COMPUTER-PROGRAM DOCUMENTATION OF AN INTERACTIVE-ACCOUNTING MODEL TO SIMULATE STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPERATIONS IN A RIVER BASIN

By Alan W. Burns

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 88-4012

Prepared in cooperation with the

SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT

Denver, Colorado
1988

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COMPUTER-PROGRAM DOCUMENTATION OF AN INTERACTIVE-ACCOUNTING MODEL TO SIMULATE STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPERATIONS IN A RIVER BASIN

By Alan W. Burns

ABSTRACT

This report describes an interactive-accounting model used to simulate streamflow, water quality, and water-supply operations in a river basin. The model uses regression equations to compute flow from incremental (internode) drainage areas by using a time series of independent variables, such as snowpack, precipitation, or gaged flow. Water-quality concentrations and loads (typically dissolved solids) then are computed from regression equations by using streamflow as the independent variable. Streamflow and water-quality loads then are routed downstream--that is, they are accumulated downstream because there is no hydraulic routing in the model with the monthly time step.

The model is designed to operate interactively so that queries can be made during simulation, allowing considerable flexibility in output. Although most data are entered from pre-existing files, the data can be modified interactively to produce new management alternatives for simulation. Because of the interactive capability of the model, a major feature of the model is its color-graphic-output options.

The model also can simulate the water-supply operations and the simplified ground-water systems of a basin. Types of water users that can be simulated include agricultural, municipal, industrial, and in-stream users, and reservoir operators. Each water user has a list of potential sources, including direct diversions, ground-water pumpage, imports, or reservoir releases; this list is entered in the order that the sources will be used to meet demand. All direct diversions are controlled to conform to the basin-wide, prior-appropriation, water-law priorities.

Documentation of the model includes a brief description of the model, simple organizational charts of the subroutines, and examples of the output graphics and tables. Detailed format instructions of the input data, examples of input data, definitions of program variables, and listings of the FORTRAN source code are provided as attachments at the back of the report.

INTRODUCTION

Most of the irrigated river basins in the semiarid western United States have similar hydrologic regimes. Snowmelt from adjacent mountains or uplands is the major source of flow in a river, which functions as a conduit to transmit water to lower elevations for irrigation and other uses. Because of the general scarcity of water, a set of water laws (based on the doctrine of prior appropriation) developed in the western United States that is distinct from the riparian system in the rest of the country. The prior-appropriation laws allocate and prioritize water to those users who first used the water. As development increased, the natural streamflow regime of these western river basins was transformed by return flows from irrigation, ground-water pumpage, storage in natural lakes and constructed reservoirs, and imports of water from other basins. The multiple reuse of the water as it is diverted, applied, returned, and rediverted, frequently concentrates the dissolved-solids contents of the water, leading to water-quality concerns and issues.

Historically, agricultural irrigation was the dominant use of water in these western rivers, and State agencies had responsibility for water administration to ensure that legal allocations of water were met. However, the ever-increasing population and accompanying need of water for commercial, industrial, and energy-related development is putting new stresses on the surface- and ground-water systems. As the demand for water increases for agricultural use and for other competing uses, planning and management are necessary for more resourceful use of water. While the need for planning and management has increased with time, the technology to improve planning and management also has increased. One of the most useful technological improvements has been the development of digital-computer models to simulate river-basin systems.

Several different models are available to simulate the hydrologic regime of such basins. The U.S. Army Corps of Engineers, Hydrologic Engineering Center, has developed a suite of models, including HEC III, HEC IV, and HEC V (U.S. Army Corps of Engineers, 1980) that are capable of simulating the quantity of flow in river basins. Another model developed by the U.S. Army Corps of Engineers, SSARR (U.S. Army Engineer Division, 1972), also has an interactive version, COSSAR. The U.S. Bureau of Reclamation also has developed river-basin simulation models such as HYDROSS (U.S. Bureau of Reclamation, 1978) and NW01 (Ribbens, 1975), which has the capability to simulate salinity (dissolved solids) in streams. Other available models include SIMYLD (Texas Water Development Board, 1972) and an interactive modification of that model, MODSIM (Shafer, 1979). All these models emphasize reservoir operations and many have varying degrees of optimization included, but none include the prior-appropriation allocation system explicitly, although some allow a priority for demands. A privately owned and operated model of the Colorado River basin in Colorado (Fleming, 1975) simulates the appropriation priorities to allocate water. None of these models attempt to simulate the ground-water/surface-water interactions explicitly. Taylor and Luckey (1972, 1974) developed a stream-aquifer model that used ground-water response functions to incorporate the time-delayed effects of ground-water pumpage and deep-percolation recharge of applied irrigation water on streamflow. Their model also used the prior-appropriation system established by Colorado water law to allocate the water of the Arkansas River basin in a

reach from Pueblo to the Colorado-Kansas State line. Many other stream-aquifer models are available that range from various types of response functions to standard ground-water-flow solutions. Most of these models are limited by the extent of the study areas, because of excessive computer resources needed for large basins.

A study was conducted by the U.S. Geological Survey, in cooperation with the Southeastern Colorado Water Conservancy District, to develop a model of the Arkansas River basin in Colorado. The model was to simulate the water quantity and quality of the Arkansas River, whose flow regime in the eastern one-half of the State is dominated by irrigation diversions and return flows. The irrigation diversions are determined by the prior-appropriation allocation system; and return flows, which greatly affect streamflow, result from the ground-water interactions of pumpage and excess irrigation applications. Thus, these functions had to be included in the model. A desired feature of the model was an interactive capability to facilitate use of the model by local water managers. The model described in this report was developed as part of this study.

The purpose of this report is to document the computer model. This documentation includes a description of the model capabilities and example inputs and outputs. Considerable information is included for potential model users, which are listed as Attachments at the back of the report. This information includes:

Attachment 1--Data instructions for streamflow and water-quality simulation.

Attachment 2--Example files of input data for streamflow and water-quality simulation.

Attachment 3--Data instructions for water-supply operations simulation.

Attachment 4--Example files of input data for water-supply operations simulation.

Attachment 5--Definition of commoned variables in subroutines for streamflow and water-quality simulation.

Attachment 6--Definition of commoned variables in subroutines for water-supply operations simulation.

Attachment 7--FORTRAN source code of subroutines for streamflow and water-quality simulation.

Attachment 8--FORTRAN source code of subroutines for water-supply operations simulation.

The computer code was designed for generic use--that is, for use in any river basin. Therefore the description of a river basin, its hydrology, and water use is entered completely through the input data. Because of the enormity and complexity of the Arkansas River basin, the basin described in this report is a hypothetical simplification for purposes of illustration.

DESCRIPTION OF THE MODEL FOR SIMULATING STREAMFLOW, WATER QUALITY, AND WATER-SUPPLY OPERATIONS

Streamflow and its accompanying water-quality load (typically dissolved solids) are routed (accumulated) using a monthly time step. No hydraulic-flow routing is included in the model. The river basin is depicted in the model as a network of nodes. The network of nodes and sets of regression equations needed to compute streamflow and water-quality concentration are stored in a file known as the basin-description file. This file provides the spatial discretization and variability of the hydrology of the basin. The information in this file can be modified interactively during a simulation to produce results for different management alternatives. A second file, which is needed prior to simulation, is the time series of a set of independent variables used by the regression equations.

The simulation of water-supply operations and ground-water systems require additional description of the natural hydrologic system, such as evapotranspiration rates and initial ground-water storage and quality, which are stored in another data file. A file also is needed that lists the water users and their demand characteristics and supply sources. Although this file needs to be available prior to simulation, the information in the file also can be modified interactively during a modeling session to produce results for various management alternatives. If the supply sources include direct diversions, then a separate file, listing the ordered priorities of the allocation laws, needs to be available.

One of the major reasons a new model was developed for this project, rather than applying an existing model, was the desire to obtain results interactively on a computer-terminal screen. Graphical output was a feasible technique to summarize and collate the many values computed by such a simulation model. Two types of illustrations are available interactively during a simulation: (1) Schematic maps that depict areal information for fixed time periods; and (2) graphs that depict time information for fixed points. Also, time-series graphs and frequency curves can be drawn to compare results of the current simulation to results stored in other files from previous simulations. Such graphical output and other limited tables and summary statistics displayed interactively provide users with information that would be difficult to obtain by evaluation of large quantities of printed computer output. Many of the illustrations in this report are examples of these outputs; commonly, these illustrations would be displayed on the computer-terminal screen.

The model is written in FORTRAN, and every attempt is made to keep it generic for use on any computer or compiler. During different stages of development, the model was run on CYBER[1], AMDAHL, Honeywell Multics, and PRIME computers. Minor modifications were necessary between computers to retrieve dates from the different computers and to handle a few character-string manipulations. The code presented in this report was used on a PRIME 9955 with the F77 compiler. All graphics use ISSCO DISSPLA. An initial version of

---

[1]Use of brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

the model was developed primarily to format data for initial development of the graphics options. That version had no capability to accumulate streamflow downstream and, thus, had little hydrologic-simulation capability. The part of the model used to simulate streamflow can be used alone without the water-use and ground-water capabilities. Simple water-use systems can be included with the hydrologic-basin description by incorporating their effects in the regression equations. An evaluation of effects of coal mines on dissolved solids (Parker and Norris, 1983) was accomplished using this model without the water-use and ground-water systems.

Algorithms for Streamflow and Water-Quality Simulation

All of the hydrologic relations in the basin described by the model use regression equations. The incremental streamflow ($\hat{Q}$) of each node in a basin (fig. 1) is determined by an algebraic equation with some independent variable. Three types of equations are available in the model to compute $\hat{Q}$ on the basis of a code for the independent variable:

$$\hat{Q}_i = a + bX, \quad (1)$$
$$\hat{Q}_i = aX^b, \text{ and} \quad (2)$$
$$\hat{Q}_i = a + bQ_u, \quad (3)$$

where $\hat{Q}_i$ is the incremental (or internode) streamflow at node i,
a is the intercept-regression coefficient,
b is the slope-regression coefficient,
X is the independent variable, and
Q_u is the streamflow at the upstream node.

For sites where measured data are to be used directly in the model, the X values would be the measured streamflow, and the regression coefficients would be chosen as 1 and 0. For sites where there is no measured data, or the length of record is insufficient, the X values could be snowpack or precipitation or measured streamflow at some other site. The regression coefficients need to be determined by statistical methods separate from the model; however, they can be adjusted during the calibration process.

The resultant incremental streamflow could represent gains in flow due to tributary inflow, overland runoff, or irrigation return flow, or the resultant incremental streamflow could represent losses in flow due to diversions, bank storage, or evapotranspiration. For each month of the year, different types of equations, independent variables, and regression coefficients can be used.

The water-quality concentration ($\hat{C}$) of each incremental streamflow also is determined by using regression equations, with the computed streamflow as the independent variable:

$$\hat{C}_i = c\hat{Q}_i^{\,d}, \quad (4)$$

where $\hat{C}_i$ is the concentration of the incremental streamflow ($\hat{Q}_i$) at node i,
c is the intercept-regression coefficient, and
d is the slope-regression coefficient.

As with the computation for streamflow, different regression coefficients for each month of the year can be used.

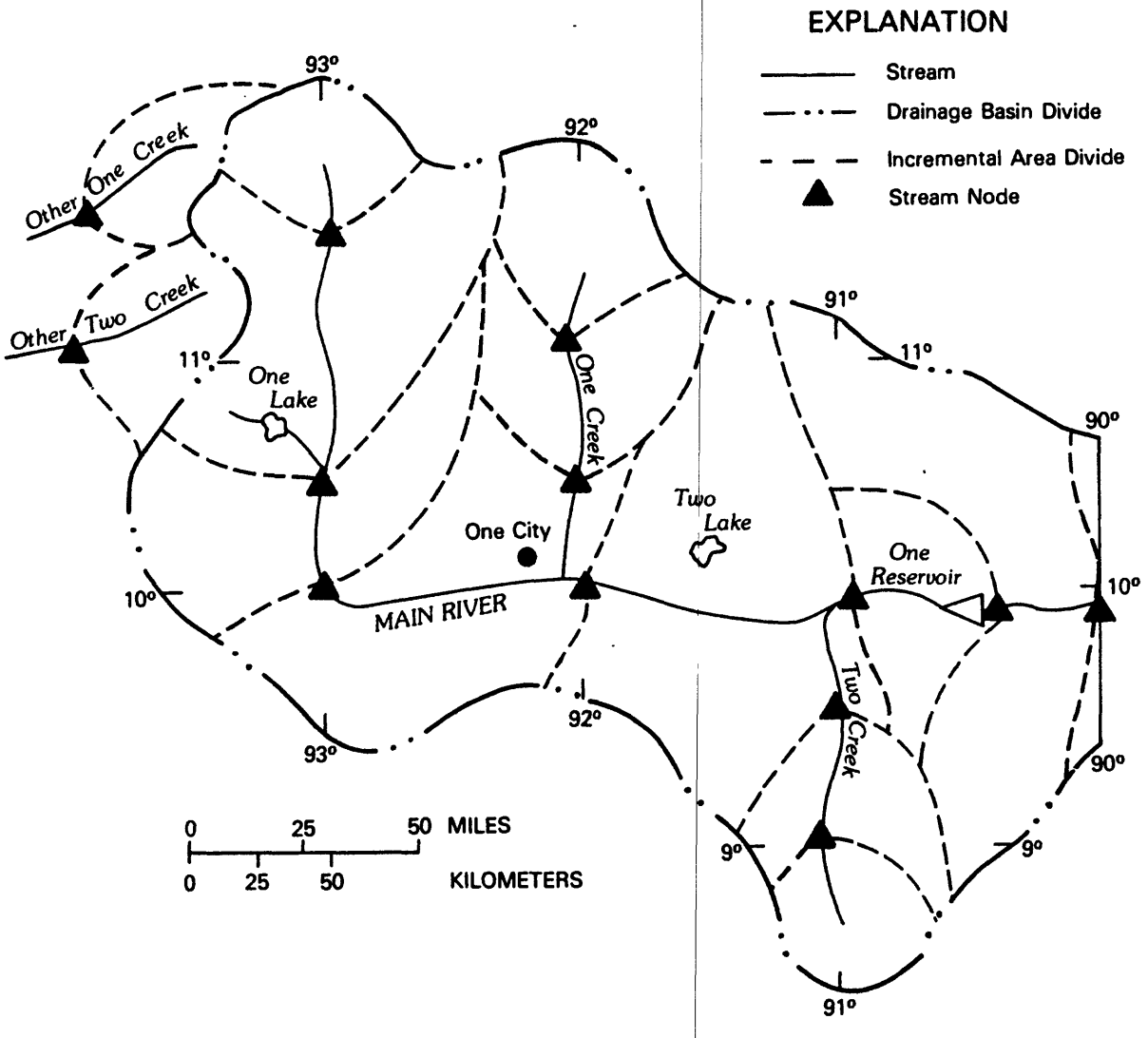

Figure 1.--Sample basin with nodes and incremental areas.

The most commonly available water-quality data is specific conductance; thus, the $\hat{C}_i$ in equation 4 commonly would be specific conductance (SC_i). To compute water-quality concentrations ($\hat{C}_i$) from specific conductance (SC), another equation is used in the model:

$$\hat{C}_i = e + f\ SC_i, \tag{5}$$

where SC_i is the specific conductance of the incremental streamflow (Q_i) at node i,
e is the intercept-regression coefficient, and
f is the slope-regression coefficient.

This equation is used to convert specific-conductance values computed using equation 4 to dissolved-solids concentrations (or any other desired conservative constituent).

Total streamflow (Q) is computed as the sum of the streamflow of all immediately upstream nodes and the incremental streamflow:

$$Q_i = \hat{Q}_i + \sum_{u=1}^{N} Q_u\ , \tag{6}$$

where Q_i is the streamflow at node i,
Q_u is the streamflow at adjacent nodes immediately upstream from node i, and
N is the number of adjacent nodes immediately upstream of node i.

The downstream water-quality concentration (C) is computed by dividing the sum of the loads (QC) reaching a node by the streamflow:

$$C_i = \frac{[\hat{Q}_i\ \hat{C}_i + \sum_{u=1}^{N} Q_u\ C_u]}{Q_i}, \tag{7}$$

where C_i is the concentration at node i, and
C_u is the concentration at adjacent nodes immediately upstream of node i.

When the incremental streamflow is negative, a factor is specified to determine the concentration at the downstream node. This factor is determined during calibration; it adjusts the concentration to account for the quantity of the water-quality load that is lost when streamflow is lost. The two extreme possibilities are: (1) The loss of streamflow is the result of a diversion and, thus, downstream concentration remains equal to the upstream concentration; or (2) the loss of streamflow is the result of evapotranspiration with no loss of water-quality load and, thus, the entire upstream load becomes concentrated downstream. The factor allows a range between these extremes, equaling 0 for possibility 1 and equaling 1 for possibility 2.

An option in the model enables the computation of the total streamflow (Q) at any node directly rather than routing streamflow to a node. With the proper code for the independent variable, equations 1, 2, or 3 can be used to compute Q_i rather than $\tilde{Q}_i$. For this condition, equations 4 and 5 are used to compute C_i rather than $\tilde{C}_i$. This option is useful for entering measured data into the model format for plotting and for later comparisons during calibration.

Model Components For Streamflow and Water-Quality Simulation

A chart depicting the organization of the subroutines that constitute the FORTRAN program to simulate the streamflow of a basin without including the water-supply operations or ground-water systems is shown in figure 2. Each of the subroutines is described briefly in the following text. A complete listing of the FORTRAN source code is listed in Attachment 7.

Subroutine INSTRK merely displays, at the terminal, a complete set of instructions of the required input data, similar to those listed in Attachment 1.

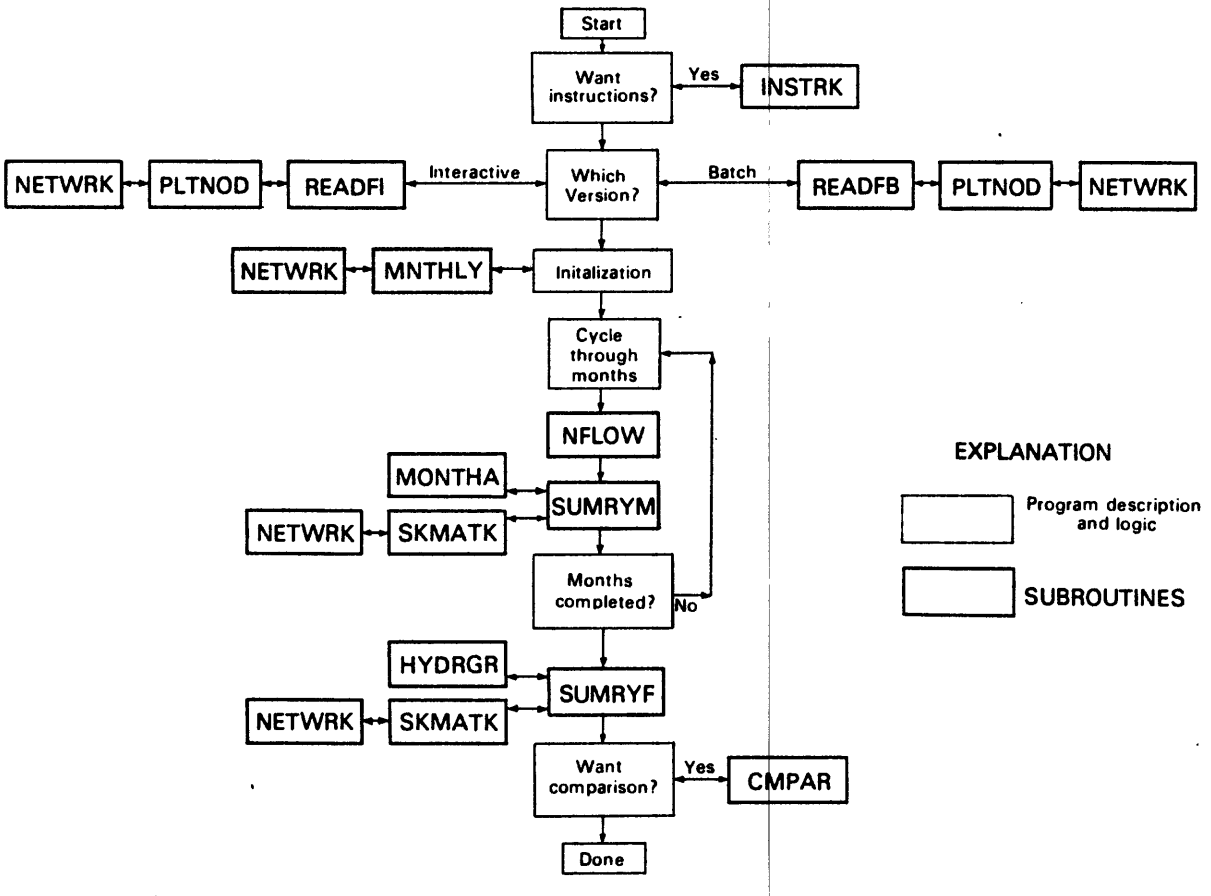

Figure 2.--Organizational chart of the subroutines used for streamflow and water-quality simulation.

Either subroutine READFI or READFB is used to read the basin-description file into the computer from logical unit 60. READFI is called when the model is operated interactively with certain information being supplied during the modeling session. READFB is called when the model is not used interactively and requires an additional data file (logical unit 64) that provides the needed information. The format of the basin-description file used by READFI or READFB is described in detail in Attachment 1, and an example of such a file is shown in Attachment 2. For each node, the data include: (1) An identification number, (2) name, (3) location, (4) concentrating factor, (5) downstream-node identifier, and (6) slope- and intercept-regression coefficients for the relation of specific conductance to dissolved-solids concentration (eq. 5). For each node, there also is a set of monthly parameters including: (1) A code to determine which variable to use from the file of independent variables and what kind of relation (either eq. 1, 2, or 3) to use to compute the streamflow; (2) slope- and intercept-regression coefficients for streamflow (eq. 1, 2, or 3); and (3) slope- and intercept-regression coefficients for the water-quality concentration for any conservative constituent (eq. 4). READFI issues prompts for modifying data if any of the data read from the basin-description file are to be temporarily modified before the simulation is begun. Both READFI and READFB have the option of drawing a schematic node location (fig. 3), which is drawn by subroutine PLTNOD. From PLTNOD, subroutine NETWRK is entered to draw the drainage pattern of streams. The network of x-y points that comprise the drainage pattern is read from a separate file using logical unit 62. The format for this digitized network of data is described in detail in Attachment 1, and an example of such a file is shown in Attachment 2.

Some accounting type variables are initialized in the mainline of the program. If a schematic of streamflow in the basin is to be updated monthly, then subroutine MNTHLY is called to draw the initial part of the schematic. From MNTHLY, subroutine NETWRK is called to draw the drainage pattern before hydrograph grids are drawn on the schematic within MNTHLY.

A loop in the mainline controls the monthly simulation. The major operative subroutine, NFLOW, is called in that loop. In NFLOW, the code for the independent variable for each node is deciphered to determine the type of relation and independent variable to be used to compute streamflow (eq. 1, 2, or 3). All the independent variables for that particular month are read from the independent-variable file (logical unit 61). The format of the independent-variable data is described in detail in Attachment 1, and an example of such a file is shown in Attachment 2. Either the incremental streamflow or the total streamflow (depending on the type of relation chosen) is computed from the regression equation. Then the appropriate water-quality concentration is computed using the streamflow as the independent variable (eq. 4) and adjusting the concentration using a linear equation (eq. 5). The total streamflow at a node then is computed (eq. 6) as the sum of all streamflow from nodes immediately upstream added to the incremental streamflow. The water-quality load is routed similarly (eq. 7), by multiplying the streamflow of the upstream nodes by their respective water-quality concentrations and summing the loads to determine the load at the downstream node. For the special case when the incremental streamflow is negative (a losing reach), the routing of the water quality is computed by using a factor that would compute the water-quality concentration somewhere between the upstream concentration and the concentration that would occur if the total load were routed downstream.

In the same monthly loop, subroutine SUMRYM is called. This routine updates all the summary statistics; stores the information for desired plots, tables, and statistics; and calls subroutine MONTHA, if the streamflow schematic is to be updated monthly. If a schematic of annual average streamflow is desired, subroutine SKMATK is called to generate that plot after simulating each December. The schematic of annual average streamflow (fig. 4) indicates the quantity of flow by the size of the symbol and prints the average flow for the particular year next to the symbol. The class interval of the water-quality concentration (normally dissolved solids) is indicated by the shape and color of the symbol. The monthly option for the streamflow schematic (fig. 5) is somewhat different from the schematic of annual average streamflow. Hydrographs are superimposed on the drainage pattern and are updated each month of the simulation, providing a movie-like effect of watching the symbols being plotted and erased and the hydrographs being drawn almost continuously while the model simulates each month of the given time period.

When the monthly loop for the period of record has been completed, subroutine SUMRYF is called. This subroutine generates summary schematics, hydrographs, and tables. If a schematic for average streamflow for the period of record (similar to fig. 4) is desired, then subroutine SKMATK is called from SUMRYF. If hydrographs are desired, then subroutine HYDRGR is called from SUMRYF to draw hydrographs of streamflow (fig. 6), water-quality concentration, and load. Generated within SUMRYF are tables of monthly streamflow (fig. 7), water-quality concentration, and load, and also a streamflow statistical summary (fig. 8).

At the completion of a simulation, a final subroutine is available that will plot and compare the streamflow, water-quality concentration, or load at any node, with the same parameter from some previous simulation. This comparison is done in subroutine CMPAR, which reads the output file created during this same simulation (logical unit 63) and some designated output from a previous simulation (logical unit 64). Three plots are generated for each comparison: (1) A histogram of both time series (fig. 9), (2) two frequency curves on the same plot (fig. 10), and (3) a histogram of the time series of the residual (or difference) between the two simulated results (fig. 11). The mean and standard deviations of the difference between the two simulated results are displayed.

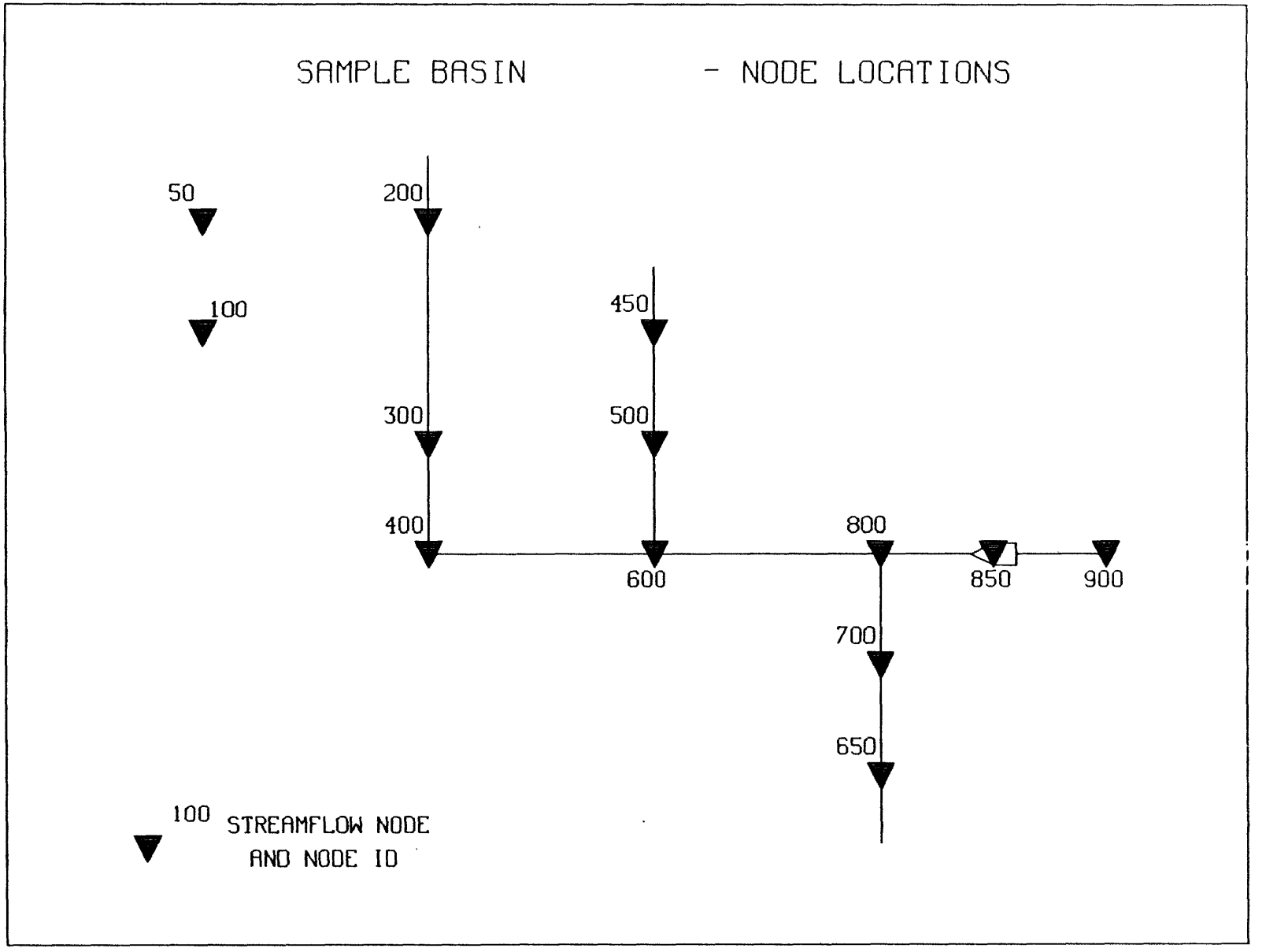

Figure 3. -- Example of a schematic for node location in the sample basin as viewed on a computer terminal.

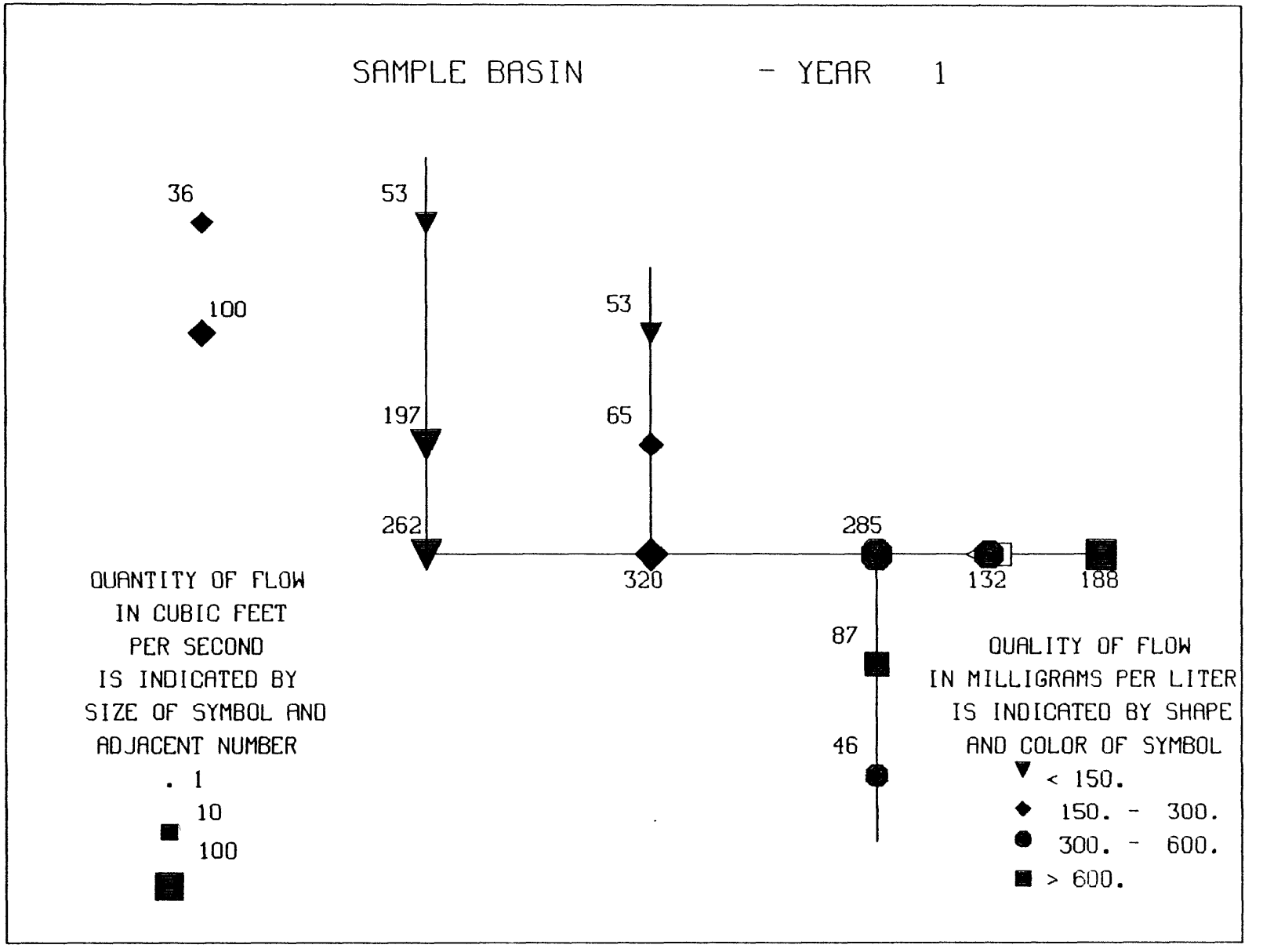

Figure 4. -- Example of a schematic for annual average streamflow in the sample basin as viewed on a computer terminal.

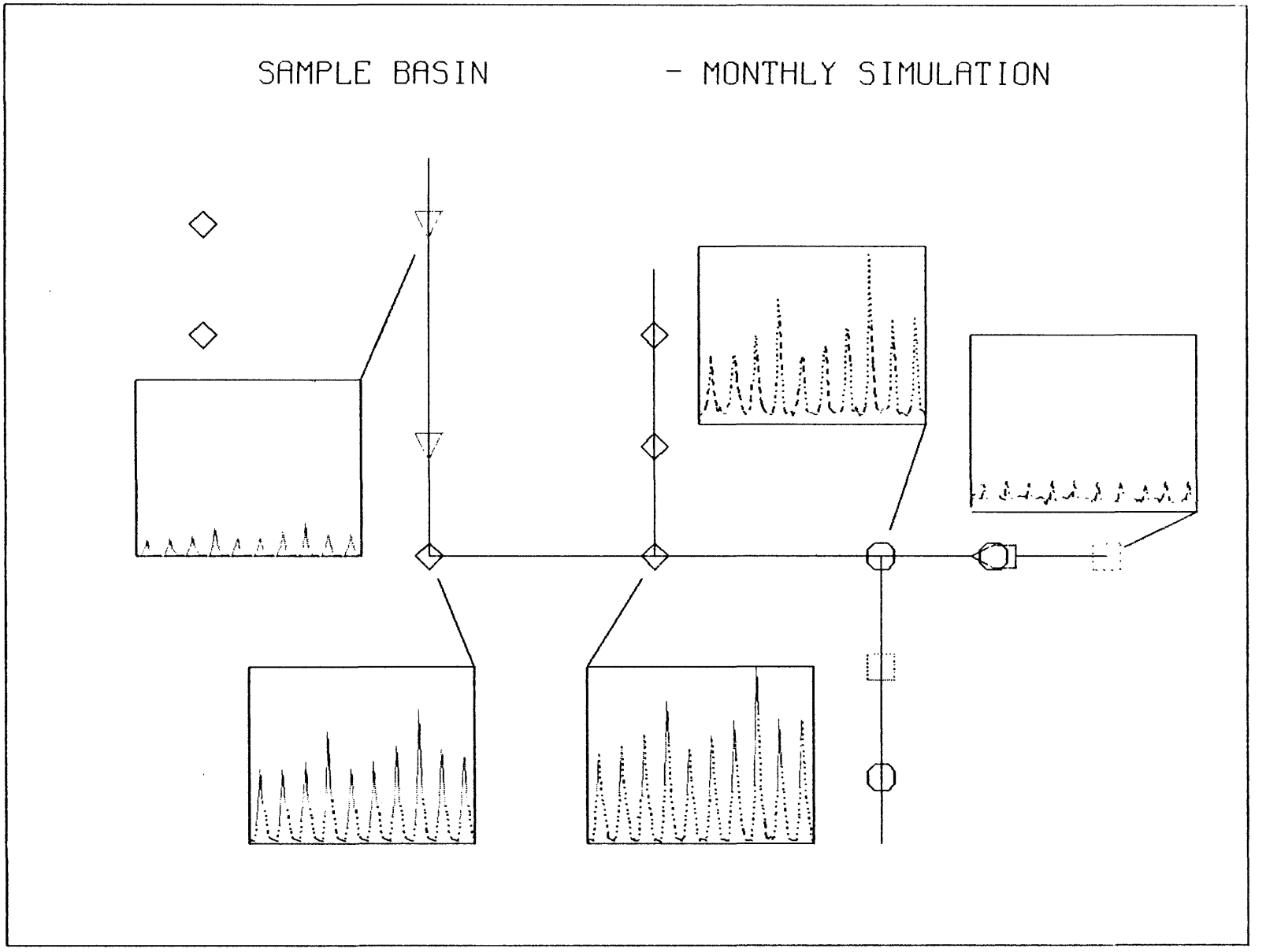

Figure 5. -- An example of a monthly streamflow schematic for the sample basin as viewed on a computer terminal.

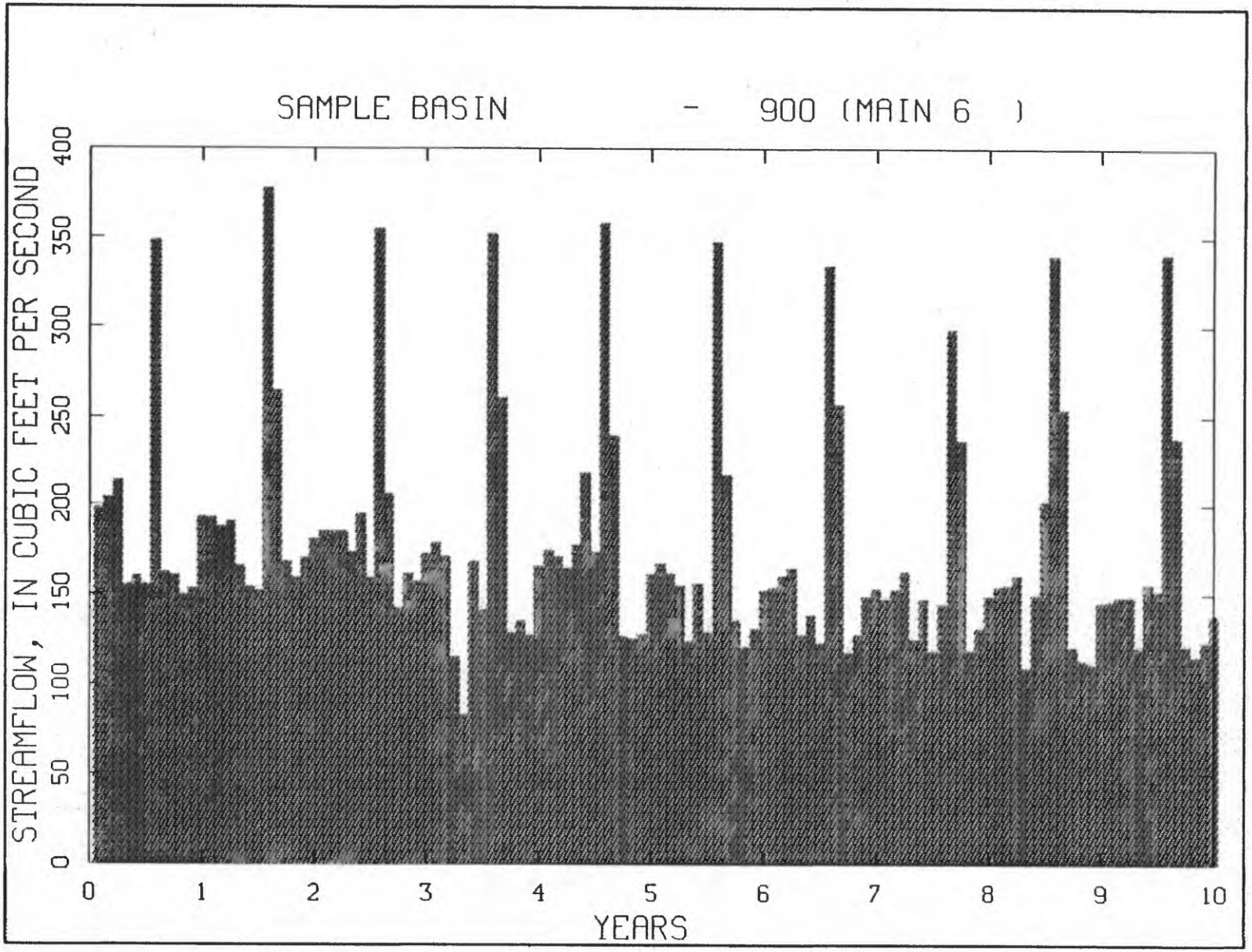

Figure 6. -- Example of a hydrograph of streamflow for a node in the sample basin as viewed on a computer terminal.

MONTHLY FLOWS, IN CUBIC FEET PER SECOND, AT NODE 900 (MAIN 6)

MONTH YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1	182	188	197	155	176	155	351	163	161	149	153	160
2	176	172	174	166	161	151	378	250	168	159	171	148
3	168	169	169	174	178	158	355	221	142	161	157	139
4	162	155	92	84	168	141	352	261	129	135	128	132
5	158	154	148	177	219	195	359	239	127	126	128	128
6	151	145	138	124	133	128	348	210	136	121	131	119
7	137	143	148	128	138	122	334	256	118	128	149	122
8	130	136	146	125	167	118	144	298	237	119	131	116
9	137	138	143	110	149	202	341	252	120	113	111	112
10	129	131	132	120	155	152	340	238	122	116	124	105

Figure 7. -- Example of a table of monthly streamflow for a node in the sample basin as viewed on a computer terminal.

THE MONTHLY STATISTICS AT NODE 900 (MAIN 6) WERE:

MONTH	STREAMFLOW (CUBIC FEET PER SECOND)		CONCENTRATION (MILLIGRAMS PER LITER)		LOAD (TONS)	
	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
1	153.22	19.22	849.97	111.29	10704.	2125.
2	153.11	18.04	778.30	104.79	9794.	1970.
3	148.70	28.09	767.10	74.65	9375.	2310.
4	136.35	30.59	599.85	51.47	6722.	1659.
5	164.41	24.30	495.80	37.37	6700.	1133.
6	152.29	28.01	389.66	34.45	4877.	1082.
7	330.10	66.47	421.78	66.25	11443.	3330.
8	238.82	35.88	571.18	94.99	11211.	1157.
9	145.93	36.15	761.95	174.29	9138.	2556.
10	132.81	17.89	1045.35	282.12	11410.	4484.
11	138.17	18.18	1206.57	336.16	13702.	4860.
12	128.14	16.99	984.49	121.14	10368.	2387.
AVERAGE	168.50	63.60	694.66	281.10	9620.	3500.

Figure 8. -- Example of a statistical summary for a node in the sample basin as viewed on a computer terminal.

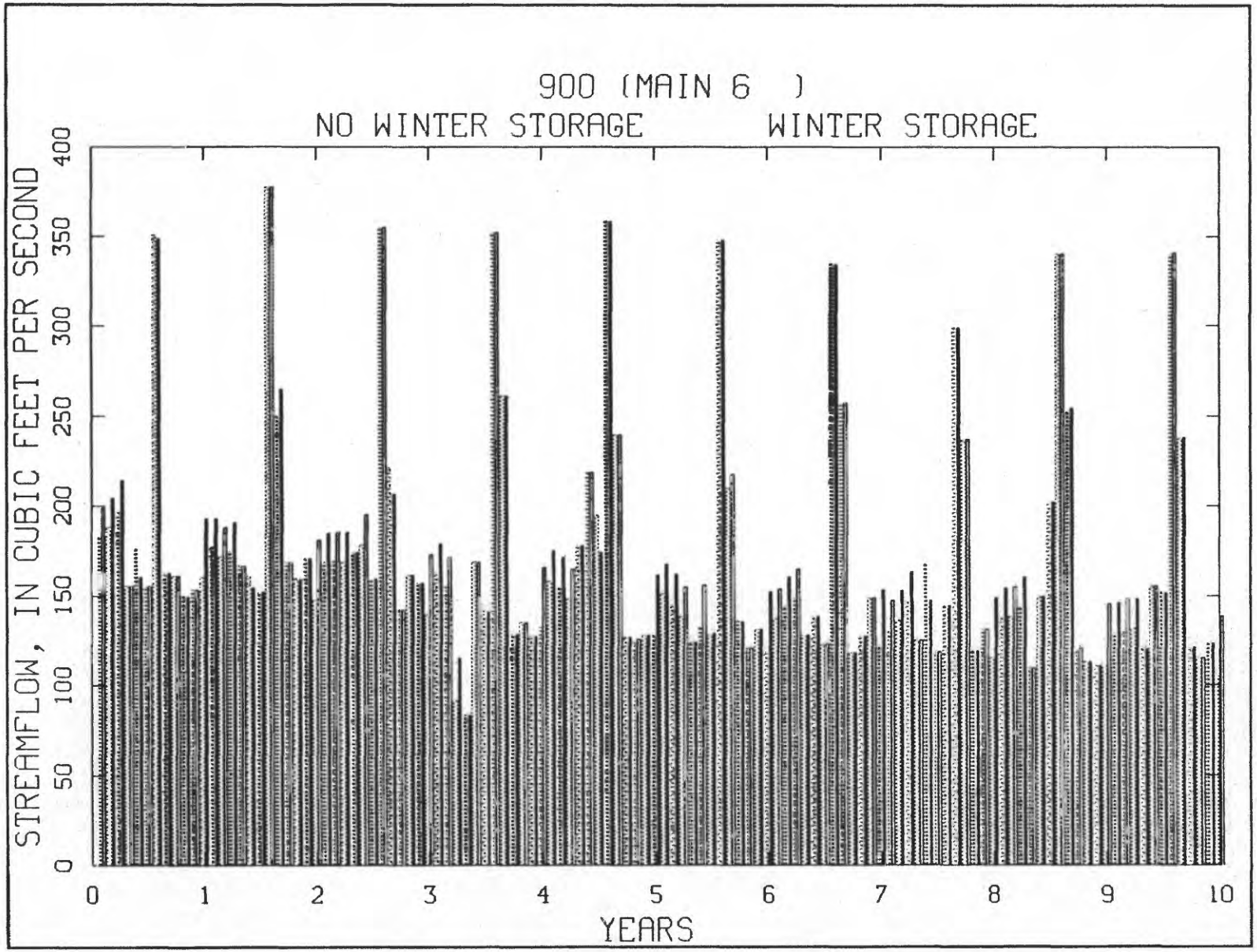

Figure 9. -- Example of a comparison histogram for a node in the sample basin as viewed on a computer terminal.

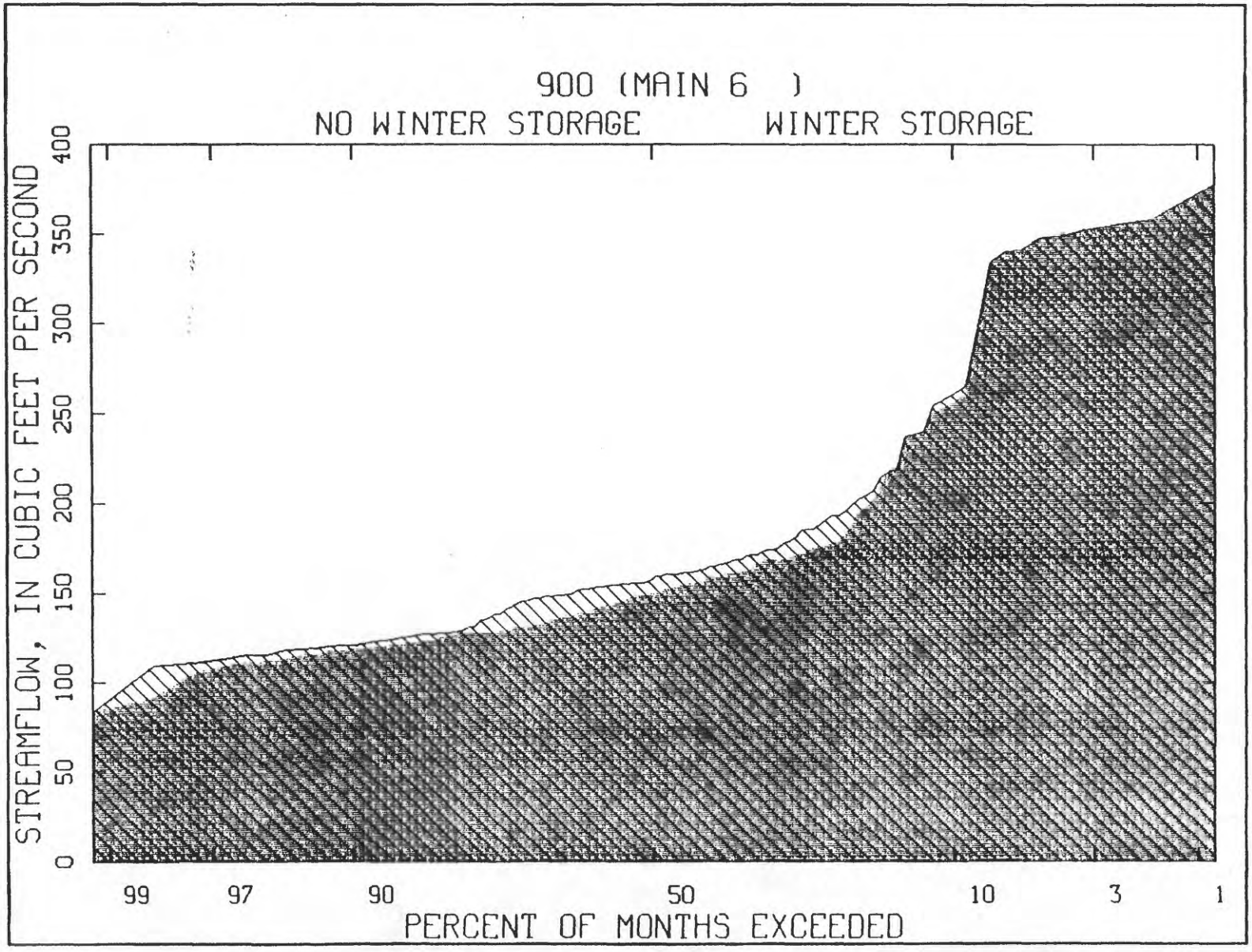

Figure 10. -- Example of two frequency curves for a node in the sample basin as viewed on a computer terminal.

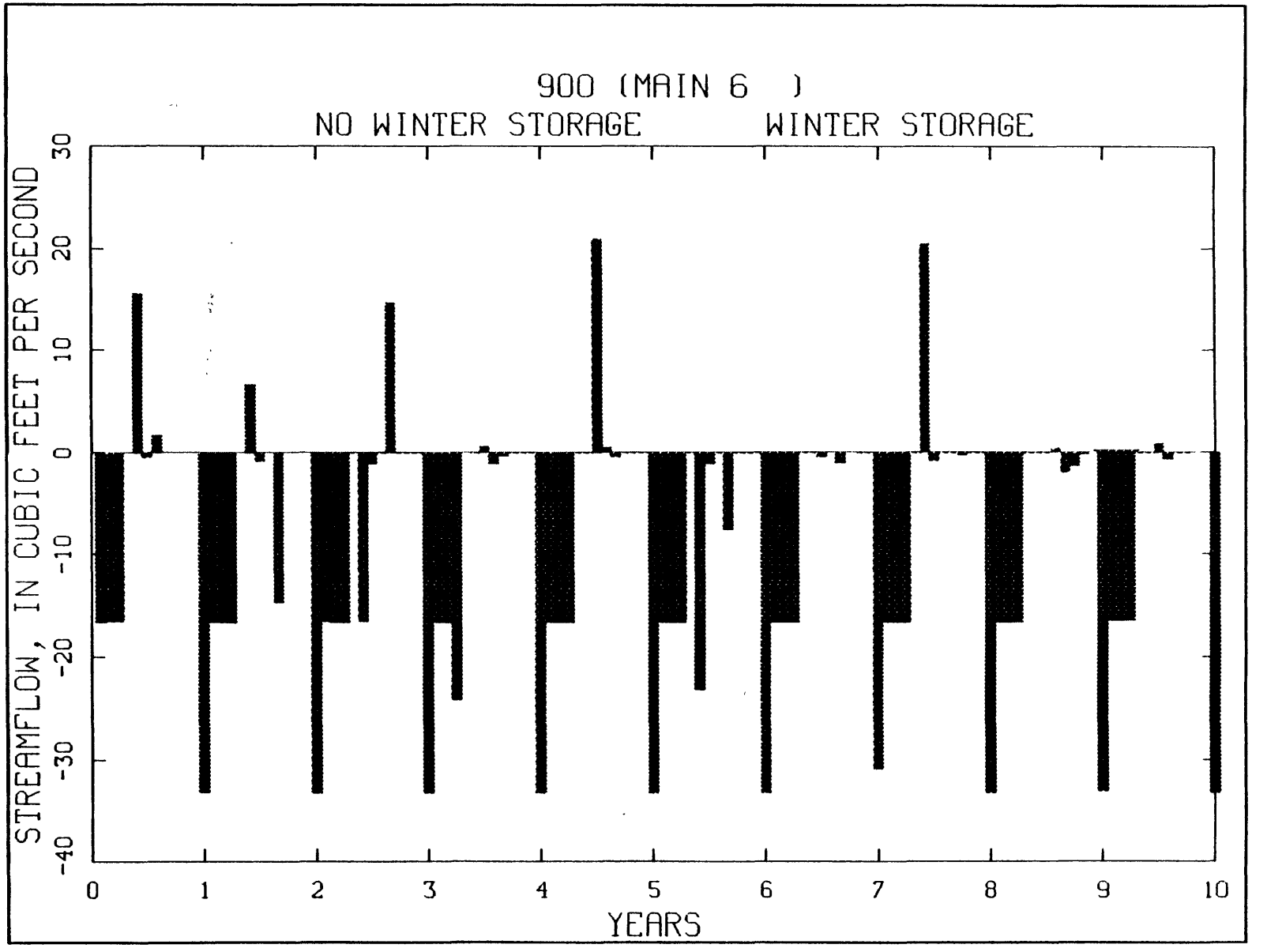

Figure 11. -- Example of a residual histogram for a node in the sample basin as viewed on a computer terminal.

Algorithms For Water-Supply Operations Simulation

Inherent to including the water-supply operations to the description of a river basin is the inclusion of the ground-water system and reservoirs. Still needed are all the features to simulate the streamflow of a basin. The incremental areas of each node (fig. 1) still are used to simulate runoff from the basin; however, simulation of the water-supply operations (fig. 12) affects streamflow through reservoir operations and diversions, and simulation of the ground-water system allows the inclusion of pumpage and return flow from water use.

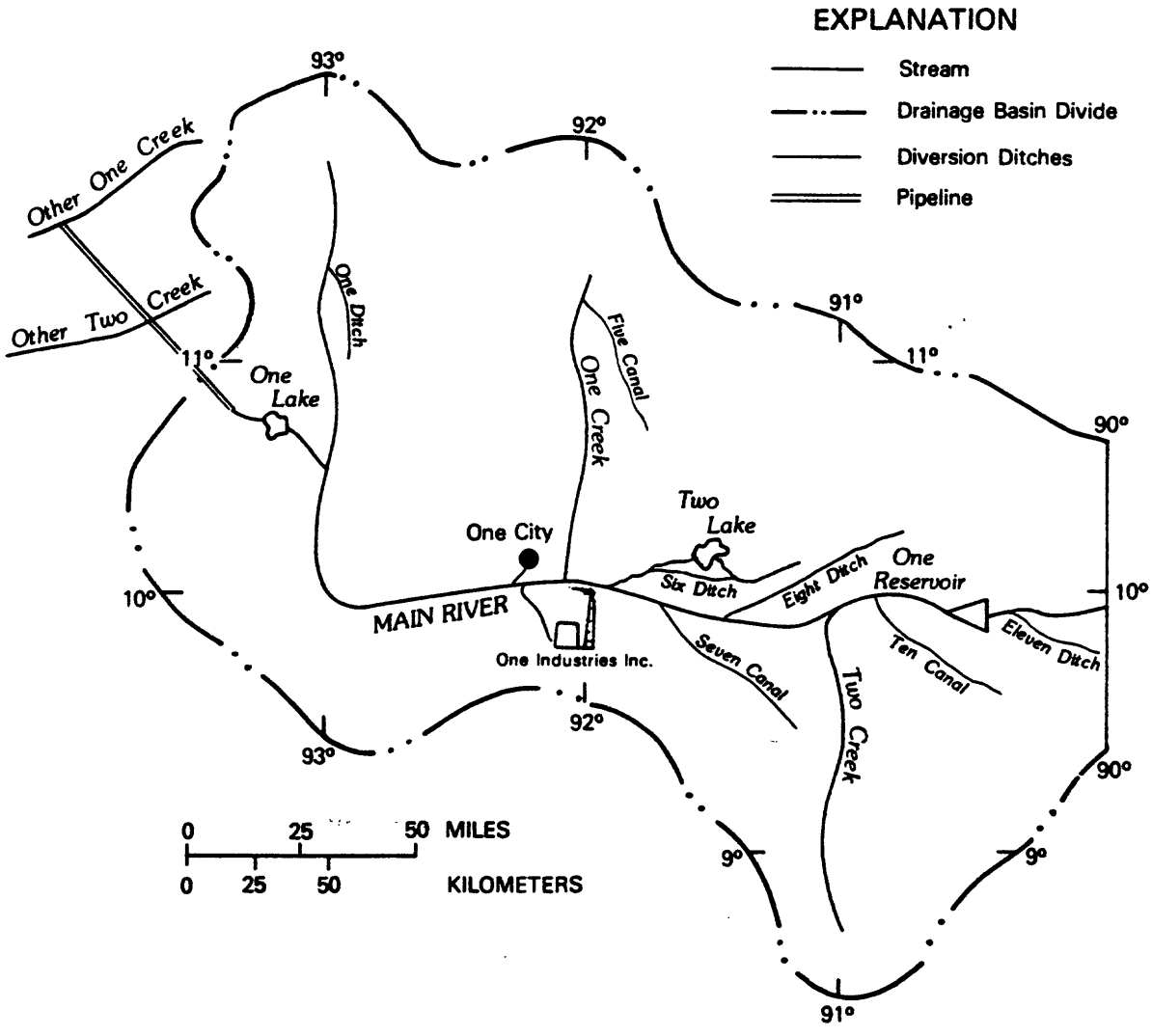

Figure 12.--Sample basin with diversion ditches and pipelines.

Simulation of the water-supply operations is based on prioritized lists of sources of water. For every water user simulated, water need is computed based on the type of use and production level. The production-level categories for the different types of users are: (1) The number of irrigated acres for agricultural users, (2) the populace served for municipal users, (3) the number of units produced for industrial users, (4) actual water demand for instream users, and (5) the reservoir capacity for reservoir operators. A perceived water demand is computed for each user, using its water need and a demand factor. This demand factor is determined during calibration by comparing measured and simulated diversions. This factor has a decipherable code that causes the perceived demand to be based on the irrigation season only or on a separate monthly curve that computes demands throughout the year.

Each water user has a list of sources of water that can be used to satisfy the perceived demand. The list is in the order in which the user will use the sources. The types of sources of water available to a water user include: (1) Direct diversions, (2) ground-water pumpage, (3) reservoir releases, (4) imports (transbasin diversions), and (5) storage diversions. When direct and storage diversions are based on the prior-appropriation doctrine of western States water law, a separate list of water rights, in their basinwide prioritized order, is needed. The list of sources for each individual water user is compared against the basinwide list of water rights to ensure conformity to the law. The determination of how much water from a specific source will be used is based on the remaining unsatisfied demand, the physical availability of the water, the legal availability of the water, and the physical capacity for providing the water as each source is evaluated in its turn.

After the water deliveries to a user have been simulated, the model then simulates the fate of that water. Computations are based on the assumption that all delivered water first satisfies the water need. All delivered water that exceeds the water need becomes return flow. Return flow may be either tailwater, which as used in the model returns to the river in the month after being delivered, or deep percolation, which as used in the model returns to the river in a time-delayed function by using ground-water response curves. A factor, entered for each user, determines the percentage of the return flow that is tailwater and deep percolation to ground water. Canal leakage, which is subtracted from diversions before delivered water is computed, also is return flow and is distributed into tailwater and deep percolation to ground water by using the same percentage factor. A second type of return-flow computation that is designed for nonagricultural type users is available. For this type of computation, return flow is computed as a percentage of the delivered water. With this type of return flow, all of the computed return flow is assigned as either tailwater or deep percolation.

The ground-water system is simulated by use of ground-water response functions (Jenkins, 1968a) that compute the time-delayed effects of ground-water stresses on streamflow. Soil moisture is not simulated in the model; thus, all land-surface activities, such as ground-water pumpage, deep percolation of excess-water applications to ground water, and canal leakage, are assumed to affect ground-water storage immediately. The magnitude and timing of the effects of those stresses that are transmitted through the aquifer to the river are functions of the aquifer properties (transmissivity and storage coefficient) and the distance to the stream. Using the methods developed by

Jenkins (1968b and 1968c) and more fully explained by Burns (1983, p. G2-G14), a unit-response function is computed by using volume-response functions:

$$\frac{v}{Qt} = \left(\frac{x^2S}{2Tt} + 1\right) \operatorname{erfc}\left(\sqrt{\frac{x^2S}{4Tt}} - \sqrt{\frac{x^2S}{4Tt}}\,\frac{2}{\sqrt{\pi}}\, e^{-\left(\frac{x^2S}{4Tt}\right)}\right), \tag{8}$$

where v is the volume of water removed from (or added to) streamflow,
Q is the rate of stress on the aquifer,
t is the time since the stress started,
x is the distance from the stream to the stress point,
S is the aquifer storage coefficient,
T is the aquifer transmissivity, and
erfc is the complementary-error function.

Jenkins (1968a) developed the surrogate parameter, SDF (Stream-Depletion Factor), for use in realistic hydrologic settings to represent x^2S/T in equation 8, which is based on idealized aquifer conditions. Within the model, unit-response functions for five SDF values (fig. 13) are computed by subtracting a volume-response function (eq. 8) with the appropriate parameters from the same volume-response function lagged in time by 1 month. Thus, whenever a stress is simulated within the model, that stress is multiplied by the appropriate unit-response function and all future effects of that stress on streamflow are stored for eventual use. The assumption of one uniform value for storage coefficient and transmissivity for the entire basin is incorporated in the model. Distances for the point of deep percolation and ground-water pumpage for each user are computed, and used with the storage coefficient and transmissivity to determine which of the SDF groups are to be used. Rather than using the computed distances, distances can be entered and used to compute other SDF values to compensate for irregular values of storage coefficient or transmissivity.

Model Components For Water-Supply Operations Simulation

A chart depicting the organization of the subroutines constituting the FORTRAN program to simulate the water-supply operations in a basin is shown in figure 14. Each of the new subroutines (some shown on fig. 14 are used for the streamflow and water-quality simulation) is described in the following text. A complete listing of the FORTRAN source code is in Attachment 8.

Subroutine NSTRK2 merely displays, at the terminal, a complete set of instructions of the required input data, similar to those listed in Attachment 3.

Either subroutine READMI or READMB is used to read the additional basin-description file into the computer from logical unit 53. READMI is called when the model is operated interactively with certain information being supplied during the modeling session. READMB is called when the model is not used interactively and requires an additional data file (logical unit 64) that provides the needed information. The format of the additional basin-description file used by READMI or READMB is described in detail in Attachment 3, and an example of such a file is listed in Attachment 4. Those data include monthly rates of crop potential evapotranspiration, lake evaporation, agricultural-irrigation demand, and instream-water demand. Other needed data

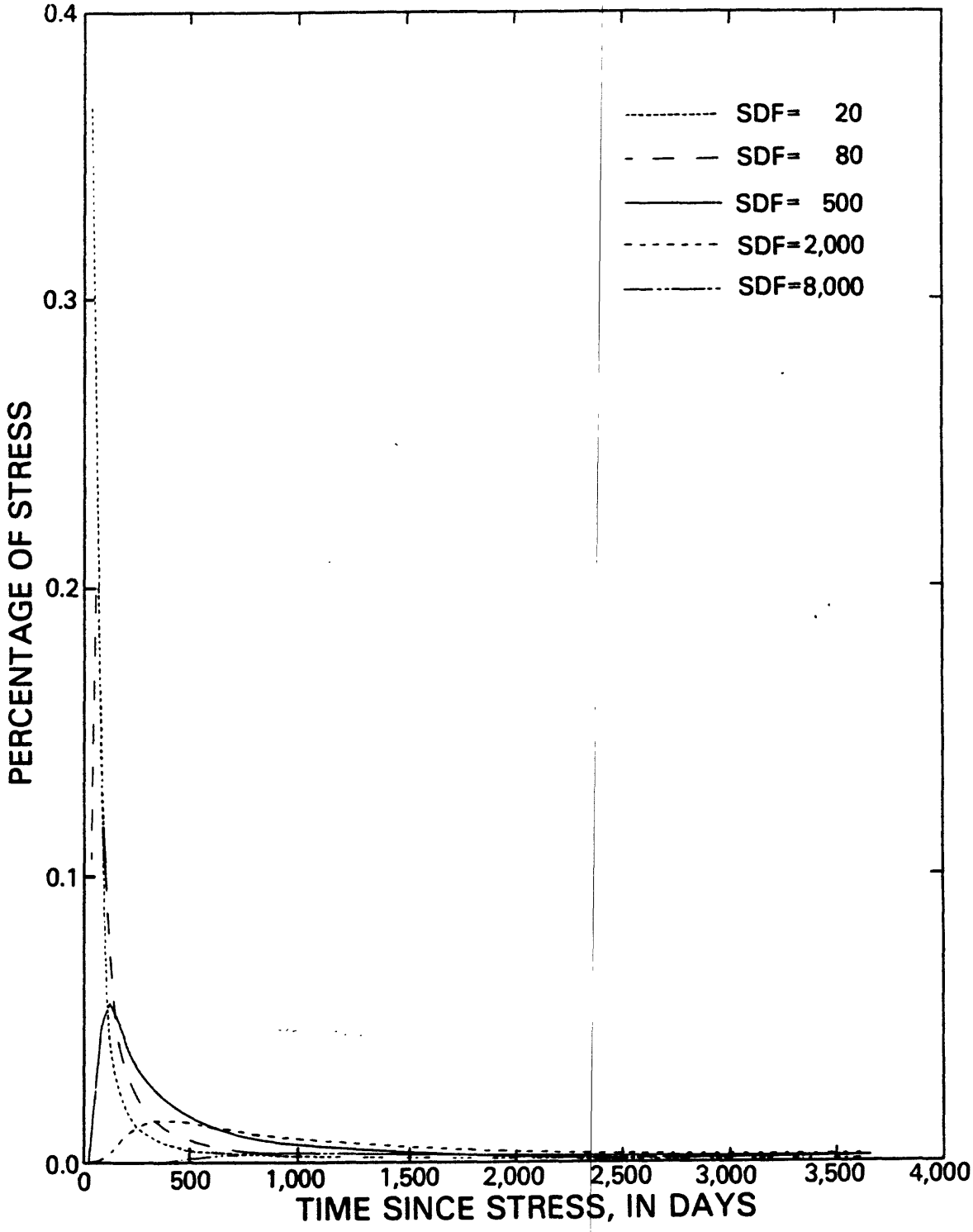

Figure 13.--Unit-response functions for five selected stream-depletion factors (SDF).

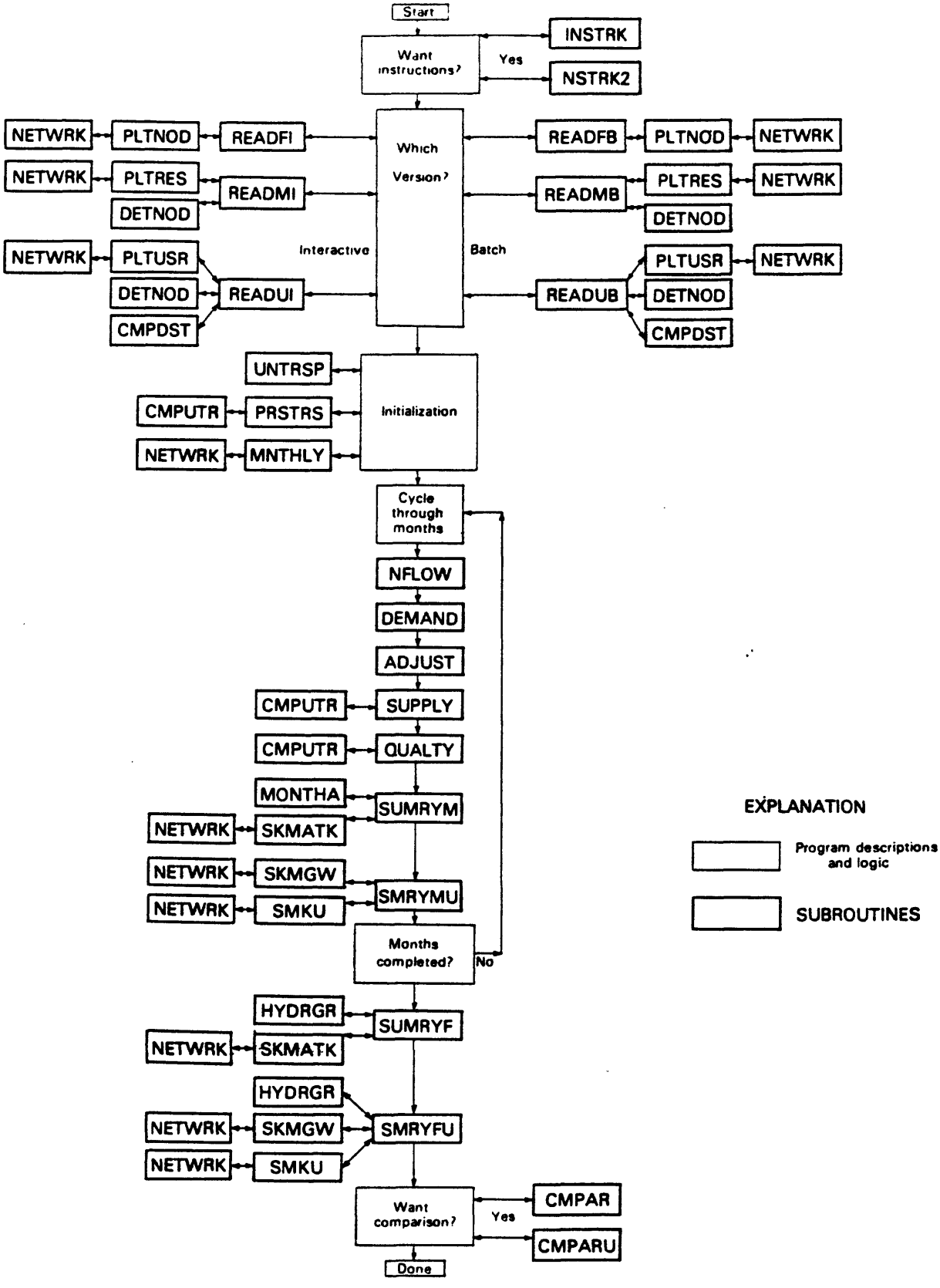

Figure 14.--Organizational chart of all model subroutines.

include the average water demand per person and per unit produced, the basin-wide average transmissivity and storage coefficient, and canal-leakage rate. Several factors and parameters needed by the model are entered through one of these subroutines. The length of each river reach is computed from the latitude-longitude location of each node, converting degrees to miles by using a conversion parameter, and sinuosity parameters read in as data. An effective precipitation factor identifies how much of the monthly precipitation falling on an irrigated area effectively contributes to plant consumptive use. The rest of the precipitation is not included in the model, except as the incremental streamflow may be based on precipitation. Finally, the model is prestressed to generate initial return flows. A prestress factor, determined during calibration, needs to be entered through one of these subroutines. All of the physical data for the reservoirs are entered into the model through either READMB or READMI. The needed data for each reservoir includes: (1) An identification number, (2) name, (3) location, (4) maximum and inactive capacities and surface area, and (5) initial contents and water-quality concentration. Also entered through one of these subroutines is the initial quantity and quality of ground water in storage for each side of the river upstream from each node. READMI issues prompts for modifying data if any of the data read from the additional basin-description file are to be temporarily modified before the simulation is run. READMI and READMB have the option of drawing a schematic for reservoir location (fig. 15), which is drawn by subroutine PLTRES. The size of the symbols correspond to the size of the reservoirs. From PLTRES, subroutine NETWRK is entered to draw the drainage pattern of streams.

The water-supply operations file is entered into the model through either subroutine READUI or READUB from logical unit 50. READUI is called when the model is operated interactively with certain information being supplied during the modeling session. READUB is called when the model is not used interactively and requires an additional data file (logical unit 64) that provides the needed information. The format of the water-supply operations file used by READUI or READUB is described in detail in Attachment 3, and an example of such a file is listed in Attachment 4. For each water user, those data include: (1) An identification number, (2) name, (3) location, (4) type of user, (5) quantity of use, (6) demand factor (relating to the perceived demand), (7) number of sources, and (8) type, percent, location, and distance of return flow. Also needed for every source of each water user is: (1) Type, (2) quantity available, and (3) location. The sources of water need to be entered in the order in which the water user is to use the sources. READUI issues prompts for modifying data if any of the data read from the water-supply operations file are to be temporarily modified before the simulation is begun. The prioritized basinwide water-rights list also is entered into the computer by one of these two subroutines from logical unit 51. The needed data include: (1) Water-user identification number, (2) name, (3) quantity, and (4) priority date of each water right. Both READUI and READUB have the option of drawing a schematic of water-user location (fig. 16), which is drawn by subroutine PLTUSR. The size of the symbols corresponds to the quantity of use for each user. Also, the lines indicate where a diversion is made, where ground water is pumped, or where excess applications recharge the ground-water systems. From PLTUSR, subroutine NETWRK is entered to draw the drainage pattern of streams.

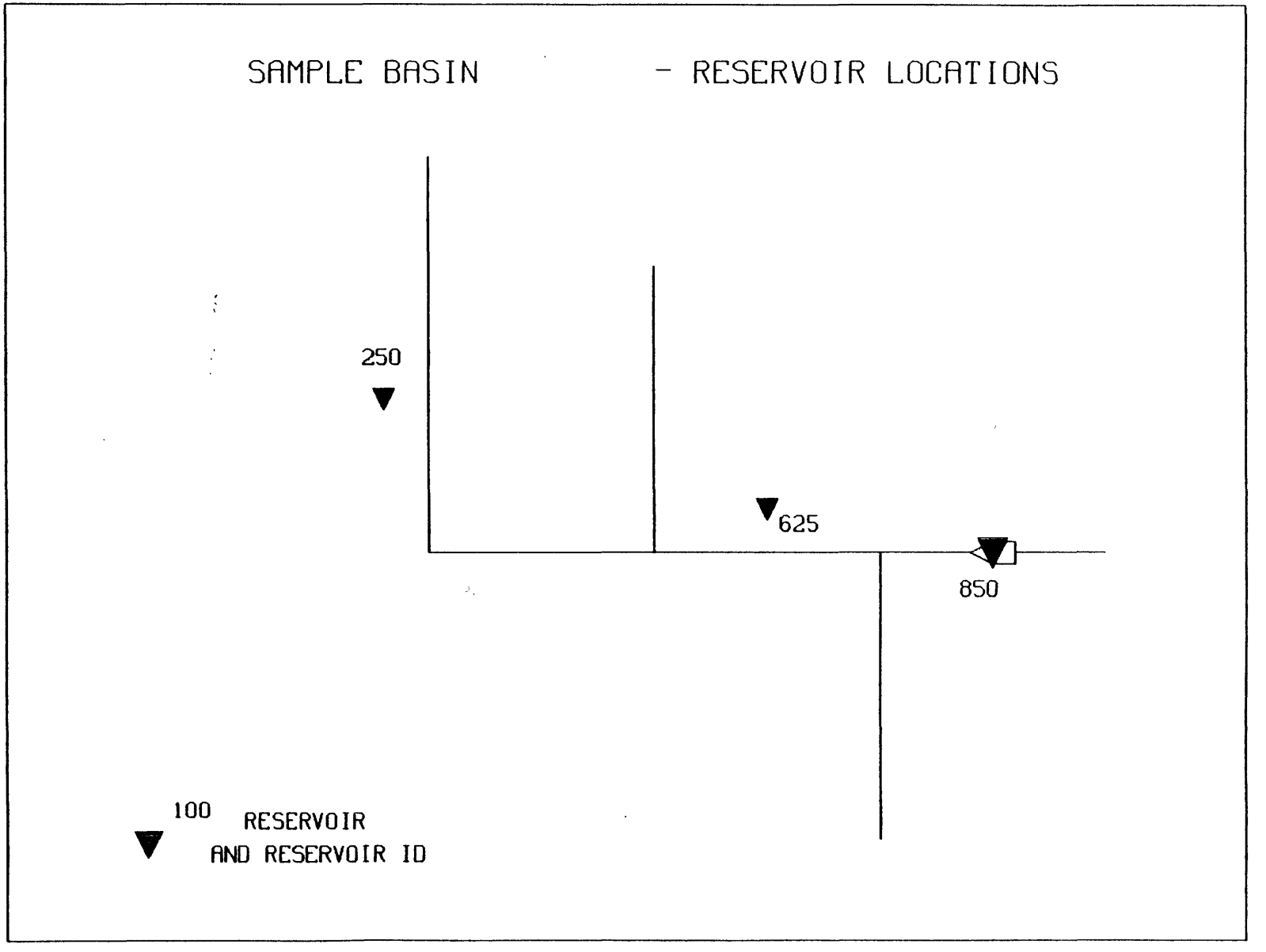

Figure 15. -- Example of a schematic for reservoir location in the sample basin as viewed on a computer terminal.

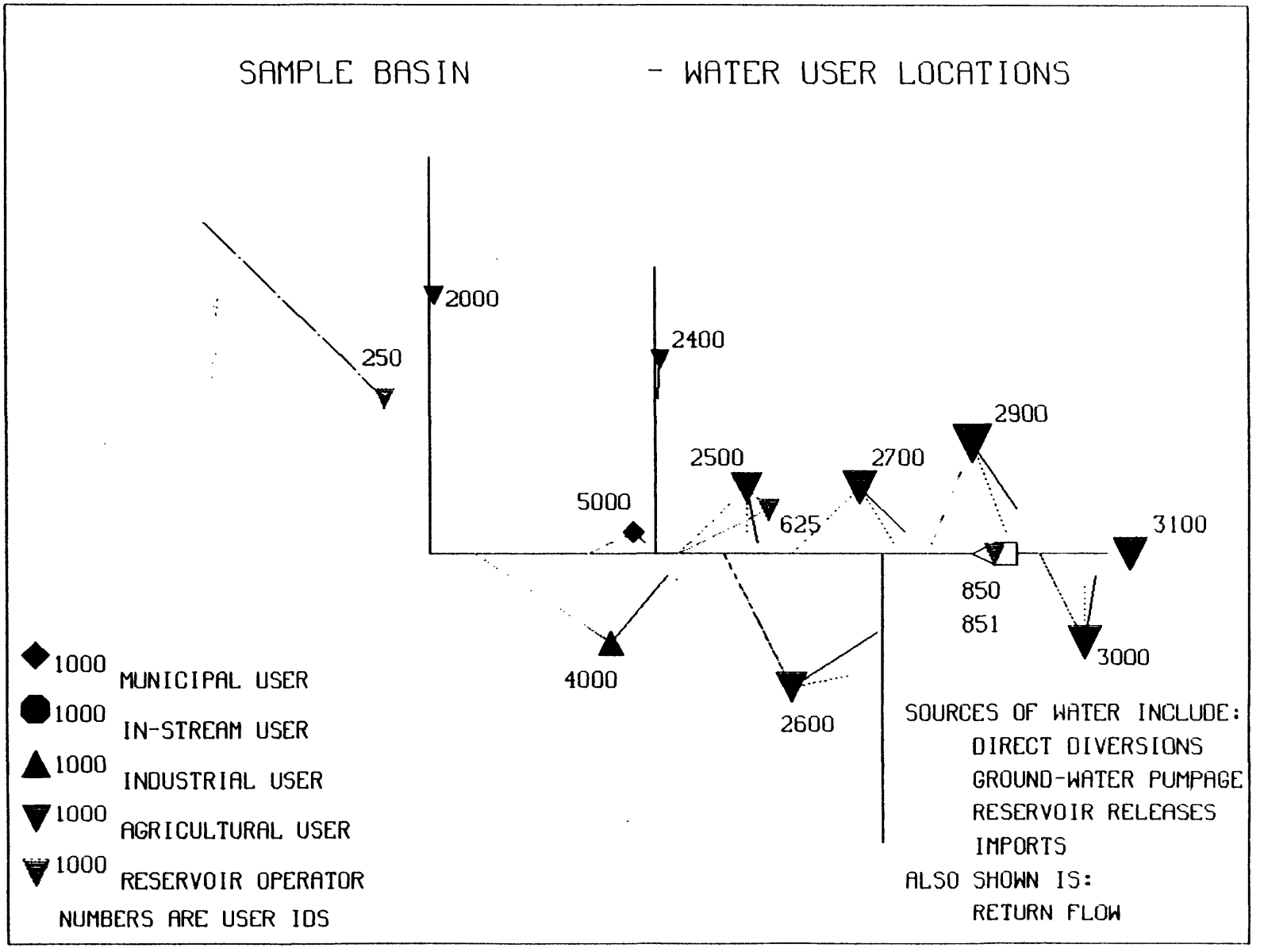

Figure 16. -- Example of a schematic for water-user location in the sample basin as viewed on a computer terminal.

Some accounting-type variables are initialized in the mainline of the program. If a streamflow schematic is to be updated monthly, then subroutine MNTHLY is called to draw the initial part of the schematic. From MNTHLY, subroutine NETWRK is called to draw the drainage pattern before hydrograph grids are drawn on the schematic within MNTHLY. The unit-response functions necessary for the simulation of the effects transmitted through the ground-water system need to be initialized. The unit-response functions for five SDF values are computed in subroutine UNTRSP. Each unit-response function is computed as the difference of two volume-response functions (computed using eq. 8), one of which is lagged 1 month behind the other. A final initialization step required is to prestress the model. This process, done in subroutine PRSTRS, generates reasonable ground-water return flows representative of historic usage; thus, when the simulation begins, the initial return flows are not all zero. Within this subroutine, 10 years of return flows, as computed by using the water-user needs multiplied by the prestress factor, are simulated to stress the aquifer. For each user and for each month of the 10-year prestress period, subroutine CMPUTR is called to multiply the assumed stress by the appropriate unit-response function.

A loop in the mainline then controls the monthly simulation. NFLOW, as described in the previous section for simulation of streamflow, is entered to generate the natural streamflow available for water use. Next, the perceived water demand for each water user is computed in subroutine DEMAND. This demand is computed based on the type of water use and the specified demand factor. This perceived demand is the driving force within the simulation model because the model attempts to obtain all the water it can from each available source until the perceived demand is satisfied.

Within subroutine ADJUST, the flows computed in NFLOW are adjusted to account for return flows generated from previous water-use activities. Similarly, ground-water storage is adjusted for those same return flows. Reservoir evaporation also is computed in this subroutine.

The next subroutine within the monthly simulation loop is SUPPLY, which simulates the water-use system. The program loops through the basinwide water-rights list to: (1) Determine which user owns the next right, (2) determine whether that user has a perceived demand for water, (3) determine if that user has other water sources that are higher in the user's priority system, and (4) determine whether sufficient water is in the river to make the diversion. If the user has other, higher priority sources of water, those sources are simulated before using the direct diversion. For direct diversions, the quantity of the diversion is defined as the minimum of: (1) The perceived demand, (2) the quantity of the water right, or (3) the legal quantity of water in the river. After a nonzero diversion has been computed, all streamflow (both upstream and downstream) is adjusted, so that no subsequent diversion can affect this more senior diversion. The adjustment is transferred upstream until sufficient inflow equal to the diversion is determined and is transferred downstream to the end node or until the river is dried up at some intervening node. After going through the entire basinwide water-rights list, the program then goes through the list of all water users to determine if any other sources of water exist in each individual priority list that have not been used in an attempt to satisfy the perceived demand.

The last operative subroutine in the monthly simulation loop is QUALTY. This subroutine simulates the streamflow similar to NFLOW, but also simulates the water-quality mixing at the same time. However unlike NFLOW, the return flows computed in ADJUST and the reservoir releases and stream diversions computed in SUPPLY are included in the simulation. The reservoirs also are simulated in this subroutine using inflows and releases computed in SUPPLY and properly accounting for water-quality mixing. Finally, each water user is simulated by computing the water quality of the applied water using the quantities from various sources computed in SUPPLY and the respective water-quality concentrations computed earlier in this subroutine. After computing the quality of the applied water, the quality of all return flows and ground water is computed. The concentration of return flow is computed by dividing the total load applied to the land surface by the quantity of the return flow; this accounts for the concentrating effects of the crop consumptive use of water. Ground-water concentrations are then computed by mixing the return flow with the ground water previously in storage.

The monthly-simulation loop is completed by calling the statistical-summary subroutines SUMRYM and SMRYMU. SUMRYM is the same as described for the streamflow simulation. Within SMRYMU, statistics for ground-water storage, water use, and reservoirs are summarized and stored. If a schematic for annual ground-water storage is desired, subroutine SKMGW is called from SMRYMU to generate that schematic after each December has been simulated. Similarly, if a schematic for annual, average water-use is desired, subroutine SKMU is called from SMRYMU to generate that schematic after each December has been simulated.

When the monthly loop has been completed for the period of record, subroutines SUMRYF and SMRYFU are called. SUMRYF is the same as described for the simulation of streamflow. SMRYFU summarizes all of the ground water, water use, and reservoirs. If a schematic for final ground-water storage (fig. 17) is desired, subroutine SKMGW is called from SMRYMU. If a schematic for period-of-record average water use (fig. 18) is desired, subroutine SKMU is called from SMRYMU. Within SMRYFU, the ground-water summaries are generated first. Ground-water storage, ground-water concentration, and return flows for any river reach and side can be displayed as hydrographs (similar to fig. 6) or as tables (similar to fig. 7). The same parameters, summed for the entire basin, also are available as hydrographs or tables. Summaries available for any water user include direct diversions, ground-water pumpage, and total applications, which are displayed as either hydrographs (similar to fig. 6) or tables (similar to fig. 7). A statistical summary (fig. 19) also is available for any water user. Any of these summaries also can be displayed for the basinwide total water use. Finally, reservoir contents or water-quality concentration can be displayed as hydrographs (similar to fig. 6) or tables (similar to fig. 7). A statistical summary for a reservoir (fig. 20) also can be displayed.

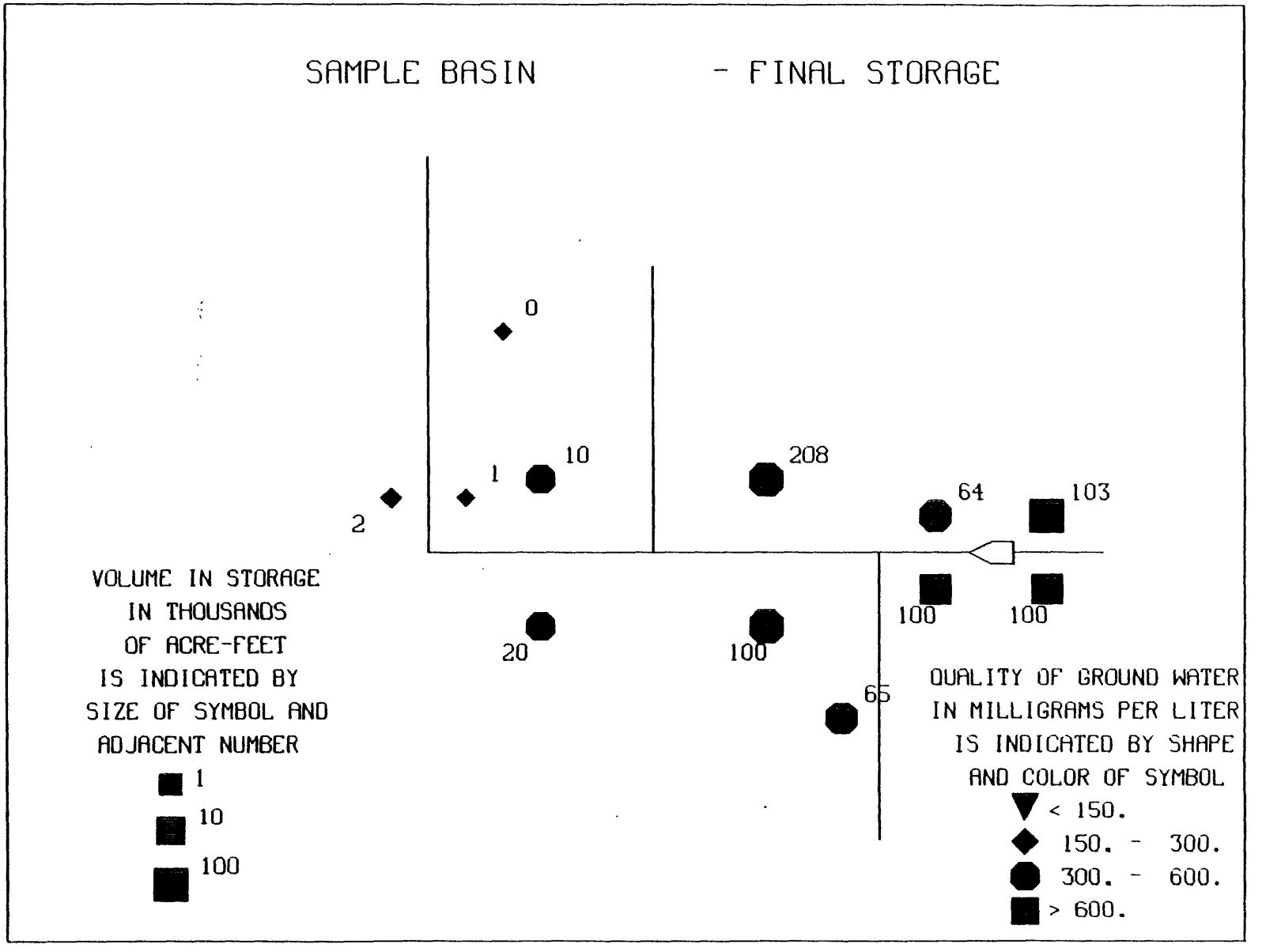

Figure 17. -- Example of a schematic for final ground-water storage in the sample basin as viewed on a computer terminal.

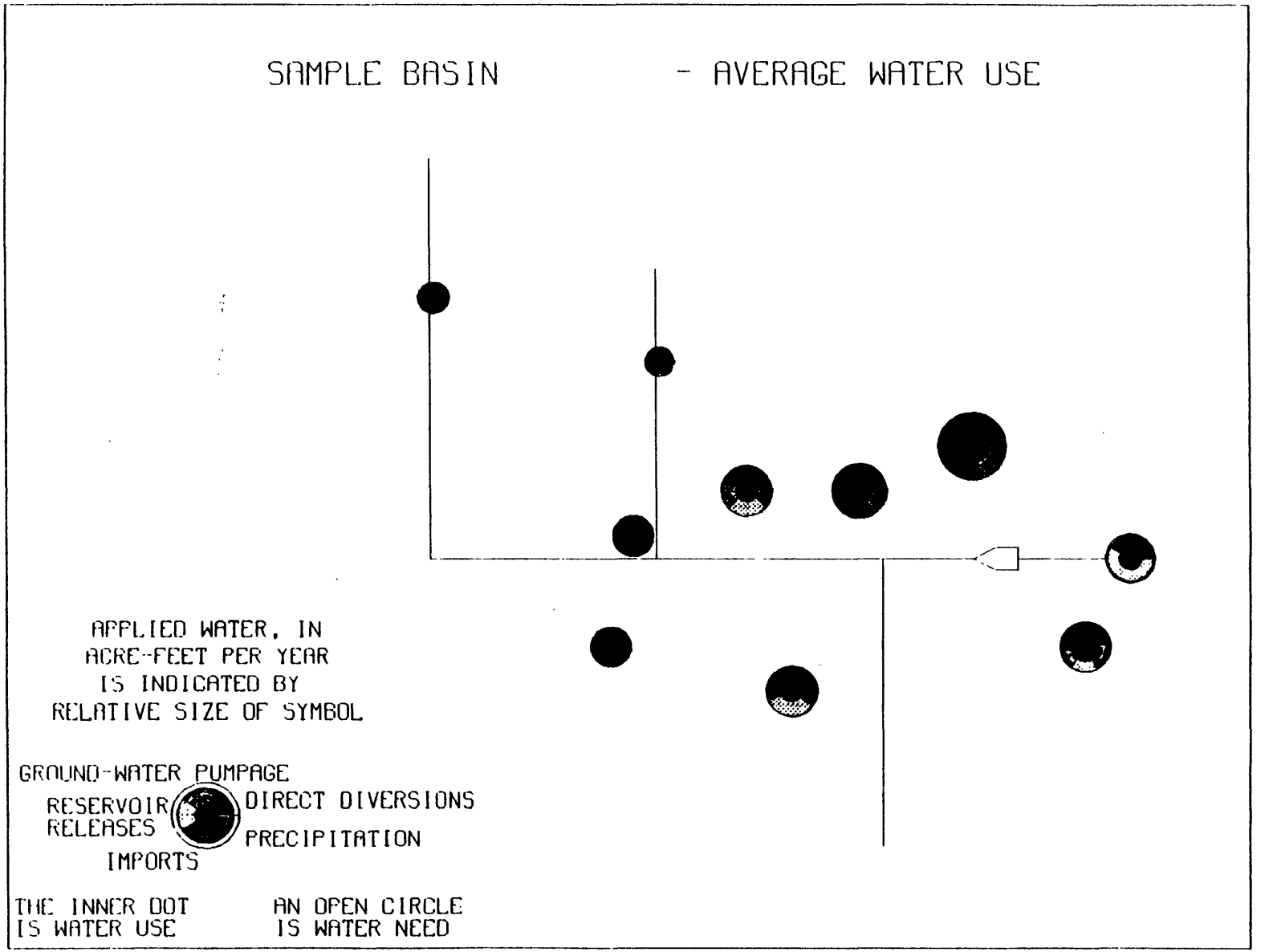

Figure 18. -- Example of a schematic for average water use in the sample basin as viewed on a computer terminal.

THE MONTHLY STATISTICS FOR USER 2500 (DITCH 6)
[VALUES ARE ACRE-FEET EXCEPT CONCENTRATION WHICH IS MILLIGRAMS PER LITER]

MONTH	WATER NEED	DIRECT DIVER-SIONS	GROUND WATER PUMP-AGE	RESER-VOIR RE-LEASES	TOTAL WATER AP-PLIED	PRE-CIP-ITA-TION	WATER CON-SUMED	CON-CEN-TRA-TION	CANAL LEAKAGE	TAIL WATER	DEEP PER-COLA-TION
1	0.	1000.	0.	0.	0.	373.	0.	0.	1000.	687.	687.
2	0.	1000.	0.	0.	0.	342.	0.	0.	1000.	671.	671.
3	0.	1000.	0.	0.	0.	576.	0.	0.	1000.	788.	788.
4	1000.	4000.	0.	0.	1475.	783.	1000.	281.	2525.	1892.	1892.
5	3000.	6395.	692.	313.	4875.	819.	3000.	296.	2525.	2610.	2610.
6	5000.	10833.	67.	0.	8375.	622.	5000.	180.	2525.	3261.	3261.
7	7000.	1244.	2356.	10275.	11350.	787.	7000.	491.	2525.	3831.	3831.
8	6000.	0.	2412.	5206.	5346.	770.	5350.	529.	2272.	1519.	1519.
9	5000.	50.	2412.	736.	2917.	442.	3075.	495.	281.	282.	282.
10	2500.	0.	2412.	0.	2412.	546.	2492.	453.	0.	233.	233.
11	0.	689.	0.	0.	172.	272.	0.	249.	517.	480.	480.
12	0.	1882.	0.	0.	0.	273.	0.	0.	1882.	1078.	1078.
TOTAL	29500.	28092.	10351.	16530.	36921.	6605.	26917.	373.	18052.	17331.	17331.

Figure 19. -- Example of a statistical summary for a water user in the sample basin as viewed on a computer terminal.

THE MONTHLY STATISTICS FOR RESERVOIR 850 (RES 1)

MONTH	STORAGE CONTENTS (ACRE-FEET)	CONCENTRATION (MILLIGRAMS PER LITER)	RESERVOIR RELEASES (ACRE-FEET)	INFLOW DIVERSIONS (ACRE-FEET)	INFLOW IMPORTS (ACRE-FEET)	LAKE EVAPORATION (ACRE-FEET)
1	22257.	539.	0.	4294.	0.	0.
2	26071.	552.	0.	3815.	0.	0.
3	31929.	575.	0.	5858.	0.	0.
4	28731.	576.	4364.	2364.	0.	2395.
5	16335.	585.	11483.	452.	0.	2729.
6	30125.	426.	8734.	23341.	0.	1634.
7	23871.	460.	4598.	0.	0.	3314.
8	21606.	480.	1250.	0.	0.	2029.
9	20718.	501.	239.	0.	0.	1296.
10	20200.	516.	0.	0.	0.	1036.
11	20099.	534.	0.	0.	0.	202.
12	21037.	529.	0.	938.	0.	0.
AVERAGE	23582.	523.	2556.	3422.	0.	1220.

Figure 20. -- Example of a statistical summary for a reservoir in the sample basin as viewed on a computer terminal.

At the completion of a simulation, two final subroutines are available that provide comparative summaries of the just-completed simulation with one previously generated. CMPAR is the same as described for the streamflow simulation. Within CMPARU, the water need, direct diversions, ground-water pumpage, reservoir releases, imports, total application, or total water consumption of any water user can be compared with the same user and parameter from a previous simulation. Reservoir contents for any reservoir also can be compared. This comparison is done by reading the output file produced during the ongoing simulation (logical unit 52) and by reading some designated output from a previous simulation (logical unit 55). For any selected parameter, the subroutine computes the mean and standard deviation of the difference between the monthly values for the period of record, and displays three plots: (1) A histogram of both time series, similar to figure 9; (2) a frequency curve of each time series, similar to figure 10; and (3) a histogram of the time series of the difference between the two simulations, similar to figure 11.

SUMMARY

An interactive-accounting model which simulates streamflow, water quality, and water-supply operations in a river basin was developed and described in this report. Regression equations are used to compute streamflow from a set of independent variables such as snowpack, precipitation, air temperature, or other streamflow. The concentrations of a conservative constituent, usually dissolved solids, also are computed with regression equations, with streamflow as the independent variable.

The model can be operated interactively, with the baseline data sets being modified to create new scenarios. Most of the model output can be displayed on a computer terminal interactively, in the form of colored graphics schematics, to show areal variations, and hydrographs, to show temporal variations.

The water-supply operations and a simplified ground-water system also can be simulated with the model. Various water users, such as agricultural, municipal, industrial, and in-stream users, plus reservoir operators are assigned water demands which they try to satisfy from an ordered list of water sources. Those sources may include direct diversions, ground-water pumpage, reservoir releases, or interbasin imports. All direct diversions are simulated such that the basinwide, prior appropriation priorities are recognized.

REFERENCES CITED

Burns, A.W., 1983, Simulated hydrologic effects of possible ground-water and surface-water management alternatives in and near the Platte River, south-central Nebraska, in Hydrologic and geomorphic studies of the Platte River basin: U.S. Geological Survey Professional Paper 1277, p. G1-G30.

Fleming, D.E., 1975, The CORSIM project: Annual meeting of the American Society of Civil Engineers, November 4, 1975, Denver, 17 p.

Jenkins, C.T., 1968a, Computation of rate and volume of stream depletion by wells: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 4, Chapter D1, 17 p.

_____1968b, Techniques for computing rate and volume of stream depletion by wells: Ground Water, v. 6, no. 2, p. 37-46.

_____1968c, Electric-analog and digital-computer model analysis of stream depletion by wells: Ground Water, v. 6, no. 6, p. 27-34.

Parker, R.S. and Norris, J.M., 1983, Simulated effects of anticipated coal mining on dissolved solids in selected tributaries of the Yampa River, northwestern Colorado: U.S. Geological Survey Water-Resources Investigations Report 83-4084, 66 p.

Ribbens, R.W., 1975, Program NW01--River network program, User's manual: Denver, U.S. Bureau of Reclamation, Engineering and Research Center, Division of Planning Coordination, 140 p.

Shafer, J.M., 1979, An interactive river basin water management model--Synthesis and application: Colorado Water Resources Research Institute Technical Report 18, 244 p.

Taylor, O.J. and Luckey, R.R., 1972, A new technique for estimating recharge using a digital model: Ground Water, v. 10, no. 6, 5 p.

_____1974, Water-management studies of a stream-aquifer system, Arkansas River valley, Colorado: Ground Water, v. 12, no. 1, 13 p.

Texas Water Development Board, 1974, Economic optimization and simulation techniques for management of regional water resource systems, river basin simulation model SIMYLD-II--Program description: Austin, 51 p.

U.S. Army Corps of Engineers, 1980, Computer program catalog of the Hydrologic Engineering Center: Davis, Calif., 16 p.

U.S. Army Engineer Division, North Pacific, 1972, Program description and user manual for SSARR model: Portland, Ore., 202 p.

U.S. Bureau of Reclamation, Upper Missouri Region, Division of Data Processing, 1978, HYDROSS-Hydrologic River Operation Study System, User's guide: Billings, Mont., 158 p.

ATTACHMENTS

Attachment 1--Data Instructions For Streamflow and Water-Quality Simulation

Three data sets must be prepared prior to using the model for streamflow simulation:

A basin description of the modeled area (logical unit 60),
a digitized network of points along the river (logical unit 62), and
a time series of all the independent variables (logical unit 61).

Record	Columns	Name	Description
The format for the basin-description file is:			
1	1- 80	TITLED	A title
2	1- 5	NNODE	The number of nodes (maximum of 100)
3	1- 10	QMAX	An estimate of the largest streamflow, in cubic feet per second (used for plotting purposes)
	11- 20	QWL1	Value of water quality, in milligrams per liter, to subdivide class 1 from class 2
	21- 30	QWL2	Value of water quality, in milligrams per liter, to subdivide class 2 from class 3
	31- 40	QWL3	Value of water quality, in milligrams per liter, to subdivide class 3 from class 4
NOTE -- records 4 and 5 are entered as a set, one for each NNODE			
4	1- 5	NODEID	A node ID number
	6- 13	NODNAM	A node name
	16- 25	YLOC	Latitude, in decimal degrees
	26- 35	XLOC	Longitude, in decimal degrees
	36- 40	NXTNOD	Node ID of the downstream node. Must be set to negative number for all terminus nodes.
	41- 50	PLTX	Plotting offset from the node symbol, in inches
	51- 60	PLTY	Plotting offset from the node symbol, in inches
	61- 70	CONCFC	Concentration factor to determine load routing when incremental streamflow is negative. Value ranges from 0.0 to 1.0, where 0.0 indicates the entire load is concentrated downstream and 1.0 indicates the concentration is maintained downstream.
	71- 80	DSA	Intercept of the water quality-specific conductance linear regression
	81- 90	DSB	Slope of the water quality-specific conductance linear regression
NOTE -- record 5 is repeated 12 times, one for each month, beginning with January.			
5	11- 15	INDEPV	Variable number of the independent variable. If the value is positive, the incremental flow is computed and routed downstream. If the value is negative, the total flow at that point is computed with no routing. If the value is less than 100, the flow is computed using linear regression and the independent variable identified by INDEPV.

Attachment 1--Data Instructions For Streamflow and Water-Quality Simulation--Continued

Record	Columns	Name	Description
Format for the basin-description file--Continued			
5	11- 15	INDEPV	If the value is greater than 100, the flow is computed using log-log regression and the independent variable identified by (INDEPV - 100). If the value is greater than 200, the flow is computed using linear regression and the independent variable is upstream streamflow.
	16- 25	NTRCPT	Intercept of the streamflow-independent variable regression.
	26- 35	SLOPE	Slope of the streamflow-independent variable regression
	36- 45	QWA	Intercept of the specific conductance-streamflow log-log regression
	46- 55	QWB	Slope of the specific conductance-streamflow log-log regression
The format for the digitized network file is:			
1	1- 10	XMIN	Largest longitude, in decimal degrees, for mapping
	11- 20	XMAX	Smallest longitude, in decimal degrees, for mapping
	21- 30	YMIN	Smallest latitude, in decimal degrees, for mapping
	31- 40	YMAX	Largest latitude, in decimal degrees, for mapping
	41- 50	XLENG	Length of x axis, in decimal degrees, on schematic hydrographs
	51- 60	YLENG	Length of y axis, in decimal degrees, on schematic hydrographs
2	1- 10	XHY	Longitude, in decimal degrees, to place first schematic hydrograph
	11- 20	YHY	Latitude, in decimal degrees, to place first schematic hydrograph
	21- 30	XHY	Longitude, in decimal degrees, to place second schematic hydrograph
	31- 40	YHY	Latitude, in decimal degrees, to place second schematic hydrograph
	41- 50	XHY	Longitude, in decimal degrees, to place third schematic hydrograph
	51- 60	YHY	Latitude, in decimal degrees, to place third schematic hydrograph
	61- 70	XHY	Longitude, in decimal degrees, to place fourth schematic hydrograph
	71- 80	YHY	Latitude, in decimal degrees, to place fourth schematic hydrograph
	81- 90	XHY	Longitude, in decimal degrees, to place fifth schematic hydrograph
	91-100	YHY	Latitude, in decimal degrees, to place fifth schematic hydrograph

Attachment 1--Data Instructions For Streamflow and Water-Quality Simulation--Continued

Record	Columns	Name	Description
Format for the digitized network file--Continued			
NOTE -- record 3 is repeated until ICARD is negative			
3	1- 5	ICARD	Code indicating disposition of data points. If value is one, start plotting data in a new sequence. If value is greater than 1, continue plotting data in sequence from previous line. If value is zero, skip the line. If value is negative, quit plotting the network.
	6- 12	YLINE	Latitude, in decimal degrees, of a point
	13- 19	XLINE	Longitude, in decimal degrees, of a point
	20- 26	YLINE	Latitude, in decimal degrees, of a point
	27- 33	XLINE	Longitude, in decimal degrees, of a point
	34- 40	YLINE	Latitude, in decimal degrees, of a point
	41- 47	XLINE	Longitude, in decimal degrees, of a point
	48- 54	YLINE	Latitude, in decimal degrees, of a point
	55- 61	XLINE	Longitude, in decimal degrees, of a point
	62- 68	YLINE	Latitude, in decimal degrees, of a point
	69- 75	XLINE	Longitude, in decimal degrees, of a point
The format for the independent variable file is:			
1	1- 80	TITLEP	A title
2	1- 5	NMONTH	The number of months (maximum of 600)
	6- 10	NINDV	The number of independent variables (maximum of 75)
3	1- 6	VARNAM	An independent variable name. There are NINDV occurrences, eight per line.
	11- 16	VARNAM	
	21- 26	VARNAM	
	31- 36	VARNAM	
	41- 46	VARNAM	
	51- 56	VARNAM	
	61- 66	VARNAM	
	71- 76	VARNAM	
NOTE -- record 4 is read as a set, one for each NMONTH, beginning in a January			
4	1- 10	VARIBL	Value of the time series of independent variables. There are NINDV occurrences, eight per line. (-99. is used to indicate missing data).
	11- 20	VARIBL	
	21- 30	VARIBL	
	31- 30	VARIBL	
	41- 50	VARIBL	
	51- 60	VARIBL	
	61- 70	VARIBL	
	71- 80	VARIBL	

Attachment 2--Example Files of Input Data for Streamflow and Water-Quality Simulation

Three data sets must be prepared prior to using the model for streamflow simulation:

A basin description of the modeled area (logical unit 60);
a digitized network of points along the river (logical unit 62); and
a time series of all the independent variables (logical unit 61).

The basin-description file is:

```
Sample basin to demonstrate model
   13
     1000.      150.      300.      600.
   50IMPORT 1        11.5      94.0 -999      -.30       .20        0.       0.0       1.0
             1        2.0       0.0      200.      -.05
             1        2.0       0.0      200.      -.05
             1        2.0       0.0      200.      -.05
             1        4.0       0.0      200.      -.05
             1       40.0       0.0      200.      -.05
             1      200.0       0.0      200.      -.05
             1      100.0       0.0      200.      -.05
             1       40.0       0.0      200.      -.05
             1       20.0       0.0      200.      -.05
             1       10.0       0.0      200.      -.05
             1        4.0       0.0      200.      -.05
             1        2.0       0.0      200.      -.05
  100IMPORT 2        11.0      94.0 -999       .05       .15        0.       0.0       1.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
             1       100.       0.0      200.       0.0
```

Attachment 2--Example Files of Input Data for Streamflow and Water-Quality Simulation--Continued

```
200MAIN 1          11.5      93.0  300      -.40       .20       0.       0.0       1.0
          101     11.00     0.020      100.      -0.05
          101     10.00      .015      100.       -.05
          101      9.00      .010      100.       -.05
          107       .02     2.000      100.       -.05
          106     45.00      .300      150.       -.20
          106     15.00     1.000      150.       -.20
          106      2.00     1.500      150.       -.20
          106     20.00      .500      150.       -.20
          106     15.00      .400      150.       -.20
          101     20.00      .050      100.       -.05
          101     15.00      .040      100.       -.05
          101     12.00      .030      100.       -.05
300MAIN 2          10.5      93.0  400      -.40       .20       0.       0.0       1.0
          101     22.00      .020      200.       -.05
          101     20.00      .015      200.       -.05
          101     18.00      .010      200.       -.05
          107       .04     2.000      200.       -.05
          106     90.00      .300      300.       -.20
          106     30.00     1.000      300.       -.20
          106      4.00     1.500      300.       -.20
          106     40.00      .500      300.       -.20
          106     30.00      .400      300.       -.20
          101     40.00      .050      200.       -.05
          101     30.00      .040      200.       -.05
          101     24.00      .030      200.       -.05
400MAIN 3          10.0      93.0  600      -.40       .20       0.       0.0       1.0
          101    12.000      .020      400.       -.05
          101     7.000      .015      400.       -.05
          101     6.000      .010      400.       -.05
          107      .030     2.000      400.       -.05
          106    60.000      .300      600.       -.20
          106    15.000     1.000      600.       -.20
          106     2.000     1.500      600.       -.20
          106    24.000      .500      600.       -.20
          106    40.000      .400      600.       -.20
          101    20.000      .050      400.       -.05
          101    22.000      .040      400.       -.05
          101    18.000      .030      400.       -.05
```

Attachment 2--Example Files of Input Data for Streamflow and Water-Quality Simulation--Continued

```
450TRIB 1A        11.0      92.0  500      -.40       .20        0.        0.0       1.0
        101      11.00      .020      200.      -.05
        101      10.00      .015      200.      -.05
        101       9.00      .010      200.      -.05
        107        .02     2.000      200.      -.05
        106      45.00      .300      300.      -.20
        106      15.00     1.000      300.      -.20
        106       2.00     1.500      300.      -.20
        106      20.00      .500      300.      -.20
        106      15.00      .400      300.      -.20
        101      20.00      .050      200.      -.05
        101      15.00      .040      200.      -.05
        101      12.00      .030      200.      -.05
500TRIB 1B        10.5      92.0  600      -.40       .20        0.        0.0       1.0
        101      5.000      .020      400.      -.05
        101      5.000      .015      400.      -.05
        101      4.000      .010      400.      -.05
        107       .005     2.000      400.      -.05
        106     10.000      .300      600.      -.20
        106      2.500     1.000      600.      -.20
        106       .300     1.500      600.      -.20
        106      4.000      .500      600.      -.20
        106      3.000      .400      600.      -.20
        101      8.000      .050      400.      -.05
        101      6.000      .040      400.      -.05
        101      6.000      .030      400.      -.05
600MAIN 4         10.0      92.0  800      -.25      -.30        0.        0.0       1.0
          2         0.       30.     2000.      -.30
          2         0.       30.     2000.      -.30
          2         0.       30.     2000.      -.30
          2         0.       30.     2000.      -.30
          2         0.       30.     1500.      -.30
          2         0.       30.     1500.      -.30
          2         0.       30.     1500.      -.30
          2         0.       30.     1500.      -.30
          2         0.       30.     1500.      -.30
          2         0.       30.     2000.      -.30
          2         0.       30.     2000.      -.30
          2         0.       30.     2000.      -.30
```

Attachment 2--Example Files of Input Data for Streamflow and Water-Quality Simulation--Continued

```
650TRIB 2A          9.0      91.0  700      -.40       .20        0.        0.0       1.0
          101    20.000      .020      600.      -.05
          101    20.000      .015      600.      -.05
          101    16.000      .010      600.      -.05
          107      .020     2.000      600.      -.05
          106    40.000      .300      900.      -.20
          106    10.000     1.000      900.      -.20
          106     1.200     1.500      900.      -.20
          106    16.000      .500      900.      -.20
          106    12.000      .400      900.      -.20
          101    32.000      .050      600.      -.05
          101    24.000      .040      600.      -.05
          101    24.000      .030      600.      -.05
700TRIB 2B          9.5      91.0  800      -.40       .20        0.        0.0       1.0
            3       -5.       30.     3000.      -.30
            3       -5.       30.     3000.      -.30
            3       -5.       30.     3000.      -.30
            3      -10.       30.     3000.      -.30
            3      -10.       30.     2500.      -.30
            3      -10.       30.     2500.      -.30
            3      -10.       30.     2500.      -.30
            3      -10.       30.     2500.      -.30
            3      -10.       30.     2500.      -.30
            3       -5.       30.     3000.      -.30
            3       -5.       30.     3000.      -.30
            3       -5.       30.     3000.      -.30
800MAIN 5          10.0      91.0  850      -.30       .20        0.        0.0       1.0
            4        5.        5.     4000.      -.30
            4        5.       10.     4000.      -.30
            4        5.       10.     4000.      -.30
            4        5.       10.     4000.      -.30
            4       -5.       10.     3000.      -.30
            4       -5.       10.     3000.      -.30
            4       -5.       10.     3000.      -.30
            4       -5.       10.     3000.      -.30
            4       -5.       10.     3000.      -.30
            4        5.       10.     4000.      -.30
            4        5.       10.     4000.      -.30
            4        5.       10.     4000.      -.30
```

Attachment 2--Example Files of Input Data for Streamflow and Water-Quality Simulation--Continued

```
850RES 1          10.0      90.5  900      -.20      -.30       0.       0.0       1.0
          5        2.5       2.5     3000.      -.30
          5        2.5       5.0     3000.      -.30
          5        2.5       5.0     3000.      -.30
          5       -2.5       5.0     3000.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     3000.      -.30
          5        2.5       2.5     3000.      -.30
          5        2.5       2.5     3000.      -.30
900MAIN 6         10.0      90.0 -999      -.20      -.30       0.       0.0       1.0
          5        2.5       2.5     3000.      -.30
          5        2.5       5.0     3000.      -.30
          5        2.5       5.0     3000.      -.30
          5       -2.5       5.0     3000.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     2500.      -.30
          5       -2.5       5.0     3000.      -.30
          5        2.5       2.5     3000.      -.30
          5        2.5       2.5     3000.      -.30
```

The digitized network file is:

```
   94.5      89.5       8.5      12.0       -1.        .8
   94.3      10.0      93.8       8.7      92.3       8.7      91.8      10.6      90.6      10.2
  1  11.80  93.00  10.00  93.00  10.00  90.60   9.95  90.50   9.95  90.40
  2  10.05  90.40  10.05  90.50  10.00  90.60  10.05  90.50  10.05  90.40
  3  10.00  90.40  10.00  90.00  10.00  90.00  10.00  90.00  10.00  90.00
  1  11.30  92.00  10.00  92.00  10.00  92.00  10.00  92.00  10.00  92.00
  1   8.70  91.00  10.00  91.00  10.00  91.00  10.00  91.00  10.00  91.00
 -1
```

The independent variable file is:

Independent variables for sample basin to demonstrate model

120	7	RAIN 1	RAIN 2	RAIN 3	RAIN 4	RAIN 5	SNOWPK	AIR TP
	1.72	0.72	0.86	0.46	0.87	-99.00	36.61	
	1.32	0.66	2.48	0.33	0.34	7.20	38.89	
	1.87	0.36	1.96	1.41	1.73	9.80	46.10	
	2.47	1.54	2.89	1.82	0.01	13.10	50.40	
	4.44	1.76	2.60	3.03	3.22	13.10	60.60	
	1.68	0.39	0.02	1.32	1.74	13.10	71.40	
	3.43	1.01	1.47	0.79	1.94	13.10	76.80	
	2.22	0.82	0.66	2.32	1.33	13.10	71.70	
	5.04	1.96	2.40	1.73	2.05	13.10	67.60	
	0.72	0.36	0.18	0.10	0.02	-99.00	59.00	
	0.86	0.90	2.78	0.81	0.38	-99.00	42.00	
	0.62	0.42	0.90	0.14	0.30	-99.00	39.00	
	0.82	0.34	0.63	0.68	0.65	-99.00	36.70	
	0.63	0.26	0.50	0.10	0.10	7.30	39.80	
	2.42	1.69	3.39	1.25	0.94	9.20	40.50	
	4.40	0.91	3.37	1.09	2.19	14.10	49.70	
	4.52	1.74	2.48	2.76	2.53	14.10	62.60	
	5.51	2.83	1.90	1.77	1.82	14.10	68.60	
	3.64	2.06	2.47	3.48	4.02	14.10	74.20	
	4.10	3.28	1.21	2.47	1.98	14.10	73.60	
	2.21	1.72	5.20	4.87	4.42	14.10	65.20	
	5.09	2.56	4.01	2.27	2.70	-99.00	55.00	
	0.40	0.23	0.17	0.14	0.19	-99.00	48.80	
	0.90	0.47	0.81	0.31	0.53	-99.00	40.70	
	0.70	0.11	0.33	0.08	0.15	-99.00	36.20	
	1.02	0.45	1.27	0.43	0.80	8.50	33.40	
	2.61	0.89	2.49	0.61	0.41	12.40	43.60	
	11.70	6.17	7.85	3.56	3.87	15.60	54.80	
	1.28	0.92	0.47	0.28	0.08	15.60	62.20	
	2.83	2.88	0.63	4.34	5.30	15.60	70.10	
	2.74	1.10	0.87	1.13	0.72	15.60	76.00	
	3.89	1.58	1.60	2.89	3.78	15.60	74.40	
	2.55	1.76	1.97	1.87	0.56	15.60	66.00	
	3.95	1.94	1.03	2.71	4.44	-99.00	55.90	
	0.18	0.07	0.10	0.03	0.06	-99.00	50.20	
	0.62	0.49	1.29	1.09	0.71	-99.00	42.20	
	0.35	0.26	0.61	0.34	0.18	-99.00	39.20	

0.68	0.46	0.80	0.11	0.02	11.20	46.30
1.52	0.23	1.43	0.26	0.24	16.00	42.40
2.64	0.56	1.85	0.73	1.17	21.40	59.60
2.94	3.18	2.60	1.42	1.51	21.40	58.60
1.48	0.50	0.32	0.75	1.44	21.40	71.00
4.44	0.98	0.24	1.66	2.34	21.40	77.50
6.54	1.20	2.59	1.02	1.75	21.40	76.70
0.43	0.61	0.18	0.09	0.08	21.40	66.00
0.35	0.17	0.03	0.31	0.48	-99.00	55.40
1.04	0.35	0.26	0.06	0.11	-99.00	45.80
0.78	0.62	1.63	1.05	0.77	-99.00	38.40
0.82	0.32	1.52	1.60	1.35	-99.00	38.20
0.47	0.09	0.11	0.11	0.40	6.10	38.50
2.58	1.36	1.47	1.18	0.79	9.20	41.20
8.33	2.47	4.09	3.51	5.71	14.40	46.40
3.45	1.90	2.23	5.63	7.38	14.40	62.20
1.37	0.34	0.55	0.45	0.40	14.40	69.20
5.77	2.91	1.32	3.03	2.88	14.40	74.20
1.76	1.31	0.48	2.99	0.69	14.40	75.30
0.40	0.20	0.01	0.04	0.16	14.40	66.20
0.61	0.32	0.61	1.33	1.00	-99.00	57.60
0.30	0.19	0.38	0.46	0.61	-99.00	45.20
0.27	0.03	0.85	0.44	0.57	-99.00	40.00
0.62	0.88	0.46	1.30	1.40	-99.00	38.40
1.38	0.53	0.71	0.30	0.41	6.80	39.60
0.86	0.57	0.78	0.06	0.06	10.40	48.20
4.15	1.53	1.89	0.92	1.42	15.80	48.20
2.75	0.91	1.22	0.73	0.87	15.80	62.60
1.44	1.54	0.83	1.26	2.09	15.80	65.40
5.60	3.57	1.87	1.98	2.60	15.80	73.80
5.76	3.93	1.60	4.03	4.54	15.80	74.20
0.78	0.36	1.65	0.74	1.90	15.80	66.00
1.30	1.30	1.49	0.35	0.21	-99.00	59.20
0.24	0.09	0.20	0.09	0.09	-99.00	47.10
1.08	0.36	0.33	0.28	0.10	-99.00	34.50
1.50	0.32	0.62	0.47	0.25	-99.00	37.50
0.50	0.12	0.40	0.62	0.72	11.50	41.20
0.70	0.45	1.81	1.20	1.40	13.30	48.00
1.98	2.82	1.20	0.24	1.65	18.60	58.60
2.62	1.34	0.98	2.18	5.18	18.60	56.30
0.75	0.23	0.01	1.77	1.91	18.60	72.20
3.70	0.95	4.34	0.48	0.85	18.60	75.80

7.39	5.37	2.96	2.96	4.11	18.60	72.80
0.91	0.13	0.12	0.06	0.69	18.60	67.20
0.93	0.69	1.05	1.07	2.42	-99.00	53.40
0.84	2.04	3.04	3.06	5.31	-99.00	40.00
0.01	0.09	0.10	0.01	0.02	-99.00	42.20
0.58	0.26	0.61	0.10	0.22	-99.00	36.20
0.65	0.79	0.73	0.28	0.46	11.20	36.10
1.77	0.62	1.20	0.92	1.52	17.40	40.20
2.31	1.25	1.90	0.85	1.75	25.50	50.30
9.27	1.64	3.61	3.85	3.54	25.50	61.10
5.97	3.48	1.90	2.32	0.91	25.50	68.20
5.12	1.24	1.94	0.56	1.78	25.50	75.60
6.00	1.01	1.72	1.35	0.86	25.50	75.30
2.23	0.45	0.23	0.10	0.31	25.50	69.80
2.30	2.10	0.71	0.07	0.55	-99.00	59.40
0.86	0.42	0.23	0.10	0.01	-99.00	38.70
0.64	0.55	0.69	0.81	0.67	-99.00	38.80
1.59	1.45	2.62	0.82	0.39	-99.00	34.00
1.39	0.58	1.32	0.70	0.37	9.60	32.70
1.94	1.32	2.39	1.86	1.10	13.80	36.20
2.35	1.32	1.87	0.22	0.13	18.10	54.00
2.83	2.02	1.50	1.30	1.70	18.10	61.80
2.20	2.44	1.33	2.70	2.40	18.10	67.90
1.85	0.51	0.29	2.33	1.42	18.10	74.60
2.66	3.01	2.30	1.29	3.16	18.10	73.60
0.08	0.17	0.19	0.17	1.22	18.10	64.50
0.33	0.01	0.10	0.01	0.04	-99.00	56.10
0.50	0.01	0.20	0.06	0.29	-99.00	42.00
0.29	0.25	0.18	0.01	0.26	-99.00	37.00
0.83	0.27	0.97	0.83	0.53	-99.00	26.60
1.22	0.17	0.02	0.11	0.06	10.50	36.40
1.66	0.79	1.94	0.64	1.11	13.40	43.50
1.88	0.93	1.91	1.02	1.63	17.70	52.60
2.88	3.32	3.77	1.63	2.73	17.70	59.90
3.73	3.12	2.95	1.96	7.54	17.70	67.10
4.84	1.97	1.35	1.75	2.78	17.70	75.10
2.99	0.42	0.59	0.88	3.16	17.70	73.50
0.97	0.38	0.31	0.01	1.16	17.70	66.30
1.52	1.41	1.28	0.83	0.86	-99.00	53.90
0.11	0.00	0.40	0.01	0.01	-99.00	53.90
0.02	0.00	0.04	0.02	0.01	-99.00	37.70

Attachment 3--Data Instructions for Water-Supply Operations Simulation

Three additional data sets must be prepared prior to using the model for water-use simulation:

Additional basin descriptions of the modeled area (logical unit 53); a description of the water-supply operations (logical unit 50); and a prioritized list of water rights (logical unit 51).

Record	Columns	Name	Description
The format for the additional basin-description file is:			
1	1- 80	TITLEM	A title
2	9- 14	PET	Monthly potential evapotranspiration, in feet, one for each of the 12 months, beginning in January
	15- 20	PET	
	21- 26	PET	
	27- 32	PET	
	33- 38	PET	
	39- 44	PET	
	45- 50	PET	
	51- 56	PET	
	57- 62	PET	
	63- 68	PET	
	69- 74	PET	
	75- 80	PET	
3	9- 14	EVAP	Monthly lake evaporation, in feet, one for each of the 12 months, beginning in January
	15- 20	EVAP	
	21- 26	EVAP	
	27- 32	EVAP	
	33- 38	EVAP	
	39- 44	EVAP	
	45- 50	EVAP	
	51- 56	EVAP	
	57- 62	EVAP	
	63- 68	EVAP	
	69- 74	EVAP	
	75- 80	EVAP	
4	9- 14	AGDMND	Monthly agricultural irrigation demand, in feet, one for each of the 12 months, beginning in January
	15- 20	AGDMND	
	21- 26	AGDMND	
	27- 32	AGDMND	
	33- 38	AGDMND	
	39- 44	AGDMND	
	45- 50	AGDMND	
	51- 56	AGDMND	
	57- 62	AGDMND	
	63- 68	AGDMND	
	69- 74	AGDMND	
	75- 80	AGDMND	

Attachment 3--Data Instructions for Water-Supply Operations Simulation--Continued

Record	Columns	Name	Description
Format for the additional basin-description file--Continued			
5	9- 14	SESNAL	Monthly instream demand, in feet, one for each of the 12 months, beginning in January
	15- 20	SESNAL	
	21- 26	SESNAL	
	27- 32	SESNAL	
	33- 38	SESNAL	
	39- 44	SESNAL	
	45- 50	SESNAL	
	51- 56	SESNAL	
	57- 62	SESNAL	
	63- 68	SESNAL	
	69- 74	SESNAL	
	75- 80	SESNAL	
6	9- 14	STCOEF	Basinwide aquifer storage coefficient (dimensionless)
	15- 20	TRANS	Basinwide aquifer transmissivity, in feet squared per day
7	9- 14	DRINK	Average municipal water demand, in acre-feet per unit
8	9- 14	CNVLAT	Factor to convert latitude, in degrees, to miles
	15- 20	CVLONG	Factor to convert longitude, in degrees, to miles
	21- 26	SNUOS1	Sinuosity factor to compute river miles east of SNLAT1
	27- 32	SNUOS2	Sinuosity factor to compute river miles between SNLAT1 and SNLAT2
	33- 38	SNUOS3	Sinuosity factor to compute river miles west of SNLAT2
	39- 44	SNLAT1	Latitude divider, in decimal degrees
	45- 50	SNLAT2	Latitude divider, in decimal degrees
	51- 56	PREFAC	Prestress factor to scale the initialization of return flows
	57- 62	SEEPFC	Canal leakage factor, in acre-feet per mile
	63- 68	PRSPFC	Limit of effective monthly precipitation, in feet
	69- 74	TAILFC	Percentage of tail water that goes through the ground-water system (ranges from 0.0 to 1.0)
9	1- 5	NRES	The number of reservoirs (maximum of 25)
NOTE -- record 10 is entered as a set, one for each NRES			
10	1- 5	RESID	A reservoir ID number
	6- 13	RESNAM	A reservoir name
	16- 25	CAPMAX	Maximum capacity of reservoir, in acre-feet
	26- 35	NACTIV	Inactive capacity of reservoir, in acre-feet
	36- 45	AREAMX	Surface area, in acres, at maximum capacity
	46- 55	RSXLOC	Longitude, in decimal degrees
	56- 65	RSYLOC	Latitude, in decimal degrees For on-channel reservoirs, RSXLOC and RSYLOC must correspond exactly to the XLOC and YLOC of a node
	66- 75	RESSTR	Initial reservoir contents, in acre-feet
	76- 85	RSCONC	Initial water-quality concentration, in milligrams per liter
	86- 90	RSXPLT	Plotting offset from the reservoir symbol, in inches
	91- 95	RSYPLT	Plotting offset from the reservoir symbol, in inches

Record	Columns	Name	Description
Format for the additional basin-description file--Continued			
NOTE -- record 11 is entered as a set, one for each NNODE			
11	9- 14	GWSTOR	Initial ground-water storage above node on side 1, in acre-feet
	15- 20	GWCONC	Initial water-quality concentration above node on side 1, in milligrams per liter
	21- 26	GWSTOR	Initial ground-water storage above node on side 2, in acre-feet
	27- 32	GWCONC	Initial water-quality concentration above node on side 2, in milligrams per liter
The format for the water-supply operations file is:			
1	1- 80	TITLEU	A title
2	1- 5	NUSERS	The number of water users (maximum of 100)
NOTE -- records 3, 4, 5, and 6 are entered as a set, one for each NUSERS			
3	1- 5	USERID	A water user ID number
	6- 13	USRNAM	A water user name
	16- 20	USRTYP	The type of water user 1 = agricultural 2 = municipal 3 = industrial 4 = in stream 5 = reservoir operator
	21- 30	NUMUSR	The quantity served by the water user If type 1, then the units are irrigated acres If type 2, then the units are populace units If type 3, then the units are units produced If type 4, then the units are actual water needed, in acre-feet If type 5, then the units are reservoir capacity available to the user, in acre-feet
	31- 40	DMDFAC	Factor to compute a water user's demand for water If value is positive, multiply by PET, If value is negative, multiply by AGDMND.
	41- 50	XLOCU	Longitude, in decimal degrees
	51- 60	YLOCU	Latitude, in decimal degrees For reservoir operators, XLOCU and YLOCU must correspond exactly to the RSXLOC and RSYLOC of a reservoir
	61- 65	USXPLT	Plotting offset from the water user symbol, in inches
	66- 70	USYPLT	Plotting offset from the water user symbol, in inches
	71- 75	IPRECP	Number indicating which of the independent variables represents the appropriate precipitation data for the water user.

Record	Columns	Name	Description
Format for the water-supply operations file--Continued			
	76- 80	IAKNT	Reservoir subaccout number appropriate for this water user
4	16- 20	NSOURC	Number of sources available to a water user (maximum of 15)
	21- 25	RFTYPE	Type of return flow 1 - a percentage of initially computed return flow becomes deep perocolation (rest is tail water) 2 - a percentage of total application becomes tail water (rest is lost from basin) 3 - a percentage of total application becomes deep percolation (rest is lost from basin) 4 - a percentage of initially computed return flow becomes tail water (rest is lost from basin) 5 - a percentage of initially computed return flow becomes deep percolation (rest is lost from basin)
	26- 35	RFVAL	Return flow percentage
	36- 45	RFXLOC	Longitude, in decimal degrees
	46- 55	RFYLOC	Latitude, in decimal degrees
	56- 65	RFDST	Distance from point of deep percolation to stream, in feet. (if 0., the program computes this value using location)
NOTE -- record 5 is repeated NSOURC times			
5	1- 5	ICODE	Type of water source 1 = direct diversion 2 = ground-water pumpage 3 = reservoir release (if reservoir releases directly to the water user rather than using the river as a conduit, enter -3) 4 = direct pipeline or tunnel importation 5 = storage diversion 6 = direct diversion used for reservoir storage
	6- 15	QUANTY	The quantity available from the source If type 1, then the legal right, in cubic feet per second If type 2, then the pumping capacity, in cubic feet per second If type 3, then the capacity of the reservoir allocated to this water user, in acre-feet (if the reservoir is a 'general-use', 'bank-account' type storage, enter the percentage allocated to this user as a negative) If type 4, then the pipeline or tunnel carrying capacity, in acre-feet If type 5, then the legal right, in acre-feet If type 6, then the legal right, in cubic feet per second

Record	Columns	Name	Description
Format for the water-supply operations file--Continued			
	16- 25	SCXLOC	Longitude, in decimal degrees
	26- 35	SCYLOC	Latitude, in decimal degrees
	36- 45	GWDST	The distance from point of pumpage to stream, in feet. If 0., the program computes this value using location.
	46- 50	NMRES	The ID number of the appropriate reservoir (RESID)
	51- 55	IACCNT	Subaccount number to identify portion of a reservoir allocated to this water user (if 0, set to 1)
	56- 60	ITIMFC	Code to indicate whether the source is available every month (if 0, it is; if 1, read TIMFAC)
NOTE -- record 6 is read only when ITIMFC is nonzero			
6	6- 10	TIMFAC	Percentage indicating how much of the source is active in each of the 12 months, beginning in January. A value of 1. indicates fully active, a value of 0. indicates the source is inactive during that particular month.
	11- 15	TIMFAC	
	16- 20	TIMFAC	
	21- 25	TIMFAC	
	26- 30	TIMFAC	
	31- 35	TIMFAC	
	36- 40	TIMFAC	
	41- 45	TIMFAC	
	46- 50	TIMFAC	
	51- 55	TIMFAC	
	56- 60	TIMFAC	
	61- 65	TIMFAC	
The format for the water rights file is:			
1	1- 80	TITLER	A title
2	1- 5	NRIGHT	The number of water rights (maximum of 200)
NOTE -- record 3 is repeated NRIGHT times			
3	1- 5	OWNER	The water user ID (USERID) who owns the right
	6- 13	NAME	The water user name (USRNAM) who owns the right
	16- 23	DATE	The date of the water right
	24- 33	AMNT	The amount of the water right (QUANTY), in cubic feet per second for direct diversions, and in acre-feet for storage diversions.
NOTE -- all of the record 3's must be ordered by DATE.			

Attachment 4--Example Files of Input Data for Water-Supply Operations Simulation

Three additional data sets must be prepared prior to using the model for water-supply operations simulation:

Additional basin descriptions of the modeled area (logical unit 53);
a description of the water-supply operations (logical unit 50); and
a prioritized list of water rights (logical unit 51).

The additional basin-description file is:

```
Sample basin to demonstrate model
PET       0.00  0.00  0.00  0.10  0.30  0.50  0.70  0.60  0.50  0.25  0.00  0.00
EVAP      0.00  0.00  0.00  0.75  0.95  1.00  1.10  0.85  0.60  0.50  0.10  0.00
AGDMND    0.05  0.05  0.05  0.20  0.40  0.55  0.75  0.65  0.55  0.40  0.20  0.10
SESNAL    0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
AQUIFER    0.2 10000
DRINK      .50
CONV FAC69.04853.310   1.4   1.6   1.2  91.1  92.5   1.3  60.3   1.0   0.0
     3
  250LAKE 1        50000.     5000.      500.      93.2      10.7    10000.      170.  .10  .15
  625LAKE 2        50000.        0.     2000.      91.5      10.2        0.        0. -.05 -.10
  850RES 1        200000.        0.    10000.      90.5      10.0        0.        0.  .15 -.20
GW01        0.    0.    0.    0.
GW02        0.    0.    0.    0.
GW03        0.    0.    0.    0.
GW04     1000.  200.  500.  200.
GW05     2000.  200. 1000.  200.
GW06        0.    0.    0.    0.
GW07        0.    0.  500.  300.
GW08    20000.  400.10000.  400.
GW09        0.    0.    0.    0.
GW10        0.    0.80000.  500.
GW11    100000  500.100000  500.
GW12    100000  600.50000.  600.
GW13    100000 1000.50000. 1000.
```

The water-supply operations file is:

```
Sample users for sample basin to demonstrate model
  14
 2000DITCH 1        1      500.        2.0     92.98     11.17-0.05-0.05    1
                    1    1       1.0     92.98     11.17      800.
   1      8.00      93.00     11.20
 4000INDUSTAL       3     2000.        1.5     92.20      9.60 0.21-0.20
                    6    2       0.7     91.95      9.90
   1      5.00      92.80     10.00
   1     50.00      92.80     10.00
   1     20.00      92.80     10.00
   1      5.00      92.80     10.00
   1    150.00      92.80     10.00
   1      0.        92.25      9.64
 5000MUNICIPL       2     1000.        2.0     92.10     10.10 0.25 0.10
                    5    2       0.5     92.05     10.05     4000.
   1      2.00      92.30     10.00
   1      1.00      92.30     10.00
   1      5.00      92.30     10.00
   1     50.00      92.30     10.00
   1      0.        92.15     10.07
 2400DITCH 5        1      500.        2.0     91.98     10.88-0.05 0.05    1
                    1    1       1.0     91.99     10.70     3000.
   1      7.00      92.00     10.90
 2500DITCH 6        1    10000.       -2.0     91.60     10.30 0.25 0.10    2
                    3    1       0.5     91.55     10.05     4000.
   1      500.      91.90     10.00
   2       40.      91.60     10.10     5000.
  -3    20000.      91.50     10.20            625
 2600DITCH 7        1    10000.        2.0     91.40      9.40 0.05-0.20    2
                    4    1       0.8     91.02      9.65
   1      100.      91.70     10.00
   1      400.      91.70     10.00
   3    20000.      91.70     10.00            250
   2       40.      91.15      9.45
```

```
2700DITCH 8        1    15000.       3.5     91.10     10.30-0.05 0.10    3
                   2    1       0.7     90.90     10.10     5000.
   1       200.     91.40     10.00
   2        10.     90.95     10.05     2000.
2900DITCH 10       1    40000.      -1.5     90.60     10.50-0.10 0.10    4
                   4    5       0.8     90.40     10.20
   1       150.     90.80     10.00
   1       500.     90.80     10.00
   1       200.     90.80     10.00
   2       100.     90.45     10.10
3000DITCH 11       1    15000.       1.5     90.10      9.60-0.05-0.10    5
                   4    1       0.8     90.05      9.90     6000.
   3       -.40     90.30     10.00            850
   1     300.00     90.30     10.00
   1     500.00     90.30     10.00
   2      40.00     90.10      9.85     8000.
3100DITCH 12       1    12500.      -1.6     89.90     10.00-0.10 0.10
                   3    2        0.     89.90     10.00        1.
   3    2000.00     89.90     10.00            850    2
   3       -.60     89.90     10.00            850
   6     200.00     89.90     10.00            850    2    1
      0.   0.   0.   1.   1.   1.   1.   1.   1.   1.   1.   0.
 250LAKE 1         5    50000.       1.0     93.20     10.70 0.10 0.15
                   1    2        0.
   4    20000.     94.00     11.50
 625LAKE 2         5    20000.       1.0     91.50     10.20-0.05-0.10
                   1    2        0.
   5    20000.     91.90     10.00
 850RES 1          5   180000.       0.1     90.50     10.00 0.15-0.20
                   1    2        0.
   5   150000.     90.50     10.00
 851RES 1(A)       5    20000.       1.0     90.50     10.00 0.15-0.35          2
                   0    2        0.
```

The format for the water rights file is:

Sample users for sample basin to demonstrate model

```
   23
 5000MUNICIPL              2.00
 4000INDUSTAL              5.00
 5000MUNICIPL              1.00
 2700DITCH 8             200.00
 5000MUNICIPL              5.00
 4000INDUSTAL             50.00
 2000DITCH 1               8.00
 4000INDUSTAL             20.00
 2400DITCH 5               7.00
 4000INDUSTAL              5.00
 5000MUNICIPL             50.00
 4000INDUSTAL            150.00
 2900DITCH 10            150.00
 2600DITCH 7             100.00
 2900DITCH 10            500.00
 3000DITCH 11            300.00
 3100DITCH 12            200.00
 2900DITCH 10            200.00
 3000DITCH 11            500.00
 2500DITCH 6             500.00
 2600DITCH 7             400.00
  625LAKE 2            20000.00 AF
  850RES 1            150000.00 AF
```

Attachment 5--Definition of Commoned Variables in Subroutines for Streamflow and Water-Quality Simulation

[Variables preceeded by a * are read by the model]

UNLABELED COMMON

*IBATCH	- Indicator of whether job is being run interactive or batch.
*IGRAPH	- Code for type of graphics terminal.
IMONTH	- Counter for the month number.
IN	- Logical unit number for input.
IOUT	- Logical unit number for output.
*IPRINT	- Indicator of whether monthly output should be printed interactively.
*IQW	- Indicator of whether to use time-weighted or discharge-weighted water-quality statistics.
IYEAR	- Counter for the year number.
JMONTH	- Counter for the month of the year.
*NINDV	- Number of independent variables in input file.
*NMONTH	- Number of months of independent variables in input file.

HYDROG

*IHY (5)	- Node ID of those nodes for which hydrograph will be plotted.
QHY (400,5)	- Time series of stream discharge to be plotted.
QWHY (400,5)	- Time series of water-quality concentration to be plotted.
QWLHY (400,5)	- Time series of water-quality load to be plotted.

NAMES

*TITL	- Title of simulation.

NTWRK

*XHY (5)	- X-coordinate for the location of small hydrograph on the schematic.
XINC	- X-axis tick mark increment on schematic.
*XLENG	- Horizontal length of small hydrograph on schematic.
*XMAX	- Maximum x-coordinate for edge of schematic.
*XMIN	- Minimum x-coordinate for edge of schematic.
*YHY (5)	- Y-coordinate for the location of small hydrograph on the schematic.
YINC	- Y-axis tick mark increment on schematic.
*YLENG	- Vertical length of small hydrograph on schematic.
*YMAX	- Maximum y-coordinate for edge of schematic.
*YMIN	- Minimum y-coordinate for edge of schematic.

Attachment 5--Definition of Commoned Variables in Subroutines for Streamflow and Water-Quality Simulation--Continued

REACHS

*CONCFC (100)	- Concentration factor used to route loads when a reach loses water.
*DSA (100)	- intercept in the regression to convert specific conductance to dissolved solids
*DSB (100)	- slope in the regression to convert specific conductance to dissolved solids
*INDEPV (100,12)	- Monthly number indicating which independent variable to be used to compute stream discharge.
*NNODE	- Number of stream nodes.
*NODEID (100)	- Node ID.
NODEUS (100)	- Node number of the main channel upstream node.
*NTRCPT (100,12)	- Monthly intercept in the regression equation used to compute stream discharge.
*NXTNOD (100)	- Node number of the downstream node.
*PLTX (100)	- Horizontal distance to offset number from symbol at node plotting position.
*PLTY (100)	- Vertical distance to offset number from symbol at node plotting position.
Q (100)	- Stream discharge.
QSUBA (100)	- Incremental (internode) stream discharge.
QW (100)	- Water-quality concentration.
*QWA (100,12)	- Monthly intercept in the regression equation used to compute water-quality concentration.
*QWB (100,12)	- Monthly slope in the regression equation used to compute water-quality concentration.
QWSUBA (100)	- Incremental (internode) water-quality concentration.
*SLOPE (100,12)	- Monthly slope in the regression equation used to compute stream discharge.
*XLOC (100)	- X-coordinate location.
*YLOC (100)	- Y-coordinate location.

REACH1

*NODNAM (100)	- 8-character node name.

SCHMTK

AQ (100)	- Annual average stream discharge.
AQW (100)	- Annual average water-quality concentration.
AXN (100)	- number of months in year
*ISKM	- Code for frequency of plotting streamflow schematic.
PORQ (100)	- Period-of-simulation average stream discharge.
PORQW (100)	- Period-of-simulation average water-quality concentration.
PORXN (100)	- number of months in period-of-simulation
*QHYMAX (5)	- Maximum stream discharge associated with horizontial length of small hydrograph on the schematic.

Attachment 5--Definition of Commoned Variables in Subroutines for Streamflow and Water-Quality Simulation--Continued

SCLFAC

*QMAX	- Maximum stream discharge associated with symbol size on the schematic
*QWL1	- Water-quality concentration class limit.
*QWL2	- Water-quality concentration class limit.
*QWL3	- Water-quality concentration class limit.

STATS

*ISS (10)	- Node ID of those nodes for which statistical summaries will be printed.
QMEAN (10,12)	- Monthly mean stream dsicharge.
QSD (10,12)	- Monthly standard deviation of stream discharge.
QWLMN (10,12)	- Monthly mean water-quality load.
QWLSD (10,12)	- Monthly standard deviation of water-quality load.
QWMEAN (10,12)	- Monthly mean water-quality concentration.
QWSD (10,12)	- Monthly standard deviation of water-quality concentration.
XNN (10,12)	- Number of months with data.

TABLES

IQTBL (5,400)	- Time series of stream discharge to be printed.
IQWLTB (5,400)	- Time series of water-quality loads to be printed.
IQWTBL (5,400)	- Time series of water-quality concentration to be printed.
*ITBL (5)	- Node ID of those nodes for which tables will be printed.

Attachment 6--Definition of Commoned Variables in Subroutines for Water-Supply Operations Simulation

[Variables preceeded by a * are read by the model]

DEMND

```
*DMDFAC (100)      - factor to compute water want
*ICODE (100,15)    - type of water source
                       1 = Direct diversion
                       2 = Ground-water pumpage
                       3 = Reservoir release
                       4 = Direct pipeline importation
                       5 = Storage diversion
 ISIDRF (100)      - side of the river the return flow occurs
 NEED (100)        - the consumptive use requirement of the user
 NODERF (100)      - node number where return flow enters the river
 NODESC (100,15)   - node number of the source of water
*NSOURC (100)      - number of sources available to user
*NUMUSR (100)      - quantity served by the user
                     if type 1, then irrigated acres
                     if type 2, then populace
                     if type 3, then units produced
                     if type 4, then water needed
                     if type 5, then reservoir capacity
*NUSERS            - the number of users
*QUANTY (100,15)   - quantity available from source
                     if type 1, then legal right
                     if type 2, then pumping capacity
                     if type 3, then reservoir capacity
                     if type 4, then physical capacity
                     if type 5, then legal right
 RFDIST (100)      - return flow distance used in response function
*RFTYPE (100)      - type of return flow
                     1 = ground-water response function
                     2 = one-month lag function
*RFVAL (100)       - percent of use returned
*RFXLOC (100)      - decimal longitude of the return flow
*RFYLOC (100)      - decimal latitude of the return flow
*SCXLOC (100,15)   - decimal longitude of the source
*SCYLOC (100,15)   - decimal latitude of the source
*USERID (100)      - a user ID number
*USRTYP (100)      - type of user
                     1 = agricultural
                     2 = muncipal
                     3 = industrial
                     4 = in stream
                     5 = reservoir operator
*USXPLT (100)      - plotting offset from user symbol
*USYPLT (100)      - plotting offset from user symbol
 WANT (100)        - computed user's water demand
*XLOCU (100)       - decimal longitude of the water user
*YLOCU (100)       - decimal latitude of the water user
```

DEMND1

*USRNAM (100)	- an 8 character user name

GW

*GWCONC (100)	- concentration of ground water in node reach
*GWSTOR (100)	- quantity of water in ground-water storage in node reach
RTRNFL (100)	- quantity of ground-water entering river that month in node reach

GWUSE

GWDIST (100)	- pumpage distance used in response function
GWPUMP (100)	- quantity of pumpage for the pumpage source
GWSOUR (100)	- source number of the pumpage source
GWUSER (100)	- user number of the pumpage source
ISDPMP (100)	- side of the river the pumpage occurs
MGW	- number of pumpage sources

HYDGRG

GWHYC (500,5)	- time series of ground-water concentration to be plotted
GWHYRF (500,5)	- time series of ground-water return flows to be plotted
GWHYS (500,5)	- time series of ground-water storage to be plotted
*IHYGW (5)	- code for node ID and side for which hydrographs will be plotted

HYDGRR

*IHYR (5)	- reservoir ID of those reservoirs for which hydrographs will be plotted
RHYC (500,5)	- time series of reservoir concentration to be plotted
RHYS (500,5)	- time series of reservoir storage contents to be plotted

HYDGRU

*IHYU (5)	- water user ID of those water users for which hydrographs will be plotted
UHYD (400,5)	- time series of direct diversions to be plotted
UHYP (400,5)	- time series of pumpage to be plotted
UHYT (400,5)	- time series of total applications to be plotted

Attachment 6--Definition of Commoned Variables in Subroutines for Water-Supply Operations Simulation--Continued

PHYSIO

*AGDMND (12)	- monthly agricultural irrigation demand values
CANLEN (100)	- length of canals
*CNVLAT	- conversion factor from degrees latitude to miles
*CVLONG	- conversion factor from degrees longitude to miles
*DRINK	- average per person water demand
*EVAP (12)	- monthly lake evaporation values
*PET (12)	- monthly potential evapotranspiration values
*PREFAC	- prestress factor to initialize return flows
*PRSPFC	- maximum rate of effective precipitation
*RAIN (50)	- monthly rain at the rain gages
RMILES (100)	- river miles from downstream end of basin
*SEEPFC	- canal leakage rate
*SESNAL (12)	- monthly instream demand values
*SNLAT1	- latitude designation to distinguish SNUOS1 and SNUOS2
*SNLAT2	- latitude designation to distinguish SNUOS2 and SNUOS3
*SNUOS1	- senuosity factor to determine river length
*SNUOS2	- senuosity factor to determine river length
*SNUOS3	- senuosity factor to determine river length
*STCOEF	- basinwide aquifer storage coefficient
*TRANS	- basinwide aquifer transmissivity
UNIT (5,120)	- unit responses for selected bands of SDF

RESPON

FRSPNZ (100,480,2)	- future ground-water flows to the river

RESUSE

MRES	- number of reservoir sources
NUMRES (100)	- the reservoir number of the reservoir source
RESRL (100)	- quantity of reservoir release of the reservoir source
RESSOR (100)	- source number of the reservoir source
RESUSR (100)	- user number of the reservoir source
TRANSL (100)	- transit loss of the reservoir source

RESVOR

*AREAMX (25)	- surface area at maximum capacity
*CAPMAX (25)	- maximum capacity of reservoir
NODRES (25)	- node where the reservoir releases water to the river
*NRES	- the number of reservoirs
RELEAS (25)	- quantity released from the reservoir
RESCUM (25)	- cumulative volume diverted during a storage year (OCT-SEP)
RESEVP (25)	- reservoir evaopration
*RESID (25)	- a reservoir ID number
*RESSTR (25)	- reservoir storage contents
*RSCONC (25)	- concentration in reservoir
*RSXLOC (25)	- decimal longitude
*RSXPLT (25)	- plotting offset from reservoir symbol
*RSYLOC (25)	- decimal latitude
*RSYPLT (25)	- plotting offset from reservoir symbol

RES1

*RESNAM (25)	- an 8 character reservoir name

RIGHTS

*NRIGHT	- the number of water rights
*OWNER (200)	- user ID number (USERID)

SKMTKU

ACN (100)	- average consumptive use
ADD (100)	- average direct diversions
AGW (100)	- average ground-water pumpage
AIM (100)	- average imports
ANEED (100)	- average water need
APR (100)	- average effective precipitation
ARR (100)	- average reservoir releases
*ISKMGW	- code for frequency of plotting ground-water schematic
*ISKMU	- code for frequency of plotting water-use schematic
*UMAX	- maximum water use associated with symbol size on the schematic

STATR

*ISSR (10)	- reservoir ID of those reservoirs for which statistical summaries will be printed
RMEANC (10,12)	- monthly mean reservoir concentration
RMEAND (10,12)	- monthly mean reservoir diversion inflow
RMEANE (10,12)	- monthly mean reservoir evaporation
RMEANI (10,12)	- monthly mean importation inflow
RMEANL (10,12)	- monthly mean leakage
RMEANR (10,12)	- monthly mean outflow release
RMEANS (10,12)	- monthly mean storage contents

STATU

*ISSU (10)	- water user ID of those water users for which statistical summaries will be printed
UMENC (10,12)	- monthly mean concentration of total applications
UMENCL (10,12)	- monthly mean canal leakage
UMENDD (10,12)	- monthly mean direct diversion
UMENDP (10,12)	- monthly mean deep percolation
UMENGW (10,12)	- monthly mean pumpage
UMENND (10,12)	- monthly mean water need
UMENP (10,12)	- monthly mean effective precipitation
UMENRR (10,12)	- monthly mean reservoir release application
UMENTA (10,12)	- monthly mean total application
UMENTW (10,12)	- monthly mean tail water
UMENWC (10,12)	- monthly mean consumptive use

Attachment 6--Definition of Commoned Variables in Subroutines for Water-Supply Operations Simulation--Continued

TABLEG

IGTBLC (5,500)	- time series of ground-water concentrations
IGTBLR (5,500)	- time series of ground-water return flows
IGTBLS (5,500)	- time series of ground-water storage
*ITBLG (5)	- code for node and side for which tables will be printed

TABLER

IRTBLC (5,500)	- time series of reservoir concentration to be printed
IRTBLS (5,500)	- time series of reservoir storage contents to be printed
*ITBLR (5)	- reservoir ID of those reservoirs for which tables will be printed

TABLEU

*ITBLU (5)	- water user ID of those water users for which tables will be printed
IUTBLD (5,500)	- time series of direct diversions
IUTBLP (5,500)	- time series of pumpage
IUTBLT (5,500)	- time series of total application

USTATS

APCONC (100)	- average concentration of the total applications
CANLEK (100)	- quantity of canal leakage for a user
DELIVR (100)	- quantity of diversions delivered to a user
DPPERC (100)	- quantity of deep percolation for a user
DIVRZN (100)	- quantity of water diverted at a node
IMPORT (100)	- quantity of importations delivered to a user
PRECIP (100)	- quantity of effective precipitation for a user
PUMPAG (100)	- quantity of ground-water pumpage delivered to a user
PUMPG (100,2)	- quantity of ground-water pumped in each node reach and side
RESREL (100)	- quantity of reservoir releases delivered to a user
TAILWR (100)	- quantity of tail water for a user

Attachment 7--FORTRAN SOURCE Code of Subroutines for Streamflow and Water-Quality Simulation

```
      CBSNMD2
      C
      C         MAINLINE OF RIVER BASIN SIMULATION MODEL (VERSION #2)
      C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
      C                WATER RESOURCES DIVISION, LAKEWOOD, CO
      C                         LATEST UPDATE 1/28/87
      C
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
      C
            DIMENSION ITITLE(20)
            CHARACTER*80 IDUM
      C
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
            IN = 1
            IOUT = 1
      C
            WRITE (IOUT,1000)
       1000 FORMAT (54H IS THIS AN INTERACTIVE SESSION (0 FOR NO, 1 FOR YES)?)
            CALL QUESZN(IBATCH)
      C
            WRITE (IOUT,1010)
       1010 FORMAT (44H     BSNMD2  RIVER BASIN SIMULATION MODEL #2 ,//,
           1 56H          WRITTEN BY ALAN W. BURNS, USGS, LAKEWOOD, COLO ,/,
           2 40H          LATEST UPDATE MADE ON 1/28/87 ,///)
            IF (IBATCH .EQ. 0) GO TO 40
      C
            WRITE (IOUT,1020)
       1020 FORMAT (53H FOR ALL QUESTIONS, 1 = YES AND ANY OTHER NUMBER = NO
           1 ,/,37H DO YOU WANT THE GENERAL EXPLANATION? )
            CALL QUESZN(IQ)
            IF (IQ - 1) 20,10,20
         10 WRITE (IOUT,1030)
       1030 FORMAT (//,65H      THIS MODEL IS THE SECOND IN A PLANNED SERIES O
           1F RIVER BASIN,/,65H SIMULATION MODELS.  VERSION #2 IS A RATHER SIM
           2PLE ROUTING MODEL.,/,66H FLOW FROM THE INTERMEDIATE DRAINAGE AREA
           3OF EACH NODE IS COMPUTED,/,61H WITH REGRESSION PARAMETERS AND A SE
           4T OF TEMPORAL INDEPENDENT ,/,66H VARIABLES.  REGRESSION PARAMETERS
           5 ARE ALSO NEEDED TO DESCRIBE THE ,/,63H WATER QUALITY-DISCHARGE RE
           6LATIONSHIPS.  INTERMEDIATE DISCHARGE,/,65H FROM EACH NODE IS THEN
           7ACCUMULATED AND ROUTED DOWNSTREAM.  WATER,/,62H QUALITY CONCENTRAT
           8IONS ARE MIXED DURING EACH FLOW ROUTING AND,/,20H LOADS ARE COMPUT
           9ED.  ,///)
```

```
C
   20 WRITE (IOUT,1040)
 1040 FORMAT (30H DO YOU WANT THE INSTRUCTIONS? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 40,30,40
   30 CALL INSTRK
C
   40 IF (IBATCH .EQ. 1) CALL READFI
      IF (IBATCH .NE. 1) CALL READFB
C
C         INITIALIZATION
C
      IYEAR = 0
      DO 50 INODE = 1,NNODE
      PORXN(INODE) = 0.
      PORQW(INODE) = 0.
   50 PORQ(INODE) = 0.
C
      IF (ISKM .NE. 1) GO TO 60
      WRITE (IDUM,1050) TITL
 1050 FORMAT (5A4,22H - MONTHLY SIMULATION$ )
      CALL MNTHLY(ITITLE)
C
C         DO MONTHLY SIMULATION OVER ALL MONTHS
C
   60 DO 100 IMONTH = 1,NMONTH
      JMONTH = IMONTH - ((IMONTH - 1)/12)*12
      IF (JMONTH - 1) 70,70,90
   70 DO 80 INODE = 1,NNODE
      AXN(INODE) = 0.
      AQW(INODE) = 0.
   80 AQ(INODE) = 0.
      IYEAR = IYEAR + 1
      IF (IBATCH .EQ. 1 .AND. ISKM .NE. 1) WRITE (IOUT,1060) IYEAR
 1060 FORMAT (26H CURRENTLY SIMULATING YEAR ,I3)
C
   90 CALL NFLOW
      CALL SUMRYM
  100 CONTINUE
C
C         SUMMARIZE AND DO ANY DESIRED COMPARISONS
C
      CALL SUMRYF
  110 IF (IBATCH .EQ. 0) GO TO 120
      WRITE (IOUT,1070)
 1070 FORMAT (66H DO YOU WANT TO COMPARE RESULTS FROM THIS RUN WITH A PR
     1EVIOUS RUN?  )
  120 CALL QUESZN(IQ)
      IF (IQ - 1) 140,130,140
  130 CALL CMPAR
      GO TO 110
  140 CONTINUE
      IF (IGRAPH .NE. 0) CALL DONEPL
C
      STOP
      END
```

```
CCMPAR
C
C          SUBROUTINE COMPARISON OF RIVER BASIN SIMULATION MODEL (#2)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/22/87
C
            SUBROUTINE CMPAR
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /REACH1/ NODNAM(100)
            DOUBLE PRECISION NODNAM
      C
            DIMENSION TITL2(5),YTEMP(3),X1(600),Y1(600),X2(600),Y2(600),
           1 X3(600),Y3(600),ITITLE(20),TITLED(20),TITLEP(20)
            DIMENSION ERAV(12),ERNM(12),ERMX(12),ERMN(12),MONMX(12),MONMN(12)
            CHARACTER*80 IDUM
            CHARACTER*6 LXNAME
      C
            DOUBLE PRECISION SD,ERRSD,XXN
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
            REWIND 63
            REWIND 64
      C
      C         SKIP DOWN TO THE MONTHLY OUTPUT
      C
            READ (63,1000) ITEST,ITEST,ITEST,ITEST
            READ (64,1000) ITEST,ITEST,ITEST
       1000 FORMAT (1A1)
            READ (64,1010) TITL2
       1010 FORMAT (20X,5A4)
            WRITE (IOUT,1020) TITL2
       1020 FORMAT (//47H THE PREVIOUS RUN YOU LOADED FOR COMPARISON IS: ,5A4)
            READ (63,1000) ITEST,ITEST,ITEST
            READ (64,1000) ITEST,ITEST
            READ (64,1030) TITLED,NNODEP
       1030 FORMAT (26X,20A4,11X,I3)
            WRITE (IOUT,1040) TITLED
       1040 FORMAT (32H ITS BASIN DESCRIPTION FILE WAS: ,/,20A4)
            READ (63,1000) ITEST,ITEST,ITEST,ITEST
            READ (64,1000) ITEST,ITEST
            READ (64,1050) TITLEP,NINDVP,MONTHP
       1050 FORMAT (29X,20A4,/,18X,I3,13X,I3)
            WRITE (IOUT,1060) TITLEP
       1060 FORMAT (35H ITS INDEPENDENT VARIABLE FILE WAS: ,/,20A4)
```

```
      READ (63,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      READ (64,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      DO 10 I = 1,NNODE
   10 READ (63,1000) ITEST
      DO 20 I = 1,NNODEP
   20 READ (64,1000) ITEST
      DO 30 I = 1,NNODE
      DO 30 LINES = 1,17
   30 READ (63,1000) ITEST
      DO 40 I = 1,NNODEP
      DO 40 LINES = 1,17
   40 READ (64,1000) ITEST
      IF (IBATCH .EQ. 0) GO TO 50
      WRITE (IOUT,1070)
 1070 FORMAT (27H ENTER THE NODE ID (5 COLS) )
   50 READ (IN,1080) INODE
 1080 FORMAT (I5,A8,2X,2F10.0,I5,3F10.0)
      DO 60 IINODE = 1,NNODE
      IF (NODEID(IINODE) .NE. INODE) GO TO 60
      GO TO 70
   60 CONTINUE
   70 IF (IBATCH .EQ. 0) GO TO 80
      WRITE (IOUT,1090)
 1090 FORMAT (50H ENTER 1 FOR FLOW, 2 FOR CONCENTRATION, 3 FOR LOAD  ,
     1 8H (1 COL)   )
   80 READ (IN,1100) ITYPE
 1100 FORMAT (I1)
      GO TO (90, 100, 110), ITYPE
   90 WRITE (IOUT,1110) NODEID(IINODE),NODNAM(IINODE)
 1110 FORMAT (47H THE FLOWS, IN CUBIC FEET PER SECOND, FOR NODE ,I5,2H (
     1 ,A8,14H) ARE COMPARED  )
      GO TO 120
  100 WRITE (IOUT,1120) NODEID(IINODE),NODNAM(IINODE)
 1120 FORMAT (54H THE CONCENTRATIONS, IN MILLIGRAMS PER LITER, FOR NODE
     1 ,I5,2H (,A8,14H) ARE COMPARED  )
      GO TO 120
  110 WRITE (IOUT,1130) NODEID(IINODE),NODNAM(IINODE)
 1130 FORMAT (30H THE LOADS, IN TONS, FOR NODE ,I5,2H (,A8,14H) ARE COMP
     1ARED )
C
  120 YMAX = 0.
      YMIN = 0.
      DIFMAX = 0.
      DIFMIN = 1.0E10
      XMONTH = 0.
      MONTHX = 0
      MONTH1 = 1
      MONTH2 = 1
      ERRMN = 0.
      ERRSD = 0.
      DO 125 J = 1,12
      ERAV(J) = 0.
      ERNM(J) = 0.
      ERMX(J) = -1.0E10
  125 ERMN(J) = 1.0E10
      MONTH = NMONTH
```

```
      IF (MONTHP .LT. MONTH) MONTH = MONTHP
C
C         READ AND SELECT DESIRED PARAMETER
C
      DO 160 IMONTH = 1,MONTH
      JMONTH = IMONTH - ((IMONTH - 1)/12)*12
      READ (63,1000) ITEST,ITEST,ITEST,ITEST,ITEST,ITEST
      READ (64,1000) ITEST,ITEST,ITEST,ITEST,ITEST,ITEST
C
      DO 130 I = 1,NNODE
      READ (63,1140) NODE,YTEMP
 1140 FORMAT (6X,I7,10X,F11.2,F13.0,F11.2)
      IF (NODE .NE. INODE) GO TO 130
      Y1(MONTH1) = YTEMP(ITYPE)
      IF (YTEMP(ITYPE) .EQ. -99.) GO TO 130
      IF (YTEMP(ITYPE) .GT. YMAX) YMAX = YTEMP(ITYPE)
  130 CONTINUE
C
      DO 140 I = 1,NNODEP
      READ (64,1140) NODE,YTEMP
      IF (NODE .NE. INODE) GO TO 140
      Y2(MONTH2) = YTEMP(ITYPE)
      IF (YTEMP(ITYPE) .EQ. -99.) GO TO 140
      IF (YTEMP(ITYPE) .GT. YMAX) YMAX = YTEMP(ITYPE)
  140 CONTINUE
C
      X1(MONTH1) = IMONTH
      X1(MONTH1) = X1(MONTH1) - .25
      X2(MONTH2) = X1(MONTH1) + .5
      IF (Y1(MONTH1) .EQ. -99.) GO TO 150
      MONTH1 = MONTH1 + 1
      IF (Y2(MONTH2) .EQ. -99.) GO TO 160
      MONTH2 = MONTH2 + 1
      ERR = Y1(MONTH1 - 1) - Y2(MONTH2 - 1)
      IF (ERR .GT. DIFMAX) DIFMAX = ERR
      IF (ERR .LT. DIFMIN) DIFMIN = ERR
      XMONTH = XMONTH + 1.
      MONTHX = MONTHX + 1
      X3(MONTHX) = IMONTH
      Y3(MONTHX) = ERR
      ERRMN = ERRMN + ERR
      ERRSD = ERRSD + ERR*ERR
      ERNM(JMONTH) = ERNM(JMONTH) + 1.
      ERAV(JMONTH) = ERAV(JMONTH) + ERR
      IF (ERR .GT. ERMX(JMONTH)) MONMX(JMONTH) = IMONTH
      IF (ERR .GT. ERMX(JMONTH)) ERMX(JMONTH) = ERR
      IF (ERR .LT. ERMN(JMONTH)) MONMN(JMONTH) = IMONTH
      IF (ERR .LT. ERMN(JMONTH)) ERMN(JMONTH) = ERR
      GO TO 160
  150 IF (Y2(MONTH2) .EQ. -99.) GO TO 160
      MONTH2 = MONTH2 + 1
  160 CONTINUE
C
      IF (XMONTH .LE. 1.) RETURN
      MONTH1 = MONTH1 - 1
      MONTH2 = MONTH2 - 1
```

```
      SD = ERRMN*ERRMN/XMONTH
      XXN = XMONTH - 1.
      ERRSD = DSQRT((ERRSD - SD)/XXN)
      ERRMN = ERRMN/XMONTH
      WRITE (IOUT,1150) ERRMN,ERRSD
 1150 FORMAT (43H THE MEAN RESIDUAL BETWEEN THE TWO RUNS IS ,F10.3,
     1 /,30H   THE STANDARD DEVIATION IS  ,F10.3)
      WRITE (IOUT,1155) (J,ERAV(J)/ERNM(J),ERMX(J),MONMX(J),ERMN(J),
     1 MONMN(J),J=1,12)
 1155 FORMAT (15X,46HMONTH  AVERAGE  MAXIMUM  MONTH  MINIMUM  MONTH ,/,
     1 (15X,I3,F11.2,F9.1,I6,F10.1,I6))
      IF (IGRAPH .EQ. 0) RETURN
C
C         PLOT THE TWO SETS OF DATA AS HYDROGRAPHS
C
      XMIN = 0.
      XMAX = MONTH + 1
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      XINC = FINC(XMAX,XMIN)
      IF (MONTH .GT. 37) XMAX = XMAX*12.
      YINC = FINC(YMAX,YMIN)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL INTAXS
      WRITE (IDUM,1160) NODEID(IINODE),NODNAM(IINODE)
 1160 FORMAT (I5,2H (,A8,2H)$)
      CALL HEIGHT(.2)
      CALL HEADIN(ITITLE,100,1.,1)
      LXNAME = 'MONTHS'
      IF (MONTH .GT. 37) LXNAME = 'YEARS '
      CALL XNAME(LXNAME,6)
      IF (ITYPE .EQ. 1) CALL YNAME(36HSTREAMFLOW, IN CUBIC FEET PER SECO
     1ND ,36)
      IF (ITYPE .EQ. 2) CALL YNAME(38HCONCENTRATION, IN MILLIGRAMS PER L
     1ITER ,38)
      IF (ITYPE .EQ. 3) CALL YNAME(23HLOAD, IN TONS PER MONTH ,23)
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL XNONUM
      CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
      CALL BARS(-.25)
      CALL SETCLR(3HRED)
      CALL MESSAG(TITL,20,4.0,5.7)
      CALL CURVE(X1,Y1,MONTH1,0)
      CALL SETCLR(5HGREEN)
      CALL MESSAG(TITL2,20,4.0,5.4)
      CALL CURVE(X2,Y2,MONTH2,0)
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      CALL SETCLR(5HWHITE)
      CALL RESET('XNONUM')
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,0.)
      ITICKS = XINC + .1
      CALL XTICKS(ITICKS)
      CALL RESET('YTICKS')
```

```
      CALL XNONUM
      CALL YNONUM
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,-1,0.,0.)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,-1,0.,0.)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,6.0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,1,10.,0.)
      CALL ENDPL(0)
C
C         PLOT THE TWO SETS OF DATA AS FREQUENCY CURVES
C
      CALL SORT(Y1,MONTH1)
      CALL PROB(X1,MONTH1)
      CALL SORT(Y2,MONTH2)
      CALL PROB(X2,MONTH2)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL INTAXS
      CALL HEIGHT(.2)
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME(26HPERCENT OF MONTHS EXCEEDED ,26)
      IF (ITYPE .EQ. 1) CALL YNAME(36HSTREAMFLOW, IN CUBIC FEET PER SECO
     1ND ,36)
      IF (ITYPE .EQ. 2) CALL YNAME(38HCONCENTRATION, IN MILLIGRAMS PER L
     1ITER ,38)
      IF (ITYPE .EQ. 3) CALL YNAME(23HLOAD, IN TONS PER MONTH ,23)
      XMIN = X1(1)
      IF (X2(1) .GT. XMIN) XMIN = X2(1)
      XMAX = X1(MONTH1)
      IF (X2(MONTH2) .LT. XMAX) XMAX = X2(MONTH2)
      XINC = XMAX - XMIN
      CALL XNONUM
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
      CALL SETCLR(3HRED)
      CALL MESSAG(TITL,20,2.5,5.7)
      CALL CURVE(X1,Y1,MONTH1,0)
      CALL HWSHD
      CALL SHDPAT(1)
      CALL SHDCRV(X1,Y1,MONTH1,X1,Y1,5HBELOW)
      CALL SETCLR(5HGREEN)
      CALL MESSAG(TITL2,20,2.5,5.4)
      CALL CURVE(X2,Y2,MONTH2,0)
      CALL RESET('HWSHD')
      CALL SHDPAT(3)
      CALL SHDCRV(X2,Y2,MONTH2,X2,Y2,5HBELOW)
      CALL SETCLR(5HWHITE)
      CALL RESET('YTICKS')
      CALL YNONUM
      CALL RLVEC (XMIN,YMIN,XMAX,YMIN,0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,-1,0.,0.)
      CALL RLVEC (XMIN,YMAX,XMAX,YMAX,0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,1,10.,0.)
      MONTH = MONTH1
```

```
      IF (MONTH2 .GT. MONTH) MONTH = MONTH2
      CALL RKRLAB(MONTH,YMAX,YMIN)
      CALL ENDPL(0)
C
C         PLOT A HYDROGRAPH OF THE RESIDUALS
C
      MONTH = NMONTH
      IF (MONTHP .LT. MONTH) MONTH = MONTHP
      XMIN = 0.
      XMAX = MONTH + 1
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      XINC = FINC(XMAX,XMIN)
      IF (MONTH .GT. 37) XMAX = XMAX*12.
      DIFINC = FINC(DIFMAX,DIFMIN)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL HEIGHT(.2)
      CALL INTAXS
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME (1H ,1)
      WRITE (IDUM,1160) NODEID(IINODE),NODNAM(IINODE)
      IF (ITYPE .EQ. 1) CALL YNAME(36HSTREAMFLOW, IN CUBIC FEET PER SECO
     1ND ,36)
      IF (ITYPE .EQ. 2) CALL YNAME(38HCONCENTRATION, IN MILLIGRAMS PER L
     1ITER ,38)
      IF (ITYPE .EQ. 3) CALL YNAME(23HLOAD, IN TONS PER MONTH ,23)
      CALL CROSS
      CALL XNONUM
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL GRAF(XMIN,XINC,XMAX,DIFMIN,DIFINC,DIFMAX)
      CALL MESSAG(TITL,20,2.0,6.1)
      CALL MESSAG(TITL2,20,6.0,6.1)
      CALL SETCLR(4HCYAN)
      CALL BARPAT(16)
      CALL BARWID(-1.)
      CALL VBARS(X3,Y3,'BASE',MONTHX)
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      CALL SETCLR(5HWHITE)
      ITICKS = XINC + .1
      CALL XTICKS(ITICKS)
      CALL RESET('YTICKS')
      CALL YNONUM
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,-1,0.,0.)
      CALL YGRAXS(DIFMIN,DIFINC,DIFMAX,6.0,1H ,-1,0.,0.)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,6.0)
      CALL YGRAXS(DIFMIN,DIFINC,DIFMAX,6.0,1H ,1,10.,0.)
      CALL RESET('XNONUM')
      CALL XTICKS(0)
      IF (MONTH.LT.38) CALL XGRAXS(XMIN,XINC,XMAX,10.,6HMONTHS,6,0.,0.)
      IF (MONTH.GT.37) CALL XGRAXS(XMIN,XINC,XMAX,10.,5HYEARS,5,0.,0.)
      CALL ENDPL(0)
C
      RETURN
      END
```

```
CHYDRGR
C
C          SUBROUTINE HYDROGRAPH OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/22/87
C
            SUBROUTINE HYDRGR(Q,ITITLE,ITYPE)
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
      C
            DIMENSION Q(1),ITITLE(1)
            DIMENSION XMON(600)
            CHARACTER*6 LXNAME
      C
            DO 10 I = 1,NMONTH
         10 XMON(I) = I
            XMIN = 0
            XMAX = NMONTH
            IF (NMONTH .GT. 37) XMAX = XMAX/12.
            XINC = FINC(XMAX,XMIN)
            IF (NMONTH .GT. 37) XMAX = XMAX*12.
            YMIN = 0.
            YMAX = Q(1)
      C
            DO 20 IMONTH = 2,NMONTH
            IF (Q(IMONTH) .GT. YMAX) YMAX = Q(IMONTH)
         20 CONTINUE
            YINC = FINC(YMAX,YMIN)
      C
            CALL RESET('ALL')
            CALL RESET('ALL')
            CALL PAGE(11.,8.5)
            CALL NOBRDR
            CALL AREA2D(10.,6.0)
            CALL INTAXS
            LXNAME = 'MONTHS'
            IF (NMONTH .GT. 37)   LXNAME = 'YEARS '
            CALL HEIGHT(.2)
            CALL HEADIN(ITITLE,100,1.,1)
            CALL XNAME(LXNAME,6)
            IF (ITYPE .EQ. 1) CALL YNAME(36HSTREAMFLOW, IN CUBIC FEET PER SECO
           1ND ,36)
            IF (ITYPE .EQ. 2) CALL YNAME(38HCONCENTRATION, IN MILLIGRAMS PER L
           1ITER ,38)
            IF (ITYPE .EQ. 3) CALL YNAME(23HLOAD, IN TONS PER MONTH ,23)
            IF (ITYPE .EQ. 4) CALL YNAME(34HDIVERSIONS, IN ACRE-FEET PER MONTH
           1 ,34)
            IF (ITYPE .EQ. 5) CALL YNAME(31HPUMPAGE, IN ACRE-FEET PER MONTH ,
           1 31)
            IF (ITYPE .EQ. 6) CALL YNAME(42HTOTAL APPLICATIONS, IN ACRE-FEET P
           1ER MONTH ,42)
            IF (ITYPE .EQ. 7) CALL YNAME(22HCONTENTS, IN ACRE-FEET ,22)
```

```
      IF (ITYPE .EQ. 8) CALL YNAME(37HRETURN FLOW, IN CUBIC FEET PER SEC
     1OND ,37)
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL XNONUM
      CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
      CALL HWSHD
      CALL BARPAT(16)
      CALL SETCLR(3HRED)
      CALL BARWID(-1.)
      CALL VBARS(XMON,Q,'BASE',NMONTH)
      IF (NMONTH .GT. 37) XMAX = XMAX/12.
      CALL SETCLR(5HWHITE)
      CALL RESET('XNONUM')
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,0.)
      CALL XNONUM
      CALL YNONUM
      CALL RESET('YTICKS')
      ITICKS = XINC + .1
      CALL XTICKS(ITICKS)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,-1,0.,0.)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,-1,0.,0.)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,6.0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,1,10.,0.)
      CALL ENDPL(0)
C
      RETURN
      END
```

```
CINSTRK
C
C         SUBROUTINE INSTRUCTION OF RIVER BASIN SIMULATION MODEL (#2)
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 9/21/87
C
           SUBROUTINE INSTRK
           COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
          1       JMONTH,IYEAR
      C
           WRITE (IOUT,1000)
       1000 FORMAT (73H Three data sets must be prepared prior to using the mo
          1del for streamflow ,/, 12H simulation: ,/,
          2 49H      A physical description of the modeled area; ,/,
          3 56H      a digitized network of points along the river; and ,/,
          4 53H      a time series of all the independent variables. ,/,
          5 49H The format for the physical description file is: ,/,
          6 37H Record  Columns   Name   Description ,/,
          7 80H+______  _______  ______  ____________________________________
          8_________________ ,/,
          9 33H    1      1- 80  TITLED  a title ,/,
          * 62H    2      1-  5  NNODE   the number of nodes (maximum of 100)
          1 ,/,
          2 78H    3      1- 10  QMAX    an estimate of the largest streamflo
          3w, in cubic feet ,/,
          4 31X,39Hper second (used for plotting purposes) ,/,
          5 77H          11- 20  QWL1    value of water quality, in milligram
          6s per liter, to ,/,
          7 31X,30Hsubdivide class 1 from class 2 )
           WRITE (IOUT,1010)
       1010 FORMAT (77H          21- 30  QWL2    value of water quality, in mi
          1lligrams per liter, to ,/,
          2 31X,30Hsubdivide class 2 from class 3 ,/,
          3 77H          31- 40  QWL3    value of water quality, in milligram
          4s per liter, to ,/,
          5 31X,30Hsubdivide class 3 from class 4 ,/,
          6 65H note -- records 4 and 5 are entered as a set, one for each NN
          7ODE ,/,
          8 42H    4      1-  5  NODEID  a node ID number ,/,
          9 37H           6- 13  NODNAM  a node name ,/,
          * 54H          16- 25  YLOC    latitude, in decimal degrees ,/,
          1 55H          26- 35  XLOC    longitude, in decimal degrees ,/,
          2 73H          36- 40  NXTNOD  node ID of the downstream node.  Mus
          3t be set to ,/,
          4 31X,39Hnegative number for all terminus nodes. ,/,
          5 73H          41- 50  PLTX    plotting offset from the node symbol
          6, in inches ,/,
          7 73H          51- 60  PLTY    plotting offset from the node symbol
          8, in inches )
           WRITE (IOUT,1020)
```

```
1020 FORMAT (77H          61- 70  CONCFC  concentration factor to deter
    1mine load routing when  ,/,
    2 31X,49Hincremental streamflow is negative.  Value ranges ,/,
    3 31X,47Hfrom 0.0 to 1.0, where 0.0 indicates the entire ,/,
    4 31X,49Hload is concentrated downstream and 1.0 indicates ,/,
    5 31X,43Hthe concentration is maintained downstream. ,/,
    6 77H          71- 80  DSA     intercept of the water quality-speci
    7fic conductance ,/,
    8 31X,17Hlinear regression ,/,
    9 73H          81- 90  DSB     slope of the water quality-specific
    *conductance ,/,
    1 31X,17Hlinear regression ,/,
    2 74H note -- record 5 is repeated 12 times, one for each month, be
    3ginning with ,/,
    4 14X,7HJanuary ,/,
    5 70H    5     11- 15  INDEPV  variable number of the independent v
    6ariable. ,/,
    7 31X,49HIf the value is positive, the incremental flow is ,/,
    8 36X,31Hcomputed and routed downstream. ,/,
    9 31X,48HIf the value is negative, the total flow at that )
     WRITE (IOUT,1030)
1030 FORMAT (36X,34Hpoint is computed with no routing. ,/,
    1 31X,42HIf the value is less than 100, the flow is ,/,
    2 36X,40Hcomputed using linear regression and the ,/,
    3 36X,42Hindependent variable identified by INDEPV. ,/,
    4 31X,45HIf the value is greater than 100, the flow is ,/,
    5 36X,41Hcomputed using log-log regression and the ,/,
    6 36X,34Hindependent variable identified by ,/,
    7 36X,15H(INDEPV - 100). ,/,
    8 31X,45HIf the value is greater than 200, the flow is ,/,
    9 36X,40Hcomputed using linear regression and the ,/,
    * 36X,44Hindependent variable is upstream streamflow. ,/,
    1 74H          16- 25  NTRCPT  intercept of the streamflow-independ
    2ent variable ,/,
    3 31X,10Hregression ,/,
    4 70H          26- 35  SLOPE   slope of the streamflow-independent
    5variable ,/,
    6 31X,10Hregression ,/,
    7 74H          36- 45  QWA     intercept of the specific conductanc
    8e-streamflow ,/,
    9 31X,18Hlog-log regression )
     WRITE (IOUT,1040)
1040 FORMAT (70H          46- 55  QWB     slope of the specific conduct
    1ance-streamflow ,/,
    2 31X,18Hlog-log regression )
     CALL QUESZN(ITEMP)
     WRITE (IOUT,1050)
1050 FORMAT (46H The format for the digitized network file is: ,/,
    1 37H Record  Columns   Name   Description ,/,
    2 80H+______  _______  ______  ____________________________________
    3_________________ ,/,
    4 76H    1      1- 10  XMIN    largest longitude, in decimal degree
    5s, for mapping ,/,
    6 77H          11- 20  XMAX    smallest longitude, in decimal degre
    7es, for mapping ,/,
```

```
     8 76H          21- 30  YMIN    smallest latitude, in decimal degree
     9s, for mapping ,/,
     * 75H          31- 40  YMAX    largest latitude, in decimal degrees
     1, for mapping ,/,
     2 76H          41- 50  XLENG   length of x axis, in decimal degrees
     3, on schematic ,/,
     4 31X,11Hhydrographs ,/,
     5 76H          51- 60  YLENG   length of y axis, in decimal degrees
     6, on schematic ,/,
     7 31X,11Hhydrographs )
      WRITE (IOUT,1060)
 1060 FORMAT (71H    2       1- 10  XHY     longitude, in decimal degrees
     1, to place first ,/,
     2 31X,20Hschematic hydrograph ,/,
     3 80H          11- 20  YHY     latitude, in decimal degrees, to pla
     4ce first schematic ,/,
     5 31X,10Hhydrograph ,/,
     6 72H          21- 30  XHY     longitude, in decimal degrees, to pl
     7ace second ,/,
     8 31X,20Hschematic hydrograph ,/,
     9 71H          31- 40  YHY     latitude, in decimal degrees, to pla
     *ce second ,/,
     1 31X,20Hschematic hydrograph ,/,
     2 71H          41- 50  XHY     longitude, in decimal degrees, to pl
     3ace third ,/,
     4 31X,20Hschematic hydrograph ,/,
     5 80H          51- 60  YHY     latitude, in decimal degrees, to pla
     6ce third schematic ,/,
     7 31X,10Hhydrograph )
      WRITE (IOUT,1070)
 1070 FORMAT (72H          61- 70  XHY     longitude, in decimal degrees
     1, to place fourth ,/,
     2 31X,20Hschematic hydrograph ,/,
     3 71H          71- 80  YHY     latitude, in decimal degrees, to pla
     4ce fourth ,/,
     5 31X,20Hschematic hydrograph ,/,
     6 71H          81- 90  XHY     longitude, in decimal degrees, to pl
     7ace fifth ,/,
     8 31X,20Hschematic hydrograph ,/,
     9 80H          91-100  YHY     latitude, in decimal degrees, to pla
     *ce fifth schematic ,/,
     1 31X,10Hhydrograph ,/,
     2 53H note -- record 3 is repeated until ICARD is negative ,/,
     3 69H    3      1-  5  ICARD   code indicating disposition of data
     4points. ,/,
     5 31X,45HIf value is one, start plotting data in a new ,/,
     6 36X,9Hsequence. ,/,
     7 31X,45HIf value is greater than 1, continue plotting ,/,
     8 36X,36Hdata in sequence from previous line. )
      WRITE (IOUT,1080)
 1080 FORMAT (31X,32HIf value is zero, skip the line. ,/,
     1 31X,48HIf value is negative, quit plotting the network. )
      WRITE (IOUT,1090)
```

```
 1090 FORMAT (66H            6- 12  YLINE   latitude, in decimal degrees,
     1 of a point ,/,
     2 67H          13- 19  XLINE   longitude, in decimal degrees, of a
     3point ,/,
     4 66H          20- 26  YLINE   latitude, in decimal degrees, of a p
     5oint ,/,
     6 67H          27- 33  XLINE   longitude, in decimal degrees, of a
     7point ,/,
     8 66H          34- 40  YLINE   latitude, in decimal degrees, of a p
     9oint ,/,
     * 67H          41- 47  XLINE   longitude, in decimal degrees, of a
     1point ,/,
     2 66H          48- 54  YLINE   latitude, in decimal degrees, of a p
     3oint ,/,
     4 67H          55- 61  XLINE   longitude, in decimal degrees, of a
     5point ,/,
     6 66H          62- 68  YLINE   latitude, in decimal degrees, of a p
     7oint ,/,
     8 67H          69- 75  XLINE   longitude, in decimal degrees, of a
     9point )
      CALL QUESZN(ITEMP)
      WRITE (IOUT,1100)
 1100 FORMAT (49H The format for the independent variable file is: ,/,
     1 37H Record  Columns   Name   Description ,/,
     2 80H+______  _______  ______  ____________________________________
     3_________________ ,/,
     4 33H    1      1- 80  TITLEP  a title ,/,
     5 63H    2      1-  5  NMONTH  the number of months (maximum of 600
     6) ,/,
     7 77H           6- 10  NINDV   the number of independent variables
     8(maximum of 75) ,/,
     9 72H    3      1-  6  VARNAM  an independent variable name.  There
     * are NINDV ,/,
     1 59H          11- 16  VARNAM       occurrences, eight per line.,/,
     2 24H          21- 26  VARNAM ,/,
     3 24H          31- 36  VARNAM ,/,
     4 24H          41- 46  VARNAM )
      WRITE (IOUT,1110)
 1110 FORMAT (24H           51- 56  VARNAM ,/,
     2 24H          61- 66  VARNAM ,/,
     4 24H          71- 76  VARNAM ,/,
     6 79H note -- record 4 is read as a set, one for each NMONTH, begin
     7ning in a January ,/,
     8 76H    4      1- 10  VARIBL  value of the time series of independ
     9ent variables. ,/,
     * 75H          11- 20  VARIBL       There are NINDV occurrences, ei
     1ght per line. ,/,
     2 70H          21- 30  VARIBL       (-99. is used to indicate missi
     3ng data) ,/,
     4 24H          31- 30  VARIBL ,/,
     5 24H          41- 50  VARIBL ,/,
     6 24H          51- 60  VARIBL ,/,
     7 24H          61- 70  VARIBL ,/,
     8 24H          71- 80  VARIBL )
C
      RETURN
      END
```

```
CMNTHLY
C
C          SUBROUTINE MONTHLY PLOT OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 3/19/87
C
            SUBROUTINE MNTHLY(ITITLE)
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /HYDROG/ IHY(5),QHY(600,5),QWHY(600,5),QWLHY(600,5)
            COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
           1               YMAX
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
            COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
      C
            DIMENSION YHYQP(5),ISYM(4),ITITLE(1)
      C
            DATA ISYM /6,5,1,0/
      C
            CALL NETWRK(ITITLE)
            XN = NMONTH
            DO 100 I = 1,5
            INODE = IHY(I)
            IF (INODE) 100,100,10
         10 CALL SETCLR(5HWHITE)
            XL = XHY(I) + XLENG
            YL = YHY(I) + YLENG
            I1 = 1
            ADIST = SQRT((XHY(I)-XLOC(INODE))**2 + (YHY(I)-YLOC(INODE))**2)
            DIST = SQRT((XL-XLOC(INODE))**2 + (YHY(I)-YLOC(INODE))**2)
            IF (DIST .GE. ADIST) GO TO 20
            ADIST = DIST
            I1 = 2
         20 DIST = SQRT((XL-XLOC(INODE))**2 + (YL-YLOC(INODE))**2)
            IF (DIST .GE. ADIST) GO TO 30
            ADIST = DIST
            I1 = 3
         30 DIST = SQRT((XHY(I)-XLOC(INODE))**2 + (YL-YLOC(INODE))**2)
            IF (DIST .GE. ADIST) GO TO 40
            ADIST = DIST
            I1 = 4
         40 GO TO (50,60,70,80), I1
         50 CALL RLVEC((XLOC(INODE)-XHY(I))*.8+XHY(I),
           1(YLOC(INODE)-YHY(I))*.8+YHY(I),XHY(I),YHY(I),0)
            GO TO 90
```

```
   60 CALL RLVEC((XLOC(INODE)-XL)*.8+XL,(YLOC(INODE)-YHY(I))*.8+YHY(I),
     1XL,YHY(I),0)
      GO TO 90
   70 CALL RLVEC((XLOC(INODE)-XL)*.8+XL,(YLOC(INODE)-YL)*.8+YL,XL,YL,0)
      GO TO 90
   80 CALL RLVEC((XLOC(INODE)-XHY(I))*.8+XHY(I),(YLOC(INODE)-YL)*.8+YL,
     1XHY(I),YL,0)
   90 CALL RLVEC(XHY(I),YHY(I),XL,YHY(I),0)
      CALL RLVEC(XL,YHY(I),XL,YL,0)
      CALL RLVEC(XL,YL,XHY(I),YL,0)
      CALL RLVEC(XHY(I),YL,XHY(I),YHY(I),0)
      YHYQP(I) = YHY(I)
  100 CONTINUE
      RETURN
C
      ENTRY MONTHA
      DO 120 INODE = 1,NNODE
      IPEN = 1
      CALL SETCLR(4HCYAN)
      IF (QW(INODE) .LT. QWL1) GO TO 110
      IPEN = 2
      CALL SETCLR(7HMAGENTA)
      IF (QW(INODE) .LT. QWL2) GO TO 110
      IPEN = 3
      CALL SETCLR(6HYELLOW)
      IF (QW(INODE) .LT. QWL3) GO TO 110
      IPEN = 4
      CALL SETCLR(3HRED)
  110 CONTINUE
      IF (Q(INODE) .LE. 0.) GO TO 120
      CALL MARKER(ISYM(IPEN))
      CALL SCLPIC(3.)
      CALL CURVE(XLOC(INODE),YLOC(INODE),1,-1)
  120 CONTINUE
C
      DO 140 I = 1,5
      INODE = IHY(I)
      IF (INODE) 140,140,130
  130 CALL SETCLR(4HCYAN)
      IF (QW(INODE) .GT. QWL1) CALL SETCLR(7HMAGENTA)
      IF (QW(INODE) .GT. QWL2) CALL SETCLR(6HYELLOW)
      IF (QW(INODE) .GT. QWL3) CALL SETCLR(3HRED)
      XL = XHY(I) + XLENG/XN
      YL = YHY(I) + Q(INODE)*YLENG/QHYMAX(I)
      CALL RLVEC(XHY(I),YHYQP(I),XL,YL,0)
      XHY(I) = XL
      YHYQP(I) = YL
```

```
  140 CONTINUE
      IF (IMONTH .EQ. NMONTH) RETURN
C
      DO 150 INODE = 1,NNODE
      IPEN = 1
      IF (QW(INODE) .GT. QWL1) IPEN = 2
      IF (QW(INODE) .GT. QWL2) IPEN = 3
      IF (QW(INODE) .GT. QWL3) IPEN = 4
      CALL SETCLR(5HBLACK)
      CALL MARKER(ISYM(IPEN))
      CALL SCLPIC(3.)
      CALL CURVE(XLOC(INODE),YLOC(INODE),1,-1)
  150 CONTINUE
C
      RETURN
      END
```

```
CNETWRK
C
C          SUBROUTINE DRAINAGE NETWORK OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/10/86
C
            SUBROUTINE NETWRK(ITITLE)
            COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
           1               YMAX
      C
            DIMENSION ITITLE(1),XLINE(5),YLINE(5)
      C
            DATA IBLANK /1H /
      C
            CALL RESET('ALL')
            CALL PAGE(11.,8.5)
            CALL HEADIN(ITITLE,100,1.43,1)
            CALL XNAME(1H ,1)
            CALL YNAME(1H ,1)
            CALL XTICKS(0)
            CALL YTICKS(0)
            CALL XNONUM
            CALL YNONUM
            REWIND 62
            READ (62,1000) XMIN,XMAX,YMIN,YMAX,XLENG,YLENG
            READ (62,1000) (XHY(I),YHY(I),I=1,5)
       1000 FORMAT (10F10.0)
            XINC = XMAX - XMIN
            YINC = YMAX - YMIN
            CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
            CALL SETCLR(4HBLUE)
      C
         10 READ (62,1010) ICARD,(YLINE(I1),XLINE(I1),I1=1,5)
       1010 FORMAT (I5,10F7.0)
            IF (ICARD) 60,10,20
         20 IF (ICARD - 1) 40,40,30
         30 CALL RLVEC(XL,YL,XLINE(1),YLINE(1),0)
         40 DO 50 I1 = 2,5
            CALL RLVEC(XLINE(I1-1),YLINE(I1-1),XLINE(I1),YLINE(I1),0)
         50 CONTINUE
            XL = XLINE(5)
            YL = YLINE(5)
            GO TO 10
      C
         60 RETURN
            END
```

```
CNFLOW
C
C         SUBROUTINE NATIVE FLOW OF RIVER BASIN SIMULATION MODEL
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 1/26/87
C
            SUBROUTINE NFLOW
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
      C
            DIMENSION VARIBL(75)
      C
            INTEGER VARNO
      C
            READ (61,1000) (VARIBL(VARNO),VARNO=1,NINDV)
       1000 FORMAT (8F10.2)
            DO 10 INODE = 1,NNODE
            Q(INODE) = 0.
         10 QW(INODE) = 0.
      C
            DO 150 INODE = 1,NNODE
            VARNO = INDEPV(INODE,JMONTH)
            IF (VARNO .LT. 0) GO TO 70
      C
      C         FOR POSITIVE VARNO, COMPUTE INCREMENTAL INFLOW AND ROUTE
      C
            IF (VARNO .LT. 100) GO TO 30
            VARNO = VARNO - 100
            IF (VARNO .LT. 100) GO TO 20
      C
      C         IF VARNO > 200, USE LINEAR REGRESSION WITH UPSTREAM FLOW
      C
            IUP = NODEUS(INODE)
            X = Q(IUP)
            GO TO 40
      C
      C         IF VARNO > 100, USE LOG-LOG REGRESSION
      C
         20 X = VARIBL(VARNO)
            QSUBA(INODE) = NTRCPT(INODE,JMONTH)*X**SLOPE(INODE,JMONTH)
            GO TO 50
      C
      C         IF VARNO < 100, USE LINEAR REGRESSION
      C
         30 X = VARIBL(VARNO)
         40 QSUBA(INODE) = NTRCPT(INODE,JMONTH) + SLOPE(INODE,JMONTH)*X
```

```
   50 QWSUBA(INODE) = 0.
      IF (QSUBA(INODE) .LE. 0.) GO TO 60
      QWSUBA(INODE) = QWA(INODE,JMONTH)*QSUBA(INODE)**QWB(INODE,JMONTH)
      QWSUBA(INODE) = DSA(INODE) + DSB(INODE)*QWSUBA(INODE)
   60 QT = Q(INODE) + QSUBA(INODE)
      IF (QT .LE. 0.) GO TO 120
      QW(INODE) = (QW(INODE)*Q(INODE) + QWSUBA(INODE)*QSUBA(INODE))/QT
      IF (QSUBA(INODE) .GE. 0.) GO TO 120
      QMIN = QW(INODE)*QT/Q(INODE)
      QW(INODE) = QW(INODE) - CONCFC(INODE)*(QW(INODE) - QMIN)
      GO TO 120
C
C         FOR NEGATIVE VARNO, COMPUTE TOTAL FLOW AND DO NOT ROUTE
C
   70 VARNO = -VARNO
      IF (VARNO .LT. 100) GO TO 90
      VARNO = VARNO - 100
      IF (VARNO .LT. 100) GO TO 80
C
C         IF VARNO > 200, USE LINEAR REGRESSION WITH UPSTREAM FLOW
C
      IUP = NODEUS(INODE)
      X = Q(IUP)
      GO TO 100
C
C         IF VARNO > 100, USE LOG-LOG REGRESSION
C
   80 X = VARIBL(VARNO)
      IF (X .EQ. -99.) GO TO 130
      QT = NTRCPT(INODE,JMONTH)*X**SLOPE(INODE,JMONTH)
      GO TO 110
C
C         IF VARNO < 100, USE LINEAR REGRESSION
C
   90 X = VARIBL(VARNO)
      IF (X .EQ. -99.) GO TO 130
  100 QT = NTRCPT(INODE,JMONTH) + SLOPE(INODE,JMONTH)*X
  110 IF (QT .LE. 0.) GO TO 120
      QW(INODE) = QWA(INODE,JMONTH)*QT**QWB(INODE,JMONTH)
      QW(INODE) = DSA(INODE) + DSB(INODE)*QW(INODE)
C
  120 IF (QT .LT. 0.) QT = 0.
      Q(INODE) = QT
      JNODE = NXTNOD(INODE)
      IF (JNODE .LT. 0) GO TO 150
      QT = Q(INODE) + Q(JNODE)
      IF (QT .LE. 0.) GO TO 140
      QW(JNODE) = (QW(INODE)*Q(INODE) + QW(JNODE)*Q(JNODE))/QT
      Q(JNODE) = QT
      GO TO 150
  130 Q(INODE) = X
  140 QW(INODE) = -99.
  150 CONTINUE
C
      RETURN
      END
```

```
CPLTNOD
C
C         SUBROUTINE PLOT NODE OF RIVER BASIN SIMULATION MODEL
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 1/21/87
C
             SUBROUTINE PLTNOD(ITITLE)
             COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
             COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
            1               YMAX
             COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
            1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
            2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
            3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
            4                QWSUBA(100),DSA(100),DSB(100)
             REAL NTRCPT
       C
             DIMENSION ITITLE(1)
       C
       C         PLOT THE NETWORK
       C
             CALL NETWRK(ITITLE)
       C
       C         PLOT THE EXPLANATION
       C
             CALL SETCLR(4HCYAN)
             CALL SOLID(XMIN+.05*XINC,YMIN+.05*YINC,2.,6)
             CALL MESSAG(15HSTREAMFLOW NODE,15,1.2,.5)
             CALL SETCLR(5HWHITE)
             CALL INTNO(100,.70,.6)
             CALL MESSAG(11HAND NODE ID,11,1.4,.2)
       C
       C         PLOT THE DATA
       C
             DO 10 INODE = 1,NNODE
             CALL SETCLR(4HCYAN)
             XTEMP = XLOC(INODE)
             YTEMP = YLOC(INODE)
             CALL SOLID(XTEMP,YTEMP,2.,6)
             CALL SETCLR(5HWHITE)
             X1 = XPOSN(XLOC(INODE),YLOC(INODE)) + PLTX(INODE)
             Y1 = YPOSN(XLOC(INODE),YLOC(INODE)) + PLTY(INODE)
          10 CALL INTNO(NODEID(INODE),X1,Y1)
             CALL ENDPL(0)
       C
             RETURN
             END
```

```
      SUBROUTINE PROB(ARRAY,NPTS)
C
      DIMENSION ARRAY(1)
C
      FAC = NPTS
      FAC = 1./(FAC+1.)
      DO 10 IX = 1,NPTS
      XI = IX
   10 ARRAY(IX) = FUNCZ(XI*FAC)
      RETURN
      END
```

```
CQUESZN
C
C          SUBROUTINE QUESTION OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
            SUBROUTINE QUESZN(IQ)
      C
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
      C
         10 READ (IN,1000) Q
       1000 FORMAT (A1)
            IF (Q .EQ. '1' .OR. Q .EQ. 'Y') GO TO 20
            IF (Q .EQ. '0' .OR. Q .EQ. 'N' .OR. Q .EQ. '') GO TO 30
            WRITE (IOUT,1010)
       1010 FORMAT (62H MUST RESPOND "1", "YES", "0", OR "NO"  -  PLEASE ANSWE
           1R AGAIN )
            GO TO 10
         20 IQ = 1
            RETURN
         30 IQ = 0
            RETURN
            END
```

```
CREADFB
C
C                SUBROUTINE READ FLOW DATA IN BATCH OF
C                  RIVER BASIN SIMULATION MODEL (#2)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE READFB
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /HYDROG/ IHY(5),QHY(600,5),QWHY(600,5),QWLHY(600,5)
      COMMON /NAMES/ TITL(5)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
     1                QHYMAX(5),PORXN(100),AXN(100)
      COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
      COMMON /STATS/ ISS(10),QMEAN(10,12),QSD(10,12),QWMEAN(10,12),
     1               QWSD(10,12),QWLMN(10,12),QWLSD(10,12),XNN(10,12)
      COMMON /TABLES/ ITBL(5),IQTBL(5,600),IQWTBL(5,600),IQWLTB(5,600)
C
      DIMENSION ITITLE(20),TITLED(20),TITLEP(20)
      CHARACTER*80 IDUM
C
      DOUBLE PRECISION VARNAM(75)
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
      INTEGER*2 JNUM,TODAY(28)
C
      IN = 65
      IOUT = 66
C
C         READ BASIN DESCRIPTION DATA
C
      READ (60,1000) TITLED
 1000 FORMAT (20A4)
      READ (60,1010) NNODE
 1010 FORMAT (I5,A8,2X,2F10.0,I5,5F10.0)
      READ (60,1020) QMAX,QWL1,QWL2,QWL3
 1020 FORMAT (8F10.2)
      QMAX = ALOG10(QMAX)
C
      DO 10 I = 1,NNODE
      READ (60,1010) NODEID(I),NODNAM(I),YLOC(I),XLOC(I),NXTNOD(I),
     1 PLTX(I),PLTY(I),CONCFC(I),DSA(I),DSB(I)
      DO 10 J = 1,12
      READ (60,1030) INDEPV(I,J),NTRCPT(I,J),SLOPE(I,J),QWA(I,J),
     1 QWB(I,J)
   10 CONTINUE
```

```
 1030 FORMAT (10X,I5,4F10.0)
C
      NNODE1 = NNODE - 1
      DO 30 I = 1,NNODE1
      DO 20 J = 1,NNODE
      IF (NXTNOD(I) .NE. NODEID(J)) GO TO 20
      NXTNOD(I) = J
      GO TO 30
   20 CONTINUE
   30 CONTINUE
C
C         COMPUTE THE ARRAY OF UPSTREAM NODES
C
      DO 40 INODE = 1,NNODE
   40 NODEUS(INODE) = 0
      DO 50 INODE = 1,NNODE
      NEXT = NXTNOD(INODE)
      IF (NODEUS(NEXT) .NE. 0) GO TO 50
      NODEUS(NEXT) = INODE
   50 CONTINUE
C
C         READ INDEPENDENT VARIABLE INFORMATION
C
      READ (61,1000) TITLEP
      READ (61,1040) NMONTH,NINDV
 1040 FORMAT (16I5)
      READ (61,1050) (VARNAM(J),J=1,NINDV)
 1050 FORMAT (8(A6,4X))
C
C         ENTER TITLE
C
      READ (IN,1000) TITL
      JNUM = 28
      CALL TIMDAT(TODAY,JNUM)
C
C         WRITE BASIN DESCRIPTION DATA
C
      WRITE (IOUT,1060) TITL,(TODAY(JNUM),JNUM=1,3)
 1060 FORMAT (20H  SIMULATION TITLE: ,5A4,23X,10HDATE RUN: ,A2,1H/,A2,
     1 1H/,A2)
      WRITE (IOUT,1070) TITLED
 1070 FORMAT (//44H THE BASIN DESCRIPTION FILE YOU ATTACHED IS:,/,20A4)
      WRITE (IOUT,1080) TITLEP,NMONTH,NINDV
 1080 FORMAT (//47H THE INDEPENDENT VARIABLE FILE YOU ATTACHED IS:,/,
     1 20A4,/,10X,19HTHAT FILE CONTAINS ,I4,22H MONTHS OF RECORD FOR ,
     2 I3,10H VARIABLES,//)
C
      WRITE (63,1090) TITL,(TODAY(JNUM),JNUM=1,3),TITLED,NNODE
 1090 FORMAT (82H1   BSNMD2 - RIVER BASIN SIMULATION MODEL #2     UPDATE
     1D 9/10/86     BY ALAN BURNS  ,///,20H  SIMULATION TITLE: ,5A4,
     2 66X,10H DATE RUN: ,A2,1H/,A2,1H/,A2,///,
     326H  BASIN DESCRIPTION FILE: ,20A4,10H CONTAINS ,I3,6H NODES )
      WRITE (63,1100) TITLEP,NINDV,NMONTH
```

```
 1100 FORMAT ( //,29H  INDEPENDENT VARIABLE FILE: ,20A4,/,10X,8HCONTAINS
     1,I3,13H RECORDS FOR ,I3,7H MONTHS  )
      WRITE (63,1110) (I,NODEID(I),NODNAM(I),XLOC(I),YLOC(I),NXTNOD(I),
     1 CONCFC(I),DSA(I),DSB(I),I=1,NNODE)
 1110 FORMAT ( //,72H  NODE   NODE    NODE      X      Y    NEXT  CONCEN
     1TRATION     TDS / SC   ,/,77H NUMBER   ID     NAME    COORD  COORD
     2  NODE     FACTOR       INTERCEPT  SLOPE,//,(I5,I8,2X,A8,2F7.2,I6,
     3 F9.2,F13.2,F9.2))
      DO 110 NOD = 1,NNODE
      WRITE (63,1120) NODEID(NOD),NODNAM(NOD)
 1120 FORMAT (/,32H REGRESSION PARAMETERS FOR NODE ,I5,2H (,A8,1H),/,
     1 76H MONTH  VARIABLE  VARIABLE    TYPE OF          STREAMFLOW
     2WATER QUALITY  ,/,77H          NUMBER      ID     RELATIONSHIP  INT
     3ERCEPT  SLOPE  INTERCEPT  SLOPE  ,/)
      DO 110 J = 1,12
      IND = INDEPV(NOD,J)
      IF (IND .LT. 0) GO TO 80
      IF (IND .GT. 100) GO TO 60
      WRITE (63,1130) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1130 FORMAT (I5,I8,6X,A6,4X,10HINC-LINEAR,F10.3,3F9.3)
      GO TO 110
   60 IND = IND - 100
      IF (IND .GT. 100) GO TO 70
      WRITE (63,1140) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1140 FORMAT (I5,I8,6X,A6,4X,10HINC-LOGLOG,F10.3,3F9.3)
      GO TO 110
   70 WRITE (63,1150) J,INDEPV(NOD,J),NTRCPT(NOD,J), SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
 1150 FORMAT (I5,I8,6X,10HUPSTREAM  ,10HINC-LINEAR,F10.3,3F9.3)
      GO TO 110
   80 IND = -IND
      IF (IND .GT. 100) GO TO 90
      WRITE (63,1160) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1160 FORMAT (I5,I8,6X,A6,4X,10HTOT-LINEAR,F10.3,3F9.3)
      GO TO 110
   90 IND = IND - 100
      IF (IND .GT. 100) GO TO 100
      WRITE (63,1170) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1170 FORMAT (I5,I8,6X,A6,4X,10HTOT-LOGLOG,F10.3,3F9.3)
      GO TO 110
  100 WRITE (63,1180) J,INDEPV(NOD,J),NTRCPT(NOD,J),SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
 1180 FORMAT (I5,I8,6X,10HUPSTREAM  ,10HTOT-LINEAR,F10.3,3F9.3)
  110 CONTINUE
C
      CALL QUESZN(IGRAPH)
      IF (IGRAPH .NE. 0) CALL COMPRS
C
C         ENTER FREQUENCY OF PLOTTING SCHEMATIC
C
      READ (IN,1040) ISKM
```

```
C
C         ENTER NODES FOR HYDROGRAPHS
C
      READ (IN,1040) IHY
      READ (IN,1020) QHYMAX
      DO 130 I = 1,5
      DO 120 J = 1,NNODE
      IF (IHY(I) .NE. NODEID(J)) GO TO 120
      IHY(I) = J
      GO TO 130
  120 CONTINUE
  130 CONTINUE
C
C         ENTER NODES FOR MONTHLY TABLES
C
      READ (IN,1040) ITBL
      DO 150 I = 1,5
      DO 140 J = 1,NNODE
      IF (ITBL(I) .NE. NODEID(J)) GO TO 140
      ITBL(I) = J
      GO TO 150
  140 CONTINUE
  150 CONTINUE
C
C         ENTER NODES FOR STATISTICAL SUMMARIES
C
      READ (IN,1040) ISS
      DO 180 I = 1,10
      IF (ISS(I) .LE. 0) GO TO 180
      DO 160 J =1,12
      XNN(I,J) = 0.
      QMEAN(I,J) = 0.
      QSD(I,J) = 0.
      QWMEAN(I,J) = 0.
      QWSD(I,J) = 0.
      QWLMN(I,J) = 0.
  160 QWLSD(I,J) = 0.
      DO 170 J = 1,NNODE
      IF (ISS(I) .NE. NODEID(J)) GO TO 170
      ISS(I) = J
      GO TO 180
  170 CONTINUE
  180 CONTINUE
C
C         PLOT NODE LOCATIONS
C
      CALL QUESZN(ILGND)
      IF (ILGND - 1) 200,190,200
  190 WRITE (IDUM,1190) TITL
 1190 FORMAT (5A4,18H - NODE LOCATIONS$ )
      CALL PLTNOD(ITITLE)
C
  200 CALL QUESZN(IQW)
      IPRINT = 0
      RETURN
      END
```

```
CREADFI
C
C              SUBROUTINE READ FLOW DATA INTERACTIVELY OF
C                  RIVER BASIN SIMULATION MODEL (#2)
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 1/26/87
C
            SUBROUTINE READFI
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /HYDROG/ IHY(5),QHY(600,5),QWHY(600,5),QWLHY(600,5)
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /REACH1/ NODNAM(100)
            DOUBLE PRECISION NODNAM
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
            COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
            COMMON /STATS/ ISS(10),QMEAN(10,12),QSD(10,12),QWMEAN(10,12),
           1               QWSD(10,12),QWLMN(10,12),QWLSD(10,12),XNN(10,12)
            COMMON /TABLES/ ITBL(5),IQTBL(5,600),IQWTBL(5,600),IQWLTB(5,600)
      C
            DIMENSION INDV(12),CEPT(12),SLP(12),QWAA(12),QWBB(12),ITITLE(20),
           1 TITLED(20),TITLEP(20)
            CHARACTER*80 IDUM
      C
            DOUBLE PRECISION INAM,VARNAM(75)
            INTEGER*2 JNUM,TODAY(28)
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
      C         READ BASIN DESCRIPTION DATA
      C
            READ (60,1000) TITLED
       1000 FORMAT (20A4)
            WRITE (IOUT,1010)
       1010 FORMAT (45H DO YOU WANT THE BASIN DESCRIPTION DISPLAYED? )
            CALL QUESZN(IPRINT)
            WRITE (IOUT,1020) TITLED
       1020 FORMAT (//44H THE BASIN DESCRIPTION FILE YOU ATTACHED IS:,/,20A4)
            READ (60,1030) NNODE
       1030 FORMAT (I5,A8,2X,2F10.0,I5,5F10.0)
            READ (60,1040) QMAX,QWL1,QWL2,QWL3
       1040 FORMAT (8F10.0)
            QMAX = ALOG10(QMAX)
            IF (IPRINT .EQ. 1) WRITE (IOUT,1050) NNODE
```

```
 1050 FORMAT (//,11H THERE ARE ,I3,19H NODES IN THE BASIN )
C
      DO 10 I = 1,NNODE
      READ (60,1030) NODEID(I),NODNAM(I),YLOC(I),XLOC(I),NXTNOD(I),
     1 PLTX(I),PLTY(I),CONCFC(I),DSA(I),DSB(I)
      DO 10 J = 1,12
      READ (60,1060) INDEPV(I,J),NTRCPT(I,J),SLOPE(I,J),QWA(I,J),
     1 QWB(I,J)
   10 CONTINUE
 1060 FORMAT (10X,I5,4F10.0)
C
      NNODE1 = NNODE - 1
      DO 30 I = 1,NNODE1
      DO 20 J = 1,NNODE
      IF (NXTNOD(I) .NE. NODEID(J)) GO TO 20
      NXTNOD(I) = J
      GO TO 30
   20 CONTINUE
   30 CONTINUE
C
C         READ INDEPENDENT VARIABLE INFORMATION
C
      READ (61,1000) TITLEP
      READ (61,1070) NMONTH,NINDV
 1070 FORMAT (16I5)
      READ (61,1080) (VARNAM(J),J=1,NINDV)
 1080 FORMAT (8(A6,4X))
C
C         DISPLAY BASIN DESCRIPTION DATA
C
      IF (IPRINT .NE. 1) GO TO 110
      WRITE (IOUT,1090) (I,NODEID(I),NODNAM(I),XLOC(I),YLOC(I),
     1 NXTNOD(I),CONCFC(I),DSA(I),DSB(I),I=1,NNODE)
 1090 FORMAT ( //,72H  NODE   NODE    NODE      X      Y    NEXT  CONCEN
     1TRATION     TDS / SC    ,/,77H NUMBER   ID     NAME    COORD  COORD
     2  NODE     FACTOR       INTERCEPT  SLOPE,//,(I5,I8,2X,A8,2F7.2,I6,
     3 F9.2,F13.2,F9.2))
   40 WRITE (IOUT,1100)
 1100 FORMAT (/,78H ENTER THE NUMBER OF THE NODE TO DISPLAY ITS REGRESSI
     1ON PARAMETERS (5 COLUMNS)  )
      READ (IN,1030) NOD
      IF (NOD .LE. 0 .OR. NOD .GT. NNODE) GO TO 110
      WRITE (IOUT,1110) NODEID(NOD),NODNAM(NOD)
 1110 FORMAT (/,32H REGRESSION PARAMETERS FOR NODE ,I5,2H (,A8,1H),/,
     1 76H MONTH  VARIABLE  VARIABLE    TYPE OF          STREAMFLOW
     2WATER QUALITY  ,/,77H         NUMBER      ID     RELATIONSHIP  INT
     3ERCEPT  SLOPE  INTERCEPT  SLOPE  ,/)
      DO 100 J = 1,12
      IND = INDEPV(NOD,J)
      IF (IND .LT. 0) GO TO 70
      IF (IND .GT. 100) GO TO 50
      WRITE (IOUT,1120) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
```

```
 1120 FORMAT (I5,I8,6X,A6,4X,10HINC-LINEAR,F10.3,3F9.3)
      GO TO 100
   50 IND = IND - 100
      IF (IND .GT. 100) GO TO 60
      WRITE (IOUT,1130) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1130 FORMAT (I5,I8,6X,A6,4X,10HINC-LOGLOG,F10.3,3F9.3)
      GO TO 100
   60 WRITE (IOUT,1140) J,INDEPV(NOD,J),NTRCPT(NOD,J),SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
 1140 FORMAT (I5,I8,6X,10HUPSTREAM  ,10HINC-LINEAR,F10.3,3F9.3)
      GO TO 100
   70 IND = -IND
      IF (IND .GT. 100) GO TO 80
      WRITE (IOUT,1150) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1150 FORMAT (I5,I8,6X,A6,4X,10HTOT-LINEAR,F10.3,3F9.3)
      GO TO 100
   80 IND = IND - 100
      IF (IND .GT. 100) GO TO 90
      WRITE (IOUT,1160) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
 1160 FORMAT (I5,I8,6X,A6,4X,10HTOT-LOGLOG,F10.3,3F9.3)
      GO TO 100
   90 WRITE (IOUT,1170) J,INDEPV(NOD,J),NTRCPT(NOD,J),SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
 1170 FORMAT (I5,I8,6X,10HUPSTREAM  ,10HTOT-LINEAR,F10.3,3F9.3)
  100 CONTINUE
      GO TO 40
C
C         DISPLAY INDEPENDENT VARIABLE INFORMATION
C
  110 WRITE (IOUT,1180) TITLEP,NMONTH,NINDV
 1180 FORMAT (//47H THE INDEPENDENT VARIABLE FILE YOU ATTACHED IS:,/,
     1 20A4,/,10X,19HTHAT FILE CONTAINS ,I4,22H MONTHS OF RECORD FOR ,
     2 I3,10H VARIABLES,//)
C
C         MODIFY BASIN DESCRIPTION DATA
C
  120 WRITE (IOUT,1190)
 1190 FORMAT (45H DO YOU WANT TO MODIFY THE BASIN DESCRIPTION? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 310,130,310
  130 WRITE (IOUT,1200)
 1200 FORMAT (27H DO YOU WANT TO ADD A NODE? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 260,140,260
C
C         ADD A NEW NODE
C
  140 WRITE (IOUT,1210)
```

```
 1210 FORMAT (78H ENTER THE NODE ID OF THE NODE UPSTREAM OF THIS NEW NOD
     1E OR THE NEGATIVE NODE ,/, 76H     ID OF THE DOWNSTREAM NODE IF TH
     2IS NEW NODE IS A HEADWATER NODE (5 COLS) )
      READ (IN,1070) IADD
      IF (IADD .LT. 0) GO TO 160
      DO 150 INOD = 1,NNODE
      IF (IADD .EQ. NODEID(INOD)) GO TO 180
  150 CONTINUE
      WRITE (IOUT,1220)
 1220 FORMAT (26HTHAT NODE ID WAS NOT FOUND )
      GO TO 140
  160 DO 170 INOD = 1,NNODE
      IF (-IADD .EQ. NODEID(INOD)) GO TO 190
  170 CONTINUE
      WRITE (IOUT,1220)
      GO TO 140
  180 INOD = INOD + 1
  190 WRITE (IOUT,1230)
 1230 FORMAT (28H ENTER THE NODE ID (5 COLS) )
      READ (IN,1070) IADD
      WRITE (IOUT,1240)
 1240 FORMAT (30H ENTER THE NODE NAME (8 COLS) )
      READ (IN,1250) INAM
 1250 FORMAT (A8)
      WRITE (IOUT,1260) XLOC(INOD)
 1260 FORMAT (46H ENTER THE X-COORDINATE (10 COLS)  OR <CR> IF ,F10.4,14
     1H IS ACCEPTABLE )
      READ (IN,1040) XL
      IF (XL .EQ. 0.) XL = XLOC(INOD)
      WRITE (IOUT,1270) YLOC(INOD)
 1270 FORMAT (46H ENTER THE Y-COORDINATE (10 COLS)  OR <CR> IF ,F10.4,14
     1H IS ACCEPTABLE )
      READ (IN,1040) YL
      IF (YL .EQ. 0.) YL = YLOC(INOD)
      NXT = NXTNOD(INOD-1)
      WRITE (IOUT,1280) NODEID(NXT)
 1280 FORMAT (62H ENTER THE NODE ID OF THE DOWNSTREAM NODE (5 COLS)  OR
     1<CR> IF ,I5,14H IS ACCEPTABLE )
      READ (IN,1070) NXTID
      IF (NXTID .EQ. 0) GO TO 210
      DO 200 NXT = 1,NNODE
      IF (NXTID .EQ. NODEID(NXT)) GO TO 210
  200 CONTINUE
      WRITE (IOUT,1220)
      GO TO 140
  210 WRITE (IOUT,1290) PLTX(INOD)
 1290 FORMAT (51H ENTER THE X PLOTTING OFFSET (10 COLS)  OR <CR> IF ,
     1 F10.2,14H IS ACCEPTABLE )
      READ (IN,1040) PTX
      IF (PTX .EQ. 0.) PTX = PLTX(INOD)
      WRITE (IOUT,1300) PLTY(INOD)
```

```
 1300 FORMAT (51H ENTER THE Y PLOTTING OFFSET (10 COLS)  OR <CR> IF ,
     1 F10.2,14H IS ACCEPTABLE )
      READ (IN,1040) PTY
      IF (PTY .EQ. 0.) PTY = PLTY(INOD)
      WRITE (IOUT,1310) CONCFC(INOD)
 1310 FORMAT (54H ENTER THE CONCENTRATION FACTOR (10 COLS)  OR <CR> IF ,
     1 F10.2,14H IS ACCEPTABLE )
      READ (IN,1040) CNCFAC
      IF (CNCFAC .EQ. 0.) CNCFAC = CONCFC(INOD)
      WRITE (IOUT,1320) DSA(INOD)
 1320 FORMAT (50H ENTER THE TDS/SC INTERCEPT (10 COLS)  OR <CR> IF ,
     1 F10.2,14H IS ACCEPTABLE )
      READ (IN,1040) DDSA
      IF (DDSA .EQ. 0.) DDSA = DSA(INOD)
      WRITE (IOUT,1330) DSB(INOD)
 1330 FORMAT (46H ENTER THE TDS/SC SLOPE (10 COLS)  OR <CR> IF ,F10.2,
     1 14H IS ACCEPTABLE )
      READ (IN,1040) DDSB
      IF (DDSB .EQ. 0.) DDSB = DSB(INOD)
C
      DO 220 J = 1,12
      WRITE (IOUT,1340) J,INDEPV(INOD,J)
 1340 FORMAT (6HMONTH ,I2,52H ENTER THE INDEPENDENT VARIABLE (5 COLS)  O
     1R <CR> IF ,I5,14H IS ACCEPTABLE )
      READ (IN,1070) INDV(J)
      IF (INDV(J) .EQ. 0) INDV(J) = INDEPV(INOD,J)
      WRITE (IOUT,1350) NTRCPT(INOD,J)
 1350 FORMAT (53H ENTER THE STREAMFLOW INTERCEPT (10 COLS)  OR <CR> IF ,
     1 F10.4,14H IS ACCEPTABLE )
      READ (IN,1040) CEPT(J)
      IF (CEPT(J) .EQ. 0.) CEPT(J) = NTRCPT(INOD,J)
      WRITE (IOUT,1360) SLOPE(INOD,J)
 1360 FORMAT (50H ENTER THE STREAMFLOW SLOPE (10 COLS)  OR <CR> IF ,
     1 F10.4,14H IS ACCEPTABLE )
      READ (IN,1040) SLP(J)
      IF (SLP(J) .EQ. 0.) SLP(J) = SLOPE(INOD,J)
      WRITE (IOUT,1370) QWA(INOD,J)
 1370 FORMAT (56H ENTER THE SC/STREAMFLOW INTERCEPT (10 COLS)  OR <CR> I
     1F,F10.4,14H IS ACCEPTABLE )
      READ (IN,1040) QWAA(J)
      IF (QWAA(J) .EQ. 0.) QWAA(J) = QWA(INOD,J)
      WRITE (IOUT,1380) QWB(INOD,J)
 1380 FORMAT (56H ENTER THE SC/STREAMFLOW SLOPE (10 COLS)  OR <CR> IF ,
     1 F10.4,14H IS ACCEPTABLE )
      READ (IN,1040) QWBB(J)
      IF (QWBB(J) .EQ. 0.) QWBB(J) = QWB(INOD,J)
  220 CONTINUE
```

```
C
      DO 240 I = 1,NNODE
      INODE = NNODE - I + 1
      IF (NXTNOD(INODE) .GT. INOD) NXTNOD(INODE) = NXTNOD(INODE) + 1
      IF (INODE .LT. INOD) GO TO 240
      IPLUS = INODE + 1
      NODEID(IPLUS) = NODEID(INODE)
      NODNAM(IPLUS) = NODNAM(INODE)
      XLOC(IPLUS) = XLOC(INODE)
      YLOC(IPLUS) = YLOC(INODE)
      NXTNOD(IPLUS) = NXTNOD(INODE)
      PLTX(IPLUS) = PLTX(INODE)
      PLTY(IPLUS) = PLTY(INODE)
      CONCFC(IPLUS) = CONCFC(INODE)
      DSA(IPLUS) = DSA(INODE)
      DSB(IPLUS) = DSB(INODE)
      DO 230 J = 1,12
      NTRCPT(IPLUS,J) = NTRCPT(INODE,J)
      SLOPE(IPLUS,J) = SLOPE(INODE,J)
      INDEPV(IPLUS,J) = INDEPV(INODE,J)
      QWA(IPLUS,J) = QWA(INODE,J)
      QWB(IPLUS,J) = QWB(INODE,J)
  230 CONTINUE
  240 CONTINUE
C
      IF (INOD .GT. NNODE) NXTNOD(NNODE) = INOD
      NNODE = NNODE + 1
      NODEID(INOD) = IADD
      NODNAM(INOD) = INAM
      XLOC(INOD) = XL
      YLOC(INOD) = YL
      NXTNOD(INOD) = NXT + 1
      PLTX(INOD) = PTX
      PLTY(INOD) = PTY
      CONCFC(INOD) = CNCFAC
      DSA(INOD) = DDSA
      DSB(INOD) = DDSB
C
      DO 250 J = 1,12
      NTRCPT(INOD,J) = CEPT(J)
      SLOPE(INOD,J) = SLP(J)
      INDEPV(INOD,J) = INDV(J)
      QWA(INOD,J) = QWAA(J)
      QWB(INOD,J) = QWBB(J)
  250 CONTINUE
      GO TO 120
C
C         CHANGE REGRESSION PARAMETERS
C
  260 WRITE (IOUT,1390)
 1390 FORMAT (45H DO YOU WANT TO CHANGE THE REGRESSION VALUES? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 290,270,290
  270 WRITE (IOUT,1400)
```

```
 1400 FORMAT (31H ENTER THE NODE NUMBER (5 COLS))
      READ (IN,1030) INODE
      DO 280 J = 1,12
      WRITE (IOUT,1340) J,INDEPV(INODE,J)
      READ (IN,1070) INDV(J)
      IF (INDV(J) .NE. 0) INDEPV(INODE,J) = INDV(J)
      WRITE (IOUT,1350) NTRCPT(INODE,J)
      READ (IN,1040) CEPT(J)
      IF (CEPT(J) .NE. 0.) NTRCPT(INODE,J) = CEPT(J)
      WRITE (IOUT,1360) SLOPE(INODE,J)
      READ (IN,1040) SLP(J)
      IF (SLP(J) .NE. 0.) SLOPE(INODE,J) = SLP(J)
      WRITE (IOUT,1370) QWA(INODE,J)
      READ (IN,1040) QWAA(J)
      IF (QWAA(J) .NE. 0.) QWA(INODE,J) = QWAA(J)
      WRITE (IOUT,1380) QWB(INODE,J)
      READ (IN,1040) QWBB(J)
      IF (QWBB(J) .NE. 0.) QWB(INODE,J) = QWBB(J)
  280 CONTINUE
      GO TO 120
C
C         CHANGE CONCENTRATION FACTOR
C
  290 WRITE (IOUT,1410)
 1410 FORMAT (68H DO YOU WANT TO CHANGE A CONCENTRATION FACTOR OR TDS/SC
     1 COEFFICIENT? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 310,300,310
  300 WRITE (IOUT,1400)
      READ (IN,1030) INODE
      WRITE (IOUT,1310) CONCFC(INODE)
      READ (IN,1040) CNCFAC
      IF (CNCFAC .NE. 0.) CONCFC(INODE) = CNCFAC
      WRITE (IOUT,1320) DSA(INODE)
      READ (IN,1040) DDSA
      IF (DDSA .NE. 0.) DSA(INODE) = DDSA
      WRITE (IOUT,1330) DSB(INODE)
      READ (IN,1040) DDSB
      IF (DDSB .NE. 0.) DSB(INODE) = DDSB
      GO TO 120
C
C         COMPUTE THE ARRAY OF UPSTREAM NODES
C
  310 DO 320 INODE = 1,NNODE
  320 NODEUS(INODE) = 0
      DO 330 INODE = 1,NNODE
      NEXT = NXTNOD(INODE)
      IF (NODEUS(NEXT) .NE. 0) GO TO 330
      NODEUS(NEXT) = INODE
  330 CONTINUE
C
C         ENTER TITLE
C
      WRITE (IOUT,1420)
```

```
 1420 FORMAT (//67H ENTER THE TITLE FOR THIS SIMULATION RUN (LIMITED TO
     120 CHARACTERS) )
      READ (IN,1000) TITL
      JNUM = 28
      CALL TIMDAT(TODAY,JNUM)
C
C         WRITE BASIN DESCRIPTION DATA
C
      WRITE (63,1430) TITL,(TODAY(JNUM),JNUM=1,3),TITLED,NNODE
 1430 FORMAT (82H1   BSNMD2 - RIVER BASIN SIMULATION MODEL #2     UPDATE
     1D 9/10/86     BY ALAN BURNS  ,///,20H  SIMULATION TITLE: ,5A4,
     2 66X,10H DATE RUN: ,A2,1H/,A2,1H/,A2,///,
     326H  BASIN DESCRIPTION FILE: ,20A4,11H, CONTAINS ,I3,6H NODES )
      WRITE (63,1440) TITLEP,NINDV,NMONTH
 1440 FORMAT ( //,29H  INDEPENDENT VARIABLE FILE: ,20A4,/,10X,8HCONTAINS
     1,I3,13H RECORDS FOR ,I3,7H MONTHS  )
      WRITE (63,1090) (I,NODEID(I),NODNAM(I),XLOC(I),YLOC(I),NXTNOD(I),
     1 CONCFC(I),DSA(I),DSB(I),I=1,NNODE)
      DO 390 NOD = 1,NNODE
      WRITE (63,1110) NODEID(NOD),NODNAM(NOD)
      DO 390 J = 1,12
      IND = INDEPV(NOD,J)
      IF (IND .LT. 0) GO TO 360
      IF (IND .GT. 100) GO TO 340
      WRITE (63,1120) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
      GO TO 390
  340 IND = IND - 100
      IF (IND .GT. 100) GO TO 350
      WRITE (63,1130) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
      GO TO 390
  350 WRITE (63,1140) J,INDEPV(NOD,J),NTRCPT(NOD,J),SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
      GO TO 390
  360 IND = -IND
      IF (IND .GT. 100) GO TO 370
      WRITE (63,1150) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
      GO TO 390
  370 IND = IND - 100
      IF (IND .GT. 100) GO TO 380
      WRITE (63,1160) J,INDEPV(NOD,J),VARNAM(IND),NTRCPT(NOD,J),
     1 SLOPE(NOD,J),QWA(NOD,J),QWB(NOD,J)
      GO TO 390
  380 WRITE (63,1170) J,INDEPV(NOD,J),NTRCPT(NOD,J),SLOPE(NOD,J),
     1 QWA(NOD,J),QWB(NOD,J)
  390 CONTINUE
C
C         ENTER GRAPHICS TERMINAL INFORMATION
C
      WRITE (IOUT,1450)
```

```
 1450 FORMAT (39H ENTER CODE FOR GRAPHICS DEVICE (1 COL) ,/,5X,
     1 11H0 FOR NONE ,/,5X,15H1 FOR TEK 4010 ,/,5X,15H2 FOR TEK 4027 ,/,
     2 5X,15H3 FOR TEK 4105 ,/,5X,15H4 FOR TEK 4107 ,/,
     3 5X,15H5 FOR HP 7475   )
      READ (IN,1070) IGRAPH
      IF (IGRAPH .EQ. 1) CALL TK4010(960)
      IF (IGRAPH .EQ. 2) CALL TK4027
      IF (IGRAPH .EQ. 3) CALL TK41(4105)
      IF (IGRAPH .EQ. 4) CALL TK41(4107)
      IF (IGRAPH .EQ. 5) CALL HP7475(1)
C
C         ENTER FREQUENCY OF PLOTTING SCHEMATIC
C
      WRITE (IOUT,1460)
 1460 FORMAT (60H ENTER THE FREQUENCY OF PLOTTING THE FLOW SCHEMATIC (5
     1COLS) ,/, 7X,18H0 FOR NO SCHEMATIC ,/, 7X,13H1 FOR MONTHLY ,/, 7X,
     2 15H12 FOR ANNUALLY ,/, 7X,34H99999 FOR PERIOD-OF-RECORD AVERAGE)
      READ (IN,1070) ISKM
C
C         ENTER NODES FOR HYDROGRAPHS
C
      WRITE (IOUT,1470)
 1470 FORMAT (65H ENTER THE NODE IDS FOR THOSE NODES AT WHICH YOU WANT H
     1YDROGRAPHS,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,1070) IHY
      IF (ISKM .NE. 1) GO TO 420
      DO 410 I = 1,5
      INODE = IHY(I)
      IF (INODE) 410,410,400
  400 WRITE (IOUT,1480) INODE
 1480 FORMAT (50H ENTER THE APPROXIMATE MAXIMUM STREAMFLOW AT NODE ,I5)
      READ (IN,1040) QHYMAX(I)
  410 CONTINUE
  420 DO 440 I = 1,5
      DO 430 J = 1,NNODE
      IF (IHY(I) .NE. NODEID(J)) GO TO 430
      IHY(I) = J
      GO TO 440
  430 CONTINUE
  440 CONTINUE
C
C         ENTER NODES FOR MONTHLY TABLES
C
      WRITE (IOUT,1490)
 1490 FORMAT (67H ENTER THE NODE IDS FOR THOSE NODES AT WHICH YOU WANT M
     1ONTHLY FLOWS,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,1070) ITBL
      DO 460 I = 1,5
      DO 450 J = 1,NNODE
      IF (ITBL(I) .NE. NODEID(J)) GO TO 450
      ITBL(I) = J
      GO TO 460
  450 CONTINUE
  460 CONTINUE
```

```
C
C         ENTER NODES FOR STATISTICAL SUMMARIES
C
      WRITE (IOUT,1500)
 1500 FORMAT (64H ENTER THE NODE IDS FOR THOSE NODES AT WHICH YOU WANT S
     1TATISTICS,/,7X,33H(5 COLS EACH - LIMIT OF 10 NODES) )
      READ (IN,1070) ISS
      DO 490 I = 1,10
      IF (ISS(I) .LE. 0) GO TO 490
      DO 470 J = 1,12
      XNN(I,J) = 0.
      QMEAN(I,J) = 0.
      QSD(I,J) = 0.
      QWMEAN(I,J) = 0.
      QWSD(I,J) = 0.
      QWLMN(I,J) = 0.
  470 QWLSD(I,J) = 0.
      DO 480 J = 1,NNODE
      IF (ISS(I) .NE. NODEID(J)) GO TO 480
      ISS(I) = J
      GO TO 490
  480 CONTINUE
  490 CONTINUE
C
C         PLOT NODE LOCATIONS
C
      IF (ISKM) 520,520,500
  500 WRITE (IOUT,1510)
 1510 FORMAT (49H DO YOU WANT TO PLOT THE NODE LOCATION SCHEMATIC? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 520,510,520
  510 WRITE (IDUM,1520) TITL
 1520 FORMAT (5A4,18H - NODE LOCATIONS$)
      CALL PLTNOD(ITITLE)
C
  520 WRITE (IOUT,1530)
 1530 FORMAT (54H THE MODEL NORMALLY COMPUTES A TIME-WEIGHTED QW VALUE.
     1 ,/,54H DO YOU WANT TO COMPUTE A DISCHARGE-WEIGHTED QW VALUE? )
      CALL QUESZN(IQW)
      WRITE (IOUT,1540)
 1540 FORMAT (44H DO YOU WANT TO DISPLAY ALL MONTHLY VALUES?  )
      CALL QUESZN(IPRINT)
C
      RETURN
      END
```

```
      SUBROUTINE RKRLAB(MONTH,YMAX,YMIN)
C
      YINC = (YMAX-YMIN)/50.
      YPLOT = -YMAX/15.
      IRECUR = 99
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 97
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 90
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 50
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 10
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 3
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      IRECUR = 1
      X = 100 - IRECUR
      X = FUNCZ(X/100.)
      CALL RLINT(IRECUR,X,YPLOT)
      CALL RLVEC(X,YMIN,X,YMIN+YINC,0)
      CALL RLVEC(X,YMAX,X,YMAX-YINC,0)
      RETURN
      END
```

```
CSKMATK
C
C          SUBROUTINE SCHEMATIC OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 12/19/86
C
      SUBROUTINE SKMATK(X,XX,ITITLE)
      COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
     1               YMAX
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
C
      DIMENSION X(1),XX(1),ITITLE(1)
      DIMENSION ISYM(4),XLINE(5),YLINE(5),ITEMP(20)
      CHARACTER*80 IDUM
C
      EQUIVALENCE (IDUM,ITEMP)
C
      DATA ISYM /6,5,1,0/
C
C         PLOT THE NETWORK
C
      CALL NETWRK(ITITLE)
C
C         PLOT THE EXPLANATION
C
      CALL SETCLR(5HWHITE)
      CALL MESSAG(16HQUANTITY OF FLOW,16,0.,2.7)
      CALL MESSAG(13HIN CUBIC FEET,13,.20,2.4)
      CALL MESSAG(10HPER SECOND,10,.35,2.1)
      CALL MESSAG(15HIS INDICATED BY,15,.05,1.8)
      CALL MESSAG(18HSIZE OF SYMBOL AND,18,-.05,1.5)
      CALL MESSAG(15HADJACENT NUMBER,15,.05,1.2)
      I = QMAX - 2.
      XI = I
      I = 10**I
      CALL INTNO(I,.90,0.9)
      X1 = XMIN + .07*XINC
      Y1 = YMIN + .13*YINC
      CALL SOLID(X1,Y1,XI,0)
      I = QMAX - 1.
      XI = I
      I = 10**I
      QPLOT = XI
      CALL INTNO(I,.93,0.6)
      Y1 = YMIN + .07*YINC
```

```
      CALL SOLID(X1,Y1,XI,0)
      I = QMAX
      XI = I
      I = 10**I
      CALL INTNO(I,.95,0.25)
      Y1 = YMIN
      CALL SOLID(X1,Y1,XI,0)
      CALL MESSAG(15HQUALITY OF FLOW,15,8.,2.1)
      CALL MESSAG(23HIN MILLIGRAMS PER LITER,23,7.45,1.8)
      CALL MESSAG(21HIS INDICATED BY SHAPE,21,7.65,1.5)
      CALL MESSAG(19HAND COLOR OF SYMBOL,19,7.8,1.2)
      CALL SETCLR(4HCYAN)
      X1 = XMAX - .17*XINC
      Y1 = YMIN + .15*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(1))
      WRITE (IDUM,1000) QWL1
 1000 FORMAT (1H<,F5.0)
      CALL MESSAG(ITEMP,6,8.5,0.9)
      CALL SETCLR(7HMAGENTA)
      Y1 = YMIN + .10*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(2))
      WRITE (IDUM,1010) QWL1,QWL2
 1010 FORMAT (F5.0,3H - ,F5.0)
      CALL MESSAG(ITEMP,13,8.5,0.6)
      CALL SETCLR(6HYELLOW)
      Y1 = YMIN + .06*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(3))
      WRITE (IDUM,1010) QWL2,QWL3
      CALL MESSAG(ITEMP,13,8.5,0.3)
      CALL SETCLR(3HRED)
      Y1 = YMIN + .01*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(4))
      WRITE (IDUM,1020) QWL3
 1020 FORMAT (1H>,F5.0)
      CALL MESSAG(ITEMP,6,8.5,0.)
C
C         PLOT THE DATA
C
      CALL SETCLR(5HWHITE)
      DO 10 INODE = 1,NNODE
      X1 = XPOSN(XLOC(INODE),YLOC(INODE)) + PLTX(INODE)
      Y1 = YPOSN(XLOC(INODE),YLOC(INODE)) + PLTY(INODE)
      JQ = X(INODE) + .5
   10 CALL INTNO(JQ,X1,Y1)
```

```
C
      DO 30 INODE = 1,NNODE
      IPEN = 1
      CALL SETCLR(4HCYAN)
      IF (XX(INODE) .LT. QWL1) GO TO 20
      IPEN = 2
      CALL SETCLR(7HMAGENTA)
      IF (XX(INODE) .LT. QWL2) GO TO 20
      IPEN = 3
      CALL SETCLR(6HYELLOW)
      IF (XX(INODE) .LT. QWL3) GO TO 20
      IPEN = 4
      CALL SETCLR(3HRED)
   20 CONTINUE
      IF (X(INODE) .LE. 0.) GO TO 30
      FAC = ALOG10(X(INODE))
      CALL SOLID(XLOC(INODE),YLOC(INODE),FAC,ISYM(IPEN))
   30 CONTINUE
      CALL ENDPL(0)
C
      RETURN
      END
```

```
CSOLID
C
C          SUBROUTINE SOLID OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/10/86
C
              SUBROUTINE SOLID(X,Y,FAC,IMARK)
              COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
        C
              IFAC = FAC*12/QMAX
              IFAC = IFAC + 1
              DO 10 II = 1,IFAC
              FAC1 = II
              FAC1 = FAC1/3.
              CALL MARKER(IMARK)
              CALL SCLPIC(FAC1)
              CALL HWSHD
           10 CALL CURVE(X,Y,1,-1)
        C
              RETURN
              END
```

```
      SUBROUTINE SORT(ARRAY,NPTS)
C
      DIMENSION ARRAY(1)
C
      DO 10 K = 1,100
      IF (2**K .GT. NPTS) GO TO 20
   10 CONTINUE
   20 K = K - 1
   30 IF (K .EQ. 0) RETURN
      I = 1
   40 J = I
      Y = ARRAY(I+K)
   50 IF (Y - ARRAY(J)) 80,60,60
   60 ARRAY(J+K) = Y
      I = I + 1
      IF (I+K-NPTS) 40,40,70
   70 IF (K .EQ. 2) GO TO 20
      K = (K-1)/2
      GO TO 30
   80 ARRAY(J+K) = ARRAY(J)
      J = J - K
      IF (J) 60,60,50
      END
```

```
CSUMRYF
C
C          SUBROUTINE FINAL SUMMARY OF RIVER BASIN SIMULATION MODEL (#2)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
            SUBROUTINE SUMRYF
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /HYDROG/ IHY(5),QHY(600,5),QWHY(600,5),QWLHY(600,5)
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /REACH1/ NODNAM(100)
            DOUBLE PRECISION NODNAM
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
            COMMON /STATS/ ISS(10),QMEAN(10,12),QSD(10,12),QWMEAN(10,12),
           1               QWSD(10,12),QWLMN(10,12),QWLSD(10,12),XNN(10,12)
            COMMON /TABLES/ ITBL(5),IQTBL(5,600),IQWTBL(5,600),IQWLTB(5,600)
      C
            DIMENSION ITITLE(20)
            CHARACTER*80 IDUM
      C
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
      C         IF ISKM = 99999, PLOT PERIOD OF RECORD SCHEMATIC
      C
            IF (ISKM - 99999) 50,10,50
         10 WRITE (IDUM,1000) TITL
       1000 FORMAT (5A4,20H - PERIOD OF RECORD$)
            DO 40 INODE = 1,NNODE
            IF (PORXN(INODE) .EQ. 0.) GO TO 40
            PORQ(INODE) = PORQ(INODE)/PORXN(INODE)
            IF (IQW) 20,20,30
         20 PORQW(INODE) = PORQW(INODE)/PORXN(INODE)
            GO TO 40
         30 IF (PORQ(INODE) .EQ. 0.) GO TO 40
            PORQW(INODE) = PORQW(INODE)/(PORQ(INODE)*PORXN(INODE))
         40 CONTINUE
      C
            CALL SKMATK(PORQ,PORQW,ITITLE)
         50 IF (ISKM .EQ. 1) CALL ENDPL(0)
      C
      C         PLOT HYDROGRAPHS
```

```
C
      DO 70 I = 1,5
      INODE = IHY(I)
      IF (INODE) 60,70,60
   60 WRITE (IDUM,1010) TITL,NODEID(INODE),NODNAM(INODE)
 1010 FORMAT (5A4,3H - ,I5,2H (,A8,2H)$)
      CALL HYDRGR(QHY(1,I),ITITLE,1)
      CALL HYDRGR(QWHY(1,I),ITITLE,2)
      CALL HYDRGR(QWLHY(1,I),ITITLE,3)
   70 CONTINUE
      NYEAR = NMONTH/12
C
C         LIST TABLES
C
      DO 170 I = 1,5
      INODE = ITBL(I)
      IF (INODE) 80,170,80
C
   80 DO 160 ITB = 1,3
      IF (IBATCH .EQ. 0) GO TO 90
      WRITE (IOUT,1020)
 1020 FORMAT (////,37H IS YOUR TERMINAL READY FOR THE TABLE)
      CALL QUESZN(IQ)
      IF (IQ - 1) 160,90,160
   90 IF (ITB - 2) 100,120,140
  100 WRITE (IOUT,1030) NODEID(INODE),NODNAM(INODE),(J,J=1,12)
 1030 FORMAT (////,50H MONTHLY FLOWS, IN CUBIC FEET PER SECOND, AT NODE
     1 ,I5,2H (,A8,1H) ,//,6H MONTH,I3,11I6,/,5H YEAR)
C
      DO 110 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  110 WRITE (IOUT,1040) IYEAR,(IQTBL(I,IMONTH),IMONTH=JMONTH,KMONTH)
 1040 FORMAT (I4,I7,11I6)
      GO TO 160
  120 WRITE (IOUT,1050) NODEID(INODE),NODNAM(INODE),(J,J=1,12)
 1050 FORMAT (////,58H MONTHLY CONCENTRATIONS, IN MILLIGRAMS PER LITER,
     1AT NODE ,I5,2H (,A8,1H) ,//,6H MONTH,I3,11I6,/,5H YEAR)
C
      DO 130 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  130 WRITE (IOUT,1040) IYEAR,(IQWTBL(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 160
  140 WRITE (IOUT,1060) NODEID(INODE),NODNAM(INODE),(J,J=1,12)
 1060 FORMAT (////,33H MONTHLY LOADS, IN TONS, AT NODE ,I5,2H (,A8,
     1 1H) ,//,6H MONTH,I3,11I6,/,5H YEAR)
C
      DO 150 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  150 WRITE (IOUT,1040) IYEAR,(IQWLTB(I,IMONTH),IMONTH=JMONTH,KMONTH)
  160 CONTINUE
  170 CONTINUE
```

```
C
C         LIST STATISTICS
C
      DO 210 I = 1,10
      INODE = ISS(I)
      IF (INODE) 180,210,180
  180 IF (IBATCH .EQ. 0) GO TO 190
      WRITE (IOUT,1070)
 1070 FORMAT (////,42H IS YOUR TERMINAL READY FOR THE STATISTICS )
      CALL QUESZN(IQ)
      IF (IQ - 1) 210,190,210
  190 WRITE (IOUT,1080) NODEID(INODE),NODNAM(INODE)
 1080 FORMAT (////,32H THE MONTHLY STATISTICS AT NODE ,I5,2H (,A8,7H) WE
     1RE:,//,54H MONTH        STREAMFLOW     CONCENTRATION        LOAD ,
     2 /,15X,40H(CUBIC         (MILLIGRAMS        (TONS) ,/,
     3 14X,27HFEET PER         PER LITER) ,/, 15X,7HSECOND) ,/,
     4 10X,3(17H  MEAN  STD DEV  ))
      TQM = 0.
      TQSD = 0.
      TQWM = 0.
      TQWSD = 0.
      TQWLM = 0.
      TQWLSD = 0.
      DO 200 JMONTH = 1,12
      XM1 = -99.
      XSD1 = -99.
      XM2 = -99.
      XSD2 = -99.
      XM3 = -99.
      XSD3 = -99.
      XNYEAR = XNN(I,JMONTH)
      IF (XNYEAR .LE. 1.) GO TO 200
      TQM = TQM + QMEAN(I,JMONTH)
      TQSD = TQSD + QSD(I,JMONTH)
      TQWM = TQWM + QWMEAN(I,JMONTH)
      TQWSD = TQWSD + QWSD(I,JMONTH)
      TQWLM = TQWLM + QWLMN(I,JMONTH)
      TQWLSD = TQWLSD + QWLSD(I,JMONTH)
      XXN = XNYEAR - 1.
      XM1 = QMEAN(I,JMONTH)/XNYEAR
      XSD1 = (QSD(I,JMONTH) - QMEAN(I,JMONTH)*XM1)/XXN
      IF (XSD1 .LT. 0.) XSD1 = 0.
      XSD1 = SQRT(XSD1)
      XM2 = QWMEAN(I,JMONTH)/XNYEAR
      XSD2 = (QWSD(I,JMONTH) - QWMEAN(I,JMONTH)*XM2)/XXN
      IF (XSD2 .LT. 0.) XSD2 = 0.
      XSD2 = SQRT(XSD2)
      IF (IQW .EQ. 1) XM2=QWLMN(I,JMONTH)/(.082188*QMEAN(I,JMONTH))
      XM3 = QWLMN(I,JMONTH)/XNYEAR
      XSD3 = (QWLSD(I,JMONTH) - QWLMN(I,JMONTH)*XM3)/XXN
      IF (XSD3 .LT. 0.) XSD3 = 0.
      XSD3 = SQRT(XSD3)
  200 WRITE (IOUT,1090) JMONTH,XM1,XSD1,XM2,XSD2,XM3,XSD3
```

```
 1090 FORMAT (I4,4X,2(F8.2,F9.2),F8.0,F9.0)
C
      XN = PORXN(INODE)
      XXN = XN - 1.
      IF (XN .LE. 1.) GO TO 210
      XSD1 = TQM*TQM/XN
      TQSD = SQRT((TQSD - XSD1)/XXN)
      TQM = TQM/XN
      XSD2 = TQWM*TQWM/XN
      TQWSD = SQRT((TQWSD - XSD2)/XXN)
      TQWM = TQWM/XN
      IF (IQW .EQ. 1) TQWM=TQWLM/(.082188*TQM*XN)
      XSD3 = TQWLM*TQWLM/XN
      TQWLSD = SQRT((TQWLSD - XSD3)/XXN)
      TQWLM = TQWLM/XN
      WRITE (IOUT,1100) TQM,TQSD,TQWM,TQWSD,TQWLM,TQWLSD
 1100 FORMAT (/,8H AVERAGE,2(F8.2,F9.2),F8.0,F9.0)
  210 CONTINUE
C
      RETURN
      END
```

```
CSUMRYM
C
C          SUBROUTINE MONTHLY SUMMARY OF RIVER BASIN SIMULATION MODEL (#2
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/20/87
C
            SUBROUTINE SUMRYM
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /HYDROG/ IHY(5),QHY(600,5),QWHY(600,5),QWLHY(600,5)
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /REACH1/ NODNAM(100)
            DOUBLE PRECISION NODNAM
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
            COMMON /STATS/ ISS(10),QMEAN(10,12),QSD(10,12),QWMEAN(10,12),
           1               QWSD(10,12),QWLMN(10,12),QWLSD(10,12),XNN(10,12)
            COMMON /TABLES/ ITBL(5),IQTBL(5,600),IQWTBL(5,600),IQWLTB(5,600)
      C
            DIMENSION QWLOAD(100),ITITLE(20)
            CHARACTER*80 IDUM
      C
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
      C         COMPUTE ANNUAL AND PERIOD-OF-RECORD AVERAGES
      C
            IF (IPRINT .EQ. 1) WRITE (IOUT,1000) IMONTH
            WRITE (63,1000) IMONTH
            WRITE (63,1010)
       1000 FORMAT (18H1  DATA FOR MONTH  ,I4 ,/   )
            IF (IPRINT .EQ. 1) WRITE (IOUT,1010)
       1010 FORMAT (55H  NODE   NODE    NODE   STREAMFLOW  CONCENTRATION  LOAD
           1 ,/,56H NUMBER   ID     NAME     (CUBIC     (MILLIGRAMS  (TONS),/,
           2 25X,23HFEET PER     PER LITER) ,/, 26X,7HSECOND) )
      C
            DO 120 INODE = 1,NNODE
            IF (Q(INODE) .EQ. -99.) GO TO 100
            AXN(INODE) = AXN(INODE) + 1.
            AQ(INODE) = AQ(INODE) + Q(INODE)
            PORXN(INODE) = PORXN(INODE) + 1.
            PORQ(INODE) = PORQ(INODE) + Q(INODE)
            IF (IQW) 10,10,20
         10 AQW(INODE) = AQW(INODE) + QW(INODE)
            PORQW(INODE) = PORQW(INODE) + QW(INODE)
            GO TO 30
         20 AQW(INODE) = AQW(INODE) + QW(INODE)*Q(INODE)
            PORQW(INODE) = PORQW(INODE) + QW(INODE)*Q(INODE)
```

```
   30 QWLOAD(INODE) = Q(INODE)*QW(INODE)*.0027*30.44
      IF (Q(INODE) .LT. 0.) Q(INODE) = 0.
      IF (QW(INODE) .LT. 0.) QW(INODE) = 0.
      IF (QWLOAD(INODE) .LT. 0.) QWLOAD(INODE) = 0.
      IF (QW(INODE) .GT. 100000.) QW(INODE) = -99.
      IF (QWLOAD(INODE) .GT. 10000000.) QWLOAD(INODE) = -99.
C
C         STORE HYDROGRAPH DATA
C
      DO 50 I = 1,5
      IF (INODE - IHY(I)) 50,40,50
   40 QHY(IMONTH,I) = Q(INODE)
      QWHY(IMONTH,I) = QW(INODE)
      QWLHY(IMONTH,I) = QWLOAD(INODE)
   50 CONTINUE
C
C         STORE TABLE DATA
C
      DO 70 I = 1,5
      IF (INODE - ITBL(I)) 70,60,70
   60 IQTBL(I,IMONTH) = Q(INODE) + .5
      IQWTBL(I,IMONTH) = QW(INODE) + .5
      IQWLTB(I,IMONTH) = QWLOAD(INODE) + .5
   70 CONTINUE
C
C         STORE STATISTICS DATA
C
      DO 90 I = 1,10
      IF (INODE - ISS(I)) 90,80,90
   80 XNN(I,JMONTH) = XNN(I,JMONTH) + 1.
      QMEAN(I,JMONTH) = QMEAN(I,JMONTH) + Q(INODE)
      QSD(I,JMONTH) = QSD(I,JMONTH) + Q(INODE)*Q(INODE)
      QWMEAN(I,JMONTH) = QWMEAN(I,JMONTH) + QW(INODE)
      QWSD(I,JMONTH) = QWSD(I,JMONTH) + QW(INODE)*QW(INODE)
      QWLMN(I,JMONTH) = QWLMN(I,JMONTH) + QWLOAD(INODE)
      QWLSD(I,JMONTH) = QWLSD(I,JMONTH) + QWLOAD(INODE)*QWLOAD(INODE)
   90 CONTINUE
      GO TO 110
C
  100 QWLOAD(INODE) = Q(INODE)
      QW(INODE) = Q(INODE)
  110 IF (IPRINT .EQ. 1) WRITE (IOUT,1020) INODE,NODEID(INODE),
     1 NODNAM(INODE),Q(INODE),QW(INODE),QWLOAD(INODE)
      WRITE (63,1020) INODE,NODEID(INODE),NODNAM(INODE),Q(INODE),
     1 QW(INODE),QWLOAD(INODE)
 1020 FORMAT (I6,I7,2X,A8,F11.2,F13.0,F11.2)
  120 CONTINUE
```

```
C
C         IF ISKM = 1, PLOT MONTHLY SCHEMATIC
C
      IF (ISKM - 1) 210,130,140
  130 CALL MONTHA
      GO TO 210
  140 IF (ISKM - 12) 210,150,210
C
C         IF ISKM = 12, PLOT ANNUAL SCHEMATIC
C
  150 IF (JMONTH - 12) 210,160,210
  160 WRITE (IDUM,1030) TITL,IYEAR
 1030 FORMAT (5A4,8H - YEAR ,I3,1H$)
      DO 190 INODE = 1,NNODE
      IF (AXN(INODE) .EQ. 0.) GO TO 190
      AQ(INODE) = AQ(INODE)/AXN(INODE)
      IF (IQW) 170,170,180
  170 AQW(INODE) = AQW(INODE)/AXN(INODE)
      GO TO 190
  180 IF (AQ(INODE) .EQ. 0.) GO TO 190
      AQW(INODE) = AQW(INODE)/(AQ(INODE)*AXN(INODE))
  190 CONTINUE
  200 CALL SKMATK(AQ,AQW,ITITLE)
C
  210 RETURN
      END
```

```
      FUNCTION FINC(FMAX,FMIN)
C
      RANGE = FMAX - FMIN
      IF (RANGE .LT. .1) GO TO 90
      IFAC = -10
   10 IFAC = IFAC + 1
      IF (10.**IFAC - RANGE) 10,20,20
   20 FINC = 10.**(IFAC - 1)
   30 IMIN = FMIN/FINC
      IF (FMIN) 40,60,60
   40 IF (FMIN/FINC + .05) 50,60,60
   50 IMIN = IMIN - 1
   60 IMAX = FMAX/FINC
      IF (IMAX - IMIN - 4) 70,80,80
   70 FINC = FINC/2.
      GO TO 30
   80 FMAX = (IMAX + 1)*FINC
      FMIN = IMIN * FINC
      RETURN
   90 FMAX = FMAX + 1.
      FMIN = FMIN - 1.
      FINC = 1.
      RETURN
      END
```

```
      FUNCTION FUNCZ(X)
C
      B = 1.
      C = X
      IF (C - .5) 20,20,10
   10 B = -1.
      C = 1. - C
   20 C = 1./(C*C)
      C = ALOG(C)
      C = SQRT(C)
      D = 2.511517 + 0.802853*C + 0.010328*C*C
      E = 1. + 1.432788*C + 0.189269*C*C + 0.001308*C*C*C
      C = C - D/E
      FUNCZ = B*C
      RETURN
      END
```

Attachment 8--FORTRAN Source Code of Subroutines
for Water-Supply Operations Simulation

```
      CBSNMD3
      C
      C         MAINLINE OF RIVER BASIN SIMULATION MODEL (VERSION #3)
      C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
      C                WATER RESOURCES DIVISION, LAKEWOOD, CO
      C                         LATEST UPDATE 5/21/87
      C
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /NAMES/ TITL(5)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
            COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
           1                QHYMAX(5),PORXN(100),AXN(100)
            COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
           1                AIM(100),APR(100),ACN(100),ANEED(100)
      C
            DIMENSION ITITLE(20)
            CHARACTER*80 IDUM
      C
            REAL ITITLE
            EQUIVALENCE (IDUM,ITITLE)
      C
            IN = 1
            IOUT = 1
      C
            WRITE (IOUT,1000)
       1000 FORMAT (54H IS THIS AN INTERACTIVE SESSION (0 FOR NO, 1 FOR YES)?)
            CALL QUESZN(IBATCH)
      C
            WRITE (IOUT,1010)
       1010 FORMAT (44H     BSNMD3  RIVER BASIN SIMULATION MODEL #3 ,//,
           1 56H          WRITTEN BY ALAN W. BURNS, USGS, LAKEWOOD, COLO ,/,
           2 40H          LATEST UPDATE MADE ON 1/28/87 ,///)
      C
            IF (IBATCH .EQ. 0) GO TO 40
            WRITE (IOUT,1020)
       1020 FORMAT (53H FOR ALL QUESTIONS, 1 = YES AND ANY OTHER NUMBER = NO
           1 ,/,37H DO YOU WANT THE GENERAL EXPLANATION? )
            CALL QUESZN(IQ)
            IF (IQ-1) 20,10,20
         10 WRITE (IOUT,1030)
       1030 FORMAT (//,64H      THIS MODEL IS THE THIRD IN A PLANNED SERIES OF
           1 RIVER BASIN,/,63H SIMULATION MODELS.  VERSION #3 USES VERSION #2
           2TO GENERATE THE,/,64H FLOW CONDITIONS OF THE BASIN.  THE COMPLETE
           3WATER USE SYSTEM IS,/,68H SIMULATED.  WATER IS OBTAINED FROM VARIO
           4US SOURCES IN A PRIORITIZED,/,60H LIST FOR EACH WATER USER TO SATI
           5SFY PERCEIVED NEEDS.  PRIOR,/,58H APPROPRIATION WATER LAWS, RESERV
           6OIR STORAGE AND RELEASES,,/,66H TRANSMOUNTAIN IMPORTS, AND GROUND-
           7WATER PUMPAGE ARE ALL SIMULATED,/,49H ALONG WITH THE RETURN FLOWS
           8OF UNCONSUMED WATER.   ,///)
```

```
   20 WRITE (IOUT,1040)
 1040 FORMAT (30H DO YOU WANT THE INSTRUCTIONS? )
      CALL QUESZN(IQ)
      IF (IQ-1) 40,30,40
   30 CALL INSTRK
      CALL NSTRK2
C
   40 IF (IBATCH .EQ. 1) CALL READFI
      IF (IBATCH .NE. 1) CALL READFB
C
      IF (IBATCH .EQ. 1) CALL READMI
      IF (IBATCH .NE. 1) CALL READMB
      IF (IBATCH .EQ. 1) CALL READUI
      IF (IBATCH .NE. 1) CALL READUB
C
C         INITIALIZATION
C
      DO 50 INODE = 1,NNODE
      PORQW(INODE) = 0.
      PORXN(INODE) = 0.
      PORQ(INODE) = 0.
      DO 50 ISIDE = 1,2
      TLWATR(INODE,ISIDE) = 0.
   50 TWCONC(INODE,ISIDE) = 0.
      DO 60 IUSER = 1,NUSERS
      ADD(IUSER) = 0.
      AGW(IUSER) = 0.
      ARR(IUSER) = 0.
      AIM(IUSER) = 0.
      APR(IUSER) = 0.
      ANEED(IUSER) = 0.
   60 ACN(IUSER) = 0.
C
      CALL UNTRSP
      CALL PRSTRS
      IYEAR = 0
C
      IF (ISKM .NE. 1) GO TO 70
      WRITE (IDUM,1050) TITL
 1050 FORMAT (5A4,22H - MONTHLY SIMULATION$ )
      CALL MNTHLY(ITITLE)
C
C         DO MONTHLY SIMULATION OVER ALL MONTHS
C
   70 DO 110 IMONTH = 1,NMONTH
      JMONTH = IMONTH - ((IMONTH-1)/12)*12
      IF (JMONTH-1) 80,80,100
   80 DO 90 INODE = 1,NNODE
      AQW(INODE) = 0.
   90 AQ(INODE) = 0.
      IYEAR = IYEAR + 1
      IF (IBATCH .EQ. 1 .AND. ISKM .NE. 1) WRITE (IOUT,1060) IYEAR
```

```
 1060 FORMAT (26H CURRENTLY SIMULATING YEAR ,I3)
C
  100 CALL NFLOW
      CALL DEMAND
      CALL ADJUST
      CALL SUPPLY
      CALL QUALTY
      CALL SUMRYM
      CALL SMRYMU
  110 CONTINUE
C
C         SUMMARIZE AND DO ANY DESIRED COMPARISONS
C
      CALL SUMRYF
      CALL SMRYFU
  120 IF (IBATCH .EQ. 0) GO TO 130
      WRITE (IOUT,1070)
 1070 FORMAT (71H DO YOU WANT TO COMPARE FLOW RESULTS FROM THIS RUN WITH
     1 A PREVIOUS RUN?  )
  130 CALL QUESZN(IQ)
      IF (IQ - 1) 150,140,150
  140 CALL CMPAR
      GO TO 120
  150 IF (IBATCH .EQ. 0) GO TO 160
      WRITE (IOUT,1080)
 1080 FORMAT (71H DO YOU WANT TO COMPARE USER RESULTS FROM THIS RUN WITH
     1 A PREVIOUS RUN?  )
  160 CALL QUESZN(IQ)
      IF (IQ - 1) 180,170,180
  170 CALL CMPARU(1)
      GO TO 150
  180 IF (IBATCH .EQ. 0) GO TO 190
      WRITE (IOUT,1090)
 1090 FORMAT (77H DO YOU WANT TO COMPARE RESERVOIR CONTENTS FROM THIS RU
     1N WITH A PREVIOUS RUN?)
  190 CALL QUESZN(IQ)
      IF (IQ - 1) 210,200,210
  200 CALL CMPARU(2)
      GO TO 180
  210 CONTINUE
      IF (IGRAPH .NE. 0) CALL DONEPL
      STOP
      END
```

```
CADJUST
C
C          SUBROUTINE ADJUST FOR RETURN FLOW OF RIVER BASIN SIMULATION MO
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 5/21/87
C
      SUBROUTINE ADJUST
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
     1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
     2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
     3                AGDMND(12),CANLEN(100),RAIN(50)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
C
C         COMPUTE MONTHLY EVAPORATION
C
      DO 10 IRES = 1,NRES
      SURFAC = RESSTR(IRES)*AREAMX(IRES)/CAPMAX(IRES)
      RESEVP(IRES) = EVAP(JMONTH)*SURFAC
   10 CONTINUE
C
C         ADJUST FLOW FOR PREVIOUSLY GENERATED RETURN FLOWS
C
      DO 40 INODE = 1,NNODE
      DO 40 ISIDE = 1,2
      RTRNFL(INODE,ISIDE) = AMIN1(FRSPNZ(INODE,1,ISIDE),
     1 GWSTOR(INODE,ISIDE))
      GWSTOR(INODE,ISIDE) = GWSTOR(INODE,ISIDE)-RTRNFL(INODE,ISIDE)
      RTRNFL(INODE,ISIDE) = RTRNFL(INODE,ISIDE)/60.3
      JNODE = INODE
   30 Q(JNODE) = Q(JNODE) + RTRNFL(INODE,ISIDE) +
     1 TLWATR(INODE,ISIDE)/60.3
      JNODE = NXTNOD(JNODE)
      IF (JNODE .GT. 0) GO TO 30
      DO 20 ITIME = 2,480
   20 FRSPNZ(INODE,ITIME-1,ISIDE) = FRSPNZ(INODE,ITIME,ISIDE)
   40 CONTINUE
```

```
C
C         REREAD INDEPENDENT VARIABLE FILE FOR PRECIPITATION DATA
C
      NCARDS = (NINDV-1)/8 + 1
      DO 50 I = 1,NCARDS
   50 BACKSPACE(61)
      READ (61,1000) (RAIN(I),I=1,NINDV)
 1000 FORMAT (8F10.2)
C
      RETURN
      END
```

```
CCMPARU
C
C          SUBROUTINE COMPARISON OF RIVER BASIN SIMULATION MODEL (#2)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE CMPARU(ICMP)
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /DEMND1/ USRNAM(100)
      DOUBLE PRECISION USRNAM
      COMMON /NAMES/ TITL(5)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /RIGHTS/ NRIGHT,OWNER(200)
C
      DIMENSION TITL2(5),YTEMP(7),X1(600),Y1(600),X2(600),Y2(600),
     1          X3(600),Y3(600),ITITLE(20),TITLED(20),TITLEP(20)
      CHARACTER*80 IDUM
      CHARACTER*6 LXNAME
C
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
      DOUBLE PRECISION ERRSD,SD,XXN
C
      REWIND 52
      REWIND 55
C
C         SKIP DOWN TO THE MONTHLY OUTPUT
```

```
C
      READ (52,1000) ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST
 1000 FORMAT (1A1)
      READ (55,1010) TITL2
 1010 FORMAT (20X,5A4)
      WRITE (IOUT,1020) TITL2
 1020 FORMAT (//47H THE PREVIOUS RUN YOU LOADED FOR COMPARISON IS: ,5A4)
      READ (52,1000) ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST
      READ (55,1030) TITLED,NNODEP
 1030 FORMAT (37X,20A4,6X,I3)
      WRITE (IOUT,1040) TITLED
 1040 FORMAT (43H ITS ADDITIONAL BASIN DESCRIPTION FILE WAS: ,/,20A4)
      DO 10 I = 1,41
      READ (52,1000) ITEST
   10 READ (55,1000) ITEST
      READ (52,1050) NRES
      READ (55,1050) NRESP
 1050 FORMAT (10X,I4)
      READ (52,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      DO 20 I = 1,NRES
   20 READ (52,1000) ITEST
      DO 30 I = 1,NRESP
   30 READ (55,1000) ITEST
      READ (52,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      DO 40 I = 1,NNODE
   40 READ (52,1000) ITEST
      DO 50 I = 1,NNODEP
   50 READ (55,1000) ITEST
      READ (52,1000) ITEST
      READ (55,1060) TITLED,NUSERP
 1060 FORMAT (18X,20A4,22X,I3)
      WRITE (IOUT,1070) TITLED
 1070 FORMAT (25H ITS WATER USER FILE WAS: ,/,20A4)
      READ (52,1000) ITEST,ITEST,ITEST,ITEST,ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST,ITEST,ITEST,ITEST,ITEST
      DO 60 I = 1,NUSERS
      READ (52,1080) NSORC
 1080 FORMAT (90X,I2)
      DO 60 LINES = 1,NSORC
   60 READ (52,1000) ITEST
      DO 70 I = 1,NUSERP
      READ (55,1080) NSORC
      DO 70 LINES = 1,NSORC
   70 READ (55,1000) ITEST
      READ (52,1000) ITEST
      READ (55,1090) TITLED,NRIGTP
 1090 FORMAT (19X,20A4,20X,I3)
      WRITE (IOUT,1100) TITLED
 1100 FORMAT (26H ITS WATER RIGHT FILE WAS: ,/,20A4)
      READ (52,1000) ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST
      DO 80 I = 1,NRIGHT
```

```
   80 READ (52,1000) ITEST
      DO 90 I = 1,NRIGTP
   90 READ (55,1000) ITEST
C
      IUSER = -99
      IRES = -99
      IF (ICMP .EQ. 2) GO TO 210
C
C         COMPARE WATER USER DATA
C
      IF (IBATCH .EQ. 0) GO TO 100
      WRITE (IOUT,1110)
 1110 FORMAT (27H ENTER THE USER ID (5 COLS) )
  100 READ (IN,1120) IUSER
 1120 FORMAT (I5,A8,2X,2F10.0,I5,3F10.0)
      DO 110 IIUSER = 1,NUSERS
      IF (USERID(IIUSER) .NE. IUSER) GO TO 110
      GO TO 120
  110 CONTINUE
  120 IF (IBATCH .EQ. 0) GO TO 130
      WRITE (IOUT,1130)
 1130 FORMAT (17H ENTER 1 FOR NEED ,/,7X,22H2 FOR DIRECT DIVERSION ,/,7X
     1 ,13H3 FOR PUMPAGE  ,/,7X,24H4 FOR RESERVOIR RELEASES ,/,7X,
     2 13H5 FOR IMPORTS ,/,7X,19H6 FOR TOTAL APPLIED ,/,7X,
     3 20H7 FOR TOTAL CONSUMED )
  130 READ (IN,1140) ITYPE
 1140 FORMAT (I1)
      GO TO (140, 150, 160, 170, 180, 190, 200), ITYPE
  140 WRITE (IOUT,1150) USERID(IIUSER),USRNAM(IIUSER)
 1150 FORMAT (40H THE WATER NEED, IN ACRED-FEET, FOR USER ,I5,2H (,A8,
     1 14H) ARE COMPARED  )
      GO TO 250
  150 WRITE (IOUT,1160) USERID(IIUSER),USRNAM(IIUSER)
 1160 FORMAT (46H THE DIRECT DIVERSIONS, IN ACRE-FEET, FOR USER ,I5,2H (
     1 ,A8,14H) ARE COMPARED )
      GO TO 250
  160 WRITE (IOUT,1170) USERID(IIUSER),USRNAM(IIUSER)
 1170 FORMAT (37H THE PUMPAGE, IN ACRE-FEET, FOR USER ,I5,2H (,A8,
     1 14H) ARE COMPARED  )
      GO TO 250
  170 WRITE (IOUT,1180) USERID(IIUSER),USRNAM(IIUSER)
 1180 FORMAT (48H THE RESERVOIR RELEASES, IN ACRE-FEET, FOR USER ,I5,
     1 2H (,A8,14H) ARE COMPARED )
      GO TO 250
  180 WRITE (IOUT,1190) USERID(IIUSER),USRNAM(IIUSER)
 1190 FORMAT (37H THE IMPORTS, IN ACRE-FEET, FOR USER ,I5,2H (,A8,
     1 14H) ARE COMPARED  )
      GO TO 250
  190 WRITE (IOUT,1200) USERID(IIUSER),USRNAM(IIUSER)
 1200 FORMAT (48H THE TOTAL APPLIED WATER, IN ACRE-FEET, FOR USER ,I5,
     1 2H (,A8,14H) ARE COMPARED  )
      GO TO 250
  200 WRITE (IOUT,1210) USERID(IIUSER),USRNAM(IIUSER)
 1210 FORMAT (48H THE TOTAL WATER CONSUMED, IN ACRE-FEET, BY USER ,I5,
     1 2H (,A8,14H) ARE COMPARED  )
      GO TO 250
```

```
C
C          COMPARE RESERVOIR DATA
C
  210 IF (IBATCH .EQ. 0) GO TO 220
      WRITE (IOUT,1220)
 1220 FORMAT (32H ENTER THE RESERVOIR ID (5 COLS) )
  220 READ (IN,1120) IRES
      DO 230 IIRES = 1,NRES
      IF (RESID(IIRES) .NE. IRES) GO TO 230
      GO TO 240
  230 CONTINUE
  240 WRITE (IOUT,1230) RESID(IIRES),RESNAM(IIRES)
 1230 FORMAT (42H THE CONTENTS, IN ACRE-FEET, FOR RESERVOIR ,I5,2H (,A8,
     1 14H) ARE COMPARED )
C
  250 YMAX = 0.
      YMIN = 0.
      DIFMAX = 0.
      DIFMIN = 1.0E10
      XMONTH = 0.
      MONTHX = 0
      MONTH1 = 1
      MONTH2 = 1
      ERRMN = 0.
      ERRSD = 0.
      MONTH = NMONTH
C
C         READ AND SELECT DESIRED PARAMETER
C
      DO 310 IMONTH = 1,MONTH
      READ (52,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST,ITEST
C
      DO 260 I = 1,NUSERS
      READ (52,1240) JUSER,YTEMP
 1240 FORMAT (8X,I5,10X,2F8.0,2F9.0,F10.0,F9.0,8X,F10.0)
      IF (JUSER .NE. IUSER) GO TO 260
      Y1(MONTH1) = YTEMP(ITYPE)
      IF (YTEMP(ITYPE) .EQ. -99.) GO TO 260
      IF (YTEMP(ITYPE) .GT. YMAX) YMAX = YTEMP(ITYPE)
  260 CONTINUE
C
      DO 270 I = 1,NUSERP
      READ (55,1240) JUSER,YTEMP
      IF (JUSER .NE. IUSER) GO TO 270
      Y2(MONTH2) = YTEMP(ITYPE)
      IF (YTEMP(ITYPE) .EQ. -99.) GO TO 270
      IF (YTEMP(ITYPE) .GT. YMAX) YMAX = YTEMP(ITYPE)
  270 CONTINUE
C
      READ (52,1000) ITEST,ITEST
      READ (55,1000) ITEST,ITEST
```

```
C
      READ (52,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      READ (55,1000) ITEST,ITEST,ITEST,ITEST,ITEST
      DO 280 I = 1,NRES
      READ (52,1250) JRES,YTEMP(1)
 1250 FORMAT (13X,I6,13X,F11.0)
      IF (JRES .NE. IRES) GO TO 280
      Y1(MONTH1) = YTEMP(1)
      IF (YTEMP(1) .EQ. -99.) GO TO 280
      IF (YTEMP(1) .GT. YMAX) YMAX = YTEMP(1)
  280 CONTINUE
      DO 290 I = 1,NRESP
      READ (55,1250) JRES,YTEMP(1)
      IF (JRES .NE. IRES) GO TO 290
      Y2(MONTH2) = YTEMP(1)
      IF (YTEMP(1) .EQ. -99.) GO TO 290
      IF (YTEMP(1) .GT. YMAX) YMAX = YTEMP(1)
  290 CONTINUE
C
      X1(MONTH1) = IMONTH
      X1(MONTH1) = X1(MONTH1) - .25
      X2(MONTH2) = X1(MONTH1) + .5
      IF (Y1(MONTH1) .EQ. -99.) GO TO 300
      MONTH1 = MONTH1 + 1
      IF (Y2(MONTH2) .EQ. -99.) GO TO 310
      MONTH2 = MONTH2 + 1
      ERR = Y1(MONTH1 - 1) - Y2(MONTH2 - 1)
      IF (ERR .GT. DIFMAX) DIFMAX = ERR
      IF (ERR .LT. DIFMIN) DIFMIN = ERR
      XMONTH = XMONTH + 1.
      MONTHX = MONTHX + 1
      X3(MONTHX) = IMONTH
      Y3(MONTHX) = ERR
      ERRMN = ERRMN + ERR
      ERRSD = ERRSD + ERR*ERR
      GO TO 310
  300 IF (Y2(MONTH2) .EQ. -99.) GO TO 310
      MONTH2 = MONTH2 + 1
  310 CONTINUE
C
      IF (XMONTH .LE. 1.) RETURN
      MONTH1 = MONTH1 - 1
      MONTH2 = MONTH2 - 1
      SD = ERRMN*ERRMN/XMONTH
      XXN = XMONTH - 1.
      ERRSD = DSQRT((ERRSD - SD)/XXN)
      ERRMN = ERRMN/XMONTH
      WRITE (IOUT,  1260) ERRMN,ERRSD
 1260 FORMAT (   43H THE MEAN RESIDUAL BETWEEN THE TWO RUNS IS ,F10.3,
     1 /,30H   THE STANDARD DEVIATION IS  ,F10.3)
      IF (IGRAPH .EQ. 0) RETURN
C
C         PLOT THE TWO SETS OF DATA AS HYDROGRAPHS
```

```
C
      XMIN = 0.
      XMAX = MONTH + 1
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      XINC = FINC(XMAX,XMIN)
      IF (MONTH .GT. 37) XMAX = XMAX*12.
      YINC = FINC(YMAX,YMIN)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL INTAXS
C
      CALL HEIGHT(.2)
      LXNAME = 'MONTHS'
      IF (MONTH .GT. 37) LXNAME = 'YEARS '
      GO TO (320,400) ICMP
  320 WRITE (IDUM,1270) USERID(IIUSER),USRNAM(IIUSER)
 1270 FORMAT (I5,2H (,A8,2H)$)
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME(LXNAME,6)
      GO TO (330,340,350,360,370,380,390), ITYPE
  330 CALL YNAME(24HWATER NEED, IN ACRE-FEET,24)
      GO TO 410
  340 CALL YNAME(31HDIRECT DIVERSIONS, IN ACRE-FEET,31)
      GO TO 410
  350 CALL YNAME(21HPUMPAGE, IN ACRE-FEET,21)
      GO TO 410
  360 CALL YNAME(32HRESERVOIR RELEASES, IN ACRE-FEET,32)
      GO TO 410
  370 CALL YNAME(21HIMPORTS, IN ACRE-FEET,21)
      GO TO 410
  380 CALL YNAME(33HTOTAL APPLIED WATER, IN ACRE-FEET,33)
      GO TO 410
  390 CALL YNAME(34HTOTAL WATER CONSUMED, IN ACRE-FEET,34)
      GO TO 410
  400 WRITE (IDUM,1270) RESID(IIRES),RESNAM(IIRES)
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME(LXNAME,6)
      CALL YNAME(30HSTORAGE CONTENTS, IN ACRE-FEET,30)
```

```
  410 CALL XTICKS(0)
      CALL YTICKS(0)
      CALL XNONUM
      CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
      CALL BARS(-.25)
      CALL SETCLR(3HRED)
      CALL MESSAG(TITL,20,4.0,5.7)
      CALL CURVE(X1,Y1,MONTH1,0)
      CALL SETCLR(5HGREEN)
      CALL MESSAG(TITL2,20,4.0,5.4)
      CALL CURVE(X2,Y2,MONTH2,0)
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      CALL SETCLR(5HWHITE)
      CALL RESET('XNONUM')
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,0.)
      ITICKS = XINC + .1
      CALL XTICKS(ITICKS)
      CALL RESET('YTICKS')
      CALL XNONUM
      CALL YNONUM
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,-1,0.,0.)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,-1,0.,0.)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,6.0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,1,10.,0.)
      CALL ENDPL(0)
C
C         PLOT THE TWO SETS OF DATA AS FREQUENCY CURVES
C
      CALL SORT(Y1,MONTH1)
      CALL PROB(X1,MONTH1)
      CALL SORT(Y2,MONTH2)
      CALL PROB(X2,MONTH2)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL INTAXS
C
      CALL HEIGHT(.2)
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME(26HPERCENT OF MONTHS EXCEEDED ,26)
      GO TO (420,500), ICMP
  420 GO TO (430,440,450,460,470,480,490), ITYPE
  430 CALL YNAME(24HWATER NEED, IN ACRE-FEET,24)
      GO TO 510
  440 CALL YNAME(31HDIRECT DIVERSIONS, IN ACRE-FEET,31)
      GO TO 510
  450 CALL YNAME(21HPUMPAGE, IN ACRE-FEET,21)
      GO TO 510
  460 CALL YNAME(32HRESERVOIR RELEASES, IN ACRE-FEET,32)
      GO TO 510
  470 CALL YNAME(21HIMPORTS, IN ACRE-FEET,21)
      GO TO 510
```

```
  480 CALL YNAME(33HTOTAL APPLIED WATER, IN ACRE-FEET,33)
      GO TO 510
  490 CALL YNAME(34HTOTAL WATER CONSUMED, IN ACRE-FEET,34)
      GO TO 510
  500 CALL YNAME(30HSTORAGE CONTENTS, IN ACRE-FEET,30)
  510 XMIN = X1(1)
      IF (X2(1) .GT. XMIN) XMIN = X2(1)
      XMAX = X1(MONTH1)
      IF (X2(MONTH2) .LT. XMAX) XMAX = X2(MONTH2)
      XINC = XMAX - XMIN
      CALL HEIGHT(.2)
      CALL XNONUM
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL GRAF(XMIN,XINC,XMAX,YMIN,YINC,YMAX)
      CALL SETCLR(3HRED)
      CALL MESSAG(TITL,20,2.5,5.7)
      CALL CURVE(X1,Y1,MONTH1,0)
      CALL HWSHD
      CALL SHDPAT(1)
      CALL SHDCRV(X1,Y1,MONTH1,X1,Y1,5HBELOW)
      CALL SETCLR(5HGREEN)
      CALL MESSAG(TITL2,20,2.5,5.4)
      CALL CURVE(X2,Y2,MONTH2,0)
      CALL RESET('HWSHD')
      CALL SHDPAT(3)
      CALL SHDCRV(X2,Y2,MONTH2,X2,Y2,5HBELOW)
      CALL SETCLR(5HWHITE)
      CALL RESET('YTICKS')
      CALL YNONUM
      CALL RLVEC (XMIN,YMIN,XMAX,YMIN,0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,-1,0.,0.)
      CALL RLVEC (XMIN,YMAX,XMAX,YMAX,0)
      CALL YGRAXS(YMIN,YINC,YMAX,6.0,1H ,1,10.,0.)
      MONTH = MONTH1
      IF (MONTH2 .GT. MONTH) MONTH = MONTH2
      CALL RKRLAB(MONTH,YMAX,YMIN)
      CALL ENDPL(0)
C
C         PLOT A HYDROGRAPH OF THE RESIDUALS
C
      MONTH = NMONTH
      IF (MONTHP .LT. MONTH) MONTH = MONTHP
      XMIN = 0.
      XMAX = NMONTH + 1
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      XINC = FINC(XMAX,XMIN)
      IF (MONTH .GT. 37) XMAX = XMAX*12.
      DIFINC = FINC(DIFMAX,DIFMIN)
      CALL RESET('ALL')
      CALL PAGE(11.,8.5)
      CALL NOBRDR
      CALL AREA2D(10.,6.0)
      CALL INTAXS
C
```

```
      CALL HEIGHT(.2)
      CALL HEADIN(ITITLE,100,1.,1)
      CALL XNAME(1H ,1)
      GO TO (520,600) ICMP
  520 GO TO (530,540,550,560,570,580,590), ITYPE
  530 CALL YNAME(24HWATER NEED, IN ACRE-FEET,24)
      GO TO 610
  540 CALL YNAME(31HDIRECT DIVERSIONS, IN ACRE-FEET,31)
      GO TO 610
  550 CALL YNAME(21HPUMPAGE, IN ACRE-FEET,21)
      GO TO 610
  560 CALL YNAME(32HRESERVOIR RELEASES, IN ACRE-FEET,32)
      GO TO 610
  570 CALL YNAME(21HIMPORTS, IN ACRE-FEET,21)
      GO TO 610
  580 CALL YNAME(33HTOTAL APPLIED WATER, IN ACRE-FEET,33)
      GO TO 610
  590 CALL YNAME(34HTOTAL WATER CONSUMED, IN ACRE-FEET,34)
      GO TO 610
  600 CALL YNAME(30HSTORAGE CONTENTS, IN ACRE-FEET,30)
  610 CALL CROSS
      CALL HEIGHT(.2)
      CALL XNONUM
      CALL XTICKS(0)
      CALL YTICKS(0)
      CALL GRAF(XMIN,XINC,XMAX,DIFMIN,DIFINC,DIFMAX)
      CALL MESSAG(TITL,20,2.0,6.1)
      CALL MESSAG(TITL2,20,6.0,6.1)
      CALL SETCLR(4HCYAN)
      CALL BARPAT(16)
      CALL BARWID(-1.)
      CALL VBARS(X3,Y3,'BASE',MONTHX)
      IF (MONTH .GT. 37) XMAX = XMAX/12.
      CALL SETCLR(5HWHITE)
      ITICKS = XINC + .1
      CALL XTICKS(ITICKS)
      CALL RESET('YTICKS')
      CALL YNONUM
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,-1,0.,0.)
      CALL YGRAXS(DIFMIN,DIFINC,DIFMAX,6.0,1H ,-1,0.,0.)
      CALL XGRAXS(XMIN,XINC,XMAX,10.,1H ,1,0.,6.0)
      CALL YGRAXS(DIFMIN,DIFINC,DIFMAX,6.0,1H ,1,10.,0.)
      CALL RESET('XNONUM')
      CALL XTICKS(0)
      IF (MONTH.LT.38) CALL XGRAXS(XMIN,XINC,XMAX,10.,6HMONTHS,6,0.,0.)
      IF (MONTH.GT.37) CALL XGRAXS(XMIN,XINC,XMAX,10.,5HYEARS,5,0.,0.)
      CALL ENDPL(0)
C
      RETURN
      END
```

```
CCMPDST
C
C          SUBROUTINE COMPUTE DISTANCE OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
            SUBROUTINE CMPDST(INODE,XXLOC,YYLOC,DIST)
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
      C
            IUP = NODEUS(INODE)
            IF (IUP .LE. 0) GO TO 10
            DISTC = SQRT((CVLONG*(XXLOC-XLOC(IUP)))**2 +
           1 (CNVLAT*(YYLOC-YLOC(IUP)))**2)*5280.
            DISTA = SQRT((CVLONG*(XXLOC-XLOC(INODE)))**2 +
           1 (CNVLAT*(YYLOC-YLOC(INODE)))**2)*5280.
            DISTB = SQRT((CVLONG*(XLOC(INODE)-XLOC(IUP)))**2 +
           1 (CNVLAT*(YLOC(INODE)-YLOC(IUP)))**2)*5280.
            S = 2.*DISTA*DISTA*DISTB*DISTB + 2.*DISTA*DISTA*DISTC*DISTC
           1 + 2.*DISTB*DISTB*DISTC*DISTC - DISTA**4 - DISTB**4 - DISTC**4
            IF (S .LE. 0.) GO TO 20
            DIST = SQRT(S)/(2.*DISTB)
            RETURN
         10 IDOWN = NXTNOD(INODE)
            DISTC = SQRT((CVLONG*(XXLOC-XLOC(INODE)))**2 +
           1 (CNVLAT*(YYLOC-YLOC(INODE)))**2)*5280.
            DISTA = SQRT((CVLONG*(XXLOC-XLOC(IDOWN)))**2 +
           1 (CNVLAT*(YYLOC-YLOC(IDOWN)))**2)*5280.
            DISTB = SQRT((CVLONG*(XLOC(IDOWN)-XLOC(INODE)))**2 +
           1 (CNVLAT*(YLOC(IDOWN)-YLOC(INODE)))**2)*5280.
            S = 2.*DISTA*DISTA*DISTB*DISTB + 2.*DISTA*DISTA*DISTC*DISTC
           1 + 2.*DISTB*DISTB*DISTC*DISTC - DISTA**4 - DISTB**4 - DISTC**4
            IF (S .LE. 0.) GO TO 20
            DIST = SQRT(S)/(2.*DISTB)
            RETURN
         20 DIST = -1000000.
            RETURN
            END
```

```
CCMPUTR
C
C                 SUBROUTINE COMPUTE FUTURE RESPONSES OF
C                    RIVER BASIN SIMULATION MODEL
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 1/23/87
C
            SUBROUTINE CMPUTR(STRESS,NODE,ISIDE,ADIST)
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      C
            DIMENSION DIST(5)
      C
            DATA DIST /3.0,3.3,3.7,4.0,4.3/
      C
            IF (STRESS .EQ. 0.) RETURN
            IF (ADIST .EQ. 0.) ADIST = 100.
            BDIST = ALOG10(ADIST)
            DO 10 I = 1,5
            IF (DIST(I) .GT. BDIST) GO TO 20
         10 CONTINUE
            I = 5
         20 DO 30 ITIME = 1,480
         30 FRSPNZ(NODE,ITIME,ISIDE) = FRSPNZ(NODE,ITIME,ISIDE) + STRESS *
           1 UNIT(I,ITIME)
            RETURN
            END
```

```
764   CDEMAND
765   C
766   C            SUBROUTINE DEMAND OF RIVER BASIN SIMULATION MODEL
767   C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
768   C                WATER RESOURCES DIVISION, LAKEWOOD, CO
769   C                         LATEST UPDATE 9/10/86
770   C
771                 SUBROUTINE DEMAND
772                 COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
773                1       JMONTH,IYEAR
774                 COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
775                1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
776                2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
777                3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
778                4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
779                5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
780                6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
781                7               TIMFAC(100,12)
782                 INTEGER USERID,USRTYP,RFTYPE
783                 REAL NUMUSR,NEED
784                 COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
785                1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
786                2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
787                3                AGDMND(12),CANLEN(100),RAIN(50)
788                 COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
789                1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
790                2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
791                3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
792                 INTEGER RESID
793                 REAL NACTIV
794         C
795                 DO 90 IUSER = 1,NUSERS
796                 IF (USRTYP(IUSER) .GT. 5) GO TO 50
797                 GO TO (10,20,30,40,100), USRTYP(IUSER)
798         C
799         C           AGRICULTURAL
800         C
801              10 NEED(IUSER) = PET(JMONTH)*NUMUSR(IUSER)
802                 IF (DMDFAC(IUSER) .LT. 0.) WANT(IUSER) =
803                1 AGDMND(JMONTH)*NUMUSR(IUSER)*(-DMDFAC(IUSER))
804                 IF (DMDFAC(IUSER) .GE. 0.) WANT(IUSER) =
805                1 PET(JMONTH)*NUMUSR(IUSER)*DMDFAC(IUSER)
806                 GO TO 90
807         C
808         C           MUNCIPAL
809         C
810              20 NEED(IUSER) = (DRINK + AGDMND(JMONTH))*NUMUSR(IUSER)
811                 GO TO 80
812         C
813         C           INDUSTRIAL
814         C
815              30 NEED(IUSER) = DRINK*NUMUSR(IUSER)
816                 GO TO 80
```

```
C
C         IN STREAM
C
   40 NEED(IUSER) = SESNAL(JMONTH)*NUMUSR(IUSER)
      GO TO 80
C
C         RESERVOIR OPERATOR
C
   50 IACCNT = IAKNT(IUSER)
      IF (DMDFAC(IUSER) .LT. 0.) GO TO 10
      DO 60 IRES = 1,NRES
      IF (USRTYP(IUSER) .NE. RESID(IRES)) GO TO 60
      NEED(IUSER) = NUMUSR(IUSER) - SBSTOR(IRES,IACCNT)
      WANT(IUSER) = NEED(IUSER)
      GO TO 90
   60 CONTINUE
C
   80 WANT(IUSER) = NEED(IUSER)*DMDFAC(IUSER)
   90 CONTINUE
C
      RETURN
  100 STOP
      END
```

```
CDETNOD
C
C          SUBROUTINE DETERMINE NODE OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/10/86
C
            SUBROUTINE DETNOD(XXLOC,YYLOC,NODE,ISIDE)
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
      C
            DISTMN = 1.0E10
            NODE = 0
            ISIDE = 1
            DO 10 INODE = 1,NNODE
            DIST = SQRT((CVLONG*(XXLOC-XLOC(INODE)))**2 +
           1 (CNVLAT*(YYLOC-YLOC(INODE)))**2)
            IF (DIST .GT. DISTMN) GO TO 10
            DISTMN = DIST
            NODE = INODE
            IF (DISTMN .EQ. 0) RETURN
         10 CONTINUE
            IDOWN = NXTNOD(NODE)
            IF (IDOWN .LT. 0) GO TO 50
         20 THETA = ATAN2(YLOC(NODE)-YLOC(IDOWN),XLOC(IDOWN)-XLOC(NODE))
            XTRANS = (XLOC(NODE)-XXLOC)*COS(THETA) + (YYLOC-YLOC(NODE))*
           1 SIN(THETA)
            YTRANS = -(XLOC(NODE)-XXLOC)*SIN(THETA) + (YYLOC-YLOC(NODE))*
           1 COS(THETA)
            IF (XTRANS) 30,30,40
         30 NODE = IDOWN
            IF (YTRANS .LT. 0.) ISIDE = 2
            RETURN
         40 IDOWN = NODE
            NODE = NODEUS(NODE)
            IF (NODE .EQ. 0) GO TO 30
            GO TO 20
         50 IF (YYLOC .LT. YLOC(NODE)) ISIDE = 2
            RETURN
            END
```

```
CNSTRK2
C
C          SUBROUTINE INSTRUCTION OF RIVER BASIN SIMULATION MODEL (#3)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/22/87
C
            SUBROUTINE NSTRK2
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
      C
            CALL QUESZN(ITEMP)
            WRITE (IOUT,1000)
       1000 FORMAT (73H Three additional data sets must be prepared prior to u
           1sing the model for ,/, 22H water-use simulation: ,/,
           259H      Additional physical descriptions of the modeled area; ,/,
           3 48H      a description of the water use system; and ,/,
           4 41H      a prioritized list of water rights. ,/,
           5 60H The format for the additional physical description file is:
           6 ,/,
           7 37H Record  Columns   Name   Description ,/,
           8 80H+_____  _______  ______  ____________________________________
           9_________________ ,/,
           * 33H    1      1- 80  TITLEM  a title ,/,
           1 76H    2      9- 14  PET     monthly potential evapotranspiration
           2, in feet, one ,/,
           3 78H          15- 20  PET          for each of the 12 months, begi
           4nning in January ,/,
           5 21H          21- 26  PET ,/, 21H          27- 32  PET ,/,
           6 21H          33- 38  PET ,/, 21H          39- 44  PET ,/,
           7 21H          45- 50  PET ,/, 21H          51- 56  PET ,/,
           8 21H          57- 62  PET ,/, 21H          63- 68  PET ,/,
           9 21H          69- 74  PET ,/, 21H          75- 80  PET )
            WRITE (IOUT,1010)
       1010 FORMAT (76H    3      9- 14  EVAP    monthly lake evaporation, in
           1feet, one for each of  ,/,
           2 66H          15- 20  EVAP         the 12 months, beginning in Jan
           3uary ,/,
           4 22H          21- 26  EVAP ,/, 22H          27- 32  EVAP ,/,
           5 22H          33- 38  EVAP ,/, 22H          39- 44  EVAP ,/,
           6 22H          45- 50  EVAP ,/, 22H          51- 56  EVAP ,/,
           7 22H          57- 62  EVAP ,/, 22H          63- 68  EVAP ,/,
           8 22H          69- 74  EVAP ,/, 22H          75- 80  EVAP ,/,
           9 78H    4      9- 14  AGDMND  monthly agricultural irrigation dema
           *nd, in feet, one ,/,
           1 78H          15- 20  AGDMND       for each of the 12 months, begi
           2nning in January ,/,
           3 24H          21- 26  AGDMND ,/, 24H          27- 32  AGDMND ,/,
           4 24H          33- 38  AGDMND ,/, 24H          39- 44  AGDMND ,/,
           5 24H          45- 50  AGDMND ,/, 24H          51- 56  AGDMND ,/,
           6 24H          57- 62  AGDMND ,/, 24H          63- 68  AGDMND ,/,
           7 24H          69- 74  AGDMND ,/, 24H          75- 80  AGDMND )
            WRITE (IOUT,1020)
```

```
 1020 FORMAT (75H    5      9- 14  SESNAL  monthly instream demand, in f
     1leet, one for each of ,/,
     2 66H          15- 20  SESNAL       the 12 months, beginning in Jan
     3uary ,/,
     4 24H          21- 26  SESNAL ,/, 24H          27- 32  SESNAL ,/,
     5 24H          33- 38  SESNAL ,/, 24H          39- 44  SESNAL ,/,
     6 24H          45- 50  SESNAL ,/, 24H          51- 56  SESNAL ,/,
     7 24H          57- 62  SESNAL ,/, 24H          63- 68  SESNAL ,/,
     8 24H          69- 74  SESNAL ,/, 24H          75- 80  SESNAL ,/,
     9 79H    6      9- 14  STCOEF  basinwide aquifer storage coefficien
     *t (dimensionless) ,/,
     1 75H          15- 20  TRANS   basinwide aquifer transmissivity, in
     2 feet squared ,/,
     3 31X,7Hper day ,/,
     4 79H    7      9- 14  DRINK   average municipal water demand, in a
     5cre-feet per unit ,/,
     6 74H    8      9- 14  CNVLAT  factor to convert latitude, in degre
     7es, to miles ,/,
     8 75H          15- 20  CVLONG  factor to convert longitude, in degr
     9ees, to miles )
      WRITE (IOUT,1030)
 1030 FORMAT (80H          21- 26  SNUOS1  sinuosity factor to compute r
     1iver miles east of SNLAT1 ,/,
     2 80H          27- 32  SNUOS2  sinuosity factor to compute river mi
     3les between SNLAT1 ,/,
     4 31X,10Hand SNLAT2 ,/,
     5 80H          33- 38  SNUOS3  sinuosity factor to compute river mi
     6les west of SNLAT2 ,/,
     7 62H          39- 44  SNLAT1  latitude divider, in decimal degrees
     8 ,/,
     9 62H          45- 50  SNLAT2  latitude divider, in decimal degrees
     * ,/,
     1 73H          51- 56  PREFAC  prestress factor to scale the initia
     2lization of ,/,
     3 31X,12Hreturn flows ,/,
     4 69H          57- 62  SEEPFC  canal leakage factor, in acre-feet p
     5er mile ,/,
     6 75H          63- 68  PRSPFC  limit of effective monthly precipita
     7tion, in feet )
      WRITE (IOUT,1040)
```

```
 1040 FORMAT (72H          69- 74  TAILFC  percentage of tail water that
     1 goes through the ,/,
     2 31X,44Hground-water system (ranges from 0.0 to 1.0) ,/,
     3 66H    9      1-  5  NRES    the number of reservoirs (maximum of
     4 25) ,/,
     5 57H note -- record 10 is entered as a set, one for each NRES ,/,
     6 47H   10      1-  5  RESID   a reservoir ID number ,/,
     7 42H           6- 13  RESNAM  a reservoir name ,/,
     8 69H          16- 25  CAPMAX  maximum capacity of reservoir, in ac
     9re-feet ,/,
     * 70H          26- 35  NACTIV  inactive capacity of reservoir, in a
     1cre-feet ,/,
     2 69H          36- 45  AREAMX  surface area, in acres, at maximum c
     3apacity ,/,
     4 55H          46- 55  RSXLOC  longitude, in decimal degrees ,/,
     5 54H          56- 65  RSYLOC  latitude, in decimal degrees ,/,
     6 31X,49HFor on-channel reservoirs, RSXLOC and RSYLOC must ,/,
     7 31X,49Hcorrespond exactly to the XLOC and YLOC of a node ,/,
     8 66H          66- 75  RESSTR  initial reservoir contents, in acre-
     9feet )
      WRITE (IOUT,1050)
 1050 FORMAT (76H          76- 85  RSCONC  initial water-quality concent
     1ration, in milligrams ,/,
     2 31X,9Hper liter ,/,
     3 78H          86- 90  RSXPLT  plotting offset from the reservoir s
     4ymbol, in inches ,/,
     5 78H          91- 95  RSYPLT  plotting offset from the reservoir s
     6ymbol, in inches ,/,
     7 58H note -- record 11 is entered as a set, one for each NNODE ,/,
     8 76H   11      9- 14  GWSTOR  initial ground-water storage above n
     9ode on side 1, ,/,
     * 31X,12Hin acre-feet ,/,
     1 75H          15- 20  GWCONC  initial water-quality concentration
     2above node on ,/,
     3 31X,31Hside 1, in milligrams per liter ,/,
     4 76H          21- 26  GWSTOR  initial ground-water storage above n
     5ode on side 2, ,/,
     6 31X,12Hin acre-feet ,/,
     7 75H          27- 32  GWCONC  initial water-quality concentration
     8above node on ,/,
     9 31X,31Hside 2, in milligrams per liter )
      CALL QUESZN(ITEMP)
      WRITE (IOUT,1060)
```

```
1060 FORMAT (38H The format for the water use file is: ,/,
     1 37H Record  Columns   Name   Description ,/,
     2 80H+______  _______  ______  ____________________________________
     3_________________ ,/,
     4 33H    1      1- 80  TITLEU  a title ,/,
     5 68H    2      1-  5  NUSERS  the number of water users (maximum o
     6f 100) ,/,
     7 73H note -- records 3, 4, 5, and 6 are entered as a set, one for
     8each NUSERS ,/,
     9 48H    3      1-  5  USERID  a water user ID number ,/,
     * 44H           6- 13  USRNAM  a water user name ,/,
     1 49H          16- 20  USRTYP  the type of water user ,/,
     2 31X,16H1 = agricultural ,/,
     3 31X,13H2 = municipal ,/,
     4 31X,14H3 = industrial ,/,
     5 31X,13H4 = in stream ,/,
     6 31X,22H5 = reservoir operator ,/,
     7 63H          21- 30  NUMUSR  the quantity served by the water use
     8r )
      WRITE (IOUT,1070)
1070 FORMAT (31X,45Hif type 1, then the units are irrigated acres ,/,
     1 31X,44Hif type 2, then the units are populace units ,/,
     2 31X,44Hif type 3, then the units are units produced ,/,
     3 31X,42Hif type 4, then the units are actual water ,/,
     4 36X,20Hneeded, in acre-feet ,/,
     5 31X,49Hif type 5, then the units are reservoir capacity ,/,
     6 36X,35Havailable to the user, in acre-feet ,/,
     7 75H          31- 40  DMDFAC  factor to compute a water user's dem
     8and for water ,/,
     9 31X,38Hif value is positive, multiply by PET, ,/,
     * 31X,41Hif value is negative, multiply by AGDMND. ,/,
     1 55H          41- 50  XLOCU   longitude, in decimal degrees ,/,
     2 54H          51- 60  YLOCU   latitude, in decimal degrees ,/,
     3 31X,45HFor reservoir operators, XLOCU and YLOCU must ,/,
     4 36X,44Hcorrespond exactly to the RSXLOC and RSYLOC ,/,
     5 36X,14Hof a reservoir ,/,
     6 79H          61- 65  USXPLT  plotting offset from the water user
     7symbol, in inches ,/,
     8 79H          66- 70  USYPLT  plotting offset from the water user
     9symbol, in inches )
      WRITE (IOUT,1080)
1080 FORMAT (78H          71- 75  IPRECP  number indicating which of th
     1e independent variables ,/,
     2 31X,49Hrepresents the appropriate precipitation data for ,/,
     3 31X,15Hthe water user. ,/,
     4 73H          76- 80  IAKNT   reservoir subaccout number appropria
     5te for this ,/,
     6 31X,10Hwater user )
      WRITE (IOUT,1090)
```

```
1090 FORMAT (69H    4     16- 20  NSOURC  number of sources available t
    4o a water user ,/,
    5 31X,15H(maximum of 15) ,/,
    6 45H          21- 25  RFTYPE  type of return flow ,/,
    7 31X,45H1 - a percentage of initially computed return ,/,
    8 36X,44Hflow becomes deep perocolation (rest is tail ,/,
    9 36X,6Hwater) ,/,
    * 31X,45H2 - a percentage of total application becomes ,/,
    1 36X,36Htail water (rest is lost from basin) ,/,
    2 31X,45H3 - a percentage of total application becomes ,/,
    3 36X,42Hdeep percolation (rest is lost from basin) ,/,
    4 31X,45H4 - a percentage of initially computed return ,/,
    5 36X,42Hflow becomes tail water (rest is lost from ,/,
    6 36X,6Hbasin) ,/,
    7 31X,45H5 - a percentage of initially computed return ,/,
    8 36X,43Hflow becomes deep percolation (rest is lost ,/,
    9 36X,11Hfrom basin) )
     WRITE (IOUT,1100)
1100 FORMAT (48H          26- 35  RFVAL   return flow percentage ,/,
    1 55H          36- 45  RFXLOC  longitude, in decimal degrees ,/,
    2 54H          46- 55  RFYLOC  latitude, in decimal degrees ,/,
    3 76H          56- 65  RFDST   distance from point of deep percolat
    4ion to stream, ,/,
    5 31X,48Hin feet. (if 0., the program computes this value ,/,
    6 36X,15Husing location) ,/,
    7 42H note -- record 5 is repeated NSOURC times ,/,
    8 46H    5      1-  5  ICODE   type of water source ,/,
    9 31X,20H1 = direct diversion ,/,
    * 31X,24H2 = ground-water pumpage ,/,
    1 31X,44H3 = reservoir release (if reservoir releases ,/,
    2 36X,44Hdirectly to the water user rather than using ,/,
    3 36X,33Hthe river as a conduit, enter -3) ,/,
    4 31X,41H4 = direct pipeline or tunnel importation ,/,
    5 31X,21H5 = storage diversion ,/,
    6 31X,47H6 = direct diversion used for reservoir storage ,/,
    7 64H          6- 15  QUANTY  the quantity available from the sour
    8ce )
     WRITE (IOUT,1110)
```

```
 1110 FORMAT (31X,46Hif type 1, then the legal right, in cubic feet ,/,
     1 36X,10Hper second ,/,
     2 31X,46Hif type 2, then the pumping capacity, in cubic ,/,
     3 36X,15Hfeet per second ,/,
     4 31X,45Hif type 3, then the capacity of the reservoir ,/,
     5 36X,42Hallocated to this water user, in acre-feet ,/,
     6 36X,44H(if the reservoir is a 'general-use', 'bank- ,/,
     7 36X,44Haccount' type storage, enter the percentage ,/,
     8 36X,37Hallocated to this user as a negative) ,/,
     9 31X,47Hif type 4, then the pipeline or tunnel carrying ,/,
     * 36X,22Hcapacity, in acre-feet ,/,
     1 31X,45Hif type 5, then the legal right, in acre-feet ,/,
     2 31X,46Hif type 6, then the legal right, in cubic feet ,/,
     3 36X,10Hper second ,/,
     4 55H          16- 25  SCXLOC  longitude, in decimal degrees ,/,
     5 54H          26- 35  SCYLOC  latitude, in decimal degrees ,/,
     6 80H          36- 45  GWDST   the distance from point of pumpage t
     7o stream, in feet. ,/,
     8 31X,44HIf 0., the program computes this value using ,/,
     9 31X,9Hlocation. )
      WRITE (IOUT,1120)
 1120 FORMAT (76H          46- 50  NMRES   the ID number of the appropri
     1late reservoir (RESID) ,/,
     2 78H          51- 55  IACCNT  subaccount number to identify portio
     3n of a reservoir ,/,
     4 31X,45Hallocated to this water user (if 0, set to 1) ,/,
     5 74H          56- 60  ITIMFC  code to indicate whether the source
     6is available ,/,
     7 31X,44Hevery month (if 0, it is; if 1, read TIMFAC) ,/,
     8 53H note -- record 6 is read only when ITIMFC is nonzero ,/,
     9 73H    6      6- 10  TIMFAC  percentage indicating how much of th
     *e source is ,/,
     1 73H          11- 15  TIMFAC       active in each of the 12 months
     2, beginning ,/,
     3 73H          16- 20  TIMFAC       in January.  A value of 1. indi
     4cates fully ,/,
     5 76H          21- 25  TIMFAC       active, a value of 0. indicates
     6 the source is ,/,
     7 69H          26- 30  TIMFAC       inactive during that particular
     8 month. )
      WRITE (IOUT,1130)
 1130 FORMAT (24H          31- 35  TIMFAC ,/,
     1 24H          36- 40  TIMFAC ,/,
     2 24H          41- 45  TIMFAC ,/,
     3 24H          46- 50  TIMFAC ,/,
     4 24H          51- 55  TIMFAC ,/,
     5 24H          56- 60  TIMFAC ,/,
     6 24H          61- 65  TIMFAC )
      CALL QUESZN(ITEMP)
      WRITE (IOUT,1140)
```

```
 1140 FORMAT (41H The format for the water rights file is: ,/,
     1 37H Record  Columns   Name   Description ,/,
     2 80H+______  _______  ______  ____________________________________
     3_________________ ,/,
     4 33H    1      1- 80  TITLER  a title ,/,
     5 69H    2      1-  5  NRIGHT  the number of water rights (maximum
     6of 200) ,/,
     7 42H note -- record 3 is repeated NRIGHT times ,/,
     8 71H    3      1-  5  OWNER   the water user ID (USERID) who owns
     9the right ,/,
     * 73H           6- 13  NAME    the water user name (USRNAM) who own
     1s the right ,/,
     2 54H          16- 23  DATE    the date of the water right ,/,
     3 79H          24- 33  AMNT    the amount of the water right (QUANT
     4Y), in cubic feet ,/,
     5 31X,40Hper second for direct diversions, and in ,/,
     6 31X,33Hacre-feet for storage diversions. ,/,
     7 55H note -- all of the record 3's must be ordered by DATE. )
      RETURN
      END
```

```
CPLTRES
C
C          SUBROUTINE PLOT RESERVOIRS OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/21/87
C
            SUBROUTINE PLTRES(ITITLE)
            COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
           1               YMAX
            COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
           1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
           2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
           3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
            INTEGER RESID
            REAL NACTIV
      C
      C         PLOT THE NETWORK
      C
            CALL NETWRK(ITITLE)
      C
      C         PLOT THE EXPLANATION
      C
            CALL SETCLR(4HCYAN)
            CALL SOLID(XMIN+.05*XINC,YMIN+.05*YINC,2.,6)
            CALL MESSAG(9HRESERVOIR,9,1.35,.5)
            CALL SETCLR(5HWHITE)
            CALL INTNO(100,.70,.6)
            CALL MESSAG(16HAND RESERVOIR ID,16,1.05,.2)
      C
      C         PLOT THE DATA
      C
            DO 10 IRES = 1,NRES
            CALL SETCLR(4HCYAN)
            IF (CAPMAX(IRES) .EQ. 0.) GO TO 10
            FAC = ALOG10(CAPMAX(IRES)) - 3.
            XTEMP = RSXLOC(IRES)
            YTEMP = RSYLOC(IRES)
            CALL SOLID (XTEMP,YTEMP,FAC,6)
            CALL SETCLR (5HWHITE)
            X1 = RSXLOC(IRES) + RSXPLT(IRES)
            Y1 = RSYLOC(IRES) + RSYPLT(IRES)
            CALL RLINT(RESID(IRES),X1,Y1)
         10 CONTINUE
      C
            CALL ENDPL(0)
      C
            RETURN
            END
```

```
CPLTUSR
C
C          SUBROUTINE PLOT WATER USER DATA OF
C                   RIVER BASIN SIMULATION MODEL
C           WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C              WATER RESOURCES DIVISION, LAKEWOOD, CO
C                      LATEST UPDATE 9/30/85
C
            SUBROUTINE PLTUSR(ITITLE)
            COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
           1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
           2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
           3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
           4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
           5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
           6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
           7               TIMFAC(100,12)
            INTEGER USERID,USRTYP,RFTYPE
            REAL NUMUSR,NEED
            COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
           1               YMAX
      C
            DIMENSION ISYM(5),ITITLE(1)
      C
            DATA ISYM /6,5,2,1,0/
      C
      C         PLOT THE NETWORK
      C
            CALL NETWRK(ITITLE)
      C
      C         PLOT THE EXPLANATION
      C
            CALL SETCLR(5HWHITE)
            CALL SOLID(XMIN-.05*XINC,YMIN+.30*YINC,2.,5)
            CALL INTNO(1000,-.35,1.95)
            CALL MESSAG(14HMUNICIPAL USER,14,.25,1.8)
            CALL SOLID(XMIN-.05*XINC,YMIN+.23*YINC,2.,1)
            CALL INTNO(1000,-.35,1.5)
            CALL MESSAG(14HIN-STREAM USER,14,.25,1.35)
            CALL SOLID(XMIN-.05*XINC,YMIN+.16*YINC,2.,2)
            CALL INTNO(1000,-.35,1.05)
            CALL MESSAG(15HINDUSTRIAL USER,15,.25,0.90)
            CALL SOLID(XMIN-.05*XINC,YMIN+.09*YINC,2.,6)
            CALL INTNO(1000,-.35,0.6)
            CALL MESSAG(17HAGRICULTURAL USER,17,.25,0.45)
            CALL SETCLR(4HCYAN)
            CALL SOLID(XMIN-.05*XINC,YMIN+.02*YINC,2.,6)
            CALL INTNO(1000,-.35,0.15)
            CALL MESSAG(18HRESERVOIR OPERATOR,18,.25,0.0)
            CALL SETCLR(5HWHITE)
            CALL MESSAG(20HNUMBERS ARE USER IDS,20,-0.3,-.35)
```

```
C
      CALL MESSAG(25HSOURCES OF WATER INCLUDE:,25,7.2,1.5)
      CALL SETCLR(4HCYAN)
      CALL MESSAG(17HDIRECT DIVERSIONS,17,7.8,1.2)
      CALL SETCLR(3HRED)
      CALL MESSAG(20HGROUND-WATER PUMPAGE,20,7.8,0.9)
      CALL SETCLR(5HGREEN)
      CALL MESSAG(18HRESERVOIR RELEASES,18,7.8,0.6)
      CALL SETCLR(7HMAGENTA)
      CALL MESSAG(7HIMPORTS,7,7.8,0.3)
      CALL SETCLR(5HWHITE)
      CALL MESSAG(14HALSO SHOWN IS:,14,7.2,0.)
      CALL MESSAG(11HRETURN FLOW,11,7.8,-0.3)
C
C         PLOT THE DATA
C
      DO 110 IUSER = 1,NUSERS
      CALL SETCLR(5HWHITE)
      IPEN = USRTYP(IUSER)
      IF (NUMUSR(IUSER) .EQ. 0.) GO TO 110
      FAC = (ALOG10(NUMUSR(IUSER))-1.)/1.2
      IF (IPEN .LT. 5) GO TO 10
      IPEN = 1
      CALL SETCLR(4HCYAN)
      FAC = 1.5
   10 XTEMP = XLOCU(IUSER)
      YTEMP = YLOCU(IUSER)
      CALL SOLID (XTEMP,YTEMP,FAC,ISYM(IPEN))
      X1 = XLOCU(IUSER) + USXPLT(IUSER)
      Y1 = YLOCU(IUSER) + USYPLT(IUSER)
   20 CALL RLINT(USERID(IUSER),X1,Y1)
      CALL SETCLR(5HWHITE)
      IF (RFXLOC(IUSER) .EQ. 0. .OR. RFYLOC(IUSER) .EQ. 0.) GO TO 30
      CALL RLVEC (XLOCU(IUSER),YLOCU(IUSER),RFXLOC(IUSER),RFYLOC(IUSER),
     1 0)
   30 NSORC = NSOURC(IUSER)
      DO 100 ISOURC = 1,NSORC
      IPEN = ICODE(IUSER,ISOURC)
      GO TO (40,50,60,70,80), IPEN
   40 CALL SETCLR(4HCYAN)
      GO TO  90
   50 CALL SETCLR(3HRED)
      GO TO 90
   60 CALL SETCLR(5HGREEN)
      GO TO 90
   70 CALL SETCLR(7HMAGENTA)
      GO TO 90
   80 CALL SETCLR(4HCYAN)
   90 CALL RLVEC(XLOCU(IUSER),YLOCU(IUSER),SCXLOC(IUSER,ISOURC),
     1 SCYLOC(IUSER,ISOURC),0)
  100 CONTINUE
  110 CONTINUE
      CALL ENDPL(0)
C
      RETURN
      END
```

```
CPRSTRS
C
C              SUBROUTINE PRESTRESS OF RIVER BASIN SIMULATION MODEL
C               WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                   WATER RESOURCES DIVISION, LAKEWOOD, CO
C                         LATEST UPDATE 4/28/87
C
            SUBROUTINE PRSTRS
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
           1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
           2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
           3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
           4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
           5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
           6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
           7               TIMFAC(100,12)
            INTEGER USERID,USRTYP,RFTYPE
            REAL NUMUSR,NEED
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      C
      C         RUN PRESTRESS FOR 10 YEARS
      C
            DO 130 IYEAR = 1,10
            DO 130 IMONTH = 1,12
      C
      C         MOVE THE RESPONSES UP A MONTH IN TIME
      C
            DO 10 INODE = 1,NNODE
            DO 10 ITIME = 2,480
            DO 10 ISIDE = 1,2
            FRSPNZ(INODE,ITIME-1,ISIDE) = FRSPNZ(INODE,ITIME,ISIDE)
         10 CONTINUE
      C
            DO 20 INODE = 1,NNODE
            DO 20 ISIDE = 1,2
         20 TLWATR(INODE,ISIDE) = 0.
      C
      C         APPROXIMATE BY USING EACH USERS DEMAND
```

```
C
      DO 130 IUSER = 1,NUSERS
      IF (USRTYP(IUSER) .GT. 5) GO TO 130
      GO TO (30,40,50,130,130), USRTYP(IUSER)
   30 USE = PET(IMONTH)*NUMUSR(IUSER)
      GO TO 60
   40 USE = (DRINK + PET(IMONTH))*NUMUSR(IUSER)
      GO TO 60
   50 USE = DRINK*NUMUSR(IUSER)
   60 RTRN = USE*PREFAC
      GO TO (90,80,80,70,70), RFTYPE(IUSER)
   70 RTRN = RTRN*RFVAL(IUSER)
      GO TO 90
   80 RTRN = USE*RFVAL(IUSER)
   90 IF (RTRN .LE. 0.) GO TO 130
      TAILWR = 0.
      GO TO (100,110,120,110,120), RFTYPE(IUSER)
  100 TAILWR = RTRN*(1. - RFVAL(IUSER))
      GO TO 120
  110 TAILWR = RTRN
  120 DPPERC = RTRN - TAILWR
      INODE = NODERF(IUSER)
      ISIDE = ISIDRF(IUSER)
      TLWATR(INODE,ISIDE) = TLWATR(INODE,ISIDE) + TAILWR*TAILFC
      FRSPNZ(INODE,1,ISIDE) = FRSPNZ(INODE,1,ISIDE) +
     1 TAILWR*(1.-TAILFC)
      CALL PRECUR(DPPERC,INODE,ISIDE,RFDIST(IUSER))
  130 CONTINUE
C
      RETURN
      END
```

```
CPRECUR
C
C                 SUBROUTINE COMPUTE FUTURE RESPONSES OF
C                    RIVER BASIN SIMULATION MODEL
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 1/23/87
C
            SUBROUTINE PRECUR(STRESS,NODE,ISIDE,ADIST)
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      C
            DIMENSION DIST(5)
      C
            DATA DIST /3.0,3.3,3.7,4.0,4.3/
      C
            IF (STRESS .EQ. 0.) RETURN
            IF (ADIST .EQ. 0.) ADIST = 100.
            BDIST = ALOG10(ADIST)
            DO 10 I = 1,5
            IF (DIST(I) .GT. BDIST) GO TO 20
         10 CONTINUE
            I = 5
         20 TOTAL = 0.
            DO 25 ITIME = 1,480
         25 TOTAL = TOTAL + UNIT(I,ITIME)
            DO 30 ITIME = 1,480
         30 FRSPNZ(NODE,ITIME,ISIDE) = FRSPNZ(NODE,ITIME,ISIDE) + STRESS *
           1 UNIT(I,ITIME)/TOTAL
            RETURN
            END
```

```
CQUALTY
C
C          SUBROUTINE WATER QUALITY OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/11/87
C
      SUBROUTINE QUALTY
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /GWUSE/ MGW,GWUSER(100),GWSOUR(100),GWDIST(100),GWPUMP(100)
     1               ,ISDPMP(100)
      INTEGER GWUSER,GWSOUR
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
      COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
     1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
     2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
     3                AGDMND(12),CANLEN(100),RAIN(50)
      COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      COMMON /RESUSE/ MRES,RESUSR(100),RESSOR(100),NUMRES(100),
     1                TRANSL(100),RESRL(100),ISBACT(100),RESQNT(100)
      INTEGER RESSOR,RESUSR
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
     1               RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
```

```
      COMMON /USTATS/ DELIVR(100),RESREL(100),IMPORT(100),PUMPAG(100),
     1                APCONC(100),DIVRZN(100),PUMPG(100,2),CANLEK(100),
     2                DPPERC(100),TAILWR(100),PRECIP(100)
      REAL IMPORT
C
C
      DO 30 INODE = 1,NNODE
      IF (INDEPV(INODE,JMONTH) .GT. 0) GO TO 20
      DO 10 JNODE = 1,INODE
      IF (NXTNOD(JNODE) .LE. 0) GO TO 10
      QSUBA(JNODE) = 0.
   10 CONTINUE
      GO TO 30
   20 QW(INODE) = 0.
      Q(INODE) = 0.
   30 CONTINUE
C
C         COMPUTE RIVER QUALITY
C
      DO 150 INODE = 1,NNODE
      QT = Q(INODE) + QSUBA(INODE)
      IF (QT .LE. 0.) GO TO 40
      QW(INODE) = (QW(INODE)*Q(INODE)+QWSUBA(INODE)*QSUBA(INODE))/QT
      IF (QSUBA(INODE) .GE. 0.) GO TO 40
      QMIN = QW(INODE)*QT/Q(INODE)
      QW(INODE) = QW(INODE) - CONCFC(INODE)*(QW(INODE)-QMIN)
   40 IF (QT .LT. 0.) QT = 0.
      Q(INODE) = QT
C
      DO 90 ISIDE = 1,2
      RTRN = RTRNFL(INODE,ISIDE)*60.3
      IF (RTRN) 50,80,60
   50 Q(INODE) = Q(INODE) + RTRNFL(INODE,ISIDE)
      IF (GWSTOR(INODE,ISIDE) .LT. .5) GO TO 55
      GWCONC(INODE,ISIDE) = ((GWSTOR(INODE,ISIDE)+RTRN)*
     1 GWCONC(INODE,ISIDE) - RTRN*QW(INODE)) / GWSTOR(INODE,ISIDE)
      IF (GWCONC(INODE,ISIDE) .LT. .5) GWCONC(INODE,ISIDE) = 0.
   54 IF (Q(INODE) .LT. 0.) Q(INODE) = 0.
      GO TO 80
   55 GWCONC(INODE,ISIDE) = 0.
      GO TO 54
   60 QT = Q(INODE) + RTRNFL(INODE,ISIDE)
      IF (QT .LE. 0.) GO TO 70
      QW(INODE) = (QW(INODE)*Q(INODE) + RTRNFL(INODE,ISIDE)*
     1 GWCONC(INODE,ISIDE)) / QT
   70 IF (Q(INODE) .LT. 0.) Q(INODE) = 0.
      Q(INODE) = QT
   80 Q(INODE) = Q(INODE) + TLWATR(INODE,ISIDE)/60.3
      IF (Q(INODE) .EQ. 0.) GO TO 90
      QW(INODE) = (QW(INODE)*Q(INODE)+TWCONC(INODE,ISIDE)/60.3)/Q(INODE)
   90 CONTINUE
```

```
C
C         ADD IN RESERVOIR RELEASES
C
      DO 100 IRES = 1,NRES
      IF (NODRES(IRES) .EQ. INODE) GO TO 110
  100 CONTINUE
      GO TO 130
  110 IF (RSXLOC(IRES).NE.XLOC(INODE) .OR. RSYLOC(IRES).NE.YLOC(INODE))
     1 GO TO 120
C
C         ON CHANNEL RESERVOIR
C
      QW(INODE) = (QW(INODE)*Q(INODE)*60.3 + RSCONC(IRES)*RESSTR(IRES))
     1 /(Q(INODE)*60.3+RESSTR(IRES))
      RSCONC(IRES) = QW(INODE)
C
  120 IF (RELEAS(IRES) .LE. 0.) GO TO 130
      QT = Q(INODE) + RELEAS(IRES)/60.3
      QW(INODE) = (QW(INODE)*Q(INODE) + RSCONC(IRES)*RELEAS(IRES)/60.3)
     1 /QT
      Q(INODE) = QT
  130 CONTINUE
C
      Q(INODE) = Q(INODE) - DIVRZN(INODE)
      JNODE = NXTNOD(INODE)
      IF (JNODE .LT. 0) GO TO 150
      QT = Q(INODE) + Q(JNODE)
      IF (QT .LE. 0.) GO TO 140
      QW(JNODE) = (QW(INODE)*Q(INODE) + QW(JNODE)*Q(JNODE))/QT
  140 Q(JNODE) = QT
  150 CONTINUE
C
C         ADJUST ALL RESERVOIRS
C
      DO 180 IRES = 1,NRES
      CONTNT = RESSTR(IRES)
      RESSTR(IRES) = RESSTR(IRES) - RESEVP(IRES)
      IF (RESSTR(IRES) .NE. 0.) RSCONC(IRES) = RSCONC(IRES)*CONTNT/
     1 RESSTR(IRES)
      CONTNT = RESSTR(IRES)
C
      DO 170 IUSER = 1,NUSERS
      IF (USRTYP(IUSER) .NE. RESID(IRES)) GO TO 170
      NSOUR = NSOURC(IUSER)
      DO 160 ISOURC = 1,NSOUR
      IF (ICODE(IUSER,ISOURC) .EQ. 4) INODIM = NODESC(IUSER,ISOURC)
      IF (ICODE(IUSER,ISOURC) .EQ. 5) INODDV = NODESC(IUSER,ISOURC)
  160 CONTINUE
      CNTNT1 = CONTNT + DELIVR(IUSER) + IMPORT(IUSER) + RESREL(IUSER)
      IF (CNTNT1 .NE. 0.) RSCONC(IRES) = (CONTNT*RSCONC(IRES) +
     1 (DELIVR(IUSER)+RESREL(IUSER))*QW(INODDV) +
     2 IMPORT(IUSER)*QW(INODIM)) / CNTNT1
      CONTNT = CNTNT1
      IF (CONTNT .EQ. 0.) RSCONC(IRES) = 0.
```

```
  170 CONTINUE
      RESSTR(IRES) = CONTNT - RELEAS(IRES)
  180 CONTINUE
C
C         INITIALIZE TAILWATER
C
      DO 190 INODE = 1,NNODE
      DO 190 ISIDE = 1,2
      TLWATR(INODE,ISIDE) = 0.
  190 TWCONC(INODE,ISIDE) = 0.
C
C         COMPUTE WATER USE QUALITY
C
      DO 330 IUSER = 1,NUSERS
      TLOAD = 0
      TAILWR(IUSER) = 0.
      DPPERC(IUSER) = 0.
      NSOUR = NSOURC(IUSER)
      DO 260 ISOURC = 1,NSOUR
      INODE = NODESC(IUSER,ISOURC)
      GO TO (200,210,230,250,200), ICODE(IUSER,ISOURC)
C
C         RIVER DIVERSIONS
C
  200 QWDEL = QW(INODE)
      GO TO 260
C
C         GROUND-WATER PUMPAGE
C
  210 DO 220 JGW = 1,MGW
      IF (GWUSER(JGW) .NE. IUSER .OR. GWSOUR(JGW) .NE. ISOURC) GO TO 220
      ISIDE = ISDPMP(JGW)
      TLOAD = TLOAD + GWPUMP(JGW)*GWCONC(INODE,ISIDE)
      GWSTOR(INODE,ISIDE) = GWSTOR(INODE,ISIDE) - GWPUMP(JGW)
  220 CONTINUE
      GO TO 260
C
C         RESERVOIR RELEASES
C
  230 DO 240 JRES = 1,MRES
      IF (RESUSR(JRES) .NE. IUSER .OR. RESSOR(JRES) .NE. ISOURC)
     1 GO TO 240
      IRES = NUMRES(JRES)
      QWRES = RSCONC(IRES)
      IF (INODE .LE. NNODE) QWRES = QW(INODE)
      TLOAD = TLOAD + RESRL(JRES)*QWRES
  240 CONTINUE
      GO TO 260
C
C         IMPORTS
C
  250 QWIMP = QW(INODE)
  260 CONTINUE
```

```
C
      CANLEK(IUSER) = AMIN1(DELIVR(IUSER)+RESREL(IUSER),
     1 SEEPFC*CANLEN(IUSER))
      PRECIP(IUSER) = 0.
      TLOAD = TLOAD + DELIVR(IUSER)*QWDEL + IMPORT(IUSER)*QWIMP
     1 - CANLEK(IUSER)*QWDEL
      TOTAL = DELIVR(IUSER) + PUMPAG(IUSER) + RESREL(IUSER)
     1 + IMPORT(IUSER) - CANLEK(IUSER)
      APCONC(IUSER) = 0.
      IF (TOTAL .NE. 0.) APCONC(IUSER) = TLOAD/TOTAL
C
C         COMPUTE RETURN FLOW (TAILWATER AND DEEP PERCOLATION)
C
      ISIDE = ISIDRF(IUSER)
      INODE = NODERF(IUSER)
      IP = IPRECP(IUSER)
      IF (IP .NE. 0) EFPRCP = AMIN1(PRSPFC,RAIN(IP))
      IF (IP .EQ. 0) EFPRCP = 0.
      PRECIP(IUSER) = NUMUSR(IUSER)*EFPRCP/12.
      TOTAL = TOTAL + PRECIP(IUSER)
      IF (TOTAL .NE. 0.) APCONC(IUSER) = TLOAD/TOTAL
      USED = AMIN1(TOTAL,NEED(IUSER))
      RTRN = TOTAL - USED
      GO TO (290,280,280,270,270), RFTYPE(IUSER)
  270 RTRN = RTRN*RFVAL(IUSER)
      TLOAD = TLOAD*RFVAL(IUSER)
      GO TO 290
  280 RTRN = TOTAL*RFVAL(IUSER)
  290 RTRN = RTRN + CANLEK(IUSER)
      TLOAD = TLOAD + CANLEK(IUSER)*QWDEL
      IF (RTRN .LE. 0.) GO TO 330
      TAILWR(IUSER) = 0.
      GO TO (300,310,320,310,320), RFTYPE(IUSER)
  300 TAILWR(IUSER) = RTRN*(1. - RFVAL(IUSER))
      TWLOAD = TLOAD*(1.-RFVAL(IUSER))
      TLOAD = TLOAD*RFVAL(IUSER)
      GO TO 320
  310 TAILWR(IUSER) = RTRN
      TWLOAD = TLOAD
      TLOAD = 0.
  320 DPPERC(IUSER) = RTRN - TAILWR(IUSER)
      TLWATR(INODE,ISIDE) = TLWATR(INODE,ISIDE) + TAILWR(IUSER)*TAILFC
      FRSPNZ(INODE,1,ISIDE) = FRSPNZ(INODE,1,ISIDE) +
     1 TAILWR(IUSER)*(1.-TAILFC)
      CALL CMPUTR(DPPERC(IUSER),INODE,ISIDE,RFDIST(IUSER))
      GWSTR = GWSTOR(INODE,ISIDE) + DPPERC(IUSER) +
     1 TAILWR(IUSER)*(1.-TAILFC)
      IF (GWSTR .NE. 0.) GWCONC(INODE,ISIDE) = (GWSTOR(INODE,ISIDE)*
     1 GWCONC(INODE,ISIDE) + TLOAD + TWLOAD*(1.-TAILFC))/GWSTR
      GWSTOR(INODE,ISIDE) = GWSTR
      IF (GWCONC(INODE,ISIDE) .LT. .5) GWCONC(INODE,ISIDE) = 0.
      IF (GWSTOR(INODE,ISIDE) .LT. .5) GWCONC(INODE,ISIDE) = 0.
  330 CONTINUE
C
      RETURN
      END
```

```
CREADMB
C
C                 SUBROUTINE READ MORE BASIN DESCRIPTION OF
C                     RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/10/87
C
      SUBROUTINE READMB
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /NAMES/ TITL(5)
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
     1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
     2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
     3                AGDMND(12),CANLEN(100),RAIN(50)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
     1                QHYMAX(5),PORXN(100),AXN(100)
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
C
      DIMENSION ITITLE(20),TITLEM(20),ISID(5)
      CHARACTER*80 IDUM
C
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
      INTEGER*2 JNUM,TODAY(28)
C
C         READ AND WRITE ADDITIONAL BASIN DESCRIPTION DATA
C
      READ (53,1000) TITLEM
```

```
 1000 FORMAT (20A4)
C
      JNUM = 28
      CALL TIMDAT(TODAY,JNUM)
      WRITE (52,1010) TITL,(TODAY(JNUM),JNUM=1,3),TITLEM,NNODE
 1010 FORMAT (82H1   BSNMD3 - RIVER BASIN SIMULATION MODEL #3     UPDATE
     1D 9/30/85     BY ALAN BURNS  ,///,20H  SIMULATION TITLE: ,5A4,
     2 66X,10H DATE RUN: ,A2,1H/,A2,1H/,A2,///,
     3 37H  ADDITIONAL BASIN DESCRIPTION FILE: ,20A4,6H, HAS ,I3,
     4 6H NODES )
C
      READ (53,1080) PET
      WRITE (52,1020) PET
 1020 FORMAT (///,55H  POTENTIAL EVAPOTRANSPIRATION (PET), IN FEET PER M
     1ONTH ,/ 5X,12F6.2)
      READ (53,1080) EVAP
      WRITE (52,1030) EVAP
 1030 FORMAT (///,36H  PAN EVAPORATION, IN FEET PER MONTH,/,5X,12F6.2)
      READ (53,1080) AGDMND
      WRITE (52,1040) AGDMND
 1040 FORMAT (///,51H  AGRICULTURAL IRRIGATION DEMAND, IN FEET PER MONTH
     1 ,/ 5X,12F6.2)
      READ (53,1080) SESNAL
      WRITE (52,1050) SESNAL
 1050 FORMAT (///,46H  SEASONAL IN-STREAM DEMAND, IN FEET PER MONTH
     1 ,/ 5X,12F6.2)
      READ (53,1080) STCOEF,TRANS
      WRITE (52,1060) STCOEF,TRANS
 1060 FORMAT (///,50H  AVERAGE BASIN STORAGE COEFFICIENT, IN PERCENT = ,
     1 F5.2,/,58H  AVERAGE BASIN TRANSMISSIVITY, IN FEET SQUARED PER DAY
     2 = ,F8.0)
      READ (53,1080) DRINK
      WRITE (52,1070) DRINK
 1070 FORMAT (///,52H  MUNICIPAL USAGE, IN ACRE-FEET PER UNIT QUANTITY =
     1 ,F8.2 )
      READ (53,1080) CNVLAT,CVLONG,SNUOS1,SNUOS2,SNUOS3,SNLAT1,SNLAT2,
     1 PREFAC,SEEPFC,PRSPFC,TAILFC
 1080 FORMAT (8X,12F6.0)
      WRITE (52,1090) PREFAC
 1090 FORMAT (///,33H  PRESTRESS FACTOR, IN PERCENT = ,F5.2)
      WRITE (52,1100) SEEPFC
 1100 FORMAT (///,48H  CANAL LEAKAGE FACTOR, IN ACRE-FEET PER MILE = ,
     1 F5.2 )
      WRITE (52,1110) PRSPFC
 1110 FORMAT (///,39H  EFFECTIVE PRECIPITATION, IN INCHES = ,F5.2)
C
C         READ AND WRITE RESERVOIR DATA
C
      READ (53,1120) NRES
 1120 FORMAT (I5)
      WRITE (52,1130) NRES
```

```
 1130 FORMAT (11H1THERE ARE ,I3,11H RESERVOIRS  ,//,
     1        108H RESERVOIR  RESERVOIR  RESERVOIR  MAXIMUM  INACTIVE  M
     2AXIMUM    X      Y    CONNECTING  INITIAL      INITIAL ,/, 111H  N
     3UMBER       ID        NAME     CAPACITY  STORAGE  SURFACE  COORD
     4COORD    RIVER     CONTENTS  CONCENTRATION ,/,35X,75H(ACRE-   (ACR
     5E-    AREA     (DE-   (DE-    NODE      (ACRE-     (MILLIGRAMS ,/,
     6 36X,39HFEET)    FEET)  (ACRES)  GREES) GREES),15X,20HFEET)     PE
     7R LITER)  )
      DO 20 IRES = 1,NRES
      READ (53,1140) RESID(IRES),RESNAM(IRES),CAPMAX(IRES),NACTIV(IRES),
     1 AREAMX(IRES),RSXLOC(IRES),RSYLOC(IRES),RESSTR(IRES),RSCONC(IRES),
     2 RSXPLT(IRES),RSYPLT(IRES)
 1140 FORMAT (I5,A8,2X,7F10.0,2F5.0)
      CALL DETNOD(RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),ISIDE)
      SBSTOR(IRES,1) = RESSTR(IRES) - NACTIV(IRES)
      DO 10 IACCNT = 2,5
   10 SBSTOR(IRES,IACCNT) = 0.
      WRITE (52,1150) IRES,RESID(IRES),RESNAM(IRES),CAPMAX(IRES),
     1 NACTIV(IRES),AREAMX(IRES),RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),
     2 RESSTR(IRES),RSCONC(IRES)
 1150 FORMAT (I6,6X,I6,6X,A8,F9.0,F10.0,F8.0,F9.3,F7.3,I6,F14.0,F12.0)
   20 CONTINUE
C
C         PLOT RESERVOIR LOCATIONS
C
      CALL QUESZN(IQ)
      IF (IQ-1) 40,30,40
   30 WRITE (IDUM,1160) TITL
 1160 FORMAT (5A4,23H - RESERVOIR LOCATIONS$)
      CALL PLTRES(ITITLE)
C
C         COMPUTE RIVER MILES
C
   40 DO 50 INODE = 1,NNODE
   50 RMILES(INODE) = 0.
      INODE = NNODE
      RMILES(INODE) = .00001
   60 JNODE = NODEUS(INODE)
      IF (JNODE .EQ. 0) GO TO 70
      SNUOSY = SNUOS1
      IF (XLOC(JNODE) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOC(JNODE) .GT. SNLAT2) SNUOSY = SNUOS3
      RMILES(JNODE) = RMILES(INODE) +
     1 SQRT(((XLOC(JNODE)-XLOC(INODE))*CVLONG)**2 + ((YLOC(JNODE)-
     2 YLOC(INODE))*CNVLAT)**2)*SNUOSY
      INODE = JNODE
      GO TO 60
```

```
   70 IZERO = 0
      NNOD1 = NNODE - 1
      DO 80 INODE = 1,NNOD1
      IF (RMILES(INODE) .NE. 0.) GO TO 80
      JNODE = NXTNOD(INODE)
      IF (JNODE .LE. 0) GO TO 80
      IZERO = 1
      IF (RMILES(JNODE) .EQ. 0.) GO TO 80
      SNUOSY = SNUOS1
      IF (XLOC(INODE) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOC(INODE) .GT. SNLAT2) SNUOSY = SNUOS3
      RMILES(INODE) = RMILES(JNODE) +
     1 SQRT(((XLOC(INODE)-XLOC(JNODE))*CVLONG)**2 + ((YLOC(INODE)-
     2 YLOC(JNODE))*CNVLAT)**2) * SNUOSY
   80 CONTINUE
      IF (IZERO .EQ. 1) GO TO 70
C
C         READ AND WRITE GROUND-WATER DATA
C
      WRITE (52,1170)
 1170 FORMAT (68H1 NODE   NODE    NODE    INITIAL GROUND-   INITIAL GROU
     1ND-     RIVER,/,68H NUMBER   ID     NAME     WATER STORAGE  WATER
     2CONCENTRATION  LENGTH,/,27X,42H(ACRE-FEET)       (MILLIGRAMS
     3(MILES) ,/,47X,10HPER LITER) ,/, 25X,33HSIDE 1  SIDE 2   SIDE 1
     4 SIDE 2   )
      DO 90 INODE = 1,NNODE
      READ (53,1080) (GWSTOR(INODE,ISIDE),GWCONC(INODE,ISIDE),ISIDE=1,2)
      WRITE (52,1180) INODE,NODEID(INODE),NODNAM(INODE),GWSTOR(INODE,1),
     1 GWSTOR(INODE,2),GWCONC(INODE,1),GWCONC(INODE,2),RMILES(INODE)
 1180 FORMAT (I5,I8,2X,A8,2F8.0,F9.0,F10.0,F9.1 )
   90 CONTINUE
C
C         ENTER FREQUENCY OF PLOTTING GROUND-WATER SCHEMATIC
C
      READ (IN,1190) ISKMGW
 1190 FORMAT (16I5)
C
C         ENTER NODES AND SIDE FOR GROUND-WATER HYDROGRAPHS
```

```
C
      READ (IN,1190) (IHYGW(J),ISID(J),J=1,5)
      DO 130 I = 1,5
      IF (IHYGW(I) .EQ. 99999) GO TO 110
      DO 100 J = 1,NNODE
      IF (IHYGW(I) .NE. NODEID(J)) GO TO 100
      IHYGW(I) = J + 1000*ISID(I)
      GO TO 130
  100 CONTINUE
      GO TO 130
  110 DO 120 J = 1,600
      GWHYS(J,I) = 0.
      GWHYC(J,I) = 0.
  120 GWHYRF(J,I) = 0.
  130 CONTINUE
C
C         ENTER NODES AND SIDE FOR MONTHLY GROUND-WATER TABLES
C
      READ (IN,1190) (ITBLG(J),ISID(J),J=1,5)
      DO 170 I = 1,5
      IF (ITBLG(I) .EQ. 99999) GO TO 150
      DO 140 J = 1,NNODE
      IF (ITBLG(I) .NE. NODEID(J)) GO TO 140
      ITBLG(I) = J + 1000*ISID(I)
      GO TO 170
  140 CONTINUE
      GO TO 170
  150 DO 160 J = 1,600
      IGTBLS(I,J) = 0
      IGTBLC(I,J) = 0
  160 IGTBLR(I,J) = 0
  170 CONTINUE
C
      RETURN
      END
```

```
CREADMI
C
C                 SUBROUTINE READ MORE BASIN DESCRIPTION OF
C                     RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 9/10/87
C
      SUBROUTINE READMI
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /NAMES/ TITL(5)
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
     1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
     2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
     3                AGDMND(12),CANLEN(100),RAIN(50)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /SCHMTK/ ISKM,PORQ(100),PORQW(100),AQ(100),AQW(100),
     1                QHYMAX(5),PORXN(100),AXN(100)
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
C
      DIMENSION ITITLE(20),TITLEM(20),ISID(2)
      CHARACTER*80 IDUM
C
      DOUBLE PRECISION NAME
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
      INTEGER*2 JNUM,TODAY(28)
C
C         READ, DISPLAY, AND WRITE ADDITIONAL BASIN DESCRIPTION DATA
C              MODIFY THE DATA, IF DESIRED
```

```
C
      READ (53,1000) TITLEM
 1000 FORMAT (20A4)
      JNUM = 28
      CALL TIMDAT(TODAY,JNUM)
      WRITE (52,1010) TITL,(TODAY(JNUM),JNUM=1,3),TITLEM,NNODE
 1010 FORMAT (82H1   BSNMD3 - RIVER BASIN SIMULATION MODEL #3     UPDATE
     1D 9/30/85     BY ALAN BURNS  ,///,20H  SIMULATION TITLE: ,5A4,
     2 66X,10H DATE RUN: ,A2,1H/,A2,1H/,A2,///,
     3 37H  ADDITIONAL BASIN DESCRIPTION FILE: ,20A4,6H, HAS ,I3,
     4 6H NODES )
C
      WRITE (IOUT,1020)
 1020 FORMAT (56H DO YOU WANT THE ADDITIONAL BASIN DESCRIPTION DISPLAYED
     1? )
      CALL QUESZN(IPRNT)
      IF (IPRNT .EQ. 1) WRITE (IOUT,1030)
 1030 FORMAT (55H THE ADDITIONAL BASIN DESCRIPTION FILE YOU ATTACHED IS:
     1 ,/,20A4)
C
      READ (53,1160) PET
      IF (IPRNT .NE. 1) GO TO 30
      WRITE (IOUT,1060) PET
   10 WRITE (IOUT,1040)
 1040 FORMAT (54H TO CHANGE ANY VALUE, ENTER MONTH NUMBER AND NEW VALUE)
      READ (IN,1050) J,PETJ
 1050 FORMAT (I2,F10.0)
      IF (J) 30,30,20
   20 PET(J) = PETJ
      GO TO 10
   30 WRITE (52,1060) PET
 1060 FORMAT (///,55H  POTENTIAL EVAPOTRANSPIRATION (PET), IN FEET PER M
     1ONTH ,/ 5X,12F6.2)
      READ (53,1160) EVAP
      IF (IPRNT .NE. 1) GO TO 60
      WRITE (IOUT,1070) EVAP
   40 WRITE (IOUT,1040)
      READ (IN,1050) J,EVAPJ
      IF (J) 60,60,50
   50 EVAP(J) = EVAPJ
      GO TO 40
   60 WRITE (52,1070) EVAP
 1070 FORMAT (///,36H  PAN EVAPORATION, IN FEET PER MONTH,/,5X,12F6.2)
      READ (53,1160) AGDMND
      IF (IPRNT .NE. 1) GO TO 90
      WRITE (IOUT,1080) AGDMND
   70 WRITE (IOUT,1040)
      READ (IN,1050) J,AGDMDJ
      IF (J) 90,90,80
   80 AGDMND(J) = AGDMDJ
      GO TO 70
   90 WRITE (52,1080) AGDMND
```

```
 1080 FORMAT (///,51H  AGRICULTURAL IRRIGATION DEMAND, IN FEET PER MONTH
     1 ,/ 5X,12F6.2)
      READ (53,1160) SESNAL
      IF (IPRNT .NE. 1) GO TO 120
      WRITE (IOUT,1090) SESNAL
  100 WRITE (IOUT,1040)
      READ (IN,1050) J,SESNLJ
      IF (J) 120,120,110
  110 SESNAL(J) = SESNLJ
      GO TO 100
  120 WRITE (52,1090) SESNAL
 1090 FORMAT (///,46H  SEASONAL IN-STREAM DEMAND, IN FEET PER MONTH
     1 ,/ 5X,12F6.2)
      READ (53,1160) STCOEF,TRANS
      IF (IPRNT .NE. 1) GO TO 130
      WRITE (IOUT,1130) STCOEF,TRANS
      WRITE (IOUT,1100)
 1100 FORMAT (33H DO YOU WANT TO ENTER NEW VALUES?)
      CALL QUESZN(IQ)
      IF (IQ .NE. 1) GO TO 130
      WRITE (IOUT,1110)
 1110 FORMAT (71H ENTER STORAGE COEFFICIENT (10 COLUMNS) AND TRANSMISSIV
     1ITY (10 COLUMNS))
      READ (IN,1120) STCOEF,TRANS
 1120 FORMAT (2F10.0)
  130 WRITE (52,1130) STCOEF,TRANS
 1130 FORMAT (///,50H  AVERAGE BASIN STORAGE COEFFICIENT, IN PERCENT = ,
     1 F5.2,/,58H  AVERAGE BASIN TRANSMISSIVITY, IN FEET SQUARED PER DAY
     2 = ,F8.0)
      READ (53,1160) DRINK
      IF (IPRNT .NE. 1) GO TO 140
      WRITE (IOUT,1150) DRINK
      WRITE (IOUT,1100)
      CALL QUESZN(IQ)
      IF (IQ .NE. 1) GO TO 140
      WRITE (IOUT,1140)
 1140 FORMAT (44H ENTER AVERAGE PER PERSON USAGE (10 COLUMNS) )
      READ (IN,1120) DRINK
  140 WRITE (52,1150) DRINK
 1150 FORMAT (///,52H  MUNICIPAL USAGE, IN ACRE-FEET PER UNIT QUANTITY =
     1 ,F8.2 )
      READ (53,1160) CNVLAT,CVLONG,SNUOS1,SNUOS2,SNUOS3,SNLAT1,SNLAT2,
     1 PREFAC,SEEPFC,PRSPFC,TAILFC
 1160 FORMAT (8X,12F6.0)
      IF (IPRNT .NE. 1) GO TO 150
      WRITE (IOUT,1180) PREFAC
      WRITE (IOUT,1100)
      CALL QUESZN(IQ)
      IF (IQ .NE. 1) GO TO 150
      WRITE (IOUT,1170)
 1170 FORMAT (36H ENTER PRESTRESS FACTOR (10 COLUMNS) )
      READ (IN,1120) PREFAC
  150 WRITE (52,1180) PREFAC
```

```
 1180 FORMAT (///,33H  PRESTRESS FACTOR, IN PERCENT = ,F5.2)
      IF (IPRNT .NE. 1) GO TO 160
      WRITE (IOUT,1200) SEEPFC
      WRITE (IOUT,1100)
      CALL QUESZN(IQ)
      IF (IQ .NE. 1) GO TO 160
      WRITE (IOUT,1190)
 1190 FORMAT (34H ENTER SEEPAGE FACTOR (10 COLUMNS) )
      READ (IN,1120) SEEPFC
  160 WRITE (52,1200) SEEPFC
 1200 FORMAT (///,48H  CANAL LEAKAGE FACTOR, IN ACRE-FEET PER MILE = ,
     1 F5.2 )
      IF (IPRNT .NE. 1) GO TO 170
      WRITE (IOUT,1220) PRSPFC
      WRITE (IOUT,1100)
      CALL QUESZN(IQ)
      IF (IQ .NE. 1) GO TO 170
      WRITE (IOUT,1210)
 1210 FORMAT (50H ENTER EFFECTIVE PRECIPITATION FACTOR (10 COLUMNS) )
      READ (IN,1120) PRSPFC
  170 WRITE (52,1220) PRSPFC
 1220 FORMAT (///,39H  EFFECTIVE PRECIPITATION, IN INCHES = ,F5.2)
C
C         READ AND DISPLAY RESERVOIR DATA
C
      READ (53,1230) NRES
 1230 FORMAT (2I5)
C
      WRITE (IOUT,1240)
 1240 FORMAT (43H DO YOU WANT TO DISPLAY THE RESERVOIR DATA?  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 1) WRITE (IOUT,1250) NRES
 1250 FORMAT (11H1THERE ARE ,I3,11H RESERVOIRS  ,//,
     1        108H RESERVOIR  RESERVOIR  RESERVOIR  MAXIMUM  INACTIVE  M
     2AXIMUM    X      Y    CONNECTING  INITIAL      INITIAL ,/, 111H  N
     3UMBER       ID        NAME     CAPACITY  STORAGE  SURFACE  COORD
     4COORD    RIVER     CONTENTS  CONCENTRATION ,/,35X,75H(ACRE-   (ACR
     5E-    AREA     (DE-   (DE-    NODE      (ACRE-     (MILLIGRAMS ,/,
     6 36X,39HFEET)    FEET)  (ACRES)  GREES) GREES),15X,20HFEET)     PE
     7R LITER)  )
      DO 190 IRES = 1,NRES
      READ (53,1260) RESID(IRES),RESNAM(IRES),CAPMAX(IRES),NACTIV(IRES),
     1 AREAMX(IRES),RSXLOC(IRES),RSYLOC(IRES),RESSTR(IRES),RSCONC(IRES),
     2 RSXPLT(IRES),RSYPLT(IRES)
 1260 FORMAT (I5,A8,2X,7F10.0,2F5.0)
      CALL DETNOD(RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),ISIDE)
      SBSTOR(IRES,1) = RESSTR(IRES) - NACTIV(IRES)
      DO 180 IACCNT = 2,5
  180 SBSTOR(IRES,IACCNT) = 0.
      IF (IQ .NE. 1) GO TO 190
      WRITE (IOUT,1270) IRES,RESID(IRES),RESNAM(IRES),CAPMAX(IRES),
     1 NACTIV(IRES),AREAMX(IRES),RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),
     2 RESSTR(IRES),RSCONC(IRES)
```

```
 1270 FORMAT (I6,6X,I6,6X,A8,F9.0,F10.0,F8.0,F9.3,F7.3,I6,F14.0,F12.0)
  190 CONTINUE
C
C         MODIFY RESERVOIR DATA
C
  200 WRITE (IOUT,1280)
 1280 FORMAT (42H DO YOU WANT TO MODIFY THE RESERVOIR DATA? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 360,210,360
C
C         ADD A NEW RESERVOIR
C
  210 WRITE (IOUT,1290)
 1290 FORMAT (32H DO YOU WANT TO ADD A RESERVOIR? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 250,220,250
  220 NRES = NRES + 1
      IRES = NRES
  230 WRITE (IOUT,1300)
 1300 FORMAT (33H ENTER THE RESERVOIR ID (5 COLS) )
      READ (IN,1230) RESID(IRES)
      WRITE (IOUT,1310)
 1310 FORMAT (36H ENTER THE RESERVOIR NAME (10 COLS) )
      READ (IN,1320) RESNAM(IRES)
 1320 FORMAT (A8)
      WRITE (IOUT,1330)
 1330 FORMAT (30H ENTER THE CAPACITY (10 COLS) )
      READ (IN,1120) CAPMAX(IRES)
      WRITE (IOUT,1340)
 1340 FORMAT (37H ENTER THE INACTIVE STORAGE (10 COLS) )
      READ (IN,1120) NACTIV(IRES)
      WRITE (IOUT,1350)
 1350 FORMAT (42H ENTER THE MAXIMUM SURFACE AREA (10 COLS) )
      READ (IN,1120) AREAMX(IRES)
      WRITE (IOUT,1360)
 1360 FORMAT (44H ENTER THE RESERVOIR X COORDINATE (10 COLS) )
      READ (IN,1120) RSXLOC(IRES)
      WRITE (IOUT,1370)
 1370 FORMAT (44H ENTER THE RESERVOIR Y COORDINATE (10 COLS) )
      READ (IN,1120) RSYLOC(IRES)
      WRITE (IOUT,1380)
 1380 FORMAT (46H ENTER THE INITIAL STORAGE CONTENTS (10 COLS) )
      READ (IN,1120) RESSTR(IRES)
      WRITE (IOUT,1390)
 1390 FORMAT (43H ENTER THE INITIAL CONCENTRATION (10 COLS) )
      READ (IN,1120) RSCONC(IRES)
      CALL DETNOD(RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),ISIDE)
      SBSTOR(IRES,1) = RESSTR(IRES) - NACTIV(IRES)
      DO 240 IACCNT = 2,5
  240 SBSTOR(IRES,IACCNT) = 0.
      RSXPLT(IRES) = -.05
      RSYPLT(IRES) = .05
      GO TO 200
C
C         CHANGE RESERVOIR DATA
```

```
C
  250 WRITE (IOUT,1400)
 1400 FORMAT (52H DO YOU WANT TO CHANGE ALL THE DATA FOR A RESERVOIR? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 310,260,310
  260 WRITE (IOUT,1410)
 1410 FORMAT (23H ENTER THE RESERVOIR ID )
      READ (IN,1230) IRESID
      DO 270 IRES = 1,NRES
      IF (IRESID .EQ. RESID(IRES)) GO TO 290
  270 CONTINUE
  280 WRITE (IOUT,1420) IRESID
 1420 FORMAT (13H RESERVOIR ID ,I5,14H WAS NOT FOUND  )
      GO TO 250
  290 WRITE (IOUT,1430)
 1430 FORMAT (74H IF THE VALUE DISPLAYED AFTER THE REQUEST IS ACCEPTABLE
     1, MERELY TYPE <CR> ,//,33H ENTER THE RESERVOIR ID (5 COLS) )
      WRITE (IOUT,1230) RESID(IRES)
      READ (IN,1230) ITEMP
      IF (ITEMP .NE. 0) RESID(IRES) = ITEMP
      WRITE (IOUT,1310)
      WRITE (IOUT,1320) RESNAM(IRES)
      READ (IN,1320) NAME
      IF (NAME .NE. '') RESNAM(IRES) = NAME
      WRITE (IOUT,1330)
      WRITE (IOUT,1120) CAPMAX(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) CAPMAX(IRES) = TEMP
      WRITE (IOUT,1340)
      WRITE (IOUT,1120) NACTIV(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) NACTIV(IRES) = TEMP
      WRITE (IOUT,1350)
      WRITE (IOUT,1120) AREAMX(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) AREAMX(IRES) = TEMP
      WRITE (IOUT,1360)
      WRITE (IOUT,1120) RSXLOC(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) RSXLOC(IRES) = TEMP
      WRITE (IOUT,1370)
      WRITE (IOUT,1120) RSYLOC(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) RSYLOC(IRES) = TEMP
      WRITE (IOUT,1380)
      WRITE (IOUT,1120) RESSTR(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) RESSTR(IRES) = TEMP
      WRITE (IOUT,1390)
      WRITE (IOUT,1120) RSCONC(IRES)
      READ (IN,1120) TEMP
      IF (TEMP .NE. 0.) RSCONC(IRES) = TEMP
      CALL DETNOD(RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),ISIDE)
      SBSTOR(IRES,1) = RESSTR(IRES) - NACTIV(IRES)
      DO 300 IACCNT = 2,5
```

```
  300 SBSTOR(IRES,IACCNT) = 0.
      RSXPLT(IRES) = -.05
      RSYPLT(IRES) = .05
      GO TO 200
C
  310 WRITE (IOUT,1440)
 1440 FORMAT (61H DO YOU WANT TO CHANGE THE INITIAL CONDITIONS OF A RESE
     1RVOIR? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 360,320,360
  320 WRITE (IOUT,1410)
      READ (IN,1230) IRESID
      DO 330 IRES = 1,NRES
      IF (IRESID .EQ. RESID(IRES)) GO TO 340
  330 CONTINUE
      GO TO 280
  340 WRITE (IOUT,1380)
      READ (IN,1120) RESSTR(IRES)
      SBSTOR(IRES,1) = RESSTR(IRES) - NACTIV(IRES)
      DO 350 IACCNT = 2,5
  350 SBSTOR(IRES,IACCNT) = 0.
      WRITE (IOUT,1390)
      READ (IN,1120) RSCONC(IRES)
      GO TO 200
C
C         PLOT RESERVOIR LOCATIONS
C
  360 WRITE (IOUT,1450)
 1450 FORMAT (54H DO YOU WANT TO PLOT THE RESERVOIR LOCATION SCHEMATIC?)
      CALL QUESZN(IQ)
      IF (IQ-1) 380,370,380
  370 WRITE (IDUM,1460) TITL
 1460 FORMAT (5A4,23H - RESERVOIR LOCATIONS$)
      CALL PLTRES(ITITLE)
C
C         WRITE RESERVOIR DATA
C
  380 WRITE (52,1250) NRES
      DO 390 IRES = 1,NRES
      WRITE (52,1270) IRES,RESID(IRES),RESNAM(IRES),CAPMAX(IRES),
     1 NACTIV(IRES),AREAMX(IRES),RSXLOC(IRES),RSYLOC(IRES),NODRES(IRES),
     2 RESSTR(IRES),RSCONC(IRES)
  390 CONTINUE
C
C         COMPUTE RIVER MILES
C
  400 DO 410 INODE = 1,NNODE
  410 RMILES(INODE) = 0.
      INODE = NNODE
      RMILES(INODE) = .00001
```

```
  420 JNODE = NODEUS(INODE)
      IF (JNODE .EQ. 0) GO TO 430
      SNUOSY = SNUOS1
      IF (XLOC(JNODE) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOC(JNODE) .GT. SNLAT2) SNUOSY = SNUOS3
      RMILES(JNODE) = RMILES(INODE) +
     1 SQRT(((XLOC(JNODE)-XLOC(INODE))*CVLONG)**2 + ((YLOC(JNODE)-
     2 YLOC(INODE))*CNVLAT)**2)*SNUOSY
      INODE = JNODE
      GO TO 420
  430 IZERO = 0
      NNOD1 = NNODE - 1
      DO 440 INODE = 1,NNOD1
      IF (RMILES(INODE) .NE. 0.) GO TO 440
      JNODE = NXTNOD(INODE)
      IF (JNODE .LE. 0) GO TO 440
      IZERO = 1
      IF (RMILES(JNODE) .EQ. 0.) GO TO 440
      SNUOSY = SNUOS1
      IF (XLOC(INODE) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOC(INODE) .GT. SNLAT2) SNUOSY = SNUOS3
      RMILES(INODE) = RMILES(JNODE) +
     1 SQRT(((XLOC(INODE)-XLOC(JNODE))*CVLONG)**2 + ((YLOC(INODE)-
     2 YLOC(JNODE))*CNVLAT)**2) * SNUOSY
  440 CONTINUE
      IF (IZERO .EQ. 1) GO TO 430
C
C         READ AND DISPLAY GROUND-WATER DATA
C
      WRITE (IOUT,1470)
 1470 FORMAT (61H DO YOU WANT TO DISPLAY THE GROUND-WATER AND RIVER-MILE
     1 DATA? )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 1) WRITE (IOUT,1480)
      WRITE (52,1480)
 1480 FORMAT (68H1 NODE   NODE    NODE    INITIAL GROUND-   INITIAL GROU
     1ND-     RIVER,/,68H NUMBER   ID     NAME     WATER STORAGE  WATER
     2CONCENTRATION  LENGTH,/,27X,42H(ACRE-FEET)       (MILLIGRAMS
     3(MILES) ,/,47X,10HPER LITER) ,/, 25X,33HSIDE 1  SIDE 2   SIDE 1
     4 SIDE 2   )
      DO 450 INODE = 1,NNODE
      READ (53,1160) (GWSTOR(INODE,ISIDE),GWCONC(INODE,ISIDE),ISIDE=1,2)
      WRITE (52,1490) INODE,NODEID(INODE),NODNAM(INODE),GWSTOR(INODE,1),
     1 GWSTOR(INODE,2),GWCONC(INODE,1),GWCONC(INODE,2),RMILES(INODE)
 1490 FORMAT (I5,I8,2X,A8,2F8.0,F9.0,F10.0,F9.1 )
      IF (IQ .NE. 1) GO TO 450
      WRITE (IOUT,1490) INODE,NODEID(INODE),NODNAM(INODE),
     1 GWSTOR(INODE,1),GWSTOR(INODE,2),GWCONC(INODE,1),GWCONC(INODE,2),
     2 RMILES(INODE)
  450 CONTINUE
C
C         MODIFY GROUND-WATER DATA
```

```
C
  460 WRITE (IOUT,1500)
 1500 FORMAT (61H DO YOU WANT TO CHANGE ANY OF THE GROUNDWATER INITIAL V
     1ALUES?  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 0) GO TO 500
  470 WRITE (IOUT,1510)
 1510 FORMAT (70H ENTER THE NODE ID FOR THE REACH (5 COLUMNS), AND THE S
     1IDE (5 COLUMNS)  )
      READ (IN,1230) NODID,ISIDE
      DO 480 INODE = 1,NNODE
      IF (NODID .EQ. NODEID(INODE)) GO TO 490
  480 CONTINUE
      GO TO 470
  490 WRITE (IOUT,1520)
 1520 FORMAT (79H ENTER THE INITIAL STORAGE (10 COLUMNS), AND INITIAL CO
     1NCENTRATION (10 COLUMNS)  )
      READ (IN,1120) GWSTOR(INODE,ISIDE),GWCONC(INODE,ISIDE)
      GO TO 460
C
C         ENTER FREQUENCY OF PLOTTING GROUND-WATER SCHEMATIC
C
  500 WRITE (IOUT,1530)
 1530 FORMAT (68H ENTER THE FREQUENCY OF PLOTTING THE GROUND-WATER SCHEM
     1ATIC (5 COLS),/,7X,18H0 FOR NO SCHEMATIC,/,7X,15H12 FOR ANNUALLY,/
     2 7X,15H99999 FOR FINAL )
      READ (IN,1540) ISKMGW
 1540 FORMAT (16I5)
C
C         ENTER NODES AND SIDE FOR GROUND-WATER HYDROGRAPHS
C
      WRITE (IOUT,1550)
 1550 FORMAT (62H ENTER THE NODE ID AND SIDE (2=NORTH OR EAST, 1=SOUTH O
     1R WEST) ,/,7X,52HFOR NODES AT WHICH YOU WANT GROUND-WATER HYDROGRA
     2PHS,/,10X,44H**NOTE**  99999 WILL PROVIDE BASINWIDE TOTAL ,/,
     3 7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,1540) (IHYGW(J),ISID(J),J=1,5)
      DO 540 I = 1,5
      IF (IHYGW(I) .EQ. 99999) GO TO 520
      DO 510 J = 1,NNODE
      IF (IHYGW(I) .NE. NODEID(J)) GO TO 510
      IHYGW(I) = J + 1000*ISID(I)
      GO TO 540
  510 CONTINUE
      GO TO 540
  520 DO 530 J = 1,500
      GWHYS(J,I) = 0.
      GWHYC(J,I) = 0.
  530 GWHYRF(J,I) = 0.
  540 CONTINUE
C
C         ENTER NODES AND SIDE FOR MONTHLY GROUND-WATER TABLES
```

```
C
      WRITE (IOUT,1560)
 1560 FORMAT (62H ENTER THE NODE ID AND SIDE (2=NORTH OR EAST, 1=SOUTH O
     1R WEST) ,/,7X,57HFOR NODES AT WHICH YOU WANT TABLES OF GROUND-WATE
     2R VALUES,/,10X,44H**NOTE**  99999 WILL PROVIDE BASINWIDE TOTAL ,/,
     3 7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,1540) (ITBLG(J),ISID(J),J=1,5)
      DO 580 I = 1,5
      IF (ITBLG(I) .EQ. 99999) GO TO 560
      DO 550 J = 1,NNODE
      IF (ITBLG(I) .NE. NODEID(J)) GO TO 550
      ITBLG(I) = J + 1000*ISID(I)
      GO TO 580
  550 CONTINUE
      GO TO 580
  560 DO 570 J = 1,600
      IGTBLS(I,J) = 0
      IGTBLC(I,J) = 0
  570 IGTBLR(I,J) = 0
  580 CONTINUE
C
C
      RETURN
      END
```

```
CREADUB
C
C          SUBROUTINE READ WATER USER DATA INTERACTIVELY OF
C                   RIVER BASIN SIMULATION MODEL
C           WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C              WATER RESOURCES DIVISION, LAKEWOOD, CO
C                      LATEST UPDATE 2/ 7/87
C
            SUBROUTINE READUB
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
           1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
           2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
           3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
           4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
           5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
           6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
           7               TIMFAC(100,12)
            INTEGER USERID,USRTYP,RFTYPE
            REAL NUMUSR,NEED
            COMMON /DEMND1/ USRNAM(100)
            DOUBLE PRECISION USRNAM
            COMMON /GWUSE/ MGW,GWUSER(100),GWSOUR(100),GWDIST(100),GWPUMP(100)
           1               ,ISDPMP(100)
            INTEGER GWUSER,GWSOUR
            COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
            COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
            COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
            COMMON /NAMES/ TITL(5)
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /RESUSE/ MRES,RESUSR(100),RESSOR(100),NUMRES(100),
           1                TRANSL(100),RESRL(100),ISBACT(100),RESQNT(100)
            INTEGER RESSOR,RESUSR
            COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
           1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
           2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
           3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
            INTEGER RESID
            REAL NACTIV
            COMMON /RES1/ RESNAM(25)
            DOUBLE PRECISION RESNAM
            COMMON /RIGHTS/ NRIGHT,OWNER(200)
            INTEGER OWNER
```

```
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
     1               RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /STATU/ ISSU(10),UMENND(10,12),UMENDD(10,12),UMENGW(10,12),
     1               UMENRR(10,12),UMENTA(10,12),UMENP(10,12),
     2               UMENWC(10,12),UMENC(10,12),UMENCL(10,12),
     3               UMENTW(10,12),UMENDP(10,12)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
C
      DIMENSION TITLEU(20),TITLER(20),ITITLE(20)
      INTEGER*2 USED(100,15)
      CHARACTER*80 IDUM
C
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
      DOUBLE PRECISION NAME,DATE
C
C         READ AND WRITE WATER USER DATA
C
      READ (50,1000) TITLEU
 1000 FORMAT (20A4)
      READ (50,1010) NUSERS
 1010 FORMAT (I5)
      WRITE (52,1020) TITLEU,NUSERS
 1020 FORMAT (18H1WATER USER FILE: ,20A4,11X,11H, CONTAINS ,I3,6H USERS,
     1 ////)
      MGW = 0
      MRES = 0
C
C         THERE ARE 5 TYPES OF WATER USERS
C
C              1 = AGRICULTURAL, NUMUSR IS IN IRRIGATED ACRES
C              2 = MUNCIPAL,     NUMUSR IS IN POPULATION
C              3 = INDUSTRIAL,   NUMUSR IS IN UNITS PRODUCED
C              4 = IN STREAM,    NUMUSR IS IN (FISH,SWIMMERS,KILOWATTS ?
C              5 = RESERVOIR OPERATORS
C
      WRITE (52,1030)
 1030 FORMAT (55H USER USER   USER  USER AMOUNT DE-      X      Y   RAIN
     1 ,16X,11HRETURN FLOW ,28X,6HSOURCE ,/,
     2 55H NUM-  ID    NAME  TYPE        MAND   COORD  COORD GAGE ,1X,
     3 34(1H_),1X,41(1H_) ,/,
     4 5H  BER,26X,4HFAC-,21X,34HTYPE FAC-    X      Y   NODE DIST- ,1X,
     5 41HTYPE  LIMIT     X      Y   NODE RES DIST- ,/,
     6 32X,3HTOR,26X,28HTOR   COORD  COORD      ANCE ,16X,
     7 26HCOORD  COORD      ID  ANCE )
      NTIMFC = 0
      DO 160 IUSER = 1,NUSERS
```

```
      READ (50,1040) USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 USXPLT(IUSER),USYPLT(IUSER),IPRECP(IUSER),IAKNT(IUSER),
     3 NSOURC(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     4 RFYLOC(IUSER),RFDST
 1040 FORMAT (I5,A8,2X,I5,4F10.0,2F5.0,2I5,/,15X,2I5,4F10.0)
      CALL DETNOD(RFXLOC(IUSER),RFYLOC(IUSER),INODE,ISIDE)
      NODERF(IUSER) = INODE
      ISIDRF(IUSER) = ISIDE
      CALL CMPDST(INODE,RFXLOC(IUSER),RFYLOC(IUSER),RFDIST(IUSER))
      IF (RFDST .NE. 0.) RFDIST(IUSER) = RFDST
      IF (USRTYP(IUSER) .EQ. 5) GO TO 10
      WRITE (52,1050) IUSER,USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IPRECP(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER),NSOURC(IUSER)
 1050 FORMAT (I4,I6,1X,A8,I3,F8.0,F5.2,F8.3,F7.3,2I4,F6.2,F8.3,F7.3,I3,
     1 F8.0,I2)
      GO TO 40
   10 DO 20 IRES = 1,NRES
      IF (RSXLOC(IRES) .EQ. XLOCU(IUSER) .AND. RSYLOC(IRES) .EQ.
     1 YLOCU(IUSER)) GO TO 30
   20 CONTINUE
      WRITE (IOUT,1060)
 1060 FORMAT (76H COORDINATES OF A RESERVOIR OPERATOR DO NOT MATCH COORD
     1INATES OF A RESERVOIR )
      STOP
   30 IRESID = RESID(IRES)
      IF (IAKNT(IUSER) .EQ. 0) IAKNT(IUSER) = 1
      WRITE (52,1070) IUSER,USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IAKNT(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER),NSOURC(IUSER),IRESID
 1070 FORMAT (I4,I6,1X,A8,I3,F8.0,F5.2,F8.3,F7.3,2I4,F6.2,F8.3,F7.3,I3,
     1 F8.0,I2,29X,I4)
      USRTYP(IUSER) = IRESID
   40 NSORC = NSOURC(IUSER)
C
C         THERE ARE 6 TYPES OF WATER SOURCES
C
C              1 = DIRECT DIVERSIONS
C              2 = GROUND-WATER PUMPAGE
C              3 = RESERVOIR RELEASES
C              4 = DIRECT PIPELINE IMPORTATION
C              5 = STORAGE DIVERSION
C              6 = DIRECT DIVERSION CHANGED TO STORAGE
C
      DO 150 ISOURC = 1,NSORC
      READ (50,1080) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),GWDST,NMRES,IACCNT,
     2 ITIMFC(IUSER,ISOURC)
```

```
 1080 FORMAT (I5,4F10.0,3I5)
      IF (ITIMFC(IUSER,ISOURC) .EQ. 0) GO TO 50
      NTIMFC = NTIMFC + 1
      ITIMFC(IUSER,ISOURC) = NTIMFC
      READ (50,1090) (TIMFAC(NTIMFC,KMONTH),KMONTH=1,12)
 1090 FORMAT (5X,12F5.0)
   50 CALL DETNOD(SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 NODESC(IUSER,ISOURC),ISIDE)
      IF (ICODE(IUSER,ISOURC) .NE. 1) GO TO 60
      SNUOSY = SNUOS1
      IF (XLOCU(IUSER) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOCU(IUSER) .GT. SNLAT2) SNUOSY = SNUOS3
      CANLEN(IUSER) =
     1 SQRT(((SCXLOC(IUSER,ISOURC)-XLOCU(IUSER))*CVLONG)**2 +
     2 ((SCYLOC(IUSER,ISOURC)-YLOCU(IUSER))*CNVLAT)**2)*SNUOSY
   60 IF (ICODE(IUSER,ISOURC) .NE. 2) GO TO 70
C
C         FOR GROUND-WATER SOURCES
C
      MGW = MGW + 1
      GWUSER(MGW) = IUSER
      GWSOUR(MGW) = ISOURC
      INODE = NODESC(IUSER,ISOURC)
      CALL CMPDST(INODE,SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 GWDIST(MGW) )
      IF (GWDST .NE. 0.) GWDIST(MGW) = GWDST
      ISDPMP(MGW) = ISIDE
      GO TO 130
C
   70 IF (IABS(ICODE(IUSER,ISOURC)) .NE. 3) GO TO 140
C
C         FOR RESERVOIR SOURCES
C
   80 MRES = MRES + 1
      RESUSR(MRES) = IUSER
      RESSOR(MRES) = ISOURC
C
      DO 90 JRES = 1,NRES
      IF (NMRES .EQ. RESID(JRES)) GO TO 100
   90 CONTINUE
      STOP
C
  100 NUMRES(MRES) = JRES
      IF (IACCNT .EQ. 0) IACCNT = 1
      ISBACT(MRES) = IACCNT
C
C              IF RIVER TRANSMITS RELEASES, COMPUTE TRANSIT LOSS
C
      IF (ICODE(IUSER,ISOURC) .LT. 0) GO TO 110
      JNODE = NODRES(JRES)
      KNODE = NODESC(IUSER,ISOURC)
      TRANSL(MRES) = 1. - .0007*ABS(RMILES(JNODE)-RMILES(KNODE))
      GO TO 120
```

```
C
C               IF DIRECT RELEASE TO CANAL, ADJUST PARAMETERS
C
  110 NODESC(IUSER,ISOURC) = NNODE + 1
      ICODE(IUSER,ISOURC) = -ICODE(IUSER,ISOURC)
      TRANSL(MRES) = 1.
C
  120 WRITE (52,1100) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 NUMRES(MRES)
 1100 FORMAT (90X,I3,F9.1,F8.3,F7.3,2I4)
      GO TO 150
  130 WRITE (52,1110) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 GWDIST(MGW)
 1110 FORMAT (90X,I3,F9.1,F8.3,F7.3,I4,4X,F7.0)
      GO TO 150
C
  140 IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 80
      WRITE (52,1100) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC)
  150 CONTINUE
  160 CONTINUE
C
C         PLOT WATER USER LOCATIONS
C
      CALL QUESZN(IQ)
      IF (IQ-1) 180,170,180
  170 WRITE (IDUM,1120) TITL
 1120 FORMAT (5A4,24H - WATER USER LOCATIONS$)
      CALL PLTUSR(ITITLE)
C
C         READ, WRITE, AND CHECK WATER RIGHT FILE
C
  180 READ (51,1000) TITLER
      READ (51,1010) NRIGHT
      WRITE (52,1130) TITLER,NRIGHT
 1130 FORMAT (19H1WATER RIGHT FILE: ,20A4,9X,11H, CONTAINS ,I3,7H RIGHTS
     1 ,///,50H     OWNER      OWNER         DATE          AMOUNT ,/,
     2      21H      ID         NAME )
      DO 190 IUSER = 1,NUSERS
      DO 190 ISOURC = 1,15
  190 USED(IUSER,ISOURC) = 0
C
      DO 250 IRIGHT = 1,NRIGHT
      READ (51,1140) OWNER(IRIGHT),NAME,DATE,AMNT
 1140 FORMAT (I5,A8,2X,A8,F10.0)
C
      DO 200 IUSER = 1,NUSERS
      IF (OWNER(IRIGHT) .EQ. USERID(IUSER)) GO TO 210
  200 CONTINUE
      WRITE (52,1150) OWNER(IRIGHT)
```

```
 1150 FORMAT (24H THERE IS NO LISTING OF ,I5,23H IN THE WATER USER FILE)
      GO TO 250
  210 ISOURC = 0
  220 ISOURC = ISOURC + 1
      IF (ISOURC .GT. NSOURC(IUSER)) GO TO 240
      IF (ICODE(IUSER,ISOURC) .EQ. 1) GO TO 230
      IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 230
      IF (ICODE(IUSER,ISOURC) .NE. 5) GO TO 220
  230 IF (USED(IUSER,ISOURC) .EQ. 1) GO TO 220
      USED(IUSER,ISOURC) = 1
      GO TO 250
  240 WRITE (52,1160) OWNER(IRIGHT),IRIGHT
 1160 FORMAT (6H USER ,I5,34H DOES NOT HAVE A SOURCE FOR RIGHT ,I3)
  250 WRITE (52,1170) OWNER(IRIGHT),NAME,DATE,AMNT
 1170 FORMAT (5X,I5,5X,A8,5X,A8,2X,F12.2)
C
      DO 270 IUSER = 1,NUSERS
      NSOUR = NSOURC(IUSER)
      DO 270 ISOURC = 1,NSOUR
      IF (ICODE(IUSER,ISOURC) .EQ. 1) GO TO 260
      IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 260
      IF (ICODE(IUSER,ISOURC) .NE. 5) GO TO 270
  260 IF (USED(IUSER,ISOURC) .EQ. 1 .OR. QUANTY(IUSER,ISOURC) .EQ. 0.)
     1 GO TO 270
      WRITE (52,1180) USERID(IUSER),ISOURC
 1180 FORMAT (10H FOR USER ,I5,13H, ITS SOURCE ,I3,
     1 19H HAS NO WATER RIGHT )
  270 CONTINUE
C
C         ENTER FREQUENCY OF PLOTTING WATER USER SCHEMATIC
C
      READ (IN,1080) ISKMU,UMAX
C
C         ENTER WATER USERS FOR HYDROGRAPHS
C
      READ (IN,1190) IHYU
 1190 FORMAT (16I5)
      DO 310 I = 1,5
      IF (IHYU(I) .EQ. 99999) GO TO 290
      DO 280 J = 1,NUSERS
      IF (IHYU(I) .NE. USERID(J)) GO TO 280
      IHYU(I) = J
      GO TO 310
  280 CONTINUE
      GO TO 310
  290 DO 300 J = 1,600
      UHYD(J,I) = 0.
      UHYP(J,I) = 0.
  300 UHYT(J,I) = 0.
  310 CONTINUE
C
C         ENTER WATER USERS FOR MONTHLY TABLES
```

```
C
      READ (IN,1190) ITBLU
      DO 350 I = 1,5
      IF (ITBLU(I) .EQ. 99999) GO TO 330
      DO 320 J = 1,NUSERS
      IF (ITBLU(I) .NE. USERID(J)) GO TO 320
      ITBLU(I) = J
      GO TO 350
  320 CONTINUE
      GO TO 350
  330 DO 340 J = 1,600
      IUTBLD(I,J) = 0
      IUTBLP(I,J) = 0
  340 IUTBLT(I,J) = 0
  350 CONTINUE
C
C         ENTER WATER USERS FOR STATISTICAL SUMMARIES
C
      READ (IN,1190) ISSU
      DO 380 I = 1,10
      IF (ISSU(I) .LE. 0) GO TO 380
      DO 360 J = 1,12
      UMENND(I,J) = 0.
      UMENDD(I,J) = 0.
      UMENGW(I,J) = 0.
      UMENRR(I,J) = 0.
      UMENTA(I,J) = 0.
      UMENP(I,J) = 0.
      UMENWC(I,J) = 0.
      UMENC(I,J) = 0.
      UMENCL(I,J) = 0.
      UMENTW(I,J) = 0.
  360 UMENDP(I,J) = 0.
      DO 370 J = 1,NUSERS
      IF (ISSU(I) .NE. USERID(J)) GO TO 370
      ISSU(I) = J
      GO TO 380
  370 CONTINUE
  380 CONTINUE
C
C         ENTER RESERVOIRS FOR HYDROGRAPHS
C
      READ (IN,1190) IHYR
      DO 400 I = 1,5
      DO 390 J = 1,NRES
      IF (IHYR(I) .NE. RESID(J)) GO TO 390
      IHYR(I) = J
      GO TO 400
  390 CONTINUE
  400 CONTINUE
C
C         ENTER RESERVOIRS FOR MONTHLY TABLES
```

```
C
      READ (IN,1190) ITBLR
      DO 420 I = 1,5
      DO 410 J = 1,NRES
      IF (ITBLR(I) .NE. RESID(J)) GO TO 410
      ITBLR(I) = J
      GO TO 420
  410 CONTINUE
  420 CONTINUE
C
C         ENTER RESERVOIRS FOR STATISTICAL SUMMARIES
C
      READ (IN,1190) ISSR
      DO 450 I = 1,10
      IF (ISSR(I) .LE. 0) GO TO 450
      DO 430 J = 1,12
      RMEANS(I,J) = 0.
      RMEANC(I,J) = 0.
      RMEANR(I,J) = 0.
      RMEAND(I,J) = 0.
      RMEANI(I,J) = 0.
  430 RMEANE(I,J) = 0.
      DO 440 J = 1,NRES
      IF (ISSR(I) .NE. RESID(J)) GO TO 440
      ISSR(I) = J
      GO TO 450
  440 CONTINUE
  450 CONTINUE
C
      RETURN
      END
```

```
CREADUI
C
C          SUBROUTINE READ WATER USER DATA INTERACTIVELY OF
C                   RIVER BASIN SIMULATION MODEL
C           WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C              WATER RESOURCES DIVISION, LAKEWOOD, CO
C                      LATEST UPDATE 2/ 7/87
C
            SUBROUTINE READUI
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
           1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
           2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
           3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
           4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
           5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
           6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
           7               TIMFAC(100,12)
            INTEGER USERID,USRTYP,RFTYPE
            REAL NUMUSR,NEED
            COMMON /DEMND1/ USRNAM(100)
            DOUBLE PRECISION USRNAM
            COMMON /GWUSE/ MGW,GWUSER(100),GWSOUR(100),GWDIST(100),GWPUMP(100)
           1               ,ISDPMP(100)
            INTEGER GWUSER,GWSOUR
            COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
            COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
            COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
            COMMON /NAMES/ TITL(5)
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /RESUSE/ MRES,RESUSR(100),RESSOR(100),NUMRES(100),
           1                TRANSL(100),RESRL(100),ISBACT(100),RESQNT(100)
            INTEGER RESSOR,RESUSR
            COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
           1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
           2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
           3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
            INTEGER RESID
            REAL NACTIV
            COMMON /RES1/ RESNAM(25)
            DOUBLE PRECISION RESNAM
            COMMON /RIGHTS/ NRIGHT,OWNER(200)
            INTEGER OWNER
```

```
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
     1               RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /STATU/ ISSU(10),UMENND(10,12),UMENDD(10,12),UMENGW(10,12),
     1               UMENRR(10,12),UMENTA(10,12),UMENP(10,12),
     2               UMENWC(10,12),UMENC(10,12),UMENCL(10,12),
     3               UMENTW(10,12),UMENDP(10,12)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
C
      DIMENSION TITLEU(20),TITLER(20),ITITLE(20),AMNT(200)
      INTEGER*2 USED(100,15)
      CHARACTER*80 IDUM
C
      DOUBLE PRECISION NAME(200),DATE(200),NAME1
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
C
C         READ AND DISPLAY WATER USER DATA
C
      READ (50,2000) TITLEU
 2000 FORMAT (20A4)
      READ (50,2010) NUSERS
 2010 FORMAT (I5)
      WRITE (52,2020) TITLEU,NUSERS
 2020 FORMAT (18H1WATER USER FILE: ,20A4,11X,11H, CONTAINS ,I3,6H USERS,
     1 ////)
      MGW = 0
      MRES = 0
C
C         THERE ARE 5 TYPES OF WATER USERS
C
C              1 = AGRICULTURAL, NUMUSR IS IN IRRIGATED ACRES
C              2 = MUNCIPAL,     NUMUSR IS IN POPULATION
C              3 = INDUSTRIAL,   NUMUSR IS IN UNITS PRODUCED
C              4 = IN STREAM,    NUMUSR IS IN (FISH,SWIMMERS,KILOWATTS ?
C              5 = RESERVOIR OPERATORS
C
      WRITE (IOUT,2030)
 2030 FORMAT (38H DO YOU WANT TO DISPLAY THE USER DATA? )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 1) WRITE (IOUT,2040)
 2040 FORMAT (55H USER USER   USER  USER AMOUNT DE-      X      Y   RAIN
     1 ,16X,11HRETURN FLOW ,28X,6HSOURCE ,/,
     2 55H NUM-  ID    NAME  TYPE        MAND   COORD  COORD GAGE ,1X,
     3 34(1H_),1X,41(1H_) ,/,
     4 5H  BER,26X,4HFAC-,21X,34HTYPE FAC-    X      Y   NODE DIST- ,1X,
     5 41HTYPE  LIMIT     X      Y   NODE RES DIST- ,/,
     6 32X,3HTOR,26X,28HTOR   COORD  COORD      ANCE ,16X,
     7 26HCOORD  COORD      ID  ANCE )
      NTIMFC = 0
```

```
C
      DO 170 IUSER = 1,NUSERS
      READ (50,2050) USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 USXPLT(IUSER),USYPLT(IUSER),IPRECP(IUSER),IAKNT(IUSER),
     3 NSOURC(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     4 RFYLOC(IUSER),RFDST
 2050 FORMAT (I5,A8,2X,I5,4F10.0,2F5.0,2I5,/,15X,2I5,4F10.0)
      CALL DETNOD(RFXLOC(IUSER),RFYLOC(IUSER),INODE,ISIDE)
      NODERF(IUSER) = INODE
      ISIDRF(IUSER) = ISIDE
      CALL CMPDST(INODE,RFXLOC(IUSER),RFYLOC(IUSER),RFDIST(IUSER))
      IF (RFDST .NE. 0.) RFDIST(IUSER) = RFDST
      IF (USRTYP(IUSER) .EQ. 5) GO TO 10
      IF (IQ .NE. 1) GO TO 50
      WRITE (IOUT,2060) IUSER,USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IPRECP(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER)
 2060 FORMAT (I4,I6,1X,A8,I3,F8.0,F5.2,F8.3,F7.3,2I4,F6.2,F8.3,F7.3,I3,
     1 F8.0,I2)
      GO TO 50
C
   10 DO 20 IRES = 1,NRES
      IF (RSXLOC(IRES) .EQ. XLOCU(IUSER) .AND. RSYLOC(IRES) .EQ.
     1 YLOCU(IUSER)) GO TO 30
   20 CONTINUE
      WRITE (IOUT,2070)
 2070 FORMAT (76H COORDINATES OF A RESERVOIR OPERATOR DO NOT MATCH COORD
     1INATES OF A RESERVOIR )
      STOP
   30 IRESID = RESID(IRES)
      IF (IAKNT(IUSER) .EQ. 0) IAKNT(IUSER) = 1
      IF (IQ .NE. 1) GO TO 40
      WRITE (IOUT,2080) IUSER,USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IAKNT(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER),NSOURC(IUSER),IRESID
 2080 FORMAT (I4,I6,1X,A8,I3,F8.0,F5.2,F8.3,F7.3,2I4,F6.2,F8.3,F7.3,I3,
     1 F8.0,I2,29X,I4)
   40 USRTYP(IUSER) = IRESID
   50 NSORC = NSOURC(IUSER)
C
C         THERE ARE 6 TYPES OF WATER SOURCES
C
C              1 = DIRECT DIVERSIONS
C              2 = GROUND-WATER PUMPAGE
C              3 = RESERVOIR RELEASES
C              4 = DIRECT PIPELINE IMPORTATION
C              5 = STORAGE DIVERSION
C              6 = DIRECT DIVERSION CHANGED TO STORAGE
```

```
C
      DO 160 ISOURC = 1,NSORC
      READ (50,2090) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),GWDST,NMRES,IACCNT,
     2 ITIMFC(IUSER,ISOURC)
 2090 FORMAT (I5,4F10.0,3I5)
      IF (ITIMFC(IUSER,ISOURC) .EQ. 0) GO TO 60
      NTIMFC = NTIMFC + 1
      ITIMFC(IUSER,ISOURC) = NTIMFC
      READ (50,2100) (TIMFAC(NTIMFC,KMONTH),KMONTH=1,12)
 2100 FORMAT (5X,12F5.0)
   60 CALL DETNOD(SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 NODESC(IUSER,ISOURC),ISIDE)
      IF (ICODE(IUSER,ISOURC) .NE. 1) GO TO 70
      SNUOSY = SNUOS1
      IF (XLOCU(IUSER) .GT. SNLAT1) SNUOSY = SNUOS2
      IF (XLOCU(IUSER) .GT. SNLAT2) SNUOSY = SNUOS3
      CANLEN(IUSER) =
     1 SQRT(((SCXLOC(IUSER,ISOURC)-XLOCU(IUSER))*CVLONG)**2 +
     2 ((SCYLOC(IUSER,ISOURC)-YLOCU(IUSER))*CNVLAT)**2)*SNUOSY
   70 IF (ICODE(IUSER,ISOURC) .NE. 2) GO TO 80
C
C         FOR GROUND-WATER SOURCES
C
      MGW = MGW + 1
      GWUSER(MGW) = IUSER
      GWSOUR(MGW) = ISOURC
      INODE = NODESC(IUSER,ISOURC)
      CALL CMPDST(INODE,SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 GWDIST(MGW) )
      IF (GWDST .NE. 0.) GWDIST(MGW) = GWDST
      ISDPMP(MGW) = ISIDE
      GO TO 140
C
   80 IF (IABS(ICODE(IUSER,ISOURC)) .NE. 3) GO TO 150
C
C         FOR RESERVOIR SOURCES
C
   90 MRES = MRES + 1
      RESUSR(MRES) = IUSER
      RESSOR(MRES) = ISOURC
C
      DO 100 JRES = 1,NRES
      IF (NMRES .EQ. RESID(JRES)) GO TO 110
  100 CONTINUE
      STOP
C
  110 NUMRES(MRES) = JRES
      IF (IACCNT .EQ. 0) IACCNT = 1
      ISBACT(MRES) = IACCNT
C
C              IF RIVER TRANSMITS RELEASES, COMPUTE TRANSIT LOSS
```

```
C
      IF (ICODE(IUSER,ISOURC) .LT. 0.) GO TO 120
      JNODE = NODRES(JRES)
      KNODE = NODESC(IUSER,ISOURC)
      TRANSL(MRES) = 1. - .0007*ABS(RMILES(JNODE)-RMILES(KNODE))
      GO TO 130
C
C             IF DIRECT RELEASE TO CANAL, ADJUST PARAMETERS
C
  120 NODESC(IUSER,ISOURC) = NNODE + 1
      ICODE(IUSER,ISOURC) = -ICODE(IUSER,ISOURC)
      TRANSL(MRES) = 1.
C
  130 IF (IQ .NE. 1) GO TO 160
      WRITE (IOUT,2110) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 NUMRES(MRES)
 2110 FORMAT (90X,I3,F9.1,F8.3,F7.3,2I4)
      GO TO 160
  140 IF (IQ .NE. 1) GO TO 160
      WRITE (IOUT,2120) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 GWDIST(MGW)
 2120 FORMAT (90X,I3,F9.1,F8.3,F7.3,I4,4X,F7.0)
      GO TO 160
C
  150 IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 90
      IF (IQ .NE. 1) GO TO 160
      WRITE (IOUT,2110) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC)
  160 CONTINUE
  170 CONTINUE
C
C         MODIFY WATER USER DATA
C
  180 WRITE (IOUT,2130)
 2130 FORMAT (37H DO YOU WANT TO MODIFY THE USER DATA? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 650,190,650
C
C         ADD A NEW USER
C
  190 WRITE (IOUT,2140)
 2140 FORMAT (27H DO YOU WANT TO ADD A USER? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 320,200,320
  200 NUSERS = NUSERS + 1
      IUSER = NUSERS
  210 WRITE (IOUT,2150)
 2150 FORMAT (28H ENTER THE USER ID (5 COLS) )
      READ (IN,2010) USERID(IUSER)
      WRITE (IOUT,2160)
```

```
 2160 FORMAT (30H ENTER THE USER NAME (8 COLS) )
      READ (IN,2170) USRNAM(IUSER)
 2170 FORMAT (A8)
      WRITE (IOUT,2180)
 2180 FORMAT (30H ENTER THE USER TYPE (5 COLS) )
      READ (IN,2010) USRTYP(IUSER)
      WRITE (IOUT,2190)
 2190 FORMAT (28H ENTER THE AMOUNT (10 COLS) )
      READ (IN,2460) NUMUSR(IUSER)
      WRITE (IOUT,2200)
 2200 FORMAT (35H ENTER THE DEMAND FACTOR (10 COLS) )
      READ (IN,2460) DMDFAC(IUSER)
      WRITE (IOUT,2210)
 2210 FORMAT (34H ENTER THE X-COORDINATE (10 COLS) )
      READ (IN,2460) XLOCU(IUSER)
      WRITE (IOUT,2220)
 2220 FORMAT (34H ENTER THE Y-COORDINATE (10 COLS) )
      READ (IN,2460) YLOCU(IUSER)
      WRITE (IOUT,2230)
 2230 FORMAT (39H ENTER THE X PLOTTING OFFSET (10 COLS) )
      READ (IN,2460) USXPLT(IUSER)
      WRITE (IOUT,2240)
 2240 FORMAT (39H ENTER THE Y PLOTTING OFFSET (10 COLS) )
      READ (IN,2460) USYPLT(IUSER)
      WRITE (IOUT,2250)
 2250 FORMAT (80H ENTER THE NUMBER OF THE INDEPENDENT VARIABLE THAT HAS
     1THE APPROPRIATE RAIN DATA )
      READ (IN,2010) IPRECP(IUSER)
      WRITE (IOUT,2260)
 2260 FORMAT (38H ENTER THE NUMBER OF SOURCES (5 COLS) )
      READ (IN,2010) NSOURC(IUSER)
      WRITE (IOUT,2270)
 2270 FORMAT (37H ENTER THE RETURN FLOW TYPE (5 COLS) )
      READ (IN,2010) RFTYPE(IUSER)
      WRITE (IOUT,2280)
 2280 FORMAT (40H ENTER THE RETURN FLOW FACTOR (10 COLS) )
      READ (IN,2460) RFVAL(IUSER)
      WRITE (IOUT,2290)
 2290 FORMAT (46H ENTER THE RETURN FLOW X-COORDINATE (10 COLS) )
      READ (IN,2460) RFXLOC(IUSER)
      WRITE (IOUT,2300)
 2300 FORMAT (46H ENTER THE RETURN FLOW Y-COORDINATE (10 COLS) )
      READ (IN,2460) RFYLOC(IUSER)
      WRITE (IOUT,2310)
 2310 FORMAT (42H ENTER THE RETURN FLOW DISTANCE (10 COLS) )
      READ (IN,2460) RFDST
      CALL CMPDST(INODE,RFXLOC(IUSER),RFYLOC(IUSER),RFDIST(IUSER))
      IF (RFDST .NE. 0.) RFDIST(IUSER) = RFDST
      CALL DETNOD(RFXLOC(IUSER),RFYLOC(IUSER),INODE,ISIDE)
      NODERF(IUSER) = INODE
      ISIDRF(IUSER) = ISIDE
      IF (USRTYP(IUSER) .NE. 5) GO TO 240
      DO 220 IRES = 1,NRES
      IF (RSXLOC(IRES) .EQ. XLOCU(IUSER) .AND. RSYLOC(IRES) .EQ.
     1 YLOCU(IUSER)) GO TO 230
```

```
  220 CONTINUE
      WRITE (IOUT,2070)
      STOP
  230 USRTYP(IUSER) = RESID(IRES)
      WRITE (IOUT,2320)
 2320 FORMAT (57H ENTER THE RESERVOIR SUBACCOUNT APPROPRIATE FOR THIS US
     1ER )
      READ (IN,2010) IAKNT(IUSER)
  240 NSORC = NSOURC(IUSER)
      DO 310 ISOURC = 1,NSORC
      WRITE (IOUT,2330) ISOURC
 2330 FORMAT (11H FOR SOURCE ,I2,32H ENTER THE SOURCE TYPE (5 COLS) )
      READ (IN,2010) ICODE(IUSER,ISOURC)
      WRITE (IOUT,2340)
 2340 FORMAT (27H ENTER THE LIMIT (10 COLS) )
      READ (IN,2460) QUANTY(IUSER,ISOURC)
      WRITE (IOUT,2350)
 2350 FORMAT (41H ENTER THE SOURCE X-COORDINATE (10 COLS) )
      READ (IN,2460) SCXLOC(IUSER,ISOURC)
      WRITE (IOUT,2360)
 2360 FORMAT (41H ENTER THE SOURCE Y-COORDINATE (10 COLS) )
      READ (IN,2460) SCYLOC(IUSER,ISOURC)
      CALL DETNOD(SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 NODESC(IUSER,ISOURC),INODE)
      IF (ICODE(IUSER,ISOURC) .NE. 2) GO TO 250
C
C         FOR GROUND-WATER SOURCES
C
      WRITE (IOUT,2370)
 2370 FORMAT (42H ENTER THE GROUND WATER DISTANCE (10 COLS) )
      READ (IN,2460) GWDST
      MGW = MGW + 1
      GWUSER(MGW) = IUSER
      GWSOUR(MGW) = ISOURC
      INODE = NODESC(IUSER,ISOURC)
      CALL CMPDST(INODE,SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 GWDIST(MGW) )
      IF (GWDST .NE. 0) GWDIST(MGW) = GWDST
      ISDPMP(MGW) = ISIDE
C
  250 IF (IABS(ICODE(IUSER,ISOURC)) .NE. 3) GO TO 300
C
C         FOR RESERVOIR SOURCES
C
      WRITE (IOUT,2380)
 2380 FORMAT (33H ENTER THE RESERVOIR ID (5 COLS) )
      READ (IN,2010) NMRES
  260 MRES = MRES + 1
      RESUSR(MRES) = IUSER
      RESSOR(MRES) = ISOURC
```

```
C
      DO 270 JRES = 1,NRES
      IF (NMRES .EQ. RESID(JRES)) GO TO 280
  270 CONTINUE
      STOP
C
  280 NUMRES(MRES) = JRES
      WRITE (IOUT,2390)
 2390 FORMAT (41H ENTER THE RESERVOIR SUB-ACCOUNT (5 COLS) )
      READ (IN,2010) IACCNT
      IF (IACCNT .EQ. 0) IACCNT = 1
      ISBACT(MRES) = IACCNT
C
C             IF RIVER TRANSMITS RELEASES, COMPUTE TRANSIT LOSS
C
      IF (ICODE(IUSER,ISOURC) .LT. 0) GO TO 290
      JNODE = NODRES(JRES)
      KNODE = NODESC(IUSER,ISOURC)
      TRANSL(MRES) = 1. - .0007*ABS(RMILES(JNODE)-RMILES(KNODE))
      GO TO 310
C
C             IF DIRECT RELEASE TO CANAL, ADJUST PARAMETERS
C
  290 NODESC(IUSER,ISOURC) = NNODE + 1
      ICODE(IUSER,ISOURC) = -ICODE(IUSER,ISOURC)
      TRANSL(MRES) = 1.
C
      GO TO 310
C
  300 IF (ICODE(ISIDE,IUSER) .EQ. 6) GO TO 260
  310 CONTINUE
      GO TO 180
C
C         CHANGE WATER USER DATA
C
  320 WRITE (IOUT,2400)
 2400 FORMAT (47H DO YOU WANT TO CHANGE ALL THE DATA FOR A USER? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 530,330,530
  330 WRITE (IOUT,2410)
 2410 FORMAT (18H ENTER THE USER ID )
      READ (IN,2010) IUSID
      DO 340 IUSER = 1,NUSERS
      IF (IUSID .EQ. USERID(IUSER)) GO TO 360
  340 CONTINUE
  350 WRITE (IOUT,2420) IUSID
 2420 FORMAT (6H USER ,I5,14H WAS NOT FOUND )
      GO TO 320
  360 WRITE (IOUT,2430) USRNAM(IUSER)
```

```
 2430 FORMAT (74H IF THE VALUE DISPLAYED AFTER THE REQUEST IS ACCEPTABLE
     1, MERELY TYPE <CR> ,//, 30H ENTER THE USER NAME (8 COLS) ,/, A8)
      READ (IN,2170) NAME1
      IF (NAME1 .NE. '') USRNAM(IUSER) = NAME1
      WRITE (IOUT,2180)
      WRITE (IOUT,2010) USRTYP(IUSER)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) USRTYP(IUSER) = ITEMP
      WRITE (IOUT,2190)
      WRITE (IOUT,2460) NUMUSR(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) NUMUSR(IUSER) = TEMP
      WRITE (IOUT,2200)
      WRITE (IOUT,2460) DMDFAC(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) DMDFAC(IUSER) = TEMP
      WRITE (IOUT,2210)
      WRITE (IOUT,2460) XLOCU(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) XLOCU(IUSER) = TEMP
      WRITE (IOUT,2220)
      WRITE (IOUT,2460) YLOCU(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) YLOCU(IUSER) = TEMP
      WRITE (IOUT,2230)
      WRITE (IOUT,2460) USXPLT(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) USXPLT(IUSER) = TEMP
      WRITE (IOUT,2240)
      WRITE (IOUT,2460) USYPLT(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) USYPLT(IUSER) = TEMP
      WRITE (IOUT,2250)
      WRITE (IOUT,2010) IPRECP(IUSER)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) IPRECP(IUSER) = ITEMP
      WRITE (IOUT,2260)
      WRITE (IOUT,2010) NSOURC(IUSER)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) NSOURC(IUSER) = ITEMP
      WRITE (IOUT,2270)
      WRITE (IOUT,2010) RFTYPE(IUSER)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) RFTYPE(IUSER) = ITEMP
      WRITE (IOUT,2280)
      WRITE (IOUT,2460) RFVAL(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) RFVAL(IUSER) = TEMP
      WRITE (IOUT,2290)
      WRITE (IOUT,2460) RFXLOC(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) RFXLOC(IUSER) = TEMP
      WRITE (IOUT,2300)
```

```
      WRITE (IOUT,2460) RFYLOC(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) RFYLOC(IUSER) = TEMP
      WRITE (IOUT,2310)
      WRITE (IOUT,2460) RFDIST(IUSER)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) RFDIST(IUSER) = TEMP
      CALL DETNOD(RFXLOC(IUSER),RFYLOC(IUSER),INODE,ISIDE)
      NODERF(IUSER) = INODE
      ISIDRF(IUSER) = ISIDE
      IF (USRTYP(IUSER) .NE. 5) GO TO 390
      DO 370 IRES = 1,NRES
      IF (RSXLOC(IRES) .EQ. XLOCU(IUSER) .AND. RSYLOC(IRES) .EQ.
     1 YLOCU(IUSER)) GO TO 380
  370 CONTINUE
      WRITE (IOUT,2070)
      STOP
  380 USRTYP(IUSER) = RESID(IRES)
      WRITE (IOUT,2320)
      WRITE (IOUT,2010) IAKNT(IUSER)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) IAKNT(IUSER) = ITEMP
  390 NSORC = NSOURC(IUSER)
      DO 520 ISOURC = 1,NSORC
      WRITE (IOUT,2330) ISOURC
      WRITE (IOUT,2010) ICODE(IUSER,ISOURC)
      READ (IN,2010) ITEMP
      IF (ITEMP .NE. 0) ICODE(IUSER,ISOURC) = ITEMP
      WRITE (IOUT,2340)
      WRITE (IOUT,2460) QUANTY(IUSER,ISOURC)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) QUANTY(IUSER,ISOURC) = TEMP
      WRITE (IOUT,2350)
      WRITE (IOUT,2460) SCXLOC(IUSER,ISOURC)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) SCXLOC(IUSER,ISOURC) = TEMP
      WRITE (IOUT,2360)
      WRITE (IOUT,2460) SCYLOC(IUSER,ISOURC)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0.) SCYLOC(IUSER,ISOURC) = TEMP
      CALL DETNOD(SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 NODESC(IUSER,ISOURC),INODE)
      IF (ICODE(IUSER,ISOURC) .NE. 2) GO TO 420
C
C         FOR GROUND-WATER SOURCES
C
      DO 400 JGW = 1,MGW
      IF (GWUSER(JGW) .EQ. IUSER .AND. GWSOUR(JGW) .EQ. ISOURC)
     1 GO TO 410
  400 CONTINUE
```

```
  410 WRITE (IOUT,2370)
      WRITE (IOUT,2010) GWDIST(JGW)
      READ (IN,2460) TEMP
      IF (TEMP .NE. 0) GWDST = TEMP
      CALL CMPDST(INODE,SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 GWDIST(JGW) )
      IF (GWDST .NE. 0) GWDIST(JGW) = GWDST
  420 IF (IABS(ICODE(IUSER,ISOURC)) .NE. 3) GO TO 510
C
C         FOR RESERVOIR SOURCES
C
  430 DO 440 JRES = 1,MRES
      IF (RESUSR(JRES) .EQ. IUSER .AND. RESSOR(JRES) .EQ. ISOURC)
     1 GO TO 450
  440 CONTINUE
  450 WRITE (IOUT,2380)
      WRITE (IOUT,2010) NUMRES(JRES)
      READ (IN,2010) ITEMP
      IF (ITEMP .EQ. 0) GO TO 480
      NMRES = ITEMP
      DO 460 IRES = 1,NRES
      IF (NMRES .EQ. RESID(IRES)) GO TO 470
  460 CONTINUE
      STOP
C
  470 NUMRES(JRES) = IRES
  480 WRITE(IOUT,2390)
      WRITE (IOUT,2010) ISBACT(JRES)
      READ (IN,2010) ITEMP
      IF (ITEMP .EQ. 0) GO TO 490
      ISBACT(JRES) = ITEMP
C
C              IF RIVER TRANSMITS RELEASES, COMPUTE TRANSIT LOSS
C
  490 IF (ICODE(IUSER,ISOURC) .LT. 0) GO TO 500
      JNODE = NODRES(IRES)
      KNODE = NODESC(IUSER,ISOURC)
      TRANSL(JRES) = 1. - .0007*ABS(RMILES(JNODE)-RMILES(KNODE))
      GO TO 520
C
C              IF DIRECT RELEASE TO CANAL, ADJUST PARAMETERS
C
  500 NODESC(IUSER,ISOURC) = NNODE + 1
      ICODE(IUSER,ISOURC) = -ICODE(IUSER,ISOURC)
      TRANSL(JRES) = 1.
      GO TO 520
C
  510 IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 430
  520 CONTINUE
      GO TO 180
C
C         CHANGE A DEMAND FACTOR
```

```
C
  530 WRITE (IOUT,2440)
 2440 FORMAT (51H DO YOU WANT TO CHANGE THE DEMAND FACTOR OF A USER?)
      CALL QUESZN(IQ)
      IF (IQ - 1) 570,540,570
  540 WRITE (IOUT,2410)
      READ (IN,2010) IUSID
      DO 550 IUSER = 1,NUSERS
      IF (IUSID .EQ. USERID(IUSER)) GO TO 560
  550 CONTINUE
      WRITE (IOUT,2420) IUSID
      GO TO 540
  560 WRITE (IOUT,2450)
 2450 FORMAT (42H ENTER THE NEW DEMAND FACTOR (10 COLUMNS) )
      READ (IN,2460) DMDFAC(IUSER)
 2460 FORMAT (F15.3)
      GO TO 180
  570 WRITE (IOUT,2470)
 2470 FORMAT (56H DO YOU WANT TO CHANGE THE RETURN FLOW FACTOR OF A USER
     1? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 610,580,610
  580 WRITE (IOUT,2410)
      READ (IN,2010) IUSID
      DO 590 IUSER = 1,NUSERS
      IF (IUSID .EQ. USERID(IUSER)) GO TO 600
  590 CONTINUE
      WRITE (IOUT,2420) IUSID
      GO TO 580
  600 WRITE (IOUT,2480)
 2480 FORMAT (47H ENTER THE NEW RETURN FLOW FACTOR (10 COLUMNS) )
      READ (IN,2460) RFVAL(IUSER)
      GO TO 180
  610 WRITE (IOUT,2490)
 2490 FORMAT (45H DO YOU WANT TO CHANGE THE SOURCES OF A USER? )
      CALL QUESZN(IQ)
      IF (IQ - 1) 650,620,650
  620 WRITE (IOUT,2500)
 2500 FORMAT (63H ENTER THE USER ID (5 COLUMNS) AND HOW MANY SOURCES (5
     1COLUMNS) )
      READ (IN,2510) IUSID,NSORC
 2510 FORMAT (16I5)
      DO 630 IUSER = 1,NUSERS
      IF (IUSID .EQ. USERID(IUSER)) GO TO 640
  630 CONTINUE
      GO TO 350
  640 NSOURC(IUSER) = NSORC
      GO TO 390
C
C         WRITE WATER USER DATA
```

```
C
  650 WRITE (52,2040)
      DO 740 IUSER = 1,NUSERS
      IF (USRTYP(IUSER) .LE. 5) GO TO 660
      ITEMP = 5
      WRITE (52,2080) IUSER,USERID(IUSER),USRNAM(IUSER),ITEMP,
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IAKNT(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER),NSOURC(IUSER),
     4 USRTYP(IUSER)
      GO TO 670
  660 WRITE (52,2060) IUSER,USERID(IUSER),USRNAM(IUSER),USRTYP(IUSER),
     1 NUMUSR(IUSER),DMDFAC(IUSER),XLOCU(IUSER),YLOCU(IUSER),
     2 IPRECP(IUSER),RFTYPE(IUSER),RFVAL(IUSER),RFXLOC(IUSER),
     3 RFYLOC(IUSER),NODERF(IUSER),RFDIST(IUSER),NSOURC(IUSER)
  670 NSORC = NSOURC(IUSER)
      DO 740 ISOURC = 1,NSORC
      IF (IABS(ICODE(IUSER,ISOURC)) .EQ. 3) GO TO 710
      IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 710
      IF (ICODE(IUSER,ISOURC) .EQ. 2) GO TO 680
      WRITE (52,2110) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC)
      GO TO 740
  680 DO 690 JGW = 1,MGW
      IF (GWUSER(JGW) .EQ. IUSER .AND. GWSOUR(JGW) .EQ. ISOURC)
     1 GO TO 700
  690 CONTINUE
  700 WRITE (52,2120) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 GWDIST(JGW)
      GO TO 740
  710 DO 720 JRES = 1,MRES
      IF (RESUSR(JRES) .EQ. IUSER .AND. RESSOR(JRES) .EQ. ISOURC)
     1 GO TO 730
  720 CONTINUE
  730 WRITE (52,2110) ICODE(IUSER,ISOURC),QUANTY(IUSER,ISOURC),
     1 SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),NODESC(IUSER,ISOURC),
     2 NUMRES(JRES)
  740 CONTINUE
C
C         PLOT WATER USER LOCATIONS
C
      WRITE (IOUT,2520)
 2520 FORMAT(55H DO YOU WANT TO PLOT THE WATER USER LOCATION SCHEMATIC?)
      CALL QUESZN(IQ)
      IF (IQ-1) 760,750,760
  750 WRITE (IDUM,2530) TITL
 2530 FORMAT (5A4,24H - WATER USER LOCATIONS$)
      CALL PLTUSR(ITITLE)
C
C         READ, DISPLAY, AND CHECK WATER RIGHTS
C
  760 READ (51,2000) TITLER
      READ (51,2010) NRIGHT
      WRITE (52,2540) TITLER,NRIGHT
```

```
 2540 FORMAT (19H1WATER RIGHT FILE: ,20A4,9X,11H, CONTAINS ,I3,7H RIGHTS
     1 ,///,50H     OWNER      OWNER          DATE          AMOUNT ,/,
     2      21H      ID          NAME )
      DO 770 IUSER = 1,NUSERS
      DO 770 ISOURC = 1,15
  770 USED(IUSER,ISOURC) = 0
      WRITE (IOUT,2550)
 2550 FORMAT (41H DO YOU WANT TO SEE THE WATER RIGHT FILE?  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 1) WRITE (IOUT,2560)
 2560 FORMAT (///,31H RIGHT  OWNER   OWNER   AMOUNT ,/, 9X,
     1 12HID      NAME  )
      DO 780 IRIGHT = 1,NRIGHT
      READ (51,2570)OWNER(IRIGHT),NAME(IRIGHT),DATE(IRIGHT),AMNT(IRIGHT)
 2570 FORMAT (I5,A8,2X,A8,F10.0)
      IF (IQ .EQ. 0) GO TO 780
      WRITE (IOUT,2580) IRIGHT,OWNER(IRIGHT),NAME(IRIGHT),AMNT(IRIGHT)
 2580 FORMAT (I5,I8,2X,A8,F10.1)
  780 CONTINUE
C
      DO 850 IRIGHT = 1,NRIGHT
  790 DO 800 IUSER = 1,NUSERS
      IF (OWNER(IRIGHT) .EQ. USERID(IUSER)) GO TO 810
  800 CONTINUE
      WRITE (IOUT,2590) IRIGHT,OWNER(IRIGHT)
 2590 FORMAT (5X,11H FOR RIGHT ,I3,11H, OWNER ID ,A8,
     1 27H DOES NOT MATCH ANY USER ID  ,/, 76H DO YOU WANT TO CHANGE IT?
     2 (HAVING AN EXTRA RIGHT HAS NO DELETERIOUS EFFECT)  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 0) GO TO 850
      WRITE (IOUT,2600)
 2600 FORMAT (32H ENTER NEW OWNER ID, (5 COLUMNS)  )
      READ (IN,2010) OWNER(IRIGHT)
      GO TO 790
  810 ISOURC = 0
  820 ISOURC = ISOURC + 1
      IF (ISOURC .LE. NSOURC(IUSER)) GO TO 830
      WRITE (IOUT,2610) USERID(IUSER),IRIGHT
 2610 FORMAT (6H USER ,I5,34H DOES NOT HAVE A SOURCE FOR RIGHT ,I3 ,/,
     1 79H DO YOU WANT TO ADD A SOURCE? (HAVING AN EXTRA RIGHT HAS NO DE
     2LETERIOUS EFFECT)  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 0) GO TO 850
      NSOURC(IUSER) = ISOURC
      WRITE (IOUT,2330) ISOURC
      READ (IN,2010) ICODE(IUSER,ISOURC)
      WRITE (IOUT,2340)
      READ (IN,2460) QUANTY(IUSER,ISOURC)
      WRITE (IOUT,2350)
      READ (IN,2460) SCXLOC(IUSER,ISOURC)
      WRITE (IOUT,2360)
      READ (IN,2460) SCYLOC(IUSER,ISOURC)
      CALL DETNOD(SCXLOC(IUSER,ISOURC),SCYLOC(IUSER,ISOURC),
     1 NODESC(IUSER,ISOURC),ISIDE)
      USED(IUSER,ISOURC) = 1
      GO TO 850
```

```
  830 IF (ICODE(IUSER,ISOURC) .EQ. 1) GO TO 840
      IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 840
      IF (ICODE(IUSER,ISOURC) .NE. 5) GO TO 820
  840 IF (USED(IUSER,ISOURC) .EQ. 1) GO TO 820
      USED(IUSER,ISOURC) = 1
  850 CONTINUE
C
      DO 880 IUSER = 1,NUSERS
      NSOUR = NSOURC(IUSER)
      DO 880 ISOURC = 1,NSOUR
      IF (ICODE(IUSER,ISOURC) .EQ. 1) GO TO 860
      IF (ICODE(IUSER,ISOURC) .EQ. 6) GO TO 860
      IF (ICODE(IUSER,ISOURC) .NE. 5) GO TO 880
  860 IF (USED(IUSER,ISOURC) .EQ. 1 .OR. QUANTY(IUSER,ISOURC) .EQ. 0.)
     1 GO TO 880
      WRITE (IOUT,2620) IUSER,USERID(IUSER),ISOURC,QUANTY(IUSER,ISOURC)
 2620 FORMAT (6H USER ,I3,7H (ID = ,I5,10H), SOURCE ,I3,
     1 19H, (WITH A LIMIT OF ,F10.1,13H HAS NO RIGHT ,/,
     2 79H DO YOU WANT TO ADD A RIGHT? (A SOURCE WITH NO RIGHT HAS NO DE
     3LETERIOUS EFFECT)  )
      CALL QUESZN(IQ)
      IF (IQ .EQ. 0) GO TO 880
      WRITE (IOUT,2630)
 2630 FORMAT (44H ENTER THE NUMERICAL NUMBER OF THE NEW RIGHT )
      READ (IN,2010) IRIGHT
      MRIGHT = NRIGHT - IRIGHT - 1
      DO 870 KRIGHT = 1,MRIGHT
      JRIGHT = NRIGHT - KRIGHT + 1
  870 OWNER(JRIGHT+1) = OWNER(JRIGHT)
      OWNER(IRIGHT) = USERID(IUSER)
      NRIGHT = NRIGHT + 1
  880 CONTINUE
C
C         WRITE WATER RIGHTS
C
      DO 890 IRIGHT = 1,NRIGHT
  890 WRITE (52,2640) OWNER(IRIGHT),NAME(IRIGHT),DATE(IRIGHT),
     1 AMNT(IRIGHT)
 2640 FORMAT (5X,I5,5X,A8,5X,A8,2X,F12.2)
C
C         ENTER FREQUENCY OF PLOTTING WATER USER SCHEMATIC
C
      WRITE (IOUT,2650)
 2650 FORMAT (65H ENTER THE FREQUENCY OF PLOTTING THE WATER USE SCHEMATI
     1C (5 COLS),/,7X,18H0 FOR NO SCHEMATIC,/,7X,15H12 FOR ANNUALLY,/,
     2 7X,34H99999 FOR PERIOD-OF-RECORD AVERAGE ,/, 45H AND ENTER THE MA
     3XIMUM ANNUAL USAGE (10 COLS) )
      READ (IN,2090) ISKMU,UMAX
C
C         ENTER WATER USERS FOR HYDROGRAPHS
C
      WRITE (IOUT,2660)
```

```
 2660 FORMAT (71H ENTER THE WATER USER IDS FOR THOSE USERS AT WHICH YOU
     1WANT HYDROGRAPHS,/,10X,44H**NOTE**  99999 WILL PROVIDE BASINWIDE T
     2OTAL ,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,2510) IHYU
      DO 930 I = 1,5
      IF (IHYU(I) .EQ. 99999) GO TO 910
      DO 900 J = 1,NUSERS
      IF (IHYU(I) .NE. USERID(J)) GO TO 900
      IHYU(I) = J
      GO TO 930
  900 CONTINUE
      GO TO 930
  910 DO 920 J = 1,600
      UHYD(J,I) = 0.
      UHYP(J,I) = 0.
  920 UHYT(J,I) = 0.
  930 CONTINUE
C
C         ENTER DESIRED WATER USERS FOR MONTHLY TABLES
C
      WRITE (IOUT,2670)
 2670 FORMAT (73H ENTER THE WATER USER IDS FOR THOSE USERS AT WHICH YOU
     1WANT MONTHLY USAGE,/,10X,44H**NOTE**  99999 WILL PROVIDE BASINWIDE
     2 TOTAL ,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,2510) ITBLU
      DO 970 I = 1,5
      IF (ITBLU(I) .EQ. 99999) GO TO 950
      DO 940 J = 1,NUSERS
      IF (ITBLU(I) .NE. USERID(J)) GO TO 940
      ITBLU(I) = J
      GO TO 970
  940 CONTINUE
      GO TO 970
  950 DO 960 J = 1,600
      IUTBLD(I,J) = 0
      IUTBLP(I,J) = 0
  960 IUTBLT(I,J) = 0
  970 CONTINUE
C
C         ENTER WATER USERS FOR STATISTICAL SUMMARIES
C
      WRITE (IOUT,2680)
```

```
 2680 FORMAT (70H ENTER THE WATER USER IDS FOR THOSE USERS AT WHICH YOU
     1WANT STATISTICS,/,10X,44H**NOTE**  99999 WILL PROVIDE BASINWIDE TO
     2TAL ,/,7X,33H(5 COLS EACH - LIMIT OF 10 NODES) )
      READ (IN,2510) ISSU
      DO 1000 I = 1,10
      IF (ISSU(I) .LE. 0) GO TO 1000
      DO 980 J = 1,12
      UMENND(I,J) = 0.
      UMENDD(I,J) = 0.
      UMENGW(I,J) = 0.
      UMENRR(I,J) = 0.
      UMENTA(I,J) = 0.
      UMENP(I,J) = 0.
      UMENWC(I,J) = 0.
      UMENC(I,J) = 0.
      UMENCL(I,J) = 0.
      UMENTW(I,J) = 0.
  980 UMENDP(I,J) = 0.
      DO 990 J = 1,NUSERS
      IF (ISSU(I) .NE. USERID(J)) GO TO 990
      ISSU(I) = J
      GO TO 1000
  990 CONTINUE
 1000 CONTINUE
C
C         ENTER RESERVOIRS FOR HYDROGRAPHS
C
      WRITE (IOUT,2690)
 2690 FORMAT (75H ENTER THE RESERVOIR IDS FOR THOSE RESERVOIRS AT WHICH
     1YOU WANT HYDROGRAPHS,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES) )
      READ (IN,2510) IHYR
      DO 1020 I = 1,5
      DO 1010 J = 1,NRES
      IF (IHYR(I) .NE. RESID(J)) GO TO 1010
      IHYR(I) = J
      GO TO 1020
 1010 CONTINUE
 1020 CONTINUE
C
C         ENTER RESERVOIRS FOR MONTHLY TABLES
C
      WRITE (IOUT,2700)
 2700 FORMAT (80H ENTER THE RESERVOIR IDS FOR THOSE RESERVOIRS AT WHICH
     1YOU WANT MONTHLY CONTENTS,/,7X,32H(5 COLS EACH - LIMIT OF 5 NODES)
     2 )
      READ (IN,2510) ITBLR
      DO 1040 I = 1,5
      DO 1030 J = 1,NRES
      IF (ITBLR(I) .NE. RESID(J)) GO TO 1030
      ITBLR(I) = J
      GO TO 1040
```

```
 1030 CONTINUE
 1040 CONTINUE
C
C         ENTER RESERVOIRS FOR STATISTICAL SUMMARIES
C
      WRITE (IOUT,2710)
 2710 FORMAT (74H ENTER THE RESERVOIR IDS FOR THOSE RESERVOIRS AT WHICH
     1YOU WANT STATISTICS,/,7X,33H(5 COLS EACH - LIMIT OF 10 NODES) )
      READ (IN,2510) ISSR
      DO 1070 I = 1,10
      IF (ISSR(I) .LE. 0) GO TO 1070
      DO 1050 J = 1,12
      RMEANS(I,J) = 0.
      RMEANC(I,J) = 0.
      RMEANR(I,J) = 0.
      RMEAND(I,J) = 0.
      RMEANI(I,J) = 0.
 1050 RMEANE(I,J) = 0.
      DO 1060 J = 1,NRES
      IF (ISSR(I) .NE. RESID(J)) GO TO 1060
      ISSR(I) = J
      GO TO 1070
 1060 CONTINUE
 1070 CONTINUE
C
      RETURN
      END
```

```
CSKMGW
C
C          SUBROUTINE SCHEMATIC OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE SKMGW(ITITLE)
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
     1               YMAX
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
C
      DIMENSION ITITLE(1)
      DIMENSION ISYM(4),XLINE(5),YLINE(5),ITEMP(20)
      CHARACTER*80 IDUM
C
      EQUIVALENCE (IDUM,ITEMP)
C
      DATA ISYM /6,5,1,0/
C
C         PLOT THE NETWORK
C
      CALL NETWRK(ITITLE)
C
C         PLOT THE EXPLANATION
C
      CALL SETCLR(5HWHITE)
      CALL MESSAG(17HVOLUME IN STORAGE,17,0.,2.7)
      CALL MESSAG(12HIN THOUSANDS,12,.30,2.4)
      CALL MESSAG(12HOF ACRE-FEET,12,.30,2.1)
      CALL MESSAG(15HIS INDICATED BY,15,.05,1.8)
      CALL MESSAG(18HSIZE OF SYMBOL AND,18,-.05,1.5)
      CALL MESSAG(15HADJACENT NUMBER,15,.05,1.2)
      SAVQMX = QMAX
      QMAX = 6.
      I = QMAX - 3.
      XI = I
      I = 10**(I-3)
      CALL INTNO(I,.90,0.9)
      X1 = XMIN + .07*XINC
      Y1 = YMIN + .13*YINC
      CALL SOLID(X1,Y1,XI,0)
      I = QMAX - 2.
      XI = I
      I = 10**(I-3)
      QPLOT = XI
```

```
      CALL INTNO(I,.93,0.55)
      Y1 = YMIN + .07*YINC
      CALL SOLID(X1,Y1,XI,0)
      I = QMAX - 1.
      XI = I
      I = 10**(I-3)
      CALL INTNO(I,.95,0.10)
      Y1 = YMIN
      CALL SOLID(X1,Y1,XI,0)
C
      CALL MESSAG(23HQUALITY OF GROUND WATER,23,7.45,1.8)
      CALL MESSAG(23HIN MILLIGRAMS PER LITER,23,7.45,1.5)
      CALL MESSAG(21HIS INDICATED BY SHAPE,21,7.65,1.2)
      CALL MESSAG(19HAND COLOR OF SYMBOL,19,7.8,0.9)
      CALL SETCLR(4HCYAN)
      X1 = XMAX - .17*XINC
      Y1 = YMIN + .10*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(1))
      WRITE (IDUM,1000) QWL1
 1000 FORMAT (1H<,F5.0)
      CALL MESSAG(ITEMP,6,8.5,0.6)
      CALL SETCLR(7HMAGENTA)
      Y1 = YMIN + .055*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(2))
      WRITE (IDUM,1010) QWL1,QWL2
 1010 FORMAT (F5.0,3H - ,F5.0)
      CALL MESSAG(ITEMP,13,8.5,0.3)
      CALL SETCLR(6HYELLOW)
      Y1 = YMIN + .01*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(3))
      WRITE (IDUM,1010) QWL2,QWL3
      CALL MESSAG(ITEMP,13,8.5,0.0)
      CALL SETCLR(3HRED)
      Y1 = YMIN - .035*YINC
      CALL SOLID(X1,Y1,QPLOT,ISYM(4))
      WRITE (IDUM,1020) QWL3
 1020 FORMAT (1H>,F5.0)
      CALL MESSAG(ITEMP,6,8.5,-.3)
C
C         PLOT THE DATA
C
      DO 60 INODE = 1,NNODE
      IUP = NODEUS(INODE)
      IF (IUP .EQ. 0) GO TO 50
      XS1 = (XLOC(INODE)+XLOC(IUP))/2. - (YLOC(INODE)-YLOC(IUP))/3.
      YS1 = (YLOC(INODE)+YLOC(IUP))/2. + (XLOC(INODE)-XLOC(IUP))/3.
      XS2 = (XLOC(INODE)+XLOC(IUP))/2. + (YLOC(INODE)-YLOC(IUP))/3.
      YS2 = (YLOC(INODE)+YLOC(IUP))/2. - (XLOC(INODE)-XLOC(IUP))/3.
```

```
C
   10 IF (GWSTOR(INODE,1) .LE. 1000.) GO TO 30
      X1 = XPOSN(XS1,YS1) - .35
      Y1 = YPOSN(XS1,YS1) - .3
      JQ = GWSTOR(INODE,1)/1000.
      CALL SETCLR(5HWHITE)
      CALL INTNO(JQ,X1,Y1)
      IPEN = 1
      CALL SETCLR(4HCYAN)
      IF (GWCONC(INODE,1) .LT. QWL1) GO TO 20
      IPEN = 2
      CALL SETCLR(7HMAGENTA)
      IF (GWCONC(INODE,1) .LT. QWL2) GO TO 20
      IPEN = 3
      CALL SETCLR(6HYELLOW)
      IF (GWCONC(INODE,1) .LT. QWL3) GO TO 20
      IPEN = 4
      CALL SETCLR(3HRED)
   20 CONTINUE
      FAC = ALOG10(GWSTOR(INODE,1))
      CALL SOLID(XS1,YS1,FAC,ISYM(IPEN))
C
   30 IF (GWSTOR(INODE,2) .LE. 500.) GO TO 60
      X1 = XPOSN(XS2,YS2) + .2
      Y1 = YPOSN(XS2,YS2) + .15
      JQ = GWSTOR(INODE,2)/1000.
      CALL SETCLR(5HWHITE)
      CALL INTNO(JQ,X1,Y1)
      IPEN = 1
      CALL SETCLR(4HCYAN)
      IF (GWCONC(INODE,2) .LT. QWL1) GO TO 40
      IPEN = 2
      CALL SETCLR(7HMAGENTA)
      IF (GWCONC(INODE,2) .LT. QWL2) GO TO 40
      IPEN = 3
      CALL SETCLR(6HYELLOW)
      IF (GWCONC(INODE,2) .LT. QWL3) GO TO 40
      IPEN = 4
      CALL SETCLR(3HRED)
   40 CONTINUE
      FAC = ALOG10(GWSTOR(INODE,2))
      CALL SOLID(XS2,YS2,FAC,ISYM(IPEN))
      GO TO 60
   50 IDOWN = NXTNOD(INODE)
      IF (IDOWN .LE. 0) GO TO 60
      XS1 = (2.*XLOC(INODE) - XLOC(IDOWN))/3.
      YS1 = (2.*YLOC(INODE) - YLOC(IDOWN))/3.
      XS2 = (XLOC(INODE) - 2.*XLOC(IDOWN))/3.
      YS2 = (YLOC(INODE) - 2.*YLOC(IDOWN))/3.
      GO TO 10
   60 CONTINUE
      CALL ENDPL(0)
      QMAX = SAVQMX
C
      RETURN
      END
```

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CSKMU
C
C          SUBROUTINE SCHEMATIC OF RIVER BASIN SIMULATION MODEL
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE SKMU(ITITLE)
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /NTWRK/ XHY(5),YHY(5),XLENG,YLENG,XMIN,YMIN,XINC,YINC,XMAX,
     1               YMAX
      COMMON /SCLFAC/ QMAX,QWL1,QWL2,QWL3
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /USTATS/ DELIVR(100),RESREL(100),IMPORT(100),PUMPAG(100),
     1                APCONC(100),DIVRZN(100),PUMPG(100,2),CANLEK(100),
     2                DPPERC(100),TAILWR(100),PRECIP(100)
      REAL IMPORT
C
      DIMENSION ITITLE(1)
      DIMENSION ISYM(5),XLINE(5),YLINE(5),ITEMP(20)
      DIMENSION USEDAT(5)
      CHARACTER*80 IDUM
C
      EQUIVALENCE (IDUM,ITEMP)
C
      DATA ISYM /16,1,3,5,17 /
C
C         PLOT THE NETWORK
C
      CALL NETWRK(ITITLE)
C
C         PLOT THE EXPLANATION
C
      CALL SETCLR(5HWHITE)
      CALL MESSAG(17HAPPLIED WATER, IN ,17,0.,2.3)
      CALL MESSAG(18HACRE-FEET PER YEAR ,18,-.05,2.05)
      CALL MESSAG(15HIS INDICATED BY,15,.05,1.80)
      CALL MESSAG(23HRELATIVE SIZE OF SYMBOL,23,-.35,1.55)
      CALL MESSAG(17HDIRECT DIVERSIONS,17,1.35,.75)
      CALL MESSAG(20HGROUND-WATER PUMPAGE,20,-.65,1.00)
      CALL MESSAG(9HRESERVOIR,9,-.40,0.70)
      CALL MESSAG(8HRELEASES,8,-.40,.50)
      CALL MESSAG(7HIMPORTS,7,.10,.20)
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      CALL MESSAG(13HPRECIPITATION,13,1.35,.40)
      CALL MESSAG(13HTHE INNER DOT,13,-.70,-.20)
      CALL MESSAG(12HIS WATER USE,12,-.70,-.40)
      CALL MESSAG(14HAN OPEN CIRCLE,14,1.60,-.20)
      CALL MESSAG(13HIS WATER NEED,13,1.60,-.40)
      CALL ENDGR(0)
C
      RAD1 = .5
      X = .75 + 1.0*XINC/(XMAX-XMIN)
      Y = .5 + .7*YINC/(YMAX-YMIN)
      ISAV = ISKMU
      ISKMU = NUSERS + 1
      USEDAT(1) = 98.
      ADD(ISKMU) = 98.
      USEDAT(2) = 99.
      AGW(ISKMU) = 99.
      USEDAT(3) = 100.
      ARR(ISKMU) = 100.
      USEDAT(4) = 101.
      AIM(ISKMU) = 101.
      USEDAT(5) = 102.
      APR(ISKMU) = 102.
C
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      CALL HWSHD
      CALL PIEPAT(ISYM,5)
      CALL PIEDTA('NONE')
      CALL PIEMOD
      CALL SHDPIE(0,0,USEDAT,5)
      CALL ENDGR(0)
C
      RAD1 = .2
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      CALL RESET('PIEMOD')
      CALL SETCLR(5HWHITE)
      CALL PIEPAT(16,1)
      CALL PIEDTA('NONE')
      CALL SHDPIE(0,0,USEDAT,1)
      CALL ENDGR(0)
C
      RAD1 = .6
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      CALL RESET('HWSHD')
      CALL PIEPAT(0,1)
      CALL PIEDTA('NONE')
      CALL SHDPIE(0,0,USEDAT,1)
      CALL ENDGR(0)
```

```
C
      RAD1 = .4
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      CALL SETCLR(5HBLACK)
      CALL PIEPAT(0,1)
      CALL PIEDTA('NONE')
      CALL SHDPIE(0,0,USEDAT,1)
      CALL ENDGR(0)
C
C         PLOT THE DATA
C
      ISAV = ISKMU
      DO 60 IUSER = 1,NUSERS
      ISKMU = IUSER
      TOTAL = ADD(IUSER) + AGW(IUSER) + ARR(IUSER) + AIM(IUSER) +
     1 APR(IUSER)
      IF (TOTAL .LE. 0.) GO TO 60
      IUSE = 1
      IF (ADD(IUSER)/TOTAL .LT. .02) GO TO 10
      USEDAT(IUSE) = ADD(IUSER)
      IUSE = IUSE + 1
   10 IF (AGW(IUSER)/TOTAL .LT. .02) GO TO 20
      USEDAT(IUSE) = AGW(IUSER)
      IUSE = IUSE + 1
   20 IF (ARR(IUSER)/TOTAL .LT. .02) GO TO 30
      USEDAT(IUSE) = ARR(IUSER)
      IUSE = IUSE + 1
   30 IF (AIM(IUSER)/TOTAL .LT. .02) GO TO 40
      USEDAT(IUSE) = AIM(IUSER)
      IUSE = IUSE + 1
   40 IF (APR(IUSER)/TOTAL .LT. .02) GO TO 50
      USEDAT(IUSE) = APR(IUSER)
      IUSE = IUSE + 1
   50 IUSE = IUSE - 1
      X = 10.*(XLOCU(IUSER)-XMIN)/(XMAX-XMIN) + .75
      Y = 6.5*(YLOCU(IUSER)-YMIN)/(YMAX-YMIN) + .5
      RADI = 1./ALOG10(UMAX/TOTAL)
      IF (RADI .LT. .1) GO TO 60
      CALL PHYSOR(X-RADI/2.,Y-RADI/2.)
      CALL AREA2D (RADI,RADI)
      CALL HWSHD
      CALL PIEPAT (ISYM,IUSE)
      CALL PIEDTA('NONE')
      CALL PIEMOD
      CALL SHDPIE(0,0,USEDAT,IUSE)
      CALL ENDGR(0)
```

```
C
      RAD1 = RADI*ACN(IUSER)/TOTAL
      IF (ACN(IUSER) .LE. 0.) GO TO 60
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      CALL RESET('PIEMOD')
      CALL SETCLR(5HWHITE)
      CALL PIEPAT(16,1)
      CALL PIEDTA('NONE')
      USEDAT(1) = ACN(IUSER)
      CALL SHDPIE(0,0,USEDAT,1)
      CALL ENDGR(0)
C
      RAD1 = RADI*ANEED(IUSER)/TOTAL
      IF (ANEED(IUSER) .LE. 0.) GO TO 60
      CALL PHYSOR(X-RAD1/2.,Y-RAD1/2.)
      CALL AREA2D (RAD1,RAD1)
      IF (ANEED(IUSER) .LT. TOTAL ) CALL SETCLR(5HBLACK)
      CALL RESET('HWSHD')
      CALL PIEPAT(0,1)
      CALL PIEDTA('NONE')
      USEDAT(1) = ANEED(IUSER)
      CALL SHDPIE(0,0,USEDAT,1)
      CALL ENDGR(0)
C
   60 CONTINUE
      CALL ENDPL(0)
      ISKMU = ISAV
C
      RETURN
      END
```

```
      SUBROUTINE MYPIE(ISEGMT,VALUE,PERCENT,RADIUS,OFFSET,ANGLE,IDRAW,
     1 IANNOT)
C
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
C
      IF (VALUE .EQ. ADD(ISKMU)) GO TO 10
      IF (VALUE .EQ. AGW(ISKMU)) GO TO 20
      IF (VALUE .EQ. ARR(ISKMU)) GO TO 30
      IF (VALUE .EQ. AIM(ISKMU)) GO TO 40
      IF (VALUE .EQ. APR(ISKMU)) GO TO 50
      CALL SETCLR(5HWHITE)
      RETURN
   10 CALL SETCLR(4HCYAN)
      RETURN
   20 CALL SETCLR(3HRED)
      RETURN
   30 CALL SETCLR(5HGREEN)
      RETURN
   40 CALL SETCLR(7HMAGENTA)
      RETURN
   50 CALL SETCLR(4HBLUE)
      RETURN
      END
```

```
CSMRYFU
C
C          SUBROUTINE FINAL SUMMARY OF RIVER BASIN SIMULATION MODEL (#3)
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE SMRYFU
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /DEMND1/ USRNAM(100)
      DOUBLE PRECISION USRNAM
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
      COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
      COMMON /NAMES/ TITL(5)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
     1               RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /STATU/ ISSU(10),UMENND(10,12),UMENDD(10,12),UMENGW(10,12),
     1               UMENRR(10,12),UMENTA(10,12),UMENP(10,12),
     2               UMENWC(10,12),UMENC(10,12),UMENCL(10,12),
     3               UMENTW(10,12),UMENDP(10,12)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
```

```
C
      DIMENSION ITITLE(20)
      CHARACTER*80 IDUM
C
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
C
      XN = NMONTH
      NYEAR = NMONTH/12
      XNYEAR = NYEAR
C
C         IF ISKMGW = 99999, PLOT FINAL GROUND-WATER STORAGE SCHEMATIC
C
      IF (ISKMGW - 99999) 30,10,30
   10 IF (IBATCH .EQ. 0) GO TO 20
      WRITE (IOUT,1000)
 1000 FORMAT (46H ARE YOU READY FOR THE GROUND-WATER SCHEMATIC?)
      CALL QUESZN(IQ)
      IF (IQ-1) 30,20,30
   20 WRITE (IDUM,1010) TITL
 1010 FORMAT (5A4,17H - FINAL STORAGE$ )
      CALL SKMGW(ITITLE)
C
C         PLOT GROUND-WATER HYDROGRAPHS
C
   30 IF (IBATCH .EQ. 0) GO TO 60
      DO 50 I = 1,5
      IF (IHYGW(I)) 40,50,40
   40 WRITE (IOUT,1020)
 1020 FORMAT (48H ARE YOU READY FOR THE GROUND-WATER HYDROGRAPHS?)
      CALL QUESZN(IQ)
      IF (IQ-1) 110,60,110
   50 CONTINUE
      GO TO 110
   60 DO 100 I = 1,5
      INODE = IHYGW(I)
      IF (INODE) 70,100,70
   70 IF (INODE .EQ. 99999) GO TO 80
      ISIDE = INODE/1000
      INODE = INODE - ISIDE*1000
      WRITE (IDUM,1030) TITL,NODEID(INODE),NODNAM(INODE),ISIDE
 1030 FORMAT (5A4,I4,1H(,A8,7H), SIDE,I2,1H$)
      GO TO 90
   80 WRITE (IDUM,1040) TITL
 1040 FORMAT (5A4,32H - BASINWIDE (UNITS ARE 1000'S)$)
   90 CALL HYDRGR(GWHYS(1,I),ITITLE,7)
      IF (INODE .EQ. 99999) WRITE (IDUM,1050) TITL
 1050 FORMAT (5A4,13H - BASINWIDE$)
      CALL HYDRGR(GWHYC(1,I),ITITLE,2)
      CALL HYDRGR(GWHYRF(1,I),ITITLE,8)
  100 CONTINUE
```

```
C
C         LIST GROUND-WATER TABLES
C
  110 DO 220 I = 1,5
      INODE = ITBLG(I)
      IF (INODE) 120,220,120
C
  120 IF (INODE .EQ. 99999) GO TO 130
      ISIDE = INODE/1000
      INODE = INODE - ISIDE*1000
  130 DO 210 ITB = 1,3
      IF (IBATCH .EQ. 0) GO TO 140
      WRITE (IOUT,1060)
 1060 FORMAT (////,37H IS YOUR TERMINAL READY FOR THE TABLE)
      CALL QUESZN(IQ)
      IF (IQ - 1) 210,140,210
  140 IF (ITB - 2) 150,170,190
C
  150 IF (INODE .NE. 99999) WRITE (IOUT,1070) NODEID(INODE),
     1 NODNAM(INODE),ISIDE,(J,J=1,12)
 1070 FORMAT (////,45H GROUND-WATER STORAGE, IN ACRE-FEET, FOR NODE ,I5,
     1 2H (,A8,7H), SIDE,I2,//,6H MONTH,I3,11I6,/,5H YEAR )
      IF (INODE .EQ. 99999) WRITE (IOUT,1080) (J,J=1,12)
 1080 FORMAT (////,56H BASINWIDE GROUND-WATER STORAGE, IN 1000'S OF ACRE
     1-FEET ,//, 6H MONTH,I3,11I6,/,5H YEAR)
      DO 160 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  160 WRITE (IOUT,1090) IYEAR,(IGTBLS(I,IMONTH),IMONTH=JMONTH,KMONTH)
 1090 FORMAT (I4,I7,11I6)
      GO TO 210
C
  170 IF (INODE .NE. 99999) WRITE (IOUT,1100) NODEID(INODE),
     1 NODNAM(INODE),ISIDE,(J,J=1,12)
 1100 FORMAT (////,52H GROUND-WATER CONCENTRATION, IN MILLIGRAMS PER LIT
     1ER ,/,5X,8HFOR NODE,I5,2H (,A8,7H), SIDE,I2,//,6H MONTH,I3,11I6,/,
     2 5H YEAR )
      IF (INODE .EQ. 99999) WRITE (IOUT,1110) (J,J=1,12)
 1110 FORMAT (////,62H BASINWIDE GROUND-WATER CONCENTRATION, IN MILLIGRA
     1MS PER LITER ,//, 6H MONTH,I3,11I6,/,5H YEAR)
      DO 180 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  180 WRITE (IOUT,1090) IYEAR,(IGTBLC(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 210
C
  190 IF (INODE .NE. 99999) WRITE (IOUT,1120) NODEID(INODE),
     1 NODNAM(INODE),ISIDE,(J,J=1,12)
 1120 FORMAT (////,52H GROUND-WATER RETURN FLOWS, IN CUBIC FEET PER SECO
     1ND ,/,5X,8HFOR NODE,I5,2H (,A8,7H), SIDE,I2,//,6H MONTH,I3,11I6,/,
     2 5H YEAR )
      IF (INODE .EQ. 99999) WRITE (IOUT,1130) (J,J=1,12)
```

```
 1130 FORMAT (////,62H BASINWIDE GROUND-WATER RETURN FLOWS, IN CUBIC FEE
     1T PER SECOND ,//, 6H MONTH,I3,11I6,/,5H YEAR)
      DO 200 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  200 WRITE (IOUT,1090) IYEAR,(IGTBLR(I,IMONTH),IMONTH=JMONTH,KMONTH)
  210 CONTINUE
  220 CONTINUE
C
C         IF ISKMU = 99999, PLOT PERIOD OF RECORD WATER USE SCHEMATIC
C
      IF (ISKMU - 99999) 260,230,260
  230 IF (IBATCH .EQ. 0) GO TO 240
      WRITE (IOUT,1140)
 1140 FORMAT (43H ARE YOU READY FOR THE WATER USE SCHEMATIC?)
      CALL QUESZN(IQ)
      IF (IQ-1) 260,240,260
  240 WRITE (IDUM,1150) TITL
 1150 FORMAT (5A4,21H - AVERAGE WATER USE$ )
      DO 250 IUSER = 1,NUSERS
      ADD(IUSER) = ADD(IUSER)/XNYEAR
      AGW(IUSER) = AGW(IUSER)/XNYEAR
      ARR(IUSER) = ARR(IUSER)/XNYEAR
      AIM(IUSER) = AIM(IUSER)/XNYEAR
      APR(IUSER) = APR(IUSER)/XNYEAR
      ANEED(IUSER) = ANEED(IUSER)/XNYEAR
  250 ACN(IUSER) = ACN(IUSER)/XNYEAR
C
      CALL SKMU(ITITLE)
C
C         PLOT WATER USE HYDROGRAPHS
C
  260 IF (IBATCH .EQ. 0) GO TO 290
      DO 280 I = 1,5
      IF (IHYU(I)) 270,280,270
  270 WRITE (IOUT,1160)
 1160 FORMAT (45H ARE YOU READY FOR THE WATER USE HYDROGRAPHS?)
      CALL QUESZN(IQ)
      IF (IQ-1) 320,290,320
  280 CONTINUE
      GO TO 320
  290 DO 310 I = 1,5
      IUSER = IHYU(I)
      IF (IUSER) 300,310,300
  300 IF (IUSER .NE. 99999) WRITE (IDUM,1170) TITL,USERID(IUSER),
     1 USRNAM(IUSER)
 1170 FORMAT (5A4,3H - ,I5,2H (,A8,2H)$ )
      IF (IUSER .EQ. 99999) WRITE (IDUM,1040) TITL
      CALL HYDRGR(UHYD(1,I),ITITLE,4)
      CALL HYDRGR(UHYP(1,I),ITITLE,5)
      CALL HYDRGR(UHYT(1,I),ITITLE,6)
  310 CONTINUE
```

```
C
C         LIST WATER USE TABLES
C
  320 DO 420 I = 1,5
      IUSER = ITBLU(I)
      IF (IUSER) 330,420,330
C
  330 DO 410 ITB = 1,3
      IF (IBATCH .EQ. 0) GO TO 340
      WRITE (IOUT,1060)
      CALL QUESZN(IQ)
      IF (IQ - 1) 410,340,410
  340 IF (ITB - 2) 350,370,390
  350 IF (IUSER .NE. 99999) WRITE (IOUT,1180) USERID(IUSER),
     1 USRNAM(IUSER),(J,J=1,12)
 1180 FORMAT (////,42H DIRECT DIVERSIONS, IN ACRE-FEET, FOR USER ,I5,
     1 2H (,A8,1H) ,//,6H MONTH,I3,11I6,/,5H YEAR)
      IF (IUSER .EQ. 99999) WRITE (IOUT,1190) (J,J=1,12)
 1190 FORMAT (////,52H BASINWIDE DIRECT DIVERSIONS, IN 1000'S OF ACRE-FE
     1ET ,//, 6H MONTH,I3,11I6,/,5H YEAR)
      DO 360 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  360 WRITE (IOUT,1090) IYEAR,(IUTBLD(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 410
C
  370 IF (IUSER .NE. 99999) WRITE (IOUT,1200) USERID(IUSER),
     1 USRNAM(IUSER),(J,J=1,12)
 1200 FORMAT (////,46H GROUND-WATER PUMPAGE, IN ACRE-FEET, FOR USER ,I5,
     1 2H (,A8,1H),//,6H MONTH,I3,11I6,/,5H YEAR)
      IF (IUSER .EQ. 99999) WRITE (IOUT,1210) (J,J=1,12)
 1210 FORMAT (////,55H BASINWIDE GROUND-WATER PUMPAGE, IN 1000'S OF ACRE
     1-FEET ,//, 6H MONTH,I3,11I6,/,5H YEAR)
      DO 380 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  380 WRITE (IOUT,1090) IYEAR,(IUTBLP(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 410
C
  390 IF (IUSER .NE. 99999) WRITE (IOUT,1220) USERID(IUSER),
     1 USRNAM(IUSER),(J,J=1,12)
 1220 FORMAT (////,43H TOTAL APPLICATIONS, IN ACRE-FEET, FOR USER,I5,
     1 2H (A8,1H),//,6H MONTH,I3,11I6,/,5H YEAR)
      IF (IUSER .EQ. 99999) WRITE (IOUT,1230) (J,J=1,12)
 1230 FORMAT (////,52H BASINWIDE TOTAL APPLICATIONS,IN 1000'S OF ACRE-FE
     1ET ,//,6H MONTH,I3,11I6,/,5H YEAR)
      DO 400 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  400 WRITE (IOUT,1090) IYEAR,(IUTBLT(I,IMONTH),IMONTH=JMONTH,KMONTH)
  410 CONTINUE
  420 CONTINUE
```

```
C
C          LIST WATER USE STATISTICS
C
      DO 480 I = 1,10
      IUSER = ISSU(I)
      IF (IUSER) 430,480,430
  430 IF (IBATCH .EQ. 0) GO TO 440
      WRITE (IOUT,1240)
 1240 FORMAT (////,42H IS YOUR TERMINAL READY FOR THE STATISTICS )
      CALL QUESZN(IQ)
      IF (IQ - 1) 480,440,480
  440 IF (IUSER .NE. 99999) GO TO 450
      WRITE (IOUT,1250)
 1250 FORMAT (////,53H THE MONTHLY STATISTICS FOR TOTAL BASINWIDE WATER
     1USE ,/, 80H  [VALUES ARE 1000 ACRE-FEET EXCEPT CONCENTRATION WHICH
     2 IS MILLIGRAMS PER LITER] ,//, 78H MONTH WATER DIRECT GROUND RESER
     3-  TOTAL  PRE-  WATER CON-  CANAL   TAIL  DEEP ,/, 78H       NEED
     4 DIVER-  WATER  VOIR   WATER  CIP-   CON- CEN- LEAKAGE WATER  PER-
     5 ,/,14X,44HSIONS  PUMP-  RE-     AP-   ITA-  SUMED TRA- ,16X,
     6 5HCOLA- ,/, 21X,37HAGE   LEASES  PLIED  TION        TION ,16X,
     7 4HTION )
      GO TO 460
  450 WRITE (IOUT,1260) USERID(IUSER),USRNAM(IUSER)
 1260 FORMAT (////,33H THE MONTHLY STATISTICS FOR USER ,I5,2H (,A8,1H),
     1     /, 75H  [VALUES ARE ACRE-FEET EXCEPT CONCENTRATION WHICH IS M
     2ILLIGRAMS PER LITER] ,//,      78H MONTH WATER DIRECT GROUND RESER
     3-  TOTAL  PRE-  WATER CON-  CANAL   TAIL  DEEP ,/, 78H       NEED
     4 DIVER-  WATER  VOIR   WATER  CIP-   CON- CEN- LEAKAGE WATER  PER-
     5 ,/,14X,44HSIONS  PUMP-  RE-     AP-   ITA-  SUMED TRA- ,16X,
     6 5HCOLA- ,/, 21X,37HAGE   LEASES  PLIED  TION        TION ,16X,
     7 4HTION )
  460 TUMND = 0.
      TUMDD = 0.
      TUMGW = 0.
      TUMRR = 0.
      TUMTA = 0.
      TUMP = 0.
      TUMWC = 0.
      TUMC = 0.
      TUMCL = 0.
      TUMTW = 0.
      TUMDP = 0.
      DO 470 JMONTH = 1,12
      TUMND = TUMND + UMENND(I,JMONTH)
      TUMDD = TUMDD + UMENDD(I,JMONTH)
      TUMGW = TUMGW + UMENGW(I,JMONTH)
      TUMRR = TUMRR + UMENRR(I,JMONTH)
      TUMTA = TUMTA + UMENTA(I,JMONTH)
      TUMP = TUMP + UMENP(I,JMONTH)
      TUMWC = TUMWC + UMENWC(I,JMONTH)
      TUMC = TUMC + UMENC(I,JMONTH)
```

```
      TUMCL = TUMCL + UMENCL(I,JMONTH)
      TUMTW = TUMTW + UMENTW(I,JMONTH)
      TUMDP = TUMDP + UMENDP(I,JMONTH)
      XM1 = UMENND(I,JMONTH)/XNYEAR
      XM2 = UMENDD(I,JMONTH)/XNYEAR
      XM3 = UMENGW(I,JMONTH)/XNYEAR
      XM4 = UMENRR(I,JMONTH)/XNYEAR
      XM5 = UMENTA(I,JMONTH)/XNYEAR
      XM6 = UMENP(I,JMONTH)/XNYEAR
      XM7 = UMENWC(I,JMONTH)/XNYEAR
      XM8 = UMENC(I,JMONTH)/XNYEAR
      IF (IQW .GT. 0 .AND. (UMENTA(I,JMONTH)+UMENP(I,JMONTH)) .NE. 0.)
     1 XM8 = UMENC(I,JMONTH)/(UMENTA(I,JMONTH)+UMENP(I,JMONTH))
      XM9 = UMENCL(I,JMONTH)/XNYEAR
      XM10 = UMENTW(I,JMONTH)/XNYEAR
      XM11 = UMENDP(I,JMONTH)/XNYEAR
  470 WRITE (IOUT,1270) JMONTH,XM1,XM2,XM3,XM4,XM5,XM6,XM7,XM8,XM9,XM10,
     1 XM11
 1270 FORMAT (I4,1X,5F7.0,F6.0,F7.0,F6.0,3F7.0)
      TUMND = TUMND/XNYEAR
      TUMDD = TUMDD/XNYEAR
      TUMGW = TUMGW/XNYEAR
      TUMRR = TUMRR/XNYEAR
      TUMTA = TUMTA/XNYEAR
      TUMP = TUMP/XNYEAR
      TUMWC = TUMWC/XNYEAR
      TUMC = TUMC/XN
      IF (IQW .GT. 0 .AND. (TUMTA+TUMP) .NE. 0.)
     1 TUMC = TUMC*XN/((TUMTA+TUMP)*XNYEAR)
      TUMCL = TUMCL/XNYEAR
      TUMTW = TUMTW/XNYEAR
      TUMDP = TUMDP/XNYEAR
      WRITE (IOUT,1280) TUMND,TUMDD,TUMGW,TUMRR,TUMTA,TUMP,TUMWC,TUMC,
     1 TUMCL,TUMTW,TUMDP
 1280 FORMAT (/, 5HTOTAL,5F7.0,F6.0,F7.0,F6.0,3F7.0)
  480 CONTINUE
C
C         PLOT RESERVOIR HYDROGRAPHS
C
      IF (IBATCH .EQ. 0) GO TO 510
      DO 500 I = 1,5
      IF (IHYR(I)) 490,500,490
  490 WRITE (IOUT,1290)
 1290 FORMAT (45H ARE YOU READY FOR THE RESERVOIR HYDROGRAPHS?)
      CALL QUESZN(IQ)
      IF (IQ-1) 540,510,540
  500 CONTINUE
      GO TO 540
  510 DO 530 I = 1,5
      IRES = IHYR(I)
      IF (IRES) 520,530,520
  520 WRITE (IDUM,1170) TITL,RESID(IRES),RESNAM(IRES)
      CALL HYDRGR(RHYS(1,I),ITITLE,7)
      CALL HYDRGR(RHYC(1,I),ITITLE,2)
  530 CONTINUE
```

```
C
C         LIST RESERVOIR TABLES
C
  540 DO 620 I = 1,5
      IRES = ITBLR(I)
      IF (IRES) 550,620,550
C
  550 DO 610 ITB = 1,2
      IF (IBATCH .EQ. 0) GO TO 560
      WRITE (IOUT,1060)
      CALL QUESZN(IQ)
      IF (IQ - 1) 610,560,610
  560 IF (ITB - 2) 570,590,590
  570 WRITE (IOUT,1300) RESID(IRES),RESNAM(IRES),(J,J=1,12)
 1300 FORMAT (////,38H CONTENTS, IN ACRE-FEET, FOR RESERVIOR ,I5,2H (,A8
     1 ,1H) ,//,6H MONTH,I3,11I6,/,5H YEAR)
C
      DO 580 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  580 WRITE (IOUT,1090) IYEAR,(IRTBLS(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 610
  590 WRITE (IOUT,1310) RESID(IRES),RESNAM(IRES),(J,J=1,12)
 1310 FORMAT (////,54H CONCENTRATION, IN MILLIGRAMS PER LITER, FOR RESER
     1VOIR ,I5,2H (,A8,1H),//,6H MONTH,I3,11I6,/,5H YEAR)
C
      DO 600 IYEAR = 1,NYEAR
      JMONTH = (IYEAR - 1)*12 + 1
      KMONTH = IYEAR*12
  600 WRITE (IOUT,1090) IYEAR,(IRTBLC(I,IMONTH),IMONTH=JMONTH,KMONTH)
      GO TO 610
  610 CONTINUE
  620 CONTINUE
```

```
C
C         LIST RESERVOIR STATISTICS
C
      DO 660 I = 1,10
      IRES = ISSR(I)
      IF (IRES) 630,660,630
  630 IF (IBATCH .EQ. 0) GO TO 640
      WRITE (IOUT,1240)
      CALL QUESZN(IQ)
      IF (IQ - 1) 660,640,660
  640 WRITE (IOUT,1320) RESID(IRES),RESNAM(IRES)
 1320 FORMAT (////,38H THE MONTHLY STATISTICS FOR RESERVOIR ,I5,2H (,A8,
     1 1H),/,8X,7HSTORAGE,18X,39HRESERVOIR    INFLOW    INFLOW      LAKE
     2 ,/,      76H MONTH  CONTENTS  CONCENTRATION  RELEASES   DIVERSION
     3S  IMPORTS  EVAPORATION ,/,8X,68H(ACRE-     (MILLIGRAMS   (ACRE-
     4   (ACRE-      (ACRE-   (ACRE-FEET) ,/,10X,53HFEET)     PER LITER)
     5     FEET)       FEET)     FEET)  )
      TRMS = 0.
      TRMC = 0.
      TRMR = 0.
      TRMD = 0.
      TRMI = 0.
      TRME = 0.
      DO 650 JMONTH = 1,12
      TRMS = TRMS + RMEANS(I,JMONTH)
      TRMC = TRMC + RMEANC(I,JMONTH)
      TRMR = TRMR + RMEANR(I,JMONTH)
      TRMD = TRMD + RMEAND(I,JMONTH)
      TRMI = TRMI + RMEANI(I,JMONTH)
      TRME = TRME + RMEANE(I,JMONTH)
      XM1 = RMEANS(I,JMONTH)/XNYEAR
      XM2 = RMEANC(I,JMONTH)/XNYEAR
      XM3 = RMEANR(I,JMONTH)/XNYEAR
      XM4 = RMEAND(I,JMONTH)/XNYEAR
      XM5 = RMEANI(I,JMONTH)/XNYEAR
      XM6 = RMEANE(I,JMONTH)/XNYEAR
  650 WRITE (IOUT,1330) JMONTH,XM1,XM2,XM3,XM4,XM5,XM6
 1330 FORMAT (I4,F12.0,F11.0,F14.0,F11.0,2F10.0)
      TRMS = TRMS/XN
      TRMC = TRMC/XN
      TRMR = TRMR/XN
      TRMD = TRMD/XN
      TRMI = TRMI/XN
      TRME = TRME/XN
      WRITE (IOUT,1340) TRMS,TRMC,TRMR,TRMD,TRMI,TRME
 1340 FORMAT (/,8H AVERAGE,F8.0,F11.0,F14.0,F11.0,2F10.0)
  660 CONTINUE
C
      RETURN
      END
```

```
CSMRYMU
C
C          SUBROUTINE MONTHLY SUMMARY OF RIVER BASIN SIMULATION MODEL (#3
C             WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C                WATER RESOURCES DIVISION, LAKEWOOD, CO
C                        LATEST UPDATE 1/26/87
C
      SUBROUTINE SMRYMU
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /DEMND1/ USRNAM(100)
      DOUBLE PRECISION USRNAM
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
      COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
      COMMON /NAMES/ TITL(5)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /REACH1/ NODNAM(100)
      DOUBLE PRECISION NODNAM
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /SKMTKU/ ISKMGW,ISKMU,UMAX,ADD(100),AGW(100),ARR(100),
     1                AIM(100),APR(100),ACN(100),ANEED(100)
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
     1               RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /STATU/ ISSU(10),UMENND(10,12),UMENDD(10,12),UMENGW(10,12),
     1               UMENRR(10,12),UMENTA(10,12),UMENP(10,12),
     2               UMENWC(10,12),UMENC(10,12),UMENCL(10,12),
     3               UMENTW(10,12),UMENDP(10,12)
```

```
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
      COMMON /USTATS/ DELIVR(100),RESREL(100),IMPORT(100),PUMPAG(100),
     1                APCONC(100),DIVRZN(100),PUMPG(100,2),CANLEK(100),
     2                DPPERC(100),TAILWR(100),PRECIP(100)
      REAL IMPORT
C
      DIMENSION ITITLE(20),TOTST(2),AVGCN(2),TOTRF(2)
      CHARACTER*80 IDUM
C
      REAL ITITLE
      EQUIVALENCE (IDUM,ITITLE)
C
C         SUMMARIZE GROUND-WATER DATA
C
      WRITE (54,1000) IMONTH
 1000 FORMAT (12H1 FOR MONTH ,I5, //,21H  NODE   NODE    NODE ,13X,
     1 6HSIDE 1,22X,6HSIDE 2 ,/,76H NUMBER   ID     NAME    STORAGE  CON
     2CEN-  RETURN   STORAGE  CONCEN-  RETURN ,/,34X,14HTRATION   FLOW ,
     3 13X,14HTRATION   FLOW ,/, 25X,51H(ACRE-   (MILLI-  (CUBIC   (ACRE
     4-   (MILLI-  (CUBIC ,/, 27X,48HFEET)   GRAMS    FEET      FEET)
     5GRAMS    FEET ,/, 36X,12HPER      PER ,15X,12HPER      PER ,/,
     6 35X,15HLITER)  SECOND) ,12X,15HLITER)  SECOND)  )
      DO 10 ISIDE = 1,2
      TOTST(ISIDE) = 0.
      AVGCN(ISIDE) = 0.
   10 TOTRF(ISIDE) = 0.
      DO 80 INODE = 1,NNODE
      WRITE (54,1010) INODE,NODEID(INODE),NODNAM(INODE),
     1 (GWSTOR(INODE,J),GWCONC(INODE,J),RTRNFL(INODE,J),J=1,2)
 1010 FORMAT (I6,I7,2X,A8,2F9.0,F8.0,1X,2F9.0,F8.0)
      DO 80 ISIDE = 1,2
      TOTST(ISIDE) = TOTST(ISIDE) + GWSTOR(INODE,ISIDE)
      AVGCN(ISIDE) = AVGCN(ISIDE) + GWCONC(INODE,ISIDE)
      IF (IQW .GT. 0) AVGCN(ISIDE) = AVGCN(ISIDE)-GWCONC(INODE,ISIDE)+
     1 GWCONC(INODE,ISIDE)*GWSTOR(INODE,ISIDE)
      TOTRF(ISIDE) = TOTRF(ISIDE) + RTRNFL(INODE,ISIDE)
      INOD = INODE + 1000*ISIDE
C
C         STORE HYDROGRAPH DATA
C
      DO 40  I = 1,5
      IF (IHYGW(I) .EQ. 99999) GO TO 30
      IF (INOD - IHYGW(I)) 40 ,20 ,40
   20 GWHYS(IMONTH,I) = GWSTOR(INODE,ISIDE)
      GWHYC(IMONTH,I) = GWCONC(INODE,ISIDE)
      GWHYRF(IMONTH,I) = RTRNFL(INODE,ISIDE)
      GO TO 40
   30 GWHYS(IMONTH,I) = GWHYS(IMONTH,I) + GWSTOR(INODE,ISIDE)/1000.
      GWHYC(IMONTH,I) = GWHYC(IMONTH,I) + GWCONC(INODE,ISIDE)
      IF (IQW .GT. 0) GWHYC(IMONTH,I) = GWHYC(IMONTH,I) -
     1 GWCONC(INODE,ISIDE)+GWCONC(INODE,ISIDE)*GWSTOR(INODE,ISIDE)/1000.
      GWHYRF(IMONTH,I) = GWHYRF(IMONTH,I) + RTRNFL(INODE,ISIDE)
   40 CONTINUE
```

```
C
C         STORE TABLE DATA
C
      DO 70  I = 1,5
      IF (ITBLG(I) .EQ. 99999) GO TO 60
      IF (INOD - ITBLG(I)) 70 ,50 ,70
   50 IGTBLS(I,IMONTH) = GWSTOR(INODE,ISIDE) + .5
      IGTBLC(I,IMONTH) = GWCONC(INODE,ISIDE) + .5
      IGTBLR(I,IMONTH) = RTRNFL(INODE,ISIDE) + .5
      GO TO 70
   60 IGTBLS(I,IMONTH) = IGTBLS(I,IMONTH) + GWSTOR(INODE,ISIDE)/1000.
      IGTBLC(I,IMONTH) = IGTBLC(I,IMONTH) + GWCONC(INODE,ISIDE)
      IF (IQW .GT. 0) IGTBLC(I,IMONTH) = IGTBLC(I,IMONTH) -
     1 GWCONC(INODE,ISIDE)+GWCONC(INODE,ISIDE)*GWSTOR(INODE,ISIDE)/1000.
      IGTBLR(I,IMONTH) = IGTBLR(I,IMONTH) + RTRNFL(INODE,ISIDE)
   70 CONTINUE
   80 CONTINUE
C
      IF (IQW .EQ. 0) GO TO 90
      IF (TOTST(1) .NE. 0.) AVGCN(1) = AVGCN(1)/TOTST(1)
      IF (TOTST(2) .NE. 0.) AVGCN(2) = AVGCN(2)/TOTST(2)
      GO TO 100
   90 AVGCN(1) = AVGCN(1)/NNODE
      AVGCN(2) = AVGCN(2)/NNODE
  100 DO 120 I = 1,5
      IF (IHYGW(I) .NE. 99999) GO TO 110
      IF (IQW .NE. 0) GWHYC(IMONTH,I) = GWHYC(IMONTH,I)/GWHYS(IMONTH,I)
      IF (IQW .EQ. 0) GWHYC(IMONTH,I) = GWHYC(IMONTH,I)/(NNODE*2.)
  110 IF (ITBLG(I) .NE. 99999) GO TO 120
      IF (IQW .NE. 0) IGTBLC(I,IMONTH)=IGTBLC(I,IMONTH)/IGTBLS(I,IMONTH)
      IF (IQW .EQ. 0) IGTBLC(I,IMONTH) = IGTBLC(I,IMONTH)/(NNODE*2)
  120 CONTINUE
      WRITE (54,1020) TOTST(1),AVGCN(1),TOTRF(1),TOTST(2),AVGCN(2),
     1 TOTRF(2)
 1020 FORMAT (/,6X,5HTOTAL,12X,2F9.0,F8.0,1X,2F9.0,F8.0)
C
C         IF ISKMGW = 12, PLOT END OF YEAR GROUND-WATER STORAGE SCHEMATIC
C
      IF (ISKMGW - 12) 150,130,150
  130 IF (JMONTH - 12) 150,140,150
  140 WRITE (IDUM,1030) TITL,IYEAR
 1030 FORMAT (5A4,8H - YEAR ,I3,1H$)
      CALL SKMGW(ITITLE)
```

```
C
C         SUMMARIZE WATER USER DATA
C
  150 WRITE (52,1040) IMONTH
 1040 FORMAT (12H1 FOR MONTH ,I5,15X,84H[ALL VALUES ARE IN ACRE-FEET EXC
     1EPT CONCENTRATION WHICH IS IN MILLIGRAMS PER LITER]  ,//,
     2 127H  USER   USER    USER     WATER  DIRECT  GROUND    RESER-   I
     3MPORTS   TOTAL   PRECIP-    WATER   CONCEN-   CANAL   TAIL    DEEP
     4 ,/,56H NUMBER   ID     NAME     NEED   DIVER-   WATER     VOIR ,
     514X,59HWATER   ITATION  CONSUMED  TRATION  LEAKAGE  WATER  PERCOL-
     6 ,/,34X,24HSIONS  PUMPAGE  RELEASES,11X,7HAPPLIED,47X,5HATION )
      TNEED = 0.
      TDLVR = 0.
      TPUMP = 0.
      TRES = 0.
      TIMPRT = 0.
      TTTL = 0.
      TPRCP = 0.
      TCONSM = 0.
      AVGCON = 0.
      TLEAK = 0.
      TTAIL = 0.
      TDP = 0.
      DO 260 IUSER = 1,NUSERS
      TOTAL = 0.
      CONSUM = 0.
      TOTAL = DELIVR(IUSER)+PUMPAG(IUSER)+RESREL(IUSER)+IMPORT(IUSER)-
     1 CANLEK(IUSER)
      IF (USRTYP(IUSER) .GT. 5) GO TO 160
      CONSUM = AMIN1(TOTAL+PRECIP(IUSER),NEED(IUSER))
      TNEED = TNEED + NEED(IUSER)
      TDLVR = TDLVR + DELIVR(IUSER)
      TPUMP = TPUMP + PUMPAG(IUSER)
      TRES = TRES + RESREL(IUSER)
      TIMPRT = TIMPRT + IMPORT(IUSER)
      TTTL = TTTL + TOTAL
      TPRCP = TPRCP + PRECIP(IUSER)
      TCONSM = TCONSM + CONSUM
      AVGCON = AVGCON + (TOTAL+PRECIP(IUSER))*APCONC(IUSER)
      TLEAK = TLEAK + CANLEK(IUSER)
      TTAIL = TTAIL + TAILWR(IUSER)
      TDP = TDP + DPPERC(IUSER)
C
      ADD(IUSER) = ADD(IUSER) + DELIVR(IUSER)
      AGW(IUSER) = AGW(IUSER) + PUMPAG(IUSER)
      ARR(IUSER) = ARR(IUSER) + RESREL(IUSER)
      AIM(IUSER) = AIM(IUSER) + IMPORT(IUSER)
      APR(IUSER) = APR(IUSER) + PRECIP(IUSER)
      ANEED(IUSER) = ANEED(IUSER) + NEED(IUSER)
      ACN(IUSER) = ACN(IUSER) + CONSUM
```

```
C
C         STORE HYDROGRAPH DATA
C
  160 DO 190 I = 1,5
      IF (IHYU(I) .EQ. 99999) GO TO 180
      IF (IUSER - IHYU(I)) 190,170,190
  170 UHYD(IMONTH,I) = DELIVR(IUSER)
      UHYP(IMONTH,I) = PUMPAG(IUSER)
      UHYT(IMONTH,I) = TOTAL
      GO TO 190
  180 IF (USRTYP(IUSER) .GT. 5) GO TO 190
      UHYD(IMONTH,I) = UHYD(IMONTH,I) + DELIVR(IUSER)/1000.
      UHYP(IMONTH,I) = UHYP(IMONTH,I) + PUMPAG(IUSER)/1000.
      UHYT(IMONTH,I) = UHYT(IMONTH,I) + TOTAL/1000.
  190 CONTINUE
C
C         STORE TABLE DATA
C
      DO 220 I = 1,5
      IF (ITBLU(I) .EQ. 99999) GO TO 210
      IF (IUSER - ITBLU(I)) 220,200,220
  200 IUTBLD(I,IMONTH) = DELIVR(IUSER) + .5
      IUTBLP(I,IMONTH) = PUMPAG(IUSER) + .5
      IUTBLT(I,IMONTH) = TOTAL + .5
      GO TO 220
  210 IF (USRTYP(IUSER) .GT. 5) GO TO 220
      IUTBLD(I,IMONTH) = IUTBLD(I,IMONTH) + DELIVR(IUSER)/1000.
      IUTBLP(I,IMONTH) = IUTBLP(I,IMONTH) + PUMPAG(IUSER)/1000.
      IUTBLT(I,IMONTH) = IUTBLT(I,IMONTH) + TOTAL/1000.
  220 CONTINUE
C
C         STORE STATISTICS DATA
C
      DO 250 I = 1,10
      IF (ISSU(I) .EQ. 99999) GO TO 240
      IF (IUSER - ISSU(I)) 250,230,250
  230 UMENND(I,JMONTH) = UMENND(I,JMONTH) + NEED(IUSER)
      UMENDD(I,JMONTH) = UMENDD(I,JMONTH) + DELIVR(IUSER)
      UMENGW(I,JMONTH) = UMENGW(I,JMONTH) + PUMPAG(IUSER)
      UMENRR(I,JMONTH) = UMENRR(I,JMONTH) + RESREL(IUSER)
      UMENTA(I,JMONTH) = UMENTA(I,JMONTH) + TOTAL
      UMENP(I,JMONTH) = UMENP(I,JMONTH) + PRECIP(IUSER)
      UMENWC(I,JMONTH) = UMENWC(I,JMONTH) + CONSUM
      UMENC(I,JMONTH) = UMENC(I,JMONTH) + APCONC(IUSER)
      IF (IQW .GT. 0) UMENC(I,JMONTH) = UMENC(I,JMONTH)-APCONC(IUSER)+
     1 APCONC(IUSER)*(TOTAL+PRECIP(IUSER))
      UMENCL(I,JMONTH) = UMENCL(I,JMONTH) + CANLEK(IUSER)
      UMENTW(I,JMONTH) = UMENTW(I,JMONTH) + TAILWR(IUSER)
      UMENDP(I,JMONTH) = UMENDP(I,JMONTH) + DPPERC(IUSER)
      GO TO 250
```

```
  240 IF (USRTYP(IUSER) .GT. 5) GO TO 250
      UMENND(I,JMONTH) = UMENND(I,JMONTH) + NEED(IUSER)/1000.
      UMENDD(I,JMONTH) = UMENDD(I,JMONTH) + DELIVR(IUSER)/1000.
      UMENGW(I,JMONTH) = UMENGW(I,JMONTH) + PUMPAG(IUSER)/1000.
      UMENRR(I,JMONTH) = UMENRR(I,JMONTH) + RESREL(IUSER)/1000.
      UMENTA(I,JMONTH) = UMENTA(I,JMONTH) + TOTAL/1000.
      UMENP(I,JMONTH) = UMENP(I,JMONTH) + PRECIP(IUSER)/1000.
      UMENWC(I,JMONTH) = UMENWC(I,JMONTH) + CONSUM/1000.
      UMENC(I,JMONTH) = UMENC(I,JMONTH) + APCONC(IUSER)
      IF (IQW .GT. 0) UMENC(I,JMONTH) = UMENC(I,JMONTH)-APCONC(IUSER)+
     1 APCONC(IUSER)*(TOTAL+PRECIP(IUSER))/1000.
      UMENCL(I,JMONTH) = UMENCL(I,JMONTH) + CANLEK(IUSER)/1000.
      UMENTW(I,JMONTH) = UMENTW(I,JMONTH) + TAILWR(IUSER)/1000.
      UMENDP(I,JMONTH) = UMENDP(I,JMONTH) + DPPERC(IUSER)/1000.
  250 CONTINUE
C
      WRITE (52,1050) IUSER,USERID(IUSER),USRNAM(IUSER),NEED(IUSER),
     1 DELIVR(IUSER),PUMPAG(IUSER),RESREL(IUSER),IMPORT(IUSER),TOTAL,
     2 PRECIP(IUSER),CONSUM,APCONC(IUSER),CANLEK(IUSER),TAILWR(IUSER),
     3 DPPERC(IUSER)
 1050 FORMAT (I5,I8,2X,A8,2F8.0,2F9.0,F10.0,F9.0,F8.0,F10.0,2F9.0,2F8.0)
  260 CONTINUE
C
      IF ((TTTL + TPRCP) .NE. 0.) AVGCON = AVGCON/(TTTL + TPRCP)
      WRITE (52,1060) TNEED,TDLVR,TPUMP,TRES,TIMPRT,TTTL,TPRCP,TCONSM,
     1 AVGCON,TLEAK,TTAIL,TDP
 1060 FORMAT (/,15X,6HTOTALS,F10.0,F8.0,2F9.0,F10.0,F9.0,F8.0,F10.0,
     1 2F9.0,2F8.0)
C
C         IF ISKMU = 12, PLOT ANNUAL WATER USE SCHEMATIC
C
      IF (ISKMU - 12) 300,270,300
  270 IF (JMONTH - 12) 300,280,300
  280 WRITE (IDUM,1070) TITL,IYEAR
 1070 FORMAT (5A4,22H - WATER USE FOR YEAR ,I3,1H$)
      CALL SKMU(ITITLE)
C
      DO 290 IUSER = 1,NUSERS
      ADD(IUSER) = 0.
      AGW(IUSER) = 0.
      ARR(IUSER) = 0.
      AIM(IUSER) = 0.
      APR(IUSER) = 0.
      ANEED(IUSER) = 0.
  290 ACN(IUSER) = 0.
C
C         SUMMARIZE RESERVOIR DATA
C
  300 WRITE (52,1080)
 1080 FORMAT (///,33H  RESERVOIR  RESERVOIR  RESERVOIR ,/,
     1 99H   NUMBER       ID        NAME     CONTENTS  CONCENTRATION  RE
     2LEASES  INFLOWS  IMPORTS  EVAPORATION  )
      DO 410 IRES = 1,NRES
```

```
C
C         STORE HYDROGRAPH DATA
C
      DO 340 I = 1,5
      IF (IRES - IHYR(I)) 340,330,340
  330 RHYS(IMONTH,I) = RESSTR(IRES)
      RHYC(IMONTH,I) = RSCONC(IRES)
  340 CONTINUE
C
C         STORE TABLE DATA
C
      DO 360 I = 1,5
      IF (IRES - ITBLR(I)) 360,350,360
  350 IRTBLS(I,IMONTH) = RESSTR(IRES) + .5
      IRTBLC(I,IMONTH) = RSCONC(IRES) + .5
  360 CONTINUE
C
C         STORE STATISTICS DATA
C
      DO 390 I = 1,10
      IF (IRES - ISSR(I)) 390,370,390
  370 RMEANS(I,JMONTH) = RMEANS(I,JMONTH) + RESSTR(IRES)
      RMEANC(I,JMONTH) = RMEANC(I,JMONTH) + RSCONC(IRES)
      RMEANR(I,JMONTH) = RMEANR(I,JMONTH) + RELEAS(IRES)
      DO 380 IUSER = 1,NUSERS
      IF (USRTYP(IUSER) .NE. RESID(IRES)) GO TO 380
      RMEAND(I,JMONTH)=RMEAND(I,JMONTH) + DELIVR(IUSER) + RESREL(IUSER)
      RMEANI(I,JMONTH) = RMEANI(I,JMONTH) + IMPORT(IUSER)
      RMEANE(I,JMONTH) = RMEANE(I,JMONTH) + RESEVP(IRES)
  380 CONTINUE
  390 CONTINUE
C
      DNFLOW = 0.
      DIMPRT = 0.
      DO 400 IUSER = 1,NUSERS
      IF (USRTYP(IUSER) .NE. RESID(IRES)) GO TO 400
      DNFLOW = DNFLOW + DELIVR(IUSER) + RESREL(IUSER)
      DIMPRT = DIMPRT + IMPORT(IUSER)
  400 CONTINUE
      WRITE (52,1090) IRES,RESID(IRES),RESNAM(IRES),RESSTR(IRES),
     1 RSCONC(IRES),RELEAS(IRES),DNFLOW,DIMPRT,RESEVP(IRES)
 1090 FORMAT (I8,I11,5X,A8,F11.0,F12.0,F13.0,2F9.0,F11.0)
  410 CONTINUE
C
      RETURN
      END
```

```
CSUPPLY
C
C          SUBROUTINE SUPPLY OF RIVER BASIN SIMULATION MODEL
C           WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C              WATER RESOURCES DIVISION, LAKEWOOD, CO
C                      LATEST UPDATE 5/21/87
C
      SUBROUTINE SUPPLY
      COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
     1       JMONTH,IYEAR
      COMMON /DEMND/ NUSERS,USERID(100),XLOCU(100),YLOCU(100),
     1               DMDFAC(100),USRTYP(100),NUMUSR(100),NSOURC(100),
     2               RFTYPE(100),RFVAL(100),RFXLOC(100),RFYLOC(100),
     3               NODERF(100),RFDIST(100),ICODE(100,15),IPRECP(100),
     4               QUANTY(100,15),SCXLOC(100,15),SCYLOC(100,15),
     5               NODESC(100,15),WANT(100),NEED(100),USXPLT(100),
     6               USYPLT(100),ISIDRF(100),IAKNT(100),ITIMFC(100,15),
     7               TIMFAC(100,12)
      INTEGER USERID,USRTYP,RFTYPE
      REAL NUMUSR,NEED
      COMMON /DEMND1/ USRNAM(100)
      DOUBLE PRECISION USRNAM
      COMMON /GW/ GWSTOR(100,2),GWCONC(100,2),RTRNFL(100,2)
      COMMON /GWUSE/ MGW,GWUSER(100),GWSOUR(100),GWDIST(100),GWPUMP(100)
     1               ,ISDPMP(100)
      INTEGER GWUSER,GWSOUR
      COMMON /HYDGRG/ IHYGW(5),GWHYS(600,5),GWHYC(600,5),GWHYRF(600,5)
      COMMON /HYDGRR/ IHYR(5),RHYS(600,5),RHYC(600,5)
      COMMON /HYDGRU/ IHYU(5),UHYD(600,5),UHYP(600,5),UHYT(600,5)
      COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
     1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
     2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
     3                AGDMND(12),CANLEN(100),RAIN(50)
      COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
     1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
     2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
     3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
     4                QWSUBA(100),DSA(100),DSB(100)
      REAL NTRCPT
      COMMON /RESUSE/ MRES,RESUSR(100),RESSOR(100),NUMRES(100),
     1                TRANSL(100),RESRL(100),ISBACT(100),RESQNT(100)
      INTEGER RESUSR,RESSOR
      COMMON /RESVOR/ NRES,RESSTR(25),RELEAS(25),NODRES(25),RESID(25),
     1                CAPMAX(25),NACTIV(25),AREAMX(25),RSXLOC(25),
     2                RSYLOC(25),RSCONC(25),RESEVP(25),RSXPLT(25),
     3                RSYPLT(25),RESCUM(25),SBSTOR(25,5)
      INTEGER RESID
      REAL NACTIV
      COMMON /RES1/ RESNAM(25)
      DOUBLE PRECISION RESNAM
      COMMON /RIGHTS/ NRIGHT,OWNER(200)
      INTEGER OWNER
      COMMON /STATR/ ISSR(10),RMEANS(10,12),RMEANC(10,12),RMEANR(10,12),
```

```
     1                RMEAND(10,12),RMEANI(10,12),RMEANE(10,12)
      COMMON /TABLEG/ ITBLG(5),IGTBLS(5,600),IGTBLC(5,600),IGTBLR(5,600)
      COMMON /TABLER/ ITBLR(5),IRTBLS(5,600),IRTBLC(5,600)
      COMMON /TABLEU/ ITBLU(5),IUTBLD(5,600),IUTBLP(5,600),IUTBLT(5,600)
      COMMON /USTATS/ DELIVR(100),RESREL(100),IMPORT(100),PUMPAG(100),
     1                APCONC(100),DIVRZN(100),PUMPG(100,2),CANLEK(100),
     2                DPPERC(100),TAILWR(100),PRECIP(100)
      REAL IMPORT
C
      DIMENSION QQ(100),QAVAIL(100),PICKUP(100),RESCON(25),WANNT(100)
C
      INTEGER USRID
      INTEGER*2 USED(100,15)
C
C         INITIALIZE ACCOUNTING
C
      DO 10 INODE = 1,NNODE
      PICKUP(INODE) = Q(INODE)
      QAVAIL(INODE) = Q(INODE)
      QQ(INODE) = Q(INODE)
      DIVRZN(INODE) = 0.
      PUMPG(INODE,1) = 0.
   10 PUMPG(INODE,2) = 0.
C
      NNOD1 = NNODE - 1
      DO 20 INODE = 1,NNOD1
      IDOWN = NXTNOD(INODE)
      IF (IDOWN .LT. 0) GO TO 20
      PICKUP(IDOWN) = PICKUP(IDOWN) - Q(INODE)
      IF (PICKUP(IDOWN) .LT. 0.) PICKUP(IDOWN) = 0.
   20 CONTINUE
C
      DO 40 IRES = 1,NRES
      RESCON(IRES) = RESSTR(IRES) - RESEVP(IRES)
      RELEAS(IRES) = 0.
      IF (IMONTH .EQ. 1) RESCUM(IRES) = 0.
      IF (JMONTH .EQ. 10) RESCUM(IRES) = 0.
      IF (RESSTR(IRES) .EQ. 0.) GO TO 40
      DO 30 IACCNT = 1,5
   30 SBSTOR(IRES,IACCNT)=SBSTOR(IRES,IACCNT)*RESCON(IRES)/RESSTR(IRES)
   40 CONTINUE
C
      DO 80 IUSER = 1,NUSERS
      DELIVR(IUSER) = 0.
      PUMPAG(IUSER) = 0.
      RESREL(IUSER) = 0.
      IMPORT(IUSER) = 0.
      WANNT(IUSER) = WANT(IUSER)
      IF (USRTYP(IUSER) .EQ. 1 .AND. DMDFAC(IUSER) .LT. 0.)
     1 WANNT(IUSER) = PET(JMONTH)*NUMUSR(IUSER)*(-DMDFAC(IUSER))
      DO 70 ISOURC = 1,15
      USED(IUSER,ISOURC) = 0
      IF (ICODE(IUSER,ISOURC) .NE. 3) GO TO 70
      DO 60 JRES = 1,MRES
      IF (RESUSR(JRES) .NE. IUSER .OR. RESSOR(JRES) .NE. ISOURC)
```

```
     1 GO TO 60
       IF (QUANTY(IUSER,ISOURC) .GE. 0.) GO TO 50
       IF (IMONTH .NE. 1 .AND. JMONTH .NE. 4) GO TO 60
       IRES = NUMRES(JRES)
       IACCNT = ISBACT(JRES)
       RESQNT(JRES) = -QUANTY(IUSER,ISOURC)*SBSTOR(IRES,IACCNT)
       GO TO 60
    50 RESQNT(JRES) = QUANTY(IUSER,ISOURC)
    60 CONTINUE
    70 CONTINUE
    80 CONTINUE
C
       DO 90 JGW = 1,MGW
       GWPUMP(JGW) = 0.
    90 CONTINUE
C
       DO 100 JRES = 1,MRES
       RESRL(JRES) = 0.
   100 CONTINUE
C
C          GO THROUGH THE DIRECT DIVERSION PRIORITY SYSTEM
C
       DO 440 IRIGHT = 1,NRIGHT
       USRID = OWNER(IRIGHT)
       DO 110 IUSER = 1,NUSERS
       IF (USRID .EQ. USERID(IUSER)) GO TO 120
   110 CONTINUE
       GO TO 440
   120 IF (WANT(IUSER) .LE. 0.) GO TO 440
C
C          GO THROUGH THE LIST OF SOURCES FOR THIS USER UNTIL THE DIRECT
C               DIVERSION IS FOUND
C
       ISOURC = 0
   130 ISOURC = ISOURC + 1
       IF (SOURC .GT. NSOURC(IUSER)) GO TO 440
       IF (USED(IUSER,ISOURC) .NE. 0) GO TO 130
C
       TYMFAC = 1.
       IF (ITIMFC(IUSER,ISOURC) .EQ. 0) GO TO 140
       NTIMFC = ITIMFC(IUSER,ISOURC)
       TYMFAC = TIMFAC(NTIMFC,JMONTH)
   140 CONTINUE
C
       GO TO (150,320,350,400,240,270), ICODE(IUSER,ISOURC)
C
C          DIRECT DIVERSION IN PRIORITY
C
   150 INODE = NODESC(IUSER,ISOURC)
       INODUP = NODEUS(INODE)
       DIVERT = AMIN1(WANT(IUSER),QUANTY(IUSER,ISOURC)*TYMFAC*60.3,
     1 QAVAIL(INODUP)*60.3)
```

```
  160 IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 440
      DELIVR(IUSER) = DELIVR(IUSER) + DIVERT
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      USED(IUSER,ISOURC) = 1
      DIVERT = DIVERT/60.3
      DIVRZN(INODE) = DIVRZN(INODE) + DIVERT
      ADJUST = 0.
      JNODE = INODUP
  170 IF (QQ(JNODE) .LE. 0.) GO TO 190
      QAVAIL(JNODE) = QAVAIL(JNODE) - DIVERT - ADJUST
      QQ(JNODE) = QQ(JNODE) - DIVERT - ADJUST
      IF (QQ(JNODE) .GE. 0.) GO TO 180
      ADJUST = QQ(JNODE) + ADJUST
  180 JNODE = NXTNOD(JNODE)
      IF (JNODE .GT. 0) GO TO 170
      JNODE = NNODE + 1
  190 QQ(JNODE) = QQ(JNODE) - DIVERT - ADJUST
      INODE = INODUP
  200 ADJUST = AMIN1 (PICKUP(INODE), DIVERT)
      PICKUP(INODE) = PICKUP(INODE) - ADJUST
      DIVERT = DIVERT - ADJUST
      IF (DIVERT .LE. 0.) GO TO 440
  210 JNODE = 0
      DO 220 JNODE1 = 1,NNOD1
      INODE1 = NXTNOD(JNODE1)
      IF (INODE1 .NE. INODE) GO TO 220
      IF (QAVAIL(JNODE1) .LE. 0.) GO TO 220
      JNODE = JNODE1
  220 CONTINUE
      IF (JNODE .NE. 0) GO TO 230
      INODE = NXTNOD(INODE)
      GO TO 210
  230 QAVAIL(JNODE) = QAVAIL(JNODE) - DIVERT
      INODE = JNODE
      GO TO 200
C
C         STORAGE DIVERSION IN PRIORITY
C
  240 INODE = NODESC(IUSER,ISOURC)
      INODUP = NODEUS(INODE)
      DO 250 IRES = 1,NRES
      IF (RESID(IRES) .EQ. USRTYP(IUSER)) GO TO 260
  250 CONTINUE
  260 IACCNT = IAKNT(IUSER)
      DIVERT = AMIN1((CAPMAX(IRES)-RESCON(IRES))*TYMFAC,
     1 QAVAIL(INODUP)*60.3,(NUMUSR(IUSER)-SBSTOR(IRES,IACCNT))*TYMFAC,
     2 QUANTY(IUSER,ISOURC)-RESCUM(IRES) )
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      RESCON(IRES) = RESCON(IRES) + DIVERT
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) + DIVERT
      RESCUM(IRES) = RESCUM(IRES) + DIVERT
      GO TO 160
```

```
C
C         DIRECT DIVERSION EXCHANGED TO STORAGE RIGHT
C
  270 IF (TYMFAC .NE. 0.) GO TO 150
      INODE = NODESC(IUSER,ISOURC)
      INODUP = NODEUS(INODE)
      DO 280 JRES = 1,NRES
      IF (RESUSR(JRES).EQ.IUSER .AND. RESSOR(JRES).EQ.ISOURC) GO TO 290
  280 CONTINUE
  290 IRES = NUMRES(JRES)
      IACCNT = ISBACT(JRES)
      INODRS = NODRES(IRES)
      INDRSU = NODEUS(INODRS)
      DIVERT = AMIN1(WANT(IUSER),QUANTY(IUSER,ISOURC)*60.3,
     1 QAVAIL(INODUP)*60.3,QAVAIL(INDRSU)*60.3)
      DO 300 JUSER = 1,NUSERS
      IF (RESID(IRES) .EQ. USRTYP(JUSER) .AND. NSOURC(JUSER) .EQ. 0)
     1 GO TO 310
  300 CONTINUE
  310 DIVERT = AMIN1(DIVERT,CAPMAX(IRES)-RESCON(IRES),
     1 NUMUSR(JUSER)-SBSTOR(IRES,IACCNT))
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 440
      RESCON(IRES) = RESCON(IRES) + DIVERT
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) + DIVERT
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      USED(IUSER,ISOURC) = 1
      DELIVR(JUSER) = DELIVR(JUSER) + DIVERT
      DIVERT = DIVERT/60.3
      DIVRZN(INODRS) = DIVRZN(INODRS) + DIVERT
      ADJUST = 0.
      INODUP = INDRSU
      JNODE = INODUP
      GO TO 170
C
C         GROUND-WATER PUMPAGE
C
  320 INODE = NODESC(IUSER,ISOURC)
C
      DO 330 JGW = 1,MGW
      IF (GWUSER(JGW) .EQ. IUSER .AND. GWSOUR(JGW) .EQ. ISOURC)
     1 GO TO 340
  330 CONTINUE
```

```
C
  340 ISIDE = ISDPMP(JGW)
      DIVERT = AMIN1(WANNT(IUSER),QUANTY(IUSER,ISOURC)*TYMFAC*60.3,
     1 GWSTOR(INODE,ISIDE) )
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 130
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      CALL CMPUTR(-DIVERT,INODE,ISIDE,GWDIST(JGW))
      PUMPAG(IUSER) = PUMPAG(IUSER) + DIVERT
      PUMPG(INODE,ISIDE) = PUMPG(INODE,ISIDE) + DIVERT
      GWPUMP(JGW) = DIVERT
      USED(IUSER,ISOURC) = 1
      GO TO 130
C
C         RESERVOIR RELEASE
C
  350 DO 390 JRES = 1,MRES
      IF (RESUSR(JRES) .NE. IUSER .OR. RESSOR(JRES) .NE. ISOURC)
     1 GO TO 390
      INODE = NODESC(IUSER,ISOURC)
      IRES = NUMRES(JRES)
      IACCNT = ISBACT(JRES)
      RESWNT = WANNT(IUSER)/TRANSL(JRES)
      RELES = AMIN1(RESWNT,RESQNT(JRES)*TYMFAC,SBSTOR(IRES,IACCNT))
C
      IF (USRTYP(IUSER) .LT. 5) GO TO 380
      DO 360 KRES = 1,NRES
      IF (RESID(KRES) .EQ. USRTYP(IUSER)) GO TO 370
  360 CONTINUE
  370 KACCNT = IAKNT(IUSER)
      RELES = AMIN1(RELES,(CAPMAX(KRES)-RESCON(KRES))*TYMFAC,
     1 (NUMUSR(IUSER)-SBSTOR(KRES,KACCNT))*TYMFAC)
      RESCON(KRES) = RESCON(KRES) + RELES*TRANSL(JRES)
      SBSTOR(KRES,KACCNT) = SBSTOR(KRES,KACCNT) + RELES*TRANSL(JRES)
C
  380 IF (RELES .LT. 0.05) RELES = 0.
      RELEAS(IRES) = RELEAS(IRES) + RELES
      RESCON(IRES) = RESCON(IRES) - RELES
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) - RELES
      RESQNT(JRES) = RESQNT(JRES) - RELES
      DIVERT = RELES*TRANSL(JRES)
      RESREL(IUSER) = RESREL(IUSER) + DIVERT
      RESRL(JRES) = DIVERT
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      USED(IUSER,ISOURC) = 1
      DIVERT = DIVERT/60.3
      IF (INODE .LE. NNODE) DIVRZN(INODE) = DIVRZN(INODE) + DIVERT
      GO TO 130
  390 CONTINUE
      GO TO 130
```

```
C
C         IMPORTED WATER
C
  400 INODE = NODESC(IUSER,ISOURC)
      DIVERT=AMIN1(QUANTY(IUSER,ISOURC)*TYMFAC,WANNT(IUSER),
     1 QAVAIL(INODE)*60.3)
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 130
      IF (USRTYP(IUSER) .LT. 5) GO TO 430
      DO 410 IRES = 1,NRES
      IF (RESID(IRES) .EQ. USRTYP(IUSER)) GO TO 420
  410 CONTINUE
  420 IACCNT = IAKNT(IUSER)
      DIVERT = AMIN1(DIVERT,(CAPMAX(IRES)-RESCON(IRES))*TYMFAC,
     1 (NUMUSR(IUSER)-SBSTOR(IRES,IACCNT))*TYMFAC)
      RESCON(IRES) = RESCON(IRES) + DIVERT
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) + DIVERT
  430 IF (DIVERT .LT. 0.05) DIVERT = 0.
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      IMPORT(IUSER) = IMPORT(IUSER) + DIVERT
      USED(IUSER,ISOURC) = 1
      GO TO 130
C
  440 CONTINUE
C
C         CHECK LIST OF USERS TO SEE IF THERE ARE ANY OTHER SOURCES
C
      DO 590 IUSER = 1,NUSERS
      IF (WANT(IUSER) .LE. 0.) GO TO 590
      ISOURC = 0
  450 ISOURC = ISOURC + 1
      IF (ISOURC .GT. NSOURC(IUSER)) GO TO 590
      IF (USED(IUSER,ISOURC) .NE. 0) GO TO 450
C
      IF (WANT(IUSER) .LE. 0.) GO TO 590
      TYMFAC = 1.
      IF (ITIMFC(IUSER,ISOURC) .EQ. 0) GO TO 460
      NTIMFC = ITIMFC(IUSER,ISOURC)
      TYMFAC = TIMFAC(NTIMFC,JMONTH)
  460 CONTINUE
C
      GO TO (450,470,500,550,450,450), ICODE(IUSER,ISOURC)
```

```
C
C         GROUND-WATER PUMPAGE
C
  470 INODE = NODESC(IUSER,ISOURC)
C
      DO 480 JGW = 1,MGW
      IF (GWUSER(JGW) .EQ. IUSER .AND. GWSOUR(JGW) .EQ. ISOURC)
     1 GO TO 490
  480 CONTINUE
C
  490 ISIDE = ISDPMP(JGW)
      DIVERT = AMIN1(WANNT(IUSER),QUANTY(IUSER,ISOURC)*TYMFAC*60.3,
     1 GWSTOR(INODE,ISIDE) )
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 450
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      CALL CMPUTR(-DIVERT,INODE,ISIDE,GWDIST(JGW))
      PUMPG(INODE,ISIDE) = PUMPG(INODE,ISIDE) + DIVERT
      PUMPAG(IUSER) = PUMPAG(IUSER) + DIVERT
      GWPUMP(JGW) = DIVERT
      USED(IUSER,ISOURC) = 1
      GO TO 450
```

```
C
C         RESERVOIR RELEASE
C
  500 DO 540 JRES = 1,MRES
      IF (RESUSR(JRES) .NE. IUSER .OR. RESSOR(JRES) .NE. ISOURC)
     1 GO TO 540
      INODE = NODESC(IUSER,ISOURC)
      IRES = NUMRES(JRES)
      IACCNT = ISBACT(JRES)
      RESWNT = WANNT(IUSER)/TRANSL(JRES)
      RELES = AMIN1(RESWNT,RESQNT(JRES)*TYMFAC,SBSTOR(IRES,IACCNT))
C
      IF (USRTYP(IUSER) .LT. 5) GO TO 530
      DO 510 KRES = 1,NRES
      IF (RESID(KRES) .EQ. USRTYP(IUSER)) GO TO 520
  510 CONTINUE
  520 KACCNT = IAKNT(IUSER)
      RELES = AMIN1(RELES,(CAPMAX(KRES)-RESCON(KRES))*TYMFAC,
     1 (NUMUSR(IUSER)-SBSTOR(KRES,KACCNT))*TYMFAC)
      RESCON(KRES) = RESCON(KRES) + RELES*TRANSL(JRES)
      SBSTOR(KRES,KACCNT) = SBSTOR(KRES,KACCNT) + RELES*TRANSL(JRES)
C
  530 IF (RELES .LT. 0.05) RELES = 0.
      RELEAS(IRES) = RELEAS(IRES) + RELES
      RESCON(IRES) = RESCON(IRES) - RELES
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) - RELES
      RESQNT(JRES) = RESQNT(JRES) - RELES
      DIVERT = RELES*TRANSL(JRES)
      RESREL(IUSER) = RESREL(IUSER) + DIVERT
      RESRL(JRES) = DIVERT
      WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      USED(IUSER,ISOURC) = 1
      DIVERT = DIVERT/60.3
      IF (INODE .LE. NNODE) DIVRZN(INODE) = DIVRZN(INODE) + DIVERT
      GO TO 450
  540 CONTINUE
      GO TO 450
```

```
C
C         IMPORTED WATER
C
  550 INODE = NODESC(IUSER,ISOURC)
      DIVERT=AMIN1(QUANTY(IUSER,ISOURC)*TYMFAC,WANNT(IUSER),
     1 QAVAIL(INODE)*60.3)
      IF (DIVERT .LT. 0.05) DIVERT = 0.
      IF (DIVERT .EQ. 0.) GO TO 450
      IF (USRTYP(IUSER) .LT. 5) GO TO 580
      DO 560 IRES = 1,NRES
      IF (RESID(IRES) .EQ. USRTYP(IUSER)) GO TO 570
  560 CONTINUE
  570 IACCNT = IAKNT(IUSER)
      DIVERT = AMIN1(DIVERT,(CAPMAX(IRES)-RESCON(IRES))*TYMFAC,
     1 (NUMUSR(IUSER)-SBSTOR(IRES,IACCNT))*TYMFAC)
      RESCON(IRES) = RESCON(IRES) + DIVERT
      SBSTOR(IRES,IACCNT) = SBSTOR(IRES,IACCNT) + DIVERT
  580 WANT(IUSER) = WANT(IUSER) - DIVERT
      WANNT(IUSER) = WANNT(IUSER) - DIVERT
      IMPORT(IUSER) = IMPORT(IUSER) + DIVERT
      USED(IUSER,ISOURC) = 1
      GO TO 450
C
  590 CONTINUE
C
      RETURN
      END
```

```
CUNTRSP
C
C       SUBROUTINE UNIT RESPONSE OF RIVER BASIN SIMULATION MODEL
C            WRITTEN BY ALAN BURNS, U.S. GEOLOGICAL SURVEY
C               WATER RESOURCES DIVISION, LAKEWOOD, CO
C                       LATEST UPDATE 9/10/86
C
            SUBROUTINE UNTRSP
            COMMON NMONTH,NINDV,IN,IOUT,IPRINT,IGRAPH,IBATCH,IQW,IMONTH,
           1       JMONTH,IYEAR
            COMMON /PHYSIO/ STCOEF,TRANS,PET(12),DRINK,SESNAL(12),RMILES(100),
           1                EVAP(12),UNIT(5,480),CNVLAT,CVLONG,SNLAT1,SNLAT2,
           2                SNUOS1,SNUOS2,SNUOS3,PREFAC,SEEPFC,PRSPFC,TAILFC,
           3                AGDMND(12),CANLEN(100),RAIN(50)
            COMMON /REACHS/ NNODE,NODEID(100),NXTNOD(100),XLOC(100),YLOC(100),
           1                PLTX(100),PLTY(100),NTRCPT(100,12),SLOPE(100,12),
           2                QWA(100,12),QWB(100,12),INDEPV(100,12),Q(100),
           3                QW(100),CONCFC(100),NODEUS(100),QSUBA(100),
           4                QWSUBA(100),DSA(100),DSB(100)
            REAL NTRCPT
            COMMON /RESPON/ FRSPNZ(100,480,2),TLWATR(100,2),TWCONC(100,2)
      C
            DIMENSION DIST(5)
            DOUBLE PRECISION ZUNIT,A,A2,B,B2,C,C2,ZI,TIME,AERFC,SDF
      C
            DATA DIST /1000.,2000.,5000.,10000.,20000./
      C
            DO 30 J=1,5
            SDF = DIST(J)*DIST(J)*STCOEF/TRANS
            A = 0.5D0*DSQRT(SDF/30.4D0)
            A2 = A*A
            ZUNIT = (2.0D0*A2+1.0D0)*AERFC(A)-1.12838D0*A*DEXP(-A2)
            UNIT(J,1) = ZUNIT
            IF (UNIT(J,1) .LT. 0.) UNIT(J,1)  =  0.
            DO 10 I = 2,480
            ZI = I
            TIME = 30.4*ZI
            A = 0.5D0*DSQRT(SDF/TIME)
            A2 = A*A
            B = 0.5D0*DSQRT(SDF/(TIME-30.4D0))
            B2 = B*B
            C  =  0.0D0
            IF (I .NE. 2) C = 0.5D0*DSQRT(SDF/(TIME-60.8D0))
            C2 = C*C
            ZUNIT = ((2.0D0*A2+1.0D0)*AERFC(A)-1.12838D0*A*DEXP(-A2))*ZI-
           1((2.0D0*B2+1.0D0)*AERFC(B)-1.12838D0*B*DEXP(-B2))*(ZI-1.0D0)*2.0D0
           2 +((2.0D0*C2+1.0D0)*AERFC(C)-1.12838D0*C*DEXP(-C2))*(ZI-2.0D0)
            UNIT(J,I) = ZUNIT
            IF (UNIT(J,I) .LT. 0.) UNIT(J,I)  =  0.
         10 CONTINUE
```

```
   30 CONTINUE
C
      DO 40 INODE = 1,NNODE
      DO 40 ITIME = 1,480
      DO 40 ISIDE = 1,2
   40 FRSPNZ(INODE,ITIME,ISIDE) = 0.
C
      RETURN
      END
```

```
      DOUBLE PRECISION FUNCTION AERFC(Z)
C
C         COMPLIMENTARY ERROR FUNCTION
C
      DOUBLE PRECISION A1,A2,A3,A4,A5,A6,Z
      IF (Z.LT.0.) WRITE (1,1000)
      IF (Z.LT.0.) STOP
      AERFC=0.0D0
      IF (X.GE.4.) GO TO 10
      A1=0.0705230784D0
      A2=0.0422820123D0
      A3=0.0092705272D0
      A4=0.0001520143D0
      A5=0.0002765672D0
      A6=0.0000430638D0
      AERFC = 1.0D0/(1.0D0+Z*(A1+Z*(A2+Z*(A3+Z*(A4+Z*(A5+Z*A6)))))**16
   10 CONTINUE
      RETURN
C
 1000 FORMAT (53H NEGATIVE ARGUEMENT FOR COMPLEMENTERY ERROR FUNCTION )
      END
```