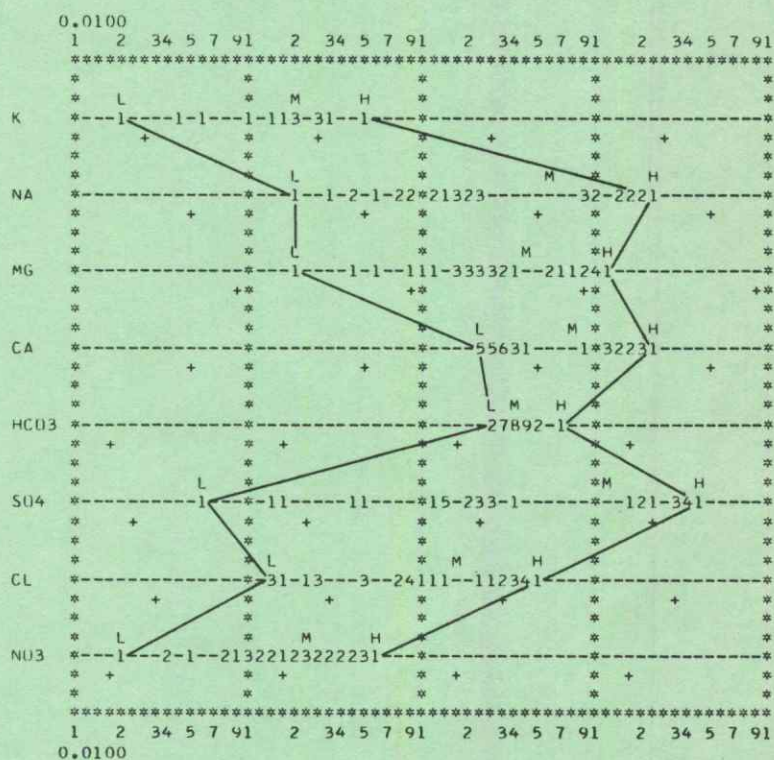


By
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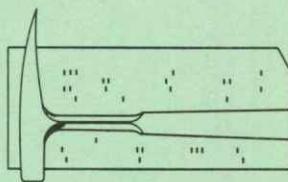
1969



Special Distribution Publication 39

STATE GEOLOGICAL SURVEY OF KANSAS

Frank C. Foley, Director



FORTTRAN IV Program for Synthesis
and Plotting of Water-Quality Data

By

Leverett H. Ropes
Charles O. Morgan
Jesse M. McNellis

Special Distribution Publication 39

Prepared by the United States Geological Survey and the
State Geological Survey of Kansas, with the cooperation
of the Environmental Health Services of the Kansas State
Department of Health and the Division of Water Resources
of the Kansas State Board of Agriculture.

State Geological Survey
The University of Kansas, Lawrence, Kansas

1969

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FORTRAN IV Program for Synthesis
and Plotting of Water-Quality Data

By

Leverett H. Ropes^{1/}; Charles O. Morgan^{1/}, and Jesse M. McNellis^{1/}
St. Paul, Minn.^{2/}; Lawrence, Kans.

ABSTRACT

The program synthesizes data from the U.S. Geological Survey's water-quality cards. Line-printer output consists of tables and two semilog graphs in which the distribution and the minimum, mean, and maximum values of a selected group of data are given. The two graphs represent front and top orthographic projections of a three-dimensional array of data.

The user selects (1) up to 16 variables, (2) data sorting according to multiple criteria such as aquifer and ranges of values of selected variables, (3) ion concentration units, (4) order of plotting, (5) log scale of the graphs, and (6) option of top-view graph.

The program is operational on the GE 635 computer at The University of Kansas Computation Center (program designation: ROPES) and the U.S. Geological Survey's IBM 360/65 program library disc (program designation: D0160).

INTRODUCTION

The FORTRAN IV digital computer program (D0160^{3/}, ROPES^{4/}) described herein facilitates the synthesis of water-quality data and associated physical parameters such as well depth and river discharge. Data sorting, data conversion, numerical summary, and graph plotting routines are combined into one program. Two semilog graphs are produced on the line printer. The principal graph consists of a set of parallel horizontal log scale axes, each corresponding to a selected constituent or parameter. On these axes the distribution, maximum, mean, and minimum values are plotted, along with a nomograph conversion scale. A second, optional graph contains the same horizontal log scale, but the individual samples are spaced along the vertical axis in the order in which they were presented to the computer. Therefore,

^{1/} *Water Resources Division, U.S. Geological Survey*

^{2/} *Present address: Denver, Colo.*

^{3/} *Designation used in the U.S. Geological Survey national program library.*

^{4/} *Designation used by the Kansas district, Water Resources Division.*

this may be a time or space axis, depending on the order of the analyses. The relationship of the two graphs is similar to the front and top orthographic projections of a three dimensional array of data.

With very little modification, the program may be used to tabulate and plot other data such as fossil assemblages, minerals, or tree rings. Such possibilities, because they are limited only by the imagination of the user, are not described here.

The program was written as a part of the cooperative effort of the U.S. Geological Survey and the State Geological Survey of Kansas, with the cooperation of the Environmental Health Services of the Kansas State Department of Health and the Division of Water Resources of the Kansas State Board of Agriculture.

The program was tested on the IBM 7040 computer and adapted to the GE 635 computer at The University of Kansas Computation Center, Richard G. Hetherington, Director. It has been adapted also to the U.S. Geological Survey's IBM 360 model 65 computer in Washington, D.C. There, the program is on the U.S. Geological Survey library disc and may be called by control cards described in appendix III.

INPUT

Input for the program may be the U.S. Geological Survey's A,B,C (ground-water hydrologic data cards); Q,R,S (ground-water quality data cards); 1,2,3, (surface-water quality data cards); Kansas designed ground-water quality data cards; or the equivalent on magnetic tape. The program will handle any combination of A,B,C cards; possible or multiple Q,R,S cards; or Q,R,S cards alone. Ground-water, surface-water, and Kansas cards may not be mixed in one group of data that is to be plotted on one graph. However, many groups of data, such as two groups of the ground-water quality data for one area and the surface-water quality data from a specific surface-water station, may be examined in one computer run as long as each group is to receive separate consideration (plotted on a separate graph). Appropriate header cards should be placed ahead of each data group. One chemical analysis, represented by one each A,B,C; Q,R,S; or 1,2,3 card, is defined as a data set. The maximum number of data sets permitted in any data group not being sorted is 200. However, if sorting routines are used, the maximum number of 200 data sets applies to any group that results after the sort.

SORTING

The program will sort data by (1) aquifers, (2) month and year, (3) discharge, (4) well depth, and (5) concentration or value of any constituent or parameter listed in table 1.

Sorting by (3), (4), or (5) may be by open-end ranges (above or below a selected value) or by a maximum of three closed ranges (values falling between a pair of selected values).

The sorting routines may be used in combination with one another.

Explanation of the limits of use of the sorting routines is given in appendix I.

OUTPUT

Output consists of tables, graphs, and explanations. The data to be listed and plotted, the units, the graph scale, and the option of a secondary graph are controlled by the header cards that are described in appendix I.

Data considered

Up to 16 chemical constituents and associated physical parameters may be selected for tabulation and plotting from a list of 48 (table 1). For brevity in this report, "constituents" will hereafter mean any of the selected data including the non-chemical parameters.

Table 1.--Constituents and parameters from which up to 16 may be selected for consideration by the program. [listed according to program designation number (IDNT)].

1. Conductivity ($\times 10^{-3}$)	17. Aluminum (Al)	34. Chromate (Cr^{+3})
2. pH	18. Iron (Fe) (assumed trivalent)	35. Chromate (Cr^{+6})
3. Temperature	19. Manganese (Mn)	36. Nickel (Ni)
4. Silicate (SiO_2)	20. Copper (Cu)	37. Cobalt (Co)
5. Calcium (Ca)	21. Lead (Pb)	38. Arsenic (As)
6. Magnesium (Mg)	22. Zinc (Zn)	39. Selenium (Se)
7. Sodium (Na)	23. Dissolved solids, determined	40. Cadmium (Cd)
8. Potassium (K)	24. Dissolved solids, calculated	41. Barium (Ba)
9. Bicarbonate (HCO_3)	25. Hardness	42. Beryllium (Be)
10. Carbonate (CO_3)	26. Noncarbonate hardness	43. Ammonia (NH_4)
11. Sulfate (SO_4)	27. Color	44. Nitrite (NO_2)
12. Chloride (Cl)	28. Bromide (Br)	45. Cyanide (CN)
13. Fluoride (F)	29. Iodide (I)	46. Hydrogen sulfide (H_2S)
14. Nitrate (NO_3)	30. Alkalinity	47. (unused)
15. Phosphate (PO_4)	31. Carbon dioxide (CO_2)	48. Discharge ($\times 10^{-3}$)
16. Boron (B)	32. Sodium-adsorption ratio	49. Well depth ($\times 10^{-1}$)
	33. Residual sodium carbonate	

Units

Chemical concentration may be listed and plotted either in milligrams per liter (mg/l) as given on the cards, or in milliequivalents per liter (me/l), in which case conversion factors are automatically applied. Well depth, usually in feet, is divided by 100; discharge usually in cubic feet per second, and conductivity, usually in micromhos per centimeter, are divided by 1,000 for convenience in plotting. When sorting according to well depth, discharge, or conductivity use the converted value. All other parameters are presented as punched on the cards.

Initial listing

A title and a tabulation of all data sets are printed as shown in figures 1a and 2a. Each analysis (data set) is assigned a reference number which represents the order in which the data were presented to the computer. The listing of ground-water data (fig. 1a) includes reference number (NUM.), well location number, well depth, date sampled, and geologic unit(s) as punched on the cards. For surface-water data (fig. 2a) the list contains reference number (NUM.), station identification, discharge, and date sampled.

Selected data listing

A listing of the selected data in the selected units is printed, following the initial listing. The title, the kind of sorting, the reference number, and the date sampled also are included. The calculated high, low, and mean values; the standard deviation; and the number of samples considered for each constituent are presented at the bottom of this listing. Figures 1b and 2b are examples of selected data lists that were taken from the data sets tabulated in the initial listings shown in figures 1a and 2a, respectively.

Principal "semilog concentration graph"

Each group of data as presented in the selected data listing is plotted on what is called a "semilog concentration graph", figures 1c and 2c. The vertical axis is not a true axis but is used to conveniently space the selected constituents in the desired order. The values of the constituents are plotted on horizontal logarithmic scales. These 12-inch wide scales are divided into 120 linear increments. The number of samples whose values fall within a given increment is indicated by printing that number in the increment. Alpha

KEARNY COUNTY, KANSAS

NUM.	WELL NUMBER	WELL DEPTH	DATE SAMPLED	GEOLOGIC UNIT(S)	
1.	2135W 6CA	120.0	11. 8. 40.	60.	0.0
2.	2135W18AA11	80.0	6. 22. 64.	60.	0.0
3.	2135W27C	163.0	5. 22. 67.	85.	0.0
4.	2135W35BA	80.0	11. 8. 40.	60.	0.0
5.	2136W10BHC	130.0	6. 22. 64.	60.	0.0
6.	2136W27HC	100.0	11. 8. 40.	60.	0.0
7.	2137W 2C1111	134.0	6. 22. 64.	60.	0.0
8.	2137W 4HC	112.0	11. 8. 40.	60.	0.0
9.	2138W17BHH	150.0	5. 12. 64.	60.	0.0
10.	2138W19111	162.0	11. 7. 40.	60.	0.0
11.	2235W23CAC	165.0	4. 26. 63.	58.	4.
12.	2236W13C11C	80.0	5. 12. 64.	60.	0.0
13.	2236W22BHH	180.0	11. 8. 40.	60.	0.0
14.	2237W 11111	800.0	4. 26. 63.	110.	0.0
15.	2237W34111	154.0	11. 7. 40.	60.	0.0
16.	2237W3511111	190.0	6. 22. 64.	60.	0.0
17.	2238W 3A11A	105.0	5. 12. 64.	60.	0.0
18.	2238W14BHH	180.0	11. 7. 40.	60.	0.0
19.	2238W34BHH	250.0	4. 26. 63.	60.	0.0
20.	2335W 3ABH	186.0	5. 8. 64.	58.	4.
21.	2335W12HC	75.0	11. 8. 40.	4.	0.0
22.	2335W1211111	350.0	5. 8. 64.	58.	4.
23.	2335W25BHH2	320.0	5. 8. 64.	58.	4.
24.	2335W29BHH	65.0	11. 8. 40.	4.	0.0
25.	2336W 41111	120.0	6. 22. 64.	60.	0.0
26.	2336W29CHC	286.0	9. 20. 61.	60.	0.0
27.	2336W33CHH	300.0	5. 12. 64.	60.	0.0
28.	2337W28111112	550.0	4. 23. 62.	110.	58.
29.	2337W33BHH	300.0	4. 23. 62.	60.	0.0
30.	2337W33BHC	307.0	9. 20. 61.	60.	0.0
31.	2337W3611111	250.0	6. 22. 64.	60.	0.0
32.	2338W 5A11	250.0	11. 7. 40.	60.	0.0
33.	2338W11111BHH	296.0	9. 20. 61.	60.	0.0
34.	2338W2511C	223.0	11. 7. 40.	60.	0.0
35.	2435W 1BBA	400.0	5. 7. 64.	58.	4.
36.	2435W 3A11	36.0	11. 8. 40.	4.	0.0
37.	2435W11111BHH	50.0	5. 19. 61.	588.	0.0
38.	2435W22C11C	65.0	5. 7. 64.	588.	0.0
39.	2435W24BHH	25.0	11. 9. 40.	588.	0.0
40.	2436W 6CH	300.0	5. 12. 64.	60.	0.0
41.	2436W11111BHH	200.0	5. 11. 64.	58.	4.
42.	2436W15111112	149.0	5. 13. 64.	58.	4.
43.	2436W16111BHH	250.0	5. 13. 64.	58.	4.
44.	2436W2211C	25.0	11. 9. 40.	588.	0.0
45.	2436W23111112	280.0	4. 26. 63.	58.	4.
46.	2436W27A1111	285.0	5. 19. 61.	58.	4.
47.	2436W277BHH	273.0	0.0 0.0 40.	58.	4.
48.	2437W12111BHH	300.0	9. 20. 61.	60.	0.0
49.	2437W201111	200.0	11. 8. 40.	60.	0.0
50.	2437W33A11A	222.0	4. 23. 62.	60.	0.0
51.	2437W33A11A	222.0	5. 11. 64.	60.	0.0
52.	2438W 6A11	174.0	11. 7. 40.	60.	0.0
53.	2438W HCBA2	163.0	5. 13. 64.	60.	0.0
54.	2438W2211C	145.0	11. 8. 40.	60.	0.0
55.	2535W 2A11	50.0	11. 9. 40.	4.	0.0
56.	2535W 6BCH	45.0	9. 20. 61.	588.	0.0
57.	2536W 3C111	40.0	9. 21. 60.	588.	0.0
58.	2536W18A11C	150.0	9. 21. 60.	588.	4.
59.	2536W18111112	149.0	6. 6. 62.	60.	0.0
60.	2536W31A11C	61.0	5. 1. 64.	4.	0.0
61.	2537W1011C	16.0	11. 8. 40.	588.	0.0
62.	2537W25BHA11	36.0	5. 1. 64.	588.	0.0
63.	2538W111BHH	15.0	11. 8. 40.	588.	0.0
64.	2538W17B1111	35.0	5. 1. 64.	4.	0.0
65.	2635W11111BHC	123.0	5. 1. 64.	4.	0.0
66.	2635W26CAH	155.0	5. 1. 64.	4.	0.0
67.	2637W11111BHH	171.0	5. 1. 64.	4.	0.0
68.	2637W2111111	330.0	4. 26. 63.	58.	4.
69.	2637W3511C	160.0	11. 9. 40.	4.	0.0
70.	2638W 3C11	160.0	11. 9. 40.	58.	4.
71.	2638W 6BCC	300.0	4. 26. 63.	110.	0.0
72.	2638W3411C	135.0	11. 9. 40.	58.	4.

Figure 1a.--Initial listing of a Kansas ground-water data deck. The reference number, NUM, assigned by the computer represents the order in which the data were presented to the computer.

KFAHMY COUNTY, KANSAS

GROUNDWATER DATA

SORTED FOR WELL DEPTHS LESS THAN OR EQUAL TO 150.

NUM.	DATE	K	NA	MG	CA	HCO3	SU4	CL	NO3
1.	11. 8. 40.	-99.9999	1.9140	2.4672	2.7445	3.6877	1.9987	1.0998	0.2419
2.	6. 22. 64.	0.1049	0.4045	1.0691	3.1936	3.9664	0.1291	0.1410	0.4678
4.	11. 8. 40.	-99.9999	1.2180	1.8093	2.2954	3.6058	1.0826	0.4512	0.1210
5.	6. 22. 64.	0.1842	2.0445	2.7139	2.6946	3.7533	2.1236	1.4100	0.3065
6.	11. 8. 40.	-99.9999	2.0880	2.2205	2.3453	3.4419	2.0612	0.8460	0.1936
7.	6. 22. 64.	0.2430	2.2620	2.6317	2.2954	3.3108	2.5400	1.0716	0.4355
8.	11. 8. 40.	-99.9999	1.5660	2.7139	2.2455	3.4255	1.7281	0.9024	0.3549
9.	5. 12. 64.	0.1637	1.7835	2.2205	2.3952	3.1141	2.3318	0.7332	0.2258
12.	5. 12. 64.	0.2558	0.4045	1.2336	3.4431	4.2450	0.4789	0.2538	0.2258
17.	5. 12. 64.	0.1714	1.6095	2.1382	2.6946	3.7533	1.4366	0.8460	0.3710
21.	11. 8. 40.	-99.9999	0.9135	1.8915	2.7944	3.5402	1.4158	0.4512	0.1210
24.	11. 8. 40.	-99.9999	0.7395	1.8093	2.7944	3.4747	1.2700	0.4794	0.0790
25.	6. 22. 64.	0.1279	1.4355	1.4803	3.8922	3.2780	2.4984	0.9024	0.3710
36.	11. 8. 40.	-99.9999	8.5260	5.4278	13.7724	3.7533	20.1121	3.6096	0.2258
37.	5. 19. 61.	-99.9999	14.0070	10.1978	12.5748	4.0811	28.5650	3.9762	0.0936
38.	5. 7. 64.	0.4349	15.7470	8.3062	17.6646	4.1958	34.6236	3.2712	0.2742
39.	11. 9. 40.	-99.9999	12.9195	10.8557	12.6247	3.8844	29.5644	2.8200	0.0710
42.	5. 13. 64.	0.3070	8.1345	6.0035	8.0838	3.1960	16.4478	2.4252	0.5162
44.	11. 9. 40.	-99.9999	9.7875	8.6352	11.0778	5.9168	19.6541	3.7506	0.0855
54.	11. 8. 40.	-99.9999	1.0875	1.4803	2.6946	3.0977	1.7905	0.2679	0.0355
55.	11. 9. 40.	-99.9999	0.7830	0.9046	2.9441	2.9994	1.2908	0.0436	0.0436
56.	9. 20. 61.	-99.9999	20.4450	9.9510	20.8083	4.5236	41.5151	4.7940	0.3387
57.	9. 21. 60.	-99.9999	18.0960	9.4576	17.2654	4.3925	36.4974	3.6942	0.1774
58.	9. 21. 60.	-99.9999	17.4435	7.7306	18.3133	2.7207	36.6848	3.9198	0.1613
59.	6. 6. 62.	0.2456	10.4400	5.7568	16.5668	2.6060	27.7322	3.1302	0.0355
60.	5. 1. 64.	0.0512	0.1957	0.5017	2.7445	2.9666	0.1624	0.1410	0.2581
61.	11. 8. 40.	-99.9999	15.1815	9.3754	16.1177	3.5238	33.7284	3.2430	0.1065
62.	5. 1. 64.	0.1470	9.1350	2.4672	11.7265	2.8355	18.5298	2.0586	0.1355
63.	11. 8. 40.	-99.9999	0.8265	1.5626	2.2455	3.0321	1.2908	0.2256	0.0194
64.	5. 1. 64.	0.0384	0.5655	0.4112	3.1936	3.2452	0.4164	0.1410	0.4678
65.	5. 1. 64.	0.0179	0.2914	0.1809	2.0958	2.3274	0.0520	0.1692	0.0936
72.	11. 9. 40.	-99.9999	1.6530	3.2896	2.8443	3.5238	3.3104	0.7050	0.1355
	MAX.	0.4349	20.4450	10.8557	20.8083	5.9168	41.5151	4.7940	0.5162
	MEAN	0.1816	5.7390	4.0280	7.2246	3.5443	11.6582	1.6307	0.2122
	MIN.	0.0179	0.1957	0.1809	2.0958	2.3274	0.0520	0.1410	0.0194
	S.D.	0.1153	6.4780	3.4123	6.2942	0.6755	14.2680	1.4844	0.1425
	NUM.	14.	32.	32.	32.	32.	32.	32.	32.

Figure 1b.--Selected data listing of eight constituents from the data deck listed in figure 1a. One open-end range sort for well depths was applied.

RUPES DIAGRAM



CONSTITUENTS ARE PLOTTED ON DASHED LINES, NUMBERS (1-9) AND LETTERS (A-Z) GIVE NUMBER OF PLOTS AT A SINGLE POSITION

0.100 EXCEPT WHEN IT IS ON THE EXTREME LEFT SIDE OF
DIAGRAM WHERE IT IS EQUAL TO SCALE AT TOP

PLOTTED CONSTITUENTS ARE IN MG/L EXCEPT WHEN MG/L + SYMBOL
IS ON THE EXTREME LEFT SIDE OF DIAGRAM, THEN VALUES ARE MG/L

7

MINNESOTA R AT MANKATO MINN

NUM.	STATION IDEN.	DISCHARGE	DATE SAMPLED
1.	25000	1460.0	10. 4. 60.
2.	25000	2730.0	5. 16. 61.
3.	25000	381.0	2. 26. 63.
4.	25000	895.0	11. 7. 63.
5.	25000	674.0	12. 19. 63.
6.	25000	375.0	1. 17. 64.
7.	25000	366.0	2. 25. 64.
8.	25000	1180.0	4. 3. 64.
9.	25000	12300.0	5. 15. 64.
10.	25000	7750.0	5. 21. 64.
11.	25000	1900.0	6. 18. 64.
12.	25000	1330.0	7. 14. 64.
13.	25000	312.0	8. 11. 64.
14.	25000	5420.0	9. 12. 64.
15.	25000	3110.0	9. 22. 64.
16.	25000	1340.0	10. 12. 64.
17.	25000	865.0	10. 27. 64.
18.	25000	460.0	11. 9. 64.
19.	25000	294.0	12. 8. 64.
20.	25000	241.0	1. 6. 65.
21.	25000	301.0	2. 10. 65.
22.	25000	385.0	3. 24. 65.
23.	25000	2520.0	4. 24. 65.
24.	25000	2240.0	4. 28. 65.
25.	25000	11600.0	5. 24. 65.
26.	25000	5750.0	7. 13. 65.
27.	25000	1220.0	8. 17. 65.
28.	25000	661.0	9. 17. 65.
29.	25000	-1000.0	10. 14. 65.
30.	25000	-1000.0	11. 29. 65.
31.	25000	-1000.0	12. 15. 65.
32.	25000	-1000.0	1. 12. 66.
33.	25000	-1000.0	2. 23. 66.
34.	25000	-1000.0	3. 28. 66.
35.	25000	-1000.0	4. 21. 66.
36.	25000	4300.0	5. 25. 66.
37.	25000	-1000.0	6. 27. 66.
38.	25000	-1000.0	7. 28. 66.
39.	25000	-1000.0	8. 19. 66.

Figure 2a.--Initial listing of a U.S. Geological Survey multiple 1,2,3 surface-water data deck. The -1000.0 indicates missing data.

MINNESOTA R AT MANKATO MINN

SURFACE-WATER DATA

NUM.	DATE	K	NA	MG	CA	HC13	S04	CL	ND3	USCH
1.	10. 4. 60.	0.1356	0.8700	8.1418	1.4970	5.5890	4.5179	0.2735	0.1774	1.4600
2.	5. 16. 61.	0.1279	0.8700	3.6186	4.8902	4.4253	4.4971	0.3102	0.1581	2.7300
3.	2. 26. 63.	0.1739	1.6530	4.3587	6.4870	7.3427	4.7053	0.4512	0.0710	0.3810
4.	11. 7. 63.	0.1535	1.3050	4.9344	6.1876	5.5726	6.2252	0.3384	0.0613	0.8950
5.	12. 19. 63.	0.1688	1.7835	5.5101	7.0359	6.9166	6.6416	0.4794	0.0581	0.6740
6.	1. 17. 64.	0.1535	1.8705	4.8522	7.2355	7.9819	7.1842	0.5076	0.0758	0.3750
7.	2. 25. 64.	0.1630	1.6530	4.5232	6.6866	6.6379	5.7463	0.4794	0.0258	0.3660
8.	4. 3. 64.	0.1791	1.1745	3.9475	5.4391	4.9498	5.2050	0.3666	0.0742	1.1800
9.	5. 15. 64.	0.0793	0.7830	3.8653	5.6886	4.8514	4.7261	0.2679	0.2419	12.3000
10.	5. 21. 64.	0.1305	0.8700	4.1120	5.7884	5.1137	4.9968	0.2425	0.2097	7.7500
11.	6. 18. 64.	0.1253	0.9570	3.4541	5.3892	5.0645	4.2473	0.2820	0.1274	1.9000
12.	7. 14. 64.	0.1279	0.9135	3.2074	4.1916	3.8680	4.3517	0.3102	0.1774	1.3300
13.	8. 11. 64.	0.1612	1.3920	3.5363	3.5928	4.1631	3.9558	0.4512	0.0000	0.3120
14.	9. 12. 64.	0.1253	0.4785	2.0560	3.3433	3.4747	1.7905	0.2820	0.3549	5.4200
15.	9. 22. 64.	0.1151	0.6960	2.8784	4.9401	5.0481	2.7691	0.3384	0.2903	3.1100
16.	10. 12. 64.	0.0998	0.8700	3.3718	5.4890	6.0643	3.0814	0.3948	0.0694	1.3400
17.	10. 27. 64.	0.1126	1.0440	3.6186	4.4411	5.2120	3.2063	0.4230	0.0903	0.8650
18.	11. 9. 64.	0.1177	1.1745	3.7008	4.8902	5.6545	3.6019	0.3948	0.0581	0.4600
19.	12. 8. 64.	0.1330	1.6530	4.5232	6.3872	7.1788	4.3514	0.5922	0.1613	0.2940
20.	1. 6. 65.	0.1228	1.5660	4.5232	4.5908	5.9332	4.0599	0.4794	0.0774	0.2410
21.	2. 10. 65.	0.1637	1.9140	3.4541	5.4890	5.6218	4.2889	0.7050	0.0903	0.3010
22.	3. 24. 65.	0.1560	1.0440	2.4672	4.1916	4.8350	2.3735	0.3948	0.0032	2.5200
23.	4. 24. 65.	0.1509	0.4002	1.8093	3.0938	2.4749	2.4984	0.1805	0.1613	2.2400
24.	4. 28. 65.	0.1407	0.3871	1.8915	3.4930	2.8519	2.5192	0.1692	0.1774	11.6000
25.	5. 24. 65.	0.1305	0.6090	2.9606	4.8403	4.0647	3.8101	0.2200	0.1355	5.7500
26.	7. 13. 65.	0.1407	0.7395	3.5363	4.4910	4.6548	3.7476	0.2312	0.1452	1.2200
27.	8. 17. 65.	0.1637	1.0440	3.4541	4.5908	5.2612	3.6227	0.3384	0.0113	0.6610
28.	9. 17. 65.	0.1535	1.0875	3.5363	4.6407	5.4579	3.4978	0.3666	0.0290	-1000.0000
29.	10. 14. 65.	0.1586	0.8265	3.5363	5.3892	5.4415	3.8517	0.2707	0.1613	-1000.0000
30.	11. 29. 65.	0.1586	1.1310	4.0298	5.3892	5.8840	3.9974	0.4794	0.1936	-1000.0000
31.	12. 15. 65.	0.1407	0.8265	3.6186	4.1916	4.7039	3.3312	0.3384	0.2419	-1000.0000
32.	1. 12. 66.	0.1535	1.2180	4.8522	6.8862	7.5722	4.7053	0.3948	0.1468	-1000.0000
33.	2. 23. 66.	0.2302	0.5655	2.1382	3.6926	3.7697	2.3527	0.2651	0.1129	-1000.0000
34.	3. 28. 66.	0.1612	0.4002	2.3850	2.4950	2.9502	2.1445	0.1354	0.0936	-1000.0000
35.	4. 21. 66.	0.1305	0.6090	3.7830	3.1437	4.4745	2.7691	0.2030	0.1613	-1000.0000
36.	5. 25. 66.	0.1637	0.9570	4.4410	5.0898	4.9170	5.2883	0.2651	0.0468	4.3000
37.	6. 27. 66.	0.1023	0.5220	3.6186	2.8942	4.1958	2.3735	0.2566	0.3065	-1000.0000
38.	7. 28. 66.	0.1458	1.0440	3.3718	4.1916	4.9498	3.3520	0.4230	0.0048	-1000.0000
39.	8. 19. 66.	0.1509	1.0875	3.6186	4.0918	4.6220	3.4353	0.3948	0.0436	-1000.0000
MAX.		0.2302	1.9140	8.1418	7.2355	7.9819	6.6416	0.7050	0.3549	12.3000
MEAN		0.1429	1.0254	3.7240	4.7814	5.1217	3.8800	0.3512	0.1237	2.4952
MIN.		0.0793	0.3871	1.8093	1.4970	2.4749	1.7905	0.1354	0.0000	0.2410
S.D.		0.0261	0.4172	1.1214	1.3053	1.2554	1.1402	0.1197	0.0870	3.2211
NUM.		39.	39.	39.	39.	39.	39.	39.	39.	29.

Figure 2b.--Selected data listing of eight constituents and discharge from the data deck listed in figure 2a. All samples were included, i.e., no sorting routines were applied.

MINNESOTA R AT MANKATO MINN

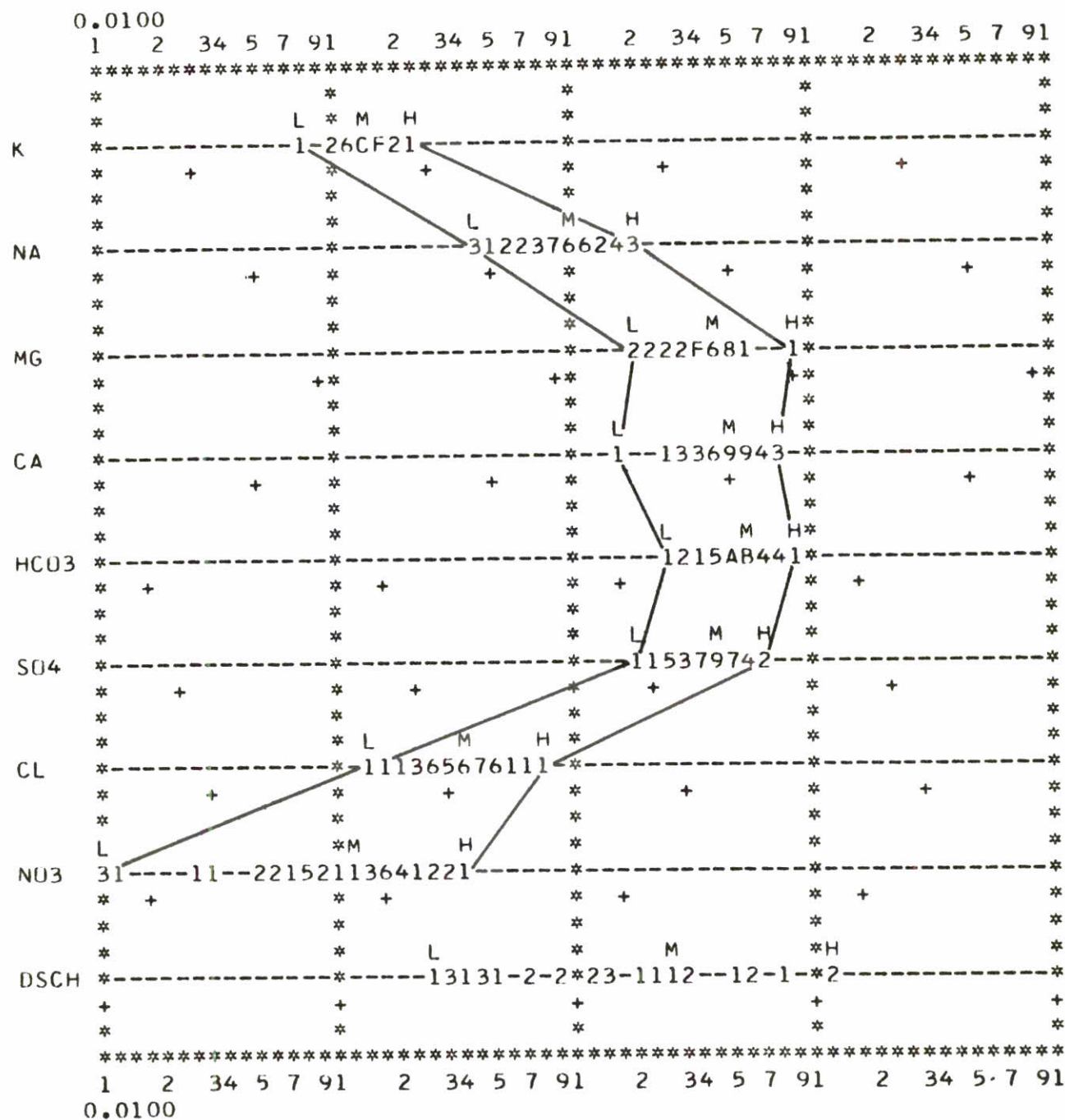


Figure 2c.--Principal "semilog concentration graph" of the data listed in figure 2b. The distribution of the river discharge, DSCH, at time of sampling is also shown. The explanation of symbols with figure 1c occurs following this and all principal graphs. The solid lines were added by hand.

MINNESOTA R AT MANKATO MINN

RUPES DIAGRAM-- TOP VIEW

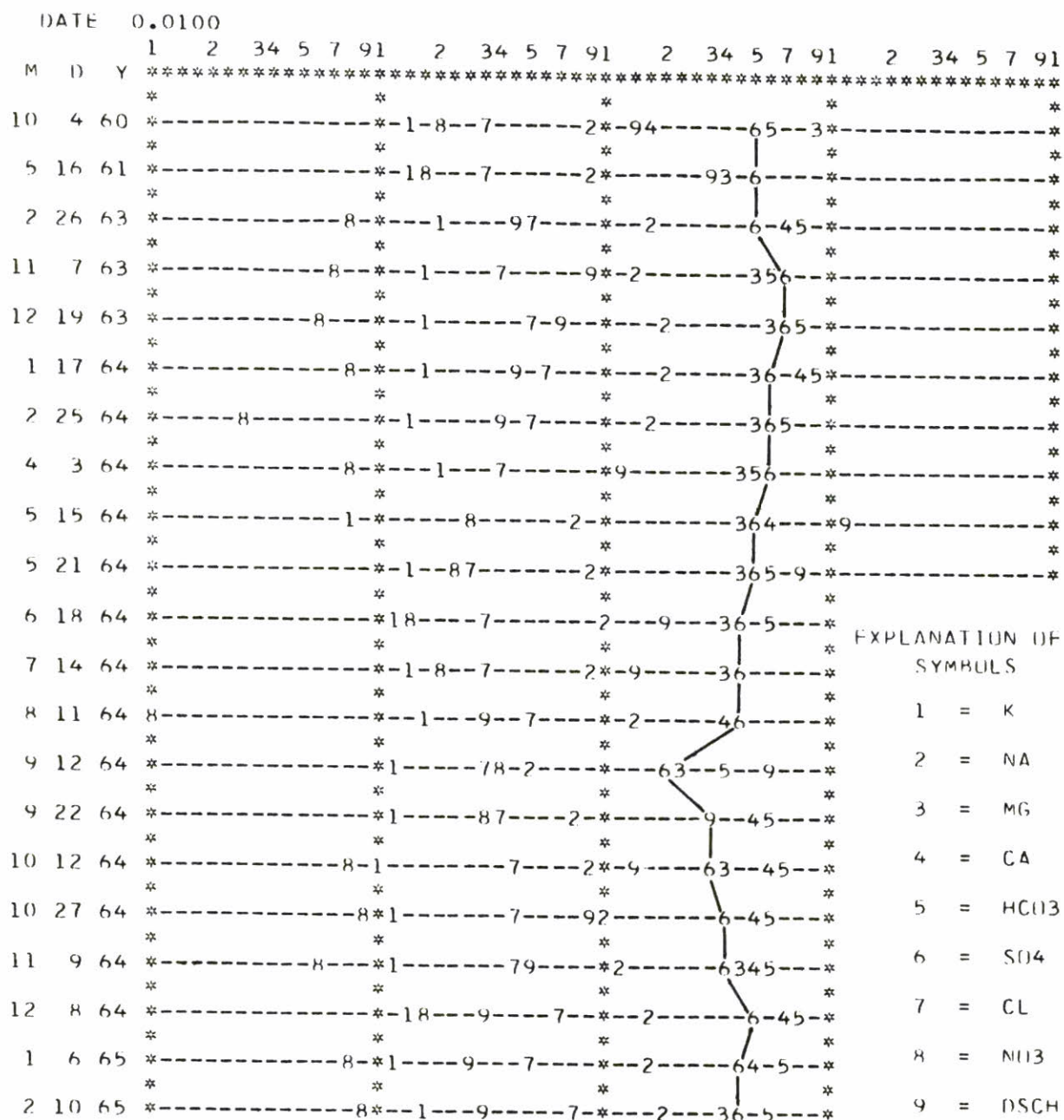


Figure 2d.--A part of the multiple-page, optional top-view graph of the data shown in figures 2b and 2c. An explanation of the symbols as shown is printed on the page following each top-view graph. The code numbers are in the order that the constituents are arranged on the principal semilog graph. The solid lines connecting the sulfate (6) values were added by hand.

characters are used for numbers above 9 because there is room for only one character per increment. The character "Z" represents 35 or more samples falling in the increment.

The alpha characters L, M, and H are plotted above the log-scale line at the increment that contains the low (L), mean (M), and high (H) values of the selected constituent.

When concentrations are plotted in milliequivalents per liter, plus signs (+) are printed immediately below the log-scale line at intervals that correspond to the milligrams per liter log-scale cycles. In this way the graph also serves as a nomogram upon which the constituent concentration may be estimated in milligrams per liter. A brief explanation of the symbols accompanies each graph.

The user selects, through the use of the parameter cards, (1) the order in which the constituents occur, (2) the number of log cycles (from 1 to 120), and (3) the value of the lowest log-scale position. The graph illustrations in the report show only four cycles from an eight-cycle setting to permit full-scale reproduction on a single page.

Top-view graph

Another optional semilog graph, called the top view (fig. 2d), contains a horizontal log scale exactly as in the preceding graph. The data sets, as presented in a selected data listing, are uniformly spaced down the vertical axis in the order in which they were presented to the computer. Therefore, the vertical axis may become a time or space axis. For example, if a given site is sampled regularly, and the data sets are placed in chronological order, the vertical axis becomes a time scale. If river discharge is a selected datum, the top view becomes a hydrograph upon which water quality also is presented. If a group of ground-water data sets are presented in such a way that they fall along a transect of an area, the vertical axis becomes a distance scale and the resultant graph is a type of water-quality cross section. The vertical scale is linear only when samples are evenly spaced in time or distance, because the data sets are plotted every one-third inch.

Each constituent is assigned a code number which represents the order in which the constituents were plotted on the principal graph. This code number is printed in the log-scale increment corresponding to that sample. The larger number takes precedence in case of overprint. You can easily locate a missing value by referring to the selected data

listing. Any known incomplete datum placed last in the plotting order will be assigned the highest code number and will, therefore, have overprint precedence. If a datum is not shown and has top overprint priority, it is obviously missing. This procedure saves checking to see whether such data are missing or overprinted.

Three-dimensional aspects

Each graph is a useful two-dimensional display of data. The concept of a three-dimensional relationship between the two graphs can be of additional value to the program user. The principal "semilog concentration graph" and the top view are actually front and top orthographic projections, respectively, of a three-dimensional array of data in which the three principal axes are (X) the log of ion concentration or parameters values, (Y) a pseudo scale along which the selected constituents or parameters are spaced, and (Z) the order (time or space position) of the analyses as presented to the computer.

Figure 3 is an oblique view of a hypothetical array of a few data which shows the relationship of these two graphs. In the simplified representation, the data values are shown as points. The three outsized points represent one example datum (magnesium-ion concentration of 1 me/l in the May sample) as it would appear in the data array and the point's projected positions on the two graphs. On the principal graph the concentration is plotted on the magnesium-ion line along with the other three projected magnesium-ion concentration values. On the top-view graph the concentration is plotted on the May sample line along with the projected concentration values of the other two ions, sodium and calcium. In both graphs the point is at the 1 me/l position.

INTERPRETATION

The program is designed as a tool to decrease greatly the time and money expended in selecting, sorting, converting, and plotting water-quality and associated data. It is a versatile multipurpose package that will permit the user to spend more time in interpretation and also will permit him to attempt syntheses not before practical. Hopefully, new interpretations of data will be found through the use of this tool.

Examples of techniques used in data interpretation that may be made easier through the use of this program are:

- (1) Sorting large groups of data according to multiple criteria; for example, well

depth greater than "X" feet in certain geologic units with sodium concentration values greater than "X" mg/l.

- (2) Calculation of summary and statistical values of sorted and unsorted data groups.
- (3) Graphic comparison of concentrations and concentration distributions of several constituents.

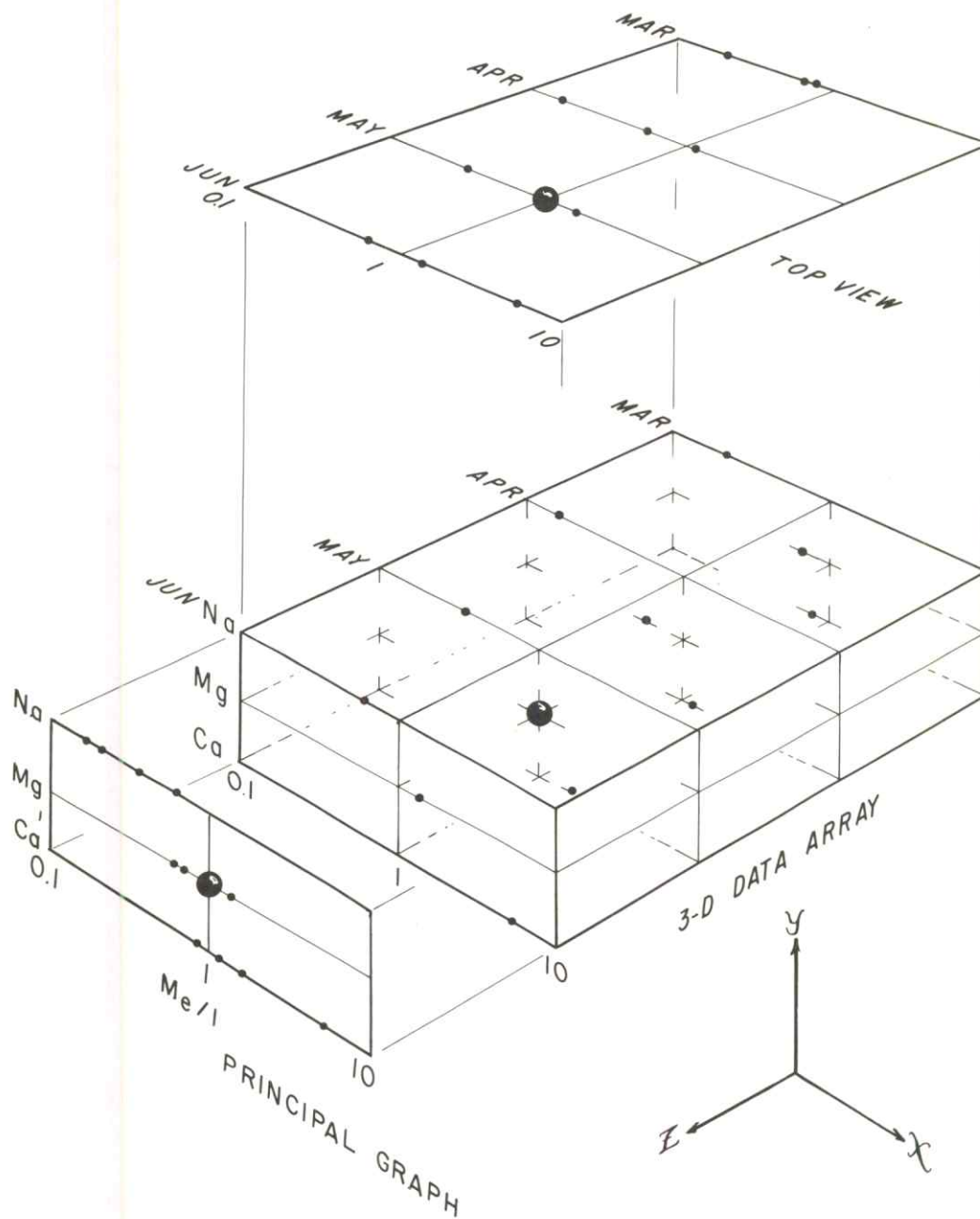


Figure 3.--Three-dimensional data array.

- (4) Graphic comparison of water chemical types.
- (5) Graphic comparison of general ion ratios.
- (6) Graphic display of high values and/or wide range of values for pollutants.
- (7) Time trend plotting.
- (8) Correlation of constituents and parameters such as total dissolved solids and river discharge.
- (9) Graphic display of water-quality changes in cross section.

An example of the use of this program is shown by figure 4, a graph of chemical data of water from wells in Kearny County, Kans., that are all less than 150 feet deep and are all finished in Pleistocene gravels (the same data as shown on figure 1c). It is apparent by the two concentration groupings of the three major cations that there are two types of water in this area. A sort by ion concentration can be made to separate these types and to see if one water type is in general more concentrated than the other, or if the water type is a different one in which some high ion concentration groups correspond to some lower concentration groups. Figures 5a, 5b, 6a, and 6b show data lists and graphs resulting from these data that have been sorted into one group having sodium concentrations greater than 5 me/l and another group having sodium concentrations equal to or less than 5 me/l.

From these separations it can be seen that the water with the higher sodium concentration also contains other ions in high concentration. By reference to the original listing, figure 1b (using the reference number), it can also be seen that the water with the lower sodium concentrations is derived primarily from two aquifers (code numbers 60 and 4). If a separate graph and set of statistics are wanted for each of these aquifers, a sort by aquifer coupled with the original well-depth sort can be made. Figures 7a and 7b are the result of sorting for the aquifer code 60. One sample in the group is markedly different from the rest, which may lead to the conclusion that this water is not coming from aquifer 60 alone, if at all. By applying a triple sort by aquifer, well depth, and sodium concentration (or other constituent), the anomalous sample is eliminated from the graph and listing (figs. 8a and 8b).

KEARNY COUNTY, KANSAS

RUPES DIAGRAM

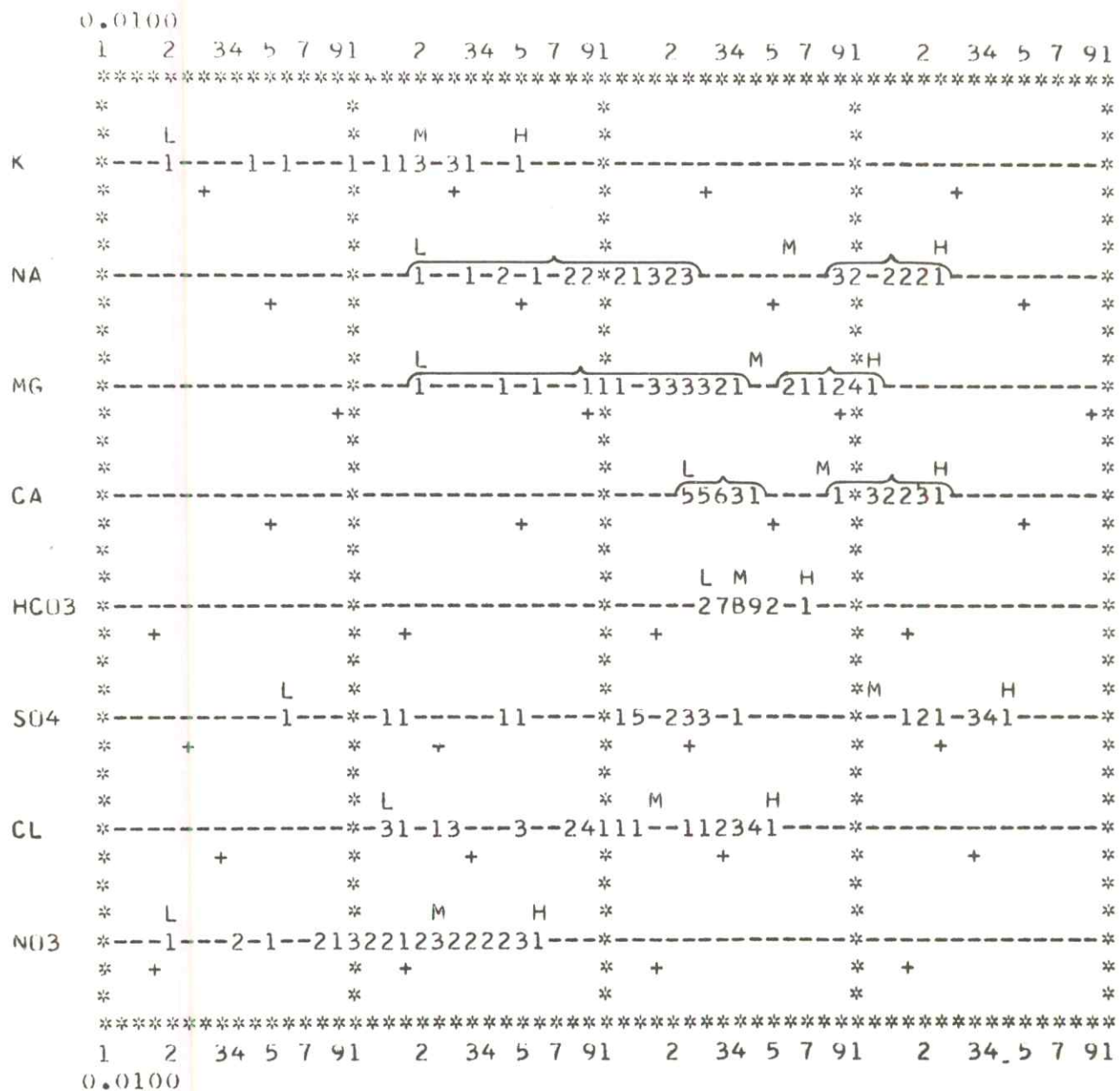


Figure 4.--Principal graph of the data listed in figure 1b showing two concentration groupings.

KEARNY COUNTY, KANSAS

GROUND-WATER DATA

SORTED FOR WELL DEPTHS LESS THAN OR EQUAL TO 150.

SORTED FOR NA VALUES GREATER THAN 5.00

NUM.	DATE	K	NA	MG	CA	HC03	SO4	CL	NO3
36.	11. 8. 40.	-99.9999	8.5260	5.4278	13.7724	3.7533	20.1121	3.6096	0.2258
37.	5. 19. 61.	-99.9999	14.0070	10.1978	12.5748	4.0811	28.5650	3.9762	0.0936
38.	5. 7. 64.	0.4349	15.7470	8.3062	17.6646	4.1958	34.6236	3.2712	0.2742
39.	11. 9. 40.	-99.9999	12.9195	10.8557	12.6247	3.8844	29.5644	2.8200	0.0710
42.	5. 13. 64.	0.3070	8.1345	6.0035	8.0838	3.1960	16.4478	2.4252	0.5162
44.	11. 9. 40.	-99.9999	9.7875	8.6352	11.0778	5.9168	19.6541	3.7506	0.0855
56.	9. 20. 61.	-99.9999	20.4450	9.9510	20.8083	4.5236	41.5151	4.7940	0.3387
57.	9. 21. 60.	-99.9999	18.0960	9.4576	17.2654	4.3925	36.4974	3.6942	0.1774
58.	9. 21. 60.	-99.9999	17.4435	7.7306	18.3133	2.7207	36.6848	3.9198	0.1613
59.	6. 6. 62.	0.2456	10.4400	5.7568	16.5668	2.6060	27.7322	3.1302	0.0355
61.	11. 8. 40.	-99.9999	15.1815	9.3754	16.1177	3.5238	33.7284	3.2430	0.1065
62.	5. 1. 64.	0.1970	9.1350	2.4672	11.7265	2.8355	18.5298	2.0586	0.1355
MAX.									
MEAN									
MIN.									
S.D.									
NUM.									
		0.4349	20.4450	10.8557	20.8083	5.9168	41.5151	4.7940	0.5162
		0.2961	13.3219	7.8471	14.7163	3.8025	28.6379	3.3910	0.1851
		0.1970	8.1345	2.4672	8.0838	2.6060	16.4478	2.0586	0.0355
		0.1029	4.1421	2.4743	3.6513	0.9324	8.3118	0.7384	0.1368
		4.	12.	12.	12.	12.	12.	12.	12.

Figure 5a.--Selected data list resulting from a combined well-depth and constituent-concentration sort as indicated.

KEARNY COUNTY, KANSAS

ROPES DIAGRAM

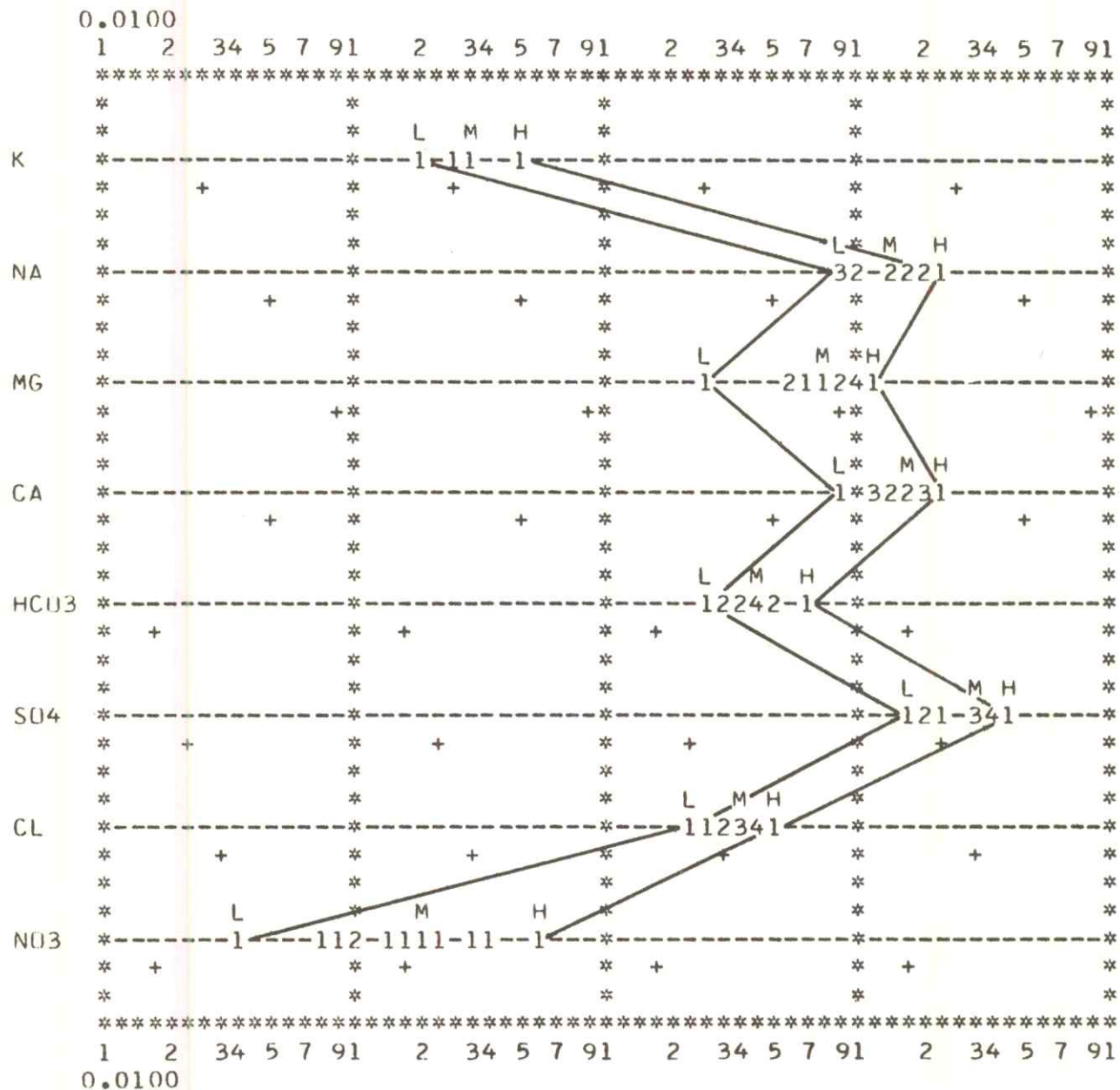


Figure 5b.--Principal graph of the data listed in figure 5a.

KFARNY COUNTY, KANSAS

GROUND-WATER DATA

SORTED FOR WELL DEPTHS LFSS THAN OR EQUAL TO 150.

SORTED FOR NA VALUES LFSS THAN OR EQUAL TO 5.00

NUM.	DATE	K	NA	MG	CA	HC03	S04	CL	ND3
1.	11. 8. 40.	-99.9999	1.9140	2.4672	2.7445	3.6877	1.9987	1.0998	0.2419
2.	6. 22. 64.	0.1049	0.4045	1.0691	3.1936	3.9664	0.1291	0.1410	0.4678
4.	11. 8. 40.	-99.9999	1.2180	1.8093	2.2954	3.6058	1.0826	0.4512	0.1210
5.	6. 22. 64.	0.1842	2.0445	2.7139	2.6946	3.7533	2.1236	1.4100	0.3065
6.	11. 8. 40.	-99.9999	2.0880	2.2205	2.3453	3.4419	2.0612	0.8460	0.1936
7.	6. 22. 64.	0.2430	2.2620	2.6317	2.2954	3.3108	2.5400	1.0716	0.4355
8.	11. 8. 40.	-99.9999	1.5660	2.7139	2.2455	3.4255	1.7281	0.9024	0.3549
9.	5. 12. 64.	0.1637	1.7835	2.2205	2.3952	3.1141	2.3318	0.7332	0.2258
12.	5. 12. 64.	0.2558	0.4045	1.2336	3.4431	4.2450	0.4789	0.2538	0.2258
17.	5. 12. 64.	0.1714	1.6095	2.1382	2.6946	3.7533	1.4366	0.8460	0.3710
21.	11. 8. 40.	-99.9999	0.9135	1.8915	2.7944	3.5402	1.4158	0.4512	0.1210
24.	11. 8. 40.	-99.9999	0.7395	1.8093	2.7944	3.4747	1.2700	0.4794	0.0790
25.	6. 22. 64.	0.1279	1.4355	1.4803	3.8922	3.2780	2.4984	0.9024	0.3710
54.	11. 8. 40.	-99.9999	1.0875	1.4803	2.6946	3.0977	1.7905	0.2679	0.0355
55.	11. 9. 40.	-99.9999	0.7830	0.9046	2.9441	2.9994	1.2908	0.2538	0.0436
60.	5. 1. 64.	0.0512	0.1957	0.5017	2.7445	2.9666	0.1624	0.1410	0.2581
63.	11. 8. 40.	-99.9999	0.8265	1.5626	2.2455	3.0321	1.2908	0.2256	0.0194
64.	5. 1. 64.	0.0384	0.5655	0.4112	3.1936	3.2452	0.4164	0.1410	0.4678
65.	5. 1. 64.	0.0179	0.2914	0.1809	2.0958	2.3274	0.0520	0.1692	0.0936
72.	11. 9. 40.	-99.9999	1.6530	3.2896	2.8443	3.5238	3.3104	0.7050	0.1355
	MAX.	0.2558	2.2620	3.2896	3.8922	4.2450	3.3104	1.4100	0.4678
	MEAN	0.1358	1.1893	1.7365	2.7295	3.3894	1.4704	0.5746	0.2284
	MIN.	0.0179	0.1957	0.1809	2.0958	2.3274	0.0520	0.1410	0.0194
	S.U.	0.0829	0.6554	0.8453	0.4513	0.4170	0.9011	0.3849	0.1469
	NUM.	10.	20.	20.	20.	20.	20.	20.	20.

Figure 6a.--Selected data list resulting from a combined well-depth and constituent-concentration sort as indicated.

KEARNY COUNTY, KANSAS

ROPES DIAGRAM

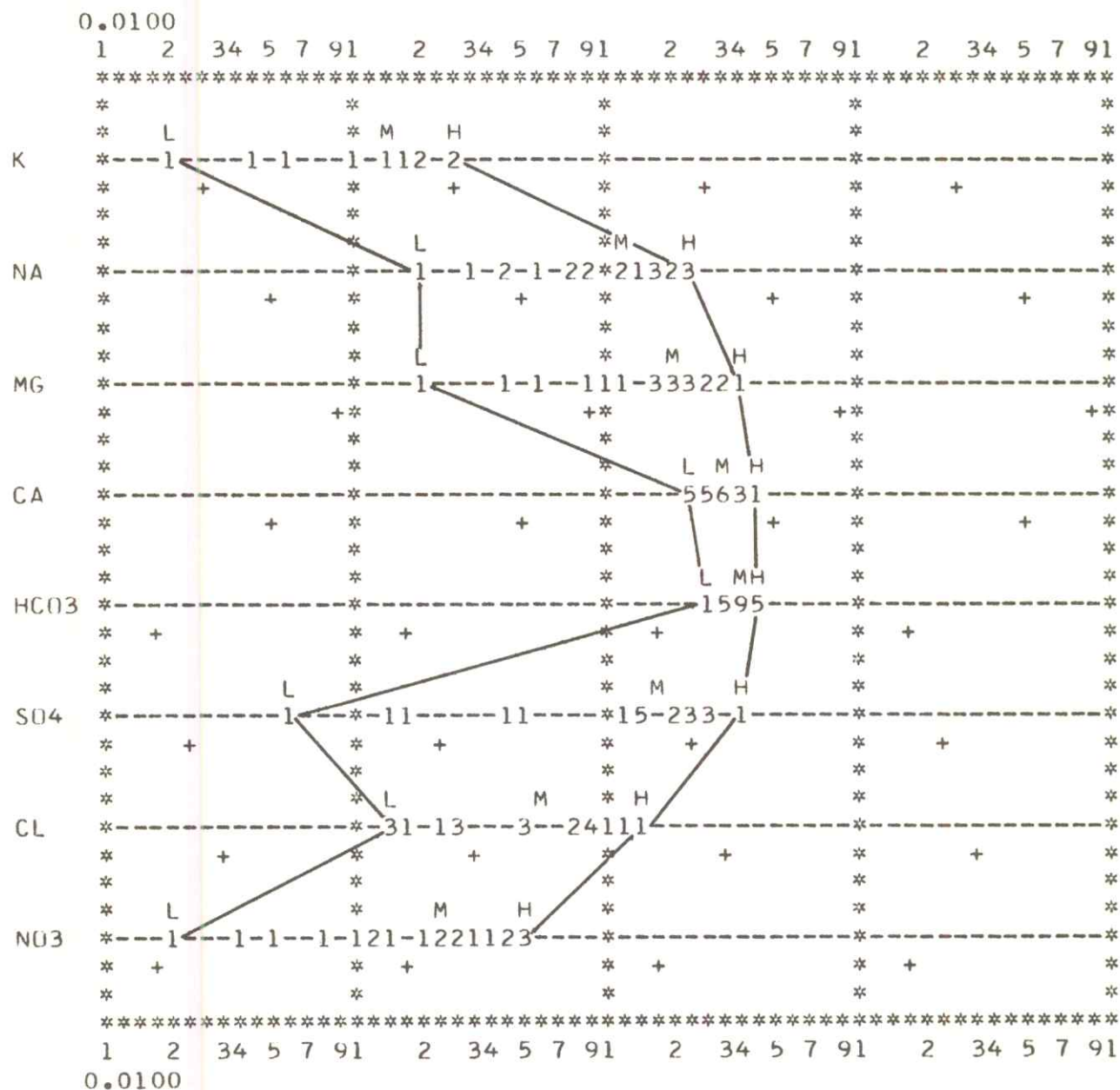


Figure 6b.--Principal graph of the data listed in figure 6a.

GRUNIG-WATER DATA

GEOLUGIC UNIT(S) 60. 0.0
SORTED FOR WELL DEPTHS LESS THAN OR EQUAL TO 150.

NUM.	DATE	K	NA	MG	CA	HC03	SD4	CL	NO3
1.	11. 8. 40.	-99.9999	1.9140	2.4672	2.7445	3.6877	1.9987	1.0998	0.2419
2.	6. 22. 64.	0.1049	0.4045	1.0691	3.1936	3.9664	0.1291	0.1410	0.4678
3.	11. 8. 40.	-99.9999	1.2180	1.8093	2.2954	3.6058	1.0826	0.4512	0.1210
4.	6. 22. 64.	0.1842	2.0445	2.7139	2.6946	3.7533	2.1236	1.4100	0.3065
5.	11. 8. 40.	-99.9999	2.0880	2.2205	2.3453	3.4419	2.0612	0.8460	0.1936
6.	6. 22. 64.	0.2430	2.2620	2.6317	2.2954	3.3108	2.5400	1.0716	0.4355
7.	11. 8. 40.	-99.9999	1.5660	2.7139	2.2455	3.4255	1.7281	0.9024	0.3549
8.	5. 12. 64.	0.1637	1.7835	2.2205	2.3952	3.1141	2.3318	0.7332	0.2258
10.	5. 12. 64.	0.2558	0.4045	1.2336	3.4431	4.2450	0.4789	0.2538	0.2258
14.	5. 12. 64.	0.1714	1.6095	2.1382	2.6946	3.7533	1.4366	0.8460	0.3710
17.	6. 22. 64.	0.1279	1.4355	1.4803	3.8922	3.2780	2.4984	0.9024	0.3710
33.	11. 8. 40.	-99.9999	1.0875	1.4803	2.6946	3.0977	1.7905	0.2679	0.0355
34.	6. 6. 62.	0.2456	10.4400	5.7568	16.5668	2.6060	27.7322	3.1302	0.0355

Figure 7a.--Selected data list resulting from a combined aquifer and well-depth sort as indicated.

KEARNY COUNTY, KANSAS

ROPES DIAGRAM

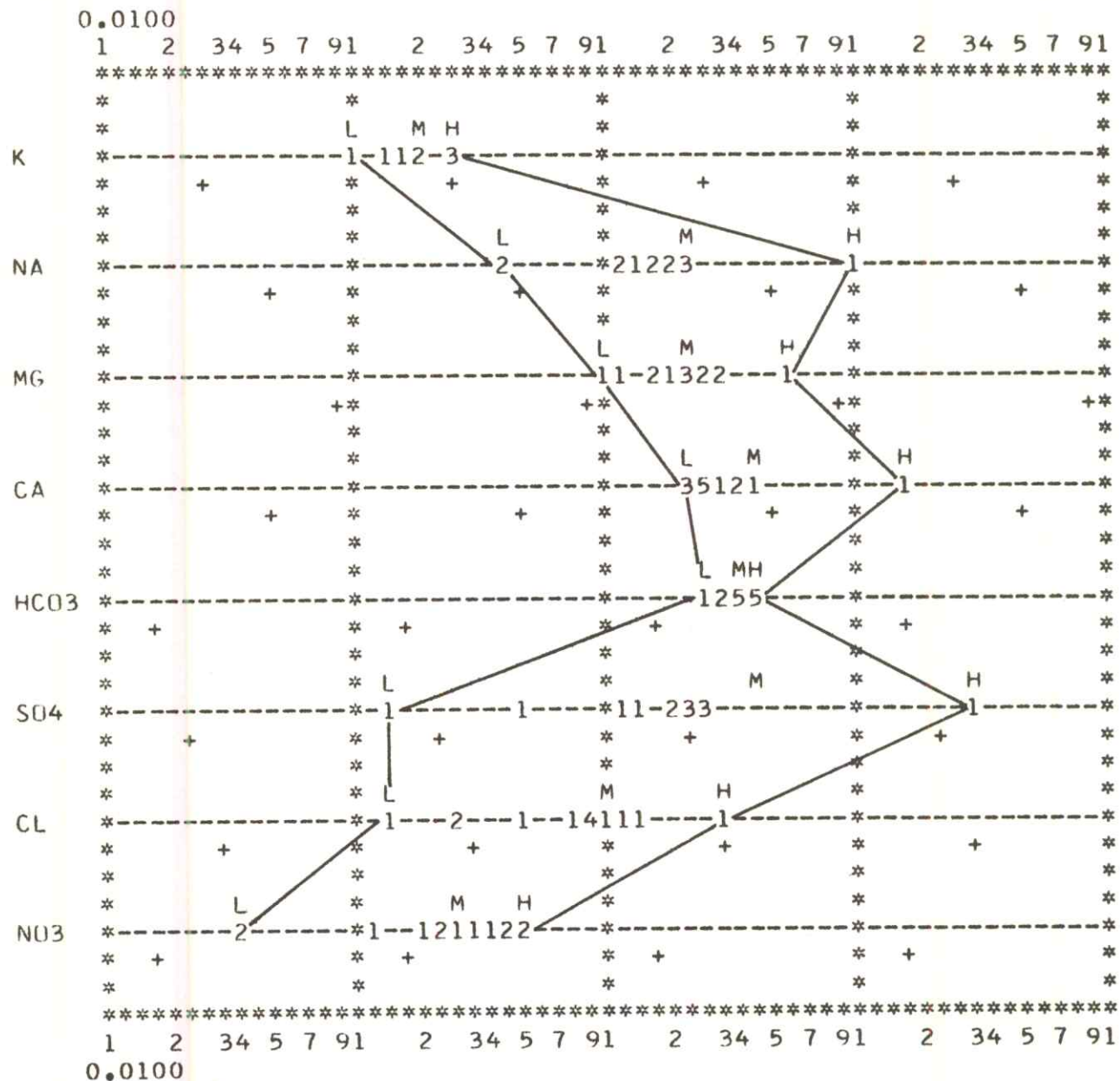


Figure 7b.--Principal graph of the data listed in figure 7a.

KEARNY COUNTY, KANSAS

GROUND-WATER DATA

		GEOLOGIC UNIT(S)		60.		0.0		150.	
		SORTED FOR WELL DEPTHS LESS THAN OR EQUAL TO							
		SORTED FOR NA VALUES LESS THAN OR EQUAL TO		5.00					
NUM.	DATE	K	NA	MG	CA	HC03	SD4	CL	NO3
1.	11. 8. 40.	-99.9999	1.9140	2.4672	2.7445	3.6877	1.9987	1.0998	0.2419
2.	6. 22. 64.	0.1049	0.4045	1.0691	3.1936	3.9664	0.1291	0.1410	0.4678
3.	11. 8. 40.	-99.9999	1.2180	1.8093	2.2954	3.6058	1.0826	0.4512	0.1210
4.	6. 22. 64.	0.1842	2.0445	2.7139	2.6946	3.7533	2.1236	1.4100	0.3065
5.	11. 8. 40.	-99.9999	2.0880	2.2205	2.3453	3.4419	2.0612	0.8460	0.1936
6.	6. 22. 64.	0.2430	2.2620	2.6317	2.2954	3.3108	2.5400	1.0716	0.4355
7.	11. 8. 40.	-99.9999	1.5660	2.7139	2.2455	3.4255	1.7281	0.9024	0.3549
8.	5. 12. 64.	0.1637	1.7835	2.2205	2.3952	3.1141	2.3318	0.7332	0.2258
10.	5. 12. 64.	0.2558	0.4045	1.2336	3.4431	4.2450	0.4789	0.2538	0.2258
14.	5. 12. 64.	0.1714	1.6095	2.1382	2.6946	3.7533	1.4366	0.8460	0.3710
17.	6. 22. 64.	0.1279	1.4355	1.4803	3.8922	3.2780	2.4984	0.9024	0.3710
33.	11. 8. 40.	-99.9999	1.0875	1.4803	2.6946	3.0977	1.7905	0.2679	0.0355
MAX.		0.2558	2.2620	2.7139	3.8922	4.2450	2.5400	1.4100	0.4678
MEAN		0.1787	1.4848	2.0149	2.7445	3.5566	1.6833	0.7438	0.2792
MIN.		0.1049	0.4045	1.0691	2.2455	3.0977	0.1291	0.1410	0.0355
S.D.		0.0554	0.6136	0.5863	0.5177	0.3456	0.7720	0.3890	0.1287
NUM.		7.	12.	12.	12.	12.	12.	12.	12.

Figure 8a.--Selected data list resulting from triply combined sort by aquifer, well depth, and constituent concentration as indicated.

KEARNY COUNTY, KANSAS

RUPES DIAGRAM

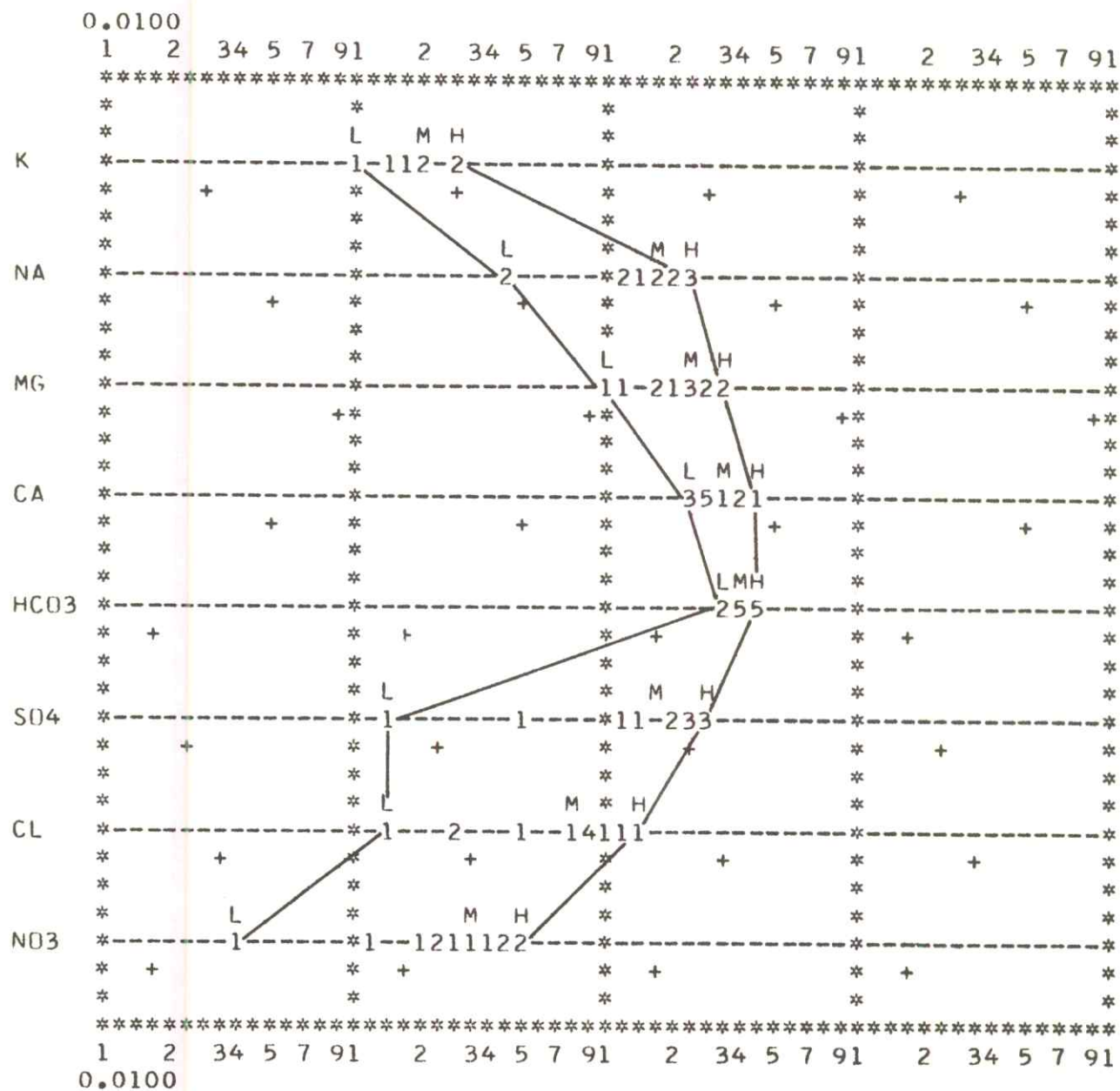


Figure 8b.--Principal graph of the data listed in figure 8a.

In these examples only a small amount of data was used in order to limit the listing for publication. The possibilities for sorting and interpreting large groups of data are almost unlimited. Aquifers, low-flow values for surface waters, and other obvious group sorting of data may be chosen in the first run. After these data are examined, other useful combinations of sorting may become more obvious. Very little additional time is required for additional sorts in a single computer run; therefore, it is more economical to investigate many possibilities in one run than to have several reruns.

SUMMARY

This program can be a valuable tool for synthesis and interpretation of water-quality data. It presents a wide variety of sorted and unsorted data by numerical lists, basic statistical data, and summary graphs. Large amounts of data can be processed quickly and economically. The printout used for the illustrations in this report were selected from 27 pages of output from one run, using three data decks, that took only 0.85 minute on the IBM 360/65. With this program, the scientist is able to spend more of his time in interpretation rather than data preparation and manipulation. He is able to try syntheses of data that before were not practical. He also obtains useful finished lists and graphs that need not be retyped or redrafted for publication, thus saving time and eliminating many errors and proofreading. The output also may be a valuable form of information to those who request basic data.

APPENDIXES

Appendix I.--Instructions for header cards.

Ø = alpha 0, b = blank

HEADER CARD NO. 1, NON-CHANGING

Field #

1 - 49 0123456789ABCDEFGHIJKLMNØPQRSTUVWXYZb+-. *bbbbXXXX

HEADER CARD NO. 2a, NON-CHANGING

1 - 78 CØNDPHbbTEMPSIØ2CAbbMGbbNAbbKbbbHCØ3CØ3bSØ4bCLbbFbbb
NØ3bPØ4bBbbbALbbFEbbMNbbCU

HEADER CARD NO. 2b, NON-CHANGING

1 - 78 PBbbZNbbDDsbCDSbHDNSNCHDCLRbBRbbIbbbALKbCØ2b
SARbRSCbCR+3CR+6NIbbCØbbASbbSEbbCD

HEADER CARD NO. 2c, NON-CHANGING

1 - 36 BAbbBEbbNH4bNØ2bCNbbH2SbbbbbbDSCHDPTH

The above cards need to be used only once. They follow the general computer control cards. For use of the program from the U.S.G.S. Washington, D.C., IBM 360 library disc, the above cards follow those listed in appendix III.

The remaining header cards are placed ahead of each data group that is to receive separate consideration; therefore, each data group is plotted on a separate graph.

HEADER CARD NO. 3 - GENERAL DATA AND GRAPH CONTROL

Field *

1-36 Title of data group, printed as punched

40 Zero or blank = Surface-water data

1 (one) = Ground-water data

42-48 A zero or blank indicates no sorting. A 1 (one) indicates sorting according to the

method defined by the field punched as follows:

- 42 By discharge or aquifer, as appropriate
- 44 By well depth
- 46 By date (surface-water or ground-water data)
- 48 By constituent

Caution: See page 29 for sorting combination possibilities

- 50 0 (zero) = Plot by me/l, 1 (one) = Plot by mg/l
- 51-60 Number of cycles in the 12-inch, 120-space, log-scale span. Punch anywhere in the field as long as decimal is included.
- 61-70 Lowest value on the log scale. Punch anywhere in the field as long as decimal is included.
- 71 Punch 1 (one) if optional top view is not desired. Otherwise leave blank or punch 0 (zero).
- 72-80 Not used on USGS data card. Punch 1 (one) in field 75 for Kansas water-quality cards.

HEADER CARD NO. 4 - DESIGNATION OF THE CONSTITUENTS OR PARAMETERS TO BE PLOTTED ON THE GRAPHS.

- 1-80 Punch the designation number (IDNT) of the constituents or other parameters as listed in table 1 in the desired sequence, right hand justified, from field 5, 10, 15, 20, ... 80 (thus 16 selections).

Example: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 - card -field location
 9 1 1 4 8 - punched value in that field

for HCO_3 , SO_4 , DSCH (discharge)

SORTING HEADER CARDS - 5, 6, 7, and 8

These must be placed in the following order if more than one type of sort was designated in header card 1.

- 5. Aquifer
- 6. Well depth or discharge
- 7. Date
- 8. Constituent concentration

HEADER CARD NO. 5 - AQUIFER SORT BY GEOLOGIC UNIT(S)

If all aquifers present are to be separated and plotted, insert card but leave all

fields, 1-80 blank. Date with no aquifer designation will be treated as a separate single aquifer group. The maximum number of aquifers in this case is limited to 30. If selected aquifers only are to be sorted, punch geologic units to be sorted every four fields, 1-4, 5-8, 9-12, etc., exactly as designated on the data card. If a no-sort plot of all data is also desired with the sorted plots, punch XXXX in the four-field group following the last geologic unit which was designated. Do not leave any four-field set all blank except after the last designated unit (or XXXX), because those following will not be considered. The maximum number of selected units which can be sorted on one run is 20 (XXXX counts as one unit).

HEADER CARDS NO. 6 AND 8 - DISCHARGE SORT, WELL DEPTH SORT, AND CONSTITUENT
CONCENTRATION SORT

1-10 Numerical value, n, which will be the one limiting value in an open-end range sort, (less than or equal to n, and/or greater than n). Punch anywhere in 1 to 10 field, but include the decimal.

1- 2 Exception to the above is on constituent-sort. The designation (from the IDNT list given in table 1) of the constituent to which the limits apply is punched right hand justified in fields 1-2.

11, 13, 15 + = sort greater than the limiting value, n

- = sort less than or equal to the limiting value, n

A = also print all data with no sort

Order of +, -, A, does not matter

21-80 Closed range selection broken down as follows:

21-30 Low value of 1st selected range

31-40 High value of 1st selected range

41-50 Low of 2nd range

51-60 High of 2nd range

61-70 Low of 3rd range

71-80 High of 3rd range

21-80 Place anywhere in proper field group as long as decimal is included. (Otherwise decimal is assumed at far right of field group.)

HEADER CARD NO. 7 - DATE-SORT

1-74 Months are punched in field-sets of 3. The first month of the first date group is punched, right hand justified in the first set in a pair of 3-field sets (for example fields 1-3). In the second 3-field set (for example fields 4-6), the last month of the first date group is punched. Repeat up to 12 date-sort groups. If only one month is to be considered, leave the second 3-field set of a date-pair blank.

75-76 Last two digits of the first year to be considered.

79-80 Last two digits of the last year to be considered.

If only one year is to be considered, place the same digit pair in both places. If the last year is left blank, the program substitutes 1999.

Year sorts apply to all the designated months, are made first, and control primary listing of data. Further sorts by months are listed separately and designated as to the months and years considered.

Caution:

In making a selection of the types of sorting that are to be applied to a group of data it must be kept in mind that all possible combinations in a multiple sort will be performed and the appropriate data presented in printout. For example, if you select to sort according to (1) well depth greater than 300 feet and sodium greater than 5 me/l and (2) well depth equal to or less than 300 feet and sodium between 1 and 3 me/l, you will get not only those combinations but also the other two possible: (3) well depth greater than 300 feet and sodium between 1 and 3 me/l and (4) well depth equal to or less than 300 feet and sodium greater than 5 me/l.

Thus the number of combinations produced in a multiple sort may easily grow very large. It is possible to produce 12,960 data sort combinations in one run of one group of A,B,C,Q,R,S cards. To avoid unwanted combinations use duplicate groups of data with different sort control cards ahead of each group. Careful planning will keep the number of duplicate data groups needed to a minimum. A few unwanted sort combinations often may be less time consuming than using many duplicate groups of data cards.

Appendix II.--Documented program listing as used on the IBM 360/65.

C	PROGRAM NO. D0160	A	1
C	TITLE: A PROGRAM FOR WATER QUALITY DATA SYNTHESIS	A	2
C	OUTPUT IS ROPES DIAGRAM	A	3
C	PROGRAMMED BY L.H. ROPES, C.O. MORGAN, J.M. MCNELLIS	A	4
C	ADAPTED FOR IBM 360 COMPUTER BY M. ROBERTS	A	5
C	SPONSOR: L. ROPES	A	6
C	LOADED ON DISK: JAN 16, 1968	A	7
C		A	8
C	ROPES000	A	9
C	-----	A	10
C	ROPES---PROGRAM TO PLOT CONSTITUENTS DETERMINED IN A CHEMICAL	A	11
C	ANALYSIS OF WATER ON A LOG10 SCALE. THE PLOT IS CALLED A ROPES	A	12
C	DIAGRAM.	A	13
C	-----	A	14
C	PROGRAMMED BY CHARLES O. MORGAN AND JESSE M. MCNELLIS, KANSAS	A	15
C	DISTRICT, WRD, USGS, LAWRENCE, KANSAS, AND LEVERETT H. ROPES,	A	16
C	MINNESOTA DISTRICT, WRD, USGS, ST. PAUL, MINNESOTA.	A	17
C	DATE COMPLETED--MARCH 1, 1967.	A	18
C	LANGUAGE--FORTRAN IV.	A	19
C	-----	A	20
C	DEVELOPED AND TESTED ON AN IBM 7040, 32K CORE, AND ADAPTED FOR USE	A	21
C	ON THE GE 635, 128K CORE, AT THE UNIVERSITY OF KANSAS COMPUTATION	A	22
C	CENTER, LAWRENCE, KANSAS.	A	23
C	SUBSEQUENTLY ADAPTED TO USGS COMPUTER, IBM 360, MODEL 65.	A	24
C	-----	A	25
C	PROGRAM ROPES REQUIRES 11 SUBROUTINES--MEL, REEDU, DATEST, MGL,	A	26
C	PULVAL, PLOTR, CSTSRT, LOGVAL, TABR, SDVU, AND LINE.	A	27
C	-----	A	28
C	INPUT DATA ARE WRD WATER-QUALITY CARDS, GROUND-WATER--ABCQRS AND	A	29
C	SURFACE-WATER--BLANK, 1, 2, 3 CARDS AND KANSAS WATER-QUALITY CARDS	A	30
C	--1, 2. OUTPUT ARE TWO IDENTIFYING AND EXPLANATORY TABLES., LOG10	A	31
C	PLOT OF SPECIFIED CONSTITUENTS, AND FOR SURFACE-WATER DATA AN	A	32
C	ADDITIONAL LOG10 PLOT OF CONSTITUENTS SAMPLED AT VARIOUS TIMES.	A	33
C	-----	A	34
C	THE PROGRAM HANDLES UP TO 200 ANALYSES.	A	35
C	-----	A	36
C	-----	A	37
C	EXPLANATION OF OUTPUT--GROUND-WATER DATA.	A	38
C	-----	A	39
C	1. TABLE OF ALL DATA THAT FALLS WITHIN TIME RANGE IF SPECIFIED,	A	40
C	THAT LISTS--	A	41
C	A. NUMBER ASSIGNED TO EACH ANALYSIS FOR REFERENCE ON	A	42
C	DIAGRAM.	A	43
C	B. WELL NUMBER.	A	44
C	C. WELL DEPTH.	A	45
C	D. DATE SAMPLED.	A	46
C	E. GEOLOGIC UNIT(S).	A	47
C	2. TABLE OF SORTED DATA, SORTED BY AQUIFER, WELL DEPTH,	A	48
C	CONSTITUENT, DATE--ALL OF THESE, ANY COMBINATION, OR NONE.	A	49
C	THE TABLE--	A	50
C	A. IDENTIFIES DATA GROUP.	A	51
C	B. IDENTIFIES GROUND OR SURFACE WATER.	A	52
C	C. IDENTIFIES SORT(S) MADE.	A	53
C	D. IDENTIFIES ANALYSIS BY REFERENCE NUMBER, SEE 1A.	A	54
C	E. IDENTIFIES SAMPLING DATE.	A	55
C	F. IDENTIFIES CONSTITUENTS TO BE PLOTTED, UP TO 16 PER	A	56
C	PLOT, AND THEIR VALUE IN ME/L OR MG/L AS REQUESTED.	A	57
C	G. LISTS MAXIMUM, MEAN, MINIMUM, AND STANDARD DEVIATION	A	58
C	FOR EACH CONSTITUENT AND THE NUMBER OF SAMPLES USED	A	59

					IN CALCULATIONS.		A	60
					3. ROPES DIAGRAM--GROUPED ANALYSES, LOG10 PLOT OF REQUESTED		A	61
					CONSTITUENT VALUES, SEMILOG FORM. CONSTITUENT NAMES ON		A	62
					VERTICAL SCALE, VALUES ON HORIZONTAL LOG10 SCALE.		A	63
					A. HAS DATA GROUP IDENTIFICATION.		A	64
					B. HAS ROPES DIAGRAM TYPE.		A	65
					C. HAS MINIMUM AND MAXIMUM LOG VALUES AT UPPER, LOWER		A	66
					DIAGRAM CORNERS LEFT AND RIGHT RESPECTIVELY.		A	67
					D. AND LOG CYCLES ARE BOUNDED BY ASTERISKS.		A	68
					E. HAS CONSTITUENT NAMES ALONG LEFT AND RIGHT SIDES.		A	69
					F. HAS 1, 2, 3, 4, 5, 7, 9 AT TOP AND BOTTOM OF DIAGRAM		A	70
					FOR EACH CYCLE.		A	71
					G. HAS AN EXPLANATION OF THE SYMBOLS ON THE DIAGRAM		A	72
					FOLLOWING THE DIAGRAM.		A	73
					-----		A	74
					EXPLANATION OF OUTPUT--SURFACE-WATER DATA. ONLY DIFFERENCES ARE		A	75
					NOTED.		A	76
					-----		A	77
					1.		A	78
					B. STATION IDENTIFICATION.		A	79
					C. DISCHARGE.		A	80
					E. NO ENTRY.		A	81
					4. ROPES DIAGRAM--ANALYSES BY TIME, LOG10 PLOT OF CONSTITUENT		A	82
					VALUES, SEMILOG FORM. DATE SAMPLED ON VERTICAL SCALE,		A	83
					CONSTITUENT VALUES ON HORIZONTAL LOG10 SCALE WITH		A	84
					CONSTITUENTS PLOTTED BY AN ASSIGNED NUMBER. THE DIAGRAM--		A	85
					A. LIKE 3A.		A	86
					B. LIKE 3B.		A	87
					C. LIKE 3C.		A	88
					D. LIKE 3D.		A	89
					E. HAS SAMPLING DATES ALONG LEFT SIDE.		A	90
					F. LIKE 3F.		A	91
					G. LIKE 3G.		A	92
					-----		A	93
					EXPLANATION OF INPUT.		A	94
					-----		A	95
					CONTROL CARDS--UNCHANGED.		A	96
					-----		A	97
					1. ARRAY OF NUMBERS, 0(ZERO) THROUGH 9, LETTERS, A THROUGH		A	98
					Z, SPECIAL CHARACTERS, A BLANK, PLUS, MINUS, PERIOD,		A	99
					AND ASTERISK, CALLED NA. A 4 COLUMN BLANK CALLED AFD,		A	100
					AND A 4 COLUMN FIELD OF XXXX CALLED BFD. ONE CARD,		A	101
					FORMAT (47A1, 2A4).		A	102
					2. ARRAY OF CONSTITUENT OR PARAMETER IDENTIFIERS, IDNT.		A	103
					3 CARDS, FORMAT (20A4). THE FOLLOWING TABLE LISTS THE		A	104
					IDNT ARRAY POSITION AND CONSTITUENT OR PARAMETER--		A	105
					-----		A	106
					NO. CONST. NO. CONST. NO. CONST. NO. CON		A	107
					1 = COND 16 = B 31 = CO2 46 = H2S		A	108
					2 = PH 17 = AL 32 = SAR 47-UNUSED		A	109
					3 = TEMP 18 = FE 33 = RSC *48 = DSCH		A	110
					4 = SIO2 19 = MN 34 = CR+3 \$49 = DPTH		A	111
					5 = CA 20 = CU 35 = CR+6		A	112
					6 = MG 21 = PB 36 = NI		A	113
					7 = NA 22 = ZN 37 = CO		A	114
					8 = K 23 = DET D.S. 38 = AS		A	115
					9 = HCO3 24 = CALC D.S. 39 = SE		A	116
					10 = CO3 25 = HARDNESS 40 = CD		A	117
					11 = SO4 26 = NON-CAR. HD. 41 = BA		A	118
					12 = CL 27 = COLOR 42 = BE		A	119

13 = F	28 = BR	43 = NH4	A 120
14 = NO3	29 = I	44 = NO2	A 121
15 = PO4	30 = ALK	45 = CN	A 122

* COND,DSCH---WHEN USED ON DIAGRAM VALUE=VALUE/1000. A 123
\$ DPTH = WELL DEPTH---WHEN USED ON DIAGRAM DEPTH = DEPTH/10. A 124

CONTROL CARDS--CHANGED AND INCLUDED WITH EACH DATA GROUP. A 125

1. AREA IDENTIFICATION ARRAY, TITLE, AND CONTROL VARIABLES A 126
ISG, IST, IWL, IDT, ICT, NPM, CYN, BLG, AND IMK. ONE A 127
CARD, FORMAT (9A4, I4, 5I2, 2F10.0, I5). A 128
TITLE - IDENTIFICATION OF AREA FROM WHICH DATA WAS A 129
COLLECTED. COLUMNS 1 - 36. A 130
ISG - INDICATOR OF DATA TYPE. WHEN ISG = 0, SURFACE- A 132
WATER DATA, ISG = 1, GROUND-WATER DATA. COLUMN A 133
40. A 134
IST - DISCHARGE OR AQUIFER SORT INDICATOR. WHEN IST A 135
= 0, NO SORT, IST = 1, SORT BY DISCHARGE OR A 136
AQUIFER DEPENDING ON DATA TYPE. COLUMN 42. A 137
IWL - WELL DEPTH SORT INDICATOR. WHEN IWL = 0, NO A 138
SORT, IWL = 1, SORT BY WELL DEPTH. COLUMN 44. A 139
IDT - DATE SORT INDICATOR. WHEN IDT = 0, NO SORT, A 140
IDT = 1, SORT BY DATE. COLUMN 46. A 141
ICT - CONSTITUENT SORT INDICATOR. WHEN ICT = 0, NO A 142
SORT, ICT = 1, SORT BY CONSTITUENT. COLUMN A 143
48. A 144
NPM - ME/L OR MG/L PLOT INDICATOR. WHEN NPM=0, ME/L A 145
VALUES ON PLOT IF POSSIBLE, NPMS=1, MG/L VALUES A 146
ON PLOT. COLUMN 50. A 147
CYN - NUMBER OF LOG CYCLES ON DIAGRAM, FOR EXAMPLE A 148
1., 2., OR 6. ETC. COLUMNS 51 - 60. A 149
BLG - LOWEST LOG VALUE ON DIAGRAM, FOR EXAMPLE .0001 A 150
OR .1 OR 1. ETC. COLUMNS 61 - 70. A 151
IMK - DATA FORMAT INDICATOR. WRD GROUND-WATER AND A 152
SURFACE-WATER DATA CARDS, PUNCH 0 OR LEAVE BLANK, A 153
KANSAS WATER-QUALITY CARDS FOR GROUND-WATER DATA, A 154
PUNCH 1 IN COLUMN 75. A 155

2. ARRAY OF CONSTITUENTS TO BE PLOTTED, IPT. UP TO 16 OF A 156
THE CONSTITUENTS IN THE IDNT ARRAY, READ IN BY NUMBER. A 157
ONE CARD, FORMAT (16I5). OBTAIN NUMBER FROM IDNT ARRAY. A 158

THE FOLLOWING FOUR CONTROL CARDS MAY OR MAY NOT BE USED. A 159

3. ARRAY OF AQUIFER OR GEOLOGIC UNIT CODES, BQ. ONE CARD, A 162
FORMAT (20A4). A 163
BQ CONTAINS AQUIFERS TO SORT FROM ALL AQUIFERS IN A 164
THE DATA. A BLANK CARD IS READ IF AQUIFERS ARE TO BE A 165
SORTED AND NO PARTICULAR AQUIFERS DESIRED. IN ORDER A 166
TO READ BQ, IST AND ISG MUST BOTH BE 1. A 167
MAXIMUM OF 20 AQUIFERS IF PUNCHED ON THE CARD, A 168
30 IF CARD LEFT BLANK A 169

4. STREAM DISCHARGE OR WELL DEPTH VARIABLES AND 2 ARRAYS A 170
OF RANGE OF DISCHARGE OR DEPTH, DSH, DT1, DT2, DT3, DL, A 171
AND DH ONE CARD, FORMAT (F10.0, A1, 1X, A1, 1X, A1, 5X, A 172
6F10.0). A 173
IF IST = 1 AND ISG = 0 THIS CARD WILL BE READ AND A 174
CAN CONTAIN THE FOLLOWING-- A 175
DSH, STREAM DISCHARGE IN CUBIC FEET PER SECOND. A 176
COLUMNS 1 - 10. PUNCH DECIMAL AFTER DISCHARGE. A 177
DT1,DT2,DT3-- COLUMNS 11,13,15 A 178
+ = SORT FOR GREATER THAN DSH A 179

C	- = SORT FOR LESS THAN OR EQUAL TO DSH	A 180
C	A = NO SORT OF DSH	A 181
C	DL AND DH ARE FOR 3 RANGES OF STREAM DISCHARGE,	A 182
C	DL BEING LOWER AND DH HIGHER LIMITS OF RANGES,	A 183
C	WITH FROM ONE TO THREE DL AND DH BEING	A 184
C	ALTERNATELY RECORDED IN COLUMNS 21-80.	A 185
C	(I.E., DL IN COLUMNS 21-30, DH IN 31-40)	A 186
C	IF ISG = 1 AND IWL = 1 THIS CARD WILL BE READ AND	A 187
C	WILL CONTAIN THE FOLLOWING--	A 188
C	DSH, WELL DEPTH IN FEET, COLUMNS 1 - 10,	A 189
C	DT1, SUBSTITUTE WELL DEPTH FOR DISCHARGE	A 190
C	DT2, SUBSTITUTE WELL DEPTH FOR DISCHARGE	A 191
C	DT3, SUBSTITUTE WELL DEPTHS FOR DISCHARGES	A 192
C	DL AND DH, SUBSTITUTE WELL DEPTH FOR STREAM	A 193
C	DISCHARGE ABOVE.	A 194
C	5. ARRAYS OF MONTHS AND YEARS FOR SORTING, AON AND YR	A 195
C	RESPECTIVELY. ONE CARD, FORMAT (24F3.0, 2F4.0).	A 196
C	IDT MUST EQUAL 1 FOR THIS CARD TO BE READ.	A 197
C	AON, ARRAY OF MONTHS, WITH MONTHS SPECIFIED BY	A 198
C	NUMBERS FROM 1 - 12. IF SPECIFIC MONTHS ARE TO BE	A 199
C	SORTED THE MONTH NUMBERS ARE PUNCHED IN COLUMNS	A 200
C	1 - 3, 7 - 9, 13 - 15 ..., 67 - 69. FOR TIME	A 201
C	PERIODS OF MORE THAN A MONTH PUNCH BEGINNING	A 202
C	MONTH FIRST AND ENDING MONTH LAST IN COLUMNS 1 -	A 203
C	3 AND 4 - 6, 7 - 9 AND 10 - 12, 13 - 15 AND 16 -	A 204
C	18, ..., 67 - 69 AND 70 - 72.	A 205
C	YR, ARRAY OF TIME PERIOD IN YEARS TO BE SORTED.	A 206
C	COLUMNS 73 - 80.	A 207
C	6. CONSTITUENT, CONSTITUENT VALUE, SORTING INDICATORS, AND	A 208
C	ARRAYS OF RANGE OF CONSTITUENT VALUES, NOCNST, VLU,	A 209
C	CT1, CT2, CT3, CL, AND CH. ONE CARD, FORMAT (I2, F8.0,	A 210
C	A1, 1X, A1, 1X, A1, 5X, 6F10.0).	A 211
C	ICT MUST EQUAL 1 FOR THIS CARD TO BE READ.	A 212
C	NOCNST, CONSTITUENT TO BE USED AS A BASIS FOR	A 213
C	SORTING, USE NUMBER FROM LIST IN IDNT ARRAY.	A 214
C	COLUMNS 1,2.	A 215
C	VLU, VALUE OF NOCNST IN ME/L IF NPM= 0, IN MG/L IF	A 216
C	NPM = 1. COLUMNS 3- 10. PUNCH DECIMAL AFTER VLU.	A 217
C	CT1, CT2, CT3=COLUMNS 11, 13, 15	A 218
C	+ = SORT FOR GREATER THAN VLU	A 219
C	- = SORT FOR LESS THAN OR EQUAL TO VLU	A 220
C	A = NO SORT ON VLU	A 221
C	CL AND CH ARE FOR 3 RANGES OF CONSTITUENT VALUES. CL	A 222
C	BEING LOWER AND CH HIGHER LIMITS OF RANGES, WITH	A 223
C	THE RANGES ALTERNATELY RECORDED IN COLUMNS	A 224
C	21-80. (I.E. CL IN 21-30, CH IN 31-40)	A 225
C	-----	A 226
C	A CARD WITH A Z IN COLUMN 1 MUST FOLLOW EACH DATA GROUP.	A 227
C	-----	A 228
C	-----	A 229
C	CALL REREAD	A 230
C	DIMENSION BQ(20)	A 231
C	USAGE OF LABELED COMMON BLOCKS.	A 232
C	- - - - - LABELED COMMON BLOCK IBAS IS USED IN SUBROUTINES LINE,	A 233
C	- - - - - REEDU, PULVAL, MGL, PLOTR, MEL, TABR, SDVU, CSTSRT,	A 234
C	- - - - - AND DATEST.	A 235
C	- - - - - LABELED COMMON BLOCK CARVAL IS USED IN SUBROUTINES LINE	A 236
C	- - - - - TABR.	A 237
C	- - - - - LABELED COMMON BLOCK ARGE IS USED IN SUBROUTINES LINE AN	A 238
C	- - - - - SDVU.	A 239

C	- - - - -	LABELED COMMON BLOCK SORTV IS USED IN SUBROUTINES PULVAL	A 240
C	- - - - -	- AND TABR.	A 241
C	- - - - -	LABELED COMMON BLOCK SRTV IS USED IN SUBROUTINES PULVAL	A 242
C	- - - - -	- TABR.	A 243
C	- - - - -	LABELED COMMON BLOCK LNPL IS USED IN SUBROUTINES LINE,	A 244
C	- - - - -	- PLOTR, TABR, SDVU, AND CSTSRT.	A 245
C	- - - - -	LABELED COMMON BLOCK DATAQ IS USED IN SUBROUTINES PULVAL	A 246
C	- - - - -	- TABR, AND DATEST.	A 247
C		ARRAYS IN COMMON NOT PREVIOUSLY EXPLAINED.	A 248
C	- - - - -	B, CONSTITUENTS, IN MGL, AND OTHER PARAMETERS.	A 249
C	- - - - -	C, FACTORS FOR CONVERTING MG/L OF B ARRAY TO ME/L IN D	A 250
C	- - - - -	D, CONSTITUENTS, IN ME/L, AND OTHER MODIFIED PARAMETERS	A 251
C	- - - - -	E, SORTED CONSTITUENTS OR PARAMETERS.	A 252
C	- - - - -	KAV, AVERAGE OR MEAN VALUE OF A CONSTITUENT OR PARAMETER	A 253
C	- - - - -	KHG, HIGHEST VALUE OF A CONSTITUENT OR PARAMETER.	A 254
C	- - - - -	KWL, LOWEST VALUE OF A CONSTITUENT OR PARAMETER.	A 255
C	- - - - -	IPY, NUMBERS, 1,2,3,4,5,7,9, AND BLANKS AT TOP AND	A 256
C	- - - - -	- BOTTOM OF ROPES DIAGRAMS, REPRESENTING NUMERIC VALUE	A 257
C	- - - - -	- IN EACH LOG CYCLE.	A 258
C	- - - - -	IPX, ASTERISKS, BLANKS, PLUSES, DASHES, NUMBERS AND	A 259
C	- - - - -	- LETTERS FORMING ROPES DIAGRAMS. A LINE AT A TIME, 121	A 260
C	- - - - -	- CHARACTERS A LINE.	A 261
C	- - - - -	IFN, PARAMETER OR CONSTITUENT FROM E ARRAY AFTER CONVERS	A 262
C	- - - - -	- IN LOGVAL SUBROUTINE THAT IS PLOTTED ON ROPES DIAGRAMS	A 263
C	- - - - -	- A LINE AT A TIME AS ORDERED BY THE IPX ARRAY.	A 264
C	- - - - -	AQ, AQUIFERS FROM A DATA GROUP, TWO AQUIFERS PER DATA SET	A 265
		COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	A 266
		COMMON /CARVAL/ KAV(16),KHG(16),KWL(16)	A 267
		COMMON /ARGE/ IPY(121),IPX(121)	A 268
		COMMON /SORTV/ DL(3),DH(3)	A 269
		COMMON /SRTV/ CL(3),CH(3)	A 270
		COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	A 271
		COMMON /DATAQ/ AON(24),YR(2),AQ(60)	A 272
		COMMON /TAPE/ T1,T2,T3,T4,T5,T6	A 273
C		SUBROUTINES CALLED ARE MEL, MGL, PLOTR, REEDU, CSTSRT, DATEST, AND	A 274
C		PULVAL.	A 275
C		READ AND WRITE UNITS, T2 THROUGH T4 ARE SCRATCH TAPES, T5 AND	A 276
C		T1 ARE CARD READER. T6 IS PRINTER.	A 277
C		ONLY TAPE UNIT T2 IS USED IN PROGRAM.	A 278
		INTEGER T1,T2,T3,T4,T5,T6	A 279
		INTEGER DT1,DT2,DT3,CT1,CT2,CT3	A 280
		T1=5	A 281
		T2=10	A 282
		T3=3	A 283
		T4=4	A 284
		T5=5	A 285
		T6=6	A 286
C		READ NA ARRAY AFD, BFD, AND BNA	A 287
		READ (T5,530) (NA(I),I=1,41),AFD,BFD,BNA	A 288
C		READ IDNT ARRAY	A 289
		READ (T5,540) (IDNT(I),I=1,60)	A 290
C		PRNTPO--TOTAL PRINT POSITIONS ON OUTPUT GRAPH	A 291
C		PRIN--PRINT POSITIONS PER INCH	A 292
		PRNTPO=120.	A 293
		PRIN=10.	A 294
C		READ TITLE ARRAY, ISG, IST, IWL, IDT, ICT, NPM, CYN, BLG, IMK	A 295
110		READ (T5,550,END=520) (TITLE(I),I=1,9),ISG,IST,IWL,IDT,ICT,NPM,CYN	A 296
		1,BLG,NTOPOP,IMK	A 297
		DO 120 IPM=1,80	A 298
120		C(IPM)=1.0	A 299

	IF (NPM.GT.0) GO TO 130	A 300
C	BRING ME/L CONVERSION VALUES INTO PROGRAM	A 301
	CALL MEL	A 302
130	CYLN=PRNTP0/CYN	A 303
C	READ CONSTITUENTS TO BE PLOTTED	A 304
	READ (T5,560) (IPT(I),I=1,16)	A 305
C	KAT-- NUMBER OF IPT VALUES	A 306
	KAT=0	A 307
C	REARRANGE IPT ARRAY TO CORRESPOND TO DATA ARRANGEMENT	A 308
	DO 140 I=1,16	A 309
	IF (IPT(I).GT.33) IPT(I)=IPT(I)+31	A 310
	IF (IPT(I).LE.33.AND.IPT(I).GE.1) IPT(I)=IPT(I)+29	A 311
140	IF (IPT(I).GT.0) KAT=KAT+1	A 312
	REWIND T2	A 313
C	IA--NUMBER OF AQUIFERS TO SORT	A 314
	IA=0	A 315
C	ITB--DATE SORT INDICATOR	A 316
	ITB=1	A 317
C	KATZ--END OF DATA GROUP INDICATOR	A 318
	KATZ=0	A 319
C	ISKP--INDICATOR USED IN REEDU FOR SKIPPING READ STATEMENT IF DATA	A 320
C	ALREADY STORED IN N ARRAY	A 321
	ISKP=1	A 322
	KON=0	A 323
	IF (IST.LT.1) GO TO 180	A 324
	IF (ISG.LT.1) GO TO 190	A 325
C	READ CONTROL CARD FOR AQUIFER SORT.	A 326
C	BLANK CARD IF SORT ALL AQUIFERS AND NO AQUIFERS READ IN	A 327
	IF (IMK.GT.0) GO TO 170	A 328
	READ (T5,570) (BQ(I),I=1,20)	A 329
	DO 160 I=1,20	A 330
	IF (BQ(I).EQ.BFD) GO TO 150	A 331
	GO TO 160	A 332
150	IA=IA+1	A 333
	AQ(I)=BFD	A 334
	AQ(I+30)=AFD	A 335
160	CONTINUE	A 336
	GO TO 180	A 337
170	READ (T5,580) (BQ(I),I=1,20)	A 338
180	IF (IWL.GT.0) GO TO 190	A 339
	GO TO 200	A 340
C	READ DISCHARGE OR WELL DEPTH SORTS, DSH, DT1, DT2, DT3, DL ARRAY	A 341
C	AND DH ARRAY	A 342
190	READ (T5,590) DSH,DT1,DT2,DT3,(DL(I),DH(I),I=1,3)	A 343
200	IF (IDT.LT.1) GO TO 220	A 344
C	READ DATE SORTS, AON ARRAY AND YR ARRAY	A 345
	READ (T5,600) (AON(I),I=1,24),(YR(I),I=1,2)	A 346
	KOT=0	A 347
	DO 210 I=1,23,2	A 348
	IF (AON(I).GT.0.) KOT=KOT+1	A 349
210	CONTINUE	A 350
	IF (YR(2).LT.1.) YR(2)=99.	A 351
220	IF (ICT.LT.1) GO TO 230	A 352
C	READ CONSTITUENT SORTS, NOCNST, VLU, CT1, CT2, CT3, CL ARRAY AND	A 353
C	CH ARRAY	A 354
	READ (T5,610) NOCNST,VLU,CT1,CT2,CT3,(CL(I),CH(I),I=1,3)	A 355
C	READ DATA CARDS	A 356
230	CALL REEDU (ISKP,KATZ,IMK,AFD)	A 357
	IF (KATZ.EQ.1) GO TO 350	A 358
C	SURFACE WATER SORTED	A 359

	IF (ISG.LT.1) GO TO 330	A 360
C	GROUND WATER--NO SORT	A 361
	IF (IST.LT.1) GO TO 330	A 362
C	CHECK IF AQUIFERS DESIGNATED	A 363
	IF (IMK.GT.0) GO TO 260	A 364
	IF (BQ(1).EQ.AFD) GO TO 290	A 365
C	SORT BY AQUIFER	A 366
	DO 240 I=1,20	A 367
	IF (BQ(I).EQ.AFD) GO TO 250	A 368
	IF (BQ(I).EQ.BFD) GO TO 330	A 369
	IF (B(63).EQ.BQ(I).OR.B(64).EQ.BQ(I)) GO TO 290	A 370
240	CONTINUE	A 371
250	IF (KATZ.GT.0) GO TO 350	A 372
260	IF (BQ(1).LT.1.) GO TO 290	A 373
	DO 270 I=1,20	A 374
	IF (BQ(I).LT.1.) GO TO 280	A 375
	IF (B(63).EQ.BQ(I).OR.B(64).EQ.BQ(I)) GO TO 290	A 376
270	CONTINUE	A 377
280	IF (KATZ.GT.0) GO TO 350	A 378
	GO TO 230	A 379
290	IF (IA.LT.1) GO TO 320	A 380
	DO 310 I=1,IA	A 381
	IF (B(63).EQ.AQ(I)) GO TO 300	A 382
	GO TO 310	A 383
300	IF (B(64).EQ.AQ(I+30)) GO TO 330	A 384
310	CONTINUE	A 385
320	IA=IA+1	A 386
	AQ(IA)=B(63)	A 387
	AQ(IA+30)=B(64)	A 388
C	IPIE--1 = ALL DATES ON DATE CARD KEPT	A 389
C	2 = DATES GROUPED FOR PLOTS	A 390
C	ITB--DATE SORT INDICATOR	A 391
C	IUT--1 = DATA KEPT	A 392
C	2 = DATA DELETED	A 393
C	KOT--NUMBER OF DATES TO PLOT	A 394
C	KAT--NUMBER OF CONSTITUENTS TO PLOT	A 395
C	IW--NUMBER OF DATA SETS STORED IN E ARRAY	A 396
330	IUT=1	A 397
	IPIE=1	A 398
C	SORT DATES IF IDT=1	A 399
	IF (IDT.GT.0) CALL DATEST (KOT,IUT,IPIE,ITB,NX)	A 400
	IF (IUT.GT.1) GO TO 340	A 401
C	PLACE DECIMAL IN MG/L VALUES OF B ARRAY,	A 402
C	CALCULATE ME/L VALUES AND STORE ME/L VALUES IN D ARRAY	A 403
	CALL MGL (ISG)	A 404
	KON=KON+1	A 405
	B(80)=KON	A 406
C	STORE DATA	A 407
	WRITE (T2) (B(I),I=1,80),(D(I),I=30,80)	A 408
340	IF (KATZ.GT.0) GO TO 350	A 409
	GO TO 230	A 410
350	CONTINUE	A 411
	IF (KON.LT.1) GO TO 510	A 412
	REWIND T2	A 413
C	WRITE TABLE IDENTIFYING DATA TO BE PLOTTED (ONLY UNWANTED DATES	A 414
C	HAVE BEEN SORTED OUT)	A 415
C	IBGN AND IEND = COUNTERS FOR LINES PER PAGE	A 416
	WRITE (T6,620)	A 417
	IBGN=1	A 418
	IEND=55	A 419

	IF (KON.LE.55) IEND=KON	A 420
360	WRITE (T6,630) (TITLE(I),I=1,9)	A 421
	IF (ISG.LT.1) WRITE (T6,640)	A 422
	IF (ISG.GT.0) WRITE (T6,650)	A 423
	DO 390 IH=IBGN,IEND	A 424
	READ (T2) (B(I),I=1,80),(D(I),I=30,80)	A 425
	AUT=B(79)	A 426
	IF (ISG.GT.0) AUT=B(28)	A 427
	IF (IMK.GT.0) WRITE (T6,660) B(80),(B(I),I=14,24),AUT,B(25),B(26),	A 428
	1B(27),B(63),B(64)	A 429
	IF (IMK.GT.0) GO TO 390	A 430
	BAQ1=AFD	A 431
	BAQ2=AFD	A 432
	IF (ISG.GT.0) BAQ1=B(63)	A 433
	IF (ISG.GT.0) BAQ2=B(64)	A 434
	IF (ISG.GT.0) GO TO 380	A 435
	DO 370 I=19,24	A 436
370	B(I)=BNA	A 437
380	WRITE (T6,670) B(80),(B(I),I=14,24),AUT,B(25),B(26),B(27),BAQ1,BAQ	A 438
	12	A 439
390	CONTINUE	A 440
	WRITE (T6,620)	A 441
	IF (IEND.EQ.KON) GO TO 400	A 442
	IBGN=IBGN+55	A 443
	IEND=IEND+55	A 444
	IF (KON.LE.IEND) IEND=KON	A 445
	GO TO 360	A 446
C	NOTE-----SORTS FOR WELL DEPTH, AQUIFERS, AND DISCHARGE ARRANGED	A 447
C	BELOW. DATES AND CONSTITUENTS ARE ARRANGED IN PLOT.	A 448
C	IW--DATA COUNT	A 449
400	ITB=2	A 450
	IDUM=0	A 451
	IF (IST.LT.1) GO TO 450	A 452
	IF (ISG.LT.1) GO TO 490	A 453
C	MDD = -2 IS INDICATOR FOR SORTING AQUIFERS	A 454
	MDD=2	A 455
	IF (IWL.GT.0) GO TO 420	A 456
	DO 410 I=1,IA	A 457
	REWIND T2	A 458
	IW=0	A 459
C	SORT AQUIFERS	A 460
	CALL PULVAL (DT1,DT2,DT3,L,KON,DSH,KAT,IW,MDD,I,L1,L2,NOCNST,KT,IW	A 461
	1L)	A 462
	IF (IW.LT.1) GO TO 410	A 463
C	PLOT DATA	A 464
	CALL PLOT (IW,KAT,IDT,KOT,BLG,KT,ISG,IST,DSH,ICT,IWL,NOCNST,VLU,C	A 465
	1T1,CT2,CT3,CYLN,IMK,I,NTOP)	A 466
410	CONTINUE	A 467
	GO TO 510	A 468
C	GROUND WATER SORTED FOR AQUIFER AND WELL DEPTH	A 469
420	DO 440 I=1,IA	A 470
	DO 430 L=1,6	A 471
	REWIND T2	A 472
	IW=0	A 473
C	SORT AQUIFER AND WELL DEPTH	A 474
	CALL PULVAL (DT1,DT2,DT3,L,KON,DSH,KAT,IW,MDD,I,L1,L2,NOCNST,KT,IW	A 475
	1L)	A 476
	IF (IW.LT.1) GO TO 430	A 477
C	PLOT DATA	A 478
	CALL PLOT (IW,KAT,IDT,KOT,BLG,KT,ISG,IST,DSH,ICT,IWL,NOCNST,VLU,C	A 479

1T1,CT2,CT3,CYLN,IMK,I,NTOPOP)	A 480
430 CONTINUE	A 481
440 CONTINUE	A 482
GO TO 510	A 483
C GROUND WATER SORTED FOR WELL DEPTH	A 484
450 IF (ISG.LT.1.OR.IWL.LT.1) GO TO 470	A 485
C MDD--4 IS INDICATOR FOR SORTING WELL DEPTH	A 486
MDD=4	A 487
C CHECK 6 POSSIBLE SORTS	A 488
DO 460 I=1,6	A 489
REWIND T2	A 490
IW=0	A 491
C SORT WELL DEPTH	A 492
CALL PULVAL (DT1,DT2,DT3,I,KON,DSH,KAT,IW,MDD,I,L1,L2,NOCNST,KT,IW	A 493
1L)	A 494
IF (IW.LT.1) GO TO 460	A 495
C PLOT DATA	A 496
CALL PLOTR (IW,KAT,IDT,KOT,BLG,KT,ISG,IST,DSH,ICT,IWL,NOCNST,VLU,C	A 497
1T1,CT2,CT3,CYLN,IMK,IDUM,NTOPOP)	A 498
460 CONTINUE	A 499
GO TO 510	A 500
C GROUND WATER OR SURFACE WATER DATA UNSORTED AS TO AQUIFER,	A 501
C DISCHARGE OR WELL DEPTH	A 502
470 REWIND T2	A 503
IW=0	A 504
DO 480 IND=1,KON	A 505
READ (T2) (B(IX),IX=1,80),(D(IY),IY=30,80)	A 506
C SORT CONSTITUENTS INTO E ARRAY AS SPECIFIED IN IPT ARRAY ALONG	A 507
C WITH DATE AND KON NUMBER	A 508
CALL CSTSRT (IW,KAT)	
480 CONTINUE	A 510
C PLOT DATA	A 511
CALL PLOTR (IW,KAT,IDT,KOT,BLG,KT,ISG,IST,DSH,ICT,IWL,NOCNST,VLU,C	A 512
1T1,CT2,CT3,CYLN,IMK,IDUM,NTOPOP)	A 513
GO TO 510	A 514
C SURFACE WATER DATA SORTED FOR DISCHARGE	A 515
C MDD--1 IS INDICATOR FOR DISCHARGE SORT	A 516
490 MDD=1	A 517
DO 500 IZ=1,6	A 518
IW=0	A 519
REWIND T2	A 520
C SORT DISCHARGE	A 521
CALL PULVAL (DT1,DT2,DT3,IZ,KON,DSH,KAT,IW,MDD,I,L1,L2,NOCNST,KT,I	A 522
1WL)	A 523
IF (IW.LT.1) GO TO 500	A 524
C PLOT DATA	A 525
CALL PLOTR (IW,KAT,IDT,KOT,BLG,KT,ISG,IST,DSH,ICT,IWL,NOCNST,VLU,C	A 526
1T1,CT2,CT3,CYLN,IMK,IDUM,NTOPOP)	A 527
500 CONTINUE	A 528
510 GO TO 110	A 529
520 STOP	A 530
C	A 531
530 FORMAT (41A1,2A4,A1)	A 532
540 FORMAT (20A4)	A 533
550 FORMAT (9A4,I4,5I2,2F10.0,I1,3X,I1)	A 534
560 FORMAT (16I5)	A 535
570 FORMAT (20A4)	A 536
580 FORMAT (20F4.0)	A 537
590 FORMAT (F10.0,A1,1X,A1,1X,A1,5X,6F10.0)	A 538
600 FORMAT (24F3.0,2F4.0)	A 539

610	FORMAT (I2,F8.0,A1,1X,A1,1X,A1,5X,6F10.0)	A	540
620	FORMAT (1H1)	A	541
630	FORMAT (1X,9A4//)	A	542
640	FORMAT (1X,4HNUM.,3X,14HSTATION IDEN. ,5X,10HDISCHARGE ,5X,12HDATE	A	543
	1 SAMPLED, /)	A	544
650	FORMAT (1X,4HNUM.,5X,12HWELL NUMBER ,5X,11HWELL DEPTH ,4X,12HDATE	A	545
	1SAMPLED,5X,17HGEOLOGIC UNIT(S) ,/)	A	546
660	FORMAT (1X,F4.0,5X,11A1,5X,F10.1,5X,3F4.0,7X,F5.0,2X,F5.0)	A	547
670	FORMAT (1X,F4.0,5X,11A1,5X,F10.1,5X,3F4.0,8X,A4,3X,A4)	A	548
	END	A	549-
C	PLOTRO00	B	1
	SUBROUTINE PLOTTR (IW,KAT,IDT,KOT,BLG,ISP,ISG,IST,DSH,ICT,IWL,NOCNS	B	2
	IT,VLU,CT1,CT2,CT3,CYLN,IMK,IAQ,NTOPOP)	B	3
C	SUBROUTINE TO AID IN FINAL SORT OF DATES AND CONSTITUENTS	B	4
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	B	
	COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	B	6
C	SUBROUTINES USED ARE DATEST, PULVAL, TABR, LOGVAL, SDVU, AND LINE	B	7
	KYLN=CYLN	B	8
	J=0	B	9
	IG=0	B	10
	KOUNT=0	B	11
	IF (IDT.LT.1) GO TO 40	B	12
	IF (KOT.EQ.0) GO TO 40	B	13
	J=1	B	14
10	IF (KOUNT.GE.KOT) GO TO 120	B	15
	IG=0	B	16
	KT=0	B	17
C	SORT DATES	B	18
	DO 30 N=1,IW	B	19
	ITB=2	B	20
	CALL DATEST (KOT,IUT,J,ITB,N)	B	21
	IF (IUT.GT.1) GO TO 30	B	22
	KT=KT+1	B	23
	DO 20 IY=1,KAT	B	24
20	E(KT+200,IY)=E(N,IY)	B	25
	E(KT+200,17)=E(N,17)	B	26
	E(KT+200,18)=E(N,18)	B	27
	E(KT+200,19)=E(N,19)	B	28
	E(KT+200,20)=E(N,20)	B	29
30	CONTINUE	B	30
	KOUNT=KOUNT+1	B	31
C	SORT CONSTITUENTS	B	32
	J=J+2	B	33
	IF (KT.LT.1) GO TO 10	B	34
	K1=201	B	35
	K2=KT+200	B	36
	GO TO 50	B	37
40	K1=1	B	38
	K2=IW	B	39
50	IF (ICT.LT.1) GO TO 80	B	40
	IF (NOCNST.GT.33) NOC=NOCNST+31	B	41
	IF (NOCNST.LE.33.AND.NOCNST.GE.1) NOC=NOCNST+29	B	42
	NOCN=0	B	43
	DO 60 I=1,16	B	44
	IF (NOC.EQ.IPT(I)) NOCN=I	B	45
60	CONTINUE	B	46
	M1=K1	B	47
	M2=K2	B	48
70	IG=IG+1	B	49
	IF (NOCN.LT.1) GO TO 80	B	50

K1=M1	B	51
K2=M2	B	52
JW=400	B	53
MDD=3	B	54
CALL PULVAL (CT1,CT2,CT3,IG,KON,VLU,KAT,JW,MDD,ITR,K1,K2,NOCN,KX,I	B	55
1WL)	B	56
IF (JW.LT.401) GO TO 110	B	57
K1=401	B	58
K2=JW	B	59
C WRITE TABLE OF SORTED DATA	B	60
80 CALL TABR (K1,K2,KAT,IDT,KOT,ISP,IST,ISG,DSH,J,IMK,ICT,IWL,IG,KX,N	B	61
1OCNST,IAQ,VLU)	B	62
C PLOT DATA ON DIAGRAM--KAT = NUMBER OF PARAMETERS TO BE PLOTTED	B	63
DO 100 IL=1,KAT	B	64
KW=0	B	65
C PULL PARAMETER FROM EACH ANALYSIS AND DETERMINE LOG VALUE	B	66
DO 90 IN=K1,K2	B	67
IF (E(IN,IL).LT.0.) GO TO 90	B	68
KW=KW+1	B	69
EVAL=E(IN,IL)	B	70
CALL LOGVAL (EVAL,BLG,CYLN,IFVAL)	B	71
IFN(KW)=IFVAL	B	72
90 CONTINUE	B	73
C PLOT PARAMETERS ON A LINE	B	74
100 CALL LINE (KW,IL,KAT,BLG,DLG,KYLN,CYLN)	B	75
C IF SURFACE WATER--PLOT TOP VIEW DIAGRAM	B	76
IF (NTOPOP.LT.1) CALL SDVU (KAT,BLG,K1,K2,DLG,KYLN,CYLN)	B	77
110 IF (ICT.GT.0.AND.IG.LT.6) GO TO 70	B	78
IF (KOUNT.GT.0) GO TO 10	B	79
120 RETURN	B	80
STOP	B	81
END	B	82-
C REEDU000	C	1
SUBROUTINE REEDU (ISKP,KATZ,IMK,AFD)	C	2
DIMENSION IC(11), R(52), S(52), P(52), IGEO(12), N(80), ICD(6), IS	C	3
1N(6,2), MN(32), NB(12)	C	4
C SUBROUTINE TO READ IN WRD ABCQRS GROUND WATER CARDS, HEADER, 1,	C	5
C 2, 3, SURFACE WATER CARDS, AND KANSAS 1, 2 WATER QUALITY CARDS	C	6
C ARRAYS DIMENSIONED IN REEDU NOT PREVIOUSLY EXPLAINED.	C	7
C - - - - - IC, STORAGE OF CARD IDENTIFIERS, SEE DATA STATEMENT.	C	8
C - - - - - R, TEMPORARY STORAGE OF LEFT-SIDE OF CONSTITUENT VALUES.	C	9
C - - - - - S, TEMPORARY STORAGE OF RIGHT-SIDE OF CONSTITUENT VALUES	C	10
C - - - - - P, DATA IN S AND R ARRAYS ARE DECODED AND COMBINED INTO	C	11
C - - - - - - P ARRAY.	C	12
C - - - - - IGEO, STORAGE FOR GEOLOGIC UNITS	C	13
C - - - - - N, TEMPORARY STORAGE OF A DATA CARD,	C	14
C - - - - - ICD, STORAGE FOR CARD IDENTIFIERS, THE A, B, C, Q, R,	C	15
C - - - - - S CARDS	C	16
C - - - - - ISN, STORAGE FOR SURFACE-WATER STATION EXPLANATION CARD.	C	17
C - - - - - MN, STORAGE FOR LOCATIONS.	C	18
C - - - - - NB, STORAGE FOR THE SOURCE OF WATER ANALYZED.	C	19
COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	C	20
COMMON /TAPE/ T1,T2,T3,T4,T5,T6	C	21
REAL MN,KMO,LWD,KDA,KYR,ITY,IGEO,KWD,IGCH,JMO,JDA,JYR,LMO,LDA,LYR,	C	22
1LST,LCO	C	23
INTEGER T1,T2,T3,T4,T5,T6	C	24
INTEGER S,R	C	25
DATA NB(1),NB(2),NB(3),NB(4),NB(5),NB(6),NB(7),NB(8),NB(9),NB(10),	C	26
1NB(11),NB(12)/4HSINK,4H R,4H S,4HCOMP,4HSEEP,4H TAP,4H PIT,4HP	C	27
2OND,4HPUMP,4HTRET,4H ,4H-100/	C	28

	DATA BZZ/1HZ/	C	29
	DATA IC(1),IC(2),IC(3),IC(4),IC(5),IC(6),IC(7),IC(8),IC(9),IC(10),	C	30
	1IC(11)/1HA,1HB,1HC,1HQ,1HR,1HS,1H ,1H1,1H2,1H3,1HZ/	C	31
	CALL REREAD	C	32
	IAG=0	C	33
	LWD=0.	C	34
	L=T5	C	35
	DO 10 I=1,52	C	36
	R(I)=-0	C	37
10	S(I)=IC(7)	C	38
C	IGCH--GEOLOGIC NAME ON S CARD	C	39
	IGCH=AFD	C	40
	IF (IMK.GT.0) GO TO 270	C	41
	DO 20 I=1,12	C	42
20	IGEO(I)=AFD	C	43
	DO 30 I=1,32	C	44
30	MN(I)=FLOAT(IC(7))	C	45
	DO 40 I=1,80	C	46
40	B(I)=0.	C	47
50	IF (ISKP.GT.1) GO TO 80	C	48
	L=T5	C	49
60	READ (L,400) (N(I),I=1,80)	C	50
	L=T5	C	51
70	ISKP=2	C	52
80	IF (N(1).EQ.IC(11)) KATZ=1	C	53
	IF (N(1).EQ.IC(11)) GO TO 390	C	54
C	JMP--CARD CODE, USED IN COMPUTED GO TO FOR FINDING CORRECT READ	C	55
C	STATEMENT	C	56
	JMP=0	C	57
	DO 90 I=1,10	C	58
	IF (N(80).EQ.IC(I)) JMP=I	C	59
90	CONTINUE	C	60
	IF (JMP.EQ.0) GO TO 110	C	61
	L=99	C	62
C	ERROR--CARD LETTER MISSING OR INCORRECT	C	63
	IF (IAG.NE.1) GO TO 100	C	64
	GO TO 190	C	65
100	GO TO (120,110,110,130,110,110,110,190,110,110), JMP	C	66
110	WRITE (T6,410) (N(I),I=1,80)	C	67
	READ (L,400) (N(I),I=1,80)	C	68
	L=T5	C	69
	GO TO 60	C	70
C	READ WRD ABC DATA CARDS	C	71
120	CONTINUE	C	72
	READ (L,420) (B(I),I=1,10),LLA,(MN(I),I=1,31)	C	73
	L=T5	C	74
	READ (T5,430) LWD,IGEO(1),IGEO(2),NOGEOL	C	75
	IF (NOGEOL.GE.1) GO TO 250	C	76
	GO TO 60	C	77
C	READ WRD QRS DATA CARDS	C	78
130	READ (L,440) (B(I),I=1,10),KMO,KDA,KYR,KWD,ITY,R(1),S(1),IPH,ITEM,	C	79
	1(R(I),S(I),I=2,10),ISOUR,ICD(4)	C	80
	L=T5	C	81
	READ (T5,450) (R(I),S(I),I=11,25),ICD(5)	C	82
	IF (KWD.LT.1.) KWD=LWD	C	83
	READ (T5,400) (N(I),I=1,80)	C	84
	IF (N(1).EQ.IC(11)) KATZ=2	C	85
	IF (N(1).EQ.IC(11)) GO TO 310	C	86
	IF (N(80).EQ.IC(6)) GO TO 150	C	87
	ISKP=2	C	88

140	IF (N(80).EQ.IC(1).OR.N(80).EQ.IC(4)) GO TO 310	C	89
	WRITE (T6,410) (N(I),I=1,80)	C	90
	READ (T5,400) (N(I),I=1,80)	C	91
	IF (N(1).EQ.IC(11)) KATZ=2	C	92
	IF (N(1).EQ.IC(11)) GO TO 310	C	93
	GO TO 140	C	94
C	READ WRD S DATA CARD	C	95
150	CONTINUE	C	96
	READ (99,460) (R(I),S(I),I=26,29),SAR,(R(I),S(I),I=31,36),IGCH,IPD	C	97
	1ZN,ICD(6)	C	98
	R(30)=SAR	C	99
	SAR1=R(30)	C	100
	IHDL=(SAR-SAR1)*10.	C	101
	IF (IHDL.LT.1) GO TO 170	C	102
	DO 160 I=1,10	C	103
	IF (IHDL.EQ.(I-1)) S(30)=NA(I)	C	104
160	CONTINUE	C	105
	GO TO 180	C	106
170	S(30)=NA(37)	C	107
180	CONTINUE	C	108
	ISKP=1	C	109
	GO TO 310	C	110
190	KWD=0.	C	111
	ITY=0.	C	112
C	READ 1,2,3 CARDS FOR SURFACE WATER DATA	C	113
	READ (L,470) (MN(I),I=1,8),KMO,KDA,KYR,B(79),R(2),S(2),R(15),S(15)	C	114
	1,R(16),S(16),R(17),S(17),R(3),S(3),R(4),S(4),R(37),S(37),R(5),S(5)	C	115
	2,R(6),S(6),R(38),S(38),(R(I),S(I),I=7,11),NOS,ICD(1)	C	116
	L=T5	C	117
	IF (ICD(1).NE.IC(8)) GO TO 110	C	118
	B(79)=B(79)*0.1	C	119
	READ (T5,480) (MN(I),I=17,24),JMO,JDA,JYR,(R(I),S(I),I=12,14),R(21	C	120
	1),S(21),R(23),S(23),R(24),S(24),R(30),S(30),R(1),S(1),IPH,R(25),S(	C	121
	225),ITEM,ICD(2)	C	122
	IF (ICD(2).NE.IC(9)) GO TO 110	C	123
	READ (T5,400) (N(I),I=1,80)	C	124
	ISKP=2	C	125
	ICD(3)=IC(7)	C	126
	IF (N(1).EQ.IC(11)) KATZ=2	C	127
	IF (N(1).EQ.IC(11)) GO TO 220	C	128
	IF (N(80).EQ.IC(10)) GO TO 210	C	129
200	IF (N(80).EQ.IC(8)) GO TO 220	C	130
	WRITE (T6,410) (N(I),I=1,80)	C	131
	READ (T5,400) (N(I),I=1,80)	C	132
	IF (N(1).EQ.IC(11)) KATZ=2	C	133
	IF (N(1).EQ.IC(11)) GO TO 220	C	134
	GO TO 200	C	135
210	CONTINUE	C	136
	READ (99,490) (MN(I),I=25,32),LMO,LDA,LYR,(R(I),S(I),I=39,41),(R(I	C	137
	1),S(I),I=18,20),(R(I),S(I),I=42,48),R(28),S(28),R(26),S(26),R(27),	C	138
	2S(27),R(49),S(49),R(50),S(50),R(29),S(29),R(51),S(51),R(52),S(52),	C	139
	3ICD(3)	C	140
220	CONTINUE	C	141
	IAG=1	C	142
	ISKP=1	C	143
	IF (KMO.EQ.JMO.AND.KDA.EQ.JDA.AND.KYR.EQ.JYR) GO TO 230	C	144
	GO TO 240	C	145
230	IF (ICD(3).EQ.IC(7)) GO TO 310	C	146
	IF (KMO.EQ.LMO.AND.KDA.EQ.LDA.AND.KYR.EQ.LYR) GO TO 310	C	147
C	WRITE ERROR IF DATES ARE NOT THE SAME	C	148

240	WRITE (T6,500) KMO,KDA,KYR,JMO,JDA,JYR,LMO,LDA,LYR	C 149
	GO TO 50	C 150
C	READ ADDITIONAL C CARDS	C 151
250	KA=3	C 152
	KB=4	C 153
260	READ (T5,400) (N(I),I=1,80)	C 154
	IF (N(80).NE.IC(3)) GO TO 70	C 155
	READ (99,510) IGEO(KA),IGEO(KB)	C 156
	KA=KA+2	C 157
	KB=KB+2	C 158
	GO TO 260	C 159
C	READ KANSAS CARDS	C 160
270	READ (T5,400) (N(I),I=1,80)	C 161
	IF (N(1).EQ.NA(36)) KATZ=1	C 162
	IF (KATZ.EQ.1) GO TO 390	C 163
	L=99	C 164
	DO 280 I=1,10	C 165
	IF (N(25).EQ.NA(I)) GO TO 290	C 166
280	CONTINUE	C 167
	B(28)=-100.	C 168
	READ (L,520) T,B(1),B(2),(B(I),I=14,24),KMO,KDA,KYR,KTY,R(2),S(2),	C 169
	1R(15),S(15),R(16),S(16),R(17),S(17),(R(I),S(I),I=3,10)	C 170
	L=T5	C 171
	GO TO 300	C 172
290	READ (L,530) T,B(1),B(2),(B(I),I=14,24),KMO,KDA,KYR,B(28),KTY,R(2)	C 173
	1,S(2),R(15),S(15),R(16),S(16),R(17),S(17),(R(I),S(I),I=3,10)	C 174
	L=T5	C 175
300	READ (T5,540) IGEO(1),IGEO(2),(R(I),S(I),I=11,14),(R(I),S(I),I=22,	C 176
	124),(R(I),S(I),I=28,31),R(1),S(1),IPH,R(25),S(25),ITEM	C 177
	ITY=0.	C 178
	IF (KTY.EQ.NA(13)) ITY=1.	C 179
	IF (KTY.EQ.NA(26)) ITY=2.	C 180
	IF (KTY.EQ.NA(22)) ITY=3.	C 181
C	IMARK--COMPLETE (1) OR PARTIAL (0) ANALYSIS	C 182
310	IMARK=0	C 183
C	IF CONSTITUENT NOT DETERMINED SUBSTITUTE -100	C 184
	DO 320 J=1,52	C 185
	DO 320 KI=1,39	C 186
	IF (S(J).EQ.NA(37).AND.R(J).LT.1) R(J)=(-100)	C 187
	IF (S(J).EQ.NA(KI)) S(J)=KI	C 188
320	CONTINUE	C 189
C	CHECK COMPLETENESS OF ANALYSIS	C 190
	IF ((S(3).EQ.37.AND.R(3).LE.0).OR.(S(4).EQ.37.AND.R(4).LE.0).OR.(S	C 191
	1(5).EQ.37.AND.R(5).LE.0).OR.(S(7).EQ.37.AND.R(7).LE.0).OR.(S(9).EQ	C 192
	2.37.AND.R(9).LE.0).OR.(S(10).EQ.37.AND.R(10).LE.0)) IMARK=1	C 193
C	COMBINE 2 SEGMENTS OF CONSTITUENTS (S AND R ARRAYS) INTO P ARRAY	C 194
	DO 330 J=1,52	C 195
	IF (S(J).EQ.37) S(J)=1	C 196
	IF (S(J).LT.11) R(J)=(S(J)-1)+(R(J)*10)	C 197
	IF (S(J).EQ.11) R(J)=R(J)*100	C 198
	IF (S(J).EQ.12) R(J)=R(J)*1000	C 199
330	CONTINUE	C 200
	DO 340 I=1,52	C 201
340	P(I)=FLOAT(R(I))+.00000001	C 202
	IF (IGEO(1).EQ.AFD) IGEO(1)=IGCH	C 203
	IF (IMK.GT.0) GO TO 360	C 204
	ICT=24	C 205
	IF (JMP.GT.6) ICT=18	C 206
C	PLACE ALL PARAMETERS INTO B ARRAY	C 207
	DO 350 I=11,ICT	C 208

350	B(I)=MN(I-10)	C	209
360	B(25)=KMO	C	210
	B(26)=KDA	C	211
	B(27)=KYR	C	212
	IF (IMK.EQ.0) B(28)=KWD	C	213
	B(29)=ITY	C	214
	B(30)=P(1)	C	215
	B(31)=IPH	C	216
	IF (B(31).EQ.0.) B(31)=(-100.)	C	217
	B(32)=ITEM	C	218
	IF (B(32).EQ.0.) B(32)=(-100.)	C	219
	IF (B(28).EQ.0.) B(28)=(-1000.)	C	220
	IF (B(79).EQ.0.) B(79)=(-1000.)	C	221
	DO 370 I=33,62	C	222
370	B(I)=P(I-31)	C	223
	B(63)=IGEO(1)	C	224
	B(64)=IGEO(2)	C	225
	DO 380 I=65,78	C	226
380	B(I)=P(I-26)	C	227
390	RETURN	C	228
C		C	229
400	FORMAT (80A1)	C	230
410	FORMAT (20H ERROR--CARD LETTER ,5X,80A1)	C	231
420	FORMAT (5F2.0,A1,F3.0,2F2.0,33A1)	C	232
430	FORMAT (19X,F4.0/27X,A4,12X,A4,31X,I1)	C	233
440	FORMAT (5F2.0,A1,F3.0,2F2.0,A1,3F2.0,F4.0,F1.0,I4,A1,2I3,I2,A1,I4, 1A1,I3,A1,I4,A1,I2,A1,I3,A1,I1,A1,I4,A1,I5,A1,I1,A1)	C	234
450	FORMAT (25X,I2,A1,I3,A1,3(I2,A1),2(I3,A1),I2,A1,I1,A1,I2,A1,2(I5,A 11),2(I3,A1),I1,2A1)	C	235
460	FORMAT (25X,2(I2,A1),I3,A1,I2,A1,F3.0,2(I2,A1),7X,4(I2,A1),8X,A4,2 1A1)	C	236
470	FORMAT (8A1,3F2.0,F7.0,I2,A1,I2,A1,I3,A1,I2,A1,I3,A1,I3,A1,I3,A1,I 14,A1,I2,A1,I2,A1,I3,A1,I1,A1,I4,A1,I5,A1,I2,A1,1X,2A1)	C	237
480	FORMAT (8A1,3F2.0,3(I2,A1),I5,A1,12X,2(I3,A1),2X,I2,A1,I4,A1,I2,I2 1,A1,12X,I2,1X,A1)	C	238
490	FORMAT (8A1,3F2.0,4(I2,A1),I1,A1,I2,A1,4(I1,A1),I2,A1,2(I1,A1),3X, 1I3,A1,2(I2,A1),2(I1,A1),I2,A1,7X,I2,A1,I1,A1,1X,A1)	C	239
500	FORMAT (12H ERROR--DATE,3(4X,3F3.0))	C	240
510	FORMAT (27X,A4,12X,A4)	C	241
520	FORMAT (A1,A1,A2,11A1,3F2.0,4X,A1,2(I2,A1),I4,A1,I2,A1,I5,A1,I4,A1 1,I5,A1,I2,A1,I3,A1,I1,A1,I4,A1,I6,A1)	C	242
530	FORMAT (A1,A1,A2,11A1,3F2.0,F4.0,A1,2(I2,A1),I4,A1,I2,A1,I5,A1,I4, 1A1,I5,A1,I2,A1,I3,A1,I1,A1,I4,A1,I6,A1)	C	243
540	FORMAT (15X,2F3.0,I2,A1,I4,A1,2(I2,A1),I5,A1,I4,A1,2(I3,A1),3(I2,A 11),I5,A1,I3,I1,A1,I3)	C	244
	END	C	245
C	PULVAL00	C	246
	SUBROUTINE PULVAL (DT1,DT2,DT3,I2,KON,DSH,KAT,IW,MDD,I,L1,L2,NOCN, 1KT,IWL)	C	247
C	SUBROUTINE TO SORT WELL DEPTHS, CONSTITUENTS, AND STREAM DISCHARGE	C	248
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	C	249
	COMMON /DATAQ/ AON(24),YR(2),AQ(60)	C	250
	COMMON /SORTV/ DL(3),DH(3)	C	251
	COMMON /SRTV/ CL(3),CH(3)	C	252
	COMMON /TAPE/ T1,T2,T3,T4,T5,T6	C	253
	INTEGER T1,T2,T3,T4,T5,T6	C	254-
	INTEGER DT1,DT2,DT3	D	1
	DATA BFD/4HXXXX/	D	2
C	SUBROUTINE CALLED --CSTRST	D	3
C	MDD--SORT INDICATOR, 1=STREAM DISCHARGE, 2=AQUIFERS,	D	4
		D	5
		D	6
		D	7
		D	8
		D	9
		D	10
		D	11
		D	12
		D	13
		D	14

C	3 = CONSTITUENTS, 4 = WELL DEPTH	D	15
	IF (MDD.NE.3) L2=KON	D	16
	IF (MDD.NE.3) L1=1	D	17
	IF (MDD.EQ.2.AND.IWL.LT.1) GO TO 100	D	18
C	SET UP SORTS FOR STREAM DISCHARGE, CONSTITUENTS, AND WELL DEPTH	D	19
	GO TO (10,20,30,40,50,60), IZ	D	20
10	KT=39	D	21
	GO TO 90	D	22
20	KT=38	D	23
	GO TO 90	D	24
30	KT=11	D	25
	GO TO 90	D	26
40	KT=1	D	27
	GO TO 70	D	28
50	KT=2	D	29
	GO TO 70	D	30
60	KT=3	D	31
70	DD1=DL(KT)	D	32
	DD2=DH(KT)	D	33
	IF (MDD.NE.3) GO TO 80	D	34
	DD1=CL(KT)	D	35
	DD2=CH(KT)	D	36
80	IF (DD1.GT.0..OR.DD2.GT.0.) GO TO 100	D	37
	GO TO 230	D	38
90	IF (DT1.EQ.NA(KT).OR.DT2.EQ.NA(KT).OR.DT3.EQ.NA(KT)) GO TO 100	D	39
	GO TO 230	D	40
100	DO 220 INO=L1,L2	D	41
	IF (MDD.EQ.3) GO TO 110	D	42
	READ (T2) (B(IX),IX=1,80),(D(IY),IY=30,80)	D	43
	GO TO 120	D	44
C	SORT DATA AND PLACE IN ARRAY	D	45
110	DD=E(INO,NOCN)	D	46
120	IF (MDD.EQ.1) DD=B(79)	D	47
	IF (MDD.EQ.2.OR.MDD.EQ.4) DD=B(28)	D	48
	IF (MDD.NE.2) GO TO 140	D	49
	IF (D(63).EQ.AQ(I).AND.D(64).EQ.AQ(I+30)) GO TO 130	D	50
	IF (AQ(I).EQ.BFD) GO TO 130	D	51
	GO TO 220	D	52
130	IF (IWL.LT.1) GO TO 180	D	53
140	GO TO (150,160,180,170,170,170), IZ	D	54
150	IF (DD.GT.DSH) GO TO 220	D	55
	IF (DSH.LT..001) GO TO 220	D	56
	IF (DD.LT..001) GO TO 220	D	57
	GO TO 180	D	58
160	IF (DD.LE.DSH) GO TO 220	D	59
	GO TO 180	D	60
170	IF (DD.GE.DD1.AND.DD.LE.DD2) GO TO 180	D	61
	GO TO 220	D	62
180	IF (MDD.EQ.3) GO TO 190	D	63
	CALL CSTSRT (IW,KAT)	D	64
	GO TO 220	D	65
190	IW=IW+1	D	66
	DO 200 ITY=1,KAT	D	67
200	E(IW,ITY)=E(INO,ITY)	D	68
	DO 210 ITX=17,20	D	69
210	E(IW,ITX)=E(INO,ITX)	D	70
220	CONTINUE	D	71
230	RETURN	D	72
	DEBUG SUBCHK		
	END	D	73-

C	MGL00000	E	1
	SUBROUTINE MGL (ISG)	E	2
C	SUBROUTINE FOR PUTTING DECIMALS IN MG/L VALUES, ALSO FOR	E	3
C	CALCULATING ME/L VALUES	E	4
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	E	5
	JAK=80	E	6
	DO 30 I=30,JAK	E	7
	IK=I-29	E	8
C	PLACE DECIMALS	E	9
	GO TO (30,20,30,10,10,10,10,10,30,30,10,10,10,10,20,20,10,20,20,10	E	10
	1,20,20,30,30,30,30,30,10,20,30,10,10,30,30,30,20,20,20,20,20,20	E	11
	2,20,20,10,20,20,10,30,30,30), IK	E	12
10	B(I)=B(I)*.1	E	13
	IF (I.EQ.60.AND.ISG.EQ.1) B(I)=B(I)*10.	E	14
	IF (I.EQ.49.AND.ISG.LT.1) B(I)=B(I)*.1	E	15
	GO TO 30	E	16
20	B(I)=B(I)*.01	E	17
	IF (I.EQ.31.AND.ISG.LT.1) B(I)=B(I)*10.	E	18
30	CONTINUE	E	19
C	CALCULATE ME/L VALUES AND STORE IN D ARRAY	E	20
	DO 50 I=30,62	E	21
	IF (B(I).LT.0.) GO TO 40	E	22
	D(I)=B(I)*C(I)	E	23
	GO TO 50	E	24
40	D(I)=B(I)	E	25
50	CONTINUE	E	26
	DO 70 I=65,80	E	27
	IF (B(I).LT.0.) GO TO 60	E	28
	D(I)=B(I)*C(I)	E	29
	GO TO 70	E	30
60	D(I)=B(I)	E	31
70	CONTINUE	E	32
	DO 80 I=1,29	E	33
80	D(I)=B(I)	E	34
	D(63)=B(63)	E	35
	D(64)=B(64)	E	36
C	DIVIDE DISCHARGE AND CONDUCTANCE BY 1000, WELL DEPTH BY 10	E	37
	IF (D(79).GT.0.) D(79)=D(79)/1000.	E	38
	D(80)=D(28)	E	39
	IF (D(80).GT.0.) D(80)=D(80)/10.	E	40
	IF (D(30).GT.0.) D(30)=D(30)/1000.	E	41
	RETURN	E	42
	END	E	43-
C	MEL00000	F	1
	SUBROUTINE MEL	F	2
C	SUBROUTINE FOR SETTING UP ARRAY OF ME/L CONVERSION FACTORS	F	3
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	F	4
C	CA++	F	5
	C(34)=.04990	F	6
C	MG++	F	7
	C(35)=.08224	F	8
C	NA++	F	9
	C(36)=.04350	F	10
C	K+	F	11
	C(37)=.02558	F	12
C	HCO3-	F	13
	C(38)=.01639	F	14
C	CO3--	F	15
	C(39)=.03333	F	16
C	SO4--	F	17

C	C(40)=.02082	F	18
	CL-	F	19
	C(41)=.02820	F	20
C	F-	F	21
	C(42)=.05263	F	22
C	NO3-	F	23
	C(43)=.01613	F	24
C	PO4---	F	25
	C(44)=.03159	F	26
C	AL+++	F	27
	C(46)=.11119	F	28
C	FE++	F	29
	C(47)=.03581	F	30
C	MN++	F	31
	C(48)=.03640	F	32
C	CU++	F	33
	C(49)=.03148	F	34
C	PB++	F	35
	C(50)=.00965	F	36
C	ZN++	F	37
	C(51)=.03059	F	38
C	BR-	F	39
	C(57)=.01251	F	40
C	I-	F	41
	C(58)=.00788	F	42
C	CR++++++	F	43
	C(66)=.11536	F	44
C	NI++	F	45
	C(67)=.03406	F	46
C	CO++	F	47
	C(68)=.03394	F	48
C	AS+++	F	49
	C(69)=.04004	F	50
C	CD++	F	51
	C(71)=.01779	F	52
C	BA++	F	53
	C(72)=0.01456	F	54
C	BE++	F	55
	C(73)=.22192	F	56
C	NH4+	F	57
	C(74)=.05544	F	58
C	NO2-	F	59
	C(75)=.02174	F	60
	RETURN	F	61
	END	F	62-
C	LOGVAL00	G	1
	SUBROUTINE LOGVAL (EVAL,BLG,CYLN,IFVAL)	G	2
C	SUBROUTINE FOR SETTING UP PARAMETER FOR LOG PLOT	G	3
C	EVAL--PARAMETER	G	4
C	IFVAL--LINE PLOT POSITION FOR EVAL	G	5
	IF (EVAL.LT.BLG) GO TO 60	G	6
	TLG=BLG	G	7
	ADL=0	G	8
10	IF (EVAL.LT.(TLG*10.)) GO TO 20	G	9
	ADL=ADL+CYLN	G	10
	TLG=TLG*10.	G	11
	GO TO 10	G	12
20	IF (EVAL.LE.1.) EVAL=EVAL*10.	G	13
	IF (EVAL.LT.1.) GO TO 20	G	14
	IF (EVAL.GE.9.99998.AND.EVAL.LE.10.00001) GO TO 40	G	15

30	IF (EVAL.GE.10.) EVAL=EVAL/10.	G	16
	IF (EVAL.GE.10.) GO TO 30	G	17
	VAL=ALOG10(EVAL)	G	18
	IFVAL=(CYLN*VAL)+ADL+1.5	G	19
	GO TO 50	G	20
40	IFVAL=ADL+1.5	G	21
50	CONTINUE	G	22
	IF (IFVAL.LE.121) GO TO 70	G	23
	IFVAL=121	G	24
	GO TO 70	G	25
60	IFVAL=1	G	26
70	RETURN	G	27
	END	G	28-
C	TABR0000	H	1
	SUBROUTINE TABR (K1,K2,KAT,IDT,KOT,ISP,IST,ISG,DSH,J,IMK,ITC,IWL,I	H	2
	1G,KX,NOCNST,IAQ,VLU)	H	3
C	SUBROUTINE FOR IDENTIFYING SORTS, LISTING SORTED DATA, AND	H	4
C	LISTING STATISTICAL DATA.	H	5
C	ARRAYS DIMENSIONED IN TABR NOT PREVIOUSLY EXPLAINED.	H	6
C	- - - - - AKT, NUMBER OF ANALYSES OR DATA SETS FOR WHICH EACH	H	7
C	- - - - - PARAMETER OR CONSTITUENT HAS HAD SUMMARY STATISTICS	H	8
C	- - - - - CALCULATED.	H	9
C	- - - - - SD, STANDARD DEVIATION FOR EACH CONSTITUENT OR PARAMETER	H	10
C	- - - - - IHD, HEADING CONTAINING CONSTITUENT IDENTIFIERS IN	H	11
C	- - - - - SUMMARY TABLE BEFORE A ROPES DIAGRAM.	H	12
	DIMENSION AKT(16), SD(16), IHD(16)	H	13
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	H	14
	COMMON /CARVAL/ AV(16),AHG(16),ALW(16)	H	15
	COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	H	16
	COMMON /DATAQ/ AON(24),YR(2),AQ(60)	H	17
	COMMON /SORTV/ DL(3),DH(3)	H	18
	COMMON /SRTV/ CL(3),CH(3)	H	19
	COMMON /TAPE/ T1,T2,T3,T4,T5,T6	H	20
	INTEGER T1,T2,T3,T4,T5,T6	H	21
	WRITE (T6,190) (TITLE(I),I=1,9)	H	22
	IF (ISG.LT.1) WRITE (T6,200)	H	23
	IF (ISG.GT.0) WRITE (T6,210)	H	24
	IF (IST.LT.1) GO TO 10	H	25
	IF (ISG.LT.1) GO TO 20	H	26
	IF (IMK.LT.1) WRITE (T6,220) AQ(IAQ),AQ(IAQ+30)	H	27
	IF (IMK.GT.0) WRITE (T6,230) AQ(IAQ),AQ(IAQ+30)	H	28
10	IF (IWL.LT.1) GO TO 60	H	29
	IF (ISP.EQ.38) WRITE (T6,240) DSH	H	30
	IF (ISP.EQ.39) WRITE (T6,250) DSH	H	31
	IF (ISP.EQ.11) WRITE (T6,260)	H	32
	IF (ISP.GE.1.AND.ISP.LE.3) WRITE (T6,270) DL(ISP),DH(ISP)	H	33
	GO TO 60	H	34
20	IF (ISP.EQ.11) GO TO 40	H	35
	IF (ISP.EQ.38) GO TO 50	H	36
	IF (ISP.LE.3) GO TO 30	H	37
	WRITE (T6,280) DSH	H	38
	GO TO 60	H	39
30	WRITE (T6,290) DL(ISP),DH(ISP)	H	40
	GO TO 60	H	41
40	WRITE (T6,300)	H	42
	GO TO 60	H	43
50	WRITE (T6,310) DSH	H	44
60	IF (IDT.LT.1) GO TO 70	H	45
	IYX=YR(1)+1900.	H	46
	IYY=YR(2)+1900.	H	47

	MOX=AON(J-2)	H	48
	MOY=AON(J-1)	H	49
	WRITE (T6,320) MOX,MOY,IYX,IYY	H	50
70	IF (ITC.LT.1) GO TO 80	H	51
	IF (KX.EQ.38) WRITE (T6,330) IDNT(NOCNST),VLU	H	52
	IF (KX.EQ.39) WRITE (T6,340) IDNT(NOCNST),VLU	H	53
	IF (KX.EQ.11) WRITE (T6,350) IDNT(NOCNST)	H	54
	IF (KX.GE.1.AND.KX.LE.3) WRITE (T6,360) IDNT(NOCNST),CL(KX),CH(KX)	H	55
80	DO 90 I=1,KAT	H	56
	IF (IPT(I).LE.62) ICT=IPT(I)-29	H	57
	IF (IPT(I).GT.65) ICT=IPT(I)-31	H	58
90	IHD(I)=IDNT(ICT)	H	59
	IY=1	H	60
	IX=8	H	61
	IF (KAT.LT.9) IX=KAT	H	62
100	WRITE (T6,370) (IHD(I),I=IY,IX)	H	63
	DO 110 I=K1,K2	H	64
110	WRITE (T6,380) E(I,20),(E(I,II),II=17,19),(E(I,IJ),IJ=IY,IX)	H	65
	IF (IY.GT.1) GO TO 170	H	66
C	DETERMINE HIGH, MEAN, LOW, STANDARD DEVIATION, AND NUMBER OF	H	67
C	SAMPLES CONSIDERED FOR SORTED DATA	H	68
	DO 160 K=1,KAT	H	69
	AV(K)=0.	H	70
	AHG(K)=0.	H	71
	ALW(K)=100000.	H	72
	AKT(K)=0.	H	73
	DO 120 I=K1,K2	H	74
	IF (E(I,K).LT.0.) GO TO 120	H	75
	AV(K)=AV(K)+E(I,K)	H	76
	AHG(K)=AMAX1(AHG(K),E(I,K))	H	77
	ALW(K)=AMIN1(ALW(K),E(I,K))	H	78
	AKT(K)=AKT(K)+1.	H	79
120	CONTINUE	H	80
	IF (AKT(K).LT.1.) GO TO 140	H	81
	AV(K)=AV(K)/AKT(K)	H	82
	IF (AKT(K).LE.1.) GO TO 150	H	83
	SD(K)=0.	H	84
	DO 130 I=K1,K2	H	85
	IF (E(I,K).LT.0.) GO TO 130	H	86
	SD(K)=SD(K)+(E(I,K)-AV(K))**2	H	87
130	CONTINUE	H	88
	SD(K)=SQRT(SD(K)/(AKT(K)-1.))	H	89
	GO TO 160	H	90
140	AV(K)=(-1.)	H	91
	AHG(K)=(-1.)	H	92
	ALW(K)=(-1.)	H	93
150	SD(K)=0.	H	94
160	CONTINUE	H	95
	KT1=1	H	96
	KT2=8	H	97
	IF (KAT.LE.KT2) KT2=KAT	H	98
170	WRITE (T6,390)	H	99
C	WRITE STATISTICAL DATA	H	100
	WRITE (T6,400) (AHG(L),L=KT1,KT2)	H	101
	WRITE (T6,410) (AV(L),L=KT1,KT2)	H	102
	WRITE (T6,420) (ALW(L),L=KT1,KT2)	H	103
	WRITE (T6,430) (SD(L),L=KT1,KT2)	H	104
	WRITE (T6,440) (AKT(L),L=KT1,KT2)	H	105
	WRITE (T6,450)	H	106
	IF (KAT.EQ.IX) GO TO 180	H	107

KT1=9	H 108
KT2=KAT	H 109
IY=9	H 110
IX=KAT	H 111
GO TO 100	H 112
180 RETURN	H 113
C	H 114
190 FORMAT (1X,9A4,/,)	H 115
200 FORMAT (1X,20HSURFACE-WATER DATA ,/,)	H 116
210 FORMAT (1X,18HGROUND-WATER DATA ,/,)	H 117
220 FORMAT (5X,18H GEOLOGIC UNIT(S) ,A4,5X,A4)	H 118
230 FORMAT (5X,18H GEOLOGIC UNIT(S) ,F5.0,5X,F5.0)	H 119
240 FORMAT (6X,36HSORTED FOR WELL DEPTHS GREATER THAN ,F10.0,/,)	H 120
250 FORMAT (6X,45HSORTED FOR WELL DEPTHS LESS THAN OR EQUAL TO ,F10.0,/,)	H 121
1/,)	H 122
260 FORMAT (6X,20HUNSORTED WELL DEPTHS,/,)	H 123
270 FORMAT (6X,23HSORTED FOR WELL DEPTHS ,F10.0,3H TO,F10.0/,)	H 124
280 FORMAT (6X,44HSORTED FOR DISCHARGES LESS THAN OR EQUAL TO ,F10.1,/,)	H 125
1/,)	H 126
290 FORMAT (6X,22HSORTED FOR DISCHARGES ,F10.1,3H TO,F10.1,/,)	H 127
300 FORMAT (6X,20HUNSORTED DISCHARGES ,/,)	H 128
310 FORMAT (6X,36H SORTED FOR DISCHARGES GREATER THAN ,F10.1,/,)	H 129
320 FORMAT (6X,20HSORTED FOR MONTH(S) ,I3,1H-,I3,2H, ,10HFOR YEARS ,I5,1H-,I5,/,)	H 130
330 FORMAT (6X,11HSORTED FOR ,A4,20HVALUES GREATER THAN ,F10.2/,)	H 131
340 FORMAT (6X,11HSORTED FOR ,A4,30HVALUES LESS THAN OR EQUAL TO ,F10.2/,)	H 132
1.2/,)	H 133
350 FORMAT (6X,23HNO SORT ON CONSTITUENT ,A4,/,)	H 134
360 FORMAT (6X,11HSORTED FOR ,A4,8H VALUES ,F10.0,3H TO,F10.0/,)	H 135
370 FORMAT (1X,4HNUM.,4X,4HDATE,2X,8(10X,A4),/,)	H 136
380 FORMAT (1X,4F4.0,8F14.4)	H 137
390 FORMAT (/,/)	H 138
400 FORMAT (13X,4HMAX.,8F14.4)	H 139
410 FORMAT (13X,4HMEAN,8F14.4)	H 140
420 FORMAT (13X,4HMIN.,8F14.4)	H 141
430 FORMAT (13X,4HS.D.,8F14.4)	H 142
440 FORMAT (13X,4HNUM.,8F14.0)	H 143
450 FORMAT (1H1)	H 144
END	H 145
C	H 146-
SDVU0000	I 1
SUBROUTINE SDVU (KAT,BLG,K1,K2,DLG,KYLN,CYLN)	I 2
C	I 3
SUBROUTINE TO PLOT TOP VIEW DIAGRAMS OF SURFACE WATER DATA	I 4
COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	I 5
COMMON /ARGE/ IPY(121),IPX(121)	I 6
COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	I 7
COMMON /TAPE/ T1,T2,T3,T4,T5,T6	I 8
C	I 9
WRITE IDENTIFICATION OF DIAGRAM AND UPPER BOUNDARY	I 10
INTEGER T1,T2,T3,T4,T5,T6	I 11
WRITE (T6,170) (TITLE(I),I=1,9)	I 12
WRITE (T6,180)	I 13
WRITE (T6,190) BLG,DLG	I 14
WRITE (T6,200) (IPY(I),I=1,121)	I 15
WRITE (T6,210) (IPX(I),I=1,121)	I 16
C	I 17
PLOT SPECIFIED CONSTITUENTS FOR EACH ANALYSIS AS SORTED PREVIOUSLY	I 18
C	I 19
THE CONSTITUENTS ARE ARRANGED LOGRITHMICALLY ON A LINE AND	I 20
C	I 21
IDENTIFIED BY DATE	
DO 120 JK=K1,K2	
DO 10 I=1,121	
10 IPX(I)=NA(37)	
DO 20 I=1,121,KYLN	

	20	IPX(I)=NA(41)	I	22
C		SPACE 1 LINES	I	23
		WRITE (T6,220) (IPX(I),I=1,121)	I	24
		DO 30 I=2,120	I	25
	30	IPX(I)=NA(39)	I	26
		DO 40 I=1,121,KYLN	I	27
	40	IPX(I)=NA(41)	I	28
		NAX=2	I	29
C		PLACE SPECIFIED CONSTITUENTS FOR ANALYSIS ON 120 CHARACTER LINE	I	30
		DO 110 JL=1,KAT	I	31
		IF (NAX.GT.36) NAX=36	I	32
		IF (E(JK,JL).LT.0.) GO TO 110	I	33
		IF (E(JK,JL).LT.BLG) GO TO 90	I	34
		TLG=BLG	I	35
		ADL=0	I	36
	50	IF (E(JK,JL).LT.(TLG*10.)) GO TO 60	I	37
		ADL=ADL+CYLN	I	38
		TLG=TLG*10.	I	39
		GO TO 50	I	40
	60	EVAL=E(JK,JL)	I	41
	70	IF (EVAL.LT.1.) EVAL=EVAL*10.	I	42
		IF (EVAL.LT.1.) GO TO 70	I	43
	80	IF (EVAL.GE.10.) EVAL=EVAL/10.	I	44
		IF (EVAL.GE.10.) GO TO 80	I	45
		VAL=ALOG10(EVAL)	I	46
		IFK=(CYLN*VAL)+ADL+1.5	I	47
		IF (IFK.LE.121) GO TO 100	I	48
		GO TO 110	I	49
	90	IFK=1	I	50
	100	IPX(IFK)=NA(NAX)	I	51
	110	NAX=NAX+1	I	52
		MON=E(JK,17)	I	53
		IDA=E(JK,18)	I	54
		IYR=E(JK,19)	I	55
C		WRITE LINE WITH SPECIFIED CONSTITUENTS	I	56
		WRITE (T6,230) MON,IDA,IYR,(IPX(I),I=1,121)	I	57
	120	CONTINUE	I	58
		DO 130 I=1,121	I	59
	130	IPX(I)=NA(37)	I	60
		DO 140 I=1,121,KYLN	I	61
	140	IPX(I)=NA(41)	I	62
C		SPACE 1 LINES	I	63
		WRITE (T6,220) (IPX(I),I=1,121)	I	64
		DO 150 I=1,121	I	65
	150	IPX(I)=NA(41)	I	66
C		WRITE LOWER BOUNDARY	I	67
		WRITE (T6,220) (IPX(I),I=1,121)	I	68
		WRITE (T6,200) (IPY(I),I=1,121)	I	69
		WRITE (T6,240) BLG,DLG	I	70
		WRITE (T6,250)	I	71
C		DEFINE SYMBOLS USED ON TOP VIEW PLOT	I	72
		WRITE (T6,260)	I	73
		DO 160 I=1,KAT	I	74
		IF (IPT(I).LE.62) ICT=IPT(I)-29	I	75
		IF (IPT(I).GE.65) ICT=IPT(I)-31	I	76
		WRITE (T6,270) NA(I+1),IDNT(ICT)	I	77
	160	CONTINUE	I	78
		WRITE (T6,250)	I	79
		RETURN	I	80
C			I	81

170	FORMAT (1X,9A4,//)	I	82
180	FORMAT (5X,25HROPES DIAGRAM-- TOP VIEW ,//)	I	83
190	FORMAT (3X,4HDATE,F8.4,107X,F10.1)	I	84
200	FORMAT (10X,121A1)	I	85
210	FORMAT (2X,8HM D Y ,121A1)	I	86
220	FORMAT (10X,121A1)	I	87
230	FORMAT (3I3,1X,121A1)	I	88
240	FORMAT (7X,F8.4,'07X,F10.1)	I	89
250	FORMAT (1H1)	I	90
260	FORMAT (1X,50HEXPLANATION OF SYMBOLS ON ROPES DIAGRAM-- TOP VIEW,/	I	91
	1//)	I	92
270	FORMAT (5X,A1,2X,1H=,2X,A4,//)	I	93
	END	I	94-
C	CSTSRT00	J	1
	SUBROUTINE CSTSRT (IW,KAT)	J	2
C	SUBROUTINE TO PLACE SPECIFIED PARAMETERS FROM SORTED ANALYSES INTO	J	3
C	E ARRAY	J	4
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	J	5
	COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	J	6
	IW=IW+1	J	7
	DO 10 IM=1,KAT	J	8
	IPT1=IPT(IM)	J	9
10	E(IW,IM)=D(IPT1)	J	10
C	E(IW, 17), (IW, 18), (IW, 19), (IW, 20), ARE MONTH, DAY, YEAR,	J	11
C	AND RUNNING COUNT, RESPECTIVELY.	J	12
	E(IW,17)=B(25)	J	13
	E(IW,18)=B(26)	J	14
	E(IW,19)=B(27)	J	15
	E(IW,20)=B(80)	J	16
	RETURN	J	17
	DEBUG SUBCHK		
	END	J	18-
C	DATEST00	K	1
	SUBROUTINE DATEST (KOT,IUT,I,ITB,N)	K	2
C	SUBROUTINE TO SORT DATES--USED IN MAINLINE FOR GROSS SORT	K	3
C	AND IN PLOT FOR DETAILED SORT	K	4
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	K	5
	COMMON /DATAQ/ AON(24),YR(2),AQ(60)	K	6
	IUT=2	K	7
	IF (ITB.GT.1) GO TO 50	K	8
	IF (B(27).GE.YR(1).AND.B(27).LE.YR(2)) GO TO 10	K	9
	GO TO 90	K	10
10	IF (KOT.LT.1) GO TO 80	K	11
	JOT=KOT*2	K	12
	DO 40 K=1,JOT,2	K	13
	IF (AON(K+1).GT.0.) GO TO 20	K	14
	IF (AON(K).EQ.B(25)) GO TO 80	K	15
	GO TO 40	K	16
20	IF (AON(K).GE.AON(K+1)) GO TO 30	K	17
	IF (B(25).GE.AON(K).AND.B(25).LE.AON(K+1)) GO TO 80	K	18
	GO TO 40	K	19
30	IF (B(25).GE.AON(K).OR.B(25).LE.AON(K+1)) GO TO 80	K	20
40	CONTINUE	K	21
	GO TO 90	K	22
50	IF (AON(I+1).GT.0.) GO TO 60	K	23
	IF (AON(I).EQ.E(N,17)) GO TO 80	K	24
	GO TO 90	K	25
60	IF (AON(I).GE.AON(I+1)) GO TO 70	K	26
	IF (E(N,17).GE.AON(I).AND.E(N,17).LE.AON(I+1)) GO TO 80	K	27
	GO TO 90	K	28

70	IF (E(N,17).GE.AON(I).OR.E(N,17).LE.AON(I+1)) GO TO 80	K	29
	GO TO 90	K	30
80	IUT=1	K	31
90	RETURN	K	32
	END	K	33-
C	LINE0000	L	1
	SUBROUTINE LINE (KW,IL,KAT,BLG,DLG,KYLN,CYLN)	L	2
C	SUBROUTINE TO PLOT DIAGRAM	L	3
	COMMON /IBAS/ B(80),C(80),D(80),NA(41),E(600,20),TITLE(9)	L	4
	COMMON /LNPL/ IPT(16),IFN(200),IDNT(60)	L	5
	COMMON /CARVAL/ AV(16),AHG(16),ALW(16)	L	6
	COMMON /ARGE/ IPY(121),IPX(121)	L	7
	COMMON /TAPE/ T1,T2,T3,T4,T5,T6	L	8
	INTEGER T1,T2,T3,T4,T5,T6	L	9
C	SUBROUTINE CALLED--LOGVAL	L	10
	DO 10 I=1,121	L	11
10	IPX(I)=NA(37)	L	12
	IF (IPT(IL).LE.62) ICT=IPT(IL)-29	L	13
	IF (IPT(IL).GE.65) ICT=IPT(IL)-31	L	14
C	DETERMINE PLOT POSITIONS FOR HIGH(AHVAL), MEAN(AVVAL), AND LOW	L	15
C	(AVAL)VALUES FOR IPT(IL) CONSTITUENTS	L	16
	AVVAL=AV(IL)	L	17
	CALL LOGVAL (AVVAL,BLG,CYLN,M2)	L	18
	AHVAL=AHG(IL)	L	19
	CALL LOGVAL (AHVAL,BLG,CYLN,M1)	L	20
	ALVAL=ALW(IL)	L	21
	CALL LOGVAL (ALVAL,BLG,CYLN,M0)	L	22
	IF (IL.GT.1) GO TO 150	L	23
C	WRITE TITLE	L	24
	WRITE (T6,340) (TITLE(I),I=1,9)	L	25
C	DETERMINE LOW AND HIGH SCALE	L	26
	LIG=120/KYLN	L	27
	DLG=BLG	L	28
	DO 20 I=1,LIG	L	29
20	DLG=DLG*10.	L	30
	DO 30 I=1,121	L	31
30	IPX(I)=NA(41)	L	32
	WRITE (T6,350) BLG,DLG	L	33
	DO 40 I=1,121	L	34
40	IPY(I)=NA(37)	L	35
	MT=1	L	36
C	SET UP LOG SCALE AND POSITION THEM ON IPY LINE	L	37
	DO 140 IK=1,9	L	38
	MT=MT+1	L	39
	GO TO (50,60,70,80,90,140,100,140,110), IK	L	40
50	ALG=0.00	L	41
	GO TO 120	L	42
60	ALG=0.30	L	43
	GO TO 120	L	44
70	ALG=0.476	L	45
	GO TO 120	L	46
80	ALG=0.60	L	47
	GO TO 120	L	48
90	ALG=0.70	L	49
	GO TO 120	L	50
100	ALG=0.851	L	51
	GO TO 120	L	52
110	ALG=0.952	L	53
120	KLG=(FLOAT(KYLN)*ALG)+1.00000001	L	54
	DO 130 I=KLK,121,KYLN	L	55

130	IPY(I)=NA(MT)	L	56
140	CONTINUE	L	57
C	WRITE LOG SCALE LINE	L	58
	WRITE (T6,360) (IPY(I),I=1,121)	L	59
C	WRITE LINE OF ***	L	60
	WRITE (T6,360) (IPX(I),I=1,121)	L	61
150	DO 160 I=1,121	L	62
160	IPX(I)=NA(37)	L	63
C	PLACE SPACERS ON LINE	L	64
	DO 170 I=1,121,KYLN	L	65
170	IPX(I)=NA(41)	L	66
C	WRITE ONE LINES WITH SPACERS	L	67
	WRITE (T6,360) (IPX(I),I=1,121)	L	68
	IF (KW.LT.1) GO TO 180	L	69
C	PLACE HIGH(H),MEAN(M),LOW(L) ON LINE	L	70
	IPX(M0)=NA(22)	L	71
	IPX(M1)=NA(18)	L	72
	IPX(M2)=NA(23)	L	73
180	WRITE (T6,360) (IPX(I),I=1,121)	L	74
C	PREPARE LINE FOR RECEIVING DATA	L	75
	DO 190 IY=2,120	L	76
190	IPX(IY)=NA(39)	L	77
	DO 200 IY=1,121,KYLN	L	78
200	IPX(IY)=NA(41)	L	79
	IF (KW.LT.1) GO TO 230	L	80
C	PLACE DATA ON CONSTITUENT LINE	L	81
	DO 220 IY=M0,M1	L	82
	IDX=2	L	83
	DO 210 IZ=1,KW	L	84
	IF (IFN(IZ).NE.IY) GO TO 210	L	85
	IF (IDX.GT.36) IDX=36	L	86
	IPX(IY)=NA(IDX)	L	87
	IDX=IDX+1	L	88
210	CONTINUE	L	89
220	CONTINUE	L	90
C	WRITE CONSTITUENT LINE	L	91
230	WRITE (T6,370) IDNT(ICT),(IPX(I),I=1,121),IDNT(ICT)	L	92
	DO 240 I=1,121	L	93
240	IPX(I)=NA(37)	L	94
	DO 250 I=1,121,KYLN	L	95
250	IPX(I)=NA(41)	L	96
C	PLACE MG/L SCALE ON LINE	L	97
	KCT=IPT(IL)	L	98
	CVAL=C(KCT)	L	99
260	IF (CVAL.LT.1.) CVAL=CVAL*10.	L	100
	IF (CVAL.LT.1.) GO TO 260	L	101
270	IF (CVAL.GE.10.) CVAL=CVAL/10.	L	102
	IF (CVAL.GE.10.) GO TO 270	L	103
	VAL=ALOG10(CVAL)	L	104
	MVAL=(VAL*CYLN)+1.5	L	105
	DO 280 I=MVAL,121,KYLN	L	106
280	IPX(I)=NA(38)	L	107
C	WRITE MG/L SCALE ON LINE	L	108
	WRITE (T6,360) (IPX(I),I=1,121)	L	109
	IF (IL.LT.KAT) GO TO 330	L	110
C	PREPARE AND WRITE 1 SPACER LINES	L	111
	DO 290 I=1,121	L	112
290	IPX(I)=NA(37)	L	113
	DO 300 I=1,121,KYLN	L	114
300	IPX(I)=NA(41)	L	115

WRITE (T6,360) (IPX(I),I=1,121)	L 116
DO 310 I=1,121	L 117
310 IPX(I)=NA(41)	L 118
C WRITE LAST LINES OF PLOT	L 119
WRITE (T6,360) (IPX(I),I=1,121)	L 120
WRITE (T6,360) (IPY(I),I=1,121)	L 121
WRITE (T6,350) BLG,DLG	L 122
WRITE (T6,380)	L 123
C DYLN--VALUE OF FIRST MG/L ON PLOT	L 124
C WRITE FOOTNOTES	L 125
DYLN=BLG*10.	L 126
WRITE (T6,390) DYLN	L 127
DO 320 I=1,KAT	L 128
IF (IPT(I).EQ.79) WRITE (T6,400)	L 129
IF (IPT(I).EQ.80) WRITE (T6,410)	L 130
IF (IPT(I).EQ.30) WRITE (T6,420)	L 131
320 CONTINUE	L 132
WRITE (T6,380)	L 133
330 RETURN	L 134
C	L 135
340 FORMAT (1X,9A4,/,1X,15HROPES DIAGRAM ,/,)	L 136
350 FORMAT (F11.4,107X,F11.2)	L 137
360 FORMAT (6X,121A1)	L 138
370 FORMAT (1X,A4,1X,121A1,1X,A4)	L 139
380 FORMAT (1H1)	L 140
390 FORMAT (///,42H EXPLANATION OF SYMBOLS ON ROPES DIAGRAM /5X,54HL	L 141
1= LOWEST CONSTITUENT VALUE, M = MEAN, AND H = HIGH /5X,117HCONSTI	L 142
2TUENTS ARE PLOTTED ON DASHED LINES, NUMBERS (1-9) AND LETTERS (A-Z	L 143
3) GIVE NUMBER OF PLOTS AT A SINGLE POSITION /10X,54H(1 = ONE, 9 =	L 144
4 NINE, A = TEN, Z = THIRTY-FIVE OR MORE) /5X,62HMILLIGRAMS PER LIT	L 145
5ER SCALE GIVEN BY + SYMBOLS. LEFT + EQUALS ,F7.3,48H EXCEPT WHEN	L 146
6IT IS ON THE EXTREME LEFT SIDE OF /10X,45HDIAGRAM WHERE IT IS EQU	L 147
7AL TO SCALE AT TOP /5X,122HPLOTTED CONSTITUENTS ARE IN ME/L EX	L 148
8CEPT WHEN MG/L + SYMBOL IS ON THE EXTREME LEFT SIDE OF DIAGRAM, TH	L 149
9EN VALUES ARE MG/L)	L 150
400 FORMAT (5X,36HDSCH = DISCHARGE DIVIDED BY 1000.)	L 151
410 FORMAT (5X,35HDPH = WELL DEPTH DIVIDED BY 10.)	L 152
420 FORMAT (5X,36HCOND = CONDUCTIVITY DIVIDED BY 1000.)	L 153
END	L 154-

Appendix III.--Instructions for cards required to initiate the program from U.S.G.S
Washington, D.C., IBM 360/65 computer program library disc.

The following cards are to be placed first in the deck-set-up in order to utilize the program from the library disc.

<u>Card columns</u>	<u>Contents</u>
	Card 1: JØB card
1-2	//
3	Originating center (D=Denver, W=Wash., R=Rolla, M=Menlo Park, F=Flagstaff)
4-5	Organization code (ex.G4=Water Res. Div.)
6-8	User registration code, as assigned by Computer Center Division
9-10	User's ID: any alphanumerics for the user's own identification. Change recommended if program is run more than once in one day.
11-15	blank, JØB, blank
16	((left parenthesis)
17-20	0160
21	, (comma)
22-25	User assigned auxiliary account number
26	, (comma)
27-30	Estimated execution time in minutes, four numeric digits required.
31	, (comma)
33-35	Estimated lines of print in thousands of lines. Four numeric digits required.
36	, (comma)
37-40	0000 (zero cards to be punched)

Card columnsContents

41-45	,1,1, (comma, one, comma, one, comma)
46	P (for production run)
47	) (right parenthesis)
48	, (comma)

Card 2 JØBLIB card to call program from library

(b = blank)

1-12	//JØBLIBbDDb
13-31	DSNAME=SYS1.LØADLIB
32	, comma
33-47	DISP=(ØLD,KEEP)
47-80	blank

Card 3, execute program

1-16	//bEXECbPGM=DØ160
------	-------------------

Card 4, printer card

1-13	//FTØ6ØØ1bDDb
13-21	SYSØUT=A

Card 5, scratch disc

1-17	//GØ.FT11FØØ1bDDb
18-34	DSNAME=SYS1.WØRK4
35	, comma
36-45	UNIT=SYSDA
46	, comma
47-71	blank
72	X (caution; easy to forget when duplicating)
73-80	blank

Card columnsContentsCard 5a, scratch disc, continued

1-2	// (slash, slash)
3-15	blank
16-27	DCB=(RECFM=V
28	, comma
29-38	LRECL=1616
39	, comma
40-52	BLKSIZE=1620)
53-80	blank

Card 6, card reader

1-14	//FT05F001bDDb
15	* (asterisk)
16-80	blank

Card n - end of data file

The last card on the complete deck-set-up, following the Z card in the last data group, must be the end of data file, "slash-asterisk", card.

1-2	/* (slash asterisk)
3-80	blank

Appendix IV.--Program abstract.

KANSAS GEOLOGICAL SURVEY COMPUTER PROGRAM
THE UNIVERSITY OF KANSAS, LAWRENCE

PROGRAM ABSTRACT

Title (If subroutine state in title):

FORTTRAN IV Program for Synthesis and Plotting of Water-Quality Data

Date: March 1967

Author, organization: Leverett H. Ropes, Charles O. Morgan, and Jesse M. McNellis

U.S. Geological Survey, Water Resources Division

Direct inquiries to: Charles O. Morgan or Jesse M. McNellis

Name: _____ Address: U.S.G.S., WRD

Box 768, Lawrence, Kansas 66044

Purpose/description: To statistically examine and diagrammatically display chemical analyses
of water for interpretation.

Mathematical method: See program listing.

Restrictions, range: Number of analyses unlimited; however, final number sorted for each plot
cannot exceed 200.

Computer manufacturer: GE and IBM

Model: GE 625 IBM 7040
GE 635 IBM 360/65

Programming language: FORTTRAN IV

Memory required: 36 K Approximate running time: _____

Special peripheral equipment required: Scratch unit 02

Remarks (special compilers or operating systems, required word lengths, number of successful runs, other machine versions, additional information useful for operation or modification of program) _____

