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SURFACE WATER SYSTEM
OPERATIONAL HANDBOOK

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Abstract

The Surface Water System, developed by WyoWRRI, provides for easy and effective streamflow data processing. Daily streamflow data are stored on magnetic tape, and are processed and maintained through a separate program tape and card-oriented instructions. Complete description of all processing and maintenance instructions, as well as detailed examples of their use, are given.

Key Words — Computer programs, data storage and retrieval, hydrologic data

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I

INTRODUCTION

This Operational Handbook is written for several purposes:

(a) To provide students and others at the University of Wyoming interested in Hydrology access to the computerized Surface Water System (SWS) of WyoWRRI.

(b) To provide guidelines for future maintenance of SWS.

(c) To gather together several groups of SWS information in one organized publication.

The Surface Water System has been designed to provide easy and effective streamflow data processing. This Handbook should provide a valuable base from which more extended and complicated data processing can be accomplished. Practice in using it will acquaint the user with the great flexibility and data handling power of SWS.

As used throughout this manual, the term "instruction(s)" refers to the mnemonic word representing the desired system action (command and/or parameter), as well as guides for preparing information retrieval and maintenance. As used in the description of mnemonic commands, b indicates a blank in a parameter field, and nothing is punched.

Also, as used in this manual, the term data bank refers in general to the station information and daily flow values as stored on tape. In particular, there are, at present, three data tapes, one for the Missouri River Basin, one for the Colorado River Basin, and one for both the Great Salt Lake Basin and Snake River Basin. There is also a system of reserve data tapes. For convenience of operation, the SWS programs, i.e. all processing and maintenance functions, are contained on a separate tape called the program tape.

II

GENERAL CONTROL INSTRUCTIONS

The general instructions enable the computer to perform tape handling and control functions necessary for the overall operation of SWS.

Certain instructions must be used in order to properly initiate and end SWS processing. Descriptions of all control functions used in SWS are described below. Each function is listed separately and arranged alphabetically by name.

An instruction consists of a command, and when required, a parameter. The command tells SWS what to do, and the parameter furnishes additional, specific information when needed.

Formats for preparation of these instructions may be found in the examples presented in Parts IV and VI.

FUNCTION	END: Terminates a SWS run, performs wrapup functions for Surface Water System, and returns control to the resident monitor.*
FORMAT	END Col. 9-11
PARAMETER	None
ACTION	Wraps up SWS run and returns control to the resident monitor.
REMARK	Control instructions for the resident monitor may follow the END card. The instructions on cards following the END card begin in Col. 17 and are the computer control functions. Parts IV and VI illustrate the use of computer control functions with SWS jobs.

* The term resident monitor refers to the computer.

FUNCTION LOCSTB: Search the assigned tape in a reverse direction for a specified station.

FORMAT LOCSTBnumb, Col. 9-14 LOCSTB
15-22 Station number

PARAMETER numb is the number identifying a station and is of the following form:

mmnnnnpp where mm is the part number, nnnn is the station number, and pp is the substation number. Each character must be numeric.

ACTION The assigned tape is searched backward until the specified station header is found. Tape is positioned in front of the first year of record for the station.

ERROR MESSAGE SWS E1 numb contains other than numeric characters.
LOCSTA E2 Station not found before beginning flag was encountered.

EXAMPLE This command could be used to effect additional processing from a station located in front of the present station. It may also be used to locate the beginning of the present station, if processing was being done toward the end of the period of record.

FUNCTION LOCSTF: Search the assigned tape in the forward direction for a specified station.

FORMAT LOCSTF*numb*

Col. 9-14 LOCSTF
15-22 8-digit station number

PARAMETER *numb* is the number identifying a station and is of the following form:

mmnnnnpp where *mm* is the part number, *nnnn* is the station number, and *pp* is the substation number. Each character must be numeric.

ACTION The assigned tape is searched forward until the specified station is found. Tape is positioned in front of the first year of record for the station.

ERROR MESSAGE
SWS E1 *numb* contains other than numeric characters.
LOCSTA E2 Station not found before the ending tape flag.

EXAMPLE This command is necessary before any data processing can begin.

FUNCTION — LOCYR: Locate a year of record and search the assigned tape in a forward direction for the record for the specified year.

FORMAT — LOCYRbyear

Col. 9-13 LOCYR
15-18 4-digit year, e.g. 1913

PARAMETER — year is the four digit year.

ACTION — The assigned tape is searched forward until the record for the specified year is found. The tape is positioned in front of the record.

REMARKS — The records for a station must be ordered by years in ascending order. Erratic results and errors will be obtained from LOCYR if this is not the case.

ERROR MESSAGE — LOCYR E1 End of station encountered before record for specified year.
LOCYR E2 A record for a year following the specified year has been encountered.

EXAMPLE — This command is used to process data from a year other than the beginning year for a station. It must be preceded by either a LOCSTF or LOCSTB command.

FUNCTION PAUSE: Halt computer operation and relay a message to the computer operator via the console printer.

FORMAT PAUSEb<u>message</u>

Col. 9-13 PAUSE
15- MOUNT TAPE ____ ON SIX
or
15- DISMOUNT TAPE ____ AND
MOUNT TAPE ____ ON SIX

PARAMETER <u>message</u> 66 or fewer characters (including spaces) terminated by six consecutive spaces or by the end of the card.

ACTION <u>message</u> is typed on the console typewriter until a minimum of six blanks is encountered (or until 66 characters have been typed); the computer is stopped. When the operator presses advance, the next SWS control instruction is read and executed.

EXAMPLE Normally, this command is used to mount the data tape. If processing is to be done from several data tapes under the same job, a PAUSE may be used to remove one data tape and mount another.

FUNCTION REMARK: Relay a Message to the computer operator via the console typewriter without stopping computer action.

FORMAT REMARKmessage

Col. 9-14 REMARK
15- INFORMATIONAL MESSAGE

PARAMETER message same as for PAUSE

ACTION message is typed on the console typewriter as for PAUSE.

EXAMPLE This command can be used to relay informational messages to the operator. Its main purpose would be in the SERVIC mode, where various tape movements might be happening, and the REMARK appears on the printed output for reference. As computer operation is not halted, REMARKs are informational only.

FUNCTION REWIND: Rewind the specified tape.

FORMAT REWIND*n*

Col. 9-14 REWIND
15-20 *6* the number designated may appear anywhere in the 6-column field but it is good practice to place it in Column 15

PARAMETER *n* a numeric tape unit designator; or blank, for the special ½" unit.

EXAMPLE This command is used within the instruction card deck to insure that the specified tape is rewound. It may be used either before processing or just before the end, or both. If used before processing, it must be preceded by a TAPE designator. Only one tape unit may be designated on each card, and any number may be used. Tape units 3, 4 or 6 are the only units acceptable to SWS.

FUNCTION SERVIC: Transfer control to the service routine executive.

FORMAT SERVIC Col. 9-14

PARAMETER None

ACTION The service executive and service routines are loaded and given control. All instructions until an ENDSRV instruction are processed by the service executive.

REMARKS RDTAPbn and WRTTAPn are used to designate tape assignments; for a full description of service routine instructions and errors, see the service routine section.

FUNCTION TAPE: Set SWS so that processing of data is from a specified unit.

FORMAT TAPEbbn

Col.	
9-12	TAPE
15	n the number of the tape unit desired. Only 3, 4 and 6 are available to SWS

PARAMETER n a numeric tape unit designator or blank for the special ½" unit.

ACTION The unit n becomes the assigned unit.

REMARKS There is no preassignment of tape unit in SWS. This tape assignment does not hold for tape processing done under SERVIC control. The SERVIC routines usually destroy the tape assignment.

ERROR MESSAGE SWS E2 Illegal tape unit specifier.

EXAMPLE Processing will not be accomplished unless the data tape to be read is so designated.

III

DATA PROCESSING INSTRUCTIONS

Data processing commands accomplish the actual compilations and computations of data from the data bank. Descriptions of all processing routines available are described below. WRRI Series No. 13 (Revised) is available from the Water Resources Research Institute office and contains reproductions of all available routines, and should be consulted along with this manual.

An instruction consists of a mnemonic command and one or more parameters. The command name is representative of the type of processing to be done. Each routine is listed separately and arranged alphabetically by name.

Formats for preparation of these instructions are found in the examples presented in Part IV. Daily streamflow data are rounded to the nearest whole cfs when processed for storage in the data bank. All processing routines utilizing these data perform no rounding on sums, products or quotients other than to the nearest cfs. For this reason, SWS data, although taken largely from USGS sources, will not exactly match published figures. The conversion to acre feet is made by multiplying cfs by 1.98347 and rounding to the nearest whole acre foot.

FUNCTION BEGIN: Reposition the tape prior to the record for the first year processed in the current station.

FORMAT BEGIN Col. 9-13

PARAMETER None

ACTION The tape is moved backward to the point at which it was positioned before the last processing instruction was executed.

EXAMPLE When more than one type of data processing is desired for the same station and period of record, BEGIN is used before the next processing command. Part IV, Example A shows the usage.

FUNCTION CLASS: Read and retain for later use the values in cfs for up to 35 flow classes, for use in DURCUR and DURTAB.

FORMAT CLASS Col. 9-13

PARAMETER None

ACTION Up to 35 values for flow classes are read from cards following the CLASS card. Values are to be punched according to a 16F5.0 format. In the field immediately following the last value a -1. should be punched.

REMARK Class flow values remain unchanged until another CLASS instruction is encountered. Values are rounded to nearest cfs value. Class values are used to segregate the daily flows for the year which were greater than or equal to the class value, but less than the next larger class value.

ERROR MESSAGE CLASS E2 Too many class values were specified.

EXAMPLE Class values are prepared on separate cards according to the above format. The first class value must be 0.0, for proper operation. See Part IV, Example A, for correct usage.

FUNCTION DAYFLO: Print tables of mean daily flows by water years.

FORMAT DAYFLO*numb* Col. 9-14 DAYFLO
15-20 Number of years to be processed

PARAMETER (Optional) *numb* is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If *numb* is missing, processing is from current positioning to end of station.

ACTION Years of record from the assigned tape are processed until (1) *numb* years of record have been processed or (2) end of station if *numb* is missing or greater than the number of years of record from the current positioning.

TABLE One daily flows table is produced for each year of record processed. The table is made up as follows: Mean daily flows are given for each day in each month of the water year. Total cfs-days, mean daily flow and flow in acre feet are given for each month. Total flow in acre feet for the water year is also given. Data are not rounded, except fractional data which are rounded to 0 or 1. Missing data (coded -1.) are not used in any computations.

FUNCTION DRAREA: Enter a drainage area into the SWS.

FORMAT DRAREA*numb* Col. 9-14 DRAREA

PARAMETER *numb* is the drainage area, punched in Columns 15-22, with a decimal point. *numb* must be in square miles, e.g. 17.6

ACTION *numb* is entered and made available to any routines requiring drainage area for the station.

REMARK The drainage area remains unchanged until another DRAREA or a LOCSTF or LOCSTB instruction is encountered. When a new station is located, its drainage area is automatically entered from the header information.

ERROR MESSAGE SWS E1 *numb* contains illegal characters.

NOTE DRAREA is normally entered through station header cards; this allows entering variable areas for study (i.e., if it is determined that a portion of the drainage area is non-contributing), or when header cards are non-existent.

FUNCTION DURCUR: Print curve of percent of time flow equals or exceeds class values.

FORMAT
```
DURCURnumb  type
DURCURnumb
DURCUR      type
```

EXAMPLE
```
DURCUR8              CSM
9 - 14 15          21-23 ←——— Columns
```

PARAMETERS numb (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned to end of station.

type (optional) designates the units of the quantity to be plotted on the vertical axis:

CFS	flow in cubic feet per second
CMD	flow value divided by mean daily flow for the period of record
CSM	flow value divided by drainage area in square miles

If type is missing, three coaxial plots with the different calibrations are made.

type is punched in Columns 21-26.

ACTION Years of record from the assigned tape are processed until (1) numb years of record have been processed or (2) end of station if numb is missing or greater than the number of years of record from the current positioning.

OUTPUT A flow duration table is produced (see DURTAB). Either one or three plots of information from the table are printed, depending on type. The horizontal axis of a plot represents the percent of time that flow equals or exceeds the plotted value. The vertical axis represents flow values in cfs, csm, or cmd, depending on type.

REMARKS Class flow values must have been entered prior to the DURCUR instruction. The drainage area should have been entered, either through station headers or the DRAREA instruction, for correct csm values. Missing data (coded -1.) are not used in any computations, and if any data for a water year are missing, the year is not processed.

ERROR MESSAGE CLASS E1 no class values have been entered.

FUNCTION DURTAB: Print a flow duration table.

FORMAT DURTAB<u>numb</u> Col. 9-14 DURTAB
15-20 Years to be processed, e.g. 10

PARAMETER <u>numb</u> (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If <u>numb</u> is missing, processing is from current positioning to end of station.

ACTION Years of record from the assigned tape are processed until (1) <u>numb</u> years of record have been processed or (2) end of station if <u>numb</u> is missing or greater than the number of years of record from the current positioning.

OUTPUT After all years of record have been processed according to <u>numb</u>, a flow duration table is printed. The number of days in each flow class is printed for each year processed, as well as the number of cfs-days in the year. For the total period processed, the total number of cfs-days, the mean annual flow in cfs-days, and the mean daily discharge in cfs are printed. For each flow class the following items are printed: the flow value of the class in cfs, csm, and cmd; the number of days flow was in the class; the number of days flow was in the class or succeeding classes; and the percent of time for which flow equals or exceeds class value. CFS, CMD, and CSM values are as defined in DURCUR.

REMARKS Class flow values must have been entered <u>prior</u> to the DURTAB instruction. The drainage area should have been entered, either through station header or the DRAREA instruction, for correct csm values. Missing data (coded -1.) are not used in any computations, and if any data for a water year are missing, the year is not processed.

ERROR MESSAGE CLASS E1 no class values have been entered.

FUNCTION LOGPT3: Print LOG-PEARSON TYPE III FREQUENCY ANALYSIS

FORMAT LOGPT3numb Col. 9-14 LOGPT3
15-20 Years to be processed, e.g. 7

PARAMETER numb (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If numb is missing, processing is from current positioning to end of station.

ACTION Years of record from the assigned tape are processed until (1) numb years of record have been processed or (2) end of station if numb is missing or greater than the number of years of record from the current positioning.

OUTPUT After all years of record (according to numb) have been processed, the following information is presented: values of skew coefficients; percent chance, recurrence interval and computed flow; each year's flow value and log.

REMARK An out of bounds skew coefficient is greater than 3. or less than -3. The flow values used are the annual instantaneous maxima, in cfs. The calculated skew coefficient is used to enter a table of Pearson Type III coordinates for various recurrence intervals or percent chance. This table, as well as basic theory of the Log-Pearson Type III method, are found in Bulletin No. 15, Water Resources Council, 1967.

ERROR MESSAGE Out of bounds flow values are printed. (0.0 < FLOW < 9999999.0). If out of bounds skew coefficients are calculated, a message is printed to that effect. In both cases, processing for the current station is halted, and according to RPT or other instructions, processing continues for other stations.

FUNCTION MADIS: Print in tabular form values of monthly and annual discharges in acre feet by water years.

FORMAT MADISb<u>numb</u> <u>STAT</u> <u>n</u> <u>m</u> <u>o</u>

EXAMPLE

MADIS	6			STAT	3	5	5	← Columns
9 - 13	15			21 24	26	32	38	

PARAMETER <u>numb</u> (optional) is the number of water years to be processed, beginning with one in front of which the tape is currently positioned. If <u>numb</u> is missing, processing is from current positioning to end of station. <u>STAT</u> indicates additional processing; see "Output" below.

ACTION Years of record from the assigned tape are processed until (1) <u>numb</u> years of record have been processed or (2) end of station if <u>numb</u> is missing or greater than the number of years of record from the current positioning. Missing data (coded -1.) are not used in computations.

OUTPUT For each year processed, the total flow in acre feet is printed for each month; the annual flow in acre feet and the percent of the mean annual flow for the period are also printed. For the period processed, the sum of the monthly and annual columns, the mean of each of the columns, and the percentage of the mean annual flow of each columnar mean are printed.

If <u>STAT</u> has been specified, additional information is computed, including standard deviation, coefficient of variation, skew coefficient, and first order serial correlation coefficient of annual flow series, in addition to the MADIS table.

If <u>STAT</u> <u>n</u> is specified, in addition to the <u>STAT</u> information, a table of <u>n</u>-year moving averages is computed and corresponding standard deviation, coefficient of variation, and serial correlation coefficients produced.

If <u>m</u> is specified, a table of <u>m</u>-year increasing averages is computed, along with the standard deviation and a partial t-statistic. The partial t-statistic is the standard deviation divided by the square root of the number of years in the period. When this value is multiplied by an appropriate t-value, and added to and subtracted from the period mean, a confidence interval on that mean is the result. If <u>m</u> is 5, the first computation will involve the first 5 years of record, then first 10, etc., until all whole <u>m</u>-year increments of record are used.

If <u>k</u> is specified, a table of <u>k</u>-year decreasing averages is computed, along with the standard deviation and the partial t-statistic, as described above. If <u>k</u> is 5, the first computation will involve the last, most recent, 5 years of record, then the most recent 10, etc., until all whole <u>k</u>-year increments of record are used.

<u>STAT</u> may be specified alone, or with either the <u>n</u> or <u>m</u> or <u>k</u> parameter, or the <u>m</u> or <u>k</u> parameter may be specified alone, or all three may be specified.

FUNCTION MONMAX: Print table of maximum mean daily flows for each month of water year.

FORMAT MONMAX<u>numb</u>

Col.	9-14	MONMAX
	15-20	Number of years to be processed, e.g. 3

PARAMETER <u>numb</u> (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If <u>numb</u> is missing, processing is from current positioning to end of station.

ACTION Years of record from the assigned tape are processed until (1) <u>numb</u> years of record have been processed or (2) end of station if <u>numb</u> is missing or greater than the number of years of record from the current positioning.

OUTPUT For each year processed, the maximum of the mean daily flows is printed for each month and for the year. For the period processed, the sums of the maximums for each month and the sum of the yearly sums are printed. The mean of each of the yearly means and the mean daily flow for the period processed are also printed.

FUNCTION MONMIN: Print table of minimum mean daily flows for each month of water year.

FORMAT MONMIN*numb*

Col. 9-14 MONMIN
15-20 Number of years to be processed, e.g. 12

PARAMETER *numb* (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If *numb* is missing, processing is from current positioning to end of station.

ACTION Years of record from the assigned tape are processed until (1) *numb* years of record have been processed or (2) end of station if *numb* is missing or greater than the number of years of record from the current positioning.

OUTPUT For each year processed, the minimum of the mean daily flows is printed for each month and for the year. For the period processed, the sums of the minimums for each month and of the yearly sums are printed. The mean of each of the yearly means and the minimum mean daily flow for the period processed are also printed.

FUNCTION — PERMAX: Print a table of maximum mean discharges for up to 12 selected time periods beginning on October 1; also print peak instantaneous flow for years.

FORMAT — PERMAX*numb* *n*

Col. 9-14 PERMAX
15-20 Number of years to be processed, e.g. 5
21-26 Number of time periods, e.g. 11

PARAMETERS — *numb* (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If *numb* is missing, processing is from current positioning to end of station.

n is the number of time periods. The time periods in days are entered on the card (the period card) *following* the PERMAX card; the values thus entered are retained until changed on another PERMAX card. If *n* is blank, it is assumed that perviously entered values are to be used; there must be no period card in this case. *n* is punched in columns 21-22 of the PERMAX card; if present it must be between 1 and 12.

The time periods suggested for use are as described in ASCE Proc. Paper No. 4725, *J. Hydraulics Div.*, 1966. Different periods may be selected by the user. Example A-2 shows proper useage.

(Format of the period card: 12I3. The periods *must* be in ascending order.)

ACTION — Years of record from the assigned tape are processed until (1) *numb* years of record have been processed or (2) end of station if *numb* is missing or greater than the number of years of record from the current positioning.

OUTPUT — For each year processed the maximum mean discharges for the specified periods (beginning on October 1) are printed; the value and date of maximum instantaneous flow are also given.

ERROR MESSAGE — PERIOD E1 ILLEGAL N = *n* *n* was less than 1 or greater than 12.

FUNCTION — PERMIN: Print a table of minimum mean discharges for up to 12 selected time periods beginning on April 1.

FORMAT — PERMIN*numb* *n*

Col. 9-14 PERMIN
15-20 Number of years to be processed, e.g. 6
21-26 Number of time periods, e.g. 11

PARAMETERS — *numb* (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If *numb* is missing, processing is from current positioning to end of station.

n (optional) is the number of time periods. The time periods in days are entered on the card (the period card) following the PERMIN card; the values thus entered are retained until changed on another PERMIN card. If *n* is blank, it is assumed that previously entered values are to be used; there must be no period card in this case. *n* is punched in Columns 21-22 of the PERMIN card; if present it must be between 1 and 12.

The time periods suggested for use are as described in ASCE Proc. Paper No. 4725, *J. Hydraulics Div.*, 1966. Different periods may be selected by the user. Example A-2 shows proper useage.

(Format of the period card: 12I3 The periods *must* be in ascending order.)

ACTION — Years of record from the assigned tape are processed until (1) *numb* years of record have been processed or (2) end of station if *numb* is missing or greater than the number of years of record from the current positioning.

OUTPUT — For each year processed, the minimum mean discharges for the specified periods (beginning on April 1) are printed.

ERROR MESSAGE — PERIOD E1 ILLEGAL N = *n* *n* was less than 1 or greater than 12.

FUNCTION — SORT: Print a list of mean daily flows for a period sorted into descending order.

FORMAT — SORTbbnumb

Col. 9-12 SORT
15-20 Number of water years to be processed, e. g. 1

PARAMETER — numb (optional) is the number of water years to be processed, beginning with the one in front of which the tape is currently positioned. If numb is missing, processing is from current positioning to end of station.

ACTION — Years of record from the assigned tape are processed until (1) numb years of record have been processed or (2) end of station if numb is missing or greater than the number of years of record from the current positioning.

OUTPUT — For the period processed, the mean daily flows which occurred are sorted into descending order. The sorted flows are then printed, along with the beginning and ending dates of the sub-periods in which the flows occurred.

REMARK — For large periods, the tapes on units 2 and 3 may be used by SORT, which precludes mounting a data tape on 3.

FUNCTION — RPT: Repeat the next Data Processing Instruction until processing for the specified station is complete.

FORMAT — RPTbbbnumb

Col. 9-11 RPT
15-22 Station identification

PARAMETER — numb is the number identifying the terminating station and is of the form specified for LOCSTF.

ACTION — The next control instruction is read and stored and repeatedly executed for successive stations on the assigned tape until after the specified station has been processed; at that time the next control instruction is read and executed normally. Prior to the second and succeeding executions of the instruction following the RPT, the next station on the assigned tape is located.

ERROR MESSAGE — SWS E1 numb contains other than numeric characters.
LOCSTA E2 The terminating station was not encountered before the ending flag.

IV

DATA PROCESSING FORMATS

Presented on the following pages are various arrangements of SWS control cards to obtain processed data. The job set-ups are presented on coding forms so that it will be clear where various commands and parameters belong, and their order in the deck.

Rather than describe each form individually, a list of rules or suggestions is presented, describing in a general manner things that can or cannot be done. This will introduce the user to the flexibility of the system, while not confining him to "stereotyped" data retrieval processes.

1. JOB Card. The job card is a standard University of Wyoming format for use on the Philco 2000, and contains an accountable job number, time and page estimates and user identification. Information for proper completion of this card will be provided by the WRRI office upon request and the overall job set-up will be checked for correct order of control cards, etc.
2. HLT Card. The purpose of the HLT card is to have the computer operator mount the SWS program tape. In the examples presented later in this section, no tape number is provided, as it is subject to change due to wear and rebuilding. The program tape number is available from the WRRI office.
3. RPL Card. The RPL card loads the SWS program and sets the computer to accept SWS control card information.
4. REWINDLO Card. At the completion of the job, the REWINDLO, JOB, REWINDLO sequence insures positive rewinding of the program and data tape(s). This sequence is shown on all examples in the following sections. The JOB card, in this sequence only, contains just JOB and the accountable job number. The REWINDLO card contains the numbers of the tape units to be rewound. The JOB, HLT, RPL and REWINDLO cards are computer system control cards, and all commands and parameters begin in Columns 17 and 25, as shown in the examples.

5. All SWS data processing control card commands begin in Column 9, with parameters beginning in Columns 15, 21, 27, etc., when required. Parameters are of several general types:

(a) Parameters used with LOCSTF, LOCSTB and RPT are the 8-digit USGS station identification numbers, and must be included.

(b) The parameter used with LOCYR is the 4-digit year identification, and must be included.

(c) Parameters used with TAPE and REWIND are single digit tape unit identifiers, and can be 3, 4, or 6, and must be included.

(d) Parameters used with DURCUR are of two types. In the first field, a number, e.g. 6, indicates that processing will be for only 6 years of record, from the point at which the data tape is positioned. (If blank, processing is for entire period of record, from record where tape is positioned.) The second parameter field may contain CFS, CSM or CMD if those single curves are desired, or blank if all three curves are desired. The curves will be for the period specified by the first parameter.

CLASS values must be entered <u>prior</u> to requesting DURCUR or DURTAB. Preparation of these cards is described in Part III and examples are in this section.

(e) The first MADIS parameter indicates the number of records to be processed (exactly like DURCUR). The second, if STAT, produces the statistics table. The third parameter, if used, e.g. 7, produces additional information for 7 year periods.

(f) The first parameter used with PERMIN or PERMAX has the same function as for DURCUR. The second indicates the number of periods to be used. This card <u>must</u> be <u>followed</u> by a card containing the desired periods. See Part VII and III for preparation of this card, and this section for examples.

(g) LOGPT3, MINTIM, MAXTIM and SORT require a parameter to indicate the number of years to be processed. If none is specified, processing is done from current positioning of the data tape to the end of the period of record.

6. Example A-1 is the basic data processing set-up. Any routine may be requested, subject of course to inclusion of CLASS or period cards when required. Example A-2 shows how to obtain all routines (except 3 of the 4 DURCUR options) for one station.
Example B-1 shows use of RPT. Example B-2 shows how data processing may be "stepped" to study changes in various n-year increments. Different data tapes may be mounted by separate jobs, or as shown in B-3.

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FORTRAN CODING FORM

A-1
PAGE 1 OF 1

PROGRAM: PRINT ONE DATA PROCESSING ROUTINE | PROGRAMMER: Wm Emberee | DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		TAPE 6	
		LØCSTF06037500	
		MADIS STAT 5 5 5	
		REWIND6	
		END	
		REWINDLØØ,6	
		JØB ____	
		REWINDLØØ,6	

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PROGRAM: PRINT ALL DATA PROCESSING ROUTINES AND LIST DATA TAPE | PROGRAMMER: Wm Embree | DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card.	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		TAPE 6	
		LØCSTE06229000	
		MADIS STAT	
		BEGIN	
		DAYFLØ3	
		BEGIN	
		CLASS	
0.0	1	0. 50. 100. 200. 500. 1000.1500.2000.5000.10000 20000-1.	
		DURCUR CFS	
		BEGIN	
		MØNMAX	
		BEGIN	
		MØNMIN	
		BEGIN	
		SØRT 1	
		BEGIN	
		PERMAX 11	
1	3	7 15 30 60 901201501 83274	
		BEGIN	
		PERMIN 11	
1	3	7 14 30 60 901201501 83274	

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FORTRAN CODING FORM

PROGRAM:

PROGRAMMER: W. Embree

DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		BEGIN	
		LØGPT 3	
		REWIND 6	
		SERVIC	
		RDTAP 6	
		LIST	
		ENDSRV	
		END	
		REWIND LØØ, 6	
		JØB	
		REWIND LØØ, 6	

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FORTRAN CODING FORM

B-1
PAGE 1 OF 1

PROGRAM: SAME ROUTINE FOR MANY STATIONS	PROGRAMMER: Wm Embree	DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card.	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		TAPE 6	
		LØGSTF 09189500	
		RPT 09290000	
		MADIS STAT	
		END	
		REWINDLØ0,6	
		JØB ____	
		REWINDLØ0,6	

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FORTRAN CODING FORM

PROGRAM: 'STEPPING' | PROGRAMMER: Wm Embree | DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		TAPE 6	
		LØCSTF06229500	
		LØCYR 1940	
		LØGPT310	
		LØCSTB06229500	
		LØCYR 1941	
		LØGPT310	
		LØCSTB06229500	
		LØCYR 1942	
		LØGPT310	
		LØCSTB06229500	
		LØGPT3	
		END	
		REWINDLØØ,6	
		JØB	
		REWINDLØØ,6	

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FORTRAN CODING FORM

PROGRAM MORE THAN ONE DATA TAPE IN SAME JOB | PROGRAMMER Wm Embree | DATE 2/70

STATEMENT NUMBER | CONT | FORTRAN STATEMENT | IDENTIFICATION

```
          JØB       standard university format card.
          HLT       MØUNT TAPE _____ ØN ZERØ  WRRI PRØGRAM
          RPL       0,BLØCKO,GØ
     PAUSE MØUNT TAPE _____ ØN SIX
     TAPE  6
     LØCSTF06316000
     MADIS          STAT
     REWIND6
     PAUSE DISMØUNT TAPE _____ AND MØUNT TAPE _____ ØN SIX
     TAPE  6
     LØCSTF09213500
     SØRT  1
     REWIND6
     END
          REWINDLØ0,6
          JØB       _____
          REWINDLØ0,6
```

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V

SERVICE INSTRUCTIONS

Commands available in the SERVIC routine are used for maintenance of the data bank, including updating existing data and adding new stations. Data tapes may be copied, either in part or in their entirety to other tapes.

Because of its specialized nature, SERVIC will only be used by WRRI personnel, with only one exception: when a user desires a LIST.

Descriptions of all control functions used for SERVIC are described in this section. Each is listed separately and arranged alphabetically by name.

Examples of the types of maintenance which may be encountered are presented in Part VI, with explanations and formats.

FUNCTION ADD: Add one or more years of record from WRRI cards to the data tape.

FORMAT ADD Col. 9-11

PARAMETER None

ACTION Cards immediately following the ADD card are read and converted to binary tape format and written on WRTTAP beginning at its current position. Cards are read until an end of station indicator is encountered.

REMARK ADD destroys SERVIC RDTAP assignment. System must be in copy mode, using SETCPY. See input format, Part VII for additional information.

ERROR MESSAGE Several self-explanatory error messages regarding input deck makeup may occur:

```
YEAR   -1 STATION    0          TOO FEW DATA CARDS
   (The normal message when ADD has worked properly)
YEAR numb STATION numb          TOO FEW DATA CARDS
YEAR numb STATION numb          TOO MANY DATA CARDS
BAD STORE CARD:   (card is printed)
```

EXAMPLE See Example C, Part VI.

FUNCTION BUILD: Accept input for a new station and add with some control information to WRTTAP.

FORMAT BUILDb*type* *sta* *yr* Col. 9-13 BUILD
15-18 *type*

PARAMETERS *type* specifies the form of input data.

USGS	input data is in the form of Corps of Engineer data cards with headers on RDTAP.
WRRI	input data is in the form of WRRI data cards with headers on RDTAP.
TAPE	input data is special BCD tape; there are to be no header cards read.
TAPEH	same as TAPE except header cards are to be read from the input tape immediately following the TAPE card.

sta used only for TAPE and TAPEH. Indicates that BUILD processing is to terminate after processing for the specified station. Station number is to be punched in Columns 21-28 in the same format as for LOCSTF.

yr used only for TAPE and TAPEH. Specifies the year which is to terminate the processing of station *sta*. The year is punched in Columns 29-32.

ACTION Data are read from RDTAP and written on WRTTAP in standard SWS form until an end of deck indicator is encountered for USGS and WRRI or until a record for *yr* of *sta* has been processed for TAPE and TAPEH. A header record is written at the beginning of each station process; an interstation flag record is written at the end of each one.
For TAPE, blank header records are written. For the other types, 3 header cards are read and their station number is compared with that of the current data. If the two are equal, the cards are entered in the header record for the current station; otherwise blank cards are entered.

REMARKS BUILD destroys RDTAP assignment.

ERROR MESSAGE SERVIC E2 illegal BUILD parameter
See also under ADD

EXAMPLE See Example C, Part VI.

FUNCTION COPY: To copy a tape which cannot be processed because of checksum errors so that some information may be salvaged.

FORMAT COPYbbsta

Col. 9-12 COPY
15-22 sta

PARAMETER sta the eight digit station identifier for the last station to be copied. (See LOCSTF)

ACTION RDTAP is copied onto WRTTAP up to and including the interstation flag following station sta. Any records containing checksum errors are altered so that the record appears to be correct.

REMARK This instruction should be used only when there is no other method for salvaging a data tape, since it does not actually correct the checksum errors.

This instruction must be preceded by SETCPY, and followed by ENDCPY instructions.

Another way to salvage a tape with "bad" data would be to:

1. Re-build the erroneous year(s), using ADD, or
2. Eliminate the "bad" year(s) by selective-copying, and then replace the "bad" data.

FUNCTION ENDCPY: Terminate copy made and reset the service routine to non-copy mode.

FORMAT ENDCPY Col. 9-14

PARAMETER None

ACTION The service routine is reset from copy mode.

FUNCTION ENDSRV: Terminate service routine control

FORMAT ENDSRV Col. 9-14

PARAMETER None

ACTION Control is returned to the SWS executive for processing of further SWS instructions.

FUNCTION HEADER: Replace a header record on tape

FORMAT HEADER Col. 9-14

PARAMETER None

ACTION WRTTAP is spaced backward one record (assumed to be a station header record), the 3 cards following the HEADER card are read and interpreted as header cards, the new header record is written on WRTTAP. Both RDTAP and WRTTAP are left positioned immediately following the header record.

REMARK For correct operation of this instruction, the service routine must be in copy mode and the previous instruction must have been a LOCSTF instruction for the station whose header is to be replaced.

EXAMPLE See Example G, Part VI.

FUNCTION LIST: Print a listing of the records on the assigned tape (RDTAP) from the beginning to the end.

FORMAT LIST Col. 9-12

PARAMETER None

ACTION RDTAP is rewound. The tape is moved forward while an analysis of the contents is performed. Contents are listed as follows:

(1) Station headers are printed in full.
(2) Listing of consecutive years of record is given for each station.
(3) Total years of record and total stations processed is given.
(4) A list and count of all stations on the tape is given.

Each record is checked for checksum verification. If a checksum error is found in any record or group of records for a station, the word CKSMER is printed following the list for the station, and the "bad" record is printed out; if no checksum error is found, no indication is given.

Flag records are not printed out, although they exist.

When the processor encounters an ending flag record, the list is considered to be complete, and RDTAP is rewound.

FUNCTION LOCFLG: To locate a flag record

FORMAT LOCFLG*ident* Col. 9-14

PARAMETER *ident* flag identifier; may be one of the following:

BEGIN	denotes the beginning flag record for the tape	Col. 15-19
INTER	denotes an interstation flag record	Col. 15-19
END	denotes the ending flag record for the tape	Col. 15-17

ACTION RDTAP is searched in the forward direction for a specified flag record. When the flag record is found, RDTAP is positioned in front of the record. If the service routine is in copy mode, each record read from RDTAP is written on WRTTAP; WRTTAP is positioned in front of the flag record.

ERROR MESSAGE
LOCFLG E1 specified flag not found before end tape
FLAG E1 illegal flag identifier

FUNCTION LOCSTF: Locate in a forward direction the records for a specified station.

FORMAT LOCSTFnumb Col. 9-14

PARAMETER numb the number for the station to be located; numb has the form:

mmnnnnpp where mm is the part number, nnnn is the station number, and pp is the substation number, Column 15-22.

ACTION RDTAP is searched in the forward direction for station numb. RDTAP is left positioned between the station header record and the first yearly record for the station. If the service routine is in copy mode, each record read from RDTAP is written on WRTTAP, which is left positioned the same as RDTAP.

ERROR MESSAGE
SERVIC E3 non-numeric numb
LOCSTA E2 station not found

FUNCTION LOCYR: Locate in a forward direction the record for a given year.

FORMAT LOCYRb*year* Col. 9-13

PARAMETER *year* the year of the record to be located, Col. 15-18.

ACTION RDTAP is searched in a forward direction for the record for *year*. RDTAP is positioned in front of the record. If the service routine is in copy mode, each record read from RDTAP is written on WRTTAP, which is left positioned the same as RDTAP.

REMARKS The records for a station are assumed to be in sequence by year. Thus, if a year is encountered which is later than the one specified, it will be assumed that the one specified is not present. No backward searching is done.

ERROR MESSAGE

SERVIC	E3	non-numeric *year*
LOCYR	E1	end of station encountered before specified record was found
LOCYR	E2	record of year later than *year* has been encountered

FUNCTION RDTAP: Assign a unit from which information is read.

FORMAT RDTAPb*n* Col. 9-13

PARAMETER *n* numeric tape unit specifier. If *n* is left blank, the special ½" unit is assumed.

ACTION The specified assignment is made.

REMARK RDTAP destroys SWS TAPE assignment. RDTAP must be used as shown in Examples C-H

ERROR MESSAGE SERVIC E1 Illegal tape specified.

FUNCTION REWIND: Rewind a tape

FORMAT REWIND*n* Col. 9-14

PARAMETER *n* numeric tape unit specifier. If *n* is left blank, the special ½" unit is assumed.

ACTION *n* is rewound

FUNCTION SETCPY: Set service routine so that records read from RDTAP are written on WRTTAP.

FORMAT SETCPY Col. 9-14

PARAMETER None

ACTION The service routine is set to copy mode.

FUNCTION SPACEB: Space backward tape one or more records.

FORMAT SPACEB*n* Col. 9-14

PARAMETER *n* the number of records to be spaced.

ACTION RDTAP is spaced backward *n* records. If the service routine is in copy mode, WRTTAP is also spaced backward *n* records.

ERROR MESSAGE SERVIC E3 non-numeric *n*.

FUNCTION: SPACEF: Space forward tape one or more records.

FORMAT SPACEF*n* Col. 9-14

PARAMETER *n* the number of records to be spaced.

ACTION RDTAP is spaced forward *n* records. If the service routine is in copy mode, each record spaced over is written onto WRTTAP.

ERROR MESSAGE SERVIC E3 non-numeric *n*.

FUNCTION WRTFLG: Write a flag record.

FORMAT WRTFLG*ident* Col. 9-14

PARAMETER *ident* flag identifier; may be one of the following:

BEGIN	denotes the beginning flag record for the tape	-Col. 15-19
INTER	denotes an interstation flag record	-Col. 15-19
END	denotes the ending flag record for the tape	-Col. 15-17

ACTION The specified flag record is written on WRTTAP.

ERROR MESSAGE FLAG E1 Illegal flag identifier.

EXAMPLE Example C in Part VI shows the proper usage of WRTFLG.

FUNCTION WRTTAP: Assign a unit on which information is to be written.

FORMAT WRTTAP*n* Col. 9-14

PARAMETER *n* numeric tape unit specifier. If *n* is left blank, the special ½" unit is assumed.

ACTION The specified assignment is made.

ERROR MESSAGE SERVIC E1 Illegal tape specifier.

VI

SERVICE FORMATS

Various control card arrangements to provide maintenance on the data bank are presented on the following pages. They represent all anticipated types of maintenance, and have been use-tested and are operational. The job set-ups are presented on coding forms so that it will be clear where various commands and parameters belong, and their order in the deck.

Each form is described individually, so that specific comments may be made. In all examples but Example C, the JOB, HLT, RPL, REWINDLO sequence is exactly as for normal data processing routines, and is required.

1. Example C is the operational set-up to generate a data tape. The initial instruction sequence generates a tape with the desired data under Philco 2000 computer control. The data cards must be in the sequence shown (also shown in Part VII). The RPL card loads the SWS program and transfers control to SWS. Beginning and a first interstation flag must be written by user. The BUILD WRRI command reads and processes the data from tape 4 and writes it on tape 3 in WRRI format. As each station is "built", it is automatically followed by an interstation flag. An ending flag must be written by user.

2. When data processed in the above manner has been verified (by MADIS, etc.) it can be merged into an existing data tape as shown in Example D. In the example, some data from tape 6 is read and copied onto tape 4. The next consecutive station is located on tape 3 and several stations are copied onto tape 4. The next consecutive station is located on tape 6, and that tape is copied to its end onto tape 4. As good practice, copying sequences should include an interstation record, and should begin in front of a header record, as shown in the example. The sequence can be carried out in a similar manner for large numbers of stations to be merged.

3. Examples E and F show three variations for updating, using ADD. A year (or years) may be added at the beginning of a period of record as shown in the first part of Example E, and a year (or years) can be added to the end of a period as shown in the second part. Updating the current water year data is done in this manner. This sequence may be repeated for any number of stations.

Updating (ADDing) may be carried out for many stations (placing the new water year data on tape) by this sequence between points A and AA on Example F:

```
   LOCSTF________
   LOCFLGINTER
   ADD
(                                                )
(50 cards for latest year, +2 STORE -1 cards)
(                                                )
   RDTAP 6
   LOCSTF________
   LOCFLGINTER
   ADD
(                                                )
(50 cards for latest year, +2 STORE -1 cards)
(                                                )
   RDTAP 6
   LOCSTF________
   LOCFLGINTER
   ADD
(                                                )
(50 cards for latest year, +2 STORE -1 cards)
(                                                )
   RDTAP 6
```

Etc.

A year may be replaced with corrected data, as shown in Example F. In order not to have duplicate 1916's in the example, the RDTAP is spaced forward past 1916, but not in copy mode, to eliminate the incorrect data.

4. Example G shows how a header record may be replaced or added. (Stations built from Corps of Engineer cards do not include header records.) The sequence illustrated may be repeated for any number of header records, provided they are in the same order as found on the data tape. The format for header cards is described in Part VII.

5. When a data tape has been built, ordered and verified, it should be copied onto the remainder of the data tapes, to update the reserve data bank. This is done as shown in Example H.

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FORTRAN CODING FORM

C

PROGRAM To BUILD A DATA TAPE FROM CARDS | PROGRAMMER W N Embree | DATE 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JOB standard university format card	
		HLT MOUNT TAPE ____ ON ZERO WRRI PROGRAM	
		REWIND 4	
		DATA	
		TAPE 4, CODE	
		{ cards for stations: { header cards (must have 3 cards)	
		* { data cards	
		2 store -1 cards	
		* repeat for all stations to be built	
STORE		-1	
STORE		-1	
STORE		-1	
		ENDDATA	
		REWIND 4	
		RPL 0, BLOCKO, GO	
		PAUSE MOUNT ____ ON THREE WRITE ENABLE THREE	
		SERVIC	
		RDTAP 4	
		WRTTAP 3	
		WRTELGBEGIN	
		WRTELGINTER	
		BUILD WRRI	
		WRTTAP 3	

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FORTRAN CODING FORM

C

PROGRAM | PROGRAMMER: W. M. Embree | DATE:

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		WRTFLGEND	
		REWIND3	
		RDTAP 3	
		LIST	
		ENDSRV	
		END	
		REWINDLØ0,3,4	
		JØB	
		REWINDLØ0,3,4	

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FORTRAN CODING FORM

PROGRAM TO COMBINE DATA FROM 2 TAPES, IN ORDER | PROGRAMMER: W N Kimbrell | DATE 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card.	
		HLT MØUNT TAPE _____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCK0,GØ	
		PAUSE MØUNT TAPE _____ ØN THREE	
		PAUSE MØUNT TAPE _____ ØN FØUR WRITE ENABLE FØUR	
		PAUSE MØUNT TAPE _____ ØN SIX	
		SERVIC	
		SETCPY	
		WRTTAP1	
		RDTAP 6	
		LØCSTF06233500	
		LØCFLGINTER	
		SPACEF1	
		ENDCPY	
		RDTAP 3	
		LØCSTF06273500	
		SPACEB1 (positions tape infront of leader record)	
		SETCPY	
		WRTTAP4	
		RDTAP 3	
		LØCSTF06274000	
		LØCELGINTER	
		SPACEF1 (positions tape after flag record)	
		ENDCPY	
		RDTAP 6	

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FORTRAN CODING FORM

D
PAGE 2 OF 2

PROGRAM | PROGRAMMER: Al McEntree | DATE:

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		SPACEB1	necessary if 06274500 is located adjacent to 06233500
		LOCSTF06274500	
		SPACEB1	
		SETCPY	(additional sequences of selective copying could be
		WRTTAP4	inserted here)
		RDTAP6	
		LOCFLGEND	
		SPACEF1	(copying ends past the ending flag.)
		ENDCPY	
		REWIND4	
		RDTAP 4	
		LIST	
		ENDSRV	
		END	
		REWINDLO0,3,4,6	
		JOB	
		REWINDLO0,3,4,6	

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FORTRAN CODING FORM

PROGRAM: To UPDATE AN EXISTING STATION | PROGRAMMER: Wm Embree | DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JOB Standard university format card	
		HLT MOUNT TAPE _____ ON ZERO WRRI PROGRAM	
		RPL 0,BLOCKO,GO	
		PAUSE MOUNT TAPE _____ ON SIX	
		PAUSE MOUNT TAPE _____ ON FOUR WRITE ENABLE FOUR	
		SERVIC	
		SETCPY	
		WRTTAP4	
		RDTAP 6	
		LOCSTF06222500	
		ADD	
		{ Cards, in WRRI format for year(s) to be added at beginning of record, e.g. 1901	
STORE		-1	
STORE		-1	
.		RDTAP 6	
		LOCSTF06642500	
		LOCYR 1966	
		SPACEF1	
		ADD	
		{ Cards for year(s) to be added to end of record, e.g. 1967	
STORE		-1	

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FORTRAN CODING FORM

PROGRAM: | PROGRAMMER: Un Embree | DATE:

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
STORE		-1	
		RDTAP 6	
		LOCELGEND	
		SPACEF1	
		ENDCPY	
		REWIND4	
		RDTAP 4	
		LIST	
		ENDSRV	
		END	
		REWINDL00,4,6	
		JOB	
		REWINDL00,4,6	

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FORTRAN CODING FORM

PROGRAM TO REPLACE A 'BAD' YEAR OF DATA | PROGRAMMER Winkenbrue | DATE 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card.	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		PAUSE MØUNT TAPE ____ ØN FØUR WRITE ENABLE FØUR	
		SERVIC	
		SETCPY	
		WRTTAP4 ← A	
		RDTAP 6	
		LØCSTF06273500	
		LØCYR 1916	
		ADD	
		{ cards for 1916	
STØRE		-1	
STØRE		-1	
		ENDCPY	
		RDTAP 6	
		SPACEF1	
		SETCPY	
		WRTTAP4 ← AA	
		RDTAP 6	
		LØCELGEND	
		SPACEF1	

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FORTRAN CODING FORM

PROGRAM | PROGRAMMER: W R Embree | DATE:

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		ENDCPY	
		REWIND4	
		RDTAP 4	
		LIST	
		ENDSRV	
		END	
		REWINDLØØ,4,6	
		JØB	
		REWINDLØØ,4,6	

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FORTRAN CODING FORM

G

PROGRAM: REPLACE A HEADER RECORD | PROGRAMMER: Wm Embree | DATE: 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JØB standard university format card	
		HLT MØUNT TAPE ____ ØN ZERØ WRRI PRØGRAM	
		RPL 0,BLØCKO,GØ	
		PAUSE MØUNT TAPE ____ ØN SIX	
		PAUSE MØUNT TAPE ____ ØN FØUR WRITE ENABLE FØUR	
		SERVIC	
		SETCPY	
		WRTTAP 4	
		RDTAP 6	
		LØCSTF 06755000	
		HEADER	
		{ standard WRRI header cards (3 per station) } sequence may be repeated	
		RDTAP 6	
		LØCELGEND	
		SPACEF 1	
		ENDCPY	
		REWIND 4	
		RDTAP 4	
		LIST	
		ENDSRV	
		END	
		REWINDLØØ,4,6	
		JØB	

REWINDLØ0;4,6

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FORTRAN CODING FORM

H

PROGRAM TO COPY AN ENTIRE DATA TAPE | PROGRAMMER W.R. Embree | DATE 2/70

STATEMENT NUMBER	CONT	FORTRAN STATEMENT	IDENTIFICATION
		JOB standard university format card	
		HLT MOUNT TAPE ____ ON ZERO WRRI PROGRAM	
		RPL 0,BLOCKO,GO	
		PAUSE MOUNT TAPE ____ ON FOUR WRITE ENABLE FOUR	
		PAUSE MOUNT TAPE ____ ON SIX	
		SERVIC	
		RDTAP 6	
		LOCELGBEGIN	
		SPACEB1	
		SETCPY	
		NRTTAP4	
		RDTAP 6	
		LOCFLGEND	
		SPACEF1	
		ENDCPY	
		REWIND4	
		RDTAP 4	
		LIST	
		ENDSRY	
		END	
		REWINDLOO,4,6	
		JOB ____	
		REWINDLOO,4,6	

VII

CARD FORMATS

Card formats are presented in detail on the following pages. Where these cards have been encountered in the preceding sections, their format has been described; however, Sheet A in this section presents a summary of all types of cards used, and exact details. The column information is of particular importance, because being off by even one punch location will insure improper functioning of SWS.

A detailed explanation of the WRRI daily data cards is presented on Sheet B. It is important that the decimal be included on daily cards 3-48. If data are punched "left justified" (the most efficient method) without a decimal, one will be implied, which will make 3 be recorded as 3000000000. The 50th card, containing the date, should contain the three letter month abbreviation and a one or two digit day number, but not exceed six characters total. If peak flow data are not available, two blank cards must be included.

Organizing several 50-card decks per station and several stations is detailed on Sheet C.

Card Formats

	Card	Col's	Contents	How Read
1	Control Card	1- 8	Ignored	
		9-14	Control instruction	A6
		15-20	First parameter field	A6
		21-80	Succeeding parameter fields	10A6
2	Header #1	1-60	Station description	12A5
		61-70	The words 'STATION NO'	2A5
		71	Ignored	
		72-80	Station number punched as follows: nnnnnn.nn	2PE9.2
	Header #2	1-80	Additional information for station	16A5
	Header #3	1-49	Additional information for station	9A5,A4
		50-59	Drainage area	F10.0
		60-80	Addition information for station	A1,4A5
3	Class Flow Card	1-80	Up to 16 5-column fields containing flow values in cfs for classes corresponding to the number of the field. (The first field on the first card is numbered 0, the second is numbered 1, etc.; the first field on the second card is numbered 16, etc.) If no decimal is punched in a field, one is implied after the fifth column	16F5.0
4	Period Card	1-36	Up to 12 3-column fields, each containing a time period in days. Period must be right justified in a field.	12I3
5	STORE -1	1- 5	The word 'STORE'	
		9-10	-1	
			All other columns should be blank	
6	Data input formats for servicing the system are on the following pages.			

Input Format for WRRI Daily Data Cards

WRRI data cards are organized into decks for each water year. The deck for a water year is made up as follows:

Card	Columns	Contents	How Read
1	1- 5	The word 'STORE'	A5
	7-10	The calendar year	I4
	12-17	The station number, punched as follows: mmnnnn, where mm is the part number and nnnn is the station number	I6
2		This card is ignored, but must be included	
3-48	1-80	Eight 10-digit fields, each containing one mean daily discharge; if a field does not contain a decimal point, one is implied between the 9th and 10th columns. 365 (or 366) fields are used.	8F10.1
49	1- 6	Maximum instantaneous flow. Must be terminated by a period (.), e.g. 3645. Blank if missing.	A10
50	1- 6	Date of maximum instantaneous peak flow. Blank if missing.	A6

NOTE: Missing daily data are coded by a -1. flow value.

Input to the Surface Water System

GENERAL Data may be input to the system from three sources: BCD tape, Corps of Engineer (coded in SWS as USGS) cards or WRRI cards. The formats for the three sources are described below.

Two instructions are available for transferring the data from its source to the binary format for the system: The BUILD instruction accepts input from any of the three sources and generates most of the required interstation and header records while transferring the data. The ADD instruction accepts input only from WRRI cards and generates no header or interstation records. For more information regarding these two instructions, see SURFACE WATER SYSTEM SERVICE INSTRUCTIONS.

FORMAT Card input

The deck for processing by the BUILD instruction consists of a group of cards for each of one or several stations, followed by an end of deck indicator. The deck for processing by the ADD instruction consists of a group of cards (WRRI only) for each of one or several years for a single station, followed by an end of station indicator. The arrangement of the two types of decks is shown below.

```
BUILD instruction deck makeup: (WRRI or USGS)
      Cards for first station
      Cards for second station
        .
        .
        .
      Cards for last station
      End of deck indicator*

      The cards for a station are ordered as follows:
          3 header cards for the station
          Deck for first year (may be of either type)
          Deck for second year (same type as first)
            .
            .
          Deck for last year (same type as first)
          End of station indicator**

ADD   instruction deck makeup:
      Deck for first year (WRRI type only)
      Deck for second year
        .
        .
      Deck for last year
      End of station indicator**
```

There must be cards for at least one station in the deck. The cards for each station must have at least one yearly deck.

* End of deck indicator is 3 STORE -1 cards.
** End of station indicator is 2 STORE -1 cards.

CONTROL

For card input the ends of stations and BUILD decks are indicated by groups of cards which serve as indicators. The result of this usage is that a message is printed at the end of each station:

YEAR -1 STATION _____ TOO FEW DATA CARDS, where the contents of the underlined blank depend on the type of deck and will in general be either 0 or 6000000. This message is normal and is only an indication that the end of station indicator has been encountered during the input process. Errors are printed out as shown in Part V, ADD.

PUBLICATIONS
of
WYOMING WATER RESOURCES RESEARCH INSTITUTE

I. WATER RESOURCES SERIES

Rechard, Paul A. and Richard McQuisten (Compilers)
1966. Glossary of Selected Hydrologic Terms
Revised Water Resources Series No. 1. Pages i - 43
1968. Funded in part by OWRR - A-001-WYO

Rechard, Paul A. and Frederick R. Potter
1966. Progress Report on the Effects of Varying Land and Water Use on Streamflow Regimen
Water Resources Series No. 2. Pages ii - 41
Funded in part by OWRR - A-001-WYO

Clement, Pierre
1966. Snow Water Acidity in Wyoming
Water Resources Series No. 3. Pages i - 11
Funded in part by OWRR - A-001-WYO

Kenney, Raymond K. and John W. Birch
1967. Population Trends in the Green and Platte River Basins of Wyoming: 1890-2010
Water Resources Series No. 4. Pages iv - 41
Funded in part by OWRR - A-001-WYO

Kildebeck, James C., Orman H. Paananen, and John W. Birch
1967. Projected Gross Residential Water Requirements in the Green and Platte River Basins of Wyoming: 1970-2010
Water Resources Series No. 5. Pages vi - 50
Funded in part by OWRR - A-001-WYO

Rechard, Paul A.
1967. Psychrometric Tables for Wyoming (High Elevations)
Water Resources Series No. 6. Pages 31
Funded in part by OWRR - A-001-WYO

McGaw, M. R.
1967. Confluence Analyses of Land Surfaces
Water Resources Series No. 7. Pages vii - 49
Funded in part by OWRR - A-001-WYO

Rechard, Paul A. (Compiled under the direction of)
1967. Water Resource Observatory Climatological Data - Water Year 1966 and Prior
Water Resources Series No. 8. Pages 323
Funded in part by OWRR - A-001-WYO

Schwer, R. Keith (Compiler)
1968. Municipal Water and Sewage Systems in Wyoming - A Source Book of Data
Water Resources Series No. 9. Pages vi - 124
Funded in part by OWRR - A-001-WYO

Rechard, Paul A. and John E. Lane
1968. The Effects of Varying Land and Water Use on Streamflow Regimen
Water Resources Series No. 10. Pages iv - 64
Funded in part by OWRR - B-001-WYO

Pierce, John M.
1968. Legal Aspects of Weather Modification - Snowpack Augmentation in Wyoming
Water Resources Series No. 11. Pages i - 61
Funded in part by OWRR - A-001-WYO

Rechard, Paul A. (Compiled under the direction of)
1968. Water Resource Observatory Climatological Data - Water Year 1967
Water Resources Series No. 12. Pages v - 391
Funded in part by OWRR - A-001-WYO

Embree, William N., Lee W. Larson and Paul A. Rechard (Compilers)
1968. Computerized System for Wyoming Surface Water Records
Revised Water Resources Series No. 13. Pages iii - 73
1970. Funded in part by Wyoming Water Planning Program and OWRR - A-001-WYO

Rechard, Paul A. (Compiled under the direction of)
1969. Water Resource Observatory Climatological Data - Water Year 1968
Water Resources Series No. 14. Pages v - 391
Funded in part by OWRR - A-001-WYO

Rechard, Paul A. (Editor)
1969. Snowy Range Water Resource Observatory (A Progress Report)
Water Resources Series No. 15. Pages iii - 34
Funded in part by OWRR - A-001-WYO A-14

Rechard, Paul A. (Compiled under the direction of)
1969. Water Resource Observatory Solar Radiation Data - Water Year 1969 and Prior
Water Resources Series No. 16 Pages iii - 39
Funded in part by OWRR - A-001-WYO

Rechard, Paul A. (Compiled under the direction of)
1970. Water Resource Observatory Climatological Data - Water Year 1969
Water Resources Series No. 17. Pages iii - 343
Funded in part by OWRR - A-001-WYO

Embree, William N.
1970. Surface Water System - Operational Handbook
Water Resources Series No. 18. Pages ii - 67
Funded in part by Wyoming Water Planning Program and OWRR - A-001-WYO

Trelease, Frank J., Theodore J. Swartz, Paul A. Rechard, Robert D. Burman
1970. Consumptive Use of Irrigation Water in Wyoming
Water Resources Series No. 19. Pages iii - 21
Funded in part by Wyoming Water Planning Program and OWRR - B-003-WYO

Embree, William N.
1970. An Approach to the Selection of a Streamflow Base Period
Water Resources Series No. 20. Pages viii - 99
Funded in part by Wyoming Water Planning Program and OWRR - A-001-WYO

II. THESES

Ferguson, James A.
1966 Development and Evaluation of an Instrument System for Determining the Vertical Energy Balance
M. S. Thesis - Civil Engineering. Pages v - 66
Funded in part by OWRR - A-001-WYO

Kite, Rodney C.
1966. A Study of the Impact on Southwestern Wyoming of Recreationists Visiting Flaming Gorge Reservoir
M. S. Thesis - Agricultural Economics. Pages ix - 89
Funded in part by OWRR - A-001-WYO

Loudon, Theodore L.
1966. Evapotranspiration and Vertical Energy Balance Measurements over Irrigated Pasture
M. S. Thesis - Civil Engineering . Pages x - 106
Funded in part by OWRR - A-001-WYO

Narum, Gailen O.
1966. Physical and Chemical Measurements of Water Stabilization Lagoons, During Winter Operation
M. S. Thesis - Civil Engineering. Pages vi - 84
Funded in part by OWRR - A-001-WYO

Potter, Frederick R.
1966. A Comparison of the Percentage of Return Flow from a Municipal System with That of an Agricultural Diversion on the Laramie River
M. S. Thesis - Civil Engineering. Pages xi - 123
Funded in part by OWRR - A-001-WYO

Gartner, F. Robert
1967. Microclimate, Vegetation, and Soils Along a Vertical Gradient on Elk Mountain, Wyoming
Ph. D. Dissertation - Range Management. Pages xii - 162
Funded in part by OWRR - A-001-WYO

Lindsay, John H.
1967. The Effect of Environmental Factors on the Leaf Water Balance of Conifers
M. S. Thesis - Botany. Pages vi - 60
Funded in part by OWRR - A-001-WYO

Wicker, Paul J.
1967. Synthetic Hydrology of Snowmelt Runoff
M. S. Thesis - Civil Engineering. Pages vii - 106
Funded in part by OWRR - A-001-WYO

Fabricius, Arden Gene
1968. Irrigation Simulations Using Evapotranspiration Estimates for Selected Locations in Southeastern Wyoming
M. S. Thesis - Agronomy. Pages iv - 116
Funded in part by OWRR - A-001-WYO

Fisher, Donald P.
1968. Runoff and Evaporation from Artificially Induced Snow Drifts
M. S. Thesis - Civil Engineering. Pages vi - 72
Funded in part by OWRR - A-001-WYO

Hannigan, John Thomas
1968. A Rainfall-Runoff Study for an Urban Area
M. S. Thesis - Civil Engineering. Pages vi - 43
Funded in part by OWRR - A-001-WYO and FWPCA

Lane, John Everett
1968. The Effects of Varying Land and Water Use on Streamflow Regimen
M. S. Thesis - Civil Engineering. Pages ix - 87
Funded in part by OWRR - B-001-WYO

Saulnier, George J.
1968. Ground Water Resources and Geomorphology of the Pass Creek Basin Area, Albany and Carbon Counties, Wyoming
M. S. Thesis - Geology. Pages vi - 91
Funded in part by OWRR - A-001-WYO A-15

Sheets, William B.
1968. The Effect of Chemical Control of Big Sagebrush on the Water Budget and Vertical Energy Balance
Ph. D. Dissertation - Agronomy. Pages xiii - 100
Funded in part by OWRR - A-001-WYO

Sorensen, James N.
1968. Marginal Value of Irrigation Water in Two Areas of Southeastern Wyoming
M. S. Thesis - Agricultural Economics. Pages viii - 131
Funded in part by OWRR - A-001-WYO

Whittenberg, Jean R.
1968. Ablation of Snow Drifts Behind Artificial Barriers
M. S. Thesis - Civil Engineering. Pages vii - 86.
Funded in part by OWRR - A-001-WYO

Reichenbaugh, Ronald Clair
1969. Selected Methods of Estimating Consumptive Use from Mountain Meadows in Wyoming
M. S. Thesis - Water Resources. Pages ix - 105
Funded in part by Wyoming Water Planning Program and OWRR - A-001-WYO

Stone, James E.
1969. Leaf Water Potential of Pinus Contorta Seedlings in Relation to Growth and Seasonal Moisture Conditions
M. S. Thesis - Botany. Pages vii - 45

Taggart, Richard J.
1969. The Economic Possibility of Adapting New Technology in Sprinkler Irrigation to the Green River Basin
M. S. Thesis - Agricultural Economics. Pages v - 68
Funded in part by OWRR - A-001-WYO

Skinner, Quentin D.
1970. Water Quality of a Glaciated Mountain Lake as Influenced by Recreation Users
M. S. Thesis - Recreation and Park Administration-Pages ix - 7-7
Funded in part by Wyoming Recreation Department and OWRR - A-001-WYO

Brown, Dennis J.
1970. The Use of Pans and a Theoretical Model to Define the Role of Evaporation in the Water Budgets of the City of Laramie and the State of Wyoming
M. S. Thesis - Water Resources. Pages ix - 133
Funded in part by OWRR - A-001-WYO and FWPCA

Embree, William Norris
1970. An Approach to the Selection of a Streamflow Base Period
M. S. Thesis - Water Resources Pages viii - 99
Funded in part by Wyoming Water Planning Program and OWRR - A-001-WYO

III. LAND AND WATER LAW REVIEW

A semi-annual journal edited in the College of Law, University of Wyoming through the Land and Water Law Center, funded in part by OWRR - A-001-WYO.

1966	Volume I	Number 1	Pages 1 - 354
	Volume I	Number 2	Pages 355-- 651
1967	Volume II	Number 1	Pages 1 - 250
	Volume II	Number 2	Pages 251 - 572
1968	Volume III	Number 1	Pages 1 - 297
	Volume III	Number 2	Pages 298 - 627
1969	Volume IV	Number 1	Pages 1 - 295
	Volume IV	Number 2	Pages 296 - 599
1970	Volume V	Number 1	Pages 1 - 256

Articles in the LAND AND WATER LAW REVIEW funded in part by OWRR - A-001-WYO

MacPherson, John, Richard A. Stacy, and William H. Vines
1966. Comment - Water Appropriation for Recreation
Volume I, Number 1. Pages 209-222

Pierce, John M.
1967. Legal Aspects of Weather Modification Snowpack Augmentation in Wyoming
Volume II, Number 2. Pages 273-319

MacPherson, John, Calvin E. Ragsdale, William J. Thomson
1967. Comment - Improvement of Existing Water Rights Through Unification - A Case Study on the Consolidation of Appropriations
Volume II, Number 2. Pages 327-364

Hillhouse, Richard A.
1968. Comment - The Federal Reserved Water Doctrine - Application to the Problem of Water for Oil Shale Development
Volume III, Number 1. Pages 75-102

Peryman, Alan W.
1969, Determining Quantity in Irrigation Appropriations
Volume IV, Number 2. Pages 501-520

McIntire, Michael V.
1970. The Disparity Between State Water Rights Records and Actual Water Use Patterns. "I Wonder Where the Water Went?"
Volume V, Number 1. Pages 23-48

Other articles in the LAND AND WATER LAW REVIEW of special interest to WyoWRRI

Trelease, Frank J. and Dellas W. Lee
1966. Priority and Progress - Case Studies of the Transfer of Water Rights
Volume I, Number 1. Pages 1-76

Ulton, Albert E.
1966. The Columbia River Treaty and Protocol
Volume I, Number 1 Pages 181-199

Phipps, David R.
1966. The Public Land Law Review Commission - A Challenge to the West
Volume I, Number 2. Pages 355-377

Trelease, Frank J.
1967. Alaska's New Water Use Act
Volume II, Number 1. Pages 1-49

Health, Milton S., Jr.
1967. Water Management Legislation in the Eastern States
Volume II, Number 1. Pages 99-116

Phipps, David R.
1967. The Public Land Law Review Commission - Identifying and Defining the Problem
Volume II, Number 2. Pages 251-271

Trelease, Frank J.
1967. Transfer of Water Rights - Errata and Addenda - Sales for Recreational Purposes and to Districts
Volume II, Number 2. Pages 321-326

Netherton, Ross D.
1968. Implementation of Land Use Policy: Police Power vs. Eminent Domain
Volume III, Number 1. Pages 33-57

Phipps, David R.
1968. The Public Land Law Review Commission - Status Report 1967-1968
Volume III, Number 2. Pages 301-317

Farnham, William H.
1968. The Improvement and Modernization of New York Water Law Within the Framework of the Riparian System
Volume III, Number 2. Pages 377-433

Moses, Raphael J.
1968. What Happened to Multiple-Purpose Resource Development? - A Plea for Reasonableness
Volume III, Number 2. Pages 435-441

McCauley, Brian T.
1968. Comment - The Nature of a Reservoir Right
Volume III, Number 2. Pages 443-462

Waite, G. Graham
1969. International Treaties Affecting Western Water Rights
Volume IV, Number 1. Pages 67-96

Bielefeld, Alvin E.
1969. Navigability in the Missouri River Basin
Volume IV, Number 1. Pages 97-119

Renne, Roland R. and Glen D. Fulcher
1969. Legal Research in Water Resources
Volume IV, Number 1. Pages 145-158

Lewis, David G.
1969. Water Appropriation - Constitutionality of Water Appropriation Statute Imposed on a Riparian Statute in North Dakota (Baeth v. Hoisveen, 157 N.W.2d 728 (N.D. 1968)
Volume IV, Number 1. Pages 185-190

Gordnier, John A.
1969. Eminent Domain: A Need for Policy Re-Consideration (Preface)
Volume IV, Number 1. Pages 191-192

Neville, Frank D.
1969. Eminent Domain - Valuation - Denial of Compensation for Loss of Business Incurred by Condemnation Proceedings. (Seferi v. Ives, 155 Conn. 580, 236 A.2d 83 (1967)
Volume IV, Number 1. Pages 193-199

Keene, Kenneth L.
1969. Eminent Domain - Valuation - Navigational Servitude Effect on Evaluation of Port Site Property
(United States v. Rands, 88 S.Ct. 265 (1967)
Volume IV, Number 1. Pages 200-208

Schuster, Robert P.
1969. Eminent Domain - Taking - Determination of Compensable Interests Through Classification of Executory Contracts (Klein v. United States, 375 F.2d 825 (Ct.Cl. 1967)
Volume IV, Number 1 Pages 209-218

Corker, Charles E.
1969. Book Review - Water Law: Planning and Policy, Cases and Materials by Joseph L. Sax
Volume IV, Number 1 Pages 219-224

Phipps, David R.
1969. The Public Land Law Review Commission - Status Report
Volume IV, Number 2 Pages 297-335

Poland, Sherman S.
1969. Development of Recreational and Related Resources at Hydro-Electric Projects Licensed by the Federal Power Commission
Volume IV, Number 2 Pages 375-398

Lyon, Michael T.
1969. Modifications in the Water Law of Chile Contained in the New Agrarian Reform Law
Volume IV, Number 2 Pages 431-474

Verleger, Philip K. and Jennie M. Crowley
1969. Air Pollution, Water Pollution, Industrial Cooperation and the Antitrust Laws
Volume IV, Number 2 Pages 475-486

Corbett, William L.
1969. Comment - Idaho - The Constitutionality of a Mandatory Permit System and Denial of a Water Use in the Public Interest
Volume IV, Number 2 Pages 487-500

Morgan, Daniel J. and David G. Lewis
1969. Comment - The State Navigation Servitude
Volume IV, Number 2 Pages 521-588

Walker, William R. and William E. Cox
1970. Jurisdiction of the Federal Power Commission Over Non-Power Water Use
Volume V, Number 1 Pages 65-75

Ahlstrom, Bert
1970. Water Law - Procedure of State Engineer in Closing Down Wells Held Contravention of Due Process (Fellhauer v. People, 447 P.2d 986 (Colo. 1968)
Volume V, Number 1 Pages 87-96

IV. OTHER PUBLICATIONS

Annual Reports

First through Fourth - August 27, 1965 - August 27, 1968

Fifth through Sixth - July 15, 1969 - July 15, 1970

Miscellaneous

Wyoming Weather Facts
1966. Compiled by the Natural Resources Research Institute
University of Wyoming, for the Wyoming Natural Resource Board
Pages 47

State Water Planning Recommendations
1966. Prepared by Water Resources Research Institute, University of Wyoming, for the Wyoming Natural Resource Board
Pages 20

Supplement - Availability of Funds under Federal Legislation
Pages 21
Supplement - Other States' Planning Programs and State Planning Organizations Pages 35
Supplement - Planning Example - North Platte River Basin
Pages 38

Kite, Rodney C. and Willard D. Schutz
1967. The Economic Impact on Southwestern Wyoming of Recreationists Visiting Flaming Gorge Reservoir
Agricultural Experiment Station
University of Wyoming - RJ No. 11 Pages 24

Burman, R. D. and T. L. Loudon
1967. Evapotranspiration and Microclimate of Irrigated Pastures and Alfalfa Under High Altitude Conditions
Reprint from Transactions of the ASAE
Volume 11, No. 1 Pages 123-128

Clark, Richard T.
1967. Water Uses in the North Platte River Basin of Wyoming
Agricultural Experiment Station
University of Wyoming - RJ No. 4 Pages 62

Schwer, R. Keith
1967. Wyoming's Trona Industry: Its Economic Significance
Division of Business and Economic Research
University of Wyoming -
Wyoming Trade Winds No. 43 Pages 21-39

Sorensen, J. N. and R. T. Clark
1970. Marginal Value of Irrigation Water and a Case Study of Transfer in Southeastern Wyoming
Agricultural Experiment Station
University of Wyoming - Bulletin 511 Pages 42