V.3.3-FLDWAV GENERALIZED FLOOD WAVE ROUTING OPERATION

Bookmarks

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Identifier: FLDWAV

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Application: All programs

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Description: Operation FLDWAV is a generalized flood routing model that can be used for real-time flood forecasting of dam-break floods and/or natural floods, dam-breach flood analysis for sunny-day piping or overtopping associated with the Probable Maximum Flood, floodplain inundation mapping for contingency dam-break flood planning and design of waterway improvements.

The model computes the outflow hydrograph from a dam due to spillway, overtopping and/or dam breach outflows. The resulting flood wave is then routed through the downstream channel/valley using a four-point implicit finite-difference numerical solution of the complete Saint-Venant equations of one-dimensional unsteady flow along with appropriate internal boundary equations representing downstream dams, bridges, weirs, waterfalls and other man-made/natural flow controls. The flow may be 'mixed' (subcritical and/or supercritical) throughout the downstream routing reach.

The following features are in Operation FLDWAV:

- o the flood may occur in a system of interconnected rivers such as the main-stem river and its tributaries
- o levee-overtopping/crevasse flows into and through levee protected flood plains
- o automatic calibration of Manning roughness coefficients for historical floods
- o use of multiple routing techniques throughout the river system
- o create output files to be used by program FLDGRF to display model output

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Allowable Time Intervals: 1, 2, 3, 4, 6, 8, 12 and 24 hours

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Time Series Used:

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Observed Stage	L	M	I	no	n/a	any 2/	yes
Observed Discharge	L3/T	CMS	I	no	n/a	any 2/	yes
Lateral Inflow	L3/T	CMS	I	no	n/a	any 2/	no
Target Pool Elevation	L	M	I	no	n/a	any 2/	yes
Gate Control Switches	DLES	INT	I	no	n/a	any 2/	yes
Upstream Stage	L	M	I	yes 1/	n/a	any 2/	no
Upstream Discharge	L3/T	CMS	I	yes 1/	n/a	any 2/	no
Downstream Stage	L	M	I	no	n/a	any 2/	no

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Downstream Discharge	L3/T	CMS	I	no	n/a	any 2/	no
Output Stage	L	M	O	no	n/a	any 3/	no
Output Discharge	L3/T	CMS	O	no	n/a	any 3/	no
Output Velocity	L/T	M/S	O	no	n/a	any 3/	no
Observed Tide	L	M	I	no	n/a	any	no
NOS Tide	L	M	I	no	n/a	any	no
Adjusted Tide	L	M	O	no	n/a	any	no
Adjusted Stage	L	M	O	no	n/a	any	no
Adjusted Discharge	L3/T	M	O	no	n/a	any	no

1/ These time series must be the same type as the upstream boundaries.

2/ All of these time series must have the same data time interval.

3/ These time series data time interval must be an even increment of the input time series data time interval.

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Input Summary: The syntax rules for the input for this Operation are as follows:

- o values are input in free format (values separated by blanks or a comma)
- o no data may be entered beyond column 72
- o enter a zero if no value is to be specified
- o decimal points are needed only of the value contains a decimal point
- o a blank line or a comment line must be entered before each data group except data groups 0-1 and 0-2; the comments are not saved and therefore are not included when the Segment definition is output)

'*' indicates the Data Group (DG) is required for any simulation.

'**' indicates the Data Group (DG) is required for any dam break simulation.

Data Group	Variable Name	Contents
0-1*	MSG	Description of the data set. A maximum of 20 lines is allowed, the last line must be EOM. Each line may have a maximum of 72 characters.
0-2*	DESC	Type of output display. For echo print of the input parameters, enter 'NODESC'. For a description of the model parameters enter 'DESC'.
1*	EPSY	Depth tolerance in Newton-Raphson Iteration scheme (0.001-1.0 FT). A good value is 0.01 FT.
	THETA	Acceleration factor in solving tributary junction problem (0.5-1.0). Varies with each problem. A good first choice is 0.8.
	F1	θ weighting factor (0.5-1.0) in finite difference technique. A good value is 0.6.
	XFACT	Factor to convert units describing the location of the computational points along the routing reach to feet; e.g., if units are in (units of MI) , XFACT=5280. When using metric units, this factor converts the units to meters: e.g., if units are in(km),XFACT=1000.
	DTHYD	Time interval (units of HR) of all input hydrographs. If time interval is not constant then set DTHYD=0. If running in NWSRFS (not in stand-alone mode) then set DTHYD>0.
	DTOUT	Time interval (units of HR) of all output hydrographs. If running in stand-alone mode (not a part of NWSRFS) then set DTOUT=0.
	METRIC	Parameter indicating if input/output is in English (METRIC=0) or Metric (METRIC=1) units. All computations within FLDWAV are done in English units; only the input/output may be displayed in metric units. See Table 1 [Bookmark] for units conversion information.
2*	JN	Total number of rivers in the system being routed simultaneously.
	NU	Number of values associated with observed

Data Group	Variable Name	Contents
		hydrographs.
	ITMAX	Maximum number of iterations allowed in the Newton-Raphson Iteration scheme for solving the system of nonlinear equations. If ITMAX=1, the nonlinear formation degenerates into a linear formation and no iterations are required in the Newton-Raphson iteration procedure. A good value is 10.
	KWARM	Number of time steps used for warm-up procedure. If KWARM=0, no warm-up is done. If KWARM> 0, the model assumes steady-state initial conditions and will solve the routing equations KWARM times without incrementing the time variable. A good value is 2. If running in NWSRFS (not stand-alone mode) or if initial conditions are not steady-state then set KWARM=0.
	KFLP	Parameter indicating the use of the floodplain (conveyance) option. If KFLP=0, no floodplain defined (composite channel used); if KFLP=1, floodplain used with conveyance (K) generated; if KFLP>2, floodplain used with K values read in and KFLP is the number of points in the conveyance table.
	NET	Parameter indicating the use of the channel network option. If NET=0, the network option is not used and a dendritic tree-type system is modeled using the relaxation algorithm. The network option is currently unavailable; set NET=0.
	ICOND	Parameter indicating the type of initial conditions. If initial conditions were not modified and will not be read in then set ICOND=0. If initial conditions are read-in then set ICOND=1 and initial conditions at interpolated cross sections will be interpolated between the read-in values. If running in stand-alone mode (not a part of NWSRFS) then set ICOND=0.
	NMAP	Number of flood inundation mapping scenarios. If no flood mapping in the system then set NMAP=0.
	IFUT(2)	Future parameters; enter three zero values for future enhancements.

Data Group	Variable Name	Contents
3*	NYQD	Number of sets of stage-discharge values in empirical rating curve at downstream boundary.
	KCG	Number of data points in spillway gate control curve of gate opening (GHT) versus time (TGHT) (DG-38,DG-39). If no movable gates in the system then set KCG=0.
	NCG	Maximum number of movable gates on any single dam in the system (ICG=2, DG-29). If no movable gates in the system then set NCG to 0.
	KPRES	Parameter indicating method of computing hydraulic radius ®). If KPRES=0, then R=A/B where A is cross-sectional flow area and B is channel top width; if KPRES=1, then R=A/P where P is wetted perimeter.
4*	NCS	Number of values in table of top width (BS) versus elevation (HS). This value applies to all cross sections in the river system.
	KPL	Parameter indicating what information will be plotted. If KPL=0, nothing is plotted; if KPL=1, water surface elevation (units of FT above Mean Sea Level) hydrographs are plotted; if KPL=2, discharge hydrographs are plotted; if KPL=3, both are plotted. This parameter has nothing to do with the FLDGRF utility. If running in NWSRFS (not in stand-alone mode) and KPL<0, stages (units of FT) will be plotted instead of elevations.
	JNK	Parameter indicating if hydraulic information will be printed. If JNK=0, nothing will be printed; if JNK>0, hydraulic information will be printed; if JNK<0, hydraulic information will be printed for specified reaches. See Table 2 [Bookmark] for description of intermediate analysis output. A good value is JNK=4 or 5.
	KREVRS	Parameter indicating use of the low flow filter. If KREVRS=0, the low flow filter is activated preventing the water surface elevations (WSELs) and discharges from going below the initial condition values; if KREVRS=1, the low flow filter is off and reverse flow is allowed.

Data Group	Variable Name	Contents
	NFGRF	Parameter indicating if data needed for the FLDGRF utility will be generated. If NFGRF=0, the data will be generated; if NFGRF=1, the data will not be generated.
5*	IOBS	Parameter indicating if observed data are available at gaging stations. If IOBS=0, no data available; if IOBS=1, data is available; if IOBS=2, observed data are available and the forecast stages will be adjusted using Manning n ranges; if IOBS=3, observed data are available and the forecast stages will be adjusted using specified balances; if IOBS=-1, a mathematical function is used to describe the inflow hydrograph. If running in stand-alone mode (not a part of NWSRFS), IOBS must be less than 2.
	KTERM	Parameter indicating if the terms in equation of motion will be printed as special information. If KTERM=0, they will not be printed; if KTERM=1, they will be printed. Normally use KTERM=0.
	NP	Parameter indicating if Automatic Calibration option is used. If NP=0, calibration is not used; if NP=-1, automatic calibration of the roughness coefficient (n) is done; if NP=-4, automatic calibration of n using average cross sections is done.
	NPST	Parameter indicating the first value in the computed stage hydrograph which will be used in the statistics needed in the automatic calibration option to determine the Manning n. If NPST=0, the first value of observed stage hydrograph will be used. If NP=0 then set NPST=0.
	NPEND	Parameter indicating the last value in the computed stage hydrograph which will be used in the statistics needed in the automatic calibration option to determine the Manning n. If NPEND=0, the last value of observed stage hydrograph will be used. If NP=0 then set NPEND=0.

Skip DG-6 if JNK is greater than or equal to 0.

Data Group	Variable Name	Contents
6	TDBG1	Time at which additional intermediate analysis information begins.

Data Group	Variable Name	Contents
	TDBG2	Time at which additional intermediate analysis information ends.
	JNKDBG	Intermediate analysis output indicator (JNK, DG-4). See Table 2 for available intermediate analysis output types.
	JDBG1	First river at which additional intermediate analysis information will be applied.
	JDBG2	Last river at which additional intermediate analysis information will be applied.
	LDBG1	First reach at which intermediate analysis information will be applied during calibration. If NP=0 (DG-5), LDBG1 is the first cross section where intermediate analysis will be applied during simulation.
	LDBG2	Last reach at which intermediate analysis information will be applied during calibration. After this reach has been calibrated, the model will stop. If NP=0 (DG-5), LDBG2 is the last cross section where intermediate analysis will be applied during simulation.
	MCMDBG	First iteration during calibration at which intermediate analysis information will be printed. If NP=0 (DG-5) then set MCMDBG=0.
7*	THE	Time (units of HR) at which routing computations will terminate. If running in NWSRFS (not stand-alone mode) then set THE=0.
	DTHII	Initial computational time step. If DTHII>0, a constant time step is used; if DTHII=0, a variable time step is used based on the inflow hydrographs and dam failure times. If DTHII<0, an array of time steps (NDT values) will be read in where NDT is the absolute value of DTHII.
	DTHPLT	Time step (units of HR) at which computed/observed hydrograph data are stored for plotting or printing. If DTHPLT=0 then set DTHPLT=DTHII. If KPL=0 (DG-4) then set DTHPLT=0.
	FRDFR	Window for critical Froude number in mixed-flow algorithm. Froude numbers in the range of (1+/- FRDFR) will be treated as though the

Data Group	Variable Name	Contents
		Froude number is equal to 1. The default value is 0.05.
	DTEXP	Computational time step (units of HR) for explicit routing. If DTEXP>0, then a constant time step is used. If DTEXP<0, then a variable time step is used based on the Courant number (C_n) where C_n is the absolute value of DTEXP. If explicit routing is not used then set DTEXP=0.
	MDT	Divisor for determining the time step ($\Delta t = t_p$/MDT). A good value is 20 for subcritical flow or 40 for supercritical flow. If a constant time step is read-in (DTHII not equal to 0) then set MDT=0.

Skip DG-8 and DG-9 if time step array is not used (DTHII greater than or equal 0).

Data Group	Variable Name	Contents
8	DTHIN(K)	Computational time step to be used until time TDTIN(K). K index goes from 1 to NDT (DG-7).
9	TDTIN(K)	Time at which DTHIN(K) is no longer used. K index goes from 1 to NDT (DG-7).
10*	NLEV	Total number of cross-section reaches in the system that have levees.
	DHLV	The difference between the maximum and minimum crest elevations along the reach (this is sometimes useful to prevent numerical problems with suddenly large outflows when the levee is first overtopped. If NLEV=0 then set DHLV to zero.
	DTHLV	Computational time step to be used during levee overtopping/failure. If NLEV=0 then set DTHLV=0.

Skip DG-11 if no levees in the system (NLEV=0).

Data Group	Variable Name	Contents
11	NJFM(K)	Sequence number of river from which levee overtopping/failure flow is passed from reach K.
	NIFM(K)	Sequence number of reach along the river from which levee flow passing into reach NITO(K).
	NJTO(K)	Sequence number of river or pond receiving flow from levee overtopping/failure in reach K.

Data Group	Variable Name	Contents
	NITO(K)	Sequence number of the reach along the river receiving flow from reach NIFM(K). If the receiving channel is a pond (i.e., level pool routing done) then set NITO(K)=0.

Repeat DG-11 for each levee reach (K=1,NLEV).

Skip DG-11a if no flood mapping in the system (NMAP=0).

Data Group	Variable Name	Contents
11a	MPRV(L)	Sequence number of main river where water surface profile will be mapped.
	MPLOC(1,L)	Sequence number of first cross section in the reach to be mapped.
	MPLOC(2,L)	Sequence number of last cross section in the reach to be mapped.
	DTMAP	Time step for flood map animation. This value is only read from the first mapping scenario (L=1). Therefore, it need not be entered for subsequent scenarios.
	SYSPTH(L)	River system name.
	TWNPTH(L)	Scenario name.

WARNING: The river system name and scenario name values are used with the fldview_dir token to define the directory in which the FLDVIEW data files are written. If the combination is not unique then the files could be overwritten. For example a Carryover Group is run which contains two Forecast Groups that have the same river system and scenario names but have different cross sections associated with them then the information for both scenarios will be written to the same directory but the data files will contain the information for the last scenario.

Repeat DG-11a for each mapping scenario (L=1,NMAP).

Data Group	Variable Name	Contents
12*	NBT(J)	Total number of actual cross sections on river J.
	NPT(1,J)	Beginning cross-section number (after interpolation) on river J for which intermediate analysis information will be printed. This parameter is required when JNK is greater than or equal to 9 .
	NPT(2,J)	Final cross-section number (after interpolation) on river J for which intermediate analysis information will be

Data Group	Variable Name	Contents
		printed. This parameter is required when JNK is greater than or equal to 9.
	MRV(J)	Number of river into which river J flows. Omit this field for main river (J=1). Note that tributary (J-1) is river J.
	NJUN(J)	Sequence number of cross section immediately upstream of tributary (J-1) confluence (this section coincides with the upstream extremity of the small sub-reach which is equivalent in length to the tributary width). Omit this field for main river (J=1).
	ATF(J)	Azimuth angle (degrees) that tributary J makes with the main river at the confluence. Omit this field for main river (J=1).
	EPQJ(J)	Discharge tolerance in Newton-Raphson Iteration scheme in main river (J=1) or in Tributary Iteration Scheme (J>1).
	COFW(J)	Coefficient of wind stress (1.1E-06 to 3.0E-06) on river J.
	VWIND(J)	Wind velocity (units of FT/S) on river J; (+) if directed upstream; (-) if directed downstream.
	WINAGL(J)	Acute angle (degrees) that wind makes with the channel axis of river J.

Repeat DG-12 for each river (J=1,JN).

Data Group	Variable Name	Contents
13*	KU(J)	Parameter indicating the type of upstream boundary condition being specified for the main river and tributaries; if KU(J)=1, a stage hydrograph is the upstream boundary condition; if KU(J)=2, a discharge hydrograph is the upstream boundary condition.
	KD(J)	Parameter indicating the type of downstream boundary condition being specified for the main river (KD(1)) and the tributaries (KD(J) where J goes from 2 to JN); if KD(1)=0, an observed tide hydrograph is specified which will be blended with a simulated tide hydrograph; if KD(1) or KD(J)=1, a stage hydrograph is the downstream boundary condition; if KD(1)=2, a discharge hydrograph is the downstream boundary condition; if KD(1)=3, a single-valued rating curve of

Data Group	Variable Name	Contents
		discharge as a function of stage is the boundary condition; if KD(1)=4, a looped rating curve is generated based on Manning's equation where the friction slope is computed based on the momentum equation; if KD(1)=5, normal flow computed from Manning's equation is the downstream boundary condition; if KD(1)=7, a looped rating curve is generated where the friction slope is computed based on conveyance; if KD(1)=1 and NYQD>0, a single-valued rating curve in which Q is a function of the computed water surface minus the read-in value of STN is the boundary condition. If running in stand-alone mode (not a part of NWSRFS), KD(1) must be greater than zero. In the case of tributaries, a stage hydrograph is generated at the downstream boundary and KD(J) is always equal to zero.
	NQL(J)	Total number of lateral flows on river J.
	NGAGE(J)	Total number of observed time series along river J (routing reach) which will be compared with computed time series; also, denotes total number of stations for which computed values will be plotted independently of FLDGRF.
	NRCM1(J)	Total number of Manning n reaches on river J.
	NQCM(J)	Total number of values in the Manning n table. Also, denotes whether Manning n is a function of water surface elevation (NQCM(J)>0) or discharge (NQCM(J)<0). If NQCM(J)=0, Manning n is a function of water surface elevation and the number of table values is equal to NCS.
	NSTR(J)	Total number of computed time series (stage, discharge, or velocity) to be stored on each river. (Number of output time series on each river). If running in stand-alone mode (not a part of NWSRFS) then set NSTR(J)=0.
	IFUT(3)	Future parameters; enter three zero values for future enhancements.

Repeat DG-13 for each river (J=1,JN).

14*	MIXF(J)	Parameter indicating the flow regime in river J. If MIXF(J)=0, river J has subcritical flow; if MIXF(J)=1, river J has supercritical

Data Group	Variable Name	Contents
		flow; if MIXF(J)>1, there is a mixture of subcritical and supercritical flow throughout river J at varying times; if MIXF(J)=2, the hydraulic jump can move upstream or downstream; if MIXF(J)=3, the hydraulic jump moves only if the Froude number exceeds 2; if MIXF(J)=4, the hydraulic jump is stationary; if MIXF(J)=5, a modified implicit technique (LPI) is used to solve mixed flows.
	MUD(J)	Parameter indicating the use of the mud/debris flow option on river J. If MUD(J)=0, dynamic routing of non-mudflow (water) will be done; if MUD(J)=1, dynamic routing of mudflow will be done.
	KFTR(J)	Parameter indicating the use of Kalman filter option on river J. If KFTR(J)=0, Kalman filter option is not used; if KFTR(J)=1, Kalman filter option will be used. Kalman filter can be turned on to update the forecast if river J has stage observations for more than 2 gaging stations.
	KLOS(J)	Parameter indicating the computation of volume losses in river J. If KLOS(J)=0, the losses will not be computed; if KLOS(J)=1, the losses will be computed.
	IFUT(6)	Future parameters; enter six zero values for future enhancements.

Repeat DG-14 for each river (J=1,JN).

Skip DG-15 if LPI technique is not used in system (all MIXF(J)'s are not equal to 5).

Data Group	Variable Name	Contents
15	KLPI(K)	Power (m) used in the LPI technique. Values range from 1 to 10 where m=10 approaches the fully dynamic technique and m=1 approaches the diffusion technique. K index goes from 1 to the number of rivers using the LPI technique. A good value is 5.

Skip DG-16 if MUDFLOW option is not used in system (all MUD(J)'s=0).

Data Group	Variable Name	Contents
16	UW1(J)	Unit weight (units of lb/FT3) of mud/debris fluid on river J.
	VIS1(J)	Dynamic viscosity (units of lb-sec/FT2) of mud/debris fluid in river J.

Data Group	Variable Name	Contents
	SHR1(J)	Initial yield stress of shear strength (units of lb/FT2) of mud/debris fluid on river J.
	POWR1(J)	Exponent in power function representing the stress-rate of strain relation of fluid in river J; if Bingham plastic is assumed for fluid then set POWR1(J)=1.0.
	IWF1(J)	Parameter indicating dry bed routing on river J. If IWF1(J)=0, the base flow at t=0 will be used all along the routing reach; if IWF1(J)>0, wave front tracking will be used where the wave front velocity (V_w) is a function of the channel velocity (V); if IWF1(J)=1, $V_w = V_{N-4}$; if IWF1(J)=2, $V_w=(K_W)(V_{N-4})$; if IWF1(J)=3, $V_w = _{CMAX}$, where $_{CMAX}$ is the maximum velocity in the channel reach, N is the current location of the wave front and K_W is the kinematic wave factor.

Repeat DG-16 for each river with mudflow (MUD(J)>0, J=1,JN).

Skip DG-17 if volume flow losses are not computed in system (all KLOS(J)'s=0).

Data Group	Variable Name	Contents
17	XLOS(1,J)	Beginning location (units of MI) of the reaches where flow loss will occur on river J.
	XLOS(2,J)	Ending location (units of MI) of the reaches where flow loss will occur on river J.
	QLOS(J)	Percentage of the loss in terms of total active flow amount; (-) for loss and (+) for gain.
	ALOS(J)	Loss distribution coefficient for river J (0.3-3.0). For a linear loss distribution then set ALOS(J)=1.

Repeat DG-17 for each river with volume flow losses (KLOS(J)>0, J=1,JN).

Data Group	Variable Name	Contents
18*	XT(I,J)	Location of station or cross section where computations are made (units can be anything since XFACT converts these units to FT); I index goes from 1 to NBT(J).
19*	DXM(I,J)	Minimum computational distance step between cross sections. If DXM(I,J) is less than the distance between two adjacent cross sections read in, then intermediate cross sections are

Data Group	Variable Name	Contents
		created within the program via a linear interpolation procedure. I index goes from 1 to NBT(J)-1.
20*	KRCHT(I,J)	Parameter indicating routing method or internal boundary condition in each reach. See Table 3 [Bookmark] for a description of each type. I index goes from 1 to (NBT(J)-1).

Repeat DG-18 through DG-20 for each river (J=1,JN).

Skip DG-21 through DG-25 if NLEV=0.

Data Group	Variable Name	Contents
21	HWLV(L)	Elevation (units of FT above Mean Sea Level) of top of levee, ridge line, etc. where weir-flow occurs. This elevation is located on the upstream end of the levee reach. If HWLV(L)<0, discharge flows through a pipe and the absolute value of HWLV(L) is the invert elevation of pipe.
	WCLV(L)	Weir-flow discharge coefficient for Δx reach where weir flow (inflow or outflow) may occur. Coefficient ranges from 2.6 to 3.2; if there is a pipe connection(HWLV(L)<0), the weir coefficient=the absolute value of (8.02 times the discharge loss coefficient times the maximum area of the pipe).
	TFLV(L)	Time (units of HR) from start of levee failure (crevasse) until the opening or breach is its maximum size. Set TFLV(L)=0 if the levee does not fail.
	BLVMX(L)	Final width (units of FT) of levee crevasse which is assumed to have a rectangular shape (200-5000 FT). Set BLVMX(L)=0 if the levee does not fail.
	HFLV(L)	Elevation (units of FT above Mean Sea Level) of water surface when levee starts to fail. Set HFLV(L)=0 if the levee does not fail.
	HLVMN(L)	Final elevation (units of FT above Mean Sea Level) of bottom of levee crevasse. Set HLVMN(L)=0 if the levee does not fail.
	SLV(L)	Slope of levee L (units of FT/FT). This parameter is used to interpolate levee reaches. Interpolation is done from the upstream end of the reach.

Data Group	Variable Name	Contents

Skip DG-22 if levee has no drainage pipe (HWLV(L) is greater than or equal to 0).

22	HPLV(L)	Centerline elevation (units of FT above Mean Sea Level) of flood drainage pipe (with flood gate).
	DPLV(L)	Diameter (units of FT) of flood drainage pipe.

Repeat DG-21 and DG-22 for each levee reach (L=1,NLEV).

Skip DG-23 through DG-25 if no ponds exist in the system (NITO(L)>0, L=1,NLEV).

23	HPOND(L)	Initial water surface elevation (units of FT above Mean Sea Level) of storage pond L in levee option.
24	SAPOND(K,L)	Surface area (acres) of storage pond L corresponding to elevation HSAP in the area-elevation curve. These values should be entered from the top of the pond (maximum elevation) to the bottom. K index goes from 1 to 8. If less than 8 values are needed to describe the pond then set the remaining values to zero.
25	HSAP(K,L)	Elevation (units of FT above Mean Sea Level) corresponding to SAPOND in the area elevation curve. These values should be entered from the top of the pond (maximum elevation) to the bottom. K index goes from 1 to 8. If less than 8 values are needed to describe the pond then set the remaining values to zero.

Repeat DG-23 through DG-25 for each pond (L=1 to number of ponds).

Skip DG-26 through DG-47 if no internal boundaries in the system (all KRCHT<10).

Skip DG-26 through DG-43 if internal boundary K is not a dam (KRCHT(K,J)<10 or KRCHT(K,J)>30).

Skip DG-26 and DG-27 if internal boundary K is not a reservoir (KRCHT(K,J) is not equal to 4 or [KRCHT(1,J)<10 or KRCHT(1,J)>30]).

26	SAR(L,K,J)	Surface area (acres) of reservoir behind dam at elevation HSAR(L,K,J). Values should be read in from the top of the reservoir to the bottom of the reservoir. L index goes from 1 to 8; if less than 8 values are needed to

Data Group	Variable Name	Contents
		describe the reservoir then set the remaining values to zero.
27	HSAR(L,K,J)	Elevation (units of FT above Mean Sea Level) at which reservoir surface area SAR(L,K,J) is defined. Values should be read in from the top of the reservoir to the bottom of the reservoir. L index goes from 1 to 8; if less than 8 values are needed to describe the reservoir then set the remaining values to zero.
28**	LAD(K,J)	Reach number corresponding to location of dam K.
	HDD(K,J)	Elevation (units of FT above Mean Sea Level) of top of dam. If the default value is specified by setting this value to 0.00 then the value printed will be the default value actually used in the calculations and the value punched will be 0.00. 1/
	CLL(K,J)	Length (units of FT) of the dam crest less the length of the uncontrolled spillway and gates. If CLL(K,J) is entered as a negative value, the length of the dam crest is variable with elevation and will be specified later as DG-30 and DG-31.
	CDOD(K,J)	Discharge coefficient for uncontrolled weir flow over the top of the dam (2.6-3.1). If the default value is specified by setting this value to 0.00 then the value printed will be the default value actually used in the calculations and the value punched will be 0.00. 1/
	QTD(K,J)	Discharge (units of CFS) through turbines. This flow is assumed constant from start of computations until the dam is 1/4 breached; thereafter, QTD(K,J) is assumed to linearly decrease to zero when ½ breached; QTD(K,J) may also be considered leaking or constant spillway flow. If this flow is time-dependent, QTD(K,J) is entered with any negative value and the time series for QTD(K,J) is specified later on DG-32 and DG-33.
	ICHAN(K,J)	Parameter indicating if channel conditions at dam K will switch from manual control (e.g., lock and dam controlled by the lockmaster) to

Data Group	Variable Name	Contents
		channel control (i.e., unsteady flow conditions). If no manual control then set ICHAN(K,J)=0; if channel control switch is allowed then set ICHAN(K,J)=1.

If dam is represented by a rating curve only then set all values in DG-28 to zero except LAD(K,J).

Data Group	Variable Name	Contents
29**	ICG(K,J)	Parameter indicating type of movable gate structure. If ICG(K,J)=0, no movable gates exist; if ICG(K,J)=1, movable gates exist using an average gate opening; if ICG(K,J)=2, multiple movable gates exist with independent gate openings.
	HSPD(K,J)	Elevation (units of FT above Mean Sea Level) of uncontrolled spillway crest. If no spillway exists then set HSPD(K,J)=0.If the default value is specified by setting this value to 0.00 then the value printed will be the default value actually used in the calculations and the value punched will be 0.00. 1/
	SPL(K,J)	Crest length (units of FT) of uncontrolled spillway. If no spillway exists, let SPL(K,J)=0.
	CSD(K,J)	Discharge coefficient of uncontrolled spillway (2.6-3.2). If CSD(K,J)<0, the failure starts in the spillway at its crest and failure is confined to a length of the spillway. If no spillway exists then set CSD(K,J)=0. If spillway is represented by an empirical rating curve then set CSD(K,J)=0 and HSPD(K,J)>0. Note that only one empirical rating is allowed at the dam. If several rating curves exist at the dam, they should be combined and entered as one rating curve.
	HGTD(K,J)	Elevation (units of FT above Mean Sea Level) of center of gate openings for average moveable gates. If the default value is specified by setting this value to 0.00 then the value printed will be the default value actually used in the calculations and the value punched will be 0.00. 1/
	CGD(K,J)	Discharge coefficient for gate flow (0.60-0.80) times the area of the gates (units of FT2). If no gate exists then set CGD(K,J)=0. If gates are represented by an empirical

Data Group	Variable Name	Contents
		rating curve then set CGD(K,J)=0. Note that only one empirical rating is allowed at the dam. If several rating curves exist at the dam, they should be combined and entered as one rating curve. If the average moveable gate option is used and submergence effects are expected, an empirical rating curve with built-in submergence should be used.

If dam is represented by a rating curve only then set all values in DG-29 to zero except HSPD(K,J).

Skip DG-30 and DG-31 if the dam crest length is constant (CLL(K,J) is greater than or equal to zero, DG-28).

30	HCRESL(L,K,J)	Elevation (units of FT above Mean Sea Level) associated with variable length of dam crest, CRESL(L,K,J), for dam. Values should be read-in starting at the minimal crest elevation to the maximum elevation. L index goes from 1 to 8; if less than 8 values are needed to describe the dam crest then set the remaining values to zero.
31	CRESL(L,K,J)	Variable length (units of FT) of dam crest for a given elevation, HCRESL(L,K,J). L index goes from 1 to 8; if less than 8 values are needed to describe the dam crest then set the remaining values to zero.

Skip DG-32 through DG-39 if running in NWSRFS (not stand-alone mode).

Skip DG-32 and DG-33 if the turbine flow is constant (QTD(K,J), DG-28, is greater than or equal to 0).

32	QTT(L,K,J)	Variable discharge (units of CFS) through the turbines; this flow is time dependent. L index goes from 1 to NU (DG-2).
33	TQT(L,K,J)	Time (units of HR) associated with discharge through turbines, QTT(L,K,J). L index goes from 1 to NU (DG-2).

Skip DG-34 and DG-35 if no rating curve is generated for the spillway or gate structure (KRCHT(K,J), DG-20,) is not equal to 11,21,12).

34	RHI(L,K,J)	Head (units of FT) above spillway crest or gate center. Head is associated with spillway or gate flow, RQI(L,K,J), in rating curve. L index goes from 1 to 8; if less than 8 values

Data Group	Variable Name	Contents
		are needed to describe the rating curve then set the remaining values to zero.
35	RQI(L,K,J)	Discharge (units of CFS) of spillway or gate rating curve corresponding to RHI(L,K,J). L index goes from 1 to 8; if less than 8 values are needed to describe the rating curve then set the remaining values to zero.

Skip DG-36 through DG-39 if no multiple movable gates (KRCHT(K,J) is not equal to 14).

Data Group	Variable Name	Contents
36	NG(K,J)	Number of movable gates in dam K.
37	GSIL(L,K,J)	Elevation (units of FT above Mean Sea Level) of the bottom of gate L.
	GWID(L,K,J)	Width of gate opening on gate L.
38	TGHT(I,L,K,J)	Time (units of HR) associated with gate opening GHT(L,K,J). I index goes from 1 to KCG (DG-3).
39	GHT(I,L,K,J)	Distance (units of FT) from bottom of gate to gate sill, GSIL(I,L,K,J). This distance is time dependent and is associated with the time array TGHT(I,L,K,J); I index goes from 1 to KCG.

Repeat DG-37 through DG-39 for each movable gate (L=1,NG(K,J)).

Skip DG-40 through DG-43 if internal boundary is not a lock and dam (KRCHT(K,J), DG-20, is not equal to 28).

Data Group	Variable Name	Contents
40	PTAR(K,J)	Elevation (units of FT above Mean Sea Level) of water surface in headwater pool at upstream face of lock and dam; this elevation is considered the target pool elevation; the lock-master controls the flow through the dam via gates to maintain the pool elevation at this target elevation.
41	CHTW(K,J)	Elevation (units of FT above Mean Sea Level) of water surface in tailwater pool at downstream face of lock and dam; this elevation is considered the elevation at which the lock-master can no longer control the flow through the dam and the flow becomes channel controlled; usually this elevation will be equal to or slightly less than the target pool elevation.

Data Group	Variable Name	Contents

Skip DG-42 and DG-43 if running in NWSRFS (not in stand-alone mode).

42	POLH(L,K,J)	Target pool elevation (same as PTAR(K,J)) for each time step; if POLH(L,K,J)=0.0 is read-in, then PTAR(K,J) is used for POLH(L,K,J). L index goes from 1 to NU (DG-2). These elevations are associated with the inflow hydrograph time array.

Skip DG-43 if lock and dam will not be manually controlled (ICHAN(K,J)=0, DG-28).

43	ITWT(L,K,J)	Parameter indicating if gates control the flow; if ITWT(L,K,J)=0, flow is controlled by the gates; if ITWT(L,K,J)=1, flow is not controlled by the gates, e.g., the entire dam is removed as in the case of the low lift dams on the lower Ohio River and the flow becomes channel controlled. L index goes from 1 to NU (DG-2). These gate control switches are associated with the inflow hydrograph time array.

Skip DG-44 through DG-46 if internal boundary is not a bridge (KRCHT(K,J) is not equal to 35).

44	LAD(K,J)	Reach number corresponding to location of bridge K.
	EMBEL2(K,J)	Crest elevation (units of FT above Mean Sea Level) of uppermost portion of road embankment.
	EMBW2(K,J)	Crest length (units of FT) of uppermost portion of road embankment (including bridge opening) measured across valley and perpendicular to flow.
	EMBEL1(K,J)	Crest elevation (units of FT above Mean Sea Level) of lower portion (emergency overflow) of road embankment. If nonexistent then set EMBEL1(K,J)=0.
	EMBW1(K,J)	Crest length (units of FT) of lower portion of road embankment measured across valley and perpendicular to flow. If nonexistent then set EMBW1(K,J)=0.
	BRGW(K,J)	Width (units of FT) of top of road embankment as measured parallel to flow.
	CDBRG(K,J)	Coefficient of discharge of flow through bridge opening (see Chow, Open Channel

Data Group	Variable Name	Contents
		Hydraulics, pages 476-490).
45	BRGHS(L,K,J)	Elevations (units of FT above Mean Sea Level) associated with widths of bridge opening; the brige opening should be closed by setting the last BRGHS(L,K,J) slightly higher (say 0.1 FT.) than the previous value; start at invert and proceed upwards. L index goes from 1 to 8; if less than 8 values are needed to describe the bridge opening then set the remaining values to zero.
46	BRGBS(L,K,J)	Width (units of FT) associated with BRGHS(L,K,J) elevation of bridge opening; the bridge opening should be closed by setting the last BRGBS(L,K,J)=0; start at invert and proceed upwards. L index goes from 1 to 8; if less than 8 values are needed to describe the bridge opening then set the remaining values to zero.

Skip DG-47 if internal boundary is not a dam or a bridge.

47**	TFH(K,J)	Time (units of HR) from beginning of breach formation until it reaches its maximum size in dam/bridge K.
	DTHDB(K,J)	Computational time step (units of HR) to be used after failure of dam/bridge K. If DTHDB(K,J)=0, the time step size will be computed as TFH(K,J)/MDT; if multiple dams/ bridges have failed, the smallest time step will be used during computations.
	HFDD(K,J)	Elevation (units of FT) of water when failure of dam/embankment K commences. If HFDD(K,J)<0, failure commences at time equal to the absolute value of HFDD(K,J) (units of HR).
	BBD(K,J)	Final (maximum) width (units of FT) of bottom of breach.
	ZBCH(K,J)	Side slope (1 vertical : ZBCH(K,J) horizontal) of breach.
	YBMIN(K,J)	Lowest elevation (units of FT above Mean Sea Level) that bottom of breach reaches.
	BREXP(K,J)	Exponent used in development of breach. Varies from 1 to 4; a typical value is 1.

Data Group	Variable Name	Contents
	CPIP(K,J)	Centerline elevation (units of FT above Mean Sea Level) of piping breach. If breach is overtopping then set CPIP(K,J)=0.

Repeat DG-26 through DG-47 for each dam/bridge on river J, K=1,NDB where NDB is the number of dams/bridges; then repeat again for each river (J=1,JN).

Skip DG-48 and DG-49 if NQL(J) is less than or equal to 0.

48	LQ1(K,J)	Sequence number of upstream cross section with lateral inflow. LQ1(K,J) must be placed in columns 1-10.
	STNAME(K,J)	Time series identifier for cross section with lateral flow. STNAME(K,J) may be up to 8 characters long and it must begin in column 13. Omit this field if running in stand-alone mode.
	DTYPE(K,J)	Time series data type for cross section with lateral flow. DTYPE(K,J) may be up to 4 characters long and it must begin in column 22. Omit this field if running in stand-alone mode.

Skip DG-49 if running in NWSRFS (not stand-alone mode).

49	QL(L,K,J)	Lateral inflow at cross section LQ1(K,J). L index goes from 1 to NU. This hydrograph is associated with the inflow hydrograph time array.

Repeat DG-48 and DG-49 for each lateral flow (K=1,NQL(J), DG-13); then repeat again for each river (J=1,JN).

Skip DG-50 through DG-53 if NGAGE(J)=0 (DG-13).

50	NGS(K,J)	Sequence number of cross section that is an observed/plotting station. NGS(K,J) must be placed in columns 1-10.
	GZ(K,J)	Gage correction to convert observed stages to mean sea level datum. GZ(K,J) must be placed in columns 11-20. Omit this field if KPL=2 (DG-4) or IOBS is less than or equal to 0 (DG-5).
	STNAME(K,J)	Time series identifier for cross section where observed data will be available or where plotting will be done. STNAME(K,J) may be up to 8 characters long and it must begin

Data Group	Variable Name	Contents
		in column 23 (it must begin in column 13 if GZ(K,J) is omitted). If running in stand-alone mode, STNAME(K,J) may be up to 20 characters long.
	DTYPE(K,J)	Time series data type for cross section where observed data will be available or where plotting will be done. DTYPE(K,J) may be up to 4 characters long and it must begin in column 32 (it must begin in column 22 if GZ(K,J) is omitted). Omit this field if running in stand-alone mode.

Skip DG-51 if running in NWSRFS (not stand-alone mode) or IOBS (DG-5) is less than or equal to 0.

51	STT(L,K,J)	Observed stage or discharge time series at cross section NGS(K,J). L index goes from 1 to NU. The time array associated with this hydrograph is the same as for the inflow hydrograph.

Skip DG-52 & DG-53 if KPL (DG-4) is not equal to 3 or IOBS (DG-5) is less than or equal to 0.

Skip DG-52 if running in stand-alone mode (not a part of NWSRFS).

52	STNAME(K,J)	Time series identifier for cross section where observed discharges will be available or where discharges will be plotted. STNAME(K,J) may be up to 8 characters long and it must begin in column 3.
	DTYPE(K,J)	Time series data type for cross section where observed discharges will be available or where discharges will be plotted. DTYPE(K,J) may be up to 4 characters long and it must begin in column 12. Omit this field if running in stand-alone mode.

Skip DG-53 if running in NWSRFS (not stand-alone mode).

53	STQ(L,K,J)	Observed discharge time series at cross section NGS(K,J), DG-50. L index goes from 1 to NU (DG-2). The time array associated with this hydrograph is the same as for the inflow hydrograph.

Repeat DG-50 through DG-53 for each gaging station (K=1,NGAGE(J), DG-13); then repeat the group for each river (J=1,JN).

Skip DG-54 if NSTR(J)=0 (DG-13) or if running in stand-alone mode

Data Group	Variable Name	Contents

(not a part of NWSRFS).

54	NST(K,J)	Sequence number of upstream cross section with an output time series. NST(K,J) must be placed in columns 1-10.
	STNAME(K,J)	Time series identifier for cross section with output time series. STNAME(K,J) may be up to 8 characters long and it must begin in column 13.
	DTYPE(K,J)	Time series data type for cross section with output time series. DTYPE(K,J) may be up to 4 characters long and it must begin in column 22.
	GZO(K,J)	Gage correction to convert output water surface elevations to stages. GZO(K,J) must be placed in columns 26-36. If the output time series is not stage then set GZO(K,J)=0.

Repeat DG-54 for each output time series (K=1,NSTR(J), DG-13); then repeat the group for each river (J=1,JN).

Skip DG-55 if IOBS is greater than or equal to 0.

55	TPG(J)	Time (units of HR) from initial steady flow to peak of specified upstream boundary hydrograph (used in mathematical function describing the hydrograph).
	RHO(J)	Ratio of peak value of specified hydrograph to initial value of the hydrograph.
	GAMA(J)	Ratio of time TG to TPG(J) where TG is time from initial steady flow to center of gravity of the specified hydrograph. GAMA(J) must be>1.
	YQI(J)	Initial steady discharge (units of CFS) or water surface elevation (units of FT above Mean Sea Level) at the upstream boundary.

Repeat DG-55 for each river (J=1,JN).

Skip DG-56 through DG-58 if KU(J)>2 (DG-13).

Skip DG-56 and DG-57 if running in NWSRFS (not stand-alone mode).

56	ST1(L,J)	Stages (units of FT) or discharges (units of CFS) at upstream boundary of river J. L index goes from 1 to NU (DG-2).

Data Group	Variable Name	Contents

Skip DG-57 if DTHYD>0 (DG-1).

57*	T1(L,J)	Time array associated with upstream hydrograph ST1(L,J). L index goes from 1 to NU (DG-2).

Skip DG-58 if running in stand-alone mode (not a part of NWSRFS) and KU(J)=2 (DG-13).

58*	STM(J)	Minimum stage (units of FT) or discharge (units of CFS) allowed at the upstream boundary. STM(J) must be placed in columns 1-10. Omit this parameter if running in stand-alone mode (not a part of NWSRFS).
	GZ1(J)	Gage correction to convert upstream stages to mean sea level datum. GZ1(J) must be placed in columns 11-20. Omit this parameter if KU(J)=2 (DG-13).
	STNAME(J)	Time series identifier for stages (units of FT) or discharges (units of CFS) at the upstream boundary. STNAME(J) may be up to 8 characters long and it must begin in column 23 (it must begin in column 13 if GZ1(J) is omitted). Omit this parameter if running in stand-alone mode (not a part of NWSRFS).
	DTYPE(J)	Time series data type for observed stages (units of FT) or discharges (units of CFS) at the upstream boundary. DTYPE(J) may be up to 4 characters long and it must begin in column 32 (it must begin in column 22 if GZ1(J) is omitted). Omit this parameter if running in stand-alone mode (not a part of NWSRFS).

Repeat DG-56 through DG-58 for each river (J=1,JN).

Skip DG-59 through DG-65 if KD(J)=0 (DG-13).

Skip DG-59 through DG-63 if KD(1)>2 (DG-13).

Skip DG-59 if running in NWSRFS (not stand-alone mode).

59	STN(K,1)	Observed stages (KD(1)=1) or discharges (KD(1)=2) at downstream boundary of main river. K index goes from 1 to NU (DG-2).

Skip DG-60 if running in stand-alone mode (not a part of NWSRFS) and KD(1) is not equal to 1 or 3 (DG-13).

60	GZN	Gage correction (units of FT above Mean Sea

Data Group	Variable Name	Contents
		Level) to convert downstream stages to mean sea level datum. GZN must be placed in columns 1-10. Omit this field if KD(1) is not equal to 1 or 3(DG-13).
	STNAME	Time series identifier for stages (KD(1)=1, DG-13) or discharges (KD(1)=2, DG-13) at downstream boundary of main river. STNAME may be up to 8 characters long and it must begin in column 13 (it must begin in column 1 if GZN is omitted). Omit this parameter if running in stand-alone mode (not a part of NWSRFS).
	DTYPE	Time series data type for stages (units of FT) or discharges (units of CFS) at the downstream boundary. DTYPE may be up to 4 characters long and it must begin in column 22 (it must begin in column 12 if GZN is omitted). Omit this parameter if running in stand-alone mode (not a part of NWSRFS).

Skip DG-61 through DG-63 if running in stand-alone mode (not a part of NWSRFS).

Skip DG-61 and DG-62 if the NOS tide is not used for the downstream boundary (KD(1), DG-13, is not equal to 0).

Data Group	Variable Name	Contents
61	STNAME	Time series identifier for NOS tide at the downstream boundary. STNAME may be up to 8 characters long and it must begin in column 3.
	DTYPE	Time series data type for NOS at the downstream boundary. DTYPE may be up to 4 characters long and it must begin in column 13.
62	STNAME	Time series identifier for the adjusted tide at the downstream boundary. STNAME may be up to 8 characters long and it must begin in column 3.
	DTYPE	Time series data type for the adjusted tide at the downstream boundary. DTYPE may be up to 4 characters long and it must begin in column 13.

Skip DG-63 if computed hydrographs are not adjusted (IOBS, DG-5, is less than 2).

Data Group	Variable Name	Contents
63	STNAME(K,J)	Time series identifier for cross section

Data Group	Variable Name	Contents
		location where the computed stage or discharge hydrograph will be adjusted based on observed data. STNAME may be up to 8 characters long and it must begin in column 3.
	DTYPE(K,J)	Time series data type for cross section location where the computed stage or discharge hydrograph will be adjusted based on observed data. DTYPE may be up to 4 characters long and it must begin in column 13.

Repeat DG-63 for each gaging station (K=1,NGAGE(J), DG-13); then repeat the group for each river (J=1,JN).

Skip DG-64 if KD(1), DG-13, is not equal to 0, or if running in stand-alone mode (not a part of NWSRFS).

Skip DG-64 through DG-66 if NYQD=0 (DG-3) OR KD(1) is not equal to 3 (DG-13).

Skip DG-64 if running in stand-alone mode (not a part of NWSRFS).

Data Group	Variable Name	Contents
64	STNAME	Rating curve identifier for cross section at downstream boundary on main river. STNAME may be up to 8 characters long and it must begin in column 1.

Skip DG-65 and DG-66 if running in NWSRFS (not stand-alone mode).

Data Group	Variable Name	Contents
65	YQD(K)	Stages (units of FT) used to define the empirical rating curve at the downstream boundary on the main river. K goes from 1 to NYQD.
66	QYQD(K)	Discharge (units of CFS) used to define the empirical rating curve at the downstream boundary on the main river. K goes from 1 to NYQD.
	Skip DG-67 if KD(1) is not equal to 5.	
67	SLFI(1)	Bed/initial water surface slope (units of FT /FT) of the main river. This slope is used to generate the single-valued rating curve at the downstream boundary.

Skip DG-68 and DG-69 if internal boundary is not a lock and dam (KRCHT(K,J) is not equal to 28, DG-20) or if running in stand-alone mode (not a part of NWSRFS).

Data Group	Variable Name	Contents
68	STNAME(K,J)	Time series identifier for cross section with target pool elevations. STNAME(K,J) may be up to 8 characters long and it must begin in column 3.
	DTYPE(K,J)	Time series data type for cross section with target pool elevations. DTYPE(K,J) may be up to 4 characters long and it must begin in column 12.

Skip DG-69 if lock and dam will never switch to channel control (ICHAN(K,J)=0, DG-28)

69	STNAME(K,J)	Time series identifier for cross section with gate control switches. STNAME(K,J) may be up to 8 characters long and it must begin in column 3.
	DTYPE(K,J)	Time series data type for cross section with gate control switches. DTYPE(K,J) may be up to 4 characters long and it must begin in column 12.

Repeat DG-68and DG-69 for each lock and dam (KRCHT(K,J)=28, DG-20); then repeat the group for each river (J=1,JN).

Skip DG-70 through DG-75 if NP is not equal to -4.

70	IFXC(I,J)	Parameter indicating if cross section has special properties when CALXS option is used. If no special properties, IFXC(I,J)=0; if actual section is to be read in, IFXC(I,J)=1; I index goes from 1 to NBT(J), DG-12.
71	HSC(J)	Invert elevation (units of FT) at the most upstream cross section on river J.
72	KAM	Parameter indicating the method for reading in cross sections in the calibration reach. If KAM=0, cross sections are described as topwidth versus depth (B versus Y) at key points in the cross section (see Figure 1 [Bookmark]); if KAM=1, cross sections are described as the power function $B=kY^m$ where m is a shape factor and k is a scaling factor (see Figure 2 [Bookmark]).
	CHNMN(I,J)	The minimum acceptable Manning n value computed during automatic calibration for calibration reach I. The default value is 0.013.

Data Group	Variable Name	Contents
	CHNMX(I,J)	The maximum acceptable value of Manning n value computed during automatic calibration for calibration reach I. The default value is 0.25.
	SXS	Average channel bottom slope (units of FT /MI) along calibration reach I.

Skip DG-73 if KAM=0.

Data Group	Variable Name	Contents
73	FKC(I,J)	Scaling parameter of the channel in-bank portion of cross section in calibration reach I described in power function.
	FMC(I,J)	Shape factor for the channel in-bank portion of cross section in calibration reach I described in power function.
	FKF(I,J)	Scaling parameter of floodplain portion of cross section in calibration reach I described in power function.
	FMF(I,J)	Shape factor for floodplain portion of cross section in calibration reach I described in power function.
	FKO(I,J)	Scaling parameter of dead storage (inactive) portion of cross section in calibration reach I described in power function.
	FMO(I,J)	Shape factor for dead storage (inactive) portion of cross section in calibration reach I described in power function.
	HB	Depth (units of FT) of cross section at top of bank.
	HF	Depth (units of FT) of cross section at top of floodplain.

Skip DG-74 and DG-75 if KAM=1.

Data Group	Variable Name	Contents
74	B1	Active top width (units of FT) of typical cross section in calibration reach I at depth Y1 (half of channel depth).
	B2	Active top width (units of FT) of typical cross section in calibration reach I at depth Y2 (top of bank).
	B3	Active top width (units of FT) of typical cross section in calibration reach I at depth

Data Group	Variable Name	Contents
		Y3 (midpoint of floodplain). Enter zero if no floodplain.
	B4	Active top width (units of FT) of typical cross section in calibration reach I at depth Y4 (maximum flood depth). Enter zero if no floodplain.
	B5	Dead storage (inactive) top width (units of FT) of typical cross section in calibration reach I at depth Y3. Enter zero if no inactive storage.
	B6	Dead storage (inactive) top width (units of FT) of typical cross section in calibration reach I at depth Y4. Enter zero if no inactive storage.
75	Y1	Depth (units of FT) of typical cross section in calibration reach I at mid-point between the invert and top of bank.
	Y2	Depth (units of FT) of typical cross section in calibration reach I at top of bank.
	Y3	Depth (units of FT) measured from invert of typical cross section in calibration reach I to midpoint between the top of bank and estimated maximum flood elevation.
	Y4	Depth (units of FT) of typical cross section in calibration reach I at an estimated maximum flood elevation.

Repeat DG-72 through DG-75 for each calibration reach (I=1,NGAGE(J)-1).

Data Group	Variable Name	Contents
76*	FLST(I,J)	Elevation (units of FT above Mean Sea Level) at which flooding commences. If no flood stage, enter zero.
	YDI(I,J)	Initial water surface elevation (units of FT above Mean Sea Level) at cross section I. If steady state conditions exist, the YDI value at the downstream location of the main river and pool levels behind dams must be read in (all other values are entered as zero) and the model will do backwater computations; otherwise, all values are read in. Omit this parameter if running in NWSRFS (not stand-alone mode).

Data Group	Variable Name	Contents
	QDI(I,J)	Initial discharge (units of CFS) at cross section I. If steady state conditions exist, all QDI values are read in as zero and the QDI values are generated by summation of flows from upstream to downstream. If KU(J) is not equal to 2, the upstream discharge (QDI(I,J)) must be read in. If unsteady-state condition exists, all QDI values are read in. Omit this parameter if running in NWSRFS (not stand-alone mode).
	AS(1,I,J)	Active channel cross-sectional area (units of FT2) below the lowest HS elevation in cross section I.
	XLAT(I,J)	Latitude of the river centerline as it crosses the channel bottom. If no flood mapping (NMAP=0), omit this field.
	XLON(I,J)	Longitude of the river centerline as it crosses the channel bottom. If no flood mapping (NMAP=0), omit this field.

Skip DG-77 through DG-83 if NP=-4 and IFXC(I,J)=0.

77*	HS(L,I,J)	Elevation (units of FT above Mean Sea Level) corresponding to each top width BS(L,I,J). Elevations are entered from the bottom of the cross section upward; L index goes from 1 to NCS.
78*	BS(L,I,J)	Top width (units of FT) of active flow portion of channel/valley cross section corresponding to each elevation HS(L,I,J). L index goes from 1 to NCS.

Skip DG-79 and DG-80 if KFLP=0.

79	BSL(L,I,J)	Top width (units of FT) of active flow portion of left floodplain corresponding to each elevation HS(L,I,J). L index goes from 1 to NCS.
80	BSR(L,I,J)	Top width (units of FT) of active flow portion of right floodplain corresponding to each elevation HS(L,I,J). L index goes from 1 to NCS.

Skip DG-81 and DG-82 if KFLP is less than or equal to 1 .

81	HKC(L,I,J)	Elevation (units of FT above Mean Sea Level) corresponding to the conveyance QKC(L,I,J). L

Data Group	Variable Name	Contents
		index goes from 1 to KFLP.
82	QKC(L,I,J)	Conveyance corresponding to elevation HKC(L,I,J). I index goes from 1 to KFLP.
83*	BSS(L,I,J)	Top width (units of FT) of dead storage (inactive) portion of channel/valley cross section corresponding to each elevation HS(L,I,J). K index goes from 1 to NCS; if no inactive storage exists, enter zero.

Repeat DG-76 through DG-83 for each cross section (I=1,NBT(J)).

Repeat DG-70 through DG-83 for each river (J=1,JN).

Skip DG-84 if KFLP is not equal to 1.

84	SNM(L,I,J)	Sinuosity coefficient (channel flow-path length/floodplain flow-path length corresponding to each elevation HS(L,I,J). L index goes from 1 to NCS.

Repeat DG-84 for all reaches (I=1,NBT(J)-1).

85*	FKEC(I,J)	Expansion or contraction coefficients. Expansion coefficients vary from -.05 to -.75 and contraction coefficients vary from +.10 to +.40, the larger values are associated with very abrupt changes in cross section along the river; if expansion/contraction is negligible then set FKEC(I,J)=0. I index goes from 1 to NBT(J)-1.
86*	NCM(I,J)	Station number of upstream-most station in subreach that has the same Manning n. I index goes from 1 to NRCM1(J).
87*	CM(L,I,J)	Manning n corresponding to each YQCM(L,I,J) value. L index goes from 1 to NQCM(J); if NQCM(J)=0, Manning n values are treated as in the DAMBRK program where Manning n is a function of the average elevation between two cross sections and L index goes from 1 to NCS.

Skip DG-88 and DG-89 if KFLP=0.

88	CML(L,I,J)	Manning n corresponding to each YQCM(L,I,J) value for left floodplain. L index goes from 1 to NQCM(J); the same rules apply for NQCM(J) as were previously stated in DG-84.
89	CMR(L,I,J)	Manning n corresponding to each YQCM(L,I,J) value for right floodplain. L index goes from 1 to NQCM(J); the same rules apply for NQCM(J) as were previously stated in DG-84.

Skip DG-90 if NQCM(J)=0.

Data Group	Variable Name	Contents
90	YQCM(L,I,J)	Water surface elevation (units of FT above Mean Sea Level) or discharges (units of CFS) associated with Manning n. L index goes from 1 to NQCM(J).

Repeat DG-87 through DG-90 for each Manning reach (I=1,NRCM1(J)).

Repeat DG-84 through DG-90 for each river (J=1,JN).

Skip DG-88 through DG-94 if DG-66 if running in stand-alone mode (not a part of NWSRFS).

Skip DG-88-90 if IOBS (DG-5) is not equal to 3

88	NSLC(J)	Total number of slices used to adjust the computed time series. J index goes from 1 to JN.
89	NQSL(J)	Parameter indicating adjustment statistics are a function of water surface elevation (NQSL(J)=0), or discharge (NQSL(J)=1). J index goes from 1 to JN.
90	SLICE(L,K,J)	Stage (units of FT) or discharge (units of CFS) range into which the statistics lie. A hydrograph will be divided into NSLC(J) elevation or discharge ranges (slices) and adjusted based on the root mean square error and bias. L index goes from 1 to NSLC(J).

Skip DG-91 through DG-94 if IOBS, DG-5, is less than 2.

91	FRMSO(L,K,J)	Root mean square error (rms) on the falling limb of the hydrograph within each slice. This value is used when no observed data exists in the slice for the current runtime. If FRMSO (L,K,J)=0, no adjustment is made to the computed stage. L index goes from 1 to NSLC(J).
92	FBIASO(L,K,J)	Bias associated with FRMSO (L,K,J). L index goes from 1 to NSLC(J).
93	RRMSO(L,K,J)	Root mean square error (rms) on the rising limb of hte hydrograph within each slice. This value is used when no observed data exists in the slice for the current runtime. If RRMSO (L,K,J)=0, no adjustment is made to the computed stage. L index goes from 1 to NSLC(J).
94	RBIASO(L,K,J)	Bias associated with RRMSO (L,K,J). L index goes from 1 to NSLC(J).

Repeat DG-90 through DG-94 for each adjusted time series (K=1, NGAG(J), DG-13); then repeat the group for each river (J=1,JN).

Skip DG-95 through DG-99 if ICOND=1 (DG-2).

Data Group	Variable Name	Contents
95	YDI(I,J)	Initial water surface elevation referenced to msl (units of FT) at each cross section. Each field represents a cross section. I=1,NBT(J) (DG-12). If all fields are left blank, the program will generate the YDI's via linear interpolation between gaging stations (this is allowed when gaging stations exist at the upstream extremities of all rivers and the downstream extremity of the main stem). If the upstream extremity of each river does not have an observed hydrograph, this YDI value must be supplied along with all the blanks for the other YDI's. If all fields are left blank except at the downstream extremity of the main stem river where the actual YDI is read in, the program will generate the YDI's via a solution of the steady flow backwater equation.

Repeat DG-95 for each river (J=1,JN).

96	QDI(I,J)	Initial discharges (units of CFS) at each cross section. Each field represents a cross section I=1,NB(J) (DG-12). If all fields are left blank except at the upstream extremity of each river, the program will generate the QDI's by summation of the flows from the upstream to downstream boundaries, including tributary inflow to the main stem and lateral inflow occurring along either the main stem or tributaries.

Repeat DG-96 for each river (J=1,JN).

Skip DG-97 if no lateral flow in the system (NQL(J)=0, DG-13, for all rivers J=1,JN)

97	QLI(K,J)	Initial lateral flow (units of CFS) for each reach with lateral flow. Each field represents a lateral flow reach. K=1,NQL(J) (DG-13).

Repeat Card number 97 for each river with lateral flow (NQL(J) not equal to 0, J=1,JN)

Skip DG-98 and DG-99 if no lock and dams in the system (all KRCHT values equal zero, DG-20).

98	PLTI(K,J)	Initial target pool elevation for each lock and dam. Each field represents a lock and dam, K=1,NUMLAD(J) where NUMLAD(J) is the sum of KRCHT=28, DG-20).

Repeat DG-98 for each river with locks and dams.

99	IWTI(K,J)	Initial gate control switch for each lock and dam. Each field represents a lock and dam, K=1,NUMLAD(J) where NUMLAD(J) is the sum of

Data Group	Variable Name	Contents
		KRCHT=28, DG-20). K=1,NUMLAD(J).

Repeat DG-99 for each river with locks and dams.

Skip DG-100 and DG-101 if NFGRF=1 (DG-4).

100*	MESAGE	40-character message describing the data set for use in FLDGRF.
101*	RIVER(J)	16-character name associated with river J. There is no comment line prior to this data group.

Repeat DG-101 for each river (J=1,JN).

Notes:

1/ The value output from program FCINIT may be different when the parameters are output with commands PRINTSEGS and PUNCHSEGS. This occurs when the user enters a zero instead of specifying a value which indicates the program should use default values. For example:

```
SEGMENT INPUT:
   DAM AT OREGON CITY USING A RATING  (ORCF)
     2   0.0   0.0    0.0    0.0    0
   DAM INFO
      0    0     0     0     0      0

FCINIT Output from PUNCH:

  LAD        HDD       CLL      CDOD        QTD     ICHAN
    2             0.00         0.00         3.00           0.00         0
  ICG        HSPD        SPL        CSD      HGTD       CGD
    0            0.00         0.00        0.00        0.00          0.00

FCINIT Output from PRINT:

   LAD           HDD          CLL      CDOD       QTD     ICHAN
    2         100000.00        0.00          3.00         0.00          0

  ICG            HSPD           SPL       CSD        HGTD       CGD
    0         100000.00         0.00         0.00   100000.00       0.00
```

In this example the HDD (Elevation of the top of dam) variable PUNCH output will contain the value of 0.00 which indicates a default value should be used. The punch output values match the original Segment input allowing the punch output to be used to redefine the Segment. However the PRINT output contains the value which is actually used in the calculations which is 100000.00 (FT above MSL). This allows the user to know exactly what values are being used in the calculations.

Program IFP uses the same rules when it outputs the value.

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Sample Input and Output: Sample input is shown in Figure 3 [Bookmark]. Sample output from the parameter print routine is shown in Figure 4 [Bookmark]. Sample output from the execution routine is shown in Figures 5 through 29 [Bookmark]. The information printed in these figures does not necessarily correspond with the input sample.

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Execution Routine Print Output: The execution print output for Operation FLDWAV is controlled by three input parameters on Card 5:
- JNK (how much information is to be generated)
- KPL (whether or not plots and statistical information is to be generated)
- KPL2 (whether or not observed data are available for plotting or generating statistical information)

Possible output available is:
1. No output - JNK=0, KPL=0.
2. Computed stage plots - JNK=0, KPL=0, KPL2=0.
3. Computed discharge plots - JNK=0, KPL=2, KPL2=0.
4. Plots of observed and computed stages and summary of statistics (Root mean square error and bias error) - JNK=0, KPL=1, KPL2=1.
5. Plots of observed and computed discharges and summary of statistics JNK=0, KPL=2, KPL2=1.
6. A table showing the time step (HR), current time (HR), number of iterations for each river, cross section location (MI), Manning's n, water surface elevation (FT above Mean Sea Level), depth (FT), Froude number, velocity (FT/SEC), discharge (1000 CFS), levee flow (1000 CFS), active flow area (1000 FT2)and total topwidth (FT) at even time increments specified by the KITPR parameter on Card 2, plus any of the plot options I (1) through (5). This option also prints the total number of iterations needed for each river when using the Newton-Raphson Iteration technique, as well as more detail statistical information - JNK=1, KPL=1 or2, KPL2=0 or 1.

There is no default printer option. JNK, KPL, KPL2 and KITPR must be supplied by the user.

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Error and Warning Messages: Error and warning messages generated by this Operation and the corrective measures to take when they occur are as follows:

A. Messages that can occur during setup.

1. **ERROR** NUMBER OF OPERATIONS IN THIS SEGMENT (XXXXXXXX) EXCEEDS THE MAXIMUM NUMBER OF OPERATIONS ALLOWED:YY

   Action: If the program is for calibration, then increase the size of the array. If the program is operational, then call your Focal POINT.

2. **ERROR** OUTPUT TIME SERIES INTERVAL(DTOUT=(XX)) MUST BE GREATER THAN OR EQUAL TO THE COMPUTATIONAL TIME STEP(DTHII=(YYY.YY))

   Action: Increase the output time series interval to be at least as large as the computational time step.

3. **ERROR** OUTPUT TIME SERIES INTERVAL (DTOUT=(XX) IS NOT AN EVEN MULTIPLE OF THE COMPUTATIONAL TIME STEP(DTHII=(YYY.YY))

Action: Change the output time interval such that DHFO = K * TM where K is a positive integer.

4. **WARNING** OBSERVED DATA TIME STEP (DTHYD=(XX)) IS NOT AN EVEN INCREMENT OF THE TIME STEP FOR PLOTTING COMPUTED DATA/22X(DTHII=(YYY.YY))2X THEREFORE THE OBSERVED DATA WILL NOT BE PLOTTED.

   Action: Verify time steps andif plots are desired make DHF=K*TM*KITPR or K*DHF=TM*KITPR where K is a positive integer.

5. **ERROR** AUTOMATIC CALIBRATION CANNOT BE USED WHEN THE INFLOW HYDROGRAPH IS GENERATED (NU=0).

   Action: If automatic calibration is desired, then specify inflow hydrograph and set NU>0. If automatic calibration is not desired set NP=0.

6. **ERROR** NUMBER OF COMPUTATIONAL POINTS (NBJ=XXX) EXCEEDS MAXIMUM NUMBER OF COMPUTATIONAL POINTS ALLOWED (NBMAX=YYY). PROGRAM TERMINATED.

   Action: Check the number of cross sections on each river (NB(J)) and set NBMAX equal to the largest value.

7. **ERROR** NUMBER OF OPERATIONS IN THIS SEGMENT (XXXXXXXX) EXCEEDS THE MAXIMUM NUMBER OF OPERATIONS ALLOWED:YY

   Action: If the program is for calibration, then increase the size of the array. If the program is operational, then call your Focal Point.

8. **ERROR** OUTPUT TIME SERIES INTERVAL(DTOUT=(XX)) MUST BE GREATER THAN OR EQUAL TO THE COMPUTATIONAL TIME STEP(DTHII=(YYY.YYY))

   Action: Increase the output time series interval to be at least as large as the computational time step.

9. **ERROR** OUTPUT TIME SERIES INTERVAL (DTOUT=(XX)IS NOT AN EVEN MULTIPLE OF THE COMPUTATIONAL TIME STEP(DTHII=(YYY.YY))

   Action: Change the output time interval such that DHFO = K * TM where K is a positive integer.

10. **WARNING** OBSERVED DATA TIME STEP (DTHYD=(XX)) IS NOT AN EVEN INCREMENT OF THE TIME STEP FOR PLOTTING COMPUTED DATA/22X(DTHII=(XXX.XX))2X THEREFORE THE OBSERVED DATA WILL NOT BE PLOTTED.

    Action: Verify time steps andif plots are desired make DHF=K*TM*KITPR or K*DHF=TM*KITPR where K is a positive integer.

11. **ERROR** AUTOMATIC CALIBRATION CANNOT BE USED WHEN THE INFLOW HYDROGRAPH IS GENERATED (NU=0).

    Action: If automatic calibration is desired, then specify inflow hydrograph and set NU>0. If automatic calibration is not desired set NP=0.

12. **ERROR** NUMBER OF COMPUTATIONAL POINTS (NBJ=XXX) EXCEEDS

MAXIMUM NUMBER OF COMPUTATIONAL POINTS ALLOWED (NBMAX=YYY). PROGRAM TERMINATED.

Action: Check the number of cross sections on each river (NB(J)) and set NBMAX equal to the largest value.

13. **ERROR** KU VALUE MUST BE EQUAL TO '1' OR '2' KU(X)=Y NOT ACCEPTED.

    Action: Check upstream boundary condition. If necessary, redefine it to be either stage (KU(J)) or discharge (KU(J)).

14. **WARNING** DOWNSTREAM BOUNDARY ON TRIBUTARIES CAN ONLY BE STAGE. KD(X)=Y NOT ALLOWED. KD(X) HAS BEEN SET TO '1'.

    Action: Unless blocked tributary option is used set KD(J)=1 or 0.

15. **WARNING** THIS IS TO AFFIRM THAT RIVER NO. X IS BLOCKED (KD(J)=2). THEREFORE NO FLOW FROM THIS TRIBUTARY WILL ENTER THE MAIN RIVER.

    Action: If the blocked tributary option is not desired then set KD(J)=1 or 0.

16. **ERROR** AUTOMATIC CALIBRATION OPTION CANNOT BE USED ON LEVEE PROBLEMS.

    Action: If automatic calibration option is not desired set NP=0.

17. **ERROR** MANNING'S N VALUES (CM) CANNOT BE SET TO ZERO WHEN THE AUTOMATIC CALIBRATION OPTION IS NOT USED.

    Action: Read in Manning's n values.

18. **ERROR** KPL MUST BE EQUAL TO '1' OR '2'. XXXXXXXX NOT ACCEPTED.

    Action: Set KPL on Card number 5 to '1' or '2'.

19. **ERROR** STAGE DATA CAN ONLY HAVE UNITS OF M (XXXX) NOT ACCEPTED.

    Action: Check the time series header card and change it if necessary.

20. **WARNING** MISSING DATA ARE NOT ALLOWED IN AUTOMATIC CALIBRATION RUN.

    Action: Check for missing data points and fill the space with interpolated values.

21. **WARNING** ON RIVER NO. XXX STATION YYYYYYYY WITH DATA TYPE ZZZ MAY HAVE MISSING DATA. MISSING DATA POINTS WILL NOT BE PLOTTED OR INCLUDED IN STATISTICS.

    Action: Check missing data points and fill them if these points are to be plotted and included in statistics.

22. **ERROR** TIME SERIES I.D. 'DUMMY' IS NOT ACCEPTABLE WHEN

AUTOMATIC CALIBRATION OPTION IS NOT USED.

Action: Check the time series identifier and redefine if necessary.

23. **ERROR** TIME SERIES I.D. 'DUMMY' IS NOT ACCEPTABLE FOR OUTPUT TIME SERIES.

    Action: Check the time series identifier and redefine it if necessary.

24. **ERROR** THE ALLOWABLE DIMENSIONS FOR OUTPUT TIME SERIES ARE 'XXXX'. 'YYYY' IS NOT ALLOWED.

    Action: Check the time series header and redefine it if necessary.

25. **ERROR** GATE CONTROL DATA CAN ONLY HAVE UNITS OF 'M'. '(XXXX)' NOT ACCEPTED.

    Action: Check the time series header and redefine it if necessary.

26. **ERROR** GATE CONTROL SWITCHES CAN ONLY HAVE UNITS OF 'INT '. '(XXXX)' NOT ACCEPTED.

    Action: Check the time series header and redefine it if necessary.

27. **ERROR** INFLOW HYDROGRAPH CAN BE GENERATED (NU=0) ON A SINGLE CHANNEL ONLY (JN=1). JN=XX NOT ALLOWED. PROGRAM TERMINATED.

    Action: If the problem has more than one river then set NU>0 and specify an input time series for each upstream boundary.

28. **ERROR** LEVEE MUST BE PLACED ON THE MAIN CHANNEL; THEREFORE NWJ(1) CANNOT BE EQUAL TO ZERO.

    Action. If possible make the channel containing the levee the main stem and let fictitious tributary connect to it.

29. **WARNING** ON RIVER NO.'XXXX'STATION '(XXXXXXXX),WITH DATA TYPE '(XXXX)' MAY HAVE MISSING DATA. MISSING DATA POINTS WILL BE GIVEN VALUES OF ZERO.

    Action: No action necessary.

30. **WARNING** THE TABLE OF TOPWIDTHS VS ELEVATION IS NOT COMPLETE FOR SECTION WWW ON RIVER NO. XX. THE LAST GOOD VALUE IS AT LEVEL YYY WHICH HAS AN ELEVATION OF ZZZZZZZZZZ FEET. AT ELEVATIONS HIGHER THAN THIS, THE MODEL WILL LINEARLY EXTRAPOLATE FROM THE LAST TWO POINTS.

    Action: Fill the table with the proper number of values.

31. **WARNING** THE TABLE OF TOPWIDTHS VS ELEVATIONS (INACTIVE) IS NOT COMPLETE FOR SECTION WWW ON RIVER NO. XX. THE LAST GOOD VALUE IS AT LEVEL YYY WHICH HAS AN ELEVATION OF ZZZZZZZZZZ FEET. AT ELEVATIONS HIGHER THAN THIS, THE MODEL WILL LINEARLY EXTRAPOLATE FROM THE LAST TWO POINTS.

Action: Fill the table with the proper number of values.

32. **WARNING** ON RIVER NO. XX CROSS SECTION NO. YYY HAS BOTH LATERAL FLOW AND FLOW DIVERSION; THEREFORE ONLY THE LATERAL FLOW WILL BE CONSIDERED IN COMPUTATIONS.

    Action: Remove either the lateral flow or the flow diversion.

33. **WARNING** NO. OF MANNING N REACHES ARE NOT EQUAL TO NO. OF OBSERVED CROSS SECTIONS LESS ONE, SO COMPUTATIONS CAN NOT BE MADE.

    Action: Redefine the number of Manning's n reaches.

34. **ERROR* THE ALLOWABLE DIMENSIONS FOR ADJUSTED TIDE TIME SERIES ARE 'XXXX'. 'YYYY' IS NOT ALLOWED.

    Action: Check the time series header and redefine it if necessary

35. **ERROR** THE ALLOWABLE DIMENSIONS FOR ADJUSTED STAGE TIME SERIES ARE 'XXXX'. 'YYYY' IS NOT ALLOWED.

    Action: Check the time series header and redefine it if necessary.

B. Messages that can occur during execution.

   None.

C. Messages that can occur during carryover transfer:

1. **WARNING** THE JN PARAMETER ON DATA GROUP 2 HAS BEEN CHANGED.

    Action: No action necessary

2. **WARNING** THE NP PARAMETER ON DATA GROUP 5 HAS BEEN CHANGED.

    Action: No action necessary

3. **WARNING** THE NCS PARAMETER ON DATA GROUP 4 HAS BEEN CHANGED.

    Action: FIND STARTING LOCATIONS OF OLD AND NEW PARAMETERS

4. **WARNING** THE SLFI PARAMETER ON DATA GROUP 63 HAS BEEN CHANGED.

    Action: No action necessary

5. **WARNING** THE SLFI PARAMETER ON DATA GROUP 9 HAS BEEN CHANGED.

    Action: No action necessary

6. **WARNING** NB(',I2,') (INPUT AND INTERPOLATED -DATA GROUPS 12 AND 19) HAS BEEN CHANGED.

    Action: No action necessary

7. **WARNING** NQL(',XX,') ON DATA GROUP 13 HAS BEEN CHANGED.

Action: No action necessary

8. **WARNING** LQ1(',XX,1H,,XX,') ON DATA GROUP 48 HAS BEEN CHANGED.

   Action: No action necessary

9. **WARNING** LAD(',XX,1H,,XX,') ON DATA GROUP 44 HAS BEEN CHANGED.

   Action: No action necessary

10. **WARNING** NRCM1(',XX,') ON DATA GROUP 13 HAS BEEN CHANGED.

    Action: No action necessary

11. **WARNING** NQCM(',XX,') ON DATA GROUP 13 HAS BEEN CHANGED.

    Action: No action necessary

12. **WARNING** NCM(',XX,1H,,XX,') ON DATA GROUP 80 HAS BEEN CHANGED.

    Action: No action necessary

13. **WARNING** THE NQCM(',XX,') PARAMETER ON DATA GROUP 13 HAS BEEN CHANGED.

    Action: No action necessary

14. **WARNING** YQCM(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 84 HAS BEEN CHANGED.

    Action: No action necessary

15. **WARNING** CM(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 81 HAS BEEN CHANGED.

    Action: No action necessary

16. **WARNING** CML(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 82 HAS BEEN CHANGED.

    Action: No action necessary

17. **WARNING** CMR(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 83 HAS BEEN CHANGED.

    Action: No action necessary

18. **WARNING** NBT(',XX,') ON DATA GROUP NO 12 HAS BEEN CHANGED.

    Action: No action necessary

19. **WARNING** XT(',XXX,',',XX, ON DATA GROUP NO 18 HAS BEEN CHANGED.

    Action: No action necessary

20. **WARNING** NN(',XXX,',',XX,') HAS BEEN CHANGED.

Action: No action necessary

21. **WARNING** DXM(',XXX,',',XX, ON DATA GROUP NO 19 HAS BEEN CHANGED.

    Action: No action necessary

22. **WARNING** X(',XX,1H,,XX,') ON DATA GROUP 25 HAS BEEN CHANGED.

    Action: No action necessary

23. **WARNING** FKEC(',XX,1H,,XX,') ON DATA GROUP 79 HAS BEEN CHANGED.

    Action: No action necessary

24. **WARNING** BS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 72 HAS BEEN CHANGED.

    Action: No action necessary

25. **WARNING** BSS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 77 HAS BEEN CHANGED.

    Action: No action necessary

26. **WARNING** HS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 27 HAS BEEN CHANGED.

    Action: No action necessary

27. **WARNING** AS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 28 HAS BEEN CHANGED.

    Action: No action necessary

28. **WARNING** AS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 73 HAS BEEN CHANGED.

    Action: No action necessary

29. **WARNING** AS(',XX,1H,,XX,1H,,XX,') ON DATA GROUP 74 HAS BEEN CHANGED.

    Action: No action necessary

30. **WARNING** SNM(',XX,1H,,XX,1H,,XX,') ON DATA GROUP NO 78 HAS BEEN CHANGED.

    Action: No action necessary

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Carryover Transfer Rules: The following rules apply to Operation FLDWAV during the carryover transfer process:

1. Carryover values are initial water surface elevations and discharges at each cross section, initial lateral flow at each lateral flow point, percent of flow initially diverted from the channel, initial target pool elevations and initial gate control switches.

2. Carryover can be transferred (i.e. existing carryover kept) only if none of the following parameters have been changed from one set of data to the next:

Parameter	Data Group	Parameter	Data Group
NBMAX	-	FKC (I,J)	79
NP	5	*NCSS	-
SLFI	63	NCML	81
NB (J)	-	*CM (L, K, J)	-
NQL (L)	13	*YCQM (L, K, J)	-
LQ (I, J)	48	CML	82
SNM	78	CMR	83
BR	-	*NCS	4
NUMLAD (J)	-	*BS (K, I, J)	72
LAD (L, J)	28	*HS (K, I, J)	71
NRCM1 (J)	13	*AS (K, I, J)	70
NQCM (J)	13	ASL	-
NCM (K, J)	80	BSL	73
X (I, J)	18	*BSS (L, I, J)	77
		*ASS (L, I, J)	-

If any of the above parameter have been changed then no carryover transfer will take place (i.e. the carryover values input during the redefinition will be used). The parameters with the (*) beside them may be changed if the change occurs above the initial conditions (e.g., the cross-section properties may be changed as long as table values below the initial conditions remain the same as before.

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Card Punch Limitations: All integer values and alphanumeric names for this Operation are punched out exactly as they are read in. All real values are punched with an F10.2 format with the following exceptions:

Variable Name	Data Group	Punch Format	
EPSY	1	F10.4	
YQCM	84	F10.0	(for discharge)
		F10.2	(for stage)
CM	81	F10.4	
SO	63	F10.6	
STM	-	F10.0	

Table 1. English/Metric Equivalents

Property	English Unit	Metric Unit	Conversion Factor (English to Metric)
Time	HR	HR	
Length	FT	M	1/3.281
Length	MI	KM	1.6093
Flow	FT3/SEC	M3/SEC	1/35.32
Area	FT2	M2	1/10.765
Surface Area	ACRE	KM2	1/247.1
Volume	ACFT	10**6 M3	1/810.833
Weir Coefficient	FT**.5/SEC	M**.5/SEC	1/1.811
Unit Weight	LB/FT3	N/M3	157.1
Shear Strength	LB/FT2	N/M2	47.88
Viscosity (Dynamic)	LB SEC/FT2	N SEC/M2	47.88
Manning n	English and Metric are same		

Although the documentation refers to English units only, the metric option is fully functional. This table can be used to determine comparable units and to convert the recommended values to metric units.

Table 2. Description of FLDWAV Intermediate Analysis Output

Output Description	JNK 0	1	4	5	9	>9
Input Echo Print and Summary of Array Sizes	X	X	X	X	X	X
Bottom Slope Profile			X	X	X	X
Initial Conditions Summary			X	X	X	X
Initial Conditions/Low Flow Filter				X	X	X
Minimum Dynamic Routing Output			X	X	X	X
Internal Boundary Information			X	X	X	X
Hydraulic Information					X	X
Levee Information				X	X	X
Subcritical/Supercritical Information			X	X	X	X
Nonconvergence Information				X	X	X
Calibration Information	X	X	X	X	X	X
Profile of Crests and Times	X	X	X	X	X	X
Computed WSEL and Discharge Hydrograph Data					X	X
Hydrograph Plot	X	X	X	X	X	X
Dynamic Routing Information at each Iteration						X

The FLDWAV model output is controlled primarily by the JNK parameter. JNK may be assigned values of 1, 4, 5, 9, 10 and 12 where the output becomes more extensive as JNK increases. It is recommended that for most runs, JNK be specified as 4; this output is considered to provide the maximum amount of information for the least number of pages of output. A JNK=1 provides the least amount of output and is intended to be used for obtaining final results to minimize permanent paper or file storage requirements. If the graphical output utility (FLDGRF) is to be used to review the output information, JNK=1 may be used. JNK values greater than 4 are to be used to obtain detailed hydraulic and numerical information for confronting and overcoming numerical difficulties that have caused aborted runs or suspect results. When a user first sets up the problem, it is highly recommended that JNK>=5 be used to ensure that the model is behaving in an acceptable manner for the problem being modeled. In some cases, the hydrographs and boundary information may indicate a successful run, but further inspection of the hydraulic information throughout the routing reach may reveal hidden problems in the data input setup.

Examples of the output shown in Figures 5 through 29. Parameters in bold print are defined. No examples are given for JNK>=10 since this is usually repetitive information per iteration. Generally, output variables are defined categorically with the first or first two letters; i.e., Q is discharge, Y is water surface elevation, X is cross-section distance location, FR is Froude number, T is time, V is velocity, A is wetted cross-sectional area, B is wetted cross-sectional topwidth and CM is Manning n. Also, the J and I counters refer to the river number and cross-section number, respectively.

Table 3. Routing methods and internal boundaries

KRCHT(I,J)	Definitions
0	Implicit Dynamic Routing
1	Implicit (Diffusion) Routing
4	Level Pool Routing
5	Explicit Dynamic Routing (Upwind)
6	Implicit (Local Partial Inertial) Routing
10	Dam
11	Dam + Q=f(Y)
21	Dam + Y=f(Q)
12	Dam + Q=f(YY)
14	Dam + Multiple Movable Gates C=f(Y,HG,FR)
15	Dam + Average Movable Gates (Corps of Engineers Type)
28	Lock and Dam
35	Bridge

Variable Definitions

Q = flow
Y = pool elevation
YY = tailwater elevation
HG = centerline of gate
C = gate coefficient
FR = Froude number

Figure 1. Cross section description for calibration option

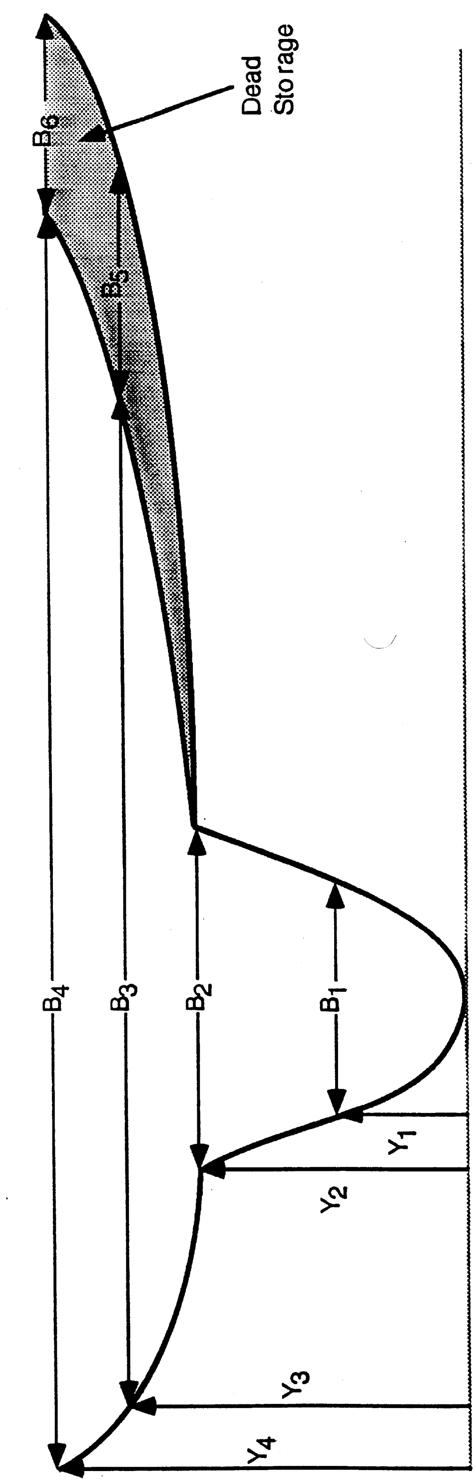

Figure 2. Cross section shapes for power function $B=kY^m$

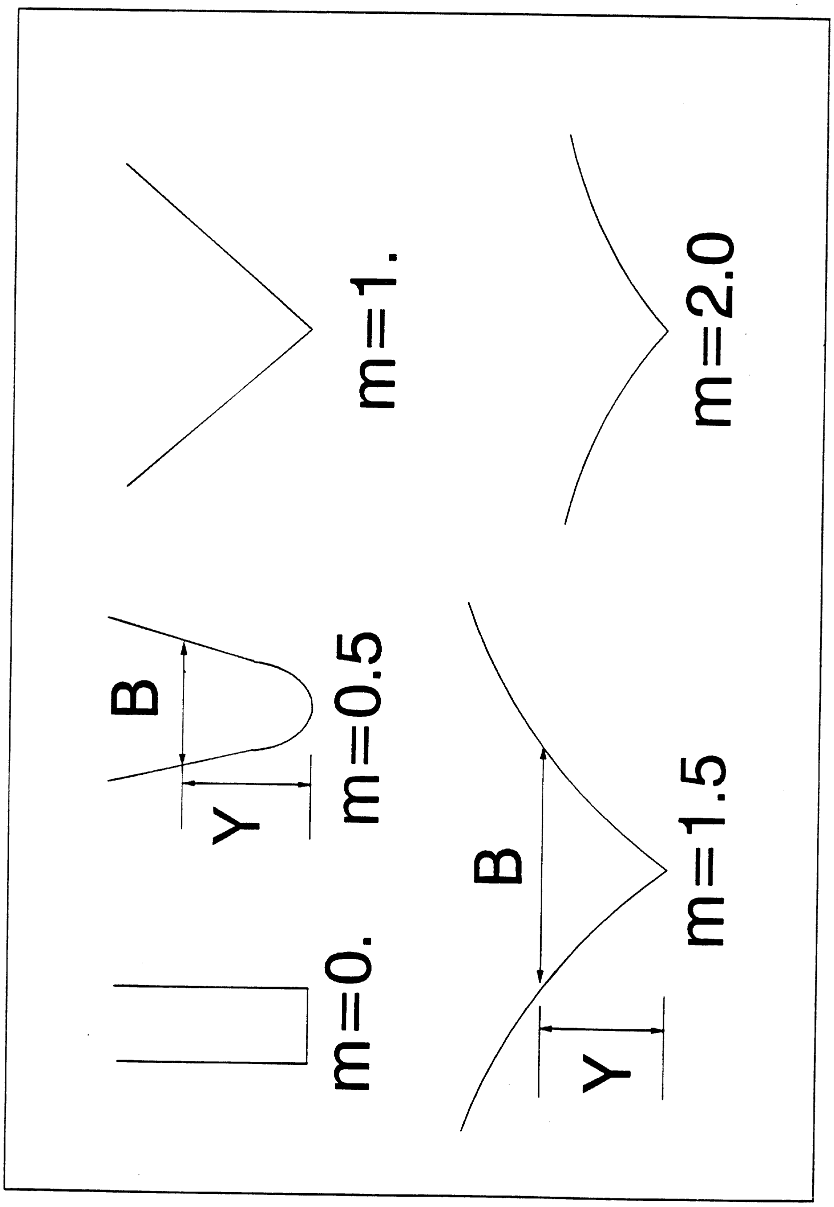

Figure 3. Sample input for Operation FLDWAV

```
                          - Column -

   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
FLDWAV      DMOINEF   INPUT CO
PROBLEM DEMOINE
Initial Conditions 4/17/98  07 cdt (12Z)
EOM
NO DESC

.01     1.0     0.6   5280.00      6.0        6     0

2         1       10        0         0        0  1 0 0 0

1         0        0        0

9         1      009        1         1

1         0        0        0         0

1.      0.25      6.0        0         0.       0

0        0.      0.0  - Levees on Des Moines

21          1       21                1000. 0.  0.  0.    Des Moines River

32          1       32    1   19   60.  100. 0.  0.  0.     Raccoon River

2   3   3    3    2    -13   21   0    0    0         Des Moines River

2   0   1    2    2    -13   33   0    0    0         Raccoon River

0   0   0    0    0 0 0 0 0 0

0   0   0    0    0 0 0 0 0 0

 211.40    210.60    209.50    208.60    208.00    207.00    206.40    205.50
 204.60    204.30    203.30    203.13    202.30    202.25    202.20    202.10
 201.60    201.56    201.40    201.30    200.70

     0.000     0.000     0.000     0.000    0.000     0.000     0.000     0.000
     0.000     0.000     0.000     0.000    0.000     0.000     0.000     0.000
     0.000     0.000     0.000     0.000

  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

  29.00     27.99     26.97     25.96     24.94     23.93     22.91     21.90
  20.88     19.85     18.83     17.80     16.78     15.76     14.73     13.71
  12.68     11.66     10.64      9.61      8.59      7.56      6.54      5.51
   4.49      3.45      3.04      2.54      2.04      1.82      1.01       .00

    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.000     0.000     0.000     0.000     0.000     0.000     0.000

         0    0    0    0    0    0    0    0
         0    0    0    0    0    0    0    0
         0    0    0    0    0    0    0    0
         0    0    0    0    0    0    0

3           GRMI4    QINE

9           DMOI4LOC SQIN

20          DESI4LOC SQIN

25          DOSI4    QINE

1         787.42      SDTI4G   TWEL
```

Figure 3. Sample input for Operation FLDWAV

```
                              - Column -

    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
10        773.68      DMOI4C   STG
21        762.52      DESI4G   STG
1         841.16      VNMI4G   STG
28        780.71      DEMI4C   STG
1           DES21140 SSTG   0.00
2           DES21060 SSTG   0.00
3           DES20950 SSTG   0.00
4           DES20860 SSTG   0.00
5           DES20800 SSTG   0.00
6           DES20700 SSTG   0.00
7           DES20640 SSTG   0.00
8           DES20550 SSTG   0.00
9           DES20460 SSTG   0.00
10          DES20430 SSTG   0.00
11          DES20330 SSTG   0.00
12          DES20313 SSTG   0.00
13          DES20230 SSTG   0.00
14          DES20225 SSTG   0.00
15          DES20220 SSTG   0.00
16          DES20210 SSTG   0.00
17          DES20160 SSTG   0.00
18          DES20156 SSTG   0.00
19          DES20140 SSTG   0.00
20          DES20130 SSTG   0.00
21          DES20070 SSTG   0.00
1           RAC02900 SSTG   0.00
2           RAC02799 SSTG   0.00
3           RAC02697 SSTG   0.00
4           RAC02596 SSTG   0.00
5           RAC02494 SSTG   0.00
6           RAC02393 SSTG   0.00
7           RAC02291 SSTG   0.00
8           RAC02190 SSTG   0.00
```

Figure 3. Sample input for Operation FLDWAV

- Column -

```
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
9           RAC02088 SSTG   0.00

10          RAC01985 SSTG   0.00

11          RAC01883 SSTG   0.00

12          RAC01780 SSTG   0.00

13          RAC01678 SSTG   0.00

14          RAC01576 SSTG   0.00

15          RAC01473 SSTG   0.00

16          RAC01371 SSTG   0.00

17          RAC01268 SSTG   0.00

18          RAC01166 SSTG   0.00

19          RAC01064 SSTG   0.00

20          RAC00961 SSTG   0.00

21          RAC00859 SSTG   0.00

22          RAC00756 SSTG   0.00

23          RAC00654 SSTG   0.00

24          RAC00551 SSTG   0.00

25          RAC00449 SSTG   0.00

26          RAC00345 SSTG   0.00

27          RAC00304 SSTG   0.00

28          RAC00254 SSTG   0.00

28          DEMI4    SSTG   780.71

29          RAC00204 SSTG   0.00

30          RAC00182 SSTG   0.00

31          RAC00101 SSTG   0.00

32          RAC00000 SSTG   0.00

100.        SDTI4    QINE

 10.        VNMI4    QINE

DESI4
RIVER 1  21  SECTIONS
    0.00      0.00              1

 784.30 789.30 792.00 792.10  799.90  800.00  805.00 810.00 820.00

    .00   1.00 700.00 800.00 1400.00 3800.00   5000.00   8300.00   8600.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00        2
```

Figure 3. Sample input for Operation FLDWAV

```
                          - Column -

    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 783.70 788.70 790.30 795.00  799.90  800.00    804.00    810.00    820.00

    .00   1.00 165.20 317.20  453.70  509.30   2564.70   3016.70  10500.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00          3

 781.50 786.50 790.40 791.30  799.90  800.00    803.10    810.00    820.00

    .00   1.00 220.00 315.00  500.00 1500.00   3100.00  13400.00  15000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          4

 780.50 785.50 787.70 789.30  798.60  800.00    802.00    810.00    820.00

    .00   1.00 162.30 309.40  357.80  446.00   1929.70   9500.00  10000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          5

 778.80 783.80 786.50 789.60  797.70  799.70    805.00    810.00    820.00

    .00   1.00 230.00 360.00  405.00 1260.00   7400.00  11000.00  11800.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          5

 776.70 781.70 785.60 796.20  797.70  797.90    803.50    803.70    810.00

    .00   1.00 233.20 392.80  549.70 1203.20   1260.00   3061.40   3100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          7

 776.00 781.00 784.40 784.60  790.00  795.00    800.00    804.10    810.00

    .00   1.00 150.00 220.00  500.00 1000.00   1350.00   1725.00   3100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          8

 775.20 780.20 782.10 782.30  793.40  793.60    795.50    795.60    810.00

    .00   1.00  78.60 135.40  310.40  548.10    555.90    778.50   3100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          9

 773.80 778.80 785.90 789.60  790.80  795.00    800.00    805.00    810.00

    .00   1.00 215.00 270.00  390.00 1000.00   1250.00   2700.00   3100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00          10

 773.50 778.50 785.00 787.00  790.00  795.00    800.00    805.00    810.00
```

Figure 3. Sample input for Operation FLDWAV

```
                                 - Column -

    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
    .00   1.00 150.00 150.00  150.00 1200.00   1575.00   3000.00   4000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         11

 771.80 776.80 780.00 784.70  791.70  795.00    800.00    805.00    810.00

    .00   1.00 150.00 277.00  344.70  500.00   2300.00   2600.00   3000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         12

 770.80 775.80 781.90 783.30  791.00  795.00    800.00    805.00    810.00

    .00   1.00 150.00 270.00  345.00  400.00    800.00   1200.00   2000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         13

 768.60 773.60 775.90 777.30  780.20  790.00    795.00    800.00    810.00

    .00   1.00  90.00 240.00  330.00  350.00    375.00   1800.00   3600.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         14

 768.10 773.10 775.80 780.10  788.80  795.00    800.00    805.00    810.00

    .00   1.00 225.00 340.00  390.00 1575.00   2000.00   3100.00   4000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         15

 767.60 772.60 775.90 780.10  789.40  795.00    800.00    805.00    810.00

    .00   1.00 210.00 375.00  400.00 2750.00   3500.00   4300.00   4900.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         16

 767.00 772.00 776.40 777.80  780.00  790.00    795.00    800.00    810.00

    .00   1.00 220.00 370.00  400.00  550.00   3000.00   5100.00   6100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         17

 764.60 769.60 773.00 777.00  780.00  790.00    800.00    805.00    810.00

    .00   1.00 150.00 275.00  390.00 1100.00   4000.00   4500.00   5000.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00         18

 763.00 768.00 769.70 771.10  780.00  790.00    795.00    800.00    810.00

    .00   1.00 340.00 605.00  710.00 1400.00   3500.00   6300.00   6500.00
```

Figure 3. Sample input for Operation FLDWAV

```
                                  - Column -

   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         19
 762.50 767.50 772.60 772.80  799.90  800.00    800.50    800.80    801.30
    .00   1.00 280.00 520.00  610.00  760.00    800.00    825.00    870.00
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         20
 762.00 767.00 769.60 782.40  784.40  784.60    789.90    795.50    801.00
    .00   1.00 290.00 390.00  460.00  630.00    670.00   1050.00   1100.00
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         21
 756.30 761.30 768.40 774.00  784.20  785.40    785.70    795.50    802.80
    .00   1.00 130.00 360.00  415.00  500.00    680.00    750.00    753.00
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
RIVER 2  32 SECTIONS
    0.00      0.00      0.00    0.00        1
 836.20 841.20 843.00 845.60  850.00  855.00    860.00    865.00    870.00
    .00   1.00 200.00 350.00  400.00  925.00   1600.00   2600.00   3400.00
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        2
 834.60 839.60 841.50 844.10  848.60  854.30    859.30    864.30    869.30
    .00   1.00 210.70 350.00  400.00  846.40   2042.90   3042.90   3814.30
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        3
 833.00 838.00 840.00 842.60  847.10  853.60    858.60    863.60    868.60
    .00   1.00 221.40 350.00  400.00  767.90   2485.70   3485.70   4228.60
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        4
 831.40 836.40 838.50 841.10  845.70  852.90    857.90    862.90    867.90
    .00   1.00 232.10 350.00  400.00  689.30   2928.60   3928.60   4642.90
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        5
 829.80 834.80 837.00 839.50  844.30  852.10    857.10    862.10    867.10
    .00   1.00 242.90 350.00  400.00  610.70   3371.40   4371.40   5057.10
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
```

Figure 3. Sample input for Operation FLDWAV

```
                               - Column -

    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
   0.00   0.00   0.00   0.00        6
 828.20 833.20 835.50 838.00  842.90  851.40    856.40    861.40    866.40
    .00   1.00 253.60 350.00  400.00  532.10   3814.30   4814.30   5471.40
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        7
 826.60 831.60 834.00 836.50  841.40  850.70    855.70    860.70    865.70
    .00   1.00 264.30 350.00  400.00  453.60   4257.10   5257.10   5885.70
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00        8
 825.00 830.00 832.50 835.00  840.00  850.00    855.00    860.00    865.00
    .00   1.00 275.00 350.00  400.00  475.00   4700.00   5700.00   6300.00
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
    .00    .00   0.00   0.00   0.00   0.00        9
 822.20 827.20 829.70 832.20  837.10  846.50    851.80    856.80    861.80
    .00   1.00 270.60 344.10  394.10  397.10   4488.20   5617.60   6229.40
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00       10
 819.50 824.50 826.90 829.40  834.10  843.00    848.50    853.50    858.50
    .00   1.00 266.20 338.20  388.20  419.10   4276.50   5535.30   6158.80
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00       11
 816.70 821.70 824.10 826.50  831.20  839.40    845.30    850.30    855.30
    .00   1.00 261.80 332.40  382.40  441.20   4064.70   5452.90   6088.20
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00       12
 814.00 819.00 821.30 823.70  828.20  835.90    842.10    847.10    852.10
    .00   1.00 257.40 326.50  376.50  463.20   3852.90   5370.60   6017.60
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00       13
 811.20 816.20 818.50 820.90  825.30  832.40    838.80    843.80    848.80
    .00   1.00 252.90 320.60  370.60  485.30   3641.20   5288.20   5947.10
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00       14
```

Figure 3. Sample input for Operation FLDWAV

- Column -

```
   5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
 808.50 813.50 815.70 818.10  822.40  828.90    835.60    840.60    845.60
    .00   1.00 248.50 314.70  364.70  507.40   3429.40   5205.90   5876.50
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         15
 805.70 810.70 812.90 815.20  819.40  825.30    832.40    837.40    842.40
    .00   1.00 244.10 308.80  358.80  529.40   3217.60   5123.50   5805.90
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         16
 803.00 808.00 810.10 812.40  816.50  821.80    829.10    834.10    839.10
    .00   1.00 239.70 302.90  352.90  551.50   3005.90   5041.20   5735.30
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         17
 800.20 805.20 807.40 809.60  813.50  818.30    825.90    830.90    835.90
    .00   1.00 235.30 297.10  347.10  573.50   2794.10   4958.80   5664.70
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         18
 797.50 802.50 804.60 806.80  810.60  814.80    822.60    827.60    832.60
    .00   1.00 230.90 291.20  341.20  595.60   2582.40   4876.50   5594.10
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         19
 794.70 799.70 801.80 803.90  807.60  811.20    819.40    824.40    829.40
    .00   1.00 226.50 285.30  335.30  617.60   2370.60   4794.10   5523.50
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         20
 792.00 797.00 799.00 801.10  804.70  807.70    816.20    821.20    826.20
    .00   1.00 222.10 279.40  329.40  639.70   2158.80   4711.80   5452.90
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         21
 789.20 794.20 796.20 798.30  801.80  804.20    812.90    817.90    822.90
    .00   1.00 217.60 273.50  323.50  661.80   1947.10   4629.40   5382.40
    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00
   0.00   0.00   0.00   0.00         22
 786.50 791.50 793.40 795.50  798.80  800.70    809.70    814.70    819.70
```

Figure 3. Sample input for Operation FLDWAV

- Column -

```
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
    .00   1.00 213.20 267.60  317.60  683.80   1735.30   4547.10   5311.80

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00        23

 783.70 788.70 790.60 792.60  795.90  797.10    806.50    811.50    816.50

    .00   1.00 208.80 261.80  311.80  705.90   1523.50   4464.70   5241.20

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00        24

 781.00 786.00 787.80 789.80  792.90  793.60    803.20    808.20    813.20

    .00   1.00 204.40 255.90  305.90  727.90   1311.80   4382.40   5170.60

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00        25

 778.20 783.20 785.00 787.00  790.00  790.10    800.00    805.00    810.00

    .00   1.00 200.00 250.00  300.00  750.00   1100.00   4300.00   5100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00        26

 775.10 780.10 780.80 785.00  790.00  795.00    800.00    805.00    810.00

    .00   1.00 150.00 230.00  260.00  730.00   3100.00   4700.00   6100.00

    .00   0.00   0.00   0.00    0.00    0.00      0.00      0.00      0.00

   0.00   0.00   0.00   0.00        27

 774.20 779.20 780.20 784.70  790.00  790.50    791.00    800.00    810.00

    .00   1.00 115.00 215.00  500.00  1380.00   1400.00   1800.00   2000.00

    .00    .00    .00    .00     .00     .00    540.00   1900.00   2000.00

   0.00   0.00   0.00   0.00        28

 773.00 778.00 779.20 784.70  790.00  790.50    791.00    800.00    810.00

    .00   1.00 115.00 215.00  500.00  1380.00   1400.00   1800.00   2000.00

    .00    .00    .00    .00     .00  000.00   3540.00    1900.00   2000.00

   0.00   0.00   0.00   0.00        29

 772.00 777.00 779.20 784.70  790.00  790.50    791.00    800.00    810.00

    .00   1.00 115.00 215.00  500.00  1380.00   1400.00   1800.00   2000.00

    .00    .00    .00    .00     .00     .00    540.00    1900.00   2000.00

   0.00   0.00   0.00   0.00        30

 771.50 776.50 778.80 789.70  790.00  793.90    799.70    799.90    810.00

    .00   1.00 210.00 310.00  400.00  2500.00   3000.00   3825.00   7000.00
```

Figure 3. Sample input for Operation FLDWAV

- Column -

```
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
    .00     .00     .00     .00   70.00  800.00    500.00      .00       .00

   0.00    0.00    0.00    0.00         31

 769.50  774.50  778.00  780.00  790.00  790.10    795.00    800.00    810.00

    .00    1.00  300.00  350.00  400.00  400.00   3000.00   4300.00   5300.00

    .00    0.00    0.00    0.00    0.00    0.00      0.00      0.00      0.00

   0.00    0.00    0.00    0.00         32

 764.00  769.00  778.20  778.80  781.00  790.00    800.00    805.00    810.00

    .00    1.00  240.00  310.00  370.00  550.00   7000.00   8200.00   9500.00

    .00    0.00    0.00    0.00    0.00    0.00      0.00      0.00      0.00

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 

1 10

     .0140     .0150     .0170     .0210     .0220     .0250     .0300     .0480
     .0570     .0570     .0570     .0570     .0570

        0.     1250.     2500.     5000.     8000.    12000.    20000.    40000.
    60000.    80000.   120000.   140000.   160000.

     .0900     .0620     .0430     .0300     .0270     .0220     .0260     .0320
     .0320     .0400     .0400     .0500     .0500

        0.     1250.     2500.     5000.     7500.    10000.    20000.    40000.
    60000.    80000.   120000.   140000.   160000.

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

1 28

     .0480     .0290     .0310     .0330     .0410     .0410     .0450     .0450
     .0480     .0500     .0500     .0500     .0500

        0.     2500.     5000.    10000.    20000.    40000.    60000.    80000.
   120000.   130000.   140000.   150000.   160000.

     .0340     .0360     .0320     .0300     .0320     .0380     .0820     .0840
     .0900     .0800     .0890     .1100     .1100

        0.     2500.     5000.     7500.    10000.    15000.    20000.    25000.
    30000.    35000.    40000.    45000.    65000
 INITIAL WATER SURFACE ELEVATIONS FOR RIVER NO. 1
    796.90    796.48    794.79    793.43    792.93    792.22    791.90    791.09
    789.88    788.58    785.57    784.62    781.39    781.40    781.35    781.26
    780.76    780.84    780.81    780.63    780.35
 INITIAL WATER SURFACE ELEVATIONS FOR RIVER NO. 2
    850.37    848.69    847.04    845.41    843.74    842.04    840.20    837.90
    835.19    832.44    829.72    826.98    824.26    821.54    818.81    816.13
    813.49    810.93    808.43    805.92    803.38    800.62    797.71    794.56
    792.14    790.05    789.32    788.01    785.56    784.67    782.95    780.72
 INITIAL DISCHARGES FOR RIVER NO. 1
   6292.46   6289.99   6288.39   6789.13   6789.02   6789.20   6789.65   6790.33
   6790.87   6823.60   6824.38   6825.23   6819.51   6818.31   6816.85   6812.62
   6817.68   6821.54   6844.42  13184.00  13264.52
 INITIAL DISCHARGES FOR RIVER NO. 2
   7617.82   7576.88   7544.37   7515.11   7486.06   7458.10   7431.10   7405.62
   7380.34   7354.39   7328.24   7301.32   7273.92   7245.68   7216.01   7184.46
   7145.55   7095.82   7036.38   6969.46   6897.56   6824.21   6757.67   6695.50
```

Figure 3. Sample input for Operation FLDWAV

- Column -

```
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
   6607.23   6591.06   6570.89   6546.37   6528.81   6527.50   6487.31   6484.10
  INITIAL LATERAL INFLOWS FOR RIVER NO. 1
    501.56     32.61     47.01
  INITIAL LATERAL INFLOWS FOR RIVER NO. 2
     62.93
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
********************
FLDWAV   OPERATION      NAME=DMOINEF      PREVIOUS NAME=INPUT CO
********************

                      PROGRAM FLDWAV -  VERSION 1.0  9/30/98

                          HYDROLOGIC RESEARCH LABORATORY
                            W/OH1 OFFICE OF HYDROLOGY
                          NOAA, NATIONAL WEATHER SERVICE
                          SILVER SPRING, MARYLAND  20910

                          *******************************
                          *******************************
                          ***                         ***
                          ***  SUMMARY OF INPUT DATA  ***
                          ***                         ***
                          *******************************
                          *******************************

PROBLEM DEMOINE

      EPSY     THETA        F1     XFACT     DTHYD     DTOUT    METRIC
      .010     1.000      .600  5280.000     6.000     6.000         0

        JN        NU     ITMAX     KWARM      KFLP       NET     ICOND   FUTURE DATA
         2         1        10         0         0         0         1    0 0 0

      NYQD       KCG       NCG     KPRES
       112         0         0         0

       NCS       KPL       JNK    KREVRS     NFGRF
         9         1         9         1         1

      IOBS     KTERM        NP      NPST     NPEND
         1         0         0         0         0

       TEH     DTHII    DTHPLT     FRDFR     DTEXP       MDT
     1.000    .25000   6.00000       .00    .00000        20

      NLEV      DHLV     DTHLV
         0    .00000    .00000

 RIVER NO.   NBT NPT1 NPT2  MRV NJUN       ATF       EPQJ      COFW     VWIND    WINAGL
    1         21    1   21                         1000.00       .00       .00       .00
    2         32    1   32    1   19     60.00     100.00       .00       .00       .00

RIVER NO.      KU    KD    NQL NGAGE NRCM1  NQCM  NSTR  FUTURE DATA
    1           2     3      3     3     2   -13    21    0 0 0
    2           2     0      1     2     2   -13    33    0 0 0

RIVER NO.    MIXF   MUD  KFTR  KLOS  FUTURE DATA
    1           0     0     0     0   0 0 0 0 0 0
    2           0     0     0     0   0 0 0 0 0 0

 XT(I, 1) I=1,NB( 1)
   211.400   210.600   209.500   208.600   208.000   207.000   206.400   205.500
   204.600   204.300   203.300   203.130   202.300   202.250   202.200   202.100
   201.600   201.560   201.400   201.300   200.700

 DXM(I, 1) I=1,NB( 1)
      .000      .000      .000      .000      .000      .000      .000      .000
      .000      .000      .000      .000      .000      .000      .000      .000
      .000      .000      .000      .000

 KRCHT(I, 1) I=1,NRCH
         0    0    0    0    0    0    0    0
         0    0    0    0    0    0    0    0
         0    0    0    0

 XT(I, 2) I=1,NB( 2)
    29.000    27.990    26.970    25.960    24.940    23.930    22.910    21.900
    20.880    19.850    18.830    17.800    16.780    15.760    14.730    13.710
    12.680    11.660    10.640     9.610     8.590     7.560     6.540     5.510
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
    4.490     3.450     3.040     2.540     2.040     1.820     1.010      .000

DXM(I, 2) I=1,NB( 2)
     .000      .000      .000      .000      .000      .000      .000      .000
     .000      .000      .000      .000      .000      .000      .000      .000
     .000      .000      .000      .000      .000      .000      .000      .000
     .000      .000      .000      .000      .000      .000      .000

KRCHT(I, 2) I=1,NRCH
        0    0    0    0    0    0    0    0
        0    0    0    0    0    0    0    0
        0    0    0    0    0    0    0    0
        0    0    0    0    0    0    0

LOCAL (LATERAL) FLOW INFO FOR RIVER J=  1

 L-FLOW (I)    LQ1(I,J)     ID         TYPE
     1            3       GRMI4       QINE
     2            9       DMOI4LOC    SQIN
     3           20       DESI4LOC    SQIN

LOCAL (LATERAL) FLOW INFO FOR RIVER J=  2

 L-FLOW (I)    LQ1(I,J)     ID         TYPE
     1           25       DOSI4       QINE

PLOTTING T.S.INFO FOR RIVER J=  1

STATION (I)    NGS(I,J)    GZ(I,J)      ID         TYPE
     1            1        787.42       SDTI4G    TWEL
     2           10        773.68       DMOI4C    STG
     3           21        762.52       DESI4G    STG

PLOTTING T.S.INFO FOR RIVER J=  2

STATION (I)    NGS(I,J)    GZ(I,J)      ID         TYPE
     1            1        841.16       VNMI4G    STG
     2           28        780.71       DEMI4C    STG

OUTPUT T.S. INFO FOR RIVER J=  1

STATION (I)      NST(I,J)     ID        TYPE      GZO(I,J)
     1              1       DES21140    SSTG          .00
     2              2       DES21060    SSTG          .00
     3              3       DES20950    SSTG          .00
     4              4       DES20860    SSTG          .00
     5              5       DES20800    SSTG          .00
     6              6       DES20700    SSTG          .00
     7              7       DES20640    SSTG          .00
     8              8       DES20550    SSTG          .00
     9              9       DES20460    SSTG          .00
    10             10       DES20430    SSTG          .00
    11             11       DES20330    SSTG          .00
    12             12       DES20313    SSTG          .00
    13             13       DES20230    SSTG          .00
    14             14       DES20225    SSTG          .00
    15             15       DES20220    SSTG          .00
    16             16       DES20210    SSTG          .00
    17             17       DES20160    SSTG          .00
    18             18       DES20156    SSTG          .00
    19             19       DES20140    SSTG          .00
    20             20       DES20130    SSTG          .00
    21             21       DES20070    SSTG          .00

OUTPUT T.S. INFO FOR RIVER J=  2

STATION (I)      NST(I,J)     ID        TYPE      GZO(I,J)
     1              1       RAC02900    SSTG          .00
     2              2       RAC02799    SSTG          .00
     3              3       RAC02697    SSTG          .00
     4              4       RAC02596    SSTG          .00
     5              5       RAC02494    SSTG          .00
     6              6       RAC02393    SSTG          .00
     7              7       RAC02291    SSTG          .00
     8              8       RAC02190    SSTG          .00
     9              9       RAC02088    SSTG          .00
    10             10       RAC01985    SSTG          .00
    11             11       RAC01883    SSTG          .00
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
     12          12       RAC01780    SSTG          .00
     13          13       RAC01678    SSTG          .00
     14          14       RAC01576    SSTG          .00
     15          15       RAC01473    SSTG          .00
     16          16       RAC01371    SSTG          .00
     17          17       RAC01268    SSTG          .00
     18          18       RAC01166    SSTG          .00
     19          19       RAC01064    SSTG          .00
     20          20       RAC00961    SSTG          .00
     21          21       RAC00859    SSTG          .00
     22          22       RAC00756    SSTG          .00
     23          23       RAC00654    SSTG          .00
     24          24       RAC00551    SSTG          .00
     25          25       RAC00449    SSTG          .00
     26          26       RAC00345    SSTG          .00
     27          27       RAC00304    SSTG          .00
     28          28       RAC00254    SSTG          .00
     29          28       DEMI4       SSTG       780.71
     30          29       RAC00204    SSTG          .00
     31          30       RAC00182    SSTG          .00
     32          31       RAC00101    SSTG          .00
     33          32       RAC00000    SSTG          .00

          UPSTREAM BOUNDARY INFORMATION

          RIVER NO     MIN Q/H   GAGE ZERO     ID      TYPE
              1         100.00              SDTI4     QINE
              2          10.00              VNMI4     QINE

          DOWSTREAM BOUNDARY INFORMATION

          RATING CURVE ID:DESI4


 RIVER NO.  1

  I=    1     FLDSTG=     .00    X=    211.40   KRCH=        0.   FKEC=       .00
          HS=         784.30    789.30    792.00    792.10    799.90    800.00    805.00
810.00    820.00
          BS=             .0       1.0     700.0     800.0    1400.0    3800.0    5000.0
8300.0    8600.0
          AS=             .0       2.5     948.9    1023.8    9603.9    9863.8   31863.8
65113.8  149613.8
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    2     FLDSTG=     .00    X=    210.60   KRCH=        0.   FKEC=       .00
          HS=         783.70    788.70    790.30    795.00    799.90    800.00    804.00
810.00    820.00
          BS=             .0       1.0     165.2     317.2     453.7     509.3    2564.7
3016.7    10500.0
          AS=             .0       2.5     135.5    1269.1    3157.8    3206.0    9354.0
26098.2   93681.7
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    3     FLDSTG=     .00    X=    209.50   KRCH=        0.   FKEC=       .00
          HS=         781.50    786.50    790.40    791.30    799.90    800.00    803.10
810.00    820.00
          BS=             .0       1.0     220.0     315.0     500.0    1500.0    3100.0
13400.0   15000.0
          AS=             .0       2.5     433.5     674.2    4178.7    4278.7   11408.6
68333.8  210333.8
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    4     FLDSTG=     .00    X=    208.60   KRCH=        0.   FKEC=       .00
          HS=         780.50    785.50    787.70    789.30    798.60    800.00    802.00
810.00    820.00
          BS=             .0       1.0     162.3     309.4     357.8     446.0    1929.7
9500.0   10000.0
          AS=             .0       2.5     182.1     559.5    3662.0    4224.6    6600.3
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
52319.1  149819.1
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    5     FLDSTG=     .00   X=    208.00   KRCH=        0.   FKEC=       .00
          HS=        778.80    783.80    786.50    789.60    797.70    799.70    805.00
810.00    820.00
          BS=            .0       1.0     230.0     360.0     405.0    1260.0    7400.0
11000.0   11800.0
          AS=            .0       2.5     314.4    1228.8    4327.1    5992.1   28941.1
74941.1  188941.1
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    6     FLDSTG=     .00   X=    207.00   KRCH=        0.   FKEC=       .00
          HS=        776.70    781.70    785.60    796.20    797.70    797.90    803.50
803.70    810.00
          BS=            .0       1.0     233.2     392.8     549.7    1203.2    1260.0
3061.4    3100.0
          AS=            .0       2.5     459.2    3777.0    4483.9    4659.2   11556.1
11988.3   31396.6
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    7     FLDSTG=     .00   X=    206.40   KRCH=        0.   FKEC=       .00
          HS=        776.00    781.00    784.40    784.60    790.00    795.00    800.00
804.10    810.00
          BS=            .0       1.0     150.0     220.0     500.0    1000.0    1350.0
1725.0    3100.0
          AS=            .0       2.5     259.2     296.2    2240.2    5990.2   11865.2
18168.9   32402.7
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    8     FLDSTG=     .00   X=    205.50   KRCH=        0.   FKEC=       .00
          HS=        775.20    780.20    782.10    782.30    793.40    793.60    795.50
795.60    810.00
          BS=            .0       1.0      78.6     135.4     310.4     548.1     555.9
778.5    3100.0
          AS=            .0       2.5      78.1      99.5    2573.7    2659.5    3708.4
3775.1   31700.3
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    9     FLDSTG=     .00   X=    204.60   KRCH=        0.   FKEC=       .00
          HS=        773.80    778.80    785.90    789.60    790.80    795.00    800.00
805.00    810.00
          BS=            .0       1.0     215.0     270.0     390.0    1000.0    1250.0
2700.0    3100.0
          AS=            .0       2.5     769.3    1666.5    2062.5    4981.6   10606.6
20481.6   34981.6
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   10     FLDSTG=     .00   X=    204.30   KRCH=        0.   FKEC=       .00
          HS=        773.50    778.50    785.00    787.00    790.00    795.00    800.00
805.00    810.00
          BS=            .0       1.0     150.0     150.0     150.0    1200.0    1575.0
3000.0    4000.0
          AS=            .0       2.5     493.3     793.3    1243.3    4618.3   11555.8
22993.3   40493.3
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
  I=   11     FLDSTG=      .00    X=    203.30    KRCH=        0.   FKEC=        .00
          HS=         771.80    776.80    780.00    784.70    791.70    795.00    800.00
805.00    810.00
          BS=             .0       1.0     150.0     277.0     344.7     500.0    2300.0
2600.0    3000.0
          AS=             .0       2.5     244.1    1247.6    3423.5    4817.3   11817.3
24067.3   38067.3
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   12     FLDSTG=      .00    X=    203.13    KRCH=        0.   FKEC=        .00
          HS=         770.80    775.80    781.90    783.30    791.00    795.00    800.00
805.00    810.00
          BS=             .0       1.0     150.0     270.0     345.0     400.0     800.0
1200.0    2000.0
          AS=             .0       2.5     463.1     757.0    3124.8    4614.8    7614.8
12614.8   20614.8
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   13     FLDSTG=      .00    X=    202.30    KRCH=        0.   FKEC=        .00
          HS=         768.60    773.60    775.90    777.30    780.20    790.00    795.00
800.00    810.00
          BS=             .0       1.0      90.0     240.0     330.0     350.0     375.0
1800.0    3600.0
          AS=             .0       2.5     107.2     338.1    1164.7    4496.6    6309.1
11746.6   38746.6
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   14     FLDSTG=      .00    X=    202.25    KRCH=        0.   FKEC=        .00
          HS=         768.10    773.10    775.80    780.10    788.80    795.00    800.00
805.00    810.00
          BS=             .0       1.0     225.0     340.0     390.0    1575.0    2000.0
3100.0    4000.0
          AS=             .0       2.5     307.6    1522.3    4697.9   10789.4   19726.9
32476.9   50226.9
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   15     FLDSTG=      .00    X=    202.20    KRCH=        0.   FKEC=        .00
          HS=         767.60    772.60    775.90    780.10    789.40    795.00    800.00
805.00    810.00
          BS=             .0       1.0     210.0     375.0     400.0    2750.0    3500.0
4300.0    4900.0
          AS=             .0       2.5     350.7    1579.1    5182.9   14002.9   29627.9
49127.9   72127.9
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   16     FLDSTG=      .00    X=    202.10    KRCH=        0.   FKEC=        .00
          HS=         767.00    772.00    776.40    777.80    780.00    790.00    795.00
800.00    810.00
          BS=             .0       1.0     220.0     370.0     400.0     550.0    3000.0
5100.0    6100.0
          AS=             .0       2.5     488.7     901.7    1748.7    6498.7   15373.7
35623.7   91623.7
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   17     FLDSTG=      .00    X=    201.60    KRCH=        0.   FKEC=        .00
          HS=         764.60    769.60    773.00    777.00    780.00    790.00    800.00
805.00    810.00
          BS=             .0       1.0     150.0     275.0     390.0    1100.0    4000.0
4500.0    5000.0
          AS=             .0       2.5     259.2    1109.2    2106.7    9556.7   35056.7
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
56306.7   80056.7
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   18     FLDSTG=     .00    X=    201.56   KRCH=        0.   FKEC=       .00
          HS=        763.00    768.00    769.70    771.10    780.00    790.00    795.00
800.00    810.00
          BS=            .0       1.0     340.0     605.0     710.0    1400.0    3500.0
6300.0    6500.0
          AS=            .0       2.5     292.4     953.8    6805.6   17355.6   29605.6
54105.6  118105.6
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   19     FLDSTG=     .00    X=    201.40   KRCH=        0.   FKEC=       .00
          HS=        762.50    767.50    772.60    772.80    799.90    800.00    800.50
800.80    801.30
          BS=            .0       1.0     280.0     520.0     610.0     760.0     800.0
825.0     870.0
          AS=            .0       2.5     719.0     799.1   16110.6   16179.1   16569.1
16812.8   17236.5
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   20     FLDSTG=     .00    X=    201.30   KRCH=        0.   FKEC=       .00
          HS=        762.00    767.00    769.60    782.40    784.40    784.60    789.90
795.50    801.00
          BS=            .0       1.0     290.0     390.0     460.0     630.0     670.0
1050.0    1100.0
          AS=            .0       2.5     380.8    4732.8    5582.8    5691.8    9136.8
13952.8   19865.3
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   21     FLDSTG=     .00    X=    200.70
          HS=        756.30    761.30    768.40    774.00    784.20    785.40    785.70
795.50    802.80
          BS=            .0       1.0     130.0     360.0     415.0     500.0     680.0
750.0     753.0
          AS=            .0       2.5     467.6    1839.5    5792.1    6341.1    6518.0
13525.0   19011.0
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0


 RIVER NO.  2

  I=    1     FLDSTG=     .00    X=     29.00   KRCH=        0.   FKEC=       .00
          HS=        836.20    841.20    843.00    845.60    850.00    855.00    860.00
865.00    870.00
          BS=            .0       1.0     200.0     350.0     400.0     925.0    1600.0
2600.0    3400.0
          AS=            .0       2.5     183.4     898.4    2548.4    5860.9   12173.4
22673.4   37673.4
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=            .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    2     FLDSTG=     .00    X=     27.99   KRCH=        0.   FKEC=       .00
          HS=        834.60    839.60    841.50    844.10    848.60    854.30    859.30
864.30    869.30
          BS=            .0       1.0     210.7     350.0     400.0     846.4    2042.9
3042.9    3814.3
          AS=            .0       2.5     203.6     932.5    2620.0    6172.3   13395.5
26110.0   43253.0
         BSS=            .0        .0        .0        .0        .0        .0        .0
.0        .0
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
        ASS=            .0        .0        .0        .0        .0        .0        .0
.0       .0

  I=    3   FLDSTG=    .00   X=     26.97  KRCH=       0.  FKEC=       .00
          HS=       833.00    838.00    840.00    842.60    847.10    853.60    858.60
863.60    868.60
          BS=           .0       1.0     221.4     350.0     400.0     767.9    2485.7
3485.7    4228.6
          AS=           .0       2.5     224.9     967.7    2655.2    6450.9   14584.9
29513.4   48799.1
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    4   FLDSTG=    .00   X=     25.96  KRCH=       0.  FKEC=       .00
          HS=       831.40    836.40    838.50    841.10    845.70    852.90    857.90
862.90    867.90
          BS=           .0       1.0     232.1     350.0     400.0     689.3    2928.6
3928.6    4642.9
          AS=           .0       2.5     247.3    1004.0    2729.0    6650.5   15695.2
32838.2   54267.0
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    5   FLDSTG=    .00   X=     24.94  KRCH=       0.  FKEC=       .00
          HS=       829.80    834.80    837.00    839.50    844.30    852.10    857.10
862.10    867.10
          BS=           .0       1.0     242.9     350.0     400.0     610.7    3371.4
4371.4    5057.1
          AS=           .0       2.5     270.8    1011.9    2811.9    6753.6   16708.9
36065.9   59637.1
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    6   FLDSTG=    .00   X=     23.93  KRCH=       0.  FKEC=       .00
          HS=       828.20    833.20    835.50    838.00    842.90    851.40    856.40
861.40    866.40
          BS=           .0       1.0     253.6     350.0     400.0     532.1    3814.3
4814.3    5471.4
          AS=           .0       2.5     295.3    1049.8    2887.3    6848.7   17714.7
39286.2   65000.5
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    7   FLDSTG=    .00   X=     22.91  KRCH=       0.  FKEC=       .00
          HS=       826.60    831.60    834.00    836.50    841.40    850.70    855.70
860.70    865.70
          BS=           .0       1.0     264.3     350.0     400.0     453.6    4257.1
5257.1    5885.7
          AS=           .0       2.5     320.9    1088.7    2926.2    6895.5   18672.2
42457.7   70314.7
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    8   FLDSTG=    .00   X=     21.90  KRCH=       0.  FKEC=       .00
          HS=       825.00    830.00    832.50    835.00    840.00    850.00    855.00
860.00    865.00
          BS=           .0       1.0     275.0     350.0     400.0     475.0    4700.0
5700.0    6300.0
          AS=           .0       2.5     347.5    1128.8    3003.8    7378.8   20316.3
46316.3   76316.3
         BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=    9   FLDSTG=    .00   X=     20.88  KRCH=       0.  FKEC=       .00
          HS=       822.20    827.20    829.70    832.20    837.10    846.50    851.80
856.80    861.80
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
         BS=           .0       1.0     270.6     344.1     394.1     397.1    4488.2
5617.6    6229.4
         AS=           .0       2.5     342.0    1110.4    2919.0    6637.6   19583.6
44848.1   74465.6
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   10     FLDSTG=      .00    X=     19.85   KRCH=        0.   FKEC=        .00
         HS=       819.50    824.50    826.90    829.40    834.10    843.00    848.50
853.50    858.50
         BS=           .0       1.0     266.2     338.2     388.2     419.1    4276.5
5535.3    6158.8
         AS=           .0       2.5     323.1    1078.6    2785.7    6378.2   19291.1
43820.6   73055.8
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   11     FLDSTG=      .00    X=     18.83   KRCH=        0.   FKEC=        .00
         HS=       816.70    821.70    824.10    826.50    831.20    839.40    845.30
850.30    855.30
         BS=           .0       1.0     261.8     332.4     382.4     441.2    4064.7
5452.9    6088.2
         AS=           .0       2.5     317.9    1030.9    2710.7    6087.5   19379.8
43173.8   72026.5
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   12     FLDSTG=      .00    X=     17.80   KRCH=        0.   FKEC=        .00
         HS=       814.00    819.00    821.30    823.70    828.20    835.90    842.10
847.10    852.10
         BS=           .0       1.0     257.4     326.5     376.5     463.2    3852.9
5370.6    6017.6
         AS=           .0       2.5     299.7    1000.3    2582.1    5814.9   19194.8
42253.5   70724.0
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   13     FLDSTG=      .00    X=     16.78   KRCH=        0.   FKEC=        .00
         HS=       811.20    816.20    818.50    820.90    825.30    832.40    838.80
843.80    848.80
         BS=           .0       1.0     252.9     320.6     370.6     485.3    3641.2
5288.2    5947.1
         AS=           .0       2.5     294.5     982.7    2503.3    5541.8   18746.5
41070.0   69158.3
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   14     FLDSTG=      .00    X=     15.76   KRCH=        0.   FKEC=        .00
         HS=       808.50    813.50    815.70    818.10    822.40    828.90    835.60
840.60    845.60
         BS=           .0       1.0     248.5     314.7     364.7     507.4    3429.4
5205.9    5876.5
         AS=           .0       2.5     277.0     952.8    2413.5    5247.8   18436.0
40024.3   67730.3
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
        ASS=           .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   15     FLDSTG=      .00    X=     14.73   KRCH=        0.   FKEC=        .00
         HS=       805.70    810.70    812.90    815.20    819.40    825.30    832.40
837.40    842.40
         BS=           .0       1.0     244.1     308.8     358.8     529.4    3217.6
5123.5    5805.9
         AS=           .0       2.5     272.1     907.9    2309.9    4930.1   18232.0
39084.8   66408.3
        BSS=           .0        .0        .0        .0        .0        .0        .0
.0        .0
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   16     FLDSTG=      .00    X=      13.71   KRCH=        0.   FKEC=        .00
          HS=         803.00    808.00    810.10    812.40    816.50    821.80    829.10
834.10    839.10
          BS=             .0       1.0     239.7     302.9     352.9     551.5    3005.9
5041.2    5735.3
          AS=             .0       2.5     255.2     879.2    2223.6    4620.3   17604.8
37722.5   64663.8
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   17     FLDSTG=      .00    X=      12.68   KRCH=        0.   FKEC=        .00
          HS=         800.20    805.20    807.40    809.60    813.50    818.30    825.90
830.90    835.90
          BS=             .0       1.0     235.3     297.1     347.1     573.5    2794.1
4958.8    5664.7
          AS=             .0       2.5     262.4     848.1    2104.3    4313.7   17110.6
36492.9   63051.6
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   18     FLDSTG=      .00    X=      11.66   KRCH=        0.   FKEC=        .00
          HS=         797.50    802.50    804.60    806.80    810.60    814.80    822.60
827.60    832.60
          BS=             .0       1.0     230.9     291.2     341.2     595.6    2582.4
4876.5    5594.1
          AS=             .0       2.5     246.0     820.3    2021.9    3989.1   16383.3
35030.6   61207.1
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   19     FLDSTG=      .00    X=      10.64   KRCH=        0.   FKEC=        .00
          HS=         794.70    799.70    801.80    803.90    807.60    811.20    819.40
824.40    829.40
          BS=             .0       1.0     226.5     285.3     335.3     617.6    2370.6
4794.1    5523.5
          AS=             .0       2.5     241.4     778.8    1926.9    3642.1   15893.7
33805.5   59599.5
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   20     FLDSTG=      .00    X=       9.61   KRCH=        0.   FKEC=        .00
          HS=         792.00    797.00    799.00    801.10    804.70    807.70    816.20
821.20    826.20
          BS=             .0       1.0     222.1     279.4     329.4     639.7    2158.8
4711.8    5452.9
          AS=             .0       2.5     225.6     752.2    1848.0    3301.7   15195.3
32371.8   57783.5
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   21     FLDSTG=      .00    X=       8.59   KRCH=        0.   FKEC=        .00
          HS=         789.20    794.20    796.20    798.30    801.80    804.20    812.90
817.90    822.90
          BS=             .0       1.0     217.6     273.5     323.5     661.8    1947.1
4629.4    5382.4
          AS=             .0       2.5     221.1     736.7    1781.5    2963.9   14312.6
30753.9   55783.4
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   22     FLDSTG=      .00    X=       7.56   KRCH=        0.   FKEC=        .00
          HS=         786.50    791.50    793.40    795.50    798.80    800.70    809.70
814.70    819.70
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
          BS=             .0       1.0     213.2     267.6     317.6     683.8    1735.3
4547.1    5311.8
          AS=             .0       2.5     206.0     710.8    1676.4    2627.7   13513.7
29219.7   53866.9
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   23     FLDSTG=    .00    X=     6.54   KRCH=        0.   FKEC=       .00
          HS=         783.70    788.70    790.60    792.60    795.90    797.10    806.50
811.50    816.50
          BS=             .0       1.0     208.8     261.8     311.8     705.9    1523.5
4464.7    5241.2
          AS=             .0       2.5     201.8     672.4    1618.9    2229.5   12707.7
27678.2   51942.9
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   24     FLDSTG=    .00    X=     5.51   KRCH=        0.   FKEC=       .00
          HS=         781.00    786.00    787.80    789.80    792.90    793.60    803.20
808.20    813.20
          BS=             .0       1.0     204.4     255.9     305.9     727.9    1311.8
4382.4    5170.6
          AS=             .0       2.5     187.4     647.7    1518.5    1880.3   11670.9
25906.4   49788.9
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   25     FLDSTG=    .00    X=     4.49   KRCH=        0.   FKEC=       .00
          HS=         778.20    783.20    785.00    787.00    790.00    790.10    800.00
805.00    810.00
          BS=             .0       1.0     200.0     250.0     300.0     750.0    1100.0
4300.0    5100.0
          AS=             .0       2.5     183.4     633.4    1458.4    1510.9   10668.4
24168.4   47668.4
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   26     FLDSTG=    .00    X=     3.45   KRCH=        0.   FKEC=       .00
          HS=         775.10    780.10    780.80    785.00    790.00    795.00    800.00
805.00    810.00
          BS=             .0       1.0     150.0     230.0     260.0     730.0    3100.0
4700.0    6100.0
          AS=             .0       2.5      55.4     853.4    2078.4    4553.4   14128.4
33628.4   60628.4
         BSS=             .0        .0        .0        .0        .0        .0        .0
.0        .0
         ASS=             .0        .0        .0        .0        .0        .0        .0
.0        .0

  I=   27     FLDSTG=    .00    X=     3.04   KRCH=        0.   FKEC=       .00
          HS=         774.20    779.20    780.20    784.70    790.00    790.50    791.00
800.00    810.00
          BS=             .0       1.0     115.0     215.0     500.0    1380.0    1400.0
1800.0    2000.0
          AS=             .0       2.5      60.5     803.0    2697.7    3167.7    3862.7
18262.7   37262.7
         BSS=             .0        .0        .0        .0        .0        .0     540.0
1900.0    2000.0
         ASS=             .0        .0        .0        .0        .0        .0     135.0
11115.0   30615.0

  I=   28     FLDSTG=    .00    X=     2.54   KRCH=        0.   FKEC=       .00
          HS=         773.00    778.00    779.20    784.70    790.00    790.50    791.00
800.00    810.00
          BS=             .0       1.0     115.0     215.0     500.0    1380.0    1400.0
1800.0    2000.0
          AS=             .0       2.5      72.1     979.6    2874.3    3344.3    4039.3
18439.3   37439.3
         BSS=             .0        .0        .0        .0        .0        .0    3540.0
1900.0    2000.0
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
         ASS=              .0        .0        .0        .0        .0        .0     885.0
25365.0   44865.0

  I=   29     FLDSTG=     .00    X=      2.04   KRCH=        0.   FKEC=       .00
          HS=        772.00    777.00    779.20    784.70    790.00    790.50    791.00
800.00    810.00
          BS=              .0       1.0     115.0     215.0     500.0    1380.0    1400.0
1800.0    2000.0
          AS=              .0       2.5     130.1    1037.6    2932.3    3402.3    4097.3
18497.3   37497.3
         BSS=              .0        .0        .0        .0        .0        .0     540.0
1900.0    2000.0
         ASS=              .0        .0        .0        .0        .0        .0     135.0
11115.0   30615.0

  I=   30     FLDSTG=     .00    X=      1.82   KRCH=        0.   FKEC=       .00
          HS=        771.50    776.50    778.80    789.70    790.00    793.90    799.70
799.90    810.00
          BS=              .0       1.0     210.0     310.0     400.0    2500.0    3000.0
3825.0    7000.0
          AS=              .0       2.5     245.1    3079.2    3185.7    8840.7   24790.7
25473.2   80139.3
         BSS=              .0        .0        .0        .0      70.0     800.0     500.0
.0         .0
         ASS=              .0        .0        .0        .0      10.5    1707.0    5477.0
5527.0    5527.0

  I=   31     FLDSTG=     .00    X=      1.01   KRCH=        0.   FKEC=       .00
          HS=        769.50    774.50    778.00    780.00    790.00    790.10    795.00
800.00    810.00
          BS=              .0       1.0     300.0     350.0     400.0     400.0    3000.0
4300.0    5300.0
          AS=              .0       2.5     529.3    1179.3    4929.3    4969.2   13299.3
31549.3   79549.3
         BSS=              .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=              .0        .0        .0        .0        .0        .0        .0
.0         .0

  I=   32     FLDSTG=     .00    X=       .00
          HS=        764.00    769.00    778.20    778.80    781.00    790.00    800.00
805.00    810.00
          BS=              .0       1.0     240.0     310.0     370.0     550.0    7000.0
8200.0    9500.0
          AS=              .0       2.5    1111.1    1276.1    2024.1    6164.1   43914.1
81914.1  126164.1
         BSS=              .0        .0        .0        .0        .0        .0        .0
.0         .0
         ASS=              .0        .0        .0        .0        .0        .0        .0
.0         .0

 REACH INFO RIVER NO.  1

   NCM(K, 1), K=1,NRCM1( 1)
         1   10

      CM(K, 1, 1)=        .0140     .0150     .0170     .0210     .0220     .0250     .0300
.0480     .0570     .0570
                          .0570     .0570     .0570
      YQCM(K, 1, 1)=         0.     1250.     2500.     5000.     8000.    12000.    20000.
40000.    60000.    80000.
                       120000.   140000.   160000.

      CM(K, 2, 1)=        .0900     .0620     .0430     .0300     .0270     .0220     .0260
.0320     .0320     .0400
                          .0400     .0500     .0500
      YQCM(K, 2, 1)=         0.     1250.     2500.     5000.     7500.    10000.    20000.
40000.    60000.    80000.
                       120000.   140000.   160000.


 REACH INFO RIVER NO.  2

   NCM(K, 2), K=1,NRCM1( 2)
         1   28

      CM(K, 1, 2)=        .0480     .0290     .0310     .0330     .0410     .0410     .0450
```

Figure 4. Sample output from Operation FLDWAV parameter print routine

```
.0450     .0480     .0500
                          .0500     .0500     .0500
      YQCM(K, 1, 2)=        0.     2500.     5000.    10000.    20000.    40000.    60000.
80000.   120000.   130000.
                        140000.   150000.   160000.

      CM(K, 2, 2)=        .0340     .0360     .0320     .0300     .0320     .0380     .0820
.0840     .0900     .0800
                          .0890     .1100     .1100
      YQCM(K, 2, 2)=        0.     2500.     5000.     7500.    10000.    15000.    20000.
25000.    30000.    35000.
                         40000.    45000.    65000.
```

Figure 5. Bottom slope profile

RIVER NO	SECT NO	X MILE	BED ELEV. FEET	REACH NO	LENGTH MILE	SLOPE FPM	ROUTING	STRUCT.
1	1	.00	5220.00	1	16.00	12.06	IMP(SUB)	
1	2	16.00	5027.00	2	.01	.00	IMP(SUB)	DAM
1	3	16.01	5027.00	3	5.00	12.40	IMP(SUB)	
1	4	21.01	4965.00	4	3.50	12.86	IMP(SUB)	
	.							
	.							
	.							
1	11	57.01	4736.00	11	2.00	3.50	IMP(SUB)	
1	12	59.01	4729.00	12	8.50	8.82	IMP(SUB)	
1	13	67.51	4654.00	13	8.00	6.63	IMP(SUB)	
1	14	75.51	4601.00					

WARNING: THE FOLLOWING DXMs SHOULD BE CHANGED

J	I	DXM(I,J)	RECOMMENDED	REASON
1	6	.750	.194	COURANT CONDITION
1	7	1.000	.264	COURANT CONDITION
1	8	1.000	.326	COURANT CONDITION
1	9	1.000	.202	COURANT CONDITION
1	10	1.100	.306	COURANT CONDITION
1	11	1.000	.222	EXP/CON CRITERIA
1	12	1.000	.425	COURANT CONDITION
1	13	1.400	.368	COURANT CONDITION

Definition of Variables in Bottom Slope Profile

River No	-	River number
Sect No	-	Cross section number
X	-	Cross section location (MI or KM)
Bed Elevation	-	Invert elevation (FT or M)
Reach No	-	Reach number
Length	-	Reach length (MI or KM)
Slope	-	Slope of reach (FT/MI or PCT)
Routing	-	Routing technique
Struct.	-	Structure within the reach
J	-	River number
I	-	Cross section number
DXM	-	Distance interval between cross sections (MI or KM)

Figure 6. Initial conditions summary

I	DISTANCE MILE	FLOW CFS	WSEL FT	DEPTH FT	MIN WSEL FT	BOTTOM FT
1	.000	13000.	5288.499	68.499	5231.191	5220.000
2	2.000	13000.	5288.500	92.625	5206.267	5195.875
.						
.						
.						
82	73.910	13000.	4621.069	9.469	4621.069	4611.600
83	75.510	13000.	4609.491	8.491	4609.491	4601.000

Definition of Variables in Initial Conditions Summary

I	-	Cross section counter
DISTANCE	-	Cross section location (MI or KM)
FLOW	-	Initial discharge (CFS or CMS)
WSEL	-	Initial water surface elevation (FT or M)
DEPTH	-	Initial depth of flow (FT or M)
MIN WSEL	-	Low flow filter (FT or M)
BOTTOM	-	Invert elevation (FT or M)

Figure 7. Initial conditions/low flow filter

```
 I=  1  X=   .000   YN= 5288.55   DEPN= 261.55  YC= 5033.55   DEPC= 6.55   IFR= 0   ITN=  0  ITC= 14
 I=  2  X=   .010   YN= 5036.35   DEPN=   9.35  YC= 5033.55   DEPC= 6.55   IFR= 0   ITN= 14  ITC= 14
  .
  .
  .
 I= 73  X= 57.910  YN= 4621.22   DEPN=  9.62   YC= 4618.02   DEPC= 6.42   IFR= 0   ITN= 12  ITC= 12
 I= 74  X= 59.510  YN= 4609.64   DEPN=  8.64   YC= 4606.61   DEPC= 5.61   IFR= 0   ITN= 12  ITC= 12


       (IFR(I,J),I=1,N)
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
  0    0    0    0

 WATER ELEVATION AT SECTION N=  74  IS    4609.49

 WATER ELEVATION AT SECTION N=  73  IS    4621.07


   BACKWATER      IN= 73     YNN=   4621.07     DEP=      9.47
        I= 72   QIL= 13003.   YIL= 4632.73   DEP= 10.53   ITB= 3
        I= 71   QIL= 13003.   YIL= 4644.56   DEP= 11.76   ITB= 3
        .
        .
        .
        I=  2   QIL= 13003.   YIL= 5036.36   DEP=   9.36  ITB= 3
        I=  1   QIL= 13003.   YIL= 5288.55   DEP= 261.55  ITB= 3

 INITIAL WATER ELEVATION:

    YDI FOR RIVER NO.  1
 5288.55   5036.36   5030.18   5024.00   5017.82   5011.63   5005.45   4999.26
 4993.07   4986.87   4980.73   4974.40   4967.82   4961.25   4954.65   4948.10
 4941.41   4935.00   4927.95   4921.06   4914.17   4907.29   4900.40   4893.51
 4886.62   4879.75   4872.83   4866.01   4859.01   4852.35   4845.02   4839.00
 4830.35   4827.67   4825.95   4824.23   4822.49   4820.75   4819.01   4817.24
 4815.44   4813.59   4810.39   4806.91   4803.31   4799.70   4795.90   4792.09
 4788.19   4784.44   4780.24   4776.87   4774.79   4772.68   4770.56   4768.40
 4765.58   4760.03   4755.33   4750.90   4746.99   4741.20   4730.76   4720.34
 4709.98   4699.59   4689.36   4678.84   4668.77   4656.56   4644.56   4632.73
 4621.07   4609.49

WATER ELEVATION FOR LOW FILTER:

    YUMN FOR RIVER   1
 5036.36   5036.36   5030.18   5024.00   5017.82   5011.63   5005.45   4999.26
 4993.07   4986.87   4980.73   4974.40   4967.82   4961.25   4954.65   4948.10
 4941.41   4935.00   4927.95   4921.06   4914.17   4907.29   4900.40   4893.51
 4886.62   4879.75   4872.83   4866.01   4859.01   4852.35   4845.02   4839.00
 4830.35   4827.67   4825.95   4824.23   4822.49   4820.75   4819.01   4817.24
 4815.44   4813.59   4810.39   4806.91   4803.31   4799.70   4795.90   4792.09
 4788.19   4784.44   4780.24   4776.87   4774.79   4772.68   4770.56   4768.40
 4765.58   4760.03   4755.33   4750.90   4746.99   4741.20   4730.76   4720.34
 4709.98   4699.59   4689.36   4678.84   4668.77   4656.56   4644.56   4632.73
 4621.07   4609.49
```

Definition of Variables in Initial Conditions/Low Flow Filter

I	-	Cross section counter
X	-	Cross section location (MI or KM)
YN	-	Normal flow WSEL (FT or M) for initial flow at t=0
DEPN	-	Normal flow depth (FT or M) for initial flow
YC	-	Critical flow WSEL (FT or M) for initial flow at t=0
DEPC	-	Critical flow depth (FT or M) for initial flow
IFR	-	Froude number indicator 0 indicates Fr<1, 1 indicates Fr>= 1
ITN	-	Number of iterations to obtain YN via bi-section solution method
ITC	-	Number of iterations to obtain YC via bi-section solution method
IN	-	Number of cross section at downstream boundary
YNN	-	WSEL (FT or M) at downstream boundary for initial flow
DEP	-	Depth (FT or M) at downstream boundary for initial flow
I	-	Cross section counter
J	-	River number
QIL	-	Discharge (CFS or CMS) at t=0 for Ith cross section
YIL	-	Computed backwater/downwater WSEL (FT or M) at t=0 for Ith cross section

DEP	-	Backwater flow depth (FT or M)
ITB	-	Number of iterations to obtain backwater elevation YIL
YDI	-	Initial water surface elevation (FT or M)
YUMN	-	Minimum water surface elevation (FT or M) used in routing computations (low flow filter)

Figure 8. Minimum dynamic routing output

```
TT =    .00000 HRS      DTH =    .02500 HRS      ITMX=  0

   RIVER=   1     QU(1)=      3.000     YU(1)=     2578.30    QU(N)=      3.000     YU(N)=     215.37

J I X(MI) H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1 1 5.000 2578.30  .01  279.904  8060. 8060.  3.0000  .0700    .00    .00   120.30   10  .0000   0
1 2 5.010 2466.45 8.40     .357    85.   85.  3.0000  .0700    .00    .72     8.45    5  .0000   0
1 3 5.112 2454.16 8.38     .358    85.   85.  3.0000  .0700    .00    .72     8.43    5  .0000   0
1 4 5.214 2441.86 8.37     .359    85.   85.  3.0000  .0700    .00    .72     8.41    5  .0000   0
1 5 5.315 2429.56 8.35     .359    86.   86.  3.0000  .0700    .00    .72     8.38    5  .0000   0
1 6 5.417 2417.26 8.33     .360    86.   86.  3.0000  .0700    .00    .72     8.36    5  .0000   0
1 7 5.519 2404.96 8.32     .361    87.   87.  3.0000  .0700    .00    .72     8.33    5  .0000   0
1 8 5.621 2392.66 8.30     .361    87.   87.  3.0000  .0700    .00    .72     8.31    5  .0000   0
1 9 5.722 2380.36 8.28     .362    87.   87.  3.0000  .0700    .00    .72     8.28    5  .0000   0
     FRMX=     .873  IFRMX=  117   FRMN=     .000  IFRMN= 1
     RESERVOIR OUTFLOW INFORMATION
J  I  TT   QU(I)  USH(MSL)   YB(MSL)   DSH(MSL) SUB  BB  QU(1)  QBRECH  QOVTOP  QOTHR
1  1 .000  3.000  2578.30   2578.30   2466.45  1.00 .00  3.000 .000    .000    3.000
```

Definition of Variables in Minimum Dynamic Routing Output

TT	- Time at which output is given (HR)
DTH	- Computational time step (HR)
ITMX	- Number of iterations in Newton-Raphson Solution of Saint-Venant Equations
RIVER	- River number
QU(1)	- Discharge (CFS or CMS) at upstream boundary
YU(1)	- Water surface elevation (FT or M) at upstream boundary
QU(N)	- Discharge (CFS or CMS) at downstream boundary)
YU(N)	- Water surface elevation (FT or M) at downstream boundary
FRMX	- Maximum Froude number in the routing reach
IFRMX	- Cross section number at which FRMX occurs
FRMN	- Minimum Froude number in the routing reach
IFRMN	- Cross section number at which FRMN occurs

Figure 9. Internal boundary information

```
TT =    .00000 HRS      DTH =    .02500 HRS      ITMX=  0

   RIVER=   1     QU(1)=      3.000     YU(1)=    2578.30    QU(N)=      3.000     YU(N)=     215.37

J I X(MI) H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1 1 5.000 2578.30  .01   79.904    60.   60.  3.0000  .0700    .00   .00   120.30   10  .0000   0
1 2 5.010 2466.45 8.40     .357    85.   85.  3.0000  .0700    .00   .72     8.45    5  .0000   0
1 3 5.112 2454.16 8.38     .358    85.   85.  3.0000  .0700    .00   .72     8.43    5  .0000   0
1 4 5.214 2441.86 8.37     .359    85.   85.  3.0000  .0700    .00   .72     8.41    5  .0000   0
1 5 5.315 2429.56 8.35     .359    86.   86.  3.0000  .0700    .00   .72     8.38    5  .0000   0
1 6 5.417 2417.26 8.33     .360    86.   86.  3.0000  .0700    .00   .72     8.36    5  .0000   0
1 7 5.519 2404.96 8.32     .361    87.   87.  3.0000  .0700    .00   .72     8.33    5  .0000   0
1 8 5.621 2392.66 8.30     .361    87.   87.  3.0000  .0700    .00   .72     8.31    5  .0000   0
1 9 5.722 2380.36 8.28     .362    87.   87.  3.0000  .0700    .00   .72     8.28    5  .0000   0

     FRMX=    .873  IFRMX=  117          FRMN=    .000  IFRMN= 1


     RESERVOIR OUTFLOW INFORMATION
J  I  TT   QU(I)  USH(MSL)   YB(MSL)  DSH(MSL)  SUB  BB  QU(1)  QBRECH  QOVTOP  QOTHR
1  1 .000  3.000   2578.30   2578.30  2466.45  1.00 .00  3.000  .00    .000    3.000
```

Definition of Variables in Internal Boundary Information

J	-	River number
I	-	Cross section number of internal boundary
TT	-	Time at which output is given (HR)
QU(I)	-	Discharge through structure (CFS or CMS)
USH(MSL)	-	Water surface elevation (FT or M above Mean Sea Level) immediately upstream of structure (pool elevation)
YB(MSL)	-	Elevation (FT or M above Mean Sea Level) of bottom of breach
DSH(MSL)	-	Water surface elevation (FT or M above Mean Sea Level) immediately downstream of structure (tailwater elevation)
SUB	-	Submergence correction factor for breach flow
BB	-	Bottom width (FT or M) of breach
QU(1)	-	Discharge (CFS or CMS) at upstream end of the reach or pool upstream of the structure
QBRECH	-	Discharge (CFS or CMS) through breach
QOVTOP	-	Discharge (CFS or CMS) over the top of dam or over crest of bridge embankment
QOTHR	-	Discharge (CFS or CMS) of all other flows (Dams: spillways, gates, turbines; Bridge: bridge opening)

Figure 10. Hydraulic information

TT = .00000 HRS DTH = .02500 HRS ITMX= 0

RIVER= 1 QU(1)= 3.000 YU(1)= 2578.30 QU(N)= 3.000 YU(N)= 215.37

J	I	X(MI)	H(MSL)	V(FPS)	A(TSQFT)	B(FT)	BT(FT)	Q(TCFS)	MANN. N	WAVHT	FROUDE	DEP(FT)	KR	QL(TCFS)	MRV
1	1	5.000	2578.30	.01	79.904	60.	60.	3.0000	.0700	.00	.00	120.30	10	.0000	0
1	2	5.010	2466.45	8.40	.357	85.	85.	3.0000	.0700	.00	.72	8.45	5	.0000	0
1	3	5.112	2454.16	8.38	.358	85.	85.	3.0000	.0700	.00	.72	8.43	5	.0000	0
1	4	5.214	2441.86	8.37	.359	85.	85.	3.0000	.0700	.00	.72	8.41	5	.0000	0
1	5	5.315	2429.56	8.35	.359	86.	86.	3.0000	.0700	.00	.72	8.38	5	.0000	0
1	6	5.417	2417.26	8.33	.360	86.	86.	3.0000	.0700	.00	.72	8.36	5	.0000	0
1	7	5.519	2404.96	8.32	.361	87.	87.	3.0000	.0700	.00	.72	8.33	5	.0000	0
1	8	5.621	2392.66	8.30	.361	87.	87.	3.0000	.0700	.00	.72	8.31	5	.0000	0
1	9	5.722	2380.36	8.28	.362	87.	87.	3.0000	.0700	.00	.72	8.28	5	.0000	0

FRMX= .873 IFRMX= 117 FRMN= .000 IFRMN= 1

RESERVOIR OUTFLOW INFORMATION

J	I	TT	QU(I)	USH(MSL)	YB(MSL)	DSH(MSL)	SUB	BB	QU(1)	QBRECH	QOVTOP	QOTHR
1	1	.000	3.000	2578.30	2578.30	2466.45	1.00	.00	3.000	.00	.000	3.000

Definition of Variables in Hydraulic Information

J	-	River number
I	-	Cross section number
X(MI)	-	Cross section location (MI of KM)
H(MSL)	-	Water surface elevation (FT or M above Mean Sea Level)
V(FPS)	-	Velocity (FT/SEC or M/SEC)
A(TSQFT)	-	Active cross sectional area (1000 FT2 or 1000 MI2)
B(FT)	-	Active topwidth (FT or M)
BT(FT)	-	Total topwidth (FT or M)
Q(TCFS)	-	Discharge (1000 CFS or 1000 CMS)
MANN. N	-	Roughness coefficient
WAVHT	-	Wave height (FT or M) - H minus initial WSEL
FROUDE	-	Froude number
DEP(FT)	-	Water depth (FT or M) - H minus invert elevation
KR	-	KRCH routing/internal boundary type parameter
QL(TCFS)	-	Lateral flow (1000 CFS or 1000 CMS)
MRV	-	River into which tributary flows

Figure 11. Levee information

TT = .50000 HRS   DTH = .50000 HRS   ITMX= 1 1

RIVER= 1   QU(1)= 3.354   YU(1)= 109.37   QU(N)= 5.994   YU(N)= 71.83

J	I	X(MI)	H(MSL)	V(FPS)	A(TSQFT)	B(FT)	BT(FT)	Q(TCFS)	MANN. N	WAVHT	FROUDE	DEP(FT)	KR	QL(TCFS)	MRV
1	1	.000	109.37	1.53	2.193	468.	468.	3.3542	.0400	.16	.12	9.37	0	.0000	0
1	2	5.000	104.14	11.36	2.088	457.	457.	2.8485	.4000	-.07	.11	9.14	0	.0000	0
1	3	10.000	99.25	1.43	2.140	463.	463.	3.0649	.0400	.03	.12	9.25	9	.0000	0
1	4	11.250	98.00	1.41	2.137	462.	462.	3.0151	.0400	.01	.12	9.25	9	.0000	0
1	5	12.500	96.77	1.40	2.150	464.	464.	3.0035	.0400	.00	.11	9.27	9	.0000	0
1	6	13.750	95.59	1.38	2.181	467.	467.	3.0008	.0400	.00	.11	9.34	9	.0000	0
1	7	15.000	94.48	1.34	2.246	474.	474.	3.0002	.0400	.00	.11	9.48	9	.0000	0
1	8	17.500	92.80	1.13	2.649	510.	510.	3.0000	.0400	.00	.09	10.30	9	.0000	0
1	9	20.000	91.93	.85	3.526	564.	564.	3.0000	.0400	.00	.06	11.93	0	.0000	0
1	0	20.100	91.80	1.74	3.452	560.	560.	6.0000	.0400	.00	.12	11.80	0	.0000	0
1	11	25.000	86.84	1.72	3.479	561.	561.	6.0000	.0400	.00	.12	11.84	9	.0000	0
1	12	26.000	85.84	1.72	3.479	561.	561.	6.0000	.0400	.00	.12	11.84	9	.0000	0
1	13	27.000	84.84	1.72	3.479	561.	561.	6.0000	.0400	.00	.12	11.84	9	.0000	0
1	14	28.000	83.84	1.72	3.479	561.	561.	5.9999	.0400	.00	.12	11.84	9	.0000	0
1	15	29.000	82.84	1.72	3.479	561.	561.	5.9996	.0400	.00	.12	11.84	9	.0000	0
1	16	30.000	81.85	1.72	3.479	562.	562.	5.9982	.0400	.00	.12	11.85	0	.0000	0
1	17	35.000	76.84	1.73	3.479	561.	561.	6.0034	.0400	.00	.12	11.84	0	.0000	0
1	18	40.000	71.83	1.73	3.473	561.	561.	5.9937	.0400	.00	.12	11.83	0	.0000	0

FRMX= .125   IFRMX= 1   FRMN= .060

RIVER= 2   QU(2)= 3.063   YU(1)= 109.24   QU(N)= 3.000   YU(N)= 91.86

J	I	X(MI)	H(MSL)	V(FPS)	A(TSQFT)	B(FT)	BT(FT)	Q(TCFS)	MANN. N	WAVHT	FROUDE	DEP(FT)	KR	QL(TCFS)	MRV
2	1	.000	109.24	1.44	2.133	462.	462.	3.0625	.0400	.03	.12	9.24	0	.0000	1
2	2	5.000	104.20	1.41	2.115	460.	460.	2.9732	.0400	.01	.12	9.20	9	.0000	1
2	3	7.500	101.71	1.42	2.121	460.	460.	3.0030	.0400	.00	.12	9.21	9	.0000	1
2	4	10.000	99.21	1.42	2.119	460.	460.	2.9997	.0400	.00	.12	9.21	9	.0000	1
2	5	11.250	97.95	1.42	2.117	460.	460.	2.9999	.0400	.00	.12	9.20	9	.0000	1
2	6	12.500	96.69	1.42	2.113	460.	460.	3.0000	.0400	.00	.12	9.19	9	.0000	1
2	7	13.750	95.43	1.42	2.105	459.	459.	3.0000	.0400	.00	.12	9.18	9	.0000	1
2	8	15.000	94.14	1.44	2.088	457.	457.	3.0000	.0400	.00	.12	9.14	0	.0000	1
2	9	20.000	91.86	.86	3.489	562.	562.	3.0000	.0400	.00	.06	11.86	0	.0000	1

FRMX= 118   IFRMX= 8   FRMN= .061   IFRMN= 9

TT	LV	JM	IM	JT	IT	QLOVTP	QLPOND	QLBRCH	BR-WDTH	WSEL-M	WSEL-T	SUB-M	SUB-T
0.500	9	1	7	1	0	0.000	75.708	0.000	0.000	93.637	94.000	1.00	1.00
0.500	10	1	8	1	0	0.000	160.862	0.000	0.000	92.361	94.000	1.00	1.00

QPOND(L)=	-237.	0.	0.
HPOND(L)=	93.99	85.00	70.00

Definition of Variables in Levee Information

L	- Pond counter
QPOND(L)	- Discharge into (+) or leaving (-) pond
HPOND(L)	- WSEL in pond (FT or M)
LV	- Levee reach number
JM	- Number of river passing flow over levee reach LV
IM	- Cross section reach number on river JM passing flow over levee reach LV
JT	- Number of river receiving flow from levee reach LV
IT	- Cross section reach number on river JT receiving flow from levee reach LV
QLOVTP	- Flow over the levee (CFS or CMS)
QLBRCH	- Flow through the levee breach (CFS or CMS)
QLPOND	- Flow from the pond (CFS or CMS)
BR-WDTH	- Width of levee breach (FT or M)
WSEL-M	- Average WSEL in reach IM (pool)
WSEL-T	- Average WSEL in reach IT (tailwater)
SUB-M	- Submergence correction factor for the main river
SUB-T	- Submergence correction factor for the tributary

Figure 12. Subcritical/Supercritical flow information

```
          L=    1     KSP=  0     KS1=  1     KSN= 12
          L=    2     KSP=  1     KS1= 12     KSN= 13
          L=    3     KSP=  0     KS1= 14     KSN= 24


  TT =     .00000 HRS      DTH =    .01250 HRS      ITMX=  0

RIVER=  1   QU(1)=    .804   YU(1)=  549.98   QU(N)=  1.204   YU(N)= 466.81

J I X(MI) H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1 10  2.001 506.49 5.71  .211   65.     65.   1.2040   .0400   .00     .56    6.49    0  .0000   0
1 11  2.250 502.56 4.22  .285   76.     76.   1.2040   .0400   .00     .38    7.56    0  .0000   0
1 12  2.500 495.14 9.11  .132   51.     51.   1.2040   .0400   .00    1.00    5.14    0  .0000   0
1 13  2.600 477.02 1.09  .109   43.     43.   1.2040   .0400   .00    1.23    5.02    0  .0000   0
1 14  2.700 477.02  .60  .007   74.     74.   1.2040   .0400   .00     .03   23.02    0  .0000   0
1 15  2.800 477.02  .21  .684   77.     77.   1.2040   .0400   .00     .01   41.02    0  .0000   0
1 16  2.900 477.02  .11  .620   60.     60.   1.2040   .0400   .00     .00   59.02    0  .0000   0
1 17  3.000 477.02  .07  .478   28.     28.   1.2040   .0400   .00     .00   77.02    0  .0000   0
1 18  3.100 477.02  .10  .108   84.     84.   1.2040   .0400   .00     .00   63.02    0  .0000   0
1 19  3.200 477.02  .15  .118   31.     31.   1.2040   .0400   .00     .01   49.02    0  .0000   0

          FRMX=   1.234  IFRMX=    1     FRMN= .002    IFRMN=  17

                     RESERVOIR OUTFLOW INFORMATION
J  I   TT   QU(I)  USH(MSL)   YB(MSL)  DSH(MSL)  SUB   BB   QU(1)  QBRECH  QOVTOP  QOTHR
1  9 .000  1.204    549.90    550.00    506.49 1.00  .00   .804   .000    .000    1.204
```

Definition of Variables in Subcritical/Supercritical Flow Information

L	-	Flow regime reach counter
KSP	-	Flow regime indicator: 0 for subcritical flow, 1 for supercritical flow
KS1	-	Beginning cross section in flow regime
KSN	-	Ending cross section in flow regime

Figure 13. Nonconvergence information

```
         L=    1     KSP=  0     KS1=  1     KSN=  2
         L=    2     KSP=  1     KS1=  2     KSN= 16
         L=    3     KSP=  0     KS1= 17     KSN= 36
         L=    4     KSP=  1     KS1= 36     KSN= 42
         L=    5     KSP=  0     KS1= 43     KSN=112


 NONCONVERGENCE FOR TT=    .08300 USING DTH=    .00415
 AT RIVER=  1  SECT NO.=    17  18  19  20
 PREVIOUS TT= .07885  NEW DTH= .00207  NEW F1= 1.00  NEW TT= .08093

         L=    1     KSP=  0     KS1=  1     KSN=  2
         L=    2     KSP=  1     KS1=  2     KSN= 17
         L=    3     KSP=  0     KS1= 18     KSN= 36
         L=    4     KSP=  1     KS1= 36     KSN= 42
         L=    5     KSP=  0     KS1= 43     KSN=112


  TT =    .08093 HRS      DTH =    .00207 HRS      ITMX=  4

RIVER=  1   QU(1)= 77.897   YU(1)= 1527.29   QU(N)=  1.002   YU(N)= 720.18

J I X(MI) H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1 1   .000 1527.29 22.15   3.517   215.    215. 77.8972  .0350  -21.71  .97   22.29  10   .0000  0
1 2   .010 1523.53 27.32   2.852   243.    243. 77.8972  .0350   14.97 1.40   18.53   0   .0000  0
1 3   .064 1568.06 28.80   2.819   241.    251. 81.1905  .0350   15.20 1.48   17.42   0   .0000  0
1 4   .117 1512.68 29.67   2.797   240.    261. 82.9958  .0350   14.43 1.53   16.40   0   .0000  0
1 5   .171 1507.33 30.04   2.774   241.    271. 83.3153  .0350   13.91 1.56   15.42   0   .0000  0
1 6   .225 1502.02 30.01   2.749   243.    283. 82.4936  .0350   13.00 1.57   14.48   0   .0000  0
1 7   .278 1496.71 29.76   2.710   245.    295. 80.6580  .0350   12.40 1.58   13.53   0   .0000  0
1 8   .332 1491.41 29.32   2.660   249.    307. 77.9996  .0350   11.40 1.58   12.59   0   .0000  0
1 9   .385 1486.11 28.75   2.595   253.    320. 74.5900  .0350   10.70 1.58   11.66   0   .0000  0
         FRMX=   1.582  IFRMX=    9     FRMN=    .282     IFRMN=  101

                        RESERVOIR OUTFLOW INFORMATION
J  I   TT   QU(I)  USH(MSL)   YB(MSL)  DSH(MSL)  SUB   BB   QU(1)  QBRECH  QOVTOP  QOTHR
1  1 .081  77.897  1527.29   1506.10   1523.53  .86  165.75 77.897  77.877 .000   .000
```

Definition of Variables in Nonconvergence Information

SECT NO.	-	Cross locations (interpolated) where nonconvergence occurred.
TT	-	Last computational time prior to nonconvergence
NEW DTH	-	New computation time step (HR) to be used (usually half of the previous time step)
NEW F1	-	New theta weighting factor to be used.
NEW TT	-	New time (HR) for which computations are made

Figure 14. Calibration information

```
RIVER NO. 1     REACH NO.  5     METROPOLIS              STA NO.  13     RIVER MILE=    991.200

  RIVER NO.  1     MANNING N REACH NO.   5

  FKC= 1000.0000     FMC=    0.5000     FKF=  400.0000     FMF=    1.0000     FKO=    0.0000     FMO=    0.0000

         X(I,J)    991.20    981.70    972.20

         IFXC=          0         0         0

           HS=    271.56    281.56    321.56    325.56    341.56    441.56
           BS=      0.00   3162.28   7071.07   8671.07  15071.07  15071.07
           AS=        0.    15811.   220478.   251963.   441900.  1949007.

     MCM= 1       TOTAL RMS (SEA)=  1.91     TOTAL MEAN DEVIATION (AVD)=  0.99

        M       IIM      RMSL      AVDL        CM            YQR
        1         0    0.0000    0.0000    0.0210        150000.
        2         5    0.7607    0.7569    0.0210        250000.
        3        18    1.4101    0.8834    0.0210        350000.
        4        29    2.9710    2.7012    0.0210        450000.
        5         6    0.2570   -0.0209    0.0210        550000.
        6         6    0.5158   -0.3314    0.0210        650000.
        7        20    0.7275   -0.6556    0.0210        750000.
        8         0    0.0000    0.0000    0.0210   10000000000.

        NEW CM=     0.0210    0.0194    0.0191    0.0168    0.0210    0.0217    0.0224    0.0210
```

Definition of Variables in Calibration Information

FKC	-	Scaling parameter of in-bank channel portion of cross section
FMC	-	Shape factor for in-bank channel portion of cross section
FKF	-	Scaling parameter of floodplain portion of cross section
FMF	-	Shape factor for floodplain portion of cross section
FKO	-	Scaling parameter of inactive portion of cross section
FMO	-	Shape factor for inactive portion of cross section
X(I,J)	-	Cross section location (MI or KM)
IFXC	-	Parameter indicating if cross sections have special properties
HS	-	Elevation (FT or M) corresponding to each topwidth
BS	-	Topwidth (FT or M) of active flow portion of cross section
AS	-	Cross-sectional area (FT2 or M2) below the corresponding HS value
MCM	-	Iteration counter of each new calibration trial in the reach
M	-	Level in Manning n table
IIM	-	No. of hydrograph points in this level
RMSL	-	Root-mean-squared (RMS) error for points in the level
AVDL	-	Maan deviation of points in this level
CM	-	Manning n value used in this range
YQR	-	Average discharge/water surface elevation is this range

Figure 15. Profile of crests and times

RVR NO.	SEC NO.	LOCATION MILE	BOTTOM FEET	TIME MAX WSEL(HR)	MAX WSEL FEET	TIME MAX FLOW(CFS)	MAX FLOW CFS	MAX VL (FPS)	MAX VC (FPS)	MAX VR (FPS)
1	1*#	0.000	500.10	7.20002	551.04	7.57502	100976.	3.18	3.66	3.17
1	2*	0.010	500.00	7.85002	533.03	7.57502	100976.	7.73	14.07	7.73
1	3	0.111	499.50	7.90002	532.42	7.60002	98258.	7.57	13.46	7.57
1	4	0.212	498.99	7.92502	531.81	7.60002	95726.	7.37	12.98	7.37
1	5	0.313	498.49	7.95002	531.20	7.67502	93227.	7.17	12.54	7.17
1	6	0.413	497.98	7.97502	530.62	7.70002	91650.	7.01	12.25	7.01
1	7	0.514	497.48	8.00002	530.04	7.72502	90403.	6.92	11.88	6.92
1	8	0.615	496.97	8.05002	529.48	7.75002	89353.	6.84	11.53	6.84
1	9	0.716	496.47	8.25002	528.94	7.77502	88337.	6.75	11.19	6.75
1	10	0.817	495.97	8.27502	528.48	7.80002	87360.	6.74	10.57	6.74
1	11	0.918	495.46	8.30002	528.02	7.82502	86456.	6.64	10.16	6.64
	.									
	.									
	.									
1	77	7.600	469.80	9.87499	498.98	9.50000	59009.	4.72	9.21	4.72
1	78	7.800	469.40	9.89999	498.39	9.52500	58782.	4.74	9.23	4.74
1	79	8.000	469.00	9.92499	497.79	9.57500	58553.	4.73	9.23	4.73
1	80	8.200	468.60	9.94999	497.21	9.60000	58314.	4.72	9.20	4.72
1	81	8.400	468.20	9.97499	496.59	9.65000	58072.	4.66	9.18	4.66
1	82	8.600	467.80	9.97499	495.88	9.67500	57846.	4.23	9.29	4.23
1	83	8.800	467.40	9.99999	495.11	9.72499	57622.	4.05	9.32	4.05
1	84	9.000	467.00	10.02499	494.22	9.77499	57394.	4.03	9.28	4.03
1	85	9.200	466.60	10.07499	493.27	9.79999	57160.	4.05	9.21	4.05
1	86	9.400	466.20	10.09999	492.25	9.87499	56931.	4.10	9.10	4.10
1	87	9.600	465.80	10.12499	491.15	9.92499	56728.	4.21	8.93	4.21
1	88	9.800	465.40	10.17499	490.01	9.99999	56539.	4.26	8.79	4.26
1	89*	10.000	465.00	10.22499	488.84	10.04999	56366.	4.38	8.51	4.38

Definition of Variables in Profile of Crests and Times

RVR NO.	- River number
SEC NO.	- Cross section number
LOCATION	- Cross section location (MI or KM)
BOTTOM	- Invert elevation (FT or M)
TIME MAX WSEL	- Time to maximum water surface elevation (hr)
MAX WSEL	- Maximum water surface elevation (FT or M)
TIME MAX FLOW	- Time to maximum flow (HR)
MAX FLOW	- Maximum flow (CFS or CMS)
MAX VL	- Maximum flow velocity in the left floodplain (FT/SEC or M/SEC) (floodplain option only)
MAX VC	- Maximum flow velocity in the channel (FT/SEC or M/SEC) (floodplain option only)
MAX VR	- Maximum flow velocity in the right floodplain (FT/SEC or M/SEC) (floodplain option only)
MAX VEL	- Maximum flow velocity in the composite channel (FT/SEC or M/SEC) (composite channel option only)

Figure 16. Computed water surface elevation and discharges

```
KTIME  TII(KTIME)     COMPUTED STAGES FOR RIVER= 1  SECTION=  1   2   43  112
    1        .000     1549.00     1508.55     1202.32     720.18
    2        .008     1548.99     1509.50     1202.33     720.18
    3        .017     1548.88     1511.81     1202.35     720.18
    4        .025     1548.53     1514.23     1202.36     720.18
    5        .033     1547.77     1516.33     1202.36     720.18
    6        .041     1546.44     1518.31     1202.36     720.18
    7        .050     1544.36     1520.23     1202.36     720.18
    8        .058     1541.37     1521.92     1202.36     720.18
    9        .066     1537.29     1523.36     1202.36     720.18
   10        .075     1531.79     1524.90     1202.36     720.18
   11        .083     1525.96     1522.33     1202.36     720.18
   12        .091     1522.53     1518.49     1202.36     720.18
   13        .100     1520.06     1517.47     1202.36     720.18

 KTIME  TII(KTIME)     COMPUTED DISCHARGE FOR RIVER= 1  SECTION=  1    2   43  112
    1        .000      1000.        1000.       1001.      1000.
    2        .008      1741.        1741.       1021.      1000.
    3        .017      5114.        5114.       1041.      1001.
    4        .025     11700.       11700.       1053.      1001.
    5        .033     21477.       21477.       1058.      1001.
    6        .041     33930.       33930.       1060.      1001.
    7        .050     48255.       48255.       1061.      1001.
    8        .058     62646.       62646.       1061.      1001.
    9        .066     76294.       76294.       1062.      1002.
   10        .075     92148.       92148.       1062.      1002.
   11        .083     66385.       66385.       1062.      1002.
   12        .091     35124.       35124.       1061.      1002.
   13        .100     28365.       28365.       1061.      1002.
```

Definition of Variables in Computed Water Surface Elevation and Discharges

KTIME - Time step counter
TII(KTIME) - Time (HR) at which computed stages and computed discharges for each river occur.
SECTION - Number of cross sections
YC(KTIME,I) - Water surface elevation (FT or M) for each time at each station where hydrograph plot is made
QC(KTIME,I) - Discharge (CFS or CMS) for each time at each station where hydrograph plot is made

Figure 17. Initial conditions/low flow filter - normal depth computations

```
I= 1   X= .000   YN= 5288.55   DEPN= 261.55   YC= 5033.55   DEPC= 6.55   IFR= 0   ITN= 0   ITC= 14
    I=  2  Y= 5076.00  F= 684119.8  FK= .0722  A= 35049.91  R= 36.57  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5051.50  F= 139161.1  FK= .0722  A= 13230.69  R= 16.08  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5039.25  F=  15225.0  FK= .0722  A=  4319.08  R=  6.89  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5033.13  F=  -8790.1  FK= .0722  A=  1106.71  R=  3.06  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.19  F=   -581.4  FK= .0722  A=  2490.10  R=  4.59  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5037.72  F=   6259.5  FK= .0722  A=  3378.31  R=  5.61  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.95  F=   2374.2  FK= .0722  A=  2922.41  R=  4.98  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.57  F=    847.2  FK= .0722  A=  2701.93  R=  4.79  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.38  F=    120.7  FK= .0722  A=  2594.93  R=  4.69  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.28  F=   -233.4  FK= .0722  A=  2542.25  R=  4.64  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.33  F=    -57.1  FK= .0722  A=  2568.52  R=  4.67  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.35  F=     31.6  FK= .0722  A=  2581.71  R=  4.68  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.34  F=    -13.7  FK= .0722  A=  2574.98  R=  4.67  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.35  F=      8.1  FK= .0722  A=  2578.21  R=  4.67  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5036.35  F=     -2.8  FK= .0722  A=  2576.59  R=  4.67  CMU= .0400  Q1= 13003.33
    .
    .
    I= 74  Y= 4610.50  F=   3243.9  FK= .0528  A=  3143.75  R=  6.62  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4605.75  F= -10606.5  FK= .0528  A=   953.20  R=  2.25  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4608.13  F=  -5008.5  FK= .0528  A=  2031.29  R=  4.40  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.31  F=  -1178.6  FK= .0528  A=  2583.60  R=  5.52  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.91  F=    960.6  FK= .0528  A=  2862.70  R=  6.07  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.61  F=   -127.2  FK= .0528  A=  2722.91  R=  5.79  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.76  F=    412.2  FK= .0528  A=  2792.74  R=  5.93  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.68  F=    141.3  FK= .0528  A=  2757.81  R=  5.86  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.65  F=      6.8  FK= .0528  A=  2740.35  R=  5.83  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.63  F=    -60.3  FK= .0528  A=  2731.63  R=  5.81  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.64  F=    -26.8  FK= .0528  A=  2735.99  R=  5.82  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.64  F=    -10.9  FK= .0528  A=  2738.06  R=  5.82  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.64  F=     -2.1  FK= .0528  A=  2739.21  R=  5.83  CMU= .0360  Q1= 13003.33
I= 74  X= 59.510 YN= 4609.64   DEPN= 8.64     YC= 4606.61   DEPC= 5.61   IFR= 0   ITN= 12  ITC=   12
```

Definition of Variables in Initial Conditions/Low Flow Filter - Normal Depth Computations

I	-	Cross section counter
X	-	Cross section location (MI or KM)
YN	-	Normal flow WSEL (FT or M) for initial flow at t=0
DEPN	-	Normal flow depth (FT or M) for initial flow
YC	-	Critical flow WSEL (FT or M) for initial flow at t=0
DEPC	-	Critical flow depth (FT or M) for initial flow
IFR	-	Froude number indicator 0 indicates Fr<1, 1 indicates Fr>= 1
ITN	-	Number of iterations to obtain YN via bi-section solution method
ITC	-	Number of iterations to obtain YC via bi-section solution method
J	-	River number
N	-	Total number of cross sections
Y	-	Water surface elevation (FT or M)
F	-	Difference between the computed discharge and the actual discharge
FK	-	1.49*SQRT(S)
A	-	Active cross sectional area (FT2 or M2)
R	-	Hydraulic Radius (FT or M)
CMU	-	Manning Roughness Coefficient
Q1	-	Discharge (CFS or CMS)

Figure 18. Initial conditions/low flow filter - downwater computations

```
I= 1   X= .000   YN= 5288.55   DEPN= 261.55   YC= 5033.55   DEPC= 6.55   IFR= 0   ITN= 0   ITC= 14
    I=  2  Y= 5076.00  F= 684119.8  FK= .0722  A= 35049.91  R= 36.57  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5051.50  F= 139161.1  FK= .0722  A= 13230.69  R= 16.08  CMU= .0400  Q1= 13003.33
    I=  2  Y= 5039.25  F=  15225.0  FK= .0722  A=  4319.08  R=  6.89  CMU= .0400  Q1= 13003.33
    .
    .
    I= 74  Y= 4609.64  F=    -26.8  FK= .0528  A=  2735.99  R=  5.82  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.64  F=    -10.9  FK= .0528  A=  2738.06  R=  5.82  CMU= .0360  Q1= 13003.33
    I= 74  Y= 4609.64  F=     -2.1  FK= .0528  A=  2739.21  R=  5.83  CMU= .0360  Q1= 13003.33
I= 74  X= 59.510 YN= 4609.64   DEPN= 8.64     YC= 4606.61   DEPC= 5.61   IFR= 0   ITN= 12  ITC=   12

         (IFR(I,J),I=1,N)
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0
    0    0    0    0
         ITB= 0   I= 73   YIR= 4609.64   QII= 13003.   YA= 4630.56   F= -3015074.000
         ITB= 1   I= 73   YIR= 4609.64   QII= 13003.   YA= 4624.29   F= -1026617.000
         ITB= 2   I= 73   YIR= 4609.64   QII= 13003.   YA= 4621.16   F=   -59822.660
         .
         .
         ITB= 11  I= 73   YIR= 4609.64   QII= 13003.   YA= 4620.98   F=     -549.270
         ITB= 12  I= 73   YIR= 4609.64   QII= 13003.   YA= 4620.98   F=      602.136

   WATER ELEVATION AT SECTION N=  74  IS    4609.49

   WATER ELEVATION AT SECTION N=  73  IS    4621.07

     BACKWATER     IN= 73     YNN= 4621.07     DEP= 9.47
            ITB= 1   I= 72   YBWO= 4631.41  YBWN= 4632.64   F= 460831.400
            ITB= 2   I= 72   YBWO= 4632.64  YBWN= 4632.73   F=  31074.660
            ITB= 3   I= 72   YBWO= 4632.73  YBWN= 4632.73   F=    106.291
      I= 72     QIL= 13003.   YIL= 4632.73       DEP= 10.53     ITB= 3
            ITB= 1   I= 71   YBWO= 4642.95  YBWN= 4644.80   F= 528940.500
            ITB= 2   I= 71   YBWO= 4644.80  YBWN= 4644.56   F= -73286.410
            ITB= 3   I= 71   YBWO= 4644.56  YBWN= 4644.56   F=    687.131
      I= 71     QIL= 13003.   YIL= 4644.56       DEP= 11.76     ITB= 3
            ITB= 1   I= 70   YBWO= 4654.70  YBWN= 4656.77   F= 538055.800
            ITB= 2   I= 70   YBWO= 4656.77  YBWN= 4656.56   F= -64059.640
            ITB= 3   I= 70   YBWO= 4656.56  YBWN= 4656.56   F=    411.615
          .
          .
      I=  3     QIL= 13003.   YIL= 5030.18       DEP= 9.38      ITB= 3
            ITB= 1   I= 2    YBWO= 5035.55  YBWN= 5036.38   F= 169358.600
            ITB= 2   I= 2    YBWO= 5036.38  YBWN= 5036.36   F=  -4883.037
            ITB= 3   I= 2    YBWO= 5036.36  YBWN= 5036.36   F=    -52.562
      I=  2      QIL= 13003.   YIL= 5036.36       DEP=   9.36     ITB= 3
      I=  1      QIL= 13003.   YIL= 5288.55       DEP= 261.55     ITB= 3
```

Definition of Variables in Initial Conditions/Low Flow Filter - Downwater Computations

- I - Cross section counter
- F - Difference between the computed discharge and the actual discharge
- YIR - Final water surface elevation (FT or M)
- QII - Discharge (same as Q1) (CFS or CMS)
- YA - Water surface elevation within the reach (FT or M)

Figure 19. Initial conditions/low flow filter - backwater computations

```
        ITB= 0    I= 73   YIR= 4609.64   QII= 13003.   YA= 4630.56   F= -3015074.000
        ITB= 1    I= 73   YIR= 4609.64   QII= 13003.   YA= 4624.29   F= -1026617.000
        ITB= 2    I= 73   YIR= 4609.64   QII= 13003.   YA= 4621.16   F=   -59822.660
        .
        .

        ITB= 11   I= 73   YIR= 4609.64   QII= 13003.   YA= 4620.98   F=     -549.270
        ITB= 12   I= 73   YIR= 4609.64   QII= 13003.   YA= 4620.98   F=      602.136

  WATER ELEVATION AT SECTION N=  74  IS    4609.49

  WATER ELEVATION AT SECTION N=  73  IS    4621.07


    BACKWATER     IN= 73     YNN= 4621.07     DEP= 9.47
           ITB= 1   I= 72   YBWO= 4631.41  YBWN= 4632.64   F= 460831.400
           ITB= 2   I= 72   YBWO= 4632.64  YBWN= 4632.73   F=  31074.660
           ITB= 3   I= 72   YBWO= 4632.73  YBWN= 4632.73   F=    106.291
     I= 72     QIL= 13003.   YIL= 4632.73       DEP= 10.53     ITB= 3
           ITB= 1   I= 71   YBWO= 4642.95  YBWN= 4644.80   F= 528940.500
           ITB= 2   I= 71   YBWO= 4644.80  YBWN= 4644.56   F= -73286.410
           ITB= 3   I= 71   YBWO= 4644.56  YBWN= 4644.56   F=    687.131
     I= 71     QIL= 13003.   YIL= 4644.56       DEP= 11.76     ITB= 3
           ITB= 1   I= 70   YBWO= 4654.70  YBWN= 4656.77   F= 538055.800
           ITB= 2   I= 70   YBWO= 4656.77  YBWN= 4656.56   F= -64059.640
           ITB= 3   I= 70   YBWO= 4656.56  YBWN= 4656.56   F=    411.615
         .
         .
     I=  3     QIL= 13003.   YIL= 5030.18       DEP= 9.38      ITB= 3
           ITB= 1   I= 2    YBWO= 5035.55  YBWN= 5036.38   F= 169358.600
           ITB= 2   I= 2    YBWO= 5036.38  YBWN= 5036.36   F=  -4883.037
           ITB= 3   I= 2    YBWO= 5036.36  YBWN= 5036.36   F=    -52.562
     I=  2      QIL= 13003.   YIL= 5036.36       DEP=   9.36     ITB= 3
     I=  1      QIL= 13003.   YIL= 5288.55       DEP= 261.55     ITB= 3


 INITIAL WATER ELEVATION:

    YDI FOR RIVER NO.  1
5288.55   5036.36   5030.18   5024.00   5017.82   5011.63   5005.45   4999.26
5993.07   4986.87   4980.73   4974.40   4967.82   4961.25   4954.65   4948.10
5941.41   4935.00   4927.95   4921.06   4914.17   4907.29   4900.40   4893.51
5886.62   4879.75   4872.83   4866.01   4859.01   4852.35   4845.02   4839.00
5830.35   4827.67   4825.95   4824.23   4822.49   4820.75   4819.01   4817.24
5815.44   4813.59   4810.39   4806.91   4803.31   4799.70   4795.90   4792.09
5788.19   4784.44   4780.24   4776.87   4774.79   4772.68   4770.56   4768.40
5765.58   4760.03   4755.33   4750.90   4746.99   4741.20   4730.76   4720.34
5709.98   4699.59   4689.36   4678.84   4668.77   4656.56   4644.56   4632.73
5621.07   4609.49
```

Definition of Variables in Initial Conditions/Low Flow Filter - Backwater Computations

I - Cross section counter
F - Difference between the computed discharge and the actual discharge
IN - Number of cross section at downstream boundary
YNN - WSEL (FT or M) at downstream boundary for initial flow
DEP - Depth (FT or M) at downstream boundary for initial flow
QIL - Discharge (CFS or CMS) at t=0 for Ith cross section
YIL - Computed backwater/downwater WSEL (FT or M) at t=0 for Ith cross section
DEP - Backwater flow depth (FT or M)
ITB - Number of iterations to obtain backwater elevation YIL
YDI - Initial water surface elevation (FT or M)
YUMN - Minimum water surface elevation (FT or M) used in routing computations (low flow filter)
YBWN - New guess for the water surface elevation (FT or M)
YBWO - Old guess for the water surface elevation (FT or M)

Figure 20. Outflow summary

```
TT =  48.00000 HRS      DTH =  24.00000 HRS      ITMX=  2  1  1  1

   RIVER=   1     QU(1)=     330.000     YU(1)=     337.15     QU(N)=     619.472     YU(N)=      257.99

J  I  X(MI)  H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1  1 1076.500 337.15  3.65  90.463  3182.  3182. 330.0000 .0294   1.58  .12   37.15   0  .0000    0
1  2 1067.300 334.30  3.07  07.291  4775.  4775. 328.9608 .0294   2.15  .11   34.30   0  .0160    0
1  3 1058.000 330.88  3.71  89.024  3845.  3845. 330.2678 .0229   2.18  .14   30.88   0  .0000    0
1  4 1049.900 328.98  3.57  91.995  3587.  3587. 328.6409 .0229   2.77  .12   33.98   0  .0000    0
1  5 1031.700 322.86  4.54  71.678  3924.  3924. 325.5422 .0199   2.26  .19   22.86   0  .0000    0
   .
   .
   .
1 19   937.400 298.45  4.25  48.958  5770.  5770. 632.6872 .0237   4.45  .15   38.45   0  .0000    0
1 20   920.000 291.49  5.04  25.068  5280.  5280. 630.1964 .0237   4.07  .18   31.49   0  .0000    0
1 21   904.500 283.91  4.92  27.549  5411.  5411. 627.2339 .0237   2.36  .18   33.91   0  .0000    0
1 22   889.000 278.75  4.15  50.285  4943.  4943. 623.9164 .0258   2.07  .13   38.75   0  .0000    0
1 23   867.700 270.83  4.11  51.008  7100.  7100. 621.2112 .0258   5.09  .16   30.83   0  .0000    0
1 24   846.400 257.99  5.40  14.722  5492.  5492. 619.4720 .0258   2.20  .21   17.99   0  .0000    0

          FRMX=     .263  IFRMX=    7          FRMN=    .112  IFRMN=   15

   RIVER=   2     QU(1)=      53.800     YU(1)=     320.50     QU(N)=      53.270     YU(N)=      315.36
J I  X(MI)  H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
2 1   30.600 320.50  3.14  17.129   728.   728.  53.8000 .0213   1.36  .11   20.50   0  .0000    1
2 2   23.000 319.30  3.01  17.831   819.   819.  53.7196 .0213   1.33  .11   19.30   0  .0000    1
2 3   15.300 317.88  3.23  16.587   823.   823.  53.6077 .0213   1.09  .13   17.88   0  .0000    1
2 4    7.700 316.47  3.15  16.956   759.   759.  53.4608 .0213    .85  .12   16.47   0  .0000    1
2 5     .000 315.36  2.80  19.053   830.   830.  53.2705 .0213    .92  .10   15.36   0  .0000    1

          FRMX=     .127  IFRMX=    3          FRMN=    .103  IFRMN=    5

   RIVER=   3     QU(1)=      53.000     YU(1)=     312.54     QU(N)=      53.644     YU(N)=      311.8
J I  X(MI)  H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
3 1   22.400 312.54  1.48  35.886  1638.  1638.  53.0000 .0184   2.51  .06   22.54   0  .0000    1
3 2   16.800 312.35  1.63  32.474  1453.  1453.  53.0368 .0184   2.49  .06   22.35   0  .0000    1
3 3   11.200 312.17  1.62  32.790  1392.  1392.  53.0819 .0184   2.49  .06   22.17   0  .0000    1
3 4    5.600 312.00  1.53  34.785  1430.  1430.  53.1536 .0183   2.49  .05   22.00   0  .3820    1
3 5     .000 311.80  1.80  29.770  1304.  1304.  53.6442 .0182   2.47  .07   21.80   0  .0000    1

          FRMX=     .066  IFRMX=    5          FRMN=    .055  IFRMN=    4

   RIVER=   4     QU(1)=     209.000     YU(1)=     354.86     QU(N)=     208.413     YU(N)=      303.7
J I  X(MI)  H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
4  1  109.900 354.86  4.63  45.134  2108.  2108. 209.0000 .0336    .21  .18   24.86   0  .0000    1
4  2  106.800 352.57  3.73  55.929  2617.  2617. 208.8759 .0336    .68  .14   22.57   0  .0000    1
4  3   94.100 345.92  3.59  58.038  2154.  2154. 208.3894 .0262    .90  .12   20.92   0  .0000    1
4  4   88.000 343.70  4.17  49.982  2350.  2350. 208.1935 .0262   1.32  .16   18.70   0  .0000    1
 .
 .
 .
4  9   30.000 312.55  4.25  50.104  2563. 2563.  212.9984 .0317    .80  .17   12.55   0  .0000    1
4 10   15.000 307.51  2.39  88.544  3515. 3888.  211.3783 .0317   1.41  .08   27.51   0  .0000    1
4 11     .000 303.73  3.25  64.068  2557. 2605.  208.4129 .0317   3.29  .11   23.73   0  .0000    1

          FRMX=     .187  IFRMX=    6          FRMN=    .084  IFRMN=   10


        TOTAL INFLOW (1000 CF)        TOTAL OUTFLOW (1000 CF)        TOTAL VOLUME    CONTINUITY ERROR
          RIVER    TRIBUTARIES           RIVER    TRIBUTARIES       CHANGE(1000 CUFT)       (PERCENT)
    81590020.00    85050680.00   158817100.00    81978020.00          4884262.00            1.76

 TOTAL VOLUME/ACTIVE VOLUME CHANGE (%) OF RIVER 1 =      94.65    242.67

    TRIBUTARY ITERATIONS =    5

    TOTAL ITERATIONS FOR EACH OF   4 RIVERS.
          37        8       17       11

    TOTAL TIME=      48.00  TOTAL NO. OF TIME STEPS: KTIME=    3  NUMTIM=    3
```

Definition of Variables in Outflow Summary

KTIME - Total number of time steps used in the computations
NUMTIM - Total number of time steps stored for use in FLDGRF model

Figure 21. Counters after interpolation information

```
NEW INPUT CROSS SECTION NO. AFTER INTERPOLATION

 RIVER NO.    1
    NN=      1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20


 RIVER NO.  1
    NGS=     1   3   5   7  12  14  16  20
    LQ1=     9
    LQN=    10

    L=    1     KRTYP= 0     KRT1=   1     KRTN=   3

    L=    2     KRTYP= 0     KRT1=   3     KRTN=   5

    L=    3     KRTYP= 0     KRT1=   5     KRTN=   7

    L=    4     KRTYP= 0     KRT1=   7     KRTN=  12

    L=    5     KRTYP= 0     KRT1=  12     KRTN=  14

    L=    6     KRTYP= 0     KRT1=  14     KRTN=  16

    L=    7     KRTYP= 0     KRT1=  16     KRTN=  20

          (SLOP(I,J),I=1,N) FOR RIVER NO.   1
  .000001   .000168   .000001   .000042   .000001   .000046   .000001   .000001
  .000001   .000001   .000022   .000001   .000021   .000001   .000031   .000001
  .000001   .000001   .000001   .000001

          QDI(I, 1)
  150600.        0.        0.        0.        0.        0.        0.        0.
       0.        0.        0.        0.        0.        0.        0.        0.
       0.        0.        0.        0.

          YDI(I, 1)
      .00       .00       .00       .00       .00       .00       .00       .00
      .00       .00       .00       .00       .00       .00       .00       .00
      .00       .00       .00      -.26
```

Definition of Variables in Counters after Interpolation Information

RIVER NO.	-	River number
NGS	-	Gage locations
LQ1	-	Beginning location for lateral flow
LQN	-	Ending location for lateral flow
L	-	Counter for different routing techniques (simulation mode) or for calibration reaches (calibration mode)
KRTYP	-	Routing type
KRT1	-	Beginning location of the routing/calibration reach
KRTN	-	Ending location of the routing/calibration reach
SLOP	-	Slope of channel
I	-	Cross section counter
J	-	River number
QDI	-	Initial discharges (CFS or CMS)
YDI	-	Initial water surface elevation (FT or M)

[Back] [Next] [Previous] [Bookmarks] [Top]

Figure 22. Levee information after interpolation

L	NJFM	NIFM	NJTO	NITO	X	HWLV	TFLV	WCLV	BLVMX	HFLV	HLVMN	SLV	HPLV	DPLV
1	1	3	1	0	10.00	107.00	3.00	2.50	125.00	1000.00	105.00	.00010	.00	.00
2	1	4	1	0	11.25	106.34	3.00	2.50	125.00	999.34	104.34	.00010	.00	.00
3	1	5	1	0	12.50	105.68	3.00	2.50	125.00	998.68	103.68	.00010	.00	.00
4	1	6	1	0	13.75	105.02	3.00	2.50	125.00	998.02	103.02	.00010	.00	.00
5	1	3	2	2	10.00	107.00	3.00	2.50	125.00	1000.00	105.00	.00010	.00	.00
.														
.														
.														
22	1	11	3	0	25.00	91.00	3.00	2.50	1000.00	91.00	89.00	.00010	.00	.00
23	1	12	3	0	26.00	90.47	3.00	2.50	1000.00	90.47	88.47	.00010	.00	.00
24	1	13	3	0	27.00	89.94	3.00	2.50	1000.00	89.94	87.94	.00010	.00	.00
25	1	14	3	0	28.00	89.42	3.00	2.50	1000.00	89.42	87.42	.00010	.00	.00
26	1	15	3	0	29.00	88.89	3.00	2.50	1000.00	88.89	86.89	.00010	.00	.00

Definition of Variables in Levee Information after Interpolation

L	-	Levee counter
NJFM	-	Number of river passing levee overtopping/failure flow
NIFM	-	Number of reach along the river with levee passing flow
NJTO	-	Number of river receiving flow from levee overtopping/failure
X	-	Cross section location (MI or KM)
HWLV	-	Elevation (FT or M) of top of levee, ridge line, etc.
TFLV	-	Time of levee failure (crevasse) WCLV - Weir-flow discharge coefficient (levee)
BLVMX	-	Final width of levee crevasse
HFLV	-	Elevation of water surface (FT or M) when levee starts to fail (FT or M)
HLVMN	-	Final elevation of bottom of levee crevasse (FT or M)
SLV	-	Slope of the levee
HPLV	-	Centerline elevation (FT or M) of flood drainage pipe (levee)
DPLV	-	Diameter of flood drainage pipe

Figure 23. Mixed flow analysis output

```
  TT =    .00000 HRS      DTH =    .00415 HRS      ITMX=  0

   RIVER=   1     QU(1)=      1.000     YU(1)=    1549.00     QU(N)=      1.000     YU(N)=     720.18

J I  X(MI) H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT  FROUDE DEP(FT) KR QL(TCFS)  MRV
1 1 .000  1549.00   .12   8.488   243.   243.  1.0000   .0350    .00     .00   44.00  10  .0000    0
1 2 .010  1508.55  8.27    .121    62.    62.  1.0000   .0350    .00    1.04    3.55   0  .0000    0
1 3 .064  1502.86  9.36    .107    62.    62.  1.0000   .0350    .00    1.26    2.23   0  .0000    0
1 4 .117  1498.24  7.29    .137    81.    81.  1.0000   .0350    .00     .99    1.97   0  .0000    0
1 5 .171  1493.41  7.36    .136    98.    98.  1.0000   .0350    .00    1.10    1.51   0  .0000    0
1 6 .225  1489.03  5.95    .168   121.   121.  1.0000   .0350    .00     .89    1.48   0  .0000    0
1 7 .278  1484.32  6.52    .153   140.   140.  1.0000   .0350    .00    1.10    1.13   0  .0000    0
1 8 .332  1480.01  5.28    .189   163.   163.  1.0000   .0350    .00     .86    1.19   0  .0000    0
1 9 .385  1475.41  5.77    .173   185.   185.  1.0000   .0350    .00    1.05     .96   0  .0000    0
          FRMX=   1.256  IFRMX=    3          FRMN=    .004  IFRMN=    1

     RESERVOIR OUTFLOW INFORMATION
J I   TT  QU(I)  USH(MSL)  YB(MSL)  DSH(MSL)   SUB    BB    QU(1)  QBRECH  QOVTOP  QOTHR
1 1 .000  1.000  1549.00   1549.00   1508.55   1.00  .00   1.000   .000    .000   1.000

  INITIAL CONDITIONS IMPROVED BY SOLVING UNSTEADY FLOW EQUATIONS WITH BOUNDARIES HELD CONSTANT
     IFR= 0 2 1 2 1 0 1 0 2 0 2 0 2 0 2 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 2 0 2 0 2 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0
ICTR=     0    0    0    0    0
     IFR= 0 2 1 2 1 0 2 0 2 0 2 0 2 0 2 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 2 0 2 0 2 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 2 1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 2 1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
     IFR= 0 0 0 0 0 0 0 0 0 0 0 0

          L=    1     KSP=  0     KS1=  1     KSN=  2
          L=    2     KSP=  1     KS1=  2     KSN= 17
          L=    3     KSP=  0     KS1= 18     KSN= 36
          L=    4     KSP=  1     KS1= 36     KSN= 42
          L=    5     KSP=  0     KS1= 43     KSN=112
 RIVER=  1     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  1     KIT =    2
MAX DQ AND MAX DY ARE FINAL MAXIMUM ERROR IN NEWTON RAPHSON ITERATION METHOD WHILE SOLVING ST. VENANT EQUATION
     MAX DQ=    .0  AT I=  0          MAX DY=  .000  AT I=  0  ITER= 0     CFACT=  1.000
     K= 1          I=    2          YNO=   1508.55          YNN=   1508.55                   F=      -1.3
    .
    .
    .
MAX DQ AND MAX DY ARE FINAL MAXIMUM ERROR IN NEWTON RAPHSON ITERATION METHOD WHILE SOLVING ST. VENANT EQUATION
     MAX DQ=    .0  AT I=  0          MAX DY=  .000  AT I=  0  ITER= 0     CFACT=  1.000

    .61343E-02   .00000E+00  -.44164E-06   .61339E-02   .78322E-03     (TERM1,TERM2,TERM3,SF,SMIN)
 RIVER=  1     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  5     KIT =    2
MAX DQ AND MAX DY ARE FINAL MAXIMUM ERROR IN NEWTON RAPHSON ITERATION METHOD WHILE SOLVING ST. VENANT EQUATION
          MAX DQ=    .0  AT I=  0          MAX DY=  .000  AT I=  0  ITER= 0     CFACT=  1.000
```

Definition of Variables in Analysis Output

TERM1	-	First term in momentum equation
TERM2	-	Second term in momentum equation
TERM3	-	Third term in momentum equation
SF	-	Friction slope
SMIN	-	Minimum allowable friction slope
MAX DQ	-	Maximum flow error using Newton Raphson technique
MAX D	-	Maximum elevation error using Newton Raphson technique
ITER	-	Iteration counter for Newton Raphson technique
CFACT	-	Multiplier used to update the next guess for flow/water elevation in the Newton Raphson technique
RIVER	-	River number
DYN/CUN REACH	-	Routing type
SUP/SUB FLOW REACH	-	Routing type
REACH	-	Reach number contained in the routing type
KIT	-	Iteration counter
K	-	Iteration counter
I	-	Cross section number
YNO	-	Old guess for the normal water surface elevation (FT or M)
YNN	-	New guess for the normal water surface elevation (FT or M)
IFR	-	Flow regime
0	-	Subcritical flow
1	-	Supercritical flow
2	-	Critical flow

Figure 24. Tributary analysis information

```
 INITIAL CONDITIONS IMPROVED BY SOLVING UNSTEADY FLOW EQUATIONS WITH BOUNDARIES HELD CONSTANT
 RIVER=  1     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  1     KIT =    2
MAX DQ AND MAX DY ARE FINAL MAXIMUM ERROR IN NEWTON RAPHSON ITERATION METHOD WHILE SOLVING ST. VENANT EQUATION
          MAX DQ=******  AT I= 24         MAX DY= 4.492  AT I= 23  ITER= 0     CFACT=  1.000
          MAX DQ=******  AT I= 24         MAX DY=  .906  AT I= 17  ITER= 1     CFACT=  1.000
          MAX DQ=     .0  AT I= 24        MAX DY=  .147  AT I= 13  ITER= 2     CFACT=  1.000
          MAX DQ=     .0  AT I= 24        MAX DY=  .000  AT I= 13  ITER= 3     CFACT=  1.000
 RIVER=  2     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  1     KIT =    2
          MAX DQ=     .0  AT I=  0        MAX DY= 1.250  AT I=  1  ITER= 0     CFACT=  1.000
          MAX DQ=     .0  AT I=  0        MAX DY=  .000  AT I=  1  ITER= 1     CFACT=  1.000
 RIVER=  3     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  1     KIT =    2
          MAX DQ=     .0  AT I=  0        MAX DY= 2.031  AT I=  1  ITER= 0     CFACT=  1.000
          MAX DQ=     .0  AT I=  0        MAX DY=  .000  AT I=  1  ITER= 1     CFACT=  1.000
 RIVER=  4     DYN/CUN REACH=  1     SUP/SUB FLOW REACH=  1     KIT =    2
          MAX DQ=     .0  AT I=  0        MAX DY= 1.080  AT I=  4  ITER= 0     CFACT=  1.000
          MAX DQ=     .0  AT I=  0        MAX DY=  .000  AT I=  4  ITER= 1     CFACT=  1.000
  RELX ITR    JRIVER          ERQ          QOLD          QNEW NEWTON ITRMX
        0         2          619.        54181.        54800.         1
        0         3         6205.        47573.        53778.         1
        0         4         1209.       206791.       208000.         1


  TT =    .00000 HRS      DTH =  24.00000 HRS      ITMX=  3  1  1  1

   RIVER=   1     QU(1)=     288.000     YU(1)=      335.12     QU(N)=    446.638     YU(N)=      255.79

J  I   X(MI) H(MSL) V(FPS)  A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N  WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
1  1 1076.500 335.12 3.42   84.139   3064.  3064. 288.0000  .0309   -.45    .12  35.12   0  .0000    0
1  2 1067.300 332.66 2.88   99.700   4442.  4442. 287.5988  .0308    .51    .11  32.66   0  .3720    0
1  3 1058.000 328.77 3.64   80.934   3787.  3787. 294.7946  .0225    .07    .14  28.77   0  .0000    0
1  4 1049.900 327.33 3.40   86.226   3387.  3387. 293.1569  .0225   1.12    .12  32.33   0  .0000    0
1  5 1031.700 321.61 4.28   66.893   3694.  3694. 286.3499  .0195   1.01    .18  21.61   0  .0000    0
.
.
.
1 20   920.000 290.04 4.37  117.613   5011.  5011. 514.2587  .0248   2.62    .16  30.04   0  .0000    0
1 21   904.500 281.31 4.42  114.388   4689.  4689. 505.1895  .0248   -.24    .16  31.31   0  .0000    0
1 22   889.000 276.18 3.68  137.917   4698.  4698. 507.9590  .0262   -.50    .12  36.18   0  .0000    0
1 23   867.700 270.33 3.24  147.489   6912.  6912. 478.5753  .0262   4.59    .12  30.33   0  .0000    0
1 24   846.400 255.79 4.34  102.819   5328.  5328. 446.6384  .0262    .00    .17  15.79   0  .0000    0

          FRMX=    .270  IFRMX=    7          FRMN=    .107  IFRMN=    2

   RIVER=   2     QU(1)=      54.800     YU(1)=      320.39     QU(N)=     54.181     YU(N)=      313.67

J I  X(MI)   H(MSL) V(FPS) A(TSQFT) B(FT) BT(FT) Q(TCFS) MANN. N WAVHT FROUDE DEP(FT) KR QL(TCFS) MRV
2 1 30.600   320.39  3.22   17.045  720.   720.  54.8000 .0212   1.25   .12     20.39   0  .0000    1
2 2 23.000   318.97  3.08   17.565  811.   811.  54.1544 .0213   1.00   .12     18.97   0  .0000    1
2 3 15.300   317.10  3.37   15.948  803.   803.  53.7437 .0213    .31   .13     17.10   0  .0000    1
2 4  7.700   315.12  3.37   15.951  738.   738.  53.7915 .0213   -.50   .13     15.12   0  .0000    1
2 5   .000   313.67  3.07   17.669  802.   802.  54.1815 .0212   -.77   .12     13.67   0  .0000    1

          FRMX=    .133  IFRMX=    3          FRMN=    .115  IFRMN=    5
```

Definition of Variables in Tributary Analysis Information

RELX ITR	-	Iteration counter
JRIVER	-	River number
ERQ	-	Flow error
QOLD	-	Flow at previous time step (CFS or CMS)
QNEW	-	Flow at current time step (CFS or CMS)

Figure 25. Downwater analysis information

```
DOWNWATER     IN=  9     YNN=    506.91     DEP=      5.71
                ITD=  1     I= 10     YDWO=    498.12     YDWN=    498.48          F=   13278.2
                ITD=  2     I= 10     YDWO=    498.48     YDWN=    498.50          F=     806.1
                ITD=  3     I= 10     YDWO=    498.50     YDWN=    498.50          F=       3.2
                ITD=  1     I= 10     YIL=  506.91     QII=  6000.     YA=  494.98     F=  234737.9
                ITD=  2     I= 10     YIL=  506.91     QII=  6000.     YA=  496.57     F=   94487.3
                ITD=  3     I= 10     YIL=  506.91     QII=  6000.     YA=  497.36     F=   50248.1
                ITD=  4     I= 10     YIL=  506.91     QII=  6000.     YA=  497.76     F=   32323.5
                ITD=  5     I= 10     YIL=  506.91     QII=  6000.     YA=  497.96     F=   24246.5
                ITD=  6     I= 10     YIL=  506.91     QII=  6000.     YA=  498.06     F=   20412.3
                ITD=  7     I= 10     YIL=  506.91     QII=  6000.     YA=  498.11     F=   18544.5
                ITD=  8     I= 10     YIL=  506.91     QII=  6000.     YA=  498.13     F=   17623.3
                ITD=  9     I= 10     YIL=  506.91     QII=  6000.     YA=  498.14     F=   17165.2
                ITD= 10     I= 10     YIL=  506.91     QII=  6000.     YA=  498.15     F=   16937.4
                ITD= 11     I= 10     YIL=  506.91     QII=  6000.     YA=  498.15     F=   16823.2
          .
          .
          .
          I= 12     QIR=     6000.     YIR=    481.35     DEP=      8.35     ITD= 12

    BACKWATER     IN=  9     YNN=    506.91     DEP=      5.71
                ITB=  1   I=  8   YBWO=  517.84  YBWN=  515.79   F=  -73417.240
                ITB=  2   I=  8   YBWO=  515.79  YBWN=  516.08   F=   13213.320
                ITB=  3   I=  8   YBWO=  516.08  YBWN=  516.08   F=      30.392
          I=  8     QIL=     6000.     YIL=    516.08     DEP=      5.48     ITB=  3
                ITB=  1   I=  7   YBWO=  526.82  YBWN=  525.19   F=  -79298.310
                ITB=  2   I=  7   YBWO=  525.19  YBWN=  524.73   F=  -14139.490
                ITB=  3   I=  7   YBWO=  524.73  YBWN=  524.82   F=    4193.991
                ITB=  4   I=  7   YBWO=  524.82  YBWN=  524.82   F=       6.298
          .
          .
          .
          I= 3     QIL=     6000.     YIL=    589.18     DEP=      5.85     ITB=  3
                ITB=  1   I=  2   YBWO=  607.14  YBWN=  605.69   F= -207120.900
                ITB=  2   I=  2   YBWO=  605.69  YBWN=  605.67   F=   -1737.361
                ITB=  3   I=  2   YBWO=  605.67  YBWN=  605.67   F=       1.942
          I=  2     QIL=     6000.     YIL=    605.67     DEP=      6.51     ITB=  3
                ITB=  1   I=  1   YBWO=  623.30  YBWN=  621.57   F= -249028.800
                ITB=  2   I=  1   YBWO=  621.57  YBWN=  621.52   F=   -7117.417
                ITB=  3   I=  1   YBWO=  621.52  YBWN=  621.52   F=     -10.743
          I=  1     QIL=     6000.     YIL=    621.52     DEP=      6.52     ITB=  3
```

Definition of Variables in Downwater Analysis Information

IN	-	Beginning cross section number for downwater computations
YNN	-	Water surface elevation at initial boundary
DEP	-	Water depth
ITD	-	Iteration counter
I	-	Cross section number
YDWO	-	Old guess for the water surface elevation (FT or M)
YDWN	-	New guess for the water surface elevation (FT or M)
F	-	Difference between the computed discharge and the actual discharge
YIL	-	Initial water surface elevation (FT or M)
QII	-	Initial discharge (CFS or CMS)
YA	-	Average water surface elevation within the reach (FT or M)

Figure 26. Conveyance analysis information

```
 GENERATING CONVEYANCE CURVE

     QKT(K)=         0.          4.         23.         67.        144.        261.        425.        641.
     QKT(K)=       915.       1253.       1659.       2139.       2698.       3340.       4070.       4892.
     QKT(K)=      5811.       6830.       7955.       9189.      10535.      11999.      13584.      15294.
     .
     .
     .
     QKT(K)=   6281732.    6348753.    6279316.    6180960.    6090048.    6005922.    5927997.    5855756.
     QKT(K)=   5788739.    5743179.    5729040.    5716623.    5705842.    5696618.    5688877.    5682550.
     QKT(K)=   5677571.    5673881.    5671424.

     QKT(K)=        0.         4.        23.        67.       144.       261.       425.       641.
     QKT(K)=      915.      1253.      1659.      2139.      2698.      3340.      4070.      4892.
     QKT(K)=     5811.      6830.      7955.      9189.     10535.     11999.     13584.     15294.
     .
     .
     .
     QKT(K)=  6281732.   6348753.   6308910.   6269067.   6229224.   6189381.   6149538.   6109695.
     QKT(K)=  6069852.   6030009.   5990166.   5950323.   5910480.   5870637.   5830794.   5790951.
     QKT(K)=  5751108.   5711265.   5671424.

     BKT(K)=     1.060      1.124      1.076      1.067      1.064      1.063      1.062      1.061
     BKT(K)=     1.061      1.061      1.061      1.061      1.060      1.060      1.060      1.060
     BKT(K)=     1.060      1.060      1.060      1.060      1.060      1.060      1.060      1.060
     .
     .
     .
     BKT(K)=     1.140      1.140      1.140      1.140      1.140      1.140      1.140      1.140
     BKT(K)=     1.140      1.139      1.139      1.139      1.139      1.139      1.139      1.138
     BKT(K)=     1.138      1.138      1.138

     J=  1     I=    1     L=   30     ERQK=  2.15     NKC(I,J)= 30

     HKC(L,I,J)=    500.10    500.36    500.61    500.87    501.12    501.38    501.64    501.89
     HKC(L,I,J)=    502.15    502.40    502.66    503.17    503.68    504.45    505.22    506.24
     HKC(L,I,J)=    507.52    509.06    510.08    511.87    513.66    515.71    518.27    521.08
     HKC(L,I,J)=    524.67    528.76    533.88    541.04    545.65    549.74

     QKC(L,I,J)=        0.        4.       23.       67.      144.      261.      425.      641.
     QKC(L,I,J)=      915.     1253.     1659.     2698.     4070.     6830.    10535.    17132.
     QKC(L,I,J)=    28377.    46855.    62858.   106576.   166867.   261695.   427088.   679722.
     QKC(L,I,J)=  1125954.  1832946.  3056293.  5309196.  6308910.  5671424.

     BEV(L,I,J)=     1.060     1.124     1.076     1.067     1.064     1.063     1.062     1.061
     BEV(L,I,J)=     1.061     1.061     1.061     1.060     1.060     1.060     1.060     1.060
     BEV(L,I,J)=     1.060     1.060     1.060     1.102     1.147     1.177     1.190     1.188
     BEV(L,I,J)=     1.177     1.164     1.149     1.137     1.140     1.138


     SNM(K,  1, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNM(K,  2, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNM(K,  3, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     .
     .
     .
     SNM(K, 88, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNM(K, 89, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00

ERQMX= 2.14 2.13 2.15 2.13 2.15 2.14 2.15 2.15 2.14 1.79* 1.79 1.79 1.79 1.79 1.79 1.78 1.79 1.78 1.78 1.79
ERQMX= 1.78 1.79 1.79 1.78 1.49 1.49 1.48 1.48 1.49 1.49* 1.49 1.49 1.49 1.49 1.24 1.24 1.24 1.49 1.24 1.48
ERQMX= 1.24 1.49 1.46 1.49 1.49 1.24 1.24 1.49 1.24 1.24* 1.24 1.03 1.24 1.24 1.24 1.24 1.24 1.24 1.03 1.03
ERQMX=  .86 1.03  .86  .86  .86  .86  .72  .72  .72  .72*  .72  .72  .72  .72  .72  .71  .72  .71 1.79  .86
ERQMX=  .86  .86  .86  .86  .86  .85  .86  .86  .86


     SNC(K,  1, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNC(K,  2, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNC(K,  3, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     .
     .
     .
     SNC(K, 87, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNC(K, 88, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
     SNC(K, 89, 1)=   1.00   1.00   1.00   1.00   1.00   1.00   1.00
```

Definition of Variables in Conveyance Analysis Information

QKT(K)	- Discharges in the initial conveyance curve (CFS or CMS)
BKT(K)	- Initial beta correction coefficient used in the momentum equation
J	- River number
I	- Cross section number
L	- Final number of points in the conveyance table
ERQK	- Flow difference between two points on the conveyance curve
NKC(I,J)	- Number of points in the conveyance curve for cross section I on

```
                 river J
HKC(L,I,J)  - Elevations in the final conveyance table (FT or M)
QKC(L,I,J)  - Discharges in the final conveyance curve (CFS or CMS)
BEV(L,I,J)  - Final beta correction coefficient used in the momentum equation
SNM         - Sinuosity coefficient used in the momentum equation
ERQMX       - Error in maximum flow
SNC         - Sinuosity coefficient used in the continuity equation
```

Figure 27. Cross section analysis information

```
** COMPUTE INITIAL FLOW, NORMAL AND INITIAL DEPTH FOR RIVER NO  1  **

   (QDI(I,1),I=1,N)
  288000.   288000.   296372.   296372.   296372.   296372.   296372.   351172.
  351172.   351172.   404950.   404950.   404950.   404950.   404950.   404950.
  405724.   613724.   613724.   613724.   613724.   613724.   613724.   613724.

   (QDI(I,2),I=1,N)
   54800.    54800.    54800.    54800.    54800.

   (QDI(I,3),I=1,N)
   53200.    53200.    53200.    53200.    53778.

   (QDI(I,4),I=1,N)
  200000.   200000.   200000.   200000.   200000.   208000.   208000.   208000.
  208000.   208000.   208000.

 INITIAL DISCHARGES:

         (QDI FOR RIVER NO.  1
  288000.   288000.   296372.   296372.   296372.   296372.   296372.   351172.
  351172.   351172.   404950.   404950.   404950.   404950.   404950.   404950.
  405724.   613724.   613724.   613724.   613724.   613724.   613724.   613724.

** COMPUTE NORMAL/CRITICAL DEPTH **
    AS(1,  1 1)=    13820. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  2 1)=    11627. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  3 1)=     9750. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  4 1)=     5727. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  5 1)=    10243. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  6 1)=    15683. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1,  7 1)=     6085. > 0.0; SUB-CRITICAL FLOW ASSUMED!
  I=  8   X=  1014.500   YN= 314.37   DEPN=  24.37   YC=  297.72   DEPC=  7.72   IFR= 0  ITN=  0  ITC= 14
    AS(1,  9 1)=    16740. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 10 1)=    20344. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 11 1)=     5440. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 12 1)=     8234. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 13 1)=    12807. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 14 1)=    12983. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 15 1)=    15838. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 16 1)=     7059. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 17 1)=    22460. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 18 1)=    23569. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 19 1)=    14143. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 20 1)=    20793. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 21 1)=    18379. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 22 1)=    22182. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 23 1)=    21317. > 0.0; SUB-CRITICAL FLOW ASSUMED!
    AS(1, 24 1)=    28453. > 0.0; SUB-CRITICAL FLOW ASSUMED!
```

Definition of Variables in Cross Section Analysis Information

AS	-	Area of cross section (FT2 or M2)
I	-	Cross section number
X	-	Cross section location (MI or KM)
YN	-	Normal flow water surface elevation (FT or M) for initial flow at t=0
DEPN	-	Normal flow depth (FT or M) for initial flow
YC	-	Critical flow water surface elevation (FT or M) for initial flow at t=0
DEPC	-	Critical flow depth (FT or M)
IFR	-	Froude number indicator: 0 indicates Fr<1, 1 indicates Fr>=1
ITN	-	Number of iterations to obtain YN via bi-section solution method
ITC	-	Number of iterations to obtain YC via bi-section solution method

Figure 28. Cross section calibration analysis information

```
   DOUBLE MAX ITERATION FOR CALIBRATION, ITMAX=    20

RIVER NO. 1     REACH NO.  1     JACKSON MI 216          STA NO.   1     RIVER MILE=    216.000

RIVER NO.  1     MANNING N REACH NO.   1

        FKC= 61.8575    FMC= .2500    FKF= 57.3247    FMF= .4000    FKO= .0000    FMO= .0000

        X(I,J)    216.00    210.00    205.00    200.00    199.99    194.99    190.00    185.00
        X(I,J)    184.00    183.00    182.00    181.00    180.00    179.99    179.00    178.00

        IFXC=          0         0         0         0         0         0         0         0
        IFXC=          0         0         0         0         0         1         1         1

          HS=    906.30    908.30    916.30    920.30    936.30   1036.30
          BS=       .00     73.56    110.00    209.81    300.00    300.00
          AS=        0.       74.      808.     1447.     5526.    35526.

TT =     .00000     DTH =   6.00000 HRS     ITMX=  0
   RIVER= 1   MANNING REACH= 1   QU(1)= .094   YU(1)= 908.54   QU(N)= .300     YU(N)=     854.68

  J    I         X         Y         V         A         B        BT         Q       CMM
  1    1    216.00    908.54      1.03       92.       75.       75.       .09     .0400
  1    2    210.00    903.39       .52      180.       80.       80.       .09     .0400
  1    3    205.00    896.26      2.25       42.       55.       55.       .09     .0400
  1    4    200.00    894.06       .34      277.       85.       85.       .09     .0400
    .
    .
  1   11    182.00    883.23       .25     1183.      176.      176.       .30     .0400
  1   12    181.00    883.21       .22     1378.      201.      201.       .30     .0400
  1   13    180.00    883.20       .19     1596.      214.      214.       .30     .0400
  1   14    179.99    858.97      1.13      266.      110.      110.       .30     .0400
  1   15    179.00    856.11      1.74      172.      110.      110.       .30     .0400
  1   16    178.00    854.68       .73      409.      160.      160.       .30     .0400
```

Definition of Variables in Cross Section Calibration Analysis Information

FKC	-	Scaling parameter of in-bank channel portion of cross section
FMC	-	Shape factor for in-bank channel portion of cross section
FKF	-	Scaling parameter of flood plain portion of cross section
FKO	-	Scaling parameter of inactive portion of cross section
FMO	-	Shape factor for inactive portion of cross section
X	-	Cross section location (MI or KM)
I	-	Cross section number
J	-	River number
IFXC	-	Parameter indicating if cross sections have special properties
HS	-	Height of section (FT or M)
BS	-	Topwidth of section (FT or M)
AS	-	Area of cross section (FT2 or M2)
TT	-	Time at which output is given (HR)
DTH	-	Computational time step
ITMX	-	Number of iterations in Newton Raphson solution of Saint-Venant equations
RIVER	-	River number
QU(1)	-	Discharge (CFS or CMS) at upstream boundary
YU(1)	-	Water surface elevation (FT or M) at upstream boundary
QU(N)	-	Discharge (CFS or CMS) at downstream boundary
YU(N)	-	Water surface elevation (FT or M) at downstream boundary
Y	-	Water surface elevation (FT or M) in cross section I
V	-	Velocity (fps or mps) in cross section I
A	-	Active area in cross section I (FT2 or M2)
B	-	Active topwidth in cross section I (FT or M)
BT	-	Total topwidth in cross section I (FT or M)
Q	-	Discharge (CFS or CMS)

Figure 29. Hydrograph plot

```
    RIVER =  4     STATION =  1     GLMSW     STG      FLOOD ELEV =  54.00 FEET
         MAX ELEV =        53.15 FEET     AT TIME =  114.000 HOUR
          MAX FLOW =        2290.79 CFS      AT TIME =   108.000 HOUR
         *----COMPUTED    +----OBSERVED                            ELEV (FEET)

TIME  44.     46.     48.     50.     52.     54.     56.     58.     60.     62.     64. Q-FCST H-FCST   H-OBS      TIME
 3/29/11+  *    .       .       .       .       !       .       .       .       .       .    .03  44.91   44.10     6.000
 3/29/17.+ *    .       .       .       .       !       .       .       .       .       .    .03  44.91   44.12    12.000
 3/29/23.     + .*      .       .       .       !       .       .       .       .       .    .09  46.14   45.65    18.000
 3/30/ 5.       .  +    .       .       .       !       .       .       .       .       .    .16  47.05   47.05    24.000
 3/30/11.       .      *+       .       .       !       .       .       .       .       .    .25  47.73   48.09    30.000
 3/30/17.       .       . * +   .       .       !       .       .       .       .       .    .35  48.32   48.90    36.000
 3/30/23.       .       .   * + .       .       !       .       .       .       .       .    .48  48.88   49.61    42.000
 3/31/ 5.       .       .    *  .+      .       !       .       .       .       .       .    .63  49.40   50.28    48.000
 3/31/11.       .       .      *.  +    .       !       .       .       .       .       .    .79  49.85   50.88    54.000
 3/31/17.       .       .       .*  +   .       !       .       .       .       .       .    .91  50.17   51.18    60.000
 3/31/23.       .       .       . *  +  .       !       .       .       .       .       .   1.03  50.42   51.40    66.000
 4/ 1/ 5.       .       .       .  *  + .       !       .       .       .       .       .   1.20  50.80   51.67    72.000
 4/ 1/11.       .       .       .       +       !       .       .       .       .       .   1.42  51.90   51.97    78.000
 4/ 1/17.       .       .       .       .+*     !       .       .       .       .       .   1.67  52.44   52.22    84.000
 4/ 1/23.       .       .       .       . + *   !       .       .       .       .       .   1.96  52.76   52.46    90.000
 4/ 2/ 5.       .       .       .       .   +*  !       .       .       .       .       .   2.28  53.07   52.70    96.000
 4/ 2/11--------------------------------------*------------------------------------------   2.29  53.14 -999.00   102.000
 4/ 2/17.       .       .       .       .     * !       .       .       .       .       .   2.29  53.14            108.000
 4/ 2/23.       .       .       .       .     * !       .       .       .       .       .   2.29  53.15            114.000
 4/ 3/ 5.       .       .       .       .     * !       .       .       .       .       .   2.28  53.14            120.000
```