ.NT(1)) IANSWR = -3
      RETURN
C
 5000 IANSWR = -1
      IF(IALPHA(N+1).NE.LSTAR(1).OR.IALPHA(N+2).NE.LSTAR(1).OR.
     1   IALPHA(N+3).NE.LBLANK(1)) GO TO 8000
      IF(NTITLE.GE.MTITLE) GO TO 8000
      NTITLE = NTITLE + 1
      DO 7000 J=1,76
 7000    LTITLE(J,NTITLE) = IALPHA(J+4)
      IF(IUNITO.LT.1) RETURN
      WRITE(IUNITO,7200) ZN(NTITLE)
 7200 FORMAT('0      ',A6,' TITLE LINE RECEIVED   ')
      RETURN
C
 8000 IF(IUNITO.LT.1) RETURN
      IF(IUNIT4.NE.IUNIT5.AND.IUNIT3.GT.0) WRITE(IUNITO,8100)
 8100 FORMAT('0      COMMENT RECEIVED   ')
      RETURN
      END
C
C
```

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C***  25 SEPTEMBER 1983   *********    DO NOT ERASE    ***     W. J. SYDORCOM00010
C***********************************************************************COM00020
C                                                                       COM00030
      SUBROUTINE COMPAR(INDEX,I,IIN,X,XIN)                              COM00040
C                                                                       COM00050
C---, THIS SUBROUTINE IS USED TO CHANGE DEFAULT VALUES USED IN PROGRAM  COM00060
C     IMPLEMENTATION. INTEGER VALUES ARE EXAMINED IF INDEX.LE.0  AND    COM00070
C     REAL VALUES ARE EXAMINED IF INDEX>0.                              COM00080
C                                                                       COM00090
C     IF THE FIRST TWO NON-BLANK CHARACTERS ARE HE, E.G. 'HELP' WAS     COM00100
C     ENTERED BY THE USER, THE SUBROUTINE RETURNS TO THE CALLING PROGRAMCOM00110
C                                                                       COM00120
C          IF IIN .NE.  0, I IS SET EQUAL TO IIN                        COM00130
C          IF IIN =  -999, I IS SET EQUAL TO 0                          COM00140
C                                                                       COM00150
C          IF XIN.NE. 0.0, X IS SET EQUAL TO XIN                        COM00160
C          IF XIN = -99.9, X IS SET EQUAL TO 0.0                        COM00170
C                                                                       COM00180
      COMMON/BR/II(20),RR(20),IALPHA(80),IF1(20),IF2(20),IZONE(2),IER(6)COM00190
C                                                                       COM00200
      INTEGER NH(1)/'H'/                                                COM00210
      INTEGER NE(1)/'E'/                                                COM00220
C                                                                       COM00230
      IFLAG = 0                                                         COM00240
      DO 100 J=1,10                                                     COM00250
  100    IF(IALPHA(J).EQ.NH(1).AND.IALPHA(J+1).EQ.NE(1)) IFLAG = IFLAG+1COM00260
      IF(IFLAG.GT.0) RETURN                                             COM00270
C                                                                       COM00280
      IF(INDEX.GT.0) GO TO 1000                                         COM00290
      IF(IIN.NE.0)     I = IIN                                          COM00300
      IF(IIN.EQ.-999) I = 0                                             COM00310
      RETURN                                                            COM00320
C                                                                       COM00330
 1000 IF(XIN.NE.0.0)   X = XIN                                          COM00340
      IF(XIN.EQ.-99.9) X = 0.0                                          COM00350
      RETURN                                                            COM00360
      END                                                               COM00370
C                                                                       COM00380
C                                                                       COM00390
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C WRITTEN BY:  R.W.STRAVOS                DO NOT ERASE                NEFRE00010
C***********************************************************************FRE00020
C                                                                       FRE00030
C     REVISION:  BY W. J. SYDOR ON  25 SEPTEMBER TO ENABLE USE OF THIS  FRE00040
C                SUBROUTINE WITH THE WATFIV AND FORTRAN77 COMPILERS.    FRE00050
C                                                                       FRE00060
C***********************************************************************FRE00070
C                                                                       FRE00080
      SUBROUTINE FREERE (IUNIT,MSG,I,INTJ,RR,IALPHA,F1,F2,IZONE)        FRE00090
C                                                                       FRE00100
C                                                                       FRE00110
C---  THIS SUBROUTINE READS A LINE OF TEXT AND CONVERTS IT TO NUMERICS. FRE00120
C                                                                       FRE00130
C     INTERNALS USED:                                                   FRE00140
C                                                                       FRE00150
C     SUBROUTINE CHECK - RETURNS A ALPHA WORD CONTAINING A DIGIT OR     FRE00160
C                        A DECIMAL POINT IF IT IS PASSED ONE, OTHER-    FRE00170
C                        WISE IT PASSES THE BLANK ALPHA WORD.           FRE00180
C     SUBROUTINE NUM - RETURNS THE NUMERIC EQUIVALENT TO THE FIRST      FRE00190
C                        DIGIT IN AN ALPHA WORD THAT CONTAINS A NUMERIC. FRE00200
C                                                                       FRE00210
      COMMON /CNTL/ IUNIT1,IUNIT2,IUNIT3,IUNIT4,IUNIT5,IUNIT6,IUNIT7,   FRE00220
     &              KNDRDR,BRANCH,MESAGE                                FRE00230
C                                                                       FRE00240
      REAL*8 RTEMP(80)                                                  FRE00250
      INTEGER DECMAL(1)       /'.   '/                                  FRE00260
      INTEGER E(1)            /'E   '/                                  FRE00270
      INTEGER F1(20)                                                    FRE00280
      INTEGER F2(20)                                                    FRE00290
      INTEGER INTJ(20)                                                  FRE00300
      INTEGER IALPHA(80)                                                FRE00310
      INTEGER IERROR(6)       /'WARN','PRNT','DIAG','END ','ERR ','DBUG'/ FRE00320
```

```
      INTEGER INTEG(2)        /'INTE','GER '/
      INTEGER IPOS(1)         /'+   '/
      INTEGER ITYPE(20,2)
      INTEGER IZONE(2)
      INTEGER NEG(1)          /'-   '/
      INTEGER REALK(2)        /'REAL','    '/
      REAL    RR(20)
      INTEGER SUM
C
      IF(IUNIT6.EQ.0) IUNIT6=6
      IF(IUNIT1.EQ.0) IUNIT1=6
      MSG1=MSG
      IF (MSG.NE.IERROR(2).AND.MSG.NE.IERROR(6)) GO TO 140
      IF (MSG.EQ.IERROR(6)) MSG1=IERROR(2)
      IF (MSG.EQ.IERROR(2)) MSG1=IERROR(3)
      WRITE (IUNIT1,120)
  120 FORMAT (' ENTERING SUBROUTINE FREERE')
  140 CONTINUE
C
      IF (IZONE(2).GE.IZONE(1)) GO TO 200
        IF (MSG1.NE.IERROR(2).AND.MSG1.NE.IERROR(3)) GO TO 180
          WRITE (IUNIT6,160)
  160     FORMAT (' ERROR IN ZONE LENGTHS FOR FREE-READ')
  180   CONTINUE
        MSG1=IERROR(1)
        GO TO 840
  200 CONTINUE
      DO 220 J=1,20
         INTJ(J)=0
         RR(J)=0.
  220 CONTINUE
      IF (IUNIT.LE.0) GO TO 260
         READ (IUNIT,240,END=780) (IALPHA(J),J=1,80)
  240    FORMAT (80A1)
  260 CONTINUE
      K=0
      KK=0
      I=0
      ISIGN=1
      I1=IZONE(1)
      KSIGN=0
      I2=IZONE(2)
      DO 700 J=I1,I2
         CALL CHECK (IALPHA,J,IIII)
         IF (IALPHA(J).NE.IIII.AND.K.LT.1) GO TO 680
         K=K+1
         IF (IALPHA(J).NE.IPOS(1).AND.IALPHA(J).NE.NEG(1)) GO TO 340
            KSIGN=KSIGN+1
            K=K-1
            IF (IALPHA(J).EQ.NEG(1)) ISIGN=(-1)
            IF (KSIGN.LE.1.AND.K.LE.1) GO TO 320
               IF (MSG1.NE.IERROR(2).AND.MSG1.NE.IERROR(3)) GO TO 300
                  WRITE (IUNIT6,280)
  280             FORMAT (' TOO MANY SIGNS OR SIGNS MISS-PLACED')
  300          CONTINUE
               MSG1=IERROR(1)
               GO TO 840
  320       CONTINUE
  340    CONTINUE
         IF (K.LT.12) GO TO 440
            IF (MSG1.NE.IERROR(2).AND.MSG1.NE.IERROR(3)) GO TO 420
               WRITE (IUNIT6,400) (IALPHA(K),K=1,80),J
  400          FORMAT (' UNABLE TO DECIPHER...TOO MANY DIGITS,',
     &         'WITHOUT A DELIMITER ENCOUNTERED:',/,
     &         1X,80A1,/,' FIELD=',I2)
  420       CONTINUE
            MSG1=IERROR(1)
            GO TO 840
  440    CONTINUE
         JJ=J+1
         IF(JJ.GT.80) GO TO 680
         CALL CHECK (IALPHA,JJ,IIII)
         IF (IALPHA(JJ).EQ.IIII) GO TO 680
            SUM=0.
            N1=J-K+1
```

```
          DO 580 L=N1,J
             CALL CHECK (IALPHA,L,IIII)
             IF (IIII.NE.DECMAL(1)) GO TO 560
             IF (KK.EQ.0) GO TO 540
                IF (MSG1.NE.IERROR(2).AND.MSG1.NE.IERROR(3))
     &                                          GO TO 520
                   WRITE (IUNIT6,500) (IALPHA(K),K=1,80),L
  500              FORMAT (' UNABLE TO DECIPHER...MULTIPLE',
     &              ' DECIMALS ENCOUNTERED',/,
     &              1X,80A1,/,7H FIELD=,I2)
  520           CONTINUE
                MSG1=IERROR(1)
                GO TO 840
  540        CONTINUE
                KK=K
                JDEC=IABS(KK)
                GO TO 580
  560        CONTINUE
                CALL NUM (IALPHA,L,NNNN)
                SUM=SUM+(NNNN*10**(K-1))
                K=K-1
  580     CONTINUE
          I=I+1
          IF (I.LT.21) GO TO 620
             WRITE (IUNIT6,600)
  600        FORMAT (38H TOO MANY NUMBERS ON A RECORD...MAX=20)
             MSG1=IERROR(1)
             GO TO 840
  620     CONTINUE
          IF (KK.LT.1) GO TO 640
             ITYPE(I,1)=REALK(1)
             ITYPE(I,2)=REALK(2)
             GO TO 660
  640     CONTINUE
             ITYPE(I,1)=INTEG(1)
             ITYPE(I,2)=INTEG(2)
  660     CONTINUE
             RTEMP(I)=FLOAT(SUM)/(10**KK)*ISIGN
             RR(I)=RTEMP(I)
             INTJ(I)=RR(I)
             IF (KSIGN.GE.1.AND.ISIGN.EQ.(-1)) N1=N1-1
             F1(I)=N1
             F2(I)=J
C
C----------------------------------------------------------------------
C
C----        THE FOLLOWING LINE WAS ADDED BY W.J. SYDOR ON 20 SEPT.
C            1983 TO ENABLE USE OF FREERE WITH THE WATFIV COMPLILER.
C
             IF(I.LE.1) GO TO 670
C
C----------------------------------------------------------------------
C
             IF(N1.NE.(F2(I-1)+2)) GO TO 670
                IF(IALPHA(N1-1).NE.E(1)) GO TO 670
                RTEMP(I-1)=RTEMP(I-1)*10.**INTJ(I)
                RTEMP(I)=0.0
                INTJ(I)=0
                RR(I)=0
                F1(I)=0
                F2(I)=0
                I=I-1
                RR(I)=RTEMP(I)
                IF(RR(I).LE.(10000*100000)) GO TO 665
                    WRITE(IUNIT6,667) RR(I)
  667               FORMAT(' * * * W A R N I N G * * * ', G15.7,/,
     &              ' EXCEEDS INTEGER MAXIMUM SIZE')
                    MSG1=IERROR(1)
  665            CONTINUE
                INTJ(I)=RR(I)
                F2(I)=J
  670        CONTINUE
             K=0
             KK=0
             ISIGN=1
```

```
               KSIGN=0
  680       CONTINUE
  700     CONTINUE
           IF (MSG.NE.IERROR(2).AND.MSG.NE.IERROR(6)) GO TO 760
              IF (I.LT.1) GO TO 840
              WRITE (IUNIT1,720) IZONE(1),IZONE(2)
  720         FORMAT(' THE NUMERIC VALUES LISTED BELOW WERE OBTAINED ',
     &          'FROM THE FIELDS:',I4,' TO',I4,
     &         /,' TYPE:     FIELD',9X,'VALUES')
              WRITE (IUNIT1,740) ((ITYPE(K,J),J=1,2),F1(K),F2(K),
     &          INTJ(K),RR(K),K=1,I)
  740         FORMAT (1X,2A4,1X,I2,1H-,I2,G10.4,4X,G13.6)
  760 CONTINUE
      GO TO 840
  780 CONTINUE
      IF (MSG.NE.IERROR(2).AND.MSG.NE.IERROR(3)) GO TO 820
         IF(IUNIT.EQ.5.OR.IUNIT.EQ.95) GO TO 820
         WRITE (IUNIT6,800) IUNIT
  800    FORMAT (' END-OF-FILE ENCOUNTERED ON UNIT NO.',I2)
  820 CONTINUE
      IF(IUNIT.EQ.5.OR.IUNIT.EQ.95) BACKSPACE IUNIT
      MSG1=IERROR(4)
C
  840 CONTINUE
      IF (MSG.NE.IERROR(2).AND.MSG.NE.IERROR(6)) GO TO 880
         WRITE (IUNIT1,860)
  860    FORMAT (' LEAVING SUBROUTINE FREERE')
  880 CONTINUE
      MSG=MSG1
      RETURN
      END
C
C
C
C***********************************************************************
C
      SUBROUTINE CHECK (IALPHA,N,IIII)
C
C
C---- THIS SUBROUTINE RETURNS AN ALPHA WORD CONTAINING A DIGIT OR
C      A DECIMAL POINT IF IT IS PASSED ONE, OTHER WISE IT
C         RETURNS THE BLANK ALPHA WORD.
C
      INTEGER BLANK(1)  /'BLAN'/
      INTEGER DIGIT(13) /'0   ','1   ','2   ','3   ','4   ','5   ',
     &                  '6   ','7   ','8   ','9   ','.   ','-   ','+   '/
      INTEGER IALPHA(80)
C
      IIII=BLANK(1)
      DO 20 K=1,13,1
   20    IF (IALPHA(N).EQ.DIGIT(K)) IIII=IALPHA(N)
      RETURN
      END
C
C
C
C***********************************************************************
C
      SUBROUTINE NUM (IALPHA,N,NNNN)
C
C
C---- THIS SUBROUTINE RETURNS THE NUMERIS EQUIVALENT TO THE FIRST DIGIT
C     IN AN ALPHA WORD THAT CONTAINS A NUMERIC.
C
      INTEGER DIGIT(10) /  '0   ','1   ','2   ','3   ','4   ','5   ',
     1                     '6   ','7   ','8   ','9   '/
      INTEGER IALPHA(80)
C
      NNNN=9999
      DO 20 K=1,10,1
   20    IF (IALPHA(N).EQ.DIGIT(K)) NNNN=K-1
      RETURN
      END
C
C
```

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C***  29 SEPTEMBER  1983     *******     DO NOT ERASE    ***    W. J. SYDOR
C************************************************************************
C
      SUBROUTINE NCHECK(LENGTH,IWORD1,N1,IWORD2,N2,IFLAG,JJFLAG)
C
C---- THIS SUBROUTINE COMPARES THE NAME IN IWORD2 TO THE NAMES IN IWORD1
C     TO DETERMINE WHETHER THE NAME IN IWORD2 HAS ALREADY BEEN ASSIGNED.
C     A WARNING MESSAGE IS ISSUED IF THE NAME IN IWORD1 IS ASSIGNED TO
C     MORE THAN ONE WATERSHED OR IF THE NAME IN IWORD2 HAS NOT BEEN
C     PREVIOUSLY DEFINED AS A WATERSHED NAME.
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      INTEGER IWORD1(LENGTH,N1),IWORD2(LENGTH,N2),JJFLAG(N1)
      INTEGER LBLANK(1)/' '/
C
C---- RESET IFLAG FROM ZERO TO ONE IF IWORD2 IS NOT ALL BLANK:
C
      I       = 0
      IFLAG   = 0
      LLFLAG  = 0
      DO 100 N=1,LENGTH
  100    IF(IWORD2(N,N2).NE.LBLANK(1)) IFLAG = 1
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,110)
C 110 FORMAT(//'0ENTERING SUBROUTINE NCHECK'//'0     N IFLAG',
C    1       '                 IWORD1               IWORD2'/)
C     DO 200 N=1,N1
C 200    IF(IUNIT1.GT.0) WRITE(IUNIT1,201) N,IFLAG,(IWORD1(L,N),L=1,8),
C    1                   (IWORD2(L,N2),L=1,8)
C 201 FORMAT(2I6,10X,8A1,10X,8A1)
      IF(IFLAG.LE.0) RETURN
C
C---- WRITE ERROR MESSAGE IF A TRIBUTARY WAS ASSIGNED TO FIRST SUBSHED:
C
      IF(N1.LT.N2) GO TO 7000
      IF(N2.GT. 1) GO TO 1900
      WRITE(IPUNCH,1999)
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,1999)
 1999 FORMAT('*'/'*  ERROR:  THE FIRST SUBSHED MAY NOT HAVE ANY ',
     1       'TRIBUTARY SUBSHEDS.'/'*')
      RETURN
C
C---- COMPARE THE NAMES FOUND IN EACH ENTRY OF IWORD1, UP TO THE N1'TH
C     NAME, FOR A MATCH WITH IWORD2(N2):
C
 1900 CONTINUE
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,1901) (IWORD2(LLL,N2),LLL=1,8)
C1901 FORMAT(//'0CHECK THAT TRIBUTARY SUBSHED  ',8A1,' HAS ALREADY BEEN'
C    1     ,' DEFINED:'//'   I     NNSUBS     NNTRIB  IFLAG LLFLAG'/)
 2000 I = I + 1
      CALL NCOMPR(LENGTH,IWORD1,I,IWORD2,N2,LFLAG)
      IF(LFLAG.EQ.0) GO TO 5000
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,2600) I,(IWORD1(LLL,I),LLL=1,8),
C    1                  (IWORD2(LLL,N2),LLL=1,8),LFLAG,LLFLAG
C2600 FORMAT(I4,2X,8A1,2X,8A1,2X,I5,I7)
      IF(I.LT.N2) GO TO 2000
C     IF(LLFLAG.LE.0.AND.IUNIT1.GT.0) WRITE(IUNIT1,3000) (IWORD2(LL,N2),
C    1                                  LL=1,8)
      IF(LLFLAG.LE.0) WRITE(IPUNCH,3000) (IWORD2(LL,N2),LL=1,8)
 3000 FORMAT('*'/'*  ERROR:  SUBSHED ',8A1,' WAS NOT PREVIOUSLY ',
     1              'DEFINED.'/'*')
      RETURN
C
C---- WRITE A WARNING MESSAGE IF IWORD1(_,I) HAS ALREADY BEEN ASSIGNED
C     AS THE NAME OF A TRIBUTARY WATERSHED:
C
 5000 LLFLAG = LLFLAG + 1
      IF(JJFLAG(I).LE.0) GO TO 6000
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,2600) I,(IWORD1(LLL,I),LLL=1,8),
C    1                  (IWORD2(LLL,N2),LLL=1,8),LFLAG,LLFLAG
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,5100) (IWORD1(J,I),J=1,LENGTH)
      WRITE(IPUNCH,5100) (IWORD1(J,I),J=1,LENGTH)
 5100 FORMAT('*'/'*  ERROR:  THE NAME ',8A1,' HAS ALREADY BEEN ',
     1    'ASSIGNED AS A TRIBUTARY SUBSHED.'/'*')
 6000 JJFLAG(I) = JJFLAG(I) + 1
```

```
      IF(I.LT.N2) GO TO 2000                                            NCH00760
      RETURN                                                            NCH00770
C                                                                       NCH00780
C---- WRITE A WARNING MESSAGE IF THE SUBSHED NAME HAS ALREADY BEEN USED:NCH00790
C                                                                       NCH00800
 7000 IF(N1.LE.0) RETURN                                                NCH00810
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,7400) (IWORD2(LLL,N2),LLL=1,8)       NCH00820
C7400 FORMAT(//'OCHECK THAT A SUBSHED NAME  ',8A1,'  IS NOT DUPLICATED:'NCH00830
C    1       //'   I     IWORD1     IWORD2  IFLAG LLFLAG'/)             NCH00840
 7500 I = I + 1                                                         NCH00850
      CALL NCOMPR(LENGTH,IWORD1,I,IWORD2,N2,LFLAG)                      NCH00860
      IF(LFLAG.EQ.0) GO TO 8000                                         NCH00870
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,7700) I,(IWORD1(LLL,I),LLL=1,8),     NCH00880
C    1                (IWORD2(LLL,N2),LLL=1,8),IFLAG,LLFLAG             NCH00890
C7700 FORMAT(I4,2X,8A1,2X,8A1,2X,I5,I7)                                 NCH00900
      IF(I.LT.N1) GO TO 7500                                            NCH00910
      RETURN                                                            NCH00920
C                                                                       NCH00930
 8000 CONTINUE                                                          NCH00940
C     IF(IUNIT1.GT.0) WRITE(IUNIT1,8001) (IWORD1(J,I),J=1,LENGTH)       NCH00950
      WRITE(IPUNCH,8001) (IWORD1(J,I),J=1,LENGTH)                       NCH00960
 8001 FORMAT('*'/'*  WARNING:  THE NAME ',8A1,' HAS ALREADY BEEN ',     NCH00970
     1    'ASSIGNED AS A SUBSHED NAME.'/'*')                            NCH00980
      RETURN                                                            NCH00990
      END                                                               NCH01000
C                                                                       NCH01010
C                                                                       NCH01020
```

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C***  25 SEPTEMBER 1983    *********     DO NOT ERASE   ***    W. J. SYDORNC000010
C***********************************************************************NC000020
C                                                                       NC000030
      SUBROUTINE NCOMPR(LENGTH,IWORD1,N1,IWORD2,N2,IFLAG)               NC000040
C                                                                       NC000050
C---- THIS SUBROUTINE COMPARES IWORD1 AND IWORD2 TO SEE IF THEIR ENTRIESNC000060
C     CORRESPONDING TO N1 AND N2, RESPECTIVELY, ARE THE SAME.  IFLAG IS NC000070
C     ASSIGNED THE VALUE ZERO IF THEY ARE THE SAME, OTHERWISE IT IS     NC000080
C     ASSIGNED THE VALUE ONE.                                           NC000090
C                                                                       NC000100
      INTEGER IWORD1(LENGTH,N1),IWORD2(LENGTH,N2)                       NC000110
C                                                                       NC000120
      IFLAG = 1                                                         NC000130
      I     = 0                                                         NC000140
 1000 I     = I + 1                                                     NC000150
      IF(IWORD2(I,N2).NE.IWORD1(I,N1)) RETURN                           NC000160
      IF(I.LT.LENGTH) GO TO 1000                                        NC000170
      IFLAG = 0                                                         NC000180
      RETURN                                                            NC000190
      END                                                               NC000200
C                                                                       NC000210
C                                                                       NC000220
```

```
C***  25 SEPTEMBER 1983   **********    DO NOT ERASE   ******  W. J. SYDOR
C***********************************************************************
C
      SUBROUTINE RIGHTJ(MSG,IWORD,LENGTH,MDM,INDEX,ICHAR)
C
C---- THIS SUBROUTINE RIGHT JUSTIFIES THE INPUT WORD CONTAINED IN IWORD
C     TO THE NUMBER OF CHARACTERS SPECIFIED BY LENGTH;  CHARACTERS
C     CORRESPONDING TO ICHAR ARE DELETED FROM THE RIGHT AND BLANKS ARE
C     ADDED TO THE LEFT.
C
      DIMENSION IWORD(LENGTH,MDM)
      INTEGER LBLANK(1)/'    '/
C
      ICOUNT = 0
      IZONE2 = LENGTH + 2
 1000 IF(IWORD(LENGTH,INDEX).NE.ICHAR) RETURN
      ICOUNT = ICOUNT + 1
      DO 2000 I=2,LENGTH
         J = IZONE2 - I
 2000    IWORD(J,INDEX) = IWORD(J-1,INDEX)
         IWORD(1,INDEX) = LBLANK(1)
      IF(ICOUNT.LT.LENGTH) GO TO 1000
      RETURN
      END
C
C
```

```
C***  29 SEPTEMBER 1983   **********    DO NOT ERASE   ******  W. J. SYDOR
C***********************************************************************
C
      SUBROUTINE SUBS1(IUNITO,IALPHA,IWORD,LENGTH,N,IZONE1)
C
C---- THIS SUBROUTINE ASSIGNS UP TO 'LENGTH' CHARACTERS FROM IALPHA TO
C     IWORD BEGINNING IN COLUMN 'IZONE1' OF IALPHA.  A BLANK FOLLOWING A
C     NON-BLANK CHARACTER SIGNALS THE TERMINATION OF A WORD.  SUBROUTINE
C     RIGHTJ IS CALLED TO RIGHT JUSTIFY IWORD FILLING SPACES TO THE LEFT
C     WITH BLANKS.
C
      DIMENSION IALPHA(80),IWORD(LENGTH,N),JWORD(80)
      INTEGER  LBLANK(1)/' '/
C
C---- INITIALIZE IWORD TO BLANKS:
C
      DO 100 I=1,LENGTH
  100    IWORD(I,N) = LBLANK(1)
      IF(IZONE1.GE.80) RETURN
      DO 200 I=1,80
  200    JWORD(I) = LBLANK(1)
C
C---- IDENTIFY THE FIRST NON-BLANK COLUMN OF IALPHA WHICH OCCURS AT OR
C     FOLLOWING IZONE1:
C
      I = IZONE1 - 1
 1000 I = I + 1
      IF(I.GT.80) GO TO 5000
      IF(IALPHA(I).EQ.LBLANK(1)) GO TO 1000
C
C---- ASSIGN 'LENGTH' CHARACTERS TO JWORD:
C
      J = 0
      K = I - 1
 2000 J = J + 1
      K = K + 1
      JWORD(J) = IALPHA(K)
      IF(K.LT.80.AND.IALPHA(K).NE.LBLANK(1)) GO TO 2000
C
C---- ASSIGN CHARACTERS IN JWORD TO IWORD:
C
      IZONE1 = K
 5000 DO 6000 J=1,LENGTH
 6000    IWORD(J,N) = JWORD(J)
      CALL RIGHTJ(MSG,IWORD,LENGTH,N,N,LBLANK(1))
      RETURN
      END
C
C
```

```fortran
C***  25 SEPTEMBER 1983    **********    DO NOT ERASE   ******  W. J. SYDOR
C***********************************************************************
C
      SUBROUTINE TABLES
C
C---- THIS SUBROUTINE PRINTS AN OUTPUT TABLE LISTING THE MAXIMUM
C     DIMENSIONS A GIVEN DATA SET WILL REQUIRE FOR AN FESHM MODEL RUN.
C     CALLED BY TESTDATA AND INTERFAC.
C
      COMMON/BLK1/PRECIP(2,120),STO,AFAC(100),FC(100),REHRU(1,2,1),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(4,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,KDAM,QSCONC,NCONF
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK14/AREDAM(2,10),XLENDM(2),NLEVLS(2),VOLD(2,10),QQD(2,10)
      COMMON/BK40/KNECHA(32),KNSTRP(32),KLHSSP(32),KNESTR(32,20)
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BKWOLF/IWOLF,MECHAN,MHRU,MESTRP,MPART,MSTRPS,
     1       PUSLE(163),SMCHRU(163)
C
      MNSTRP = MESTRP + 1
      MNCHAN = MECHAN + 1
      NOSTEP = NSECC/INT(DTO)
      NCSTEP = NSECC/INT(DTC)
      IF(IUNIT7.GT.0) WRITE(IUNIT7,9920) NGAGES,NPCINT,NTSS,NLANUS,
     1          NDHRUS,NTELES,MHRU,MSTRPS,MESTRP,MNSTRP,MECHAN,MNCHAN,
     2          NOSTEP,NCSTEP
 9920 FORMAT('1'//'0REQUIRED DIMENSIONS FOR AN FESHM MODEL RUN:'/
     1         '+____________________________________________'///
     29X,'THE NUMBER OF RAINGAGES                      (NGAGES): ',I6/
     39X,'THE NUMBER OF RAINFALL INCREMENTS            (NPCINT): ',I6/
     7                  /
     49X,'THE NUMBER OF SUBSHEDS                       (NTSS  ): ',I6/
     59X,'THE NUMBER OF LANDUSE TYPES                  (NLANUS): ',I6/
     69X,'THE NUMBER OF HRUS                           (NDHRUS): ',I6/
     79X,'THE TOTAL NUMBER OF ELEMENTS                 (NTELES): ',I6/
     7                  /
     89X,'THE MAXIMUM NUMBER OF HRUS IN AN ELEMENT     (MHRU  ): ',I6/
     99X,'THE MAXIMUM NUMBER OF FLOWSTRIPS IN A SUBSHED (MSTRPS): ',I6/
     *9X,'THE MAXIMUM NUMBER OF ELEMENTS IN A FLOWSTRIP (MESTRP): ',I6/
     19X,'THE MAXIMUM NUMBER OF NODES IN A FLOWSTRIP    (MNSTRP): ',I6/
     29X,'THE MAXIMUM NUMBER OF CHANNEL ELEMENTS        (MECHAN): ',I6/
     39X,'THE MAXIMUM NUMBER OF NODES IN A CHANNEL REACH (MNCHAN):',I7//
     39X,'THE MAXIMUM NUMBER OF OVERLAND TIME STEPS     (NOSTEP): ',I6/
     39X,'THE MAXIMUM NUMBER OF CHANNEL  TIME STEPS     (NCSTEP):',I7/)
      RETURN
      END
C
C
```

```
C***  25 SEPTEMBER 1983   **********   DO NOT ERASE  ******  W. J. SYDOR
C***************************************************************************
C
      SUBROUTINE TITLE(IANSWR,INDEX,IUNIT)
C
C---- THIS SUBROUTINE READS AN INPUT TITLE LINE.  IF INDEX IS GREATER
C     THAN ZERO, THE TITLE IS WRITTEN TO IPUNCH.
C
      COMMON/CNTL/IUNIT1,IUNIT2,IUNIT4,IUNIT5,IUNIT6,IUNIT7,IPUNCH,
     &       KNDRDR,BRANCH,MESAGE
      COMMON/BTITLE/NTITLE,MTITLE,MDM,LTITLE(80,10),IFRMT(20),LMONTH(12)
      INTEGER LSTAR1(1)/'*'/
      INTEGER NQ(1)/'Q'/,NU(1)/'U'/,NI(1)/'I'/,NT(1)/'T'/
C
      IANSWR = 0
  500 IF(INDEX.LT.10) READ (IUNIT4,1000,END=5000) (LTITLE(J,1),J=1,80)
      IF(INDEX.GE.10) READ (IUNIT5,1000,END=5000) (LTITLE(J,1),J=1,80)
      IF(LTITLE(1,1).NE.LSTAR1(1)) GO TO 600
C     WRITE(IUNIT6,591)
C 591 FORMAT('0            COMMENT RECEIVED       '//)
      GO TO 500
  600 DO 650 I=1,10
  650    IF(LTITLE(I,1).EQ.NQ(1).AND.LTITLE(I+1,1).EQ.NU(1).AND.
     1      LTITLE(I+2,1).EQ.NI(1).AND.LTITLE(I+3,1).EQ.NT(1)) IANSWR=-3
      IF(IANSWR.EQ.-3) RETURN
      IF(IUNIT7.LE.0.OR.IUNIT.LE.0) GO TO 700
      WRITE(IUNIT7,2000) (LTITLE(J,1),J=1,80)
  700 IF(IUNIT1.LE.0.OR.IUNIT.LE.0) GO TO 800
      WRITE(IUNIT1,1000) (LTITLE(J,1),J=1,80)
  800 IF(INDEX.LT.10) GO TO 4000
      WRITE(IPUNCH,3000) (LTITLE(J,1),J=1,80)
 1000 FORMAT(80A1)
 2000 FORMAT('1'//'0',80A1//)
 3000 FORMAT(80A1/'*'/'*')
 4000 CONTINUE
 5000 BACKSPACE IUNIT5
 9900 RETURN
      END
C
C
```

Appendix A.2 Additional Parameter Definitions and Glossary of External Variables

Parameters not identified in the context of COMMENT statements in the corresponding preceding programs are described below. These are followed by a description of external variables.

ADDITIONAL PARAMETER DEFINITIONS

Common Block CNTL - IUNIT1, IUNIT3, IUNIT4, IUNIT5, IUNIT6, IUNIT7, IPUNCH are input/output (read/write) unit numbers for the programs:

IUNIT7	was used for writing intermediate scratch outputs during program development and is not needed for program implementation.
IUNIT3	is used by the interval program for the assignment of the read input describing the format of input data the standard V.P.I. format is not employed.
IUNIT4	is used for input unit designator for data files; required by all programs except SETUP.
IUNIT5	is used to read from the terminal.
IUNIT6	is used to write to the terminal.
IUNIT7	is used as the output file designator for files containing lines up to 133 characters in length, i.e., listing output files.
IPUNCH	is used as the output file indicator for files containing lines up to 80 characters in length.
KNDRDR	was not used.
BRANCH	was not used.
MESAGE	was not used.

COMMON BLOCK BKNUM contains number and Roman numeral descriptors:

NUMBER	contains the integers from 1-100.
LROMAN	contains the Roman numerals from 1-17.

COMMON BLOCK SYMBOLS contains symbols used in input data read comparisons.

LALPHA	contains the letters of the alphabet A-Z.
LDIGIT	contains the digits 0-9 and symbols '.', '-', and '+'
LBLANK	contains the blank character.
LDASH	contains '-'
LDOT	contains '.'
LPLUS	contains '+'
LSTAR	contains '*'

COMMON BLOCK DELT contains the following parameters:

DTOMIN	the minimum calculated time step for overland flow based on overland flow characteristics in the watershed.
DTCMIN	The minimum calculated time step for channel flow based on channel flow parameters within the watershed.
SLOPE	The slope value against which the ratio of relief-to-length is compared.

COMMON BLOCK BKS contains subshed name and relationship information:

NSUBS	is the number of subsheds present.
NNSUBS	is the matrix containing subshed names.
NNT1	is the matrix of first tributary subshed names.
NNT2	is the matrix of second tributary subshed names.
NNT3	is the matrix of third tributary subshed names.

COMMON BLOCK BTITLE contains title information:

NTITLE	is the number of title lines present.
MTITLE	is the maximum number of title lines allowed.
MDM	is a maximum dimension indicator (set equal to 80).
LTITLE	is the input title matrix.
LFRMT	is not used.
LMONTH	is a vector of month name abbreviations.

COMMON BLOCK BKZ contains name vector information:

ZN	contains the words FIRST, SECOND, etc.
NNBASE	contains the word 'BASE'.
NNDATA	contains the word 'DATA'.
NNDEFA	contains the letters 'DEFA' (from 'default').
NNQUIT	contains the word 'QUIT'.
NNSTAR	contains '*** '
LLFRMT	is not used.

COMMON BK40 contains number of element vectors:

KNECHA	is the number of channel elements in each subshed.
KNSTRP	is the number of flow strips in each subshed.
KLHSSP	is the number of flowstrips on the left side of the channel in each subshed.
KNESTR	is the number of elements in each flowstreip of each subshed.

COMMON BLOCK BK41 contains re-dimensioned overland flow parameters:

ZXLEN	are the lengths of each flowstrip within each subshed (XLEN).
ZRELIE	are the values of the relief parameters for each flowstrip within each subshed (RELIEF).
ZAREA	are the values of the flow strip areas within each subshed (AREA).
ZWIDTH	are the values of the top width of each flow strip within each subshed (TWIDTH).
KNDAMS	is the number of flood control structures in each subshed.

COMMON BLOCK BK42 contains redimensioned channel flow parameter characteristics:

YXLEN(I,J)	is the length (XLEN) of the Jth channel in the Ith subshed.
YRELIE(I,J)	is the relief (RELIEF) of the Jth channel element in the Ith subshed.
YTWIDT(I,J)	is the topwidth (TWIDTH) of the Jth channel element in the Ith subshed.
YHT(I,J)	is the height (HT) of the Jth channel element in the Ith subshed.
YRCOEF(I,J)	is the roughness coefficient for the Jth channel element in the Ith subshed.
YBASE(I,J)	is the base of the trapezoid (BASE) of the Jth channel element in the Ith subshed.
KKNDAM(I)	is the number of dams on channels in the Ith subshed.

GLOSSARY

DEFINITIONS of PARAMETERS IN FESHM & INTERFACE PROGRAMS

AFLU	value of 'A' in Holtan's equation for a given landuse
AREA	area, in acres, of the element in a given strip
AREDAM	area, in acres, of a flood-detention structure
BASE	base of trapezoid (default is 0.0 feet) (generalized trapezoidal crossection)
CUSLE	cropping-management factor C from USLE equation
DEPTH	depth of the 'A' horizon
DIA	diameter of particular particle type (mm)
DSLU	potential depression storage for a given element
DTO	time increment for overland flow calculations in seconds
FAW	available water potential as a fraction of soil profile
FC	final infiltration rate
FGW	gravity water potential as a fraction of soil profile
FHRU	area of an HRU as a fraction of a given element
HT	depth for topwidth (default is 2.0 feet) (generalized trapezoidal crossection)
IHRU	identifying number of an HRU for a given element
INTPCM	precipitation time interval in minutes INTPCM = INTPCS/60
INTPCS	time interval of precipitation records
LANDU	landuse number for a particular HRU
LHSSPS	number of strips on left side of channel
MONTH	month in which storm occurs
N	a counter for the number of intervals in precipitation records
NCONF1	number of first channel entering confluence
NCONF2	number of second channel entering confluence
NCONF3	number of third channel entering confluence
NCPRIN	time interval for channel flow output display (seconds)
NCOUNT	the number of intervals per hour
NDAMS	number of dams in given strip (same value for each element in the strip)
NDAY	the day corresponding to the input rainfall record
NDHRUS	number of different types of HRUs in the watershed
NECHAN	number of channel elements in the subshed
NGAGES	number of rain gages in the watershed
NHOUR	the hour corresponding to the time of the breakpoints for the input rainfall records
NHOURC	number of hours in the output discharge record
NHOURR	number of hours of rainfall
NHRU	number of HRUs in a given element
NLANUS	number of different types of land uses in watershed
NLEVLS	number of volume-discharge levels describing the discharge hydrograph of the flood-detention structure
NMIN	the minute corresponding to the time of the breakpoints for the input rainfall records
NMONTH	the month corresponding to the input rainfall record
NNTRVL	storm duration in hours
NOPRIN	time interval for overland flow output display (seconds)

NPART	number of particle types in a particular soil
NPCINT	number of precipitation intervals for the storm NPCINT = NSECR/INTPCS
NPOVER	print code controlling overland flow output for a given subshed
NRGAGE	number of raingages affecting a given element; not necessary when NGAGES = 1 Note: when more than one raingage is employed, there can be no more than 80 elements.
NRAIN	a data read/write control designator: if NRAIN>0, the program terminates following read/write of input precipitation data; if NRAIN<1, the program processes a complete data set.
NSECC	=3600*NHOURC
NSECR	number of seconds of rainfall NSECR = 3600 * NHOURR
NSED	index indicating if sediment calculations are desired; if NSED=1, sediment calculations are performed
NSOIL	soil type number for each HRU
NST	number of soil types in the watershed
NSTART	starting time of storm
NSTRPS	number of strips in a given overland flow plane
NTELES	total number of elements in the watershed
NTSS	number of subsheds in the watershed
NYEAR	year in which storm occurs
PCINTH	precipitation time interval in hours PCINTH=INTPCM/60.0 NSECC=3600*NHOURC
PRECIP	precipitation records for each raingage and time interval
PUSLE	contouring factor P from USLE equation
QQD	discharge from the flood-detention structure for a given volume-discharge level
RAIN	the rainfall intensity (inches/hour). If input data is given in other units, enter the value of the multiplier needed to convert to inches/hour as the value for "factor"
RAININ	the input rainfall intensity (original data units)
RCLU	roughness coefficient in Manning's equation for a given landuse type
RCOEF	roughness coefficient of the element in the channel
RELDAM	relief of the flood-detention structure drainage element
RELIEF	relief of the element in a given strip
SG	specific gravity of a particular particle type
SLOHRU	slope class for each HRU
SMCHRU	antecedent soil moisture as a fraction of field capacity for each individual HRU
SMCWS	antecedent soil moisture as a fraction of field capacity for the entire watershed
TOTAL	accumulated rainfall recorded at the raingage
TYPE	amount of particle type as a fraction of total amount of soil (expressed as a decimal)
TWDAM	top width of the downstream node of the flood-detention structure drainage element

TWIDTH	top width of the downstream node of the element in the channel for a 2-foot depth (triangular crossection)
VOLD	volume, in acre-feet, of the detention pond for a given volume discharge level
XKUSLE	erodibility factor K from USLE equation
XLEN	length of the element in a given strip
XLEN	length of the element in the channel
XLENDM	length of the flood-detention structure drainage element

Appendix B. FESHM Program Listing

A program listing of the FESHM is provided on the following pages.

```
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(80,120),NRGAGE(80)
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)
     1,DSLU(25)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      NZIP=1
      CALL INPUT
      CALL EXCESS
      NZIP=8
      CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)
      NELEM=0
      NCONF=0
      DO 85 NSSHED=1,NTSS
      CALL OVERL
85    CALL CHANL
      STOP
      END
C
C
C***********************************************************************
C
C
      SUBROUTINE INPUT
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120),
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)
      COMMON/BLK2/REFE(80,120),NRGAGE(80)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)
     1,DSLU(25)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      DIMENSION ITITLE(20)
      GO TO (99,98,97,96,95),NZIP
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C     PUT ONE LINE TITLE AT TOP OR THE COMBINED DATA SET
C     --IT SHOULD PRECEDE THE PRINT CONTROL FILE--
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
```

```
C***********DATA SET NUMBER 1:  DESCRIPTION OF OUTPUT TABLES************
C--------IF NTBLHS=1 TABLE LISTING HRU'S AND DESCRIPTIVE CHARACTERISTICS
C           IS PRINTED; IF NTBLHS=0 IT IS NOT
C--------IF NTBLPE=1 TABLE LISTING PRECIPITATION AND PRECIPITATION
C           EXCESS FOR BOTH HRU'S AND ELEMENTS IS PRINTED; IF NTBLPE=0
C           IT IS NOT
C--------NOPRIN = TIME INTERVAL AT WHICH OVERLAND FLOW OUTPUT IS
C           DISPLAYED
C--------NCPRIN = TIME INTERVAL AT WHICH CHANNEL FLOW OUTPUT IS
C           DISPLAYED
99    CONTINUE
      READ(5,12345)ITITLE
12345     FORMAT(20A4)
      WRITE(6,54321)ITITLE
54321     FORMAT(' ',20A4)
      READ(5,10)NTBLHS,NTBLPE,NOPRIN,NCPRIN
10    FORMAT(2I5,2I10)
C--------NPOVER = PRINT CODE CONTROLLING OVERLAND FLOW OUTPUT FOR
C           A GIVEN SUB-SHED
C             NPOVER=0; NO OUTPUT
C                   =1; OUTPUT FOR BOTTOM NODES OF STRIPS ONLY
C                   =2; OUTPUT AT ALL NODES OF SELECTED STRIPS
C                       FOR WHICH ADDITIONAL CODES MUST BE READ
      READ(5,100)(NPOVER(K),K=1,40)
100   FORMAT(40I2)
C*******NOTE*** ADDING NPSTRP CONTROLS TO PROGRAM...SMT 2/18/82*********
         DO 104 K=1,40
           IF (NPOVER(K).NE.2) GO TO 104
C---------NPSTRP = PRINT CODE FOR OVERLAND FLOW AT ALL NODES
C         OF SELECTED STRIPS
C             NPSTRP=0; NO OUTPUT FOR STRIP
C                   =1; OUTPUT AT ALL NODES OF THE STRIP
        READ(5,100)(NPSTRP(K,I),I=1,40)
 104    CONTINUE
C*****************END OF NEW INPUT**************************************
C--------NPCHAN = PRINT CODE CONTROLLING CHANNEL FLOW OUTPUT FOR
C           A GIVEN SUB-SHED
C             NPCHAN=0; NO OUTPUT
C                   =1; OUTPUT FOR BOTTOM NODE OF CHANNEL ONLY
C                   =2; OUTPUT AT ALL NODES OF THE CHANNEL
      READ(5,100)(NPCHAN(K),K=1,40)
      GO TO 40
C**********DATA SET NUMBER 2:  DESCRIPTION OF THE STORM EVENT***********
C--------NGAGES = NUMBER OF RAIN GAGES IN THE WATERSHED
C--------NHOURR = NUMBER OF HOURS OF RAINFALL
C--------INTPCS = TIME INTERVAL OF PRECIPITATION RECORDS
C--------SMCWS = ANTECEDENT SOIL MOISTURE AS A FRACTION OF
C           FIELD CAPACITY FOR THE ENTIRE WATERSHED
95    READ(5,7)NGAGES,NHOURR,NHOURC,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     >SMCWS
7     FORMAT(4I10,4I5,F5.0)
C--------NSTART = STARTING TIME OF STORM
C--------MONTH = MONTH IN WHICH STORM OCCURS
C--------NDAY = DAY IN WHICH STORM OCCURS
C--------NYEAR = YEAR IN WHICH STORM OCCURS
C--------NSECR = NUMBER OF SECONDS OF RAINFALL
      NSECR=3600*NHOURR
C--------NPCINT = NUMBER OF PRECIPITATION INTERVALS FOR THE STORM
      NPCINT=NSECR/INTPCS
C--------INTPCM = PRECIPITATION TIME INTERVAL IN MINUTES
      INTPCM=INTPCS/60
C--------PCINTH = PRECIPITATION TIME INTERVAL IN HOURS
      PCINTH=INTPCM/60.0
      NSECC=3600*NHOURC
      DO 12 I=1,NGAGES
C--------PRECIP = PRECIPITATION RECORDS FOR EACH RAIN GAGE AND
C           TIME INTERVAL
12    READ(5,9)(PRECIP(I,JX),JX=1,NPCINT)
9     FORMAT(8F10.5)
      IF(NGAGES.EQ.1)GO TO 50
C--------NRGAGE = NUMBER OF RAIN GAGE AFFECTING A GIVEN ELEMENT;
C           NOT NECESSARY WHEN NGAGES=1
      READ(5,8)(NRGAGE(L),L=1,80)
8     FORMAT(80I1)
      GO TO 52
```

```
50    DO 53 L=1,80
53    NRGAGE(L)=1
52    READ(5,55)(GINDEX(I),I=1,12)
      IF(SMCWS.GT.0.0)GO TO 54
      READ(5,55)(EVP(I),I=1,12)
55    FORMAT(12F6.2)
      DO 58 J=1,NGAGES
      READ(5,56)(DAILPC(J,I),I=1,30)
56    FORMAT(8F10.5)
58    CONTINUE
C*************DATA SET NUMBER 3:  INDEXING CONTROL FOR HRUS*************
C--------NTSS = NUMBER OF SUB-SHEDS IN THE WATERSHED
C--------NTELES = TOTAL NUMBER OF ELEMENTS IN THE WATERSHED
C--------NDHRUS = NUMBER OF DIFFERENT TYPES OF HRU'S IN THE WATERSHED
C--------NLANUS=NUMBER OF DIFFERENT TYPES OF LAND USES IN THE WATERSHED
54    READ(5,1)NTSS,NTELES,NDHRUS,NLANUS
1     FORMAT(4I10)
      DO 6 I=1,NTELES
C--------NHRU = NUMBER OF HRU'S IN A GIVEN ELEMENT
      READ(5,3)NHRU(I)
3     FORMAT(I10)
      N=NHRU(I)
C--------IHRU = IDENTIFYING NUMBER OF AN HRU FOR A GIVEN ELEMENT
      READ(5,4)(IHRU(I,J),J=1,N)
4     FORMAT(10I8)
C--------FHRU = AREA OF AN HRU AS A FRACTION OF A GIVEN ELEMENT
6     READ(5,5)(FHRU(I,J),J=1,N)
5     FORMAT(10F8.4)
C***********DATA SET NUMBER 4:  DESCRIPTION OF HRU PROPERTIES***********
C--------AFLU = VALUE OF 'A' IN HOLTAN'S EQUATION FOR A GIVEN LAND USE
C           TYPE
      READ(5,33)(AFLU(I),I=1,NLANUS)
C--------DSLU = POTENTIAL DEPRESSION STORAGE FOR A GIVEN ELEMENT
      READ(5,33)(DSLU(I),I=1,NLANUS)
C--------RCLU = ROUGHNESS COEFFICIENT IN MANNING'S EQUATION FOR A GIVEN
C           LAND USE TYPE
      READ(5,33)(RCLU(I),I=1,NLANUS)
33    FORMAT(8F10.2)
      DO 21 I=1,NDHRUS
C--------LANDU = LAND USE NUMBER FOR A PARTICULAR HRU
C--------FAW = AVAILABLE WATER POTENTIAL AS A FRACTION OF SOIL PROFILE
C--------FGW = GRAVITY WATER POTENTIAL AS A FRACTION OF SOIL PROFILE
C--------FC = FINAL INFILTRATION RATE
C--------DEPTH = DEPTH OF THE 'A' HORIZON
C--------SLOHRU = SLOPE CLASS FOR EACH HRU
21    READ(5,22)LANDU(I),FAW(I),FGW(I),FC(I),DEPTH(I),SLOHRU(I),CUSLE(I)
     1,XKUSLE(I)
22    FORMAT(I10,3F10.3,F10.0,9X,A1,2F10.3)
C*****DATA SET NUMBER 5:  TIME INCREMENTS AND ORDERING OF CHANNELS******
C--------DTO = TIME INCREMENT FOR OVERLAND FLOW CALCULATIONS IN SECONDS
C--------DTC = TIME INCREMENT FOR CHANNEL FLOW CALCULATIONS IN SECONDS
      READ(5,51)DTO,DTC
51    FORMAT(2F10.0)
      IF(NTSS.EQ.1)GO TO 40
      NTSSX=NTSS+1
C--------BOUNDARY CONDITION CODE FOR CHANNEL; NOT NECESSARY WHEN NTSS=1
C              NODE1=0; DISCHARGE IS ZERO AT UPSTREAM NODE OF CHANNEL
C                   =1; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A
C                       STREAM CONFLUENCE OF TWO CHANNELS
C                   =2; TOTAL DISCHARGE FROM WATERSHED IS SUM OF
C                       DISCHARGE FROM LAST TWO SUBSHEDS
C                   =3; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A
C                       SINGLE CHANNEL (USED TO SUBDIVIDE AN EXISTING
C                       SUBSHED INTO SMALLER SUBSHEDS)
C                   =4; UPSTREAM NODE OF CHANNEL IS DOWNSTREAM FROM A
C                       STREAM CONFLUENCE OF THREE CHANNELS
C                   =5; TOTAL DISCHARGE FROM WATERSHED IS SUM OF
C                        DISCHARGE FROM LAST THREE SUBSHEDS
      READ(5,25)(NODE1(I),I=1,NTSSX)
25    FORMAT(16I5)
      DO 30 I=1,NTSSX
      IF(NODE1(I).EQ.0)GO TO 30
      IF(NODE1(I).GE.4)GO TO 31
```

```
C--------NCONF1 = NUMBER OF FIRST CHANNEL ENTERING CONFLUENCE           FES02120
C--------NCONF2 = NUMBER OF SECOND CHANNEL ENTERING CONFLUENCE          FES02130
C--------NCONF3 = NUMBER OF THIRD CHANNEL ENTERING CONFLUENCE           FES02140
      READ(5,35)NCONF1(I),NCONF2(I)                                     FES02150
35    FORMAT(2I5)                                                       FES02160
      GO TO 30                                                          FES02170
31    READ(5,36)NCONF1(I),NCONF2(I),NCONF3(I)                           FES02180
36    FORMAT(3I5)                                                       FES02190
30    CONTINUE                                                          FES02200
      GO TO 40                                                          FES02210
C********DATA SET NUMBER 6:  OVERLAND FLOW ELEMENT DESCRIPTORS**********FES02220
C--------NSTRPS = NUMBER OF STRIPS IN A GIVEN OVERLAND FLOW PLANE       FES02230
C--------LHSSPS = NUMBER OF STRIPS ON LEFT SIDE OF CHANNEL              FES02240
C--------NECHAN = NUMBER OF CHANNEL ELEMENTS IN THE SUBSHED             FES02250
98    READ(5,89)NSTRPS,LHSSPS,NECHAN                                    FES02260
89    FORMAT(3I5)                                                       FES02270
      READ(5,92)(NESTRP(I),I=1,NSTRPS)                                  FES02280
92    FORMAT(16I5)                                                      FES02290
      GO TO 40                                                          FES02300
97    DO 70 I=1,NE                                                      FES02310
C--------XLEN = LENGTH OF THE ELEMENT IN A GIVEN STRIP                  FES02320
C--------RELIEF = RELIEF OF THE ELEMENT IN A GIVEN STRIP                FES02330
C--------AREA = AREA, IN ACRES, OF THE ELEMENT IN A GIVEN STRIP         FES02340
C--------TWIDTH = TOP WIDTH OF THE DOWNSTREAM NODE OF THE ELEMENT IN A  FES02350
C             GIVEN STRIP                                               FES02360
C--------NDAMS = NUMBER OF DAMS IN A GIVEN STRIP (SAME VALUE FOR EACH   FES02370
C             ELEMENT IN THE STRIP)                                     FES02380
70    READ(5,75)XLEN(I),RELIEF(I),AREA(I),TWIDTH(I+1)                   FES02390
75    FORMAT(2F10.0,F10.1,F10.0)                                        FES02400
      GO TO 40                                                          FES02410
C*********DATA SET NUMBER 8:  CHANNEL FLOW ELEMENT DESCRIPTORS**********FES02420
96    DO 90 K=1,NE                                                      FES02430
C--------XLEN = LENGTH OF THE ELEMENT IN THE CHANNEL                    FES02440
C--------RELIEF = RELIEF OF THE ELEMENT IN THE CHANNEL                  FES02450
C--------RCOEF = ROUGHNESS COEFFICIENT OF THE ELEMENT IN THE CHANNEL    FES02460
C--------TWIDTH = TOP WIDTH OF THE DOWNSTREAM NODE OF THE ELEMENT       FES02470
C             IN THE CHANNEL FOR A 2-FOOT DEPTH (TRIANGULAR XSECTION)   FES02480
C*** GENERALIZED TRAPEZOIDAL XSECTION*** MDS 4/7/82                     FES02490
C                                                                       FES02500
C        HT = DEPTH FOR TOPWIDTH (DEFAULT IS 2.0 FEET)                  FES02510
C        BASE = BASE OF TRAPEZOID (DEFAULT IS 0.0 FEET)                 FES02520
C                                                                       FES02530
      READ(5,71)XLEN(K),RELIEF(K),RCOEF(K),TWIDTH(K+1),HT(K+1),BASE(K+1)FES02540
71    FORMAT(6F10.4)                                                    FES02550
      IF(HT(K+1).LE.0.0) HT(K+1)=2.0                                    FES02560
90    CONTINUE                                                          FES02570
40    RETURN                                                            FES02580
      END                                                               FES02590
C                                                                       FES02600
C                                                                       FES02610
C***********************************************************************FES02620
C                                                                       FES02630
C                                                                       FES02640
C                                                                       FES02650
C                                                                       FES02660
C***********************************************************************FES02670
C                                                                       FES02680
C                                                                       FES02690
      SUBROUTINE EXCESS                                                 FES02700
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120), FES02710
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)  FES02720
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                               FES02730
      COMMON/BLK2/REFE(80,120),NRGAGE(80)                               FES02740
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)  FES02750
     1,DSLU(25)                                                         FES02760
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)            FES02770
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,FES02780
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,FES02790
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,NDFES02800
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF                              FES02810
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)                FES02820
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)       FES02830
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES02840
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1 FES02850
     111)                                                               FES02860
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      DIMENSION SLOPCL(11),SLOPCO(11)
      DATA SLOPCL/'A','B','C','D','E','F'/
      DATA SLOPCO/1.00,0.80,0.60,0.40,0.20,0.00/
      NZIP=5
      CALL INPUT
      NZIP=7
      CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)
      DO 21 I=1,NDHRUS
      ACCDP(I)=0.0
      KIHRU(I)=0
      DO 22 K=1,6
      IF(SLOPCL(K).EQ.SLOHRU(I))GO TO 24
22    CONTINUE
24    J=LANDU(I)
      AFAC(I)=AFLU(J)
      DEPSTO(I)=SLOPCO(K)*DSLU(J)
      IF(AFAC(I).LE.0.0)GO TO 20
      CEXP(I)=FGW(I)/FAW(I)
      GO TO 23
20    CEXP(I)=0.0
23    STOMAX(I)=(FAW(I)+FGW(I))*DEPTH(I)
21    CONTINUE
      IF(NTBLHS.EQ.0)GO TO 60
      NZIP=2
      CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)
60    DO 120 I=1,NGAGES
      DO 103 L=1,NTELES
      IF(NRGAGE(L).NE.I)GO TO 103
      N=NHRU(L)
      DO 102 M=1,N
      MN=IHRU(L,M)
      KIHRU(MN)=I
102   CONTINUE
103   CONTINUE
      WRITE(6,959)
959   FORMAT(4X,'HRU',7X,'SMC',6X,'CUSLE',4X,'XKUSLE',/)
55    DO 17 K=1,NDHRUS
      IF(KIHRU(K).NE.I)GO TO 17
      IF(AFAC(K).LE.0.0)GO TO 58
      SMC=SMCWS
      IF(SMCWS.GT.0.0)GO TO 56
      DPAW=FAW(K)*DEPTH(K)
      XLEVEL=0.5*DPAW
      STOI=STOMAX(K)-XLEVEL
      DO 1 L=1,30
      XLEVEL=XLEVEL+DAILPC(I,L)
      IF(XLEVEL.GE.STOMAX(K))XLEVEL=STOMAX(K)
      IF(XLEVEL.GE.DPAW)GO TO 52
      WOUT=0.0
      GO TO 54
52    DEPSEP=24.0*FC(K)
      IF(L.EQ.30)DEPSEP=FLOAT(NSTART-1)*DEPSEP/24.0
      IF(DEPSEP.GT.(XLEVEL-DPAW))GO TO 53
      WOUT=DEPSEP
      GO TO 54
53    WOUT=XLEVEL-DPAW
54    ADJLEV=XLEVEL-WOUT
      EVPOR=EVP(MONTH)
      IF((NDAY+L).LE.30)EVPOR=EVP(MONTH-1)
      WOUT=((ADJLEV/DPAW)*EVPOR)/30.0
      IF(ADJLEV.GT.DPAW)WOUT=EVPOR/30.0
      IF(DAILPC(I,L).GT.0.0)WOUT=WOUT/2.0
      IF(L.EQ.30)WOUT=FLOAT(NSTART-1)*WOUT/24.0
      XLEVEL=ADJLEV-WOUT
1     STOI=STOMAX(K)-XLEVEL
      SMC=XLEVEL/DPAW
      IF(SMC.LE.0.0)SMC=0.0
      WRITE(6,59)K,SMC,CUSLE(K),XKUSLE(K)
59    FORMAT(I10,3F10.3)
      GO TO 57
56    STOI=STOMAX(K)-(SMC*FAW(K)*DEPTH(K))
      IF(STOI.LT.0.0)STOI=0.0
57    STO=STOI
58    DO 12 J=1,NPCINT
      IF(AFAC(K).LE.0.0)GO TO 41
```

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      CALL HOLTAN(K,I,J,PCINTH,MONTH)                                   FES03620
      GO TO 12                                                          FES03630
41    REHRU(K,I,J)=PRECIP(I,J)                                          FES03640
      IF(ACCDP(K).GE.DEPSTO(K))GO TO 12                                 FES03650
      REHRU(K,I,J)=PRECIP(I,J)-DEPSTO(K)+ACCDP(K)                       FES03660
      IF(REHRU(K,I,J).LE.0.0)REHRU(K,I,J)=0.0                           FES03670
      ACCDP(K)=ACCDP(K)+PRECIP(I,J)                                     FES03680
      IF(ACCDP(K).GT.DEPSTO(K))ACCDP(K)=DEPSTO(K)                       FES03690
12    CONTINUE                                                          FES03700
17    CONTINUE                                                          FES03710
120   CONTINUE                                                          FES03720
      DO 14 I=1,NGAGES                                                  FES03730
      DO 31 M=1,NDHRUS                                                  FES03740
31    KIHRU(M)=0                                                        FES03750
      DO 13 L=1,NTELES                                                  FES03760
      IF(NRGAGE(L).NE.I)GO TO 13                                        FES03770
      K=NHRU(L)                                                         FES03780
      DO 101 M=1,K                                                      FES03790
      MN=IHRU(L,M)                                                      FES03800
      KIHRU(MN)=I                                                       FES03810
101   CONTINUE                                                          FES03820
      IF(NRGAGE(L).NE.I)GO TO 13                                        FES03830
      DO 15 J=1,NPCINT                                                  FES03840
      REFE(L,J)=0.0                                                     FES03850
      MHRU=NHRU(L)                                                      FES03860
      DO 16 N=1,MHRU                                                    FES03870
      K=IHRU(L,N)                                                       FES03880
      REFE(L,J)=REFE(L,J)+REHRU(K,I,J)*FHRU(L,N)                        FES03890
16    CONTINUE                                                          FES03900
15    CONTINUE                                                          FES03910
13    CONTINUE                                                          FES03920
      IF(NTBLPE.EQ.0)GO TO 14                                           FES03930
      NZIP=1                                                            FES03940
      CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)                               FES03950
14    CONTINUE                                                          FES03960
      RETURN                                                            FES03970
      END                                                               FES03980
C                                                                       FES03990
C                                                                       FES04000
C***********************************************************************FES04010
C                                                                       FES04020
C                                                                       FES04030
      SUBROUTINE HOLTAN(K,I,J,PCINTH,MONTH)                             FES04040
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120), FES04050
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)  FES04060
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                               FES04070
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)                FES04080
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES04090
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1 FES04100
     11)                                                                FES04110
      RECMAX=FC(K)*PCINTH                                               FES04120
      STANWT=PRECIP(I,J)+ACCDP(K)                                       FES04130
      IF(STO.EQ.0.0.AND.FC(K).EQ.0.0)GO TO 9                            FES04140
      IF(STO.GT.0.0)GO TO 77                                            FES04150
      XINF=RECMAX                                                       FES04160
      GO TO 8                                                           FES04170
77    F1=GINDEX(MONTH)*AFAC(K)*STO**CEXP(K)+FC(K)                       FES04180
      XP=STO-STANWT                                                     FES04190
      F2=FC(K)                                                          FES04200
      IF(XP.GT.0.0)F2=GINDEX(MONTH)*AFAC(K)*XP**CEXP(K)+FC(K)           FES04210
      FA=(F1+F2)/2.0                                                    FES04220
      TA=STANWT/FA                                                      FES04230
      EPS1=0.0                                                          FES04240
      IF(TA.LE.PCINTH)GO TO 2                                           FES04250
1     EPS1=EPS1+0.00015                                                 FES04260
      TESTIN=STANWT-EPS1                                                FES04270
      XXP=STO-TESTIN                                                    FES04280
      F2=FC(K)                                                          FES04290
      IF(XXP.GT.0.0)F2=GINDEX(MONTH)*AFAC(K)*XXP**CEXP(K)+FC(K)         FES04300
      FA=(F1+F2)/2.0                                                    FES04310
      TA=TESTIN/FA                                                      FES04320
      IF(TA.GT.PCINTH)GO TO 1                                           FES04330
      XINF=TESTIN                                                       FES04340
      GO TO 7                                                           FES04350
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2     CONTINUE                                                          FES04360
      XINF=STANWT                                                       FES04370
      IF(XINF.LE.STO)GO TO 7                                            FES04380
      XINF=STO                                                          FES04390
      STO=0.0                                                           FES04400
      GO TO 8                                                           FES04410
9     XINF=0.0                                                          FES04420
      REHRU(K,I,J)=STANWT-DEPSTO(K)                                     FES04430
      IF(REHRU(K,I,J).LE.0.0)REHRU(K,I,J)=0.0                           FES04440
      GO TO 75                                                          FES04450
7     STO=STO-XINF                                                      FES04460
8     REHRU(K,I,J)=STANWT-(XINF+DEPSTO(K))                              FES04470
      IF(REHRU(K,I,J).LT.0.0)REHRU(K,I,J)=0.0                           FES04480
      IF(STO.LT.0.0)STO=0.0                                             FES04490
      AVM=FAW(K)*DEPTH(K)                                               FES04500
      GRM=STOMAX(K)-AVM                                                 FES04510
      WATER=STOMAX(K)-STO                                               FES04520
      GRWAT=AVM-WATER                                                   FES04530
      IF(GRWAT.GT.0.0)GO TO 75                                          FES04540
      IF(PRECIP(I,J).GE.RECMAX)GO TO 75                                 FES04550
      RECOV=RECMAX-PRECIP(I,J)                                          FES04560
      IF(RECOV.GT.ABS(GRWAT))RECOV=ABS(GRWAT)                           FES04570
      STO=STO+RECOV                                                     FES04580
      IF(STO.GT.GRM)STO=GRM                                             FES04590
75    REMAIN=STANWT-XINF                                                FES04600
      IF(REMAIN.LT.DEPSTO(K))GO TO 70                                   FES04610
      ACCDP(K)=DEPSTO(K)                                                FES04620
      GO TO 71                                                          FES04630
70    ACCDP(K)=REMAIN                                                   FES04640
71    RETURN                                                            FES04650
      END                                                               FES04660
C                                                                       FES04670
C                                                                       FES04680
C***********************************************************************FES04690
C                                                                       FES04700
C                                                                       FES04710
      SUBROUTINE OUTPUT(I,K,NTIME,NPRINC,NHEAD)                         FES04720
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120), FES04730
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)  FES04740
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                               FES04750
      COMMON/BLK2/REFE(80,120),NRGAGE(80)                               FES04760
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)                FES04770
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES04780
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES04790
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)  FES04800
     1,DSLU(25)                                                         FES04810
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)            FES04820
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES04830
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,FES04840
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,FES04850
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,NDFES04860
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF                              FES04870
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)                FES04880
      COMMON/BLK11/NESTRP(10)                                           FES04890
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)                  FES04900
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES04910
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),      FES04920
     *QQS(11)                                                           FES04930
      INTEGER OVER/'OVER'/,CHNL/'CHNL'/                                 FES04940
      GO TO (99,98,97,96,95,94,93,92,83),NZIP                           FES04950
93    CONTINUE                                                          FES04960
      CALL STRMHD (MONTH,NDAY,NYEAR,NSTART,SMCWS)                       FES04970
      GO TO 101                                                         FES04980
98    CONTINUE                                                          FES04990
      CALL HRUHD(NDHRUS)                                                FES05000
      GO TO 101                                                         FES05010
99    CONTINUE                                                          FES05020
      CALL PRCOUT (I,NPCINT,NDHRUS,NTELES,INTPCM)                       FES05030
      GO TO 101                                                         FES05040
92    CONTINUE                                                          FES05050
      CALL ROUTHD (DTO,DTC)                                             FES05060
      GO TO 101                                                         FES05070
94    CONTINUE                                                          FES05080
      IF(NTIME.GT.NPRINC)GO TO 97                                       FES05090
                CALL OVERHD (NHEAD,NSSHED,K,NE)                         FES05100
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97     CONTINUE
       NP=NPOVER(NSSHED)
       CALL STPOUT (NN,NTIME,NPRINC,OVER,NSECC)
       GO TO 101
96     CONTINUE
       NP=NPCHAN(NSSHED)
       IF(NTIME.GT.NPRINC)GO TO 95
            CALL CHANHD (NSSHED,NE,K)
95     CONTINUE
            NP=NPCHAN(NSSHED)
            CALL STPOUT (NN,NTIME,NPRINC,CHNL,NSECC)
       GO TO 101
83     CONTINUE
       CALL OUTLET (NSECC,NPRINC,NCPRIN,DTC,NTSSX,HOUR,QQX,QQSX)
101    RETURN
       END
       SUBROUTINE STRMHD (MONTH,NDAY,NYEAR,NSTART,SMCWS)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C         STRMHD: WRITE STORM HEADER          MDS 4/9/82
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
       WRITE(6,401)MONTH,NDAY,NYEAR
401    FORMAT(1X,'STORM EVENT--',I2,'/',I2,'/',I2)
       WRITE(6,402)NSTART
402    FORMAT(1X,'STARTING TIME--',I2,':00')
       NPERCT=IFIX(100.0*SMCWS+0.5)
       IF(SMCWS.EQ.0.0)GO TO 501
       WRITE(6,403)NPERCT
403    FORMAT(1X,'INITIAL MOISTURE CONDITION FOR THE WATERSHED--',I3,'% O
      1F FIELD CAPACITY')
       GO TO 101
501    WRITE(6,502)
502    FORMAT(1X,'INITIAL MOISTURE CONDITION FOR THE WATERSHED-- DETERMIN
      1ED INTERNALLY FOR EACH HRU')
101    RETURN
       END
       SUBROUTINE HRUHD(NDHRUS)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C      HRUHD: WRITES HEADERS FOR HRU TABLE          MDS 4/9/82
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
       COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120),
      1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)
      2,DEPSTO(100),ACCDP(100),SLOHRU(100)
       COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)
      1,DSLU(25)
       COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)
       WRITE(6,23)
23     FORMAT('1',46X,'SUMMARY OF HYDROLOGIC RESPONSE UNITS')
       WRITE(6,24)
24     FORMAT(//2X,'HRU',1X,'LANDUSE',1X,'SLOPE',1X,'MANNINGS',1X,'DEPRES
      1SION',1X,'HOLTANS',1X,'FRACTION OF',3X,'FRACTION OF',4X,'EXPONENT'
      2,4X,'FINAL INFIL-',3X,'DEPTH OF THE',4X,'MAXIMUM'/3X,'NO',4X,'NO',
      33X,'CLASS',5X,'N',6X,'STORAGE',5X,'A',4X,'AVAIL WATER',2X,'GRAVITY
      4 WATER',7X,'C',7X,'TRATION RATE',5X,'A HORIZON',5X,'STORAGE'/'  ')
       DO 21 I=1,NDHRUS
       J=LANDU(I)
21     WRITE(6,26)I,LANDU(I),SLOHRU(I),RCLU(J),DEPSTO(I),AFAC(I),FAW(I),F
      1GW(I),CEXP(I),FC(I),DEPTH(I),STOMAX(I)
26     FORMAT(I5,I6,5X,A1,F9.3,3F10.3,3X,F10.3,5X,F10.3,4X,F10.3,5X,F10.2
      1,2X,F10.2)
101    RETURN
       END
```

```
      SUBROUTINE PRCOUT (I,NPCINT,NDHRUS,NTELES,INTPCM)                 FES05800
C                                                                       FES05810
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC FES05820
C                                                                       FES05830
C     PRCOUT:  TO WRITE PRECIPITATION                   MDS 4/9/82      FES05840
C                                                                       FES05850
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC    FES05860
C                                                                       FES05870
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120), FES05880
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)  FES05890
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                               FES05900
      COMMON/BLK2/REFE(80,120),NRGAGE(80)                               FES05910
      DIMENSION NUMBER(24)                                              FES05920
      WRITE(6,30)I                                                      FES05930
30    FORMAT('1',46X,'PRECIPITATION EXCESS FOR RAINGAGE NUMBER',I2)     FES05940
      WRITE(6,3)INTPCM                                                  FES05950
3     FORMAT(///34X,'HRU PRECIPITATION EXCESS FOR EACH',1X,I2,'-MINUTE IFES05960
     1NCREMENT OF THE STORM')                                           FES05970
      AINT=NPCINT                                                       FES05980
      NTAB=AINT/24.0+.99                                                FES05990
      NUMTAB=1                                                          FES06000
13    L=0                                                               FES06010
      LH=1                                                              FES06020
      DO 100 MN=1,NTAB                                                  FES06030
      WRITE(6,4)                                                        FES06040
4     FORMAT(//39X,'PRECIPITATION INCREMENTS FROM THE BEGINNING OF THE SFES06050
     1TORM')                                                            FES06060
      DO 5 M=1,24                                                       FES06070
      L=L+1                                                             FES06080
5     NUMBER(M)=L                                                       FES06090
      WRITE(6,33)NUMBER                                                 FES06100
33    FORMAT(4X,24I5)                                                   FES06110
      WRITE(6,6)                                                        FES06120
6     FORMAT(/60X,'PRECIPITATION')                                      FES06130
      KH=24*MN                                                          FES06140
      IF(MN.EQ.NTAB)KH=NPCINT                                           FES06150
      WRITE(6,7)(PRECIP(I,K),K=LH,KH)                                   FES06160
7     FORMAT(5X,24F5.2)                                                 FES06170
      IF(NUMTAB.EQ.2)GO TO 19                                           FES06180
      WRITE(6,8)                                                        FES06190
8     FORMAT(/1X,'HRU',52X,'PRECIPITATION EXCESS',50X,'HRU')            FES06200
      DO 10 J=1,NDHRUS                                                  FES06210
      IF(KIHRU(J).EQ.0)GO TO 10                                         FES06220
      WRITE(6,9)J,(REHRU(J,I,K),K=LH,KH)                                FES06230
      WRITE(6,69)J                                                      FES06240
10    CONTINUE                                                          FES06250
9     FORMAT(1X,I3,1X,24F5.2)                                           FES06260
69    FORMAT('+',125X,I3)                                               FES06270
      GO TO 100                                                         FES06280
19    WRITE(6,16)                                                       FES06290
16    FORMAT(/1X,'ELE',52X,'PRECIPITATION EXCESS',50X,'ELE')            FES06300
      DO 18 J=1,NTELES                                                  FES06310
      IF(NRGAGE(J).NE.I)GO TO 18                                        FES06320
      WRITE(6,17)J,(REFE(J,K),K=LH,KH)                                  FES06330
17    FORMAT(1X,I3,1X,24F5.2)                                           FES06340
      WRITE(6,68)J                                                      FES06350
68    FORMAT('+',125X,I3)                                               FES06360
18    CONTINUE                                                          FES06370
100   LH=KH+1                                                           FES06380
      IF(NUMTAB.EQ.2)GO TO 101                                          FES06390
      WRITE(6,11)INTPCM                                                 FES06400
11    FORMAT(///32X,'ELEMENT PRECIPITATION EXCESS FOR EACH',1X,I2,'-MINUFES06410
     1TE INCREMENT OF THE STORM')                                       FES06420
      NUMTAB=2                                                          FES06430
      GO TO 13                                                          FES06440
101   RETURN                                                            FES06450
      END                                                               FES06460
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      SUBROUTINE ROUTHD  (DTO,DTC)                                      FES06470
C                                                                       FES06480
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCMDS 4/9/82FES06490
C                                                                       FES06500
C     ROUTHD:  WRITES HEADER FOR ROUTING SECTION                        FES06510
C                                                                       FES06520
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC    FES06530
C                                                                       FES06540
      NDTO=IFIX(DTO)                                                    FES06550
      NDTC=IFIX(DTC)                                                    FES06560
      WRITE(6,410)NDTO                                                  FES06570
410   FORMAT('1',1X,'ROUTING TIME INCREMENT FOR OVERLAND FLOW--',I4,1X,'FES06580
     1SECONDS')                                                         FES06590
      WRITE(6,411)NDTC                                                  FES06600
411   FORMAT(1X,'ROUTING TIME INCREMENT FOR CHANNEL FLOW--',I4,1X,'SECONFES06610
     1DS')                                                              FES06620
101   RETURN                                                            FES06630
      END                                                               FES06640
      SUBROUTINE OVERHD (NHEAD,NSSHED,K,NE)                             FES06650
C                                                                       FES06660
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC MDS 4/9/82             FES06670
C                                                                       FES06680
C     OVERHD:  WRITES THE HEADER FOR OVERLAND FLOW SECTION              FES06690
C                                                                       FES06700
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC     FES06710
C                                                                       FES06720
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES06730
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES06740
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES06750
C                                                                       FES06760
      IF(NHEAD.EQ.1)GO TO 81                                            FES06770
         WRITE(6,61)NSSHED                                              FES06780
61    FORMAT('1',41X,'OVERLAND FLOW INFORMATION FOR SUB-SHED NUMBER',I3)FES06790
      NHEAD=1                                                           FES06800
81    WRITE(6,91)                                                       FES06810
91    FORMAT(//6X,'OVERLAND FLOW',10X,'ELEMENT',7X,'ELEMENT',7X,'ELEMENTFES06820
     1',4X,'ELEMENT',4X,'ELEMENT',5X,'ELEMENT',12X,'NODE',7X,'NODE'/7X,'FES06830
     2STRIP NUMBER',11X,'NUMBER',5X,'AREA (ACRES)',5X,'LENGTH',5X,'RELIEFES06840
     3F',5X,'SLOPE',5X,'MANNING N',10X,'NUMBER',5X,'WIDTH')             FES06850
      DO 70 I=1,NE                                                      FES06860
      J=I+1                                                             FES06870
      IF(I.GT.1)GO TO 29                                                FES06880
      WRITE(6,25)K,I,AREA(I),XLEN(I),RELIEF(I),SLOPE(I),RCOEF(I),J,TWI  FES06890
     1DTH(J)                                                            FES06900
25    FORMAT(11X,I2,18X,I2,9X,F7.1,8X,F7.1,4X,F6.1,6X,F5.3,7X,F5.3,14X,IFES06910
     12,5X,F7.1)                                                        FES06920
      GO TO 70                                                          FES06930
29    WRITE(6,28)I,AREA(I),XLEN(I),RELIEF(I),SLOPE(I),RCOEF(I),J,TWIDT  FES06940
     1H(J)                                                              FES06950
28    FORMAT(31X,I2,9X,F7.1,8X,F7.1,4X,F6.1,6X,F5.3,7X,F5.3,14X,I2,5X,F7FES06960
     1.1)                                                               FES06970
70    CONTINUE                                                          FES06980
101   RETURN                                                            FES06990
      END                                                               FES07000
      SUBROUTINE CHANHD (NSSHED,NE,K)                                   FES07010
C                                                                       FES07020
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC   MDS 4/9/82                      FES07030
C                                                                       FES07040
C     CHANHD:  WRITES HEADER FOR CHANNEL FLOW INFORMATION               FES07050
C                                                                       FES07060
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  FES07070
C                                                                       FES07080
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES07090
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES07100
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES07110
      WRITE(6,12)NSSHED                                                 FES07120
   12 FORMAT('1',41X,'CHANNEL FLOW INFORMATION FOR SUB-SHED NUMBER',I3) FES07130
      WRITE(6,60)                                                       FES07140
60    FORMAT(//1X,'ELEMENT',7X,'ELEMENT',7X,'ELEMENT',7X,'ELEMENT',8X,  FES07150
     *'ELEMENT',12X,'NODE',7X,'WIDTH',2X,'DEPTH',2X,'BASE',/,           FES07160
     * 2X,'NUMBER',8X,'LENGTH',                                         FES07170
     *  8X,'RELIEF',8X,'SLOPE',8X,'MANNING N',10X,'NUMBER')             FES07180
      DO 90 K=1,NE                                                      FES07190
      L=K+1                                                             FES07200
      WRITE(6,80)K,XLEN(K),RELIEF(K),SLOPE(K),RCOEF(K),L,TWIDTH(L),     FES07210
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     * HT(L),BASE(L)
80    FORMAT(3X,I2,10X,F7.1,7X,F6.1,9X,F5.3,10X,F5.3,14X,I2,6X,3F7.2)
90    CONTINUE
101   RETURN
      END
      SUBROUTINE OUTLET (NSECC,NPRINC,NCPRIN,DTC,NTSSX,HOUR,QQX,QQSX)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC MDS 4/10/82
C
C     OUTLET:  PRINTS THE OUTPUT FROM THE IMAGINARY CHANNEL
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11)
     *,QQS(11)
C
83    WRITE(6,310)NTSSX
310   FORMAT('1',' CHANNEL FLOW FOR IMAGINARY SUB-SHED NUMBER',I3)
      WRITE(6,311)
311   FORMAT(/56X,'TIME',3X,'DISCHARGE',2X,'S-FLOW(KG/S)',3X,'S-CONC(KG/
     1L)')
      NPRTS=NSECC/NPRINC
      DO 312 NTI=1,NPRTS
      HOUR=FLOAT(NTI*NPRINC)/3600.0
      JT=NTI*NCPRIN/IFIX(DTC)
      NPC1=NCONF1(NTSSX)
      NPC2=NCONF2(NTSSX)
      IF(NODE1(NTSSX).EQ.5)GO TO 450
      QQX=QCONF(JT,1)+QCONF(JT,2)
C  **  UNITS NOW KG/SEC **
      QQSX=       (QSCONF(JT,1)+QSCONF(JT,2))
      IF(QQX.LE.0.0)GO TO 451
C    *** UNITS NOW KG/L ***
      QSCONC=0.0353*QQSX/QQX
      GO TO 312
451   QSCONC=0.0
      GO TO 312
450   NPC3=NCONF3(NTSSX)
      QQX=QCONF(JT,1)+QCONF(JT,2)+QCONF(JT,3)
C   ***  UNITS NOW KG/SEC  ****
      QQSX=       (QSCONF(JT,1)+QSCONF(JT,2)+QSCONF(JT,3))
      IF(QQX.LE.0.0)GO TO 453
C   *** UNITS NOW KG/L  ***
      QSCONC=0.0353*QQSX/QQX
      GO TO 312
453   QSCONC=0.0
312   WRITE(6,313)HOUR,QQX,QQSX,QSCONC
313   FORMAT(1X,F10.2,1X,F10.5,2F15.6)
101   RETURN
      END
C
C
C**********************************************************************
C
C
      SUBROUTINE OVERL
      COMMON/BLK2/REFE(80,120),NRGAGE(80)
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)
     1,DSLU(25)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK11/NESTRP(10)
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
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      DIMENSION RC(10),A(16),REFELE(10)                                 FES07970
      NPRINC=NOPRIN                                                     FES07980
      NZIP=2                                                            FES07990
      CALL INPUT                                                        FES08000
      NHEAD=0                                                           FES08010
      DO 50 K=1,NSTRPS                                                  FES08020
      NTIME=IFIX(DTO+0.01)                                              FES08030
      NE=NESTRP(K)                                                      FES08040
      NN=NE+1                                                           FES08050
      NZIP=3                                                            FES08060
      CALL INPUT                                                        FES08070
      WIDINF(K)=TWIDTH(NN)                                              FES08080
      DO 70 I=1,NE                                                      FES08090
         TSED=0.0                                                       FES08100
      SLOPE(I)=RELIEF(I)/XLEN(I)                                        FES08110
      RCOEF(I)=0.0                                                      FES08120
      L=NELEM+I                                                         FES08130
      MHRU=NHRU(L)                                                      FES08140
      DO 8 N=1,MHRU                                                     FES08150
      J=IHRU(L,N)                                                       FES08160
      M=LANDU(J)                                                        FES08170
      RCOEF(I)=RCOEF(I)+(RCLU(M)*FHRU(L,N))                             FES08180
8     CONTINUE                                                          FES08190
70    CONTINUE                                                          FES08200
      DO 100 I=1,NN                                                     FES08210
      AO(I)=0.0                                                         FES08220
100   QO(I)=0.0                                                         FES08230
      V1=0.0                                                            FES08240
      V2=0.0                                                            FES08250
      V3=0.0                                                            FES08260
      A01=0.0                                                           FES08270
      A02=0.0                                                           FES08280
      A03=0.0                                                           FES08290
      Q1=0.0                                                            FES08300
      Q2=0.0                                                            FES08310
      Q3=0.0                                                            FES08320
 2    IF(NE.GT.1)GO TO 1111                                             FES08330
      NDT=IFIX(DTO)                                                     FES08340
20    JT=NTIME/INTPCS+1                                                 FES08350
      L=NELEM+1                                                         FES08360
      REFELE(1)=REFE(L,JT)                                              FES08370
      RQ(1)=(REFELE(1)/(FLOAT(INTPCS)*12.0))*((43560.0*AREA(1))/XLEN(1))FES08380
      GO TO 30                                                          FES08390
3000  IF(NE.GT.1)GO TO 1111                                             FES08400
      RQ(1)=0.0                                                         FES08410
30    LT=NTIME/IFIX(DTO+0.01)                                           FES08420
      RHS1=(2.0*A01)/15.0+A02/15.0-A03/30.0+(NDT/(2.0*XLEN(1)))*Q1-((2.0FES08430
     1*NDT)/(3.0*XLEN(1)))*Q2+(NDT/(6.0*XLEN(1)))*Q3+(NDT/6.0)*RQ(1)    FES08440
      RHS2=A01/15.0+(8.0/15.0)*A02+A03/15.0+((2.0*NDT)/(3.0*XLEN(1)))*Q1FES08450
     1-((2.0*NDT)/(3.0*XLEN(1)))*Q3+((2.0*NDT)/3.0)*RQ(1)               FES08460
      RHS3=-A01/30.0+A02/15.0+(2.0/15.0)*A03-(NDT/(6.0*XLEN(1)))*Q1+((2.FES08470
     10*NDT)/(3.0*XLEN(1)))*Q2-(NDT/(2.0*XLEN(1)))*Q3+(NDT/6.0)*RQ(1)   FES08480
      A2=(9.0/4.0)*RHS2-(3.0/2.0)*RHS1-(3.0/2.0)*RHS3                   FES08490
      A3=12.0*RHS2-6.0*RHS1-6.0*A2                                      FES08500
      A1=15.0*RHS2-8.0*A2-A3                                            FES08510
      IF(A1.LE.0.0)A1=0.0                                               FES08520
      IF(A2.LE.0.0)A2=0.0                                               FES08530
      IF(A3.LE.0.0)A3=0.0                                               FES08540
      D1=A1/TWIDTH(2)                                                   FES08550
      D2=A2/TWIDTH(2)                                                   FES08560
      D3=A3/TWIDTH(2)                                                   FES08570
      V1=0.0                                                            FES08580
      V2=(1.49*D2**.67*SLOPE(1)**.5)/RCOEF(1)                           FES08590
      V3=(1.49*D3**.67*SLOPE(1)**.5)/RCOEF(1)                           FES08600
      Q1=0.0                                                            FES08610
      Q2=A2*V2                                                          FES08620
      Q3=A3*V3                                                          FES08630
      VV(1)=V1                                                          FES08640
      VV(2)=V3                                                          FES08650
      QQ(1)=Q1                                                          FES08660
      QQ(2)=Q3                                                          FES08670
      DD(1)=D1                                                          FES08680
      DD(2)=D3                                                          FES08690
      AA(1)=A1                                                          FES08700
      AA(2)=A3                                                          FES08710
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      A01=A1                                                            FES08720
      A02=A2                                                            FES08730
      A03=A3                                                            FES08740
      GO TO 286                                                         FES08750
1111  IF(NTIME.GT.NSECR)GO TO 3001                                      FES08760
      JT=NTIME/INTPCS+1                                                 FES08770
      DO 105 I=1,NE                                                     FES08780
      L=NELEM+I                                                         FES08790
      REFELE(I)=REFE(L,JT)                                              FES08800
105   RQ(I)=(REFELE(I)/(FLOAT(INTPCS)*12.0))*((43560.0*AREA(I))/XLEN(I))FES08810
      GO TO 2000                                                        FES08820
3001  DO 110 I=1,NE                                                     FES08830
110   RQ(I)=0.0                                                         FES08840
2000  LT=NTIME/IFIX(DTO+0.01)                                           FES08850
      DT=DTO                                                            FES08860
      CALL FAREA(DT)                                                    FES08870
      CALL FRATEO(LT)                                                   FES08880
286   QOUT(K,LT)=QQ(NN)/TWIDTH(NN)                                      FES08890
      CALL DETERO(JT,LT,K,NTIME)                                        FES08900
      IF(NTIME/NOPRIN*NOPRIN.NE.NTIME)GO TO 177                         FES08910
      IF(NPOVER(NSSHED).EQ.0)GO TO 177                                  FES08920
      IF(NPOVER(NSSHED).EQ.1)GO TO 173                                  FES08930
      IF(NPSTRP(NSSHED,K).EQ.0)GO TO 177                                FES08940
173   NZIP=6                                                            FES08950
      CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)                               FES08960
177   DO 320 I=1,NN                                                     FES08970
      AO(I)=AA(I)                                                       FES08980
320   QO(I)=QQ(I)                                                       FES08990
      NTIME=NTIME+IFIX(DTO+0.01)                                        FES09000
      IF(NTIME.GT.NSECR)GO TO 5000                                      FES09010
      IF(NTIME/INTPCS*INTPCS.EQ.NTIME-IFIX(DTO+0.01))GO TO 2            FES09020
      IF(NE.EQ.1)GO TO 30                                               FES09030
      GO TO 2000                                                        FES09040
5000  IF(NTIME.LE.NSECC)GO TO 3000                                      FES09050
      NELEM=NELEM+NE                                                    FES09060
50    CONTINUE                                                          FES09070
      RETURN                                                            FES09080
      END                                                               FES09090
C                                                                       FES09100
C                                                                       FES09110
C***********************************************************************FES09120
C                                                                       FES09130
C                                                                       FES09140
      SUBROUTINE DETERO(JT,LT,K,NTIME)                                  FES09150
      COMMON/BLK1/PRECIP(3,120),STO,AFAC(100),FC(100),REHRU(100,3,120), FES09160
     1KIHRU(100),STOMAX(100),CEXP(100),DAILPC(3,30),GINDEX(12),EVP(12)  FES09170
     2,DEPSTO(100),ACCDP(100),SLOHRU(100)                               FES09180
      COMMON/BLK2/REFE(80,120),NRGAGE(80)                               FES09190
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES09200
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES09210
      COMMON/BLK5/RCLU(25),FHRU(80,15),LANDU(100),NHRU(80),IHRU(80,15)  FES09220
     1,DSLU(25)                                                         FES09230
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)            FES09240
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES09250
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,FES09260
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,FES09270
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,NDFES09280
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF                              FES09290
      COMMON/BLK10/FAW(100),FGW(100),DEPTH(100),AFLU(25)                FES09300
      COMMON/BLK11/NESTRP(10)                                           FES09310
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)                  FES09320
      COMMON/BLK18/ECUSLE(100),EKUSLE(100),CUSLE(100),XKUSLE(100)       FES09330
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES09340
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1 FES09350
     11)                                                                FES09360
      DIMENSION TRNSED(11),SEDSTO(10)                                   FES09370
      TRNSED(1)=0.0                                                     FES09380
      DO 1001 I=1,NE                                                    FES09390
      L=NELEM+I                                                         FES09400
      MM=NRGAGE(L)                                                      FES09410
      IF(LT.GT.1)GO TO 109                                              FES09420
      TRNSED(I+1)=0.0                                                   FES09430
      SEDSTO(I)=0.0                                                     FES09440
      ECUSLE(L)=0.0                                                     FES09450
      EKUSLE(L)=0.0                                                     FES09460
      MHRU=NHRU(L)                                                      FES09470
```

```
      DO 18 N=1,MHRU
      KK=IHRU(L,N)
      ECUSLE(L)=ECUSLE(L)+CUSLE(KK)*FHRU(L,N)
18    EKUSLE(L)=EKUSLE(L)+XKUSLE(KK)*FHRU(L,N)
C*****DETRAI UNITS ARE KG/SEC
109   DETRAI=4701.571*ECUSLE(L)*EKUSLE(L)*AREA(I)*(PRECIP(MM,JT)/FLOAT(I
     1NTPCM))**2
      IF(NTIME.GT.NSECR)DETRAI=0.0
C*****DETOFL UNITS ARE KG/SEC
      DETOFL=338.3687*ECUSLE(L)*EKUSLE(L)*AREA(I)*SLOPE(I)*QQ(I+1)/TWIDT
     1H(I+1)
C*****DETSED UNITS ARE KG/SEC/FT
      DETSED(I)=(DETRAI+DETOFL)/TWIDTH(I+1)
      SEDSTO(I)=SEDSTO(I)+DETSED(I)
      IF(QQ(I+1)/TWIDTH(I+1).GT.0.00825)GO TO 100
C*****TRNSPT UNITS ARE KG/SEC/FT
      TRNSPT=1.9309898*SLOPE(I)*SQRT(QQ(I+1)/TWIDTH(I+1))
      GO TO 101
100   TRNSPT=2576.002*SLOPE(I)*(QQ(I+1)/TWIDTH(I+1))**2
101   IF(TRNSPT.LE.SEDSTO(I))GO TO 102
      TRNSED(I+1)=SEDSTO(I)
      GO TO 103
102   TRNSED(I+1)=TRNSPT
103   CONTINUE
      LVAR=MOD(LT,100)
      IF(LVAR .NE. 0 ) GO TO 104
      DIFF=SEDSTO(I)-TRNSED(I+1)+TRNSED(I)
C     WRITE(7,777)I,QQ(I+1),SEDSTO(I),TRNSED(I+1),DIFF,DETRAI,DETOFL
C777    FORMAT(I3,1X,6E12.4)
104        CONTINUE
      SEDSTO(I)=SEDSTO(I)-TRNSED(I+1)+TRNSED(I)
      QQS(I+1)=TRNSED(I+1)
1001  CONTINUE
C  ***  CHANGE TO KG/SEC/FT: SMT 3/27/82  ***
C     QQS(NN)=TRNSED(NN)
      QSCONC=DETSED(1)
      TRNSCH(K,LT)=TRNSED(NN)
999   CONTINUE
      RETURN
      END
C
C
C***********************************************************************
C
C
      SUBROUTINE CHANL
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      DIMENSION HYDRAD(11),YY(11)
      NPRINC=NCPRIN
      NTIME=IFIX(DTC+0.01)
      NE=NECHAN
      NN=NE+1
      IF(NTSS.EQ.1)GO TO 5
      IF(NODE1(NSSHED).GT.0)NCONF=0
      DO 1 I=NSSHED,NTSSX
      IF(NCONF1(I).GT.0.AND.NCONF1(I).EQ.NSSHED)NCONF=NCONF+1
      IF(NCONF1(I).GT.0.AND.NCONF1(I).EQ.NSSHED)GO TO 5
      IF(NCONF2(I).GT.0.AND.NCONF2(I).EQ.NSSHED)NCONF=NCONF+1
      IF(NCONF2(I).GT.0.AND.NCONF2(I).EQ.NSSHED)GO TO 5
      IF(NCONF3(I).GT.0.AND.NCONF3(I).EQ.NSSHED)NCONF=NCONF+1
      IF(NCONF3(I).GT.0.AND.NCONF3(I).EQ.NSSHED)GO TO 5
```

```
1       CONTINUE
5       NZIP=4
        CALL INPUT
        DO 70 I=1,NE
70      SLOPE(I)=RELIEF(I)/XLEN(I)
        DO 100 I=1,NN
        AO(I)=0.0
100     QO(I)=0.0
1000    JT=NTIME/IFIX(DTO+0.01)+1
C
C ***   SECTION TO ALLOW NO ELEMENTS ON LEFT OR RIGHT SIDE OF CHANNEL
C       ********** MDS 5/11/81 **********
C
        IF(LHSSPS.EQ.0.OR.LHSSPS.EQ.NSTRPS)GOTO 106
C
        CHALEN=0.0
        NLSS=1
        NRSS=LHSSPS+1
        XLSLEN=WIDINF(NLSS)
        XRSLEN=WIDINF(NRSS)
        DO 105 I=1,NE
        CHALEN=CHALEN+XLEN(I)-.005
        IF(CHALEN.GE.XLSLEN)GO TO 2
        GO TO 3
2       NLSS=NLSS+1
        XLSLEN=XLSLEN+WIDINF(NLSS)
3       IF(CHALEN.GE.XRSLEN)GO TO 4
        GO TO 105
4       NRSS=NRSS+1
        XRSLEN=XRSLEN+WIDINF(NRSS)
105     RQ(I)=QOUT(NLSS,JT)+QOUT(NRSS,JT)
        GOTO 3000
C
106     CONTINUE
        DO 107 I=1,NE
           RQ(I)=QOUT(I,JT)
107     CONTINUE
C
3000    LT=NTIME/IFIX(DTC+0.01)
        DT=DTC
        CALL FAREA(DT)
        CALL FRATEC(LT)
        IF(NTSS.EQ.1)GO TO 75
        QCONF(LT,NCONF)=QQ(NN)
75      CALL CHASED(NTIME,NPRINC,JT,LT)
        IF(NTIME/NCPRIN*NCPRIN.NE.NTIME)GO TO 310
        IF(NPCHAN(NSSHED).EQ.0)GO TO 310
        NZIP=4
        CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)
  310   DO 320 I=1,NN
        AO(I)=AA(I)
320     QO(I)=QQ(I)
        NTIME=NTIME+IFIX(DTC+0.01)
        IF(NTIME.GT.NSECC)GO TO 6000
        IF(NTIME/IFIX(DTO+.01)*IFIX(DTO+.01).EQ.NTIME-(IFIX(DTC+.01)))GO T
     1O 1000
        GO TO 3000
6000    IF(NTSS.EQ.1)GO TO 7000
        IF(NTSSX.GT.(NSSHED+1))GO TO 7000
        IF(NODE1(NTSSX).EQ.0)GO TO 7000
        NZIP=9
        CALL OUTPUT(I,K,NTIME,NPRINC,NHEAD)
7000    RETURN
        END
C
C
C************************************************************************
C
C
        SUBROUTINE FAREA(DT)
        COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
        COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
```

```
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      DIMENSION R1(10),R2(10)
      DO 125 I=1,NN
      DO 125 J=1,NN
125   A1(I,J)=0.0
      A1(1,1)=2./3.
      A1(1,2)=1./3.
      A1(NN,NN-1)=1./3.
      A1(NN,NN)=2./3.
      R1(1)=(QO(2)-QO(1))/(XLEN(1))
      R1(NN)=(QO(NN)-QO(NN-1))/(XLEN(NN-1))
      R2(1)=RQ(1)
      R2(NN)=RQ(NE)
      IF(NE.EQ.1)GO TO 131
      N=1
      DO 130 M=2,NE
      A1(M,N)=1./3.
      A1(M,N+1)=4./3.
      A1(M,N+2)=1./3.
      R1(M)=((QO(M)-QO(M-1))/XLEN(M-1))+((QO(M+1)-QO(M))/XLEN(M))
      R2(M)=RQ(M-1)+RQ(M)
130   N=N+1
131   DO 155 I=1,NN
      SUM=0.0
      DO 150 J=1,NN
      CX=A1(I,J)*AO(J)/DT
150   SUM=SUM+CX
155   RC(I)=SUM+R2(I)-R1(I)
      CALL SOLVE(NN,IERROR)
      RETURN
      END
C
C
C***********************************************************************
C
C
      SUBROUTINE SOLVE(NN,IERROR)
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      DIMENSION A(10),B(10),C(10),U(10),ABCL(10),Y(10)
      J=0
      DO 9 I=1,NN
      J=J+1
      IF(I.EQ.1)GO TO 12
      A(I)=A1(I,J-1)
12    B(I)=A1(I,J)
      IF(I.EQ.NN)GO TO 9
      C(I)=A1(I,J+1)
9     CONTINUE
      U(1)=B(1)
      DO 1 I=2,NN
      IF(U(I-1).EQ.0.0)GO TO 4
      ABCL(I)=A(I)/U(I-1)
1     U(I)=B(I)-ABCL(I)*C(I-1)
      Y(1)=RC(1)
      DO 2 I=2,NN
2     Y(I)=RC(I)-ABCL(I)*Y(I-1)
      IF(U(NN).EQ.0.0)GO TO 4
      X(NN)=Y(NN)/U(NN)
      NM1=NN-1
      DO 3 I=1,NM1
3     X(NN-I)=(Y(NN-I)-C(NN-I)*X(NN+1-I))/U(NN-I)
      IERROR=1
      RETURN
4     IERROR=2
      RETURN
      END
C
C
C***********************************************************************
C
C
```

```
      SUBROUTINE FRATEC(LT)                                             FES11720
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)                FES11730
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES11740
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES11750
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)            FES11760
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES11770
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,FES11780
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,FES11790
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,NDFES11800
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF                              FES11810
      COMMON/BLK15/A1(11,11),RC(11),X(11)                               FES11820
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES11830
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1 FES11840
     11)                                                                FES11850
      DIMENSION HYDRAD(11),Z(11)                                        FES11860
C     DETERMINE UPSTREAM BOUNDARY CONDITIONS                            FES11870
      IF(NTSS.EQ.1)GO TO 2                                              FES11880
      IF(NODE1(NSSHED).GT.0)GO TO 1                                     FES11890
2     QQ(1)=0.0                                                         FES11900
      GO TO 4                                                           FES11910
1     IF(NODE1(NSSHED).EQ.3)GO TO 3                                     FES11920
      IF(NODE1(NSSHED).EQ.0)GO TO 4                                     FES11930
      IF(NODE1(NSSHED).EQ.4)GO TO 5                                     FES11940
      NPC1=NCONF1(NSSHED)                                               FES11950
      NPC2=NCONF2(NSSHED)                                               FES11960
      QQ(1)=QCONF(LT,1)+QCONF(LT,2)                                     FES11970
      GO TO 4                                                           FES11980
3     NPC1=NCONF1(NSSHED)                                               FES11990
      QQ(1)=QCONF(LT,1)                                                 FES12000
      GO TO 4                                                           FES12010
5     NPC1=NCONF1(NSSHED)                                               FES12020
      NPC2=NCONF2(NSSHED)                                               FES12030
      NPC3=NCONF3(NSSHED)                                               FES12040
      QQ(1)=QCONF(LT,1)+QCONF(LT,2)+QCONF(LT,3)                         FES12050
4     DO 275 I=2,NN                                                     FES12060
      AA(I)=X(I)*DTC                                                    FES12070
      Z(I)=(TWIDTH(I)-BASE(I))/(2.0*HT(I))                              FES12080
      IF(Z(I).GT.0.0) GO TO 272                                         FES12090
C                                       RECTANGULAR SECTION             FES12100
C                                                                       FES12110
          DD(I)=AA(I)/BASE(I)                                           FES12120
          GO TO 273                                                     FES12130
272   CONTINUE                                                          FES12140
C                                       TRAPEZOIDAL OR TRIANGULAR SECTION FES12150
C                                                                       FES12160
      DD(I)=(-BASE(I)/Z(I)+SQRT((BASE(I)/Z(I))**2.                      FES12170
     * +4.*ABS(AA(I))/Z(I)))/2.                                         FES12180
273   CONTINUE                                                          FES12190
      IF(AA(I).GT.0.0)GO TO 274                                         FES12200
          QQ(I)=0.0                                                     FES12210
          VV(I)=0.0                                                     FES12220
          DD(I)=0.0                                                     FES12230
          GO TO 275                                                     FES12240
274   CONTINUE                                                          FES12250
      HYDRAD(I)=AA(I)/(BASE(I)+2.0*DD(I)*SQRT(1.0+Z(I)**2.))            FES12260
      VV(I)=(1.49*SQRT(SLOPE(I-1))*HYDRAD(I)**0.67)/RCOEF(I-1)          FES12270
      QQ(I)=VV(I)*AA(I)                                                 FES12280
275   CONTINUE                                                          FES12290
      AA(1)=X(1)*DTC                                                    FES12300
      RETURN                                                            FES12310
      END                                                               FES12320
C                                                                       FES12330
C                                                                       FES12340
C***********************************************************************FES12350
C                                                                       FES12360
C                                                                       FES12370
C                                                                       FES12380
C                                                                       FES12390
C***********************************************************************FES12400
C                                                                       FES12410
C                                                                       FES12420
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      SUBROUTINE FRATEO(LT)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      QQ(1)=0.0
      DO 275 I=2,NN
      AA(I)=X(I)*DTO
      DD(I)=AA(I)/TWIDTH(I)
      IF(AA(I).GT.0.0)GO TO 274
      QQ(I)=0.0
      VV(I)=0.0
      DD(I)=0.0
      GO TO 275
274   VV(I)=(1.49*SQRT(SLOPE(I-1))*DD(I)**0.67)/RCOEF(I-1)
      QQ(I)=VV(I)*AA(I)
275   CONTINUE
      AA(1)=X(1)*DTO
      RETURN
      END
C
C
C*********************************************************************
C
C
      SUBROUTINE CHASED(NTIME,NPRINC,JT,LT)
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK13/NPOVER(40),NPCHAN(40),NPSTRP(40,40)
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      DIMENSION HYDRAD(11),YY(11)
      IF(LT.GT.1)GO TO 1000
      DO 100 I=1,NN
      AOS(I)=0.0
100   QOS(I)=0.0
1000  CHALEN=0.0
C
C *** ALLOWS NO LEFT OR RIGHT ELEMENTS IN SUBSHED...MDS 5/13/81
C
      IF(LHSSPS.EQ.0.OR.LHSSPS.EQ.NSTRPS)GOTO 106
C
      NLSS=1
      NRSS=LHSSPS+1
      XLSLEN=WIDINF(NLSS)
      XRSLEN=WIDINF(NRSS)
      DO 105 I=1,NE
      CHALEN=CHALEN+XLEN(I)-.005
      IF(CHALEN.GE.XLSLEN)GO TO 2
      GO TO 3
2     NLSS=NLSS+1
      XLSLEN=XLSLEN+WIDINF(NLSS)
3     IF(CHALEN.GE.XRSLEN)GO TO 4
      GO TO 105
4     NRSS=NRSS+1
      XRSLEN=XRSLEN+WIDINF(NRSS)
105   RQS(I)=TRNSCH(NLSS,JT)+TRNSCH(NRSS,JT)
      GOTO 3000
C
```

```
106   CONTINUE
      DO 107 I=1,NE
         RQS(I)=TRNSCH(I,JT)
107   CONTINUE
C
3000  CALL FAREAS
      CALL FRATES(LT)
      IF(QQ(NN).EQ.0.0)GO TO 5
      IF(NTSS.EQ.1)GO TO 101
      QSCONF(LT,NCONF)=QQS(NN)
C   **** CHANGES CU.FT. TO LITERS  ****
101   QSCONC=0.0353*QQS(NN)/QQ(NN)
      GO TO 6
5     QSCONC=0.0
6     DO 320 I=1,NN
      AOS(I)=AAS(I)
320   QOS(I)=QQS(I)
      RETURN
      END
C
C
C*********************************************************************
C
C
      SUBROUTINE FAREAS
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,ND
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF
      COMMON/BLK15/A1(11,11),RC(11),X(11)
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1
     11)
      DIMENSION R1(10),R2(10)
      DO 125 I=1,NN
      DO 125 J=1,NN
125   A1(I,J)=0.0
      A1(1,1)=2./3.
      A1(1,2)=1./3.
      A1(NN,NN-1)=1./3.
      A1(NN,NN)=2./3.
      R1(1)=(QOS(2)-QOS(1))/(XLEN(1))
      R1(NN)=(QOS(NN)-QOS(NN-1))/(XLEN(NN-1))
      R2(1)=RQS(1)
      R2(NN)=RQS(NE)
      IF(NE.EQ.1)GO TO 131
      N=1
      DO 130 M=2,NE
      A1(M,N)=1./3.
      A1(M,N+1)=4./3.
      A1(M,N+2)=1./3.
      R1(M)=((QOS(M)-QOS(M-1))/XLEN(M-1))+((QOS(M+1)-QOS(M))/XLEN(M))
      R2(M)=RQS(M-1)+RQS(M)
130   N=N+1
131   DO 155 I=1,NN
      SUM=0.0
      DO 150 J=1,NN
      CX=A1(I,J)*AOS(J)/DTC
150   SUM=SUM+CX
155   RC(I)=SUM+R2(I)-R1(I)
      CALL SOLVE(NN,IERROR)
      RETURN
      END
C
C
C*********************************************************************
C
C
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      SUBROUTINE FRATES(LT)                                             FES13880
      COMMON/BLK3/QOUT(10,1000),QCONF(6000,3),WIDINF(10)                FES13890
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),QQ(11)FES13900
     1,AREA(10),VV(11),DD(11),HT(11),BASE(11)                           FES13910
      COMMON/BLK6/NODE1(10),NCONF1(10),NCONF2(10),NCONF3(10)            FES13920
      COMMON/BLK8/SLOPE(10),RCOEF(10),RELIEF(10)                        FES13930
      COMMON/BLK9/NOPRIN,SMCWS,NSECR,PCINTH,DTO,DTC,NSECC,NTBLHS,NTBLPE,FES13940
     1NTELES,NDHRUS,NLANUS,NGAGES,NHOURR,INTPCS,NSTART,MONTH,NDAY,NYEAR,FES13950
     2NPCINT,INTPCM,NTSS,NSTRPS,NSSHED,NELEM,NZIP,NE,NN,NCPRIN,NHOURC,NDFES13960
     3AMS,NTSSX,LHSSPS,NECHAN,QSCONC,NCONF                              FES13970
      COMMON/BLK15/A1(11,11),RC(11),X(11)                               FES13980
      COMMON/BLK19/TRNSCH(10,1000),DETSED(10)                           FES13990
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),QQS(1 FES14000
     11)                                                                FES14010
      DIMENSION HYDRAD(10)                                              FES14020
C     DETERMINE UPSTREAM BOUNDARY CONDITIONS                             FES14030
      IF(NTSS.EQ.1)GO TO 2                                              FES14040
      IF(NODE1(NSSHED).GT.0)GO TO 1                                     FES14050
2     QQ(1)=0.0                                                         FES14060
      GO TO 4                                                           FES14070
1     IF(NODE1(NSSHED).EQ.3)GO TO 3                                     FES14080
      IF(NODE1(NSSHED).EQ.0)GO TO 4                                     FES14090
      IF(NODE1(NSSHED).EQ.4)GO TO 5                                     FES14100
      NPC1=NCONF1(NSSHED)                                               FES14110
      NPC2=NCONF2(NSSHED)                                               FES14120
      QQS(1)=QSCONF(LT,1)+QSCONF(LT,2)                                  FES14130
      GO TO 4                                                           FES14140
3     NPC1=NCONF1(NSSHED)                                               FES14150
      QQS(1)=QSCONF(LT,1)                                               FES14160
      GO TO 4                                                           FES14170
5     NPC1=NCONF1(NSSHED)                                               FES14180
      NPC2=NCONF2(NSSHED)                                               FES14190
      NPC3=NCONF3(NSSHED)                                               FES14200
      QQS(1)=QSCONF(LT,1)+QSCONF(LT,2)+QSCONF(LT,3)                     FES14210
4     DO 275 I=2,NN                                                     FES14220
      AAS(I)=X(I)*DTC                                                   FES14230
      QQS(I)=VV(I)*AAS(I)                                               FES14240
      IF(AAS(I).GT.0.0)GO TO 275                                        FES14250
      AAS(I)=0.0                                                        FES14260
      QQS(I)=0.0                                                        FES14270
275   CONTINUE                                                          FES14280
      AAS(1)=X(1)*DTC                                                   FES14290
      RETURN                                                            FES14300
      END                                                               FES14310
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCFES14320
C                                                                       FES14330
C                                                                       FES14340
      SUBROUTINE STPOUT (NN,NTIME,NPRINC,NTYPE,NSECC)                   FES14350
C                                                                       FES14360
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC        MDS 4/9/82                 FES14370
C                                                                       FES14380
C     STPOUT: SETS UP OUTPUT FORMATS FOR OUTPUT FROM OVERLAND FLOW      FES14390
C             STRIPS                                                    FES14400
C     4/14/82 VERSION WILL SET UP OUTPUT FOR ALL NODES                  FES14410
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC FES14420
C                                                                       FES14430
      COMMON/BLK4/XLEN(10),TWIDTH(11),RQ(10),AO(11),QO(11),AA(11),      FES14440
     *   QQ(11),AREA(10),VV(11),DD(11),HT(11),BASE(11)                  FES14450
      COMMON/BLK20/AOS(11),QOS(11),RQS(11),QSCONF(6000,3),AAS(11),      FES14460
     *   QQS(11)                                                        FES14470
      DIMENSION QP(144,11),QSP(144,11),SED(144,11),TSED(144,11)         FES14480
      DIMENSION WIDTH(11),HOUR(144),TQ(144,11)                          FES14490
      INTEGER OVER/'OVER'/,CHNL/'CHNL'/,PRT                             FES14500
      NTI=NTIME/NPRINC                                                  FES14510
      DT=FLOAT(NPRINC)                                                  FES14520
      HOUR(NTI)=FLOAT(NTI*NPRINC)/3600.0                                FES14530
      DO 225 I=1,NN                                                     FES14540
          NODE=I                                                        FES14550
          WIDTH(I)=TWIDTH(NODE)                                         FES14560
          IF(NTYPE.EQ.CHNL) WIDTH(NODE)=1.0                             FES14570
          QP(NTI,NODE)=QQ(NODE)                                         FES14580
          QSP(NTI,NODE)=QQS(NODE)*WIDTH(NODE)                           FES14590
          IF(NTI.GT.1) GO TO 224                                        FES14600
              TSED(1,NODE)=0.0                                          FES14610
              TQ(1,NODE)=0.0                                            FES14620
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                GO TO 225
224         CONTINUE
            TSED(NTI,NODE)=TSED(NTI-1,NODE)+(QSP(NTI-1,NODE)
     *          +QSP(NTI,NODE))*DT/(2.*1000.)
            TQ(NTI,NODE)=TQ(NTI-1,NODE)+(QP(NTI-1,NODE)
     *          +QP(NTI,NODE))*DT/(2.*35.3147)
225   CONTINUE
      PRT=MOD(NTI,144)
      IF(NTIME.LT.NSECC.AND.PRT.NE.0) GO TO 999
            DO 240 I=1,NN,4
                  NSTART=(I-1)
                  NWRITE=NN-NSTART
                  IF(NWRITE.GT.4) NWRITE=4
                  CALL NODHD(NSTART,NWRITE)
                  LCOUNT=MINO(NTI,144)
                  DO 230 J=1,LCOUNT
                        NS=NSTART+1
                        NEND=NSTART+NWRITE
                        WRITE(6,226) HOUR(J),(QP(J,K),TSED(J,K),
     *                        TQ(J,K),K=NS,NEND)
226   FORMAT(1X,F5.2,4(F9.2,F12.3,F10.1))
230                     CONTINUE
240               CONTINUE
999   RETURN
      END
        SUBROUTINE NODHD(NSTART,NN)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC MDS 4/14/82
C       NODHD: SETS UP MULTIPLE NODE OUTPUT ( FOUR NODES PER LINE)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
        L=1+NSTART
        LL=2 +NSTART
        LLL=3   +NSTART
        LLLL=4    +NSTART
        NWRITE=4
        IF(NN-NSTART.GE.4)GO TO 215
        NWRITE=NN-NSTART
  217   GO TO (212,213,314),NWRITE
  212   WRITE(6,203)L
  203   FORMAT(/20X,'NODE',I3/2X,'TIME',
       *  6X,'CFS',6X,'M.TONS',6X,'CU.M')
        GO TO 216
  213   WRITE(6,209)L,LL
  209   FORMAT(/20X,'NODE',I3,24X,'NODE',I3/2X,'TIME',
       *2(6X,'CFS',6X,'M.TONS',6X,'CU.M'))
        GO TO 216
  314   WRITE(6,310)L,LL,LLL
  310   FORMAT(/20X,'NODE',I3,24X,'NODE',I3,24X,'NODE',I3/2X,'TIME',
       *3(6X,'CFS',6X,'M.TONS',6X,'CU.M'))
        GO TO 216
  215   WRITE(6,211)L,LL,LLL,LLLL
  211   FORMAT(/20X,'NODE',I3,24X,'NODE',I3,24X,'NODE',I3,24X,'NODE',I3/
       *2X,'TIME',4(6X,'CFS',6X,'M.TONS',6X,'CU.M'))
  216   RETURN
        END
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Virginia's Agricultural Experiment Stations

1—Blacksburg
Virginia Tech

2—Steeles Tavern
Shenandoah Valley Research Station

3—Orange
Piedmont Research Station

4—Winchester
Winchester Fruit Research Laboratory

5—Middleburg
Virginia Forage Research Station

6—Warsaw
Eastern Virginia Research Station

7—Suffolk
Tidewater Research and Continuing Education Center

8—Blackstone
Southern Piedmont Research and Continuing Education Center

9—Critz
Reynolds Homestead Research Center

10—Glade Spring
Southwest Virginia Research Station

11—Hampton
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