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AN EVALUATION AND APPLICATION OF A DIGITAL HYDROLOGIC SIMULATION MODEL TO AN IDAHO WATERSHED

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ABSTRACT

Watershed simulation models have many engineering applications in the areas of research and project planning and management. In this study the Kentucky Watershed Model, a Fortran version of the Stanford Watershed Model, was adapted for use in Idaho.

The model was applied and evaluated on the Palouse River near Potlatch, Idaho, a 317 sq.mi. watershed in northern Idaho. Daily flows were synthesized and plotted against recorded flows for the 1967-1968 and 1969-1970 water years. The synthesized annual water yield was found to be 7.34 and 13.59 inches respectively versus recorded values of 5.68 and 12.05 inches. A tendency to underestimate peaks early in the runoff season and to underestimate the spring recession was also observed. An adjustment to the valley precipitation estimate was made to account for orographic influences on the amount of precipitation received in the upper mountainous region of the watershed.

CHAPTER I

INTRODUCTION

DIGITAL SIMULATION CONCEPT IN WATERSHED HYDROLOGY

Hydrology, a branch of earth science, deals with the occurance, movement and distribution of water either above, on or under the earth's surface.

The hydrologic regimes of streams and rivers provide the fundamental information used for the design, planning and operation of hydraulic engineering projects (Crawford and Linsley, 1966). Thus a thorough understanding of the hydrologic cycle and the water budget is a necessary condition for optimal utilization of the water resource on earth. In order to better perform this task, simulation techniques have been brought into this field recently utilizing the high-speed electronic digital or analog computer. Through the use of computers, an indirect investigation of the response and the behavior of the interrelationships among the hydrologic components can be attained.

Dawdy (1969) stated, "One of the major aims of hydrology is to determine meaningful measures which describe a particular element of hydrology." These measures may be the response of floods, low flows, or parameters which describe the physical system. Simulation models are structured so as to contain within their parameters all the information concerning these measures and responses. "A second major aim of hydrology is prediction." (Dawdy,1969). Examples are prediction of a flood from a snowpack or rain-storm and the prediction of response of an aquifer to certain withdrawals.

What is simulation? Simulation in general is a representation of reality. It is a technique by which complex systems can be analyzed with less difficulty and expense than would be required by manipulation of the prototype. In digital simulation in hydrology, the system is a collection of quantitative hydrologic concepts with mathematical representation in the form of a digital computer program. Such a system, or model, is usually designed to simulate streamflows over a preselected period of time. The input to the model is usually climatological, physical or geographical data for a specified watershed. If each of these concepts is well established and every physical component of the watershed is properly represented in the model, the entire model would be unique and all physical processes in the watershed could be accurately simulated (Crawford and Linsley, 1966).

STUDY OBJECTIVES

Crawford and Linsley of the Department of Civil Engineering, Stanford University have made a pioneering effort in modelling the hydrologic cycle through their development of the Stanford Watershed Model. It is the purpose of this study to adapt the Kentucky version of the Stanford Watershed Model for use on the computer system available at the University of Idaho, and to apply the model to an Idaho watershed. It was in this context that the study was initiated with these general objectives:

(1) To study some basic concepts in watershed modelling.

(2) To present a watershed model application in a documentary form that would allow later users to use the model efficiently.

Some basic knowledge of hydrologic model building and a brief review of those watershed models that already exist was deemed necessary before proper, practical watershed simulation could be performed. Chapter II contains this information along with a short description of the Kentucky Watershed Model. Due primarily to limited storage capacity of the IBM 360/40 computer at the University of Idaho, changes and modifications of the computer program were made. These are described in Chapter III. Chapter IV contains a discussion of the simulation of a watershed in Idaho, the selection of parameters and input data justifications, and the presentation and discussion of the results. Finally, conclusions and recommendations are given in Chapter V.

CHAPTER II

LITERATURE REVIEW

WATERSHED SIMULATION MODELS

The hydrologic cycle is fairly easy to describe in qualitative terms because the interactions between major components are well known. But the extension of this qualitative knowledge to obtain quantitative results is very difficult due to the fact that hydrologic processes are very complex, interrelated and strongly time dependent (Crawford and Linsley, 1966). The advent of the computer provided a valuable tool by which synthesized streamflow records can be obtained from a mathematical model with climatological data and physical characteristics of the study watershed as inputs. Watershed modelling consists of recognizing the various phases of the physical processes involved in the hydrologic cycle on a watershed and mathematically describing them as a continuous and dynamic system. Dawdy (1969) stated: "Quantitative estimates require modelling. The more closely the model approximates the system modeled, the more accurate is the prediction obtained by using the model." There is always a compromise between simplicity and accuracy of the model. The desirability of compromise is well documented in previous work and is based on minimizing both cost and effort. Model building is not a simple task. It may take several years to develop a model and thousands of man hours to use

(Dawdy, 1969). Such model building is both an art and a science. The science comes in the theoretical derivation and empirical verification of equations describing hydrologic phenomenon. The art comes in reviewing these available equations and supporting data, and estimating and adjusting certain parameters and calibrating the model in the manner which will give the best results (James, 1972).

The attempt to develop mathematical simulation models in hydrology is underlain by two basic assumtions which have been indicated by Dawdy (1969): "First is the belief that a properly designed and calibrated model will summarize the hydrology of any particular system, second is the belief that the model can be used for prediction either on a short term or a long term basis to extend the available data base." The following criteria or requirements are considered to be necessary in developing watershed models (Crawford and Linsley, 1966):

(1) The model should include the complete hydrologic system.

(2) It should be flexible enough to be easily applied to different watersheds with existing hydrologic data.

(3) It should be sufficiently sensitive to reflect changes in output data when input parameters are modified.

(4) The model should be physically relevant so that estimates of other useful data in addition

to streamflow can be obtained.

Crawford and Linsley made a pioneering effort to make watershed modelling practical for general use through their development of the Stanford Watershed Model at Stanford University beginning in 1959. They represented each process by an equation or series of equations containing parameters which vary in value for different watersheds and whose specific values are read in as input data. The model was structured in a general form which could be applied to all watersheds by using a set of parameter values which are found through trial and error by providing acceptable matching of simulated to recorded flows or measured moisture storage (James, 1972). The flexibility of the model allows the user to change or introduce equations freely to reflect new scientific information. The Stanford Watershed Model has been through four stages of development. Model I was developed in 1959, and considered only the elementary hydrologic concepts of a watershed. Model II was introduced in 1962 and included improvements and revisions that were incorporated into Model I. Model III was released in 1964 followed by Model IV in 1966. Model IV differs from model III in that the input data have been simplified, adjustments have been made in some moisture routing equations, and runoff has been combined from subwatersheds into a common hydrograph (Ligon and others, 1969).

Ever since the appearance of the Stanford Watershed Model, others have adapted this model to their own research or application needs. Many have modified the program and translated the language for use in their local computer facilities. Others have attempted to increase program capabilities or extend the printed output for additional information. For the past few years, published reports have shown that these sorts of efforts have been made at Kentucky University (James, 1970); Clemson University, South Carolina (Ligon and others, 1969); Virginia Polytechnic Institute and State University, Virginia (Shanholtz and others, 1971; Shanholtz and Lillard, 1971); Soil Conservation Service, Portland, Oregon (Rallison, n.d.); and at Ohio State University, Ohio (Ricca, 1972). Other than the above Stanford-type watershed models, there are many similar models which have subsequently been developed both in government agencies and in universities, which have made notable contributions to watershed hydrology. Among these are: TVA Continuous Daily-streamflow Model (TVA, 1972); Indiana Watershed Runoff Estimation Model (Lee and Delleur, 1972); and USDAHL-70 Model (Holtan and Lopez, 1971).

In addition to digital simulation, electronic analog computers also have been employed for modelling particular problems for which they are most appropriate. In 1960, the Hydraulic Laboratory of the University of California built an analog model for the purpose of routing floods in a particular river system (Riley and Chadwick, 1967). Research in electronic analog models of hydrologic systems began at Utah State University in 1963 and such a device was subsequently designed and built in 1964. An analog computer program has been developed for simulating flood conditions on the Kitakami River of Japan in 1965 (Riley and Chadwick, 1967). The electronic analog computer has several important advantages in simulating the hydrologic phenomena as indicated by Riley and Chadwick (1967):

(1) It behaves electronically in a manner analogous with the problem solved. If problem size doubled, the amount of analog equipment required also doubled but the time for solving the problem remains the same.

(2) Many processes occur in nature are time-dependent and are differential in form. Analog computers are able to integrate problem variables continuously instead of using numerical approximation.

(3) Because of the capability for continuous output feedback during problem solving, program optimization can be undertaken on the analog computer during the computation process.

Although the analog computer has the aforementioned advantages in simulation of hydrologic phenomena, digital simulation is still the most widely used method due to the wider availability and large storage capacity of the digital computer.

THE KENTUCKY WATERSHED MODEL

One of the major difficulties of using the Stanford Watershed Model is the programming language. The original program was written in the SUBALGOL language (Stanford University modification of the Burroughs Corporation ALGOL language) used by the Stanford Computer Center. Douglas L. James of the University of Kentucky has translated and modified the model into FORTRAN IV language. The differences which exist between the Stanford Model and the Kentucky Model are the addition of input data simplifications, the use of a revised procedure for reading storage gage rainfalls, and the addition of a section for printout of daily soil moisture (Ligon and others, 1969).

The model upon which this study was based is the latest version (dated June 6, 1970) of the Kentucky Watershed Model where minor reprogramming has been done to increase computational efficiency, to introduce some new options, and to revise output format. This Kentucky Watershed Model is composed of one master program (MAIN) and seven subroutine programs. The MAIN controls operations as directed by coded control options, performs the moisture accounting process to synthesize flows, calls subroutines and handles program output. The input data required for a computer run may be divided into the following six groups:

(1) Data used to title the watershed, to identify the computer run, to specify the desired program options and to request specific output. Fourteen values of these control options which select the program features the user wishes to use are listed in TABLE 2-1.

(2) Time-area histogram data.

(3) Data to describe climatological events during the water year.

(4) Data to initialize watershed moisture storage starting October 1 of the first water year being synthesized.

(5) Values for watershed parameters either measured or estimated by the user.

(6) Daily recorded streamflow data for the purpose of correlating the recorded and synthesized flows.

TABLE 2-1 Definition of the optional control code used in the Kentucky Watershed Model

CONOPT	Code	Definition
1	1	program prints out 15-minute storm details.
	0	program does not print out these values.
2	1	hourly rainfall is to be divided equally into 15-minute periods.
	0	hourly rainfall is not to be divided equally into 15-minute periods.
3	1	program reads in average daily evaporation during 10-day periods.
	2	program reads in average annual lake evaporation and the average annual number of recorded rainy days.
	0	program reads in 365 or 366 daily pan evaporation totals and monthly pan evaporation coefficient values.
4	1	program prints out daily flow error table at end of year.
	0	program neither calculates nor prints out these values.
5	1	program prints out 20 top hourly rainfall and runoff values during the year.
	0	program does not print these values.
6	1	program prints daily values of soil moisture storage.
	0	program does not print these values.
7	1	program reads in additional snow data.
	0	program treats all precipitation as rainfall.
8	1	program accepts input from more than one recording rain gage.
	0	program accepts only one recording gage.

TABLE 2-1 (continued)

CONOPT	Code	Definition
9	1	program reads in 365 or 366 daily recorded streamflows.
	0	program does not read in these values.
10	1	program will read new watershed parameters.
	0	program will not read these data.
11	1	program reads in daily values of diverted flow in cfs.
	0	program does not read in these values.
12	1	program routes streamflow on an hourly basis.
	0	program routes streamflow on 15-minute basis.
13	1	the length of time-area-histogram is to be varied with flow velocity.
	0	the length is not to be varied with flow velocity.
14	1	program prints daily recorded streamflows.
	0	program does not print these records.

Subroutine READ is employed to read numerical input data from punched data cards. READ is specially developed for free input data format with explanatory messages and is written in computer machine language for the IBM 360/65.

Subroutine DAYOUT prints a table of daily values given the magnitude of each desired value, the day of the year of the last day of each month, and the number of days in the year. It converts values arranged by calendar-year day into the water-year month order printout.

Subroutine EVPDAY uses regional data to distribute a total annual evaporation over the days of the year. According to the type of data the user has available, he can choose from among three approaches to read the necessary information as specified by control option 3.

Subroutine PREPRD divides precipitation among the 15-minute periods using the average distribution approach.

Subroutine RTVARY is used for varying stream routing time according the streamflow magnitude.

Subroutine SNOWMELT is used for the calculation of runoff and evaporation from snow when snowfall is a significant part of the precipitation of an area.

A watershed can be visualized as an open physical system with precipitation as input and streamflow as output (FIGURE 2-1). The logic concept of the computer program is based on a moisture balance within the watershed boundary, where all precipitation falling on the watershed is accounted for until it evaporates or flows out of the watershed.

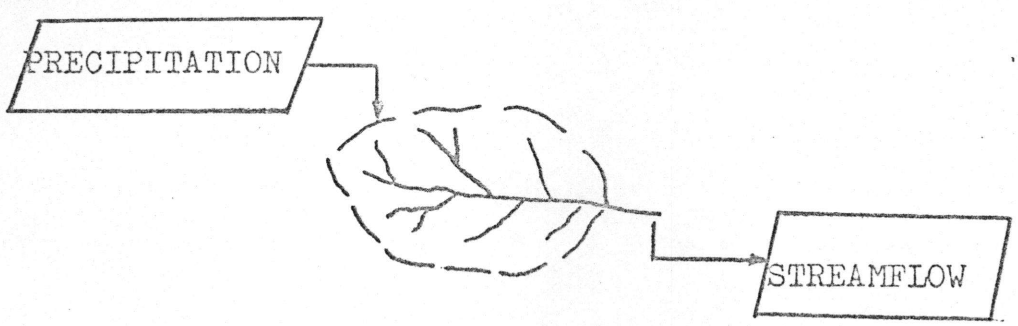

FIGURE 2-1 Watershed as an open physical system

FIGURE 2-2 is a schematic diagram of the operation of the hydrologic cycle in the Stanford Watershed Model (Crawford and Linsley, 1966). Each box represents a hydrologic component or a classification of moisture storage. The arrows represent processes whereby moisture moves from one type of storage to another (James, 1972). Precipitation and potential evapotranspiration are the major data inputs. Additional data are needed if snowfall is included in the model. Precipitation is first subjected to interception, then stored in the snowpack and in three soil moisture storages - upper zone storage, lower zone storage and groundwater storage. Precipitation falling on impervious areas contributes directly to the channel inflow. The upper zone and lower zone storage control the overland flow, interflow, infiltration and percolation to the ground water storage. Evaporation and transpiration may occur from all of these storages and remove water from the watershed. The moisture accounting period is 15-minutes. The total channel inflow from impervious areas, overland flow, interflow and groundwater flow is then routed to the watershed outlet by the time-area routing method and the result is simulated streamflow.

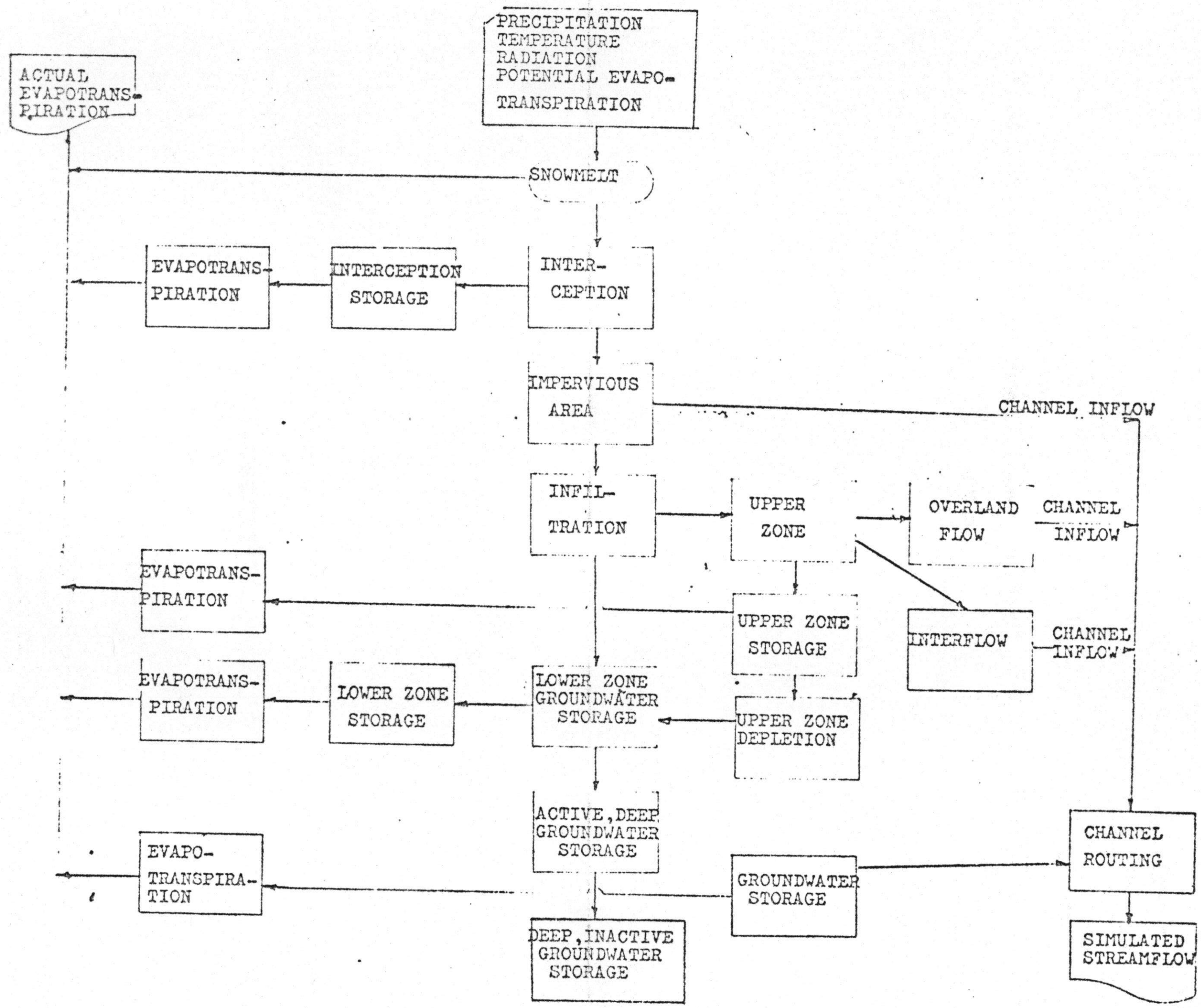

FIGURE 2-2 Schematic diagram of the operation of Stanford Watershed Model

CHAPTER III

CHANGES INCORPORATED INTO THE KENTUCKY WATERSHED MODEL

The model employed in this study was the Kentucky version of the Stanford Watershed Model (or Kentucky Watershed Model). This particular model was used simply because the program deck is readily available and the model itself is considered general enough to be applied to watersheds in the western states. In order to operate this model on the IBM 360/40 computer currently available at the University of Idaho, some changes and modifications of the program were made. The primary effect of the modifications was reduction in the storage requirement and the execution time. During experimental runs, minor improvements which appeared to be beneficial were also incorporated into the program. These are described in the following paragraphs. The program presently (as of June, 1973) in operation consists of one MAIN program and five subroutines. The changes that have been made are summarized below:

SUBROUTINE READ

Subroutine READ in the original program was written in machine language for IBM 360/65. This subroutine is now replaced by conventional FORTRAN IV read statements. Consequently, revision of the associated input data format was required. This change introduced more difficulty in data preparation and also added more computer run time. Special care should be exercised in arranging the input data. Data cards must be arranged in a sequence that can be read in according to the particular control option used within the program.

SUBROUTINE EVPDAY

To reduce the storage requirement, subroutine EVPDAY was removed from the program. As a consequence, the use of "2" in control option 3 was eliminated. This means that the program must read in daily evaporation data either as averages over ten-day periods or as 365 or 366 daily pan evaporation items with monthly pan evaporation coefficient values.

PROGRAM TERMINATION

Program termination statements were revised to give additional control. The original program terminated upon reaching the END-OF-FILE card and in turn printed out error messages. To eliminate error messages new statements were inserted to cause exit when end of record was read.

At the beginning of the program, the number of years of recorded data to be input is read in by the following statements.

```
C READ IN NUMBER OF YEARS OF RECORDED DATA REQUIRED
      READ(5,2050) NOYR
```

```
2050   FORMAT(I2)
```

At the end of the program, a counter is set up and is checked to direct the program whether to go back to start a new year or to terminate the program:

```
      NOYR=NOYR-1
      IF(NOYR.EQ.0) GO TO 117
```

With this added capacity, any number of years records can be simulated.

ADDITIONAL CONTROL OPTION TABLE PRINTOUT

For the convenience of correlating the program printout with the options specified, the following statements were added to print out the control option table:

```
      WRITE(6,998)
  998 FORMAT('1',15X,'CONTROL OPTION CODE TABLE')
      DO 99 J=1,14
   99 WRITE(6,999) CONOPT(J),J
  999 FORMAT(/50X,'* ',I2,' * OPTION ',I2,' *')
```

This printed table permits the user to easily correlate the program output with that particular set of control options used without going back to the data deck. The meaning of each code can be found in Chapter II Table 2-1. A sample printout is presented below:

CONTROL OPTION CODE TABLE

```
* 1 * OPTION  1 *
* 0 * OPTION  2 *
* 1 * OPTION  3 *
* 1 * OPTION  4 *
* 0 * OPTION  5 *
* 0 * OPTION  6 *
* 0 * OPTION  7 *
* 0 * OPTION  8 *
* 1 * OPTION  9 *
* 0 * OPTION 10 *
* 1 * OPTION 11 *
* 1 * OPTION 12 *
* 0 * OPTION 13 *
* 1 * OPTION 14 *
```

CHAPTER IV

APPLICATION TO AN IDAHO WATERSHED

One of the objectives of this study was to evaluate the effectiveness of the Kentucky Watershed Model in predicting the streamflow from a watershed in Idaho. The Palouse River near Potlatch was selected for this application.

GENERAL DESCRIPTION OF THE STUDY WATERSHED

The Palouse River watershed near Potlatch (FIGURE 4-1) is located in Latah and Benewah Counties in northern Idaho. It is situated approximately 18 miles north of Moscow, Idaho in the St. Joe National Forest. The mountains are spurs and bordering ridges of the Coeur d' Alene Mountain division of the northern Rocky Mountains.

Bedrock strata in the basin are of the Precambrian Belt Supergroup; these are principally older rocks consisting of argillites, silty argillites, and some quartzites. This type of bedrock prevails downstream through the Laird Park area on the main stem. Boulders, cobbles, gravels and substrate in the main river and its tributaries are of this nature. Similar loose rock underlying the broad flood plain continue to a point just east of Princeton. At this point lava flows of the Columbia River Group, form a basaltic bedrock stream floor at places with gravel and silty

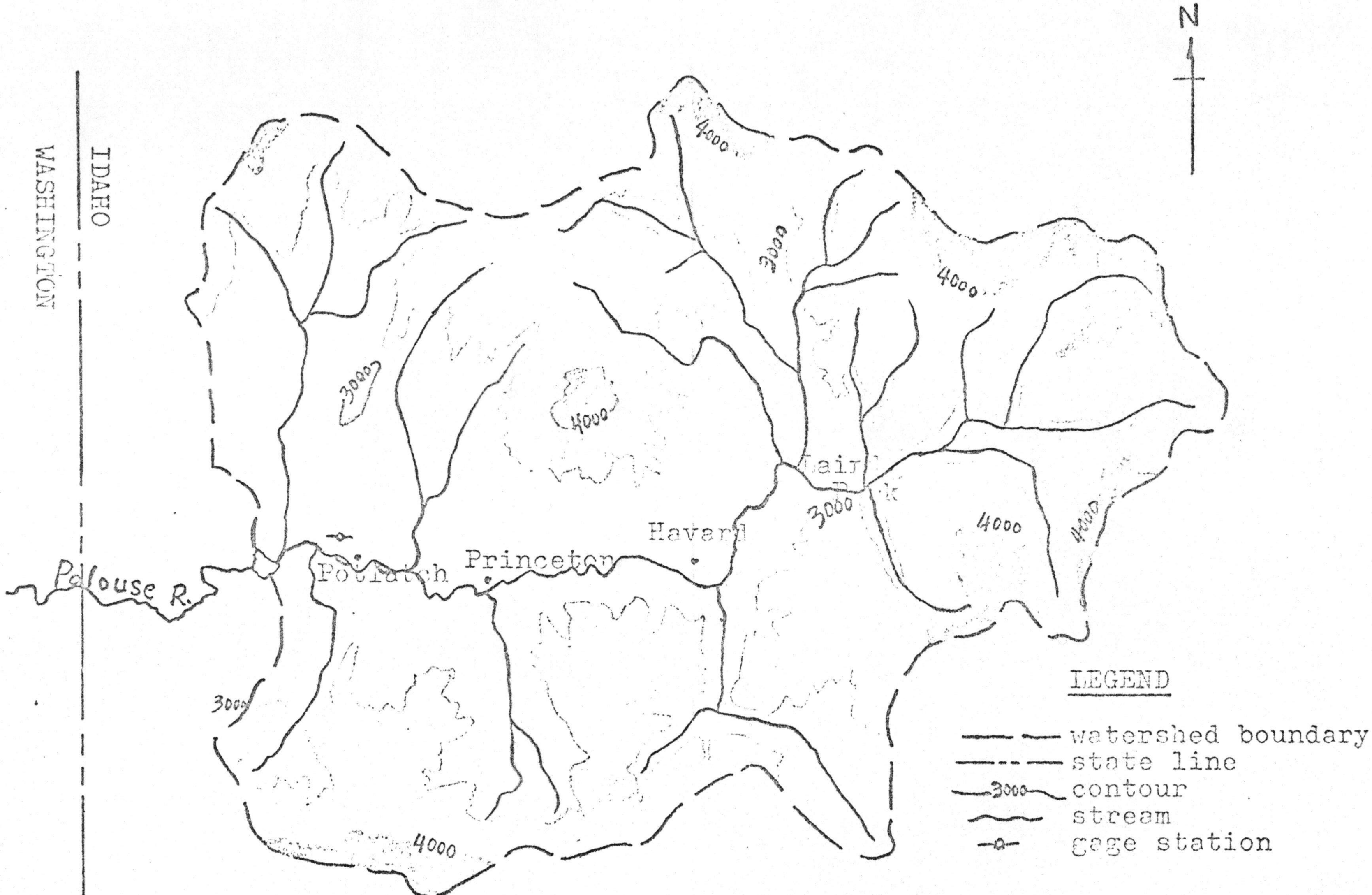

FIGURE 4-1 The Palouse River near Potlatch watershed

sand substrate other places to Potlatch. Loess covers the area from Laird Park downward with increasing thickness toward the lower end. This material contributes considerable silt in the streams at some times of the year. The watershed eventually drains into the Snake River, and subsequently into the Columbia River.

Land slopes of the watershed are moderate to steep with an elevation range of 2480 ft to 5060 ft above sea level. The climate is temperate with average annual temperature of 45°F. The average annual precipitation is 25 inches mostly in fall, winter and spring month. Snowfall is the major form of precipitation during the winter months. The principal source of moisture is the Pacific Ocean and weather patterns move generally from west to east. The higher elevations are forest covered while cropland with interspersed timber is the major land use in lower elevations. Detailed soil survey have been made by the Soil Conservation Service and by Clark, Coleman and Rupeiks Inc. Seattle, Washington. The general soil characteristics of the area are summarized in TABLE 4-1. Some of the physiographic characteristics of the watershed are summarized below:

Drainage area: 317 sq.mi.

Elongation ratio: 0.576

Total watershed relief: 2580 ft.

Drainage density: 1.65 mi./sq.mi.

TABLE 4-1 Summary of general soil characteristics of Palouse River watershed

Soil Type	Watershed Area (%)	Depth (inches)	Available Water Capacity(inches)	Natural Drainage
Helmer Silt Loam	2	60	8-11	Somewhat poor
Huckleberry Stony Silt Loam	37	20-40	5-8	Good
Minaloose Gravelly Loam	29	20-40	4-7	Good
Santa Silt Loam	10	60	6-9	Moderately good
Stanford Silt Loam	4	60	5-8	Somewhat poor
Taney Silt Loam	4	60	6-9	Moderately good
Uvi Silt Loam	3	20-40	5-8	Good
Vassar Silt Loam	11	40-60	6-9	Good

Average mean channel slope: 0.5%

Total stream length: 510 miles

The streamflow was simulated at the point where the stream gage is located at latitude of 45°54'55" North, longitude 116°57'00" East in Latah County, on the left bank 20 feet down stream from a bridge on U.S. Highway 95, 1.0 mile downstream from Deep Creek, 2.0 miles west of Potlatch. The average annual discharge for eight years of record is 265 cfs (or 11.35 inches of runoff) with a maximum discharge of 51,910 cfs and a minimum of 1.2 cfs. Non-recording temperature and precipitation gages are located 3 miles NNE of Potlatch, at latitude 46°58' North and longitude 116°53' East.

PREPARATION OF INPUT DATA

One of the major problems in the application of a watershed model is the collection of the required input data and the determination of parameter values. Suitable determination of watershed parameter values is the key to the successful application of a watershed model. When a user applies the model to a watershed, he must collect the necessary meteorological data from historical records, measure the required soil and physiographic watershed characteristics, estimate proper values for certain parameters, and then adjust these parameter values by trial-and-error methods until a certain degree of accuracy is attained. These adjustments and calibrations are the art of modelling. It requires familiarity with the model employed and some understanding of the sensitivity of the parameters under study. In using the Kentucky Watershed Model, this process is greatly aided by studying recently published reports written by James (1970), Ross (1970) and Liou (1970). However, the decision of selecting a final set of parameter values is essentially subjective. Ross (1970) presented the set of parameters used in the Kentucky Watershed Model in a schematic diagram shown in FIGURE 4-2. The underlined parameters are those which were not measurable. The following table gives the range of values for each parameter used in the Kentucky Watershed Model.

Parameter name	Range of value*	Reference or source
FIMP	0-1	Ross (1970) p.40
VINTMR	0.01-0.20	Ross (1970) p.40
GWETF	usually 0	Ross (1970) p.40
SUBWF	usually 0	Ross (1970) p.41
OFMN	0.009-0.200	V.T.Chou (1959) Open Channel Hydraulics p.110-113
OFMNIS	0.013-0.100	Ross (1970) p.44
IFRC	0.100-0.620	Ross (1970) p.87; James (1970) p.48
BFRC	0.722-0.9967	Ross (1970) p.87; James (1970) p.48
BFNLR	0.9-1.0	Ross (1970) p.47
ETLF	0.20-0.30	Ross (1970) p.53
SIAC	0.15-0.70	Ross (1970) p.115
BMIR	1.12-21.85	Ross (1970) p.130,131; James (1970) p.46

Parameter name	Range of value	Reference or source
BIVF	0.0-3.91	Ross (1970) p.87
CSRX	0.887-0.962	Ross (1970) p.87
FSRX	0.900-0.990	Ross (1970) p.87; James (1970) p.48
EXQPV	0.1-0.25	Ross (1970) p.24
BUZC	0.43-7.42	Ross (1970) p.87
SUZC	0.35-2.04	Ross (1970) p.87
LZC	2.03-28.05	Ross (1970) p.87

* Values taken mainly from Kentucky state.

Without doubt, prior knowledge of the expected direction and magnitude of responses to selected changes in input data, is helpful in minimizing the number of trials required to obtain an optimal set of input values. This was accomplished in this study by numerous simulation runs using Elkhorn Creek data from Kentucky. Such parameters as ETLF, LZC, SIAC, VINTMR, BIVF, BMIR were given particular attention since they are more sensitive than others as indicated by Ross (1970). Each parameter was changed, either alone or with several others, and the effect of this change on the simulated streamflow was noted. When it was felt that sufficient experience had been gained in operating the model, the model was applied to the Palouse River near Potlatch.

The application to the Palouse River logically began with the collection of data. This data collection

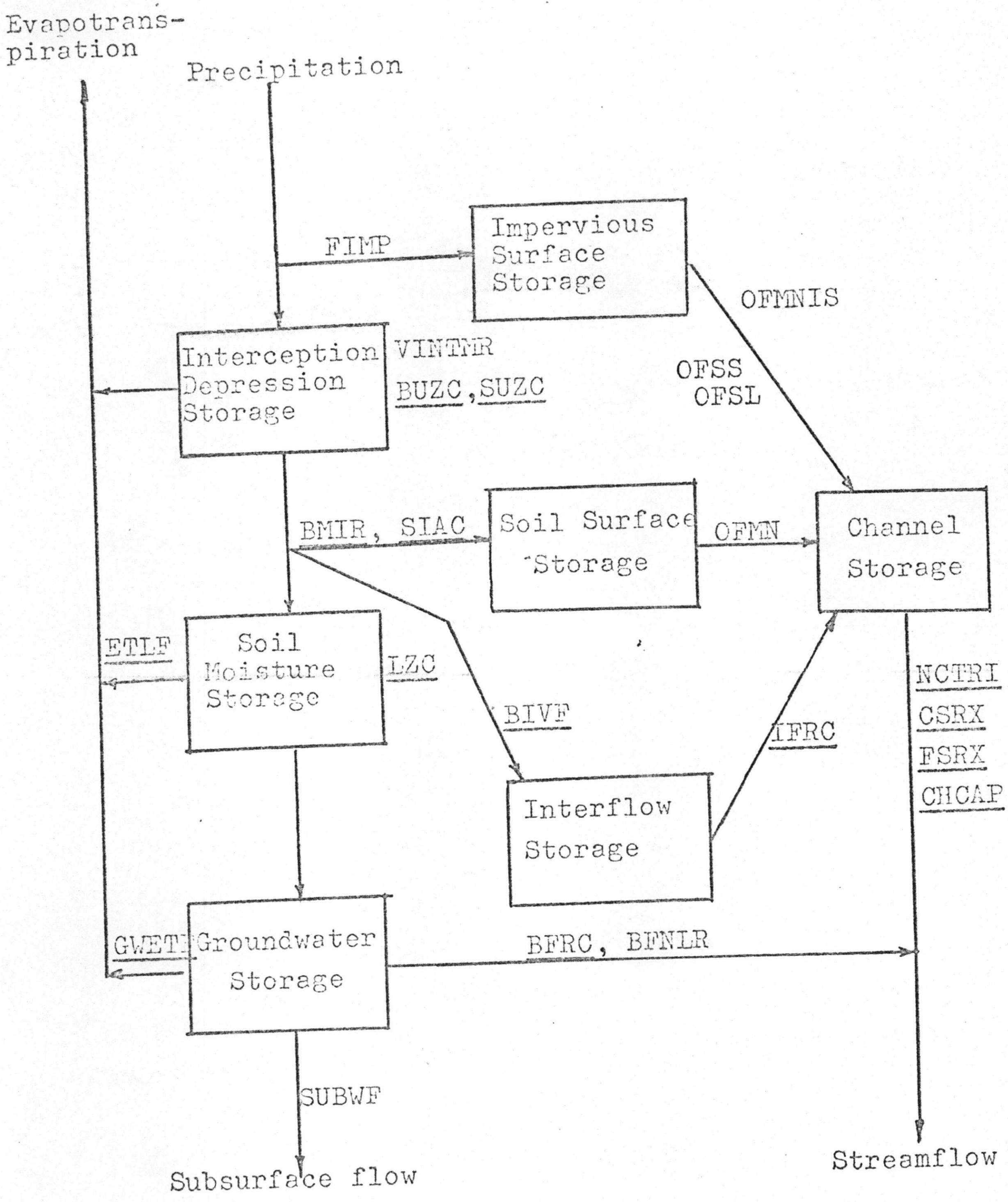

FIGURE 4-2 Schematic diagram of the parameters used in the Kentucky Watershed Model

was divided into three groups:

Group I Recorded climatological data- such as precipitation, evaporation, temperature, radiation, etc. can be obtained from the monthly publication of U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service. Daily streamflow data can be obtained from the Surface Water Records published by United States Department of the Interior, Geological Survey.

Group II Measurable or assignable parameter data- such as AREA, RMPF, FIMP, FWTR, OFSS, OFSL, OFMN, EPCM, CTRI, NCTRI, CHCAP, etc. are obtainable from a topographic map or from a knowledge of the watershed.

Group III Estimated data- such as IFRC, BUZC, SUZC, LZC, ETLF, SIAC, BMIR, CSRX, FSRX, etc. These parameters can be estimated initially from whatever physical and hydrologic data are available or with reference to other similar watersheds. Further adjustments are required based on the feedback from trial simulations.

Difficulty was encountered in finding hourly precipitation data. The Potlatch rain gage is of the non-recording type read once per day. However, a gage at Plummer, 30 miles north of Potlatch, did have hourly data. Therefore, the precipitation at Potlatch was distributed throughout each precipitation period in the same ratio as the precipitation at Plummer. After the input data were collected, a few initial trial runs were conducted to examine the effects of parameter variations. Most attention was given to the evapotranspiration loss factor, the soil moisture storage index, the base flow recession constant, the interflow volume factor and the seasonal infiltration adjustment constant. Attempts were made to manipulate these parameters in order to obtain a better match between synthesized and recorded streamflows. Computerized optimization techniques have been devised to substitute for the manual approach used in this work. Owing to the limitation of the available computer facilities, it was not possible to use such techniques in this study. For the first trial run, the synthesized annual runoff was 6.64 inches which was very low compared to the recorded annual runoff of 12.05 inches. Since increasing the interflow volume and decreasing the infiltration rate will increase the total runoff, the value of BIVF was changed from 3.5 to 5.0 and BMIR was changed from 6.0 to 4.0 in the second trial run. This increased the synthesized annual runoff to 6.84 inches with the correlation coefficient (r) equal to 0.8323 as opposed to an r value of 0.8416 for the first trial. In the third trial run, the value of LZS was increased from the initial estimated value of 2.0 to 5.0. Increasing the LZS value increases the soil moisture ratio, LZS/LZC, which in turn will increase the interflow volume and the total annual runoff. After this trial run, the synthesized annual runoff was increased to 8.94 inches. However, the r value was decreased to 0.8071. The changes involved in the fourth trial run were to decrease the seasonal infiltration adjustment constant, SIAC, which should increase runoff in summer; to increase the base flow recession constant, BFRC, which should reduce the peak recession rate; to decrease the evapotranspiration rate, ETLF, which should increase the total runoff. The synthesized total annual runoff obtained from this trial run was 8.69 inches and the correlation coefficient between synthesized and recorded streamflows was 0.8214. The results and the set of parameter values chosen for this particular run will be presented later in this chapter.

FURTHER ADJUSTMENT OF PRECIPITATION

In comparing the outflow hydrograph obtained from the fourth run, it was observed that the simulated annual streamflow (8.69 inches of runoff) was lower than that of the recorded (12.05 inches). The simulated monthly flows were also low in general but especially in summer months. The timing of the peaks seemed to match fairly well, but the recession rate was too high. Since the only source of moisture is precipitation, attention was then drawn to the justification of the input precipitation. The precipitation records used in the model input were from a single rain gage located at the watershed outlet, the lowest elevation in the drainage. For more accurate representation of the precipitation amount over the entire watershed, it was decided that consideration should be given to the variations of precipitation distribution at different elevations in the basin. Rationale for this precipitation adjustment was supplied by Bloomsburg (1958). This study develops an elevation-precipitation relationship from isohyetal and contour maps for Crumerine and Gnat Creek watersheds near Moscow. These watersheds are approximately 12 miles from the study watershed and although smaller, have about the same relief and aspect. Taking the base point as having 100% precipitation, Bloomsburg used the following precipitation-elevation correction:

which increased the synthesized annual total runoff to 13.59 inches. At this stage, efforts were then concentrated in adjusting such parameters as SIAC, BIVF, BMIR and LZS to increase runoff in summer and to reduce peak recessions for better agreement between simulated and recorded flows. An additional verifying run was conducted for the 1967-1968 water year.

PRESENTATION OF RESULTS AND DISCUSSION

In this section, the simulation results of the application of the model to the Palouse River near Potlatch watershed are presented. As has been mentioned earlier several trials were required before a visually acceptable fit of the simulated and recorded hydrographs was obtained. This is admittedly a subjective procedure but it is widely used in hydrology. It also allows the hydrologist to concentrate on those parts of the annual hydrograph which are of interest to him. Undoubtedly a finer fit could be made if given sufficient time and efforts. TABLE 4-2 gives the parameter values selected for water year 1969-1970 before and after the adjustment of precipitation. Definitions of the parameters are given in Appendix A, Dictionary of Program Variables. TABLE 4-3 and FIGURE 4-3 show the comparison of the monthly synthesized streamflows with recorded streamflows and the daily streamflow hydrograph respectively for 1969-1970 before the precipitation adjust-

TABLE 4-2 Summary of parameter values for Palouse River near Potlatch watershed before and after the adjustment of precipitation

Parameters	Values prior to precipitation adjustment	Values after precipitation adjustment
Snowmelt		
BDDFSM	0.002	0.002
SPBFLW	0.05	0.05
SPTWCC	2.5	2.5
SPM	1.2	1.2
ELDIF	0.5	0.5
XDNFS	0.05	0.05
FFOR	0.65	0.65
FFSI	0.03	0.03
MRNSM	0.0126	0.0126
D SMGH	0.02	0.02
PXCSA	0.2	0.2
Watershed		
RGPMB	1.0	1.0
AREA	317.0	317.0
FIMP	0.0	0.0

Parameters	Values prior to precipitation adjustment	Values after precipitation adjustment
FWTR	0.0	0.0
<u>Overland flow</u>		
OFSS	0.29	0.29
OFSL	1500.0	1500.0
OFMN	0.050	0.050
OFMNIS	0.015	0.015
IFRC	0.40	0.40
<u>Initial moisture storage</u>		
GWS	0.02	0.02
UZS	0.0	0.0
LZS	4.0	4.0
BFNX	0.02	0.02
IFS	0.0	0.0
<u>Soil moisture</u>		
VINTMR	0.15	0.15
BUZC	1.0	1.0
SUZC	0.60	0.60

TABLE 4-2 (continued)

Parameters	Values prior to precipitation adjustment	Values after precipitation adjustment
LZC	6.5	7.4
ETLF	0.27	0.27
SUBWF	0.0	0.0
SIAC	0.50	0.30
BMIR	4.0	6.0
BIVF	5.0	5.5
Channel routing and groundwater		
CSRX	0.95	0.95
FSRX	0.97	0.97
CHCAP	2000.0	2000.0
EXQPV	0.25	0.25
BFNLR	1.0	1.0
BFRC	0.85	0.85

TABLE 4-3 Monthly synthesized and recorded streamflows for water year 1969-1970 before precipitation adjustment

Month	Synthesized (cfs-days)	Recorded (cfs-days)	Difference (%)
Oct.	291.1	387.3	+24.8
Nov.	154.8	418.9	+63.1
Dec.	2689.6	1335.8	-101.4
Jan.	25454.5	21994.0	-15.7
Feb.	19619.5	25376.0	+22.7
Mar.	15817.1	21334.0	+25.9
Apr.	7489.0	15658.0	+52.2
May	1570.0	12154.0	+87.1
Jun.	669.7	2517.0	+73.4
Jul.	224.0	810.0	+72.4
Aug.	79.7	309.8	+74.3
Sep.	5.8	388.1	+98.5
TOTAL	74064.8	102682.8	+27.8

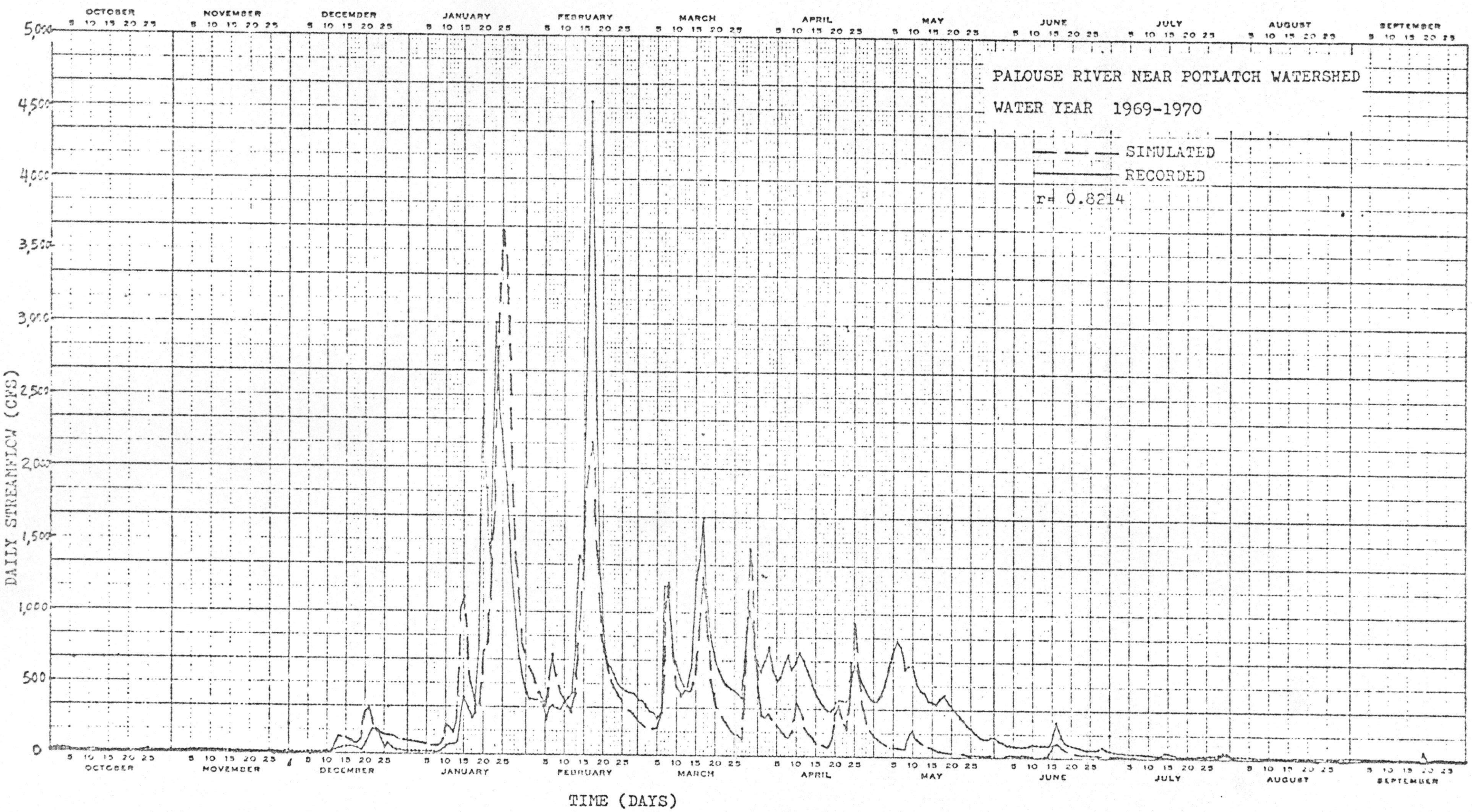

FIGURE 4-3 Daily streamflow hydrograph for water year 1969-1970 before precipitation adjustment

ment was made. TABLE 4-4 and TABLE 4-5 show the monthly synthesized and recorded streamflows for water year 1969-1970 and water year 1967-1968 respectively. The daily streamflow hydrographs for water year 1969-1970 and 1967-1968 are also presented in FIGURE 4-4 and FIGURE 4-5 respectively.

In evaluating the accuracy of the model output, a visual examination of plotted hydrographs is a reliable method. But it is somewhat subjective in most instances. The use of the linear correlation coefficient between synthesized and recorded flows, for example, gives an objective indication of the response of one value relative to another. The error table from the computer printout summarized the events occurring at preselected flow intervals over the period of analysis, and the standard errors were also calculated for each respective interval.

It was observed that the precipitation adjustment was necessary in order to better represent the average precipitation over the entire watershed. The results shown did indicate that this adjustment was appropriate. Other than precipitation, a few parameters also control the synthesized monthly and annual yields. These are the parameters related to the infiltration and soil moisture storage factors, such as LZC (lower zone capacity), LZS (lower zone storage), and BMIR (basic maximum infiltration rate) were found particularly sensitive to surface runoff.

TABLE 4-4 Monthly synthesized and recorded streamflows for water year 1969-1970 after precipitation adjustment

Month	Synthesized (cfs-days)	Recorded (cfs-days)	Difference (%)
Oct.	310.6	387.3	+19.8
Nov.	261.1	418.9	+37.7
Dec.	3240.0	1335.8	-142.6
Jan.	27756.6	21994.0	-26.2
Feb.	28659.0	25376.0	-12.9
Mar.	22946.3	21334.0	-7.6
Apr.	10372.5	15658.0	+33.8
May	3208.4	12154.0	+73.6
Jun.	2090.8	2517.0	+16.9
Jul.	1149.2	810.0	-41.9
Aug.	455.8	309.8	-47.1
Sep.	23.9	388.1	+93.8
TOTAL	100473.9	102682.8	+2.2

TABLE 4-5 Monthly synthesized and recorded streamflows for water year 1967-1968

Month	Synthesized (cfs-days)	Recorded (cfs-days)	Difference (%)
Oct.	455.0	418.0	-8.8
Nov.	898.0	513.3	-75.0
Dec.	8850.9	2409.0	-267.4
Jan.	6672.5	2332.0	-186.1
Feb.	31261.3	27798.0	-12.5
Mar.	10176.6	6843.0	-48.7
Apr.	2487.6	4659.0	+46.6
May	596.8	1662.0	+64.1
Jun.	283.0	784.0	+63.9
Jul.	48.9	222.1	+78.0
Aug.	3.9	161.5	+97.6
Sep.	822.0	614.3	-33.8
TOTAL	62556.6	48417.1	-29.2

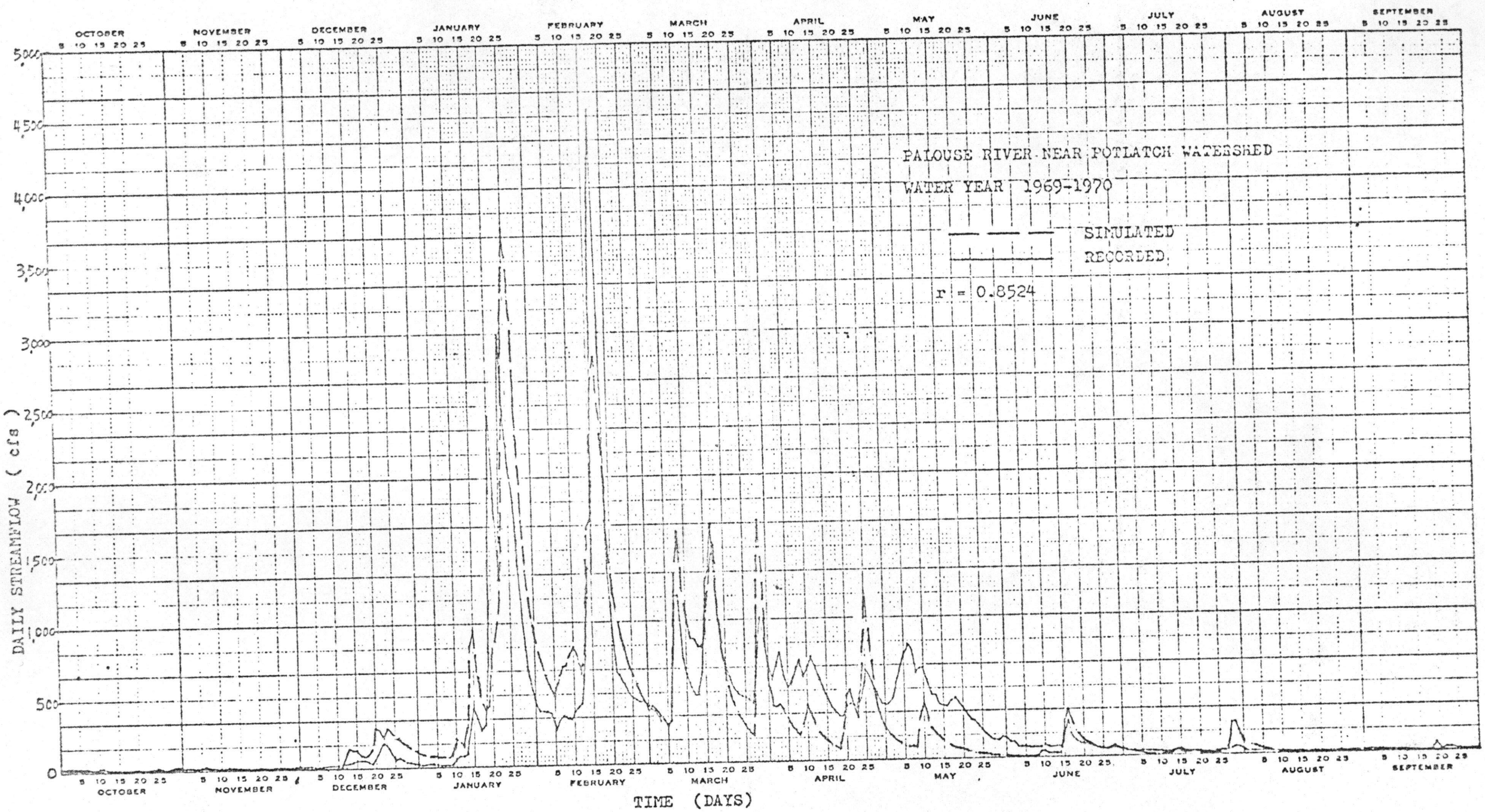

FIGURE 4-4 Daily streamflow hydrograph for water year 1969-1970 after precipitation adjustment

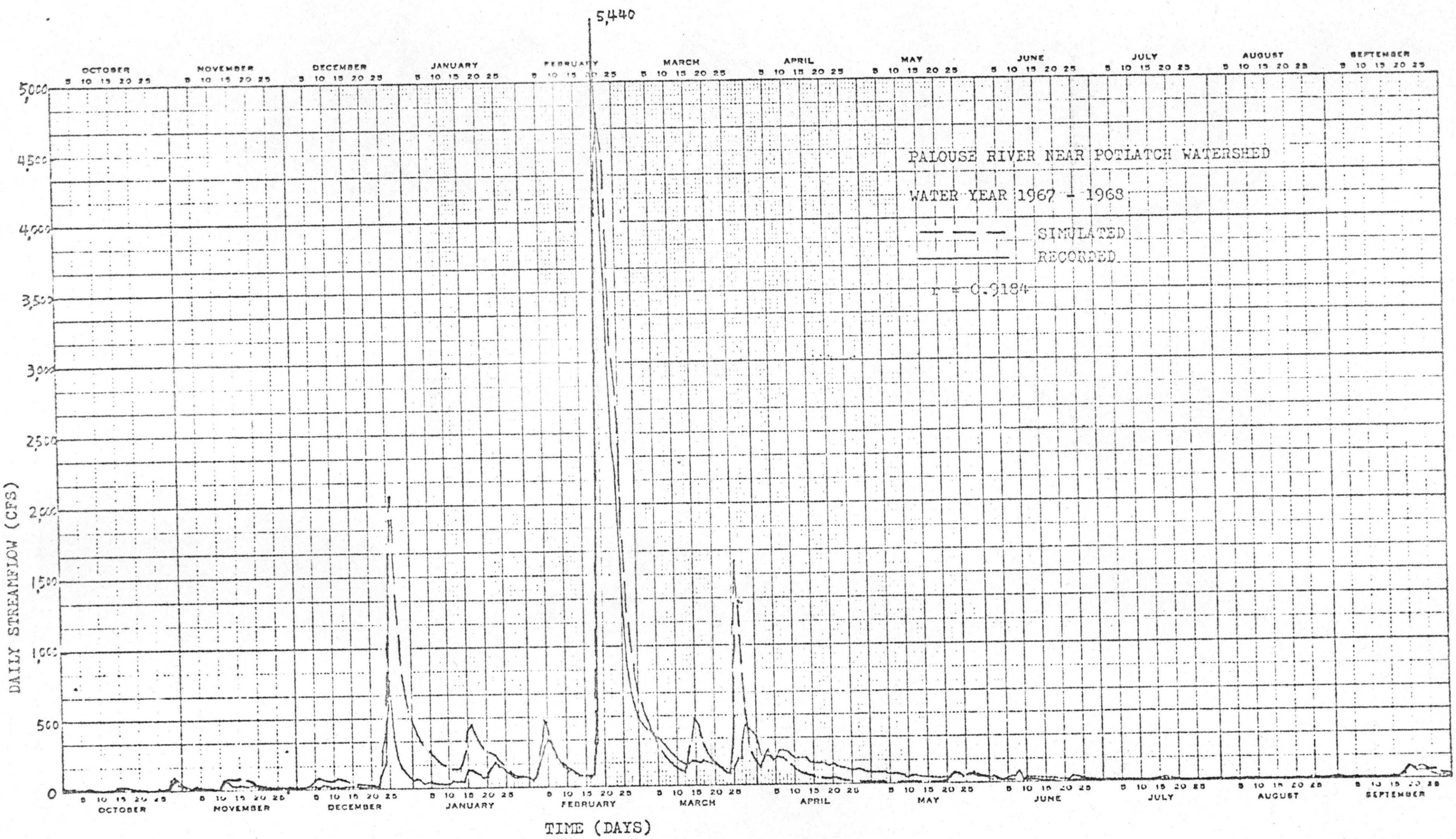

FIGURE 4-5 Daily streamflow hydrograph for water year 1967-1968

If LZC is decreased and LZS is increased, the annual water yield will also increase while an increase in MBIR will reduce runoff during storm periods. CSRX (channel storage routing index), FSRX (flood plain storage routing index), BIVF (basic interflow volume factor) were found more responsible for flood peaks. An increase in CSRX will result in a decrease in small flood peaks while an increase in FSRX will result in a decrease in large flood peaks. If it is desired to both reduce storm peaks in general and also extend the recession limb, then BIVF should be increased. The correlation coefficient, r, is 0.8524 for water year 1969-1970 and 0.9184 for water year 1967-1968. The agreement is considered acceptable for most months, although there were a few discrepancies in some months and peak discharges. In particular, the synthesized runoff in the early portion of winter is overestimated while the spring runoff is underestimated. There are exceptions to this in some spring peaks which are overestimated while their recessions are greatly underestimated. Additional manipulation of some parameters could lead to some improvement in matching the flood peaks. An explanation of these discrepancies could be due to large spatial and temporal variation of some storms over the watershed. The lack of accuracy of the potential evapotranspiration data and the snowmelt routine might explain the low simulated monthly volumes in spring and summer. The model accuracy also could be affected by the assumption that watershed characteristics are evenly distributed throughout each time-area element. Any exception to this assumption could cause the departures between synthesized and recorded streamflows. Heterogeneous watersheds with different climatological and physiographic characteristics could be handled by subdividing the watershed into subdrainages or subwatersheds, and combining the results for each subwatershed to obtain the final hydrograph.

In conducting the analysis of the accuracy of the model output, two factors should be remembered. "First, the adequacy of the rainfall network to correctly represent the rainfall on the watershed,and second, the accuracy of the stream gage recording watershed response." (Crawford and Linsley, 1966). In most cases, the precipitation pattern is the major cause of departure of synthesized from recorded flows. There is no point in attempting to improve the accuracy of simulation beyond the accuracy of the input rainfall data.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The model application and evaluation were made on the Palouse River near Potlatch in Idaho. During the application, difficulty was encountered in collecting the hourly precipitation data for the watershed, and in obtaining a set of values for the model parameters that would give the best fit of the outflow hydrograph. Considerable understanding of the model is necessary before a proper, practical application can be made to a watershed. Simulation techniques permit investigation of the effect of specific changes within the system being synthesized. Some conclusions are summarized as the result of this study:

1. The Kentucky Watershed Model can be adapted to operate on the IBM 360/40 digital computer at the University of Idaho.

2. The results of application of the model to an Idaho watershed are documented and presented. The model appears to reproduce the daily hydrograph within the accuracy of basic input data.

3. The application of the model to Idaho conditions seems feasible.

4. More study is necessary on the effect of precipitation variation over the basin on the simulated hydrograph.

In mountainous terrain, it may be necessary to divide the watershed into subwatersheds in order to account for this variation.

RECOMMENDATIONS

With the present level of understanding and the experience gained through the use of the Kentucky Watershed Model, the following recommendations are given:

1. A further break down of the main program into several subroutines seems necessary in order to provide an easier investigation of each hydrologic component.

2. The means of input data could be greatly simplified by using the free format input routine available at the Idaho Computer Center.

3. For a watershed with a single rain gage, the effect of errors in the measurement of watershed average rainfall should be given further investigation.

4. Calibration of the model should be extended to more watersheds with different physiographic and meterological conditions where data are available. Watersheds selected from southern Idaho should be included in this analysis.

5. Attention should be given to selecting the proper watershed parameters for each watershed under study.

6. The model needs to be modified to include the effect of urban development within the watershed.

7. Further research could be done in developing better relationships between model parameter values and the physical watershed characteristics for easier usage of the model.

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ELEVATION (FT)	PRECIPITATION (%)
4000	200
3500	170
3000	140
2800	120
2700	110
2600 less	100

Adapting these data to the Palouse River watershed, the approximate average percentage of the precipitation over the entire watershed with respect to the base point was calculated as below:

ELEVATION (FT)	AREA (%)	PRECIPITATION (%)	WEIGHTED PRECIP.(%)
4000 up	8	200	16
3000-4000	45	170	76
2600-3000	41	120	49
2600 less	6	100	6
		TOTAL:	147

Adjustment was then made to increase the input hourly precipitation data by the amount of 147%. However, results showed that this amount of precipitation was giving too high an annual runoff volume. Several other values were tried and it was found that 125% was a reasonable value

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APPENDIX A

Dictionary of Program Variables

VARIABLE NAME	UNITS	DEFINITION
ABFSL	DAY	ACCUMULATED BASE FLOW SEQUENCE LENGTH
ABFV	IN	ANNUAL BASE FLOW VOLUME
ACRFMI	-	ACCUMULATED CASES IN ALL RECORDED FLOOD MAGNITUDE INTERVALS
ADBF	IN	ACCUMULATED DAILY BASE FLOW
ADIF	IN	ACCUMULATED DAILY INTERFLOW
ADRSP	CFS	ACCUMULATED SUM OF DRSP
AETX	IN	ANNUAL EVAPOTRANSPIRATION INDEX
AEX90	IN	ANTECEDENT EVAPORATION INDEX, DECAY RATE = 0.9
AEX96	IN	ANTECEDENT EVAPORATION INDEX, DECAY RATE = 0.96
AFSIL	IN	ANNUAL FOREST SNOW INTERCEPTION LOSS
AHP	IN	ACCUMULATED HOURLY PRECIPITATION
AIFSL	DAY	ACCUMULATED INTERFLOW SEQUENCE LENGTH
AIFV	IN	ANNUAL INTERFLOW VOLUME
AMBER	IN	ANNUAL MOISTURE BALANCE ERROR
AMBF	IN	ACCUMULATED MONTHLY BASE FLOW
AMFSIL	IN	ACCUMULATED MONTHLY FOREST SNOW INTERCEPTION LOSS
AMIF	IN	ACCUMULATED MONTHLY INTERFLOW
AMNET	IN	ACCUMULATED MONTHLY NET EVAPOTRANSPIRATION
AMPET	IN	ACCUMULATED MONTHLY POTENTIAL EVAPOTRANSPIRATION
AMPREC	IN	ACCUMULATED MONTHLY PRECIPITATION
AMRPM	IN	ACCUMULATED MONTHLY RAIN PLUS MELT
AMRTF	CFS	ACCUMULATED MONTHLY RECORDED TOTAL FLOW

AMSE	IN	ACCUMULATED MONTHLY STREAM EVAPORATION
AMSNE	IN	ACCUMULATED MONTHLY SNOW EVAPORATION
AMSTF	CFS	ACCUMULATED MONTHLY SYNTHESIZED TOTAL FLOW
ANET	IN	ANNUAL NET EVAPOTRANSPIRATION
AOFV	IN	ANNUAL OVERLAND FLOW VOLUME
APET	IN	ANNUAL POTENTIAL EVAPOTRANSPIRATION
APPKP	-	ACCUMULATED PARAMETER PEAK PRODUCTS
APREC	IN	ANNUAL PRECIPITATION
AREA	SQ MI	AREA OF WATERSHED
ARHF	IN	ACCUMULATED ROUTED HYDROGRAPH FLOW
ARHPF	CFS	ACCUMULATED RECORDED HYDROGRAPH PEAK FLOWS
ARPM	IN	ANNUAL RAIN PLUS MELT
ARSTR	-	ACCUMULATED RATIO OF SYNTHESIZED TO RECORDED FLOWS
ASE	IN	ANNUAL SNOW EVAPORATION
ASEV	IN	ANNUAL STREAM EVAPORATION VOLUME
ASM	IN	ANNUAL SNOWFALL MOISTURE
ASMRG	IN	ANNUAL SNOWFALL MOISTURE REACHING GROUND
ASRR	CFS	ABSTRACTED SYNTHESIZED ROUTED RUNOFFS
ASRX	-	AVERAGE VALUE OF SRX
ATF	SFD	ACCUMULATED TOTAL FLOW
ATFV	SFD	ANNUAL TOTAL FLOW VOLUME
AVRHPF	CFS	AVERAGE VALUE OF RHPF
AWSBIT	-	ACCUMULATOR FOR WATERSHED BITS
BBMIR	IN/HR	CURRENT BEST ESTIMATE OF BASIC MAXIMUM INFILTRATION RATE

BBUZC	-	CURRENT BEST ESTIMATE OF BASIC UPPER ZONE STORAGE CAPACITY FACTOR
BBYLZS	IN	CURRENT BEST ESTIMATE OF BEGINNING OF YEAR LOWER ZONE STORAGE
BDDFSM	IN/HR	BASIC DEGREE DAY FACTOR FOR SNOW MELT
BETLF	-	CURRENT BEST ESTIMATE OF EVAPOTRANSPIRATION LOSS FACTOR
BFHRC	-	BASE FLOW HOURLY RECESSION CONSTANT
BFNHR	-	BASE FLOW HOURLY NONLINEAR RECESSION ADJUSTMENT FACTOR
BFNLR	-	BASE FLOW NONLINEAR RECESSION ADJUSTMENT FACTOR
BFNRL	-	BASE FLOW NONLINEAR RECESSION LOGARITHM
BFNX	IN	CURRENT VALUE OF BASE FLOW NONLINEAR RECESSION INDEX
BFRC	-	BASE FLOW RECESSION CONSTANT
BFRL	-	BASE FLOW RECESSION LOGARITHM
BFSRX	-	CURRENT BEST ESTIMATE OF FSRX
BISRX	-	BIG INCREMENTAL STORAGE ROUTING INDEX
BIVF	-	BASIC INTERFLOW VOLUME FACTOR
BLZC	IN	CURRENT BEST ESTIMATE OF LOWER ZONE STORAGE CAPACITY
BMIR	IN/HR	BASIC MAXIMUM INFILTRATION RATE WITHIN WATERSHED
BSIAC	-	CURRENT BEST ESTIMATE OF SEASONAL INFILTRATION ADJUSTMENT FACTOR
BSUZC	-	CURRENT BEST ESTIMATE OF SEASONAL UPPER ZONE STORAGE CAPACITY FACTOR
BTRI	-	BASE TIME ROUTING INCREMENTS
BUZC	-	BASIC UPPER ZONE STORAGE CAPACITY FACTOR
BYGWS	IN	BEGINNING OF YEAR GROUNDWATER STORAGE

BYIFS	IN	BEGINNING OF YEAR INTERFLOW STORAGE
BYLZS	IN	BEGINNING OF YEAR LOWER ZONE STORAGE
BYUZS	IN	BEGINNING OF YEAR UPPER ZONE STORAGE
CBF	IN/HR	CURRENT BASE FLOW
CCRFMI	-	CASES IN CURRENT RECORDED FLOW MAGNITUDE INTERVAL
CDSDR	-	CURRENT DAY FOR WHICH STORM DETAILS REQUESTED
CHBF	CFS	CURRENT HYDROGRAPH BASE FLOW
CHCAP	CFS	CHANNEL CAPACITY-INDEXED TO BASIN OUTLET
CHPV	-	CURRENT HYDROGRAPH PARAMETER VALUE
CIVM	-	CURRENT INTERFLOW VOLUME MULTIPLIER
CMIR	IN	CURRENT MAXIMUM INFILTRATION RATE DURING PERIOD
CN	-	1 = A.M., 2 = P.M.
CONOPT	-	CONTROL OPTION
CRFMI	-	CASES RECORDED IN FLOW MAGNITUDE INTERVAL
CRSBBF	CFS	CURRENT RECESSION SEQUENCE BEGINNING BASE FLOW
CRSBIF	CFS	CURRENT RECESSION SEQUENCE BEGINNING INTERFLOW
CRSBTF	CFS	CURRENT RECESSION SEQUENCE BEGINNING TOTAL FLOW
CRSTF	CFS	CURRENT RECESSION SEQUENCE TOTAL FLOWS
CRSOBF	CFS	CURRENT RECESSION SEQUENCE BASE FLOW ON DAY ZERO
CRSOIF	CFS	CURRENT RECESSION SEQUENCE INTERFLOW ON DAY ZERO
CSRX	-	CHANNEL STORAGE ROUTING INDEX
CTRI	-	CURRENT TIME ROUTING INCREMENTS
DATE	-	CURRENT DAY OF THE MONTH
DAY	-	CURRENT DAY OF THE YEAR
DBFRC	-	DOUBLE PRECISION BFRC

DDIW	CFS	DATED DIVERSIONS INTO WATERSHED
DFCC	-	DAILY FLOW CORRELATION COEFFICIENT
DIFRC	-	DOUBLE PRECISION IFRC
DIV	CFS	DIVERSION INTO BASIN, MEAN DAILY FLOW
DMNT	DEGF	DATED MINIMUM TEMPERATURE
DMXT	DEGF	DATED MAXIMUM TEMPERATURE
DNFS	-	DENSITY OF NEW FALLEN SNOW
DPET	IN	DATED POTENTIAL EVAPOTRANSPIRATION
DPSE	IN	DATED POTENTIAL SNOW EVAPORATION
DPY	-	DAYS PER YEAR
DRAF	CFS	DIFFERENCE BETWEEN RECORDED AND AVERAGE FLOW
DRGPM	-	DATED RECORDING GAGE PRECIPITATION MULTIPLIER
DRHP	IN	DATED RECORDED HOURLY PRECIPITATION
DRSF	CFS	DATED RECORDED STREAMFLOW
DRSGP	IN	DATED RECORDED STORAGE GAGE PRECIPITATION
DRSP	CFS	DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED HYDROGRAPH PEAKS
DSAF	CFS	DIFFERENCE BETWEEN SYNTHESIZED AND AVERAGE FLOW
DSMGH	IN	RATE OF DAILY SNOWMELT FROM GROUND HEAT
DSSF	CFS	DATED SYNTHESIZED STREAMFLOW
EDLZS	IN	END OF DAY VALUES OF LZS
EHSGD	-	ENDING HOUR OF STORAGE GAGE DAY
EHSGDF	-	ENDING HOUR OF STORAGE GAGE DAY-FLOATING POINT
EID	-	EXPONENT OF INFILTRATION RATE DECAY WITH INCREASED SOIL MOISTURE CONTENT

ELDIF	1000ft	ELEVATION DIFFERENCE BETWEEN BASE THERMOMETER AND BASIN MEAN ELEVATION
EMAET	IN	ESTIMATED MAXIMUM ANNUAL EVAPOTRANSPIRATION
EMATF	SFD	END OF MONTH ACCUMULATED TOTAL FLOWS
EMBFNX	IN	END OF MONTH BASE FLOW NONLINEAR RECESSION INDEX
EMFDP	-	EXTREME MONTHLY FLOW DEVIATION PARAMETER
EMGWS	IN	END OF MONTH GROUNDWATER STORAGE
EMIFS	IN	END OF MONTH INTERFLOW STORAGE
EMLZS	IN	END OF MONTH LOWER ZONE STORAGE
EMSIAM	-	END OF MONTH SEASONAL INFILTRATION ADJUSTMENT MULTIPLIER
EMUZC	IN	END OF MONTH UPPER ZONE STORAGE CAPACITY
EMUZS	IN	END OF MONTH UPPER ZONE STORAGE
EPAET	IN	ESTIMATED POTENTIAL ANNUAL EVAPOTRANSPIRATION
EPCM	-	EVAPORATION PAN COEFFICIENT FOR MONTH
EPS	-	MAXIMUM REQUIRED ESTIMATING TOLERANCE
EQD	IN	EQUILIBRIUM DEPTH OF OVERLAND FLOW
EQDF	-	EQUILIBRIUM DEPTH FACTOR FOR OVERLAND FLOW
EQDFIS	-	EQUILIBRIUM DEPTH FACTOR FOR OVERLAND FLOW, IMPERVIOUS SURFACES
EQDIS	IN	EQUILIBRIUM DEPTH OF OVERLAND FLOW IMPERVIOUS SURFACES
ERR	CFS	DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED DATED STREAMFLOW
ETIBF	CFS	ERROR TABLE INTERVAL BOUNDARY FLOODS
ETLF	-	EVAPOTRANSPIRATION LOSS FACTOR
EXQPV	-	EXPONENT OF FLOW PROPORTIONAL TO VELOCITY
FBUZC	-	ADJUSTMENT FACTOR FOR BUZC

FCNTRI	-	FLOATING POINT CHANGE IN NUMBER OF TIME ROUTING INCREMENTS
FDAY	-	FLOATING POINT CURRENT DAY OF THE YEAR
FDPY	-	FLOATING POINT DAYS PER YEAR
FDSC	-	FIRST DIFFERENTIAL OF SINE CURVE MAGNITUDE
FETLF	-	ADJUSTMENT FACTOR FOR ETLF
FFOR	-	FRACTION OF THE WATERSHED BEING FOREST
FFSI	-	FRACTION OF SNOW ON FOREST INTERCEPTED
FHPP	-	FRACTIONAL HOUR PER PERIOD
FIMP	-	FRACTION OF THE WATERSHED BEING IMPERVIOUS
FIRR	-	FRACTION OF INCOMING RADIATION REFLECTED BY SNOW SURFACE AS A FUNCTION OF AGE
FKRFMI	-	FLOATING POINT VALUE OF KRFMI
FLZC	-	ADJUSTMENT FACTOR FOR LZC
FMR	-	FRACTION OF MOISTURE RETENTION
FMXTRI	-	FLOATING POINT MAXIMUM NUMBER OF TIME ROUTING INCREMENTS
FNBTRI	-	FLOATING POINT NUMBER OF BASIC TIME ROUTING INCREMENTS
FNCTRH	-	FLOATING POINT NUMBER OF CURRENT TIME ROUTING HOURS
FNOFM	-	FLOATING POINT NUMBER OF OVERLAND FLOW MONTHS
FNPTRI	-	FLOATING POINT NUMBER OF PREVIOUS TIME ROUTING INCREMENTS
FNRHP	-	FLOATING POINT NUMBER OF RECORDED HYDROGRAPH PEAKS
FNSTRI	-	FLOATING POINT NUMBER OF SUBSEQUENT TIME ROUTING INCREMENTS
FNTRI	-	FLOATING POINT NUMBER OF TIME ROUTING INCREMENTS
FPER	-	FRACTION OF THE WATERSHED BEING PERVIOUS
FRERS	CFS	FLOW RISE ENDING RECESSION SEQUENCE

FSIAC	-	ADJUSTMENT FACTOR FOR SIAC
FSIL	IN	HOURLY FOREST SNOW INTERCEPTION LOSS
FSRX	-	FLOOD PLAIN STORAGE ROUTING INDEX
FSUZC	-	ADJUSTMENT FACTOR FOR SUZC
FTA	-	FACTOR FOR ESTIMATING DIURNAL TEMPERATURE VARIATION BASED ON SINE CURVE
FTX	-	FALL TROUBLE INDEX
FWTR	-	FRACTION OF THE WATERSHED BEING WATER
GWET	IN	CURRENT HOURLY GROUNDWATER EVAPOTRANSPIRATION
GWETF	-	GROUNDWATER EVAPOTRANSPIRATION FACTOR
GWS	IN	CURRENT GROUNDWATER STORAGE
HBF	CFS	HYDROGRAPH BASE FLOW
HBFM	-	HYDROGRAPH BASE FLOW MULTIPLIER
HNTRI	-	HYDROGRAPH NUMBER OF TIME ROUTING INCREMENTS
HOUR	-	CURRENT HOUR OF THE DAY
HOURF	HR	CURRENT HOUR OF THE DAY, FLOATING POINT
HRF	-	FIRST HOUR OF LOOP
HRL	-	LAST HOUR OF LOOP
HSE	IN	CURRENT HOURLY STREAM EVAPORATION
HSF	IN	HOURLY SNOWFALL
HSFRG	IN	HOURLY SNOWFALL REACHING GROUND
HSM	IN	HOURLY SNOWMELT RATE
HSRX	-	HYDROGRAPH STORAGE ROUTING INDEX
HTH	-	HOURS INTO DAY WHEN HYDROGRAPH STOPS OR STARTS
IBTPR	HR	TIME FROM BEGINNING OF SAVED RUNOFF TO RECORDED HYDROGRAPH

		PEAK
IBTPS	-	TIME FROM BEGINNING OF SAVED RUNOFF TO SYNTHESIZED HYDROGRAPH PEAK
IDAY1	-	INDEX TO 10-DAY PERIOD
IDAY2	-	INDEX WITHIN 10-DAY PERIOD
IDYB	-	DAY OF ROUTING HYDROGRAPH BEGINNING
IDYE	-	DAY OF ROUTING HYDROGRAPH ENDING
IFPRC	-	INTERFLOW PERIOD RECESSION CONSTANT
IFRC	-	INTERFLOW RECESSION CONSTANT
IFRL	-	INTERFLOW RECESSION LOGARITHM
IFS	IN	INTERFLOW STORAGE
IFT	-	INDICATOR OF FALL TROUBLE
IHRB	-	HOUR OF DAY OF ROUTING HYDROGRAPH BEGINNING
IHRE	-	HOUR OF DAY OF ROUTING HYDROGRAPH ENDING
INHPT	HR	INTEGER NUMBER OF HOURS BETWEEN HYDROGRAPH PRINTING POINTS
IPPH	-	INTEGER PERIODS PER HOUR
IPTE	HR	TIME FROM PEAK OF RECORDED HYDROGRAPH TO END OF SAVED RUNOFF
ISGRD	-	CURRENT STORAGE GAGE RAINFALL DAY
IWBG	-	INDEX NUMBER OF WEATHER BUREAU PRECIPITATION GAGE
KAA	-	COUNTER OF APPROPRIATE ELEMENT FROM ALBEDO ARRAY
KAAO	-	PRECEDING VALUE OF KAA
KAFH	-	COUNTER FOR ABSTRACTED FLOW HYDROGRAPH
KAHP	-	COUNTER FOR ABSTRACTING HYDROGRAPH POINTS
KBRC	-	COUNTER OF ROUGH CYCLES SINCE BEST ONE

KB1-7 - COUNTERS FOR COMBINING WATERSHED BITS

KDBCK - BACKWARD DAY COUNTER

KDFOR - FORWARD DAY COUNTER

KDRS - COUNTER OF CURRENT DAY IN RECESSION SEQUENCE

KDY - COUNTER FOR DAY

KFFC - COUNTER EQUALLING ONE ON FIRST FINE ADJUSTMENT CYCLE

KHBCK - BACKWARD HOUR COUNTER

KHFOR - FORWARD HOUR COUNTER

KHOUR - COUNTER FOR HOUR OF DAY

KHPT - COUNTER OF CURRENT HYDROGRAPH POINT

KHYD - COUNTER SPECIFYING CURRENT HYDROGRAPH

KH1-3 - COUNTERS FOR FIXING HYDROGRAPH ROUTING PARAMETERS

KIA - COUNTER FOR INITIALIZING ARRAYS

KISRX - COUNTER FOR INCREMENTING STORAGE ROUTING INDEX

KLCCA - COUNTER FOR LIMITING NUMBER OF CHANNEL CAPACITY ADJUSTMENTS

KMO - COUNTER INDEXING MONTH OF THE YEAR

KM1-6 - MONTH COUNTERS

KPA - COUNTER DESIGNATING PARAMETER TO BE AVERAGED

KPCH - COUNTED POINTS IN CURRENT HYDROGRAPH

KPRD - COUNTER FOR PERIOD

KPSH - COUNTER POINTS IN SUBSCRIPTED HYDROGRAPH

KRC - COUNTER OF CURRENT ROUGH CYCLE

KRD - COUNTER FOR READING DATA ARRAYS

KRFMI - COUNTER FOR RECORDED FLOW MAGNITUDE INTERVAL

KRHP	— COUNTER FOR RECORDED HYDROGRAPH PEAKS
KRIA	— COUNTER OF APPROPRIATE ELEMENT FROM RADIATION INCIDENCE ARRAY
KRS	— COUNTER FOR RECESSION SEQUENCE NUMBER
KSD	— COUNTER FOR RECESSION SEQUENCE DAYS
KSQ	— COUNTER FOR REVISED SEQUENCES
KTA	— COUNTER FOR TITLE ARRAY
KTRI	— COUNTER FOR TIME ROUTING INCREMENTS
KT20	— COUNTER FOR TOP 20 VALUES
KWD	— COUNTER FOR WRITING DATA ARRAYS
KWSM	— COUNTER OF WEST SUMMER MONTHS
K1AH	— COUNTER FOR FIRST ACCEPTED HYDROGRAPH
K24H	— COUNTER FOR SECOND ACCEPTED HYDROGRAPH
LBFO	— LOGICAL VARIABLE SET TRUE WHERE BASE FLOW ONLY ENCOUNTERED
LBMIR	— LOGICAL VARIABLE SET TRUE WHEN EXERCISING SUBSTITUTE APPROACH FOR EVALUATING BMIR
LBUZC	— LOGICAL VARIABLE SET TRUE WHEN EXERCISING SUBSTITUTE APPROACH FOR EVALUATING BUZC
LDAY	— LAST DAY OF YEAR
LHOUR	— LAST HOUR OF DAY
LLZC	— LOGICAL VARIABLE SET TRUE WHEN EXERCISING SUBSTITUTE APPROACH FOR EVALUATING LZC
LNIBRS	— LAST VALUE OF NIBRS
LNPR	— LOGICAL VARIABLE SET TRUE FOR NONEQUAL PERIOD RAINFALL

LNTRI	-	LAST NUMBER OF TIME ROUTING INCREMENTS
LRC	-	LOGICAL VARIABLE SET TRUE DURING ROUGH ADJUSTMENT CYCLES
LSHA	-	LOGICAL VARIABLE KEPT TRUE WHILE SYNTHESIZED HYDROGRAPH IS ACCEPTED FOR COMPARISION WITH RECORDED HYDROGRAPH
LSHFT	-	LOGICAL VARIABLE SET TRUE WHILE SHIFTING THE NUMBER OF TIME ROUTING INCREMENTS
LSHP	-	LOGICAL VARIABLE SET TRUE DURING STORM HYDROGRAPH PERIODS
LZC	IN	LOWER ZONE STORAGE CAPACITY
LZRX	-	LOWER ZONE MOISTURE RETENTION INDEX
LZS	IN	CURRENT LOWER ZONE STORAGE
LZSR	-	CURRENT LOWER ZONE STORAGE RATIO (LZS/LZC)
MBDS	-	MONTH BEGINNING DRY SEASON
MBWS	-	MONTH BEGINNING WET SEASON
MDAY	-	DAY OF YEAR OF LAST DAY OF PREVIOUS MONTH
MEDCY	-	MONTH END DATES-CALENDAR YEAR
MEDWY	-	MONTH END DATES-WATER YEAR
MFDP	-	MONTHLY FLOW DEVIATION PARAMETER
MHSM	IN	MINIMUM HOURLY SNOWMELT RATE
MHTP	-	MULTIPLIER CONVERTING FROM HOURS TO PERIODS
MNDRS	-	MAXIMUM NUMBER OF DAYS IN RECESSION SEQUENCE
MNRC	-	MINMUM NUMBER OF ROUGH CYCLES
MNRD	-	MEAN ANNUAL NUMBER OF RAINY DAYS
MNTRI	-	MINMUM NUMBER OF TIME ROUTING INCREMENTS
MNX	-	MONTH INDEX

MONTH	-	CURRENT MONTH OF THE YEAR
MONTH1	-	COUNTER FOR BEGINNING MONTH
MRNSM	IN	MAXIMUM RATE OF NEGATIVE SNOWMELT (SNOW CHILLING)
MRSL	DAY	MINMUM RECESSION SEQUENCE LENGTH
MXA	-	MONTH INDEX ARRAY
MXTRH	-	MAXIMUM NUMBER OF TIME ROUTING HOURS
MXTRI	-	MAXIMUM NUMBER OF TIME ROUTING INCREMENTS
M1R	-	MONTH WITH MOST RUNOFF
M1SP	-	MONTH WITH MOST SUMMER PRECIPITATION
M11	-	SET AT 11 IF AUGUST IS A BASE FLOW MONTH
M12	-	SET AT 12 IF SEPTEMBER IS A BASE FLOW MONTH
M2R	-	MONTH WITH SECOND MOST RUNOFF
M2SP	-	MONTH WITH SECOND MOST SUMMER PRECIPITATION
NATRH	-	NUMBER OF ANTICIPATED TIME ROUTING HOURS
NBTRI	-	NUMBER OF BASE TIME ROUTING INCREMENTS
NCSTRI	-	NUMBER OF CURRENT TIME ROUTING INCREMENTS DURING SHIFTING
NCTRH	-	NUMBER OF CURRENT TIME ROUTING HOURS
NCTRI	-	NUMBER OF CURRENT TIME ROUTING INCREMENTS
NDAY	-	NEXT DAY OF YEAR
NDRS	DAY	NUMBER OF DAYS IN RECESSION SEQUENCE
NDRSC	DAY	NUMBER OF DAYS IN CURRENT RECESSION SEQUENCE
NDRSC1	DAY	NUMBER OF DAYS IN CURRENT RECESSION SEQUENCE LESS 1
NDRSC2	DAY	NUMBER OF DAYS IN CURRENT RECESSION SEQUENCE LESS 2
NDSDP	DAY	NUMBER OF DAYS FOR WHICH STORM DETAILS HAVE ALREADY BEEN PRINTED

NDSDR	DAY	NUMBER OF DAYS FOR WHICH STORM DETAILS REQUESTED
NFRHA	-	NUMBER OF FIRST RAINFALL HOUR ADJUSTED, PREVIOUS DAY
NFTR	-	NUMBER OF FIRST TRIP TO BE RUN FOR A GIVEN STATION YEAR
NHOUR	-	NEXT HOUR OF DAY
NHPT	HR	NUMBER OF HOURS BETWEEN HYDROGRAPH PRINTING POINTS
NIBRS	-	NUMBER OF TIME ROUTING INTERVALS BETWEEN RECORDED AND SYNTHESIZED PEAKS
NIRTS	-	NUMBER OF TIME ROUTING INTERVALS FROM RECORDED TO SYNTHESIZED PEAK
NLTR	-	NUMBER OF LAST TRIP TO BE RUN FOR A GIVEN STATION YEAR
NNSTRI	-	NUMBER OF NEXT TIME ROUTING INCREMENT DURING SHIFTING
NOFM	-	NUMBER OF OVERLAND FLOW MONTHS
NORHP	-	NUMBER OF ORIGINAL RECORDED HYDROGRAPH PEAKS
NOYR	YEAR	NUMBER OF YEAR TO BE SIMULATED
NRHA	-	NUMBER OF RAINFALL HOURS ADJUSTED, CURRENT DAY
NRHP	-	NUMBER OF RECORDED HYDROGRAPH PEAKS
NRHP1	-	NUMBER OF RECORDED HYDROGRAPH PEAKS LESS ONE
NRS	-	NUMBER OF RECESSION SEQUENCES
NRTRI	-	NUMBER OF TIME ROUTING INCREMENTS REMAINING TO BE ROUTED
NSGRD	-	NUMBER OF STORAGE GAGE RAINFALL DAYS
NSYC	-	NUMBER OF STATION YEAR, CURRENT ONE BEING RUN
NSYT	-	NUMBER OF STATION YEARS, TOTAL INCLUDED IN A GIVEN JOB
NTRS	-	NUMBER OF TENTATIVE RECESSION SEQUENCES

OCT1BF	-	OCTOBER FIRST BASE FLOW
OFMN	-	OVERLAND FLOW MANNING'S N
OFMNIS	-	OVERLAND FLOW MANNING'S N, IMPERVIOUS SURFACES
OFR	IN	CURRENT OVERLAND FLOW RUNOFF
OFRF	-	OVERLAND FLOW ROUTING FACTOR
OFRFIS	-	OVERLAND FLOW ROUTING FACTOR, IMPERVIOUS SURFACES
OFRIS	IN	CURRENT OVERLAND FLOW RUNOFF, IMPERVIOUS SURFACES
OFS	IN	OVERLAND FLOW STORAGE
OFSL	FT	OVERLAND FLOW SURFACE LENGTH
OFSS	-	OVERLAND FLOW SURFACE SLOPE
OFUS	IN	CURRENT OVERLAND FLOW UNROUTED STORAGE
OFUSIS	IN	CURRENT OVERLAND FLOW UNROUTED STORAGE, IMPERVIOUS SURFACES
PBIVF	-	PERVIOUS VALUE OF BIVF
PBMIR	IN/HR	PREVIOUS VALUE OF BMIR
PBUZC	-	PREVIOUS ESTIMATE OF BASIC UPPER ZONE STORAGE CAPACITY FACTOR
PDAY	-	PREVIOUS DAY OF THE YEAR
PEAI	IN	PRECIPITATION EXCESS AFTER INFILTRATION
PEBI	IN	PRECIPITATION EXCESS, BEFORE INFILTRATION
PEIS	IN	PRECIPITATION EXCESS ON IMPERVIOUS SURFACES
PEP	IN	PRECIPITATION ESTIMATED FOR PERIOD
PET	IN	CURRENT DAILY POTENTIAL EVAPOTRANSPIRATION
PETLF	-	PREVIOUS ESTIMATE OF EVAPOTRANSPIRATION LOSS FACTOR
PETU	IN	UNADJUSTED CURRENT DAILY POTENTIAL EVAPOTRANSPIRATION

PE4P	IN	PRECIPITATION ESTIMATES FOR 4 PERIODS
PGW	IN	PERCOLATION TO GROUND WATER
PLZC	IN	PREVIOUS ESTIMATE OF LZC
PLZS	IN	PERCOLATION TO LOWER ZONE STORAGE
PMEIFS	IN	PERIOD MOISTURE ENTERING INTERFLOW STORAGE
PMELZS	IN	PERIOD MOISTURE ENTERING LOWER ZONE STORAGE
PMEOFS	IN	PERIOD MOISTURE ENTERING OVERLAND FLOW STORAGE
PMEUZS	IN	PERIOD MOISTURE ENTERING UPPER ZONE STORAGE
PPH	-	PERIODS PER HOUR
PPI	IN	PRECIPITATION PASSING INTERCEPTION
PRD	-	CURRENT PERIOD OF THE HOUR
PRDF	-	CURRENT PERIOD OF THE HOUR-FLOATING POINT
PRH	IN	PRECIPITATION RECORDED FOR HOUR
PRLH	IN	PRECIPITATION RECORDED FOR LAST HOUR
PRM1	IN	PRECIPITATION DURING WETTEST MONTH
PRM2	IN	PRECIPITATION DURING SECOND WETTEST MONTH
PRNH	IN	PRECIPITATION RECORDED FOR NEXT HOUR
PSIAC	-	PREVIOUS ESTIMATE OF SEASONAL INFILTRATION ADJUSTMENT
PSUZC	-	PREVIOUS ESTIMATED OF SEASONAL UPPER ZONE STORAGE CAPACITY FACTOR
PXCSA	IN	PRECIPITATION INDEX FOR CHANGING SNOW ALBEDO
RA	-	RECESSION ALPHA
RAA	IN	RAINFALL ADJUSTMENT ADDITION
RADF	CFS	RECORDED AVERAGE DAILY FLOW

RAM	-	RAINFALL ADJUSTMENT MULTIPLIER
RATFV	SFD	RECORDED ANNUAL TOTAL FLOW VOLUME
RA1-6	-	REGRESSION ACCUMULATORS
RB	-	RECESSION BETA
RBF	CFS	RECORDED BASE FLOW
RD	-	RECESSION DISCRIMINANT
RDPT	IN	RECORDED DAILY PRECIPITATION TOTAL
RFRISE	IN	RECORDED FLOW RISE
RGPM	-	RECORDING GAGE PRECIPITATION MULTIPLIER
RGPMB	-	RECORDING GAGE PRECIPITATION MULTIPLIER - BASIC
RHFMC	IN	ROUTED HYDROGRAPH FLOW AT MINIMUM CUTOFF
RHFO	IN	PRECEDING ROUTED HYDROGRAPH FLOW
RHF1	IN	CURRENT ROUTED HYDROGRAPH FLOW (EXCLUDING BASE FLOW)
RHPD	-	RECORDED HYDROGRAPH PEAK DAY
RHPF	CFS	RECORDED HYDROGRAPH PEAK FLOW
RHPH	-	RECORDED HYDROGRAPH PEAK HOUR
RICD	-	RADIATION INCIDENCE FOR THE CURRENT DAY
RICY	-	RADIATION INCIDENCE OVER THE CALENDAR YEAR
RIF	CFS	RECORDED INTERFLOW
RINT	-	REGRESSION INTERCEPT
RMFX	-	RECORDED MONTHLY FLOW INDEX
RMPF	CFS	REQUESTED MINIMUM DAILY PEAK FLOW TO BE PRINTED
RMWR	IN	RAINFALL MAXIMUM WITHOUT RUNOFF
RSBBF	CFS	ESTIMATED BASE FLOW AT BEGINNING OF RECESSION SEQUENCE

RSBD	-	RECESSION SEQUENCE BEGINNING DAY
RSBFRC	-	RECESSION SEQUENCE BASE FLOW RECESSION CONSTANT
RSBIF	CFS	ESTIMATED INTERFLOW AT BEGINNING OF RECESSION SEQUENCE
RSFM	CFS	RECESSION SEQUENCE FLOW MINIMUM
RSFN	CFS	RECORDED STREAMFLOW ON NEW DAY
RSF1	CFS	RECORDED STREAMFLOW ON DAY 1
RSF2	CFS	RECORDED STREAMFLOW ON DAY 2
RSIFRC	-	RECESSION SEQUENCE INTERFLOW RECESSION CONSTANT
RSL	DAY	CURRENT RECESSION SEQUENCE LENGTH
RSLP	-	REGRESSION SLOPE
RSPTF	IN	ROUTED SYNTHESIZED PERIOD TOTAL FLOW
RSTF	CFS	RECESSION SEQUENCE TOTAL FLOWS
RSTR	-	RATIO OF SYNTHESIZED TO RECORDED FLOW
RWRAIN	IN	RECORDED WATERSHED RAINFALL
SADF	CFS	SYNTHESIZED AVERAGE DAILY FLOW
SARAX	IN	SNOW ALBEDO RAINFALL AGING INDEX
SASFX	IN	SNOW ALBEDO SNOWFALL FRESHENING INDEX
SATFV	SFD	SYNTHESIZED ANNUAL TOTAL FLOW VOLUME
SATFVI	IN	SYNTHESIZED ANNUAL TOTAL FLOW VOLUME IN INCHES
SATRI	-	SHIFT ADJUSTMENTS FOR TIME ROUTING INCREMENTS
SAX	-	SNOW ALBEDO INDEX
SBF	CFS	SYNTHESIZED BASE FLOW
SBFRS	CFS	SYNTHESIZED BASE FLOW DURING THE FIRST THREE DAYS OF EACH RECESSION SEQUENCE

SDEPTH	IN	AVERAGE DEPTH OF SNOW ON GROUND
SDRSP	-	SMALLEST VALUE OF DRSP
SDSC	-	SECOND DIFFERENTIAL OF SINE CURVE MAGNITUDE
SE	IN	CURRENT DAILY SNOW EVAPORATION
SERA	CFS	ACCUMULATED ABSOLUTE DIFFERENCES BETWEEN RECORDED AND SYNTHESIZED DAILY STREAMFLOWS FOR INTERVAL
SERAV	CFS	AVERAGE INTERVAL ABSOLUTE DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED DAILY STREAMFLOWS
SERR	CFS	ACCUMULATED DIFFERENCES BETWEEN RECORDED AND SYNTHESIZED DAILY STREAMFLOWS FOR INTERVAL
SERRV	CFS	AVERAGE INTERVAL DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED DAILY STREAMFLOWS
SESF	CFS	STANDARD ERROR OF SYNTHESIZED FLOWS BY MAGNITUDE INTERVAL
SET	IN	CURRENT HOURLY SOIL EVAPOTRANSPIRATION
SFDX	-	SUMMER FLOW DEVIATION INDEX
SFMD	-	SNOW FROZEN MOISTURE DENSITY
SGMD	-	STORAGE GAGE MOVING DAY (WHEN IT IS MOVED DURING WATER YEAR)
SGRT	-	STORAGE GAGE READING TIME
SGRT2	-	SECOND STORAGE GAGE READING TIME
SHM	-	SYNTHESIZED HYDROGRAPH MULTIPLIER
SHPF	CFS	SYNTHESIZED HYDROGRAPH PEAK FLOW
SIAC	-	SEASONAL INFILTRATION ADJUSTMENT CONSTANT
SIAM	-	SEASONAL INFILTRATION ADJUSTMENT MULTIPLIER

SIF	CFS	SYNTHESIZED INTERFLOW
SIFRS	CFS	SYNTHESIZED INTERFLOW DURING THE FIRST THREE DAYS OF EACH RECESSION SEQUENCE
SISRX	-	SMALL INCREMENTAL STORAGE ROUTING INDEX
SMFX	-	SYNTHESIZED MONTHLY FLOW INDEX
SNTRI	-	SAVED NUMBER OF TIME ROUTING INCREMENTS
SOFMD	-	SUM OF OVERLAND FLOW MONTH DEVIATIONS
SOFRF	-	SNOW OVERLAND FLOW ROUTING FACTOR
SOFRFI	-	SNOW OVERLAND FLOW ROUTING FACTOR IMPERVIOUS SURFACES
SPBF	IN	SYNTHESIZED PERIOD BASE FLOW
SPBFLW	-	SNOW PACK BASIC MAXIMUM FRACTION IN LIQUID WATER
SPDR	IN	SYNTHESIZED PERIOD DIRECT RUNOFF
SPIF	IN	SYNTHESIZED PERIOD INTERFLOW
SPLW	IN	SNOW PACK LIQUID WATER CONTENT
SPLWC	IN	SNOWPACK LIQUID WATER HOLDING CAPACITY
SPM	-	SNOW PRECIPITATION MULTIPLIER
SPOF	CFS	SYNTHESIZED PERIOD OVERLAND FLOW (INCLUDING CHANNEL PRECIPITATION)
SPTF	IN	SYNTHESIZED PERIOD TOTAL FLOW
SPTW	IN	SNOW PACK TOTAL WATER CONTENT
SPTWCC	IN	SNOWPACK MINIMUM TOTAL WATER FOR COMPLETE BASIN COVERAGE
SQER	CFS	ACCUMULATED SQUARES OF DIFFERENCES BETWEEN RECORDED AND SYNTHESIZED DAILY STREAMFLOWS
SQPKD	-	SUM OF SQUARED PEAK DIFFERENCES
SRR	CFS	STORM RUNOFF ROUTED DOWN CHANNELS

SRX	-	CURRENT STORAGE ROUTING INDEX
SSERA	CFS	ACCUMULATED ABSOLUTE DIFFERENCES BETWEEN RECORDED AND SYNTHESIZED FLOWS OVER INTERVALS
SSERAV	CFS	OVERALL AVERAGE ABSOLUTE DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED FLOWS
SSERR	CFS	ACCUMULATED DIFFERENCES BETWEEN RECORDED AND SYNTHESIZED FLOWS OVER INTERVALS
SSERRV	CFS	OVERALL AVERAGE DIFFERENCE BETWEEN RECORDED AND SYNTHESIZED FLOWS
SSESF	CFS	ACCUMULATED STANDARD ERROR OF SYNTHESIZED FLOW OVER INTERVALS
SSQM	-	SUM OF THE SQUARES OF THE MONTHLY FLOW DEVIATIONS
SSQPKD	-	SMALLEST VALUE OF SQPKD
SSR	CFS	SYNTHESIZED STORM RUNOFF (NOT CHANNEL ROUTED)
SSRT	-	SQUARE ROOT OF OVERLAND FLOW SURFACE SLOPE
SSSQM	-	CURRENT SMALLEST ESTIMATE OF SSQM
STMD	-	SNOW TOTAL MOISTURE DENSITY
SUBWF	-	SUBSURFACE WATER FLOW OUT OF THE BASIN
SUZC	-	SEASONAL UPPER ZONE STORAGE CAPACITY FACTOR
SWSMD	-	SUM OF WET SUMMER MONTH DEVIATIONS
TANSM	IN	TOTAL ACCUMULATED NEGATIVE SNOWMELT (SNOW CHILLING)
TBRD	-	TOTAL BASE FLOW RECESSION DAYS
TDFP12	-	TIME OF DAILY FLOOD PEAK, 12-HOUR CLOCK
TDFP24	-	TIME OF DAILY FLOOD PEAK, 24-HOUR CLOCK

TDSF	CFS	TOTAL DAILY STREAMFLOW
TEH	DEGF	TEMPERATURE ESTIMATED FOR HOUR
TFCFS	CFS	CURRENT TOTAL FLOW
TFMAX	CFS	MAXIMUM TOTAL FLOW DURING CURRENT DAY
TFMRT	CFS	TOTAL STREAMFLOW AT MAXIMUM STREAM ROUTING TIME
TFSRX	-	TRIAL VALUE OF FSRX
TFX	CFS	TOTAL STREAMFLOW INDEX
THGR	IN/HR	TOTAL HOURLY GROSS RUNOFF
THSF	CFS	TOTAL HOURLY STREAMFLOW
TIRD	-	TOTAL INTERFLOW RECESSION DAYS
TITLE	-	TITLE OF CURRENT STATION YEAR
TMBF	IN	TOTALS OF MONTHLY BASE FLOW
TMFSIL	IN	TOTALS OF MONTHLY FOREST SNOW INTERCEPTION LOSS
TMIF	IN	TOTALS OF MONTHLY INTERFLOW
TMNET	IN	TOTALS OF MONTHLY NET EVAPOTRANSPIRATION
TMOF	IN	TOTALS OF MONTHLY OVERLAND FLOW
TMPET	IN	TOTALS OF MONTHLY POTENTIAL EVAPOTRANSPIRATION
TMPREC	IN	TOTALS OF MONTHLY PRECIPITATION
TMRPM	IN	TOTALS OF MONTHLY RAIN PLUS MELT
TMRTF	SFD	TOTALS OF MONTHLY RECORDED TOTAL FLOW
TMSE	IN	TOTALS OF MONTHLY STREAM EVAPORATION
TMSNE	IN	TOTALS OF MONTHLY SNOW EVAPORATION
TMSTF	SFD	TOTALS OF MONTHLY SYNTHESIZED TOTAL FLOW

TMSTFI	IN	TOTALS OF MONTHLY SYNTHESIZED TOTAL FLOW IN INCHES
TMTFCY	SFD	TOTALS OF MONTHLY TOTAL FLOW BY CALENDAR YEAR
TMTFWY	SFD	TOTALS OF MONTHLY TOTAL FLOW BY WATER YEAR
TOFR	IN	CURRENT TOTAL OVERLAND FLOW RUNOFF
TPLR	-	TOTAL TO PERVIOUS LAND RATIO
TRHF	IN/HR	CURRENT TIME ROUTED HYDROGRAPH FLOW
TRHV	-	TOTAL RECORDED HYDROGRAPH VOLUME
TRIP	-	COUNTER SPECIFYING PROGRAM PORTIONS
TSHV	-	TOTAL SYNTHESIZED HYDROGRAPH VOLUME
TSRX	-	ARRAY OF TRIAL STORAGE ROUTING INDICES
T20OFH	IN	TOP 20 VALUES DURING THE YEAR OF HOURLY OVERLAND FLOW
T20PRH	IN	TOP 20 VALUES DURING THE YEAR OF HOURLY PRECIPITATION
UHFA	IN	UNROUTED HYDROGRAPH FLOW ARRAY
URHF	IN	CURRENT UNROUTED HYDROGRAPH FLOW
UZC	IN	UPPER ZONE STORAGE CAPACITY
UZINFX	-	UPPER ZONE INFILTRATION INDEX
UZINLZ	IN/HR	CURRENT UPPER ZONE INFILTRATION TO LOWER ZONE
UZRX	-	UPPER ZONE MOISTURE RETENTION INDEX
UZS	IN	CURRENT UPPER ZONE STORAGE
VDCY	-	VALUE DATED BY CALENDAR DAY
VDMD	-	VALUE DATED BY MONTH DAY
VINTCR	IN	VEGETATIVE INTERCEPTION - CURRENT RATE PER PERIOD
VINTMR	IN/HR	VEGETATIVE INTERCEPTION - MAXIMUM RATE
VWIN	SFD	VOLUME OF AN INCH OF RUNOFF FROM WATERSHED

WAPV	-	WEIGHTED AVERAGE PARAMETER VALUE
WCFS	CFS	WATERSHED CFS EQUALLING ONE INCH PER HOUR
WEIFS	IN	WATER ENTERING INTERFLOW STORAGE
WFDX	-	WINTER FLOW DEVIATION INDEX
WI	IN	WATER INFILTRATION
WSBIT	-	WATERSHED BIT FOR RESTRUCTURING TIME-AREA HISTOGRAM
WSG	-	WEIGHTING FACTOR FOR STORAGE RAIN GAGE
WSG2	-	SECOND WEIGHTING FACTOR FOR STORAGE RAIN GAGE
WSM	-	NUMBER OF WET SUMMER MONTHS
WT4AM	DEGF	AVERAGE 4 A.M. TEMPERATURE OVER WATERSHED
WT4PM	DEGF	AVERAGE 4 P.M. TEMPERATURE OVER WATERSHED
XDNFS	-	INDEX DENSITY OF NEW-FALLEN SNOW
XELR	-	RAIN INDEX FOR ESTIMATING LAPSE RATE 0.0=DRY,4.0=RAIN
XMPFT	-	INDEX OF MONTHLY PREDOMINATE FLOW TYPE
YEAR	-	LAST TWO DIGITS OF CURRENT YEAR
YR1	-	LAST TWO DIGITS OF FIRST CALENDAR YEAR IN WATER YEAR
YR2	-	LAST TWO DIGITS OF SECOND CALENDAR YEAR IN WATER YEAR
YTITLE	-	YEAR TITLE

APPENDIX B

Computer Program

```
C ****************************************************************************
C
C
C    THIS PROGRAM IS BASED ON THE KENTUCKY VERSION OF THE STANFORD
C    WATERSHED MODEL. PROGRAM JUSTIFICATIONS HAVE BEEN MADE AS STATED BELOW TO
C    OPERATE ON THE IBM 360/40 DIGITAL COMPUTER:
C    (1) READ SUBROUTINE HAS BEEN CHANGED INTO CONVENTIONAL READ STATEMENT
C    ALONG WITH THE INPUT DATA FORMAT.
C    (2) EVPDAY SUBROUTINE HAS BEEN TAKEN OUT WITHOUT ANY INTERFERRENCE
C    WITH THE MAIN PROGRAM.
C    (3) ADDITIONAL CONTROL WAS ADDED TO TERMINATE THE PROGRAM.
C    (4) MORE COMMENT STATEMENTS BEEN ADDED.
C    (5) ADDITIONAL OPTION CODE PRINT OUT.
C
C
C   KENTUCKY WATERSHED MODEL (VERSION OF JUNE 6, 1970)                   MAIN0001
C     BASED ON STANFORD WATERSHED MODELS III & IV                        MAIN0002
C
C
C *********************************************************************
C
      DIMENSION BTRI(99), CONOPT(15), CRFMI(22), CTPI(99), DDIW(366),    MAIN0003
     1  DMNT(366), DMXT(366), DPSE(366), DRGPM(366), DRHP(366,24),       MAIN0004
     2  DRSGP(366), DPET(366), DRSF(366), DSSF(366), EDLZS(366),         MAIN0005
     3  EMBFNX(12), EMGWS(12), EMIFS(12), EMLZS(12), EMSIAM(12),         MAIN0006
     4  EMUZC(12), EMUZS(12), EPCM(12), FIRR(15), MEDCY(12), MEDWY(12),  MAIN0007
     5  RICY(37), SATRI(99), SERA(22), SERR(22), SESF(22), SQER(22),     MAIN0008
     6  THSF(24), TITLE(20), TMBF(12), TMFSIL(12), TMIF(12), TMNET(12),  MAIN0009
     7  TMOF(12), TMPET(12), TMPREC(12), TMRPM(12), TMRTF(12), TMSE(12),MAIN0010
     8  TMSNE(12), TMSTF(12), TMSTFI(12), T20OFH(21), T20PRH(21),        MAIN0011
     9  UHFA(99), YTITLE(20)                                             MAIN0012
      LOGICAL  LSHFT                                                     MAIN0013
      INTEGER  CDSDR,CN,CONOPT,DATE,DAY,DPY,EHSGD,HOUR,HRF,HRL,PDAY,     MAIN0014
     1  PRD,RHPD,RHPH,RSBD,SGMD,SGRT,SGRT2,YEAR,YR1,YR2                  MAIN0015
      REAL  IFPRC,IFRC,IFRL,IFS,LZC,LZRX,LZS,LZSR,MHSM,MNRD,MRNSM,NHPT   MAIN0016
      DATA  MEDCY/  0,      31,59,90,120,151,181,212,243,273,304,334/    MAIN0017
      DATA  MEDWY/304,334,365,31,59,90,120,151,181,212,243,273         / MAIN0018
```

```
C
C     PEAD IN NUMBER OF YEARS OF INPUT DATA REQUIRED.
C
      READ(5,2050)NOYR                                                  IDAH0001
 2050 FORMAT(I2)                                                        IDAH0002
  100 CONTINUE                                                          MAIN0019
C
C     CONTROL OPTIONS (BALANCE OF DATA VARIES WITH SPECIFIED OPTIONS).
C
      DO 101 KRD=1,14
  101 READ(5,2000) CONOPT(KRD)
 2000 FORMAT(I2)
      WRITE(6,997)
  997 FORMAT('1')                                                       IDAH0003
      WRITE(6,998)                                                      IDAH0004
  998 FORMAT('1'.45X,'CONTROL OPTION CODE TABLE')                       IDAH0005
      DO 99 J=1,14                                                      IDAH0006
   99 WRITE(6,999) CONOPT(J),J                                          IDAH0007
  999 FORMAT(/50X,'* ',I2,' * OPTION ',I2,' *')                         IDAH0008
      DO 102 KIA = 1,99                                                 MAIN0022
      SATRI(KIA) = 0.0                                                  MAIN0023
      CTRI(KIA)=0.0                                                     MAIN0024
      BTRI(KIA) = 0.0                                                   MAIN0025
  102 UHFA(KIA)=0.0                                                     MAIN0026
      READ(5,2001) NCTRI
 2001 FORMAT(I3)
      READ(5,2002) (CTRI(KRD),KRD=1,NCTRI)
 2002 FORMAT(10F7.5)
      IF(CONOPT(7) .NE. 1) GO TO 110                                    MAIN0030
      READ(5,2003)(FIRR(KRD),KRD=1,15)                                  MAIN0031
 2003 FORMAT(15F5.3)
C
C     READ IN RADIATION INCIDENCE OVER CALENDAR YEAR.
C
      READ(5,2004)(RICY(KRD),KRD=1,37)                                  MAIN0033
 2004 FORMAT(10F5.3)
C
```

```
C     READ IN DATED POTENTIAL SNOW EVAPORATION DATA OVER WATER YEAR.
C                                                                       MAIN0035
      READ(5,2005)(DPSE(KRD),KRD=274,360,10)
 2005 FORMAT(9F7.5)                                                     MAIN0037
      READ(5,2006)(DPSE(KRD),KRD=1,273,10)
 2006 FORMAT(10F7.5)                                                    MAIN0039
      DO 109 IDAY2 = 1, 9                                               MAIN0040
      DO 108 IDAY1 = 274,360,10                                         MAIN0041
      DAY = IDAY1 + IDAY2                                               MAIN0042
  108 DPSE(DAY) = DPSE(IDAY1)                                           MAIN0043
      DO 109 IDAY1 = 1,273,10                                           MAIN0044
      DAY = IDAY1 + IDAY2                                               MAIN0045
      IF(DAY .GT. 273) GO TO 109                                        MAIN0046
      DPSE(DAY) = DPSE(IDAY1)                                           MAIN0047
  109 CONTINUE                                                          MAIN0048
      DPSE(366) = DPSE(59)                                              MAIN0049
      DPSE(365) = DPSE(363)                                             MAIN0050
      DPSE(364) = DPSE(363)
C
C     READ IN SNOWMELT PARAMETERS.
C
      READ(5,2007)BDDFSM,SPBFLW,SPTWCC,SPM,ELDIF,XDNFS,FFOR,FFSI
 2007 FORMAT(8F10.0)
      READ(5,3007)MRNSM,DSMGH,PXCSA
 3007 FORMAT(3F10.7)
  110 READ(5,2008) RMPF
 2008 FORMAT(F10.0)
C
C     READ IN WATERSHED PARAMETERS.
C
      READ(5,2009) RGPMB,AREA,FIMP,FWTR
 2009 FORMAT(4F10.4)
C
C     READ IN SOIL MOISTURE PARAMETERS.
C
      READ(5,2010) VINTMR,BUZC,SUZC,LZC,ETLF,SUBWF,GWETF,SIAC,BMIR,BIVF
 2010 FORMAT(10F8.6)
```

```
      FPER = 1.0 - FIMP - FWTR                                          MAIN0081
      IF(FPER .GT. 0.01) GO TO 114                                      MAIN0082
      TPLR = 100.0                                                      MAIN0083
      FPER = 0.01                                                       MAIN0084
      GO TO 115                                                         MAIN0085
  114 TPLR = (1.0 - FWTR)/FPER                                          MAIN0086
  115 VINTCR = 0.25*VINTMR                                              MAIN0087
      HSE = 0.0                                                         MAIN0088
      NRTRI = 0                                                         MAIN0089
      PEAI = 0.0                                                        MAIN0090
      SPIF = 0.0                                                        MAIN0091
      CBF = GWS*BFRL*(1.0 + BFNRL*BFNX)                                 MAIN0092
      SPDR = 0.0                                                        MAIN0093
      OFUS = 0.0                                                        MAIN0094
      OFUSIS = 0.0                                                      MAIN0095
      OFR = 0.0                                                         MAIN0096
      OFRIS = 0.0                                                       MAIN0097
      PEIS = 0.0                                                        MAIN0098
      RHFO = 0.0                                                        MAIN0099
      URHF = 0.0                                                        MAIN0100
      AMIF = 0.0                                                        MAIN0101
      AMNET = 0.0                                                       MAIN0102
      AMPET = 0.0                                                       MAIN0103
      AMSNE = 0.0                                                       MAIN0104
      AMFSIL = 0.0                                                      MAIN0105
      SASFX = 0.0                                                       MAIN0106
      SARAX = 0.0                                                       MAIN0107
      SRX = CSRX                                                        MAIN0108
      VWIN = 26.8888*AREA                                               MAIN0109
      WCFS = 24.0*VWIN                                                  MAIN0110
      RHFMC = 0.025/WCFS                                                MAIN0111
      TFCFS = CBF*WCFS                                                  MAIN0112
      SSRT = SQRT(OFSS)                                                 MAIN0113
      OFRF = 1020.0*SSRT/(OFMN*OFSL)                                    MAIN0114
      OFRFIS = 1020.0*SSRT/(OFMNIS*OFSL)                                MAIN0115
      EQDF = 0.00982*((OFMN*OFSL/SSRT)**0.6)                            MAIN0116
      EQDFIS = 0.00982*((OFMNIS*OFSL/SSRT)**0.6)                        MAIN0117
```

```
      SOFRF = OFRF                                                      MAIN0118
      SOFRFI = OFRFIS                                                   MAIN0119
      SDEPTH = 0.0                                                      MAIN0120
      ASM = 0.0                                                         MAIN0121
      IF(CONOPT(7) .EQ. 0) GO TO 116                                    MAIN0122
      WT4AM = 60.0                                                      MAIN0123
      WT4PM = 60.0                                                      MAIN0124
      SAX = 15.0                                                        MAIN0125
      TANSM = 0.0                                                       MAIN0126
      SPTW = 0.0                                                        MAIN0127
      STMD = 0.7                                                        MAIN0128
      SFMD = 0.7                                                        MAIN0129
      ASMRG = 0.0                                                       MAIN0130
  116 READ(5,2) TITLE                                                   MAIN0131
    2 FORMAT(20A4)                                                      MAIN0132
C  BEGIN NEW YEAR                                                       MAIN0133
  117 BYLZS = LZS                                                       MAIN0134
      BYUZS = UZS                                                       MAIN0135
      BYGWS = GWS                                                       MAIN0136
      BYIFS = IFS                                                       MAIN0137
      DO 118 KIA = 1,22                                                 MAIN0138
      CRFMI(KIA) = 0.0                                                  MAIN0139
      SESF(KIA) = 0.0                                                   MAIN0140
      SERR(KIA) = 0.0                                                   MAIN0141
      SERA(KIA) = 0.0                                                   MAIN0142
  118 SQER(KIA) = 0.0                                                   MAIN0143
      RGPM = RGPMB                                                      MAIN0144
      DO 119 KIA = 1,21                                                 MAIN0145
      T20OFH(KIA) = 0.0                                                 MAIN0146
  119 T20PRH(KIA) = 0.0                                                 MAIN0147
      DO 120 KIA = 1,12                                                 MAIN0148
  120 EPCM(KIA) = 1.0                                                   MAIN0149
      RDPT=0.0                                                          MAIN0150
      PDAY=274
      READ(5,2014) YR1,YR2                                              MAIN0152
 2014 FORMAT(2I3)
      READ(5,2) YTITLE
```

```
      DPY=365                                                           MAIN0154
      IF(MOD(YR2,4) .EQ. 0) DPY = 366                                   MAIN0155
      IF(CONOPT(1).EQ.1) READ(5,2040) CDSDR,NDSDR                       MAIN0156
 2040 FORMAT(2I3)
      NDSDP = 0                                                         MAIN0157
      MEDWY(5) = 59                                                     MAIN0158
      IF(DPY .EQ. 366) MEDWY(5) = 366                                   MAIN0159
C                                                                       MAIN0160
C  READ EVAPORATION DATA
C                                                                       MAIN0161
      IF(CONOPT( 3) .NE. 1) GO TO 125
  121 READ(5,2015)(DPET(KRD),KRD=274,360,10)
 2015 FORMAT(4X,9F6.4)
  122 READ(5,2016)(DPET(KRD),KRD=1,273,10)
 2016 FORMAT(10F6.4)
      DO 124 IDAY2 = 1,9                                                MAIN0166
      DO 123 IDAY1 = 274,360,10                                         MAIN0167
      DAY = IDAY1 + IDAY2                                               MAIN0168
  123 DPET(DAY) = DPET(IDAY1)                                           MAIN0169
      DO 124 IDAY1 = 1,273,10                                           MAIN0170
      DAY = IDAY1 + IDAY2                                               MAIN0171
      IF(DAY .GT. 273) GO TO 124                                        MAIN0172
      DPET(DAY) = DPET(IDAY1)                                           MAIN0173
  124 CONTINUE                                                          MAIN0174
      DPET(366) = DPET(59)                                              MAIN0175
      DPET(365) = DPET(363)                                             MAIN0176
      DPET(364) = DPET(363)                                             MAIN0177
      GO TO 127                                                         MAIN0178
  125 IF(CONOPT( 3) .EQ. 2) GO TO 130                                   MAIN0179
      DAY = 274                                                         MAIN0180
  126 READ(5,2017)DPET(DAY)
 2017 FORMAT(F6.4)
      IF(DAY .EQ. 273) GO TO 127                                        MAIN0182
      CALL DAYNXT(DAY, DPY)                                             MAIN0183
      GO TO 126                                                         MAIN0184
C
C   READ MONTHLY PAN COEFFICIENTS.
```

```
C
  127 READ(5,2018)(EPCM(MONTH),MONTH=1,12)                    MAIN0187
 2018 FORMAT(2X,12F5.2)                                        MAIN0188
      IF(EPAET .NE. 0.0) GO TO 133                             MAIN0189
      DO 129 DAY = 1,DPY                                       MAIN0190
  129 EPAET = EPAET + DPET(DAY)                                MAIN0191
      IF(EPCM(6) .NE. 1.0) EPAET = 0.7*EPAET
      GO TO 131
  130 READ(5,2019)EPAET,MNRD                                   MAIN0193
 2019 FORMAT(2F5.2)
      EMAET = EPAET*(365.0 + MNRD)/404.0                       MAIN0194
C
C     CALL EVPDAY(DPET,EMAET)                                  MAIN0195
C
  131 AETX = 24.0*EPAET/365.0                                  MAIN0196
      AEX96 = 1.2*AETX                                         MAIN0197
      AEX90 = 0.3*AETX                                         MAIN0198
      SIAM = 1.2**SIAC                                         MAIN0199
      UZC = SUZC*AEX90 + BUZC*EXP(-2.7*LZS/LZC)                MAIN0200
      IF(UZC .LT. 0.25) UZC = 0.25                             MAIN0201
      SGRT = 0                                                 MAIN0202
      DO 132 DAY = 1,366                                       MAIN0203
      DDIW(DAY) = 0.0                                          MAIN0204
      DRSF(DAY) = 0.0                                          MAIN0205
      DRGPM(DAY) = RGPMB                                       MAIN0206
      DRSGP(DAY) = 0.0                                         MAIN0207
      DO 132 HOUR = 1,24                                       MAIN0208
  132 DRHP(DAY,HOUR) = 0.0                                     MAIN0209
  133 IF(CONOPT(9) .NE. 1) GO TO 135                           MAIN0210
      DAY = 274                                                MAIN0211
      DRSF(366) = 0.0
C
C     READ DAILY RECORDED STREAMFLOW DATA.
C
  134 READ(5,2020)DRSF(DAY)                                    MAIN0213
 2020 FORMAT(F7.0)
      CALL DAYNXT(DAY, DPY)
```

```
      IF(DAY .NE. 274) GO TO 134                                        MAIN0214
  135 IF(CONOPT(11) .NE. 1) GO TO 137                                   MAIN0215
      DAY = 274                                                         MAIN0216
      DDIW(366) = 0.0                                                   MAIN0217
  136 READ(5,2021)DDIW(DAY)
 2021 FORMAT(F5.0)
      CALL DAYNXT(DAY, DPY)                                             MAIN0219
      IF(DAY .NE. 274) GO TO 136                                        MAIN0220
  137 IF(CONOPT(7) .EQ. 0) GO TO 139                                    MAIN0221
      DAY = 274                                                         MAIN0222
C
C   READ DAILY MAX. AND MIN. TEMPERATURE.
C
  138 READ(5,2022)DMXT(DAY),DMNT(DAY)
 2022 FORMAT(2F5.0)
      CALL DAYNXT(DAY, DPY)                                             MAIN0224
      IF(DAY .NE. 274) GO TO 138                                        MAIN0225
C
C   READ NUMBER OF STORAGE GAGE RAINFALL DAYS.
C
  139 READ(5,2023)NSGRD
 2023 FORMAT(I2)
      IF(NSGRD .EQ. 0) GO TO 141                                        MAIN0227
      READ(5,2024)WSG,SGRT
 2024 FORMAT(2F5.0)
      IF(CONOPT(8) .EQ. 1) READ(5,2025) WSG2,SGRT2,SGMD
 2025 FORMAT(3F5.0)
      DO 140 KRD = 1,NSGRD                                              MAIN0230
      READ(5,2026)ISGRD
 2026 FORMAT(I5)
  140 READ(5,2030) DRSGP(ISGRD)
 2030 FORMAT(F5.0)
C
C  READ RECORDING RAIN GAGE HOURLY TOTALS                               MAIN0233
C
  141 READ(5,2027)IWBG,YEAR,MONTH,DATE,CN
 2027 FORMAT(I4,I2,I2,I2,I1)
```

```
C
C  PUNCH NO NUMBER AFTER CN ON YEAR .EQ. 98 CARD                MAIN0235
C                                                               MAIN0236
      IF(YEAR .GE. 98) GO TO 144                                MAIN0237
      HRF = 12*(CN - 1) + 1                                     MAIN0238
      HRL = 12*(CN - 1) + 12                                    MAIN0239
      DAY = MEDCY(MONTH) + DATE
  142 READ(5,2028)(DRHP(DAY,HOUR),HOUR=HRF,HRL)
 2028 FORMAT(12F5.0)                                            MAIN0242
      IF(DPY .NE. 366 .OR. MONTH .NE. 2 .OR. DATE .NE. 29) GO TO 141 MAIN0243
      DO 143 HOUR = HRF, HRL                                    MAIN0244
      DRHP(366,HOUR) = DRHP(60,HOUR)                            MAIN0245
  143 DRHP(60,HOUR) = 0.0                                       MAIN0246
      GO TO 141                                                 MAIN0247
C
C  CALCULATE PRECIPITATION WEIGHTING FACTORS
C                                                               MAIN0248
  144 DAY = 274                                                 MAIN0249
      IF(NSGRD .EQ. 0) GO TO 151                                MAIN0250
      PDAY = 274                                                MAIN0251
      RDPT = 0.0                                                MAIN0252
  145 EHSGD = SGRT                                              MAIN0253
      IF(SGRT .EQ. 0) EHSGD = 24                                MAIN0254
      EHSGDF = EHSGD                                            MAIN0255
  146 CONTINUE                                                  MAIN0256
      DO 150 HOUR = 1,24                                        MAIN0257
      RDPT = RDPT + DRHP(DAY,HOUR)                              MAIN0258
      IF(HOUR .NE. EHSGD) GO TO 150                             MAIN0259
      IF(RDPT .LE. 0.0) GO TO 147                               MAIN0260
      IF(SGRT .EQ. 0) PDAY = DAY                                MAIN0261
      DRGPM (PDAY) = (DRSGP(DAY)*WSG + RDPT*(1.0 - WSG))/RDPT   MAIN0262
      IF(CONOPT(3) .NE. 0) DPET(PDAY) = 0.5*DPET(PDAY)          MAIN0263
      IF(SGRT .NE. 0) PDAY = DAY                                MAIN0264
      RDPT = 0.0                                                MAIN0265
      GO TO 150                                                 MAIN0266
  147 IF(DRSGP(DAY) .LE. 0.0) GO TO 149                         MAIN0267
      DO 148 KHOUR = 1,EHSGD
```

```
148 DRHP(DAY,KHOUR) = (WSG*DRSGP(DAY))/EHSGDF
149 IF(SGRT .NE. 0) PDAY = DAY
150 CONTINUE
    CALL DAYNXT(DAY,DPY)
    IF(DAY .EQ. 274) GO TO 151
    IF(CONOPT(8) .EQ. 0) GO TO 146
    IF(DAY .NE. SGMD) GO TO 146
    WSG = WSG2
    SGRT = SGRT2
    GO TO 145
151 MONTH = 1
    MDAY = 273
    AMRPM = 0.0
    AMPREC = 0.0
    AMBF = 0.0
    AMSE = 0.0
    AMSTF = 0.0
    AMRTF = 0.0
    WRITE(6,3) (TITLE(KTA), KTA = 1,20)
  3 FORMAT(1H1,10X,20A4)
    WRITE(6,4) (YTITLE(KTA), KTA = 1,20),YR1,YR2
  4 FORMAT(1H ,20A4,2X, ' WATER YEAR 19',I2,'-',I2)
    WRITE(6,5)
  5 FORMAT( ' OCTOBER  ')
C
C  BEGIN DAY LOOP
C
 152 TDSF = 0.0
     PET = EPCM(MONTH)*DPET(DAY)
     PETU = PET
     TFMAX = 0.0
C
C  EVAPOTRANSPIRATION ADJUSTMENTS
C
     IF(CONOPT(7) .NE. 1) GO TO 153
     IF(DMXT(DAY) - 4.0*ELDIF .LT. 40.0) PET = 0.0
     IF(SPTW .GT. SPTWCC) PET = FFOR*PET
```

```
C                                                                       MAIN0301
C     CALCULATION OF SNOW EVAPORATION                                   MAIN0302
C                                                                       MAIN0303
      IF(DMNT(DAY) .GT. 32.0 .OR. SPTW .LE. DPSE(DAY)) GO TO 153        MAIN0304
      SE = DPSE(DAY)                                                    MAIN0305
      AMSNE = AMSNE + SE                                                MAIN0306
      SPTW = SPTW - SE                                                  MAIN0307
      IF(SFMD .GT. 0.0) SDEPTH = SDEPTH - SE/SFMD                       MAIN0308
  153 DO 202 HOUR = 1,24                                                MAIN0309
      IF((NSGRD .EQ. 0) .AND. (DRHP(DAY,HOUR) .NE. 0.0)  .AND. (PET .EQ.MAIN0310
     1  PETU) .AND. (CONOPT(3) .EQ. 1)) PET = 0.5*PET                   MAIN0311
  154 IF(HOUR .EQ. SGRT + 1) RGPM = DRGPM(DAY)                          MAIN0312
      IF(HOUR .EQ. 9) HSE = (FWTR*PET)/12.0                             MAIN0313
      IF(HOUR .EQ.21) HSE = 0.0                                         MAIN0314
      PRH = RGPM*DRHP(DAY,HOUR)                                         MAIN0315
      AMPREC = AMPREC  + PRH                                            MAIN0316
C                                                                       MAIN0317
C     ENTER SNOWMELT SUBROUTINE                                         MAIN0318
C                                                                       MAIN0319
      IF(CONOPT(7) .EQ. 1) CALL SNCMEL(BDDFSM,SPTWCC,SPM,ELDIF,DAY,     MAIN0320
     1  SPBFLW, XDNFS,FFOR,FFSI,MRNSM,DSMGH,SDEPTH,STMD, PXCSA,HOUR,    MAIN0321
     2  SAX,SOFRF,OFRFIS,SOFRFI,AMFSIL,PRH,SPTW,TANSM,SPLW,SFMD,OFRF,   MAIN0322
     3  WT4AM,WT4PM,ASM,ASMRG,SASFX,SARAX,DMXT,DMNT,RICY,FIRR)          MAIN0323
  155 AMRPM = AMRPM + PRH                                               MAIN0324
  156 TOFR = 0.0                                                        MAIN0325
      ARHF = 0.0                                                        MAIN0326
C                                                                       MAIN0327
C   15 MINUTE ACCOUNTING AND ROUTING LOOP                               MAIN0328
C                                                                       MAIN0329
      DO 187 PRD = 1,4                                                  MAIN0330
      PEBI = 0.0                                                        MAIN0331
      PPI = 0.0
      OFR = 0.0
      OFRIS = 0.0
      WI = 0.0
      WEIFS = 0.0
      PMEUZS = 0.0
```

```
                                                                    MAIN0332
      PMELZS = 0.0                                                  MAIN0333
      PMEIFS = 0.0                                                  MAIN0334
      PMEOFS = 0.0                                                  MAIN0335
      PEP = 0.25*PRH                                                MAIN0336
      IF(CONOPT(2) .EQ. 1) CALL PREPRD(RGPM,DRHP,DAY,HOUR,DPY,PRD,PEP,  MAIN0337
     1  PRH)                                                        MAIN0338
      IF(PEP .GT. 0.0) GO TO 157                                    MAIN0339
      IF(OFUS .GT. 0.0) GO TO 159                                   MAIN0340
      IF(IFS .GT. 0.0) GO TO 170                                    MAIN0341
      IF(NRTRI .GT. 0) GO TO 172                                    MAIN0342
      TRHF = 0.0                                                    MAIN0343
      IF(RHFO .GT. 0.0) GO TO 181                                   MAIN0344
      GO TO 184
C                                                                   MAIN0345
C  RAINFALL UPPER ZCNE INTERACTION
C                                                                   MAIN0346
  157 IF(PEP .GE. VINTCR) GO TO 158                                 MAIN0347
      UZS = UZS + PEP*TPLR                                          MAIN0348
      VINTCR = VINTCR - PEP                                         MAIN0349
      PPI = 0.0                                                     MAIN0350
      PEBI = 0.0                                                    MAIN0351
      PMEUZS = PEP                                                  MAIN0352
      IF(OFUS .GT. 0.0) GO TO 159                                   MAIN0353
      GO TO 170                                                     MAIN0354
  158 PPI = PEP - VINTCR                                            MAIN0355
      UZS = UZS + VINTCR*TPLR                                       MAIN0356
      VINTCR = 0.0                                                  MAIN0357
      LZSR = LZS/LZC                                                MAIN0358
      UZC = SUZC*AEX90 + BUZC*EXP(-2.7*LZSR)                        MAIN0359
      IF(UZC .LT. 0.25) UZC = 0.25                                  MAIN0360
      UZRX = 2.0*ABS(UZS/UZC - 1.0) + 1.0                           MAIN0361
      FMR = (1.0/(1.0 + UZRX))**UZRX                                MAIN0362
      IF(UZS .GT. UZC) FMR = 1.0 - FMR                              MAIN0363
      PEBI = PPI*FMR                                                MAIN0364
      PMEUZS = PEP - PEBI                                           MAIN0365
      UZS = UZS + PPI - PEBI
C
```

```
C  LOWER ZONE AND GROUNDWATER INFILTRATION                              MAIN0366
C
  159 LZSR = LZS/LZC                                                    MAIN0367
      EID = 4.0*LZSR                                                    MAIN0368
      IF(LZSR .LE. 1.0) GO TO 160                                       MAIN0369
      EID = 4.0 + 2.0*(LZSR - 1.0)                                      MAIN0370
      IF(LZSR .LE. 2.0) GO TO 160                                       MAIN0371
      EID = 6.0                                                         MAIN0372
C
C   WATER ENTERING AS INFLTRATION,INTERFLOW, AND DIRECT RUNOFF.
C
  160 PEBI = PEBI + OFUS                                                MAIN0373
      CMIR = 0.25*SIAM*BMIR/(2.0**EID)                                  MAIN0374
      CIVM = BIVF*2.0**LZSR                                             MAIN0375
      IF(CIVM .LT. 1.0) CIVM = 1.0                                      MAIN0376
      PEAI = PEBI*PEBI/(2.0*CMIR*CIVM)                                  MAIN0377
      WI = PEBI*PEBI/(2.0*CMIR)                                         MAIN0378
      IF(PEBI .GE. CMIR) WI = PEBI - 0.5*CMIR                           MAIN0379
      IF(PEBI .GE. CMIR*CIVM) PEAI = PEBI - 0.5*CMIR*CIVM               MAIN0380
      WEIFS = WI - PEAI                                                 MAIN0381
      IF(PEBI .LE. OFUS) GO TO 161                                      MAIN0382
      PMELZS = (PEBI - WI)*((PEBI - OFUS)/PEBI)                         MAIN0383
      PMEIFS = WEIFS*((PEBI - OFUS)/PEBI)                               MAIN0384
      PMEOFS = PEAI*((PEBI - OFUS)/PEBI)                                MAIN0385
  161 CONTINUE                                                          MAIN0386
C
C   EQUILIBRIUM SURFACE DETENTION STORAGE.
C
      IF((PEAI - OFUS) .GT. 0.0) GO TO 162                              MAIN0387
      EQD = (OFUS + PEAI)/2.0                                           MAIN0388
      GO TO 163                                                         MAIN0389
  162 EQD = EQDF*((PEAI - OFUS)**0.6)                                   MAIN0390
  163 IF((OFUS + PEAI) .GT. (2.0*EQD)) EQD = 0.5*(OFUS + PEAI)          MAIN0391
      IF((OFUS + PEAI) .LE. 0.001) GO TO 164                            MAIN0392
C
C   OVERLAND FLOW FROM PERVIOUS SURFACES.
C
```

```
      OFR = 0.25*OFRF*(((OFUS + PEAI)*0.5)**1.67)*((1.0 + 0.6*((OFUS +   MAIN0393
     1  PEAI)/(2.0*EQD))**3.0)**1.67)                                     MAIN0394
      IF(OFR .GT. (0.75*PEAI)) OFR = 0.75*PEAI                            MAIN0395
C
C   OVERLAND FLOW FRCM IMPERVIOUS SURFACES.
C
  164 IF(FIMP .EQ. 0.0) GO TO 168                                         MAIN0396
  165 PEIS = PPI + OFUSIS                                                 MAIN0397
      IF((PEIS - OFUSIS) .GT. 0.0) GO TO 166                              MAIN0398
      EQDIS = (OFUSIS + PEIS)/2.0                                         MAIN0399
      GO TO 167                                                           MAIN0400
  166 EQDIS = EQDFIS*((PEIS - OFUSIS)**0.6)                               MAIN0401
  167 IF((OFUSIS + PEIS) .GT. (2.0*EQDIS)) EQDIS = 0.5*(OFUSIS + PEIS)    MAIN0402
      IF((OFUSIS + PEIS) .LE. 0.01) GO TO 168                             MAIN0403
      OFRIS = 0.25*CFRFIS*(((OFUSIS + PEIS)*0.5)**1.67)*((1.0 + 0.6*((    MAIN0404
     1  OFUSIS + PEIS)/(2.0*EQDFIS))**3.0)**1.67)                         MAIN0405
      IF(OFRIS .GT. PEIS) OFRIS = PEIS                                    MAIN0406
  168 TOFR = TOFR + FPER*OFR + FIMP*OFRIS + PPI*FWTR                      MAIN0407
      OFUSIS = PEIS - OFRIS                                               MAIN0408
      OFUS = PEAI - OFR                                                   MAIN0409
      IF(OFUS .GE. 0.001) GO TO 169                                       MAIN0410
      LZS = LZS + OFUS                                                    MAIN0411
      OFUS = 0.0                                                          MAIN0412
      OFRIS = OFRIS + OFUSIS                                              MAIN0413
      OFUSIS = 0.0                                                        MAIN0414
C
C   QUANTITIES RETAINED IN VARIOUS SOIL LOCATIONS.
C
  169 LZRX = 1.5*ABS(LZS/LZC - 1.0) + 1.0                                 MAIN0415
      FMR = (1.0/(1.0 + LZRX))**LZRX                                      MAIN0416
      IF(LZS .LT. LZC) FMR = 1.0 - FMR*(LZS/LZC)                          MAIN0417
      PLZS = FMR*(PEBI - WI)                                              MAIN0418
      PGW = (1.0 -FMR)*(PEBI - WI)*(1.0 - SUBWF)*FPER                     MAIN0419
      GWS = GWS + PGW                                                     MAIN0420
      BFNX = BFNX + PGW                                                   MAIN0421
      LZS = LZS + PLZS                                                    MAIN0422
      IFS = IFS + WEIFS*FPER                                              MAIN0423
```

```
  170 SPIF = IFRL*IFS                                                    MAIN0424
      AMIF = AMIF + SPIF                                                 MAIN0425
      IFS = IFS - SPIF                                                   MAIN0426
      IF(IFS .GE. 0.0001) GO TO 171                                      MAIN0427
      LZS = LZS + IFS                                                    MAIN0428
      IFS = 0.0                                                          MAIN0429
  171 UHFA(1) = FPER*OFR + PPI*FWTR + FIMP*OFRIS + SPIF                  MAIN0430
      SPDR = UHFA(1)                                                     MAIN0431
C
C  ROUTING                                                               MAIN0432
C
  172 IF(CONOPT(12) .NE. 1) GO TO 173                                    MAIN0433
      URHF = URHF + 0.25*UHFA(1)                                         MAIN0434
      IF(PRD .NE. 4) GO TO 181                                           MAIN0435
      UHFA(1) = URHF                                                     MAIN0436
  173 TRHF = 0.0                                                         MAIN0437
      KTRI = NCTRI                                                       MAIN0438
      IF(CONOPT(13) .EQ. 1) KTRI = NCSTRI                                MAIN0439
  174 URHF = UHFA(KTRI)                                                  MAIN0440
      IF(URHF .LE. 0.0) GO TO 176                                        MAIN0441
  175 TRHF = TRHF + URHF*CTRI(KTRI)                                      MAIN0442
      IF(CONOPT(13) .EQ. 1 .AND. LSHFT .AND. KTRI .GE. 2) TRHF = TRHF +  MAIN0443
     1  URHF*SATRI(KTRI - 1)                                             MAIN0444
      UHFA(KTRI + 1) = URHF                                              MAIN0445
      GO TO 177                                                          MAIN0446
  176 UHFA(KTRI+ 1) = 0.0                                                MAIN0447
  177 KTRI = KTRI - 1                                                    MAIN0448
      IF(KTRI .GE. 1) GO TO 174                                          MAIN0449
  178 IF(URHF .LE. 0.0) GO TO 179                                        MAIN0450
      NRTRI = NCTRI                                                      MAIN0451
      IF(CONOPT(13) .EQ. 1) NRTRI = MXTRI                                MAIN0452
  179 NRTRI = NRTRI - 1                                                  MAIN0453
      UHFA(1) = 0.0                                                      MAIN0454
      IF(CONOPT(13) .NE. 1) GO TO 180                                    MAIN0455
      NNSTRI = NCSTRI + 1                                                MAIN0456
      UHFA(NNSTRI) = 0.0                                                 MAIN0457
  180 URHF = 0.0                                                         MAIN0458
```

```
  181 IF(SRX .LE. CSRX) SRX = CSRX                                        MAIN0459
      RHF1 = TRHF - SRX*(TRHF - RHFO)                                     MAIN0460
      RHFO = RHF1                                                         MAIN0461
      IF(RHFO .LT. RHFMC) RHFO = 0.0                                      MAIN0462
      TFCFS = (4.0*RHF1 + CBF - HSE)*WCFS                                 MAIN0463
      IF(CONOPT(13) .NE. 1) GO TO 182                                     MAIN0464
      IF(CONOPT(12) .EQ. 1 .AND. PRD .NE. 4) GO TO 182                    MAIN0465
      CALL RTVARY (CTRI,SATRI,BTRI,CHCAP,NBTRI,MXTRI,NCSTRI,EXQPV,LSHFT,MAIN0466
     1  TFCFS)                                                            MAIN0467
      DATE = MOD(DAY,MDAY)                                                MAIN0468
      IF(LSHFT) WRITE(6,6) DATE,HOUR,PRD,NCSTRI                           MAIN0469
    6 FORMAT(2X,I2,2X,I2,2X,I2,2X, ' HISTOGRAM CHANGES TO',1X,I2,1X,      MAIN0470
     1 '  ELEMENTS')                                                      MAIN0471
  182 CONTINUE                                                            MAIN0472
      IF(TFCFS .LE. 0.5*CHCAP) SRX = CSRX                                 MAIN0473
      IF((TFCFS .GT. 0.5*CHCAP) .AND. (TFCFS .LT. 2.0*CHCAP)) SRX = CSRXMAIN0474
     1  +(FSRX - CSRX)*((TFCFS - 0.5*CHCAP)/(1.5*CHCAP))**3               MAIN0475
      IF(TFCFS .GT. 2.0*CHCAP) SRX = FSRX                                 MAIN0476
      IF(TFCFS .LE. TFMAX) GO TO 183                                      MAIN0477
      PRDF = PRD                                                          MAIN0478
      TDFP24 = HOUR                                                       MAIN0479
      IF(PRD .LE. 3) TDFP24 = (TDFP24 - 1.0) + 0.15*PRDF                  MAIN0480
      TFMAX = TFCFS                                                       MAIN0481
  183 ARHF = ARHF + RHF1                                                  MAIN0482
C
C  STORM OUTPUT REQUESTED BY CONOPT(1)                                    MAIN0483
C
  184 IF(CONOPT(1) .NE. 1) GO TO 186                                      MAIN0484
      IF(DAY .NE. CDSDR) GO TO 186                                        MAIN0485
      IF(HOUR .EQ. 1 .AND. PRD .EQ. 1) WRITE(6,7)                         MAIN0486
    7 FORMAT(1H , 21X, 'RAINFALL DEPOSITION',12X, 'MOISTURE STORAGE',     MAIN0487
     1  14X, 'STREAMFLOW ORIGIN',6X, 'STREAM OUTFLOW'/2X, ' DY HR PD RA MAIN0488
     2IN   EUZS   ELZS   EIFS   EOFS        UZS     LZS     IFS    OFS   SMAIN0489
     3POF    SPIF    SPBF    SPTF   INCHES    CFS ')                      MAIN0490
      DATE = MOD(DAY,MDAY)                                                MAIN0491
      OFS = OFUS*FPER + OFUSIS*FIMP                                       MAIN0492
      SPOF = OFR*FPER + OFRIS*FIMP + PPI*FWTR                             MAIN0493
```

```
C
C    READ IN OVERLAND FLOW PARAMETERS.
C
      READ(5,2011) CFSS,OFSL,OFMN,OFMNIS,IFRC
 2011 FORMAT(5F10.3)
C
C    READ IN CHANNEL ROUTING AND GROUNDWATER PARAMETERS.
C
      READ(5,2012) CSRX,FSRX,CHCAP,EXQPV,BFNLR,BFRC
 2012 FORMAT(6F10.5)
      BFHRC=BFRC**(1.0/24.0)                                            MAIN0058
      BFRL = -ALOG(BFHRC)                                               MAIN0059
      BFNRL = 0.0                                                       MAIN0060
      IF(BFNLR .LT. 0.00001 .OR. BFNLR .GT. 0.9999) GO TO 111           MAIN0061
      BFNHR = BFNLR**(1.0/24.0)                                         MAIN0062
      BFNRL = -ALOG(BFNHR)                                              MAIN0063
  111 IFPRC = IFRC**(1.0/96.0)                                          MAIN0064
      IFRL = -ALOG(IFPRC)                                               MAIN0065
C
C    STARTING MOISTURE STORAGE VALUES AS OF OCTOBER 1.
C                                                                       MAIN0066
      READ(5,2013) GWS,UZS,LZS,BFNX,IFS
 2013 FORMAT(5F5.0)
      LSHFT = .FALSE.                                                   MAIN0067
      IF(CONOPT(13) .NE. 1) GO TO 113                                   MAIN0068
      NBTRI = NCTRI                                                     MAIN0069
      FNTRI = NCTRI                                                     MAIN0070
      MXTRI = (10.0**EXQPV)*FNTRI + 0.5                                 MAIN0071
      IF(MXTRI .GE. 98) WRITE(6,1)                                      MAIN0072
    1 FORMAT( ' WARNING: EXQPV ARRAY OVER RUN ')                        MAIN0073
      NCSTRI = 99                                                       MAIN0074
      DO 112 KIA = 1, NBTRI                                             MAIN0075
  112 BTRI(KIA) = CTRI(KIA)                                             MAIN0076
      TFCFS = 1.0                                                       MAIN0077
      CALL RTVARY (CTRI,SATRI,BTRI,CHCAP,NBTRI,MXTRI,NCSTRI,EXQPV,LSHFT,MAIN0078
     1  TFCFS)                                                          MAIN0079
  113 EPAET=0.0                                                         MAIN0080
```

```
      SPBF = 0.25*(CBF-HSE)                                              MAIN0494
      SPTF = SPDR + SPBF                                                 MAIN0495
      SPDR = 0.0                                                         MAIN0496
      IF(RHFO .LE. 0.0) TFCFS = (CBF - HSE)*WCFS                         MAIN0497
      RSPTF = 0.25*TFCFS/WCFS                                            MAIN0498
      WRITE(6,8) DATE,HOUR,PRD,PEP,PMEUZS,PMELZS,PMEIFS,PMEOFS,UZS,LZS   MAIN0499
     1,IFS,OFS,SPCF,SPIF,SPBF,SPTF,RSPTF,TFCFS                           MAIN0500
    8 FORMAT(2X,I2,1X,I2,1X,I1,5(1X,F6.4),2X,4(F7.4),2X,5(1X,F6.4),1X,   MAIN0501
     1  F7.1)                                                            MAIN0502
      IF(HOUR .EQ. 24 .AND. PRD .EQ. 4) GO TO 185                        MAIN0503
      GO TO 186                                                          MAIN0504
  185 NDSDP = NDSDP + 1                                                  MAIN0505
      IF(NDSDR .EQ. NDSDP) GO TO 186                                     MAIN0506
      CALL DAYNXT(CDSDR,DPY)                                             MAIN0507
  186 CONTINUE                                                           MAIN0508
      IF(VINTCR .LT. 0.25*VINTMR) VINTCR = VINTCR + DPET(DAY)/96.0       MAIN0509
  187 CONTINUE                                                           MAIN0510
C
C  END OF 15 MINUTE LOOP                                                 MAIN0511
C
      IF(CONOPT(5) .NE. 1) GO TO 197                                     MAIN0512
C
C  HOURLY OVERLAND FLOW AND RAINFALL SORTING                             MAIN0513
C
      IF(TOFR .LE. 0.0) GO TO 193                                        MAIN0514
      KT20 = 20                                                          MAIN0515
  188 IF(KT20 .LT. 1) GO TO 192                                          MAIN0516
      IF(TOFR .GT. T20OFH(KT20)) GO TO 189                               MAIN0517
      GO TO 190                                                          MAIN0518
  189 T20OFH(KT20+1) = T20OFH(KT20)                                      MAIN0519
      GO TO 191                                                          MAIN0520
  190 T20OFH(KT20+1) = TOFR                                              MAIN0521
      GO TO 193                                                          MAIN0522
  191 KT20 = KT20 - 1                                                    MAIN0523
      GO TO 188                                                          MAIN0524
  192 T20OFH(1) = TOFR                                                   MAIN0525
  193 IF(PRH .LE. 0.0) GO TO 197                                         MAIN0526
```

```
C                                                               MAIN0560
C   4 PM ADJUSTMENTS OF VARIOUS VALUES
C                                                               MAIN0561
  198 IF(HOUR .NE. 16) GO TO 202                                MAIN0562
      AEX90 = 0.9*(AEX90 + PET)                                 MAIN0563
      AEX96 = 0.96*(AEX96 + PET)
C                                                               MAIN0564
C   INFILTRATION CORRECTION
C                                                               MAIN0565
      SIAM = (AEX96/AETX)**SIAC                                 MAIN0566
      IF(SIAM .LT. 0.33) SIAM = 0.33                            MAIN0567
      BFNX = 0.97*BFNX                                          MAIN0568
      IF(PET .EQ. 0.0) GO TO 202
C                                                               MAIN0569
C   EVAP-TRANS LOSS FROM GROUNDWATER
C                                                               MAIN0570
      GWET = GWS*GWETF*PET*FPER                                 MAIN0571
      GWS = GWS - GWET                                          MAIN0572
      BFNX = BFNX - GWET                                        MAIN0573
      IF(BFNX .LT. 0.0) BFNX = 0.0                              MAIN0574
      AMPET = AMPET + PET                                       MAIN0575
      IF(PET .GE. UZS) GO TO 199                                MAIN0576
      UZS = UZS - PET                                           MAIN0577
      AMNET = AMNET + PET                                       MAIN0578
      GO TO 202                                                 MAIN0579
  199 PET = PET - UZS                                           MAIN0580
      AMNET = AMNET + UZS                                       MAIN0581
      UZS = 0.0                                                 MAIN0582
      LZSR = LZS/LZC                                            MAIN0583
      IF(PET .GE. ETLF*LZSR) GO TO 200                          MAIN0584
      SET = PET*(1.0 - PET/(2.0*ETLF*LZSR))                     MAIN0585
      GO TO 201                                                 MAIN0586
  200 SET = 0.5*ETLF*LZSR                                       MAIN0587
  201 LZS = LZS - SET                                           MAIN0588
      AMNET = AMNET + SET                                       MAIN0589
  202 CONTINUE
C
```

```
C  END OF HOUR LOOP                                                       MAIN0590
C
      DSSF(DAY) = TDSF/24.0                                               MAIN0591
      IF(CONOPT(11) .EQ. 1) DSSF(DAY) = DSSF(DAY) + DDIW(DAY)             MAIN0592
  203 AMRTF = AMRTF + DRSF(DAY)                                           MAIN0593
      AMSTF = AMSTF + DSSF(DAY)                                           MAIN0594
      IF(CONOPT(6) .EQ. 1) EDLZS(DAY) = LZS                               MAIN0595
C
C  STORE ERRORS AND FLOW DURATION                                         MAIN0596
C
      IF(CONOPT(4) .NE. 1) GO TO 204                                      MAIN0597
      ERR = DSSF(DAY) - DRSF(DAY)                                         MAIN0598
      IF(DRSF(DAY) .LT. 1.0) KRFMI = 1.0                                  MAIN0599
      IF(DRSF(DAY) .GT. 1.0) KRFMI= 2.0*ALOG(DRSF(DAY)) + 2.0             MAIN0600
      CRFMI(KRFMI) = CRFMI(KRFMI) + 1.0                                   MAIN0601
      SERR(KRFMI) = SERR(KRFMI) + ERR                                     MAIN0602
      SERA(KRFMI) = SERA(KRFMI) + ABS(ERR)                                MAIN0603
      SQER(KRFMI) = SQER(KRFMI) + ERR*ERR                                 MAIN0604
      SESF(KRFMI) = 0.0                                                   MAIN0605
      IF(CRFMI(KRFMI) .GT. 1.0) SESF(KRFMI) = SQRT(ABS((SQER(KRFMI) -     MAIN0606
     1  SERR(KRFMI)**2/CRFMI(KRFMI))/(CRFMI(KRFMI) - 1.0)))               MAIN0607
  204 IF(DAY .EQ. 366) MDAY = 337                                         MAIN0608
      CATE = MOD(DAY,MDAY)                                                MAIN0609
      IF(TFMAX .LE. RMPF) GO TO 206                                       MAIN0610
      WRITE(6,9) CATE, (THSF(HOUR),HOUR=1,12)                             MAIN0611
    9 FORMAT(1H ,1X/,1X,I4,2X,'AM',1X,6F8.1,3X,6F8.1)                     MAIN0612
      WRITE(6,10) (THSF(HOUR),HOUR=13,24), DSSF(DAY)                      MAIN0613
   10 FORMAT(1H1,6X,'PM',1X,6F8.1,3X,7F8.1)                               MAIN0614
      IF(TDFP24 .LT. 12.0) GO TO 205                                      MAIN0615
      TDFP12 = TDFP24 - 12.0                                              MAIN0616
      WRITE(6,11) TFMAX, TDFP12                                           MAIN0617
   11 FORMAT(1H/,10X,'MAXIMUM=',F8.1,2X,'C.F.S.',5X,'TIME',3X,F5.2,2X,    MAIN0618
     1  ' P.M. ')
      GO TO 206                                                           MAIN0620
  205 WRITE(6,12) TFMAX,TDFP24                                            MAIN0621
   12 FORMAT(1H ,10X,'MAXIMUM=',F8.1,2X,'C.F.S.',5X,'TIME',3X,F5.2,2X,    MAIN0622
     1  'A.M.')                                                           MAIN0623
```

```
  206 IF(CONOPT(7) .EQ. 1 .AND. SDEPTH .GT. 0.0) WRITE(6,13)DATE,        MAIN0624
     1SDEPTH,STMD,SAX,TANSM,SPLW                                         MAIN0625
   13 FORMAT(3X,I4,2X,'SDEPTH=',F8.2,2X,'STMD=',F6.2,2X,'SAX=',F6.2,     MAIN0626
     1  2X,'TANSM=',F6.2,2X,'SPLW=',F6.2)                                MAIN0627
C
C  MONTHLY SUMMARY STORAGE                                               MAIN0628
C
      IF(DAY .NE. MEDWY(MONTH)) GO TO 220                                MAIN0629
      TMSTF(MONTH) = AMSTF                                               MAIN0630
      AMSTF = 0.0                                                        MAIN0631
      TMRTF(MONTH) = AMRTF                                               MAIN0632
      AMRTF = 0.0                                                        MAIN0633
      EMBFNX(MONTH) = BFNX                                               MAIN0634
      TMPREC(MONTH) = AMPREC                                             MAIN0635
      AMPREC = 0.0                                                       MAIN0636
      TMRPM(MONTH) = AMRPM                                               MAIN0637
      AMRPM = 0.0                                                        MAIN0638
      TMBF(MONTH) = AMBF                                                 MAIN0639
      AMBF = 0.0                                                         MAIN0640
      TMIF(MONTH) = AMIF                                                 MAIN0641
      AMIF = 0.0                                                         MAIN0642
      TMSE(MONTH) = AMSE                                                 MAIN0643
      AMSE = 0.0                                                         MAIN0644
      TMPET(MONTH) = AMPET                                               MAIN0645
      AMPET = 0.0                                                        MAIN0646
      TMNET(MONTH) = AMNET                                               MAIN0647
      AMNET = 0.0                                                        MAIN0648
      TMSNE(MONTH) = AMSNE                                               MAIN0649
      AMSNE = 0.0                                                        MAIN0650
      TMFSIL(MONTH) = AMFSIL                                             MAIN0651
      AMFSIL = 0.0                                                       MAIN0652
      EMGWS(MONTH) = GWS                                                 MAIN0653
      UZC = SUZC*AEX90 + BUZC*EXP(-2.7*LZS/LZC)                          MAIN0654
      IF(UZC .LT. 0.25) UZC = 0.25                                       MAIN0655
      EMUZC(MONTH) = UZC                                                 MAIN0656
      EMUZS(MONTH) = UZS                                                 MAIN0657
      EMSIAM(MONTH) = SIAM                                               MAIN0658
```

```
      EMLZS(MONTH) = LZS
      EMIFS(MONTH) = IFS
      IF(MONTH .EQ. 5) MEDWY(5) = 59
      MDAY = MEDWY(MONTH)
  207 IF(MONTH .NE. 0) GO TO (208,209,210,211,212,213,214,215,216,217,
     1  218,219),MONTH
  208 WRITE(6,14)
   14 FORMAT(1H ,'NOVEMBER')
      GO TO 219
  209 WRITE(6,15)
   15 FORMAT(1H ,'DECEMBER')
      GO TO 219
  210 WRITE(6,16)
   16 FORMAT(1H ,'JANUARY')
      GO TO 219
  211 WRITE(6,17)
   17 FORMAT(1H ,'FEBRUARY')
      GO TO 219
  212 WRITE(6,18)
   18 FORMAT(1H ,'MARCH')
      GO TO 219
  213 WRITE(6,19)
   19 FORMAT(1H ,'APRIL')
      GO TO 219
  214 WRITE(6,20)
   20 FORMAT(1H ,'MAY')
      GO TO 219
  215 WRITE(6,21)
   21 FORMAT(1H ,'JUNE')
      GO TO 219
 2160 WRITE(6,22)
   22 FORMAT(1H ,'JULY')
      GO TO 219
  217 WRITE(6,23)
   23 FORMAT(1H ,'AUGUST')
      GO TO 219
  218 WRITE(6,24)
```

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   24 FORMAT(1H ,'SEPTEMBER')
  219 MONTH = MONTH + 1
  220 CALL DAYNXT(DAY,DPY)
      IF(DAY .NE. 274) GO TO 152
C
C  END OF DAY LOOP
C
  221 CONTINUE
  222 WRITE(6,25) (TITLE(KTA), KTA=1,20,1)
   25 FORMAT(1H1,10X,20A4)
      WRITE(6,26) (YTITLE(KTA),KTA=1,15,1),YR1,YR2
   26 FORMAT(1H ,15A4,3X, 'WATER YEAR  19',I2,1H-,I2,7X,
     1 '  KENTUCKY WATERSHED MODEL  ' )
C
C  ANNUAL SUMMARY
C
      SATFV = 0.0
      RATFV = 0.0
      APREC = 0.0
      ABFV = 0.0
      ARPM = 0.0
      ASEV = 0.0
      ANET = 0.0
      APET = 0.0
      AIFV = 0.0
      ASE = 0.0
      AFSIL = 0.0
      DO 223 MONTH = 1,12
      SATFV = SATFV + TMSTF(MONTH)
      RATFV = RATFV + TMRTF(MONTH)
      APREC = APREC + TMPREC(MONTH)
      ABFV = ABFV + TMBF(MONTH)
      ARPM = ARPM + TMRPM(MONTH)
      ASEV = ASEV + TMSE(MONTH)
      ANET = ANET + TMNET(MONTH)
      APET = APET + TMPET(MONTH)
      AIFV = AIFV + TMIF(MONTH)
```

```
      ASE = ASE + TMSNE(MONTH)
  223 AFSIL = AFSIL + TMFSIL(MONTH)
      IF(CONOPT(14) .NE. 1) GO TO 224
      WRITE(6,27)
   27 FORMAT(1H///44X, 'RECORDED                FLOWS ')
      CALL  DAYOUT(DRSF,MEDWY,DPY)
  224 WRITE(6,28)
   28 FORMAT(1H///44X, 'SYNTHESIZED         FLOWS')
      CALL  DAYOUT (DSSF,MEDWY,DPY)
      WRITE(6,29) (TMSTF(KWD), KWD=1,12), SATFV
   29 FORMAT(1H ,1X, 'SYNTHETIC',3X,12F8.1,2X,F10.1,2X,'SFD')
      DO 225 MONTH = 1,12
  225 TMSTFI(MONTH) = (TMSTF(MONTH))/VWIN
      SATFVI = SATFV/VWIN
      WRITE(6,30) (TMSTFI(KWD), KWD=1,12),SATFVI
   30 FORMAT(1X,'TOTAL',8X,12F8.3,4X,F7.3,2X,'INCHES')
      DO 226 MONTH = 1,12
      TMOF(MONTH) = TMSTFI(MONTH)- TMIF(MONTH) - TMBF(MONTH) +
     1  TMSE(MONTH)
  226 IF(TMOF(MONTH) .LT. 0.0) TMOF(MONTH) = 0.0
      AOFV = SATFVI - AIFV - ABFV + ASEV
      IF(AOFV .LT. 0.0) AOFV = 0.0
      WRITE(6,31) (TMOF(KWD), KWD=1,12), AOFV
   31 FORMAT(1X,'OVERLAND ',5X,12F8.3,4X,F7.3,2X,'INCHES')
      WRITE(6,32) (TMIF(KWD), KWD=1,12),AIFV
   32 FORMAT(1X,'INTERFLOW',4X,12F8.3,4X,F7.3,2X,'INCHES')
      WRITE(6,33) (TMBF(KWD), KWD=1,12),ABFV
   33 FORMAT(1X,'BASE',9X,12F8.3,4X,F7.3,2X,'INCHES')
      WRITE(6,34) (TMSE(KWD), KWD=1,12), ASEV
   34 FORMAT(1X,'STRM EVAP',4X,12F8.3,4X,F7.3,2X,'INCHES')
      IF(CONOPT(9) .EQ. 0) GO TO 227
      WRITE(6,35) (TMRTF(KWD), KWD=1,12),RATFV
   35 FORMAT(1X,'RECORDED',4X,12F8.1,2X,F10.1,2X,'SFD')
      RATFVI = RATFV/VWIN
      WRITE(6,36) RATFVI
   36 FORMAT(112X,F9.2,2X,'INCHES')
  227 WRITE(6,37) (TMPREC(KWD), KWD=1,12),APREC
```

```
37 FORMAT( 1X,'PRECIP',7X,12F8.2,3X,F8.2,2X,'INCHES')                MAIN0766
   IF(CONOPT(7) .EQ.1) WRITE(6,38) (TMRPM(KWD), KWD=1,12),ARPM         MAIN0767
38 FORMAT(1X,'RAIN+MELT',4X,12F8.2,3X,F8.2,2X,'INCHES')                MAIN0768
   IF(CONOPT(7) .EQ.1) WRITE(6,39) (TMSNE(KWD), KWD=1,12),ASE          MAIN0769
39 FORMAT(1X, 'SURSNOWEVAP',3X,12F8.3,3X,F7.3,2X,'INCHES')             MAIN0770
   IF(CONOPT(7) .EQ.1) WRITE(6,40) (TMFSIL(KWD), KWD=1,12),AFSIL       MAIN0771
40 FORMAT(1X, 'INTSNOWLOSS',3X,12F8.3,3X,F7.3,2X,'INCHES')             MAIN0772
   WRITE(6,41) (TMNET(KWD), KWD=1,12),ANET                             MAIN0773
41 FORMAT(1X,' EVP/TRAN-NET',2X,12F8.3,3X,F7.3,2X,'INCHES')            MAIN0774
   WRITE(6,42) (TMPET(KWD), KWD=1,12),APET                             MAIN0775
42 FORMAT(3X,10H-POTENTIAL,2X,12F8.3,3X,F7.3,2X,'INCHES')              MAIN0776
   WRITE(6,43) (EMUZS(KWD), KWD=1,12)                                  MAIN0777
43 FORMAT(1X,' STORAGES-UZS',2X,12F8.3,12X,'INCHES')                   MAIN0778
   WRITE(6,44) (EMLZS(KWD), KWD=1,12)                                  MAIN0779
44 FORMAT(10X,'LZS',2X,12F8.3,12X,'INCHES')                            MAIN0780
   WRITE(6,45) (EMIFS(KWD), KWD=1,12)                                  MAIN0781
45 FORMAT(10X,'IFS',2X,12F8.3,12X,'INCHES')                            MAIN0782
   WRITE(6,46) (EMGWS(KWD), KWD=1,12)                                  MAIN0783
46 FORMAT(10X,'GWS',2X,12F8.3,12X,'INCHES')                            MAIN0784
   WRITE(6,47) (EMUZC(KWD), KWD=1,12)                                  MAIN0785
47 FORMAT(1X, 'INDICES- UZC',2X,12F8.3)                                MAIN0786
   WRITE(6,48) (EMBFNX(KWD), KWD=1,12)                                 MAIN0787
48 FORMAT(9X,'BFNX',2X,12F8.3)                                         MAIN0788
   WRITE(6,49) (EMSIAM(KWD), KWD=1,12)                                 MAIN0789
49 FORMAT(9X,'SIAM',2X,12F8.3)                                         MAIN0790
   IF(CONOPT(7) .NE. 1) SPM = 1.0                                      MAIN0791
   AMBER = (LZS - BYLZS + IFS - BYIFS)*FPER + (UZS - BYUZS + GWS -     MAIN0792
  1 BYGWS)*(1.0 - FWTR) + SATFV/VWIN + ANET*FPER + ASEV - APREC         MAIN0793
  2 + ASE + AFSIL - ((SPM - 1.0)/SPM)*ASM                              MAIN0794
   WRITE(6,50) AMBER                                                   MAIN0795
50 FORMAT(1H ,'BALANCE',5X,F10.4,2X,'INCHES')                          MAIN0796
   IF(CONOPT(7) .NE. 1) GO TO 228                                      MAIN0797
   WRITE(6,51) ASM, ASMRG                                              MAIN0798
51 FORMAT(1H , 'CHECK ON SNOW',5X,F10.4,5X,F10.4)                      MAIN0799
   ASM = 0.0                                                           MAIN0800
   ASMRG = 0.0                                                         MAIN0801
228 CONTINUE                                                           MAIN0802
```

```
      IF(CONOPT(4) .NE. 1) GO TO 232                                    MAIN0803
      WRITE(6,52)                                                       MAIN0804
   52 FORMAT(1H1,10X, 'DAILY FLOW DURATION AND ERROR TABLE')            MAIN0805
      WRITE(6,53)                                                       MAIN0806
   53 FORMAT(1H/,10X, 'FLOW INTERVAL',5X,'CASES',3X,'AV.ERROR',3X,      MAIN0807
     1  ' AVR. ABS. ERROR',3X, 'STANDARD ERROR')                        MAIN0808
      SSESF = 0.0                                                       MAIN0809
      SSERA = 0.0                                                       MAIN0810
      SSERR = 0.0                                                       MAIN0811
      ACRFMI = 0.0                                                      MAIN0812
      DO 230 KRFMI = 1,22                                               MAIN0813
      IF(KRFMI .EQ. 1) ETIBF = 0.0                                      MAIN0814
      IF(KRFMI .EQ. 2) ETIBF = 1.0                                      MAIN0815
      FKRFMI = KRFMI                                                    MAIN0816
      IF(KRFMI .GT. 2) ETIBF = EXP((FKRFMI/2.0) - 1.0)                  MAIN0817
      CCRFMI = CRFMI(KRFMI)                                             MAIN0818
      IF(CCRFMI .EQ. 0.0) WRITE(6,54) ETIBF, CCRFMI                     MAIN0819
   54 FORMAT(1H ,1X,13X,F8.1,1H-,F9.1,F12.1,5X,F8.2,5X,F8.2)            MAIN0820
      IF(CCRFMI .EQ. 0.0) GO TO 229                                     MAIN0821
      SERAV = SERA(KRFMI)/CCRFMI                                        MAIN0822
      SERRV = SERR(KRFMI)/CCRFMI                                        MAIN0823
      IF(CCRFMI .EQ. 1) WRITE(6,54) ETIBF,CCRFMI,SERRV,SERAV            MAIN0824
      IF(CCRFMI .NE. 1) WRITE(6,54) ETIBF,CCRFMI,SERRV,SERAV,           MAIN0825
     1SESF(KRFMI)                                                       MAIN0826
  229 ACRFMI = ACRFMI + CRFMI(KRFMI)                                    MAIN0827
      IF(ACRFMI .EQ. 0.0) GO TO 230                                     MAIN0828
      SSERR= SSERR + SERR(KRFMI)                                        MAIN0829
      SSERRV= SSERR/ACRFMI                                              MAIN0830
      SSERA = SSERA + SERA(KRFMI)                                       MAIN0831
      SSERAV = SSERA/ACRFMI                                             MAIN0832
  230 SSESF = SSESF + SESF(KRFMI)                                       MAIN0833
      WRITE(6,55) ACRFMI,SSERRV,SSERAV,SSESF                            MAIN0834
   55 FORMAT(1H ,22X,F9.1,F12.1,5X,F8.2,5X,F8.2)                        MAIN0835
      FDPY = DPY                                                        MAIN0836
      SADF = SATFV/FDPY                                                 MAIN0837
      RADF = RATFV/FDPY                                                 MAIN0838
      RA1 = 0.0                                                         MAIN0839
```

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                                                                       MAIN0840
      RA2 = 0.0                                                        MAIN0841
      RA3 = 0.0                                                        MAIN0842
      DO 231 DAY = 1,DPY                                               MAIN0843
      DRAF = DRSF(DAY) - RADF                                          MAIN0844
      DSAF = DSSF(DAY) - SADF                                          MAIN0845
      RA1 = RA1 + DRAF*DRAF                                            MAIN0846
      RA2 = RA2 + DSAF*DSAF                                            MAIN0847
  231 RA3 = RA3 + DRAF*DSAF                                            MAIN0848
      DFCC= RA3/SQRT(RA1*RA2)                                          MAIN0849
      WRITE(6,56) DFCC                                                 MAIN0850
   56 FORMAT(1H ,10X, 'CORRELATION COEFFICIENT (DAILY)',3X,F10.4)      MAIN0851
  232 CONTINUE                                                         MAIN0852
      IF(CONOPT(5) .NE. 1) GO TO 233                                   MAIN0853
C
C   OUTPUT MAXIMUM RUNOFF, PRECIPITATION AT END OF YEARS
C                                                                      MAIN0854
      WRITE(6,57)                                                      MAIN0855
   57 FORMAT(1H ,10X, 'TWENTY HIGHEST CLOCKHOUR RAINFALL EVENTS IN THE MAIN0856
     1WATER YEAR')                                                     MAIN0857
      WRITE(6,58) (T20PRH(KT20), KT20=1,20)                            MAIN0858
   58 FORMAT(1H ,5X,20F6.3)                                            MAIN0859
      WRITE(6,59)                                                      MAIN0860
   59 FORMAT(1H ,10X, 'TWENTY HIGHEST CLOCKHOUR OVERLAND FLOW RUNOFF EV MAIN0861
     1ENTS IN THE WATER YEAR ')                                        MAIN0862
      WRITE(6,58) (T20OFH(KT20), KT20=1,20)                            MAIN0863
  233 CONTINUE                                                         MAIN0864
      IF(CONOPT(6) .EQ. 0) GO TO 234                                   MAIN0865
      WRITE(6,60)                                                      MAIN0866
   60 FORMAT(1H1,30X, 'DAILY SOIL MOISTURE OUTPUT ')                   MAIN0867
      CALL DAYOUT(EDLZS,MEDWY,DPY)                                     MAIN0868
  234 CONTINUE                                                         MAIN0869
      IF(CONOPT(10) .EQ. 1) GO TO 100                                  IDAHO009
      NOYR=NOYR-1                                                      IDAHO010
      IF(NOYR.NE.0) GO TO 117                                          MAIN0871
      END
C ******************************************************************** DYNX0001
      SUBROUTINE DAYNXT(DAY,DPY)
```

```
C                                                                     DYNX0002
C  DETERMINES NUMBER OF NEXT DAY OF THE YEAR
C                                                                     DYNX0003
      INTEGER  DAY,DPY                                                DYNX0004
      DAY = DAY + 1                                                   DYNX0005
      IF(DAY .EQ. 366) DAY = 1                                        DYNX0006
      IF(DAY .EQ. 6C .AND. DPY .EQ. 366) DAY = 366                    DYNX0007
      IF(DAY .EQ. 367) DAY = 60                                       DYNX0008
      RETURN                                                          DYNX0009
      END
C ************************************************************************
      SUBROUTINE DAYOUT(VDCY,MEDWY,DPY)                               DYOT0001
C                                                                     DYOT0002
C  PRINTS TABLE OF DAILY VALUES
C
C                                                                     DYOT0003
      DIMENSICN  MEDWY(12),VDCY(366),VDMD(12)                         DYOT0004
      INTEGER  DATE,DAY,DPY                                           DYOT0005
  100 WRITE(6,1)                                                      DYOT0006
    1 FORMAT(7X,'DAY',7X,'OCT',5X,'NOV',5X,'DEC',5X,'JAN',5X,'FEB',5X,  DYOT0007
     1  'MAR',5X,'APR',5X,'MAY',5X,'JUNE'5X,'JUL',5X,'AUG',5X,'SEPT' )   DYOT0008
      MEDWY(3) = 0                                                    DYOT0009
      DO 104 DATE = 1,28,1                                            DYOT0010
      IF(MOD(DATE,5) .NE. 1) GO TO 102                                DYOT0011
      DO 101 KMO = 1,12                                               DYOT0012
      DAY = MEDWY(KMO) + DATE                                         DYOT0013
  101 VDMD(KMO) = VDCY(DAY)                                           DYOT0014
      WRITE(6,2) DATE,VDMD(12),(VDMD(KWD), KWD=1,11)                  DYOT0015
    2 FORMAT(1H ,3X,I6,3X,12F8.1)                                     DYOT0016
      GO TO 104                                                       DYOT0017
  102 DO 103 KMO = 1,12                                               DYOT0018
      DAY = MEDWY(KMO) + DATE                                         DYOT0019
  103 VDMD(KMC) = VDCY(DAY)                                           DYOT0020
      WRITE(6,3) DATE,VDMD(12),(VDMD(KWD), KWD = 1,11)                DYOT0021
    3 FORMAT(1X,3X,I6,3X,12F8.1)                                      DYOT0022
  104 CONTINUE                                                        DYOT0023
      IF(DPY .NE. 366) GO TO 106
```

```
      DATE = 29                                                         DYOT0024
      VDCY(60) = VDCY(366)                                              DYOT0025
      DO 105 KMO = 1,12                                                 DYOT0026
      DAY = MEDWY(KMO) + DATE                                           DYOT0027
  105 VDMD(KMO) = VDCY(DAY)                                             DYOT0028
      WRITE(6,3) DATE,VDMD(12),(VDMD(KWD), KWD=1,11)                    DYOT0029
      GO TO 107                                                         DYOT0030
  106 CONTINUE                                                          DYOT0031
      WRITE(6,4) VDCY(302),VDCY(333),VDCY(363),VDCY(29),VDCY(88),       DYOT0032
     1VDCY(119),VDCY(149),VDCY(180),VDCY(210),VDCY(241),VDCY(272)       DYOT0033
    4 FORMAT(1X,7X,'29',3X,4F8.1,8X,7F8.1)                              DYOT0034
  107 CONTINUE                                                          DYOT0035
  108 WRITE(6,5) VDCY(303),VDCY(334),VDCY(364),VDCY(30),VDCY(89),       DYOT0036
     1VDCY(120),VDCY(150),VDCY(181),VDCY(211),VDCY(242),VDCY(273)       DYOT0037
    5 FORMAT(1X,7X,'30',3X,4F8.1,8X,7F8.1)                              DYOT0038
      WRITE(6,6) VDCY(304),VDCY(365),VDCY(31),VDCY(90),VDCY(151),       DYOT0039
     1VDCY(212),VDCY(243)                                               DYOT0040
    6 FORMAT(1X, 7X,'31',3X,F8.1,8X,2F8.1,8X,F8.1,8X,F8.1,8X,2F8.1)     DYOT0041
      MEDWY(3) = 365                                                    DYOT0042
      RETURN                                                            DYOT0043
      END                                                               DYOT0044
C ******************************************************************************
      SUBROUTINE PREPRD(RGPM,DRHP,DAY,HOUR,DPY,PRD,PEP,PRH)             PREP0001
C
C  DIVIDES HOURLY PRECIPITATION TOTALS AMONG PERIODS FOR SMALL BASINS   PREP0002
C
C
      DIMENSION DRHP(366,24), PE4P(4)                                   PREP0003
      INTEGER DAY,DPY,HOUR,PRD                                          PREP0004
      PEP = 0.0                                                         PREP0005
      IF(PRH .EQ. 0.0) RETURN                                           PREP0006
      IF(PRD .EQ. 1) GO TO 100                                          PREP0007
      PEP = PE4P(PRD)                                                   PREP0008
      RETURN                                                            PREP0009
  100 LHOUR = HOUR - 1                                                  PREP0010
      LDAY = DAY                                                        PREP0011
      IF(LHOUR .GE. 1) GO TO 101                                        PREP0012
```

```
      LHOUR = 24                                                        PREP0013
      LDAY = DAY - 1                                                    PREP0014
      IF(LDAY .EQ. 0) LDAY = 365                                        PREP0015
      IF(LDAY .EQ. 365) LDAY = 59                                       PREP0016
      IF(LDAY .EQ. 59 .AND. DPY .EQ. 366) LDAY = 366                    PREP0017
  101 PRLH = RGPM*DRHP(LDAY,LHOUR)                                      PREP0018
      NHOUR = HOUR + 1                                                  PREP0019
      NDAY = DAY                                                        PREP0020
      IF(NHOUR .LE. 24) GO TO 102                                       PREP0021
      NHOUR = 1                                                         PREP0022
      CALL DAYNXT(NDAY,DPY)                                             PREP0023
  102 PRNH = RGPM*DRHP(NDAY,NHOUR)                                      PREP0024
      IF(PRH .GT. PRLH .AND. PRH .GT. PRNH) GO TO 103                   PREP0025
      GO TO 104                                                         PREP0026
  103 PE4P(1) = 0.10                                                    PREP0027
      PE4P(2) = 0.28                                                    PREP0028
      PE4P(3) = 0.46                                                    PREP0029
      PE4P(4) = 0.16                                                    PREP0030
      GO TO 108                                                         PREP0031
  104 IF(PRH .LT. PRLH .AND. PRH .LT. PRNH) GO TO 105                   PREP0032
      GO TO 106                                                         PREP0033
  105 PE4P(1) = 0.28                                                    PREP0034
      PE4P(2) = 0.10                                                    PREP0035
      PE4P(3) = 0.16                                                    PREP0036
      PE4P(4) = 0.46                                                    PREP0037
      GO TO 108                                                         PREP0038
  106 IF(PRNH .GE. PRLH) GO TO 107                                      PREP0039
      PE4P(1) = 0.46                                                    PREP0040
      PE4P(2) = 0.16                                                    PREP0041
      PE4P(3) = 0.28                                                    PREP0042
      PE4P(4) = 0.10                                                    PREP0043
      GO TO 108                                                         PREP0044
  107 PE4P(1) = 0.10                                                    PREP0045
      PE4P(2) = 0.28                                                    PREP0046
      PE4P(3) = 0.16                                                    PREP0047
      PE4P(4) = 0.46                                                    PREP0048
  108 DO 109 KPRD = 1,4                                                 PREP0049
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```
  109 PE4P(KPRD) = PE4P(KPRD)*PRH                                         PREP0050
      PEP = PE4P(1)                                                       PREP0051
      RETURN                                                              PREP0052
      END                                                                 PREP0053
C ***********************************************************************************
      SUBROUTINE RTVARY(CTRI,SATRI,BTRI,CHCAP,NBTRI,MXTRI,NCTRI,EXQPV,    RTVY0001
     1  LSHFT,TFCFS)                                                      RTVY0002
C
C
C
      DIMENSION  AWSBIT(99),BTRI(99),CTRI(99),SATRI(99)                   RTVY0003
      LOGICAL  LSHFT                                                      RTVY0004
      DO 100 KIA = 1,MXTRI                                                RTVY0005
      SATRI(KIA) = C.0                                                    RTVY0006
  100 AWSBIT(KIA) = 0.0                                                   RTVY0007
      LSHFT = .FALSE.                                                     RTVY0008
      FMXTRI = MXTRI                                                      RTVY0009
      FNBTRI = NBTRI                                                      RTVY0010
      FNPTRI = NCTRI                                                      RTVY0011
      TFX = TFCFS                                                         RTVY0012
      TFMRT = 0.1*CHCAP                                                   RTVY0013
      IF(TFX .LT. TFMRT) TFX = TFMRT                                      RTVY0014
      IF(FNPTRI .EQ. FMXTRI .AND. TFX .EQ. TFMRT) RETURN                  RTVY0015
      FNTRI = FNBTRI*(CHCAP/TFX)**EXQPV + 0.5                             RTVY0016
      IF(FNTRI .LT. 1.0) FNTRI = 1.01                                     RTVY0017
      NCTRI = FNTRI                                                       RTVY0018
      FNSTRI = NCTRI                                                      RTVY0019
      IF(FNSTRI .NE. FNPTRI) LSHFT = .TRUE.                               RTVY0020
      IF(.NOT. LSHFT) RETURN                                              RTVY0021
      IF(FNPTRI .GT. 98.5) GO TO 101                                      RTVY0022
      FCNTRI = ABS(FNSTRI - FNPTRI)                                       RTVY0023
      IF(FCNTRI .LE. 1.1) GO TO 101                                       RTVY0024
      IF(FNSTRI .GT. FNPTRI) FNSTRI = FNPTRI + 1.0                        RTVY0025
      IF(FNSTRI .LT. FNPTRI) FNSTRI = FNPTRI - 1.0                        RTVY0026
      NCTRI = FNSTRI                                                      RTVY0027
  101 KB1 = 0                                                             RTVY0028
      KB2 = 1                                                             RTVY0029
```

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      KB3 = 0                                                           RTVY0030
  102 KB1 = KB1 + 1                                                     RTVY0031
      IF(KB1 .GT. NBTRI) GO TO 105                                      RTVY0032
      KB4 = 0                                                           RTVY0033
      WSBIT = BTRI(KB1)/FNSTRI                                          RTVY0034
  103 KB4 = KB4 + 1                                                     RTVY0035
      IF(KB4 .GT. NCTRI) GO TO 102                                      RTVY0036
      AWSBIT(KB2) = AWSBIT(KB2) + WSBIT                                 RTVY0037
      KB3 = KB3 + 1                                                     RTVY0038
      IF(KB3 .LT. NBTRI) GO TO 104                                      RTVY0039
      KB3 = 0                                                           RTVY0040
      KB2 = KB2 + 1                                                     RTVY0041
  104 GO TO 103                                                         RTVY0042
  105 IF(FNPTRI .GT. 98.5) GO TO 108                                    RTVY0043
      DO 107 KB6 = 1,NCTRI                                              RTVY0044
      DO 106 KB7 = 1,KB6                                                RTVY0045
  106 SATRI(KB6) = SATRI(KB6) + AWSBIT(KB7) - CTRI(KB7)                 RTVY0046
  107 CONTINUE                                                          RTVY0047
  108 DO 109 KB5 = 1,MXTRI                                              RTVY0048
  109 CTRI(KB5) = AWSBIT(KB5)                                           RTVY0049
      RETURN                                                            RTVY0050
      END                                                               RTVY0051
C ***********************************************************************
      SUBROUTINE SNCMEL(BDDFSM,SPTWCC,SPM,ELDIF,DAY,SPBFLW,XDNFS,FFOR,  SNOW0001
     1 FFSI,MRNSM,DSMGH,SDEPTH,STMD,PXCSA,HOUR,SAX,SOFRF,OFRFIS,SOFRFI,SNOW0002
     2 AMFSIL,PRH,SPTW,TANSM,SPLW,SFMD,OFRF,WT4AM,WT4PM,ASM,ASMRG,      SNOW0003
     3 SASFX,SARAX,DMXT,DMNT,RICY,FIRR)                                 SNOW0004
C
C  SNOWMELT COMPUTATION                                                 SNOW0005
C
C
      DIMENSION  DMNT(366),DMXT(366),FIRR(15),RICY(37)                  SNOW0006
      INTEGER  DAY,HOUR                                                 SNOW0007
      REAL  MHSM,MRNSM                                                  SNOW0008
      IF((DAY .NE. 274) .OR. (HOUR .NE. 1)) GO TO 100                   SNOW0009
      SPLW = 0.0                                                        SNOW0010
      XELR = 0.0                                                        SNOW0011
```

```
      SDSC = 0.0278                                              SNOW0012
      FDSC = 0.0                                                 SNOW0013
      FTA = 0.0                                                  SNOW0014
      RICD = 0.0                                                 SNOW0015
      KRIA = 0                                                   SNOW0016
  100 CONTINUE                                                   SNOW0017
C
C  CALCULATION OF HOURLY AIR TEMPERATURE                         SNOW0018
C     DMXT CURRENT DAY, DMNT NEXT DAY                            SNOW0019
C
      IF(HOUR .NE. 4) GO TO 101                                  SNOW0020
      FDSC = 0.0                                                 SNOW0021
      FTA = FDSC                                                 SNOW0022
      WT4PM = DMXT(DAY) - 4.0*ELDIF + (XELR/4.0)*0.7*ELDIF       SNOW0023
  101 IF(HOUR .EQ. 10) SDSC = -0.0278                            SNOW0024
      IF(HOUR .EQ. 22) SDSC = 0.0278                             SNOW0025
      IF(HOUR .NE. 16) GO TO 102                                 SNOW0026
      NDAY = DAY + 1                                             SNOW0027
      IF(NDAY .EQ. 366) NDAY = 1                                 SNOW0028
      IF(NDAY .EQ. 60 .AND. DMXT(366) .NE. 0.0) NDAY = 366       SNOW0029
      IF(NDAY .EQ. 367) NDAY = 60                                SNOW0030
      WT4AM = DMNT(NDAY) - (XELR/4.0)*3.3*ELDIF                  SNOW0031
  102 IF(PRH .LE. 0.0 .OR. XELR .GE. 4.0) GO TO 103              SNOW0032
      WT4AM = WT4AM - 0.825*ELDIF                                SNOW0033
      WT4PM = WT4PM + 0.175*ELDIF                                SNOW0034
      XELR = XELR + 1.0                                          SNOW0035
  103 IF(PRH .NE. 0.0 .OR. XELR .LE. 0.0) GO TO 104              SNOW0036
      WT4AM = WT4AM + 0.825*ELDIF                                SNOW0037
      WT4PM = WT4PM - 0.175*ELDIF                                SNOW0038
      XELR = XELR - 1.0                                          SNOW0039
  104 TEH = WT4AM + FTA*(WT4PM - WT4AM)                          SNOW0040
      FDSC = FDSC + SDSC                                         SNOW0041
      FTA = FTA + FDSC                                           SNOW0042
      IF(PRH+SPTW .EQ. 0.0) GO TO 128                            SNOW0043
      IF(HOUR .NE. 24) GO TO 105                                 SNOW0044
C
C  CALCULATION OF TIME AGING OF THE SNOWPACK                     SNOW0045
```

```
C                                                                        SNOW0046
      SAX = SAX + 1.0                                                    SNOW0047
      IF(SAX .GT. 15.0) SAX = 15.0                                       SNOW0048
  105 IF(TEH .GT. 32.0) GO TO 110
C
C  PRECIPITATION IN FORM OF SNOW - CALCULATE INTERCEPTION DENSITY OF NEWSNOW0049
C    SNOW COMPACTION, AND SETTLING SNOW PACK AND THE EFFECT ON ALBEDO   SNOW0050
C
      IF(PRH .LE. 0.0) GO TO 110                                         SNOW0051
      PRH = SPM*PRH                                                      SNOW0052
      HSF = PRH                                                          SNOW0053
      ASM = ASM + HSF                                                    SNOW0054
      PRH = (1.0 - (FFSI*FFOR))*PRH                                      SNOW0055
      HSFRG = PRH                                                        SNOW0056
      ASMRG = ASMRG + HSFRG                                              SNOW0057
      FSIL = FFSI*FFOR*HSF                                               SNOW0058
      AMFSIL = AMFSIL + FSIL                                             SNOW0059
      IF(TEH .LE. 0.0) GO TO 106                                         SNOW0060
      DNFS = XDNFS + ((0.01*TEH)**2)                                     SNOW0061
      GO TO 107                                                          SNOW0062
  106 DNFS = XDNFS                                                       SNOW0063
  107 IF(SPTW .GT. 0.0 .AND. SDEPTH .GT. SPTW) SDEPTH = SDEPTH - ((PRH* SNOW0064
     1   SDEPTH/SPTW)*((0.10*SDEPTH)**0.25))                             SNOW0065
      SPTW = SPTW + PRH                                                  SNOW0066
      SDEPTH = SDEPTH + (PRH/DNFS)                                       SNOW0067
      SASFX = SASFX + PRH                                                SNOW0068
      IF(SASFX .GE. PXCSA) GO TO 108                                     SNOW0069
      GO TO 109                                                          SNOW0070
  108 SAX = SAX - 1.0                                                    SNOW0071
      IF(SAX .LT. 0.0) SAX = 0.0                                         SNOW0072
      SASFX = SASFX - PXCSA                                              SNOW0073
  109 PRH = 0.0                                                          SNOW0074
  110 CONTINUE                                                           SNOW0075
      IF(SPTW .LE. 0.0) GO TO 127                                        SNOW0076
C                                                                        SNOW0077
C  SEASONAL MELT FACTOR ADJUSTMENT
C
```

```
      FDAY = DAY                                                        SNOW0078
      KAAO = KRIA                                                       SNOW0079
      KRIA = 1.0 + (FDAY/10.0)                                          SNOW0080
      IF(KAAO .NE. KRIA) RICD = RICY(KRIA)                              SNOW0081
      IF(TEH .LE. 32.0) GO TO 111                                       SNOW0082
      GO TO 114                                                         SNOW0083
C
C  CALCULATION OF NEGATIVE MELT                                         SNOW0084
C
  111 IF(TANSM .LE. 11.5*MRNSM) GO TO 112                               SNOW0085
      IF(TANSM .LT. 1.0) TANSM = TANSM + ((5.0*MRNSM)**(1.3 + 2.0*      SNOW0086
     1  TANSM))                                                         SNOW0087
      GO TO 113                                                         SNOW0088
  112 TANSM = TANSM + MRNSM                                             SNOW0089
  113 IF(TANSM .GT. 0.08*SPTW) TANSM = 0.08*SPTW                        SNOW0090
      GO TO 127                                                         SNOW0091
C
C  EFFECT OF RAIN ON ALBEDO                                             SNOW0092
C
  114 SARAX = SARAX + PRH                                               SNOW0093
      IF(SARAX .LT. PXCSA/2.0) GO TO 115                                SNOW0094
      SAX = SAX + 1.0                                                   SNOW0095
      IF(SAX .GT. 15.0) SAX = 15.0                                      SNOW0096
      SASFX = 0.0                                                       SNOW0097
      SARAX = SARAX - (PXCSA/2.0)                                       SNOW0098
  115 IF(TEH .GT. 32.0) HSM = (TEH -32.0)*BDDFSM                        SNOW0099
      IF(TEH .LT. 32.0) HSM = 0.0                                       SNOW0100
      HSM = HSM*RICD                                                    SNOW0101
      KAA = 1.0 + SAX                                                   SNOW0102
      IF(SAX .LT. 15.0) HSM = HSM*(1.0 - ((1.0 - FFOR)*FIRR(KAA)))      SNOW0103
      IF(SAX .EQ. 15.0) HSM = HSM*(1.0 - ((1.0 - FFOR)*FIRR(15)))       SNOW0104
      IF(PRH .GT. 0.0) HSM = HSM + ((TEH - 32.0)*(PRH/144.0))           SNOW0105
      IF(STMD .GT. 0.3 .AND. SPTW .LT. SPTWCC) GO TO 116                SNOW0106
      GO TO 117                                                         SNOW0107
  116 MHSM = HSM                                                        SNOW0108
      HSM = (SPTW/SPTWCC)*HSM                                           SNOW0109
      IF(HSM .LT. 0.1*MHSM) HSM = 0.1*MHSM                              SNOW0110
```

```
  117 IF(HSM .LT. SPTW) GO TO 118                                    SNOW0111
      HSM = SPTW                                                     SNOW0112
      SDEPTH = 0.0                                                   SNOW0113
      SPTW = 0.0                                                     SNOW0114
      SPLW = 0.0                                                     SNOW0115
      RICD = 0.0                                                     SNOW0116
      TANSM = 0.0                                                    SNOW0117
      SAX = 15.0                                                     SNOW0118
      OFRF = SOFRF                                                   SNOW0119
      OFRFIS = SOFRFI                                                SNOW0120
      GO TO 122                                                      SNOW0121
  118 SPTW = SPTW - HSM                                              SNOW0122
      IF(SFMD .LE. 0.0) GO TO 122                                    SNOW0123
      IF(SAX .GE. 15.0) GO TO 121                                    SNOW0124
      IF(SAX .GE. 6.0) GO TO 119                                     SNOW0125
      SDEPTH = SDEPTH - (HSM/(0.5*SFMD))                             SNOW0126
      GO TO 122                                                      SNOW0127
  119 IF(SAX .LE. 10.0) GO TO 120                                    SNOW0128
      SDEPTH = SDEPTH - (HSM/(0.9*SFMD))                             SNOW0129
      GC TO 122                                                      SNOW0130
  120 SDEPTH = SDEPTH - (HSM/(0.7*SFMD))                             SNOW0131
      GO TO 122                                                      SNOW0132
  121 SDEPTH = SDEPTH - (HSM/SFMD)                                   SNOW0133
  122 CONTINUE                                                       SNOW0134
      IF(SPTW .LT. 0.00001) SPTW = 0.0                               SNOW0135
C
C  CALCULATION OF LIQUID-WATER-HOLDING CAPACITY                      SNOW0136
C
      SPLWC = SPBFLW*SPTW                                            SNOW0137
      IF(SFMD .GT. 0.6) SPLWC = SPBFLW*(3.0 - 3.33*SFMD)*SPTW        SNOW0138
      IF(SPLWC .LT. 0.0) SPLWC = 0.0                                 SNOW0139
C
C  ACCOUNTING OF MELT WATER AND RAIN                                 SNOW0140
C
      IF((SPLW + HSM + PRH) .GT. (SPLWC + TANSM)) GO TO 123          SNOW0141
      GO TO 124                                                      SNOW0142
  123 PRH = HSM + PRH + SPLW - SPLWC - TANSM                         SNOW0143
```

```
                                                                SNOW0144
      SPLW = SPLWC                                              SNOW0145
      SPTW = SPTW + TANSM                                       SNOW0146
      TANSM = 0.0                                               SNOW0147
      GO TO 127                                                 SNOW0148
  124 IF((HSM + PRH) .LE. TANSM) GO TO 126                      SNOW0149
  125 SPTW = SPTW + TANSM                                       SNOW0150
      SPLW = SPLW + HSM + PRH - TANSM                           SNOW0151
      PRH = 0.0                                                 SNOW0152
      TANSM = 0.0                                               SNOW0153
      GO TO 127                                                 SNOW0154
  126 TANSM = TANSM - HSM - PRH                                 SNOW0155
      SPTW = SPTW + HSM + PRH                                   SNOW0156
      PRH = 0.0                                                 SNOW0157
  127 CONTINUE                                                  SNOW0158
      HSM = 0.0
C                                                               SNOW0159
C  CALCULATION OF DENSITY AND ADJUSTMENT OF OVERLAND FLOW TIME
C                                                               SNOW0160
      IF(SDEPTH .LE. 0.0 .OR. SPTW .GE. SDEPTH) GO TO 128       SNOW0161
      STMD = (SPTW + SPLW)/SDEPTH                               SNOW0162
      SFMD = SPTW/SDEPTH                                        SNOW0163
      OFRF = 0.33*SOFRF                                         SNOW0164
      IF(SPTW .LE. SPTWCC) OFRF = (1.0 - (SPTW/SPTWCC)*0.67)*SOFRF  SNOW0165
  128 IF(SDEPTH .LE. 0.0) OFRF = SOFRF                          SNOW0166
      OFRFIS = SOFRFI*OFRF/SOFRF
C                                                               SNOW0167
C  CALCULATION OF GROUNDMELT
C                                                               SNOW0168
      IF( HOUR .NE. 12 .OR. SPTW .LE. 0.0) RETURN               SNOW0169
      IF(SPTW .LE. DSMGH) GO TO 129                             SNOW0170
      PRH = PRH + DSMGH                                         SNOW0171
      SPTW = SPTW - DSMGH                                       SNOW0172
      IF(STMD .LT. 0.50 .AND. SDEPTH .GT. 2.0*DSMGH) SDEPTH = SDEPTH -  SNOW0173
     1  2.0*DSMGH                                               SNOW0174
      RETURN                                                    SNOW0175
  129 PRH = SPTW + PRH + SPLW
```

```
      TANSM = 0.0                                                       SNOW0176
      RICD = 0.0                                                        SNOW0177
      SPLW = 0.0                                                        SNOW0178
      SDEPTH = 0.0                                                      SNOW0179
      SPTW = 0.0                                                        SNOW0180
      SAX = 15.0                                                        SNOW0181
      OFRF = SOFRF                                                      SNOW0182
      OFRFIS = SOFRFI                                                   SNOW0183
      RETURN                                                            SNOW0184
      END                                                               SNOW0185
```

APPENDIX C

LISTING OF DATA CARDS FOR

1967-68 WATERYEAR

114
57
171

```
01    *NCYR
 0 * OPTION 1, 1 IF 15-MINUTE STORM DETAILS ARE REQUESTED
 0 * OPTION 2, 1 IF RAIN IS NOT TO BE DIVIDED EQUALLY AMONG 15-MINUTE PERIOD
 1 * OPTION 3, 1 IF EVAPORATION IS READ BY 10-DAY PERIODS
 1 * OPTION 4, 1 IF DAILY FLOW ERROR TABLE IS REQUESTED
 1 * OPTION 5, 1 IF 20 TOP RAINFALLS AND OVERLAND FLOWS ARE REQUESTED
 1 * OPTION 6, 1 IF DAILY VALUES OF SOIL MOISTURE STORAGE ARE REQUESTED
 1 * OPTION 7, 1 IF SNOW IS TO BE INCLUDED IN ANALYSIS
 0 * OPTION 8, 1 IF THE STORAGE SITE MOVED DURING THE YEAR
 1 * OPTION 9, 1 IF DAILY RECORDED STREAM FLOWS ARE TO BE READ
 0 * OPTION 10, 1 IF NEXT YEAR OF DATA REQUIRES READING NEO OATERSHED PARAMETERS
 0 * OPTION 11, 1 IF DIVERSIONS ARE TO BE READ
 1 * OPTION 12, 1 IF STREAM ROUTING IS TO BE DONE HOURLY
 0 * OPTION 13, 1 IF LENGTH OF TIME-AREA-HISTOGRAM IS TO BE VARIED WITH FLOW
 1 * OPTION 14, 1 IF RECORDED STREAMFLOWS ARE TO BE PRINTED
 25                                                                     NBTRI
0.0068 0.0163 0.0301 0.0331 0.0350 0.0512 0.0560 0.0551 0.0577 0.1033
0.0441 0.0309 0.0301 0.0349 0.0306 0.0350 0.0411 0.0358 0.0411 0.0377
0.0577 0.0551 0.0363 0.0161 0.0095
0.50 0.50 0.50 0.45 0.40 0.35 0.30 0.25 0.20 0.15 0.10 0.08 0.06 0.04 0.02
 0.55 0.56 0.57 0.61 0.67 0.75 0.80 0.83 0.87 0.92
 0.96 0.99 1.00 1.00 0.98 0.95 0.91 0.87 0.84 0.81
 0.79 0.77 0.75 0.73 0.72 0.71 0.70 0.69 0.68 0.67
 0.65 0.64 0.62 0.60 0.57 0.56 0.55
0.0000 0.0000 0.0000 0.049  0.046  0.045  0.045  0.050  0.046         * FALL
0.044  0.046  0.050  0.047  0.047  0.046  0.046  0.047  0.048  0.051  * WINTER
0.051  0.051  0.049  0.049  0.051  0.0000 0.0000 0.0000 0.0000 0.0000 * SPRING
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000               * SUMMER
 0.002     0.05       2.5       1.2       0.5     0.05      0.65      0.03
  0.0126    0.02      0.2
  1000.0        * RMPF
 1.0      317.0      0.0       0.0
 0.15    1.0      0.60     7.4     0.27     0.0      0.0     0.30     6.0    5.5
 0.29     1500.0    0.050     0.015     0.40                     /FSS
 0.95        0.97    2000.0   0.25     1.0        0.85
0.02 0.0  4.0   0.02 0.0
DEVELOPMENT OF SYNTHESIZED STREAM FLOWS FOR A REPRESENTATIVE YEAR
```

```
67 68        * WATER YEAR
PALOUSE RIVER NEAR POTLATCH,IDAHO
   0.12700.11000.08800.06960.06000.04680.03980.03450.0312
0.02830.02780.02880.02970.03160.03260.03500.03880.04650.0720
0.09600.12400.19500.19400.20000.20700.24200.19500.26600.2950
0.31800.24200.30400.32000.32100.19800.14300.1310
  0.85 0.90 0.80 0.60 0.40 0.25 0.40 0.60 0.70 0.75 0.80 0.85       * EPC4
3.5
3.8
4.7
6.6
15.
21.
20.
11.
3.5
6.0
12.
4.7
10.
27.
24.
24.
15.
2.2
4.7
5.4
8.5
4.7
4.9
8.0
12.
8.
8.8
20.
64.
32.
```

23.
14.
12.
11.
15.
3.1
1.9
5.1
8.8
9.4
13.
54.
59.
28.
24.
32.
24.
22.
29.
19.
8.2
12.
14.
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11.
17.
11.
8.3
6.0
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17.
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18.
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4.5
4.7
7.7
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10.
14.
122.
184.
765.
366.
228.
148.
110.
88.
57.
63.
52.
34.
47.
46.
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32.
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37.
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124.
122.
102.
92.
77.
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141.
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154.
137.
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268.
348.
272.
208.
181.
137.
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115.
92.
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77.
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69.
302.

3440.
5440.
4130.
3470.
2420.
2200.
1340.
914.
707.
569.
487.
433.
407.
368.
345.
342.
318.
282.
250.
222.
185.
165.
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325.
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262.
230.
210.
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173.
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152.
154.
141.
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137.
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3.5
3.3
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2.6
3.4
3.0
3.0
3.3
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6.6
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94.
70.
49.
56.
52.
43.
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26.
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OCT. 1967

21.	
13.	
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55.	45.
52.	31.
58.	44.
64.	28.
58.	36.
58.	28.
66.	41.
78.	34.
72.	37.
72.	34.
58.	49.
57.	45.
55.	41.
55.	42.
58.	25.
63.	33.
69.	27.
69.	36.
59.	28.
65.	26.
58.	33.
60.	33.
52.	39.
50.	25.
50.	40.
49.	24.
47.	29.
52.	39.
46.	29.
61.	37.
60.	39.
55.	32.
48.	21.
45.	26.

50.	16.
52.	17.
56.	17.
48.	29.
60.	34.
44.	39.
51.	41.
47.	29.
50.	37.
56.	39.
56.	41.
56.	35.
53.	37.
54.	23.
45.	31.
50.	24.
44.	30.
38.	27.
49.	31.
38.	22.
45.	32.
35.	25.
34.	10.
36.	14.
32.	25.
35.	30.
37.	15.
37.	21.
42.	28.
41.	33.
43.	34.
44.	31.
34.	27.
36.	27.
32.	25.
35.	23.
44.	33.

44.	26.
30.	12.
28.	6.
28.	3.
26.	5.
17.	10.
26.	15.
31.	22.
26.	16.
18.	3.
25.	5.
36.	24.
41.	35.
44.	35.
40.	34.
43.	33.
44.	32.
42.	34.
37.	30.
31.	27.
33.	29.
35.	17.
24.	5.
29.	7.
31.	16.
29.	10.
29.	-5.
31.	15.
36.	14.
40.	21.
40.	25.
36.	23.
36.	12.
44.	33.
45.	33.
45.	35.
40.	30.

```
      KT20 = 20                                                        MAIN0527
  194 IF(KT20 .LT. 1) GO TO 196                                        MAIN0528
      IF(PRH .GT. T20PRH(KT20)) GO TO 195                              MAIN0529
      T20PRH(KT20 + 1) = PRH                                           MAIN0530
      GO TO 197                                                        MAIN0531
  195 T20PRH(KT20+1) = T20PRH(KT20)                                    MAIN0532
      KT20 = KT20 - 1                                                  MAIN0533
      GO TO 194                                                        MAIN0534
  196 T20PRH(1) = PRH                                                  MAIN0535
C
C  ADDING GROUNDWATER FLOW                                             MAIN0536
C
  197 CBF = GWS*BFRL*(1.0 + BFNRL*BFNX)                                MAIN0537
      GWS = GWS - CBF                                                  MAIN0538
      AMBF = AMBF + CBF                                                MAIN0539
      THGR = ARHF + CBF                                                MAIN0540
      IF(HSE .GT. THGR) HSE = THGR                                     MAIN0541
      AMSE = AMSE + HSE                                                MAIN0542
      THSF(HOUR) = (THGR - HSE)*WCFS                                   MAIN0543
      TDSF = TDSF + THSF(HOUR)                                         MAIN0544
C
C  DRAINING OF UPPER ZONE STORAGE                                      MAIN0545
C
      UZINFX = (UZS/UZC) - (LZS/LZC)                                   MAIN0546
      IF(UZINFX .LE. 0.0) GO TO 198                                    MAIN0547
      LZSR = LZS/LZC                                                   MAIN0548
      UZINLZ = 0.003*BMIR*UZC*UZINFX**3.0                              MAIN0549
      IF(UZINLZ .GT. UZS) UZINLZ = UZS                                 MAIN0550
      UZS = UZS - UZINLZ                                               MAIN0551
      LZRX = 1.5*ABS(LZSR - 1.0) + 1.0                                 MAIN0552
      FMR = (1.0/(1.0 + LZRX))**LZRX                                   MAIN0553
      IF(LZS .LT. LZC) FMR = 1.0 - FMR*LZSR                            MAIN0554
      PGW = (1.0-FMR)*UZINLZ*(1.0 - SUBWF)*FPER                        MAIN0555
      PLZS = FMR*UZINLZ                                                MAIN0556
      LZS = LZS + PLZS                                                 MAIN0557
      GWS = GWS + PGW                                                  MAIN0558
      BFNX = BFNX + PGW                                                MAIN0559
```

55.	42.
52.	36.
58.	29.
57.	32.
57.	28.
64.	28.
65.	30.
67.	30.
60.	23.
60.	36.
66.	36.
59.	41.
46.	29.
49.	28.
47.	33.
49.	23.
48.	24.
48.	25.
57.	43.
51.	34.
47.	28.
50.	30.
51.	41.
46.	33.
45.	26.
49.	22.
56.	24.
63.	25.
66.	33.
56.	29.
49.	37.
39.	34.
42.	29.
46.	33.
49.	37.
51.	42.
46.	24.

56.	24.
60.	32.
51.	39.
49.	29.
54.	33.
46.	34.
42.	29.
46.	29.
52.	27.
64.	31.
71.	33.
60.	37.
40.	25.
46.	18.
48.	29.
47.	34.
43.	27.
50.	19.
53.	21.
47.	29.
46.	26.
51.	21.
58.	21.
55.	27.
51.	26.
52.	32.
55.	36.
62.	24.
74.	24.
78.	37.
68.	40.
56.	30.
62.	25.
70.	25.
65.	29.
65.	28.
48.	31.

59.	36.
68.	26.
72.	31.
72.	32.
70.	32.
65.	36.
60.	42.
56.	41.
61.	36.
70.	34.
77.	32.
77.	33.
82.	36.
75.	50.
60.	45.
59.	40.
62.	41.
66.	31.
64.	39.
59.	42.
67.	34.
67.	44.
65.	45.
62.	30.
70.	28.
78.	46.
72.	53.
65.	42.
70.	32.
74.	32.
68.	39.
61.	46.
64.	47.
70.	39.
73.	39.
68.	43.
63.	34.

62.	42.
64.	36.
71.	33.
82.	35.
75.	41.
85.	34.
78.	46.
73.	52.
70.	40.
65.	51.
75.	48.
78.	38.
85.	40.
85.	49.
78.	50.
59.	42.
55.	35.
70.	43.
80.	33.
89.	35.
92.	37.
96.	42.
95.	43.
94.	52.
92.	50.
95.	43.
90.	50.
82.	51.
93.	47.
75.	53.
73.	40.
70.	50.
70.	45.
76.	33.
75.	40.
83.	35.
84.	35.

70.	42.
79.	34.
75.	39.
79.	34.
85.	37.
86.	44.
91.	40.
95.	44.
97.	48.
89.	48.
95.	38.
87.	41.
91.	37.
85.	40.
85.	47.
82.	46.
82.	49.
79.	40.
86.	39.
86.	37.
87.	42.
84.	56.
87.	43.
85.	36.
77.	39.
61.	50.
58.	47.
75.	38.
67.	49.
63.	40.
63.	42.
65.	47.
66.	48.
71.	33.
70.	37.
82.	47.
80.	41.

76.	49.
66.	52.
67.	49.
77.	35.
84.	36.
87.	39.
70.	44.
67.	39.
72.	34.
78.	38.
83.	36.
84.	42.
76.	40.
85.	35.
92.	42.
85.	41.
80.	40.
73.	53.
74.	40.
63.	51.
60.	45.
64.	43.
63.	48.
57.	47.
58.	36.
46.	36.
43.	39.
59.	38.
66.	41.
73.	34.
76.	38.
79.	36.
63.	44.
70.	32.
77.	35.
77.	37.
0	

```
73016710 11
          0.02 0.07 0.03          0.01 0.0080.0080.008
73016710 12
          0.04
73016710 22
                0.02          0.01          0.01
73016710 31
0.01            0.02 0.02 0.06          0.01
73016710111
   0.02 0.11 0.03 0.05 0.01 0.02
73016710112
      0.01 0.01
73016710131
                                        0.01 0.03
73016710132
0.03 0.01 0.007       0.003
73016710141
0.01 0.02 0.01
73016710191
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
73016710211
                                    0.02 0.02 0.02
73016710212
0.02 0.02
73016710222
0.03 0.04 0.03 0.04 0.03          0.04 0.03 0.04 0.03
73016710231
0.01 0.01
73016710232
0.01 0.01
73016710271
            0.03          0.03 0.03 0.03 0.03 0.03 0
73016710272
0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0
73016710281
0.20 0.2  0.2
73016711 72
```

```
73016712092
            0.008                   0.008
73016712161
                              0.01  0.02        0.01
73016712191
0.03  0.03  0.03  0.03  0.03  0.02
73016712201
                                    0.006
73016712202
                                                0.006
73016712212
0.002       0.0020.0040.0010.0060.01  0.01  0.01  0.01  0.0020.003
73016712221
0.03  0.0150.015        0.04  0.02  0.03  0.07  0.05  0.05  0.09  0.06
73016712222
0.07  0.07  0.07  0.02              0.01                          0.02
73016712231
0.13  0.23
73016712242
0.03  0.03  0.04  0.04  0.03  0.03  0.04  0.04  0.03  0.03  0.03  0.03
73016712251
0.06  0.12  0.12  0.18  0.12  0.12  0.15  0.21  0.24  0.21  0.02
73016712261
0.01                          0.01                                0.01
73016712262
0.01                          0.01
73016712271
                  0.02  0.04  0.02
73016712311
                                          0.03  0.01
73016712312
                                                0.01  0.01
73016801011
            0.13  0.13
73016801051
0.01  0.01  0.01  0.01  0.01  0.01
73016801082
```

```
                                             0.03 0.03 0.03
73016801091
0.03 0.03                     0.03 0.03
73016801092
          0.03                                        0.03 0.03
73016801101
0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03
73016801102
                                        0.03
73016801111
0.02
73016801151
0.0180.0180.0180.0180.0180.0180.0180.0180.0180.0180.0180.018
73016801152
0.0180.018
73016801162
     0.05
73016801201
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01
73016801211
               0.0150.0150.0150.0150.015
73016801301
                    0.07
73016802022
     0.12 0.03 0.07
73016802032
               0.02 0.05 0.05 0.07 0.01 0.03 0.01 0.02 0.02
73016802041
                    0.0250.06 0.04 0.02
73016802172
               0.02 0.07 0.10 0.07      0.03 0.02 0.02 0.14
73016802181
0.03 0.03 0.03 0.01                                    0.02
73016802182
0.03 0.03 0.05 0.05 0.09 0.11 0.08 0.11 0.13 0.14 0.08 0.03
73016802191
0.05 0.02 0.02           0.02 0.04           0.02 0.04 0.06
```

```
73016802192
0.20 0.14 0.13 0.14 0.18 0.06 0.12 0.08 0.08 0.02 0.10 0.10
73016802201
0.05 0.10
73016802202
                                                  0.25 0.10
73016802211
0.06 0.11 0.04 0.04 0.02 0.09 0.12 0.08 0.12 0.10 0.03 0.04
73016802221
                                                       0.02
73016802222
0.06 0.01                                    0.02
73016802231
          0.01     0.04 0.12 0.13 0.13 0.10
73016803081
0.01                          0.01                     0.01
73016802131
0.14 0.04 0.04
73016802132
                                             0.0120.0250.012
73016803142
                         0.11 0.10
73016803162
     0.01 0.01 0.01 0.0100.01 0.01 0.01 0.01 0.01
73016803171
0.01
73016803172
0.01
73016802251
                                             0.45 0.03 0.10
73016803252
0.04
73016803261
     0.01 0.03 0.03                          0.01
73016803262
          0.01
73016804021
```

```
0.02      0.02      0.06      0.04 0.04 0.02           0.02
73016804041
     0.0050.002               0.002
73016804042
     0.01      0.0020.002          0.002          0.002
73016804051
     0.01                                    0.01 0.02 0.01
73016804052
0.01      0.01           0.06                          0.01
73016804061
0.006     0.006                         0.006
73016804062
     0.01      0.0060.01
73016804071
               0.01                               0.0040.004
73016804121
0.0050.0050.0050.0050.005
73016804122
0.0050.0050.0050.0050.005
73016804191
                                             0.06 0.06
73016804201
0.0050.0050.0050.0050.005
73016804202
0.0050.0050.0050.0050.005
73016804261
0.0020.0020.0020.0020.002
73016804262
0.0020.0020.0020.0020.0020.0020.002
73016804302
0.008     0.0020.002
73016805131
0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.010
73016805142
     0.0070.007                         0.01 0.02
73016805151
0.0010.0010.0010.0010.0010.001
```

```
73016805152
0.0010.0010.0010.0010.0010.001
73016805201
                              0.04 0.01                0.13 0.14
73016805202
0.18 0.01 0.005     0.01
73016805211
0.03                               0.02 0.07 0.05 0.02 0.01
73016805212
                              0.01 0.07                     0.01
73016805251
                    0.02 0.02 0.04 0.04 0.03 0.01 0.02 0.02
73016805252
0.06 0.04 0.03 0    0.03           0.02      0.01      0.01
73016805291
               0.0150.015          0.0150.015
73016806021
                                             0.02 0.02
73016806022
                         0.02 0.02 0.03
73016806051
0.01 0.01 0.01 0.01 0.01 0.01
73016806052
0.01 0.01 0.01 0.01 0.01 0.01
73016806062
                                   0.04 0.04 0.04 0.04
73016806071
          0.02 0.03 0.01 0.01 0.02      0.04 0.04 0.04
73016806072
     0.01 0.01 0.02 0.03 0.0?      0.01 0.01
73016806082
     0.01 0.01                     0.01
73016806112
0.01      0.15 0.03 0.03
73016806121
0.0050.0050.0050.0050.005
73016806122
```

```
0.0050.0050.0050.0050.005
73016806132
          0.01
73016806221
0.06 0.09 0.14 0.09 0.05 0.01
73016806292
          0.07
73016806301
0.0020.0020.0020.0020.0020.0020.0020.0020.0020.0020.0020.002
73016807121
          0.05 0.10 0.02 0.10 0.20 0.04 0.02
73016807122
0.06
73016807192
                         0.0250.02                 0.0030.003
73016807202
               0.06 0.06 0.06 0.06 0.05
73016808101
0.0020.0020.0020.002
73016808102
0.0020.0020.0020.002
73016808131
                                        0.02
73016808132
     0.02          0.02
73016808141
               0.01 0.02 0.01 0.02 0.01 0.0200.01 0.01 0.01
73016808142
0.01 0.02 0.01 0.02 0.01 0.01
73016808151
0.0100.04 0.04 0.04 0.04 0.04
73016808161
0.0010.0010.0010.0010.001
73016808162
0.0010.0010.0010.0010.001
73016808201
               0.03 0.03
```

```
73016808202
                                                      0.01 0.03 0.03
73016808211
0.02 0.01      0.02 0.02 0.02               0.02 0.02      0.02
73016808241
                                                      0.03 0.03 0.03
73016808242
0.03 0.03 0.01
73016808262
                                0.0050.005
73016808271
                                     0.0050.0050.0050.0050.005
73016808272
                                0.0050.0050.005         0.0050.005
73016808281
0.110
73016809121
0.0050.0050.0050.005
73016809132
                           0.04 0.01                        0.02
73016809141
0.20 0.30 0.16 0.04        0.20
73016809142
                                          0.20              0.04
73016809151
0.01
73016809152
        0.04        0.01           0.01
73016809171
                                0.0040.0040.001
73016809172
                                     0.0020.0040.01 0.0150.017
73016809181
0.10 0.25 0.12 0.20 0.30 0.14 0.14 0.12 0.10 0.10 0.03
73016809182
                                                    0.06 0.02
73016809191
```

```
0.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.001
73016809201
                                             0.01 0.08 0.05

73016809202
0.05 0.02 0.03                     0.02 0.0  0.01      0.01
73016809211
0.0060.04                     0.01 0.01 0.0080.008      0.008
73016809212
0.02           0.04 0.04                     0.0080.008
73016809221
0.14 0.07
73019809301
```

APPENDIX D

OUTPUT FOR THE PALOUSE RIVER FOR THE 1967-68 WATERYEAR

```
// ASSGN SYS002,X'00C'
// ASSGN SYS003,X'00E'
// EXEC
```

```
CONTROL OPTION CODE TABLE

*  0 * OPTION  1 *
*  0 * OPTION  2 *
*  1 * OPTION  3 *
*  1 * OPTION  4 *
*  1 * OPTION  5 *
*  1 * OPTION  6 *
*  1 * OPTION  7 *
*  0 * OPTION  8 *
*  1 * OPTION  9 *
*  0 * OPTION 10 *
*  0 * OPTION 11 *
*  1 * OPTION 12 *
*  0 * OPTION 13 *
*  1 * OPTION 14 *
```

34.	29.
42.	30.
45.	38.
48.	35.
48.	39.
47.	28.
48.	29.
47.	34.
42.	25.
28.	16.
17.	7.
27.	7.
38.	16.
37.	25.
34.	16.
41.	30.
44.	34.
44.	33.
46.	39.
45.	29.
45.	23.
32.	23.
30.	25.
32.	23.
36.	18.
31.	25.
45.	24.
40.	23.
35.	19.
29.	22.
47.	19.
46.	25.
42.	35.
49.	41.
53.	42.
49.	42.
47.	41.

```
              DEVELOPMENT OF SYNTHESIZED STREAM FLOWS FOR A REPRESENTATIVE YEAR
 PALOUSE RIVER NEAR POTLATCH,IDAHO                                              WATER YEAR 1967-68
OCTOBER
NOVEMBER
    29  SDEPTH=     0.39  STMD=  0.19  SAX= 15.00  TANSM=  0.01  SPLW=  0.00
DECEMBER
     4  SDEPTH=     0.16  STMD=  0.15  SAX= 15.00  TANSM=  0.00  SPLW=  0.0
     5  SDEPTH=     0.73  STMD=  0.21  SAX= 15.00  TANSM=  0.01  SPLW=  0.01
     6  SDEPTH=     0.47  STMD=  0.19  SAX= 15.00  TANSM=  0.01  SPLW=  0.01
     7  SDEPTH=     0.90  STMD=  0.19  SAX= 15.00  TANSM=  0.01  SPLW=  0.01
     8  SDEPTH=     0.61  STMD=  0.17  SAX= 15.00  TANSM=  0.01  SPLW=  0.01
     9  SDEPTH=     0.87  STMD=  0.19  SAX= 15.00  TANSM=  0.0   SPLW=  0.01
    10  SDEPTH=     0.03  STMD=  0.16  SAX= 15.00  TANSM=  0.00  SPLW=  0.00
    16  SDEPTH=     0.52  STMD=  0.05  SAX= 15.00  TANSM=  0.00  SPLW=  0.0
    17  SDEPTH=     0.48  STMD=  0.01  SAX= 15.00  TANSM=  0.00  SPLW=  0.0
    19  SDEPTH=     1.77  STMD=  0.10  SAX= 15.00  TANSM=  0.01  SPLW=  0.0
    20  SDEPTH=     1.43  STMD=  0.09  SAX= 15.00  TANSM=  0.01  SPLW=  0.0
    21  SDEPTH=     1.14  STMD=  0.12  SAX= 15.00  TANSM=  0.01  SPLW=  0.0
    22  SDEPTH=     2.77  STMD=  0.22  SAX= 15.00  TANSM=  0.0   SPLW=  0.03
    23  SDEPTH=     2.70  STMD=  0.22  SAX= 15.00  TANSM=  0.0   SPLW=  0.03
    24  SDEPTH=     2.56  STMD=  0.22  SAX= 15.00  TANSM=  0.0   SPLW=  0.03

  25  AM    426.4   457.9   491.2   540.8   578.6   619.2     671.6   742.8   824.7   909.4   940.6   980.3
```

```
     PM   1021.3  1072.6  1133.1  1201.4  1275.9  1356.1    1440.6  1525.6  1605.0  1676.8  1742.1  1802.6  1043.2

          MAXIMUM=  1829.6  C.F.S.     TIME   12.00   P.M.
   25  SDEPTH=    2.43  STMD=  0.21  SAX= 15.00  TANSM=  0.0   SPLW=  0.02

 26  AM   1859.8  1914.4  1966.4  2015.7  2063.0  2111.1    2153.3  2188.8  2214.3  2228.3  2230.8  2237.4


     PM   2226.9  2204.2  2176.3  2144.5  2109.6  2077.5    2038.5  1998.2  1956.9  1914.9  1872.6  1830.2  2072.2
          MAXIMUM=  2231.8  C.F.S.     TIME   10.45   A.M.
   26  SDEPTH=    1.74  STMD=  0.20  SAX= 15.00  TANSM=  0.0   SPLW=  0.02

 27  AM   1789.1  1747.9  1707.6  1668.2  1629.8  1592.4    1556.1  1520.8  1486.6  1453.5  1421.4  1393.2
```

```
     PM    1366.5  1342.3  1319.1  1296.7  1274.9  1253.5     1232.4  1211.6  1191.0  1170.2  1149.6  1129.2  1412.6
          MAXIMUM=  1805.8  C.F.S.      TIME     0.15  A.M.
    27  SDEPTH=     1.18  STMD=  0.23  SAX= 15.00  TANSM=  0.0   SPLW=  0.01

   28  AM    1109.0  1089.3  1070.0  1051.4  1033.5  1016.3     1000.1   984.7   970.3   957.1   944.8   943.5


     PM     933.3   923.2   913.7   904.6   895.6   886.4      877.0   867.4   857.3   846.6   835.6   824.9   947.3
          MAXIMUM=  1119.0  C.F.S.      TIME     0.15  A.M.
    28  SDEPTH=     0.59  STMD=  0.22  SAX= 15.00  TANSM=  0.01  SPLW=  0.01
    29  SDEPTH=     0.19  STMD=  0.20  SAX= 15.00  TANSM=  0.00  SPLW=  0.00
    30  SDEPTH=     0.15  STMD=  0.12  SAX= 15.00  TANSM=  0.00  SPLW=  0.00
    31  SDEPTH=     0.47  STMD=  0.15  SAX= 15.00  TANSM=  0.01  SPLW=  0.00
JANUARY
     1  SDEPTH=     2.71  STMD=  0.11  SAX= 14.00  TANSM=  0.02  SPLW=  0.00
     2  SDEPTH=     2.28  STMD=  0.11  SAX= 15.00  TANSM=  0.02  SPLW=  0.00
     3  SDEPTH=     1.83  STMD=  0.10  SAX= 15.00  TANSM=  0.01  SPLW=  0.00
     4  SDEPTH=     1.35  STMD=  0.09  SAX= 15.00  TANSM=  0.01  SPLW=  0.00
     5  SDEPTH=     1.54  STMD=  0.08  SAX= 15.00  TANSM=  0.01  SPLW=  0.00
     6  SDEPTH=     0.95  STMD=  0.06  SAX= 15.00  TANSM=  0.00  SPLW=  0.00
     8  SDEPTH=     0.74  STMD=  0.14  SAX= 15.00  TANSM=  0.01  SPLW=  0.0
     9  SDEPTH=     1.58  STMD=  0.18  SAX= 15.00  TANSM=  0.02  SPLW=  0.01
    10  SDEPTH=     2.56  STMD=  0.21  SAX= 15.00  TANSM=  0.04  SPLW=  0.02
    11  SDEPTH=     2.38  STMD=  0.21  SAX= 15.00  TANSM=  0.04  SPLW=  0.02
    12  SDEPTH=     2.00  STMD=  0.21  SAX= 15.00  TANSM=  0.01  SPLW=  0.02
    13  SDEPTH=     1.25  STMD=  0.21  SAX= 15.00  TANSM=  0.0   SPLW=  0.01
    14  SDEPTH=     0.34  STMD=  0.20  SAX= 15.00  TANSM=  0.0   SPLW=  0.00
    30  SDEPTH=     0.50  STMD=  0.10  SAX= 15.00  TANSM=  0.00  SPLW=  0.00
FEBRUARY

   18  AM     293.1   320.5   350.7   371.5   388.8   407.8      427.9   449.1   471.0   495.1   519.8   549.5
```

	PM	590.1	629.5	679.3	728.5	793.9	863.9	923.9	993.5	1068.5	1146.8	1215.3	1261.8	664.2
	MAXIMUM=	1257.3	C.F.S.		TIME	12.00	P.M.							
19	AM	1324.7	1373.6	1427.8	1473.8	1524.5	1590.7	1674.5	1732.4	1787.9	1850.6	1923.3	2002.7	
	PM	2100.1	2196.4	2293.8	2395.6	2503.5	2599.8	2722.7	2844.9	2973.4	3073.8	3221.4	3373.2	2166.0
	MAXIMUM=	3366.1	C.F.S.		TIME	12.00	P.M.							
20	AM	3503.6	3651.1	3741.4	3325.8	3905.1	3980.0	4051.6	4122.5	4194.6	4269.3	4345.7	4422.2	

	PM	4496.3	4564.8	4625.1	4675.1	4713.3	4739.0	4752.2	4753.9	4745.1	4726.6	4758.0	4778.4	4347.5
		MAXIMUM= 4765.9 C.F.S. TIME 7.00 P.M.												
21	AM	4776.6	4786.6	4765.9	4743.7	4708.2	4712.2	4725.1	4733.5	4758.5	4786.8	4812.1	4820.7	
	PM	4803.2	4789.1	4778.9	4774.0	4775.0	4780.6	4791.5	4807.1	4825.4	4843.3	4857.5	4866.4	4784.2
		MAXIMUM= 4882.6 C.F.S. TIME 12.00 P.M.												
22	AM	4868.7	4864.6	4854.9	4840.6	4822.5	4800.8	4774.9	4744.1	4707.3	4663.8	4613.4	4556.6	

	PM	4527.2	4468.3	4398.0	4324.8	4249.7	4172.9	4095.3	4017.3	3938.8	3865.5	3782.8	3699.1	4443.8
		MAXIMUM=	4882.4	C.F.S.	TIME	1.00	A.M.							
23	AM	3614.6	3530.0	3448.7	3365.9	3313.6	3292.5	3274.5	3260.5	3249.6	3190.5	3139.7	3097.7	
	PM	3065.0	3041.8	3027.9	3023.9	3028.8	3039.5	3051.7	3061.9	3068.5	3072.1	3073.5	3073.7	3183.6
		MAXIMUM=	3651.6	C.F.S.	TIME	0.15	A.M.							
24	AM	3073.3	3073.5	3075.5	3080.3	3087.1	3093.3	3095.6	3091.1	3078.5	3057.8	3029.7	2995.7	
	PM	2956.8	2914.2	2868.7	2821.1	2772.1	2722.0	2671.4	2620.8	2570.4	2520.5	2471.3	2422.9	2881.8
		MAXIMUM=	3107.7	C.F.S.	TIME	7.00	A.M.							
25	AM	2375.5	2329.1	2283.8	2239.7	2196.8	2155.0	2114.4	2075.0	2036.8	1999.6	1963.6	1928.7	

	PM	1894.8	1861.9	1830.0	1799.1	1769.1	1739.9	1711.5	1683.9	1657.2	1631.2	1606.0	1581.5	1936.0
		MAXIMUM=	2398.2	C.F.S.	TIME	0.15	A.M.							
26	AM	1557.7	1534.6	1512.1	1490.2	1468.9	1448.2	1428.1	1408.4	1389.4	1370.8	1352.6	1335.0	
	PM	1317.8	1301.0	1284.7	1268.7	1253.2	1237.9	1223.0	1208.5	1194.2	1180.4	1166.8	1153.5	1336.9
		MAXIMUM=	1571.1	C.F.S.	TIME	0.15	A.M.							
27	AM	1140.6	1127.9	1115.5	1103.4	1091.5	1079.9	1068.5	1057.4	1046.4	1035.7	1025.3	1015.0	
	PM	1004.9	995.0	985.3	975.8	966.4	957.2	948.2	939.3	930.5	921.9	913.5	905.2	1014.6
		MAXIMUM=	1149.4	C.F.S.	TIME	0.15	A.M.							

MARCH

13 SDEPTH= 0.10 STMD= 0.14 SAX= 15.00 TANSM= 0.00 SPLW= 0.0

25	AM	74.7	74.2	73.7	73.2	72.7	72.2	71.8	71.3	70.8	132.9	165.8	232.5

	PM	282.9	313.5	353.7	408.0	475.4	552.5	639.7	750.2	855.8	949.9	1034.6	1112.2	371.4

MAXIMUM= 1141.4 C.F.S. TIME 12.00 P.M.

26	AM	1181.9	1246.4	1309.0	1367.7	1425.6	1489.3	1557.3	1626.6	1688.6	1735.8	1767.7	1787.6	
	PM	1800.2	1801.7	1803.5	1778.3	1747.9	1713.6	1676.5	1637.5	1597.2	1556.4	1515.4	1474.5	1595.3

MAXIMUM= 1795.8 C.F.S. TIME 1.15 P.M.

27	AM	1434.0	1394.0	1354.6	1316.0	1278.2	1241.4	1205.5	1170.6	1136.8	1104.1	1072.4	1041.9	

852.6 828.6 805.4 783.0 761.4 740.4 1049.2

1449.3 C.F.S. TIME 0.15 A.M.

5 SDEPTH= 0.08 STMD= 0.15 SAX= 15.00 TANSM= 0.00 SPLW= 0.0

MAY
JUNE
JULY
AUGUST
SEPTEMBER

DEVELOPMENT OF SYNTHESIZED STREAM FLOWS FOR A REPRESENTATIVE YEAR

PALOUSE RIVER NEAR POTLATCH,IDAHO — WATER YEAR 1967-68 — KENTUCKY WATERSHED MODEL

RECORDED FLOWS

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN*	JUL	AUG	SEPT
1	3.5	14.0	16.0	63.0	53.0	438.0	210.0	78.0	56.0	10.0	4.2	4.0
2	3.8	12.0	16.0	52.0	65.0	407.0	210.0	73.0	30.0	10.0	3.9	7.4
3	4.7	11.0	14.0	34.0	183.0	368.0	212.0	72.0	17.0	10.0	3.6	9.1
4	6.6	15.0	14.0	47.0	268.0	345.0	183.0	73.0	28.0	10.0	3.6	3.9
5	15.0	3.1	24.0	46.0	348.0	342.0	188.0	60.0	32.0	10.0	3.8	3.5
6	21.0	1.9	17.0	30.0	272.0	318.0	232.0	63.0	34.0	9.0	3.8	3.3
7	20.0	5.1	30.0	32.0	208.0	282.0	230.0	63.0	33.0	8.0	2.5	4.8
8	11.0	8.8	28.0	32.0	181.0	250.0	230.0	58.0	65.0	7.0	2.5	2.6
9	3.5	9.4	17.0	33.0	137.0	222.0	210.0	44.0	12.0	6.0	3.1	2.6
10	6.0	13.0	18.0	37.0	106.0	185.0	195.0	54.0	32.0	4.0	2.5	3.4
11	12.0	54.0	18.0	46.0	115.0	165.0	185.0	50.0	30.0	5.2	2.0	3.0
12	4.7	59.0	17.0	43.0	92.0	154.0	173.0	53.0	32.0	8.0	2.2	3.0
13	10.0	28.0	15.0	49.0	69.0	158.0	173.0	45.0	33.0	6.3	2.5	3.3
14	27.0	24.0	16.0	42.0	67.0	171.0	158.0	48.0	31.0	14.0	2.6	6.8
15	24.0	32.0	18.0	124.0	77.0	167.0	152.0	47.0	28.0	11.0	2.5	6.6
16	24.0	24.0	13.0	122.0	69.0	158.0	154.0	55.0	27.0	8.8	2.5	11.0
17	15.0	22.0	4.5	102.0	69.0	173.0	141.0	46.0	21.0	8.2	3.0	19.0
18	2.2	29.0	4.7	92.0	302.0	160.0	137.0	34.0	19.0	5.8	3.1	30.0
19	4.7	19.0	7.7	77.0	3440.0	146.0	130.0	38.0	17.0	5.4	5.1	94.0
20	5.4	8.2	10.0	32.0	5440.0	132.0	137.0	39.0	16.0	8.0	5.6	70.0
21	8.5	12.0	10.0	141.0	4130.0	126.0	122.0	54.0	15.0	10.0	3.5	49.0
22	4.7	14.0	14.0	176.0	3470.0	119.0	115.0	66.0	35.0	4.0	8.0	56.0
23	4.9	15.0	122.0	154.0	2420.0	119.0	112.0	57.0	30.0	5.8	5.4	52.0
24	8.0	11.0	184.0	137.0	2200.0	112.0	105.0	38.0	25.0	6.6	10.0	43.0
25	12.0	17.0	765.0	119.0	1340.0	116.0	103.0	57.0	20.0	7.4	6.3	30.0
26	8.0	11.0	366.0	97.0	914.0	193.0	102.0	48.0	16.0	3.8	3.4	26.0
27	8.8	8.8	228.0	65.0	707.0	195.0	108.0	61.0	14.0	3.6	7.3	22.0
28	20.0	6.0	148.0	69.0	569.0	325.0	96.0	54.0	13.0	3.1	8.8	21.0
29	64.0	12.0	110.0	63.0	487.0	305.0	78.0	52.0	12.0	4.0	9.2	13.0
30	32.0	14.0	88.0	67.0		262.0	78.0	44.0	11.0	5.1	19.0	11.0
31	23.0		57.0	59.0		230.0		38.0		4.0	16.0	

SYNTHESIZED FLOWS

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN*	JUL	AUG	SEPT		
1	25.9	35.3	5.3	404.8	48.3	564.1	128.1	6.5	23.5	2.6	0.3	0.1		
2	22.1	28.4	4.5	351.7	84.0	476.2	202.3	5.5	20.0	2.2	0.3	0.1		
3	19.0	23.2	11.5	308.6	257.0	403.2	252.6	4.7	17.1	1.9	0.2	0.0		
4	16.2	19.6	38.4	272.5	472.9	341.8	194.3	4.0	14.5	1.6	0.2	0.0		
5	13.7	16.6	65.4	242.7	455.3	290.3	165.9	3.4	12.3	1.3	0.2	0.0		
6	11.7	14.1	75.5	217.4	326.7	246.6	199.2	2.9	10.7	1.1	0.1	0.0		
7	9.9	12.1	65.5	195.9	248.5	209.5	188.7	2.5	15.2	1.0	0.1	0.0		
8	8.4	10.3	57.4	176.7	201.0	178.0	161.7	2.1	16.5	0.8	0.1	0.0		
9	7.2	10.0	52.1	158.2	168.1	151.2	138.0	1.8	14.0	0.7	0.1	0.0		
10	6.1	27.3	58.3	143.9	143.0	128.5	116.9	1.5	11.9	0.6	0.1	0.0		
11	5.7	63.9	71.0	132.5	122.4	109.1	98.4	1.3	11.5	0.5	0.1	0.0		
12	4.9	68.2	64.2	123.2	105.5	92.7	83.3	1.1	11.7	3.7	0.1	0.0		
13	4.2	61.1	55.7	136.6	90.7	230.0	71.2	0.9	9.9	4.2	0.0	0.0		
14	3.6	61.0	48.8	214.1	77.9	316.7	60.6	0.8	8.4	3.5	0.0	1.8		
15	3.1	73.4	43.0	401.8	67.0	469.3	51.5	0.7	7.2	3.0	0.2	3.5		
16	2.6	64.5	37.8	450.3	57.7	417.7	43.7	0.6	6.1	2.6	0.2	4.1		
17	2.2	53.3	34.0	389.8	89.7	204.3	37.1	0.5	5.2	2.2	0.2	4.0		
18	1.9	44.2	31.2	324.5	664.2	231.5	31.6	0.4	4.4	1.8	0.2	41.3		
19	1.7	37.1	23.9	272.2	2166.0	186.2	38.2	0.3	3.7	1.6	0.1	82.4		
20	1.5	31.5	27.5	252.1	4347.5	155.3	43.0	16.7	3.2	1.6	0.1	74.5		
21	1.3	26.7	26.7	252.5	4784.2	131.7	35.7	54.4	2.7	1.9	0.1	76.5		
22	1.4	22.7	46.7	231.7	4443.8	112.1	29.1	68.5	9.6	1.6	0.1	95.1		
23	2.3	19.3	265.3	198.4	3183.6	95.4	24.1	56.1	9.0	1.4	0.1	93.2		
24	1.9	16.4	396.0	168.8	2881.8	81.3	20.4	44.8	7.6	1.1	0.1	78.3		
25	1.6	13.9	1043.2	143.2	1936.0	371.4	17.4	55.3	6.5	1.0	0.1	65.5		
26	1.4	11.9	2072.2	121.8	1336.9	1595.3	14.8	62.6	5.5	0.8	0.1	54.6		
27	2.0	10.1	1412.6	103.6	1014.6	1049.2	12.5	53.2	4.7	0.7	0.1	46.1		
28	65.3	8.5	947.3	88.2	814.2	543.3	10.6	45.2	4.0	0.6	0.1	39.2		
29	94.8	7.3	718.8	75.1	672.8	318.9	9.0	38.4	3.5	0.5	0.1	33.3		
30	64.6	6.3	571.8	64.1		215.0	7.7	32.6	3.0	0.4	0.1	28.3		
31	45.0		474.0	55.4		160.8		27.7		0.4	0.1			
SYNTHETIC	455.0	898.0	3850.9	6672.5	31261.3	10176.6	2487.6	596.8	283.0	48.9	3.9	822.0	62556.6	SFD
TOTAL	0.053	0.105	1.038	0.783	3.668	1.194	0.292	0.070	0.033	0.006	0.000	0.096	7.339	INCHES
OVERLAND	0.0	0.000	0.001	0.001	0.009	0.008	0.001	0.0	0.0	0.000	0.000	0.0	0.019	INCHES
INTERFLOW	0.012	0.008	0.407	0.025	1.746	0.428	0.026	0.003	0.000	0.000	0.000	0.010	2.665	INCHES
BASE	0.042	0.097	0.631	0.757	1.913	0.758	0.265	0.067	0.033	0.006	0.000	0.086	4.655	INCHES
STRM EVAP	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	INCHES
RECORDED	418.0	513.3	2409.9	2332.0	27798.0	6843.0	4659.0	1662.0	784.0	222.1	161.5	614.3	48417.1	SFD
													5.68	INCHES
PRECIP	2.43	1.49	4.49	1.45	5.82	1.33	0.70	1.45	1.55	0.93	1.11	3.74	26.50	INCHES
RAIN+MELT	2.45	1.45	4.22	1.15	5.82	1.34	0.72	1.45	1.56	0.93	1.11	3.74	25.95	INCHES
SUBSNOWEVAP	0.0	0.045	0.410	0.535	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.990	INCHES
INTSNOWLOSS	0.002	0.002	0.028	0.022	0.0	0.002	0.002	0.0	0.001	0.0	0.0	0.0	0.059	INCHES
EVP/TRAN-NET	2.031	1.028	0.181	0.161	0.190	0.273	0.959	2.882	3.153	3.246	2.486	2.196	18.787	INCHES
-POTENTIAL	2.340	1.028	0.181	0.161	0.190	0.273	0.970	3.245	3.776	6.526	6.063	4.502	29.255	INCHES
STORAGES-UZS	0.421	0.180	0.332	0.320	0.343	0.363	0.0	0.0	0.0	0.0	0.0	0.023		INCHES
LZS	3.940	4.523	7.021	7.555	9.104	9.301	9.222	7.707	6.096	3.777	2.397	3.807		INCHES
IFS	0.000	0.0	0.001	0.0	0.001	0.001	0.0	0.0	0.0	0.0	0.0	0.0		INCHES
GWS	0.025	0.004	0.304	0.037	0.434	0.093	0.005	0.018	0.002	0.000	0.000	0.019		INCHES
INDICES- UZC	0.594	0.306	0.250	0.250	0.250	0.250	0.250	0.610	0.771	1.399	1.535	0.896		
BFNX	0.049	0.063	0.749	0.578	1.870	1.021	0.491	0.251	0.111	0.045	0.018	0.082		
SIAM	0.963	0.798	0.592	0.490	0.476	0.491	0.692	0.962	1.058	1.227	1.247	1.153		

BALANCE -0.0026 INCHES

CHECK ON SNOW 3.0180 2.9591

DAILY FLOW DURATION AND ERROR TABLE

FLOW INTERVAL	CASES	AV.ERROR	AVR. ABS. ERROR	STANDARD ERROR
0.0-	0.0			
1.0-	0.0			
1.6-	13.0	-1.1	2.97	4.05
2.7-	30.0	-0.9	4.78	6.68
4.5-	29.0	-0.2	6.39	9.25
7.4-	46.0	-1.8	8.32	9.62
12.2-	40.0	8.4	19.17	22.87
20.1-	38.0	20.1	37.78	53.38
33.1-	34.0	32.2	65.74	96.75
54.6-	37.0	27.4	71.83	131.12
90.0-	35.0	60.5	127.15	203.67
148.4-	36.0	100.5	172.95	342.52
244.7-	14.0	170.4	215.75	460.94
403.4-	4.0	156.6	156.57	75.87
665.1-	3.0	336.2	336.23	76.48
1096.6-	1.0	596.0	596.01	
1808.0-	2.0	722.7	722.70	57.84
2981.0-	3.0	118.0	967.34	1216.04
4914.8-	1.0	-1092.5	1092.48	
8103.1-	0.0			
13359.7-	0.0			
22026.5-	0.0			
	366.0	38.6	79.82	2767.08

CORRELATION COEFFICIENT (DAILY) 0.9184

TWENTY HIGHEST CLOCKHOUR RAINFALL EVENTS IN THE WATER YEAR

0.450 0.300 0.300 0.250 0.250 0.245 0.233 0.220 0.216 0.213 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.180

TWENTY HIGHEST CLOCKHOUR OVERLAND FLOW RUNOFF EV ENTS IN THE WATER YEAR

0.008 0.001 0.001 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000

DAILY SCIL MOISTURE OUTPUT

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN*	JUL	AUG	SEPT
1	4.0	3.9	4.5	7.0	7.6	9.1	9.3	9.1	7.6	6.0	3.7	2.4
2	4.0	3.9	4.5	7.0	7.6	9.1	9.3	9.0	7.6	5.9	3.6	2.3
3	4.0	3.9	4.6	7.1	7.7	9.1	9.3	8.9	7.5	5.8	3.6	2.3
4	4.0	3.9	4.7	7.1	7.8	9.1	9.3	8.8	7.4	5.7	3.5	2.2
5	3.9	3.9	4.8	7.1	7.8	9.1	9.4	8.7	7.4	5.6	3.4	2.2
6	3.9	3.9	4.9	7.1	7.8	9.1	9.4	8.6	7.3	5.5	3.4	2.1
7	3.8	3.9	4.9	7.1	7.8	9.1	9.4	8.5	7.3	5.4	3.3	2.1
8	3.7	3.9	4.9	7.1	7.8	9.1	9.4	8.5	7.3	5.3	3.3	2.1
9	3.7	4.0	4.9	7.1	7.8	9.1	9.4	8.4	7.3	5.2	3.2	2.0
10	3.6	4.2	5.0	7.1	7.8	9.1	9.4	8.3	7.3	5.1	3.1	2.0
11	3.6	4.2	5.0	7.1	7.8	9.1	9.4	8.2	7.3	5.0	3.1	2.0
12	3.6	4.3	5.1	7.1	7.8	9.1	9.4	8.1	7.3	5.0	3.0	1.9
13	3.6	4.4	5.1	7.2	7.8	9.1	9.4	8.1	7.3	5.0	3.0	1.9
14	3.6	4.5	5.1	7.3	7.8	9.2	9.4	8.1	7.2	5.0	3.0	2.0
15	3.6	4.5	5.1	7.5	7.8	9.2	9.4	8.1	7.1	4.9	3.0	2.0
16	3.6	4.5	5.1	7.5	7.8	9.2	9.4	8.0	7.0	4.8	3.0	2.0
17	3.5	4.5	5.1	7.5	7.9	9.2	9.4	7.9	6.9	4.7	2.9	2.1
18	3.5	4.5	5.1	7.5	8.2	9.2	9.4	7.8	6.8	4.6	2.9	3.0
19	3.5	4.5	5.1	7.5	8.6	9.2	9.4	7.7	6.7	4.6	2.8	3.1
20	3.4	4.5	5.1	7.5	8.7	9.2	9.4	7.7	6.6	4.6	2.8	3.3
21	3.4	4.5	5.1	7.5	9.0	9.2	9.4	7.8	6.5	4.5	2.8	3.5
22	3.5	4.5	5.3	7.6	9.0	9.2	9.4	7.8	6.5	4.5	2.7	3.7
23	3.5	4.5	5.6	7.6	9.1	9.2	9.4	7.8	6.5	4.4	2.7	3.8
24	3.5	4.5	5.8	7.6	9.1	9.2	9.4	7.8	6.5	4.3	2.7	3.8
25	3.5	4.5	6.7	7.6	9.1	9.3	9.4	7.8	6.4	4.2	2.6	3.8
26	3.5	4.5	6.8	7.6	9.1	9.3	9.4	7.8	6.3	4.1	2.6	3.8
27	3.5	4.5	6.9	7.6	9.1	9.3	9.3	7.8	6.2	4.1	2.5	3.8
28	3.9	4.5	7.0	7.6	9.1	9.3	9.3	7.8	6.2	4.0	2.5	3.8
29	3.9	4.5	7.0	7.6	9.1	9.3	9.2	7.8	6.2	3.9	2.5	3.8
30	3.9	4.5	7.0	7.6		9.3	9.2	7.8	6.1	3.8	2.4	3.8
31	3.9		7.0	7.6		9.3		7.7		3.8	2.4	