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Water Quality Modeling of Reservoir System Operations Using HEC-5

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14. ABSTRACT
This training document provides guidance on the application of the HEC-5 computer program to a typical water quality study. The purpose of this training document is to familiarize the first time user of HEC-5 with the procedure to follow for collecting, assembly, and manipulating water quality input data. The document conveys many significant items not normally discussed in a users manual or even in lectures.

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US Army Corps of Engineers
Institute for Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616

(530) 756-1104
(530) 756-8250 FAX
www.hec.usace.army.mil

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WATER QUALITY MODELING OF RESERVOIR SYSTEM OPERATIONS USING HEC-5

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CHAPTER I

INTRODUCTION

The U.S. Army Corps of Engineers is responsible for the operation of hundreds of multiple purpose reservoirs in addition to maintenance of hundreds of miles of non-reservoir projects (e.g., levees and navigation channels). Management of reservoir releases for water quality can be analyzed to determine the operation with any one of the numerously available reservoir computer programs [WRE 1969a, HEC 1972, U.S. Army 1977, HEC 1978, Loftis 1980]. With river water quality programs, the impact of specified reservoir releases can be evaluated at downstream points of interest [HEC 1978].

The problem with using single project models is the difficulty of coordinating releases among projects which impact on a single location. This is particularly obvious in Figure 1 where the operation of both reservoirs A and B impact on the amount and quality of water at City A (i.e., control point 3). As the system is expanded further downstream, the computations necessary to provide a best operation of reservoirs A through D for control point 7 obviously require a comprehensive system approach.

The "HEC-5, Simulation of Flood Control and Conservation Systems, Appendix on Water Quality Analysis" computer model [HEC 1986] has been developed specifically for evaluating the type of problem shown in Figure 1. The model is capable of evaluating a reservoir system of up to ten reservoirs and up to thirty control points. The model will determine a best system operation for water quantity and quality; evaluating operational concerns like flood control, hydropower, water supply, and irrigation diversions. Changing needs and natural inputs can also be accommodated.

The HEC-5 water quality routines can be used to determine the quality constituents available with the best system water quantity operation or alternately the best water quality operation. The model can analyze water temperature, up to three conservative and three non-conservative constituents, dissolved oxygen and phytoplankton. Optional computation intervals from hourly to monthly are available. Graphical post-processor capability can be interfaced through other available software.

This training document provides guidance on the application of the HEC-5 computer program to a typical water quality study. The purpose of this training document is to familiarize the first time user of HEC-5 with the procedure to follow for collecting, assembly, and manipulating water quality input data. The optional types of executions and the proper interpretation of results are also discussed at some length. The author conveys many significant items not normally discussed in a users manual or even in short course lectures. These items resulted from experience gained by completing several studies with this water quality model.

Following the procedures in this document will help the reader apply HEC-5 to routinely encountered problems involving evaluation of water quality conditions in existing and/or proposed multipurpose reservoir systems.

The HEC-5 water quality model is new and therefore a research tool until it has been successfully applied to numerous practical problems. The HEC would appreciate your comments and observations which could be added to this report or to the users manual regarding experiences with the application of HEC-5. As desirable improvements are identified, modifications will be made.

Additional assistance in understanding HEC-5 is available by contacting Mr. Willey at (916) 551-1748 or (FTS) 460-1748.

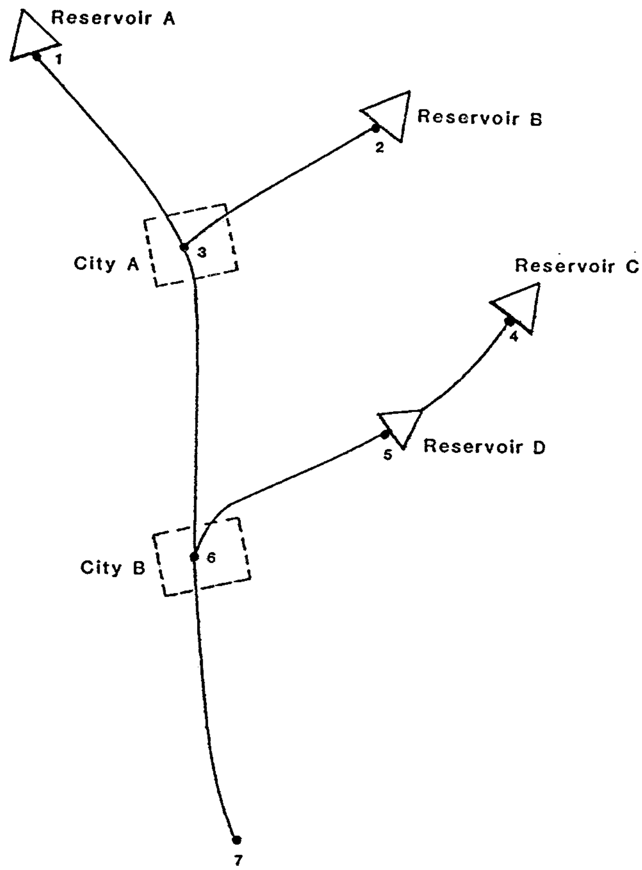

Figure 1

TYPICAL RESERVOIR SYSTEM SCHEMATIC

CHAPTER II

MATHEMATICAL MODEL

The mathematical model, "HEC-5, Simulation of Flood Control and Conservation Systems, Appendix on Water Quality Analysis," has been used to analyze the Sacramento Valley [Willey 1985], Kanawha River Basin [Willey 1986], and the Monongahela River Basin [Willey 1987] Reservoir Systems. The computer program Users Manual [HEC 1986], and several technical papers [Duke 1984, Willey 1982, 1983, 1984, and 1987] adequately document the details of the model concepts and the input description, so only a brief overview is provided in this chapter.

The HEC-5 water quality computer program is composed of a flow simulation module (HEC-5A) and the water quality simulation module (HEC-5Q). They are an integrated package with feedback capability between the two modules. Each module, the gate selection routine and the flow alteration option are described below.

Flow Simulation Module

The flow simulation module was developed to assist in planning studies for evaluating proposed reservoirs in a system and to assist in sizing the flood control and conservation storage requirements for each project recommended for the system. The program can be used in studies made immediately after the occurrence of a flood to show the effects of existing and/or proposed reservoirs on flows and damages in the system. The program should also be useful in selecting the proper reservoir releases throughout the system during flood emergencies in order to minimize flooding as much as possible and yet empty the system as quickly as possible while maintaining a balance of flood control storage ("balanced pool") among the reservoirs.

The above purposes are accomplished by simulating the operation of a system of reservoirs of any configuration for short interval historical floods or for long duration nonflood periods or for combinations of the two. Specifically the program may be used to determine:

a. Flood control and conservation storage requirements for each reservoir in the system.
b. The influence of a system of reservoirs on the spatial and temporal distribution of runoff in a basin.
c. The evaluation of operational criteria for both flood control and conservation (including hydropower) for a system of reservoirs.
d. The expected annual flood damages, system costs, and system net benefits for flood damage reduction.
e. The system of existing and proposed reservoirs or other alternatives that result in the maximum net flood control benefits for the system by making simulation runs for selected alternative systems.

Water Quality Simulation Module

The water quality simulation module was developed to simulate temperature, as well as three user-selected conservative and three user-selected non-conservative constituents. The model also allows dissolved oxygen to be simulated if the user selects either carbonaceous or nitrogeneous oxygen demanding constituents. An option for phytoplankton evaluation is also available.

The water quality simulation module accepts system flows generated by the flow simulation module and computes the distribution of all the water quality constituents in each of the reservoirs in the system and their associated downstream river reaches. The reservoirs may be in any arbitrary parallel and tandem configuration.

The water quality simulation module also selects the gate openings for reservoir selective-withdrawal structures to meet user-specified water quality objectives at downstream control points. If the objectives cannot be satisfied with the previously computed "balanced pool" flows, the model will compute a modified flow distribution necessary to better satisfy all down-stream objectives. With these capabilities, the planner may evaluate the effects of proposed reservoir-stream system modifications on water quality and determine how a reservoir intake structure should be operated to achieve desired water quality objectives within the system.

Each reservoir is assumed to be a control point, in keeping with the concepts used in the development of the flow simulation module. Additional control points may be placed in the stream system below the reservoirs at stream confluences and any other desirable locations.

Computational time steps from hourly to monthly are optional. The model is limited to simulations of one calendar year.

The reservoirs are represented by a series of one-dimensional horizontal elements such as those shown in Figure 2. Each horizontal element is characterized by an area, thickness and volume. In the aggregate, the assemblage of layered volume elements is a geometric representation of the prototype reservoir. This one-dimensional representation has been shown to represent adequately water quality conditions in many deep, well stratified reservoirs by Eiker [US Army 1977], Baca [1977] and Water Resources Engineers [1968, 1969a, 1969b].

Each horizontal layer is assumed to be completely mixed with all isopleths parallel to the water surface both laterally and longitudinally. External inflows and withdrawals occur as sources or sinks within each layer and are instantaneously dispersed and homogeneously mixed throughout each element from the headwaters of the impoundment to the dam. It is not

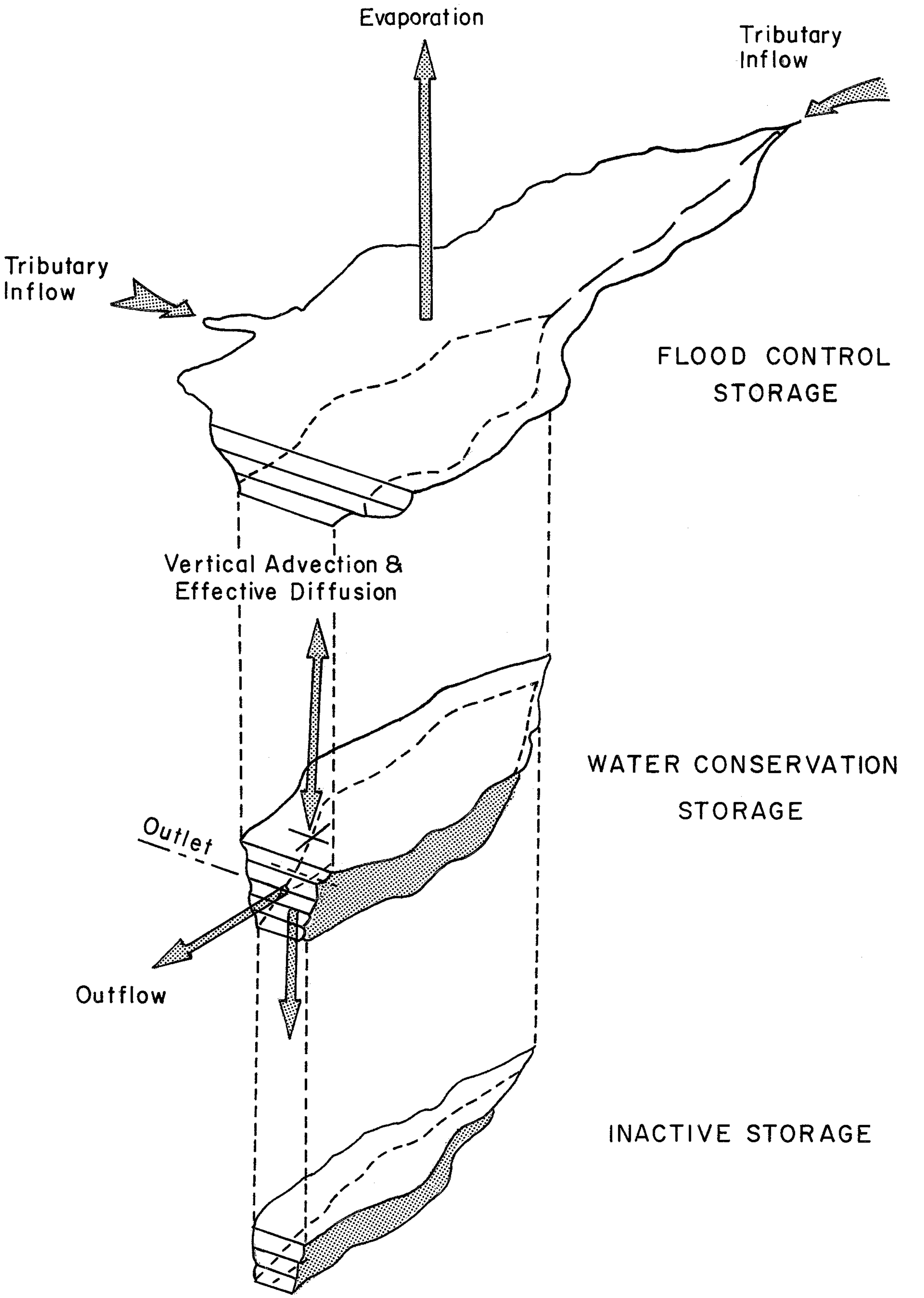

Figure 2

GEOMETRIC REPRESENTATION OF A STRATIFIED RESERVOIR AND MASS TRANSPORT MECHANISM possible, therefore, to model longitudinal variations in water quality constituents. Simulation results are most representative of conditions in the main reservoir body.

Vertical advection is governed by the location of inflow to, and outflow from, the reservoir. Thus the computation of the zones of distribution and withdrawal for inflows and outflows are of considerable significance in operation of the model. The WES withdrawal method [Bohan 1973] is used for determining the allocation of outflow. The Debler inflow allocation method [Debler 1959] is used for the placement of inflows.

Vertical advection (physical movement of mass due to continuity balance) is the net interelement flow and is one of two transport mechanisms used in the module to transport water quality constituents between elements. Effective diffusion is the other transport mechanism. The effective diffusion is composed of molecular and turbulent diffusion and convective (physical movement of water due to density instability) mixing.

Wind and flow-induced turbulent diffusion and convective mixing are the dominant components of effective diffusion in the epilimnion of most reservoirs. In quiescent, well-stratified reservoirs, molecular diffusion may be a significant component in the metalimnion and hypolimnion. For deep, well-stratified reservoirs with significant inflows to or withdrawals from the hypolimnion, flow induced turbulence in the hypolimnion dominates. For weakly stratified reservoirs, wind induced or wind and flow induced turbulent diffusion will be the dominant component of the effective diffusion throughout the reservoir. One of two methods may be selected by the user to calculate effective diffusion coefficients. For shallow weakly stratified reservoirs, the wind controlled mixing [HEC 1978] method is appropriate, while the stability method [HEC 1978] is more appropriate for deeper well stratified reservoirs. Both of these methods have been shown in numerous applications to adequately represent the mixing phenomena for heat and dissolved water quality constituents when properly applied.

The stream system is represented conceptually as a linear network of segments or volume elements as shown in Figure 3. Each element is characterized by length, width, cross-sectional area, hydraulic radius, energy slope, Manning's n, and a flow and depth relationship. Flow rates at stream control points are calculated within the flow simulation module using any one of the several programmed hydrologic routing methods. Within the flow simulation module, incremental local flows (i.e., inflow between adjacent control points) are assumed to be located at the nearest control point.

Within the water quality simulation module, the incremental local flow may be divided into components and placed at different locations within the stream reach (i.e., that portion of the stream bounded by the two control points). A flow balance is

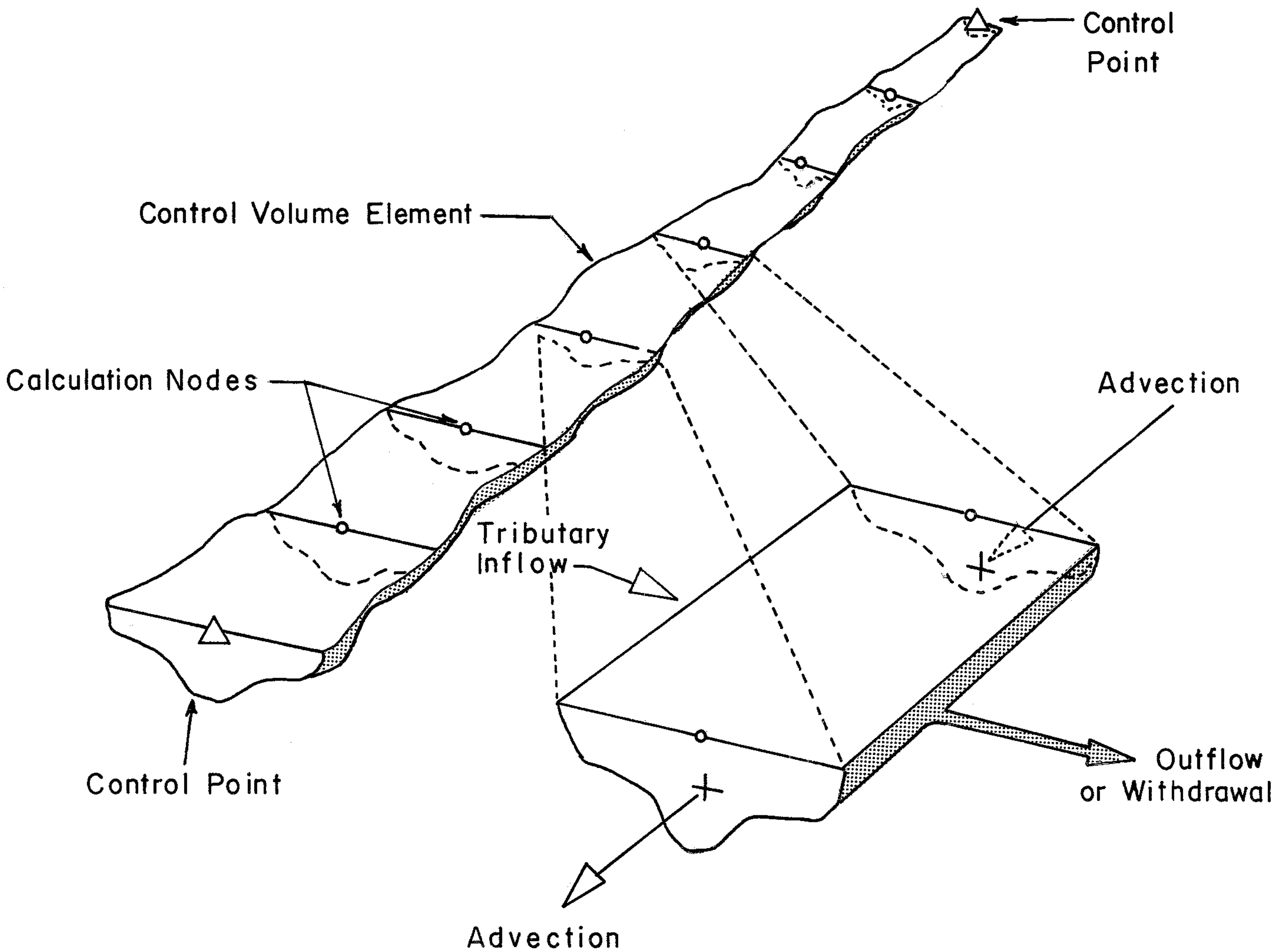

Figure 3

GEOMETRIC REPRESENTATION OF STREAM SYSTEM AND MASS TRANSPORT MECHANISM used to determine the flow rate at element boundaries. Any flow imbalance (i.e., the difference in the flow at the upstream control point plus all tributary inflows and the flow at the downstream control point) is distributed uniformly to the flows at each element boundary. Once interelement flows are established, the depth, surface width, and cross sectional area are computed at each element boundary either by using the input flow-depth relationship or by assuming normal depth.

Gate Selection Routine

Once the desired reservoir release and the target water quality to meet downstream needs has been computed, the gate selection algorithm determines which ports should be open and what flow rate should pass through each open port in order to maximize a particular function of the downstream water quality target concentrations. Solution of this problem is accomplished by using mathematical optimization techniques. The objective function is related to meeting downstream target qualities subject to various hydraulic constraints on the individual ports.

The reservoir intake structure can have up to two wet wells, containing up to eight ports each, and a flood control outlet. It is assumed that releases through any of these ports (including the flood control outlet) leave the reservoir through a common pipe. At any given time, only one port in either wet well and the flood control outlet may be operated. Hence, the algorithm provides flows through three ports at most.

The HEC-5 model also provides for releases through an uncontrolled spillway. These releases are not a part of the gate selection algorithm, but the water quality of the spillway releases are considered by the gate selection algorithm.

The algorithm proceeds by considering a sequence of problems, each representing a different combination of open ports. For each combination, the optimal allocation of total flow to ports is determined. The combination of open ports with the highest water quality index defines the optimal operation strategy for the time period under consideration.

There are four different types of combinations of open ports. For one-port problems, all of the flow is taken from a single port and the water quality index is computed. For two-port problems, combinations of one port in each wet well and combinations of each port with the flood gate are considered. For three-port problems, combinations of one port in each wet well and the floodgate are considered. The total flow to be released downstream is specified externally to the gate selection routine, but if the flow alteration option is selected, then the flow can be treated as an additional decision variable and the flow for which the water quality index is maximized is also determined.

For each combination of open ports, a sequence of flow allocation strategies is generated using a gradient method, a gradient projection method, or a Newton projection method as appropriate. The value of any flow allocation strategy is determined by evaluation of a water quality index subject to the hydraulic constraints of the system. The sequence converges to the optimal allocation strategy for the particular combination of open ports. These problems are solved very efficiently by using mathematical optimization techniques that take advantage of the problem structure, namely a quadratic objective function with linear constraints.

Flow Alteration Routine

The flow alteration routine is designed to change the reservoir releases, computed by the flow simulation module, to better satisfy the stream control point water quality objectives. Timing of intervening tributary inflows are considered. Second order effects, such as reaeration and external heating due to increased or decreased stream surface area, are not included.

The calculation procedure for the flow alteration option is as follows:

1. The relative mass of a water quality parameter being simulated that needs to be added to the flow at the control point (for those constituents below the target) or reduced in the flow at the control point (for those constituents above the target) is computed.

2. The average reservoir release concentration is computed for all reservoirs for which the constituent concentration in the releases is greater than the target concentration at the control point of interest (for those constituents below the target) or for which the constituent concentration in the releases is less than the target at the control point of interest (for those constituents above the target).

3. The total dilution flow requirement is then computed by dividing the result of step 1 by the result of step 2 to provide the total flow release needed to bring the constituent concentration at the control point of interest to the target.

4. The flow is then apportioned to the reservoirs capable of bringing the control point constituent concentration to the target in proportion to the flows originally computed for those reservoirs by the flow simulation module.

Thus the flow alteration requirement can be computed for each control point and for each constituent. The various computed flow rates are then combined by using the coefficients of a linear programming objective function and the deviation of the respective constituent concentrations from the target concentrations at each respective control point.

Once the flow augmentation requirement is determined, the flow simulation module is recalled and the computations for flow and water quality are repeated for the final results.

Summary

HEC-5 model is capable of simulating the water quality effects of the operation of a system of reservoirs. Each reservoir may be operated to satisfy a number of objectives, including flood control, low-flow, hydropower production, water supply and water quality control. The water quality portion of the model simulates temperature and eight water quality constituents including dissolved oxygen and phytoplankton. The model will determine the water quality needed from all reservoir releases to meet specified downstream water quality objectives and will determine the gate openings in each reservoir that will yield the appropriate reservoir release water quality. Should it be necessary, flows will be altered to ensure that downstream water quality objectives are met. The model selects the "best" solution for the system-wide reservoir operation.

CHAPTER III

RESERVOIR SYSTEM DESCRIPTION

The Sacramento Valley reservoir system consists of four major reservoirs as shown in Figure 4. Shasta and Keswick are tandem reservoirs in parallel with Oroville and Folsom Reservoirs. Numerous tributaries and irrigation diversions are involved.

Shasta and Keswick Reservoirs are located on the Sacramento River in northern California in the northern end of the Sacramento Valley about 240 river miles north of Sacramento. Keswick is a reregulation reservoir designed to even-out the daily hydropower releases from Shasta. Below Shasta and above Keswick, inter-basin water transfers enter the Sacramento River through Spring Creek. Along the Sacramento River, Cow Creek and Cottonwood Creek are major inflowing tributaries and the Anderson-Cottonwood, Tehama-Colusa, Corning and Glenn-Colusa Irrigation District Canals are major irrigation diversions.

Oroville Reservoir is located on the Feather River in the Sierra foothills about 95 river miles north of Sacramento. Major tributaries entering the Feather River include the Yuba and Bear Rivers. Major diversions are located immediately below Oroville Dam from the Thermalito Afterbay. The Feather River flows into the Sacramento River near Verona.

Folsom Reservoir is located on the American River in the Sierra foothills about 30 miles east of Sacramento. The American River below Folsom Reservoir is leveed with no major tributaries entering before its confluence with the Sacramento River at Sacramento (I Street).

The Sacramento River continues to flow south towards the San Francisco Bay via the Sacramento and San Joaquin Delta. This study's lower boundary is located near Hood about 20 miles south of Sacramento and just upstream of the Delta's maze of interconnected waterways.

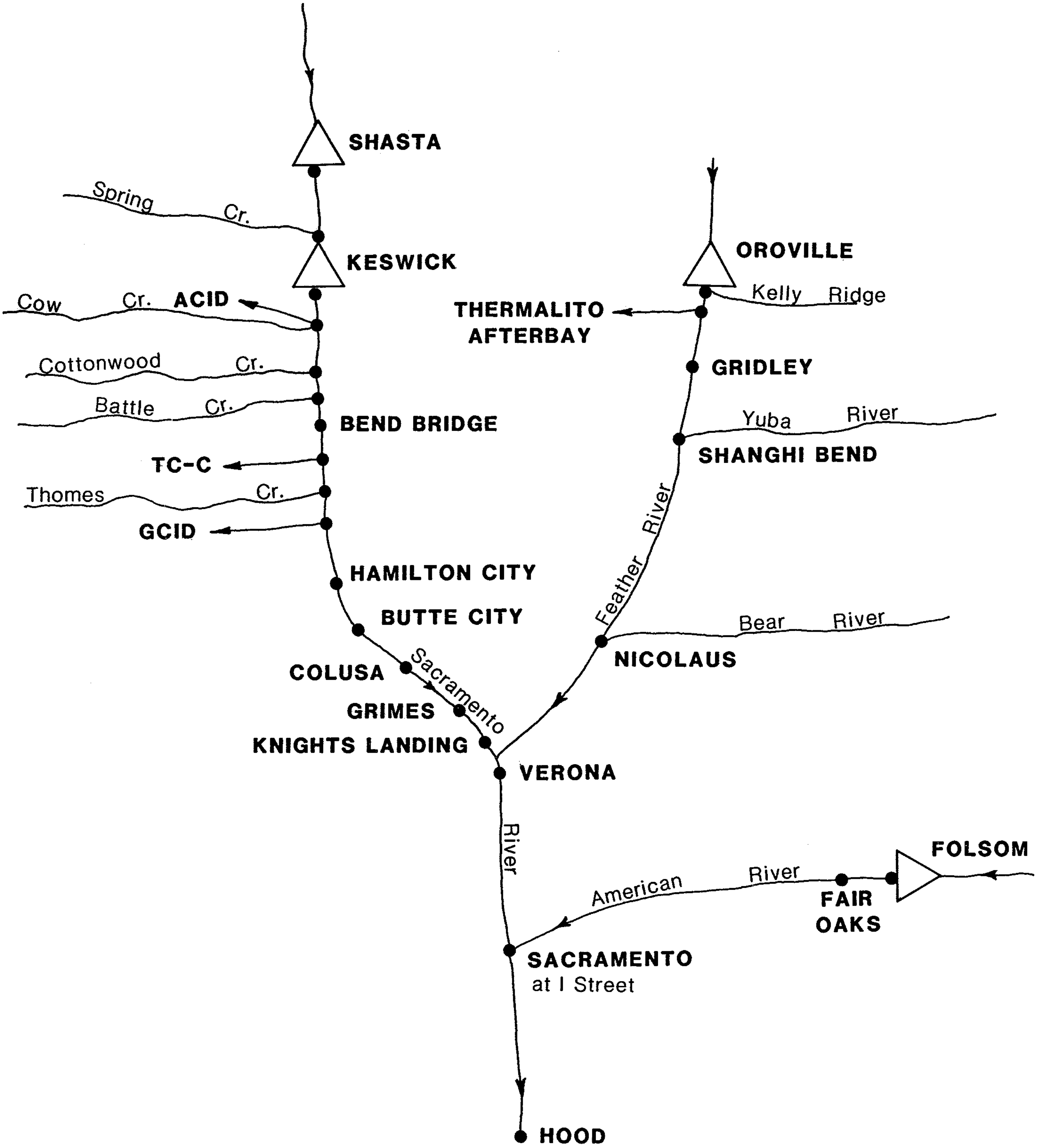

Figure 4

SACRAMENTO VALLEY RESERVOIR SYSTEM SCHEMATIC

CHAPTER IV

APPLICATION PROCEDURE

The application of the HEC-5 to the Sacramento Valley reservoir system, described in Chapter III, or to any other system begins with data collection, assembly, and manipulation. Each of these tasks in addition to model execution is discussed below. Interpretation of results is discussed in Chapter V.

Data Collection

The HEC-5 model data requirements are similar to those of most comprehensive water quality models. The data to be collected are categorized into three types; time independent, required time dependent and optional time dependent.

The time independent data include: physical description of the reservoir (i.e., elevation vs. volume, surface area and discharge capacity; and vertical reservoir segmentation), physical description of the river (i.e., river mile vs. cross section and channel discharge capacity; and river reach segmentation), control point desired and required flows, model coefficients (i.e., flow routing; reservoir diffusion; physical, chemical and biological reactions rates) and initial conditions for the start of the simulation. The input data for the Sacramento Valley reservoir system is shown in Appendix A. The time independent data for the water quantity input are on the RL, RO, RS, RQ, RA, RE, R2, CP, ID and RT records. For the water quality input, the time independent data are on L1, L2, LR, L3, L6, L7, L8, PL, L9, C1, C2, C5, C6, C7, SA, DK, CR, S1, S2, SR, S3, S4 and KR records.

The required time dependent data include: evaporation, wind speed, cloud cover, air temperature, dew point temperature, flow diversions, inflow quantity and quality for all reservoir and river tributaries, discharge quantity from reservoirs, and control point target water quality conditions. The time dependent data are on the R3, IN, QA and QD records for the water quantity input. The input for the water quality portion are on the EZ, ET, CT, I2 and I4 records.

The optional time dependent data include: reservoir storages; river flows at other than control points; and reservoir water quality profiles and river time series plots. These data are used as checks (using auxillary graphics programs) on the model output in contrast to the previously mentioned data which are required to make the model work. This data is referred to as calibration data.

Data Assembly

Sources for the data categorized above are numerous. In general, they include all water-related agencies at the federal, state, local and private levels. To name a few, the following should all be considered when searching for data:

Corps of Engineers (COE)
Bureau of Reclamation (BUR)
Geological Survey (USGS)
Environmental Protection Agency (EPA)
state departments of natural resources
state environmental protection agencies
state colleges and universities
city and county public works offices
utility, water and flood control districts

Meteorological data (dry bulb temperature, dew point temperature, cloud cover and wind speed) are readily available from the U.S. Weather Service, local airports and universities. The primary data source for Corps of Engineers offices is the U.S. Air Force Environmental Technical Applications Center (OL-A USAFETAC) and for other offices is the NOAA's National Weather Service (NWS) office; both in Asheville, North Carolina. They should be contacted early in the data assembly task, and an order should be placed for the required meterological data. Normally it will take 30 to 60 days to receive the data after the request is made. This data service is free to the Corps of Engineers and is documented in Department of Army Pamphlet 115-1. It is recommended that data format CD 144 be requested from OL-A USAFETAC at (FTS) 672-0218 or NWS at (704) 259-0682.

Data Manipulation

For simplification, the meteorological data should be reformatted with the "Weather" computer program [HEC 1986] and then input to the "Heat Exchange" computer program [U.S. Army 1977], available from HEC, which provides output in the form necessary for the HEC-5 program (i.e., ET record images). If HEC-5 computation intervals shorter than daily are going to be used, the use of the "Heat Exchange" program should be substituted with a similar utility program.

The cross-sectional data may be already available in the proper format if previous flood plain or flood damage analysis were studied using the HEC-2 program. Because HEC-2 is a widely used water surface profile program, the author has found the cross-sectional data already available in the proper format on many past water quality studies. For simplification, the HEC-2 type data should be input to the "GEDA" computer program [HEC 1981], available from the HEC, which provides output in the form necessary for the HEC-5Q program (i.e., S3 card images).

The meteorological and cross-sectional data account for about 60% of the water quality portion of the data to be prepared on a typical study.

Tributary inflows, diversions and reservoir discharges may be readily available from WATSTORE and STORET data systems. WATSTORE is managed by the USGS and contains streamflow data. STORET is managed by the EPA and contains water quality data. These computer data systems can often provide the necessary inflow and reservoir discharge quantity and quality data. Modification of output format to the required HEC-5 input format for the IN, QA, QD and I4 cards is trivial. Past experience has shown that the flow data from WATSTORE is often not available at the same location as water quality data from STORET. Therefore judgement must be used to determine its usability by direct transfer of location or appropriate adjustment. The two types of data must be compatible for the computer program to calculate the appropriate constituent load time series. This type of data is about 20% of the water quality portion of the input data.

The remaining 20% of the typical data set is located by searching through COE reservoir regulation manuals, searching through COE files and making numerous judgement decisions regarding a thorough knowledge of the study objectives, the drainage area being studied and the concepts employed by the HEC-5 model.

Model Execution

The model can be used in several different ways. The cheapest, fastest execution, also requiring the least data preparation, is a steady state analysis. The input, calculation and output intervals are monthly. These may be used for screening monthly data for multiple years to find a critical period (poor water quality condition) for more detailed analysis. This method will only find the most critical period of at least monthly duration and not necessarily critical periods of shorter duration.

The model can be used to study temperature only or temperature and any combination of up to three conservative parameters (i.e., chlorides, total dissolved solids - TDS, alkalinity, specific conductance), up to three nonconservative parameters (i.e., coliform, carbonaceous biochemical oxygen demand - CBOD, ammonia) and dissolved oxygen (DO). If the phytoplankton option is requested, the parameters in the model must include at least temperature, TDS, nitrate, phosphate, phytoplankton, CBOD, ammonia, and DO. The more parameters simulated, the more computation and data preparation time involved. The phytoplankton option is particularly time consuming since all the parameter calculations possible are being performed with this option.

The model can be used for existing and/or proposed reservoirs. If an existing condition is being simulated, usually the objective is to reproduce historical events through model calibration. The calibration option can take about 50% less computer time because the time-consuming linear programming algorithms are not used.

Calibration should begin by reproducing observed temperature profiles in the reservoirs and stream channels. The reservoir diffusion coefficients, A1 and GSWH, provide the best initial adjustments. The second step in reservoir calibration involves adjustments to the three factors affecting light penetration:

secchi disk; solar radiation absorbed near surface, XQPCT; and depth associated with XQPCT amount of solar radiation. The above five variables are interrelated and will need to be adjusted simultaneously. Although many other variables affect the thermal and water quality constituent calibration of reservoirs, it is not recommended to adjust them unless you have more data than normal for reproducing observed profiles. Reservoir calibration decisions may include the user's choice of the input weather station.

The calibration of the river profiles may also involve the users choice of weather stations to index the meteorology affecting the river. Unless more than normal data are available, it is not recommended to adjust any model variables.

Once the model has been calibrated, the objective may be to modify an existing reservoir operation pattern or to evaluate the impact of proposed new reservoirs or channel modifications. This analysis requires the use of the linear programming algorithm and the increase of computer time is significant.

The simulation mode discussed above can be used either to evaluate the best water quality that can be provided throughout the system for given reservoir discharges (obtained either external to the simulation or determined by the HEC-5 quantity part of the model) or to evaluate the best water quality operation without preconceived discharge quantities. The former operation is referred to as a balanced pool operation and the latter as a flow augmentation operation.

The balanced pool operation is the standard HEC-5 analysis for flow. When using the balanced pool operation, the water quality portion of the program simply evaluates the best vertical level for withdrawal at each reservoir (assuming multiple level intakes are available) to meet all downstream water quality targets for the given reservoir discharge.

The flow augmentation operation allows the model to relax the balanced pool concept and to decide how much flow should come from which reservoir and at which vertical level in order to meet downstream water quality targets. Sometimes downstream water quality improvements require significantly increased discharge rates to obtain only small improvements in water quality. This flow augmentation operation is the most-costly execution and not always a practical alternative for real world regulation given power, water conservation and flood control storage considerations.

For this demonstration application, the input data shown in Appendix A was executed using the calibration option. Application of this option allows the user to define the exact level of the intake structure operated and the exact quantity of discharge from each dam. This is the normal method of model application when calibrating the model to observed historical data. This application was executed for water temperature, specific conductance, alkalinity, CBOD, ammonia, and dissolved oxygen because this was the data available. Actually, all these types of data are very limited in availability on most tributaries but some of them (e.g., temperature, dissolved oxygen and specific conductance) are more readily available as in-channel data. The in-channel data are the optional time dependent data used for calibration.

Selected portions of the computer output are shown in Appendix B. Graphical displays of the results are shown in Appendix C and are discussed in Chapter V.

CHAPTER V

SIMULATION RESULTS

The Sacramento Valley reservoir system operation described in Chapter III was simulated using HEC-5 and produced results which were compared to water quantity and quality data in the four reservoirs and at all downstream control points. The data for comparison purposes consisted of discharge rates at most control points as well as water temperature at many of the same locations. Other water quality parameters are less available but are compared where they are available.

The model simulation for the Sacramento Valley system used temperature, specific conductance (sometimes called electrical conductivity), alkalinity, carbonaceous biochemical oxygen demand (CBOD), ammonia (NH3) and dissolved oxygen (DO). These specific parameters were chosen based on the availability of at least limited data except for CBOD which was estimated and adjusted by calibration to reproduce DO.

The Sacramento Valley reservoir system results are shown in Appendix B in an abbreviated form. The computer output begins with an echo of the input data. These output should be examined carefully to insure that the program is getting the data that the user expects the program to execute. This step of interpretation of results is important and well worth the required time.

The remainder of the computer output are the day-by-day results of water quality profiles in the reservoirs and along the stream network. The output is quite voluminous and only selected portions have been included. Because it is so voluminous, it is also difficult to interpret in tabular form.

The graphical display of these results is included as Appendix C for the reservoirs and at selected locations along the stream network. While this graphical capability is not a part of HEC-5, an option exists for the model to write the results to an HEC data storage system called DSS [HEC 1985]. An HEC graphics program called DSPLAY (described in the DSS manual) can read the results from DSS and produce plots as shown. These plots satisfactorily demonstrate the capability of HEC-5 to reasonably reproduce observed reservoir and stream profiles on large systems.

The legends at the bottom of the reservoir water quality plots, pages C1-C16, define simulated and observed data for various dates. Shasta, Oroville and Folsom Reservoirs have sufficient observed temperature data to be useful for calibration purposes. Sufficient observed data for the other parameters were not available except in Folsom Reservoir as shown.

Considering the model limitation of having only one weather station for the entire system (subsequently modified to use parameter statements), it is the author's opinion that the reproduction is quite good. Perhaps some further refinement could be achieved with additional trials, but the acceptability of the model can be demonstrated with these results. The Oroville Reservoir observed data anomaly in June (page C6) cannot be explained with the available input, particularly when the much cooler observed hypolimnion temperatures of May and July are noted.

The legend at the bottom of the time series stream plots defines the various observed and simulated water quality parameters for the study period. As with the reservoir plots, only those locations which have sufficient observed data to be used for calibration purposes are shown. Unlike the simulated data, the observed data points are often more than one-day apart. Extreme caution should be applied to any interpolation between observed data points.

In general, the calibration of the model is quite good along the Sacramento River for all the observed parameters downstream to Hamilton City. Butte City and Colusa temperatures (pages C24 and C26 respectively) show that significant warming of this reach of the Sacramento River takes place at least during the Spring (April and May 1979). This temperature consideration, in addition to the lack of sufficient simulated quantity of flow at Butte City and Colusa (pages C23 and C25 respectively) suggests that the undefined return flows on the Sacramento River between Hamilton City to Knights Landing are sufficiently large to cause significant errors. Other parameter reproductions are also poor; apparently due to undefined return flows.

The Feather River below Oroville and the American River below Folsom lack sufficient water quality data to provide adequate information for calibration purposes. The reproduction of observed flow is shown in pages C29 and C30.

Careful interpretation and evaluation of the Sacramento River results lead the author to encourage the continued application of this model to help develop understanding of the workings and operation of any stream system.

CHAPTER VI

SUMMARY

HEC-5 can be used for comprehensive water quality studies involving complex river network and reservoir systems. The program is used to compute the best operation for a reservoir system and determine either the water quality condition resulting from the best water quantity operation (balanced pool method) or the best water quality operation without maintaining balanced reservoir conservation pools for the system (flow alteration method).

The HEC-5 model uses a linear optimization scheme to determine the target water quality at the dam to best meet all user weighted downstream targets. Then a non-linear scheme is used with user weights to determine how the intake structure will be operated.

The Sacramento River results and results of the two additional applications referenced in Chapter II have each provided model improvements and added confidence in the model validation. While it is true that large comprehensive data sets have not been used to validate the model, the author believes that the variety of years modeled and the variety of locations studied have provided sufficient experience to the Corps of Engineers to warrant the continued use and application of the HEC-5 water quality model.

It is the conclusion of this study that HEC-5 is a viable tool for evaluating reservoir systems operation for water quality analysis.

CHAPTER VII

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APPENDIX A

HEC-5 Input for Sacramento River System Water Quality Modeling

```
T1              HEC-5 INPUT FOR
T2          SHASTA, OROVILLE AND FOLSOM
T3              RESERVOIR SYSTEM TEST
J1     0       1       5       3       4       2       0       0
J2     0       1       0       0       0       0       0
J3    12       0       0       0       0       1       0       0
J9             0       0       1
RL     1 4137800  587000 1000000 3252100 4552200 4552200
RL     1       1      -1       0  587000
RL     2       1      -1       0 1000000
RL     3       1       0       0    9999    9999    9999 4370000 4552200 4552200
RL                               4552200 4552200 4552200 4552200 3892000    9999
RL     4       1      -1       0 4552200
RL     5       1      -1       0 4552200
RO    14       2       3       4       5       6       7       8       9      10
RO    11      12      19      22      23
RS   -18      10     818    1248    3275    3320    3436    3554    3676    3801
RS  3928    3980    4059    4193    4330    4470    4613    4759    4908
RQ    18       0   14000   33700   71500   72000   73600   74900   76400   77600
RQ 79000   79700   85000  100000  130000  170000  220000  267800  400000
RA    18     200    7500   10800   22700   22800   23400   24000   24700   25200
RA 25800   26100   26400   27100   27700   28300   28900   29600   30200
RE    18     630     840     887    1008    1010    1015    1020    1025    1030
RE  1035    1037    1040    1045    1050    1055    1060    1065    1070
R2  7500    2000                     240
R3 99.99   99.99   99.99     .09    6.02   10.41   11.28    8.93    8.12   -4.49
R3 99.99   99.99
CP     1   79000    1500    1000
IDSHASTA   303.8
RT     1       2
CP     2    7900    1500    1000
IDSPRING CR 300
RT     2       3
RL     3   22677    2000    5000   22000   22000   30000
RO
RS    18      10   11172   14705   25237   25298   25457   25626   25807   26001
RS 26207   26426   26657   26901   27157   27426   27707   28003   28316
RQ    18       0   15000   30000  110000  111000  120000  130000  140000  150000
RQ160000  170000  180000  190000  200000  210000  220000  230000  248000
RA    18      50     200     250     300     310     325     350     375     400
RA   425     450     475     500     525     550     575     610     640
RE    18   437.5   526.8   542.5   580.8   581.0   581.5   582.0   582.5   583.0
RE 583.5   584.0   584.5   585.0   585.5   586.0   586.5   587.0   587.5
R2  7500    2000                     240
R3 99.99   99.99   99.99     .09    6.02   10.41   11.28    8.93    8.12   -4.49
R3 99.99   99.99
CP     3   79000    3500    3000
IDKESWICK 294.6
RT     3       4     1.2      .1      24
CP     4   80000    4000    3500
IDACID-COW 280.1
RT     4       5     1.2      .1      24
DR     4                                              -5
CP     5   80000    4000    3500
```

```
IDCOTTONWD 273.2
RT     5       6
CP     6  100000    4000    3500
IDBEND BR 260.2
RT     6       7     1.2      .1      24
CP     7  100000    4000    3500
IDTC-C CANAL 243
RT     7       8     1.2      .1      24
DR     7                                              -5
CP     8  100000    4000    3500
IDGCID CANAL 206
RT     8       9     1.2      .1      24
DR     8                                              -5
CP     9  125000    4000    3500
IDHAM CITY 199.3
RT     9      10
CP    10  130000    4000    3500
IDBUTTE CY 168.5
RT    10      11
CP    11  135000    4000    3500
IDCOLUSA 143.4
RT    11      12
CP    12  140000    4000    3500
IDGRIMES 117.7
RT    12      19     1.2      .1      24
RL    13 3059593  640000  852200 2788000 3538000 3814000
RL     1      13    -1.0          640000
RL     2      13    -1.0          852200
RL     3      13       0       0    9999    9999    9999 3001900 3391900 3537000
RL                               3537000 3537000 3537000 3350500 3163000    9999
RL     4      13    -1.0         3538000
RL     5      13    -1.0         3814000
RO     8      14      15      16      17      18      19      22      23
RS   -15       1      10      32      75     148     261     419     629     901
RS  1244    1666    2181    2801    3544    3791
RQ    15       0       0       0       0       0       0       0       0    4000
RQ  8000    8000    8000    8000    8000  590000
RA    15      70     300     600    1100    1830    2700    3600    4800    6100
RA  7600    9300   11300   13500   16200   19000
RE    15     250     300     350     400     450     500     550     600     650
RE   700     750     800     850     900     923
R2  5000    2500                     120
R3 99.99   99.99   99.99     .35    5.08    8.02    8.56    7.77    7.72   -2.03
R3 99.99   99.99
CP    13  180000     150     100
IDOROV DAM 75.4
RT    13      14
CP    14  180000     150     100
IDTD POOL 71.8
RT    14      15     1.2      .1      24
DR    14                                              -5
CP    15  180000     150     100
IDFEATHER R 58.8
RT    15      16
CP    16  180000     150     100
```

```
IDGRIDLEY 45.6
RT    16      17     1.2      .1      24
CP    17  300000    2300    2000
IDSHANGHI  26.2
RT    17      18     1.2      .1      24
CP    18  320000    2300    2000
IDNICOLAUS 8.1
RT    18      19     1.2      .1      24
CP    19  435000    6300    5500
IDVERONA 80.2
RT    19      22     1.2      .1      24
RL    20  832100    1000   90000  610000 1010000 1120000
RL     1      20    -1.0       0    1000
RL     2      20    -1.0       0   90000
RL     3      20       0       0    9999    9999    9999  840000 1009000 1009000
RL                                1009000 1009000 1009000 1009000  610000    9999
RL     4      20    -1.0       0 1010000
RL     5      20    -1.0       0 1120000
RO     3      21      22      23
RS   -12       1       8      24      49      89     152     251     398     535
RS   835    1115    1176
RQ    12    4360    7640    8000    8000    8000    8000    8000    8000    8000
RQ257960  599580  663940
RA    12      90     510     740    1250    1950    3120    4780    7020    8200
RA 10520   11930   12200
RE    12     225     250     275     300     325     350     375     400     418
RE   450     475     480
R2  7500    5000                      72
R3 99.99   99.99   99.99     2.5     8.2    11.2    10.4     9.8     8.1     1.0
R3 99.99   99.99
CP    20  115000    1300    1000
IDFOLSOM 28.5
RT    20      21     1.2      .1      24
DR    20                                               1
QD    12    9999    9999    9999      62     104     134     136     129     122
QD    72    9999    9999
CP    21  115000    1300    1000
IDFAIR OAKS 21.5
RT    21      22     1.2      .1      24
CP    22  435000    7600    6500
IDI STREET 59.5
RT    22      23     1.2      .1      24
CP    23  435000    7600    6500
IDHOOD 38.3
RT    23       0
ED
BF     0     214            079040100     210      24
ZW A=HEC5Q F=SIM
IN     1  1APR79    8520    7810    7910    7920    8740    9170    7510    7130
IN  6740    7460    6500    6930    6580    6950    6930    9080    8170    7200
IN  6750    7170    7570    8150    9290    9180    8450    7270    8130    7680
IN  8320    8840   10210    9580    7980    7920   12230   13210   13690   12460
IN  9940   10560    9670    8360    9010    9370    9490    7650    8300    8050
IN  7190    7460    7770    7530    6260    7740    7060    6370    4400    4450
```

IN	4930	4740	4970	4590	4370	2660	4750	6490	3680	4030
IN	3970	2280	3420	5600	4870	3940	4070	2950	1490	2710
IN	3890	4450	4500	4870	5820	890	1810	4630	3710	4210
IN	2880	3760	1750	2380	3610	4440	3580	3690	3760	1590
IN	2790	3570	4390	4290	5010	3110	2340	1930	3820	3740
IN	5120	3680	2530	2110	3060	4080	2920	3590	4490	4370
IN	1830	1850	3430	3970	4090	2780	3460	1900	2530	2830
IN	3340	3590	4310	4050	1490	1540	3450	3360	3940	3480
IN	4190	1290	1760	3480	4770	3290	4020	3060	1610	2080
IN	2800	3430	4460	4150	4400	3010	2920	1290	3750	4630
IN	4320	3390	1420	2460	3260	4930	3780	3500	3820	3010
IN	2290	1880	3720	3820	3540	4520	3090	3040	2860	3290
IN	3120	3660	2910	2720	3010	4170	2490	3060	2970	3480
IN	2300	3300	3170	3740	4270	3250	3400	3180	3550	4690
IN	5200	6030	5480	4200	1990	1650	3680	4680	9120	18220
IN	5970	2670	2310	5080	3320	6710				
IN	2	1APR79	718	517	557	595	480	559	495	364
IN	366	315	230	235	0	0	0	279	0	0
IN	370	0	0	215	0	0	0	0	0	492
IN	506	485	632	0	0	0	0	0	215	783
IN	964	433	515	236	0	314	313	352	424	429
IN	742	724	740	873	795	802	736	989	914	796
IN	674	537	604	738	587	582	581	742	601	686
IN	552	877	623	810	665	563	556	593	638	558
IN	617	560	561	585	653	2590	560	805	555	557
IN	579	556	973	2220	2550	2800	2560	2560	2340	2830
IN	2790	2760	2850	2710	2610	2180	1680	2170	2320	2080
IN	2260	2250	2290	2220	2390	2310	2350	1650	1630	1740
IN	1650	1620	1580	1690	2470	2460	2620	2610	2590	2350
IN	2590	2600	2610	2660	2580	2240	2630	2560	2600	2740
IN	2740	2790	2840	2790	2970	2880	2790	2830	2570	2530
IN	2520	2450	2620	2620	2580	2710	2700	2680	2700	1460
IN	1560	1480	1570	1570	1670	1640	1630	1540	1330	1550
IN	1550	1540	1650	1490	1500	1580	1490	1570	1480	1480
IN	1480	1500	1530	1500	1300	418	433	430	432	430
IN	505	428	374	376	419	416	417	484	460	456
IN	623	1610	1640	1660	2360	2280	2300	2280	2290	2480
IN	2530	2280	2200	2290	2290	2290				
IN	4	1APR79	609	551	509	478	467	491	509	462
IN	461	451	432	418	416	439	438	502	800	679
IN	510	462	437	443	585	1610	868	712	1000	745
IN	655	610	1070	889	733	695	1540	1530	1510	1200
IN	991	821	719	657	618	611	586	577	539	505
IN	496	478	465	456	437	392	367	349	317	296
IN	269	246	223	205	194	188	182	154	142	126
IN	114	113	107	101	87	76	71	72	76	80
IN	83	84	78	78	73	69	63	60	57	54
IN	47	42	37	38	37	37	44	47	47	48
IN	46	40	34	36	35	32	27	27	19	20
IN	21	22	23	19	19	18	20	20	18	19
IN	23	18	17	13	12	10	11	11	12	8
IN	9.1	12	10	9.7	11	12	11	11	18	14
IN	13	13	16	20	23	21	25	22	17	19
IN	10	17	54	95	111	73	68	63	55	52
IN	48	32	27	26	25	23	17	16	15	12

Most of the Time Series Inflow (IN), Specified Discharge (QA), Natural Flow (NQ), and Division (QD) Records have been deleted from this listing.

QD	14	1APR79	499	498	479	467	467	468	467	467
QD	580	772	919	992	1095	1244	1281	1564	1750	1781
QD	1917	2079	2265	2463	2484	2394	2377	2287	2212	2189
QD	2189	2204	2186	2237	2408	2690	2962	3072	3223	3423
QD	3434	3550	3661	3658	3665	3704	3658	3594	3519	3472
QD	3379	3321	3230	3131	3086	3019	2929	2876	2864	2828
QD	2821	2844	2840	2860	2895	2928	3008	3082	3124	3125
QD	3158	3192	3210	3292	3280	3291	3312	3310	3357	3356
QD	3359	3360	3359	3361	3355	3369	3366	3377	3396	3403
QD	3414	3399	3367	3345	3339	3283	3224	3220	3203	3198
QD	3224	3222	3220	3208	3221	3245	3262	3271	3304	3318
QD	3352	3357	3375	3346	3320	3291	3289	3277	3301	3289
QD	3272	3256	3245	3248	3226	3215	3211	3198	3203	3189
QD	3171	3178	3159	3124	3122	3132	3097	3055	3054	3077
QD	3053	2988	2972	2968	2967	2929	2884	2830	2780	2767
QD	2745	2712	2681	2610	2498	2391	2384	2352	2257	2193
QD	2113	2010	1940	1895	1827	1713	1580	1518	1499	1445
QD	1423	1345	1273	1206	1179	1161	1146	1140	1123	1035
QD	966	967	972	954	957	962	954	974	1028	1070
QD	1065	1066	1043	1024	1023	1019	1020	1024	1019	1024
QD	1017	1017	1016	1021	1021	1022	1014	1001	999	870
QD	799	694	515	517	516	610				

NOLIST
EJ

```
TI          WATER QUALITY DATA FOR
TI        SHASTA, OROVILLE AND FOLSOM
TI          RESERVOIR SYSTEM TEST
JA        790401  791027      23        4        C         0
EZ            -1
ET            91    58.3   121.6   2032.2    11.0
ET            92    60.5   118.1   2083.4    10.0
ET            93    62.9    91.8   1618.1     7.0
ET            94    72.9    67.5   2081.8     4.0
ET            95    64.4   118.5   2060.8     9.0
ET            96    58.1    79.0   1016.9     6.0
ET            97    65.3   107.1   2142.5     8.0
ET            98    58.5   141.7   1486.5    12.0
ET            99    58.8   111.6   1858.7    10.0
ET           100    56.0   125.3   2007.7    12.0
ET           101    65.3    94.9   1856.2     7.0
ET           102    63.4   116.0   1864.8     9.0
ET           103    67.8    98.3   2229.5     7.0
ET           104    68.5    99.2   2196.4     7.0
ET           105    65.6    96.8   1551.0     7.0
ET           106    57.4   140.2   1339.5    12.0
ET           107    60.2    88.5   1580.8     7.0
ET           108    64.1    78.2   2203.9     6.0
ET           109    67.2    68.4   2302.6     5.0
ET           110    58.7    74.8   1121.7     6.0
ET           111    65.3    80.3   1824.4     6.0
ET           112    59.3   121.8   1383.7    10.0
ET           113    60.6   123.5   1824.4    10.0
ET           114    65.0    81.3   1847.1     6.0
ET           115    68.4    62.9   1407.7     4.0
ET           116    62.2    87.5    829.5     6.0
ET           117    71.3    79.6   2014.9     5.0
ET           118    68.4    87.9   2032.7     6.0
ET           119    63.7    84.3   1153.3     6.0
ET           120    63.2   128.1   1882.5    10.0
ET           121    65.6    85.3   1682.0     6.0
ET           122    72.4   105.7   2449.9     7.0
ET           123    64.9   153.6   2335.7    12.0
ET           124    59.5   131.5   1184.1    11.0
ET           125    59.6   151.3   1718.9    13.0
ET           126    59.0   118.3   1481.1    10.0
ET           127    56.6   124.4   1489.1    11.0
ET           128    63.2   106.7   2558.3     9.0
ET           129    63.1   126.9   2566.9    11.0
ET           130    70.8    94.0   2575.5     7.0
ET           131    76.4    76.3   2583.8     5.0
ET           132    87.7    68.0   2506.3     3.0
ET           133    89.0    69.1   2516.4     3.0
ET           134    82.2    96.2   2519.5     5.0
ET           135    67.5   180.6   2540.8    13.0
ET           136    77.5    88.0   2415.0     5.0
ET           137    80.9    92.8   2557.5     5.0
ET           138    77.5   132.7   2565.2     8.0
ET           139    73.3   156.2   2560.2    10.0
```

Most of the Weather Records (ET) have been deleted from this listing.

ET	273	74.0	83.6	1659.7	5.0
ET	274	72.4	109.7	1639.5	7.0
ET	275	69.4	134.1	1614.9	9.0
ET	276	76.5	44.5	770.3	2.0
ET	277	68.9	118.0	1586.8	8.0
ET	278	70.4	94.0	1539.6	6.0
ET	279	65.2	100.9	749.5	7.0
ET	280	64.5	135.0	1511.2	10.0
ET	281	63.7	76.0	900.4	5.0
ET	282	75.4	59.7	1494.0	3.0
ET	283	71.1	81.6	1343.6	5.0
ET	284	66.7	115.0	1329.5	8.0
ET	285	64.7	76.1	866.6	5.0
ET	286	66.6	107.5	689.2	7.0
ET	287	66.4	108.4	680.2	7.0
ET	288	69.0	97.0	966.7	6.0
ET	289	68.4	105.5	1393.1	7.0
ET	290	66.9	75.9	1254.9	5.0
ET	291	57.3	121.5	495.5	10.0
ET	292	59.2	165.7	483.0	13.0
ET	293	57.2	101.1	1051.9	8.0
ET	294	60.0	58.1	1271.8	4.0
ET	295	58.9	79.1	921.8	6.0
ET	296	60.4	108.3	628.1	8.0
ET	297	59.0	104.8	624.7	8.0
ET	298	58.5	116.4	616.5	9.0
ET	299	61.8	72.1	1231.0	5.0
ET	300	67.2	39.4	1257.3	2.0
ET	301	58.1	96.1	1256.1	8.0
ET	302	51.7	156.4	1257.0	16.0
ET	303	51.1	70.0	732.9	6.0
ET	-304	58.5	66.7	1199.3	5.0

```
QC              1       1       0       0       1       1       1
TQ   SPECIFIC CONDUCTANCE
TQ   TOTAL ALKALINITY
TQ   CARBONACEOUS BOD
TQ   AMMONIA AS N
TQ   DISSOLVED OXYGEN
L1             30       1
L2      1      10       0       5      .6     1.5       1
LR      1  100000
L3            .01   1.0-6   .3-4        0     -.7
L6    330  186000    1037
L7     18   14000     815
L8      0      50     850    1800    3350    3400    3500    3600    3700    3800
L8           3900    3950    4000    4500    4600    4700    4800    4900    5000
PL     10     100       0      -2
PL      5     100       0     -.1
PL      3     100       0     -.1
PL      1     100       0      -2
PL      3     100       0     -10
PL      5     100     3.2     -.7      .1   -.005
L9      0     5.7     5.7     6.2     8.5     8.7     8.9     9.1     9.3     9.4
L9            9.5     9.6     9.7     9.7     9.8     9.8     9.8     9.8     9.8
C1            130     130     130     130     130     130     130     130     130
C1            130     130     130     130     130     130     130     130     130
C2             45      45      45      45      45      45      45      45      45
C2             45      45      45      45      45      45      45      45      45
C5             .1      .1      .1      .1      .1      .1      .1      .1      .1
C5             .1      .1      .1      .1      .1      .1      .1      .1      .1
C6           .002    .002    .002    .002    .002    .002    .002    .002    .002
C6           .002    .002    .002    .002    .002    .002    .002    .002    .002
C7              5       5       5       5       5       5       5       5       5
C7              5       5       5       5       5       5       5       5       5
SA            100     100     100     100     100     100     100     100     100
SA            100     100     100     100     100     100     100     100     100
DK              0      .1     .05   1.463    4.57
L2      3      10   47500       3      .6       1       1
LR
L3            .01   1.0-6   .3-4        0     -.7
L6    200  248000     560
L7   1173   15000     514
L8      0      40     450     500     600     610     640     670     700     730
L8            760     790     820     850     880     910     940     970    1000
PL     10     100       0      -2
PL      5     100       0     -.1
PL      3     100       0     -.1
PL      1     100       0      -2
PL      3     100       0     -10
PL      5     100     3.2     -.7      .1   -.005
L9              9       9       9       9       9       9       9       9       9
L9              9       9       9       9       9       9       9       9       9
C1            130     130     130     130     130     130     130     130     130
C1            130     130     130     130     130     130     130     130     130
C2             45      45      45      45      45      45      45      45      45
C2             45      45      45      45      45      45      45      45      45
C5             .1      .1      .1      .1      .1      .1      .1      .1      .1
C5             .1      .1      .1      .1      .1      .1      .1      .1      .1
```

C6		.002	.002	.002	.002	.002	.002	.002	.002	.002
C6		.002	.002	.002	.002	.002	.002	.002	.002	.002
C7		5	5	5	5	5	5	5	5	5
C7		5	5	5	5	5	5	5	5	5
SA		100	100	100	100	100	100	100	100	100
SA		100	100	100	100	100	100	100	100	100
DK		0	.1	.05	1.463	4.57				
L2	13	14	0	10	.4	1				
LR	2	30000								
L3		0.01	1.0-6	.3-4	0	-.7				
L6	180	350000	901							
L7	10	4000	652	720	788	856				
L7	10	4000	669	737	805	873				
L8		200	400	600	800	1000	1200	1400	1600	1800
L8		2000	2300	2600	3000	3300	3500			
PL	10	100	0	-2						
PL	5	100	0	-.1						
PL	3	100	0	-.1						
PL	1	100	0	-2						
PL	3	100	0	-10						
PL	5	100	3.2	-.7	.1	-.005				
L9		6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67
L9		7.78	9.44	12.8	10.0	12.8	12.8			
C1		62	62	62	62	62	62	62	62	62
C1		62	62	62	62	62	62			
C2		40	40	40	40	40	40	40	40	40
C2		40	40	40	40	40	40			
C5		0	0	0	0	0	0	0	0	0
C5		0	0	0	0	0	0			
C6		0	0	0	0	0	0	0	0	0
C6		0	0	0	0	0	0			
C7		.5	1	1.5	2	2.5	3	3.5	4	5
C7		6	7	8	9	10	10			
SA		100	100	100	100	100	100	100	100	100
SA		100	100	100	100	100	100			
DK		0	.1	.05	1.463	4.57				
L2	20	7	0	12	.4	2				
LR	3	26400								
L3		.01	1.0-6	1.-4	0	-.7				
L6	336	567000	418							
L7	10.4	8000	307							
L8		100	500	1000	2000	3000	4000	5000	6000	7000
L8		8000	9000	10000	11000					
PL	10	100	0	-2						
PL	5	100	0	-.1						
PL	3	100	0	-.1						
PL	1	100	0	-2						
PL	3	100	0	-10						
PL	5	100	3.2	-.7	.1	-.005				
L9		8	8	8.5	8.5	9	9.3	10	12.7	13.3
L9		13.3	13.3	13.3	13.3					
C1		70	70	70	70	70	70	70	70	70
C1		70	70	70	70					
C2		20	20	20	20	20	20	20	20	20
C2		20	20	20	20					

C5		0	0	0	0	0	0	0	0	0
C5		0	0	0	0					
C6		.02	.02	.02	.02	.02	.02	.02	.02	.02
C6		.02	.02	.02	.02					
C7		10.5	10.5	10.7	10.7	10.7	10.6	11.1	11.4	11.3
C7		11.3	11.3	11.3	11.3					
SA		100	100	100	100	100	100	100	100	100
SA		100	100	100	100					
DK		0	.1	.05	1.463	4.57				
CR		1.047	1.047	1.047	1.0159					
S1		30	1	0	95	21				
S2	1	303.80	2	300.00	1.90	300.0	4			
S2					1					
S2	3	294.58	4	275.94	4.66	280.1	5			
S2	4	275.94	5	271.28	2.33	273.2	6			
S2	5	271.28	6	261.96	4.66	271.2	7			
S2	6	261.96	7	243.32	4.66					
S2	7	243.32	8	206.04	4.66	225.1	8			
S2	8	206.04	9	196.72	4.66					
S2	9	196.72	10	168.76	4.66					
S2	10	168.76	11	140.80	4.66					
S2	11	140.80	12	117.50	4.66					
S2	12	117.50	19	80.22	4.66					
S2	13	75.38	14	71.82	1.78	75.00	9			
S2	14	71.82	15	58.84	3.245	58.84	9			
S2	15	58.84	16	45.56	3.32					
S2	16	45.56	17	26.25	2.41375	29.65	10			
S2	17	26.25	18	8.76	4.3725	12.30	11			
S2	18	8.76	19	0.0	4.38					
S2	19	80.22	22	59.64	4.116					
S2	20	28.53	21	20.93	2.533					
S2	21	20.93	22	0.0	4.186					
S2	22	59.64	23	38.28	2.67					
SR	-1	23	1	2						
S3	1	303.800	478.00	0.	0.00	0.	0.0518			
S3	1	303.800	479.00	116.	0.92	121.	0.0518			
S3	1	303.800	480.00	243.	1.43	133.	0.0518			
S3	1	303.800	481.00	382.	1.86	145.	0.0518			
S3	1	303.800	482.00	534.	2.24	154.	0.0518			
S3	1	303.800	483.00	693.	2.58	165.	0.0518			
S3	1	303.800	484.00	864.	2.88	176.	0.0518			
S3	1	303.800	485.00	1042.	3.18	182.	0.0518			
S3	1	303.800	486.00	1227.	3.46	187.	0.0518			
S3	1	303.800	487.00	1416.	3.72	191.	0.0518			
S3	1	303.800	489.00	1807.	4.21	200.	0.0518			
S3	1	303.800	491.00	2215.	4.65	208.	0.0518			
S3	1	303.800	493.00	2642.	5.05	219.	0.0516			
S3	1	303.800	495.00	3095.	5.38	234.	0.0512			
S3	1	303.800	497.00	3584.	5.64	256.	0.0503			
S3	1	303.800	499.00	4116.	5.91	277.	0.0497			
S3	1	303.800	501.00	4699.	5.99	310.	0.0478			
S3	1	303.800	503.00	5366.	5.83	361.	0.0447			
S3	1	303.800	506.00	6585.	5.84	444.	0.0431			
S3	1	303.800	509.00	8019.	6.02	517.	0.0430			
S3	1	303.800	512.00	9695.	6.25	593.	0.0432			

Most of the Cross Section Geometry (S3) records
have been deleted from this listing.

S3	23	38.280	-27.20	0.	0.00	0.	0.0350		
S3	23	38.280	-26.20	37.	0.70	62.	0.0350		
S3	23	38.280	-25.20	107.	1.21	78.	0.0350		
S3	23	38.280	-24.20	197.	1.46	108.	0.0350		
S3	23	38.280	-23.20	329.	1.67	151.	0.0350		
S3	23	38.280	-22.20	500.	1.93	187.	0.0350		
S3	23	38.280	-21.20	699.	2.24	210.	0.0350		
S3	23	38.280	-20.20	921.	2.49	236.	0.0350		
S3	23	38.280	-19.20	1173.	2.68	276.	0.0350		
S3	23	38.280	-18.20	1457.	2.95	293.	0.0350		
S3	23	38.280	-16.20	2100.	3.29	352.	0.0350		
S3	23	38.280	-14.20	2818.	3.89	365.	0.0350		
S3	23	38.280	-12.20	3559.	4.43	377.	0.0350		
S3	23	38.280	-10.20	4323.	4.95	386.	0.0350		
S3	23	38.280	-8.20	5110.	5.40	399.	0.0350		
S3	23	38.280	-6.20	5919.	5.84	410.	0.0350		
S3	23	38.280	-4.20	6749.	6.26	420.	0.0350		
S3	23	38.280	-2.20	7601.	6.66	431.	0.0350		
S3	23	38.280	0.80	8919.	7.22	447.	0.0350		
S3	23	38.280	3.80	10285.	7.75	463.	0.0350		
S3	23	38.280	6.80	11695.	8.26	477.	0.0350		
S4		488.00	484.00	474.00	470.82	448.33	412.26	380.34	361.08	349.15
S4		326.12	304.00	288.02	265.60	252.15	245.73	234.40	212.83	196.14
S4		186.62	173.24	154.59	149.59	144.68	131.72	114.81	107.99	100.84
S4		90.88	82.48	75.01	64.09	57.11	49.00	41.94	39.89	35.20
S4		32.80	30.70	26.86	22.49	20.97	20.92	18.02	13.21	10.86
S4		6.00	5.00	4.00	3.00	225	207	207	150	126.4
S4		105	94	80	72	61	60	57	54	48
S4		45	44	37	36	35	34	33	27	19
S4		11	4	3.0	1.5	1.0	0.5	117	109	96
S4		85	65	42	30	20	10	0	-1	-2
S4		-3	-4	-5	-6	-7				

KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
KR		.1	.1	.05	1.463	4.57
CT	1	790401	12	1	0	
CT		-791031	12	1	0	
CT		790401	130	1	0	
CT		-791031	130	1	0	
CT		790401	60	1	0	
CT		-791031	60	1	0	
CT		790401	5	1	0	
CT		-791031	5	1	0	
CT		790401	.1	1	0	
CT		-791031	.1	1	0	
CT		790401	5	0	1	
CT		-791031	5	0	1	
CT	2	790401	12	1	0	
CT		-791031	12	1	0	
CT		790401	130	1	0	
CT		-791031	130	1	0	
CT		790401	60	1	0	
CT		-791031	60	1	0	
CT		790401	5	1	0	
CT		-791031	5	1	0	
CT		790401	.1	1	0	
CT		-791031	.1	1	0	
CT		790401	5	0	1	
CT		-791031	5	0	1	
CT	3	790401	12	1	0	
CT		-791031	12	1	0	
CT		790401	130	1	0	
CT		-791031	130	1	0	
CT		790401	60	1	0	
CT		-791031	60	1	0	
CT		790401	5	1	0	
CT		-791031	5	1	0	
CT		790401	.1	1	0	
CT		-791031	.1	1	0	

Most of the Control Point Target records (CT) have been deleted from this listing.

```
CT     23  790401     14      1      0
CT         790516     19      1      0
CT         790614   21.5      1      0
CT         790726   22.5      1      0
CT         790823   21.0      1      0
CT         790913   21.5      1      0
CT        -791031   19.0      1      0
CT         790401    150      1      0
CT         790515    130      1      0
CT         790612    148      1      0
CT         790726    130      1      0
CT         790823    157      1      0
CT         790913    189      1      0
CT        -791031    190      1      0
CT         790401     64      1      0
CT         790515     43      1      0
CT         790612     51      1      0
CT         790726     48      1      0
CT         790823     69      1      0
CT         790913     72      1      0
CT        -791031     72      1      0
CT         790401     20      1      0
CT        -791031     20      1      0
CT         790401      5      1      0
CT        -791031      5      1      0
CT         790401     10      0      1
CT         790726    7.8      0      1
CT        -791031    7.8      0      1
I1         790401 791031
I2                     0 INFLOW = TOTAL LOCAL FLOW
I4         790401     -1  491031      -1      -1
I2              1      0 SHASTA INFLOW
I4         790401    -15  490707     -12  791031      -5      -1
I2                     0 SHASTA INFLOW EC
I4         790401    120  790529     120  790716     140  791011     120
I4         791031    120      -1
I2                     0 SHASTA INFLOW ALKALINITY
I4         790401     55  790502      55  790529      45  790716      50
I4         790911     64  791031      64      -1
I2                     0 SHASTA INFLOW BOD
I4         790401    1.5  791031      .8      -1
I2                     0 SHASTA INFLOW NH3
I4         790401      0  790716     .02  790919     .03  791031       0
I4             -1
I2             -1      0 SHASTA INFLOW DO
I4         790401    100  791031     100      -1
I2                     0 INFLOW = TOTAL LOCAL FLOW
I4         790401     -1  491031      -1      -1
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I2                        0 OROVILLE INFLOW
I4        790401       12.8  790701      14.0  790718     18.3  790801     12.0
I4        790901       10.0  791001      7.22  791031     4.44      -1
I2                        0 OROVILLE INFLOW EC
I4        790401         62  790718        60  791031       60      -1
I2                        0 OROVILLE INFLOW ALKALINITY
I4        790401        150  791031       150      -1
I2                        0 OROVILLE INFLOW BOD
I4        790401          5  791031         5      -1
I2                        0 OROVILLE INFLOW AMMONIA
I4        790401        .01  790718         0  791031        0      -1
I2                        0 OROVILLE INFLOW DISOLVED OXYGEN
I4        790401       10.4  790718       8.5  791031      8.5      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4        790401         -1  491031        -1      -1
I2                        0 FOLSOM INFLOW
I4        790401        8.0  790530      14.0  790727     14.0  791022     15.0
I4            -1
I2                        0  FOLSOM INFLOW EC
I4        790401         74  790516        71  790614       76  790718       74
I4        790807         67  790911        62  791031       61      -1
I2                        0  FOLSOM INFLOW ALKALINITY
I4        790401         20  790530        13  790727       19  791031       19
I4            -1
I2                        0  FOLSOM INFLOW BOD
I4        790401          5  791031         5      -1
I2                        0  FOLSOM INFLOW AMMONIA
I4        790401        .01  790530       .09  790718      .02  790727        0
I4        790807        .01  791031       .01      -1
I2                        0  FOLSOM INFLOW DO
I4        790401       10.7  790516       9.4  790530     10.6  790614      9.1
I4        790718        9.5  790727        10  790807      7.9  790911      8.6
I4        791031       10.6      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4        790401         -1  491031        -1      -1
I2             1          0 SPRING CR. INFLOW
I4        790401         -5  790707        -2  791031       -7      -1
I2                        0 SPRING CR. EC
I4        790401        200  791031       200      -1
I2                        0 SPRING CR. ALKALINITY
I4        790401         55  791031        55      -1
I2                        0 SPRING CR. BOD
I4        790401          0  791031         0      -1
I2                        0 SPRING CR. NH3
I4        790401        .00  791031       .00      -1
I2            -1          0 SPRING CR. DO
I4        790401        125  791031       125      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4        790401         -1  491031        -1      -1
I2             1          0 COW CR. INFLOW
I4        790401          0  790707        -2  791031       -7      -1
I2                        0 COW CR. EC
I4        790401        200  791031       200      -1
I2                        0 COW CR. ALKALINITY
I4        790401        100  791031       100      -1
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I2                        0 COW CR. BOD
I4      790401            0  791031        0      -1
I2                        0 COW CR. NH3
I4      790401          .00  791031      .00      -1
I2          -1            0 COW CR. DO
I4      790401          135  791031      135      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4      790401           -1  491031       -1      -1
I2           1            0 COTTONWOOD CR. INFLOW
I4      790401            0  790707       -2  791031      -7      -1
I2                        0 COTTONWOOD CR. EC
I4      790401          200  791031      200      -1
I2                        0 COTTONWOOD CR. ALKALINITY
I4      790401          100  791031      100      -1
I2                        0 COTTONWOOD CR. BOD
I4      790401            0  791031        0      -1
I2                        0 COTTONWOOD CR. NH3
I4      790401          .00  791031      .00      -1
I2          -1            0 COTTONWOOD CR. DO
I4      790401          135  791031      135      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4      790401           -1  491031       -1      -1
I2           1            0 BATTLE CR. INFLOW
I4      790401            0  790707       -2  791031      -7      -1
I2                        0 BATTLE CR. EC
I4      790401          200  791031      200      -1
I2                        0 BATTLE CR. ALKALINITY
I4      790401          100  791031      100      -1
I2                        0 BATTLE CR. BOD
I4      790401            0  791031        0      -1
I2                        0 BATTLE CR. NH3
I4      790401          .00  791031      .00      -1
I2          -1            0 BATTLE CR. DO
I4      790401          135  791031      135      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4      790401           -1  491031       -1      -1
I2           1            0 THOMES CR. INFLOW
I4      790401            5  790625        9  791031       5      -1
I2                        0 THOMES CR. EC
I4      790401          350  791031      350      -1
I2                        0 THOMES CR. ALKALINITY
I4      790401          350  791031      350      -1
I2                        0 THOMES CR. BOD
I4      790401           10  790601       20  791001      20  791031      10
I4          -1
I2                        0 THOMES CR. NH3
I4      790401          .05  791031      .05      -1
I2          -1            0 THOMES CR. DO
I4      790401          135  791031      135      -1
I2                        0 INFLOW = TOTAL LOCAL FLOW
I4      790401           -1  491031       -1      -1
I2                        0 BYPASSED FEATHER RIVER
I4      790401         13.9  790418     14.4  790516    17.8  790718    15.6
I4      790815         15.6  790919     12.2  791031    12.2      -1
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I2                     0 BYPASSED FEATHER RIVER EC
I4          790401    68  790418      68  790516      64  790718       65
I4          790815    65  791031      51      -1
I2                     0 BYPASSED FEATHER RIVER ALKALINITY
I4          790401    40  791031      50      -1
I2                     0 BYPASSED FEATHER RIVER BOD
I4          790401    .5  791031      .5      -1
I2                     0 BYPASSED FEATHER RIVER AMMONIA
I4          790401   .03  790516     .01  790718       0  791031        0
I4              -1
I2                     0 BYPASSED FEATHER RIVER DISSOLVED OXYGEN
I4          790401    10  790418      10  790516     9.2  790718      8.6
I4          790815   7.6  790919     6.2  791031     6.2      -1
I2                     0 INFLOW = TOTAL LOCAL FLOW
I4          790401    -1  491031      -1      -1
I2                     0 YUBA RIVER
I4          790401  11.0  790424    13.5  790524    15.5  790621     18.0
I4          790726  16.5  790823    11.5  790920    15.5  791031     15.5
I4              -1
I2                     0 YUBA RIVER EC
I4          790401    87  790424      92  790523      72  790621       78
I4          790726    74  790823      76  790920      76  791031       76
I4              -1
I2                     0 YUBA RIVER ALKALINITY
I4          790401    34  790424      36  790523      29  790621       31
I4          790726    31  790823      31  790920      32  791031       32
I4              -1
I2                     0 YUBA RIVER BOD
I4          790401   10.  791031     10.      -1
I2                     0 YUBA RIVER AMMONIA
I4          790401   .01  790424     .00  790523     .02  790621      .00
I4          790726   .00  790823     .02  790921     .00  791031      .00
I4              -1
I2                     0 YUBA RIVER DO
I4          790401  11.0  790424    10.8  790523    10.0  790621      9.5
I4          790726   9.9  790823     9.9  790920    10.3  791031     10.3
I4              -1
I2                     0 INFLOW = TOTAL LOCAL FLOW
I4          790401    -1  491031      -1      -1
I2                     0 BEAR RIVER
I4          790401  13.5  790424    14.5  790523    21.0  790621     24.0
I4          790726  25.5  790823    25.5  790920    19.0  791031     19.0
I4              -1
I2                     0 BEAR RIVER EC
I4          790401    91  790424      89  790523      82  790621      210
I4          790726   174  790823     199  790920     190  791031      190
I4              -1
I2                     0 BEAR RIVER ALKALINITY
I4          790401    30  790424      28  790523      26  790621       67
I4          790726    63  790823      75  790920      74  791031       74
I4              -1
I2                     0 BEAR RIVER BOD
I4          790401   10.  791031     10.      -1
I2                     0 BEAR RIVER AMMONIA
I4          790401   .35  791031     .35      -1
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I2                     0 BEAR RIVER DO
I4         790401   11.0  790424      9.7  790523      8.3  790621      8.8
I4         790823    9.9  790920      8.4  791031      8.4      -1
G1790401   791031
G2      1  790401  791031       0        0        1        1
G2      3  790401  791031       0        0        1        1
G2     13  790401  791031       0        0        1        4        1        4
G2     20  790401 -791031       0        0        1        1
ER
```

APPENDIX B

Selected Computer Output for Sacramento River System Water Quality Modeling

WATER QUALITY DATA FOR
SHASTA, OROVILLE AND FOLSOM
RESERVOIR SYSTEM TEST

DAYS OF SIMULATION	210	
FIRST DAY OF SIMULATION	91	(79/ 4/ 1)
FINAL DAY OF SIMULATION	300	(79/10/27)
NUMBER OF CONTROL POINTS	23	
NUMBER OF RESERVOIRS	4	
INPUT UNITS (ENGLISH=0/METRIC=1)	0	
WATER TEMPERATURE UNITS	C	
SCRATCH FILE NUMBER 2	62	
SCRATCH FILE NUMBER 3	21	
SCRATCH FILE NUMBER 4	64	
SCRATCH FILE NUMBER 5	65	
SCRATCH FILE NUMBER 6	66	
SCRATCH FILE NUMBER 7	67	

METEOROLOGICAL DATA SUMMARY

DATE	ZONE	EQT.TEMP	HEAT.EXC	SHORT.WV	WIND.SPD	ZONE	EQT.TEMP	HEAT.EXC	SHORT.WV	WIND.SPD
91/24	1	58.30	121.60	2032.20	11.00					
92/24	1	60.50	118.10	2083.40	10.00					
93/24	1	62.90	91.80	1618.10	7.00					
94/24	1	72.90	67.50	2081.80	4.00					
95/24	1	64.40	118.50	2060.80	9.00					
96/24	1	58.10	79.00	1016.90	6.00					
97/24	1	65.30	107.10	2142.50	8.00					
98/24	1	58.50	141.70	1486.50	12.00					
99/24	1	58.80	111.60	1858.70	10.00					
100/24	1	56.00	125.30	2007.70	12.00					
101/24	1	65.30	94.90	1856.20	7.00					
102/24	1	63.40	116.00	1864.80	9.00					
103/24	1	67.80	98.30	2229.50	7.00					
104/24	1	68.50	99.20	2196.40	7.00					
105/24	1	65.60	96.80	1551.00	7.00					
106/24	1	57.40	140.20	1339.50	12.00					
107/24	1	60.20	88.50	1580.80	7.00					
108/24	1	64.10	78.20	2203.90	6.00					
109/24	1	67.20	68.40	2302.60	5.00					
110/24	1	58.70	74.80	1121.70	6.00					
111/24	1	65.30	80.30	1824.40	6.00					
112/24	1	59.30	121.80	1383.70	10.00					
113/24	1	60.60	123.50	1824.40	10.00					
114/24	1	65.00	81.30	1847.10	6.00					
115/24	1	68.40	62.90	1407.70	4.00					
116/24	1	62.20	87.50	829.50	6.00					
117/24	1	71.30	79.60	2014.90	5.00					
118/24	1	68.40	87.90	2032.70	6.00					
119/24	1	63.70	84.30	1153.30	6.00					
120/24	1	63.20	128.10	1882.50	10.00					
121/24	1	65.60	85.30	1682.00	6.00					
122/24	1	72.40	105.70	2449.90	7.00					
123/24	1	64.90	153.60	2335.70	12.00					
124/24	1	59.50	131.50	1184.10	11.00					

285/24	1	64.70	76.10	866.60	5.00
286/24	1	66.60	107.50	689.20	7.00
287/24	1	66.40	108.40	680.20	7.00
288/24	1	69.00	97.00	966.70	6.00
289/24	1	68.40	105.50	1393.10	7.00
290/24	1	66.90	75.90	1254.90	5.00
291/24	1	57.30	121.50	495.50	10.00
292/24	1	59.20	165.70	483.00	13.00
293/24	1	57.20	101.10	1051.90	8.00
294/24	1	60.00	58.10	1271.80	4.00
295/24	1	58.90	79.10	921.80	6.00
296/24	1	60.40	108.30	628.10	8.00
297/24	1	59.00	104.80	624.70	8.00
298/24	1	58.50	116.40	616.50	9.00
299/24	1	61.80	72.10	1231.00	5.00
300/24	1	67.20	39.40	1257.30	2.00
301/24	1	58.10	96.10	1256.10	8.00
302/24	1	51.70	156.40	1257.00	16.00
303/24	1	51.10	70.00	732.90	6.00
304/24	1	58.50	66.70	1199.30	5.00

IN ADDITION TO TEMPERATURE, THE FOLLOWING CONSTITUENTS ARE BEING SIMULATED. (EXCEPT AS NOTED)

SPECIFIC CONDUCTANCE
TOTAL ALKALINITY
CARBONACEOUS BOD
AMMONIA AS N
DISSOLVED OXYGEN

***** INDICATES QUALITY DATA WILL BE READ BUT NOT SIMULATED

RESERVOIR RELATED DATA

PRINTOUT INTERVAL, DAYS	30
VERTICAL LAYER PRINTOUT INTERVAL	1

RESERVOIR NUMBER 1

CONTROL POINT I.D.	1
LAYER THICKNESS, FT	10.0
MAXIMUM WATER SURFACE ELEVATION, FT	1070.0
BOTTOM ELEVATION, FT	630.0
STARTING RESERVOIR VOLUME, ACFT	4137800.
SECCHI DISK DEPTH, FT	5.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.50
FRACTION OF SOLAR ENERGY ABSORBED	0.60
METEOROLOGICAL DATA ZONE	1

INFLOW I.D.	EFFECTIVE RES. LENGTH,FT
1	100000.

WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01
WATER COLUMN CRITICAL STABILITY (GSWH), KG/M3/M	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.30E-04
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	330.00	186000.00	41	1037.00
WET WELL 1	18.00	14000.00	19	815.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS				
1	1.00E+01	1.00E+02	0.00E+00	-2.00E+00		
2	5.00E+00	1.00E+02	0.00E+00	-1.00E-01		
3	3.00E+00	1.00E+02	0.00E+00	-1.00E-01		
6	1.00E+00	1.00E+02	0.00E+00	-2.00E+00		
7	3.00E+00	1.00E+02	0.00E+00	-1.00E+01		
8	5.00E+00	1.00E+02	3.20E+00	-7.00E-01	1.00E-01	-5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	630.0	200.	0.	13737.	50.	5.70
2	640.0	547.	13737.	7211.	88.	5.70
3	650.0	895.	20948.	10685.	126.	5.70
4	660.0	1242.	31633.	14159.	164.	5.70
5	670.0	1590.	45791.	17633.	202.	5.70
6	680.0	1937.	63424.	21107.	240.	5.70
7	690.0	2284.	84531.	24580.	279.	5.70
8	700.0	2632.	109111.	28054.	317.	5.70
9	710.0	2979.	137166.	31528.	355.	5.70
10	720.0	3327.	168694.	35002.	393.	5.70
11	730.0	3674.	203696.	38476.	431.	5.70
12	740.0	4021.	242172.	41950.	469.	5.70
13	750.0	4369.	284122.	45424.	507.	5.70
14	760.0	4716.	329546.	48898.	545.	5.70
15	770.0	5063.	378444.	52372.	583.	5.70
16	780.0	5411.	430816.	55846.	621.	5.70
17	790.0	5758.	486662.	59320.	660.	5.70
18	800.0	6106.	545982.	62794.	698.	5.70
19	810.0	6453.	608776.	66268.	736.	5.70
20	820.0	6800.	675043.	69741.	774.	5.70
21	830.0	7148.	744785.	73215.	812.	5.70
22	840.0	7495.	818000.	78471.	850.	5.70
23	850.0	8199.	896471.	85508.	1052.	5.81
24	860.0	8903.	981979.	92545.	1254.	5.91
25	870.0	9606.	1074524.	99582.	1456.	6.02
26	880.0	10310.	1174106.	107038.	1659.	6.13
27	890.0	11098.	1281144.	115893.	1838.	6.26
28	900.0	12081.	1397037.	125727.	1967.	6.45
29	910.0	13064.	1522765.	135561.	2095.	6.64
30	920.0	14048.	1658325.	145395.	2223.	6.83
31	930.0	15031.	1803720.	155228.	2351.	7.02
32	940.0	16015.	1958949.	165062.	2479.	7.21
33	950.0	16998.	2124011.	174896.	2607.	7.40
34	960.0	17981.	2298907.	184730.	2735.	7.59
35	970.0	18965.	2483637.	194564.	2863.	7.78
36	980.0	19948.	2678200.	204397.	2991.	7.97
37	990.0	20931.	2882597.	214231.	3119.	8.16
38	1000.0	21915.	3096828.	221066.	3248.	8.35
39	1010.0	22299.	3317895.	226985.	3400.	8.70
40	1020.0	23099.	3544880.	236985.	3600.	9.10
41	1030.0	24299.	3781865.	257333.	3800.	9.40
42	1040.0	27168.	4039198.	277682.	4000.	9.70
43	1050.0	28368.	4316880.	289682.	4600.	9.80
44	1060.0	29568.	4606562.	301682.	4800.	9.80
45	1070.0	30768.	4908243.	301682.	5000.	9.80

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS.1	CONS.2	CONS.3	NONCONS.1	NONCONS.2	NONCONS.3	OXYGEN	O2 SOURCE/SINK
1	630.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
2	640.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
3	650.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
4	660.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
5	670.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
6	680.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
7	690.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
8	700.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
9	710.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
10	720.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
11	730.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
12	740.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
13	750.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
14	760.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
15	770.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
16	780.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
17	790.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
18	800.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
19	810.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
20	820.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
21	830.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
22	840.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
23	850.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
24	860.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
25	870.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
26	880.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
27	890.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
28	900.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
29	910.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
30	920.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
31	930.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
32	940.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
33	950.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
34	960.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
35	970.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
36	980.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
37	990.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
38	1000.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
39	1010.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
40	1020.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
41	1030.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
42	1040.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
43	1050.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
44	1060.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
45	1070.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00

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CONSTITUENT NO. 1  IS   SPECIFIC CONDUCTANCE
CONSTITUENT NO. 2  IS   TOTAL ALKALINITY
CONSTITUENT NO. 3  IS NOT BEING SIMULATED
CONSTITUENT NO. 4  IS NOT BEING SIMULATED
CONSTITUENT NO. 5  IS   CARBONACEOUS BOD
CONSTITUENT NO. 6  IS   AMMONIA AS N
CONSTITUENT NO. 7  IS   DISSOLVED OXYGEN


DECAY RATES AND CONVERSION FACTORS ARE

CONSTITUENT NO. 4 DECAY RATE =           0.0000
CONSTITUENT NO. 5 DECAY RATE =           0.1000
CONSTITUENT NO. 6 DECAY RATE =           0.0500
CONSTITUENT NO. 5 CONVERSION FACTOR =    1.4630
CONSTITUENT NO. 6 CONVERSION FACTOR =    4.5700
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RESERVOIR NUMBER 2

CONTROL POINT I.D. 3

LAYER THICKNESS, FT	10.0
MAXIMUM WATER SURFACE ELEVATION, FT	587.5
BOTTOM ELEVATION, FT	437.5
STARTING RESERVOIR VOLUME, ACFT	22677.
SECCHI DISK DEPTH, FT	3.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.00
FRACTION OF SOLAR ENERGY ABSORBED	0.60
METEOROLOGICAL DATA ZONE	1
(U/S STREAM SEC.) 47500.	
WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01
WATER COLUMN CRITICAL STABILITY (GSWH), KG/M3/M	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.30E-04
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	200.00	248000.00	12	560.00
WET WELL 1	1173.00	15000.00	8	514.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS				
1	1.00E+01	1.00E+02	0.00E+00	-2.00E+00		
2	5.00E+00	1.00E+02	0.00E+00	-1.00E-01		
3	3.00E+00	1.00E+02	0.00E+00	-1.00E-01		
6	1.00E+00	1.00E+02	0.00E+00	-2.00E+00		
7	3.00E+00	1.00E+02	0.00E+00	-1.00E+01		
8	5.00E+00	1.00E+02	3.20E+00	-7.00E-01	1.00E-01	-5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	437.5	50.	0.	594.	40.	9.00
2	447.5	67.	594.	752.	86.	9.00
3	457.5	84.	1346.	920.	132.	9.00
4	467.5	100.	2266.	1088.	178.	9.00
5	477.5	117.	3354.	1256.	224.	9.00
6	487.5	134.	4610.	1424.	270.	9.00
7	497.5	151.	6033.	1592.	315.	9.00
8	507.5	168.	7625.	1760.	361.	9.00
9	517.5	184.	9385.	1933.	407.	9.00
10	527.5	202.	11318.	2182.	452.	9.00
11	537.5	234.	13499.	2454.	484.	9.00
12	547.5	257.	15953.	2631.	513.	9.00
13	557.5	270.	18584.	2761.	539.	9.00
14	567.5	283.	21345.	2891.	565.	9.00
15	577.5	296.	24236.	4648.	591.	9.00
16	587.5	634.	28883.	4648.	1000.	9.00

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS.1	CONS.2	CONS.3	NONCONS.1	NONCONS.2	NONCONS.3	OXYGEN	O2 SOURCE/SINK
1	437.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
2	447.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
3	457.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
4	467.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
5	477.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
6	487.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
7	497.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
8	507.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
9	517.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
10	527.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
11	537.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
12	547.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
13	557.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
14	567.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
15	577.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
16	587.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00

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    CONSTITUENT NO. 1  IS   SPECIFIC CONDUCTANCE
    CONSTITUENT NO. 2  IS   TOTAL ALKALINITY
    CONSTITUENT NO. 3  IS NOT BEING SIMULATED
    CONSTITUENT NO. 4  IS NOT BEING SIMULATED
    CONSTITUENT NO. 5  IS   CARBONACEOUS BOD
    CONSTITUENT NO. 6  IS   AMMONIA AS N
    CONSTITUENT NO. 7  IS   DISSOLVED OXYGEN


DECAY RATES AND CONVERSION FACTORS ARE

    CONSTITUENT NO. 4 DECAY RATE =          0.0000
    CONSTITUENT NO. 5 DECAY RATE =          0.1000
    CONSTITUENT NO. 6 DECAY RATE =          0.0500
    CONSTITUENT NO. 5 CONVERSION FACTOR =   1.4630
    CONSTITUENT NO. 6 CONVERSION FACTOR =   4.5700
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RESERVOIR NUMBER 3

CONTROL POINT I.D.	13
LAYER THICKNESS, FT	14.0
MAXIMUM WATER SURFACE ELEVATION, FT	923.0
BOTTOM ELEVATION, FT	250.0
STARTING RESERVOIR VOLUME, ACFT	3059593.
SECCHI DISK DEPTH, FT	10.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.00
FRACTION OF SOLAR ENERGY ABSORBED	0.40
METEOROLOGICAL DATA ZONE	1

INFLOW I.D.	EFFECTIVE RES. LENGTH,FT
2	30000.

WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01
WATER COLUMN CRITICAL STABILITY (GSWH), KG/M3/M	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.30E-04
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	180.00	350000.00	47	901.00
WET WELL 1	10.00	4000.00	29	652.00
			34	720.00
			38	788.00
			43	856.00
WET WELL 2	10.00	4000.00	30	669.00
			35	737.00
			40	805.00
			45	873.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS				
1	1.00E+01	1.00E+02	0.00E+00	-2.00E+00		
2	5.00E+00	1.00E+02	0.00E+00	-1.00E-01		
3	3.00E+00	1.00E+02	0.00E+00	-1.00E-01		
6	1.00E+00	1.00E+02	0.00E+00	-2.00E+00		
7	3.00E+00	1.00E+02	0.00E+00	-1.00E+01		
8	5.00E+00	1.00E+02	3.20E+00	-7.00E-01	1.00E-01	-5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	250.0	70.	0.	2411.	200.	6.67
2	264.0	132.	2411.	2274.	256.	6.67
3	278.0	193.	4685.	3136.	312.	6.67
4	292.0	255.	7821.	4066.	368.	6.67
5	306.0	326.	11886.	5152.	424.	6.67
6	320.0	410.	17038.	6328.	480.	6.67
7	334.0	494.	23366.	7504.	536.	6.67
8	348.0	578.	30870.	9083.	592.	6.67
9	362.0	720.	39954.	11133.	648.	6.67
10	376.0	871.	51086.	13250.	704.	6.67
11	390.0	1022.	64336.	15434.	760.	6.67
12	404.0	1183.	79770.	17853.	816.	6.67
13	418.0	1368.	97622.	20440.	872.	6.67
14	432.0	1552.	118062.	23027.	928.	6.67
15	446.0	1737.	141090.	26006.	984.	6.67
16	460.0	1978.	167096.	29534.	1040.	6.67
17	474.0	2241.	196630.	33219.	1096.	6.67
18	488.0	2504.	229850.	36882.	1152.	6.67
19	502.0	2764.	266731.	40387.	1208.	6.67
20	516.0	3005.	307118.	43758.	1264.	6.67
21	530.0	3246.	350877.	47130.	1320.	6.67
22	544.0	3487.	398006.	50904.	1376.	6.67
23	558.0	3785.	448910.	55384.	1432.	6.67
24	572.0	4127.	504294.	60166.	1488.	6.67
25	586.0	4468.	564461.	64949.	1544.	6.67
26	600.0	4810.	629410.	69810.	1600.	6.67
27	614.0	5163.	699219.	74749.	1656.	6.67
28	628.0	5516.	773968.	79688.	1712.	6.67
29	642.0	5868.	853656.	84896.	1768.	6.67
30	656.0	6260.	938552.	90731.	1824.	6.80
31	670.0	6702.	1029283.	96925.	1880.	7.11
32	684.0	7144.	1126208.	103118.	1936.	7.42
33	698.0	7587.	1229326.	109312.	1992.	7.74
34	712.0	8029.	1338638.	115506.	2072.	8.18
35	726.0	8472.	1454144.	121699.	2156.	8.64
36	740.0	8914.	1575843.	128206.	2240.	9.11
37	754.0	9401.	1704050.	135811.	2324.	9.71
38	768.0	10000.	1839861.	144200.	2408.	10.65
39	782.0	10600.	1984061.	152589.	2492.	11.59
40	796.0	11199.	2136650.	160866.	2576.	12.53
41	810.0	11782.	2297515.	168986.	2680.	12.24
42	824.0	12359.	2466501.	177061.	2792.	11.46
43	838.0	12936.	2643562.	185360.	2904.	10.67
44	852.0	13544.	2828922.	195227.	3012.	10.11
45	866.0	14345.	3024149.	206438.	3096.	10.90
46	880.0	15146.	3230587.	217650.	3180.	11.68
47	894.0	15947.	3448237.	198627.	3264.	12.46
48	908.0	12429.	3646864.	126696.	3370.	12.80
49	922.0	5671.	3773560.	126696.	3491.	12.80

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS.1	CONS.2	CONS.3	NONCONS.1	NONCONS.2	NONCONS.3	OXYGEN	O2 SOURCE/SINK
1	250.0	62.00	40.00	0.00	0.00	0.00	0.00	0.5	100.00
2	264.0	62.00	40.00	0.00	0.00	0.00	0.00	0.6	100.00
3	278.0	62.00	40.00	0.00	0.00	0.00	0.00	0.8	100.00
4	292.0	62.00	40.00	0.00	0.00	0.00	0.00	0.9	100.00
5	306.0	62.00	40.00	0.00	0.00	0.00	0.00	1.1	100.00
6	320.0	62.00	40.00	0.00	0.00	0.00	0.00	1.2	100.00
7	334.0	62.00	40.00	0.00	0.00	0.00	0.00	1.3	100.00
8	348.0	62.00	40.00	0.00	0.00	0.00	0.00	1.5	100.00
9	362.0	62.00	40.00	0.00	0.00	0.00	0.00	1.6	100.00
10	376.0	62.00	40.00	0.00	0.00	0.00	0.00	1.8	100.00
11	390.0	62.00	40.00	0.00	0.00	0.00	0.00	1.9	100.00
12	404.0	62.00	40.00	0.00	0.00	0.00	0.00	2.0	100.00
13	418.0	62.00	40.00	0.00	0.00	0.00	0.00	2.2	100.00
14	432.0	62.00	40.00	0.00	0.00	0.00	0.00	2.3	100.00
15	446.0	62.00	40.00	0.00	0.00	0.00	0.00	2.5	100.00
16	460.0	62.00	40.00	0.00	0.00	0.00	0.00	2.6	100.00
17	474.0	62.00	40.00	0.00	0.00	0.00	0.00	2.7	100.00
18	488.0	62.00	40.00	0.00	0.00	0.00	0.00	2.9	100.00
19	502.0	62.00	40.00	0.00	0.00	0.00	0.00	3.0	100.00
20	516.0	62.00	40.00	0.00	0.00	0.00	0.00	3.2	100.00
21	530.0	62.00	40.00	0.00	0.00	0.00	0.00	3.3	100.00
22	544.0	62.00	40.00	0.00	0.00	0.00	0.00	3.4	100.00
23	558.0	62.00	40.00	0.00	0.00	0.00	0.00	3.6	100.00
24	572.0	62.00	40.00	0.00	0.00	0.00	0.00	3.7	100.00
25	586.0	62.00	40.00	0.00	0.00	0.00	0.00	3.9	100.00
26	600.0	62.00	40.00	0.00	0.00	0.00	0.00	4.0	100.00
27	614.0	62.00	40.00	0.00	0.00	0.00	0.00	4.3	100.00
28	628.0	62.00	40.00	0.00	0.00	0.00	0.00	4.6	100.00
29	642.0	62.00	40.00	0.00	0.00	0.00	0.00	4.8	100.00
30	656.0	62.00	40.00	0.00	0.00	0.00	0.00	5.1	100.00
31	670.0	62.00	40.00	0.00	0.00	0.00	0.00	5.4	100.00
32	684.0	62.00	40.00	0.00	0.00	0.00	0.00	5.7	100.00
33	698.0	62.00	40.00	0.00	0.00	0.00	0.00	6.0	100.00
34	712.0	62.00	40.00	0.00	0.00	0.00	0.00	6.2	100.00
35	726.0	62.00	40.00	0.00	0.00	0.00	0.00	6.5	100.00
36	740.0	62.00	40.00	0.00	0.00	0.00	0.00	6.8	100.00
37	754.0	62.00	40.00	0.00	0.00	0.00	0.00	7.1	100.00
38	768.0	62.00	40.00	0.00	0.00	0.00	0.00	7.4	100.00
39	782.0	62.00	40.00	0.00	0.00	0.00	0.00	7.6	100.00
40	796.0	62.00	40.00	0.00	0.00	0.00	0.00	7.9	100.00
41	810.0	62.00	40.00	0.00	0.00	0.00	0.00	8.2	100.00
42	824.0	62.00	40.00	0.00	0.00	0.00	0.00	8.5	100.00
43	838.0	62.00	40.00	0.00	0.00	0.00	0.00	8.8	100.00
44	852.0	62.00	40.00	0.00	0.00	0.00	0.00	9.0	100.00
45	866.0	62.00	40.00	0.00	0.00	0.00	0.00	9.3	100.00
46	880.0	62.00	40.00	0.00	0.00	0.00	0.00	9.6	100.00
47	894.0	62.00	40.00	0.00	0.00	0.00	0.00	9.9	100.00
48	908.0	62.00	40.00	0.00	0.00	0.00	0.00	10.0	100.00
49	922.0	62.00	40.00	0.00	0.00	0.00	0.00	10.0	100.00

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     CONSTITUENT NO. 1  IS   SPECIFIC CONDUCTANCE
     CONSTITUENT NO. 2  IS   TOTAL ALKALINITY
     CONSTITUENT NO. 3  IS NOT BEING SIMULATED
     CONSTITUENT NO. 4  IS NOT BEING SIMULATED
     CONSTITUENT NO. 5  IS   CARBONACEOUS BOD
     CONSTITUENT NO. 6  IS   AMMONIA AS N
     CONSTITUENT NO. 7  IS   DISSOLVED OXYGEN


DECAY RATES AND CONVERSION FACTORS ARE

     CONSTITUENT NO. 4 DECAY RATE =          0.0000
     CONSTITUENT NO. 5 DECAY RATE =          0.1000
     CONSTITUENT NO. 6 DECAY RATE =          0.0500
     CONSTITUENT NO. 5 CONVERSION FACTOR =   1.4630
     CONSTITUENT NO. 6 CONVERSION FACTOR =   4.5700
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RESERVOIR NUMBER 4

CONTROL POINT I.D.	20
LAYER THICKNESS, FT	7.0
MAXIMUM WATER SURFACE ELEVATION, FT	480.0
BOTTOM ELEVATION, FT	225.0
STARTING RESERVOIR VOLUME, ACFT	832100.
SECCHI DISK DEPTH, FT	12.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	2.00
FRACTION OF SOLAR ENERGY ABSORBED	0.40
METEOROLOGICAL DATA ZONE	1

INFLOW I.D.	EFFECTIVE RES. LENGTH,FT
3	26400.

WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01
WATER COLUMN CRITICAL STABILITY (GSWH), KG/M3/M	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.10E-03
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	336.00	567000.00	28	418.00
WET WELL 1	10.40	8000.00	12	307.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS				
1	1.00E+01	1.00E+02	0.00E+00	-2.00E+00		
2	5.00E+00	1.00E+02	0.00E+00	-1.00E-01		
3	3.00E+00	1.00E+02	0.00E+00	-1.00E-01		
6	1.00E+00	1.00E+02	0.00E+00	-2.00E+00		
7	3.00E+00	1.00E+02	0.00E+00	-1.00E+01		
8	5.00E+00	1.00E+02	3.20E+00	-7.00E-01	1.00E-01	-5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION	AREA	VOLUME	ELEMENT VOL	WIDTH	TEMPERATURE
	FT	ACRE	ACFT	ACFT	FT	C
1	225.0	90.	0.	2002.	100.	8.00
2	232.0	196.	2002.	1747.	212.	8.00
3	239.0	303.	3750.	2492.	324.	8.00
4	246.0	409.	6242.	3220.	436.	8.00
5	253.0	511.	9462.	3909.	560.	8.06
6	260.0	606.	13370.	4575.	700.	8.20
7	267.0	701.	17946.	5242.	840.	8.34
8	274.0	796.	23187.	5942.	980.	8.48
9	281.0	901.	29129.	6681.	1240.	8.50
10	288.0	1008.	35810.	7426.	1520.	8.50
11	295.0	1114.	43235.	8294.	1800.	8.50
12	302.0	1256.	51529.	9593.	2080.	8.54
13	309.0	1485.	61122.	11200.	2360.	8.68
14	316.0	1715.	72322.	12807.	2640.	8.82
15	323.0	1944.	85129.	14554.	2920.	8.96
16	330.0	2214.	99683.	16498.	3200.	9.06
17	337.0	2500.	116181.	18497.	3480.	9.14
18	344.0	2785.	134678.	20614.	3760.	9.23
19	351.0	3104.	155291.	23554.	4040.	9.33
20	358.0	3625.	178845.	27199.	4320.	9.52
21	365.0	4146.	206044.	30845.	4600.	9.72
22	372.0	4667.	236889.	34558.	4880.	9.92
23	379.0	5207.	271446.	38388.	5160.	10.43
24	386.0	5761.	309834.	42269.	5440.	11.19
25	393.0	6316.	352103.	46150.	5720.	11.94
26	400.0	6870.	398253.	50107.	6000.	12.70
27	407.0	7446.	448360.	54142.	6389.	12.93
28	414.0	8023.	502503.	57984.	6778.	13.17
29	421.0	8544.	560487.	61374.	7094.	13.30
30	428.0	8991.	621861.	64506.	7312.	13.30
31	435.0	9439.	686367.	67639.	7531.	13.30
32	442.0	9886.	754006.	70771.	7750.	13.30
33	449.0	10334.	824776.	73908.	7969.	13.30
34	456.0	10783.	898685.	77052.	8240.	13.30
35	463.0	11232.	975737.	80197.	8520.	13.30
36	470.0	11681.	1055934.	83446.	8800.	13.30
37	477.0	12160.	1139380.	83446.	9400.	13.30

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS.1	CONS.2	CONS.3	NONCONS.1	NONCONS.2	NONCONS.3	OXYGEN	O2 SOURCE/SINK
1	225.0	70.00	20.00	0.00	0.00	0.00	0.02	10.5	100.00
2	232.0	70.00	20.00	0.00	0.00	0.00	0.02	10.5	100.00
3	239.0	70.00	20.00	0.00	0.00	0.00	0.02	10.5	100.00
4	246.0	70.00	20.00	0.00	0.00	0.00	0.02	10.5	100.00
5	253.0	70.00	20.00	0.00	0.00	0.00	0.02	10.5	100.00
6	260.0	70.00	20.00	0.00	0.00	0.00	0.02	10.6	100.00
7	267.0	70.00	20.00	0.00	0.00	0.00	0.02	10.6	100.00
8	274.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
9	281.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
10	288.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
11	295.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
12	302.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
13	309.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
14	316.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
15	323.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
16	330.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
17	337.0	70.00	20.00	0.00	0.00	0.00	0.02	10.7	100.00
18	344.0	70.00	20.00	0.00	0.00	0.00	0.02	10.6	100.00
19	351.0	70.00	20.00	0.00	0.00	0.00	0.02	10.6	100.00
20	358.0	70.00	20.00	0.00	0.00	0.00	0.02	10.8	100.00
21	365.0	70.00	20.00	0.00	0.00	0.00	0.02	10.9	100.00
22	372.0	70.00	20.00	0.00	0.00	0.00	0.02	11.0	100.00
23	379.0	70.00	20.00	0.00	0.00	0.00	0.02	11.1	100.00
24	386.0	70.00	20.00	0.00	0.00	0.00	0.02	11.2	100.00
25	393.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
26	400.0	70.00	20.00	0.00	0.00	0.00	0.02	11.4	100.00
27	407.0	70.00	20.00	0.00	0.00	0.00	0.02	11.4	100.00
28	414.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
29	421.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
30	428.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
31	435.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
32	442.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
33	449.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
34	456.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
35	463.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
36	470.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00
37	477.0	70.00	20.00	0.00	0.00	0.00	0.02	11.3	100.00

```
     CONSTITUENT NO. 1  IS   SPECIFIC CONDUCTANCE
     CONSTITUENT NO. 2  IS   TOTAL ALKALINITY
     CONSTITUENT NO. 3  IS NOT BEING SIMULATED
     CONSTITUENT NO. 4  IS NOT BEING SIMULATED
     CONSTITUENT NO. 5  IS   CARBONACEOUS BOD
     CONSTITUENT NO. 6  IS   AMMONIA AS N
     CONSTITUENT NO. 7  IS   DISSOLVED OXYGEN


DECAY RATES AND CONVERSION FACTORS ARE

     CONSTITUENT NO. 4 DECAY RATE =           0.0000
     CONSTITUENT NO. 5 DECAY RATE =           0.1000
     CONSTITUENT NO. 6 DECAY RATE =           0.0500
     CONSTITUENT NO. 5 CONVERSION FACTOR =    1.4630
     CONSTITUENT NO. 6 CONVERSION FACTOR =    4.5700


THERMAL ADJUSTMENT FACTORS FOR

     CONSTITUENT NO. 4 DECAY RATE =           1.0470
     CONSTITUENT NO. 5 DECAY RATE =           1.0470
     CONSTITUENT NO. 6 DECAY RATE =           1.0470
     OXYGEN REAERATION RATE =                 1.0159
```

STREAM RELATED DATA

PRINTOUT INTERVAL, DAYS	30
PRINTOUT INTERVAL, ELEMENTS	1
CROSS SECTION PRINT CONTROL	0
NUMBER OF CROSS SECTIONS	95
POINTS DEFINING CROSS SECTION GEOMETRY	21
X-SECTION WIDTH ADJUSTMENT RATIO	1.00

STREAM REACH DATA

REACH	UP STREAM CP.	UP STREAM LOC.	DOWN STREAM CP.	DOWN STREAM LOC.	ELT LENGTH MILE	TRIB LOCATIONS AND NUMBER					
1	1	303.8	2	300.0	1.90	300.0	4	0.0	0	0.0	0
2	3	294.6	4	275.9	4.66	280.1	5	0.0	0	0.0	0
3	4	275.9	5	271.3	2.33	273.2	6	0.0	0	0.0	0
4	5	271.3	6	262.0	4.66	271.2	7	0.0	0	0.0	0
5	6	262.0	7	243.3	4.66	0.0	0	0.0	0	0.0	0
6	7	243.3	8	206.0	4.66	225.1	8	0.0	0	0.0	0
7	8	206.0	9	196.7	4.66	0.0	0	0.0	0	0.0	0
8	9	196.7	10	168.8	4.66	0.0	0	0.0	0	0.0	0
9	10	168.8	11	140.8	4.66	0.0	0	0.0	0	0.0	0
10	11	140.8	12	117.5	4.66	0.0	0	0.0	0	0.0	0
11	12	117.5	19	80.2	4.66	0.0	0	0.0	0	0.0	0
12	13	75.4	14	71.8	1.78	75.0	9	0.0	0	0.0	0
13	14	71.8	15	58.8	3.25	58.8	9	0.0	0	0.0	0
14	15	58.8	16	45.6	3.32	0.0	0	0.0	0	0.0	0
15	16	45.6	17	26.3	2.41	29.7	10	0.0	0	0.0	0
16	17	26.3	18	8.8	4.37	12.3	11	0.0	0	0.0	0
17	18	8.8	19	0.0	4.38	0.0	0	0.0	0	0.0	0
18	19	80.2	22	59.6	4.12	0.0	0	0.0	0	0.0	0
19	20	28.5	21	20.9	2.53	0.0	0	0.0	0	0.0	0
20	21	20.9	22	0.0	4.19	0.0	0	0.0	0	0.0	0
21	22	59.6	23	38.3	2.67	0.0	0	0.0	0	0.0	0

METEOROLOGICAL AND REAERATION CONTROLS

ELEMENT	LOCATION		MET.ZONE	K2 METHOD	K2(IF SET)	POINT K2
1	302.85	1	1	(OCONNER AND DOBBINS)		
2	300.95	2	1	(OCONNER AND DOBBINS)		
3	292.25	3	1	(OCONNER AND DOBBINS)		
4	287.59		1	(OCONNER AND DOBBINS)		
5	282.93		1	(OCONNER AND DOBBINS)		
6	278.27	4	1	(OCONNER AND DOBBINS)		
7	274.77	4	1	(OCONNER AND DOBBINS)		
8	272.44	5	1	(OCONNER AND DOBBINS)		
9	268.95	5	1	(OCONNER AND DOBBINS)		
10	264.29	6	1	(OCONNER AND DOBBINS)		
11	259.63	6	1	(OCONNER AND DOBBINS)		
12	254.97		1	(OCONNER AND DOBBINS)		
13	250.31		1	(OCONNER AND DOBBINS)		
14	245.65	7	1	(OCONNER AND DOBBINS)		

15	240.99	7	1	(OCONNER AND DOBBINS)
16	236.33		1	(OCONNER AND DOBBINS)
17	231.67		1	(OCONNER AND DOBBINS)
18	227.01		1	(OCONNER AND DOBBINS)
19	222.35		1	(OCONNER AND DOBBINS)
20	217.69		1	(OCONNER AND DOBBINS)
21	213.03		1	(OCONNER AND DOBBINS)
22	208.37	8	1	(OCONNER AND DOBBINS)
23	203.71	8	1	(OCONNER AND DOBBINS)
24	199.05	9	1	(OCONNER AND DOBBINS)
25	194.39	9	1	(OCONNER AND DOBBINS)
26	189.73		1	(OCONNER AND DOBBINS)
27	185.07		1	(OCONNER AND DOBBINS)
28	180.41		1	(OCONNER AND DOBBINS)
29	175.75		1	(OCONNER AND DOBBINS)
30	171.09	10	1	(OCONNER AND DOBBINS)
31	166.43	10	1	(OCONNER AND DOBBINS)
32	161.77		1	(OCONNER AND DOBBINS)
33	157.11		1	(OCONNER AND DOBBINS)
34	152.45		1	(OCONNER AND DOBBINS)
35	147.79		1	(OCONNER AND DOBBINS)
36	143.13	11	1	(OCONNER AND DOBBINS)
37	138.47	11	1	(OCONNER AND DOBBINS)
38	133.81		1	(OCONNER AND DOBBINS)
39	129.15		1	(OCONNER AND DOBBINS)
40	124.49		1	(OCONNER AND DOBBINS)
41	119.83	12	1	(OCONNER AND DOBBINS)
42	115.17	12	1	(OCONNER AND DOBBINS)
43	110.51		1	(OCONNER AND DOBBINS)
44	105.85		1	(OCONNER AND DOBBINS)
45	101.19		1	(OCONNER AND DOBBINS)
46	96.53		1	(OCONNER AND DOBBINS)
47	91.87		1	(OCONNER AND DOBBINS)
48	87.21		1	(OCONNER AND DOBBINS)
49	82.55	19	1	(OCONNER AND DOBBINS)
50	74.49	13	1	(OCONNER AND DOBBINS)
51	72.71	14	1	(OCONNER AND DOBBINS)
52	70.20	14	1	(OCONNER AND DOBBINS)
53	66.95		1	(OCONNER AND DOBBINS)
54	63.71		1	(OCONNER AND DOBBINS)
55	60.46	15	1	(OCONNER AND DOBBINS)
56	57.18	15	1	(OCONNER AND DOBBINS)
57	53.86		1	(OCONNER AND DOBBINS)
58	50.54		1	(OCONNER AND DOBBINS)
59	47.22	16	1	(OCONNER AND DOBBINS)
60	44.35	16	1	(OCONNER AND DOBBINS)
61	41.94		1	(OCONNER AND DOBBINS)
62	39.53		1	(OCONNER AND DOBBINS)
63	37.11		1	(OCONNER AND DOBBINS)
64	34.70		1	(OCONNER AND DOBBINS)
65	32.28		1	(OCONNER AND DOBBINS)
66	29.87		1	(OCONNER AND DOBBINS)
67	27.46	17	1	(OCONNER AND DOBBINS)
68	24.06	17	1	(OCONNER AND DOBBINS)
69	19.69		1	(OCONNER AND DOBBINS)

70	15.32		1	(OCONNER AND DOBBINS)
71	10.95	18	1	(OCONNER AND DOBBINS)
72	6.57	18	1	(OCONNER AND DOBBINS)
73	2.19	19	1	(OCONNER AND DOBBINS)
74	78.16	19	1	(OCONNER AND DOBBINS)
75	74.05		1	(OCONNER AND DOBBINS)
76	69.93		1	(OCONNER AND DOBBINS)
77	65.81		1	(OCONNER AND DOBBINS)
78	61.70	22	1	(OCONNER AND DOBBINS)
79	27.26	20	1	(OCONNER AND DOBBINS)
80	24.73		1	(OCONNER AND DOBBINS)
81	22.20	21	1	(OCONNER AND DOBBINS)
82	18.84	21	1	(OCONNER AND DOBBINS)
83	14.65		1	(OCONNER AND DOBBINS)
84	10.46		1	(OCONNER AND DOBBINS)
85	6.28		1	(OCONNER AND DOBBINS)
86	2.09	22	1	(OCONNER AND DOBBINS)
87	58.31	22	1	(OCONNER AND DOBBINS)
88	55.64		1	(OCONNER AND DOBBINS)
89	52.97		1	(OCONNER AND DOBBINS)
90	50.30		1	(OCONNER AND DOBBINS)
91	47.63		1	(OCONNER AND DOBBINS)
92	44.96		1	(OCONNER AND DOBBINS)
93	42.29		1	(OCONNER AND DOBBINS)
94	39.62	23	1	(OCONNER AND DOBBINS)

*** WARNING *** ZERO HYDRAULIC SLOPE BETWEEN CROSS-SECTIONS 51 AND 52
********** SLOPE SET TO .0001 ***********
*** WARNING *** ZERO HYDRAULIC SLOPE BETWEEN CROSS-SECTIONS 49 AND 75
********** SLOPE SET TO .0001 ***********

DECAY RATES FOR STREAM REACHES

REACH NO	CONS 4	CONS 5	CONS 6	CONVERSION FACTORS	
1	0.100	0.100	0.050	1.463	4.570
2	0.100	0.100	0.050	1.463	4.570
3	0.100	0.100	0.050	1.463	4.570
4	0.100	0.100	0.050	1.463	4.570
5	0.100	0.100	0.050	1.463	4.570
6	0.100	0.100	0.050	1.463	4.570
7	0.100	0.100	0.050	1.463	4.570
8	0.100	0.100	0.050	1.463	4.570
9	0.100	0.100	0.050	1.463	4.570
10	0.100	0.100	0.050	1.463	4.570
11	0.100	0.100	0.050	1.463	4.570
12	0.100	0.100	0.050	1.463	4.570
13	0.100	0.100	0.050	1.463	4.570
14	0.100	0.100	0.050	1.463	4.570
15	0.100	0.100	0.050	1.463	4.570
16	0.100	0.100	0.050	1.463	4.570
17	0.100	0.100	0.050	1.463	4.570
18	0.100	0.100	0.050	1.463	4.570
19	0.100	0.100	0.050	1.463	4.570
20	0.100	0.100	0.050	1.463	4.570
21	0.100	0.100	0.050	1.463	4.570

```
CONTROL POINT   1

    TEMPERATURE OBJECTIVES, C
       DATE       TARGET          WEIGHTING           RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION CONTROL
      790401       12.00       1.00        0.00                0       0       0       0       0
     -791031       12.00       1.00        0.00                0       0       0       0       0

      SPECIFIC CONDUCTANCE
       DATE       TARGET          WEIGHTING
      790401      130.00       1.00        0.00
     -791031      130.00       1.00        0.00

      TOTAL ALKALINITY
       DATE       TARGET          WEIGHTING
      790401       60.00       1.00        0.00
     -791031       60.00       1.00        0.00

      CARBONACEOUS BOD
       DATE       TARGET          WEIGHTING
      790401        5.00       1.00        0.00
     -791031        5.00       1.00        0.00

      AMMONIA AS N
       DATE       TARGET          WEIGHTING
      790401        0.10       1.00        0.00
     -791031        0.10       1.00        0.00

      DISSOLVED OXYGEN
       DATE       TARGET          WEIGHTING
      790401        5.00       0.00        1.00
     -791031        5.00       0.00        1.00
CONTROL POINT   2

    TEMPERATURE OBJECTIVES, C
       DATE       TARGET          WEIGHTING           RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION CONTROL
      790401       12.00       1.00        0.00                0       0       0       0       0
     -791031       12.00       1.00        0.00                0       0       0       0       0

      SPECIFIC CONDUCTANCE
       DATE       TARGET          WEIGHTING
      790401      130.00       1.00        0.00
     -791031      130.00       1.00        0.00

      TOTAL ALKALINITY
       DATE       TARGET          WEIGHTING
      790401       60.00       1.00        0.00
     -791031       60.00       1.00        0.00
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Most of the Control Point Target records (CT) have been deleted from this listing.

CONTROL POINT 23

TEMPERATURE OBJECTIVES, C

DATE	TARGET	WEIGHTING	
790401	14.00	1.00	0.00
790516	19.00	1.00	0.00
790614	21.50	1.00	0.00
790726	22.50	1.00	0.00
790823	21.00	1.00	0.00
790913	21.50	1.00	0.00
-791031	19.00	1.00	0.00

RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION CONTROL

0	0	0	0	0
0	0	0	0	0

SPECIFIC CONDUCTANCE

DATE	TARGET	WEIGHTING	
790401	150.00	1.00	0.00
790515	130.00	1.00	0.00
790612	148.00	1.00	0.00
790726	130.00	1.00	0.00
790823	157.00	1.00	0.00
790913	189.00	1.00	0.00
-791031	190.00	1.00	0.00

TOTAL ALKALINITY

DATE	TARGET	WEIGHTING	
790401	64.00	1.00	0.00
790515	43.00	1.00	0.00
790612	51.00	1.00	0.00
790726	48.00	1.00	0.00
790823	69.00	1.00	0.00
790913	72.00	1.00	0.00
-791031	72.00	1.00	0.00

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FIRST DAY OF INFLOW QUALITY RECORD      790401
LAST DAY OF INFLOW QUALITY RECORD       791031
TOTAL NUMBER OF DAYS                       214

TRIB  1 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  1 ...   1 CARDS READ FOR  SHASTA INFLOW                     ( RTO = 1.00 )
TRIB  1 ...   2 CARDS READ FOR  SHASTA INFLOW EC
TRIB  1 ...   2 CARDS READ FOR  SHASTA INFLOW ALKALINITY
TRIB  1 ...   1 CARDS READ FOR  SHASTA INFLOW BOD
TRIB  1 ...   2 CARDS READ FOR  SHASTA INFLOW NH3
TRIB  1 ...   1 CARDS READ FOR  SHASTA INFLOW DO                  ( RTO = 1.00 )
TRIB  2 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  2 ...   2 CARDS READ FOR  OROVILLE INFLOW
TRIB  2 ...   1 CARDS READ FOR  OROVILLE INFLOW EC
TRIB  2 ...   1 CARDS READ FOR  OROVILLE INFLOW ALKALINITY
TRIB  2 ...   1 CARDS READ FOR  OROVILLE INFLOW BOD
TRIB  2 ...   1 CARDS READ FOR  OROVILLE INFLOW AMMONIA
TRIB  2 ...   1 CARDS READ FOR  OROVILLE INFLOW DISOLVED OXYGEN
TRIB  3 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  3 ...   2 CARDS READ FOR  FOLSOM INFLOW
TRIB  3 ...   2 CARDS READ FOR   FOLSOM INFLOW EC
TRIB  3 ...   2 CARDS READ FOR   FOLSOM INFLOW ALKALINITY
TRIB  3 ...   1 CARDS READ FOR   FOLSOM INFLOW BOD
TRIB  3 ...   2 CARDS READ FOR   FOLSOM INFLOW AMMONIA
TRIB  3 ...   3 CARDS READ FOR   FOLSOM INFLOW DO
TRIB  4 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. INFLOW                 ( RTO = 1.00 )
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. EC
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. ALKALINITY
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. BOD
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. NH3
TRIB  4 ...   1 CARDS READ FOR  SPRING CR. DO                     ( RTO = 1.00 )
TRIB  5 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  5 ...   1 CARDS READ FOR  COW CR. INFLOW                    ( RTO = 1.00 )
TRIB  5 ...   1 CARDS READ FOR  COW CR. EC
TRIB  5 ...   1 CARDS READ FOR  COW CR. ALKALINITY
TRIB  5 ...   1 CARDS READ FOR  COW CR. BOD
TRIB  5 ...   1 CARDS READ FOR  COW CR. NH3
TRIB  5 ...   1 CARDS READ FOR  COW CR. DO                        ( RTO = 1.00 )
TRIB  6 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. INFLOW             ( RTO = 1.00 )
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. EC
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. ALKALINITY
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. BOD
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. NH3
TRIB  6 ...   1 CARDS READ FOR  COTTONWOOD CR. DO                 ( RTO = 1.00 )
TRIB  7 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. INFLOW                 ( RTO = 1.00 )
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. EC
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. ALKALINITY
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. BOD
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. NH3
TRIB  7 ...   1 CARDS READ FOR  BATTLE CR. DO                     ( RTO = 1.00 )
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TRIB  8 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  8 ...   1 CARDS READ FOR  THOMES CR. INFLOW                       ( RTO = 1.00 )
TRIB  8 ...   1 CARDS READ FOR  THOMES CR. EC
TRIB  8 ...   1 CARDS READ FOR  THOMES CR. ALKALINITY
TRIB  8 ...   2 CARDS READ FOR  THOMES CR. BOD
TRIB  8 ...   1 CARDS READ FOR  THOMES CR. NH3
TRIB  8 ...   1 CARDS READ FOR  THOMES CR. DO                           ( RTO = 1.00 )
TRIB  9 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB  9 ...   2 CARDS READ FOR  BYPASSED FEATHER RIVER
TRIB  9 ...   2 CARDS READ FOR  BYPASSED FEATHER RIVER EC
TRIB  9 ...   1 CARDS READ FOR  BYPASSED FEATHER RIVER ALKALINITY
TRIB  9 ...   1 CARDS READ FOR  BYPASSED FEATHER RIVER BOD
TRIB  9 ...   2 CARDS READ FOR  BYPASSED FEATHER RIVER AMMONIA
TRIB  9 ...   2 CARDS READ FOR  BYPASSED FEATHER RIVER DISSOLVED OXYGEN
TRIB 10 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB 10 ...   3 CARDS READ FOR  YUBA RIVER
TRIB 10 ...   3 CARDS READ FOR  YUBA RIVER EC
TRIB 10 ...   3 CARDS READ FOR  YUBA RIVER ALKALINITY
TRIB 10 ...   1 CARDS READ FOR  YUBA RIVER BOD
TRIB 10 ...   3 CARDS READ FOR  YUBA RIVER AMMONIA
TRIB 10 ...   3 CARDS READ FOR  YUBA RIVER DO
TRIB 11 ...   1 CARDS READ FOR  INFLOW = TOTAL LOCAL FLOW
TRIB 11 ...   3 CARDS READ FOR  BEAR RIVER
TRIB 11 ...   3 CARDS READ FOR  BEAR RIVER EC
TRIB 11 ...   3 CARDS READ FOR  BEAR RIVER ALKALINITY
TRIB 11 ...   1 CARDS READ FOR  BEAR RIVER BOD
TRIB 11 ...   1 CARDS READ FOR  BEAR RIVER AMMONIA
TRIB 11 ...   2 CARDS READ FOR  BEAR RIVER DO

TIME ( YEAR/MONTH/DAY/HOUR ) VS. INFLOW QUALITY AT CONTROL POINTS

TRIB  1 ...  INFLOW = TOTAL LOCAL FLOW           INFLOW RATE AS FRACTION OF LOCAL FLOW
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    -1.00  79/11/ 1/ 0    -1.00

TRIB  1 ...  SHASTA INFLOW                       TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0   -15.00  79/ 7/ 8/ 0   -12.00  79/11/ 1/ 0    -5.00

TRIB  1 ...  SHASTA INFLOW EC                      SPECIFIC CONDUCTANCE
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0   120.00  79/ 5/30/ 0   120.00  79/ 7/17/ 0   140.00  79/10/12/ 0   120.00  79/11/ 1/ 0   120.00

TRIB  1 ...  SHASTA INFLOW ALKALINITY              TOTAL ALKALINITY
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    55.00  79/ 5/ 3/ 0    55.00  79/ 5/30/ 0    45.00  79/ 7/17/ 0    50.00  79/ 9/12/ 0    64.00  79/11/ 1/ 0    64.00

TRIB  1 ...  SHASTA INFLOW BOD                     CARBONACEOUS BOD
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     1.50  79/11/ 1/ 0     0.80

TRIB  1 ...  SHASTA INFLOW NH3                     AMMONIA AS N
     TIME        VALUE      TIME       VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/ 7/17/ 0     0.02  79/ 9/20/ 0     0.03  79/11/ 1/ 0     0.00
```

```
TRIB  1 ...  SHASTA INFLOW DO                        DISSOLVED OXYGEN AS PERCENT SATURATION
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0   100.00  79/11/ 1/ 0   100.00

TRIB  2 ...  INFLOW = TOTAL LOCAL FLOW                INFLOW RATE AS FRACTION OF LOCAL FLOW
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    -1.00  79/11/ 1/ 0    -1.00

TRIB  2 ...  OROVILLE INFLOW                                   TEMPERATURE, C
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    12.80  79/ 7/ 2/ 0    14.00  79/ 7/19/ 0    18.30  79/ 8/ 2/ 0    12.00  79/ 9/ 2/ 0    10.00  79/10/ 2/ 0     7.22
 79/11/ 1/ 0     4.44

TRIB  2 ...  OROVILLE INFLOW EC                          SPECIFIC CONDUCTANCE
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    62.00  79/ 7/19/ 0    60.00  79/11/ 1/ 0    60.00

TRIB  2 ...  OROVILLE INFLOW ALKALINITY                  TOTAL ALKALINITY
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0   150.00  79/11/ 1/ 0   150.00

TRIB  2 ...  OROVILLE INFLOW BOD                         CARBONACEOUS BOD
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     5.00  79/11/ 1/ 0     5.00

TRIB  2 ...  OROVILLE INFLOW AMMONIA                     AMMONIA AS N
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     0.01  79/ 7/19/ 0     0.00  79/11/ 1/ 0     0.00

TRIB  2 ...  OROVILLE INFLOW DISOLVED OXYGEN          DISSOLVED OXYGEN, MG/L
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    10.40  79/ 7/19/ 0     8.50  79/11/ 1/ 0     8.50

TRIB  3 ...  INFLOW = TOTAL LOCAL FLOW                INFLOW RATE AS FRACTION OF LOCAL FLOW
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    -1.00  79/11/ 1/ 0    -1.00

TRIB  3 ...  FOLSOM INFLOW                                     TEMPERATURE, C
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     8.00  79/ 5/31/ 0    14.00  79/ 7/28/ 0    14.00  79/10/23/ 0    15.00

TRIB  3 ...   FOLSOM INFLOW EC                           SPECIFIC CONDUCTANCE
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    74.00  79/ 5/17/ 0    71.00  79/ 6/15/ 0    76.00  79/ 7/19/ 0    74.00  79/ 8/ 8/ 0    67.00  79/ 9/12/ 0    62.00
 79/11/ 1/ 0    61.00

TRIB  3 ...   FOLSOM INFLOW ALKALINITY                   TOTAL ALKALINITY
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0    20.00  79/ 5/31/ 0    13.00  79/ 7/28/ 0    19.00  79/11/ 1/ 0    19.00

TRIB  3 ...   FOLSOM INFLOW BOD                          CARBONACEOUS BOD
      TIME      VALUE      TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE       TIME      VALUE
 79/ 4/ 2/ 0     5.00  79/11/ 1/ 0     5.00
```

```
TRIB  3 ...   FOLSOM INFLOW AMMONIA                    AMMONIA AS N
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    0.01  79/ 5/31/ 0    0.09  79/ 7/19/ 0    0.02  79/ 7/28/ 0    0.00  79/ 8/ 8/ 0    0.01  79/11/ 1/ 0    0.01

TRIB  3 ...   FOLSOM INFLOW DO                         DISSOLVED OXYGEN, MG/L
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   10.70  79/ 5/17/ 0    9.40  79/ 5/31/ 0   10.60  79/ 6/15/ 0    9.10  79/ 7/19/ 0    9.50  79/ 7/28/ 0   10.00
 79/ 8/ 8/ 0    7.90  79/ 9/12/ 0    8.60  79/11/ 1/ 0   10.60

TRIB  4 ...  INFLOW = TOTAL LOCAL FLOW                 INFLOW RATE AS FRACTION OF LOCAL FLOW
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   -1.00  79/11/ 1/ 0   -1.00

TRIB  4 ...  SPRING CR. INFLOW                         TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   -5.00  79/ 7/ 8/ 0   -2.00  79/11/ 1/ 0   -7.00

TRIB  4 ...  SPRING CR. EC                             SPECIFIC CONDUCTANCE
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0  200.00  79/11/ 1/ 0  200.00

TRIB  4 ...  SPRING CR. ALKALINITY                     TOTAL ALKALINITY
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   55.00  79/11/ 1/ 0   55.00

TRIB  4 ...  SPRING CR. BOD                            CARBONACEOUS BOD
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    0.00  79/11/ 1/ 0    0.00

TRIB  4 ...  SPRING CR. NH3                            AMMONIA AS N
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    0.00  79/11/ 1/ 0    0.00

TRIB  4 ...  SPRING CR. DO                             DISSOLVED OXYGEN AS PERCENT SATURATION
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0  125.00  79/11/ 1/ 0  125.00

TRIB  5 ...  INFLOW = TOTAL LOCAL FLOW                 INFLOW RATE AS FRACTION OF LOCAL FLOW
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   -1.00  79/11/ 1/ 0   -1.00

TRIB  5 ...  COW CR. INFLOW                            TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    0.00  79/ 7/ 8/ 0   -2.00  79/11/ 1/ 0   -7.00

TRIB  5 ...  COW CR. EC                                SPECIFIC CONDUCTANCE
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0  200.00  79/11/ 1/ 0  200.00

TRIB  5 ...  COW CR. ALKALINITY                        TOTAL ALKALINITY
     TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0  100.00  79/11/ 1/ 0  100.00
```

```
TRIB  5 ...  COW CR. BOD                        CARBONACEOUS BOD
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/11/ 1/ 0     0.00

TRIB  5 ...  COW CR. NH3                        AMMONIA AS N
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/11/ 1/ 0     0.00

TRIB  5 ...  COW CR. DO                         DISSOLVED OXYGEN AS PERCENT SATURATION
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   135.00  79/11/ 1/ 0   135.00

TRIB  6 ...  INFLOW = TOTAL LOCAL FLOW          INFLOW RATE AS FRACTION OF LOCAL FLOW
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    -1.00  79/11/ 1/ 0    -1.00

TRIB  6 ...  COTTONWOOD CR. INFLOW              TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/ 7/ 8/ 0    -2.00  79/11/ 1/ 0    -7.00

TRIB  6 ...  COTTONWOOD CR. EC                  SPECIFIC CONDUCTANCE
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   200.00  79/11/ 1/ 0   200.00

TRIB  6 ...  COTTONWOOD CR. ALKALINITY          TOTAL ALKALINITY
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   100.00  79/11/ 1/ 0   100.00

TRIB  6 ...  COTTONWOOD CR. BOD                 CARBONACEOUS BOD
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/11/ 1/ 0     0.00

TRIB  6 ...  COTTONWOOD CR. NH3                 AMMONIA AS N
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/11/ 1/ 0     0.00

TRIB  6 ...  COTTONWOOD CR. DO                  DISSOLVED OXYGEN AS PERCENT SATURATION
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   135.00  79/11/ 1/ 0   135.00

TRIB  7 ...  INFLOW = TOTAL LOCAL FLOW          INFLOW RATE AS FRACTION OF LOCAL FLOW
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0    -1.00  79/11/ 1/ 0    -1.00

TRIB  7 ...  BATTLE CR. INFLOW                  TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0     0.00  79/ 7/ 8/ 0    -2.00  79/11/ 1/ 0    -7.00

TRIB  7 ...  BATTLE CR. EC                      SPECIFIC CONDUCTANCE
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   200.00  79/11/ 1/ 0   200.00

TRIB  7 ...  BATTLE CR. ALKALINITY              TOTAL ALKALINITY
     TIME      VALUE      TIME       VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE      TIME      VALUE
 79/ 4/ 2/ 0   100.00  79/11/ 1/ 0   100.00
```

```
TRIB  7 ...  BATTLE CR. BOD                         CARBONACEOUS BOD
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0      0.00  79/11/ 1/ 0      0.00

TRIB  7 ...  BATTLE CR. NH3                         AMMONIA AS N
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0      0.00  79/11/ 1/ 0      0.00

TRIB  7 ...  BATTLE CR. DO                        DISSOLVED OXYGEN AS PERCENT SATURATION
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0    135.00  79/11/ 1/ 0    135.00

TRIB  8 ...  INFLOW = TOTAL LOCAL FLOW            INFLOW RATE AS FRACTION OF LOCAL FLOW
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0     -1.00  79/11/ 1/ 0     -1.00

TRIB  8 ...  THOMES CR. INFLOW                    TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0      5.00  79/ 6/26/ 0      9.00  79/11/ 1/ 0      5.00

TRIB  8 ...  THOMES CR. EC                          SPECIFIC CONDUCTANCE
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0    350.00  79/11/ 1/ 0    350.00

TRIB  8 ...  THOMES CR. ALKALINITY                  TOTAL ALKALINITY
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0    350.00  79/11/ 1/ 0    350.00

TRIB  8 ...  THOMES CR. BOD                         CARBONACEOUS BOD
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0     10.00  79/ 6/ 2/ 0     20.00  79/10/ 2/ 0     20.00  79/11/ 1/ 0     10.00

TRIB  8 ...  THOMES CR. NH3                         AMMONIA AS N
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0      0.05  79/11/ 1/ 0      0.05

TRIB  8 ...  THOMES CR. DO                        DISSOLVED OXYGEN AS PERCENT SATURATION
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0    135.00  79/11/ 1/ 0    135.00

TRIB  9 ...  INFLOW = TOTAL LOCAL FLOW            INFLOW RATE AS FRACTION OF LOCAL FLOW
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0     -1.00  79/11/ 1/ 0     -1.00

TRIB  9 ...  BYPASSED FEATHER RIVER                          TEMPERATURE, C
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0     13.90  79/ 4/19/ 0     14.40  79/ 5/17/ 0     17.80  79/ 7/19/ 0     15.60  79/ 8/16/ 0     15.60  79/ 9/20/ 0     12.20
 79/11/ 1/ 0     12.20

TRIB  9 ...  BYPASSED FEATHER RIVER EC              SPECIFIC CONDUCTANCE
      TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE       TIME       VALUE
 79/ 4/ 2/ 0     68.00  79/ 4/19/ 0     68.00  79/ 5/17/ 0     64.00  79/ 7/19/ 0     65.00  79/ 8/16/ 0     65.00  79/11/ 1/ 0     51.00
```

TRIB 9 ... BYPASSED FEATHER RIVER ALKALINITY — TOTAL ALKALINITY

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	40.00	79/11/ 1/ 0	50.00						

TRIB 9 ... BYPASSED FEATHER RIVER BOD — CARBONACEOUS BOD

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.50	79/11/ 1/ 0	0.50						

TRIB 9 ... BYPASSED FEATHER RIVER AMMONIA — AMMONIA AS N

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.03	79/ 5/17/ 0	0.01	79/ 7/19/ 0	0.00	79/11/ 1/ 0	0.00		

TRIB 9 ... BYPASSED FEATHER RIVER DISSOLVED OXYGENDISSOLVED OXYGEN, MG/L

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	10.00	79/ 4/19/ 0	10.00	79/ 5/17/ 0	9.20	79/ 7/19/ 0	8.60	79/ 8/16/ 0	7.60
79/ 9/20/ 0	6.20								
79/11/ 1/ 0	6.20								

TRIB 10 ... INFLOW = TOTAL LOCAL FLOW — INFLOW RATE AS FRACTION OF LOCAL FLOW

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00						

TRIB 10 ... YUBA RIVER — TEMPERATURE, C

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	11.00	79/ 4/25/ 0	13.50	79/ 5/25/ 0	15.50	79/ 6/22/ 0	18.00	79/ 7/27/ 0	16.50
79/ 8/24/ 0	11.50								
79/ 9/21/ 0	15.50	79/11/ 1/ 0	15.50						

TRIB 10 ... YUBA RIVER EC — SPECIFIC CONDUCTANCE

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	87.00	79/ 4/25/ 0	92.00	79/ 5/24/ 0	72.00	79/ 6/22/ 0	78.00	79/ 7/27/ 0	74.00
79/ 8/24/ 0	76.00								
79/ 9/21/ 0	76.00	79/11/ 1/ 0	76.00						

TRIB 10 ... YUBA RIVER ALKALINITY — TOTAL ALKALINITY

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	34.00	79/ 4/25/ 0	36.00	79/ 5/24/ 0	29.00	79/ 6/22/ 0	31.00	79/ 7/27/ 0	31.00
79/ 8/24/ 0	31.00								
79/ 9/21/ 0	32.00	79/11/ 1/ 0	32.00						

TRIB 10 ... YUBA RIVER BOD — CARBONACEOUS BOD

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	10.00	79/11/ 1/ 0	10.00						

TRIB 10 ... YUBA RIVER AMMONIA — AMMONIA AS N

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.01	79/ 4/25/ 0	0.00	79/ 5/24/ 0	0.02	79/ 6/22/ 0	0.00	79/ 7/27/ 0	0.00
79/ 8/24/ 0	0.02								
79/ 9/22/ 0	0.00	79/11/ 1/ 0	0.00						

TRIB 10 ... YUBA RIVER DO — DISSOLVED OXYGEN, MG/L

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	11.00	79/ 4/25/ 0	10.80	79/ 5/24/ 0	10.00	79/ 6/22/ 0	9.50	79/ 7/27/ 0	9.90
79/ 8/24/ 0	9.90								
79/ 9/21/ 0	10.30	79/11/ 1/ 0	10.30						

TRIB 11 ... INFLOW = TOTAL LOCAL FLOW — INFLOW RATE AS FRACTION OF LOCAL FLOW

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00						

TRIB 11 ... BEAR RIVER — TEMPERATURE, C

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	13.50	79/ 4/25/ 0	14.50	79/ 5/24/ 0	21.00	79/ 6/22/ 0	24.00	79/ 7/27/ 0	25.50	79/ 8/24/ 0	25.50
79/ 9/21/ 0	19.00	79/11/ 1/ 0	19.00								

TRIB 11 ... BEAR RIVER EC — SPECIFIC CONDUCTANCE

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	91.00	79/ 4/25/ 0	89.00	79/ 5/24/ 0	82.00	79/ 6/22/ 0	210.00	79/ 7/27/ 0	174.00	79/ 8/24/ 0	199.00
79/ 9/21/ 0	190.00	79/11/ 1/ 0	190.00								

TRIB 11 ... BEAR RIVER ALKALINITY — TOTAL ALKALINITY

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	30.00	79/ 4/25/ 0	28.00	79/ 5/24/ 0	26.00	79/ 6/22/ 0	67.00	79/ 7/27/ 0	63.00	79/ 8/24/ 0	75.00
79/ 9/21/ 0	74.00	79/11/ 1/ 0	74.00								

TRIB 11 ... BEAR RIVER BOD — CARBONACEOUS BOD

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	10.00	79/11/ 1/ 0	10.00								

TRIB 11 ... BEAR RIVER AMMONIA — AMMONIA AS N

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.35	79/11/ 1/ 0	0.35								

TRIB 11 ... BEAR RIVER DO — DISSOLVED OXYGEN, MG/L

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	11.00	79/ 4/25/ 0	9.70	79/ 5/24/ 0	8.30	79/ 6/22/ 0	8.80	79/ 8/24/ 0	9.90	79/ 9/21/ 0	8.40
79/11/ 1/ 0	8.40										

INGATE BLANK COMMON = 41582

***** CALIBRATION MODE ***** GATE SPECIFICATIONS *****

START TIME (YRMODA) 790401   END TIME (YRMODA) 791031

RES I.D.	START TIME	END TIME	SPILLWAY CFS	FLOOD CONTROL CFS	WET WELL 1 FLOW CFS	WET WELL 1 GATE NO	WET WELL 2 FLOW CFS	WET WELL 2 GATE NO
1	790401	791031	0.00	0.00	1.00	1.	0.00	0.
3	790401	791031	0.00	0.00	1.00	1.	0.00	0.
13	790401	791031	0.00	0.00	1.00	4.	1.00	4.
20	790401	-791031	0.00	0.00	1.00	1.	0.00	0.

*RTCOF

```
ROUTING COEFFICIENTS FROM RES       1 TO MY
MY=      2 1.0000
MY=      3 1.0000
MY=      4 0.2857 0.5102 0.1458 0.0416 0.0119 0.0034
MY=      5 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
MY=      6 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
MY=      7 0.0233 0.1249 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014

MY=      8 0.0067 0.0476 0.1411 0.2285 0.2302 0.1640 0.0950 0.0478 0.0212 0.0083
           0.0029
MY=      9 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
           0.0119 0.0048 0.0017
MY=     10 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
           0.0119 0.0048 0.0017
MY=     11 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
           0.0119 0.0048 0.0017
MY=     12 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
           0.0119 0.0048 0.0017
MY=     19 0.0005 0.0058 0.0277 0.0773 0.1426 0.1869 0.1854 0.1479 0.1001 0.0595
           0.0317 0.0153 0.0068 0.0028 0.0010
MY=     22 0.0002 0.0019 0.0110 0.0371 0.0845 0.1386 0.1727 0.1710 0.1408 0.1001
           0.0630 0.0358 0.0185 0.0088 0.0039 0.0016
MY=     23 0.0000 0.0006 0.0041 0.0165 0.0447 0.0886 0.1341 0.1612 0.1596 0.1345
           0.0993 0.0655 0.0392 0.0215 0.0109 0.0052 0.0023
```

```
ROUTING COEFFICIENTS FROM RES      13 TO MY
MY=     14 1.0000
MY=     15 0.2857 0.5102 0.1458 0.0416 0.0119 0.0034
MY=     16 0.2857 0.5102 0.1458 0.0416 0.0119 0.0034
MY=     17 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
MY=     18 0.0233 0.1249 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014

MY=     19 0.0067 0.0476 0.1411 0.2285 0.2302 0.1640 0.0950 0.0478 0.0212 0.0083
           0.0029
MY=     22 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
           0.0119 0.0048 0.0017
MY=     23 0.0005 0.0058 0.0277 0.0773 0.1426 0.1869 0.1854 0.1479 0.1001 0.0595
           0.0317 0.0153 0.0068 0.0028 0.0010

ROUTING COEFFICIENTS FROM RES      20 TO MY
MY=     21 0.2857 0.5102 0.1458 0.0416 0.0119 0.0034
MY=     22 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
MY=     23 0.0233 0.1249 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014

INTERPOLATION OF RESERVOIR LEVELS (RL CARDS) WAS USED,
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RESERVOIR MODEL RESULTS

RESERVOIR NO 1 .. CONTROL POINT 1

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5
	EVAPORATION RATE, AC.FT./DAY	6.86

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
1	8839.8	3.2	120.0	55.00	0.00	0.00	0.96	0.00	13.4

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	6232.9	5.9	129.0	45.96	0.00	0.00	0.08	0.00	5.6
TOTAL OUTFLOW	6232.9	5.9	129.0	45.95	0.00	0.00	0.08	0.00	5.6

RESERVOIR INFORMATION	WATER SURFACE ELEVATION, FT	1048.27
	RESERVOIR SURFACE AREA, AC	28161.
	RESERVOIR STORAGE VOLUME, ACFT	4270990.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
5.0	17.1	131.6	46.14	0.00	0.00	0.03	0.00	9.4
15.0	13.3	129.8	45.57	0.00	0.00	0.03	0.00	7.4
25.0	9.2	129.3	45.77	0.00	0.00	0.05	0.00	5.8
35.0	8.0	128.6	46.45	0.00	0.00	0.09	0.00	6.1
45.0	7.4	128.4	46.64	0.00	0.00	0.09	0.00	6.2
55.0	7.3	128.4	46.56	0.00	0.00	0.09	0.00	6.1
65.0	7.2	128.6	46.44	0.00	0.00	0.08	0.00	6.0
75.0	7.2	128.7	46.31	0.00	0.00	0.07	0.00	5.9
85.0	7.1	128.8	46.20	0.00	0.00	0.07	0.00	5.8
95.0	7.1	128.9	46.11	0.00	0.00	0.06	0.00	5.8
105.0	7.0	129.0	46.03	0.00	0.00	0.06	0.00	5.7
115.0	6.8	129.0	45.99	0.00	0.00	0.06	0.00	5.7
125.0	6.7	129.0	46.00	0.00	0.00	0.07	0.00	5.7
135.0	6.5	129.0	46.04	0.00	0.00	0.07	0.00	5.7
145.0	6.4	128.9	46.14	0.00	0.00	0.08	0.00	5.8

155.0	6.3	128.8	46.19	0.00	0.00	0.09	0.00	5.8
165.0	6.2	128.8	46.21	0.00	0.00	0.09	0.00	5.8
175.0	6.1	128.8	46.20	0.00	0.00	0.09	0.00	5.8
185.0	6.0	128.8	46.18	0.00	0.00	0.09	0.00	5.8
195.0	5.9	128.8	46.15	0.00	0.00	0.09	0.00	5.7
205.0	5.9	128.9	46.12	0.00	0.00	0.09	0.00	5.7
215.0	5.8	128.9	46.08	0.00	0.00	0.08	0.00	5.7
225.0	5.7	129.0	46.02	0.00	0.00	0.08	0.00	5.6
235.0W1	5.7	129.1	45.90	0.00	0.00	0.07	0.00	5.5
245.0	5.7	129.2	45.80	0.00	0.00	0.06	0.00	5.5
255.0	5.6	129.3	45.73	0.00	0.00	0.06	0.00	5.4
265.0	5.6	129.3	45.68	0.00	0.00	0.05	0.00	5.4
275.0	5.6	129.4	45.64	0.00	0.00	0.05	0.00	5.4
285.0	5.6	129.4	45.61	0.00	0.00	0.05	0.00	5.3
295.0	5.6	129.4	45.57	0.00	0.00	0.05	0.00	5.3
305.0	5.6	129.5	45.54	0.00	0.00	0.05	0.00	5.3
315.0	5.6	129.5	45.51	0.00	0.00	0.05	0.00	5.3
325.0	5.6	129.5	45.48	0.00	0.00	0.05	0.00	5.2
335.0	5.6	129.5	45.46	0.00	0.00	0.05	0.00	5.2
345.0	5.6	129.6	45.45	0.00	0.00	0.05	0.00	5.2
355.0	5.6	129.6	45.43	0.00	0.00	0.04	0.00	5.2
365.0	5.6	129.6	45.42	0.00	0.00	0.04	0.00	5.2
375.0	5.6	129.6	45.41	0.00	0.00	0.04	0.00	5.2
385.0	5.6	129.6	45.39	0.00	0.00	0.04	0.00	5.1
395.0	5.6	129.6	45.37	0.00	0.00	0.04	0.00	5.1
405.0	5.6	129.7	45.32	0.00	0.00	0.04	0.00	5.1
415.0	5.7	129.8	45.20	0.00	0.00	0.03	0.00	5.0

RESERVOIR MODEL RESULTS

RESERVOIR NO 2 .. CONTROL POINT 3

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA		
	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5
	EVAPORATION RATE, AC.FT./DAY	0.07

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
50	6717.9	6.6	134.2	46.60	0.00	0.00	0.07	0.00	6.4

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	6717.8	6.9	132.2	46.18	0.00	0.00	0.06	0.00	6.2
TOTAL OUTFLOW	6717.8	6.9	132.2	46.18	0.00	0.00	0.06	0.00	6.2

RESERVOIR INFORMATION		
	WATER SURFACE ELEVATION, FT	569.70
	RESERVOIR SURFACE AREA, AC	285.
	RESERVOIR STORAGE VOLUME, ACFT	22000.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
5.0	8.3	134.4	46.57	0.00	0.00	0.06	0.00	6.8
15.0	7.4	134.4	46.57	0.00	0.00	0.06	0.00	6.5
25.0	7.1	134.4	46.57	0.00	0.00	0.06	0.00	6.5
35.0	7.0	134.6	46.59	0.00	0.00	0.06	0.00	6.4
45.0	6.9	134.5	46.58	0.00	0.00	0.06	0.00	6.4
55.0W1	6.9	134.0	46.50	0.00	0.00	0.06	0.00	6.4
65.0	6.9	133.2	46.38	0.00	0.00	0.06	0.00	6.3
75.0	6.8	132.5	46.27	0.00	0.00	0.06	0.00	6.2
85.0	6.6	131.3	46.08	0.00	0.00	0.06	0.00	6.0
95.0	6.4	130.3	45.88	0.00	0.00	0.06	0.00	5.9
105.0	6.2	129.1	45.55	0.00	0.00	0.06	0.00	5.7
115.0	6.1	127.1	44.75	0.00	0.00	0.05	0.00	5.6
125.0	5.9	123.9	43.38	0.00	0.00	0.04	0.00	5.4

RESERVOIR MODEL RESULTS

RESERVOIR NO 3 .. CONTROL POINT 13

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA		
	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5
	EVAPORATION RATE, AC.FT./DAY	14.87

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
2	7803.9	13.2	61.5	150.00	0.00	0.00	3.42	0.00	9.9

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	1781.0	12.9	61.9	82.36	0.00	0.00	0.68	0.00	8.3
WET WELL NO 2	1781.0	14.6	61.9	78.71	0.00	0.00	0.52	0.00	8.6
TOTAL OUTFLOW	3561.9	13.8	61.9	80.53	0.00	0.00	0.60	0.00	8.5

RESERVOIR INFORMATION		
	WATER SURFACE ELEVATION, FT	884.25
	RESERVOIR SURFACE AREA, AC	15389.
	RESERVOIR STORAGE VOLUME, ACFT	3297820.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
7.0W2	16.1	62.0	70.43	0.00	0.00	0.28	0.00	9.0
21.0	13.9	61.9	89.64	0.00	0.00	0.76	0.00	8.3
35.0W1	12.6	61.9	87.82	0.00	0.00	0.78	0.00	8.2
49.0	12.2	61.9	81.14	0.00	0.00	0.70	0.00	8.3
63.0	11.7	62.0	51.60	0.00	0.00	0.12	0.00	8.3
77.0	11.5	62.0	46.36	0.00	0.00	0.05	0.00	8.3
91.0	11.4	62.0	43.81	0.00	0.00	0.02	0.00	8.2
105.0	11.0	62.0	41.59	0.00	0.00	0.01	0.00	7.8
119.0	10.2	62.0	40.32	0.00	0.00	0.00	0.00	7.3
133.0	9.4	62.0	40.05	0.00	0.00	0.00	0.00	6.9
147.0	8.9	62.0	40.01	0.00	0.00	0.00	0.00	6.6
161.0	8.4	62.0	40.00	0.00	0.00	0.00	0.00	6.3
175.0	8.0	62.0	40.00	0.00	0.00	0.00	0.00	6.0
189.0	7.6	62.0	40.00	0.00	0.00	0.00	0.00	5.8
203.0	7.3	62.0	40.00	0.00	0.00	0.00	0.00	5.4

217.0	7.0	62.0	40.00	0.00	0.00	0.00	0.00	5.1
231.0	6.9	62.0	40.00	0.00	0.00	0.00	0.00	4.9
245.0	6.8	62.0	40.00	0.00	0.00	0.00	0.00	4.7
259.0	6.8	62.0	40.00	0.00	0.00	0.00	0.00	4.5
273.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	4.3
287.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	4.1
301.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.9
315.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.7
329.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.6
343.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.4
357.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.3
371.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.1
385.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	3.0
399.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.9
413.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.7
427.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.6
441.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.4
455.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.3
469.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.2
483.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	2.0
497.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.9
511.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.8
525.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.6
539.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.5
553.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.4
567.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.2
581.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.1
595.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	1.0
609.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	0.9
623.0	6.7	62.0	40.00	0.00	0.00	0.00	0.00	0.8

RESERVOIR MODEL RESULTS

RESERVOIR NO 4 .. CONTROL POINT 20

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA		
	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5
	EVAPORATION RATE, AC.FT./DAY	77.29

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
3	6279.9	10.9	72.1	16.62	0.00	0.00	3.42	0.01	9.9

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	2448.0	9.2	71.5	19.50	0.00	0.00	0.55	0.01	9.1
TOTAL OUTFLOW	2448.0	9.2	71.5	19.50	0.00	0.00	0.55	0.01	9.1

RESERVOIR INFORMATION		
	WATER SURFACE ELEVATION, FT	461.82
	RESERVOIR SURFACE AREA, AC	11157.
	RESERVOIR STORAGE VOLUME, ACFT	963353.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
3.5	16.3	70.5	20.15	0.00	0.00	0.00	0.01	10.4
10.5	16.3	70.5	20.15	0.00	0.00	0.00	0.01	10.4
17.5	15.7	70.4	20.10	0.00	0.00	0.00	0.01	10.7
24.5	14.1	70.2	20.03	0.00	0.00	0.02	0.01	10.9
31.5	13.0	70.2	19.96	0.00	0.00	0.06	0.01	10.9
38.5	12.1	70.3	19.82	0.00	0.00	0.18	0.01	10.8
45.5	11.5	70.6	19.49	0.00	0.00	0.48	0.01	10.5
52.5	11.0	71.0	18.91	0.00	0.00	1.03	0.01	10.1
59.5	10.7	71.2	18.70	0.00	0.00	1.21	0.01	9.8
66.5	10.6	71.3	18.70	0.00	0.00	1.21	0.01	9.8
73.5	10.4	71.3	18.90	0.00	0.00	1.00	0.01	9.7
80.5	10.3	71.3	19.00	0.00	0.00	0.89	0.01	9.6
87.5	10.1	71.3	19.07	0.00	0.00	0.82	0.01	9.5
94.5	10.0	71.4	19.13	0.00	0.00	0.77	0.01	9.4
101.5	9.8	71.4	19.19	0.00	0.00	0.72	0.01	9.3
108.5	9.7	71.4	19.25	0.00	0.00	0.68	0.01	9.3

115.5	9.6	71.4	19.30	0.00	0.00	0.64	0.01	9.2
122.5	9.5	71.5	19.35	0.00	0.00	0.61	0.01	9.2
129.5	9.4	71.5	19.40	0.00	0.00	0.58	0.01	9.1
136.5	9.3	71.5	19.44	0.00	0.00	0.55	0.01	9.1
143.5	9.2	71.5	19.48	0.00	0.00	0.52	0.01	9.0
150.5	9.1	71.6	19.52	0.00	0.00	0.50	0.01	9.0
157.5W1	9.0	71.6	19.56	0.00	0.00	0.48	0.01	9.0
164.5	9.0	71.6	19.59	0.00	0.00	0.46	0.01	9.0
171.5	8.9	71.6	19.63	0.00	0.00	0.44	0.01	8.9
178.5	8.8	71.6	19.66	0.00	0.00	0.43	0.01	8.9
185.5	8.7	71.6	19.69	0.00	0.00	0.41	0.01	8.9
192.5	8.7	71.6	19.71	0.00	0.00	0.40	0.01	8.9
199.5	8.7	71.6	19.72	0.00	0.00	0.40	0.01	8.9
206.5	8.6	71.6	19.73	0.00	0.00	0.39	0.01	8.9
213.5	8.6	71.6	19.74	0.00	0.00	0.38	0.01	8.9
220.5	8.6	71.6	19.75	0.00	0.00	0.38	0.01	8.9
227.5	8.6	71.6	19.76	0.00	0.00	0.38	0.01	8.9
234.5	8.6	71.6	19.76	0.00	0.00	0.37	0.01	8.9

STREAM MODEL RESULTS

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA (MET.ZONE 1)	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5

RESERVOIR RELEASES

RESERVOIR NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
1	6232.9	5.9	129.00	45.95	0.00	0.00	0.08	0.00	5.6
3	6717.9	6.9	132.24	46.18	0.00	0.00	0.06	0.00	6.2
13	3562.0	13.8	61.92	80.53	0.00	0.00	0.60	0.00	8.5
20	2448.0	9.2	71.55	19.50	0.00	0.00	0.55	0.01	9.1

LOCAL FLOWS AND WATER QUALITY

C.P. NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
2	485.0	13.2	200.00	55.00	0.00	0.00	0.00	0.00	13.2
4	610.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
5	897.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
6	510.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
8	410.0	23.7	350.00	350.00	0.00	0.00	10.03	0.01	11.6
14	89.0	15.8	66.36	41.34	0.00	0.00	0.34	0.00	9.7
15	400.0	15.8	66.36	41.34	0.00	0.00	0.34	0.00	9.7
17	581.0	13.9	88.21	34.67	0.00	0.00	6.84	0.00	10.6
18	356.0	15.7	87.67	27.62	0.00	0.00	6.84	0.08	9.4

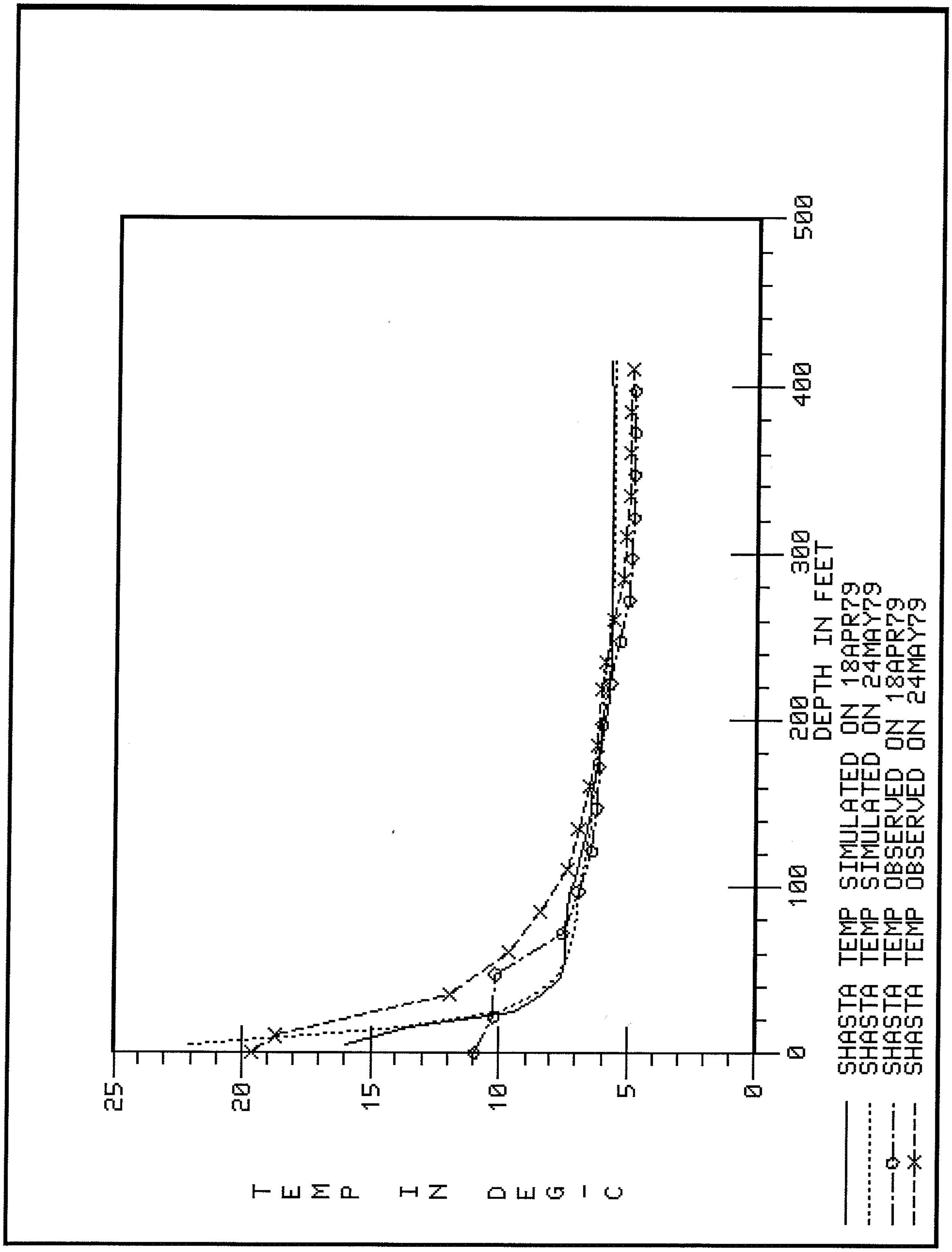
STREAM WATER QUALITY

LOCATION	C.P./TRIB	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L	MEAN FLOW CFS	W/S ELEV. FT	TIME DAYS
302.85	1 / 0	6.0	129.00	45.94	0.00	0.00	0.08	0.00	5.7	6232.9	493.2	0.05
300.95	2 / 4	6.6	134.17	46.60	0.00	0.00	0.07	0.00	6.4	6717.9	491.5	0.05
292.25	3 / 0	7.2	132.02	46.15	0.00	0.00	0.06	0.00	7.0	6717.9	475.7	0.13
287.59		7.5	131.86	46.12	0.00	0.00	0.06	0.00	7.5	6622.1	458.1	0.22
282.93		7.7	131.72	46.10	0.00	0.00	0.06	0.00	8.0	6526.3	429.6	0.31
278.27	4 / 5	8.8	137.56	50.78	0.00	0.00	0.06	0.00	8.8	7040.5	395.2	0.40
274.77	4 / 0	8.9	137.51	50.79	0.00	0.00	0.06	0.00	8.9	6689.7	374.2	0.44
272.44	5 / 6	9.9	144.81	56.59	0.00	0.00	0.05	0.00	9.5	7655.7	365.5	0.04
268.95	5 / 7	10.4	147.09	58.86	0.00	0.00	0.05	0.00	9.7	8234.7	354.2	0.12
264.29	6 / 0	10.6	147.06	58.90	0.00	0.00	0.05	0.00	9.8	8234.7	336.0	0.09
259.63	6 / 0	10.4	142.64	57.19	0.00	0.00	0.04	0.00	9.7	8234.7	313.8	0.19
254.97		10.6	142.64	57.24	0.00	0.00	0.04	0.00	9.8	8337.3	295.7	0.28
250.31		10.8	142.65	57.28	0.00	0.00	0.04	0.00	9.9	8439.9	279.6	0.36
245.65	7 / 0	10.9	142.66	57.33	0.00	0.00	0.04	0.00	10.0	8542.6	262.2	0.46
240.99	7 / 0	11.1	142.68	57.39	0.00	0.00	0.04	0.00	10.1	7906.2	249.0	0.57

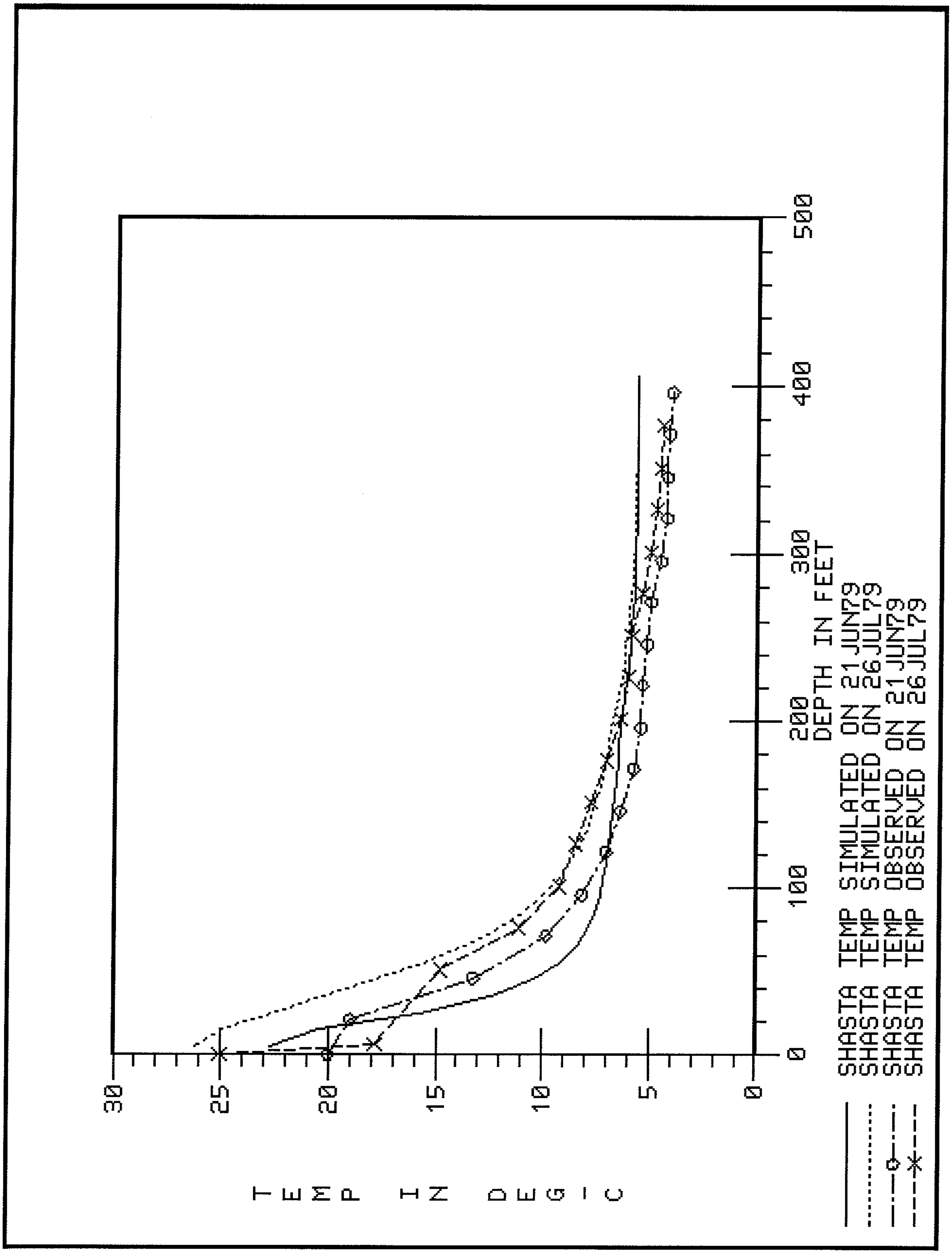
10.95	18 /11	13.6	51.15	30.20	0.00	0.00	2.61	0.00	10.0	2722.8	21.6	3.54
6.57	18 / 0	13.9	51.54	30.32	0.00	0.00	2.60	0.00	9.9	2796.5	16.0	3.75
2.19	19 / 0	14.2	52.04	30.44	0.00	0.00	2.54	0.00	9.9	2833.2	14.4	0.49
78.16	19 / 0	14.2	59.12	64.45	0.00	0.00	1.15	0.00	9.9	9737.6	11.6	0.63
74.05		14.3	59.12	64.15	0.00	0.00	1.14	0.00	9.9	9680.0	8.7	0.77
69.93		14.4	59.12	63.82	0.00	0.00	1.13	0.00	9.9	9622.4	8.6	0.93
65.81		14.5	59.11	63.45	0.00	0.00	1.12	0.00	10.3	9564.8	8.6	1.13
61.70	22 / 0	14.6	59.08	63.05	0.00	0.00	1.10	0.00	10.7	9507.3	5.2	1.34
27.26	20 / 0	9.3	71.55	19.50	0.00	0.00	0.55	0.01	9.3	2448.0	108.6	0.04
24.73		9.5	71.55	19.50	0.00	0.00	0.55	0.00	9.5	2479.7	96.2	0.09
22.20	21 / 0	9.9	71.55	19.50	0.00	0.00	0.55	0.00	9.7	2511.4	84.3	0.17
18.84	21 / 0	10.4	71.55	19.50	0.00	0.00	0.55	0.00	10.0	2543.1	71.9	0.32
14.65		10.8	71.55	19.50	0.00	0.00	0.55	0.00	10.2	2528.0	53.0	0.45
10.46		11.3	71.55	19.51	0.00	0.00	0.55	0.00	10.4	2513.0	35.7	0.62
6.28		11.7	71.55	19.51	0.00	0.00	0.54	0.00	10.4	2498.0	23.0	0.77
2.09	22 / 0	12.1	71.55	19.51	0.00	0.00	0.54	0.00	10.4	2482.9	12.2	0.91
58.31	22 / 0	10.2	71.55	19.50	0.00	0.00	0.55	0.00	10.4	11917.6	1.0	1.04
55.64		10.2	71.55	19.51	0.00	0.00	0.55	0.00	10.4	11837.3	0.0	1.20
52.97		10.3	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11757.1	0.0	1.35
50.30		10.4	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11676.8	0.0	1.48
47.63		10.5	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11596.6	0.0	1.61
44.96		10.6	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11516.4	0.0	1.73
42.29		10.7	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11436.1	0.0	1.85
39.62	23 / 0	10.8	71.55	19.51	0.00	0.00	0.54	0.00	10.4	11355.9	0.0	1.97

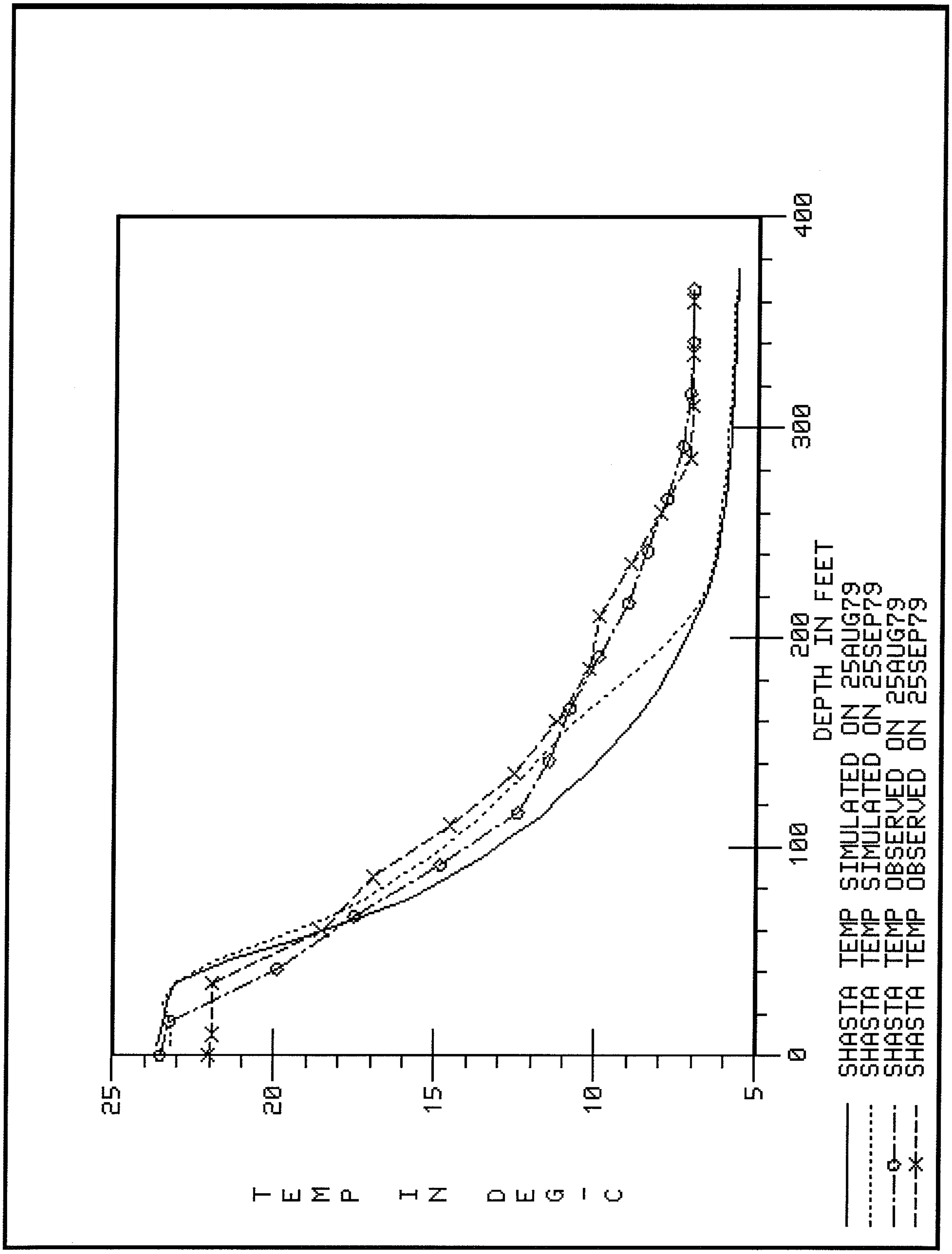
APPENDIX C

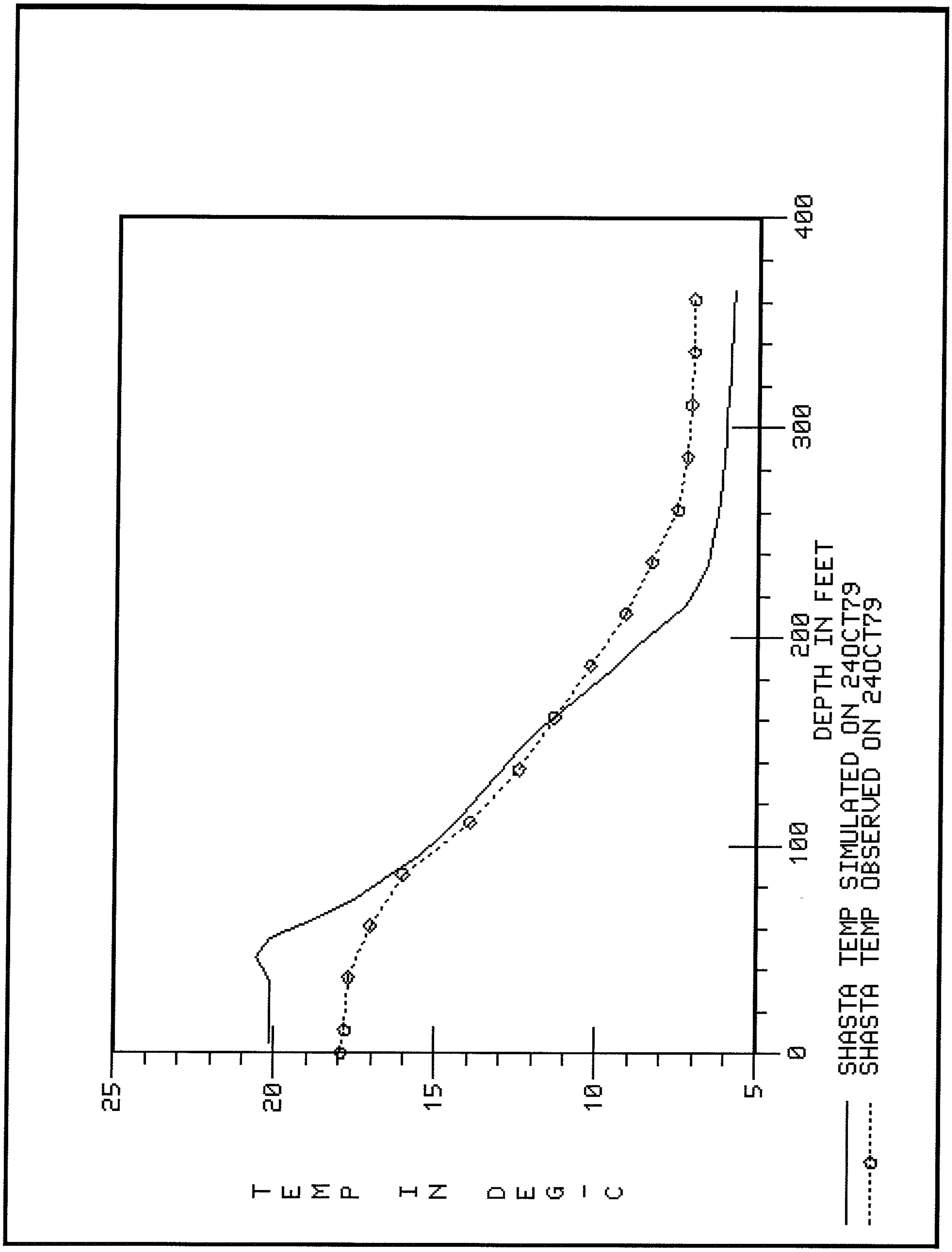
Graphical Displays of Sacramento River System Water Quality Modeling

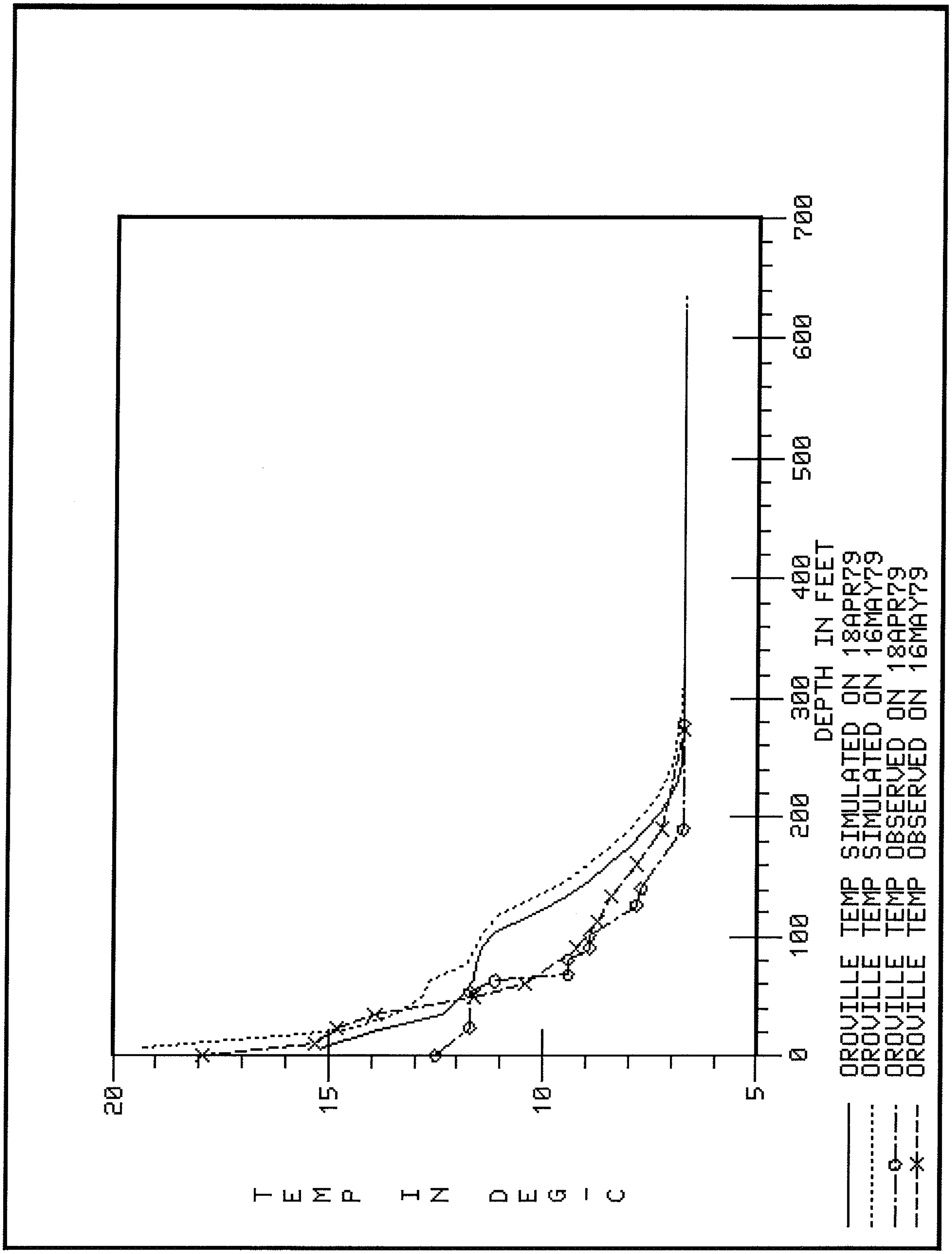


TEMP IN DEG C
25
20
15
10
5
0
0
100
200
300
400
500
DEPTH IN FEET
SHASTA TEMP SIMULATED ON 18APR79
SHASTA TEMP SIMULATED ON 24MAY79
SHASTA TEMP OBSERVED ON 18APR79
SHASTA TEMP OBSERVED ON 24MAY79

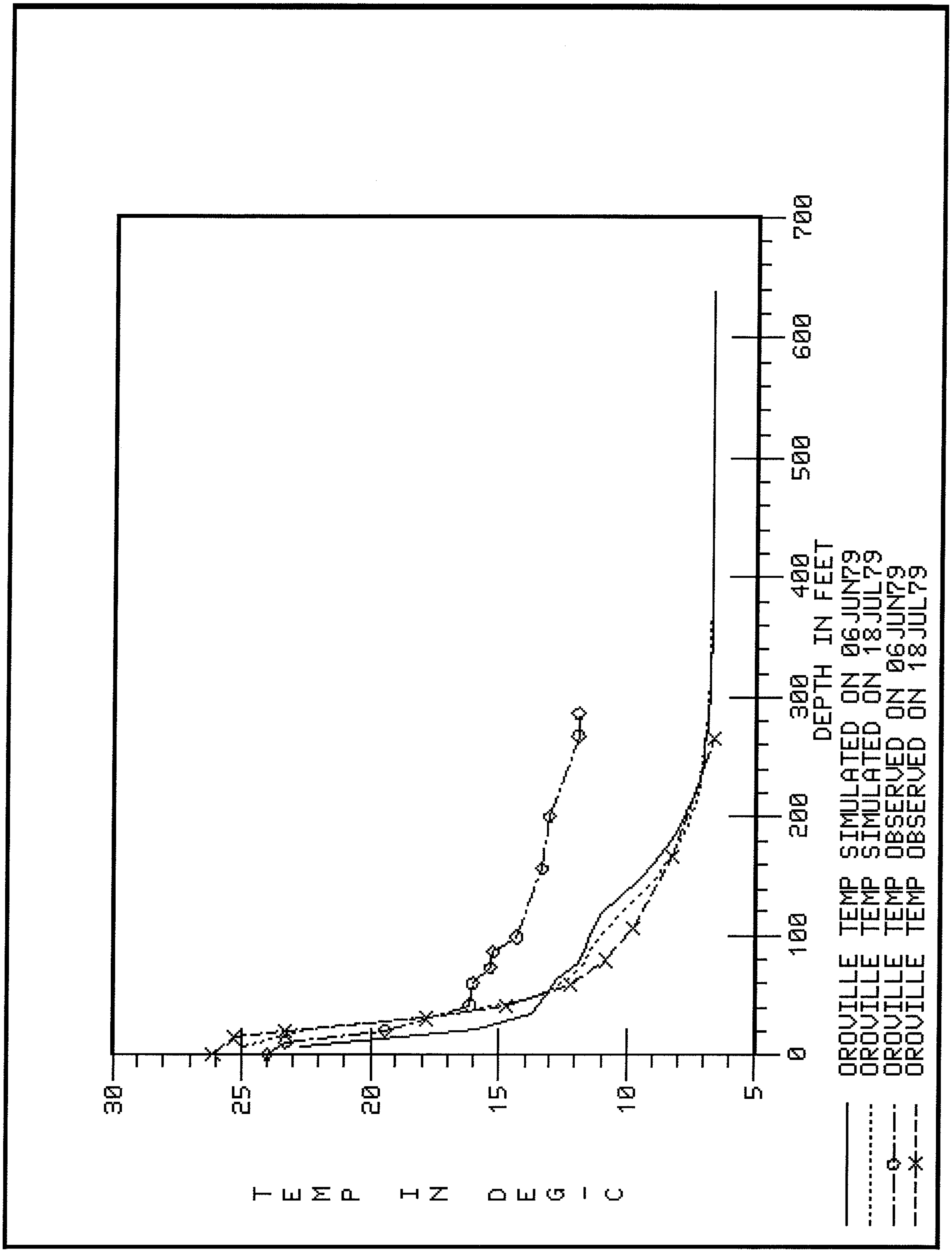

TEMP IN DEG-C
30
25
20
15
10
5
0
0
100
200
300
400
500
DEPTH IN FEET
SHASTA TEMP SIMULATED ON 21JUN79
SHASTA TEMP SIMULATED ON 26JUL79
SHASTA TEMP OBSERVED ON 21JUN79
SHASTA TEMP OBSERVED ON 26JUL79

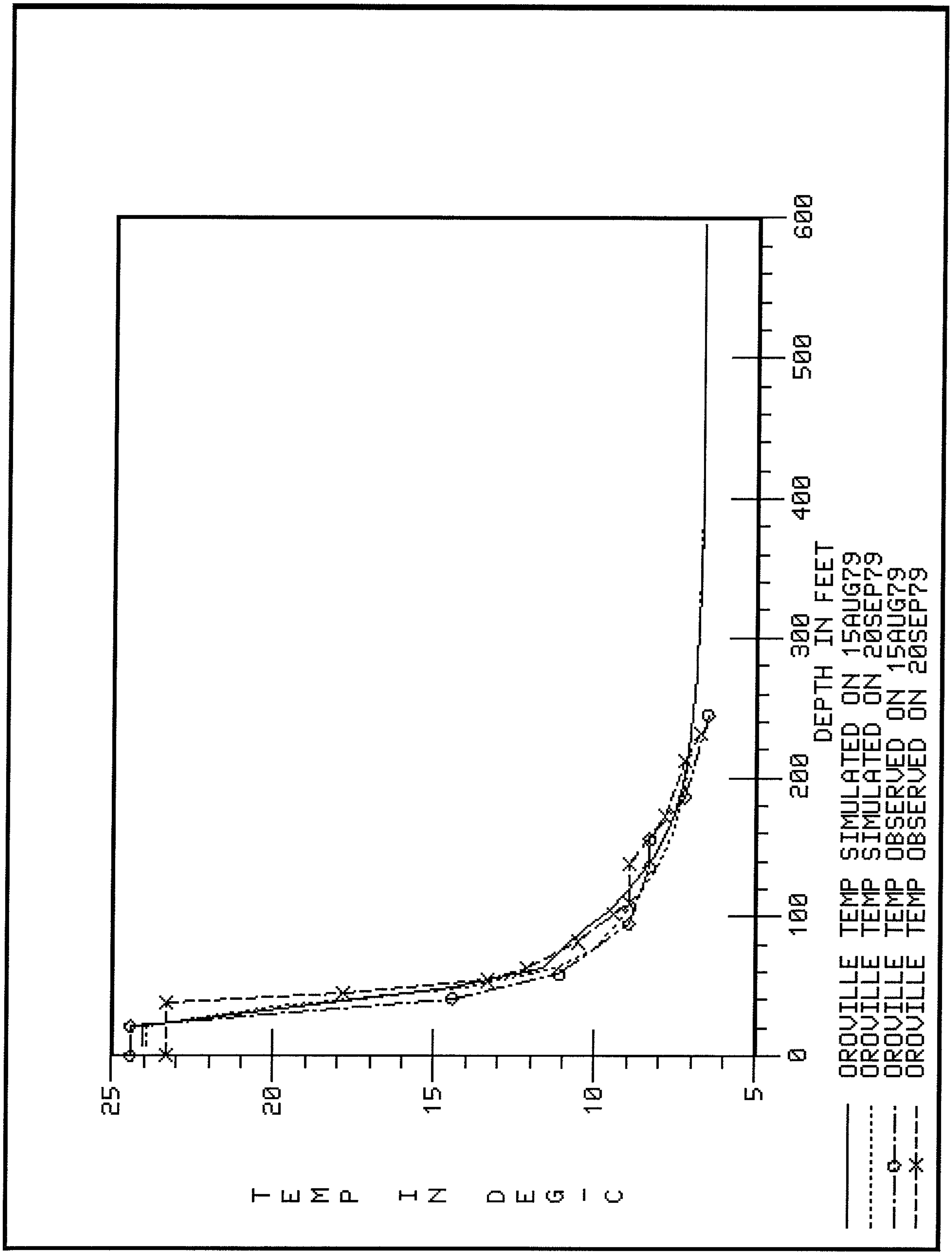

TEMP IN DEG C
DEPTH IN FEET
25
20
15
10
5
0
100
200
300
400
SHASTA TEMP SIMULATED ON 25AUG79
SHASTA TEMP SIMULATED ON 25SEP79
SHASTA TEMP OBSERVED ON 25AUG79
SHASTA TEMP OBSERVED ON 25SEP79

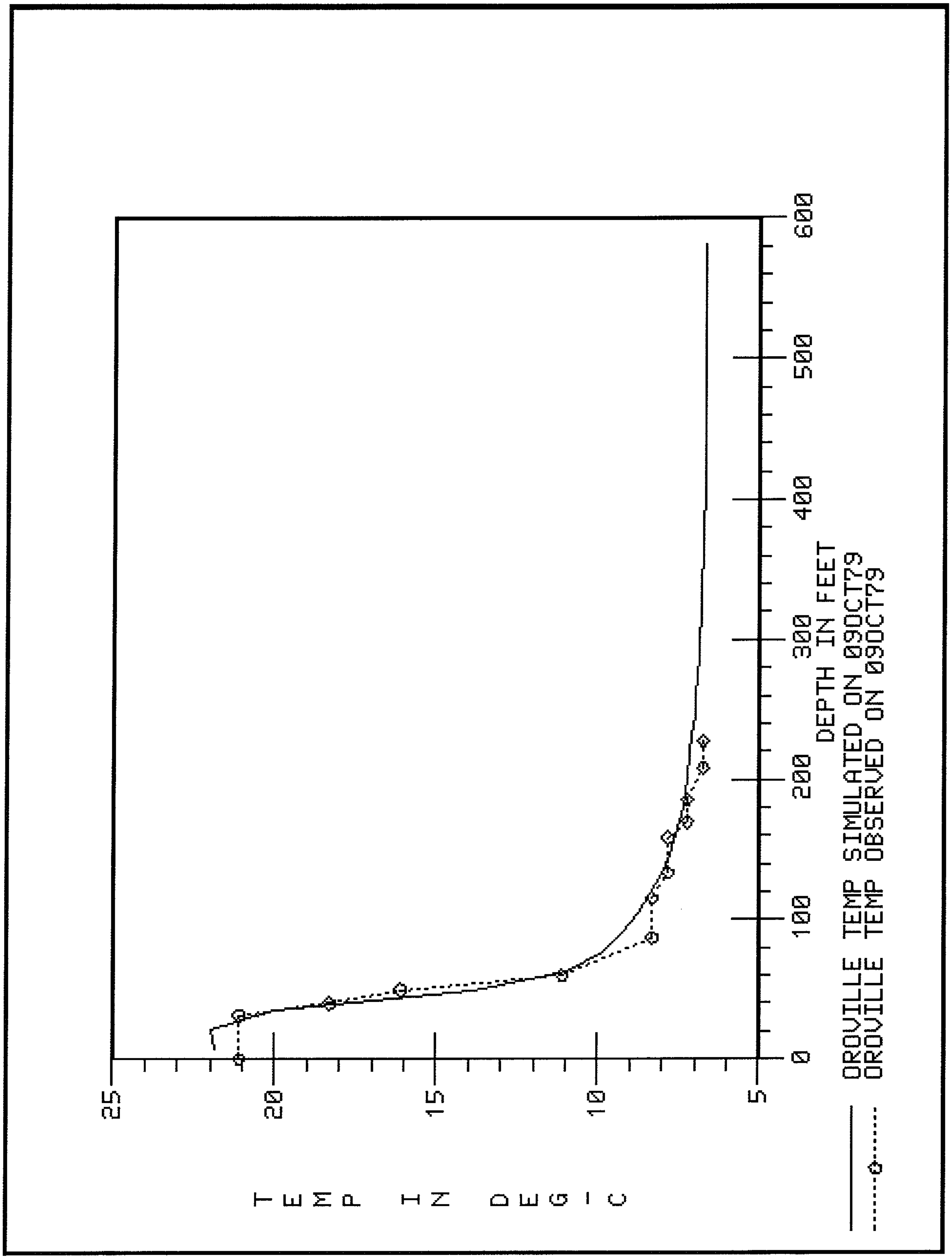

TEMP IN DEG-C
25
20
15
10
5
0
100
200
300
400
DEPTH IN FEET
SHASTA TEMP SIMULATED ON 24OCT79
SHASTA TEMP OBSERVED ON 24OCT79



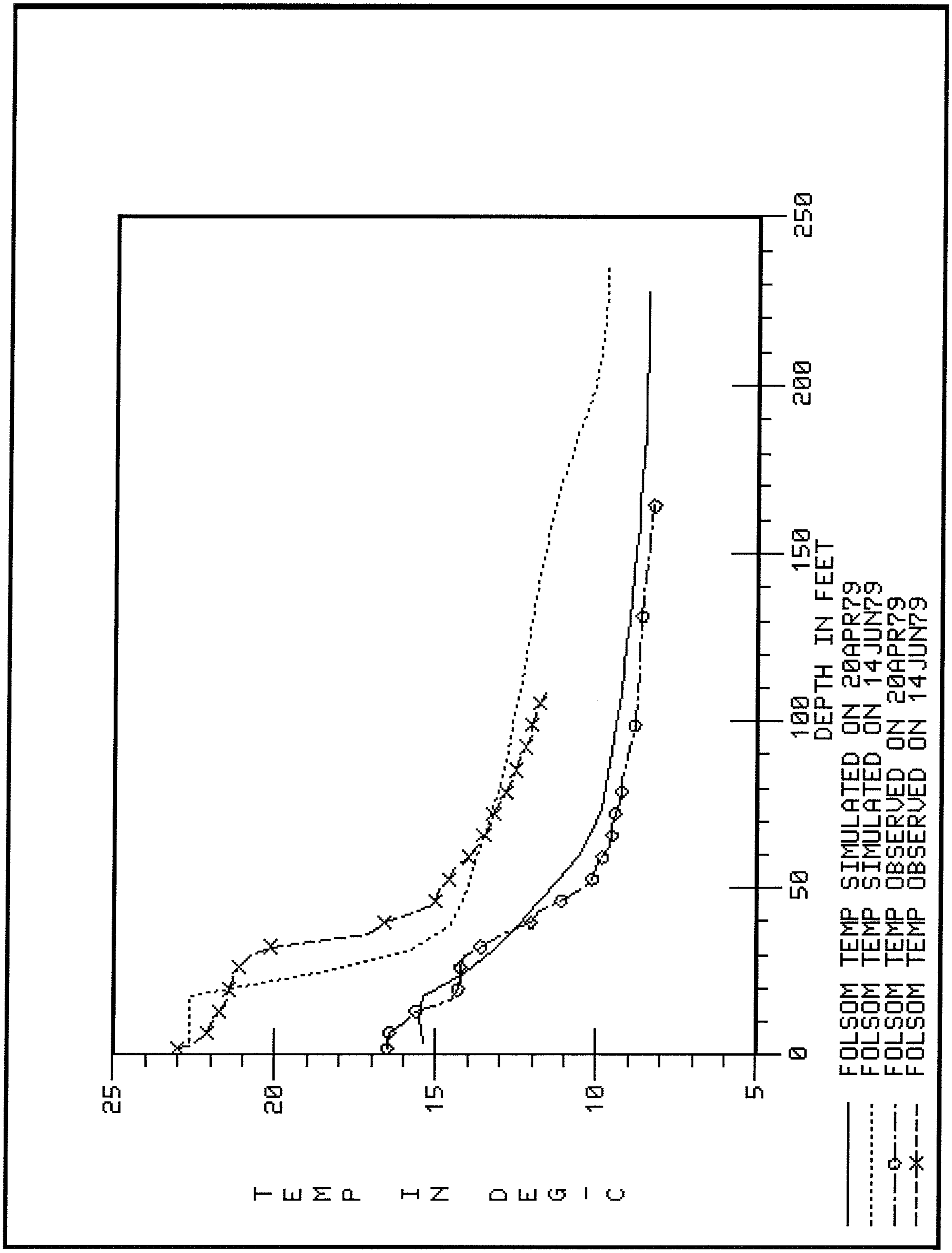
TEMP IN DEG C
DEPTH IN FEET
OROVILLE TEMP SIMULATED ON 18APR79
OROVILLE TEMP SIMULATED ON 16MAY79
OROVILLE TEMP OBSERVED ON 18APR79
OROVILLE TEMP OBSERVED ON 16MAY79


TEMP IN DEG C
30
25
20
15
10
5
0
100
200
300
400
500
600
700
DEPTH IN FEET
OROVILLE TEMP SIMULATED ON 06JUN79
OROVILLE TEMP SIMULATED ON 18JUL79
OROVILLE TEMP OBSERVED ON 06JUN79
OROVILLE TEMP OBSERVED ON 18JUL79

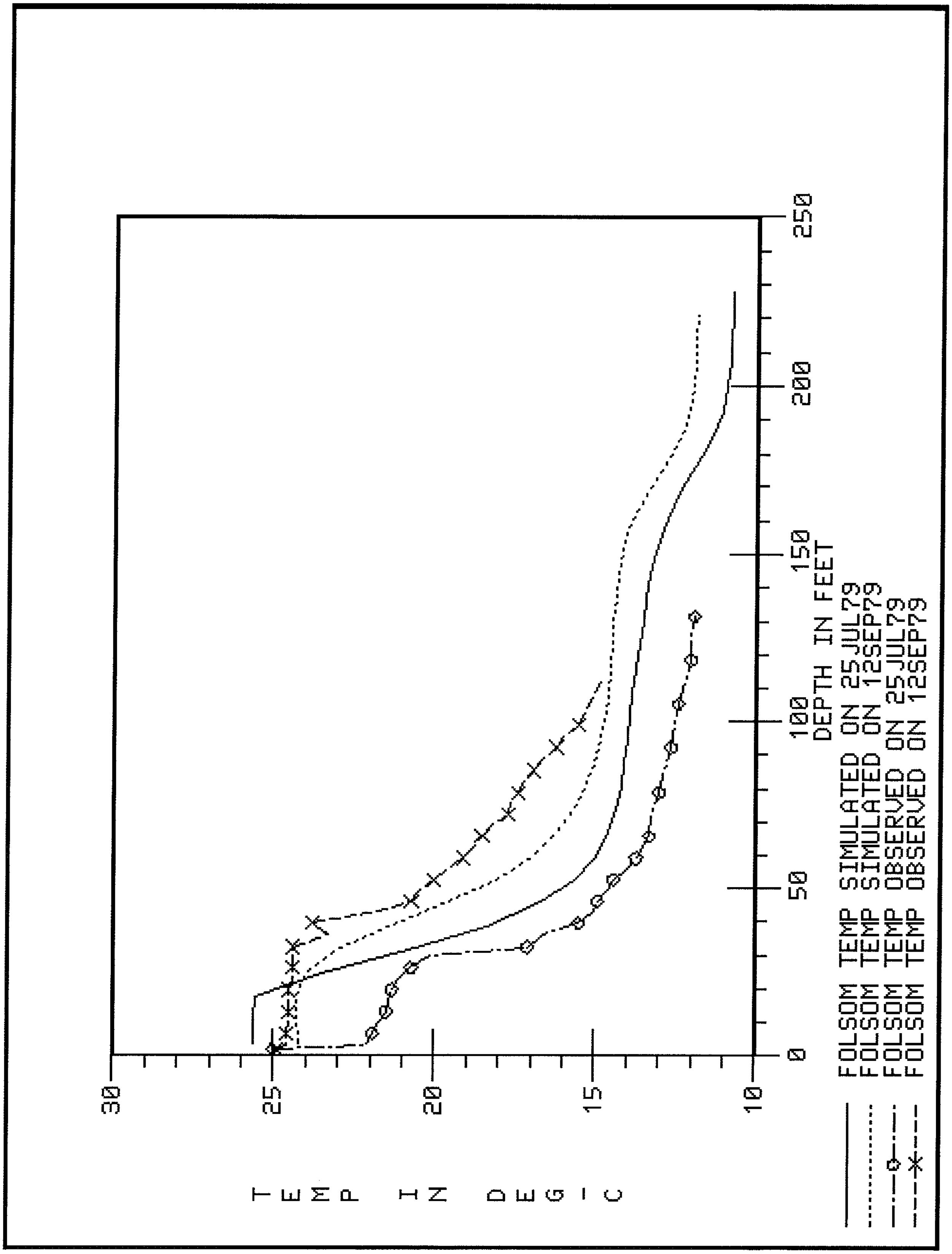

TEMP IN DEG-C
25
20
15
10
5
0
100
200
300
400
500
600
DEPTH IN FEET
OROVILLE TEMP SIMULATED ON 15AUG79
OROVILLE TEMP SIMULATED ON 20SEP79
OROVILLE TEMP OBSERVED ON 15AUG79
OROVILLE TEMP OBSERVED ON 20SEP79

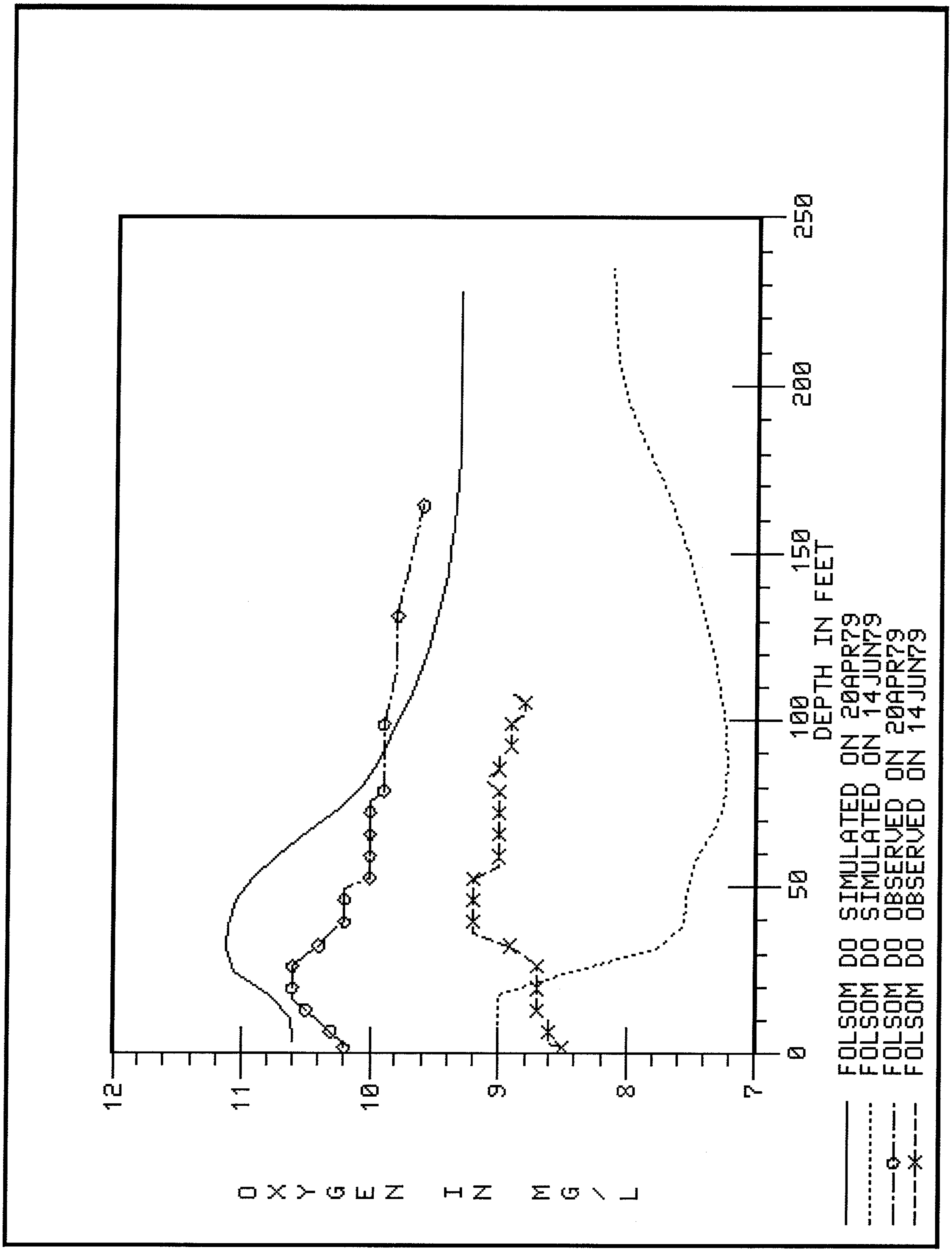


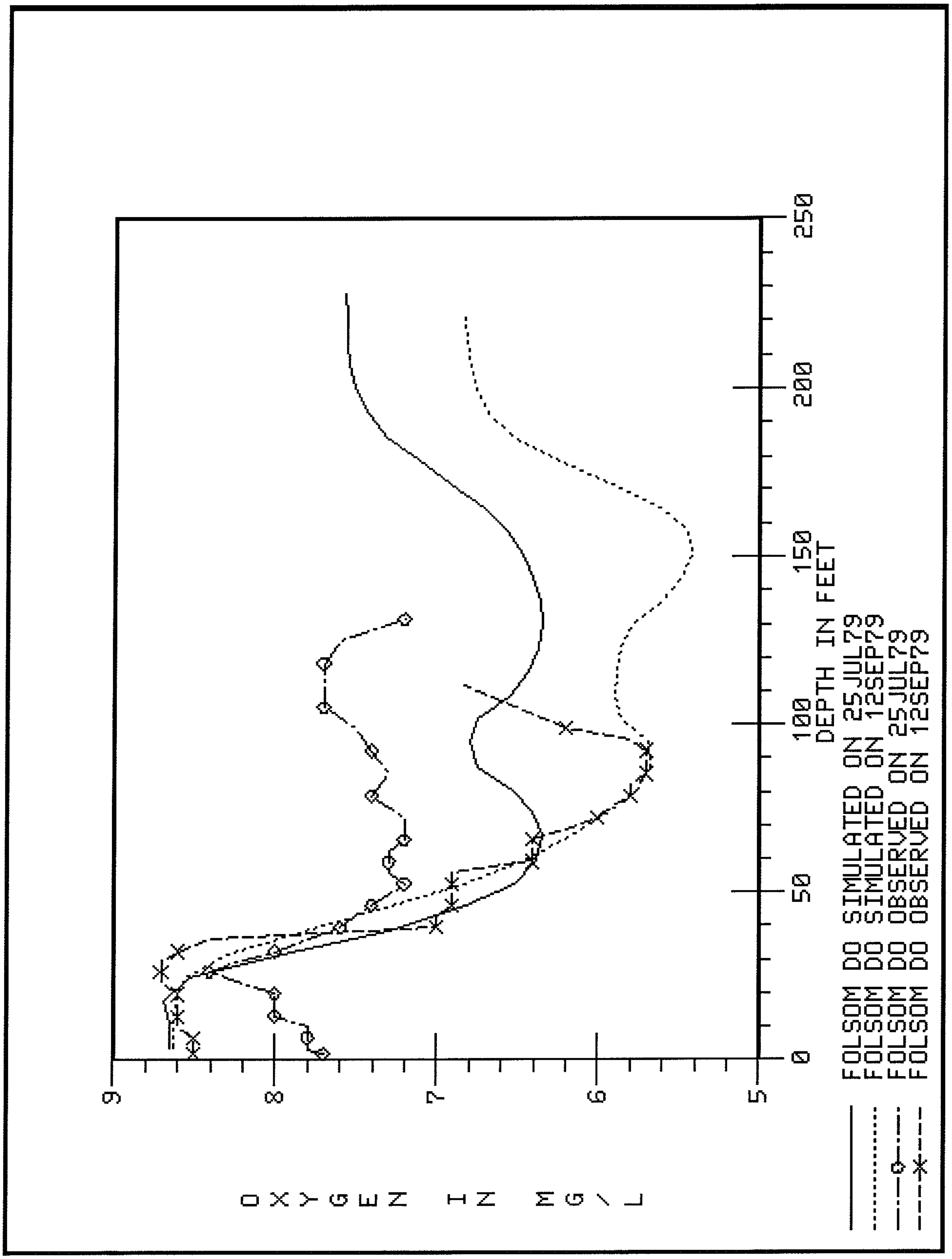
TEMP IN DEG C
25
20
15
10
5
0
100
200
300
400
500
600
DEPTH IN FEET
OROVILLE TEMP SIMULATED ON 09OCT79
OROVILLE TEMP OBSERVED ON 09OCT79

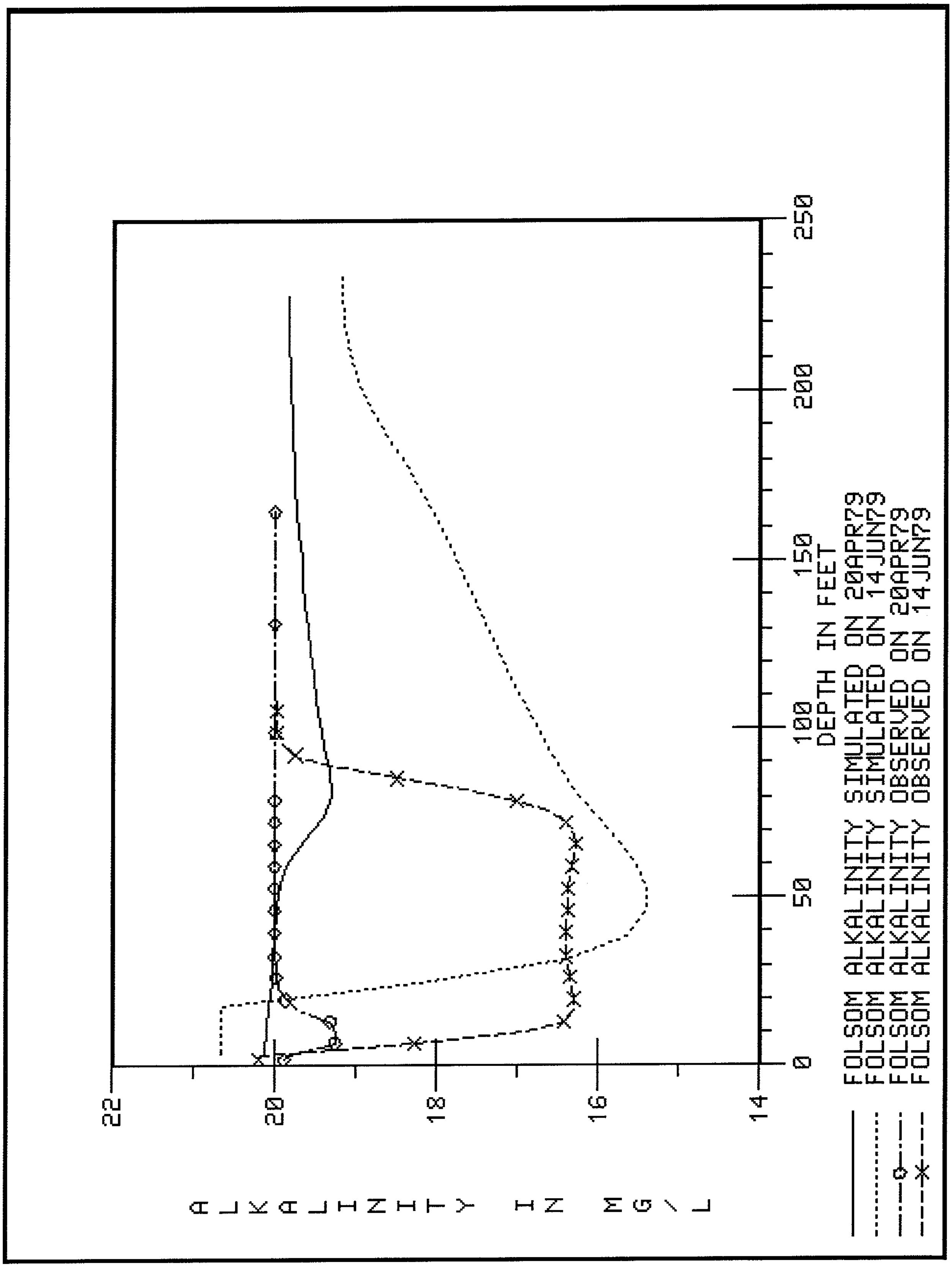


TEMP IN DEG C
DEPTH IN FEET
25
20
15
10
5
0
50
100
150
200
250
FOLSOM TEMP SIMULATED ON 20APR79
FOLSOM TEMP SIMULATED ON 14JUN79
FOLSOM TEMP OBSERVED ON 20APR79
FOLSOM TEMP OBSERVED ON 14JUN79

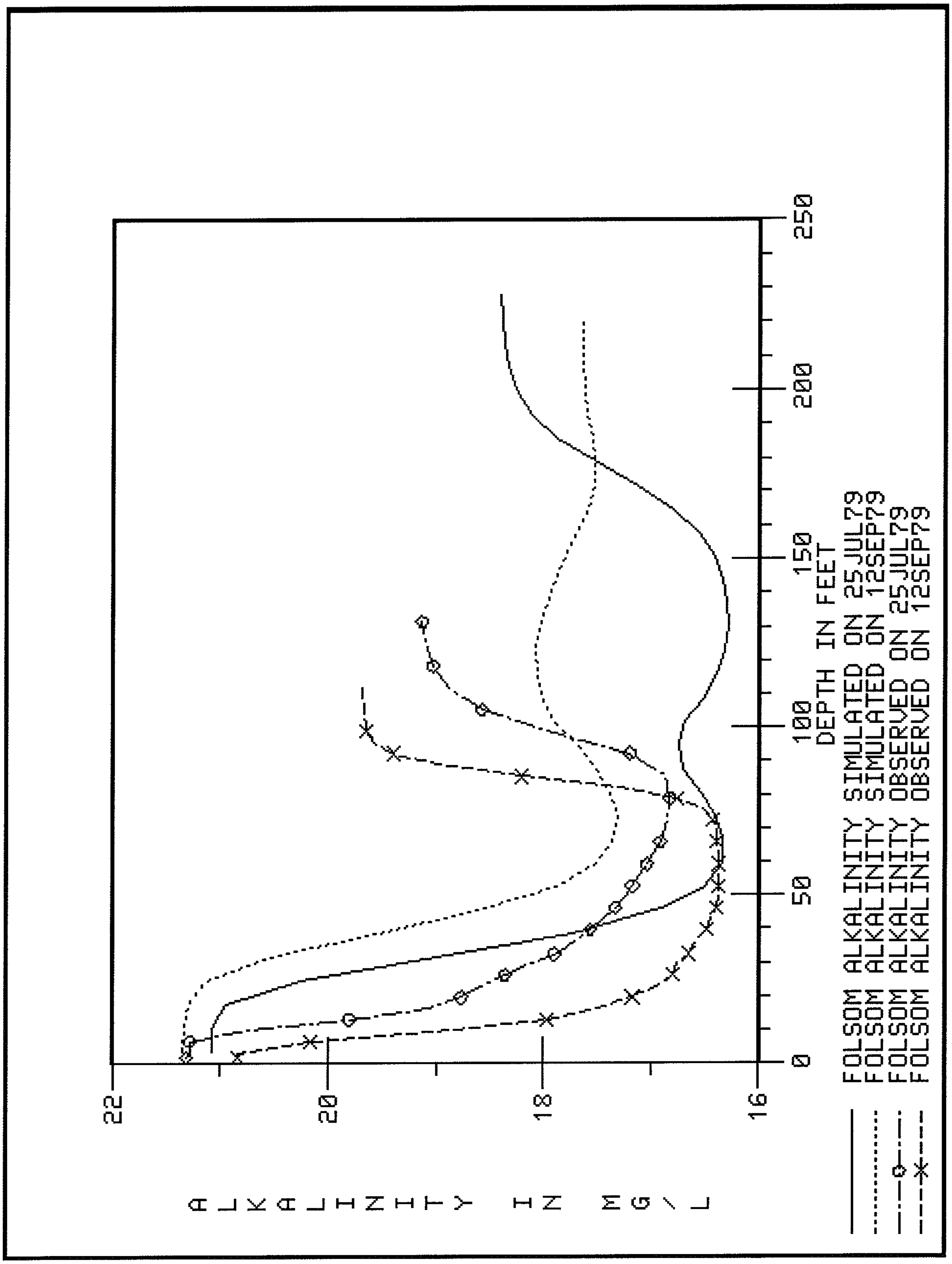

TEMP IN DEG-C
DEPTH IN FEET
30
25
20
15
10
0
50
100
150
200
250
FOLSOM TEMP SIMULATED ON 25JUL79
FOLSOM TEMP SIMULATED ON 12SEP79
FOLSOM TEMP OBSERVED ON 25JUL79
FOLSOM TEMP OBSERVED ON 12SEP79

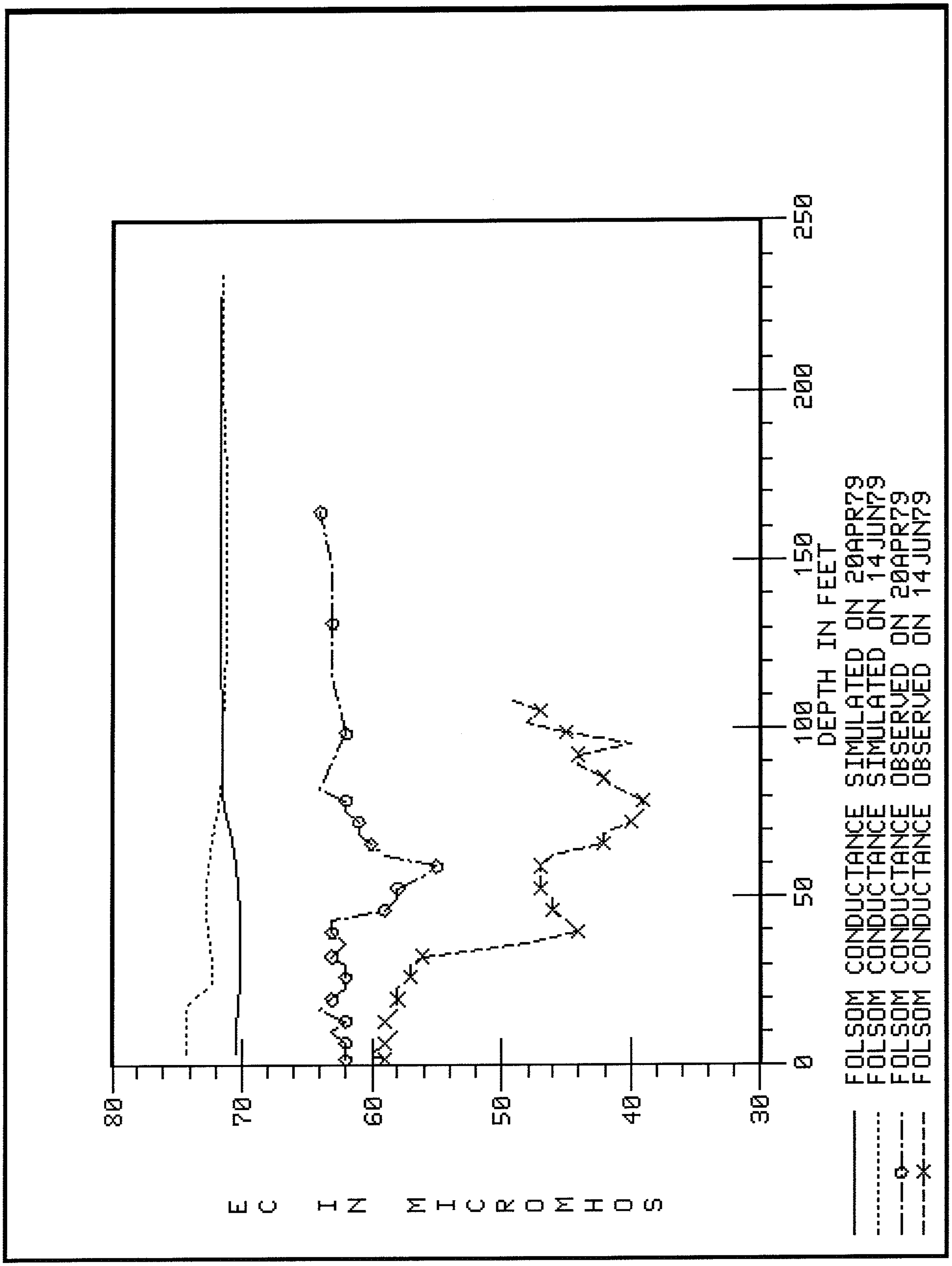

OXYGEN IN MG/L
12
11
10
9
8
7
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM DO SIMULATED ON 20APR79
FOLSOM DO SIMULATED ON 14JUN79
FOLSOM DO OBSERVED ON 20APR79
FOLSOM DO OBSERVED ON 14JUN79

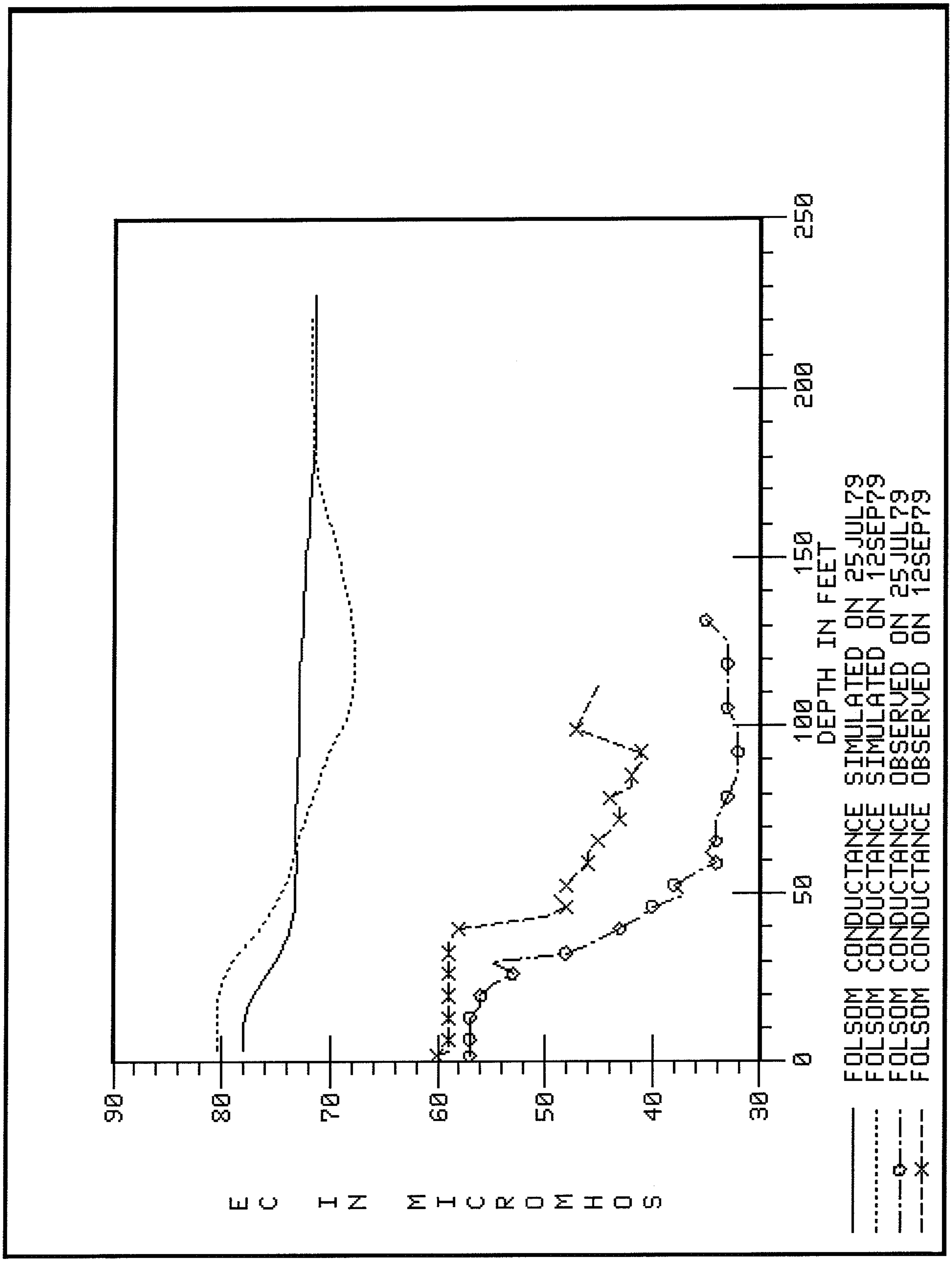

OXYGEN IN MG/L
9
8
7
6
5
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM DO SIMULATED ON 25JUL79
FOLSOM DO SIMULATED ON 12SEP79
FOLSOM DO OBSERVED ON 25JUL79
FOLSOM DO OBSERVED ON 12SEP79

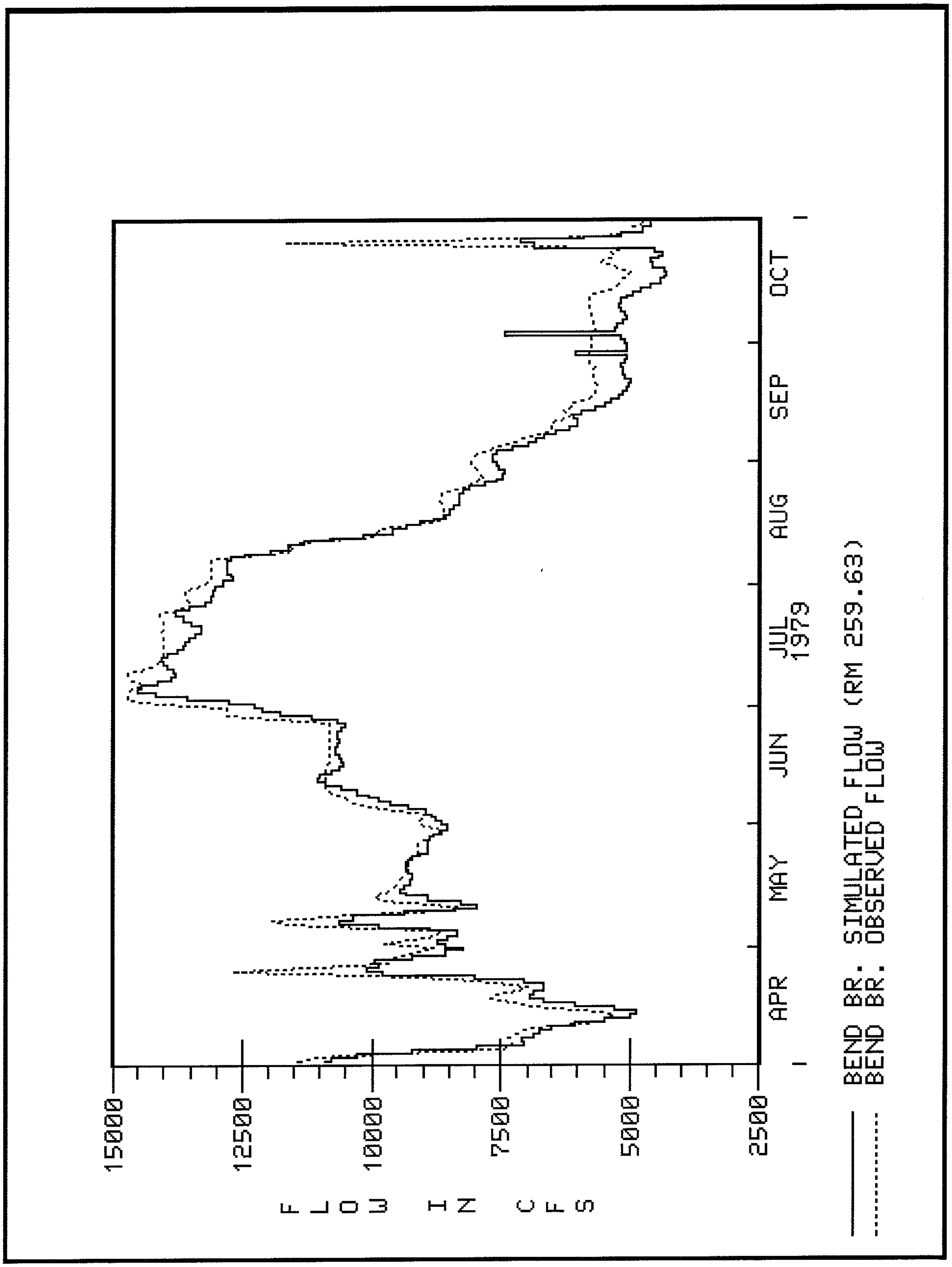


ALKALINITY IN MG/L
22
20
18
16
14
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM ALKALINITY SIMULATED ON 20APR79
FOLSOM ALKALINITY SIMULATED ON 14JUN79
FOLSOM ALKALINITY OBSERVED ON 20APR79
FOLSOM ALKALINITY OBSERVED ON 14JUN79

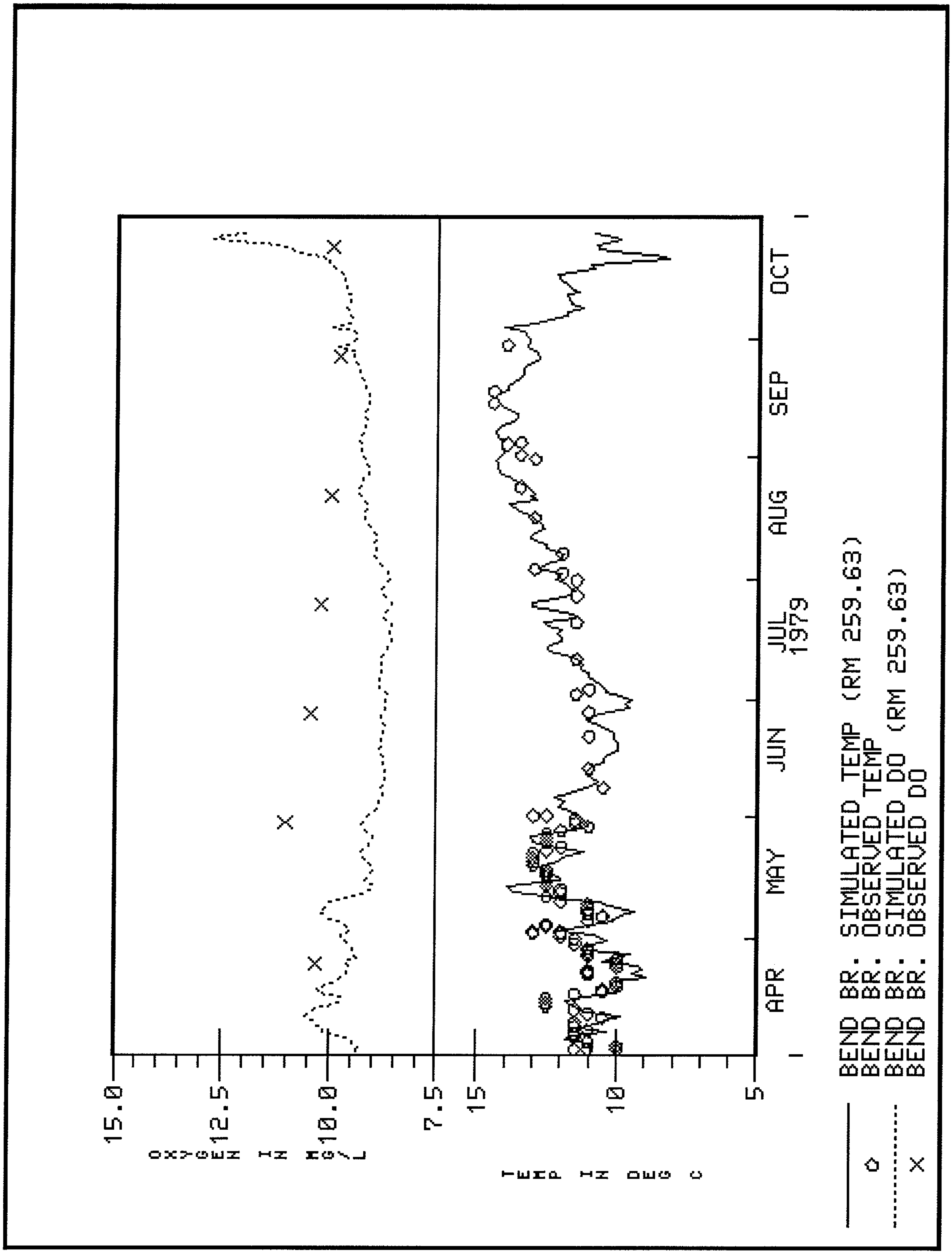

ALKALINITY IN MG/L
22
20
18
16
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM ALKALINITY SIMULATED ON 25JUL79
FOLSOM ALKALINITY SIMULATED ON 12SEP79
FOLSOM ALKALINITY OBSERVED ON 25JUL79
FOLSOM ALKALINITY OBSERVED ON 12SEP79


EC IN MICROMHOS
80
70
60
50
40
30
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM CONDUCTANCE SIMULATED ON 20APR79
FOLSOM CONDUCTANCE SIMULATED ON 14JUN79
FOLSOM CONDUCTANCE OBSERVED ON 20APR79
FOLSOM CONDUCTANCE OBSERVED ON 14JUN79

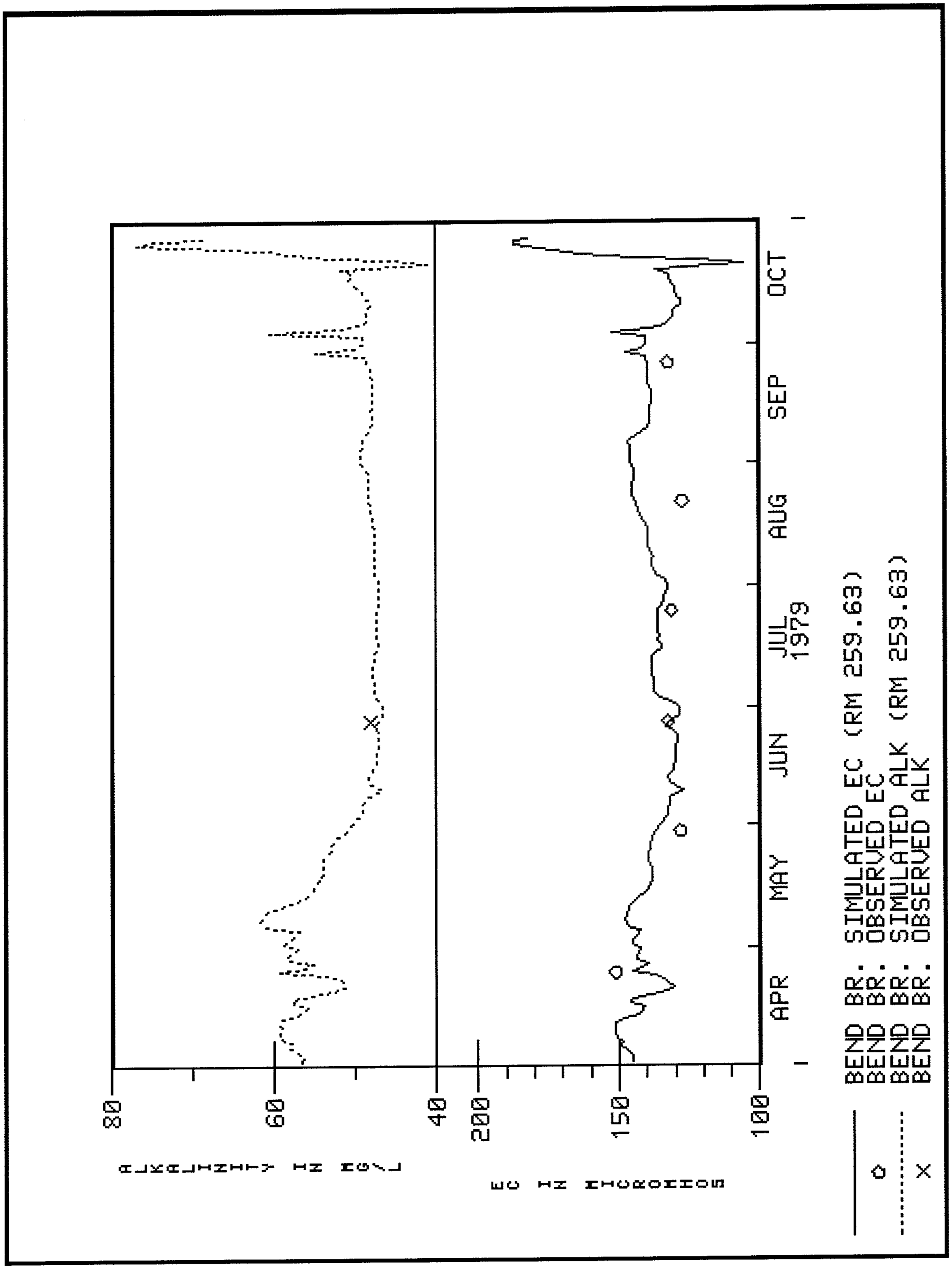

EC IN MICROMHOS
90
80
70
60
50
40
30
0
50
100
150
200
250
DEPTH IN FEET
FOLSOM CONDUCTANCE SIMULATED ON 25JUL79
FOLSOM CONDUCTANCE SIMULATED ON 12SEP79
FOLSOM CONDUCTANCE OBSERVED ON 25JUL79
FOLSOM CONDUCTANCE OBSERVED ON 12SEP79



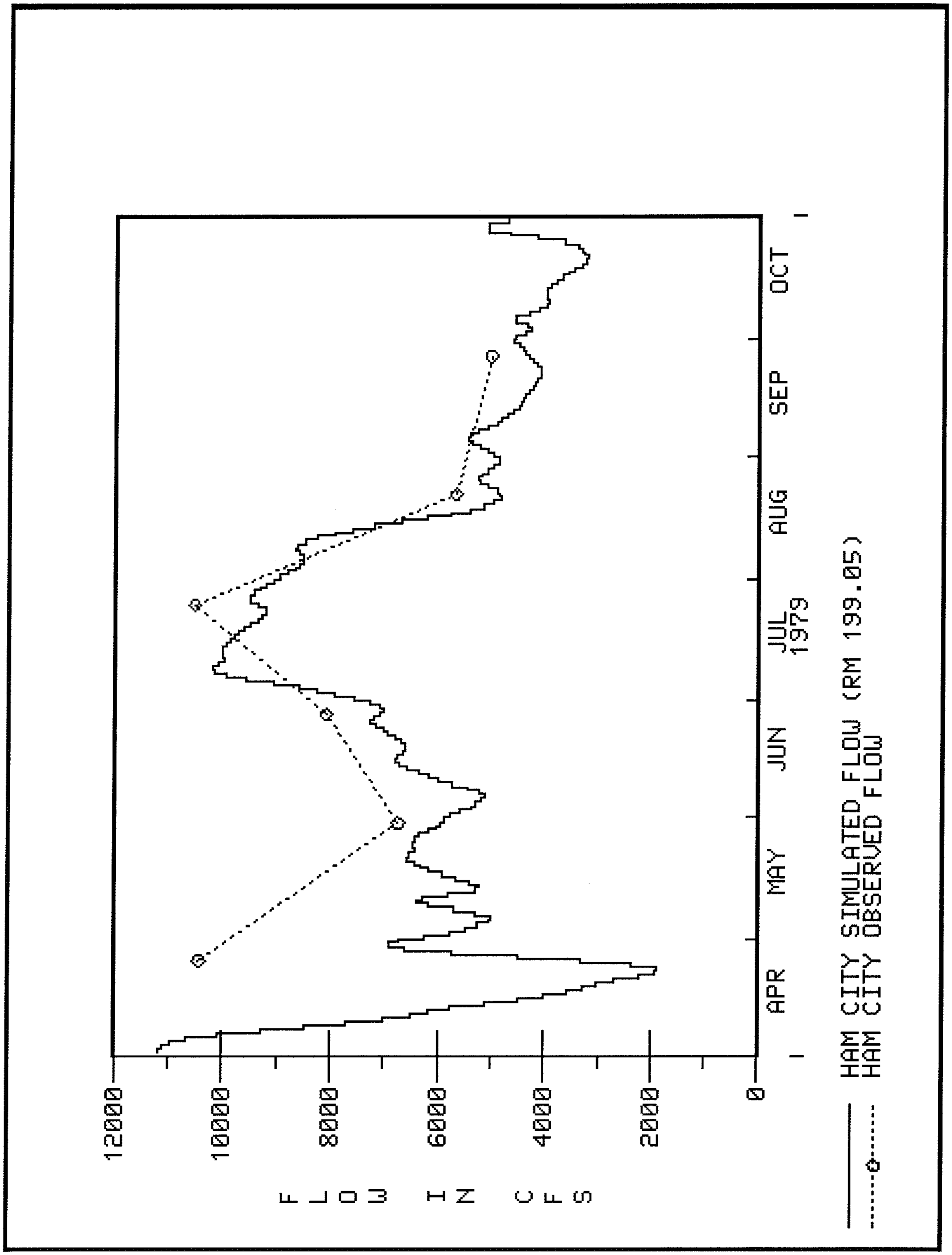
FLOW IN CFS
15000
12500
10000
7500
5000
2500
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
BEND BR. SIMULATED FLOW (RM 259.63)
BEND BR. OBSERVED FLOW

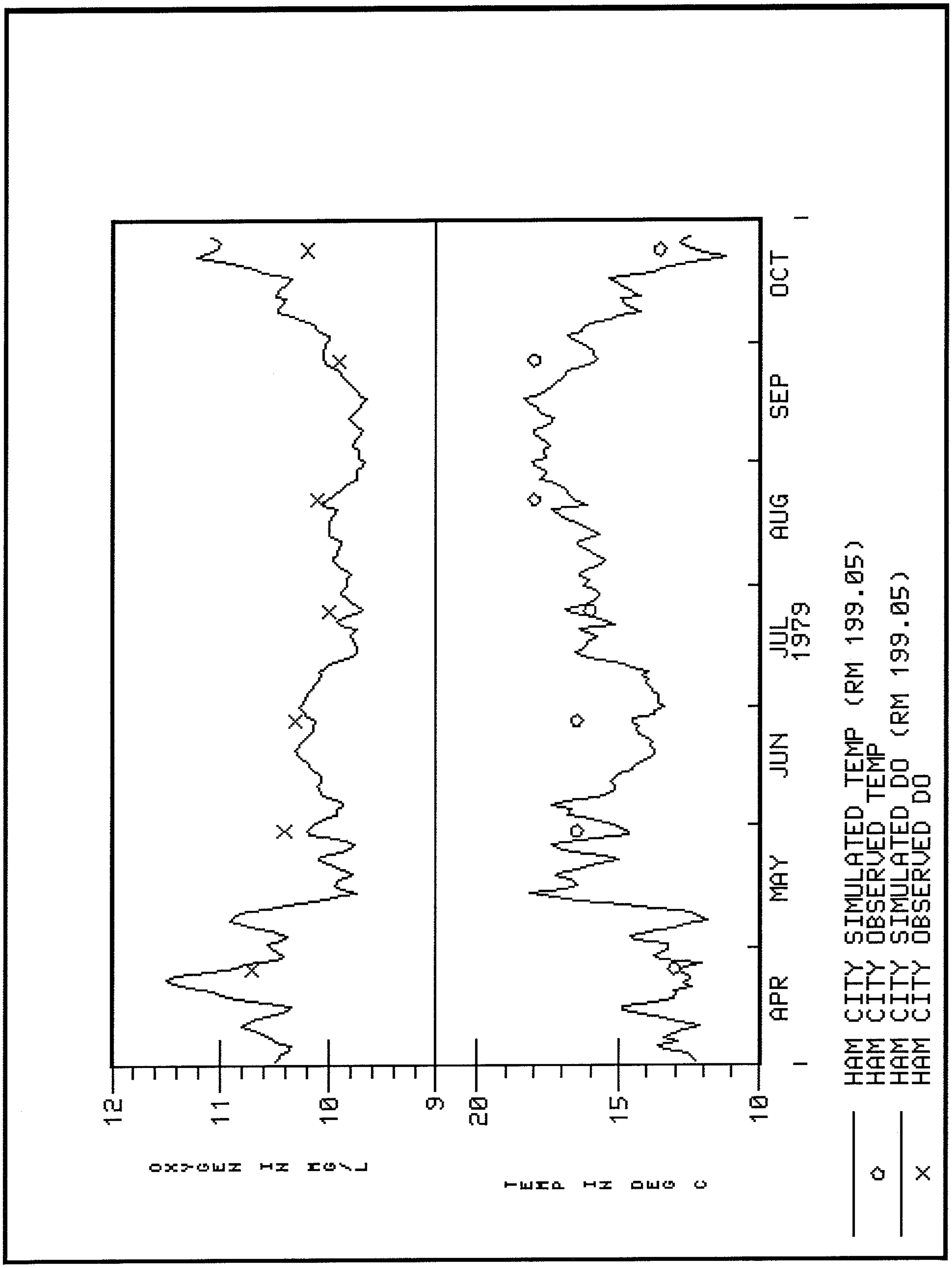


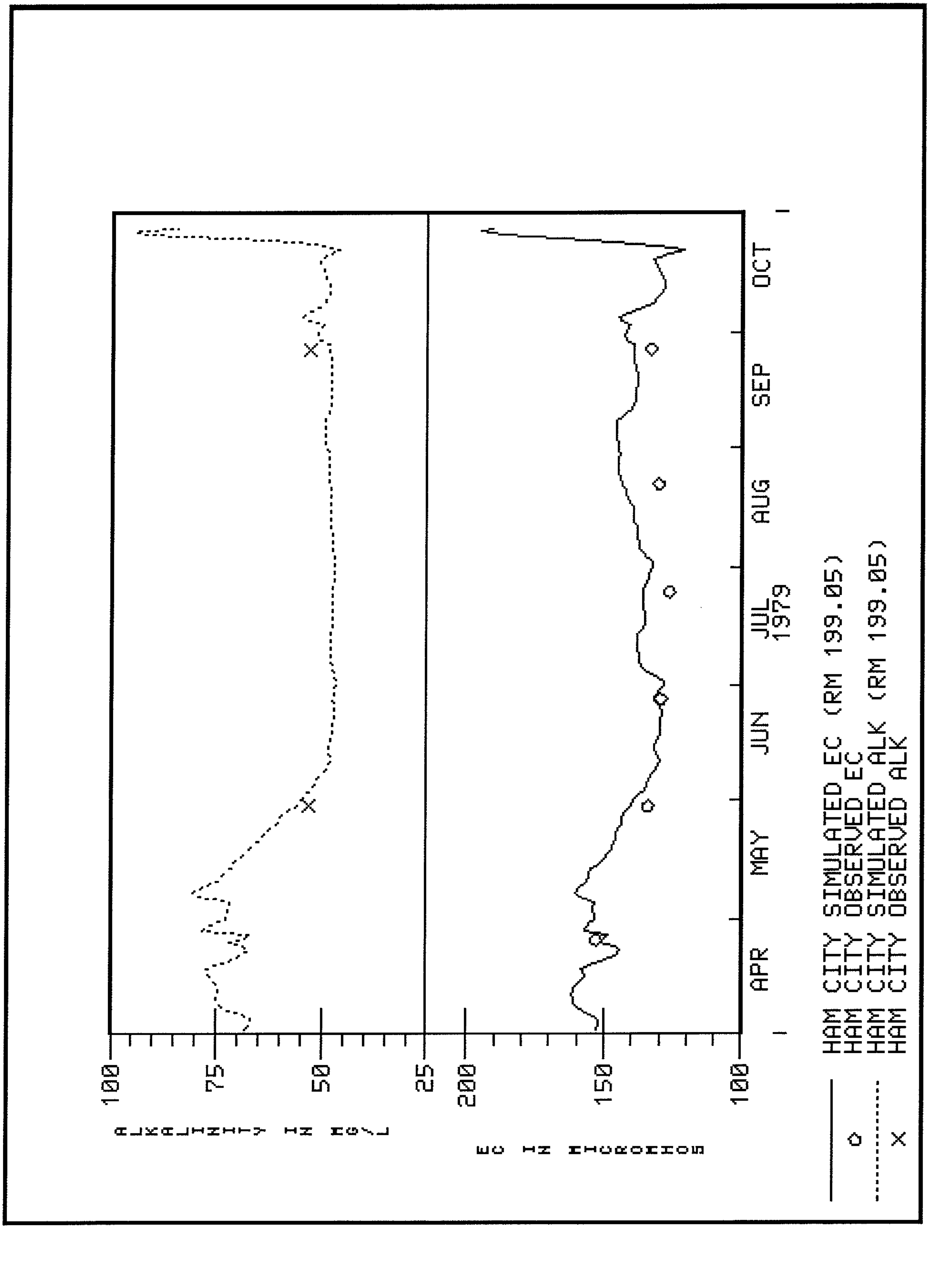
OXYGEN IN MG/L
TEMP IN DEG C
15.0
12.5
10.0
7.5
15
10
5
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
BEND BR. SIMULATED TEMP (RM 259.63)
BEND BR. OBSERVED TEMP
BEND BR. SIMULATED DO (RM 259.63)
BEND BR. OBSERVED DO

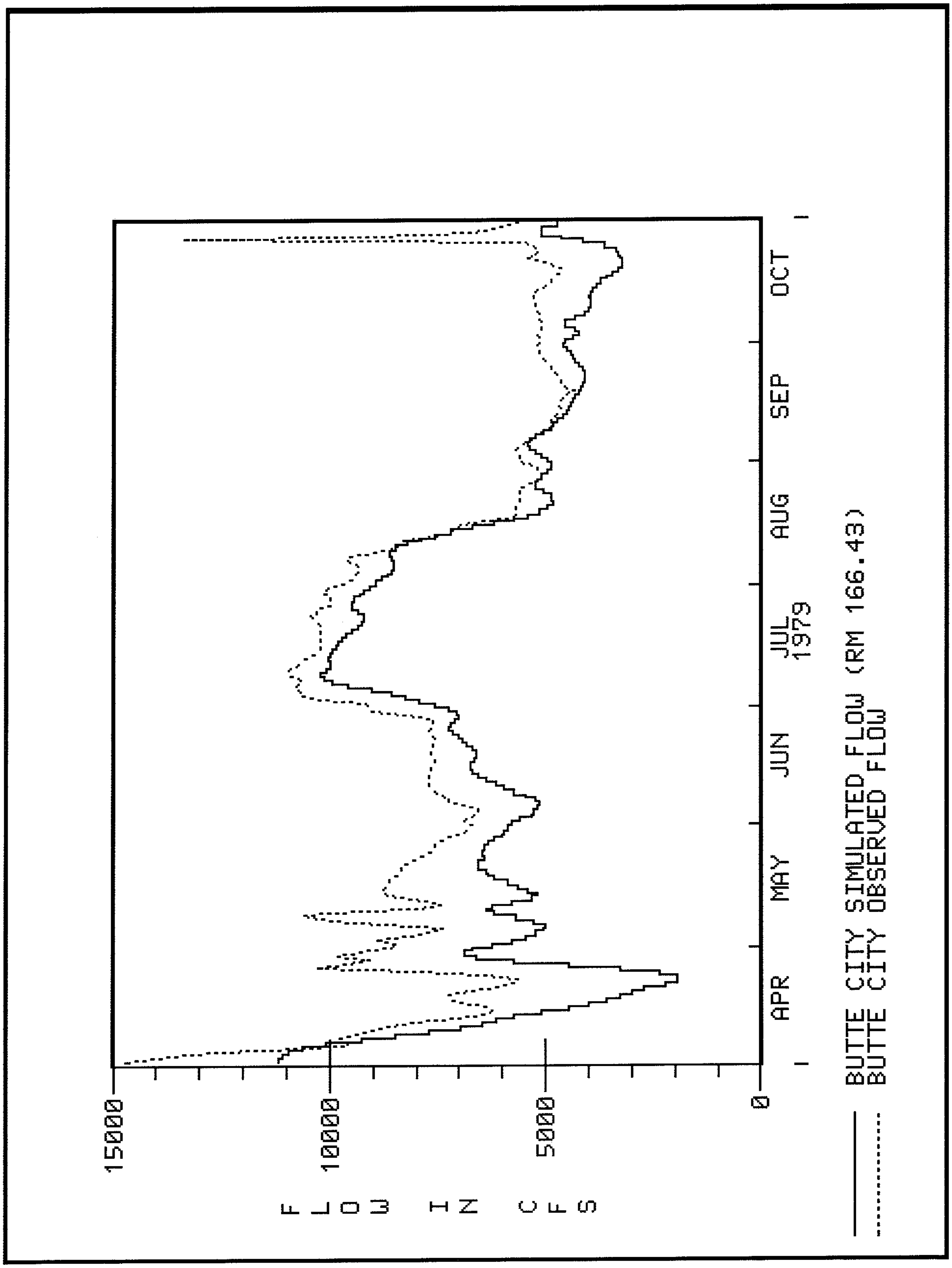


80
60
40
200
150
100
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
BEND BR. SIMULATED EC (RM 259.63)
BEND BR. OBSERVED EC
BEND BR. SIMULATED ALK (RM 259.63)
BEND BR. OBSERVED ALK

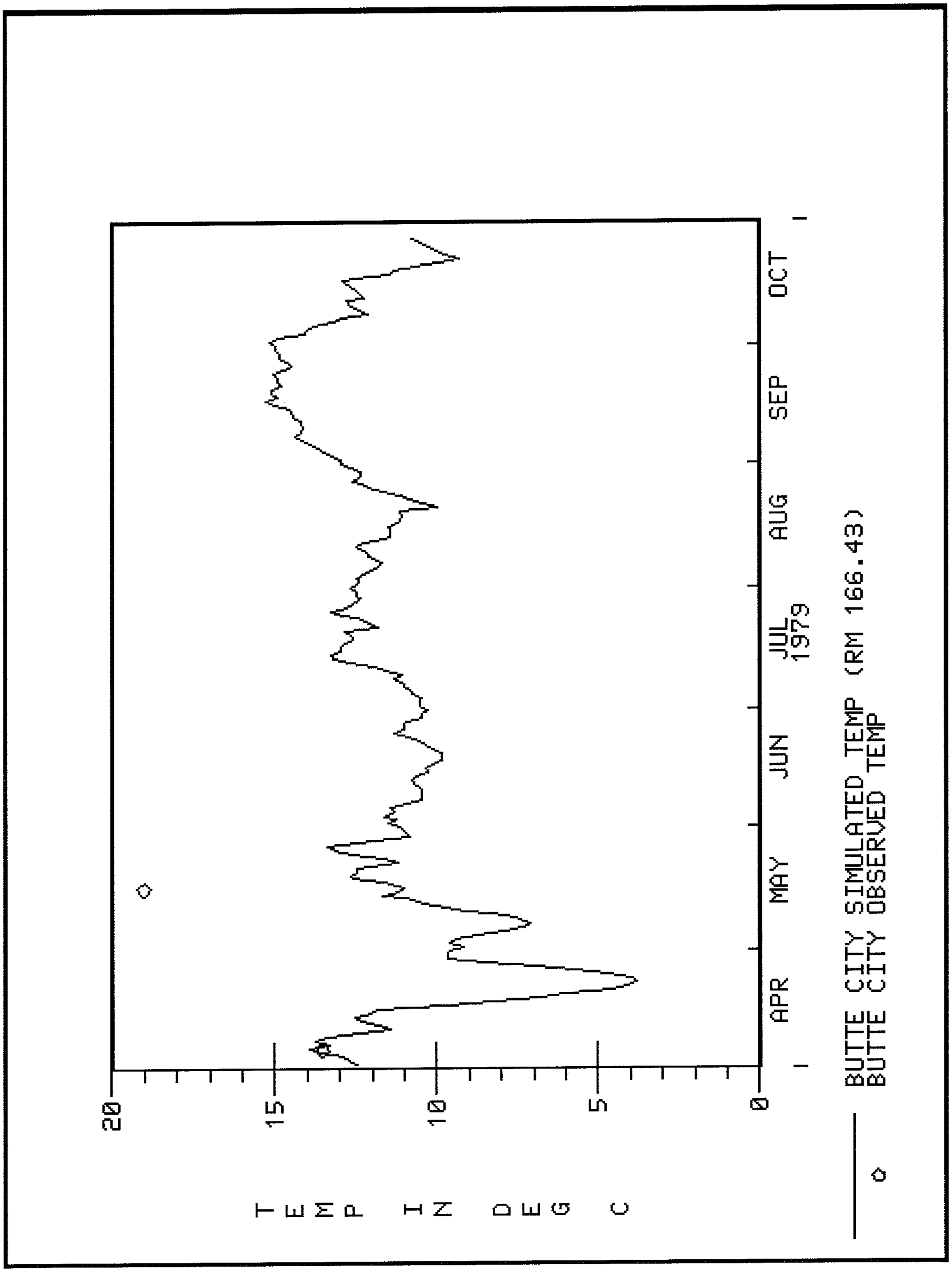

FLOW IN CFS
12000
10000
8000
6000
4000
2000
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
HAM CITY SIMULATED FLOW (RM 199.05)
HAM CITY OBSERVED FLOW


OXYGEN IN MG/L
TEMP IN DEG C
12
11
10
9
20
15
10
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
HAM CITY SIMULATED TEMP (RM 199.05)
HAM CITY OBSERVED TEMP
HAM CITY SIMULATED DO (RM 199.05)
HAM CITY OBSERVED DO

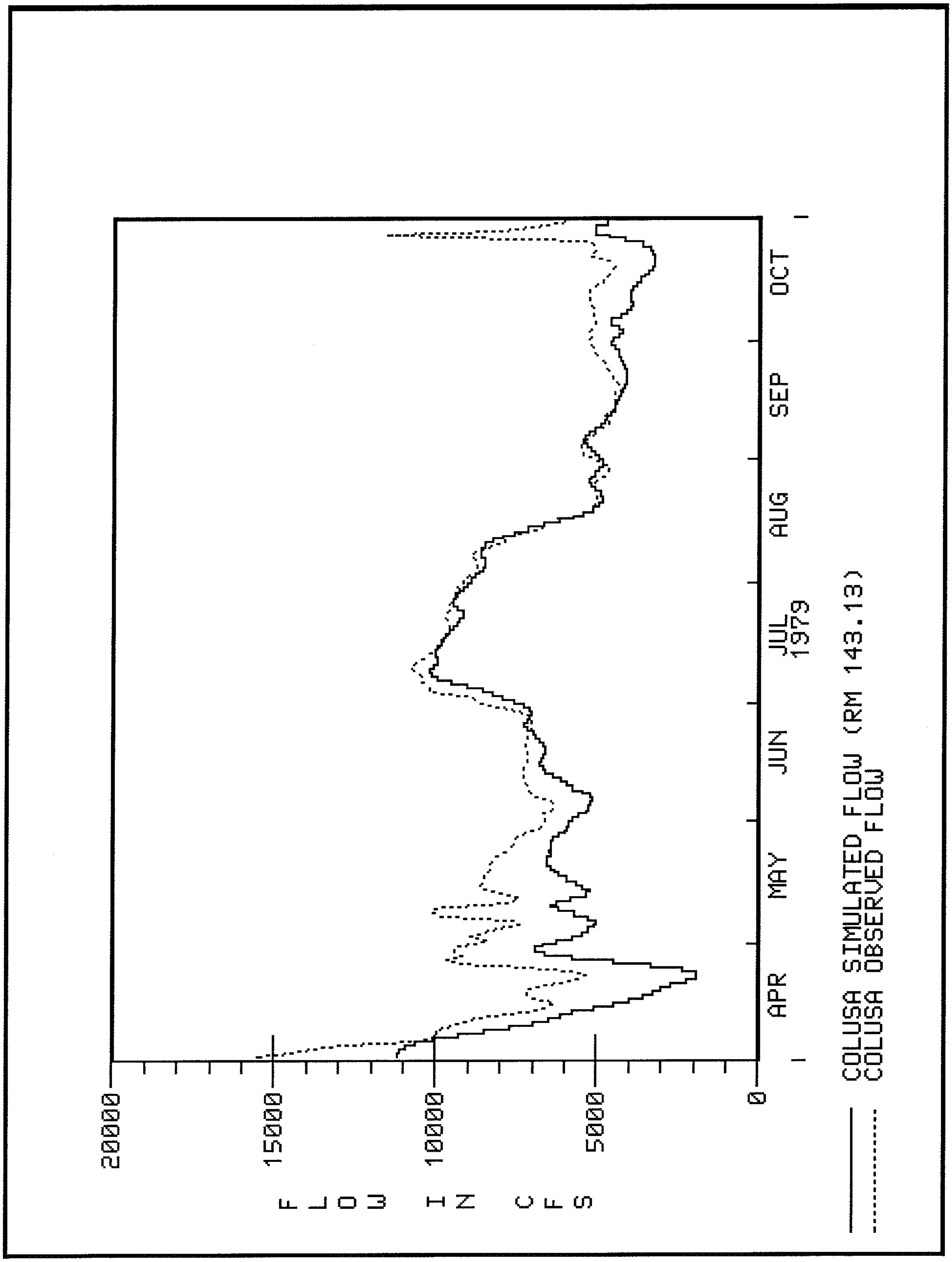

100
75
50
25
200
150
100
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
HAM CITY SIMULATED EC (RM 199.05)
HAM CITY OBSERVED EC
HAM CITY SIMULATED ALK (RM 199.05)
HAM CITY OBSERVED ALK



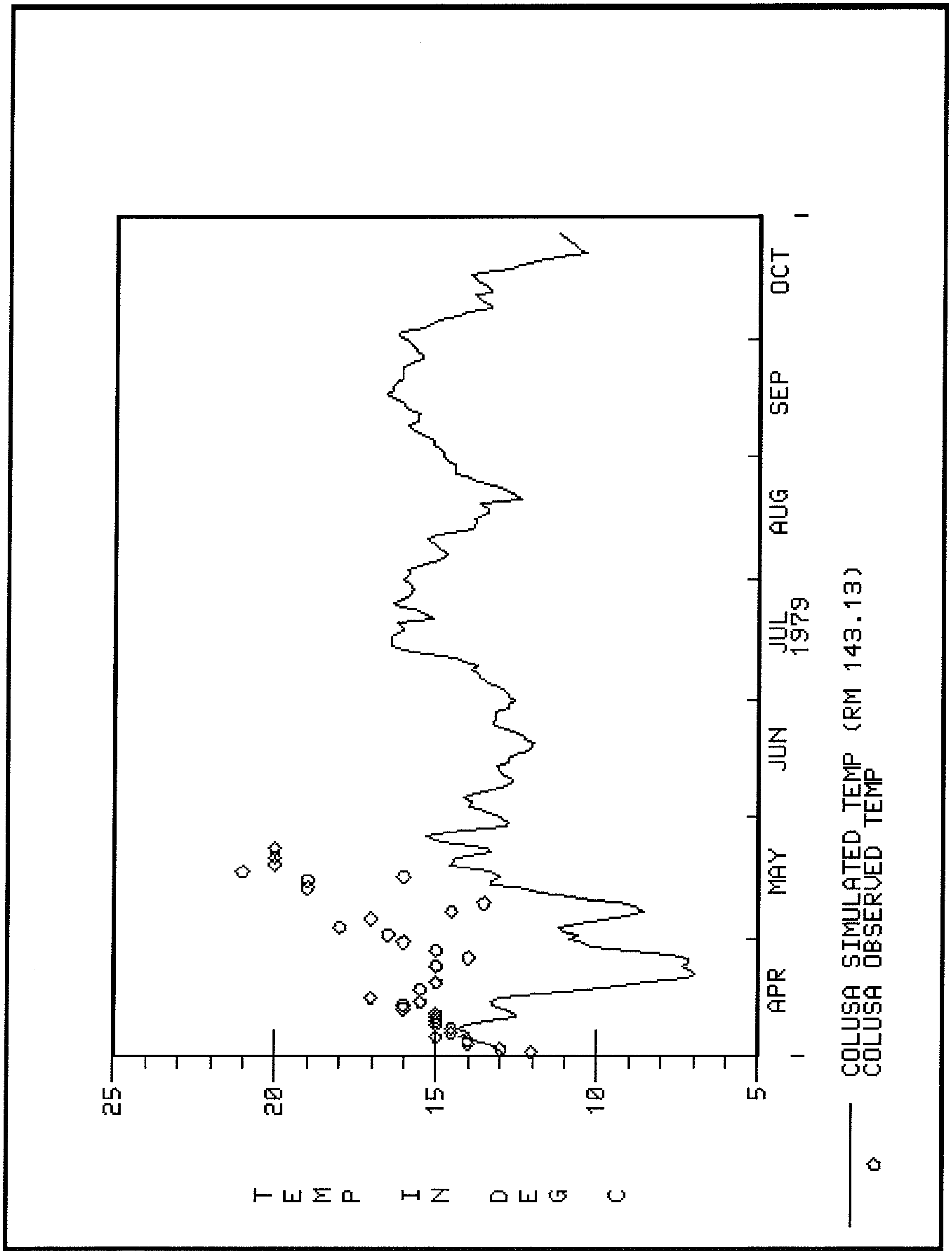
FLOW IN CFS
15000
10000
5000
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
BUTTE CITY SIMULATED FLOW (RM 166.43)
BUTTE CITY OBSERVED FLOW

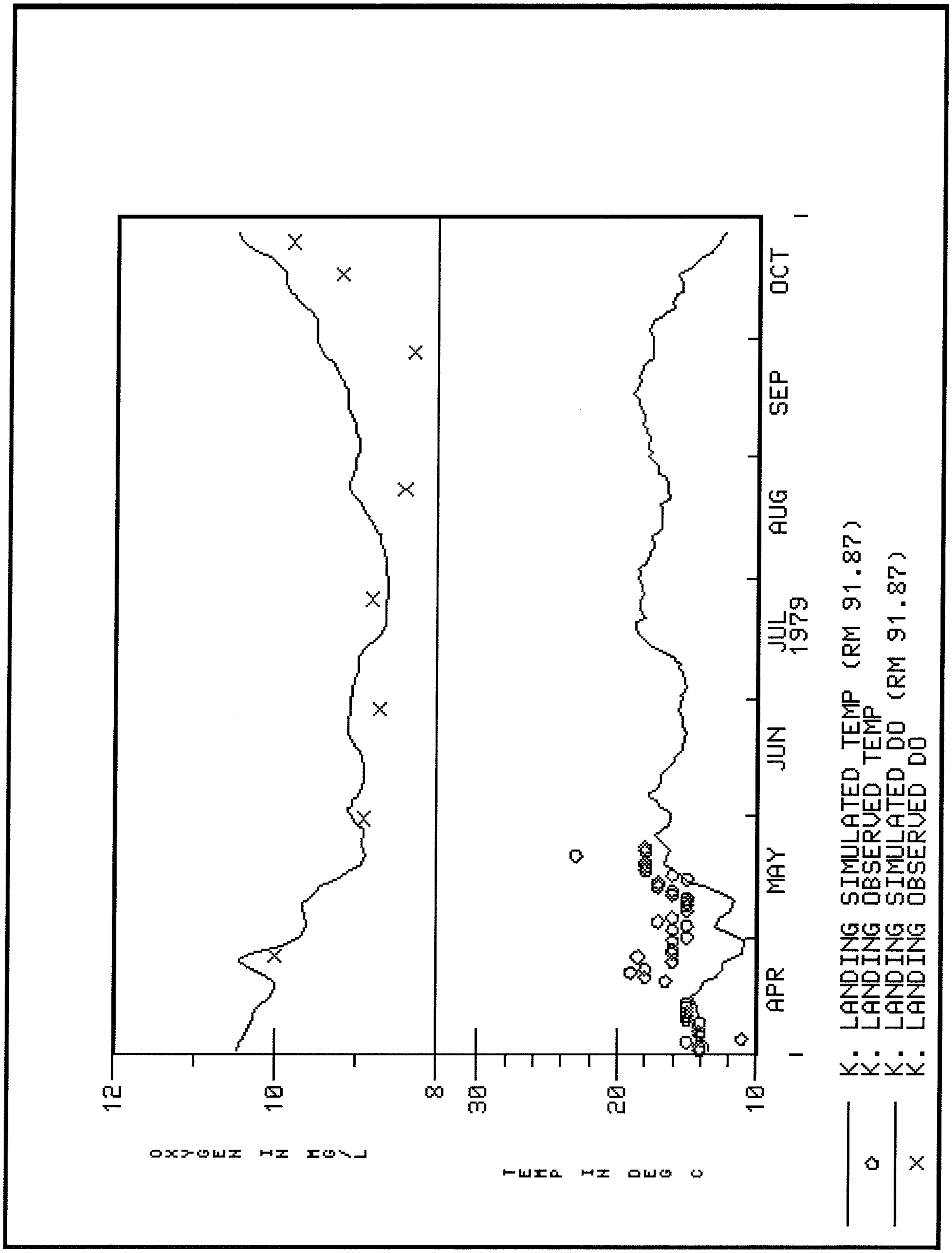


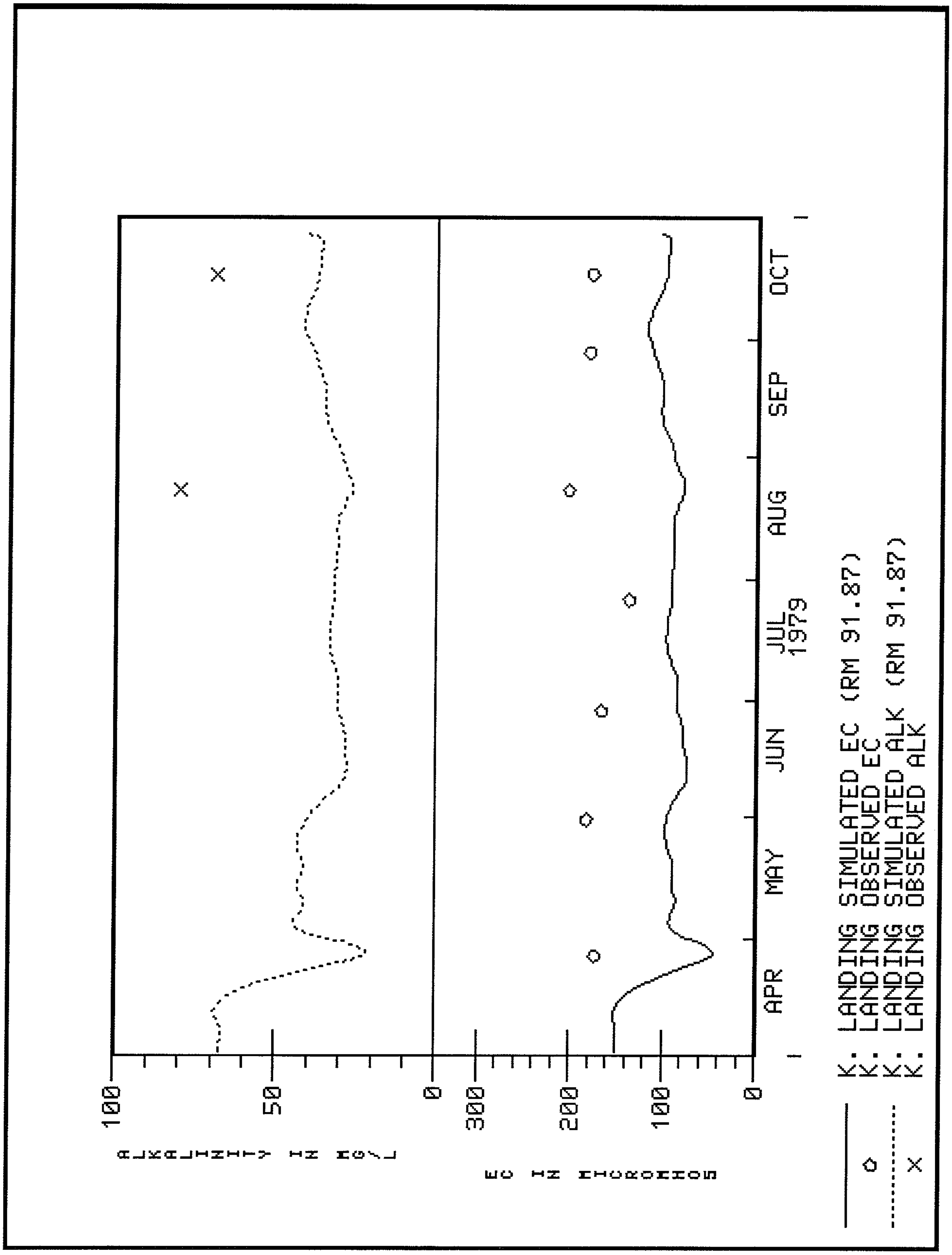
TEMP IN DEG C
20
15
10
5
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
BUTTE CITY SIMULATED TEMP (RM 166.43)
BUTTE CITY OBSERVED TEMP

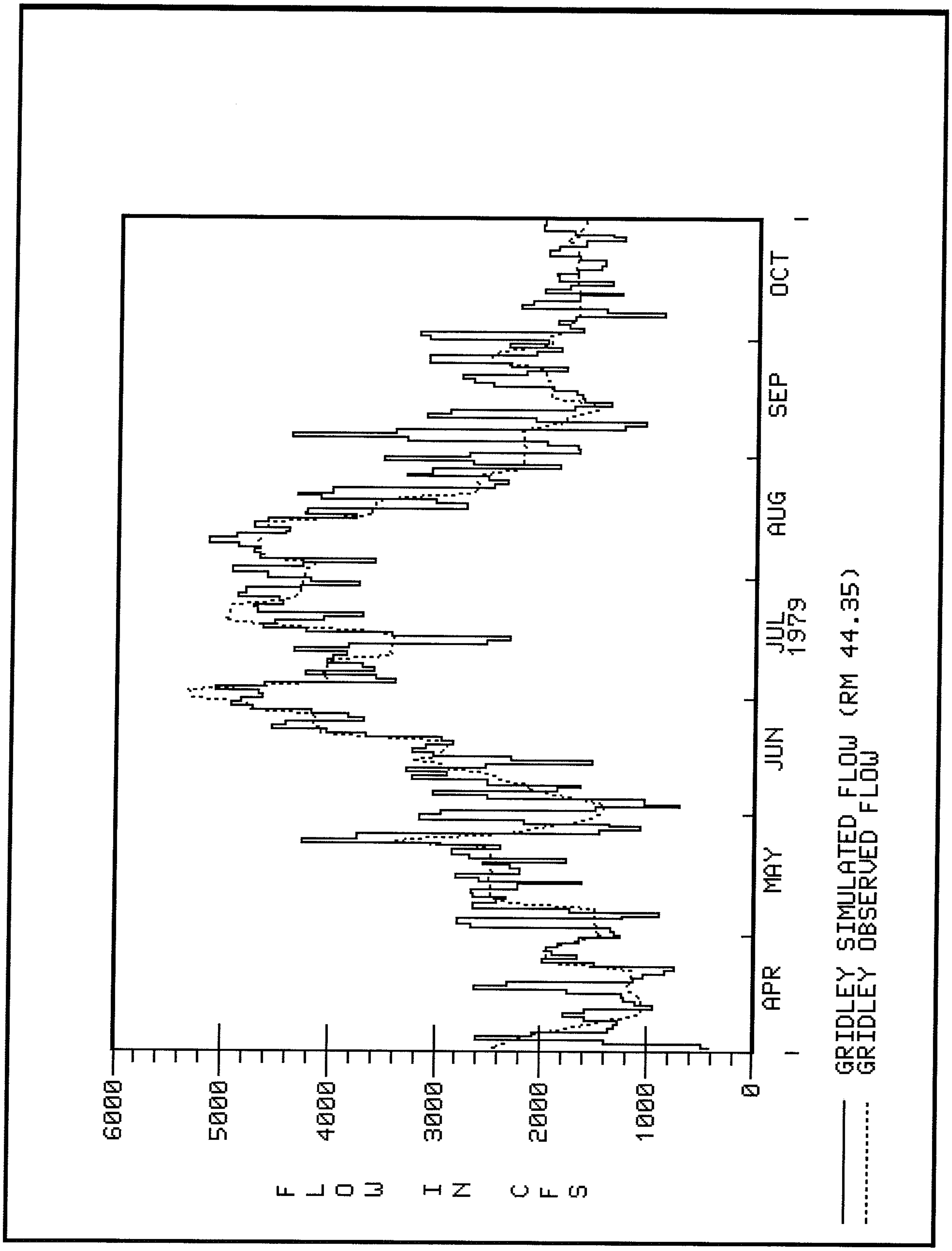


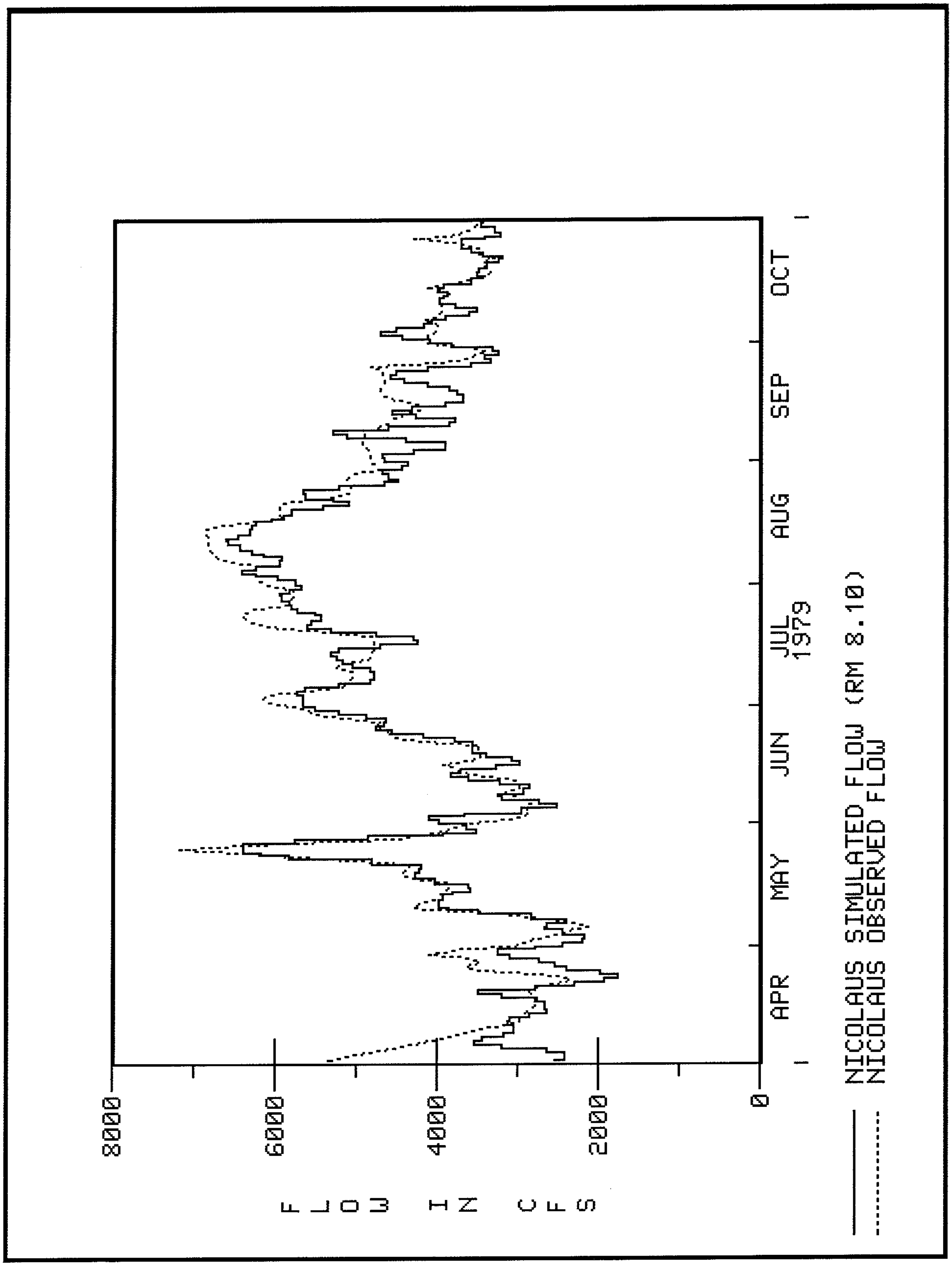
FLOW IN CFS
20000
15000
10000
5000
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
COLUSA SIMULATED FLOW (RM 143.13)
COLUSA OBSERVED FLOW


TEMP IN DEG C
25
20
15
10
5
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
COLUSA SIMULATED TEMP (RM 143.13)
COLUSA OBSERVED TEMP


OXYGEN IN MG/L
TEMP IN DEG C
12
10
8
30
20
10
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
K. LANDING SIMULATED TEMP (RM 91.87)
K. LANDING OBSERVED TEMP
K. LANDING SIMULATED DO (RM 91.87)
K. LANDING OBSERVED DO


100
50
0
300
200
100
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
K. LANDING SIMULATED EC (RM 91.87)
K. LANDING OBSERVED EC
K. LANDING SIMULATED ALK (RM 91.87)
K. LANDING OBSERVED ALK


FLOW IN CFS
6000
5000
4000
3000
2000
1000
0
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
GRIDLEY SIMULATED FLOW (RM 44.35)
GRIDLEY OBSERVED FLOW



FLOW IN CFS
0
2000
4000
6000
8000
APR
MAY
JUN
JUL
1979
AUG
SEP
OCT
NICOLAUS SIMULATED FLOW (RM 8.10)
NICOLAUS OBSERVED FLOW