THESIS

STREAMFLOW SYNTHESIS AND WATER ALLOCATION BY WATER RIGHT PRIORITIES

Submitted by

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In partial fulfillment of the requirements

for the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Spring, 1980

COLORADO STATE UNIVERSITY

Spring, 1980

WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY WILLIAM KENT HOLT ENTITLED STREAMFLOW SYNTHESIS AND WATER ALLOCATION BY WATER RIGHT PRIORITIES BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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ABSTRACT OF THESIS

STREAMFLOW SYNTHESIS AND WATER ALLOCATION BY WATER RIGHT PRIORITIES

A computerized streamflow model was developed that allocates water by the doctrine of prior appropriations. The function of the model is to simulate the impacts of physical or legal changes in a stream system managed on the basis of priority of water rights.

Given a specified value of streamflow and a desired level of demand, the model predicts the amount of water available to individual users.

The model has been applied to the White River in Colorado. Results indicate that the model is a useful tool in predicting streamflows and water availability for individual users.

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ACKNOWLEDGMENTS

This thesis is only partially creditable to the author. Due to the help and influence of others, the process kept in motion. Along with much needed guidance, R.A. Longenbaugh provided encouragement and the necessary prodding. The other members of the graduate committee, Dr. W.D. Striffler, and Dr. F.M. Smith, must also be thanked for their support and advice. Dr. Ivan Wymore and Dr. Duong Nguyen were very patient while providing a great deal of technical assistance.

The staff of the Colorado Water Data Bank had a few good laughs over my approach to computer language, but always were willing to help diagnose problems. A special thanks to Wesley Signs, Division 6 Engineer, whose imagination and solid judgement provided invaluable insight concerning water administration.

Financial support was provided by the Federal Energy Administration (FEA contract CA-050041-00), the Colorado Energy Research Institute (CERI contract 047-17), the Colorado Division of Water Resources, the Colorado River Water Conservancy District, and Chevron U.S.A., Inc.

Others willingly contributed their time and talents to keep the ball rolling. Many thanks to those individuals and especially to Gail Frick, Linda Signs, and Karen McPherren who helped with the typing and organization.

The last and largest "thank-you" must go to my wife Grace who not only did much of the typing, but also gave encouragement and understanding throughout what proved to be a rather long, but valued, experience.

STREAMFLOW SYNTHESIS AND WATER ALLOCATION BY WATER RIGHT PRIORITIES

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I. INTRODUCTION

The increasing use of water, particularly in the arid areas of the western United States is creating much concern among competing users of limited water supplies. The Colorado River basin is a prime example in which existing and potential uses demand more water than the system can produce.

The increasing development of the vast oil shale and coal reserves in the upper Colorado basin will place a tremendous strain on the existing water resources. Also, additional uses in the form of trans-mountain diversions, municipal and irrigation requirements, and instream uses will cause further competition for available water. Planners and decision makers must take these and other factors such as water quality, compacts, treaties, and local water laws into account in order to pick the best possible alternatives for development and management of the water supplies.

Proper forecasting of impacts caused by changes in use patterns on any stream system is invaluable in order to maximize the use of limited supplies. Due to the very nature and complexity of the systems, computer simulation or modeling of those systems is a valuable tool in assessing the various aspects related to water planning. Simulation by computer allows planners to handle the large amounts of data associated with the complex physical interactions composing a stream system and enables users to generate essential information unavailable by other techniques. The information can then be used by the decision makers to pick the best solution among the many alternatives with a greater confidence in the outcome.

Many models have been built to handle the types of problems involved in hydrology and other disciplines related to water management. One of the areas where study is needed, concerns the interaction between streamflow simulation and the actual allocation of water. This interaction is extremely important as water supplies are allocated in most of the western United States by laws relating to the prior appropriations doctrine meaning "first in time, first in right". Limited supplies are allocated on the basis of the priority of water rights held by the user.

The amount of water any individual user is entitled to at a given instant of time depends on both the amount of streamflow and the amounts and priorities of the water rights involved. These priorities are based on the date assigned to the water right when the right was granted. Each individual state has jurisdiction over waters within its boundaries, and there is considerable non-uniformity in the laws between the states. However, the premise of prior appropriations is valid, the earlier the date, the better the right.

The simulation technique presented here is an attempt to link the administrative system used in Colorado, a prior appropriation state, with the physical system . Each system acts as a constraint on the other.

The approach taken in this study is to apply an accounting process for the simulation of flows on a single stream. Actual physical processes are not handled on an individual basis but are input as aggregate values which are used in the calculation of either inflow or outflow values.

The ability to determine which of the water rights would be allowed to divert water, assuming various stages of water resource development, is one of the most useful features of the model. The availability of water depends on the priority and amount of the individual right in relationship to the physical characteristics of the watershed above the point of diversion.

Under a given set of conditions the model is useful in evaluating the amount of water available for specific water rights, assuming that the following types of changes are introduced into the system:

1. New diversions.
2. Changes of locations in diversions.
3. Minimum flow restrictions for compacts or environmental requirements.
4. Changes in type of use for existing diversions.
5. Changes in irrigated acreage for agricultural diversions.
6. Effects of increased or decreased flows into diversions.
7. Effects of increased or decreased streamflows.
8. Changes in location of irrigation return flows.
9. Increased or decreased irrigation efficiency.

The primary assumption in the design of the system is that the model will be applicable to stream systems in the upper Colorado River basin or other similar watersheds where limitations to water use are the physical availability of water and the concept of water rights as defined by the prior appropriations doctrine.

II. STUDY AREA DESCRIPTION - WHITE RIVER BASIN

A. Physical System

The White River basin in northwestern Colorado covers approximately 4,000 square miles (Fig. 2.1). The river is tributary to the Green River in Utah, and is part of the Colorado River system.

Elevations within the basin vary from almost 12,000 ft. to less than 5,000 ft. (Fig. 2.2). This extreme elevation difference directly affects the precipitation amounts and distribution at any given location (Fig. 2.3).

Stream hydrographs in the White River are typified by good base flows with higher flows in May, June and July resulting from snowmelt runoff (Fig. 2.4). The majority of the water originates from a relatively small area at the eastern end of the basin. This area varies in elevation from about 8,000 to 12,000 ft. above sea level.

There are about 30,000 acres of irrigated land in the basin (Fig. 2.5). The region of most concentrated irrigation lies in a band approximately one mile on either side of the White River in the central portion of the basin. This strip is about 25 miles long in the vicinity of the town of Meeker at about 6,000 ft. in elevation. Almost all of the water is currently used for production of grass or alfalfa hay crops on land located along the river bottoms or on low terraces that lie at the base of steep hillsides. The climate of this region is typified by cold winters and warm dry summers. The mean annual precipitation is about 12-15 inches with some snow accumulation in most winters. The growing season is limited by frost and generally runs from about the first week in May through the first week in September.

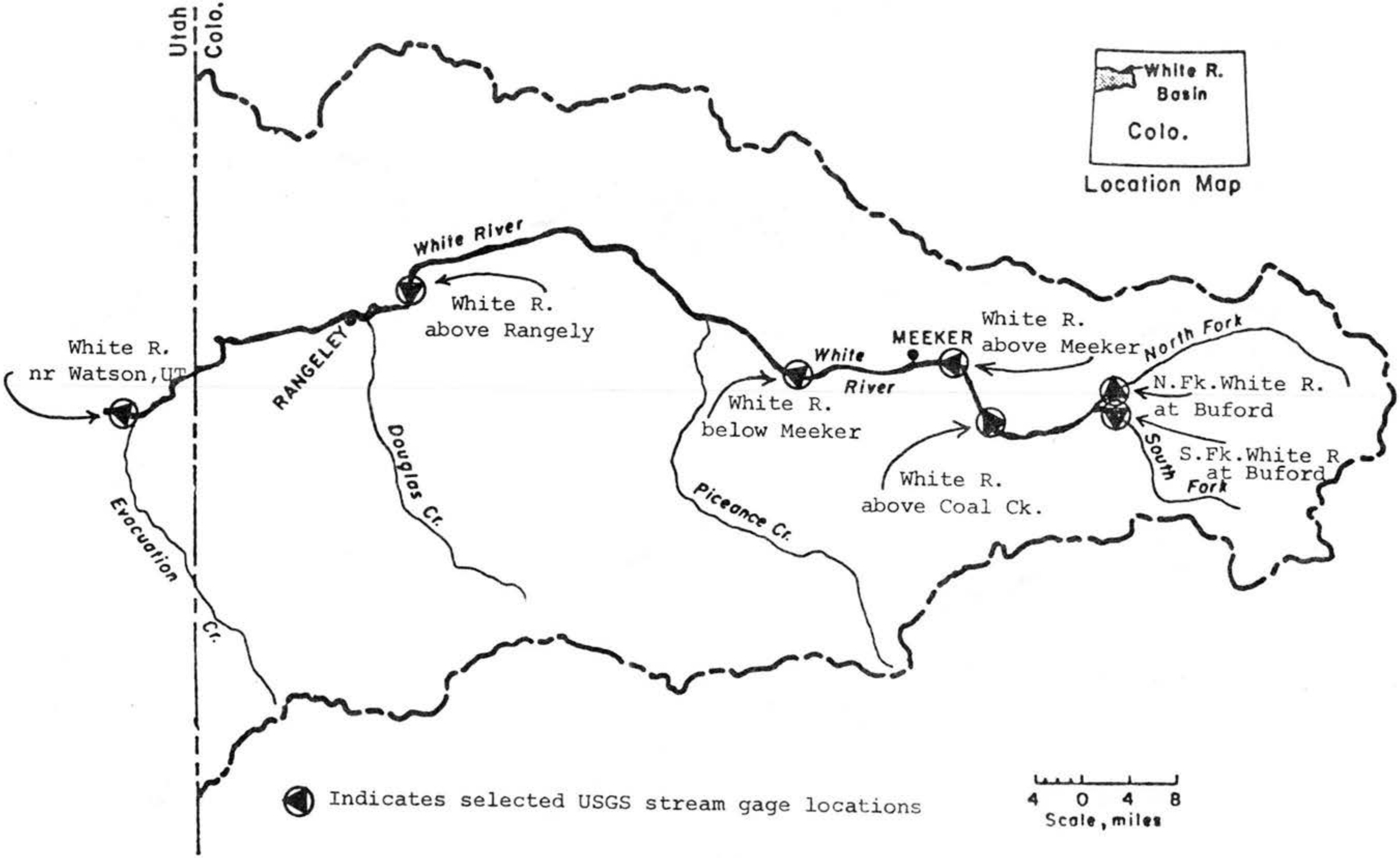

Figure 2.1 White River Basin

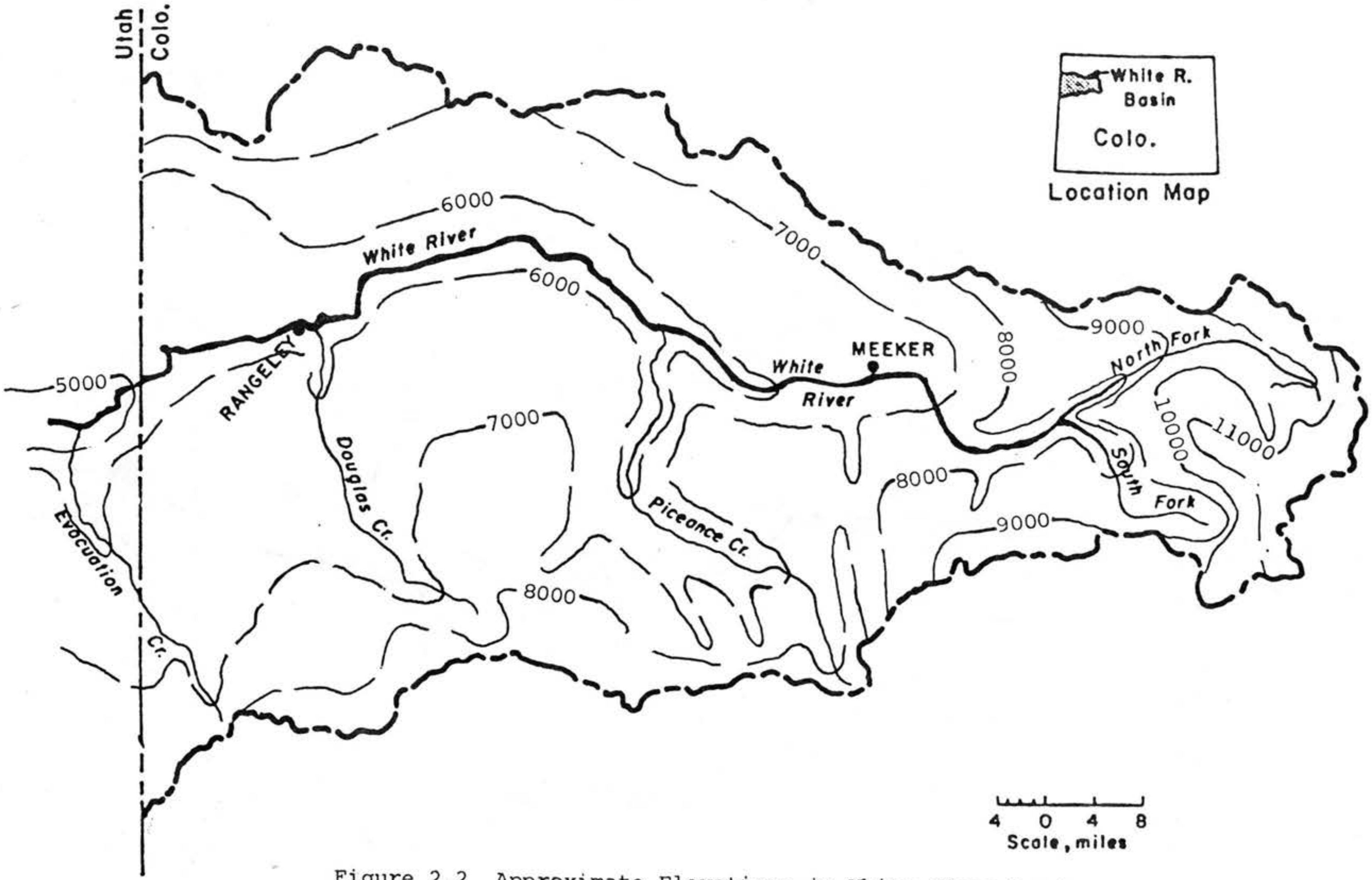

Figure 2.2 Approximate Elevations in White River Basin
(Contour intervals in 1000 feet)

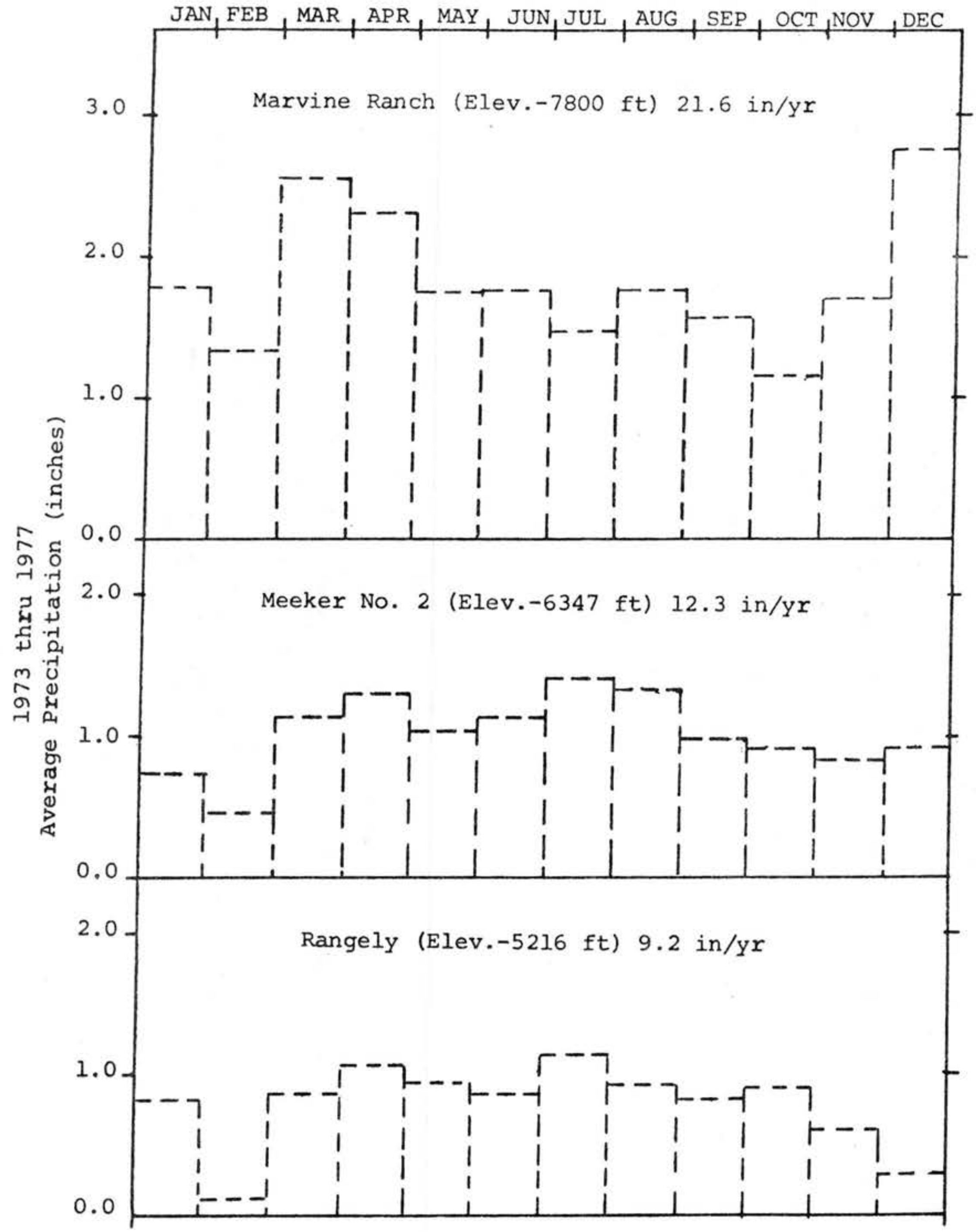

Figure 2.3 Monthly Precipitation for Selected Weather Stations in the White River Basin

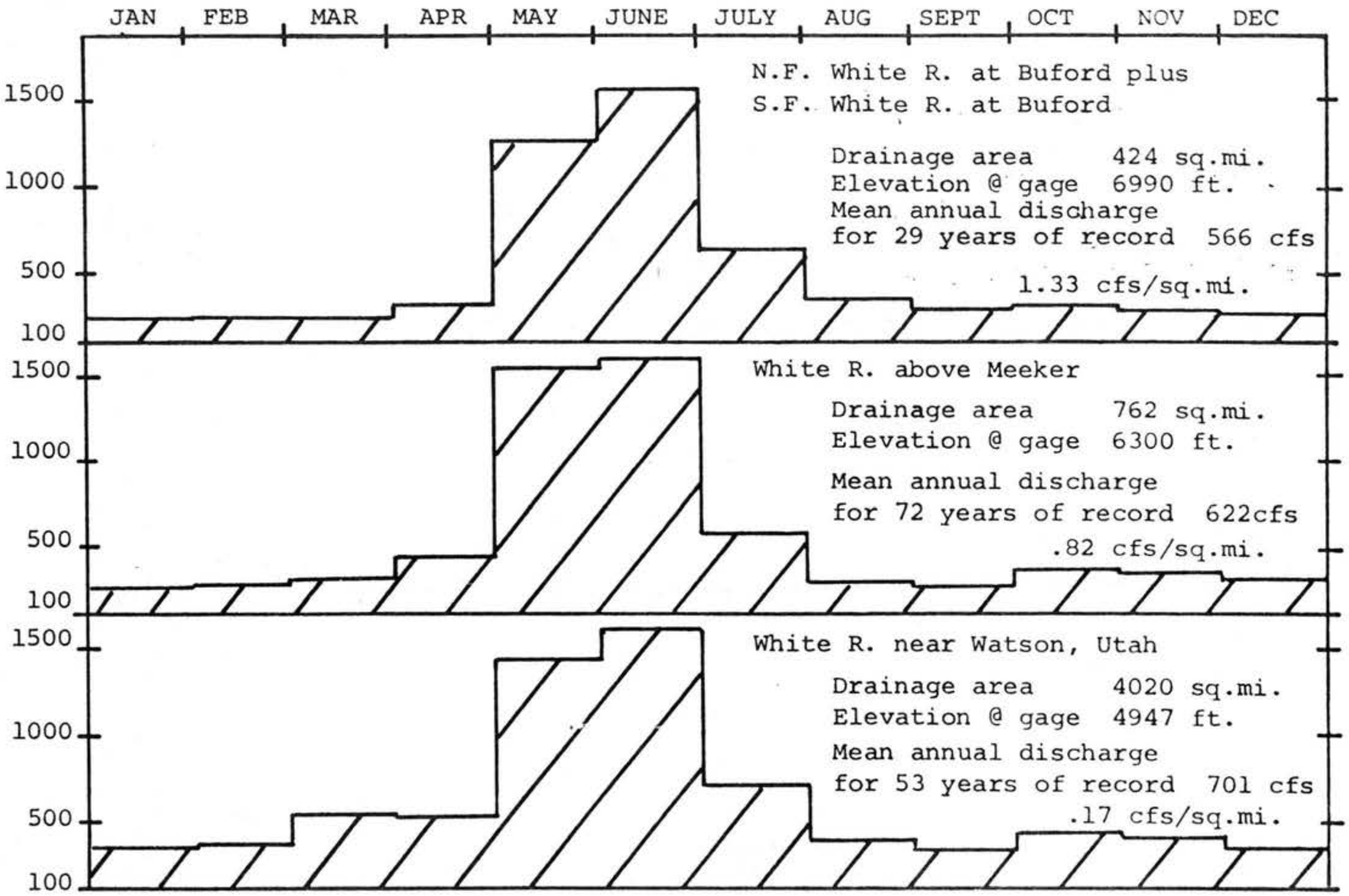

Figure 2.4 Mean Monthly Flows - 1973 thru 1977 Water Years
for Selected USGS Gaging Station Data

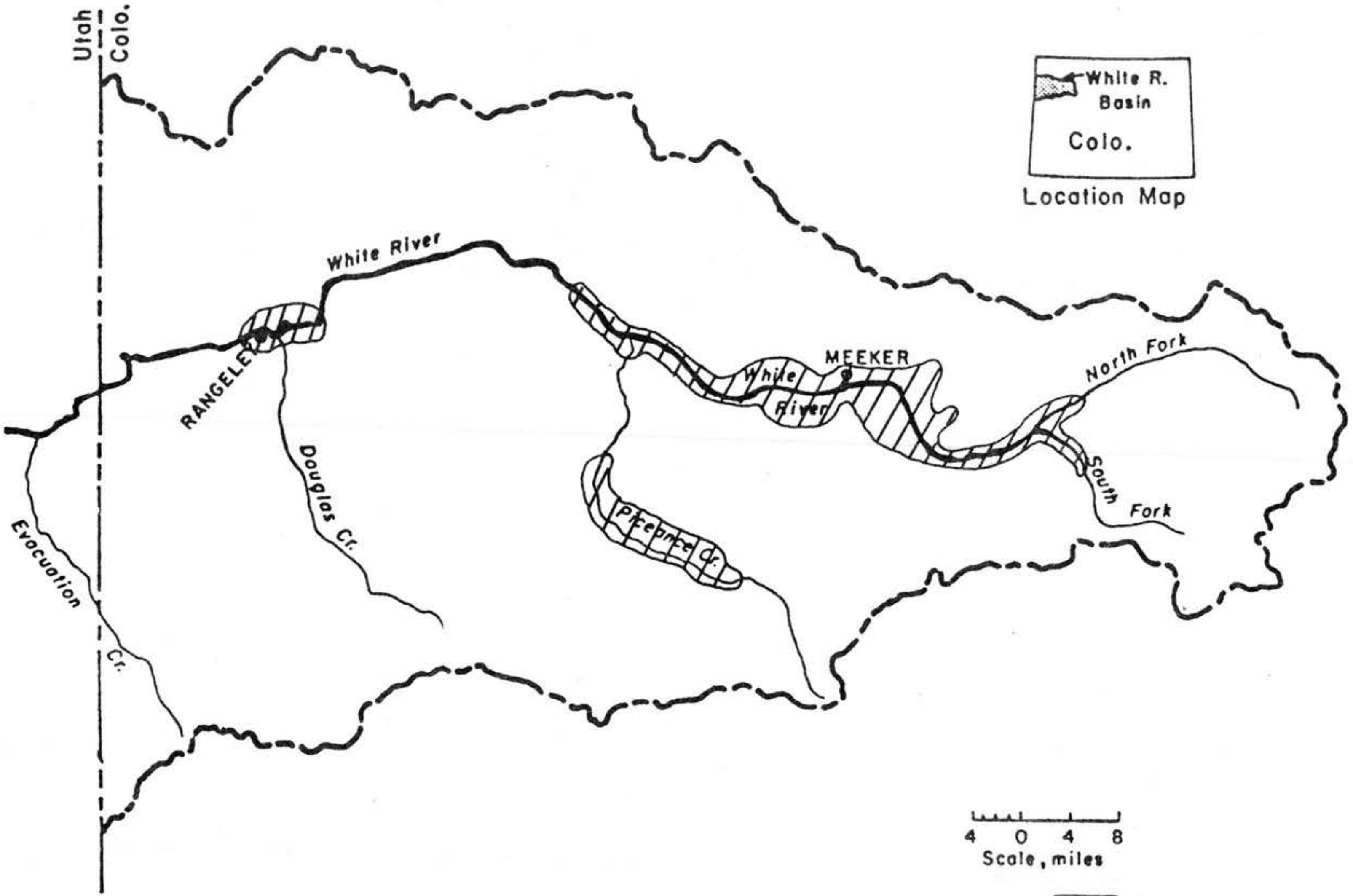

Fig 2.5 Location of Significant Irrigated Areas In the White River Basin

The lower end of the basin extending westerly into Utah is a dry semi-desert environment. Limited irrigation is practiced in this unit due to generally poor soils and rough topography.

The Piceance basin is a sub-unit of the White River and lies along the south central border of the larger basin. At present the primary use of this area is grazing with some bottomland irrigation that is limited by short water supplies. This area contains vast amounts of potential oil reserves locked in the shale of the Green River formation. It is this potential energy source plus the significant coal deposits along the northern boundaries of the White River basin that pose a threat of conflict between competing water users.

Water requirements for new energy-related industry will consume large amounts of previously unused water. Presently, of the half million acre feet of runoff produced by the White River, only about 50,000 AF are consumed as a result of man-related activities. Approximately 90% of this amount is accounted for in irrigation practices. This leaves a considerable amount of water available for future energy-related uses, assuming that legal, social, and economic constraints do not prevent such activities

B. Legal System

Colorado, as do all other western states, bases its water law on the prior appropriations doctrine. The doctrine implies that those appropriating water first will not be deprived of that water by subsequent users. In times of insufficient supplies those users with the earliest priorities enjoy the available water at the expense of those with the latest priorities who must go without. The basin rank concept used in the model is a numerical ranking of the relative priority of a particular water right within a given stream system. A senior water right will have lower basin rank number than a junior water right. This number is generated by the Colorado water data bank and complies with the statutes of Colorado state law.

Different types of water rights exist within the Colorado legal framework. Absolute rights are those that have been perfected by applying the water to beneficial use. It is the conditional water rights that cause the uncertainties in water resource planning. While the absolute direct diversions in the White River basin total about 2600 cfs, the conditional water rights total over 5500 cfs. The average discharge of the White River at Watson, Utah is only 700 cfs.

In addition to the freeflow or direct rights, there are also a multitude of storage rights decreed in the White River drainage. Again, the majority of these are conditional rights that would, by themselves, severely over-appropriate the basin if all the proposed projects were built.

III. STRUCTURE OF MODEL

A. General Methodology

The model, called the DISTRIW model, is a group of routines that simulate the actual allocation of available water flowing in a stream. The amount allocated to an individual user depends on several constraining parameters: the desired diversion demand, the magnitude of the streamflow, and the water rights held by the user.

The physical routines route water down the stream, add or subtract accretion water, add tributary water, subtract diverted water, and redistribute calculated return flows. The administrative routines are designed to reallocate water from one user to another based on a comparison of water rights.

The model uses the mass balance concept to account for all gains and losses of water from a stream system. The model is initialized at a point of known streamflow at the upstream end of the selected stream system. The program then moves downstream to each successive control point; a control point being a point of diversion, point of known flow, or a point of required flow, adding or subtracting all gains and losses to the system. A diagram of the type of stream system the model is designed to simulate is shown in Fig. 3.1.

Should the amount of water be less than the desired amount at a control point, the operation switches to a water administration routine. This routine will take away water from upstream diversions that have either insufficient rights for the amount of diverted water, or whose water rights are junior to the active control point downstream

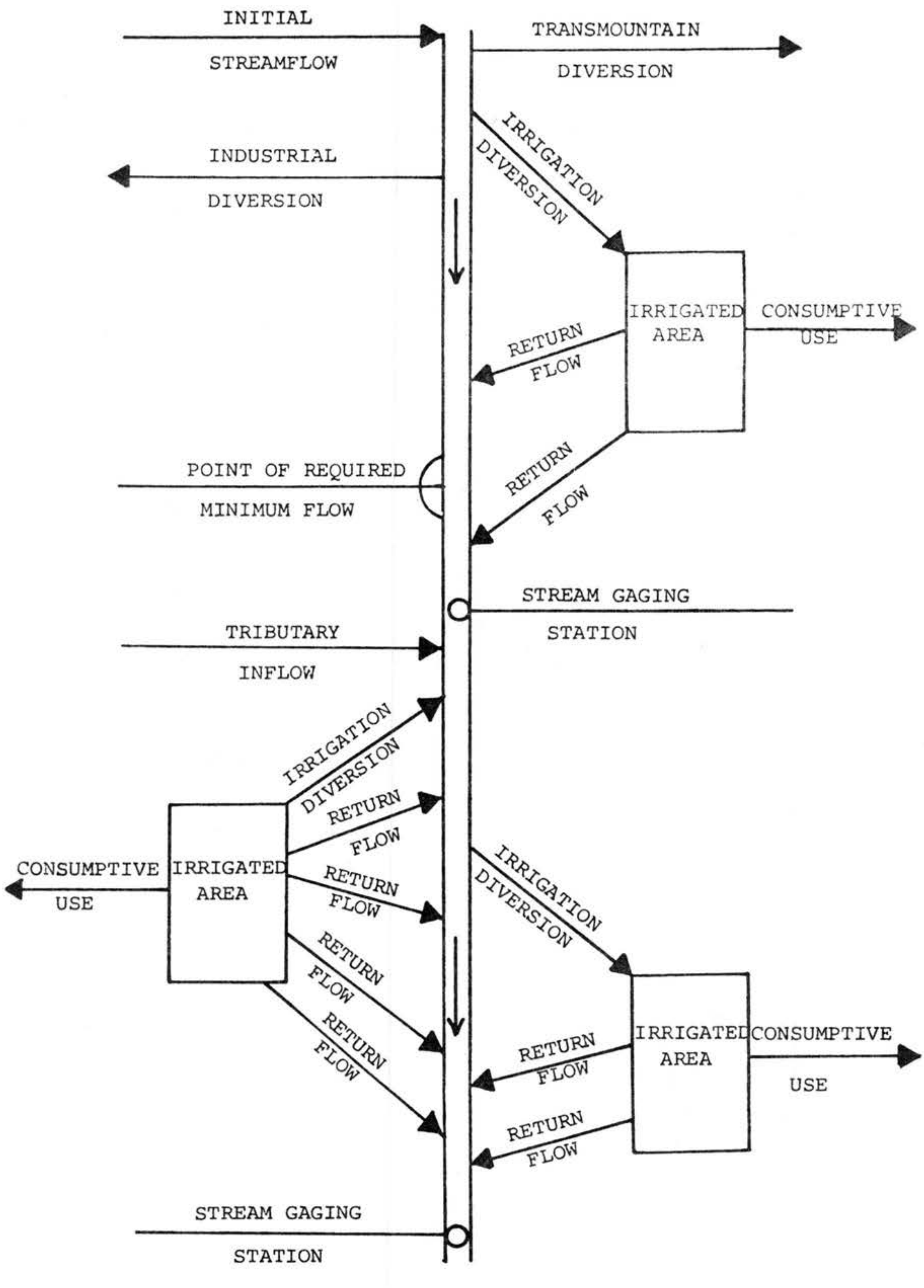

Figure 3.1. Section of a typical stream system.

where the shortage occurs. Once water is taken away from an upstream diversion the model will route the water from the upstream control point to the downstream control point, readjusting all flow values in between. Successive iterations may be necessary until the downstream control point is satisfied or no more junior diversions can be curtailed.

Different types of control points can be handled by the model. An irrigation control point is used to describe an irrigation diversion where part of the total water diverted from the stream is consumed and the remainder is returned to the stream.

Total consumptive control points have all diverted water lost from the system. The water injected for secondary oil recovery at Rangeley would be one example. Transmountain diversions out of the basin would also be in this category. Minimum flow control points such as for compacts or fishery requirements can also be considered. It is assumed that these control points would be non-consumptive. The last type of control point is a non-active control point. This would be a point of known flow such as a streamgage with no physical or legal impact on the stream. Non-active control points are used to tune the model to historic data.

Linkage within and between components is provided by the use of a unique identification number attached to all parameters for each control point. Control point parameters and their function within the model are described in Table 3.1.

Tributaries are not considered as control points, but their flows are added into the mainstem streamflow at the point of confluence. Tributary data are also linked by identification numbers as shown in Table 3.2.

TABLE 3.1

CONTROL POINT PARAMETERS

1. Identification number - unique to each control point.
2. Stream mile - describes relative position of each control point on the stream.
3. Elevation - used in computing irrigation consumptive use.
4. Name of control point.
5. Irrigated acreage - used in computing irrigation consumptive use.
6. Return flow fractions - used in redistributing computed irrigation return flows back to the stream (one to four values per control point).
7. Return flow stream miles - used in redistributing computed irrigation return flows back to the stream (one to four values per control point).
8. Desired amount - desired diverted amount at the point of diversion of a control point. For a minimum flow control point this is the desired streamflow passing that point.
9. Water rights - used to reallocate short water supplies. For any individual right the following parameters are necessary:
    a. Identification number of control point.
    b. Basin rank - describing relative seniority of the right.
    c. Decreed amount - amount of flow the control point is entitled to under the water right.

TABLE 3.2

TRIBUTARY PARAMETERS

Tributary Parameters

1. Identification number
2. Name of tributary
3. Stream mile on mainstem that tributary occurs
4. Inflow to mainstem

All identification numbers were supplied by the Colorado Water Data Bank, District 43 subset.

B. Consumptive Use and Return Flows

Estimates of consumptive use and return flow for individual control points are based on potential consumptive use calculations from the CONSUMP program and irrigated acreage. Under full water supply situations

$$CU = (PCU)(A) \qquad (1)$$

$$RF = DQ - CU \qquad (2)$$

where

CU = Consumptive use

PCU = Potential consumptive use per unit of irrigated surface area

A = Surface area irrigated

RF = Return flow

DQ = Diverted amount

In mountain areas such as the White River, the climatic conditions will cause variations in the potential consumptive use from the upper end of the basin to the lower. Contrasts in crop types, precipitation, temperature, and other factors influencing evapotranspiration rates can be dramatic from one location to the next. Adjustments in potential consumptive use are made according to elevation.

$$PCU_A = PCU_B + \Delta PCU\,(EL_B - EL_A)$$

where

PCU_A = Potential consumptive use of the irrigated area (volume per unit time per unit irrigated area)

EL_A = Elevation at which PCU_A will be calculated

PCU_B = Potential consumptive use at midrange elevation of the basin (volume per unit time per unit irrigated area)

EL_B = Elevation at which PCU_B is calculated

PCU = Change in potential consumptive use per unit of elevation (volume per unit time per unit irrigated area per unit elevation)

The rate of change in potential consumptive use was derived from linear regression equations. The data was supplied by the CONSUMP program for various regions within the study reach. This relationship for July and August of 1975 can be seen in Fig. 3.2.

In the White River basin most irrigation practices will actually apply much more water than is actually necessary for crop production. However, one of the goals of this program is to demonstrate the effects of a reallocation in short water supply situations. Hence, it is necessary to have the capability to synthesize results of short water supplies on diverted amounts, consumptive use, and return flows. Under short water supply situations the consumptive use and return flow are calculated as a percentage of the total water diverted, and are no longer a function of potential consumptive uses and irrigated area.

$$RF = (PRT)(DQ)$$

$$CU = (1 - PRT)(DQ)$$

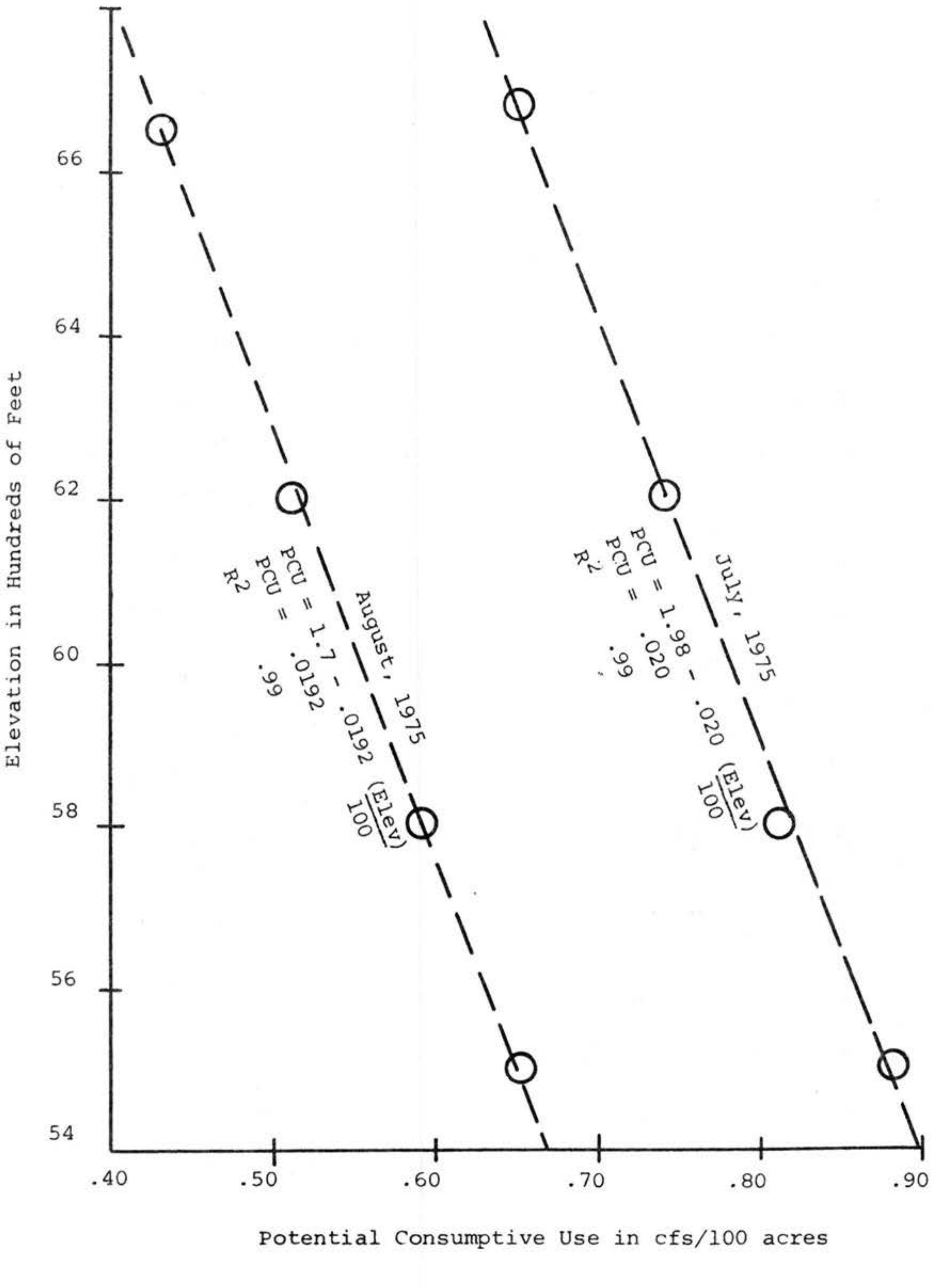

Figure 3.2 Computed Consumptive Use at Various Elevations

where

RF = Return flow (volume per unit time).

DQ = Diverted amount (volume per unit time).

CU = Consumptive use (volume per unit time).

PRT = Lower limit of return flow (dimensionless).

The percent of total return flow, PRT, is a direct input and describes average irrigation system efficiency in short water supply situations. The purpose is to limit the amount of return flow to a specific portion of the total irrigation water for those diversions with insufficient water supplies. This limit is controlled by a number of factors including soil types, crop types, climatic features, topography, irrigation method, and economic considerations. Setting this limit at a value lower than the calculated value under historic conditions of full water supply implies that a certain increase in efficiency is possible. Given that an irrigator is partially cut off from all of the water he has historically diverted, the assumption is that he will improve his efficiency with the remaining supply until the limit is reached where further improvement is uneconomical.

A graphical explanation can be seen in Fig. 3.3 of both consumptive use and return flows. Picking the value of the PRT is at least partially subjective due to data limitations. The value lies somewhere between the value that is calculated for historic data in the White River basin and values documented in other areas where short supplies and high efficiencies are the rule.

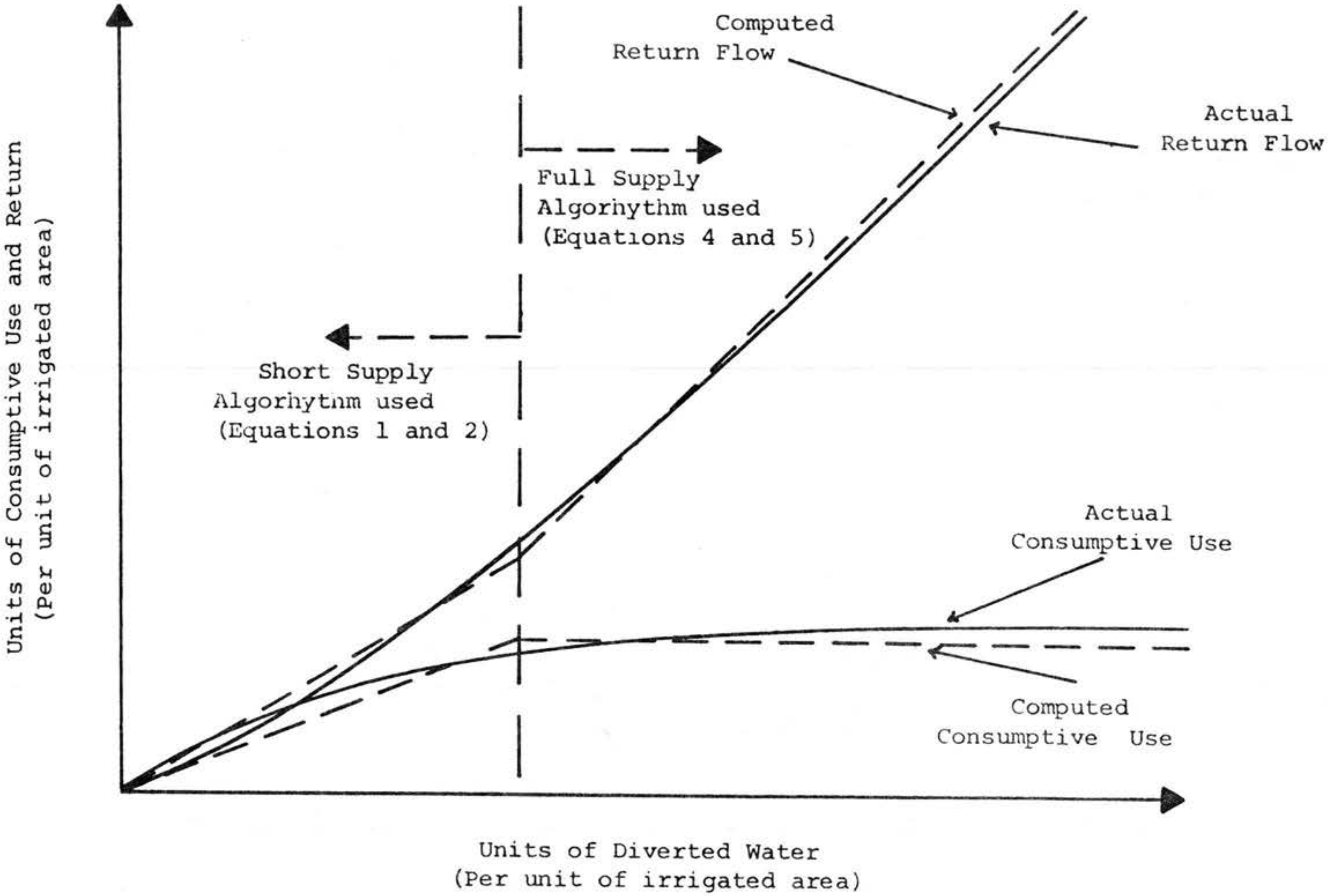

Figure 3.3 Hypothetical Consumptive Use and Return Flow Relationships

C. Streamflow Routing

The routing components in the model are based on mass balance procedures. The model operates with average monthly flow rate data, hence lag times in streamflow between control points and lag times in irrigation return flows are ignored and assumed to be instantaneous. Water is routed down the stream as a fixed value changing only when inflow, return flow, or accretion water are added or when water is diverted out of the stream. Inflows can be either tributary inflows or return flows from irrigation. Water diverted out of the river may be either totally consumed or partially consumed, depending on the type of control point. If the control point is for irrigation the diverted amount will be subtracted from the streamflow. The consumptive use and return flow will then be calculated using either the full or short supply algorithm. The calculated return flow values are split into as many as four parts and stored. These stored values will be added back to the streamflow at some downstream control point or points, depending on the stream mile at which the model is working.

If the control point is determined to be totally consumptive, the diverted amount will be subtracted from the streamflow, and the model will proceed to the next downstream control point. In the case of minimum flow control points or non-active control points, no action is taken, and the process moves immediately downstream.

D. Reallocation by Priority of Water Right

The reallocation routine is based on procedures used by the Colorado Division of Water Resources to administer all waters within the boundaries of the state. Similar procedures are used in all other states where the doctrine of prior appropriations governs the concept of water rights.

This routine allows for a reallocation of surface water when shortages exist. The reallocation process is set to conform with the concept of priority of rights, that is, first in time, first in right. The ranking of water rights by priority is assigned using a combination of decree date and the appropriation date assigned by the court at the time of adjudication. The ranks, also called basin ranks, used in the White River basin were assigned by a computer program from the Colorado Water Data Bank.

The first link to the water right component is implemented in the routing component of the model. Here the amount of water diverted to a control point is assigned to the water rights attached to the control point. A control point may or may not have any water rights, and there is no limit on the number of water rights for a control point. The assumption is made that water will be assigned to the senior water right first, and any remaining water will be assigned to the next most senior right, etc. If more water is diverted than the sum of the water rights, the difference is considered as an undecreed supply (i.e., no water rights).

As the model is proceeding downstream from control point to control point, the desired amount for each control point is checked against the amount of streamflow immediately above the control point. If there is sufficient water in the stream to supply the desired amount at the control point, the model will continue normally in the routing routine.

Should there be insufficient streamflow to supply the control point, the model switches to the reallocation routine.

The first step in the reallocation routine is to indicate the amount of shortage, commonly named "call", and the priority or basin rank of the call. The purpose of this is to identify the shortage and rank of the most senior water right that would be unsatisfied in relation to streamflow and the desired amount for the control point. A flow chart of the logic is shown in Fig. 3.4.

Once the call and its corresponding basin rank have been identified, the model then proceeds back upstream, checking each upstream control point for undecreed water. If undecreed water is found, this water is subject to curtailment. This curtailment of any diverted water is commonly called the "cut". If no undecreed water is found, the program then searches all water rights in reverse order (i.e., largest basin rank number first) for the following criteria:

1. Basin rank greater than basin rank of call.
2. Control point with corresponding ident must be upstream of calling ditch.
3. Supplied amount greater than zero.
4. Control point with corresponding ident must not be a minimum flow control point.

The purpose of this search is to find the most junior upstream water right diverting water that is depleting streamflow. If a junior water right is found meeting these specifications, then the control point attached to this water right is subject to a cut. Should no such rights be found, the program will go back downstream to the point of

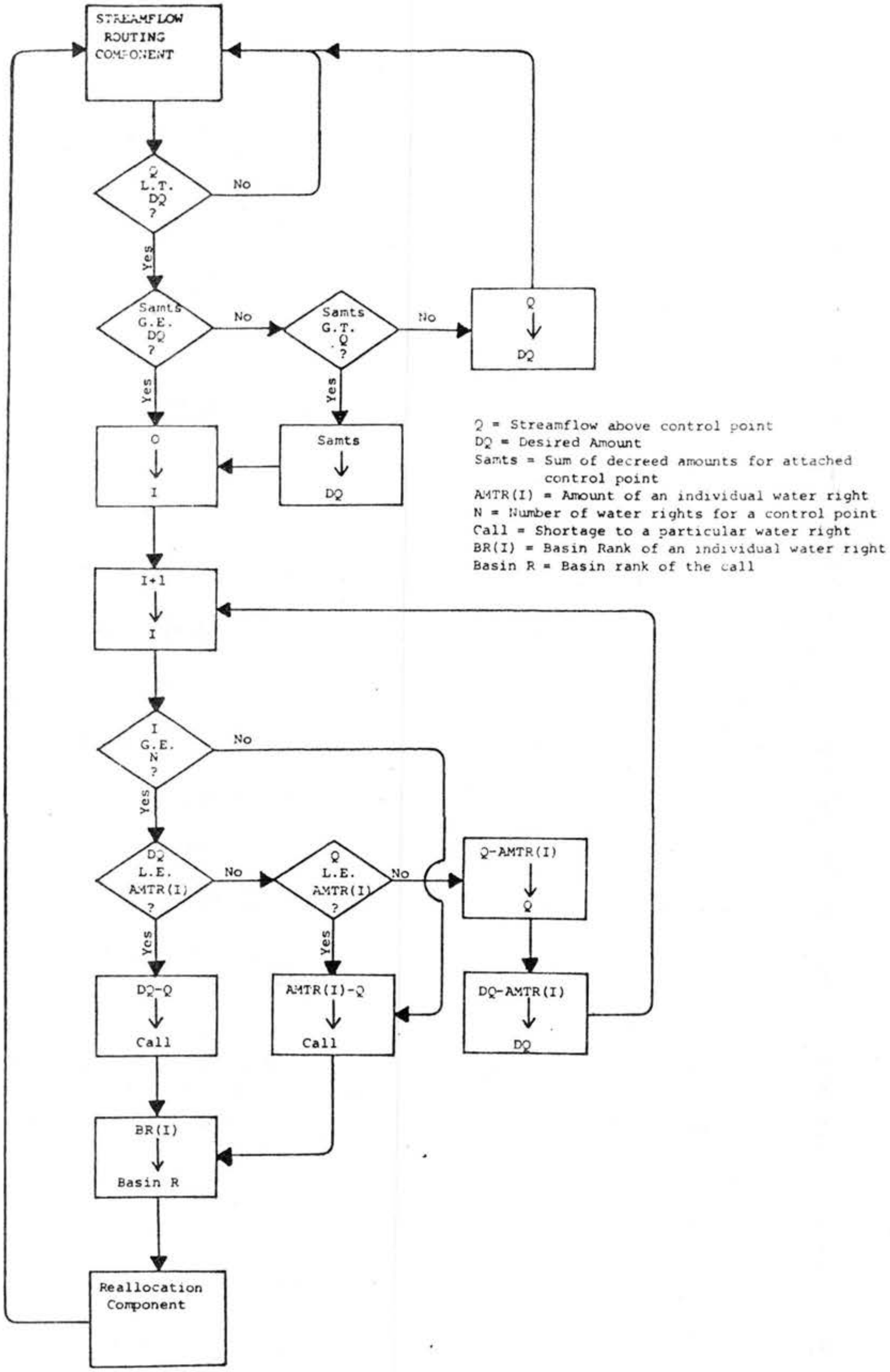

Figure 3.4 Logic diagram for "call" identification.

shortage, setting the desired amount equal to the streamflow and returning to the routing module.

Computing the amount of water to be cut from a control point with either an undecreed supply or a junior water right is one of the more complex subroutines in the program. The amount of water to be cut may or may not be equal to the amount of water called, but is limited to the total undecreed supply or supplied water to the junior water right. The maximum amount of water that could be cut from any diversion would be the sum of all undecreed water plus water diverted under water rights with basin ranks larger than those identified in a call. Determining the total amount of water cut from any structure may require successive iterations through both the routing and reallocation routines.

The type of upstream control point, the location of return flows, the irrigation efficiency, and the potential consumptive use are all factors in computing the amount of water to be cut. Assuming that the upstream control point is either a total consumptive use diversion or an irrigation diversion with all return flow returning below the calling ditch, then the computed cut will be equal to the call. If the upstream diversion is an irrigation diversion and all of the return flow is back in the stream above the calling ditch, then the computed cut will be equal to the change in total diversion that results in the change in consumptive use being equal to the call. If the upstream irrigation diversion has return flows both above and below the calling ditch, then a combination of both previous cases would apply.

The stream and ditch configuration in Fig. 3.5 is an example of the first type of situation, the call being equal to the cut. Assume the following conditions exist:

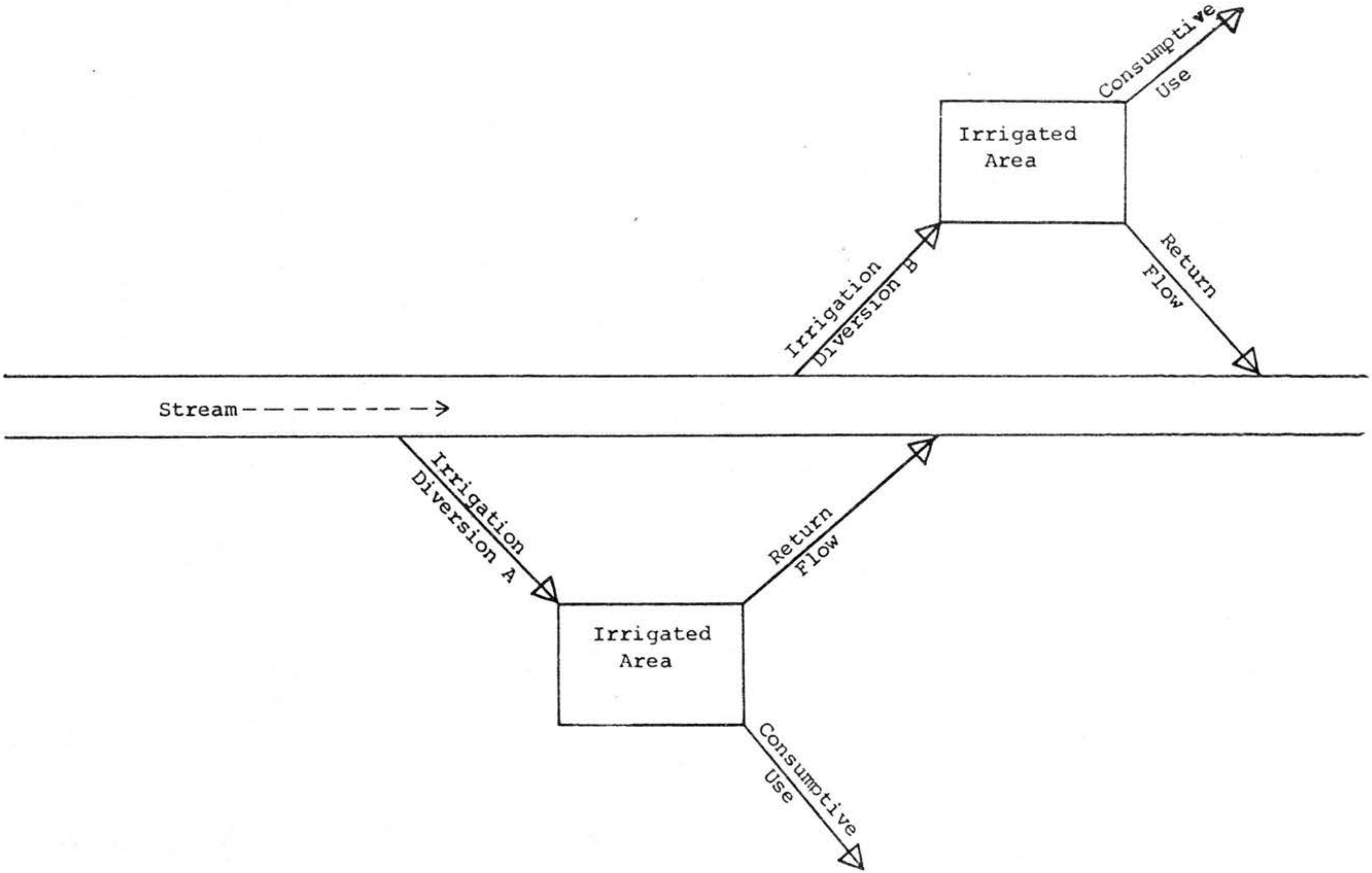

Figure 3.5 Case I: Return Flow from Diversion A below Diversion B

1. Potential consumptive use = .01 cfs/acre.
2. Lower limit of return flow (PRT) = .50.
3. Forty cfs in stream above Ditch A.
4. Ditch A has 1000 acres and is presently diverting 30 cfs with the 10 cfs consumptive use and 20 cfs of return flow.
5. Ditch A has the following water rights:

BASIN RANK	DECREED AMOUNT	ASSIGNED AMOUNT
1	10 cfs	10
3	30 cfs	20

6. Ditch B has 1000 acres and desires to divert 40 cfs with the following water rights:

BASIN RANK	DECREED AMOUNT
2	40 cfs

There will be 10 cfs in the river immediately above Ditch B. The call on the river from basin rank no. 2 would be 30 cfs. The program would identify Ditch A as having the most junior water right and would thus be subject to a cut.

Since the return flow from Ditch A is all below Ditch B, the calculated cut will be equal to the call (30 cfs). However, the assigned amount to basin rank 3 is less than the cut. The actual cut is then limited to 20 cfs and Ditch A would be curtailed by this amount. Ditch A now has 10 cfs of remaining diversion. This would indicate a short water supply situation as the calculated percentage of the return flow using the full water supply algorithm is less than the lower limit of return flow. Therefore, the new diversion components for Ditch A are:

CONUSE = (.5)(10) = 5 cfs

RETURN FLOW = 10 - 5 = 5 cfs

The diverted amount now to Ditch B is 30 cfs, and, while less than the desired amount, it is still a full water supply situation because the consumptive use has not been reduced.

CONUSE = (.01)(1000) = 10 cfs

RETURN FLOW = 30 - 10 = 20 cfs

Case 2 (Fig. 3.6) is identical to Case 1, except the assumption here is that all the return flow is back in the river above Diversion B. This now gives 30 cfs in the river above Ditch B, and the call will be 10 cfs. The computed cut from Ditch A will now depend on the change in consumptive use caused by the cut. The equation for computing a cut to irrigation diversions going from a full to a partial water situation is:

$$\text{CUT} = \text{DQ} - \frac{\text{CU}}{1-\text{PRT}} + \left[\frac{\text{CALL} - \text{DQ} + \frac{\text{CU}}{1-\text{PRT}} + (\text{SUMP})(\text{RTN}) + (\text{SUMP})(\text{CU}) - \frac{(\text{SUMP})(\text{CU})}{1-\text{PRT}}}{1 - (\text{SUMP})(\text{PRT})}\right] \quad (3)$$

where

DQ = Initial diverted amount to junior ditch.

CU = Previously computed consumptive use.

RTN = Previously computed return flow.

CALL = Shortage to senior water right.

SUMP = Percentage of total return flow back in river above the senior water right.

PRT = Lower limit of return flow as a fraction of total diversion.

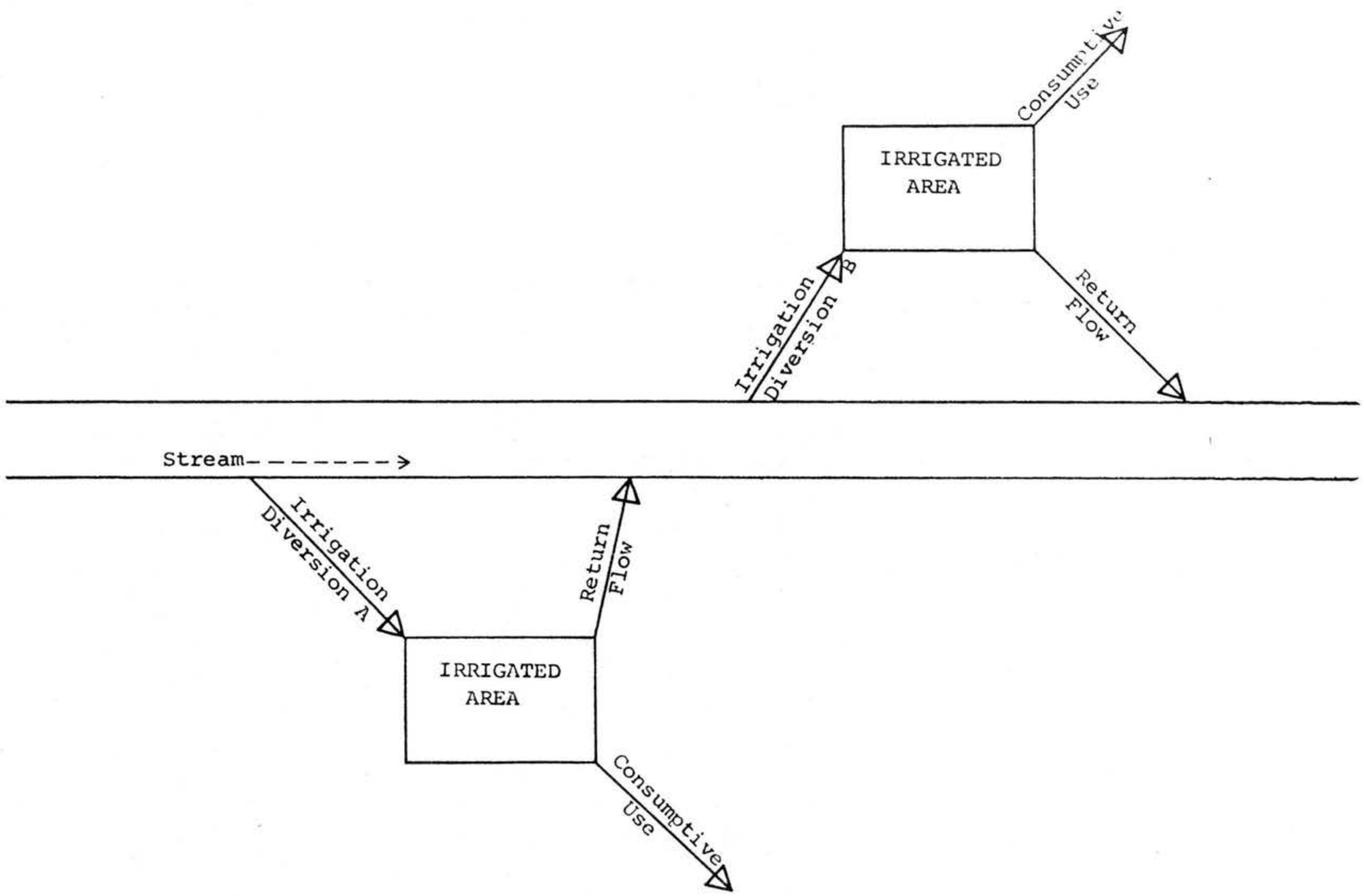

Figure 3.6 Case II: Return Flow from Diversion A above Diversion B.

In this particular case

$$\text{CUT} = 30 - \frac{10}{1-.5} + \frac{10 - 30 + \frac{10}{1-.5} + (1)(20) + (1)(10) - \frac{(1)(10)}{1-.5}}{1 - (1)(.5)} \tag{4}$$

$$\text{CUT} = 30 - 20 + \frac{10}{.5} \tag{5}$$

$$\text{CUT} = 30 \text{ cfs}$$

A cut of 30 cfs would equal the total diversion for Ditch A. The actual cut would be limited to the 20 cfs supplied to the junior right, leaving both ditches unsatisfied according to their desired amounts. The resultant reallocation is as follows: Ditch A diverting 10 cfs with consumptive use of 5 cfs and return flow of 5 cfs; Ditch B diverting 35 cfs with consumptive use of 10 cfs and return flow of 25 cfs.

Another typical situation (Fig. 3.7) is where part of the upstream ditch has some return flow above the senior ditch and some below. In this case assume that 25% of the total return flow is below the downstream ditch. This time there will be 25 cfs in the river and the resultant call will be 15 cfs. The computed cut from the equation is

$$\text{CUT} = 30 - \frac{10}{1-.5} + \frac{15 - 30 + \frac{10}{1-.5} + (.75)(20) + (.75)(10) - \frac{(.75)(10)}{1-.5}}{1 - (.75)(.5)} \tag{6}$$

$$\text{CUT} = 30 - 20 + \frac{15 - 30 + 20 + 15 + 7.5 - 15}{1 - .375} \tag{7}$$

$$\text{CUT} = 30$$

Again the cut would take all of the diversion and must be limited to the supplied amount of the junior water right. The resulting

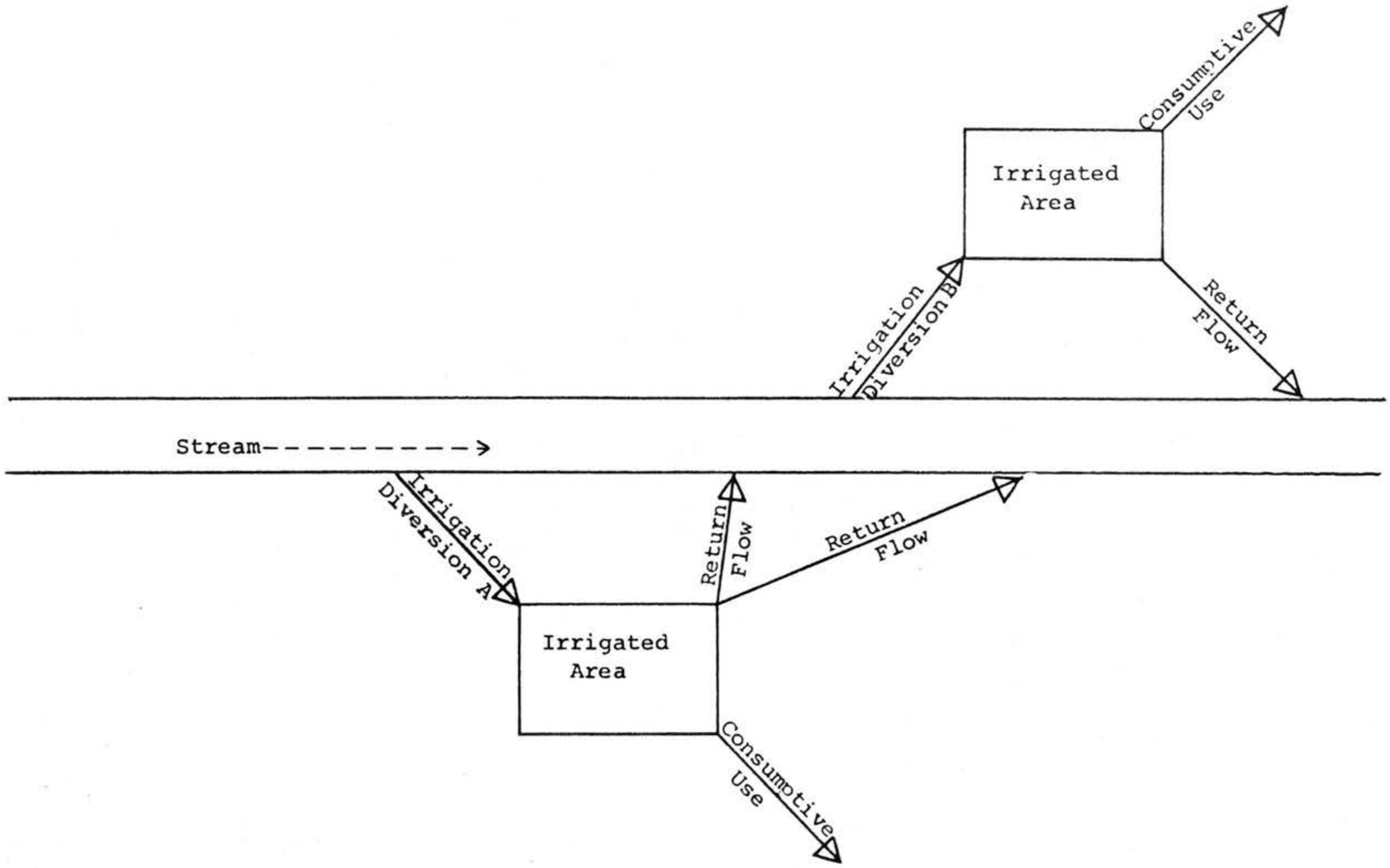

Figure 3.7 Case III: Return Flow from Diversion A above and below Diversion B

reallocation is as follows: Ditch A diverting 10 cfs with a consumptive use of 5 cfs and return flow of 5 cfs; Ditch B diverting 33.75 cfs with a consumptive use of 10 cfs and return flow of 23.75 cfs.

In all of the previous cases, the cut has been limited by the water rights. For the last example assume that there were 35 cfs in the river above Point B and the call is 5 cfs. This will be the same as the previous example with an additional 10 cfs in the river (Fig. 3.7).

$$\text{CUT} = 30 - 20 + \frac{5 - 30 + 20 + 15 + 7.5 - 15}{1 - .375} \tag{8}$$

$$\text{CUT} = 14$$

This time the cut will not be limited by supplied amount to basin rank three and the computed cut would be taken from the original 30 cfs diversion leaving 16 cfs to Ditch A with a consumptive use of 8 cfs and a return flow of 8 cfs. Ditch B is now diverting 40 cfs with a consumptive use of 10 cfs and a return flow of 30 cfs.

It is also possible to cut water from an upstream diversion and have no increase in water to the downstream senior water user. This particular situation assumes that while less water is available to the upstream diversions, there is still sufficient water for a full water supply, hence no change in consumptive use. The only difference is that the reallocated water is routed down the stream instead of through the return flow component of the diversion. The conditions for this situation are as follows:

1. All of the return flow from the upstream diversion has returned to the river above the downstream ditch.

2. The amount of water cut is limited by the supplied amount to the water right.

3. The cut must be fairly small in relationship to the diverted amount so that the cut does not force the return flow divided by the total diversion to be less than the PRT.

E. River Accretion and Losses

All unexplained gains or losses in streamflow between points of known flow can be considered. Adjustments to streamflow can be made in order that the model output will fit gaging station data quite precisely. These adjustments are made by inputing "river accretion factors". The factors are not calculated within the model, but must be handled externally; the model having first been run with all river accretion factors set to zero. The assumption of this methodology is that accretion water, which may be positive or negative, will be distributed uniformly between the upstream and downstream non-active control points. The river accretion factors are used to explain the aggregation of the following:

1. Unidentified stream inflows to the stream system.
2. Gains in streamflow from groundwater supplies.
3. Losses due to groundwater recharge from the stream.
4. Losses from consumptive use by phreatophytes.
5. Evaporation from the water surfaces.
6. Changes in soil moisture.
7. Incorrect data inputs.

Calculations of the river accretion factor between any inactive control points of known flow in the stream system are given by:

$$RAF = \frac{MEASQ(I) - CALCQ(I) - MEASQ(I-1) + CALCQ(I-1)}{INITQ}$$

where

CALCQ(I) = Streamflow value computed by the model at any non-active control point of known flow.

MEASQ(I) = Measured streamflow value at any non-active control point.

CALCQ(I-1) = Calculated streamflow value at the next upstream control point.

MEASQ(I-1) = Measured streamflow value at the next upstream control point.

INITQ = Initial streamflow into system with all river accretion factors set to zero. This is the measured value of streamflow at the upper end of the stream.

The river accretion factor for any reach of the river is a function of the initial streamflow, and is input into the model on subsequent runs. The application of these values to the calculation of streamflows between adjoining control points is handled in the following manner:

$$NEWQ = CALQ + (RAF)(INITQ) \frac{STMI(I) - STMI(I-1)}{STMI_2 - STMI_1}$$

where

NEWQ = Streamflow at a given point corrected by accretion factor.

CALCQ = Calculated uncorrected streamflow at a given point.

RAF = River accretion factor for all control points between two points of known flow.

INITQ = Initial Streamflow.

STMI(I) = Stream mile of control point.

STMI(I-1) = Stream mile of next upstream control point.

$STMI_2$ = Stream mile of downstream point of known flow.

$STMI_1$ = Stream mile of upstream point of known flow.

The river accretion factor either increases or decreases streamflow values depending on the sign of the factor. The magnitude of the amount is determined by the value of the factor, the distance between control points, and the initial streamflow value. The factors themselves vary with time and from reach to reach along the stream. While they are not considered in the reallocation routine, they may force extra water to be reallocated under certain circumstances to make up for stream losses.

F. Data Selection and Requirements

Any attempt at modeling a stream system where matching historical data is desired must first include an investigation into data availability. This data must be analyzed as to quality and quantity in relation to the results and purpose of the model. The internal structure, level of sophistication, and reliability of the results are directly related to the model builder's ability to evaluate the available data.

From an analysis of the hydrologic data for the White River, the following data types were selected and subjectively evaluated as to quality and quantity:

1. Water Rights - From Colorado Division of Water Resources, District 43 water rights subset by basin rank - Colorado Water Data Bank (quality - very good).
2. Historic Diversion Records - From Colorado Division of Water Resources, District 43, 1974 and 1975 Annual Water Diversion Records - Colorado Water Data Bank (quality - fair).
3. Streamflow Records - From Water Resource Data for Colorado - U.S.G.S., 1974, 1975, 1976 (quality - excellent for tributaries where gages have been established. Ungaged tributary flows must be estimated.)
4. Consumptive Use Data - From unpublished output from COSUMP program developed by Colorado State University for the Federal Energy Administration Project as part of "Analysis of Methods for the Determination of Water Availability for Energy Development", January 1977 (quality - fair).
5. Control Point Physical Parameters - From unpublished NODE system developed by Colorado State University for the Federal Energy Administration Project as part of "Analysis of Methods for Energy Development", January 1977 (quality - good). For surface diversions this data includes:
   a. Name of diversion.
   b. Identification number.
   c. Relative location on stream (stream mile).
   d. Irrigated Acreage.
   e. Elevation.

For inactive control points, this data includes:

a. Streamgage name.

b. Relative location on stream for inflow tributaries

For inflow tributaries this data includes:

a. Tributary name.

b. Identification number.

c. Relative location on stream.

6. Return Flow Locations and Percentage of Total Return - Compiled from U.S.G.S. quad maps, field measurements and personal knowledge of the system (quality - fair to poor).

G. Discussion of Assumptions

Numerous assumptions have been made in the compilation of the DISTRIW program. These assumptions may be the result of data deficiencies and requirements, time, understanding of the system, simplicity, or basic purpose of the model. The primary assumption is with respect to time. All functions of the stream are assumed to occur simultaneously. Lag times for flows, streamflows, and all internal processes in the system are ignored. By having all inputs and outputs as average monthly values, errors introduced by actual lag times tend to be obscured, but not eliminated. In the White River errors caused by disregarding lag may be insignificant compared to other sources of error.

Return flow points and the fraction of total computed return flow for those points are considered to be constant. In actual practice this is not the case. The return flows vary somewhat depending on water availability, stage of crop growth, soil conditions, operation of system, human preference, etc.

The river accretion factors are an aggregate of all unexplained gains or losses in the river system and are used to tune the model to historic data. The calculated amount of water gained or lost is a function of the accretion factor and the initial streamflow. The choice of using the inital streamflow in this calculation was, at least in part, subjective. In a reach of the river that is gaining water either from ground water or undefined tributaries, it is assumed that changes in gains with respect to time will be proportional to changes in initial streamflow value. Reaches of the river which are losing water, especially those far downstream, tend to lose water at a more constant rate. Assuming that losses are a function of the initial streamflow in these cases is technically incorrect and could cause significant errors if the river accretion factor is negative and very large in magnitude, especially if the value of the initial streamflow used in a prediction is much larger or smaller than the historic value.

There are a number of assumptions made regarding the calculation of consumptive use and return flow which in turn are the basis for part of the mass balance and reallocation routines. These assumptions are listed as follows:

1. In a full water supply situation, any increase in irrigation diversion will not increase consumptive use, but the increase will be routed as excess return flow.
2. In a short water supply situation, the return flow and consumptive use are a fixed proportion of the diverted amount. The ratio of return flow to consumptive use is also constant for the whole river system.

3. The change in potential consumptive use is a linear function of elevation.

Regarding the relationship of diversions to their respective water rights, several assumptions are made. For any single control point the water rights, diverted amounts, and irrigated acreage operate as a single unit. The users within a ditch system cannot exercise their water rights individually regardless of ownership status. Any short or excess water supplies must be allocated to the total acreage within a ditch system.

IV. MODEL TESTING AND APPLICATION

A hypothetical stream system (Fig. 4.1) was used to confirm the logic and demonstrate the program capabilities. The fixed physical parameters for the structures are shown in Table 4.1, and the water rights data are displayed in Table 4.2. The variable physical parameters are included in Tables 4.3 and 4.4. The complete input-string in the proper order and format is shown in Fig. A.2 (Appendix A).

The results of the analysis begin with a summary of each individual reallocation of water by priority of water right (Table 4.5). The table isolates each individual shortage that occurs and the corresponding action taken to satisfy all water rights criteria. A brief description of the process involved is as follows:

> The initial streamflow at stream mile .5 is 50 cfs at the most upstream control point, irrigation diversion 1. This diversion takes 20 cfs out of the stream. Four cfs are consumed and 16 cfs are returned to the stream. This leaves 46 cfs in the stream above irrigation diversion 2. The desired diverted amount here is 60 cfs, so a call is identified from basin rank 4 for 14 cfs. Irrigation diversion 1 is cut 10 cfs of unadjudicated water to supply the shortage to diversion 2. This reduction in water to the upstream diversion is not sufficient to reduce the consumptive use and the net result is that no additional water is gained downstream. It has just forced diversion number 1 to become more efficient with the remaining supply.

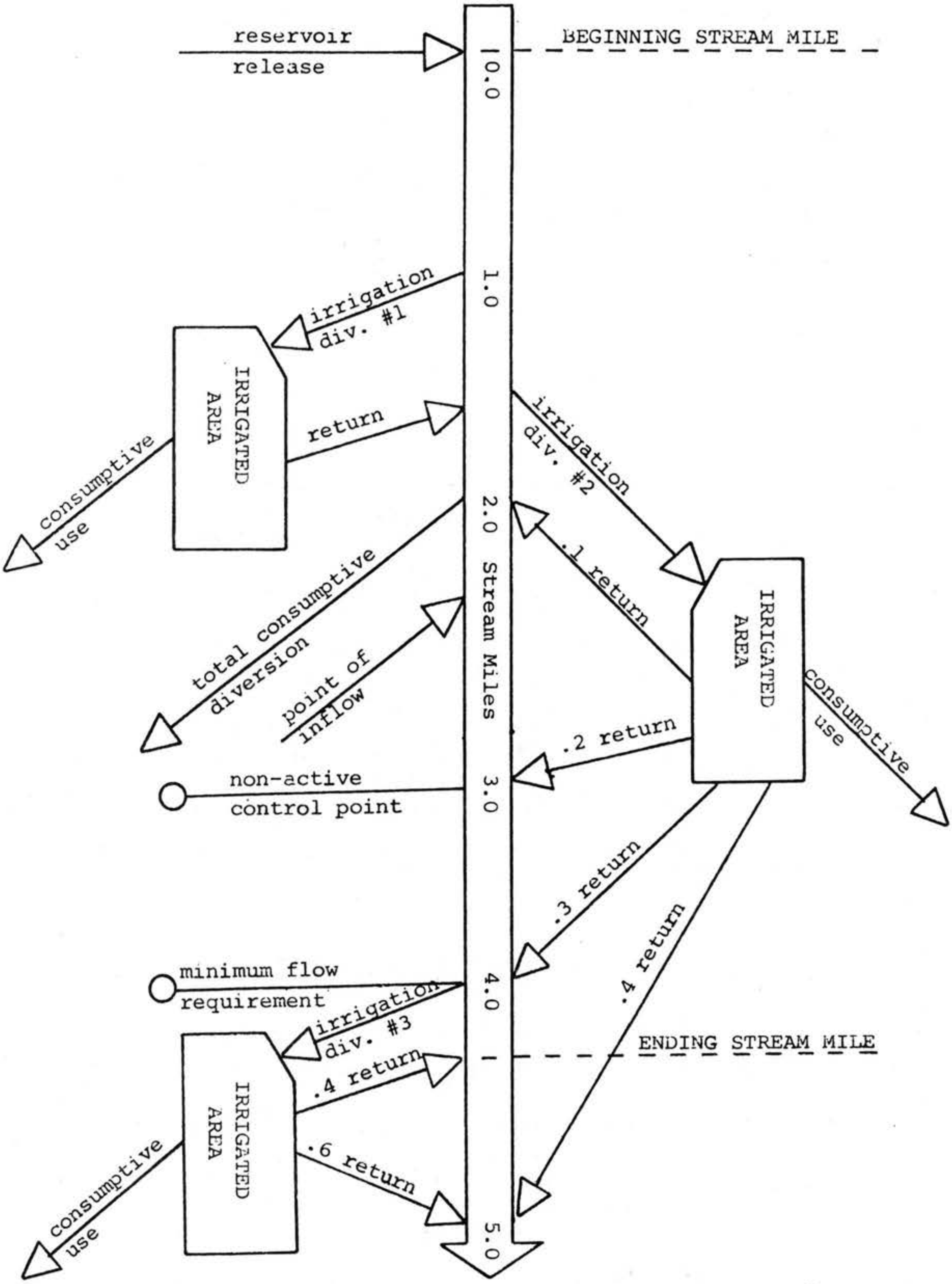

Figure 4.1 Diagram of Hypothetical Stream System

Table 4.1 Fixed Physical Parameters (Case I)

CERI-FEA WATER FOR ENERGY PROJECT--WHITE RIVER BASIN EVALUATION AREA

PROGRAM FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT

STRUCTURE INPUT DATA

				RETURN FLOW ALLOCATIONS							
STRUCTURE NAME	ELEV	STREAM MILE	IRRIGATED ACRES	STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN
Irrigation Diversion 1	6000	1.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Irrigation Diversion 2	5500	1.50	2000.00	2.00	.10	3.00	.20	4.00	.30	5.00	.40
Total Consumption Divrsn		2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Active Control Pt		3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flow Requirement		4.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Irrigation Diversion 3	5000	4.10	400.00	4.20	.40	5.00	.60	0.00	0.00	0.00	0.00

Table 4.2 Water Rights Data (Case I)

WATER RIGHTS DATA INPUT

STRUCTURE NAME	BASIN RANK	IDENT NO	DECREED AMOUNT
Irrigation Diversion 1	1	500	10.00
Flow Requirement	2	3000	40.00
Irrigation Diversion 2	3	600	30.00
Irrigation Diversion 2	4	600	40.00
Irrigation Diversion 3	7	700	15.00
Total Consumption Divrsn	9	1000	50.00

Table 4.3 Variable Physical Parameters (Case I)

USER INSTRUCTIONS FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT PROGRAM TEST 1

STREAM INFLOW DATA

Initial Stream Mile = .50

Initial Stream Flow = 50.00

LOCAL TRIBUTARY FLOWS

STREAM NAME	IDENT	STREAM MILE	FLOW
Reservoir Release	400	.50	0.00
Point of Inflow	1	2.50	25.00

Stream Mile of Last Downstream Control Point = 4.25

Table 4.4 Variable Physical Parameters (Case I)

DESIRED FLOWS FOR STRUCTURES

STRUCTURE NAME	IDENT	DESIRED AMOUNT
Irrigation Diversion 1	500	20.00
Irrigation Diversion 2	600	60.00
Total Consumption Divrsn	1000	40.00
Non Active Control Pt	0	0.00
Flow Requirement	3000	40.00
Irrigation Diversion 3	700	0.00

River Accretion Factors 0.0000 .1000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000

Potential Consumptive Use Per Acre = .0100 at Elev 6000 Ft Rate of Change/1000 Ft Elev = .0010000

Lower Limit of Return Flow as Fraction of Total Diversion .5000

Table 4.5 Individual Reallocations (Case I)

OUTPUT ANALYSIS FROM PROGRAM

REALLOCATION OF WATER BY PRIORITY OF INDIVIDUAL WATER RIGHTS

CALL FROM SENIOR DIVERSION

STRUCTURE NAME	IDENT	RANK	SHORTAGE
Irrigation Diversion 2	600	4	14.00
Irrigation Diversion 2	600	4	14.00
Total Consumption Divrsn	1000	9	40.00
Flow Requirement	3000	2	3.50

CUT FROM JUNIOR DIVERSION

STRUCTURE NAME	IDENT	RANK	CURTAILMENT
Irrigation Diversion 1	500	0	10.00
No Reallocation Made	0	0	0.00
No Reallocation Made	0	0	0.00
Irrigation Diversion 2	600	4	4.82

A second call, again for 14 cfs, with basin rank 4 is identified at diversion 2. This time there is no unadjudicated or junior water upstream. No reallocation is made.

Irrigation diversion 2 will now divert the entire flow of the stream of 46 cfs. The consumptive use is calculated at 21 cfs and 25 cfs of return flow. This return flow will go back to the stream at four different points: 10% of the 25 cfs at stream mile 2; 20% at stream mile 3; 30% at stream mile 4; and 40% at stream mile 5.

The next diversion downstream is the total consumption diversion, and, as the name implies, no water diverted at this control point will return to the stream. The desired amount here is 40 cfs. There is no water in the stream, and because the water rights are junior to those diverting water above, there is no reallocation made.

The next control point downstream is non-active indicating a gaging station. There will be 27.5 cfs at this point with 25 cfs contributed by the point of inflow plus 2.5 cfs return flow from irrigation diversion 2. No action is taken at this point except changing the accretion factor from 0.00 to .1. Below this point there will be 5.00 cfs water added to the streamflow at a rate of 4.0 cfs per mile.

The next downstream control point is for minimum streamflow requirements with a desired flow of 40 cfs. With only 36.5 cfs in the river another call is identified for 3.5 cfs with a basin rank of 2. A cut of 4.82 cfs from basin rank 4 is diverted by irrigation diversion 2. This cut changes the diverted amount, consumptive use, and return flows of irrigation diversion 2, and is sufficient to supply the minimum flow requirement of 40 cfs.

The program continues the routing of water from irrigation diversion 2 back downstream to the last control point, readjusting all necessary values. The desired amount for irrigation diversion 3 is zero, so no action is taken. The program halts at stream mile 4.25.

The effects of the reallocation procedures on the stream system and the component results are shown in Table 4.6. A summary of useful system parameters is also included in Table 4.6. Table 4.7 is a tabulation of each individual water right. This table demonstrates the concept of filling the water rights with the supplied amount according to the priority of all rights attached to that control point.

The program was rerun with the original data with the computed "supplemental water necessary to supply shortages" of 54 cfs added in as a reservoir release (Table 4.8). The individual reallocation summary (Table 4.9) shows no shortages in the system, and the "available surplus water" (Table 4.10) has been substituted for "supplemental water necessary to supply shortage" in the previous example, and has a value of zero. The system is now optimized with no shortages and no surpluses.

As a further exercise the reservoir release was increased by 100 cfs (Table 4.11) to demonstrate the ability of the program to calculate available surplus water (Table 4.12).

Application to White River Study Area

The DISTRIW model was applied to the main stem of the White River as part of FEA Project CA-05-50041-00 concerning water for energy

Table 4.6 Final Allocation (Case I)

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
Irrigation Diversion 1	500	1.00	10.00	4.00	6.00	40.00	10.00
Irrigation Diversion 2	600	1.50	41.18	20.59	20.59	4.82	18.82
Total Consumption Divrsn	1000	2.00	0.00	0.00	0.00	4.82	40.00
Non Active Control Pt	0	3.00	0.00	0.00	0.00	31.88	0.00
Flow Requirement	3000	4.00	0.00	0.00	0.00	40.00	0.00
Irrigation Diversion 3	700	4.10	0.00	0.00	0.00	48.58	0.00

SUMMARY

System Yield = 80.00
Water Diverted Out Of System Or Totally Consumed = 0.00
Sum Of Irrigation Diversions = 51.18
Total Irrigation Consumptive Use = 24.59
Irrigation Return as Fraction of Total Irrigation Diversion = .52
Final Stream Flow At Last Downstream Control Point = 47.18
Minimum Stream Flow = 4.82 At Stream Mile = 2.00
Supplemental Water Necessary to Supply Shortages = 54.00

Table 4.7 Summary of Supplied Water (Case I)

SUMMARY OF WATER RIGHTS AND ALLOCATION BY STRUCTURE

STRUCTURE NAME	IDENT	RANK	DECREED AMOUNT	SUPPLIED AMOUNT	UNDECREED SUPPLY	TOTAL DIVERSION
Irrigation Diversion 1	500					
		1	10.00	10.00		
		TOTALS	10.00	10.00	0.00	10.00
Irrigation Diversion 2	600					
		3	30.00	30.00		
		4	40.00	11.18		
		TOTALS	70.00	41.18	0.00	41.18
Total Consumption Divrsn	1000					
		9	50.00	0.00		
		TOTALS	50.00	0.00	0.00	0.00
Flow Requirement	3000					
		2	40.00	40.00		
		TOTALS	40.00	40.00	0.00	40.00
Irrigation Diversion 3	700					
		7	15.00	0.00		
		TOTALS	15.00	0.00	0.00	0.00

Table 4.8 Variable Physical Parameters (Case II)

USER INSTRUCTIONS FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT PROGRAM TEST 2

STREAM INFLOW DATA

Initial Stream Mile = .50

Initial Stream Flow = 50.00

LOCAL TRIBUTARY FLOWS

STREAM NAME	IDENT	STREAM MILE	FLOW
Reservoir Release	400	.50	54.00
Point of Inflow	1	2.50	25.00

Stream Mile of Last Downstream Control Point = 4.25

Table 4.9 Individual Reallocations (Case II)

OUTPUT ANALYSIS FROM PROGRAM

REALLOCATION OF WATER BY PRIORITY OF INDIVIDUAL WATER RIGHTS

CALL FROM SENIOR DIVERSION				CUT FROM JUNIOR DIVERSION			
STRUCTURE NAME	IDENT	RANK	SHORTAGE	STRUCTURE NAME	IDENT	RANK	CURTAILMENT

No shortages exist in this system

Table 4.10 Final Allocation (Case II)

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
Irrigation Diversion 1	500	1.00	20.00	4.00	16.00	84.00	0.00
Irrigation Diversion 2	600	1.50	60.00	21.00	39.00	40.00	0.00
Total Consumption Divrsn	1000	2.00	40.00	0.00	0.00	0.00	0.00
Non Active Control Pt	0	3.00	0.00	0.00	0.00	28.90	0.00
Flow Requirement	3000	4.00	0.00	0.00	0.00	40.70	0.00
Irrigation Diversion 3	700	4.10	0.00	0.00	0.00	52.80	0.00

SUMMARY

System Yield = 134.00
Water Diverted Out Of System Or Totally Consumed = 40.00
Sum Of Irrigation Diversions = 80.00
Total Irrigation Consumptive Use = 25.00
Irrigation Return As Fraction Of Total Irrigation Diversion = .69
Final Stream Flow At Last Downstream Control Point = 53.40
Minimum Stream Flow = 0.00 At Stream Mile = 2.00
Available Surplus Water = 0.00

Table 4.11 Variable Physical Parameters (Case III)

USER INSTRUCTIONS FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT PROGRAM TEST 3

STREAM INFLOW DATA

Initial Stream Mile = .50

Initial Stream Flow = 50.00

LOCAL TRIBUTARY FLOWS

STREAM NAME	IDENT	STREAM MILE	FLOW
Reservoir Release	400	.50	154.00
Point of Inflow	1	2.50	25.00

Stream Mile of Last Downstream Control Point = 4.25

Table 4.12 Final Allocation (Case III)

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
Irrigation Diversion 1	500	1.00	20.00	4.00	16.00	184.00	0.00
Irrigation Diversion 2	600	1.50	60.00	21.00	39.00	140.00	0.00
Total Consumption Divrsn	1000	2.00	40.00	0.00	0.00	100.00	0.00
Non Active Control Pt	0	3.00	0.00	0.00	0.00	128.90	0.00
Flow Requirement	3000	4.00	0.00	0.00	0.00	140.70	0.00
Irrigation Diversion 3	700	4.10	0.00	0.00	0.00	152.80	0.00

SUMMARY

System Yield = 234.00
Water Diverted Out Of System Or Totally Consumed = 40.00
Sum Of Irrigation Diversions = 80.00
Total Irrigation Consumptive Use = 25.00
Irrigation Return As Fraction Of Total Irrigation Diversion = .69
Final Stream Flow At Last Downstream Control Point = 153.40
Minimum Stream Flow = 100.00 At Stream Mile = 2.00
Available Surplus Water = 100.00

development. Included were all major diversion structures on the main stem between the confluence of the North and South Forks of the White River to the downstream U.S.G.S. gaging station near Watson, Utah, a distance of 144.50 stream miles with an elevation change of about 2000 ft. The model was tuned to historic data for several time periods. Average monthly values for July and August of 1974 and 1975 were analyzed and compared to gaging station data for the corresponding time periods. Adjustment of ungaged tributary flows and the addition of the proper river accretion factors allows the calculated streamflow values to match the gaging station data quite closely for subsequent computer runs. A comparison of computed and actual flow values is tabulated for August 1974 in Table 4.13.

The utility of the DISTRIW program lies in its ability to predict the effects of changes to a particular stream system. Prior to 1977 there has been no shortage of water on the main stem of the White River, hence there has been no administration of diversions according to the priority of water rights. Should a shortage develop as a result of an extreme drought condition or increased use, it would be very beneficial to know ahead of time the effects of such a shortage. Prior knowledge of the location of water shortages, relative amounts, and the identification of which users would suffer, and to what degree, should be of considerable help to planners and administrators in managing limited water resources.

The first example of the predictive power of the DISTRIW model deals with introducing drought conditions into the stream systems. The tuned data for August of 1974 was used with the initial streamflow and all tributary flows reduced to approximate flow conditions that might occur once every 100-200 years. The irrigation demand (Desired Amounts) was

Table 4.13 COMPARISON OF MEASURED AND COMPUTED STREAMFLOWS IN THE WHITE RIVER (AUGUST 1974)

U.S.G.S. Stream Gage	Measured Average Monthly Q	Computed Q
White River ab. Coal Ck.	279	282
White River nr. Meeker	309	312
White River bel. Meeker	394	396
White River ab. Rangely	395	397
White River nr. Watson, UT	373	376

increased by 25%, and the potential consumptive use was increased by 50% to approximate conditions of high temperatures and no rainfall.

The reallocation of water by priority of water right table (Table D.4) generated by the DISTRIW program tabulates the individual reallocations made to satisfy all water right criteria. The following comments should be of some help in understanding the table results.

1. The first shortage to be evaluated occurred at the Highland Ditch. The most senior unsatisfied water right has a basin rank of 33 and the computed shortage is 27.27 cfs.
2. The first reallocation to be made was curtailing the diverted amount of the Dreyfuss Ditch by 6.33 cfs. The basin rank of zero indicates that this was undecreed water, that part of the diversion over and above the sum of the water rights.
3. While a curtailment of 6.33 cfs was made to the Dreyfuss Ditch, The next call from the senior diversion indicates that there was no increase in streamflow at the Highland Ditch resulting from this curtailment. The reason for this goes back to the assumption that less than desired flow into any irrigation structure will force an increase in efficiency until the "lower limit of return flow as a fraction of the total diversion" is reached. The curtailment of 6.33 cfs to the Dreyfuss Ditch has not forced the ratio of return flow to diverted amount to be less than .7. This is a function of the very high initial value of (return (return flow/desired amount). The necessary water is supplied to the Highland Ditch during successive iterations by other structures upstream.

4. The final shortage to the Highland Ditch (basin rank 393) was for 46.00 cfs. The program indicates that there was no reallocation made. In other words, there were no longer any junior water rights upstream that were diverting water.
5. A total curtailment of 90.4 cfs was necessary to supply the senior rights. The net gain to the senior rights is 58.3 cfs. This is the sum of the first calls by the senior water rights minus all calls where no reallocation was made.

The final allocation of available water supply and the summary are shown in Table D.5. Of considerable interest are the streamflow values and the shortages to each diversion. The model predicted zero streamflows at stream mile 15.05 and stream mile 31.34. The supplemental water necessary to supply shortages was calculated at 131.49 cfs. The irrigation efficiency as reflected in the irrigation return as a fraction of total diversion has increased from .20 to .25. This amounts to 25% improvement in irrigation efficiency for the entire system.

Another type of problem that can be handled by the DISTRIW program is involved with projecting the effects of new demands on the present system. These demands may be from new diversions, transfer of water rights, increased irrigated acreage, minimum flow requirements, or interstate compacts. Table D.6 is a partial listing of the output where hypothetical changes were introduced into the system that represent what may occur in the future. Again, the control data for August 1974 were used as input with the following changes:

1. 1966 initial streamflow.
2. A diversion of 125 cfs to Yellow Creek Reservoir.

3. Niblock Ditch acreage increased by 600 acres and desired flow set at 85 cfs.
4. 100 cfs reservoir release to a transbasin diversion.
5. 200 cfs desired flow for USBR Yellow Jacket project supplying water to 7500 acres of irrigated land.

The summary indicates a shortage of 94.80 cfs. Assuming that sufficient reservoir water was available, an additional release of 104.80 cfs would satisfy all demands and allow a minimum flow of 10.0 cfs at stream mile 15.05.

While the two previous computer runs were simulating hypothetical situations, they do demonstrate the utility of the program in water resource planning. The model helps reduce uncertainties of water resou ce planning by increasing the user's ability to analyze a very compl x system. Reducing the number of uncertainties will lower costs associated with water resource development and utilization.

The DISTRIW model was developed and tested on the CDC 6400 digital computer at Colorado State University. The program, as run for the White River, requires 70K of core memory, and takes about 20 seconds to compile. Run time varies with the number of control points and the number of iterations required to reallocate water. Average run times were on the order of 15 to 25 seconds.

V. CONCLUSIONS AND RECOMMENDATIONS

The DISTRIW model was developed to provide information concerning water availability in river basins governed by the doctrine of prior appropriations. It was designed as a predictive tool to help eliminate the uncertainties associated with water planning and administration.

The primary function of the model is to synthesize streamflows and allocate the available water by the prior appropriations doctrine. A given amount of water is routed down a stream using an accounting process to adjust for all inflow and outflow. Should there be insufficient flow at any point to satisfy a particular user, the program will reallocate the available water to the user with the most senior water right. All streamflows will then be readjusted to conform with that reallocation and the routing process will continue.

The DISTRIW model can be used to evaluate the effects of the following system changes:

1. Low flow and drought conditions.
2. New diversions.
3. Changes in points of diversion.
4. Changes in type of use, such as from irrigation to industrial.
5. Minimum streamflow requirements for fisheries or interstate compacts.
6. Changes in irrigated acreages.
7. Changes in diverted amounts.
8. Altered return flow regimes.
9. Imported water, reservoir releases, or flow augmentation.

10. Changes that affect consumptive use such as weather modification or changes in crop type.
11. Changes in irrigation efficiency.

The model also has the following characteristics which enhance the useability and utility to resource managers:

1. Contains the basic algorithm for reallocation by priority of water right as dictated by the prior appropriations doctrine.
2. Input data are simple and generally available. Even in relatively undermanaged stream systems, there should be sufficient data to drive the model.
3. Changes in the physical system or changes in the water rights system can be easily evaluated by data substitutions or additions.
4. Computer output contains many listed and computed parameters that are useful in water administration and planning studies.

The major limitations of the program are as follows:

1. Lack of any capability to handle ground water and its interaction with surface flows.
2. The reallocation component does not handle alternate points of diversion.
3. Large errors could occur in the reallocation process when using average monthly data, if the extreme daily values are much different from the mean values for the month.
4. Actual diverted amounts to irrigation may reflect human preference and could be independent of historic values.
5. Return flow relationships may not be adequately defined in terms of time and location.

6. There is no capability for return flows to be intercepted and reused before returning to the stream system.
7. Lag times could cause errors if the stream travel times are long, and if irrigation occurs long distances from the river.
8. The method of handling river accretion may not be adequate for other stream systems.
9. An algorithm for calculation of return flows for municipal water is needed.
10. Irrigation efficiency under short water supply situations is assumed to be constant over the entire basin. Actually, this may vary considerably depending on method of application, transportation losses, crop type, soil type, climate, field slope and aspect, drainage patterns, stage of crop development, ground water regime, and the individual preferences of the irrigator.
11. There is no provision to store and release reservoir water under the priority system, and no provisions for trades and exchanges that develop when reservoir storage exists.
12. There is no provision to handle control points on tributaries or to reallocate junior water diverted from tributaries down to senior water rights on the main stem.

Specific recommendations that would improve the value of the DISTRIW model might deal with these weaknesses or may satisfy some other particular need. Data quality and availability are common problems potential users must recognize when analyzing model results. Particularly, regarding consumptive use and return flow parameters, there needs to be additional studies done in order to improve confidence in the model's ability to accurately describe any river system.

Better estimates of flows from ungaged tributaries would improve model results. There are several techniques available that could be adopted to evaluate flows from ungaged watersheds.

Unexplained streamflow gains and losses are handled in the model. The method used, however, is subject to scrutiny, and further investigation is needed into the actual physical processes involved.

The program itself was designed to interface a physical system with a legal system. Substitution of model components to more accurately describe either feature would improve the reliabilty of the results. The user must remember that the individual characteristics of the stream system, the availability of adequate data, and the basic purpose of the analysis must all be weighed when applying computer techniques to practical problems dealing with water resource planning and management.

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APPENDIX A. USER DOCUMENTATION

The DISTRIW program was designed and tested using average monthly flow rates in cubic ft. per second. The program will function properly with flow rates in other units of measure provided all inputs in the data set are consistent. The following listing describes the data used in the model and units applicable for the output to be in cubic feet per second.

Fixed physical parameters

1. Control point name (Alphabetic)
2. Elevation of control point (Feet/100)
3. Stream mile of control point (Miles)
4. Irrigated area of control point (Acres)
5. Irrigation diversion return flow stream miles (Miles)
6. Fraction of total return flow for a particular irrigation diversion returning to stream at the corresponding irrigation return flow stream mile (Dimensionless)
7. Tributary name (Alphabetic)
8. Stream mile of tributary (Miles)

Fixed water right parameters

1. Basin rank number (Dimensionless)
2. Amount of flow (decreed amount) assigned to a water right (ft^3/sec)

Variable physical parameters

1. Potential consumptive use (cfs/acre)
2. Elevation at which consumption is calculated (Feet)
3. Rate of change in consumptive use by elevation (cfs/acre/1000ft)
4. Lower limit of return flow as a fraction of the total diversion (Dimensionless)
5. Desired flow for control point (cfs)
6. Tributary inflows (cfs)
7. Initial stream flow (cfs)
8. Starting and ending points on stream system (Miles)

The data set and corresponding output from one computer run with the DISTRIW model will represent the average values for a given time period. Monthly values have been used in testing and evaluation of the model results. Time periods shorter or longer than one month can be used depending on the specific situation and the results desired by the user. Shorter periods, however, may introduce problems with data limitations and time lag problems. Longer periods generally will cause a lack of sensitivity if extreme values in the physical system are much different from the mean values used in the input string.

Following are punching instructions for the preparation of the input data deck.

Data Title Card — identification of data used in 8A10 Format

Node Card — control points and inflow points of the following types

1. diversions
   a. irrigation

b. total consumption - all waters diverted from this point will be lost to system as in the case of a transbasin diversion

2. minimum flow requirements - all fishery, compact, or salinity requirements
3. non-active control points - gaging stations or other points of known flows
4. points of inflow - tributaries and reservoir releases

All types of node cards, except those for non-active control points, must have a unique ident number punched in one of the following spaces: 9-13, 14-18, 19-23, 24-28, 04 29-33 in F5.0 format.

For non-active control points all spaces 9-33 must be zero or blank. Idents for points of inflow must be greater than zero and less than 500. All other idents must be greater than 499 and less than 3500.

ELEVATION	in hundreds of units for all irrigation diversions must be punched in spaces 37-38 in F2.0 format
Name of Control or Inflow Point	in A format - punch in spaces 39-62
Stream Mile of Point	punch in spaces 63-68 in F6.2 format (largest number downstream)
Irrigated Surface Area	for irrigation diversions - punch in spaces 76-80 in F5.0 format. All non-irrigation control points must be zero or blank

Right Card	water rights input. It is not necessary that all control points have a water right. All water rights, however, must have a control point with a matching ident
RIGHT	punch RIGHT in first five spaces
Basin Rank	relative priority of water right punched in spaces 6-10 in F5.0 format
Ident	punched in spaces 16-20 in F5.0 format
Amount	punched in spaces 26-35 in F10.4 format
RETRN card	designates stream mile and fraction of total return flow for a particular ident returning to system at that stream mile. As many as four return flow points can be specified for any irrigation diversion
RETRN	punch RETRN in first 5 spaces
Ident No.	punch in spaces 6-10 in F5.0 format

Then, for

A. Most upstream point of return - punch stream mile in spaces 11-16 in F6.2 format. Fraction of total return flow in spaces 17-20 in F4.3 format

B. Next downstream point of return -- punch stream mile in spaces 21-26 in F6.2 format. Fraction of total return flow in spaces 27-30 in F4.3 format

C. Next downstream point of return - punch stream mile in spaces 31-36 in F6.2 format. Fraction of total return flow in spaces 37-40 in F4.3 format

D. Most downstream point of return - punch stream mile in spaces 41-46 in F6.2 format. Fraction of total return flow in spaces 47-50 in F4.3 format

If all of the return flow from an irrigation diversion returns above the next downstream control point, the RETRN card can be omitted. RETRN cards for total consumption diversion must be omitted. RETRN cards for minimum flow requirements must have zero or blanks in spaces 11-16 and a 1.0 in spaces 17-20 in F4.3 format. It is not necessary to use all four pairs of return flow options but the sum of the fractions must equal 1.0. Return A must be filled first, return B second, etc. The stream mile of return A must be greater than stream mile of the diversion also stream mile B greater than A, C greater than B, and D greater than C.

DIVRN card	desired flow for diversions or minimum flow requirement. This card should be omitted if the desired flow for a control point is to be zero or the control point is of the non-active type
DIVRN	punch DIVRN in first 5 spaces
Ident No.	punch in spaces 6-10 in F5.0 format
Amount	punch in spaces 11-20 in F10.4 format
INFLW card	tributary flows and reservoir releases
INFLW	punch INFLW in spaces 1-5
Ident No.	punch in spaces 6-10 in F5.0 format
Amount of flow	punch in spaces 11-20 in F10.4 format
RTNCT card	potential consumptive use, lower limit of return flow, elevation at which potential consumptive use

is computed, and rate of change in potential consumptive use by elevation

RTNCT — punch RTNCT in spaces 1-5.

potential consumptive use in units of flow per unit of irrigated surface area per day - punch in spaces 6-15 in F10.6 format.

lower limit of return as fraction of total diversion punch in spaces 16-20 in F5.3 format.

elevation at which potential consumptive use is computed - punch in spaces 21-25 in F5.0 format.

rate of change of potential consumptive use by elevation in rate of flow per unit irrigated surface area per day per 1000 units of elevation - punch in spaces 26-35 in F10.7 format.

<u>INITQ card</u>	inital streamflow, initial stream mile, ending stream mile, river accretion factors
INITQ	punch INITQ in spaces 1-5
Initial streamflow	punch in spaces 6-15 in F10.2 format
Initial stream mile	punch in spaces 16-25 in F10.2 format (must be less than or equal to stream mile of most upstream control point)
Ending stream mile	punch in spaces 26-35 in F10.2 format (must be greater than or equal to stream mile of most downstream control point)
River accretion factors	these are unexplained gains or losses in the system between non-active control points expressed as a fraction of initial stream flow. Punched in

spaces 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80 in 9F5.4 format. These factors can be zero or blank.

The accretion factor in spaces 36-40 is to adjust the flow between the initial stream mile and the first downstream non-active control point. The accretion in spaces 41-45 adjusts between first and second non-active points, spaces 46-50 are for the second and third, etc. The ending stream mile will also be considered as a non-active control point in deciding which of the factors is used in the program. The number of accretion factors to be used then is the number of control points whose ident is zero or blank plus one.

Deck Set-Up -- The following cards for fixed physical data must be stacked in the following order

1. Data Title Card (one only)
2. Node Cards - stack all control points by increasing stream mile number (going downstream) with lowest stream mile number on top
3. Node Cards - stack all tributary and reservoir release cards by increasing stream mile number
4. Right Cards - stack by increasing rank number. For numbers of equal basin rank, stack first the card whose stream mile on the node card with the same ident is the lowest number

The following cards are non-critical as to order

RETRN cards

DIVRN cards

INFLW cards

RTNCT card (one only)

INITQ card (one only)

A basic flow chart of the program logic is diagramed in Fig. A.1. A program listing is provided in Appendix B.

Several types of output are produced by the DISTRIW program. The two basic output types are those listing or describing the inputs and the second type is related results of the program analysis. The following table headings are those relating to the input data.

1. Structure Input Data - Describes the fixed physical parameters for all control points
2. Water Rights Data Input - Listing of water rights parameters by relative seniority
3. Local Tributary Flows - Listing of all tributaries and their inflows into the mainstem
4. Desired Flows for Structures - Input flows for all control points

Those ouputs relating to the computation results are listed under the following table headings.

1. Reallocation of Water by Priority of Water Rights Listing - This identifies the control points and amounts involved in the reallocation procedure when water supplies are insufficient to supply all users. The procedure is controlled by the relative seniority of individual water rights.

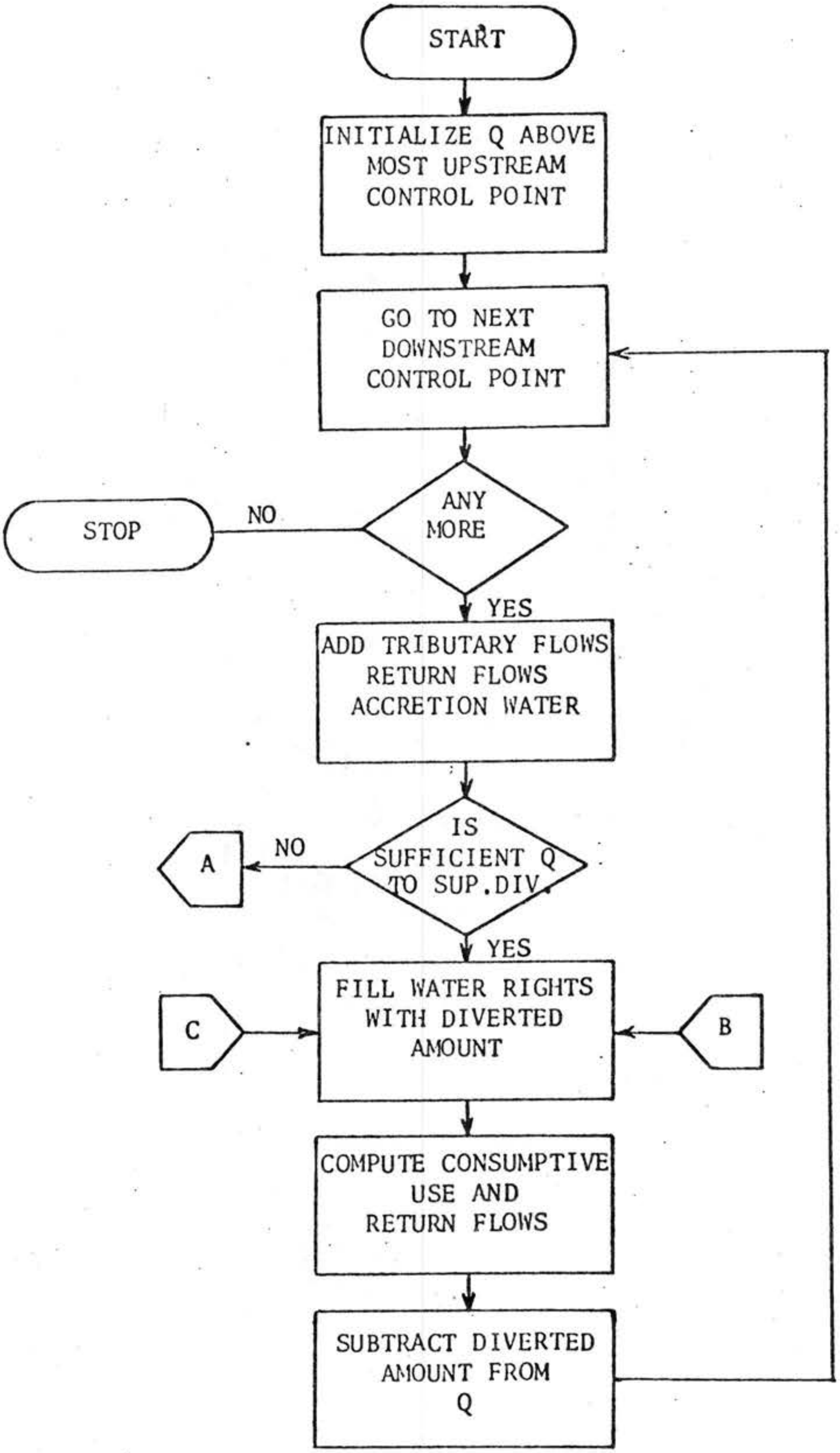
START
INITIALIZE Q ABOVE MOST UPSTREAM CONTROL POINT
GO TO NEXT DOWNSTREAM CONTROL POINT
ANY MORE
NO
STOP
YES
ADD TRIBUTARY FLOWS RETURN FLOWS ACCRETION WATER
IS SUFFICIENT Q TO SUP.DIV.
NO
A
YES
FILL WATER RIGHTS WITH DIVERTED AMOUNT
C
B
COMPUTE CONSUMPTIVE USE AND RETURN FLOWS
SUBTRACT DIVERTED AMOUNT FROM Q

Figure A.1

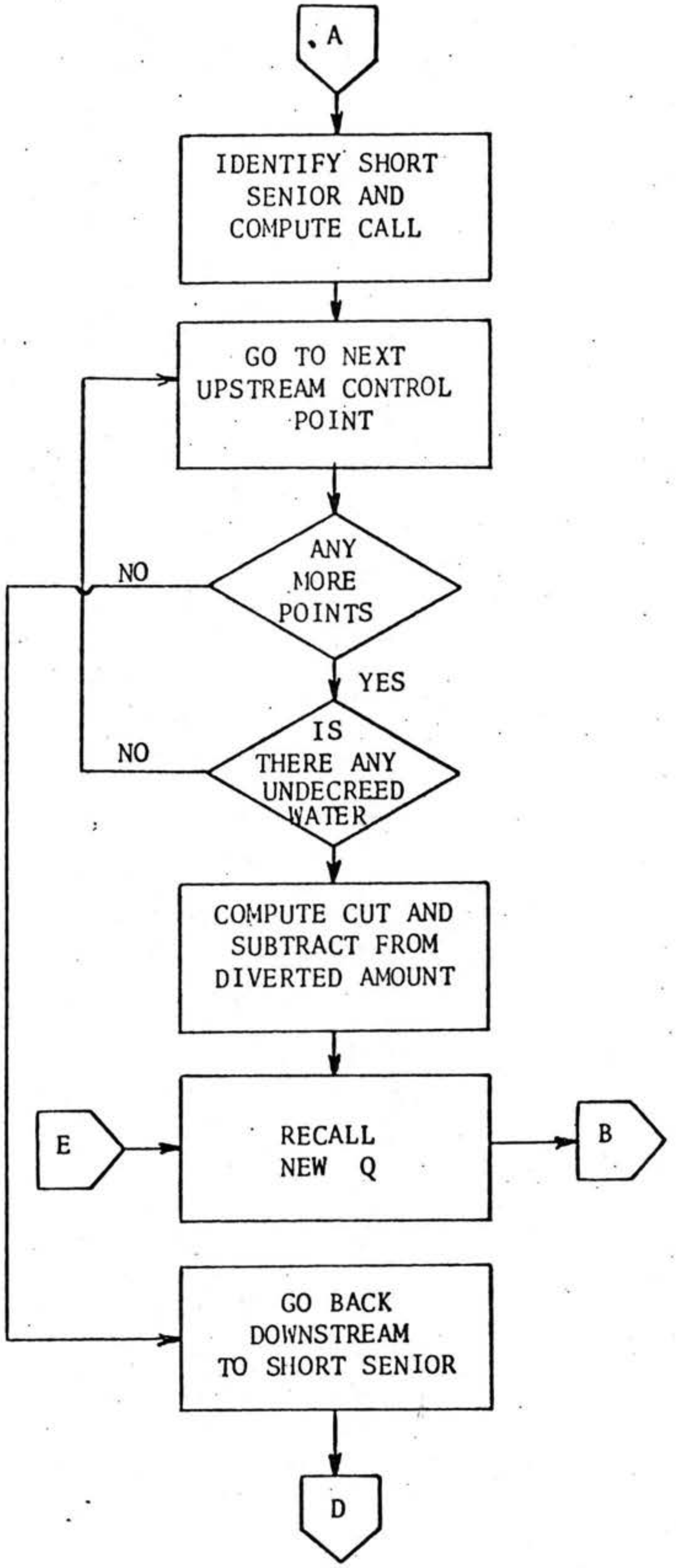

Figure A.1 (Continued).

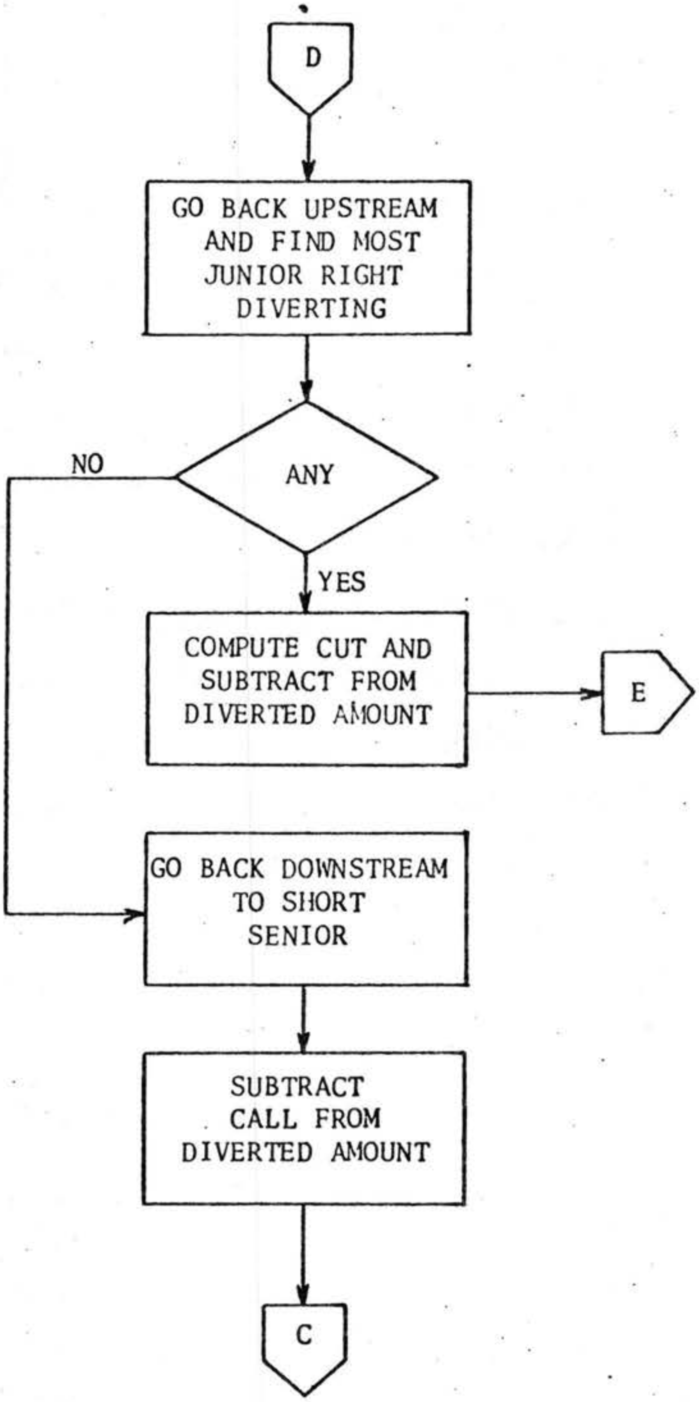

Figure A.1 (Continued).

2. Final Allocation of Water Supplies Listing - This table shows diverted amounts, consumptive use, return flows, stream flows, and shortages at each individual control point.
3. Summary of Allocation - This includes totals on system yields, water diverted out of system, irrigation consumptive use and percent return flow. The place and amount of minimum streamflows are also included along with a calculation of surplus water available or the amount of supplemental water necessary to supply shortages.
4. Summary of Water Rights and Allocation by Structure - A table provides additional information on water right amounts, corresponding supplies, and diversions with insufficient water rights. The table contains totals on all calculations by structure.

```
INITQ       50.0      0.50      4.25  0.0  0.1
STNCT        .01   0.5 6000      .001
INFLW00001      25.0
DIVRN03000      40.0
DIVRN01000      40.0
DIVRN00600      60.0
DIVRN00500      20.0
RETRN03000   0.0 1.0
RETRN00700   4.2  .4    5.0  .6
RETRN00600   2.0  .1    3.0  .2   4.0 .3   5.0  .4
RIGHT00009      01000         50.0
RIGHT00007      00700         15.0
RIGHT00004      00600         40.0
RIGHT00003      00600         30.0
RIGHT00002      03000         40.0
RIGHT00001      00500         10.0
          00001                       POINT OF INFLOW              2.50
          00400                       RESERVOIR RELEASE             .50
          00700                      50IRRIGATION DIVERSION     3  4.10       400
          03000                       FLOW REQUIREMENT             4.00
          00000                       NON ACTIVE CONTROL PT        3.00
          01000                       TOTAL CONSUMPTION DIVRSN     2.00
          00600                      55IRRIGATION DIVERSION     2  1.50      2000
          00500                      60IRRIGATION DIVERSION     1 1.00        400
USER INSTRUCTIONS FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT PROGRAM TEST 1
```

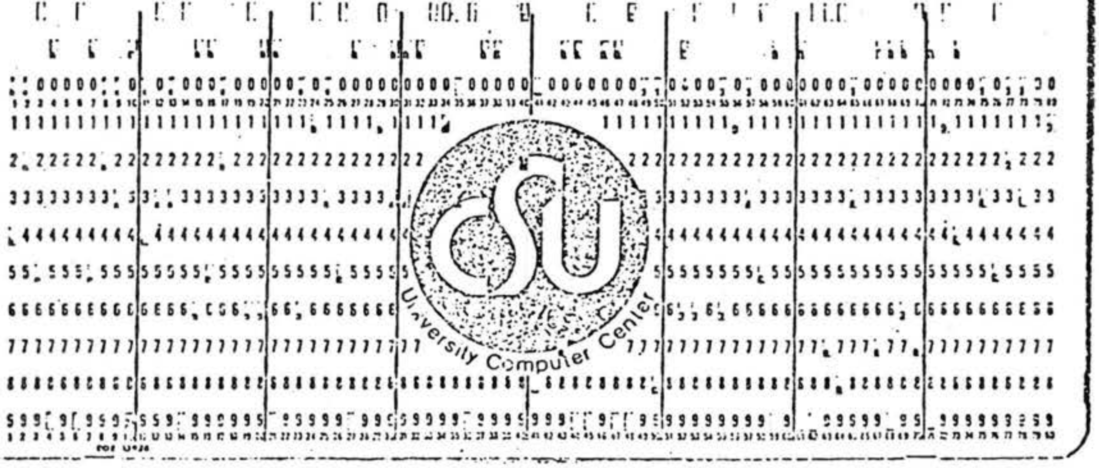

Figure A.2

APPENDIX B

LISTING OF DISTRIW

```
      PROGRAM DISTRIW
     1(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE2)
C
      REAL              LOCFLW      , MILE1       , MILE2       ,
     1         MILE3    , MILE4       , MIL1        , MIL2        ,
     2         MIL3     , MIL4        , IDR         , IDD         ,
     3         IDSR     , IDSTR       , LOCSTM      , IDSTM       ,
     4         DSIRDQ   , INQ         , IDENTR      , IDTEMP
      DIMENSION         NAME(20 ,3) , MILE1(10 )  , MILE2(10 )  ,
     1         MILE3(10 ) , MILE4(10 ) , PCT1(10 )  , PCT2(10 )   ,
     2         PCT3(10 )  , PCT4(10 )  , BGR(9)     , DSIRDQ(15 ) ,
     3         JRITE(15 ,4), FRITE(15 ,2), NAMES(15 ,3), IDTEMP(12) ,
     4         IDSR(15 )  , IDD(15 )   , IDSTM(5 )  , CDATA(8)    ,
     5         LOCFLW(50) , NAMEJ(15 ,3), IITLE(8),
     6         B(4,10),C(4,20)
      COMMON /KUSUMP/   A(24,30 )   , PETCON      , PRT         ,
     1         ZT       , JB          , J           , CALL        ,
     2         YCUT     , JJN1        , ADOG        , BSELV       ,
     3         RAT
C
C     SET MAIN ARRAY TO ZERO AND INITIALIZE WORKING VARIABLES
C
      JBZ = 0
      DO 110 I = 1,24
         DO 100 J = 1,30
            A(I,J) = 0.
  100    CONTINUE
  110 CONTINUE
        DO 111 I=1,4
       DO 112 J=1,20
        C(I,J)=0.
  112  CONTINUE
       DO 113 K=1,10
        B(I,K)=0.
  113  CONTINUE
  111 CONTINUE
C
C     SET INITIAL SUBSCRIPTS TO ZERO
C
      ITQ = 0
      IFLW = ITQ
      IDIV = IFLW
      IRTRN = IDIV
      IRITE = IRTRN
      INODE2 = IRITE
      INODE1 = INODE2
      NCARD = INODE1
C
C     READ ALL INPUT DATA CARDS
C
      READ (5,1040) IITLE
C
      DO 120 I = 1,500
         READ (5,1050) CTITL,(CDATA(J),J = 1,8)
         IF (EOF(5).NE.0) GO TO 130
         WRITE (2,1050) CTITL,CDATA
         NCARD = NCARD + 1
  120 CONTINUE
  130 REWIND 2
C
C     SEPARATE CARDS BY TITLE
C
      DO 250 I = 1,NCARD
```

```
      READ (2,1050) CTITL,CDATA
      IF (CTITL.EQ.5HRIGHT) GO TO 190
      IF (CTITL.EQ.5HRETRN) GO TO 200
      IF (CTITL.EQ.5HDIVRN) GO TO 210
      IF (CTITL.EQ.5HINFLW) GO TO 220
      IF (CTITL.EQ.5HRTNCT) GO TO 230
      IF (CTITL.EQ.5HINITQ) GO TO 240
C
C     TRANSLATE NODE CARD
C
      DECODE (75,1060,CDATA) (IDTEMP(J),J = 1,5),ELEV,(NAME(I,J),J =
     1 1,3),STMI,ACRE
      DO 150 J = 2,5
         IF (IDTEMP(J).EQ.0.) GO TO 140
         GO TO 150
  140    JM1 = J - 1
         GO TO 160
  150 CONTINUE
C
C     DECIDE STREAM OR DITCH
C
  160 IF (IDTEMP(JM1).EQ.0.0) GO TO 180
      IF (IDTEMP(JM1).LT.500.) GO TO 170
      IF (IDTEMP(JM1).LT.3500.) GO TO 180
      GO TO 250
C
C      FILL STREAM IDENT, MILE
C
  170 INODE2 = INODE2 + 1
      B( 3,INODE2) = IDTEMP(JM1)
      B( 2,INODE2) = STMI
      GO TO 250
C
C     FILL STMMI,IDENTS,ACRES
C
  180 INODE1 = INODE1 + 1
      A(6,INODE1) = IDTEMP(JM1)
      A(5,INODE1) = STMI
      A(19,INODE1) = ACRE
      A(24,INODE1) = ELEV * 100.
      GO TO 250
C
C     FILL RANK,IDENTR,AMT
C
  190 DECODE (75,1070,CDATA) RANK,IDENTR,AMT
      IRITE = IRITE + 1
      C(1,IRITE) = RANK
      C(2,IRITE) = IDENTR
      C(3,IRITE) = AMT
      GO TO 250
C
C      STORE TEMPORARILY RETURN MILES, PERCENTS
C
  200 DECODE (75,1080,CDATA) IDR,MIL1,PCENT1,MIL2,PCENT2,MIL3,PCENT3,
     1 MIL4,PCENT4
      IRTRN = IRTRN + 1
      IDSR(IRTRN) = IDR
      MILE1(IRTRN) = MIL1
      PCT1(IRTRN) = PCENT1
      MILE2(IRTRN) = MIL2
      PCT2(IRTRN) = PCENT2
      MILE3(IRTRN) = MIL3
      PCT3(IRTRN) = PCENT3
```

```
         MILE4(IRTRN) = MIL4
         PCT4(IRTRN) = PCENT4
         GO TO 250
C
C     STORE TEMPORARILY DESIRED DIVERTED AMOUNTS
C
  210    IDIV = IDIV + 1
         DECODE (75,1090,CDATA) IDD(IDIV),DSIRDQ(IDIV)
         GO TO 250
C
C     STORE TEMPORARILY TRIBUTARY INFLOWS
C
  220    IFLW = IFLW + 1
         DECODE (75,1100,CDATA) IDSTM(IFLW),LOCFLW(IFLW)
         GO TO 250
C
C     STORE CONSTANTS FOR COMPUTING CONSUMPTIVE USE
C
  230    DECODE (75,1110,CDATA) PETCON,PRT,BSELV,RAT
         GO TO 250
C
C     STORE INITIAL STREAMFLOW,START,STOP STREAM MILES, ACCRETION FACTOR
C
  240    DECODE (75,1120,CDATA) INQ,STRT,STP,(BGR(IX),IX = 1,9)
  250 CONTINUE
C
C     FILL MAIN ARRAY RETURN STMMI,PERCENTS
C
      DO 270 I = 1,IRTRN
         DO 260 J = 1,INODE1
            IF (IDSR(I).NE.A(6,J)) GO TO 260
            A(10,J) = MILE1(I)
            A(14,J) = PCT1(I)
            A(11,J) = MILE2(I)
            A(15,J) = PCT2(I)
            A(12,J) = MILE3(I)
            A(16,J) = PCT3(I)
            A(13,J) = MILE4(I)
            A(17,J) = PCT4(I)
  260    CONTINUE
  270 CONTINUE
C
C     FILL ARRAY FOR DIVERTED AMOUNTS
C
      DO 290 I = 1,IDIV
         DO 280 J = 1,INODE1
            IF (IDD(I).NE.A(6,J)) GO TO 280
            A(20,J) = DSIRDQ(I)
            A(7,J) = A(20,J)
  280    CONTINUE
  290 CONTINUE
C
C     FILL ARRAY INFLOW
C
      DO 310 I = 1,IFLW
         DO 300 J = 1,INODE2
            IF (B( 3,J).NE.IDSTM(I)) GO TO 300
            B( 1,J) = LOCFLW(I)
  300    CONTINUE
  310 CONTINUE
C     DEFINE MATRIX LIMITS AND INITIALIZE STREAMFLOW
      II = IRITE
      JJ = INODE1 + 1
```

```
      JJN1 = JJ - 1
      KK = INODE2
      J = 0
      INUB = 0
      A(5,JJ) = STP
      Q = INQ
      DO 330 N = 1,JJN1
         DO 320 M = 10,19
            IF (A(M,N).EQ. - 0.0) A(M,N) = 0.0
  320    CONTINUE
  330 CONTINUE
C
C     PRINT FIXED PHYSICAL PARAMETERS FOR CONTROL POINTS
C
      WRITE (6,1130)
      WRITE (6,1140)
      WRITE (6,1150)
      DO 340 I = 1,JJN1
         IELV = A(24,I)
  340 WRITE (6,1160) (NAME(I,K),K = 1,3),IELV,A(5,I),A(19,I),A(10,I),A(1
     14,I),A(11,I),A(15,I),A(12,I),A(16,I),A(13,I),A(17,I)
      WRITE (6,1170)
      WRITE (6,1180)
      WRITE (6,1190)
      WRITE (6,1200)
      WRITE (6,1190)
C     PRINT WATER RIGHTS BASIN RANK LISTING
      DO 360 I = 1,II
         IRANK = C(1,I)
         IUNT = C(2,I)
         DO 350 M = 1,JJ
            IF (A(6,M).EQ.C(2,I)) GO TO 360
  350    CONTINUE
  360 WRITE (6,1210) (NAME(M,N),N = 1,3),IRANK,IUNT,C(3,I)
      WRITE (6,1190)
      WRITE (6,1220) TITLE
      WRITE (6,1230)
      WRITE (6,1240) STRT,INQ
      WRITE (6,1250)
C     PRINT TRIBUTARY INFLOWS
      DO 370 I = 1,KK
         IDNT = B( 3,I)
         JJPI = JJ + I - 1
  370 WRITE (6,1260) (NAME(JJPI,K),K = 1,3),IDNT,B( 2,I),B( 1,I)
      WRITE (6,1270)
      WRITE (6,1280) STP
      WRITE (6,1290)
      DO 380 I = 1,JJN1
         IDNT = A(6,I)
  380 WRITE (6,1300) (NAME(I,K),K = 1,3),IDNT,A(20,I)
      WRITE (6,1310)
C     PRINT RIVER ACCRETION FACTORS AND CONSUMPTIVE USE PARAMETERS
      WRITE (6,1320) (BGR(K),K = 1,9)
      ISELV = BSELV
      WRITE (6,1330) PETCON,ISELV,RAT
      WRITE (6,1340) PRT
C
C      START COMPUTATIONS
C
C       ADD INFLOWS ABOVE CONTROL POINT 1
C
      AKST = STRT
      IBR = 1
```

```
      DO 390 I = 1,JJ
         IF (A(6,I).NE.0.0) GO TO 390
         AKML = A(5,I)
         GO TO 400
         AKML = A(5,I)
  390 CONTINUE
C     ADD ACCRETION WATER
  400 IF ((AKML - AKST).LE.0.0) GO TO 410
      Q = Q + INQ * ((A(5,1) - STRT)/(AKML - AKST)) * BGR(IBR)
  410 DO 420 K = 1,KK
         IF (B( 2,K).GE.A(5,J + 1)) GO TO 560
         IF (B( 2,K).LT.STRT) GO TO 420
         Q = Q + B( 1,K)
  420 CONTINUE
      GO TO 560
C
C        ADD INFLOWS
C
  430 DO 440 K = 1,KK
         IF (B( 2,K).LT.A(5,J)) GO TO 440
         IF (B( 2,K).GE.A(5,J + 1)) GO TO 440
         Q = Q + B( 1,K)
  440 CONTINUE
      IBR = 1
C
C     ADD RETURN FLOWS AND DECIDE RIVER ACCRETION FACTOR
C
      IF (A(10,J).NE.0.0) GO TO 450
      Q = Q + A(9,J)
  450 DO 500 I = 1,J
         IF (A(6,I).NE.0.0) GO TO 460
         IBR = IBR + 1
  460    IF (A(10,I).LT.A(5,J)) GO TO 470
         IF (A(10,I).GE.A(5,J + 1)) GO TO 500
         Q = Q + A(14,I) * A(9,I)
  470    IF (A(11,I).LT.A(5,J)) GO TO 480
         IF (A(11,I).GE.A(5,J + 1)) GO TO 500
         Q = Q + A(15,I) * A(9,I)
  480    IF (A(12,I).LT.A(5,J)) GO TO 490
         IF (A(12,I).GE.A(5,J + 1)) GO TO 500
         Q = Q + A(16,I) * A(9,I)
  490    IF (A(13,I).GE.A(5,J + 1)) GO TO 500
         IF (A(13,I).LT.A(5,J)) GO TO 500
         Q = Q + A(17,I) * A(9,I)
  500 CONTINUE
      JX = J + 1
      AKST = STRT
      DO 510 IM = 1,J
         IM1 = J + 1 - IM
         IF (A(6,IM1).NE.0.0) GO TO 510
         AKST = A(5,IM1)
         GO TO 520
  510 CONTINUE
  520 DO 530 IM = JX,JJ
         IF (A(6,IM).NE.0.0) GO TO 530
         AKML = A(5,IM)
         GO TO 540
  530 CONTINUE
C
C     ADD ACCRETION WATER
C
  540 IF ((AKML - AKST).LE.0.0) GO TO 550
      Q = Q + INQ * ((A(5,J + 1) - A(5,J))/(AKML - AKST)) * BGR(IBR)
```

```
  550 IF (Q.GT.0.0) GO TO 560
      Q = 0.0
  560 IF ((J + 1).EQ.JJ) GO TO 860
      J = J + 1
C
C     DECIDE WHETHER ENOUGH WATER TO SUPPLY NEXT DIVERSION
C
      A(18,J) = Q
C
C     STORE STREAMFLOW VALUE
C
      IF (Q.LT.A(7,J)) GO TO 610
  570 IF ((A(10,J).EQ.0.0).AND.(A(14,J).EQ.1.0)) GO TO 580
      Q = Q - A(7,J)
C     FILL WATER RIGHTS, SENIOR FIRST
  580 REMQ = A(7,J)
      DO 600 I = 1,II
         IF (C(2,I).NE.A(6,J)) GO TO 600
         IF (C(3,I).GT.REMQ) GO TO 590
         C(4,I) = A(3,I)
         REMQ = REMQ - A(3,I)
         GO TO 600
  590    C(4,I) = REMQ
C
C        COMPUTE CONSUMPTIVE USE AND RETURN FLOWS
C
         CALL CURTN
         GO TO 430
  600 CONTINUE
      CALL CURTN
      GO TO 430
C
C     COMPUTE SHORTAGE AND IDENTIFY SENIOR WATER RIGHT
C
  610 SAMTS = 0.0
      DO 620 I = 1,II
         IF (C(2,I).NE.A(6,J)) GO TO 620
         SAMTS = SAMTS + C(3,I)
  620 CONTINUE
      IF (SAMTS.GE.A(7,J)) GO TO 640
      IF (SAMTS.GT.Q) GO TO 630
      A(7,J) = Q
C
C     NO WATER RIGHTS ARE SHORT, CONTINUE ROUTING
C
      GO TO 570
C     DEFINE THE CALL
  630 A(7,J) = SAMTS
  640 REMDQ = A(7,J)
      DO 650 N = 1,II
         I = N
         IT = I
         IF (C(2,I).NE.A(6,J)) GO TO 650
         IF (REMDQ.LE.C(3,I)) GO TO 660
         IF (Q.LE.C(3,I)) GO TO 670
         Q = Q - C(3,I)
         REMDQ = REMDQ - C(3,I)
  650 CONTINUE
  660 CALL = REMDQ - Q
      GO TO 680
  670 CALL = C(3,I) - Q
  680 JA = J
      JBZ = 1
```

```
      INUB = INUB + 1
      JRITE(INUB,1) = C(2,I)
      JRITE(INUB,2) = C(1,I)
      FRITE(INUB,1) = CALL
      DO 690 IRT = 1,3
  690 NAMES(INUB,IRT) = NAME(J,IRT)
C     NO UPSTREAM DIVERSIONS EXIST NO REALLOCATION MADE
      IF (JA.NE.1) GO TO 700
      A(7,JA) = A(18,JA)
      J = JA
      JRITE(INUB,4) = 0
      JRITE(INUB,3) = JRITE(INUB,4)
      FRITE(INUB,2) = 0.0
      NAMEJ(INUB,1) = 10H  NO REALL
      NAMEJ(INUB,2) = 10HOCATION MA
      NAMEJ(INUB,3) = 4HDE
C     CONTINUE ROUTING
      GO TO 570
C
C     GO UPSTREAM AND FIND UNDECREED DIVERSIONS
C
  700 JA = JA - 1
      IF ((A(10,JA).EQ.0.0).AND.(A(14,JA).EQ.1.0)) JA = JA - 1
      SAMTS = 0.0
      DO 710 N = 1,II
         IF (C(2,N).NE.A(6,JA)) GO TO 710
         SAMTS = SAMTS + C(3,N)
  710 CONTINUE
      IF (A(7,JA).GT.SAMTS) GO TO 720
      IF (JA.EQ.1) GO TO 760
      GO TO 700
  720 JB = JA
      ZT = A(7,JA) - SAMTS
C
C     DEFINE THE CUT
C
      CALL COMCUT
      JA = JB
      PREV = A(7,JA)
      IF (YCUT.LT.(A(7,JA) - SAMTS)) GO TO 730
      A(7,JA) = SAMTS
      GO TO 740
C     CUT UNADJUDICATED WATER
  730 A(7,JA) = A(7,JA) - YCUT
  740 CUT = PREV - A(7,JA)
      JRITE(INUB,3) = A(6,JA)
      JRITE(INUB,4) = 0
      FRITE(INUB,2) = CUT
      DO 750 IRT = 1,3
  750 NAMEJ(INUB,IRT) = NAME(JA,IRT)
      J = JA
      Q = A(18,J)
C
C     CONTINUE ROUTING FROM UPSTREAM CONTROL POINT
C
      GO TO 570
C
C     FIND MOST JUNIOR RIGHT UPSTREAM THAT IS DIVERTING
C
  760 I = IT
      IP1 = I + 1
      DO 790 ISMALL = IP1,II
         ISM = II - ISMALL + IP1
```

```
          IF (A(4,ISM).LE.0.001) GO TO 790
          DO 770 JT = 1,JJ
             JB = JT
             IF (A(6,JB).EQ.C(2,ISM)) GO TO 780
  770     CONTINUE
  780     IF ((A(10,JB).EQ.0.0).AND.(A(14,JB).EQ.1.0)) GO TO 790
          IF (A(5,JB).LT.A(5,J)) GO TO 800
  790 CONTINUE
C     NO JUNIOR WATER RIGHTS HAVE BEEN FOUND NO REALLOCATION IS MADE
      JRITE(INUB,4) = 0
      JRITE(INUB,3) = JRITE(INUB,4)
      FRITE(INUB,2) = 0.0
      NAMEJ(INUB,1) = 10H  NO REALL
      NAMEJ(INUB,2) = 10HOCATION MA
      NAMEJ(INUB,3) = 4HDE
      GO TO 840
  800 IT = ISM
      ZT = C(4,IT)
C
C     DEFINE CUT
C
      CALL COMCUT
      PREV = A(7,JB)
      IF (YCUT.GT.C(4,ISM)) GO TO 810
C     CUT JUNIOR WATER RIGHT
      A(7,JB) = A(7,JB) - YCUT
      GO TO 820
  810 A(7,JB) = A(7,JB) - A(4,ISM)
  820 CUT = PREV - A(7,JB)
      C(4,ISM) = C(4,ISM) - CUT
      JRITE(INUB,3) = C(2,ISM)
      JRITE(INUB,4) = C(1,ISM)
      FRITE(INUB,2) = CUT
      DO 830 IRT = 1,3
  830 NAMEJ(INUB,IRT) = NAME(JB,IRT)
      IF (CUT.EQ.0.0) GO TO 840
      J = JB
      Q = A(18,J)
C
C     CONTINUE ROUTING FROM UPSTREAM DITCH
C
      GO TO 570
  840 Q = A(18,J)
      FINK = A(7,J) - CALL
      IF (FINK.GT.Q) GO TO 850
      A(7,J) = FINK
C     FUTILE CALL GO BACK DOWNSTREAM AND CONTINUE ROUTING
      GO TO 570
  850 A(7,J) = 0
      GO TO 570
C
C     PRINT FINAL RESULTS
C
  860 WRITE (6,1350)
      WRITE (6,1360)
      IF (JBZ.EQ.1) GO TO 870
      WRITE (6,1370)
      GO TO 890
  870 DO 880 I = 1,INUB
  880 WRITE (6,1380) (NAMES(I,K),K = 1,3),(JRITE(I,K),K = 1,2),FRITE(I,1
     1),(NAMEJ(I,K),K = 1,3),(JRITE(I,K),K = 3,4),FRITE(I,2)
  890 WRITE (6,1390)
      WRITE (6,1400)
```

```
      TCONSUM = 0.
      SUM2 = TCONSUM
      SUM1 = SUM2
      DCON = 0.0
      DO 950 I = 1,JJM1
         IF ((A(10,I).NE.0.0).OR.(A(14,I).NE.1.0)) GO TO 910
         DVTSR = 0.0
         IF (A(20,I).LE.A(7,I)) GO TO 920
         IF (A(18,I).EQ.A(7,I)) GO TO 920
         IF (A(18,I).GE.A(20,I)) GO TO 900
         A(7,I) = A(18,I)
         GO TO 920
  900    A(7,I) = A(20,I)
         GO TO 920
  910    DVTSR = A(7,I)
         IF (A(9,I).NE.0.0) GO TO 920
         SUM1 = SUM1 + A(7,I)
  920    SUM2 = SUM2 + A(4,I)
         TCONSUM = TCONSUM + A(8,I)
         DO 930 M = 1,4
            K = M + 9
            L = K + 4
            IF (A(K,I).EQ.0.0) GO TO 940
            IF (A(K,I).LT.STP) GO TO 930
            DCON = DCON + (A(9,I) * A(L,I))
  930    CONTINUE
  940    IDNT = A(6,I)
         QBLOW = A(18,I) - A(7,I)
         IF ((A(10,I).EQ.0.0).AND.(A(14,I).EQ.1.0)) QBLOW = A(18,I)
         SHORTS = A(20,I) - A(7,I)
  950 WRITE (6,1410) (NAME(I,K),K = 1,3),IDNT,A(5,I),DVTSR,A(8,I),A(9,I)
     1,QBLOW,SHORTS
      WRITE (6,1420)
      SUM3 = SUM2 + TCONSUM
      PRTRN = SUM2/SUM3
      YIELD = Q + TCONSUM + SUM1 + DCON
      WRITE (6,1440)
      WRITE (6,1430)
      WRITE (6,1440)
      WRITE (6,1450) YIELD
      WRITE (6,1460) SUM1
      WRITE (6,1470) SUM3
      WRITE (6,1480) TCONSUM,PRTRN
      WRITE (6,1490) Q
      JJ = JJ - 1
      FMIN = 10000.
      DO 980 JPRNT = 1,JJ
         IF ((A(10,JPRNT).NE.0.0).OR.(A(14,JPRNT).NE.1.0)) GO TO 960
         QBEL = A(18,JPRNT)
         GO TO 970
  960    QBEL = A(18,JPRNT) - A(7,JPRNT)
  970    IF (QBEL.GT.FMIN) GO TO 980
         FMIN = QBEL
         STMMIN = A(5,JPRNT)
  980 CONTINUE
      WRITE (6,1500) FMIN,STMMIN
C     COMPUTE SUPPLEMENTAL WATER NEEDED OR SURPLUS WATER
      CALL NOSHORT
      IF (ADDQ.GT.0.0) GO TO 990
      ADDQ =  - ADDQ
      WRITE (6,1510) ADDQ
      GO TO 1000
  990 WRITE (6,1520) ADDQ
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1000 WRITE (6,1440)
     WRITE (6,1530)
     WRITE (6,1540)
     WRITE (6,1550)
     WRITE (6,1560)
     WRITE (6,1550)
     DO 1030 J = 1,JJ
        IF (A(6,J).EQ.0.0) GO TO 1030
        IDNT = A(6,J)
        WRITE (6,1570) (NAME(J,K),K = 1,3),IDNT
        SUMRITE = 0.0
        SUPLI = 0.0
        DO 1010 I = 1,II
           IF (C(2,I).NE.A(6,J)) GO TO 1010
           SUPLI = SUPLI + A(4,I)
           IRANK = C(1,I)
           SUMRITE = SUMRITE + C(3,I)
           WRITE (6,1580) IRANK,C(3,I),C(4,I)
1010    CONTINUE
        EXTRA = A(7,J) - SUMRITE
        IF (EXTRA.GT.0.0) GO TO 1020
        EXTRA = 0.0
1020    WRITE (6,1590) SUMRITE,SUPLI,EXTRA,A(7,J)
        WRITE (6,1600)
1030 CONTINUE
     STOP
C
1040 FORMAT (8A10)
1050    FORMAT (A5,7A10,A5)
1060    FORMAT (3X,5F5.0,3X,F2.0,2A10,A4,F6.2,7X,F5.0)
1070    FORMAT (F5.0,5X,F5.0,5X,F10.4,45X)
1080    FORMAT (F5.0,4(F6.2,F4.3),30X)
1090    FORMAT (F5.0,F10.4,60X)
1100    FORMAT (F5.0,F10.4,60X)
1110    FORMAT (F10.6,F5.3,F5.0,F10.7,45X)
1120    FORMAT (3F10.2,9F5.4)
1130 FORMAT (1H1,///,34X, 65HCERI-FEA WATER FOR ENERGY PROJECT--WHITE R
    1IVER BASIN EVALUATION AREA)
1140 FORMAT (//,40X, 55HPROGRAM FOR WATER ALLOCATION BY PRIORITY OF WAT
    1ER RIGHT,///,56X, 24HSTRUCTURE    INPUT    DATA,//)
1150 FORMAT (1X,135(1H*)/,81X, 23HRETURN FLOW ALLOCATIONS,/,54X,82(1H*)
    1/,8X,  9HSTRUCTURE,20X,  6HSTREAM,2X,  9HIRRIGATED,1X,4(20H  STREA
    2M  PERCENT OF)/,10X,  4HNAME,13X,  5HELEV.,6X,  4HMILE,5X,  5HACRE
    3S,3X,4(20H   MILE    TOT RETURN)/,1X,135(1H*)/)
1160 FORMAT (1X,2A10,A4,3X,I4,1X,10(F10.2))
1170 FORMAT (/,1X,135(1H*))
1180 FORMAT (1H1,///,57X, 23HWATER RIGHTS DATA INPUT,//)
1190 FORMAT (/,40X,60(1H*)/)
1200 FORMAT (45X, 14HSTRUCTURE NAME,10X,  5HBASIN,7X,  5HIDENT,7X,  7HD
    1ECREED,/,69X,  4HRANK,8X,  3HNO.,9X,  6HAMOUNT)
1210 FORMAT (40X,2A10,A4,6X,I4,8X,I4,4X,F10.2)
1220 FORMAT (1H1,//,28X,80(1H*),/,28X,6A10,/,28X,80(1H*))
1230 FORMAT (///,57X,(1H*), 18HSTREAM INFLOW DATA,(1H*)//)
1240 FORMAT (56X, 23HINITIAL STREAM MILE    =,F8.2//,56X, 23HINITIAL STR
    1EAM FLOW    =,F8.2///)
1250 FORMAT (57X, 21HLOCAL TRIBUTARY FLOWS,///,38X,60(1H*)/,44X, 11HSTR
    1EAM NAME,10X,  5HIDENT,4X, 11HSTREAM MILE,5X,  4HFLOW,/,38X,60(1H*
    2)/)
1260 FORMAT (38X,2A10,A4,4X,I4,2X,F10.2,2X,F10.2)
1270 FORMAT (/,38X,60(1H*))
1280 FORMAT (///,42X, 48HSTREAM MILE OF LAST DOWNSTREAM CONTROL POINT
    1 =,F8.2)
1290 FORMAT (1H1,///,54X, 28HDESIRED FLOWS FOR STRUCTURES,//,53X, 29H
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   1                                     ,/,44X,48(1H*)/,49X, 14HSTRUCTURE NAME,
     28X,  5HIDENT,4X, 12HDESIRED AMNT,/,44X,48(1H*)/)
1300 FORMAT (44X,2A10,A4,4X,I4,4X,F10.2)
1310 FORMAT (/,44X,48(1H*))
1320 FORMAT (///,5X, 23HRIVER ACCRETION FACTORS,9F10.4)
1330 FORMAT (///,5X, 36HPOTENTIAL CONSUMPTIVE USE PER ACRE =,F6.4,2X,
    17HAT ELEV,1X,I4,  4H FT.,5X, 30HRATE OF CHANGE/1000 FT. ELEV =,F10
    2.7)
1340 FORMAT (///,5X, 59HLOWER LIMIT OF RETURN FLOW AS FRACTION OF TOTAL
    1 DIVERSION  ,F10.4,//)
1350 FORMAT (1H1,//,65X,  6HOUTPUT,/,58X, 21HANALYSIS FROM PROGRAM,//)
1360 FORMAT (/,51X, 33HREALLOCATION OF WATER BY PRIORITY,//,53X, 29H OF
    1 INDIVIDUAL WATER RIGHTS  ,///,6X,60(1H*),5X,60(1H*)/,23X, 26HCALL
    2 FROM SENIOR DIVERSION,39X, 25HCUT FROM JUNIOR DIVERSION,/,11X, 14
    3HSTRUCTURE NAME,8X,  5HIDENT,6X,  4HRANK,6X,  8HSHORTAGE,12X, 14HS
    4TRUCTURE NAME,8X,  5HIDENT,8X,  4HRANK,4X, 11HCURTAILMENT,/,6X,60(
    51H*),5X,60(1H*)/)
1370 FORMAT (5X, 35H  NO SHORTAGES EXIST IN THIS SYSTEM)
1380 FORMAT (6X,2A10,A4,4X,I4,8X,I4,4X,F10.2,8X,2A10,A4,3X,I4,6X,I4,4X,
    1F10.2)
1390 FORMAT (/,6X,60(1H*),5X,60(1H*))
1400 FORMAT (1H1,///,47X, 42HFINAL ALLOCATION OF AVAILABLE WATER SUPPLY
    1,//,53X, 29H  BY WATER RIGHT PRIORITIES  ,///,14X,108(1H*)/,19X, 1
    24HSTRUCTURE NAME,8X,  5HIDENT,7X,  6HSTREAM,5X,  8HDIVERTED,2X, 11
    3HCONSUMPTIVE,4X,  6HRETURN,3X, 11HSTREAM FLOW,3X,  8HSHORTAGE,/,42
    4X,  3HNO.,9X,  4HMILE,7X,  6HAMOUNT,7X,  3HUSE,9X,  4HFLOW,4X, 12H
    5BELOW DIVRSN,/,14X,108(1H*)/)
1410 FORMAT (14X,2A10,A4,4X,I4,2X,6(F10.2,2X))
1420 FORMAT (/,14X,108(1H*)///)
1430 FORMAT (45X,  7HSUMMARY)
1440 FORMAT (14X,71(1H*))
1450 FORMAT (14X, 14HSYSTEM YIELD =,F10.2)
1460 FORMAT (/,14X, 50HWATER DIVERTED OUT OF SYSTEM OR TOTALLY CONSUMED
    1 =,F10.2)
1470 FORMAT (/,14X, 30HSUM OF IRRIGATION DIVERSIONS =,F10.2)
1480 FORMAT (/,14X, 34HTOTAL IRRIGATION CONSUMPTIVE USE =,F10.2,//,14X,
    1 61HIRRIGATION RETURN AS FRACTION OF TOTAL IRRIGATION DIVERSION =,
    2F10.2)
1490 FORMAT (/,14X, 53HFINAL STREAM FLOW AT LAST DOWNSTREAM CONTROL POI
    1NT  =,F10.2)
1500 FORMAT (/,14X, 22HMINIMUM STREAM FLOW  =,F10.2, 19H  AT STREAM MIL
    1E  =,F10.2)
1510 FORMAT (/,14X, 25HAVAILABLE SURPLUS WATER =,F10.2)
1520 FORMAT (/,14X, 50HSUPPLEMENTAL WATER NECESSARY TO SUPPLY SHORTAGES
    1 =,F10.2)
1530 FORMAT (1H1,///,49X, 38HSUMMARY OF WATER RIGHTS AND ALLOCATION,/)
1540 FORMAT (62X, 12HBY STRUCTURE,/)
1550 FORMAT (/,4X,130(1H*))
1560 FORMAT (11X, 14HSTRUCTURE NAME,12X,  5HIDENT,11X,  4HRANK,6X, 14HD
    1ECREED AMOUNT,3X, 15HSUPPLIED AMOUNT,3X, 15HUNDECREED SUPPLY,3X, 1
    25HTOTAL DIVERSION)
1570     FORMAT (6X,2A10,A4,8X,I4)
1580         FORMAT (53X,I4,7X,F10.2,8X,F10.2)
1590     FORMAT (/,53X,  6HTOTALS,5X,F10.2,8X,F10.2,8X,F10.2,8X,F10.2)
1600     FORMAT (4X,130(1H-))
         END
```

```
      SUBROUTINE CURTN
C
C     COMPUTE CONSUMPTIVE USE AND RETURN FLOW
C
      COMMON /KOSUMP/        A(24,30 )    , PETCON       , PRT          ,
     1         ZT           , JB           , J            , CALL         ,
     2         YCUT         , JJN1         , ADDG         , BSELV        ,
     3         RAT
      RATS = ((BSELV - A(24,J))/1000.) * RAT
      PCU = (PETCON + RATS) * A(19,J)
      IF (A(19,J).EQ.0.0) GO TO 120
      IF ((A(7,J) - PCU).LT.(A(7,J) * PRT)) GO TO 100
      A(9,J) = A(7,J) - PCU
      GO TO 110
  100 A(9,J) = A(7,J) * PRT
  110 A(8,J) = A(7,J) - A(9,J)
  120 RETURN
      END
      SUBROUTINE COMCUT
C
C     COMPUTE CUT
C
      COMMON /KOSUMP/        A(24,30 )    , PETCON       , PRT          ,
     1         ZT           , JB           , J            , CALL         ,
     2         YCUT         , JJN1         , ADDG         , BSELV        ,
     3         RAT
      IF (CALL.GE.ZT) GO TO 130
      IF (A(9,JB).NE.0.0) GO TO 100
      YCUT = CALL
      GO TO 150
  100 SPCT = 0.0
      IF (A(10,JB).NE.0.) GO TO 110
      SPCT = 1.0
      GO TO 120
  110 IF (A(10,JB).GE.A(5,J)) GO TO 120
      SPCT = A(14,JB)
      IF (A(11,JB).GE.A(5,J)) GO TO 120
      SPCT = SPCT + A(15,JB)
      IF (A(12,JB).GE.A(5,J)) GO TO 120
      SPCT = SPCT + A(16,JB)
      IF (A(13,JB).GE.A(5,J)) GO TO 120
      SPCT = SPCT + A(17,JB)
  120 IF (A(9,JB).LT.(PRT * A(7,JB))) GO TO 140
      YCUT = CALL/(1.000001 - SPCT)
      IF ((A(7,JB) - YCUT) * (1.0 - PRT).GE.A(8,JB)) GO TO 150
      ZDG = A(8,JB)/(1.000001 - PRT)
      ZRQ = ZDG - A(8,JB)
      XKALL = CALL - A(7,JB) + ZDG + (SPCT * (A(9,JB) - ZRQ))
      YKUT = XKALL/(1.000001 - (SPCT * PRT))
      YCUT = A(7,JB) - ZDG + YKUT
      GO TO 150
  130 YCUT = ZT
      GO TO 150
  140 YCUT = CALL/(1.0 - (SPCT * PRT))
  150 YCUT = YCUT + .001
      RETURN
      END
      SUBROUTINE NOSHORT
      COMMON /KOSUMP/        A(24,30 )    , PETCON       , PRT          ,
     1         ZT           , JB           , J            , CALL         ,
     2         YCUT         , JJN1         , ADDG         , BSELV        ,
     3         RAT
      DIMENSION              S(3,20 )
```

```
      ADDQ = 0.0
      TAM = 0.0
      DO 100 J = 1,JJN1
         S(1,J) = A(20,J) - A(7,J)
         S(3,J) = 0.0
         S(2,J) = S(3,J)
         IF (S(1,J).EQ.0.0) GO TO 100
         TAM = 1.0
100   CONTINUE
      IF (TAM.EQ.0.0) GO TO 310
      DO 230 J = 1,JJN1
         IF (A(7,J).EQ.A(20,J)) GO TO 230
         ADDQ = ADDQ + S(1,J)
         IF ((A(10,J).NE.0.0).OR.(A(14,J).NE.1.0)) GO TO 110
         S(3,J) = A(20,J)
         A(9,J) = A(7,J)
         GO TO 130
110      IF (A(19,J).EQ.0.0) GO TO 230
         RATS = ((BSELV - A(24,J))/1000.) * RAT
         PCU = (PETCON + RATS) * A(19,J)
         IF ((A(20,J) - PCU).LT.(A(20,J) * PRT)) GO TO 120
         S(3,J) = A(20,J) - PCU
         GO TO 130
120      S(3,J) = A(20,J) * PRT
130      DO 220 KO = 1,4
            N1 = 1
            K = KO + 9
            L = K + 4
            J1 = J + 1
            DO 210 I = J1,JJN1
               IF (S(1,I).EQ.0.0) GO TO 210
               IF (A(10,J).NE.0.0) GO TO 140
               IF (S(1,I).LE.(S(3,J) - A(9,J))) GO TO 150
               S(1,I) = S(1,I) - (S(3,J) - A(9,J))
               GO TO 230
140            IF (A(K,J).GE.A(5,I)) GO TO 210
               IF (A(K,J).EQ.0.0) GO TO 230
               IF (S(1,I).LE.((S(3,J) - A(9,J)) * A(L,J))) GO TO 180
               S(1,I) = S(1,I) - ((S(3,J) - A(9,J)) * A(L,J))
               IF (S(1,I).LE.((S(3,J) - A(9,J)) * A(L,J))) GO TO 180
               S(1,I) = S(1,I) - ((S(3,J) - A(9,J)) * A(L,J))
               GO TO 220
150            RGE = S(3,J) - A(9,J) - S(1,I)
               S(1,I) = 0.0
               IT = I + 1
               DO 170 IR = IT,JJN1
                  IF (S(1,IR).EQ.0.0) GO TO 170
                  IF (S(1,IR).LE.RGE) GO TO 160
                  S(1,IR) = S(1,IR) - RGE
                  GO TO 230
160               RGE = RGE - S(1,IR)
                  S(1,IR) = 0.0
170            CONTINUE
               GO TO 240
180            RMNT = ((S(3,J) - A(9,J)) * A(L,J)) - S(1,I)
               S(1,I) = 0.0
               IK = I + 1
               DO 200 IP = IK,JJN1
                  IF (S(1,IP).EQ.0.0) GO TO 200
                  IF (S(1,IP).LE.RMNT) GO TO 190
                  S(1,IP) = S(1,IP) - RMNT
                  GO TO 220
190               RMNT = RMNT - S(1,IP)
```

```
                S(1,IP) = 0.0
200           CONTINUE
              GO TO 230
210         CONTINUE
220      CONTINUE
230 CONTINUE
240 DO 300 J = 1,JJN1
       IF (A(20,J).EQ.0.0) GO TO 300
       S(2,J) = S(2,J) + ADDQ
       IF (A(20,J).EQ.A(7,J)) GO TO 300
       RTRN = S(3,J) - A(9,J)
       IF (A(10,J).NE.0.0) GO TO 260
       IO = J + 1
       DO 250 I = IO,JJN1
          S(2,I) = S(2,I) + RTRN - A(20,J) + A(7,J)
250    CONTINUE
       GO TO 300
260    JP = J + 1
       DO 270 M = JP,JJN1
          S(2,M) = S(2,M) + A(7,J) - A(20,J)
270    CONTINUE
       DO 290 N = 1,4
          K = N + 9
          L = K + 4
          DO 280 M = JP,JJN1
             IF (A(K,J).EQ.0.0) GO TO 300
             IF (A(K,J).GE.A(5,M)) GO TO 280
             S(2,M) = S(2,M) + (RTRN * A(L,J))
280       CONTINUE
290    CONTINUE
300 CONTINUE
310 TMAX = 0.0
    RMIN = 10000.
    DO 320 I = 1,JJN1
       IF (A(20,I).EQ.0.0) GO TO 320
       TMAX = A(18,I) + S(2,I) - A(20,I)
       IF (TMAX.GT.RMIN) GO TO 320
       RMIN = TMAX
       IO = I
320 CONTINUE
    ADDQ = ADDQ - RMIN
    DO 330 J = 1,JJN1
       IF ((A(10,J).NE.0.0).OR.(A(14,J).NE.1.0)) GO TO 330
       A(9,J) = 0.0
330 CONTINUE
    RETURN
    END
00                                                              02/15/77
```

APPENDIX C

SAMPLE INPUT DATA FOR PROGRAM DISTRIW

CERI-FEA WATER FOR ENERGY PROJECT--WHITE RIVER BASIN EVALUATION AREA

PROGRAM FOR WATER ALLOCATION BY PRIORITY OF WATER RIGHT

STRUCTURE INPUT DATA

STRUCTURE NAME	ELEV.	STREAM MILE	IRRIGATED ACRES	RETURN FLOW ALLOCATIONS							
				STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN	STREAM MILE	PERCENT OF TOT RETURN
WHITE R PL NO 2	6800	.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NELSON DITCH	6800	.91	47.00	1.40	.25	2.40	.75	0.00	0.00	0.00	0.00
GREENSTREET DITCH EXT	6800	1.41	87.00	2.49	.40	3.30	.60	0.00	0.00	0.00	0.00
LA KAMP DITCH	6800	2.50	51.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ELK CREEK DITCH	6800	3.49	130.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WALTER WARNER DITCH	6800	5.00	17.00	6.67	1.00	0.00	0.00	0.00	0.00	0.00	0.00
WALTER WARNER DITCH NO 2	6700	6.64	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEW ARCHER WARNER	6700	7.48	51.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DREIFÜSS DITCH	6600	9.04	89.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MILLER CREEK DITCH	6600	10.00	3473.00	12.05	.20	19.00	.10	24.35	.30	26.03	.40
DREYFUSS DITCH	6700	10.20	53.00	11.00	.25	12.00	.50	12.50	.25	0.00	0.00
WARREN SMITH DITCH	6600	12.08	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEAL PUMP STATION	6600	13.23	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OAK RIDGE PARK	6600	13.24	1866.00	15.70	.20	15.75	.30	17.50	.20	19.16	.30
CARSTENS PUMP STATION	6500	13.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GOVREAU PUMP STATION	6500	13.63	27.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEEKER WATER WORKS PL	6500	14.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HIGHLAND DITCH	6500	14.35	2510.00	15.80	.15	20.00	.15	23.20	.20	24.35	.50
OLD AGENCY DITCH	6400	15.05	627.00	16.00	.40	16.90	.20	17.85	.20	19.35	.20
LOWLAND DITCH	6400	15.77	347.00	16.30	.60	16.60	.40	0.00	0.00	0.00	0.00
WAGNER DITCH	6400	16.30	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHITE RIVER ABOVE COAL C	6400	16.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STORY GULCH PARACHUTE PL	6400	16.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOUTH SIDE HIGHLINE	6400	19.38	460.00	19.60	.10	20.00	.10	21.00	.45	21.52	.35
WHITE RIVER NEAR MEEKER	6300	20.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHERIDAN AND MORTON D	6200	20.46	44.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEEKER DITCH	6200	21.46	66.00	24.50	.30	25.00	.20	25.50	.20	26.08	.30
B P FRANKLIN DITCH 1	6200	22.60	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEEKER WATER SYS PL	6200	23.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISLAND DITCH	6200	23.68	33.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEEKER BRIDGE DITCH	6200	23.97	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIBLOCK DITCH	6200	26.09	1366.00	28.00	.15	30.00	.20	32.50	.15	34.95	.50
DORRELL DITCH 1	6100	27.47	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHITE R 14 MI CK PL	6100	28.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PEASE DITCH	6100	28.52	367.00	30.00	.25	31.70	.25	33.95	.25	35.00	.25
STRAWBERRY CK PL	6100	28.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

POWELL PARK DITCH	6100	28.92	1845.00	31.00	.20	32.60	.10	34.95	.40	38.30	.30
HAY BRETHERTON DITCH	6000	31.02	403.00	32.00	.25	32.70	.25	33.25	.25	35.00	.25
INDEPENDENT DITCH	6000	31.34	165.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JAMES HAYES DITCH	6000	33.33	131.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HALPEN PUMP PIPELINE	6000	33.70	135.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LORING DITCH	6000	38.24	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IVO E SCHULTZ D AND PUMP	6000	39.24	51.00	39.34	.50	39.50	.50	0.00	0.00	0.00	0.00
WHITE RIVER BELOW MEEKER	5900	39.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
~~HAY DITCH 2~~	~~5900~~	~~40.00~~	~~46.00~~	~~0.00~~	~~0.00~~	~~0.00~~	~~0.00~~	~~0.00~~	~~0.00~~	~~0.00~~	~~0.00~~
THOMAS DITCH 3	5900	40.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THOMAS DITCH	5900	40.59	54.00	40.80	1.00	0.00	0.00	0.00	0.00	0.00	0.00
THOMAS DITCH 2	5900	40.71	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHITE R PICEANCE PL	5900	41.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCDOWELL DITCH	5900	42.51	203.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCDOWELL DITCH NO 1	5900	43.50	110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALHOUN DITCH	5900	44.08	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IMES AND REYNOLD DITCH	5800	45.59	153.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHERMAN TAYLOR DITCH	5800	46.00	199.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KELLOGG GULCH PL	5800	46.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BLACKS GULCH PL	5800	49.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GEORGE S WHITTER DITCH	5800	49.63	167.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHITE R MESA D JACOBS P	5800	50.21	95.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUPERIOR OIL PL	5700	50.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC WILLIAMS AND GEORGE D	5700	50.70	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MINER MARTIN DITCH	5700	51.39	54.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WRAY GULCH PL	5700	51.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OHIO ERTL PL	5700	52.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WHITE R PUMPING PL	5700	52.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAMMOTH DITCH	5700	52.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORNEY CORCORAN DITCH	5700	52.73	129.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WOLF RIDGE PL	5700	53.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LITTLE DITCH	5700	54.82	209.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEAD IRRIGATION SYSTEM	5600	58.21	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JOHN DELANEY DITCH	5600	58.49	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BLAIR DITCH	5600	60.88	193.00	61.00	.50	62.00	.50	0.00	0.00	0.00	0.00
E H IMES DITCH	5600	64.48	41.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROOKED WASH PL	5600	66.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PEDRICK DITCH	5600	66.84	503.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BASSETT DITCH	5500	71.53	32.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCGURDER	5500	73.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MOBLEY PIPELINE 1	5500	74.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WOLF CK PL	5500	74.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAWRENCE DITCH	5500	74.46	67.00	75.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
STADTMAN DITCH	5500	75.83	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THOMPSON DITCH	5500	76.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALDWELL DITCH NO 1	5500	77.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QUEEN DITCH	5400	78.84	58.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BEARD DITCH	5400	79.21	57.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BUCKNER DITCH	5400	80.27	58.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HALL DITCH	5400	80.61	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAMMOND DITCH	5400	83.37	334.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SAVAGE DITCH	5300	88.36	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPRING CREEK PUMP	5300	88.98	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPRING CREEK 1	5300	89.00	48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPRING CK D PUMP 3	5300	89.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SPRING CREEK 2	5300	89.25	32.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
GROSS NICHOLS DITCH	5300	92.31	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RANGELY POWER CONDUIT	5300	94.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
DOUGLAS CANAL	5300	94.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
L K DITCH 1	5300	94.65	31.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SUPERIOR PUMPBACK NO 3	5300	95.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
GOEDER DITCH	5300	95.54	149.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
WHITE RIVER AB RANGELY	5300	97.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
HEFLEY PUMP PLANT NO 2	5300	97.53	76.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
HEFLEY PUMP PLANT NO 1	5300	100.58	74.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CALAVAT DITCH	5300	100.59	150.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
STOREY DITCH 1	5300	102.50	63.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
STOREY DITCH 2	5200	103.07	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
STROUD DITCH	5200	103.23	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CHASE AND COLTHARP D	5200	103.83	95.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RANGELY WATER PLANT	5200	104.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PURDY IRRIGATION PUMP	5200	105.18	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
HEFLEY PUMP PLANT NO 3	5200	105.64	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
UINTAH OIL REFIN CO PL	5200	107.55	0.00	0.00	0.00	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
MOON LAKE PL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
MOON LAKE STALEY PIPELINE	5200	107.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PIONEER DITCH	5200	108.37	177.00	108.80	.50	109.30	.50	0.00	0.00	0.00	0.00	
GEORGE MENGE D	5200	108.50	65.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
STANDOLIND OIL CO PL	5200	108.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
MCLAUGHLIN PIPELINE	5200	110.27	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TEXAS CO PL	5200	111.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
SUPERIOR PUMPBACK NO 2	5200	112.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CALIFORNIA CO WATER PL	5200	113.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RIDGEWAY AND STATELER D	5200	120.24	162.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
MEAGER DIVERSION	5100	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
WHITE RIVER NR WATSON UT	4900	144.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

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WATER RIGHTS DATA INPUT

STRUCTURE NAME	BASIN RANK	IDENT NO.	DECREED AMOUNT
POWELL PARK DITCH	1	883	20.00
ELK CREEK DITCH	2	623	1.60
MEEKER DITCH	8	808	20.00
OLD AGENCY DITCH	9	849	8.50
LA KAMP DITCH	10	752	1.00
NIBLOCK DITCH	16	842	2.40
SOUTH SIDE HIGHLINE	17	935	4.00
OLD AGENCY DITCH	19	849	5.00
LITTLE DITCH	31	769	3.00
ELK CREEK DITCH	32	623	1.00
HIGHLAND DITCH	33	694	45.00
SOUTH SIDE HIGHLINE	33	935	4.00
LOWLAND DITCH	53	777	1.00
POWELL PARK DITCH	55	883	20.00
OLD AGENCY DITCH	56	849	2.50
NIBLOCK DITCH	65	842	2.40
SOUTH SIDE HIGHLINE	70	935	4.00
OAK RIDGE PARK	80	848	25.00
MAMMOTH DITCH	81	787	1.80
LOWLAND DITCH	84	777	.60
HEFLEY PUMP PLANT NO 1	112	687	5.41
NIBLOCK DITCH	113	842	24.80
IMES AND REYNOLD DITCH	119	710	13.10
DREYFUSS DITCH	122	608	2.80
LOWLAND DITCH	132	777	6.80
JAMES HAYES DITCH	133	718	1.00
MCDOWELL DITCH	135	800	4.00
SHERIDAN AND MORTON D	136	926	2.80
IMES AND REYNOLD DITCH	137	710	2.20
MILLER CREEK DITCH	138	819	57.70
IMES AND REYNOLD DITCH	139	710	1.60
PIONEER DITCH	140	877	17.10
HAMMOND DITCH	141	677	12.20
DREYFUSS DITCH	145	608	.60
RIDGEWAY AND STATELER D	146	902	6.90
HALL DITCH	147	674	3.20
SHERIDAN AND MORTON D	148	926	3.00
MC WILLIAMS AND GEORGE D	149	796	4.10
NEW ARCHER WARNER	152	841	2.20
STADTMAN DITCH	155	949	3.10
THOMPSON DITCH	168	970	1.00
LITTLE DITCH	171	769	2.80
BASSETT DITCH	173	531	2.00
HAY BRETHERTON DITCH	186	681	8.40
PEDRICK DITCH	188	868	10.00
PEDRICK DITCH	190	868	16.80
HIGHLAND DITCH	231	694	104.90
GEORGE S WHITTER DITCH	234	653	2.60
NEW ARCHER WARNER	237	841	.30
JOHN DELANEY DITCH	274	727	1.80
GREENSTREET CREEK	282	695	1.00
HIGHLAND DITCH	283	694	16.32
MEEKER WATER WORKS PL	289	811	3.42
QUEEN DITCH	296	886	2.00
PEDRICK DITCH	303	868	2.50
DREIFUSS DITCH	305	607	2.34
HEFLEY PUMP PLANT NO 1	306	687	.28
HEFLEY PUMP PLANT NO 3	307	689	9.58
CHASE AND COLTHARP D	308	573	7.40
GOEDER DITCH	309	657	1.40
STADTMAN DITCH	311	949	1.00
BLAIR DITCH	321	546	6.40
BLAIR DITCH	322	546	1.80
WALTER WARNER DITCH	334	992	.85
OAK RIDGE PARK	338	848	25.20
OLD AGENCY DITCH	339	849	3.80
INDEPENDENT DITCH	340	711	2.90
GROSS NICHOLS DITCH	356	669	4.80
MCDOWELL DITCH	359	800	2.82
HAY DITCH 2	360	684	1.00
ELK CREEK DITCH	362	623	1.52

MEEKER DITCH	363	808	5.70
CALHOUN DITCH	364	563	1.30
CALHOUN DITCH	365	563	1.94
LORING DITCH	367	774	.59
LORING DITCH	369	774	.88
HAY BRETHERTON DITCH	370	681	6.00
HAY DITCH 2	371	684	1.44
WARREN SMITH DITCH	372	996	1.19
LA KAMP DITCH	373	752	1.84
GREENSTREET CREEK	374	637	4.05
NIBLOCK DITCH	376	842	29.80
POWELL PARK DITCH	376	883	27.64
WALTER WARNER DITCH	382	992	1.25
OLD AGENCY DITCH	383	849	15.60
CHASE AND COLTHARP D	386	573	.80
CHASE AND COLTHARP D	387	573	12.29
PEASE DITCH	392	867	5.98
HIGHLAND DITCH	393	694	48.12
NELSON DITCH	395	840	.81
FORNEY CORCORAN DITCH	398	640	6.00
NELSON DITCH	401	840	1.23
THOMAS DITCH 2	403	966	1.47
MINER MARTIN DITCH	405	823	2.00
WARREN SMITH DITCH	407	996	1.78
THOMAS DITCH 2	411	966	2.20
SHERIDAN AND MORTON D	412	926	1.11
E H IMES DITCH	412	613	3.69
LITTLE DITCH	414	769	4.08
MINER MARTIN DITCH	415	823	3.00
OAK RIDGE PARK	422	848	16.59
GOEDER DITCH	424	657	.50
HAMMOND DITCH	430	677	4.55
HAMMOND DITCH	431	677	14.35
NEW ARCHER WARNER	448	841	2.74
BUCKNER DITCH	456	556	.91
BUCKNER DITCH	457	556	2.09
FORNEY CORCORAN DITCH	459	640	5.47
E H IMES DITCH	461	613	5.52
BLAIR DITCH	462	546	3.65
PEDRICK DITCH	463	868	9.08
MILLER CREEK DITCH	464	819	30.30
STADTMAN DITCH	468	949	7.70
WALTER WARNER DITCH NO 2	473	993	.06
[illegible]	[illegible]	[illegible]	[illegible]
STROUD DITCH	476	956	.62
WALTER WARNER DITCH NO 2	477	993	.10
HEFLEY PUMP PLANT NO 1	480	687	4.25
STROUD DITCH	481	956	.93
QUEEN DITCH	493	886	3.08
BLAIR DITCH	495	546	1.34
LAWRENCE DITCH	496	758	2.07
LAWRENCE DITCH	497	758	3.11
MILLER CREEK DITCH	502	819	12.00
GROSS NICHOLS DITCH	503	669	.87
HIGHLAND DITCH	510	694	18.12
JAMES HAYES DITCH	511	718	1.62
HIGHLAND DITCH	518	694	56.98
B P FRANKLIN DITCH 1	520	515	.27
JAMES HAYES DITCH	530	718	1.62
L K DITCH 1	531	751	1.49
TEXAS CO PL	534	1448	1.00
STANDOLIND OIL CO PL	536	1470	.52
GOEDER DITCH	540	657	3.30
PEASE DITCH	543	867	5.68
ISLAND DITCH	562	713	2.00
HEFLEY PUMP PLANT NO 3	565	689	11.40
SPRING CREEK 1	567	940	5.20
SPRING CREEK 2	567	941	5.20
HEFLEY PUMP PLANT NO 1	568	687	5.60
SPRING CK D PUMP 3	569	1451	5.20
CALIFORNIA CO WATER PL	572	564	.31
BEARD DITCH	573	536	4.50
RANGELY WATER PLANT	576	889	2.60
CALIFORNIA CO WATER PL	577	564	1.33
SPRING CREEK PUMP	579	939	6.30
SAVAGE DITCH	581	915	3.60
MEEKER WATER SYS PL	583	810	4.00
STOREY DITCH 1	587	954	10.00
STOREY DITCH 2	588	955	2.20
HAY BRETHERTON DITCH	589	681	7.10
CALAVAT DITCH	592	570	10.40
PEASE DITCH	593	867	.90
INDEPENDENT DITCH	594	711	2.00

MEAD IRRIGATION SYSTEM	596	806	3.00
WHITE R MESA D JACOBS P	604	1008	4.00
PEASE DITCH	606	867	.20
CALIFORNIA CO WATER PL	607	564	9.69
HAY BRETHERTON DITCH	608	681	.75
MEEKER WATER SYS PL	610	810	3.00
RANGELY WATER PLANT	613	889	28.35
MCGURDER	617	802	5.25
WAGNER DITCH	622	1044	3.00
OAK RIDGE PARK	626	848	10.00
POWELL PARK DITCH	630	883	15.00
GEORGE S WHITTER DITCH	631	653	7.00
DORRELL DITCH 1	632	604	.50
OAK RIDGE PARK	640	848	22.21
IMES AND REYNOLD DITCH	642	710	1.00
IMES AND REYNOLD DITCH	644	710	3.70
NEW ARCHER WARNER	645	841	.69
DREIFUSS DITCH	647	607	5.58
IVO E SCHULTZ D AND PUMP	649	714	5.00
CALHOUN DITCH	650	563	.86
OAK RIDGE PARK	651	848	32.00
DREYFUSS DITCH	655	608	2.49
THOMAS DITCH	658	965	6.00
UINTAH OIL REFIN CO PL	661	974	3.15
THOMAS DITCH 3	663	967	2.50
HIGHLAND DITCH	667	694	33.00
~~CALDWELL DITCH NO 1~~	~~675~~	~~1028~~	~~8.00~~
THOMAS DITCH 2	677	966	6.00
DREIFUSS DITCH	682	607	1.50
GREENSTREET DITCH EXT	689	665	8.90
MOBLEY PIPELINE 1	697	826	8.00
MCLAUGHLIN PIPELINE	699	805	8.00
NIBLOCK DITCH	700	842	.60
MCDOWELL DITCH NO 1	705	1034	5.00
HIGHLAND DITCH	709	694	241.00
PURDY IRRIGATION PUMP	711	884	2.00
CALIFORNIA CO WATER PL	713	564	10.00
MOONLAKE STALEY PIPELINE	714	830	125.20
SHERMAN TAYLOR DITCH	716	1036	5.00
NIBLOCK DITCH	718	842	1.35
PEASE DITCH	719	867	11.25
GOVREAU PUMP STATION	720	663	.89
CARSTENS PUMP STATION	720	567	.89
NEAL PUMP STATION	720	837	.89
RANGELY POWER CONDUIT	724	1454	620.00
DOUGLAS CANAL	724	1453	120.00
DREIFUSS DITCH	725	607	1.50
NEW ARCHER WARNER	727	841	2.79
WOLF RIDGE PL	728	1244	100.00
NIBLOCK DITCH	733	842	5.15
PEASE DITCH	738	867	1.00
WHITE R PUMPING PL	739	1456	100.00
MOONLAKE STALEY PIPELINE	741	830	55.10
IMES AND REYNOLD DITCH	742	710	2.05
WHITE R 14 MI CK PL	747	1458	200.00
WHITE R PL NO 2	750	1459	120.00
HALPEN PUMP PIPELINE	751	673	4.00
HIGHLAND DITCH	753	694	2.60
KELLOGG GULCH PL	762	1236	100.00
BLACKS GULCH PL	762	1235	100.00
WRAY GULCH PL	762	1239	100.00
CROOKED WASH PL	762	1238	100.00
SUPERIOR PUMPBACK NO 3	763	1251	24.00
SUPERIOR PUMPBACK NO 2	763	1250	12.00
SUPERIOR OIL PL	764	1237	12.00
WHITE R PICEANCE PL	768	1243	100.00
OHIO ERTL PL	769	1245	55.00
STORY GULCH PARACHUTE PL	769	1247	6.00
SUPERIOR OIL PL	770	1237	12.00
MOON LAKE PL	781	1246	6.00
ELK CREEK DITCH	789	623	2.00
ELK CREEK DITCH	812	623	2.93
WOLF CK PL	873	1248	70.00
ELK CREEK DITCH	887	623	.40
HEFLEY PUMP PLANT NO 2	912	688	.40
STRAWBERRY CK PL	914	1254	400.00
WRAY GULCH PL	916	1239	450.00
MEAGER DIVERSION	939	1255	20.00
GEORGE MENGE D	942	1105	1.00

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WHITE RIVER MAINSTEM*AVE. MONTHLY DATA AUG. 1974* BUFORD TO WATSON UTAH GAGE

STREAM INFLOW DATA

INITIAL STREAM MILE = 0.00

INITIAL STREAM FLOW = 398.00

LOCAL TRIBUTARY FLOWS

STREAM NAME	IDENT	STREAM MILE	FLOW
BIG BEAVER CREEK	2	.57	1.20
GREENSTREET CREEK	102	1.61	2.00
NORTH ELK CREEK	12	3.48	20.00
DRY CREEK	10	8.36	5.00
MILLER CREEK	26	10.20	15.80
VEATCH GULCH	109	13.69	1.00
COAL CREEK	7	19.16	1.00
MEEKER DOME BELOW 93045	308	22.00	5.00
CURTIS CREEK	8	22.22	.50
SULPHUR CREEK	42	23.23	0.00
FLAG CR + AGENCY PRK	16	24.35	1.00
STRAWBERRY CREEK	40	34.95	.50
HAY GULCH	63	40.58	0.00
BLACK GULCH	101	48.85	1.00
WRAY GULCH	153	51.54	0.00
PICEANCE CREEK	33	52.39	34.60
CROOKED WASH	320	66.36	0.00
YELLOW CREEK	49	68.77	1.58
WOLF CREEK	144	74.77	1.00
HAMMOND DRAW	341	87.00	0.00
RED WASH	325	91.61	1.50
DOUGLAS CREEK	9	104.81	0.00
STINKING WATER CREEK	331	113.40	0.00
COTTONWOOD CREEK	335	128.30	0.00
EVACUATION CREEK	13	142.24	0.00

STREAM MILE OF LAST DOWNSTREAM CONTROL POINT = 144.50

DESIRED FLOWS FOR STRUCTURES

STRUCTURE NAME	IDENT	DESIRED AMNT
WHITE R PL NO 2	1459	0.00
NELSON DITCH	840	.58
GREENSTREET DITCH EXT	665	2.90
LA KAMP DITCH	752	.90
ELK CREEK DITCH	623	.68
WALTER WARNER DITCH	992	0.00
WALTER WARNER DITCH NO 2	993	0.00
NEW ARCHER WARNER	841	4.06
DREIFUSS DITCH	607	1.50
MILLER CREEK DITCH	819	84.90
DREYFUSS DITCH	608	9.78
WARREN SMITH DITCH	996	0.00
NEAL PUMP STATION	837	0.00
OAK RIDGE PARK	848	42.40
CARSTENS PUMP STATION	567	0.00
GOVREAU PUMP STATION	663	0.00
MEEKER WATER WORKS PL	811	.50
HIGHLAND DITCH	694	113.70
OLD AGENCY DITCH	849	6.10
LOWLAND DITCH	777	0.00
WAGNER DITCH	1044	0.00
WHITE RIVER ABOVE COAL C	0	0.00
STORY GULCH PARACHUTE PL	1247	0.00
SOUTH SIDE HIGHLINE	935	7.40
WHITE RIVER NEAR MEEKER	0	0.00
SHERIDAN AND MORTON D	926	2.00
MEEKER DITCH	808	17.20
B P FRANKLIN DITCH 1	515	.68
MEEKER WATER SYS PL	810	1.80
ISLAND DITCH	713	2.00
MEEKER BRIDGE DITCH	1042	0.00
NIBLOCK DITCH	842	43.90
DORRELL DITCH 1	604	.20
WHITE R 14 MI CK PL	1458	0.00
PEASE DITCH	867	15.00
STRAWBERRY CK PL	1254	0.00
POWELL PARK DITCH	883	26.13
HAY BRETHERTON DITCH	681	15.00
INDEPENDENT DITCH	711	2.10
JAMES HAYES DITCH	718	0.00
HALPEN PUMP PIPELINE	673	1.70
LORING DITCH	774	.40
IVO E SCHULTZ D AND PUMP	714	5.00
WHITE RIVER BELOW MEEKER	0	0.00

HAY DITCH 2	684	1.42
THOMAS DITCH 3	967	0.00
THOMAS DITCH	965	0.00
THOMAS DITCH 2	966	1.74
WHITE R PICEANCE PL	1243	0.00
MCDOWELL DITCH	800	.13
MCDOWELL DITCH NO 1	1034	0.00
CALHOUN DITCH	563	0.00
IMES AND REYNOLD DITCH	710	2.90
SHERMAN TAYLOR DITCH	1036	0.00
KELLOGG GULCH PL	1236	0.00
BLACKS GULCH PL	1235	0.00
GEORGE S WHITTER DITCH	653	0.00
WHITE R MESA D JACOBS P	1008	.65
SUPERIOR OIL PL	1237	0.00
MC WILLIAMS AND GEORGE D	796	0.00
MINER MARTIN DITCH	823	0.00
WRAY GULCH PL	1239	0.00
OHIO ERTL PL	1245	0.00
WHITE R PUMPING PL	1456	0.00
MAMMOTH DITCH	787	0.00
FORNEY CORCORAN DITCH	640	0.00
WOLF RIDGE PL	1244	0.00
LITTLE DITCH	769	5.00
MEAD IRRIGATION SYSTEM	806	0.00
JOHN DELANEY DITCH	727	.58
BLAIR DITCH	546	0.00
E H IMES DITCH	613	0.00
CROOKED WASH PL	1238	0.00
PEDRICK DITCH	868	7.10
BASSETT DITCH	531	0.00
MCGURDER	802	0.00
MOBLEY PIPELINE 1	826	0.00
WOLF CK PL	1248	0.00
LAWRENCE DITCH	758	3.55
STADTMAN DITCH	949	8.45
THOMPSON DITCH	970	0.00
CALDWELL DITCH NO 1	1028	0.00
QUEEN DITCH	886	1.29
BEARD DITCH	536	3.19
BUCKNER DITCH	556	2.13
HALL DITCH	674	0.00
HAMMOND DITCH	677	5.00
SAVAGE DITCH	915	0.00
SPRING CREEK PUMP	939	3.87
SPRING CREEK 1	940	2.58
SPRING CK D PUMP 3	1451	0.00
SPRING CREEK 2	941	0.00
GROSS NICHOLS DITCH	669	2.84
RANGELY POWER CONDUIT	1454	0.00
DOUGLAS CANAL	1453	0.00
L K DITCH 1	751	.68
SUPERIOR PUMPBACK NO 3	1251	0.00
GOEDER DITCH	657	.45

WHITE RIVER AB RANGELY	0	0.00
HEFLEY PUMP PLANT NO 2	688	0.00
HEFLEY PUMP PLANT NO 1	687	10.00
CALAVAT DITCH	570	3.87
STOREY DITCH 1	954	0.00
STOREY DITCH 2	955	0.00
STROUD DITCH	956	.58
CHASE AND COLTHARP D	573	0.00
RANGELY WATER PLANT	889	2.00
PURDY IRRIGATION PUMP	884	0.00
HEFLEY PUMP PLANT NO 3	689	3.68
UINTAH OIL REFIN CO PL	974	0.00
MOON LAKE PL	1246	0.00
MOONLAKE STALEY PIPELINE	830	0.00
PIONEER DITCH	877	1.77
GEORGE MENGE D	1105	0.00
STANDOLIND OIL CO PL	1470	0.00
MCLAUGHLIN PIPELINE	805	2.90
TEXAS CO PL	1448	0.00
SUPERIOR PUMPBACK NO 2	1250	0.00
CALIFORNIA CO WATER PL	564	0.00
RIDGEWAY AND STATELER D	902	0.00
MEAGER DIVERSION	1255	0.00
WHITE RIVER NR WATSON UT	0	0.00

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RIVER ACCRETION FACTORS .1100 -.0100 -.0400 -.0700 -.0400 0.0000 0.0000 0.0000 0.0000

POTENTIAL CONSUMPTIVE USE PER ACRE = .0060 AT ELEV 6500 FT. RATE OF CHANGE/1000 FT. ELEV = .0012000

LOWER LIMIT OF RETURN FLOW AS FRACTION OF TOTAL DIVERSION .6500

APPENDIX D

SAMPLE OUTPUT DATA FOR PROGRAM DISTRIW

OUTPUT
ANALYSIS FROM PROGRAM

REALLOCATION OF WATER BY PRIORITY

OF INDIVIDUAL WATER RIGHTS

CALL FROM SENIOR DIVERSION				CUT FROM JUNIOR DIVERSION			
STRUCTURE NAME	IDENT	RANK	SHORTAGE	STRUCTURE NAME	IDENT	RANK	CURTAILMENT
NO SHORTAGES EXIST IN THIS SYSTEM							

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY

BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO.	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
WHITE R PL NO 2	1459	.05	0.00	0.00	0.00	398.13	0.00
NELSON DITCH	840	.91	.58	.20	.38	401.03	0.00
GREENSTREET DITCH EXT	665	1.41	2.90	.49	2.41	399.56	0.00
LA KAMP DITCH	752	2.50	.90	.29	.61	404.79	0.00
ELK CREEK DITCH	623	3.49	.68	.24	.44	428.80	0.00
WALTER WARNER DITCH	992	5.00	0.00	0.00	0.00	433.25	0.00
WALTER WARNER DITCH NO 2	993	6.64	0.00	0.00	0.00	437.60	0.00
NEW ARCHER WARNER	841	7.48	4.06	.29	3.77	435.77	0.00
DREIFUSS DITCH	607	9.04	1.50	.52	.98	447.17	0.00
MILLER CREEK DITCH	819	10.00	84.90	20.42	64.48	365.80	0.00
DREYFUSS DITCH	608	10.20	9.78	.31	9.47	356.55	0.00
WARREN SMITH DITCH	996	12.08	0.00	0.00	0.00	397.34	0.00
NEAL PUMP STATION	837	13.23	0.00	0.00	0.00	402.76	0.00
OAK RIDGE PARK	848	13.24	42.40	10.97	31.43	360.38	0.00
CARSTENS PUMP STATION	567	13.30	0.00	0.00	0.00	360.54	0.00
GOVREAU PUMP STATION	663	13.63	0.00	0.00	0.00	361.42	0.00
MEEKER WATER WORKS PL	811	14.35	.50	0.00	0.00	363.83	0.00
HIGHLAND DITCH	694	14.35	113.70	15.06	98.64	250.13	0.00
OLD AGENCY DITCH	849	15.05	6.10	2.14	3.96	245.89	0.00
LOWLAND DITCH	777	15.77	0.00	0.00	0.00	263.51	0.00
WAGNER DITCH	1044	16.30	0.00	0.00	0.00	281.30	0.00
WHITE RIVER ABOVE COAL C	0	16.50	0.00	0.00	0.00	281.83	0.00
STORY GULCH PARACHUTE PL	1247	16.65	0.00	0.00	0.00	281.68	0.00
SOUTH SIDE HIGHLINE	935	19.38	7.40	2.59	4.81	297.07	0.00
WHITE RIVER NEAR MEEKER	0	20.45	0.00	0.00	0.00	311.75	0.00
SHERIDAN AND MORTON D	926	20.46	2.00	.28	1.72	309.74	0.00
MEEKER DITCH	808	21.46	17.20	.42	16.78	295.61	0.00
B P FRANKLIN DITCH 1	515	22.60	.68	.10	.58	301.18	0.00
MEEKER WATER SYS PL	810	23.34	1.80	0.00	0.00	319.08	0.00
ISLAND DITCH	713	23.68	2.00	.21	1.79	316.81	0.00
MEEKER BRIDGE DITCH	1042	23.97	0.00	0.00	0.00	318.36	0.00
NIBLOCK DITCH	842	26.09	43.90	8.69	35.21	384.96	0.00
DORRELL DITCH 1	604	27.47	.20	.07	.13	383.63	0.00
WHITE R 14 MI CK PL	1458	28.10	0.00	0.00	0.00	388.53	0.00
PEASE DITCH	867	28.52	15.00	2.38	12.62	373.18	0.00
STRAWBERRY CK PL	1254	28.60	0.00	0.00	0.00	373.12	0.00
POWELL PARK DITCH	883	28.92	26.13	9.15	16.98	346.72	0.00
HAY BRETHERTON DITCH	681	31.02	15.00	2.66	12.34	343.60	0.00
INDEPENDENT DITCH	711	31.34	2.10	.73	1.36	341.24	0.00
JAMES HAYES DITCH	718	33.33	0.00	0.00	0.00	360.37	0.00
HALPEN PUMP PIPELINE	673	33.70	1.70	.60	1.10	358.36	0.00

LORING DITCH	774	38.24	.40	.13	.27	389.65	0.00
IVO E SCHULTZ D AND PUMP	714	39.24	5.00	.34	4.66	389.19	0.00
WHITE RIVER BELOW MEEKER	0	39.90	0.00	0.00	0.00	393.32	0.00
HAY DITCH 2	684	40.00	1.42	.31	1.11	391.85	0.00
THOMAS DITCH 3	967	40.21	0.00	0.00	0.00	392.86	0.00
THOMAS DITCH	965	40.59	0.00	0.00	0.00	392.67	0.00
THOMAS DITCH 2	966	40.71	1.74	.46	1.28	390.87	0.00
WHITE R PICEANCE PL	1243	41.50	0.00	0.00	0.00	391.77	0.00
MCDOWELL DITCH	800	42.51	.13	.05	.08	391.15	0.00
MCDOWELL DITCH NO 1	1034	43.50	0.00	0.00	0.00	390.76	0.00
CALHOUN DITCH	563	44.08	0.00	0.00	0.00	390.48	0.00
IMES AND REYNOLD DITCH	710	45.59	2.90	1.02	1.88	386.85	0.00
SHERMAN TAYLOR DITCH	1036	46.00	0.00	0.00	0.00	388.53	0.00
KELLOGG GULCH PL	1236	46.80	0.00	0.00	0.00	388.15	0.00
BLACKS GULCH PL	1235	49.00	0.00	0.00	0.00	388.08	0.00
GEORGE S WHITTER DITCH	653	49.63	0.00	0.00	0.00	387.77	0.00
WHITE R MESA D JACOBS P	1008	50.21	.65	.23	.42	386.84	0.00
SUPERIOR OIL PL	1237	50.36	0.00	0.00	0.00	387.19	0.00
MC WILLIAMS AND GEORGE D	796	50.70	0.00	0.00	0.00	387.03	0.00
MINER MARTIN DITCH	823	51.39	0.00	0.00	0.00	386.69	0.00
WRAY GULCH PL	1239	51.59	0.00	0.00	0.00	386.60	0.00
OHIO ERTL PL	1245	52.20	0.00	0.00	0.00	386.30	0.00
WHITE R PUMPING PL	1456	52.25	0.00	0.00	0.00	386.28	0.00
MAMMOTH DITCH	787	52.50	0.00	0.00	0.00	420.76	0.00
FORNEY CORCORAN DITCH	640	52.73	0.00	0.00	0.00	420.64	0.00
WOLF RIDGE PL	1244	53.80	0.00	0.00	0.00	420.13	0.00
LITTLE DITCH	769	54.82	5.00	1.45	3.55	414.63	0.00
MEAD IRRIGATION SYSTEM	806	58.21	0.00	0.00	0.00	416.53	0.00
JOHN DELANEY DITCH	727	58.49	.58	.20	.38	415.82	0.00
BLAIR DITCH	546	60.88	0.00	0.00	0.00	415.04	0.00
E H IMES DITCH	613	64.48	0.00	0.00	0.00	413.29	0.00
CROOKED WASH PL	1238	66.00	0.00	0.00	0.00	412.56	0.00
PEDRICK DITCH	868	66.84	7.10	2.49	4.61	405.05	0.00
BASSETT DITCH	531	71.53	0.00	0.00	0.00	408.97	0.00
MCGURDER	802	73.09	0.00	0.00	0.00	408.22	0.00
MOBLEY PIPELINE 1	826	74.20	0.00	0.00	0.00	407.68	0.00
WOLF CK PL	1248	74.35	0.00	0.00	0.00	407.61	0.00
LAWRENCE DITCH	758	74.46	3.55	.48	3.07	404.00	0.00
STADTMAN DITCH	949	75.83	8.45	.49	7.96	398.96	0.00
THOMPSON DITCH	970	76.38	0.00	0.00	0.00	406.65	0.00
CALDWELL DITCH NO 1	1028	77.00	0.00	0.00	0.00	406.35	0.00
QUEEN DITCH	886	78.84	1.29	.42	.87	404.17	0.00
BEARD DITCH	536	79.21	3.19	.42	2.77	401.67	0.00
BUCKNER DITCH	556	80.27	2.13	.42	1.71	401.79	0.00
HALL DITCH	674	80.61	0.00	0.00	0.00	403.34	0.00
HAMMOND DITCH	677	83.37	5.00	1.75	3.25	397.00	0.00
SAVAGE DITCH	915	88.36	0.00	0.00	0.00	397.83	0.00
SPRING CREEK PUMP	939	88.98	3.87	.22	3.65	393.66	0.00
SPRING CREEK 1	940	89.00	2.58	.36	2.22	394.72	0.00
SPRING CK D PUMP 3	1451	89.05	0.00	0.00	0.00	396.92	0.00
SPRING CREEK 2	941	89.25	0.00	0.00	0.00	396.82	0.00
GROSS NICHOLS DITCH	669	92.31	2.84	.11	2.73	394.00	0.00
RANGELY POWER CONDUIT	1454	94.39	0.00	0.00	0.00	395.72	0.00
DOUGLAS CANAL	1453	94.40	0.00	0.00	0.00	395.71	0.00

L K DITCH 1	751	94.65	.68	.23	.45	394.91	0.00
SUPERIOR PUMPBACK NO 3	1251	95.40	0.00	0.00	0.00	395.00	0.00
GOEDER DITCH	657	95.54	.45	.16	.29	394.48	0.00
WHITE RIVER AB RANGELY	0	97.40	0.00	0.00	0.00	393.87	0.00
HEFLEY PUMP PLANT NO 2	688	97.53	0.00	0.00	0.00	393.83	0.00
HEFLEY PUMP PLANT NO 1	687	100.58	10.00	.55	9.45	382.80	0.00
CALAVAT DITCH	570	100.59	3.87	1.12	2.75	388.37	0.00
STOREY DITCH 1	954	102.50	0.00	0.00	0.00	390.48	0.00
STOREY DITCH 2	955	103.07	0.00	0.00	0.00	390.29	0.00
STROUD DITCH	956	103.23	.58	.19	.39	389.65	0.00
CHASE AND COLTHARP D	573	103.83	0.00	0.00	0.00	389.84	0.00
RANGELY WATER PLANT	889	104.48	2.00	0.00	0.00	387.62	0.00
PURDY IRRIGATION PUMP	884	105.18	0.00	0.00	0.00	387.38	0.00
HEFLEY PUMP PLANT NO 3	689	105.64	3.68	.38	3.30	383.55	0.00
UINTAH OIL REFIN CO PL	974	107.55	0.00	0.00	0.00	386.21	0.00
MOON LAKE PL	1246	107.80	0.00	0.00	0.00	386.12	0.00
MOONLAKE STALEY PIPELINE	830	107.93	0.00	0.00	0.00	386.08	0.00
PIONEER DITCH	877	108.37	1.77	.62	1.15	384.16	0.00
GEORGE MENGE D	1105	108.50	0.00	0.00	0.00	384.11	0.00
STANDOLIND OIL CO PL	1470	108.60	0.00	0.00	0.00	384.08	0.00
MCLAUGHLIN PIPELINE	805	110.27	2.90	.76	2.14	381.77	0.00
TEXAS CO PL	1448	111.00	0.00	0.00	0.00	383.66	0.00
SUPERIOR PUMPBACK NO 2	1250	112.50	0.00	0.00	0.00	383.16	0.00
CALIFORNIA CO WATER PL	564	113.99	0.00	0.00	0.00	382.65	0.00
RIDGEWAY AND STATELER D	902	120.24	0.00	0.00	0.00	380.54	0.00
MEAGER DIVERSION	1255	127.00	0.00	0.00	0.00	378.26	0.00
WHITE RIVER NR WATSON UT	0	144.50	0.00	0.00	0.00	372.34	0.00

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SUMMARY

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SYSTEM YIELD = 470.78

WATER DIVERTED OUT OF SYSTEM OR TOTALLY CONSUMED = 4.30

SUM OF IRRIGATION DIVERSIONS = 482.56

TOTAL IRRIGATION CONSUMPTIVE USE = 94.14

IRRIGATION RETURN AS FRACTION OF TOTAL IRRIGATION DIVERSION = .80

FINAL STREAM FLOW AT LAST DOWNSTREAM CONTROL POINT = 372.34

MINIMUM STREAM FLOW = 245.89 AT STREAM MILE = 15.05

AVAILABLE SURPLUS WATER = 245.89

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SUMMARY OF WATER RIGHTS AND ALLOCATION

BY STRUCTURE

STRUCTURE NAME	IDENT	RANK	DECREED AMOUNT	SUPPLIED AMOUNT	UNDECREED SUPPLY	TOTAL DIVERSION
WHITE R PL NO 2	1459					
		750	120.00	0.00		
		TOTALS	120.00	0.00	0.00	0.00
NELSON DITCH	840					
		395	.81	.58		
		401	1.23	0.00		
		TOTALS	2.04	.58	0.00	.58
GREENSTREET DITCH EXT	665					
		689	8.90	2.90		
		TOTALS	8.90	2.90	0.00	2.90
LA KAMP DITCH	752					
		10	1.00	.90		
		373	1.84	0.00		
		TOTALS	2.84	.90	0.00	.90
ELK CREEK DITCH	623					
		2	1.60	.68		
		32	1.00	0.00		
		362	1.52	0.00		
		789	2.00	0.00		
		812	2.93	0.00		
		887	.40	0.00		
		TOTALS	9.45	.68	0.00	.68
WALTER WARNER DITCH	992					
		334	.85	0.00		
		382	1.25	0.00		
		TOTALS	2.10	0.00	0.00	0.00
WALTER WARNER DITCH NO 2	993					
		473	.06	0.00		
		477	.10	0.00		
		TOTALS	.16	0.00	0.00	0.00

NEW ARCHER WARNER	841					
		152	2.20	2.20		
		237	.30	.30		
		448	2.74	1.56		
		645	.69	0.00		
		727	2.79	0.00		
		TOTALS	8.72	4.06	0.00	4.06
DREIFUSS DITCH	607					
		305	2.34	1.50		
		647	5.58	0.00		
		682	1.50	0.00		
		725	1.50	0.00		
		TOTALS	10.92	1.50	0.00	1.50
MILLER CREEK DITCH	819					
		138	57.70	57.70		
		464	30.30	27.20		
		502	12.00	0.00		
		TOTALS	100.00	84.90	0.00	84.90
DREYFUSS DITCH	608					
		122	2.80	2.80		
		145	.60	.60		
		655	2.49	2.49		
		TOTALS	5.89	5.89	3.89	9.78
WARREN SMITH DITCH	996					
		372	1.19	0.00		
		407	1.78	0.00		
		TOTALS	2.97	0.00	0.00	0.00
NEAL PUMP STATION	837					
		720	.89	0.00		
		TOTALS	.89	0.00	0.00	0.00
OAK RIDGE PARK	848					
		80	25.00	25.00		
		338	25.20	17.40		
		422	16.59	0.00		
		626	10.00	0.00		
		640	22.21	0.00		
		651	32.00	0.00		
		TOTALS	131.00	42.40	0.00	42.40

CARSTENS PUMP STATION	567					
		720	.89	0.00		
		TOTALS	.89	0.00	0.00	0.00
GOVREAU PUMP STATION	663					
		720	.89	0.00		
		TOTALS	.89	0.00	0.00	0.00
MEEKER WATER WORKS PL	811					
		289	3.42	.50		
		TOTALS	3.42	.50	0.00	.50
HIGHLAND DITCH	694					
		33	45.00	45.00		
		231	104.90	68.70		
		283	16.32	0.00		
		393	48.12	0.00		
		510	18.12	0.00		
		518	56.98	0.00		
		667	33.00	0.00		
		709	241.00	0.00		
		753	2.60	0.00		
		TOTALS	566.04	113.70	0.00	113.70
OLD AGENCY DITCH	849					
		9	8.50	6.10		
		19	5.00	0.00		
		56	2.50	0.00		
		339	3.80	0.00		
		383	15.60	0.00		
		TOTALS	35.40	6.10	0.00	6.10
LOWLAND DITCH	777					
		53	1.00	0.00		
		84	.60	0.00		
		132	6.80	0.00		
		TOTALS	8.40	0.00	0.00	0.00
WAGNER DITCH	1044					
		622	3.00	0.00		
		TOTALS	3.00	0.00	0.00	0.00
STORY GULCH PARACHUTE PL	1247					
		769	6.00	0.00		
		TOTALS	6.00	0.00	0.00	0.00

SOUTH SIDE HIGHLINE	935					
		17	4.00	4.00		
		33	4.00	3.40		
		70	4.00	0.00		
		TOTALS	12.00	7.40	0.00	7.40
SHERIDAN AND MORTON D	926					
		136	2.80	2.00		
		148	3.00	0.00		
		412	1.11	0.00		
		TOTALS	6.91	2.00	0.00	2.00
MEEKER DITCH	808					
		8	20.00	17.20		
		363	5.70	0.00		
		TOTALS	25.70	17.20	0.00	17.20
B P FRANKLIN DITCH 1	515					
		520	.27	.27		
		TOTALS	.27	.27	.41	.68
MEEKER WATER SYS PL	810					
		583	4.00	1.80		
		610	3.00	0.00		
		TOTALS	7.00	1.80	0.00	1.80
ISLAND DITCH	713					
		562	2.00	2.00		
		TOTALS	2.00	2.00	0.00	2.00
MEEKER BRIDGE DITCH	1042					
		154	4.00	0.00		
		TOTALS	4.00	0.00	0.00	0.00
NIBLOCK DITCH	842					
		16	2.40	2.40		
		65	2.40	2.40		
		113	24.80	24.80		
		376	29.80	14.30		
		700	.60	0.00		
		718	1.35	0.00		
		733	5.15	0.00		
		TOTALS	66.50	43.90	0.00	43.90

DORRELL DITCH 1	604					
		632	.50	.20		
		TOTALS	.50	.20	0.00	.20
WHITE R 14 MI CK PL	1458					
		747	200.00	0.00		
		TOTALS	200.00	0.00	0.00	0.00
PEASE DITCH	867					
		392	5.98	5.98		
		543	5.68	5.68		
		593	.90	.90		
		606	.20	.20		
		719	11.25	2.24		
		738	1.00	0.00		
		TOTALS	25.01	15.00	0.00	15.00
STRAWBERRY CK PL	1254					
		914	400.00	0.00		
		TOTALS	400.00	0.00	0.00	0.00
POWELL PARK DITCH	883					
		1	20.00	20.00		
		55	20.00	6.13		
		376	27.64	0.00		
		630	15.00	0.00		
		TOTALS	82.64	26.13	0.00	26.13
HAY BRETHERTON DITCH	681					
		186	8.40	8.40		
		370	6.00	6.00		
		589	7.10	.60		
		608	.75	0.00		
		TOTALS	22.25	15.00	0.00	15.00
INDEPENDENT DITCH	711					
		340	2.90	2.10		
		594	2.00	0.00		
		TOTALS	4.90	2.10	0.00	2.10
JAMES HAYES DITCH	718					
		133	1.00	0.00		
		511	1.62	0.00		
		530	1.62	0.00		
		TOTALS	4.24	0.00	0.00	0.00

HALPEN PUMP PIPELINE	673					
		751	4.00	1.70		
		TOTALS	4.00	1.70	0.00	1.70
LORING DITCH	774					
		367	.59	.40		
		369	.88	0.00		
		TOTALS	1.47	.40	0.00	.40
IVO E SCHULTZ D AND PUMP	714					
		649	5.00	5.00		
		TOTALS	5.00	5.00	0.00	5.00
HAY DITCH 2	684					
		360	1.00	1.00		
		371	1.44	.42		
		TOTALS	2.44	1.42	0.00	1.42
THOMAS DITCH 3	967					
		663	2.50	0.00		
		TOTALS	2.50	0.00	0.00	0.00
THOMAS DITCH	965					
		658	6.00	0.00		
		TOTALS	6.00	0.00	0.00	0.00
THOMAS DITCH 2	966					
		403	1.47	1.47		
		411	2.20	.27		
		677	6.00	0.00		
		TOTALS	9.67	1.74	0.00	1.74
WHITE R PICEANCE PL	1243					
		768	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
MCDOWELL DITCH	800					
		135	4.00	.13		
		359	2.82	0.00		
		TOTALS	6.82	.13	0.00	.13

MCDOWELL DITCH NO 1	1034					
		705	5.00	0.00		
		TOTALS	5.00	0.00	0.00	0.00
CALHOUN DITCH	563					
		364	1.30	0.00		
		365	1.94	0.00		
		650	.86	0.00		
		TOTALS	4.10	0.00	0.00	0.00
IMES AND REYNOLD DITCH	710					
		119	13.10	2.90		
		137	2.20	0.00		
		139	1.60	0.00		
		642	1.00	0.00		
		644	3.70	0.00		
		742	2.05	0.00		
		TOTALS	23.65	2.90	0.00	2.90
SHERMAN TAYLOR DITCH	1036					
		716	5.00	0.00		
		TOTALS	5.00	0.00	0.00	0.00
KELLOGG GULCH PL	1236					
		762	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
BLACKS GULCH PL	1235					
		762	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
GEORGE S WHITTER DITCH	653					
		234	2.60	0.00		
		631	7.00	0.00		
		TOTALS	9.60	0.00	0.00	0.00
WHITE R MESA D JACOHS P	1008					
		604	4.00	.65		
		TOTALS	4.00	.65	0.00	.65
SUPERIOR OIL PL	1237					
		764	12.00	0.00		
		770	12.00	0.00		
		TOTALS	24.00	0.00	0.00	0.00

MC WILLIAMS AND GEORGE D	796					
		149	4.10	0.00		
		TOTALS	4.10	0.00	0.00	0.00
MINER MARTIN DITCH	823					
		405	2.00	0.00		
		415	3.00	0.00		
		TOTALS	5.00	0.00	0.00	0.00
WRAY GULCH PL	1239					
		762	100.00	0.00		
		916	450.00	0.00		
		TOTALS	550.00	0.00	0.00	0.00
OHIO ERTL PL	1245					
		769	55.00	0.00		
		TOTALS	55.00	0.00	0.00	0.00
WHITE R PUMPING PL	1456					
		739	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
MAMMOTH DITCH	787					
		81	1.80	0.00		
		TOTALS	1.80	0.00	0.00	0.00
FORNEY CORCORAN DITCH	640					
		398	6.00	0.00		
		459	5.47	0.00		
		TOTALS	11.47	0.00	0.00	0.00
WOLF RIDGE PL	1244					
		728	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
LITTLE DITCH	769					
		31	3.00	3.00		
		171	2.80	2.00		
		414	4.08	0.00		
		TOTALS	9.88	5.00	0.00	5.00
MEAD IRRIGATION SYSTEM	806					
		596	3.00	0.00		
		TOTALS	3.00	0.00	0.00	0.00

JOHN DELANEY DITCH	727					
		274	1.80	.58		
		TOTALS	1.80	.58	0.00	.58
BLAIR DITCH	546					
		321	6.40	0.00		
		322	1.80	0.00		
		462	3.65	0.00		
		495	1.34	0.00		
		TOTALS	13.19	0.00	0.00	0.00
E H IMES DITCH	613					
		412	3.69	0.00		
		461	5.52	0.00		
		TOTALS	9.21	0.00	0.00	0.00
CROOKED WASH PL	1238					
		762	100.00	0.00		
		TOTALS	100.00	0.00	0.00	0.00
PEDRICK DITCH	868					
		188	10.00	7.10		
		190	16.80	0.00		
		303	2.50	0.00		
		463	9.08	0.00		
		TOTALS	38.38	7.10	0.00	7.10
BASSETT DITCH	531					
		173	2.00	0.00		
		TOTALS	2.00	0.00	0.00	0.00
MCGURDER	802					
		617	5.25	0.00		
		TOTALS	5.25	0.00	0.00	0.00
MOBLEY PIPELINE 1	826					
		697	8.00	0.00		
		TOTALS	8.00	0.00	0.00	0.00
WOLF CK PL	1248					
		873	70.00	0.00		
		TOTALS	70.00	0.00	0.00	0.00

LAWRENCE DITCH	758					
		496	2.07	2.07		
		497	3.11	1.48		
		TOTALS	5.18	3.55	0.00	3.55
STADTMAN DITCH	949					
		155	3.10	3.10		
		311	1.00	1.00		
		468	7.70	4.35		
		TOTALS	11.80	8.45	0.00	8.45
THOMPSON DITCH	970					
		168	1.00	0.00		
		TOTALS	1.00	0.00	0.00	0.00
CALDWELL DITCH NO 1	1028					
		675	8.00	0.00		
		TOTALS	8.00	0.00	0.00	0.00
QUEEN DITCH	886					
		296	2.00	1.29		
		493	3.08	0.00		
		TOTALS	5.08	1.29	0.00	1.29
BEARD DITCH	536					
		573	4.50	3.19		
		TOTALS	4.50	3.19	0.00	3.19
BUCKNER DITCH	556					
		456	.91	.91		
		457	2.09	1.22		
		TOTALS	3.00	2.13	0.00	2.13
HALL DITCH	674					
		147	3.20	0.00		
		TOTALS	3.20	0.00	0.00	0.00
HAMMOND DITCH	677					
		141	12.20	5.00		
		430	4.55	0.00		
		431	14.35	0.00		
		TOTALS	31.10	5.00	0.00	5.00

SAVAGE DITCH	915					
		581	3.60	0.00		
		TOTALS	3.60	0.00	0.00	0.00
SPRING CREEK PUMP	939					
		579	6.30	3.87		
		TOTALS	6.30	3.87	0.00	3.87
SPRING CREEK 1	940					
		567	5.20	2.58		
		TOTALS	5.20	2.58	0.00	2.58
SPRING CK D PUMP 3	1451					
		569	5.20	0.00		
		TOTALS	5.20	0.00	0.00	0.00
SPRING CREEK 2	941					
		567	5.20	0.00		
		TOTALS	5.20	0.00	0.00	0.00
GROSS NICHOLS DITCH	669					
		356	4.80	2.84		
		503	.87	0.00		
		TOTALS	5.67	2.84	0.00	2.84
RANGELY POWER CONDUIT	1454					
		724	620.00	0.00		
		TOTALS	620.00	0.00	0.00	0.00
DOUGLAS CANAL	1453					
		724	120.00	0.00		
		TOTALS	120.00	0.00	0.00	0.00
L K DITCH 1	751					
		531	1.49	.68		
		TOTALS	1.49	.68	0.00	.68
SUPERIOR PUMPBACK NO 3	1251					
		763	24.00	0.00		
		TOTALS	24.00	0.00	0.00	0.00

GOEDER DITCH	657					
		309	1.40	.45		
		424	.50	0.00		
		540	3.30	0.00		
		TOTALS	5.20	.45	0.00	.45
HEFLEY PUMP PLANT NO 2	688					
		912	.40	0.00		
		TOTALS	.40	0.00	0.00	0.00
HEFLEY PUMP PLANT NO 1	687					
		112	5.41	5.41		
		266	.20	.20		
		306	.28	.28		
		480	4.25	4.11		
		568	5.60	0.00		
		TOTALS	15.74	10.00	0.00	10.00
CALAVAT DITCH	570					
		592	10.40	3.87		
		TOTALS	10.40	3.87	0.00	3.87
STOREY DITCH 1	954					
		587	10.00	0.00		
		TOTALS	10.00	0.00	0.00	0.00
STOREY DITCH 2	955					
		588	2.20	0.00		
		TOTALS	2.20	0.00	0.00	0.00
STROUD DITCH	956					
		476	.62	.58		
		481	.93	0.00		
		TOTALS	1.55	.58	0.00	.58
CHASE AND COLTHARP D	573					
		308	7.40	0.00		
		386	.80	0.00		
		387	12.29	0.00		
		TOTALS	20.49	0.00	0.00	0.00
RANGELY WATER PLANT	889					
		576	2.60	2.00		
		613	28.35	0.00		
		TOTALS	30.95	2.00	0.00	2.00

PURDY IRRIGATION PUMP	884					
		711	2.00	0.00		
		TOTALS	2.00	0.00	0.00	0.00
HEFLEY PUMP PLANT NO 3	689					
		307	9.58	3.68		
		565	11.40	0.00		
		TOTALS	20.98	3.68	0.00	3.68
UINTAH OIL REFIN CO PL	974					
		661	3.15	0.00		
		TOTALS	3.15	0.00	0.00	0.00
MOON LAKE PL	1246					
		781	6.00	0.00		
		TOTALS	6.00	0.00	0.00	0.00
MOONLAKE STALEY PIPELINE	830					
		714	125.20	0.00		
		741	55.10	0.00		
		TOTALS	180.30	0.00	0.00	0.00
PIONEER DITCH	877					
		140	17.10	1.77		
		TOTALS	17.10	1.77	0.00	1.77
GEORGE MENGE D	1105					
		942	1.00	0.00		
		TOTALS	1.00	0.00	0.00	0.00
STANDOLIND OIL CO PL	1470					
		536	.52	0.00		
		TOTALS	.52	0.00	0.00	0.00
MCLAUGHLIN PIPELINE	805					
		699	8.00	2.90		
		TOTALS	8.00	2.90	0.00	2.90
TEXAS CO PL	1448					
		534	1.00	0.00		
		TOTALS	1.00	0.00	0.00	0.00

SUPERIOR PUMPBACK NO 2	1250					
		763	12.00	0.00		
		TOTALS	12.00	0.00	0.00	0.00
CALIFORNIA CO WATER PL	564					
		572	.31	0.00		
		577	1.33	0.00		
		607	9.69	0.00		
		713	10.00	0.00		
		TOTALS	21.33	0.00	0.00	0.00
RIDGEWAY AND STATELER D	902					
		146	6.90	0.00		
		TOTALS	6.90	0.00	0.00	0.00
MEAGER DIVERSION	1255					
		939	20.00	0.00		
		TOTALS	20.00	0.00	0.00	0.00

OUTPUT

ANALYSIS FROM PROGRAM

REALLOCATION OF WATER BY PRIORITY

OF INDIVIDUAL WATER RIGHTS

CALL FROM SENIOR DIVERSICN				CUT FROM JUNIOR DIVERSICN			
STRUCTURE NAME	IDENT	RANK	SHORTAGE	STRUCTURE NAME	IDENT	RANK	CURTAILMENT
HIGHLAND DITCH	694	33	27.27	DREYFUSS DITCH	608	0	6.33
HIGHLAND DITCH	694	33	27.27	MILLER CREEK DITCH	819	0	6.13
HIGHLAND DITCH	694	33	22.21	GREENSTREET DITCH EXT	665	689	3.63
HIGHLAND DITCH	694	33	21.46	DREYFUSS DITCH	608	655	2.49
HIGHLAND DITCH	694	33	21.46	MILLER CREEK DITCH	819	502	12.00
HIGHLAND DITCH	694	33	11.14	MILLER CREEK DITCH	819	464	12.95
HIGHLAND DITCH	694	283	16.32	MILLER CREEK DITCH	819	464	17.35
HIGHLANC DITCH	694	283	1.40	NEW ARCHER WARNER	841	448	2.57
HIGHLAND DITCH	694	283	1.40	OAK RIDGE PARK	848	422	1.40
HIGHLAND DITCH	694	393	48.12	OAK RIDGE PARK	848	422	1.90
HIGHLAND DITCH	694	393	46.22	NELSON DITCH	840	395	.72
HIGHLAND DITCH	694	393	46.00	NO REALLOCATION MADE	0	0	0.00
OLD AGENCY CITCH	849	9	7.09	HIGHLAND DITCH	694	393	2.12
OLD AGENCY DITCH	849	9	4.97	LA KAMP DITCH	752	373	.12
OLD AGENCY DITCH	849	9	4.94	OAK RIDGE PARK	848	338	4.94
POWELL PARK DITCH	883	55	.34	ISLAND DITCH	713	0	.50
POWELL PARK DITCH	883	55	.34	B P FRANKLIN DITCH 1	515	0	.58
POWELL PARK DITCH	883	55	.28	LOWLAND DITCH	777	0	6.77
HAY BRETHERTON DITCH	681	589	2.54	LOWLAND DITCH	777	0	1.22
HAY BRETHERTON DITCH	681	589	2.18	PEASE DITCH	867	719	2.90
INDEPENDENT DITCH	711	340	2.62	PEASE DITCH	867	719	3.09
INDEPENDENT DITCH	711	340	.40	DORRELL DITCH 1	604	632	.25
INDEPENDENT DITCH	711	340	.33	PEASE DITCH	867	606	.20
INDEPENCENT DITCH	711	340	.18	PEASE DITCH	867	593	.24

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY

BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO.	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
WHITE R PL NO 2	1459	.05	0.00	0.00	0.00	139.34	0.00
NELSON DITCH	840	.91	0.00	0.00	0.00	140.41	.72
GREENSTREET DITCH EXT	665	1.41	0.00	0.00	0.00	140.79	3.63
LA KAMP DITCH	752	2.50	1.00	.30	.70	141.32	.12
ELK CREEK DITCH	623	3.49	.85	.26	.59	148.92	0.00
WALTER WARNER DITCH	992	5.00	0.00	0.00	0.00	150.66	0.00
WALTER WARNER DITCH NO 2	993	6.64	0.00	0.00	0.00	151.91	0.00
NEW ARCHER WARNER	841	7.48	2.50	.45	2.05	150.05	2.57
DREIFUSS DITCH	607	9.04	1.88	.56	1.31	153.16	0.00
MILLER CREEK DITCH	819	10.00	57.70	17.31	40.39	97.50	48.42
DREYFUSS DITCH	608	10.20	3.40	.46	2.94	94.26	8.82
WARREN SMITH DITCH	996	12.08	0.00	0.00	0.00	111.49	0.00
NEAL PUMP STATION	837	13.23	0.00	0.00	0.00	113.10	0.00
OAK RIDGE PARK	848	13.24	45.26	13.58	31.68	67.85	8.24
CARSTENS PUMP STATION	567	13.30	0.00	0.00	0.00	67.89	0.00
GOVREAU PUMP STATION	663	13.63	0.00	0.00	0.00	68.14	0.00
MEEKER WATER WORKS PL	811	14.35	.63	0.00	0.00	68.41	0.00
HIGHLAND DITCH	694	14.35	61.32	18.40	42.92	7.09	80.80
OLD AGENCY DITCH	849	15.05	7.62	2.29	5.34	.00	0.00
LOWLAND DITCH	777	15.77	8.40	2.52	5.88	7.99	10.35
WAGNER DITCH	1044	16.30	0.00	0.00	0.00	16.97	0.00
WHITE RIVER ABOVE COAL C	0	16.50	0.00	0.00	0.00	20.65	0.00
STORY GULCH PARACHUTE PL	1247	16.65	0.00	0.00	0.00	22.84	0.00
SOUTH SIDE HIGHLINE	935	19.38	9.25	2.78	6.47	34.14	0.00
WHITE RIVER NEAR MEEKER	0	20.45	0.00	0.00	0.00	40.74	0.00
SHERIDAN AND MORTON D	926	20.46	2.50	.41	2.09	38.23	0.00
MEEKER DITCH	808	21.46	21.50	.62	20.88	21.45	0.00
B P FRANKLIN DITCH 1	515	22.60	.27	.08	.19	25.04	.58
MEEKER WATER SYS PL	810	23.34	2.25	0.00	0.00	31.36	0.00
ISLAND DITCH	713	23.68	2.00	.31	1.69	29.26	.50
MEEKER BRIDGE DITCH	1042	23.97	0.00	0.00	0.00	30.87	0.00
NIBLOCK DITCH	842	26.09	54.87	12.79	42.09	46.35	0.00
DORRELL DITCH 1	604	27.47	0.00	0.00	0.00	45.96	.25
WHITE R 14 MI CK PL	1458	28.10	0.00	0.00	0.00	52.09	0.00
PEASE DITCH	867	28.52	12.32	3.48	8.85	39.64	6.43
STRAWBERRY CK PL	1254	28.60	0.00	0.00	0.00	39.62	0.00
POWELL PARK DITCH	883	28.92	32.66	9.80	22.86	6.87	0.00
HAY BRETHERTON DITCH	681	31.02	18.75	3.87	14.88	2.72	0.00
INDEPENDENT DITCH	711	31.34	2.62	.79	1.84	.00	0.00
JAMES HAYES DITCH	718	33.33	0.00	0.00	0.00	23.24	0.00

HALPEN PUMP PIPELINE	673	33.70	2.13	.64	1.49	21.01	0.00
LORING DITCH	774	38.24	.50	.15	.35	59.20	0.00
IVO E SCHULTZ D AND PUMP	714	39.24	6.25	.49	5.76	59.88	0.00
WHITE RIVER BELOW MEEKER	0	39.90	0.00	0.00	0.00	65.45	0.00
HAY DITCH 2	684	40.00	1.77	.45	1.33	63.66	0.00
THOMAS DITCH 3	967	40.21	0.00	0.00	0.00	64.95	0.00
THOMAS DITCH	965	40.59	0.00	0.00	0.00	64.88	0.00
THOMAS DITCH 2	966	40.71	2.17	.65	1.52	62.69	0.00
WHITE R PICEANCE PL	1243	41.50	0.00	0.00	0.00	64.08	0.00
MCDOWELL DITCH	800	42.51	.16	.05	.11	63.74	0.00
MCDOWELL DITCH NO 1	1034	43.50	0.00	0.00	0.00	63.69	0.00
CALHOUN DITCH	[illegible]	44.08	0.00	0.00	0.00	63.59	0.00
IMES AND REYNOLD DITCH	710	45.59	3.63	1.09	2.54	59.71	0.00
SHERMAN TAYLOR DITCH	1036	46.00	0.00	0.00	0.00	62.18	0.00
KELLOGG GULCH PL	1236	46.80	0.00	0.00	0.00	62.04	0.00
BLACKS GULCH PL	1235	49.00	0.00	0.00	0.00	62.02	0.00
GEORGE S WHITTER DITCH	653	49.63	0.00	0.00	0.00	61.91	0.00
WHITE R MESA D JACOBS P	1008	50.21	.81	.24	.57	61.00	0.00
SUPERIOR OIL PL	1237	50.36	0.00	0.00	0.00	61.54	0.00
MC WILLIAMS AND GEORGE D	796	50.70	0.00	0.00	0.00	61.49	0.00
MINER MARTIN DITCH	823	51.39	0.00	0.00	0.00	61.37	0.00
WRAY GULCH PL	1239	51.59	0.00	0.00	0.00	61.34	0.00
OHIO ERTL PL	1245	52.20	0.00	0.00	0.00	61.23	0.00
WHITE R PUMPING PL	1456	52.25	0.00	0.00	0.00	61.22	0.00
MAMMOTH DITCH	787	52.50	0.00	0.00	0.00	73.29	0.00
FORNEY CORCORAN DITCH	640	52.73	0.00	0.00	0.00	73.25	0.00
WOLF RIDGE PL	1244	53.80	0.00	0.00	0.00	73.07	0.00
LITTLE DITCH	769	54.82	6.25	1.88	4.37	66.65	0.00
MEAD IRRIGATION SYSTEM	806	58.21	0.00	0.00	0.00	70.45	0.00
JOHN DELANEY DITCH	727	58.49	.72	.22	.51	69.68	0.00
BLAIR DITCH	546	60.88	0.00	0.00	0.00	69.78	0.00
E H IMES DITCH	613	64.48	0.00	0.00	0.00	69.17	0.00
CROOKED WASH PL	1238	66.00	0.00	0.00	0.00	68.91	0.00
PEDRICK DITCH	868	66.84	8.87	2.66	6.21	59.89	0.00
BASSETT DITCH	531	71.53	0.00	0.00	0.00	65.86	0.00
MCGURDER	802	73.09	0.00	0.00	0.00	65.60	0.00
MOBLEY PIPELINE 1	826	74.20	0.00	0.00	0.00	65.41	0.00
WOLF CK PL	1248	74.35	0.00	0.00	0.00	65.38	0.00
LAWRENCE DITCH	758	74.46	4.44	.68	3.75	60.93	0.00
STADTMAN DITCH	949	75.83	10.56	.69	9.87	54.24	0.00
THOMPSON DITCH	970	76.38	0.00	0.00	0.00	64.01	0.00
CALDWELL DITCH NO 1	1028	77.00	0.00	0.00	0.00	63.91	0.00
QUEEN DITCH	886	78.84	1.61	.48	1.13	61.98	0.00
BEARD DITCH	536	79.21	3.99	.59	3.40	59.06	0.00
BUCKNER DITCH	556	80.27	2.66	.60	2.06	59.62	0.00
HALL DITCH	674	80.61	0.00	0.00	0.00	61.63	0.00
HAMMOND DITCH	677	83.37	6.25	1.88	4.37	54.91	0.00
SAVAGE DITCH	915	88.36	0.00	0.00	0.00	58.44	0.00
SPRING CREEK PUMP	939	88.98	4.84	.31	4.52	53.49	0.00
SPRING CREEK 1	940	89.00	3.22	.50	2.72	54.79	0.00
SPRING CK D PUMP 3	1451	89.05	0.00	0.00	0.00	57.50	0.00
SPRING CREEK 2	941	89.25	0.00	0.00	0.00	57.47	0.00
GROSS NICHOLS DITCH	669	92.31	3.55	.16	3.39	53.93	0.00
RANGELY POWER CONDUIT	1454	94.39	0.00	0.00	0.00	56.97	0.00

DOUGLAS CANAL	1453	94.40	0.00	0.00	0.00	56.97	0.00
L K DITCH 1	751	94.65	.85	.26	.59	56.07	0.00
SUPERIOR PUMPBACK NO 3	1251	95.40	0.00	0.00	0.00	56.54	0.00
GOECER DITCH	657	95.54	.56	.17	.39	55.96	0.00
WHITE RIVER AB RANGELY	0	97.40	0.00	0.00	0.00	56.03	0.00
HEFLEY PUMP PLANT NO 2	688	97.53	0.00	0.00	0.00	56.01	0.00
HEFLEY PUMP PLANT NO 1	687	100.58	12.50	.77	11.73	43.06	0.00
CALAVAT DITCH	570	100.59	4.84	1.45	3.39	49.95	0.00
STOREY DITCH 1	954	102.50	0.00	0.00	0.00	53.06	0.00
STOREY DITCH 2	955	103.07	0.00	0.00	0.00	52.97	0.00
STRCUD DITCH	956	103.23	.72	.22	.51	52.22	0.00
CHASE AND COLTHARP D	573	103.83	0.00	0.00	0.00	52.64	0.00
RANGELY WATER PLANT	889	104.48	2.50	0.00	0.00	50.05	0.00
PURDY IRRIGATION PUMP	884	105.18	0.00	0.00	0.00	49.94	0.00
HEFLEY PUMP PLANT NO 3	689	105.64	4.60	.53	4.07	45.27	0.00
UINTAH OIL REFIN CO PL	974	107.55	0.00	0.00	0.00	49.06	0.00
MOON LAKE PL	1246	107.80	0.00	0.00	0.00	49.03	0.00
MOONLAKE STALEY PIPELINE	830	107.93	0.00	0.00	0.00	49.01	0.00
PIONEER DITCH	877	108.37	2.21	.66	1.55	46.73	0.00
GEORGE MENGE D	1105	108.50	0.00	0.00	0.00	46.71	0.00
STANOOLIND OIL CO PL	1470	108.60	0.00	0.00	0.00	46.70	0.00
MCLAUGHLIN PIPELINE	805	110.27	3.63	1.06	2.57	44.37	0.00
TEXAS CO PL	1448	111.00	0.00	0.00	0.00	46.83	0.00
SUPERIOR PUMPBACK NO 2	1250	112.50	0.00	0.00	0.00	46.61	0.00
CALIFORNIA CO WATER PL	564	113.99	9.38	0.00	0.00	37.02	0.00
RIDGEWAY AND STATELER D	902	120.24	0.00	0.00	0.00	36.09	0.00
MEAGER DIVERSION	1255	127.00	0.00	0.00	0.00	35.09	0.00
WHITE RIVER NR WATSON UT	0	144.50	0.00	0.00	0.00	32.50	0.00

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SUMMARY

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SYSTEM YIELD = 157.81

WATER DIVERTED OUT OF SYSTEM OR TOTALLY CONSUMED = 14.75

SUM OF IRRIGATION DIVERSIONS = 451.00

TOTAL IRRIGATION CONSUMPTIVE USE = 110.55

IRRIGATION RETURN AS FRACTION OF TOTAL IRRIGATION DIVERSION = .75

FINAL STREAM FLOW AT LAST DOWNSTREAM CONTROL POINT = 32.50

MINIMUM STREAM FLOW = .00 AT STREAM MILE = 31.34

SUPPLEMENTAL WATER NECESSARY TO SUPPLY SHORTAGES = 131.49

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OUTPUT
ANALYSIS FROM PROGRAM

REALLOCATION OF WATER BY PRIORITY

OF INDIVIDUAL WATER RIGHTS

CALL FROM SENIOR DIVERSION				CUT FROM JUNIOR DIVERSION			
STRUCTURE NAME	IDENT	RANK	SHORTAGE	STRUCTURE NAME	IDENT	RANK	CURTAILMENT
HIGHLAND DITCH	694	33	21.26	DREYFUSS DITCH	608	0	3.89
HIGHLAND DITCH	694	33	21.26	GREENSTREET DITCH EXT	665	689	2.90
HIGHLAND DITCH	694	33	20.77	YELLOW JACKET CANAL	1473	665	20.77
HIGHLAND DITCH	694	231	68.70	YELLOW JACKET CANAL	1473	665	68.70
OLD AGENCY DITCH	849	9	4.84	YELLOW JACKET CANAL	1473	665	4.84

FINAL ALLOCATION OF AVAILABLE WATER SUPPLY

BY WATER RIGHT PRIORITIES

STRUCTURE NAME	IDENT NO.	STREAM MILE	DIVERTED AMOUNT	CONSUMPTIVE USE	RETURN FLOW	STREAM FLOW BELOW DIVRSN	SHORTAGE
YLOJKT RES H2O-TRNSBSN	2473	0.00	100.00	0.00	0.00	170.00	0.00
YELLOW JACKET CANAL	1473	.10	105.69	31.71	73.98	164.49	94.31
WHITE R PL NO 2	1459	.05	0.00	0.00	0.00	164.40	0.00
NELSON DITCH	840	.91	.58	.17	.41	166.57	0.00
GREENSTREET DITCH EXT	665	1.41	0.00	0.00	0.00	167.57	2.90
LA KAMP DITCH	752	2.50	.90	.27	.63	170.94	0.00
ELK CREEK DITCH	623	3.49	.68	.20	.48	192.67	0.00
WALTER WARNER DITCH	992	5.00	0.00	0.00	0.00	195.86	0.00
WALTER WARNER DITCH NO 2	993	6.64	0.00	0.00	0.00	198.82	0.00
NEW ARCHER WARNER	841	7.48	4.06	.29	3.77	196.27	0.00
DREIFUSS DITCH	607	9.04	1.50	.45	1.05	206.34	0.00
MILLER CREEK DITCH	819	10.00	84.90	20.42	64.48	124.22	0.00
DREYFUSS DITCH	608	10.20	5.89	.31	5.58	118.69	3.89
WARREN SMITH DITCH	996	12.08	0.00	0.00	0.00	154.96	0.00
NEAL PUMP STATION	837	13.23	0.00	0.00	0.00	158.42	0.00
OAK RIDGE PARK	848	13.24	42.40	10.97	31.43	116.04	0.00
CARSTENS PUMP STATION	567	13.30	0.00	0.00	0.00	116.15	0.00
GOVREAU PUMP STATION	663	13.63	0.00	0.00	0.00	116.74	0.00
MEEKER WATER WORKS PL	811	14.35	.50	0.00	0.00	118.54	0.00
HIGHLAND DITCH	694	14.35	113.70	15.06	98.64	4.84	0.00
OLD AGENCY DITCH	849	15.05	6.10	1.83	4.27	.00	0.00
LOWLAND DITCH	777	15.77	0.00	0.00	0.00	17.01	0.00
WAGNER DITCH	1044	16.30	0.00	0.00	0.00	34.47	0.00
WHITE RIVER ABOVE COAL C	0	16.50	0.00	0.00	0.00	34.83	0.00
STORY GULCH PARACHUTE PL	1247	16.65	0.00	0.00	0.00	34.73	0.00
SOUTH SIDE HIGHLINE	935	19.38	7.40	2.22	5.18	106.67	0.00
WHITE RIVER NEAR MEEKER	0	20.45	0.00	0.00	0.00	121.77	0.00
SHERIDAN AND MORTON D	926	20.46	2.00	.28	1.72	119.77	0.00
MEEKER DITCH	808	21.46	17.20	.42	16.78	109.76	0.00
B P FRANKLIN DITCH 1	515	22.60	.68	.10	.58	123.16	0.00
MEEKER WATER SYS PL	810	23.34	1.80	0.00	0.00	148.66	0.00
ISLAND DITCH	713	23.68	2.00	.21	1.79	146.47	0.00
MEEKER BRIDGE DITCH	1042	23.97	0.00	0.00	0.00	148.10	0.00
NIBLOCK DITCH	842	26.09	85.00	12.50	72.50	174.16	0.00
DORRELL DITCH 1	604	27.47	.20	.06	.14	173.19	0.00
WHITE R 14 MI CK PL	1458	28.10	0.00	0.00	0.00	183.86	0.00
PEASE DITCH	867	28.52	15.00	2.38	12.62	168.62	0.00
STRAWBERRY CK PL	1254	28.60	0.00	0.00	0.00	168.58	0.00
POWELL PARK DITCH	883	28.92	26.13	7.84	18.29	142.27	0.00
HAY BRETHERTON DITCH	681	31.02	15.00	2.66	12.34	147.42	0.00
INDEPENDENT DITCH	711	31.34	2.10	.63	1.47	145.14	0.00
JAMES HAYES DITCH	718	33.33	0.00	0.00	0.00	170.62	0.00

HALPEN PUMP PIPELINE	673	33.70	1.70	.51	1.19	168.71	0.00
LORING DITCH	774	38.24	.40	.12	.28	220.44	0.00
IVO E SCHULTZ D AND PUMP	714	39.24	5.00	.34	4.66	220.65	0.00
WHITE RIVER BELOW MEEKER	0	39.90	0.00	0.00	0.00	224.95	0.00
HAY DITCH 2	684	40.00	1.42	.31	1.11	223.50	0.00
THOMAS DITCH 3	967	40.21	0.00	0.00	0.00	224.54	0.00
THOMAS DITCH	965	40.59	0.00	0.00	0.00	224.42	0.00
THOMAS DITCH 2	966	40.71	1.74	.46	1.28	222.64	0.00
WHITE R PICEANCE PL	1243	41.50	0.00	0.00	0.00	223.66	0.00
MCDOWELL DITCH	800	42.51	.13	.04	.09	223.20	0.00
MCDOWELL DITCH NO 1	1034	43.50	0.00	0.00	0.00	222.96	0.00
CALHOUN DITCH	563	44.08	0.00	0.00	0.00	222.77	0.00
IMES AND REYNOLD DITCH	710	45.59	2.90	.87	2.03	219.38	0.00
SHERMAN TAYLOR DITCH	1036	46.00	0.00	0.00	0.00	221.27	0.00
KELLOGG GULCH PL	1236	46.80	0.00	0.00	0.00	221.01	0.00
BLACKS GULCH PL	1235	49.00	0.00	0.00	0.00	221.28	0.00
GEORGE S WHITTER DITCH	653	49.63	0.00	0.00	0.00	221.08	0.00
WHITE R MESA D JACOBS P	1008	50.21	.65	.20	.45	220.24	0.00
SUPERIOR OIL PL	1237	50.36	0.00	0.00	0.00	220.64	0.00
MC WILLIAMS AND GEORGE D	796	50.70	0.00	0.00	0.00	220.53	0.00
MINER MARTIN DITCH	823	51.39	0.00	0.00	0.00	220.30	0.00
WRAY GULCH PL	1239	51.59	0.00	0.00	0.00	220.24	0.00
OHIO ERTL PL	1245	52.20	0.00	0.00	0.00	220.04	0.00
WHITE R PUMPING PL	1456	52.25	0.00	0.00	0.00	220.02	0.00
MAMMOTH DITCH	787	52.50	0.00	0.00	0.00	254.54	0.00
FORNEY CORCORAN DITCH	640	52.73	0.00	0.00	0.00	254.46	0.00
WOLF RIDGE PL	1244	53.80	0.00	0.00	0.00	254.11	0.00
LITTLE DITCH	769	54.82	5.00	1.45	3.55	248.78	0.00
MEAD IRRIGATION SYSTEM	806	58.21	0.00	0.00	0.00	251.21	0.00
JOHN DELANEY DITCH	727	58.49	.58	.17	.41	250.54	0.00
BLAIR DITCH	546	60.88	0.00	0.00	0.00	250.16	0.00
YELLOW CK TUNNEL AND PL	2501	61.38	125.00	0.00	0.00	124.99	0.00
E H IMES DITCH	613	64.48	0.00	0.00	0.00	123.97	0.00
CROOKED WASH PL	1238	66.00	0.00	0.00	0.00	123.47	0.00
PEDRICK DITCH	868	66.84	7.10	2.13	4.97	116.10	0.00
BASSETT DITCH	531	71.53	0.00	0.00	0.00	121.11	0.00
MCGURDER	802	73.09	0.00	0.00	0.00	120.59	0.00
MOBLEY PIPELINE 1	826	74.20	0.00	0.00	0.00	120.23	0.00
WOLF CK PL	1248	74.35	0.00	0.00	0.00	120.18	0.00
LAWRENCE DITCH	758	74.46	3.55	.48	3.07	116.59	0.00
STADTMAN DITCH	949	75.83	8.45	.49	7.96	111.76	0.00
THOMPSON DITCH	970	76.38	0.00	0.00	0.00	119.54	0.00
CALDWELL DITCH NO 1	1028	77.00	0.00	0.00	0.00	119.34	0.00
QUEEN DITCH	886	78.84	1.29	.39	.90	117.44	0.00
BEARD DITCH	536	79.21	3.19	.42	2.77	115.03	0.00
BUCKNER DITCH	556	80.27	2.13	.42	1.71	115.33	0.00
HALL DITCH	674	80.61	0.00	0.00	0.00	116.92	0.00
HAMMOND DITCH	677	83.37	5.00	1.50	3.50	111.01	0.00
SAVAGE DITCH	915	88.36	0.00	0.00	0.00	112.87	0.00
SPRING CREEK PUMP	939	88.98	3.87	.22	3.65	108.80	0.00
SPRING CREEK 1	940	89.00	2.58	.36	2.22	109.86	0.00
SPRING CK D PUMP 3	1451	89.05	0.00	0.00	0.00	112.07	0.00
SPRING CREEK 2	941	89.25	0.00	0.00	0.00	112.00	0.00
GROSS NICHOLS DITCH	669	92.31	2.84	.11	2.73	109.65	0.00
RANGELY POWER CONDUIT	1454	94.39	0.00	0.00	0.00	111.70	0.00

DOUGLAS CANAL	1453	94.40	0.00	0.00	0.00	111.70	0.00
L K DITCH 1	751	94.65	.68	.20	.48	110.93	0.00
SUPERIOR PUMPBACK NO 3	1251	95.40	0.00	0.00	0.00	111.16	0.00
GOEDER DITCH	657	95.54	.45	.14	.31	110.67	0.00
WHITE RIVER AB RANGELY	0	97.40	0.00	0.00	0.00	110.37	0.00
HEFLEY PUMP PLANT NO 2	688	97.53	0.00	0.00	0.00	110.34	0.00
HEFLEY PUMP PLANT NO 1	687	100.58	10.00	.55	9.45	99.64	0.00
CALAVAT DITCH	570	100.59	3.87	1.12	2.75	105.22	0.00
STOREY DITCH 1	954	102.50	0.00	0.00	0.00	107.53	0.00
STOREY DITCH 2	955	103.07	0.00	0.00	0.00	107.40	0.00
STROUD DITCH	956	103.23	.58	.17	.41	106.79	0.00
CHASE AND COLTHARP D	573	103.83	0.00	0.00	0.00	107.06	0.00
RANGELY WATER PLANT	889	104.48	2.00	0.00	0.00	104.91	0.00
PURDY IRRIGATION PUMP	884	105.18	0.00	0.00	0.00	104.75	0.00
HEFLEY PUMP PLANT NO 3	689	105.64	3.68	.38	3.30	100.96	0.00
UINTAH OIL REFIN CO PL	974	107.55	0.00	0.00	0.00	103.82	0.00
MOON LAKE PL	1246	107.80	0.00	0.00	0.00	103.77	0.00
MOONLAKE STALEY PIPELINE	830	107.93	0.00	0.00	0.00	103.74	0.00
PIONEER DITCH	877	108.37	1.77	.53	1.24	101.87	0.00
GEORGE MENGE D	1105	108.50	0.00	0.00	0.00	101.84	0.00
STANDOLIND OIL CO PL	1470	108.60	0.00	0.00	0.00	101.81	0.00
MCLAUGHLIN PIPELINE	805	110.27	2.90	.76	2.14	99.77	0.00
TEXAS CO PL	1448	111.00	0.00	0.00	0.00	101.75	0.00
SUPERIOR PUMPBACK NO 2	1250	112.50	0.00	0.00	0.00	101.40	0.00
CALIFORNIA CO WATER PL	564	113.99	0.00	0.00	0.00	101.06	0.00
RIDGEWAY AND STATELER D	902	120.24	0.00	0.00	0.00	99.63	0.00
MEAGER DIVERSION	1255	127.00	0.00	0.00	0.00	98.08	0.00
WHITE RIVER NR WATSON UT	0	144.50	0.00	0.00	0.00	94.07	0.00

SUMMARY

SYSTEM YIELD = 449.18

WATER DIVERTED OUT OF SYSTEM OR TOTALLY CONSUMED = 229.30

SUM OF IRRIGATION DIVERSIONS = 622.56

TOTAL IRRIGATION CONSUMPTIVE USE = 125.81

IRRIGATION RETURN AS FRACTION OF TOTAL IRRIGATION DIVERSION = .80

FINAL STREAM FLOW AT LAST DOWNSTREAM CONTROL POINT = 94.07

MINIMUM STREAM FLOW = .00 AT STOEAM MILE = 15.05

SUPPLEMENTAL WATER NECESSARY TO SUPPLY SHORTAGES = 94.80