JD. LINES

Manual Gauge

CANADA

AUTOMATED MANUAL GAUGE COMPUTATIONS

PREPARED BY: K.W. STEWART
PROGRAMMER-ANALYST

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HEAD, DATA CONTROL SECTION

DEPARTMENT OF THE ENVIRONMENT
INLAND WATERS BRANCH – WATER SURVEY OF CANADA
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INTRODUCTION

This manual has been prepared to provide the Water Survey of Canada with a set of detailed instructions to automate streamflow and water level computations for those stations which are equipped with only a manual gauge.

This MANUAL computer program has been designed to be as compatible as possible with the STREAM computer program. Therefore, many of the instructions and card formats given herein are identical to those given in the manual of "Automated Streamflow Computations", dated June 1, 1971 or the "Manual of Hydrometric Office Procedures", dated March 1, 1971. The major differences in the two programs are in the "Station Name" card and the first "Gauge Correction" card; the only additional card format is for the "Gauge Readings" card.

The MANUAL program will compute the daily mean gauge height and/or daily discharge from one to four manual gauge readings per day, and estimate by linear interpolation, the daily discharges when readings are missing. The gauge readings are keypunched "free form". If there are 2, 3 or 4 readings per day, equal weight is given to each reading to arrive at the mean gauge reading for the day. The daily mean gauge correction is applied to the daily mean gauge reading to give the daily mean gauge height which is the value that is printed on the Annual Page. The daily mean shift correction is applied to the daily mean gauge height to give the effective daily mean gauge height. This effective daily mean gauge height is used with the appropriate Stage-Discharge Table to give the daily mean discharge.

If an analog record is available for part of the year or if a graph of observed readings is drawn for a specific period it may be processed by Pencil Follower, using the STREAM computer program and producing "Updating Correction" cards for subsequent use directly in the MANUAL computer program.

The main options which are available in this program and which are coded in the "Station Name" card are as follows:

1. Four months of gauge readings per page with a maximum of four readings per day. This is always produced automatically.

2. Twelve months of data per page on a calendar year basis:

   (a) daily discharges in cfs, including monthly summaries with the total in cfs-days, the mean discharge in cfs, and the maximum and minimum daily discharges and a summary for the year or period with the mean in cfs, the total in acre-feet and the maximum and minimum daily discharges with their dates of first occurrence.

   (b) daily water levels in feet, with or without the monthly means and a summary for the year or period consisting of only the maximum and/or minimum daily water levels with their dates of first occurrence.

3. Card output of daily discharges and/or daily water levels.

4. Gauge readings in tenths, hundredths, or thousandths.

5. Plot of the annual hydrograph for daily water levels and/or daily discharges.

6. Type of data to be computed, i.e. whether water levels only or both water levels and discharges.

Therefore, as with the STREAM computer program, it is possible to obtain the two annual pages of computer printouts and to have the daily water levels and/or daily discharges and their associated symbols punched onto cards. Either these cards or the card images on magnetic tape can then be sent to Ottawa for merging with the FLOW and LEVELS files of historical data, for distribution to users or for publications.

This is the first edition of such a manual and is, of course, subject to revision as new or improved procedures are developed.

INSTRUCTIONS FOR KEYPUNCHING GAUGE READINGS

(Card Format 71-023)

Card Column(s)	
1 - 7	contain the station number, e.g. 05AA001.
8	is blank
9 - 19	contain the first date for which gauge readings are given on this card. The form of this date is as follows: columns 9-11 for the first 3 letters of the month columns 12-14, for the day, right justified columns 15-19, for the year, right justified For example, JAN 15 1971
20	is blank
21 - 80	contain the gauge readings (no symbols allowed)

See page 17 for the drum card format.

For a month with either full or partial records, punching of the data (in column 21) is to start on the first day for which a figure is given and punching is to stop on the last day of that month for which a figure is given. Up to four readings for any one day may be entered. Negative alues are permitted. The data fields (columns 21-80) are punched "free form", i.e. without right or left justification or padding. For each day, the gauge reading is followed by a + sign; however, if there is more than one reading for that day, these readings are separated by a $ sign. For the data fields for each day, all digits (including the zero in, say, 0.12) and the decimal point are punched, but not commas or blanks. Enter a 12-punch (+ sign) only, for the missing days between the terminal days for which there is a record for that month. For example, starting in col. 21, 1.22+1.23+1.24$1.25$1.26+++1.10+0.96+ indicates that the reading for the first day for that card was 1.22, and that the reading for the seventh day was 0.96, that three readings were given for the third day, and that no readings were available for the fourth and fifth days.

The gauge reading must be complete on each card, i.e. the last reading on any card should not overflow into the next card. Digits after the last 12-punch (+ sign) or the last $ sign on that card will be ignored. Therefore, if the + sign or $ sign was not entered, then completely repunch the last reading into the next card.

Symbols are not to be keypunched. They will be entered as Updating Corrections as required. This includes the symbols A,B or E and also the symbol D which may be used as an Updating Correction to indicate that the stream or lake is "dry" or that there is no water at the gauge.

The same number of decimal points must be shown for all the readings during the year for that station. The coding in column 11 of the "Station Name" card (71-021) must agree with the number of decimal places in the gauge readings.

UPDATING CORRECTIONS

(Format 70-017)

The Updating Corrections in the MANUAL program are the same as in the STREAM program except that the symbol D is allowed in the MANUAL program and not in STREAM. Therefore, "Updating Correction" cards from the STREAM program may be used in the MANUAL program, but not vice versa.

Cards in this table contain daily gauge heights and daily discharges with their respective symbols which are to override or update the daily results as computed by the MANUAL program itself. The date on which this correction is to apply is also punched on the same card with the correction(s). If the gauge height for a given day is computed manually and this is to override the MANUAL results, the discharge must also be computed manually and appear on the same card with the gauge height for the given day. It is permissible to change only the daily discharge and not the gauge height.

All symbols that are required in the output listing must be entered as Updating Corrections. To assign a symbol to the gauge height or the daily discharge it is not necessary that the gauge height or daily discharge be present on the card. The symbols which are allowed are A for manual gauge, B for ice conditions and E for estimated. The symbol D may also be used to indicate that the stream or lake is dry or that there is no water at the gauge. For "water level only" stations, the symbol E may be used, especially if this value is required for a "month-end" elevation for reservoir contents. The symbol A is not required if all computations are made from manual gauge readings. However, if part of the records were computed from a recording gauge, then the symbol A is required to identify those days.

If the same combination of updating corrections is to apply for more than one day, the range is given by inserting the first and last days of the range on the card.

All the dates entered on these cards are checked by the computer program to see if they are legitimate and also to be sure that each successive date is later (i.e. greater) than the previous date processed. If an updating correction is to be applied to one day only, the first date field of the range is entered but the last date field is left blank.

To override the gauge height or daily discharge so that the MANUAL results are dropped, and if there are no manually computed results to be inserted, it is necessary to insert -9999.99 (i.e. less than -9000.) in the gauge height or daily discharge field.

Examples:

FIRST DAY	GAUGE HEIGHT	SYMBOL	DISCHARGE	SYMBOL	LAST DAY
FEB 1 1969		D	0	B	
FEB 2 1969			0	B	APR 9 1969
MAY 3 1969	4.79		102		
JUN 15 1969	-9999.99		7.5	E	
DEC 21 1969		B		B	DEC 30 1969
DEC 31 1969			93.7	B	

In the above examples, the symbol D is entered to indicate that the stream was "dry" on February 1, 1969 and that the corresponding discharge was 0 under ice conditions. From February 2 to April 9, 1969 the daily discharges were 0 under ice conditions with no observation of "water level". For May 3, 1969 a gauge height of 4.79 feet and a discharge of 102 cfs were to update the results. For June 15, 1969 no gauge height was to be printed but a discharge of 7.5 cfs was estimated. From December 21, 1969 to December 30, 1969 the symbol B for ice conditions was to be applied to the gauge heights and the daily discharges. For December 31, 1969 a daily discharge of 93.7 cfs and the symbol B were to override any discharge results computed by the MANUAL program.

All of these "Updating Correction" cards (70-017) contain the station number in columns 1-7, the card sequence number in columns 78-80 and the symbol "UC" in columns 47-48 to signify updating corrections. The end of this Updating Correction Table is signalled by inserting an "End of Updating Correction Table" card (70-018) which contains only the station number, the symbol "UC" and the card number 999. There is no limit to the number of "Updating Correction" cards.

STAGE-DISCHARGE TABLE

(Format 68-003)

The program checks that these cards contain the same station number as the "Station Name" card (format 71-021), that their card sequence numbers are in the correct order, and that all the cards have the same table number. Additional cards may be entered into the table by placing "Sequence Reset" cards (format 68-012) before and/or after the additions.

Because these cards contain the stage and discharge figures at the end of straight line segments of the stage-discharge curve, the program builds up a table of slopes of difference in discharge divided by the difference in gauge height.

One gauge height and one discharge are punched into each card. All the cards are numbered in order of ascending gauge height (and discharge), starting at number 1 for the first card (Zero is not allowed). All the cards except the first one must contain a gauge height and a discharge that are both larger than the corresponding values punched on the previous card. The last card in the table is followed by an "End of Stage-Discharge Table" card (format 68-004).

The first and last gauge heights in the table are always punched with their corresponding discharge. For the remainder of the table the general rule is to punch only gauge heights at which the difference in discharge changes value.

Example:

Feet	cfs	Difference
2.10	10.2	
		0.3
2.20	10.5	
		0.4
2.30	10.9	
		0.5
2.40	11.4	
		0.6
2.50	12.0	
		0.6
2.60	12.6	
		0.7
2.70	13.3	
		0.7
2.80	14.0	
		0.8
2.90	14.8	
		0.8
3.00	15.6	
		0.8
3.10	16.4	

In the above example it is only necessary to punch one card for each of the following gauge heights: 2.10, 2.20, 2.30, 2.40, 2.60, 2.80 and 3.10 in that order.

The program assumes straight line segments between the points supplied. Any gauge heights that fall outside the range of the table during computations will cause error messages to be printed and the corresponding daily data to be deleted. However, there is one exception to this rule. When the discharge is to be zero below a given gauge height, the discharge on the first card has a value of zero. In this case the program will assume a discharge value of zero for all gauge heights below that first gauge height.

Example:	Feet	cfs
	0.30	0
	0.40	20.2
	0.50	50.2

In the above example, the first card contains a gauge height of 0.30 and a discharge of zero. The program will assume a discharge of zero for all gauge heights below 0.30 feet. The second card would contain a gauge height of 0.40 and a discharge of 20.2. The program will interpolate between 0 and 20.2 cfs for gauge heights between 0.30 and 0.40 feet.

It is possible that because of rounding, two or more gauge heights have the same discharge. This might happen, for example, on form R42A for the lower portion of the curve where discharges are listed every hundredth of a foot. These values must be listed in such a way that the discharge on one card is always greater than that on the previous card. This can be done by using the original unrounded figures from which the table was derived or by changing the discharge by an amount that is not significant for the station in question.

Example:	Feet	cfs (unrounded)	cfs (rounded)
	0.71	0.00	0
	0.72	0.0085	0.01
	0.73	0.0108	0.01
	0.74	0.0134	0.01
	0.75	0.0163	0.02
	0.76	0.0196	0.02
	0.77	0.0233	0.02
	0.78	0.0273	0.03

In the above example, the first card will contain a gauge height of 0.71 and a discharge of zero so that all gauge heights below 0.71 will yield a discharge of zero. It is immaterial whether the discharge on the first card is entered as "0", "0.0" or "0.00". To the program the discharge has a value of zero and it cannot distinguish between the different ways of writing zero. Because the discharges at 0.72, 0.73 and 0.74 feet are all 0.01 cfs when rounded it is necessary to enter the unrounded values.

The number of cards in the Stage-Discharge Table should be kept to a realistic minimum because the computation time is increased as the table becomes larger. At the low end of the table when discharges are small it is not necessary to try to duplicate the rounded figures which appear on form R42A. For example, if the discharges between 0.80 and 0.90 feet were obtained by interpolating to hundredths and rounded it is only necessary to punch the values of 0.80 and 0.90 feet because the program will interpolate between these values. The largest number of cards that can be included in the table varies from 150 to 250 depending upon the computer installation. This is a program constant.

An expanded Stage-Discharge Table can be printed out by putting a "1" (one) in column 12 of the "Station Name" card (format 71-021). The program prints out discharges every one hundredth of a foot for the whole range of the table. Since producing this table is time consuming it should be printed only once for each table. In subsequent computer runs with the same table, column 12 of the "Station Name" card (format 71-021) should contain a blank so that the expanded table will not be printed.

GAUGE CORRECTIONS

(Format 71-022)

This format differs from the STREAM version only in that the name of the manual gauge is entered in columns 38-75 (of the first card only) or on the "End of Gauge Correction Table" card if there are no gauge corrections. Note that the drum card skips columns 38-77 and therefore the drum card should be engaged after the gauge name has been keypunched.

All of these "Gauge Correction" cards contain the station number, the card sequence number and the symbol "GC" to signify gauge corrections.

Each "Gauge Correction" card (format 71-022) contains one correction, in feet, the date and time of day at which it applies and a card number. The cards are numbered in sequence and must be in chronological order, i.e. the date and time of day on one card must never be smaller than the time on the previous card. The maximum number of gauge correction cards allowed varies from 25 to 50 depending upon the computer installation.

The general rule is to supply the program with the value of the correction every time it changes. The program interpolates linearly between the points supplied and assumes a correction of zero up to the time of the first correction and after the time of the last correction.

Example:

0.02	1430	APR 5 1969	card 1
0.02	1100	MAY 24 1969	card 2
0.00	1100	MAY 24 1969	card 3
0.00	1300	JUL 15 1969	card 4
-0.03	930	AUG 3 1969	card 5
-0.03	0	JAN 1 1970	card 6

In the above example the gauge correction will be zero up to 14:30 on April 5, 1969. The correction will be 0.02 from then until 11:00 on May 24, 1969 at which time it will become zero and remain zero until 13:00 on July 15, 1969. From then until 9:30 on August 3, 1969 the program will compute the gauge correction by interpolating between 0.00 and -0.03 linearly with time. Between 9:30 on August 3, 1969 and 0:00 on January 1, 1970 the correction will be -0.03 and after 0:00 on January 1, 1970 the program will assume a zero correction.

If the correction is to become effective at midnight on a certain day, the time of the correction should be given as zero (0) hour of the next day, <u>not</u> as 2400 hours of that day.

The last "Gauge Correction" card (format 71-022) is followed by an "End of Gauge Correction Table" card (format 68-006) which is always the last card in the table.

If no gauge corrections are to be applied, i.e. the correction is always zero, then the "Gauge Correction" cards (format 71-022) are omitted and the only card in the table is the "End of Gauge Correction Table" card (format 68-006) which must always be present.

SHIFT CORRECTIONS

(Format 68-007)

All of these "Shift Correction" cards contain the station number, the card sequence number and the symbol "SC" to signify shift corrections.

Each "Shift Correction" card (format 68-007) contains one correction, in feet, the date and time of day at which it applies and a card number. The maximum number of shift correction cards allowed varies from 50 to 200 depending upon the computer installation.

The Shift or Backwater Correction Table is handled by the program in exactly the same way as the Gauge Correction Table and is prepared in the same fasnion (see the example for gauge corrections).

The last "Shift Correction" card (format 68-007) is followed by an "End of Shift Correction Table" card (format 68-008) which is always the last card in the table.

If no shift or backwater corrections are to be applied, i.e. the correction is always zero, then the "Shift Correction" cards (format 68-007) are omitted and the only card in the table is the "End of Shift Correction Table" card (format 68-008) which must always be present.

CARD FORMATS

In the descriptions of the card formats listed below it is assumed that all columns which are not mentioned are to be left blank. In all examples "b" stands for a blank. The various types of cards are listed in the order in which they appear in a deck set-up.

DATE CARD 68-001

Card Column(s)

1-4 contain the word "DATE".

5 is blank.

6-16 contain the date on which the data are run on the computer, e.g. JULbb6b1970 for July 6, 1970. ("b" stands for a blank). Note that the month is represented by its first three letters and that the day of the month and year are right justified in columns 11 and 16, respectively. N.B. This is the standard format for punching an alpha-numeric date, except on other types of cards it will be in a different set of columns.

STATION NAME CARD 71-021

Card Column(s)	
1-7	contain the station number.
8	contains the code to determine the type of output listing desired. blank or 2 - 12 months per page of daily discharges including monthly and annual summaries plus 12 months per page of daily water levels without the monthly and annual summaries for the period or the year. 3 - 12 months per page of daily discharges including monthly and annual summaries plus 12 months per page of daily water levels with the monthly mean water levels and the summary for the year or the period as specified in columns 17-21.
9	contains the code to determine the type of card output desired. C - updating correction cards are punched for all the days which have available data up to and including the date specified on the "Current Datum" card (70-019) in columns 70-80. 1 - water level card output only (LEVELS). 2 - daily discharge card output only (FLOW). 3 - both water level and daily discharge card output (FLOW and LEVELS).
10	is blank
11	contains the code to determine the type of station. blank - for most stations. (gauge readings in hundredths of feet). W - for a weir station. (gauge readings in thousandths of feet). T - for stations where gauge readings are expressed to tenths of feet.
12	contains the code for the stage-discharge table printout. blank - expanded Stage-Discharge Table not printed 1 - expanded Stage-Discharge Table printed.
13	is blank
14	contains the code for annual hydrograph plots. blank - no hydrographs plotted. 1 - only the water level hydrograph plot. 2 - only the discharge hydrograph plot. 3 - both the water level and the discharge hydrographs.
15	contains the code to determine the type of data to be computed. blank - both water levels and discharges. 1 - only water levels are collected.
16	contains the code for linear interpolation between the discharges. blank - missing daily discharges will be obtained by linear interpolation. 1 - missing daily discharges will not be calculated automatically.
17-18	contain the beginning month for the summary for a period of months within the year, e.g. 03 for March; if blank, the month will be assumed to be January.
19-20	contain the ending month for the summary for a period of months within the year, e.g. 10 for October; if blank the month will be assumed to be December.
21	contains the code to determine the type of water level summary for the year or period. blank - both maximum and minimum daily water levels. 1 - only the maximum daily water level. 2 - only the minimum daily water level.
22-80	contain the station name which should be centred between columns 22 and 80.

CURRENT DATUM CARD 70-019

Card Column(s)	
1-7	contain the station number.
8	is blank.
9-19	are blank.
20-69	contain the name of the current datum being used. The name should be left justified beginning in column 20.
70-80	contain the date of the last day for which updating correction cards are required. This date is used to stop the punching of updating correction cards. If this field is left blank, the program will punch updating correction cards for all the days which have data available.

OTHER DATUM CARD 70-020

Card Column(s)	
1-7	contain the station number.
8	is blank.
9-18	contain the conversion factor from the current datum to another datum, right justified.
19	is blank.
20-69	contain the name of another datum which may be of importance. This name should be left justified beginning in column 20. Note: If this other datum is not applicable both the conversion factor and the name fields should be left blank.

UPDATING CORRECTION CARDS 70-017

Card Column(s)	
1-7	contain the station number.
8	is blank.
9-19	contain the first date on which the corrections on this card are to be applied. The form of this date is as follows: columns 9-11 for the first 3 letters of the month, columns 12-14 for the day right justified, columns 15-19 for the year right justified. For example, JUN 12 1969
20	is blank.
21-30	gauge height updating correction in tenths, hundredths or thousandths of feet, if required.
31	is blank.
32	gauge height symbol, if required.
33	is blank.
34-43	daily discharge updating correction, if required. The daily discharge should be right justified if a decimal point is not punched.
44	is blank.
45	daily discharge symbol, if required.
46	is blank.
47-48	contain the letters "UC" which stand for updating correction.
49	is blank.
50-60	contain the last date on which the corrections on this card are to be applied. The form of this date is again month, day and then year.
61-77	are blank.
78-80	card sequence number right justified in column 80. The first card in the table must be card no. 1.

END OF UPDATING CORRECTION TABLE CARD 70-018

Card Column(s)

1-7	contain the station number.
8-46	are blank.
47-48	contain the letters "UC".
49-77	are blank.
78-80	contain 999. A card sequence number of 999 signals the end of the updating correction table.

Note: This card must always be present even if there are no updating corrections.

STAGE-DISCHARGE CARDS 68-003

Card Column(s)

1-7	contain the station number, e.g. 05AB003.
8	is blank.
9-16	contain the stage in feet. If the figure contains a decimal, the decimal point must be punched. If the figure does not contain a decimal, it must be right justified.
17-27	contain the discharge in cfs. The rules regarding decimals and right justification apply to both discharge and stage figures.
28	is blank.
29-31	contain the number of the Stage-Discharge Table right justified.
32	is blank.
33-43	contain the date of the Stage-Discharge Table, e.g. APRb10b1970 for April 10, 1970. Note that the month is represented by its first three letters and that the day of the month and the year are right justified in columns 38 and 43 respectively.
44-76	are blank.
77-80	contain the card sequence number right justified in column 80. The first card in the table is card no. 1.

END OF STAGE-DISCHARGE TABLE CARD 68-004

Card Column(s)

1-7	contain the station number.
8-28	are blank.
29-43	same as for the "Stage-Discharge" card (68-003)
44-77	are blank.
78-80	contain "999". This is the code which signals the end of the table.

GAUGE CORRECTION CARDS 71-022

Card Column(s)	
1-7	contain the station number, e.g. 05AB003.
8	is blank.
9-16	contain the gauge correction in feet. If the correction is minus, the sign must be punched; if positive, no sign is punched. When the correction contains a decimal point, the decimal must be punched. The figure must be right justified in column 16 if there is no decimal point.
17	is blank.
18-19	contain the hour of the day in which the correction is to be applied, i.e. 09 for 9 a.m. Note that the 24-hour clock is used. If columns 18 and 19 are left blank it is the same as if they contained 00.
20-21	contain the minute of the hour in which the correction is to be applied. If the minute is 00, columns 20 and 21 may be left blank.
22	is blank.
23-33	contain the date on which the correction is to be applied, e.g. SEPbb6b1970 for September 6, 1970.
34	is blank.
35-36	contain the letters "GC" which stand for gauge correction.
37	is blank.
38-75	contain the name of the manual gauge for which readings are given, e.g. staff, cantilever, wire weight, etc.
76-77	are blank
78-80	card sequence number right justified in column 80. The first card in the table is card no. 1.

END OF GAUGE CORRECTION TABLE CARD 68-006

Card Column(s)	
1-7	contain the station number.
8-34	are blank.
35-36	contain the letters "GC".
37-77	are blank.
78-80	contain 999. This code signals the end of the table. N.B. This card must always be used, even if there are no gauge corrections.

SHIFT CORRECTION CARDS 68-007

Card Column(s)	
1-34	contain information concerning shift corrections in the same format as for gauge corrections (format 71-022). Therefore, refer to the description of Gauge Correction cards substituting the word shift for gauge.
35-36	contain the letters "SC" which stand for shift correction.
37-80	similar to gauge corrections (format 71-022).

END OF SHIFT CORRECTION TABLE CARD 68-008

Card Column(s)	
1-7	contain the station number.
8-34	are blank.
35-36	contain the letters "SC".
37-77	are blank.
78-80	contain 999. This code signals the end of the table. N.B. This card must always be used, even if there are no shift corrections.

GAUGE READINGS CARDS 71-023

Card Column(s)

1-7	contain the station number, e.g. 05AB003.
8	is blank.
9-19	contain the date on which the first gauge reading is available for that month, e.g. JULb11b1970.
20	is blank.
21-80	contain the gauge readings

SEQUENCE RESET CARD 68-012

Card Column(s)

1-7	contain the station number, e.g. 05AB003.
8-75	are blank.
76	contains the letter "R" (for reset card).
77-80	contain the sequence number of the card which follows immediately. In other words, the program will expect tne next card to bear the same sequence number as this card. It is used to reset the card sequence number and will save repunching cards when a sequence error is detected.

Note: This reset card can be used with any of tne following types of cards: "Updating Correction" card (format 70-017), "Stage-Discharge" card (format 68-003), "Gauge Correction" card (format 71-022), "Shift Correction" card (format 68-007).

END OF READINGS...97 CARD 68-013

Card Column(s)

1-2	contain the number "97".
3-4	are blank.
5-7	contain the initials of the person responsible for the computations.
8-80	are blank.

END OF STATION...98 CARD 68-014

Card Column(s)

1-2	contain the number "98".
3-80	are blank.

END OF RUN...99 CARD 68-015

Card Column(s)

1-2	contain the number "99".
3-80	are blank.

DRUM CARDS

In the drum cards the punches 12, 11, 0 and 1 control the standard functions. The four functions are as follows:

12 punch for field definition; that is, continuation of a skip or a duplicate,
11 punch to initiate automatic skipping,
0 punch to initiate automatic duplicating,
1 punch for the alphabetic shift.

The Gauge Readings drum card can be used as an example to illustrate these functions. With the drum card engaged, the Card Punch keyboard puncnes numeric data unless alphabetic data are specified. Thus, with 1-punches in columns 3-4 and 9-11, it is not necessary to suppress the alphabetic key while punching the station number and month. The 0-punch in column 1 initiates the duplication of the station number and with a 12-punch in columns 2-7, the duplicating continues to the end of tne station number in column 7. Column 8 is not duplicated because it does not contain a 12-punch. The 11-punch in columns 8, 12, 15 and 20 will cause the Card Punch to skip these columns and to leave them blank.

When any one of these 4 drum cards is being used the Card Punch setup is always the same: AUTO SKIP DUP toggle switch OFF and AUTO FEED and PRINT switches ON. With the AUTO SKIP DUP switch OFF the drum card can only properly select numeric from alphabetic characters and can not skip a column or duplicate information automatically. Thus, while the first card is being punched manually, the AUTO SKIP DUP toggle switch is turned ON for each of these 4 applications.

To summarize, the AUTO SKIP DUP toggle switch is turned ON within the first card when:

- the Gauge Readings drum card is in column 8 after the station number has been entered.
- the Updating Correction Table drum card is in column 61 after the last date has been punched.
- the Stage-Discharge Table drum card is in column 44 after the year of the table has been entered.
- the Gauge Correction Table drun card is in column 76 after the name of the manual gauge has been entered.
- the Shift Correction Table drum card is in column 37 after the SC has been entered.

UPDATING CORRECTION TABLE DRUM CARD

Card Column(s)	Punches	
1	0	(zero)
2	12	(+ sign)
3-4	12-1	(letter A)
5-7	12	(+ sign)
8	11	(- sign)
9-11	1	
12	11	(- sign)
13-14	blank	
15	11	(- sign)
16-19	blank	
20	11	(- sign)
21-30	blank	
31	11	(- sign)
32	1	
33	11	(- sign)
34-43	blank	
44	11	(- sign)
45	1	
46	11	(- sign)
47	0-1	(/)
48	12-1	(letter A)
49	11	(- sign)
50-52	1	
53	11	(- sign)
54-55	blank	
56	11	(- sign)
57-60	blank	
61	11	(- sign)
62-77	12	(+ sign)
78-80	blank	

STAGE-DISCHARGE TABLE DRUM CARD

Card Column(s)	Punches	
1	0	(zero)
2	12	(+ sign)
3-4	12-1	(letter A)
5-7	12	(+ sign)
8	11	(- sign)
9-16	blank for the gauge height	
17-27	blank for the discharge	
28	11	(- sign)
29	0-1	(/)
30-31	12	(+ sign)
32-36	12-1	(letter A)
37-38	12	(+ sign)
39	12-1	(letter A)
40-43	12	(+ sign)
44	11	(- sign)
45-77	12	(+ sign)
78-80	blank	

Stage-Discharge Tables numbered less than 10 using this Drum Card must be recorded as two digits, (e.g. 02 for table number 2). Similarly, all the days of the month must be coded with two digits, (e.g. May 06 for May 6). If a decimal point consistently occurs in the same column a zero can be inserted in this column of the drum card so that once the decimal point is punched on the first card, it will thereafter be duplicated automatically. For instance if all the gauge heights on the stage-discharge cards were in tenths of feet, then a zero could be inserted on the drum card in column 15 to duplicate the decimal point.

GAUGE/SHIFT CORRECTION TABLE DRUM CARD

Card Column(s)	Punches	
1	0	(zero)
2	12	(+ sign)
3-4	12-1	(letter A)
5-7	12	(+ sign)
8	11	(- sign)
9-10	12	(+ sign)
11-13	blank for the correction in feet	
14	0	(zero)
15-16	blank	
17	11	(- sign)
18-21	blank	
22	11	(- sign)
23-25	1	
26	11	(- sign)
27-28	blank	
29	11	(- sign)
30-33	blank	
34	11	(- sign)
35	0-1	(/)
36	12-1	(letter A)
37	11	(- sign)
38-77	12	(+ sign)
78-80	blank	

The gauge or shift corrections punched using this drum card are in hundredths of feet with the decimal point in column 14 duplicated automatically and with up to three digits before the decimal. If three digits are not enough the 12-punches (+ sign) in columns 9 and 10 can be removed.

When using the MANUAL program, the Gauge Correction Table drum card is engaged after the name of the manual gauge has been entered in columns 38-75 on the first card. After this drum card is engaged the AUTO SKIP DUP, AUTO FEED and AUTO PRINT toggle switches must be in the ON position.

GAUGE READING DRUM CARD

Card Column(s)	Punches	
1	0	(zero)
2	12	(+ sign)
3-4	12-1	(letter A)
5-7	12	(+ sign)
8	11	(- sign)
9-11	1	
12	11	(- sign)
13-14	blank	
15	11	(- sign)
16-19	blank	
20	11	(- sign)
21-80	blank	

If the year is constant for the gauge readings, drum card columns 16-19 may be punched as 0+++ to duplicate the year on successive cards.

PREPARING DATA FOR A COMPUTER RUN

The program will process any number of stations in a single computer run. The data for each station can cover several years of record.

Figure 1 shows how the data for each station are arranged. The cards are placed in the following order:

1. Station Name Card (71-021)

This card follows either the "Date" card (68-001) or an "End of Station ...98" card (68-014). The station number and name on this card are assumed to be correct. If the station number is in fact wrong, then the program will assume that all cards with a different station number (e.g. the correct one) are incorrect. The program assumes that this card is followed by the "Current Datum" card (70-019).

2. Current Datum Card (70-019)

3. Other Datum Card (70-020)

4. Updating Correction Table

If there are any updating corrections the first "Updating Correction" card (70-017) always follows the "Other Datum" Card (70-020). The program will continue to read cards and expect them to be "Updating Correction" cards (70-017) until an "End of Updating Correction Table" card (70-018) is detected. If this card is missing all the following cards will be read and interpreted as "Updating Correction" cards.

The "End of Updating Correction Table" card (70-018) follows either the last "Updating Correction" card when there are updating corrections to be applied, or the "Other Datum" card (70-020) when there are no updating corrections.

5. Stage-Discharge Table

The first "Stage-Discharge" card (68-003) always follows the "End of Updating Correction Table" card (70-018). The program will keep expecting "Stage-Discharge" cards (68-003) until the "End of Stage-Discharge Table" card (68-004) is found. Should that card be missing the program will keep on reading cards expecting them to be "Stage-Discharge" cards (68-003).

The "End of Stage-Discharge Table" card (68-004) always follows the last "Stage-Discharge" card (68-003) in the table and it is followed by either a "Gauge Correction" card (71-022) when there are gauge corrections, or by an "End of Gauge Correction Table" card (68-006) when there are no gauge corrections.

These cards are not required for stations for which only water leval data are being computed.

6. Gauge Correction Table

If there are gauge corrections the first "Gauge Correction" card (71-022) always follows the "End of Stage-Discharge Table" card (68-004). The program will keep expecting "Gauge Correction cards (71-022) until the "End of Gauge Correction Table" card (68-006) is found. Should that card be missing the program will keep on reading cards expecting them to be "Gauge Correction" cards (71-022).

The "End of Gauge Correction Table" card (68-006) follows either the last "Gauge Correction" card (71-022) when there are gauge corrections, or the "End of Stage-Discharge Table" card (68-004) when there are no gauge corrections. It is followed by either a "Shift Correction" card (68-007) when there are shift corrections, or by an "End of Shift Correction Table" card (68-008) when there are no shift corrections.

7. Shift or Backwater Correction Table

If there are shift corrections the first "Shift Correction" card (68-007) always follows the "End of Gauge Correction Table" card (68-006). The program will keep expecting "Shift Correction" cards (68-007) until the "End of Shift Correction Table" card (68-008) is found. Should that card be missing the program will keep on reading cards expecting them to be "Shift Correction" cards (68-007).

The "End of Shift Correction Table" card (68-008) follows either the last "Shift Correction" card (68-007) when there are shift corrections, or the "End of Gauge Correction Table" card (68-006) when there are no shift corrections.

These cards are not required for stations for which only water level data are being computed.

8. A "Sequence Reset" card (68-012) does not influence the control of the program. It simply resets the card count and goes back to reading the same type of card it was expecting when the "Sequence Reset" card (68-012) was read.

9. Gauge Readings Deck

The above mentioned tables are followed by the gauge readings deck. These cards are followed by an "End of Readings...97" card (68-013).

10. The "End of Station...98" card (68-014) always follows an "End of Readings...97" card (68-013) which is then always followed by the "Station Name" card (71-021) for the next station to be processed.

The "End of Run...99" card (68-015) follows the "End of Readings...97" card (68-013) if this is the last station to be run and is always the last card of the input data deck to the program.

Figure 2 shows how the data are arranged for the computer run. The cards are placed in the following order:

(a) Computing Centre Control Cards

These cards retrieve the "MANUAL" program from disk or drum storage and give it control to read the following cards.

(b) Date Card (68-001)

This card contains the current date and is used to date the listings. It is punched just before the data are sent for a computer run.

(c) Station Decks

The "Date" card (68-001) is followed by a number of station decks. Each of these decks is arranged as described above. Every station deck except the last station deck of the run is followed by an "End of Station...98" card (68-014). This card indicates to the program that this is the end of the station deck just read and that another station deck follows.

(d) End of Run...99

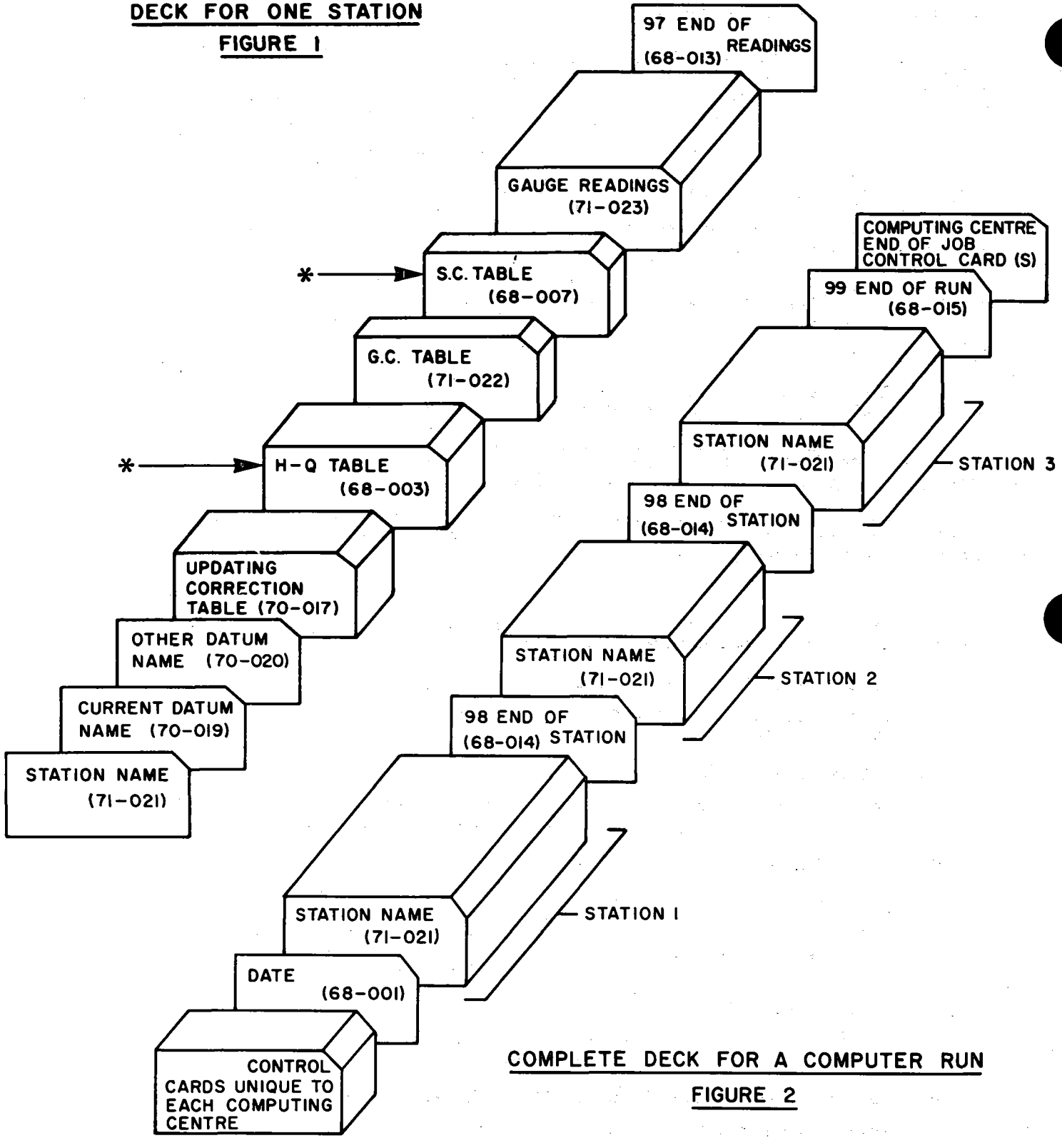
The "End of Run...99" card (68-015) indicates the end of the last station deck and the end of the computer run.

(e) Computing Centre End of Job Control Card(s)

This card(s) terminates the computer run.

DECK FOR ONE STATION

FIGURE 1



COMPLETE DECK FOR A COMPUTER RUN

FIGURE 2

OUTPUT LISTING

Every page is printed with the standard page heading which contains the Division name, current date, page number, location of the District Office, and the station name and number from the "Station Name" card (71-021). The current date, that is, the date of the computer run is obtained from the "Date" card (68-001).

Two types of output listings of data are available from this program. They are the three months per page printout of gauge readings and the annual page printout of daily water levels and/or daily discharges. The selection of this is made on the "Station Name" card (format 71-021). The printout with 3 months of gauge readings per page will always be given. The type of annual page printout is optional.

The material printed on the output listings will now be described in the order in which it appears.

1. Name of the Current Datum

This name is taken from the "Current Datum" card (70-019) and is printed without any modification.

2. Name of the Other Datum

If another datum is desired, the name of this other datum and the factor to convert from the current datum are printed. If the conversion factor is left blank then the name of the other datum will not be printed.

3. Updating Correction Table

One line is printed for each "Updating Correction" card (format 70-017) showing the card number, the first day of the correction, the updating gauge height and its symbol, the updating daily discharge and its symbol and the last day of the correction. The "End of Updating Correction Table" card (format 70-018) causes the message "END OF TABLE" to be printed.

If there are no updating corrections and thus only the "End of Updating Correction Table" card is present, then the message "NONE" is printed.

4. Stage-Discharge Table

The table number and the date on which it was prepared are printed first followed by the first and last card (format 68-003) of the Stage-Discharge Table. The card number, the gauge height and the discharge are printed for both of these cards. The "End of Stage-Discharge Table" card (format 68-004) causes the message "END OF TABLE" to be printed.

5. Gauge Corrections

One line is printed for each "Gauge Correction" card (format 71-022) showing the type of manual gauge, the card number, the date, the time of day and the correction. The "End of Gauge Correction Table" card (format 68-006) causes the message "END OF TABLE" to be printed.

If there are no gauge corrections and only the "End of Gauge Correction Table" card is present, then the message "NONE" is printed.

LODGE CREEK AT PALMER RAPIDS

STATION NO. 11AB082

WATER LEVELS ARE REFERRED TO AN ASSUMED DATUM

ADD 1064.58 FEET TO CONVERT TO GSC DATUM

UPDATING CORRECTIONS TO THE GAUGE HEIGHTS AND DISCHARGES

CARD NO.	FIRST DAY GAUGE HEIGHT	SYMBOL	DISCHARGE	SYMBOL	LAST DAY
1	JAN 1 1965			B	APR 6 1965
2	OCT 6 1965		D		

END OF TABLE

STAGE-DISCHARGE TABLE NO. 5 DATED NOV 19 1965

CARD NO.	FEET	CFS
1	3.000	0.000
122	12.700	2400.000

END OF TABLE

GAUGE CORRECTIONS FOR THE WIRE WEIGHT GAUGE

CARD NO.	DATE	TIME	FEET
1	JAN 1 1965	-0--0	-.030
2	JAN 1 1966	-0--0	-.010

END OF TABLE

SHIFT OR BACKWATER CORRECTIONS

CARD NO.	DATE	TIME	FEET
1	JUL 29 1965	-0--0	.030
2	SEP 3 1965	12--0	-.050
3	SEP 22 1965	12--0	0.000

END OF TABLE

ERRORS IN THE GAUGE READINGS

NONE

COMPUTED BY KWS

LODGE CREEK AT PALMER RAPIDS

STATION NO. 11AB082

READINGS IN FEET FOR THE WIRE WEIGHT GAUGE

DAY	APR 1965				DAY	MAY 1965				DAY	JUN 1965				DAY
1	4.25				1	6.15				1	3.67	3.64			1
2	5.32				2					2	3.62	3.62			2
3	5.27				3	5.24				3	3.59	3.56			3
4	4.32				4					4	3.55	3.54			4
5	4.34				5	4.89				5	3.54	3.52			5
6	4.35				6					6	3.52	3.50			6
7	4.35				7	4.47				7	3.51	3.49			7
8	4.58				8					8	3.47	3.48			8
9	4.60	4.61	4.75	4.70	9	4.23				9	3.49	3.47			9
10	4.61				10					10	3.45	3.44			10
11	4.64				11	4.12				11	3.43	3.40			11
12	4.70				12					12	3.38	3.58			12
13	4.75				13	4.18				13	4.47	3.81			13
14	5.56				14					14	3.62	3.94			14
15	5.97				15	3.93				15	4.22	4.07			15
16	6.15				16					16	3.84	3.74			16
17	6.27				17	3.75				17	3.71	3.76			17
18	6.43				18					18	4.31	4.87			18
19					19	3.69				19	4.67	4.63			19
20	6.53				20					20	4.97	4.09			20
21	6.66				21	3.68				21	4.28	4.10			21
22	6.84				22					22	3.99	3.91			22
23	6.93	6.94	7.02		23	3.70				23	3.89	3.79			23
24	7.17				24					24	3.73	3.70			24
25	7.38				25	3.74				25	4.00	10.84			25
26	7.59				26					26	11.80	10.94			26
27	7.64				27	3.83				27	10.57	8.84			27
28	7.81				28					28	8.05	7.62			28
29	7.95				29	3.96				29	5.95	5.55			29
30	8.05	8.07			30					30	5.27	5.12			30
31					31	3.72				31					31

6. Shift or Backwater Corrections

One line is printed for each "Shift Correction" card (format 68-007) showing the card number, the date, the time of day and the correction. The "End of Shift Correction Table" card (format 68-008) causes the message "END OF TABLE" to be printed.

If there are no shift corrections and only the "End of Shift Correction Table" card (format 68-008) is present, then the message "NONE" is printed.

7. Errors in the Gauge Readings

Any keypunching errors on the "Gauge Readings" cards (71-023) are listed within this section. If there are no errors the message "NONE" is printed.

The initials of the person who prepared or computed the input data will be given as follows: Computed by ABC. This is obtained from the "END OF READINGS ... 97 CARD" (68-013).

8. Expanded Stage-Discharge Table

This table is optional and is only printed out if the "Station Name" card (format 71-021) has a "1" (one) is column 12.

Discharges in cfs are printed for every one hundredth (0.01) of a foot for the whole range of the Stage-Discharge Table. There are ten discharges per line and if some of these values fall outside the range of the table the program fills in the line by putting "-9999.99" instead of a discharge.

9. Three Months of Gauge Readings per Page

This is always produced automatically. The station name and number and the type of manual gauge are given in the heading.

The Gauge Readings page consists of a maximum of three readings per day with four months per page. A maximum of seven spaces, including the decimal point, has been allowed for the reading. Negative values are allowed. The readings are given in feet and will be expressed to the same number of decimal places for the entire year; this is given in column 11 of the "Station Name" card (71-021).

If there had been a keypunching error for any reading this will be identified by seven asterisks and a footnote. To correct such an error or to insert a missing reading, either the entire card must be re-keypunched or correct values submitted as Updating Corrections. An appropriate note must be made on the Gauge Readings page.

10. Annual Page of Water Levels

This page and the annual page of daily discharges will be obtained from the code of "2" or "3" in column 8 of the "Station Name" card (71-021). This page contains all the daily water levels for up to one year together with the appropriate symbols. Days for which results are not available for any reason are blank filled. Similarly, days which are not applicable for a particular month such as November 31 are blank filled. For most stations these water levels are printed to two decimal places but for weir stations they are printed to three decimal places; water levels for some stations are given in tenths of feet.

An appropriate reference is given in a footnote for the symbols which have appeared on this page. The only symbols allowed are A, B and E. The symbol D may have been entered as an Updating Correcting to indicate that the stream or lake is dry or that there is no water at the gauge. This is shown as "DRY" on the water levels page.

LODGE CREEK AT PALMER RAPIDS

STATION NO. 11AB082

(PRELIMINARY) DAILY WATER LEVEL IN FEET FOR 1965

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	5.10	5.50	4.87	4.22	6.13	3.64	3.84	4.69	5.55	4.22	4.51		1
2	5.11	5.48	4.83	5.30		3.60	3.84	4.70	5.56	3.46	4.53	5.19	2
3	5.12	5.48	4.81	5.25	5.22	3.56	4.42	4.70	5.56	3.44	5.09	5.15	3
4	5.12	5.18	4.75	4.30		3.53	4.42	4.70	5.58	3.20	5.11	5.13	4
5	5.10	5.27	4.75	4.32	4.87	3.51	4.42	5.29	4.24		5.07	3.90	5
6	5.36	5.29	4.71	4.33		3.49	4.40	5.31	4.23	DRY	5.06	3.93	6
7	5.38	4.98	4.65	4.33	4.45	3.48	4.40	5.32	4.18		5.08	3.95	7
8	5.42	5.07	4.65	4.56		3.46	4.39	4.99	4.15	2.89		5.21	8
9	5.74	5.12	4.60	4.65	4.21	3.46	4.39	4.98	4.18	3.41	5.06	5.21	9
10	5.79	4.69	4.59	4.59		3.43	4.39	4.96	4.21	4.60	5.00	5.21	10
11	5.74	4.70	4.56	4.62	4.10	3.40	3.93	5.83	4.20	4.60	5.03	5.20	11
12	5.70	4.70	4.52	4.68		3.46	3.93	6.06	4.19	4.59	5.04	5.20	12
13		4.70	4.50	4.73	4.16	4.12	3.91	6.06	4.20	4.57	5.06	5.21	13
14		4.75	4.48	5.54		3.76	3.92	6.03	4.20	4.58	4.66	5.21	14
15		4.75	4.44	5.95	3.91	4.13	3.94	5.00	4.19	4.58	4.67	5.72	15
16		4.74	4.42	6.13		3.77	3.93	4.94	4.20	4.58	4.68	5.75	16
17		5.49	4.39	6.25	3.73	3.72	4.67	4.89	4.18	4.57	5.10	5.75	17
18		5.47	4.36	6.41		4.57	4.67	4.87	4.18	4.58	5.09	5.76	18
19		5.42	4.35		3.67	4.63	4.67	5.45	4.18	4.55	5.07	5.77	19
20		5.15	4.33	6.51		4.51	4.71	5.50	4.17	4.55	5.06	5.76	20
21		5.17	4.28	6.64	3.66	4.17	5.03	5.52	4.14	4.55	5.06	5.73	21
22		5.14	4.23	6.82		3.93	7.51	5.51	4.16	4.56	5.12	5.73	22
23		5.15	4.23	6.94	3.68	3.82	7.62	5.48	4.18	4.54		5.69	23
24	6.13	5.07	4.74	7.15		3.70	7.78	5.47	4.20	4.54		5.72	24
25	6.13	5.04	5.02	7.36	3.72	7.40	7.76	5.46	4.22	4.54		5.72	25
26	6.15	5.01	5.43	7.57		11.35	7.66	5.46	4.22	4.54		5.72	26
27	6.14	4.97	4.19	7.62	3.81	9.69	7.53	5.47	4.22	5.17		5.71	27
28	6.13	4.93	4.18	7.79		7.82	7.41	5.48	4.22	5.15		5.69	28
29	5.55		4.19	7.93	3.94	5.73	6.81	5.48	4.23	4.49		5.66	29
30	5.51		4.20	8.04		5.18	6.25	5.50	4.23	4.50		5.65	30
31	5.50		4.20		3.70		5.63	5.53		4.52		5.63	31
MEAN		5.09	4.53			4.60	5.23	5.31	4.38				MEAN

SUMMARY FOR THE YEAR 1965

MAXIMUM DAILY WATER LEVEL, 11.35 FEET ON JUN 26

MINIMUM DAILY WATER LEVEL, DRY ON OCT 6

WATER LEVELS ARE REFERRED TO AN ASSUMED DATUM

ADD 1064.58 FEET TO CONVERT TO GSC DATUM

LODGE CREEK AT PALMER RAPIDS

STATION NO. 11AB082

(PRELIMINARY) DAILY DISCHARGE IN CUBIC FEET PER SECOND FOR 1965

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	134 B	194 B	106 B	44.9 B	297	11.6	20.9	89.1	194	44.9	69.6	147 E	1
2	136 B	191 B	101 B	164 B	225 E	9.8	20.9	90.1	196	4.9	71.5	148	2
3	137 B	191 B	99.3 B	157 B	152	8.2	61.3	90.1	196	4.3	133	142	3
4	137 B	146 B	93.1 B	51.2 B	129 E	7.1	61.3	90.1	199	.40	136	139	4
5	134 B	160 B	93.1 B	52.8 B	106	6.4	61.3	164	43.4	.30 E	130	24.0	5
6	173 B	163 B	89.1 B	53.6 B	85.0 E	5.8	59.6	167	42.7	0	128	25.7	6
7	176 B	117 B	83.1 B	53.6	64.0	5.5	59.6	169	39.1	.10 E	131	26.9	7
8	182 B	130 B	83.1 B	74.4	54.1 E	4.9	58.7	119	37.0	0	130 E	151	8
9	231 B	137 B	78.2 B	83.1	44.2	4.9	58.7	117	39.8	3.5	128	151	9
10	239 B	87.1 B	77.3 B	77.3	40.3 E	4.0	58.7	115	41.9	78.2	119	151	10
11	231 B	88.1 B	74.4 B	80.2	36.3	3.3	25.7	246	41.2	78.2	124	149	11
12	225 B	88.1 B	70.6 B	86.1	38.4 E	4.9	25.7	285	40.5	77.3	125	149	12
13	231 B	88.1 B	68.7 B	91.1	40.5	37.7	24.6	285	41.9	75.4	128	151	13
14	237 B	93.1 B	66.8 B	200	32.6 E	16.9	25.2	278	41.9	76.3	84.1	151	14
15	243 B	93.1 B	63.1 B	267	24.6	38.4	26.3	118	41.2	76.3	85.1	228	15
16	249 B	92.1 B	61.3 B	297	20.1 E	17.4	25.7	112	41.9	76.3	86.1	233	16
17	255 B	193 B	58.7 B	318	15.5	15.1	85.1	107	41.2	75.4	134	233	17
18	261 B	190 B	56.1 B	347	14.2 E	75.4	85.1	105	41.2	76.3	133	235	18
19	267 B	182 B	55.2 B	357 E	12.9	81.1	85.1	184	41.2	73.5	130	236	19
20	273 B	142 B	53.6 B	366	12.7 E	69.6	89.1	191	40.5	73.5	128	235	20
21	279 B	145 B	49.6 B	391	12.4	41.2	124	194	39.1	73.5	128	230	21
22	285 B	140 B	45.6 B	426	12.9 E	25.7	570	193	40.5	74.4	137	230	22
23	291 B	142 B	45.6 B	450	13.3	19.9	595	187	41.9	72.5	138 E	223	23
24	297 B	130 B	92.1 B	493	14.2 E	14.2	631	185	43.4	72.5	139 E	228	24
25	297 B	125 B	122 B	537	15.1	546	627	184	44.9	72.5	140 E	228	25
26	301 B	121 B	184 B	583	17.3 E	1830	604	184	44.9	72.5	141 E	228	26
27	299 B	116 B	42.7 B	595	19.4	1200	575	185	44.9	145	143 E	227	27
28	297 B	112 B	41.9 B	634	22.9 E	641	548	185	44.9	142	144 E	223	28
29	202 B		42.7 B	666	26.3	230	430	185	45.6	67.7	145 E	219	29
30	196 B		43.4 B	693	20.3 E	146	323	188	45.6	68.7	146 E	217	30
31	194 B		43.4 B		14.2		217	193		70.6		214	31
TOTAL	7089	3796.7	2284.8	8689.3	1632.7	5122.0	6262.6	5184.4	1877.3	1827.00	3734.4	5572.6	TOTAL
MEAN	229	136	73.7	290	52.7	171	202	167	62.6	58.9	124	180	MEAN
AC-FT	14100	7530	4530	17200	3240	10200	12400	10300	3720	3620	7410	11100	AC-FT
MAX	301	194	184	693	297	1830	631	285	199	145	146	236	MAX
MIN	134	87.1	41.9	44.9	12.4	3.3	20.9	89.1	37.0	0	69.6	24.0	MIN

SUMMARY FOR THE YEAR 1965

MEAN DISCHARGE, 145 CFS
TOTAL DISCHARGE, 105000 AC-FT
MAXIMUM DAILY DISCHARGE, 1830 CFS ON JUN 26
MINIMUM DAILY DISCHARGE, 0 CFS ON OCT 6

B-ICE CONDITIONS
E-ESTIMATED

10. Annual Page of Water Levels (continued)

Following the daily water levels, the monthly mean water levels are optional for the complete months. A summary for the period or year is also optional. This gives the maximum and the minimum daily water levels and their dates of first occurrence. To obtain the monthly mean water levels and the summary for the period or year a code of "3" is punched in column 8 of the "Station Name" card (71-021). The period of months is specified in columns 17-20, and if only the maximum or only the minimum water level is to be printed, this is coded in column 21. If a code is not given, the annual page of daily water levels and daily discharges are obtained assuming the code of "2" in column 8 of the "Station Name" card.

A line for the manual entry of the Maximum Instantaneous Water Level is not given as with the STREAM program because this value usually is not available for stations equipped with only a manual gauge. However, if such a value is available from say a graph of observed readings, this will have to be entered by hand on this page.

The name of the current datum to which these water levels are referred is printed at the bottom of the page with the name of one other datum and the conversion factor, if applicable.

11. Annual Page of Daily Discharges

This page is obtained with the annual page of water levels by punching a code of "2" or "3" in column 8 of the "Station Name" card, and contains all the daily discharges and their symbols for up to one year. For the complete months the non-rounded total in cfs-days, the rounded mean in cfs and the maximum and the minimum rounded daily discharges are printed. The daily discharges and their summary for the month are lined up within each month according to the position of the decimal point in the results. If very large numbers and very small numbers appear within the same month, the small numbers are right justified and if the large numbers contain too many digits to allow lining up, then they are shifted to the right by one position or in the worst case by two positions. A footnote is printed in the lower right hand corner of this page to denote the meaning of the daily discharge symbols which appear on this page. Only the three symbols A, B and E are allowed.

If four or more complete consecutive months are available, a summary for the period or possibly for the year is printed. This summary for the period or the year contains the rounded mean discharge in cfs, the total discharge in acre-feet, and the maximum and the minimum daily discharge and their dates of first occurrence.

As for the "Water level page", the line for the Maximum Instantaneous Discharge must be entered by hand, if applicable.

12. Error Messages

Most error messages and warnings will be printed immediately when the condition is detected by the program. There is one exception: error message (36) "OUTSIDE THE RANGE OF THE STAGE-DISCHARGE TABLE". This message is always printed on a separate page, after the annual page containing the daily discharge data.

OUTPUT CARDS

To allow the program to handle two or more Stage-Discharge Tables within the same year and thus have a complete year on the annual page, it is possible to have "Updating Correction" cards (70-017) punched by the computer program itself. These cards can be obtained by putting a "C" (for corrections) in column 9 of the "Station Name" card (71-021). If only part of the available data are to be punched out, then the date of the last required day is entered in columns 70 to 80 of the "Current Datum" card (70-019). Thus, it is possible to have all the data, as computed with one Stage-Discharge Table, punched out onto cards on a given computer run. Then these "Updating Correction" cards and the next Stage-Discharge Table with its gauge readings are submitted and the program is able to join these two sources of data into one and, if desired, produce a complete annual page. For example, Stage-Discharge Table No. 2 is to be applied up to April 12, 1970 and No. 3 is to be applied from April 13, 1970 to the end of the year. To handle this situation, the following steps are involved. First, process all the gauge readings up to April 12, 1970 using table No. 2 but have updating corrections punched up to and including April 12, 1970. Now insert these Updating Correction cards with table No. 3 and all its gauge readings from April 13 onward and resubmit the deck for processing. In this manner, it is possible to process a station with any number of Stage-Discharge Tables within a year and still obtain the complete annual page. The number of "Updating Correction" cards will simply increase in number for each successive computer run.

At the end of the year when the final annual page listing is being prepared, it is possible to have these water levels and/or daily discharges and their symbols punched out onto cards which will be sent to Ottawa to update the LEVELS and the FLOW files respectively. The selection of these output cards, which we shall call LEVELS and FLOW cards respectively, is made on the "Station Name" card (format 71-021). The daily values on these cards are packed to eliminate blanks and are separted by a plus sign, "+". The card format is as follows:

Card Column(s)

1 :	type of record indicator, 1 for discharges in cfs and 4 for water levels in hundredths of feet. 5 for water levels in tenths of feet.
2 :	district codes, 2 - Vancouver 6 - Montreal 3 - Calgary 7 - Halifax 4 - Winnipeg 8 - Regina 5 - Guelph
3-9 :	station number.
10-17:	date of the first water level or daily discharge beginning in column 21. 10-12 three digit year, i.e. 969 for 1969. 13-15 alphabetic month, i.e. SEP for September. 16-17 numeric day of the month, i.e. 03 for the third day.
18-20:	blanks.
21-80:	the daily data, either water levels or discharges together with their symbols in a "free form" packed format. The values for each day are separated by a plus sign, "+".

Sample LEVELS and FLOW Output Cards

Examples of the LEVELS, water level, output cards are as follows:

```
4305CJ003969JUN 1  1.95+2.11+2.20+2.17+2.15+2.14+2.16+2.54+2.73+2.72+2.68+2.72+

4305CJ003969JUN13  2.72+3.13+3.53+3.55+3.26+2.78+2.75+2.75+2.72+2.74+2.74+3.17+

4305CJ003969JUN25  3.28E+2.42+1.85+1.83E+1.78+1.78+
```

The first card contains the daily water levels from June 1, 1969 to June 12, 1969. Similarly June 13-24 of 1969 are on the second card in the example and June 25-30 of 1969 are on the third card. The water levels on June 25 and 28, 1969 were estimated as noted by the symbol E.

Examples of the FLOW, daily discharge, output cards are as follows:

```
1305CJ003969JUN16  917+1120+956+939+939+926+937+939+799+657E++546+540+523+515+

1305CJ003969JUL27  101+94.7+48.2+3.2+.86E+
```

The daily discharges from June 16 to June 30, 1969 are on the first card. The daily discharge on June 25 of 657 cfs has been estimated as the symbol "E" indicates and there is no discharge available for June 26. The daily discharges from July 27 to July 31, 1969 are on the second card in the example.

ERROR MESSAGES

The program cannot directly recognize the different types of cards that make up the input deck. When the input cards are in the correct sequence the program reads the cards correctly because each card tells the program what type of card to expect next. If some cards are missing, are mispunched or are misplaced, the program will normally print the correct error message and point to the source of error. However, the error in question might cause the program to make the wrong assumption about the card following the one that is in error and issue error messages for cards that would normally be correct had the original error not occurred. Whenever the program prints out an error message that does not seem to apply to the card in question, one must go back and find out why the program expected a different type of card.

Although these messages occupy only one line of computer paper, some of them have had to be continued on one or more lines in this description.

In the description of the error messages the following notations will be used:

(a) NNNN indicates numeric data such as a card sequence number

(b) AAAA indicates alphanumeric data such as the station number

(c) ffff.fff or a similar series of lower case letters represent figures computed by the program.

The following is a table showing the messages in the order they usually appear in the output listing and the message numbers under which they are described in this section.

(1) ** J20106 ** ERROR ON DATE CARD ** STOP ** AAAA AAAA AAAA AAAA

This message indicates that the first data card read by the program did not have the letters D A T E in columns 1 to 4 inclusive or had an erroneous date such as KUN 10 1970 instead of JUN 10 1970. The sixteen A's at the end of the message are a copy of what was in the first sixteen columns of the first card. A common error is to forget to include the "Date" card in the deck setup which will also produce this message. This is a critical error message and all processing will terminate.

(2) *** WRONG STATION NO. AAAAAAA ON THE CURRENT DATUM CARD ***

The station number, AAAAAAA, on the "Current Datum" card (70-019) is not the same as that on the "Station Name" card (71-021). The seven A's represent the contents of columns 1-7 of the "Current Datum" card. This is simply a warning message and processing continues on the assumption that the other information on the "Current Datum" card is correct. This message will appear on the first page of the output listing for a station immediately below the station name at the top of the page.

(5) *** WRONG STATION NO. AAAAAAA ON THE OTHER DATUM CARD ***

The station number, AAAAAAA, on the "Other Datum" card (70-020) is not the same as that on the "Station Name" card (71-021). The seven A's represent the contents of columns 1-7 of the "Other Datum" card. This is simply a warning message and processing continues on the assumption that the other information on the "Other Datum" card is correct. This message may appear after message 2, or after the statement: WATER LEVELS ARE REFERRED TO..."Name of Current Datum".

(6) SEQ. RESET *** CARD NO. NNNN TO FOLLOW CARD NO. MMMM ***

This message simply indicates that a "Sequence Reset" card (68-012) has been encountered, that the card sequence number has been adjusted, and that the job has been processed as if there had been no interruption. This message may appear in many places on the output listing while processing the Updating Correction Table, the Stage-Discharge Table or the Gauge/Shift Correction Tables.

(7) *** NNNN DATA FROM WRONG CORRECTION TABLE ***

This message indicates that a card which is supposedly part of either the Gauge Correction or the Shift Correction Table does not contain the letters "GC" or "SC" respectively in columns 35 and 36 or is supposedly part of the Updating Correction Table and does not contain the letters "UC" in columns 47 and 48. This critical message may appear in the middle of the Updating or Gauge or Shift Correction Tables. If this message appears within the Updating Correction Table then none of the updating corrections are applied but the data available as manual gauge readings are computed. When this message occurs within the Gauge Correction Table, daily gauge heights and discharges are not computed and message number 38, ALL DATA DELETED DUE TO DETECTED ERRORS, is printed after the manual gauge readings. If this message appears within the Shift Correction Table, then daily discharges are not computed.

(8) *** SEQ. ERROR *** CARD NO. NNNN FOLLOWS CARD NO. MMMM ***

This message indicates that the cards have been mixed up or that a "Sequence Reset" card (68-012) has been omitted. This message may appear within the Updating Correction Table, the Stage-Discharge Table, or the Gauge or Shift Correction Table. This message is printed immediately after the card in error is read. If this critical message is printed within:

(a) the Updating Correction Table, then none of the updating corrections will be applied.
(b) the Stage-Discharge Table or the Shift Correction Table, then the daily discharges are not computed.
(c) the Gauge Correction Table, then the daily data are not computed and message 38 appears: ALL DATA DELETED DUE TO DETECTED ERRORS.

(9) *** NNNN WRONG STATION NO. AAAAAAA ***

If the station number on card NNNN is not the same as the station number on the "Station Name" card (71-021) this message will appear in the listing as soon as the card has been read. This message may appear within the Updating Correction Table, the Stage-Discharge Table, or the Gauge or Shift Correction Table. This error has the same effect as error number 8.

(10) *** *** WRONG STATION NUMBER ON SEVERAL CARDS ***

This message may appear only once in each of the Updating Correction Table, Stage-Discharge Table, Gauge Correction Table or Shift Correction Table. A counter is reset to zero for each change of table. This message appears when an incorrect station number has been detected on four cards in one of the tables. Once this message has been printed within a table neither error message 9 nor 10 is printed when subsequent station number errors occur for the same table. This message can occur once for each table. This critical message has the same effect as errors 8 and 9.

(11) *** NNNN DATE ERROR ***

This message indicates that the date is in error on the card with a sequence number of NNNN. For example, the month is mis-spelled or a day greater than 31 has been entered. This message may appear in 4 places in the output listing:

(a) Updating Correction Table

This message appears within the Updating Correction Table if either the first or last date on the "Updating Correction" card is meaningless, if the first date is not later than the date read from the previous "Updating Correction" Card, or the last date is previous to the first date on an "Updating Correction" card. Any of these 3 situations will cause this message to be printed and the result will be that none of the updating corrections within the table will be applied.

(b) Gauge Correction Table

This message appears within the Gauge Correction Table if the date on card number NNNN is in error. The result of this mistake is that none of the daily data will be computed and message 38 appears on a page by itself after the manual gauge readings.

(c) Shift Correction Table

This message appears within the Shift Correction Table if the date on card number NNNN is in error. The result of this is that the daily discharges will not be calculated.

(d) Errors in the Gauge Readings

This message appears within this section if the date on a "Manual Gauge Reading" card is meaningless or if it is not later than the previous date. Either of these situations will cause this message to be printed and the result will be that all of the manual gauge readings on this card are completely ignored.

(12) *** NNNN INVALID CHARACTER = "X" IN THE DISCHARGE / GAUGE HEIGHT ***

This message only appears in the Updating Correction Table and indicates that an invalid character such as a letter has been keypunched on the "Updating Correction" card with sequence number NNNN in the gauge height/discharge field, whichever is applicable. An example in the discharge field would be as follows:

2 APR 10 1969 3.28 80.K E

In this example the letter "K" has been punched in the daily discharge field rather than the numeric digit 5. The consequence of this will be that none of the updating corrections will be applied. The appropriate term "GAUGE HEIGHT" or "DISCHARGE" is printed.

(13) *** NNNN A SIGN OR DECIMAL POINT BUT NO DATA IN THE DISCHARGE / GAUGE HEIGHT ***

This message simply means that there are no numeric digits in the gauge height/discharge field but that a sign or decimal point had been punched. None of the updating corrections will be applied because of this error. This message only appears in the Updating Correction Table and only the appropriate term "GAUGE HEIGHT" or "DISCHARGE" will be printed.

(14) *** NNNN UPDATING CORRECTIONS MUST BE RIGHT JUSTIFIED IN THE DISCHARGE / GAUGE HEIGHT ***

This message means that a gauge height/discharge on an "Updating Correction" card without a decimal point has been prepared with at least one blank following the gauge height/discharge. 127b is an example. Without a decimal point the program does not assume that all blanks are zeros. But with a decimal point the program assumes that all blanks are zeros. The appropriate phrase "GAUGE HEIGHT" or "DISCHARGE" is of course printed, not both, unless both are in error. As a result of this none of the updating corrections will be applied.

(15) *** NNNN MORE THAN ONE DECIMAL POINT IN THE DISCHARGE / GAUGE HEIGHT ***

When an "Updating Correction" card was keypunched more than one decimal point was accidentally inserted in the gauge height/discharge field. Only the appropriate term "GAUGE HEIGHT" or "DISCHARGE" is printed. None of the updating corrections will be applied because of this error.

(16) *** NNNN MORE THAN ONE SIGN IN THE DISCHARGE / GAUGE HEIGHT ***

When an "Updating Correction" card was keypunched more than one sign, plus or minus, was accidentally put in the gauge height/discharge field. Only the appropriate term "GAUGE HEIGHT" or "DISCHARGE" will of course be printed. None of the updating corrections will be applied because of this error.

(17) *** NNNN INVALID SYMBOL = "X" FOR THE DISCHARGE / GAUGE HEIGHT ***

This message simply means that a symbol other than a blank, A, B or E has been placed on an "Updating Correction" card for either the gauge height symbol or the daily discharge symbol. The symbol D is allowed for gauge heights only. The appropriate phrase "GAUGE HEIGHT" or "DISCHARGE" is printed, but not both, unless both are in error. Because of this error none of the updating corrections will be applied.

(18) *** NNNN AN UPDATING GAUGE HEIGHT REQUIRES AN UPDATING DISCHARGE ***

This is allowed as an updating correction where water level data only are being computed.

However, for streamflow stations, this message means that a gauge height updating correction was submitted without updating the daily discharge. Thus even when the gauge height is to be deleted by using a -9999.99 gauge height, the appropriate discharge must also be entered on the "Updating Correction" card. For example,

```
7     APR 11 1970     -9999.99        0.36 B
```

(19) ***NNNN WRONG STAGE-DISCHARGE TABLE NO. ***

This message indicates that a "Stage-Discharge" card, numbered NNNN, contains a table number that is different from that on the first card of the table. This message will appear in the middle of the Stage-Discharge Table with the result that none of the daily discharges will be computed for this station.

(20) *** **** WRONG STAGE-DISCHARGE TABLE NO. ON SEVERAL CARDS ***

This message indicates that the Stage-Discharge Table number on four cards is different from that on the first card of the table. This message appears in the middle of the Stage-Discharge Table with the same result as message 19. Subsequent "Stage-Discharge" cards with the incorrect table number will not have message 19 or 20 printed. This is to avoid the printing of message 19 for each table number error and produce an excessively long listing when in fact the first card of the table could be the one in error.

(21) *** NNNN hhhhhhhh.hhh qqqqqqq.qqq GAUGE HT. NOT GREATER THAN GAUGE HT. ON PREVIOUS CARD ***

This message indicates that the gauge height (hhhhhhhh.hhh) in the Stage-Discharge Table, on card number NNNN, is less than or equal to the gauge height on the previous card. The qqqqqqq.qqq represents the discharge keypunched on card NNNN. This message appears in the middle of the Stage-Discharge Table with the result that the daily discharges will not be computed for this station.

(22) *** NNNN hhhhhhhh.hhh qqqqqqq.qqq DISCHARGE NOT GREATER THAN DISCHARGE ON PREVIOUS CARD ***

This message indicates that the discharge (qqqqqqq.qqq) in the Stage-Discharge Table, on card NNNN, is less than or equal to the discharge on the previous card. The hhhhhhhh.hhh represents the gauge height keypunched on card NNNN. This message appears in the middle of the Stage-Discharge Table with the result that the daily discharges will not be computed for this station.

(23) *** TABLE TOO LONG *** MORE THAN mmmm CARDS ***

This message indicates that there are more cards in the Stage-Discharge, Gauge, or Shift Correction Tables than the maximum number mmmm, for which core memory has been reserved. If this message appears in the middle of the Stage-Discharge or Shift Correction Table the daily discharges will not be computed for this station. But if this message appears within the Gauge Correction Table then no daily data will be computed for this station and message 38 will appear by itself on a later page.

(24) *** NNNN TIME AT WHICH CORRECTION OCCURS LESS THAN TIME OF PREVIOUS CORRECTION ***

The time of the correction shown on the "Gauge or Shift Correction" card, whichever is being processed, is less than the time at which the previous correction occurred. The sequence number of the card at fault is NNNN. If this message appears within the Gauge Correction Table no daily data will be computed for this station and message 38 will appear by itself on a later page. But if this message appears in the Shift Correction Table then gauge heights will be computed but not daily discharges.

(36) *** APR 15 1970 G. HT. + SHIFT CORR. = hhhhh.hhh FEET, OUTSIDE THE RANGE OF THE STAGE-DISCHARGE TABLE

This message indicates that the effective gauge height (corrected gauge height + shift correction) is outside the range of the Stage-Discharge Table on April 15, 1970. The effective gauge height is represented by hhhhh.hhh.

Error message 36 is generated during the computation of the data and is saved for printing at a later stage after the daily data have been printed.

(38) ***** ALL DATA DELETED DUE TO DETECTED ERRORS

This error message indicates that a critical error(s) has occurred within the Gauge Correction Table or within all the Manual Gauge Readings. This message will be printed after the Manual Gauge Readings if one of the error messages 7 to 11, 23 or 24 appears within the Gauge Correction Table or if one of the error messages 41 to 50 appears for each Manual Gauge Reading.

(41) *** TOO MANY DIGITS PER READING ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge reading contains more than 7 digits per reading. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(42) *** TOO MANY DECIMAL POINTS ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings contains more than one decimal point. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(43) *** EMBEDDED BLANK WITHIN READING ***

This message only appears in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings contains an embedded blank. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(44) *** INVALID CHARACTER ***

This message only appears in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings contains a character other than a blank, the digits 0 to 9, a decimal point or a minus sign. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(45) *** TOO MANY MINUS SIGNS ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings contains more than one minus sign. The card in error is printed first and on the next line a star appears beneath the second minus sign within the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(46) *** EMBEDDED MINUS SIGN ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings contains a minus sign which follows a digit(s) 0 to 9 or a decimal point. The card in error is printed first and on the next line a star appears beneath the minus sign within the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge reading and a blank appears on the annual page.

(47) *** MORE THAN 4 READINGS PER DAY ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that more than 4 gauge readings have been keypunched for a given day. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge readings and a blank appears on the annual page.

(48) *** DECIMAL POINT MISSING ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings does not contain a decimal point. The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge readings and a blank appears on the annual page.

(49) *** NNN DIGITS AFTER THE DECIMAL POINT ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that one of the manual gauge readings does not contain the number of digits after the decimal point as specified in column 11 of the "Station Name" card (71-021). The card in error is printed first and on the next line a star appears at the end of the gauge reading that is in error. In the printout of gauge readings, 7 stars appear in place of the gauge readings and a blank appears on the annual page.

(50) *** MISSING GAUGE READING OR DATE ERROR ***

This message appears only in the section ERRORS IN THE GAUGE READINGS and means that either the manual gauge readings for a given day carry from one card to another but the date on the second card is for a later day or the last manual gauge reading on the first card should have been followed by a plus sign (+) and not a dollar sign ($). The second card is printed followed by this error message. The last gauge reading on the first card is replaced by 7 stars in the printout of gauge readings and by a blank on the annual page.

QUALITY CHECKING

1. Ensure that the station name and number are correct.

2. Verify the name of the current datum and, if applicable, also verify the name of the "other datum" and the conversion factor.

3. Ensure that each line in the Updating Correction Table contains the proper gauge height, discharge and symbols and that the correct date has been entered. These are of importance because they override the data as computed from the gauge readings.

4. Note that the daily gauge heights and/or discharges must be computed manually if the gauge or shift correction is variable during the day. This is then submitted as an Updating Correction.

5. Ensure that the Stage-Discharge Table is correct. When a Stage-Discharge Table is used for the first time, an expanded table should be requested. It is only necessary to ensure that the points placed in the table as points at the end of straight line segments appear correctly in the expanded table. The program will interpolate correctly between those points. When an expanded table is not requested, the abbreviated table shown on the listing should be checked to ensure that the correct table number is being used and that it has the correct number of cards.

6. Check the Gauge and Shift Correction Tables, line for line, to ensure that they are exactly as required.

7. Verify the printouts of the gauge readings and if there is an error, either re-keypunch that card of readings or use an Updating Correction card and re-run the entire station. It may be desirable to also check the readings on the punched cards against those listed in the observer's books, prior to submitting the station for a computer run.

8. Using the original records, compute at least six (6) daily gauge heights and/or discharges manually to ensure that the data have been computed correctly. Initial and date the annual page of daily water levels and/or discharges when this has been done.

9. Complete "Station Analysis", form R242.

PERMANENT STORAGE OF CARD IMAGES ON MAGNETIC TAPE

A standard filing system will be set up in each District Office such that all the final cards used as input to the "MANUAL" computer program for all the stations for a calendar year will be placed on one tape. The cards for that calendar year can then be destroyed. The decks for the current year and the previous year will be kept on cards and all cards previous to this will be stored on tape.

These cards will be placed on a tape using a card to tape utility routine available at each Computing Centre. These cards should be placed on the tape in ascending order according to station number and the last ten cards should have a station number of 99ZZ999. This tape should have card image records 80 characters long blocked 10 such that each block contains 800 characters. For the CDC computers this tape should have 7 tracks with a density of 556 bpi and for the IBM computers the tape should have 9 tracks with a density of 800 bpi. The tape used should be 2400 feet long and thus will have a capacity of at least 100,000 card images. This tape will be stored in the tape library of the Computing Centre each District Office is now using. Of course the names of the stations thus stored on tape will be placed on District files for future reference. Each tape generated in this fashion should be copied using a utility routine available at each Computing Centre and stored in a location which is temperature and humidity controlled. One copy will be stored in Ottawa. At least once each year all of these tapes should be rewound and cleaned to release the tension and thus reduce the danger of losing or destroying the data.

The cost of storing one tape at a Computing Centre usually varies from $30 to $60 annually. Depending upon these rates it may be cheaper to buy a tape and thus reduce the storage charges.

Thus all the District Offices will have tapes in the same format so that the same computer program can retrieve the station(s) required. This program, called SAVE, is under development and will be operational in 1972.

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S74

Stewart, K.W.

Automated manual gauge computations.