

EVALUATION OF SELECTED SURFACE-WATER-QUALITY STATIONS IN WYOMING

by S. J. Rucker IV and L. L. DeLong

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#### STATION NUMBERS AND RECORDS

Each U.S. Geological Survey surface-water-quality site or gaging station has been assigned a station number in downstream order for identification purposes. Surface-water-quality stations located at or near gaging stations have the same number as the gaging station. The complete 8-digit number for each station, such as 06259000, includes the 2-digit part number 06, indicating the drainage basin, plus the 6-digit downstream order number 259000. Part numbers used in this report are: 06, Missouri River basin; 10, Great Basin; and 13, Snake River basin. Increasing numbers refer to stations progressively farther downstream. Records used in this report are published annually in the U.S. Geological Survey Water Resources Data for Wyoming (for example, see U.S. Geological Survey, 1976).

## CONVERSION FACTORS

For the use of readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

| <u>Multiply</u>       | <u>By</u> | <u>To obtain</u>       |
|-----------------------|-----------|------------------------|
| cubic foot per second | 0.02832   | cubic meter per second |
| ton per day           | 0.9072    | megagram per day       |
| mile                  | 1.609     | kilometer              |
| acre-foot             | 0.001233  | cubic hectometer       |

# EVALUATION OF SELECTED SURFACE-WATER-QUALITY STATIONS IN WYOMING

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## ABSTRACT

Data from 56 surface-water-quality stations, operated in cooperation with the Wyoming Department of Agriculture, were evaluated to determine (1) the adequacy of the data used to describe the dissolved-solids load, and (2) the effectiveness of the sampling frequency after 10 years of operation. Additionally, tables of regression coefficients relating the major dissolved constituents to specific conductance and to streamflow were determined. Stations in the Green River basin were excluded; an analysis of salinity in the Green River basin was presented in a previous report by DeLong (1977). Together, DeLong's report and this one comprise a statewide evaluation of the water-quality data program in Wyoming.

Monthly mean dissolved-solids loads were estimated for 16 stations using daily specific conductance and streamflow. These loads compared favorably with loads estimated using DeLong's multivariable equation relating streamflow to data obtained from chemical analyses of monthly samples. DeLong's equation was then applied to the remaining stations. Hydrographs showing the cumulative dissolved-solids loads for the 1970-75 water years are presented.

The data provide reasonable estimates of the dissolved-solids loads for 33 of the stations as well as describe the chemical quality of the water. Results indicate that sampling frequency can be decreased.

Chemical quality of the water at the remaining 23 stations is described by the data. However, if estimates of loads are required, daily sampling for specific conductance will be necessary for 6 stations, and streamflow records will be necessary for 20 stations.

The usefulness of the stations to identify point sources of dissolved solids is limited. Caution needs to be used when considering loads at any of the stations because there are diversions upstream from almost all of them, and little is known about the quantity of water in the return flows or the dissolved-solids concentration present.

## INTRODUCTION

The U.S. Geological Survey, in cooperation with the Wyoming Department of Agriculture, has conducted a surface-water-quality program in Wyoming since 1965. The Wyoming State Engineer, the Wyoming Department

of Environmental Quality, and various irrigation and weed-control districts have participated in the program through the Wyoming Department of Agriculture.

The U.S. Bureau of Reclamation, the U.S. Environmental Protection Agency, the U.S. Bureau of Land Management, and the Wyoming Department of Environmental Quality conduct (1982) quality-of-water programs in cooperation with the U.S. Geological Survey, adding to the Wyoming Department of Agriculture program.

The main purpose of the program is to determine the chemical quality of the water in terms of the major dissolved inorganic constituents and dissolved solids, commonly called salinity. The major dissolved constituents are silica, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. Iron, boron, and total phosphorus have been determined on an intermittent basis (since 1973).

Energy-resource development and changing agricultural techniques have stimulated a need for data on trace elements, nutrients, pesticides, herbicides, and sediment. Biological data on lakes and streams also are needed.

#### Purpose

This report evaluates surface-water-quality stations operated in the Wyoming Department of Agriculture cooperative program. The evaluation is to consider if (1) the data collected adequately represent the dissolved-solids load at each station, and (2) if sampling frequency can be decreased. Additionally, the purpose is to provide (1) tables of coefficients relating concentrations of major dissolved constituents to specific conductance and to flow and time, and (2) a graphic depiction of cumulative dissolved-solids load for each station considered.

#### Scope

Data for 56 surface-water-quality stations were analyzed. Station locations are shown in figure 1. Sampling stations and periods of record for which data were analyzed are listed in table 1. The data were compiled from monthly samples collected prior to October 1976.

Concentrations and loads for 12 stations in the Green River basin were presented in a report by DeLong (1977). Further discussion of these stations is outside the scope of this report; however, the two reports together comprise a statewide evaluation of the surface-water-quality data program in Wyoming.

#### METHOD OF ANALYSIS

The adequacy of data collected to describe the quality of water in a stream may be evaluated in terms of how well the data define the dissolved-solids load a stream transports. For this study, daily samples for specific conductance and monthly samples for major dissolved



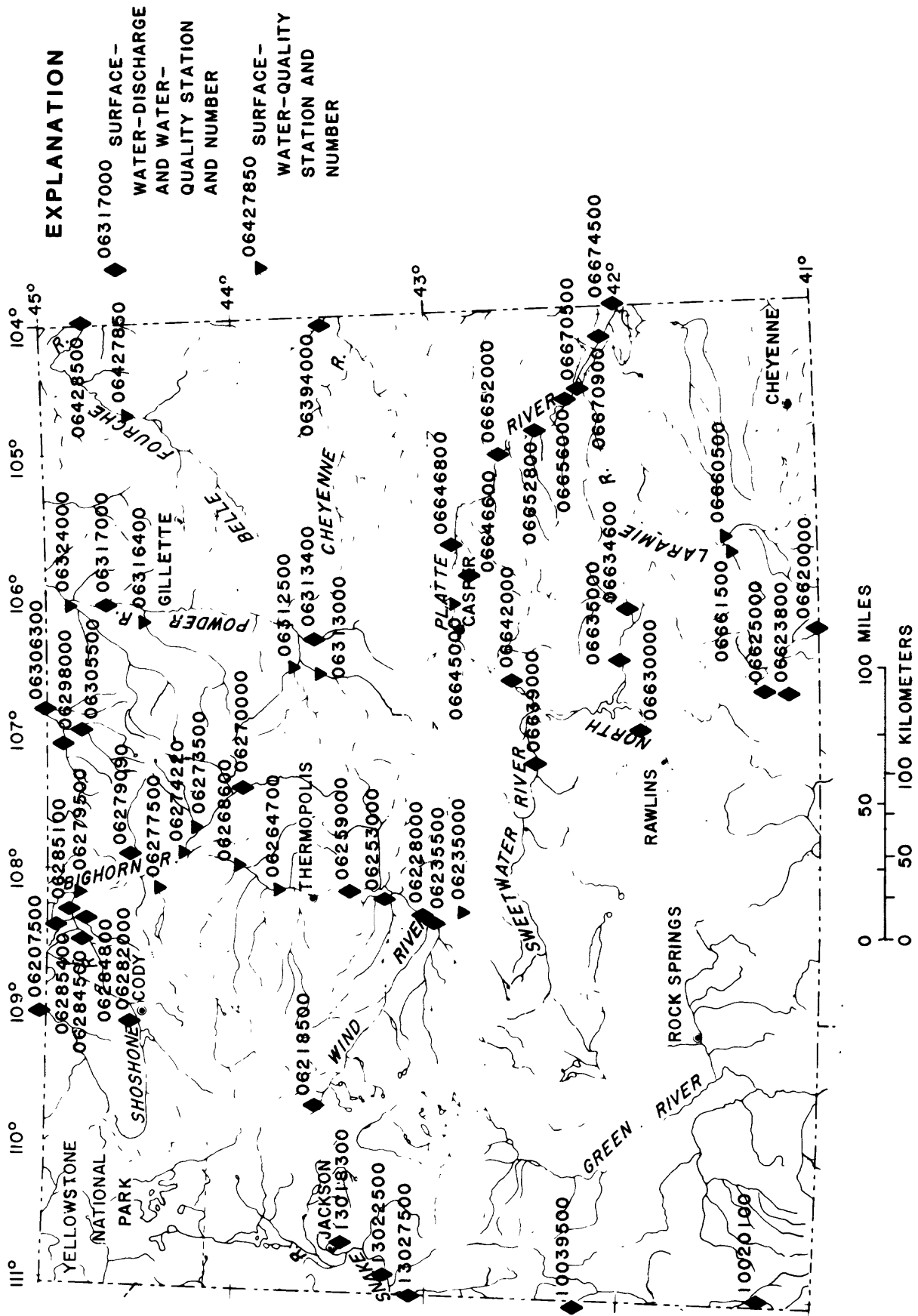


Figure 1.--Location of surface-water quality stations used in study.

Table 1.--Period of record for surface-water-quality stations  
(through 1975 water year)

[See figure 1 for locations]

| Station number        | Station name  | Period of record |
|-----------------------|---|------------------|
| 06207500              | Clarks Fork Yellowstone River near Belfry, Montana-----           | 1970-75          |
| 06218500              | Wind River near Dubois, Wyo.-----                                 | 1968-75          |
| 06228000              | Wind River at Riverton, Wyo.-----                                 | 1971-75          |
| <sup>1</sup> 06235000 | Beaver Creek near Arapahoe, Wyo.-----                             | 1968-75          |
| 06235500              | Little Wind River near Riverton, Wyo.---                          | 1971-75          |
| 06253000              | Fivemile Creek near Shoshoni, Wyo.-----                           | 1968-75          |
| 06259000              | Wind River below Boysen Reservoir, Wyo.-                          | 1971-75          |
| <sup>1</sup> 06264700 | Bighorn River at Lucerne, Wyo.-----                               | 1968-75          |
| <sup>1</sup> 06268600 | Bighorn River at Worland, Wyo.-----                               | 1970-75          |
| 06270000              | Nowood River near Ten Sleep, Wyo.-----                            | 1968-75          |
| <sup>1</sup> 06273500 | Paint Rock Creek near mouth, below Hyattville, Wyo.-----          | 1968-75          |
| <sup>1</sup> 06274220 | Nowood River at Manderson, Wyo.-----                              | 1968-75          |
| <sup>1</sup> 06277500 | Greybull River near Basin, Wyo.-----                              | 1968-75          |
| <sup>1</sup> 06279090 | Shell Creek near Greybull, Wyo.-----                              | 1968-75          |
| 06279500              | Bighorn River at Kane, Wyo.-----                                  | 1971-75          |
| 06282000              | Shoshone River below Buffalo Bill Reservoir, Wyo.-----            | 1968-75          |
| <sup>2</sup> 06284500 | Bitter Creek near Garland, Wyo.-----                              | 1974-75          |
| <sup>2</sup> 06284800 | Whistle Creek near Garland, Wyo.-----                             | 1974-75          |
| <sup>2</sup> 06285100 | Shoshone River near Lovell, Wyo.-----                             | 1974-75          |
| <sup>2</sup> 06285400 | Sage Creek at Sidon Canal, near Deaver, Wyo.-----                 | 1974-75          |
| 06298000              | Tongue River near Dayton, Wyo.-----                               | 1968-75          |
| 06305500              | Goose Creek below Sheridan, Wyo.-----                             | 1968-75          |
| 06306300              | Tongue River at State line, near Decker, Montana-----             | 1971-75          |
| <sup>1</sup> 06312500 | Powder River near Kaycee, Wyo.-----                               | 1968-75          |
| <sup>1</sup> 06313000 | South Fork Powder River near Kaycee, Wyo.                         | 1968-75          |
| <sup>1</sup> 06313400 | Salt Creek near Sussex, Wyo.-----                                 | 1968-75          |
| <sup>1</sup> 06316400 | Crazy Woman Creek at upper station, near Arvada, Wyo.-----        | 1968-75          |
| 06317000              | Powder River at Arvada, Wyo.-----                                 | 1971-75          |
| 06324000              | Clear Creek near Arvada, Wyo.-----                                | 1968-75          |
| 06394000              | Beaver Creek near Newcastle, Wyo.-----                            | 1969-75          |
| <sup>1</sup> 06427850 | Belle Fourche River at Devils Tower, Wyo.                         | 1968-75          |
| 06428500              | Belle Fourche River at Wyoming-South Dakota State line-----       | 1971-75          |
| 06620000              | North Platte River near Northgate, Colorado-----                  | 1968-75          |
| 06623800              | Encampment River above Hog Park Creek, near Encampment, Wyo.----- | 1968-75          |
| 06625000              | Encampment River at mouth, near Encampment, Wyo.-----             | 1968-75          |

Table 1.--Period of record for surface-water-quality stations  
(through 1975 water year)--Continued

| Station number        | Station name   | Period of record |
|-----------------------|--|------------------|
| 06630000              | North Platte River above Seminoe Reservoir, near Sinclair, Wyo.----- | 1970-75          |
| 06634600              | Little Medicine Bow River near Medicine Bow, Wyo.-----               | 1968-75          |
| 06635000              | Medicine Bow River above Seminoe Reservoir, near Hanna, Wyo.-----    | 1968-75          |
| 06639000              | Sweetwater River near Alcova, Wyo.-----                              | 1968-75          |
| 06642000              | North Platte River at Alcova, Wyo.-----                              | 1970-75          |
| <sup>1</sup> 06645000 | North Platte River below Casper, Wyo.---                             | 1968-75          |
| 06646600              | Deer Creek below Millar Wasteway, at Glenrock, Wyo.-----             | 1971-75          |
| 06646800              | North Platte River near Glenrock, Wyo.--                             | 1971-75          |
| 06652000              | North Platte River at Orin, Wyo.-----                                | 1968-75          |
| 06652800              | North Platte River below Glendo Reservoir, Wyo.-----                 | 1968-75          |
| 06656000              | North Platte River below Guernsey Reservoir, Wyo.-----               | 1969-75          |
| <sup>1</sup> 06660500 | Laramie River at Two Rivers, Wyo.-----                               | 1968-75          |
| <sup>1</sup> 06661500 | Little Laramie River at Two Rivers, Wyo.                             | 1968-75          |
| 06670500              | Laramie River near Fort Laramie, Wyo.---                             | 1971-75          |
| <sup>3</sup> 06670900 | North Platte River near Lingle, Wyo.----                             | 1969-75          |
| 06674500              | North Platte River at Wyoming-Nebraska State line-----               | 1971-75          |
| 10020100              | Bear River above reservoir, near Woodruff, Utah-----                 | 1969-75          |
| 10039500              | Bear River at Border, Wyo.-----                                      | 1971-75          |
| 13018300              | Cache Creek near Jackson, Wyo.-----                                  | 1968-75          |
| 13022500              | Snake River above reservoir, near Alpine, Wyo.-----                  | 1968-75          |
| 13027500              | Salt River above reservoir, near Etna, Wyo.-----                     | 1968-75          |

<sup>1</sup> Ungaged station.

<sup>2</sup> Composite sampling discontinued in 1973.

<sup>3</sup> Discontinued in 1975.

constituents were collected at 16 stations. Daily streamflow also was measured at the stations. The data were used to estimate monthly mean dissolved-solids loads as follows:

1. Specific conductance was related to the dissolved-solids concentration in the monthly samples, and daily specific conductance and streamflow were then used to estimate the load.
2. The dissolved-solids concentration was related directly to streamflow, and the load was estimated.

Simple and multivariable regression techniques were used to describe relationships between concentration, time, and discharge. Rigorous discussions of statistical analysis of water-quality data are presented in reports by Steele (1971, 1973) and DeLong (1977).

#### Estimates of Concentration

Concentrations of the major dissolved inorganic constituents in a stream can be related to the specific conductance by the following equation (Steele, 1971, p. 10):

$$C_i = E_i + F_i K \quad (1)$$

where

$i$  = index for individual constituent;  
 $C_i$  = constituent concentration, in milligrams per liter;  
 $E_i$  = regression constant (intercept), in milligrams per liter;  
 $F_i$  = regression coefficient (slope), in  
 $\frac{\text{milligrams per liter}}{\text{microsiemens per centimeter at } 25^\circ \text{ Celsius}}$ ; and

$K$  = specific conductance, in microsiemens per centimeter at  $25^\circ$  Celsius.

Estimates of concentration derived from this equation can be evaluated in terms of the standard error of estimate (SE) and the correlation coefficient ( $r$ ). The SE indicates the reliability of the quantitative relationship between variables of the regression equation and is the standard deviation of the distribution (assumed normal) of residuals about the regression line. The  $r$  value is a measure of the intensity of the relationship between two variables. A value for  $r$  of  $\pm 1.0$  is perfect and 0.0 indicates no correlation. Coefficients  $E_i$  and  $F_i$  were determined for the major dissolved inorganic constituents by simple regression and are listed in table 2 with the  $r$  and SE for each set of coefficients.

Using daily specific conductance to estimate daily constituent concentrations requires (in addition to monthly chemical analyses) either daily sampling for specific conductance by an observer and transport of

Table 2.--Regression results, concentration versus specific conductance

$$C_i = E_i + F_i K$$

where

C = constituent concentration, in milligrams per liter;  
 i = index for individual constituents;  
 E = regression constant (intercept), in milligrams per liter;  
 F = slope; and  
 K = specific conductance, in microsiemens per centimeter at 25° Celsius

Constituents (concentrations are in milligrams per liter)

Ca = calcium                      SO<sub>4</sub> = sulfate  
 Mg = magnesium                 Cl = chloride  
 Na = sodium                      TH = total hardness  
 K = potassium                    DS = dissolved solids  
 HCO<sub>3</sub> = bicarbonate              (sum of constituents)

r = correlation coefficient  
 SE = standard error of estimate,  
       in milligrams per liter  
 N = number of samples

| Con-stitu-ent   | E    | F      | r     | SE  | N  | Con-stitu-ent   | E    | F      | r     | SE  | N  |
|---|------|--------|-------|-----|----|---|------|--------|-------|-----|----|
| 06207500 Clarks Fork Yellowstone River near Belfry, Mont. 1970-75 water years |      |        |       |     |    | 06218500 Wind River near Dubois, Wyo. 1968-75 water years       |      |        |       |     |    |
| Ca  | 2.2  | 0.1155 | 0.975 | 2.6 | 66 | Ca  | 1.1  | 0.1207 | 0.877 | 2.5 | 77 |
| Mg  | -2.3 | .0425  | .922  | 1.8 | 66 | Mg  | -1.0 | .0286  | .643  | 1.3 | 77 |
| Na  | .5   | .0313  | .945  | 1.1 | 66 | Na  | 1.7  | .0330  | .676  | 1.3 | 77 |
| K   | .3   | .0035  | .625  | .4  | 66 | K   | 1.0  | .0062  | .572  | .3  | 77 |
| HCO <sub>3</sub>  | 15   | .3970  | .972  | 9.7 | 66 | HCO <sub>3</sub>  | 2.1  | .5274  | .922  | 8.3 | 77 |
| SO <sub>4</sub>   | -12  | .1791  | .937  | 6.7 | 66 | SO <sub>4</sub>   | -3.9 | .0750  | .643  | 3.3 | 75 |
| Cl  | .2   | .0058  | .419  | 1.2 | 57 | Cl  | -1.3 | .0194  | .225  | 3.1 | 72 |
| TH  | -6.7 | .4823  | .954  | 15  | 66 | TH  | -1.5 | .4219  | .938  | 5.8 | 77 |
| DS  | 2.8  | .5867  | .994  | 6.7 | 66 | DS  | 19   | .5578  | .945  | 7.2 | 76 |
| 06228000 Wind River at Riverton, Wyo. 1971-75 water years                     |      |        |       |     |    | 06235000 Beaver Creek near Arapahoe, Wyo. 1968-75 water years   |      |        |       |     |    |
| Ca  | 0.7  | 0.1094 | 0.954 | 3.9 | 47 | Ca  | 9.1  | 0.0864 | 0.938 | 19  | 62 |
| Mg  | -1.3 | .0308  | .761  | 3.0 | 47 | Mg  | -2.0 | .0256  | .842  | 9.8 | 62 |
| Na  | -5.5 | .0758  | .866  | 5.0 | 47 | Na  | -36  | .1249  | .980  | 15  | 62 |
| K   | 1.1  | .0031  | .749  | .3  | 47 | K   | 2.7  | .0033  | .826  | 1.3 | 62 |
| HCO <sub>3</sub>  | 16   | .3630  | .931  | 16  | 47 | HCO <sub>3</sub>  | 79   | .0979  | .855  | 35  | 62 |
| SO <sub>4</sub>   | -18  | .2134  | .963  | 6.8 | 47 | SO <sub>4</sub>   | -72  | .3866  | .990  | 33  | 62 |
| Cl  | -1.9 | .0180  | .818  | 1.4 | 46 | Cl  | -35  | .0842  | .975  | 11  | 61 |
| TH  | -2.5 | .3958  | .946  | 15  | 46 | TH  | 13   | .3221  | .967  | 51  | 62 |
| DS  | -12  | .6567  | .990  | 10  | 47 | DS  | -83  | .7646  | .994  | 52  | 62 |
| 06235500 Little Wind River near Riverton, Wyo. 1971-75 water years            |      |        |       |     |    | 06253000 Fivemile Creek near Shoshoni, Wyo. 1968-75 water years |      |        |       |     |    |
| Ca  | 8.8  | 0.0815 | 0.951 | 6.2 | 45 | Ca  | 5.9  | 0.0606 | 0.932 | 18  | 83 |
| Mg  | -6.0 | .0470  | .960  | 3.3 | 46 | Mg  | -9.7 | .0270  | .830  | 14  | 84 |
| Na  | -9.6 | .0810  | .978  | 4.1 | 45 | Na  | -38  | .1641  | .988  | 19  | 83 |
| K   | 1.0  | .0019  | .476  | .8  | 46 | K   | 2.5  | .0006  | .473  | .9  | 84 |
| HCO <sub>3</sub>  | 36   | .1803  | .955  | 13  | 46 | HCO <sub>3</sub>  | 116  | .0672  | .921  | 22  | 84 |
| SO <sub>4</sub>   | -55  | .4001  | .975  | 22  | 46 | SO <sub>4</sub>   | -194 | .5323  | .994  | 46  | 83 |
| Cl  | -5   | .0126  | .767  | 2.5 | 46 | Cl  | -3.3 | .0141  | .941  | 3.9 | 84 |
| Th  | -3.8 | .3981  | .983  | 18  | 46 | TH  | -26  | .2620  | .951  | 66  | 84 |
| DS  | -39  | .7221  | .987  | 28  | 46 | DS  | -170 | .8372  | .995  | 64  | 84 |

Table 2.--Regression results, concentration versus specific conductance--Continued

| Con-stitu-ent  | E    | F      | r     | SE  | N  | Con-stitu-ent  | E    | F      | r     | SE  | N  |
|--|------|--------|-------|-----|----|--|------|--------|-------|-----|----|
| 06259000 Wind River below Boysen Reservoir, Wyo. 1971-75 water years             |      |        |       |     |    | 06264700 Bighorn River at Lucerne, Wyo. 1968-75 water years                    |      |        |       |     |    |
| Ca   | 13   | 0.0647 | 0.823 | 6.0 | 54 | Ca   | 7.1  | 0.0772 | 0.846 | 5.1 | 74 |
| Mg   | 2.1  | .0223  | .740  | 2.7 | 54 | Mg   | -2.7 | .0304  | .735  | 3.0 | 74 |
| Na   | 7.3  | .0755  | .849  | 6.3 | 54 | Na   | -23  | .1233  | .954  | 4.1 | 74 |
| K  | 1.8  | .0009  | .419  | .3  | 54 | K  | 1.5  | .0021  | .506  | .4  | 74 |
| HCO <sub>3</sub>   | 68   | .1379  | .806  | 14  | 54 | HCO <sub>3</sub>   | 57   | .1538  | .875  | 9.0 | 74 |
| SO <sub>4</sub>  | 14   | .2625  | .808  | 25  | 53 | SO <sub>4</sub>  | -75  | .4053  | .976  | 9.5 | 74 |
| Cl   | -5   | .0135  | .586  | 2.5 | 53 | Cl   | -3.2 | .0199  | .727  | 2.0 |    |
| TH   | 42   | .2520  | .895  | 17  | 54 | TH   | 5.8  | .3188  | .972  | 8.1 | 74 |
| DS   | 77   | .5117  | .873  | 38  | 54 | DS   | -56  | .7339  | .987  | 12  | 74 |
| 06268600 Bighorn River at Worland, Wyo. 1970-75 water years                      |      |        |       |     |    | 06270000 Nowood River near Ten Sleep, Wyo. 1968-75 water years                 |      |        |       |     |    |
| Ca   | 9.5  | 0.0708 | 0.830 | 6.4 | 51 | Ca   | 9.5  | 0.1277 | 0.933 | 9.0 | 75 |
| Mg   | -1.5 | .0289  | .721  | 3.7 | 51 | Mg   | -6.8 | .0486  | .908  | 4.1 | 76 |
| Na   | -22  | .1224  | .964  | 4.5 | 51 | Na   | -18  | .0491  | .826  | 6.1 | 76 |
| K  | .3   | .0040  | .748  | .5  | 51 | K  | .7   | .0018  | .501  | .6  | 76 |
| HCO <sub>3</sub>   | 49   | .1602  | .879  | 12  | 51 | HCO <sub>3</sub>   | 81   | .1560  | .821  | 20  | 76 |
| SO <sub>4</sub>  | -52  | .3750  | .967  | 13  | 51 | SO <sub>4</sub>  | -124 | .4962  | .938  | 33  | 76 |
| Cl   | -7.7 | .0279  | .861  | 2.2 | 51 | Cl   | 1.5  | .0009  | .150  | 1.1 | 73 |
| TH   | 17   | .2958  | .971  | 9.7 | 51 | TH   | -9.1 | .5251  | .983  | 18  | 76 |
| DS   | -42  | .7127  | .988  | 15  | 51 | DS   | -78  | .7970  | .993  | 18  | 76 |
| 06273500 Paint Rock Creek near mouth, below Hyattville, Wyo. 1968-75 water years |      |        |       |     |    | 06274220 Nowood River at Manderson, Wyo. 1968-75 water years                   |      |        |       |     |    |
| Ca   | -2.3 | 0.1318 | 0.983 | 7.5 | 74 | Ca   | 24   | 0.0961 | 0.863 | 17  | 71 |
| Mg   | -1.5 | .0389  | .947  | 4.0 | 77 | Mg   | -1.2 | .0469  | .335  | 40  | 72 |
| Na   | -9.4 | .0556  | .956  | 5.1 | 77 | Na   | -12  | .0590  | .833  | 12  | 72 |
| K  | .2   | .0023  | .888  | .4  | 77 | K  | .1   | .0028  | .688  | .9  | 72 |
| HCO <sub>3</sub>   | 39   | .2015  | .956  | 19  | 77 | HCO <sub>3</sub>   | 79   | .1256  | .772  | 31  | 72 |
| SO <sub>4</sub>  | -65  | .4293  | .986  | 22  | 77 | SO <sub>4</sub>  | -48  | .4305  | .930  | 51  | 72 |
| Cl   | 1.4  | .0014  | .261  | 1.6 | 75 | Cl   | .7   | .0033  | .686  | 1.0 | 70 |
| TH   | -11  | .4877  | .997  | 11  | 77 | TH   | 44   | .4228  | .923  | 53  | 72 |
| DS   | -50  | .7667  | .996  | 22  | 77 | DS   | 8.1  | .7009  | .940  | 76  | 72 |
| 06277500 Greybull River near Basin, Wyo. 1968-75 water years                     |      |        |       |     |    | 06279090 Shell Creek near Greybull, Wyo. 1968-75 water years                   |      |        |       |     |    |
| Ca   | 20   | 0.0537 | 0.751 | 11  | 74 | Ca   | 4.6  | 0.1052 | 0.976 | 7.9 | 75 |
| Mg   | 1.6  | .0274  | .735  | 5.7 | 74 | Mg   | -1.8 | .0379  | .927  | 5.1 | 79 |
| Na   | -37  | .1505  | .905  | 16  | 74 | Na   | -26  | .0961  | .967  | 8.3 | 78 |
| K  | 1.3  | .0021  | .604  | .6  | 74 | K  | .2   | .0019  | .789  | .5  | 79 |
| HCO <sub>3</sub>   | 59   | .2280  | .896  | 25  | 74 | HCO <sub>3</sub>   | 110  | .1050  | .802  | 26  | 79 |
| SO <sub>4</sub>  | -63  | .3560  | .981  | 16  | 74 | SO <sub>4</sub>  | -142 | .5216  | .984  | 31  | 79 |
| Cl   | -1.3 | .0099  | .700  | 2.1 | 73 | Cl   | 1.8  | .0014  | .360  | 1.2 | 78 |
| TH   | 64   | .2394  | .778  | 41  | 73 | TH   | 6.1  | .4160  | .988  | 21  | 78 |
| DS   | -36  | .7185  | .995  | 17  | 74 | DS   | -102 | .8184  | .995  | 27  | 78 |
| 06279500 Bighorn River at Kane, Wyo. 1971-75 water years                         |      |        |       |     |    | 06282000 Shoshone River below Buffalo Bill Reservoir, Wyo. 1968-75 water years |      |        |       |     |    |
| Ca   | 15   | 0.0691 | 0.864 | 6.0 | 54 | Ca   | -6.0 | 0.1428 | 0.964 | 4.8 | 72 |
| Mg   | -5.6 | .0356  | .759  | 4.5 | 54 | Mg   | -1.9 | .0307  | .830  | 2.5 | 72 |
| Na   | -11  | .1021  | .906  | 7.1 | 53 | Na   | 1.2  | .0400  | .706  | 4.8 | 72 |
| K  | .1   | .0042  | .689  | .7  | 54 | K  | -.2  | .0071  | .864  | .5  | 72 |
| HCO <sub>3</sub>   | 58   | .1562  | .809  | 17  | 54 | HCO <sub>3</sub>   | -5.7 | .4173  | .980  | 10  | 72 |
| SO <sub>4</sub>  | -45  | .3725  | .914  | 24  | 54 | SO <sub>4</sub>  | -13  | .2092  | .971  | 6.2 | 71 |
| Cl   | -5.7 | .0229  | .779  | 2.7 | 54 | Cl   | -.2  | .0083  | .748  | .9  | 70 |
| TH   | 9.7  | .3259  | .902  | 23  | 54 | TH   | -21  | .4803  | .981  | 11  | 70 |
| DS   | -13  | .6854  | .931  | 40  | 54 | DS   | -7.9 | .6439  | .994  | 8.2 | 72 |

Table 2.--Regression results, concentration versus specific conductance--Continued

| Con-stitu-ent  | E    | F      | r     | SE  | N  | Con-stitu-ent  | E    | F      | r     | SE  | N  |
|--|------|--------|-------|-----|----|--|------|--------|-------|-----|----|
| 06284500 Bitter Creek near Garland, Wyo.<br>1974-75 water years                |      |        |       |     |    | 06284800 Whistle Creek near Garland, Wyo.<br>1974-75 water years             |      |        |       |     |    |
| Ca   | 29   | 0.0342 | 0.944 | 5.8 | 23 | Ca   | 25   | 0.0341 | 0.982 | 17  | 22 |
| Mg   | 4.0  | .0178  | .971  | 2.1 | 23 | Mg   | .9   | .0215  | .977  | 12  | 22 |
| Na   | -59  | .1862  | .987  | 15  | 23 | Na   | -55  | .1898  | .987  | 80  | 22 |
| K  | 2.3  | .0013  | .731  | .6  | 23 | K  | 2.5  | .0013  | .958  | 1.0 | 22 |
| HCO <sub>3</sub>   | 106  | .1456  | .954  | 22  | 23 | HCO <sub>3</sub>   | 120  | .0607  | .963  | 44  | 22 |
| SO <sub>4</sub>  | -121 | .4039  | .982  | 38  | 23 | SO <sub>4</sub>  | -145 | .5015  | .982  | 248 | 22 |
| Cl   | -3.5 | .0127  | .958  | 1.8 | 23 | Cl   | -1.1 | .0101  | .908  | 12  | 22 |
| TH   | 88   | .1609  | .968  | 20  | 23 | TH   | 70   | .1735  | .977  | 98  | 22 |
| DS   | -81  | .7434  | .989  | 55  | 23 | DS   | -99  | .7915  | .986  | 343 | 22 |
| 06285100 Shoshone River near Lovell, Wyo.<br>1974-75 water years               |      |        |       |     |    | 06285400 Sage Creek at Sidon Canal, near<br>Deaver, Wyo. 1974-75 water years |      |        |       |     |    |
| Ca   | -9.0 | 0.0983 | 0.917 | 9.4 | 19 | Ca   | 45   | 0.0511 | 0.909 | 23  | 22 |
| Mg   | -2.8 | .0306  | .939  | 2.4 | 19 | Mg   | -4.6 | .0401  | .955  | 12  | 23 |
| Na   | -.2  | .0901  | .922  | 8.3 | 19 | Na   | -20  | .1287  | .929  | 49  | 23 |
| K  | .9   | .0045  | .507  | 1.7 | 19 | K  | 3.7  | .0008  | .621  | 1.0 | 23 |
| HCO <sub>3</sub>   | 25   | .2405  | .961  | 15  | 19 | HCO <sub>3</sub>   | 140  | .0719  | .876  | 38  | 23 |
| SO <sub>4</sub>  | -42  | .3275  | .972  | 17  | 19 | SO <sub>4</sub>  | -91  | .4941  | .957  | 143 | 23 |
| Cl   | -1.6 | .0142  | .856  | 1.9 | 19 | Cl   | 1.6  | .0077  | .911  | 3.3 | 23 |
| TH   | -37  | .3757  | .933  | 32  | 19 | TH   | 86   | .2956  | .945  | 98  | 23 |
| DS   | -25  | .6854  | .980  | 30  | 19 | DS   | 30   | .7576  | .956  | 223 | 22 |
| 06298000 Tongue River near Dayton, Wyo.<br>1968-75 water years                 |      |        |       |     |    | 06305500 Goose Creek below Sheridan, Wyo.<br>1968-75 water years             |      |        |       |     |    |
| Ca   | 7.1  | 0.1095 | 0.749 | 3.6 | 97 | Ca   | 8.0  | 0.0777 | 0.934 | 6.5 | 89 |
| Mg   | -2.5 | .0524  | .742  | 1.8 | 97 | Mg   | -5.7 | .0684  | .958  | 4.5 | 89 |
| Na   | 1.5  | .0008  | .033  | .9  | 97 | Na   | -4.6 | .0470  | .947  | 3.5 | 89 |
| K  | .9   | -.0006 | .075  | .3  | 96 | K  | .3   | .0042  | .670  | 1.0 | 89 |
| HCO <sub>3</sub>   | 15   | .5385  | .921  | 8.5 | 97 | HCO <sub>3</sub>   | 29   | .3456  | .955  | 24  | 89 |
| SO <sub>4</sub>  | -2.0 | .0315  | .380  | 2.9 | 96 | SO <sub>4</sub>  | -34  | .2668  | .948  | 20  | 89 |
| Cl   | .6   | .0066  | .109  | 2.3 | 91 | Cl   | -.1  | .0081  | .582  | 2.5 | 89 |
| TH   | 16   | .4613  | .826  | 12  | 97 | TH   | -3.0 | .4747  | .984  | 19  | 88 |
| DS   | 18   | .4807  | .901  | 8.6 | 97 | DS   | -13  | .6493  | .985  | 25  | 89 |
| 06306300 Tongue River at State line, near<br>Decker, Mont. 1971-75 water years |      |        |       |     |    | 06312500 Powder River near Kaycee, Wyo.<br>1968-75 water years               |      |        |       |     |    |
| Ca   | 9.4  | 0.0802 | 0.931 | 7.0 | 57 | Ca   | 27   | 0.0691 | 0.921 | 10  | 68 |
| Mg   | -4.6 | .0644  | .878  | 7.7 | 57 | Mg   | 2.8  | .0342  | .906  | 5.7 | 70 |
| Na   | -7.3 | .0559  | .944  | 4.3 | 57 | Na   | -44  | .1162  | .956  | 13  | 69 |
| K  | .8   | .0038  | .645  | 1.0 | 57 | K  | .9   | .0017  | .773  | .5  | 70 |
| HCO <sub>3</sub>   | 51   | .2892  | .915  | 27  | 56 | HCO <sub>3</sub>   | 129  | .0774  | .741  | 25  | 70 |
| SO <sub>4</sub>  | -50  | .3279  | .949  | 24  | 57 | SO <sub>4</sub>  | -87  | .4081  | .983  | 26  | 69 |
| Cl   | -1.3 | .0089  | .258  | 7.1 | 56 | Cl   | -27  | .0645  | .954  | 7.2 | 70 |
| TH   | 7.2  | .4620  | .962  | 28  | 56 | TH   | 78   | .3157  | .960  | 33  | 70 |
| DS   | -20  | .6856  | .971  | 37  | 57 | DS   | -45  | .7275  | .992  | 33  | 70 |
| 06313000 South Fork Powder River near Kaycee,<br>Wyo. 1968-75 water years      |      |        |       |     |    | 06313400 Salt Creek near Sussex, Wyo.<br>1968-75 water years                 |      |        |       |     |    |
| Ca   | 86   | 0.0697 | 0.637 | 56  | 64 | Ca   | 199  | 0.1464 | 0.351 | 38  | 76 |
| Mg   | 10   | .0232  | .600  | 21  | 64 | Mg   | 110  | -.0063 | .222  | 27  | 76 |
| Na   | -140 | .1625  | .891  | 55  | 64 | Na   | -229 | .2528  | .926  | 99  | 76 |
| K  | .02  | .0025  | .664  | 1.9 | 64 | K  | -4.5 | .0035  | .419  | 7.3 | 76 |
| HCO <sub>3</sub>   | 111  | .0249  | .314  | 50  | 64 | HCO <sub>3</sub>   | 25   | .1054  | .498  | 177 | 76 |
| SO <sub>4</sub>  | 54   | .4834  | .951  | 105 | 64 | SO <sub>4</sub>  | 1579 | -.3916 | .174  | 215 | 75 |
| Cl   | -164 | .0887  | .776  | 48  | 64 | Cl   | -858 | .3147  | .932  | 119 | 76 |
| TH   | 209  | .2838  | .752  | 165 | 62 | TH   | 936  | -.0671 | .367  | 149 | 76 |
| DS   | -63  | .8379  | .980  | 113 | 64 | DS   | 780  | .5699  | .939  | 202 | 76 |

Table 2.--Regression results, concentration versus specific conductance--Continued

| Con-stituent   | E    | F      | r     | SE  | N  | Con-stituent  | E    | F      | r     | SE  | N  |
|--|------|--------|-------|-----|----|---|------|--------|-------|-----|----|
| 06316400 Crazy Woman Creek at upper station, near Arvada, Wyo. 1968-75 water years |      |        |       |     |    | 06317000 Powder River at Arvada, Wyo. 1971-75 water years                                     |      |        |       |     |    |
| Ca   | -33  | 0.1186 | 0.893 | 37  | 71 | Ca  | 74   | 0.0316 | 0.608 | 28  | 41 |
| Mg   | 3.2  | .0477  | .738  | 27  | 70 | Mg  | -8.4 | .0270  | .846  | 12  | 42 |
| Na   | -55  | .1070  | .970  | 17  | 68 | Na  | -108 | .1836  | .956  | 39  | 42 |
| K  | 1.2  | .0019  | .580  | 1.6 | 71 | K   | 1.0  | .0022  | .817  | 1.1 | 42 |
| HCO <sub>3</sub>   | 76   | .0971  | .878  | 33  | 71 | HCO <sub>3</sub>  | 95   | .0737  | .572  | 74  | 42 |
| SO <sub>4</sub>  | -246 | .6206  | .965  | 105 | 71 | SO <sub>4</sub>   | 3.0  | .3251  | .863  | 134 | 41 |
| Cl   | .4   | .0059  | .686  | 3.9 | 71 | Cl  | -114 | .1419  | .907  | 46  | 42 |
| TH   | -69  | .4933  | .987  | 50  | 71 | TH  | 140  | .1931  | .823  | 93  | 42 |
| DS   | -268 | .9481  | .995  | 59  | 71 | DS  | -110 | .7535  | .988  | 81  | 42 |
| 06324000 Clear Creek near Arvada, Wyo. 1968-75 water years                         |      |        |       |     |    | 06394000 Beaver Creek near Newcastle, Wyo. 1969-75 water years                                |      |        |       |     |    |
| Ca   | 10   | 0.0840 | 0.944 | 12  | 79 | Ca  | 113  | 0.0676 | 0.720 | 106 | 96 |
| Mg   | -9.9 | .0587  | .952  | 7.3 | 81 | Mg  | -4.8 | .0314  | .832  | 35  | 96 |
| Na   | -26  | .0894  | .955  | 11  | 81 | Na  | -162 | .1541  | .935  | 95  | 96 |
| K  | .8   | .0033  | .737  | 1.2 | 81 | K   | 4.2  | .0004  | .401  | 1.6 | 97 |
| HCO <sub>3</sub>   | 85   | .1313  | .838  | 33  | 81 | HCO <sub>3</sub>  | 167  | .0029  | .074  | 63  | 97 |
| SO <sub>4</sub>  | -132 | .5153  | .981  | 40  | 81 | SO <sub>4</sub>   | 205  | .3301  | .893  | 273 | 96 |
| Cl   | 1.1  | .0032  | .416  | 2.7 | 81 | Cl  | -310 | .2100  | .937  | 129 | 96 |
| TH   | -14  | .4508  | .982  | 33  | 81 | TH  | 251  | .2978  | .837  | 320 | 97 |
| DS   | -101 | .8157  | .990  | 45  | 81 | DS  | -66  | .7950  | .979  | 271 | 97 |
| 06427850 Belle Fourche River at Devils Tower, Wyo. 1968-75 water years             |      |        |       |     |    | 06428500 Belle Fourche River at Wyoming-South Dakota State line 1971-75 water years           |      |        |       |     |    |
| Ca   | -31  | 0.1475 | 0.856 | 38  | 88 | Ca  | -69  | 0.1787 | 0.960 | 24  | 46 |
| Mg   | -5.2 | .0442  | .831  | 13  | 88 | Mg  | -13  | .0475  | .890  | 11  | 46 |
| Na   | 43   | .0274  | .447  | 23  | 86 | Na  | 8.3  | .0472  | .835  | 15  | 44 |
| K  | 6.2  | .0004  | .187  | .9  | 88 | K   | 5.4  | .0013  | .557  | .9  | 47 |
| HCO <sub>3</sub>   | 86   | .0961  | .729  | 38  | 88 | HCO <sub>3</sub>  | 35   | .1023  | .774  | 39  | 47 |
| SO <sub>4</sub>  | -76  | .5204  | .881  | 118 | 87 | SO <sub>4</sub>   | -211 | .6310  | .989  | 44  | 46 |
| Cl   | 4.2  | .0018  | .261  | 2.9 | 88 | Cl  | 2.5  | .0024  | .633  | 1.4 | 47 |
| TH   | -90  | .5437  | .867  | 132 | 85 | TH  | -220 | .6371  | .973  | 21  | 44 |
| DS   | -12  | .7927  | .898  | 165 | 88 | DS  | -262 | .9688  | .991  | 63  | 46 |
| 06625000 North Platte River near Northgate, Colo. 1968-75 water years              |      |        |       |     |    | 06623800 Encampment River above Hog Park Creek, near Encampment, Wyo. 1968-75 water years     |      |        |       |     |    |
| Ca   | 8.4  | 0.0821 | 0.658 | 3.3 | 86 | Ca  | 1.5  | 0.0986 | 0.776 | 1.1 | 71 |
| Mg   | -2.3 | .0358  | .564  | 1.8 | 86 | Mg  | .0   | .0229  | .685  | .3  | 71 |
| Na   | -.2  | .0536  | .688  | 2.0 | 86 | Na  | .4   | .0320  | .439  | .9  | 71 |
| K  | .9   | .0044  | .169  | .9  | 86 | K   | .0   | .0169  | .306  | .7  | 71 |
| HCO <sub>3</sub>   | 22   | .4005  | .805  | 10  | 86 | HCO <sub>3</sub>  | 5.6  | .4412  | .782  | 4.8 | 71 |
| SO <sub>4</sub>  | -10  | .1319  | .589  | 6.3 | 86 | SO <sub>4</sub>   | 2.7  | .0169  | .119  | 1.9 | 71 |
| Cl   | .6   | .0111  | .163  | 2.4 | 85 | Cl  | .5   | .0039  | .093  | .6  | 70 |
| TH   | 9.3  | .3625  | .869  | 7.5 | 78 | TH  | 3.7  | .3397  | .839  | 3.0 | 71 |
| DS   | 15   | .5332  | .944  | 6.5 | 86 | DS  | 12   | .5187  | .800  | 5.2 | 71 |
| 06625000 Encampment River at mouth, near Encampment, Wyo. 1968-75 water years      |      |        |       |     |    | 06630000 North Platte River above Seminole Reservoir, near Sinclair, Wyo. 1970-75 water years |      |        |       |     |    |
| Ca   | -0.5 | 0.1283 | 0.981 | 2.9 | 88 | Ca  | 5.4  | 0.0969 | 0.945 | 4.2 | 69 |
| Mg   | -.1  | .0156  | .734  | 1.7 | 88 | Mg  | -2.8 | .0345  | .860  | 2.6 | 69 |
| Na   | -.7  | .0541  | .984  | 1.1 | 88 | Na  | -3.9 | .0660  | .968  | 2.1 | 69 |
| K  | .3   | .0073  | .901  | .4  | 88 | K   | .9   | .0036  | .635  | .5  | 69 |
| HCO <sub>3</sub>   | 8.2  | .3515  | .970  | 10  | 88 | HCO <sub>3</sub>  | 38   | .2312  | .899  | 14  | 69 |
| SO <sub>4</sub>  | -6.6 | .1547  | .930  | 6.7 | 85 | SO <sub>4</sub>   | -34  | .2890  | .953  | 12  | 68 |
| Cl   | .4   | .0302  | .807  | 2.5 | 88 | Cl  | -2.4 | .0291  | .728  | 3.4 | 69 |
| TH   | -1.5 | .3867  | .991  | 6.1 | 82 | TH  | 1.2  | .3865  | .984  | 8.8 | 68 |
| DS   | -1.1 | .6449  | .980  | 15  | 88 | DS  | -11  | .6529  | .991  | 11  | 69 |



Table 2.--Regression results, concentration versus specific conductance--Continued

| Con-stituent   | E    | F      | r     | SE  | N   | Con-stituent   | E    | F      | r     | SE  | N  |
|--|------|--------|-------|-----|-----|--|------|--------|-------|-----|----|
| 06634600 Little Medicine Bow River near Medicine Bow, Wyo. 1968-75 water years |      |        |       |     |     | 06635000 Medicine Bow River above Seminole Reservoir, near Hanna, Wyo. 1968-75 water years |      |        |       |     |    |
| Ca   | 6.7  | 0.0922 | 0.893 | 12  | 80  | Ca   | 13   | 0.0780 | 0.895 | 14  | 71 |
| Mg   | -2.0 | .0286  | .791  | 5.9 | 81  | Mg   | -12  | .0526  | .951  | 6.2 | 72 |
| Na   | -5.9 | .0864  | .885  | 12  | 81  | Na   | -12  | .0857  | .923  | 13  | 71 |
| K  | 2.6  | .0017  | .491  | .8  | 81  | K  | 1.5  | .0014  | .469  | .9  | 72 |
| HCO <sub>3</sub>   | 86   | .1105  | .785  | 23  | 81  | HCO <sub>3</sub>   | 95   | .0662  | .662  | 27  | 72 |
| SO <sub>4</sub>  | -68  | .4156  | .971  | 27  | 81  | SO <sub>4</sub>  | -103 | .4868  | .988  | 28  | 72 |
| Cl   | -1.3 | .0140  | .833  | 2.5 | 81  | Cl   | -11  | .0317  | .870  | 6.5 | 72 |
| TH   | 8.3  | .3476  | .928  | 37  | 81  | TH   | -15  | .4101  | .969  | 37  | 71 |
| DS   | -13  | .6963  | .979  | 39  | 81  | DS   | -64  | .7676  | .993  | 33  | 72 |
| 06639000 Sweetwater River near Alcova, Wyo. 1968-75 water years                |      |        |       |     |     | 06642000 North Platte River at Alcova, Wyo. 1970-75 water years                            |      |        |       |     |    |
| Ca   | 6.6  | 0.0852 | 0.851 | 4.9 | 78  | Ca   | 18   | 0.0688 | 0.471 | 4.2 | 63 |
| Mg   | .2   | .0177  | .534  | 2.6 | 78  | Mg   | 2.6  | .0238  | .281  | 2.7 | 63 |
| Na   | -7.1 | .0918  | .967  | 2.3 | 78  | Na   | -.8  | .0610  | .802  | 1.5 | 63 |
| K  | 1.9  | .0076  | .815  | .5  | 78  | K  | 2.8  | .0003  | .027  | .4  | 63 |
| HCO <sub>3</sub>   | 42   | .2829  | .921  | 11  | 78  | HCO <sub>3</sub>   | 94   | .1069  | .409  | 7.8 | 63 |
| SO <sub>4</sub>  | -16  | .1679  | .929  | 6.3 | 78  | SO <sub>4</sub>  | -23  | .2805  | .781  | 6.8 | 56 |
| Cl <sup>4</sup>  | -7.8 | .0582  | .891  | 2.8 | 78  | Cl <sup>4</sup>  | -11  | .0433  | .452  | 2.8 | 63 |
| TH   | 16   | .2883  | .949  | 9.2 | 77  | TH   | 59   | .2640  | .757  | 7.5 | 63 |
| DS   | 1.1  | .6223  | .985  | 10  | 78  | DS   | 48   | .5313  | .911  | 7.9 | 63 |
| 06645000 North Platte River below Casper, Wyo. 1968-75 water years             |      |        |       |     |     | 06646600 Deer Creek below Millar Wasteway, at Glenrock, Wyo. 1971-75 water years           |      |        |       |     |    |
| Ca   | 23   | 0.0554 | 0.813 | 5.0 | 108 | Ca   | 14   | 0.0785 | 0.909 | 13  | 53 |
| Mg   | -2.9 | .0349  | .851  | 2.7 | 108 | Mg   | -.7  | .0470  | .939  | 6.3 | 56 |
| Na   | -26  | .1116  | .955  | 4.4 | 103 | Na   | -25  | .0963  | .887  | 18  | 56 |
| K  | 2.2  | .0017  | .474  | .4  | 101 | K  | .8   | .0018  | .827  | .5  | 56 |
| HCO <sub>3</sub>   | 126  | .0504  | .507  | 11  | 105 | HCO <sub>3</sub>   | 36   | .2982  | .977  | 24  | 56 |
| SO <sub>4</sub>  | -95  | .4241  | .954  | 17  | 110 | SO <sub>4</sub>  | -33  | .2954  | .988  | 17  | 55 |
| Cl <sup>4</sup>  | -4.0 | .0261  | .705  | 3.3 | 109 | Cl <sup>4</sup>  | -9.1 | .0280  | .640  | 12  | 56 |
| TH   | 49   | .2796  | .946  | 12  | 108 | TH   | 42   | .3744  | .956  | 42  | 54 |
| DS   | -39  | .6972  | .969  | 23  | 96  | DS   | -19  | .6913  | .997  | 18  | 56 |
| 06646800 North Platte River near Glenrock, Wyo. 1971-75 water years            |      |        |       |     |     | 06652000 North Platte River at Orin, Wyo. 1968-75 water years                              |      |        |       |     |    |
| Ca   | 27   | 0.0515 | 0.820 | 3.8 | 46  | Ca   | 23   | 0.0595 | 0.754 | 6.0 | 80 |
| Mg   | -2.8 | .0363  | .787  | 3.0 | 46  | Mg   | -5.3 | .0385  | .796  | 3.4 | 80 |
| Na   | -22  | .1074  | .946  | 3.9 | 46  | Na   | -15  | .0978  | .944  | 3.9 | 80 |
| K  | 2.4  | .0015  | .416  | .4  | 46  | K  | 2.1  | .0022  | .454  | .5  | 80 |
| HCO <sub>3</sub>   | 117  | .0683  | .537  | 11  | 46  | HCO <sub>3</sub>   | 85   | .1290  | .787  | 12  | 80 |
| SO <sub>4</sub>  | -82  | .4119  | .962  | 12  | 46  | SO <sub>4</sub>  | -62  | .3732  | .973  | 10  | 80 |
| Cl   | -1.9 | .0217  | .655  | 2.6 | 46  | Cl   | -3.9 | .0261  | .748  | 2.7 | 80 |
| TH   | 53   | .2830  | .912  | 13  | 46  | TH   | 35   | .3082  | .937  | 13  | 80 |
| DS   | -15  | .6742  | .980  | 15  | 46  | DS   | -3.0 | .6565  | .984  | 14  | 80 |
| 06652800 North Platte River below Glendo Reservoir, Wyo. 1968-75 water years   |      |        |       |     |     | 06656000 North Platte River below Guernsey Reservoir, Wyo. 1969-75 water years             |      |        |       |     |    |
| Ca   | 24   | 0.0541 | 0.735 | 6.4 | 75  | Ca   | 0.2  | 0.0971 | 0.795 | 6.4 | 68 |
| Mg   | -21  | .0629  | .883  | 4.3 | 75  | Mg   | -11  | .0484  | .701  | 4.3 | 68 |
| Na   | -6.1 | .0846  | .963  | 3.0 | 75  | Na   | 8.7  | .0573  | .775  | 4.1 | 68 |
| K  | .3   | .0054  | .849  | .4  | 75  | K  | .6   | .0052  | .651  | .5  | 68 |
| HCO <sub>3</sub>   | 7.0  | .2440  | .916  | 14  | 75  | HCO <sub>3</sub>   | -81  | .4111  | .807  | 26  | 68 |
| SO <sub>4</sub>  | -43  | .3422  | .979  | 9.1 | 75  | SO <sub>4</sub>  | 60   | .1709  | .658  | 17  | 68 |
| Cl   | -4.6 | .0268  | .774  | 2.8 | 75  | Cl   | -4.4 | .0255  | .514  | 3.7 | 68 |
| TH   | -27  | .3946  | .975  | 11  | 75  | TH   | -46  | .4426  | .931  | 15  | 68 |
| DS   | -38  | .6982  | .991  | 12  | 75  | DS   | 4.9  | .6394  | .962  | 16  | 68 |

Table 2.--Regression results, concentration versus specific conductance--Continued

| Constituent  | E    | F      | r     | SE  | N  | Constituent  | E    | F      | r     | SE  | N  |
|--|------|--------|-------|-----|----|--|------|--------|-------|-----|----|
| 06660500 Laramie River at Two Rivers, Wyo. 1968-75 water years                 |      |        |       |     |    | 06661500 Little Laramie River at Two Rivers, Wyo. 1968-75 water years        |      |        |       |     |    |
| Ca   | 13   | 0.0781 | 0.974 | 5.8 | 74 | Ca   | 8.4  | 0.0844 | 0.877 | 5.5 | 74 |
| Mg   | -8.1 | .0522  | .977  | 3.6 | 74 | Mg   | -2.5 | .0422  | .894  | 2.5 | 74 |
| Na   | -21  | .0870  | .986  | 4.7 | 74 | Na   | -9.8 | .0746  | .919  | 3.8 | 74 |
| K  | 1.1  | .0021  | .853  | .4  | 74 | K  | -.2  | .0045  | .636  | .6  | 74 |
| HCO <sub>3</sub>   | 81   | .1000  | .878  | 17  | 74 | HCO <sub>3</sub>   | 76   | .1953  | .736  | 22  | 74 |
| SO <sub>4</sub> <sup>3</sup>   | -111 | .4750  | .992  | 20  | 74 | SO <sub>4</sub> <sup>3</sup>   | -76  | .3562  | .938  | 16  | 73 |
| Cl <sub>4</sub>  | -5.5 | .0298  | .918  | 4.1 | 74 | Cl <sub>4</sub>  | -5.7 | .0272  | .726  | 3.1 | 74 |
| TH   | -1.2 | .4122  | .994  | 15  | 74 | TH   | 12   | .3828  | .960  | 13  | 74 |
| DS   | -72  | .7659  | .997  | 20  | 74 | DS   | -40  | .6930  | .990  | 12  | 74 |
| 06670500 Laramie River near Fort Laramie, Wyo. 1971-75 water years             |      |        |       |     |    | 06670900 North Platte River near Lingle, Wyo. 1969-75 water years            |      |        |       |     |    |
| Ca   | 21   | 0.0785 | 0.686 | 9.8 | 46 | Ca   | -23  | 0.1330 | 0.951 | 4.5 | 75 |
| Mg   | .3   | .0308  | .491  | 6.3 | 48 | Mg   | 2.2  | .0258  | .924  | 1.1 | 75 |
| Na   | -17  | .0885  | .901  | 4.9 | 48 | Na   | -1.7 | .0754  | .942  | 2.8 | 75 |
| K  | 1.7  | .0040  | .607  | .6  | 48 | K  | 1.5  | .0047  | .635  | .6  | 75 |
| HCO <sub>3</sub>   | 57   | .2655  | .871  | 17  | 48 | HCO <sub>3</sub>   | -64  | .4001  | .926  | 17  | 75 |
| SO <sub>4</sub> <sup>3</sup>   | -27  | .2599  | .950  | 9.3 | 47 | SO <sub>4</sub> <sup>3</sup>   | 27   | .2057  | .884  | 11  | 75 |
| Cl <sub>4</sub>  | -4.2 | .0278  | .884  | 1.7 | 48 | Cl <sub>4</sub>  | -6.6 | .0288  | .920  | 1.3 | 75 |
| TH   | 50   | .3313  | .896  | 19  | 48 | TH   | -48  | .4367  | .974  | 11  | 75 |
| DS   | .9   | .6626  | .981  | 15  | 48 | DS   | -59  | .7368  | .986  | 13  | 75 |
| 06674500 North Platte River at Wyoming-Nebraska State line 1971-75 water years |      |        |       |     |    | 10020100 Bear River above reservoir, near Woodruff, Utah 1969-75 water years |      |        |       |     |    |
| Ca   | 3.3  | 0.0909 | 0.883 | 5.9 | 48 | Ca   | 21   | 0.0682 | 0.692 | 8.0 | 55 |
| Mg   | 8.2  | .0143  | .519  | 2.9 | 46 | Mg   | -7   | .0608  | .908  | 3.1 | 55 |
| Na   | -42  | .1407  | .957  | 5.2 | 48 | Na   | -11  | .0561  | .847  | 3.9 | 55 |
| K  | -1.4 | .0089  | .832  | .7  | 46 | K  | -.7  | .0070  | .681  | .8  | 55 |
| HCO <sub>3</sub>   | -79  | .4033  | .937  | 18  | 46 | HCO <sub>3</sub>   | 30   | .4703  | .951  | 16  | 54 |
| SO <sub>4</sub> <sup>3</sup>   | 46   | .1893  | .877  | 13  | 48 | SO <sub>4</sub> <sup>3</sup>   | -12  | .0749  | .792  | 6.5 | 55 |
| Cl <sub>4</sub>  | -6.4 | .0291  | .880  | 1.9 | 48 | Cl <sub>4</sub>  | -9.4 | .0529  | .805  | 4.4 | 55 |
| TH   | 47   | .2806  | .926  | 14  | 46 | TH   | 24   | .4172  | .954  | 14  | 54 |
| DS   | -60  | .7381  | .471  | 22  | 46 | DS   | -.1  | .5665  | .992  | 7.8 | 55 |
| 10039500 Bear River at Border, Wyo. 1971-75 water years                        |      |        |       |     |    | 13018300 Cache Creek near Jackson, Wyo. 1968-75 water years                  |      |        |       |     |    |
| Ca   | 35   | 0.0503 | 0.446 | 6.2 | 61 | Ca   | 27   | 0.0600 | 0.505 | 3.4 | 87 |
| Mg   | -1.4 | .0429  | .656  | 3.0 | 61 | Mg   | 12   | .0071  | .163  | 1.4 | 87 |
| Na   | -12  | .0620  | .797  | 2.9 | 61 | Na   | -1.6 | .0123  | .552  | .6  | 87 |
| K  | 1.8  | .0007  | .076  | .6  | 61 | K  | .3   | .0011  | .094  | .4  | 87 |
| HCO <sub>3</sub>   | 138  | .2156  | .621  | 17  | 61 | HCO <sub>3</sub>   | 142  | .2094  | .583  | 9.8 | 87 |
| SO <sub>4</sub> <sup>3</sup>   | -25  | .1433  | .732  | 8.1 | 61 | SO <sub>4</sub> <sup>3</sup>   | -8.3 | .0477  | .485  | 2.9 | 87 |
| Cl <sub>4</sub>  | -19  | .0749  | .792  | 3.5 | 61 | Cl <sub>4</sub>  | .2   | .0022  | .121  | .6  | 87 |
| TH   | 77   | .3109  | .788  | 15  | 61 | TH   | 121  | .1665  | .569  | 8.1 | 87 |
| DS   | 49   | .4915  | .848  | 19  | 61 | DS   | 109  | .2217  | .609  | 9.7 | 87 |
| 13022500 Snake River above reservoir, near Alpine, Wyo. 1968-75 water years    |      |        |       |     |    | 13027500 Salt River above reservoir, near Etna, Wyo. 1968-75 water years     |      |        |       |     |    |
| Ca   | 27   | 0.0475 | 0.489 | 7.5 | 89 | Ca   | 31   | 0.0665 | 0.438 | 4.8 | 89 |
| Mg   | 4.2  | .0151  | .484  | 2.4 | 89 | Mg   | -6.2 | .0504  | .467  | 3.4 | 89 |
| Na   | 5.2  | .0068  | .314  | 1.8 | 89 | Na   | -16  | .0599  | .540  | 3.3 | 89 |
| K  | 1.3  | .0016  | .333  | .4  | 89 | K  | .7   | .0012  | .110  | .4  | 89 |
| HCO <sub>3</sub>   | 96   | .1091  | .507  | 16  | 88 | HCO <sub>3</sub>   | 130  | .2301  | .588  | 11  | 89 |
| SO <sub>4</sub> <sup>3</sup>   | 11   | .1000  | .555  | 13  | 89 | SO <sub>4</sub> <sup>3</sup>   | -34  | .1353  | .660  | 5.5 | 89 |
| Cl <sub>4</sub>  | 2.3  | .0081  | .249  | 2.8 | 89 | Cl <sub>4</sub>  | -37  | .1105  | .561  | 5.8 | 89 |
| TH   | 92   | .1642  | .478  | 27  | 84 | TH   | 47   | .3827  | .779  | 11  | 89 |
| DS   | 109  | .2370  | .558  | 31  | 69 | DS   | 8.0  | .5508  | .922  | 8.2 | 89 |

samples to the laboratory or operation of a conductivity recorder. This method produces very good results, but, because it is very expensive, sampling at most daily stations was discontinued in 1975.

Alternatively, concentrations can be estimated by relating monthly sample data to streamflow as follows:

$$C_i = A_i Q^{B_i} \quad (2)$$

where

- $i$  = index for individual constituent;
- $C_i$  = constituent concentration, in milligrams per liter;
- $Q$  = discharge, in cubic feet per second;
- $A_i$  = regression coefficient (slope), in  $\frac{\text{milligrams per liter}}{\text{cubic feet per second}}$ ;
- and
- $B_i$  = regression coefficient (intercept), dimensionless.

DeLong (1977) adjusted  $A_i$  and  $B_i$  for seasonal variation by adding the season-related variable of time  $t$  (expressed as day of the water year, see table 3).  $A_i$  and  $B_i$  take the form

$$\begin{aligned} \log_{10} A_i &= [B_0 + B_1 \sin(\alpha t) + B_2 \cos(\alpha t)]_i; \text{ and} \\ B_i &= [B_3 + B_4 \sin(\alpha t) + B_5 \cos(\alpha t)]_i \end{aligned}$$

where

- $B_0$  through  $B_5$  = regression coefficients;
- $\alpha$  = 0.987 degrees per day or 0.0172 radians per day;
- and
- $t$  = day of the water year (table 3).

After substituting these terms, equation 2 becomes

$$C_i = 10^{[B_0 + B_1 \sin(\alpha t) + B_2 \cos(\alpha t)]_i} Q^{[B_3 + B_4 \sin(\alpha t) + B_5 \cos(\alpha t)]_i} \quad (2A)$$

The reader may refer to DeLong (1977) for a more rigorous discussion of this approach.

Coefficients  $B_0$  through  $B_5$  were determined for the major dissolved inorganic constituents by a multivariable regression technique from a computer program developed by Glover (1978). They are listed in table 4 (at the end of report) with the multiple correlation coefficient,  $R$ , and standard error of estimate,  $SE$ , for each set of coefficients.

Table 3.--Sequence-number conversion, date to water-year day

| Day | Oct | Nov | Dec | Jan | Feb   | * | Mar | Apr | May | June | July | Aug | Sept |
|-----|-----|-----|-----|-----|-------|---|-----|-----|-----|------|------|-----|------|
| 1   | 1   | 32  | 62  | 93  | 124   |   | 152 | 183 | 213 | 244  | 274  | 305 | 336  |
| 2   | 2   | 33  | 63  | 94  | 125   |   | 153 | 184 | 214 | 245  | 275  | 306 | 337  |
| 3   | 3   | 34  | 64  | 95  | 126   |   | 154 | 185 | 215 | 246  | 276  | 307 | 338  |
| 4   | 4   | 35  | 65  | 96  | 127   |   | 155 | 186 | 216 | 247  | 277  | 308 | 339  |
| 5   | 5   | 36  | 66  | 97  | 128   |   | 156 | 187 | 217 | 248  | 278  | 309 | 340  |
| 6   | 6   | 37  | 67  | 98  | 129   |   | 157 | 188 | 218 | 249  | 279  | 310 | 341  |
| 7   | 7   | 38  | 68  | 99  | 130   |   | 158 | 189 | 219 | 250  | 280  | 311 | 342  |
| 8   | 8   | 39  | 69  | 100 | 131   |   | 159 | 190 | 220 | 251  | 281  | 312 | 343  |
| 9   | 9   | 40  | 70  | 101 | 132   |   | 160 | 191 | 221 | 252  | 282  | 313 | 344  |
| 10  | 10  | 41  | 71  | 102 | 133   |   | 161 | 192 | 222 | 253  | 283  | 314 | 345  |
| 11  | 11  | 42  | 72  | 103 | 134   |   | 162 | 193 | 223 | 254  | 284  | 315 | 346  |
| 12  | 12  | 43  | 73  | 104 | 135   |   | 163 | 194 | 224 | 255  | 285  | 316 | 347  |
| 13  | 13  | 44  | 74  | 105 | 136   |   | 164 | 195 | 225 | 256  | 286  | 317 | 348  |
| 14  | 14  | 45  | 75  | 106 | 137   |   | 165 | 196 | 226 | 257  | 287  | 318 | 349  |
| 15  | 15  | 46  | 76  | 107 | 138   |   | 166 | 197 | 227 | 258  | 288  | 319 | 350  |
| 16  | 16  | 47  | 77  | 108 | 139   |   | 167 | 198 | 228 | 259  | 289  | 320 | 351  |
| 17  | 17  | 48  | 78  | 109 | 140   |   | 168 | 199 | 229 | 260  | 290  | 321 | 352  |
| 18  | 18  | 49  | 79  | 110 | 141   |   | 169 | 200 | 230 | 261  | 291  | 322 | 353  |
| 19  | 19  | 50  | 80  | 111 | 142   |   | 170 | 201 | 231 | 262  | 292  | 323 | 354  |
| 20  | 20  | 51  | 81  | 112 | 143   |   | 171 | 202 | 232 | 263  | 293  | 324 | 355  |
| 21  | 21  | 52  | 82  | 113 | 144   |   | 172 | 203 | 233 | 264  | 294  | 325 | 356  |
| 22  | 22  | 53  | 83  | 114 | 145   |   | 173 | 204 | 234 | 265  | 295  | 326 | 357  |
| 23  | 23  | 54  | 84  | 115 | 146   |   | 174 | 205 | 235 | 266  | 296  | 327 | 358  |
| 24  | 24  | 55  | 85  | 116 | 147   |   | 175 | 206 | 236 | 267  | 297  | 328 | 359  |
| 25  | 25  | 56  | 86  | 117 | 148   |   | 176 | 207 | 237 | 268  | 298  | 329 | 360  |
| 26  | 26  | 57  | 87  | 118 | 149   |   | 177 | 208 | 238 | 269  | 299  | 330 | 361  |
| 27  | 27  | 58  | 88  | 119 | 150   |   | 178 | 209 | 239 | 270  | 300  | 331 | 362  |
| 28  | 28  | 59  | 89  | 120 | 151   |   | 179 | 210 | 240 | 271  | 301  | 332 | 363  |
| 29  | 29  | 60  | 90  | 121 | (152) |   | 180 | 211 | 241 | 272  | 302  | 333 | 364  |
| 30  | 30  | 61  | 91  | 122 | ---   |   | 181 | 212 | 242 | 273  | 303  | 334 | 365  |
| 31  | 31  | --  | 92  | 123 | ---   |   | 182 | --- | 243 | ---  | 304  | 335 | ---  |

\* For months of March through September, add one (1) to number in table for sequence conversion of days for leap years.

### Estimates of Load

Mean dissolved-solids loads can be computed for any given period of days from daily streamflow records and concentrations estimated by one of the methods listed in the previous section. The equation used is

$$\bar{L} = (b/d) \sum_{j=1}^d C_j Q_j \quad (3)$$

where

$\bar{L}$  = mean daily load, in tons per day;

$b$  = 0.0027 (tons per milligrams) (seconds per day) (liters per cubic foot);

$d$  = number of days, dimensionless;

$C_j$  = daily concentration, in milligrams per liter; and

$Q_j$  = daily mean discharge, in cubic feet per second.

A large number of calculations are involved in estimating dissolved-solids loads; therefore, equations 1, 2, and 3 were incorporated into a computer program developed by Glover (1978). Card output from the program was used with an off-line card reader and X-Y plotter to produce hydrographs of monthly mean dissolved-solids load. These hydrographs were then used to compare loads estimated from equations 1 and 2A. The hydrographs also provide a visual aid for comparing the variability of the load transported by a stream on a monthly basis.

### REGRESSION RESULTS

#### Estimates of Concentration

Using equations 1 and 2A, concentrations were estimated for calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, total hardness, and dissolved solids. Values of  $E_i$ ,  $F_i$ ,  $SE_i$  and  $r_i$  for equation 1 are listed in table 2. The values of  $r$  are greater than 0.8 for most constituents versus specific conductance relationships and many are greater than 0.9.

The brief summary below lists each constituent and the number of stations where correlation coefficients were greater than 0.8 using equation 3 (see table 4).

| Constituent      | <u>Number of stations</u><br>( $r > 0.8$ ) |
|------------------|--|
| Calcium          | 37   |
| Magnesium        | 29   |
| Sodium           | 39   |
| Potassium        | 9  |
| Bicarbonate      | 41   |
| Sulfate          | 36   |
| Chloride         | 20   |
| Total hardness   | 46   |
| Dissolved solids | 47   |

Correlation coefficients and standard errors of estimate usually are poor for less abundant constituents such as silica, potassium, chloride, and nutrients (nitrogen and phosphorus compounds). One reason is that the concentrations of these substances are low relative to the other constituents in solution.

Silica, potassium, and phosphorus compounds react with the sediment in a complex manner that tends to keep the concentrations in a narrow range (Hem, 1970, p. 103, 150, 183). Phosphorus and nitrogen compounds are nutrients for the biological communities in streams and lakes. Chloride, if present in sufficient quantity, had improved regression statistics (SE and  $r$ ). For these constituents the coefficients for only potassium and chloride are included in table 2.

The values of  $r$  for stations near the headwaters of streams or downstream from reservoirs generally were less than 0.8; however, the standard errors of estimate usually were less than 10 percent of the mean concentration (0.04 log units). A reservoir (surface-water or groundwater) is a relatively well-mixed pool, and regardless of the volume of outflow the concentration tends to remain constant and the SE small.

#### Estimates of Load

Using concentrations obtained from equation 1, monthly mean dissolved-solids loads were calculated (eq. 3) for 16 stations where daily specific conductance was available. These calculations were repeated using concentrations obtained from the multivariable regression model (eq. 2A). Graphs of the results (figs. 2-17) show that the lines representing each method tend to coincide and general agreement exists.

An effort was made to determine what some of the larger discrepancies between loads estimated from the two methods (as illustrated in figs. 8 and 11, stations 06285100 and 06317000) might be on a long-term basis. Cumulative dissolved-solids loads at these stations for the

1970-75 water years (figs. 18-19) indicate only a 6- or 7-percent difference in total load. Discrepancies in total loads at most of the stations were less than 6 percent.

Cumulative dissolved-solids-load hydrographs (figs. 20-39) were then plotted for all stations including those with data from monthly sampling only. The multivariable regression results for these stations are valid because each major stream analyzed had at least one daily specific-conductance station on it or its tributaries. The figures illustrate loads during 1970-75 water years and are useful in comparing stations.

## STATION EVALUATIONS

### Dissolved-Solids Hydrographs

The load hydrographs (figs. 2-17) show that total loads and timing of peak loads are similar among stations. For example, the average load for station 06228000 (fig. 2) approximated 300 to 400 tons per day except during the spring runoff when it was between 500 and 1,800 tons per day. The average load for station 06235500 (fig. 3) was between 400 and 500 tons per day and between 1,300 to 1,700 tons per day during peak runoffs (except in 1973). Station 06259000 (fig. 4) had an average load generally in excess of 1,000 tons per day and peak loads of as much as 4,400 tons per day.

Cumulative dissolved-solids loading at surface-water-quality stations in the Wyoming Department of Agriculture network and for the segments enclosed by them and nearby stations are shown in figures 18-39. The Powder River, Belle Fourche River, and Beaver Creek in north-central and northeastern Wyoming have only one station on each stream (stations 06317000, 06428500, and 06394000) where discharge information is available; thus, loading of segments cannot be compared.

Some caution needs to be used in the interpretation of the cumulative-load hydrographs (figs. 18-39). For example, the loading of the Wind River between Dubois (station 06218500) and Riverton (station 06228000) is shown in figure 21. However, Bull Lake on Bull Lake Creek (a tributary), Dinwoody Lakes on Dinwoody Creek, and Pilot Butte Reservoir (all within this reach) store in excess of 182,000 acre-feet of water. Some of this water is diverted for irrigation and returned to the Wind River downstream from station 06228000 via Fivemile Creek and Muddy Creek. Therefore, the loading of the stream reach between Dubois and Riverton is only partly represented in the hydrograph.

The dissolved-solids load contributed by the above return flows, as well as that contributed by Badwater Creek, Poison Spider Creek, and other returns that may exist, is depicted in figure 22. The hydrograph depicts the loading of reaches of the Wind River upstream of Wind River at Riverton (station 06228000), Little Wind River near Riverton (station 06235500), Fivemile Creek near Shoshoni (station 06253000), and Wind River below Boysen Reservoir (station 06259000).

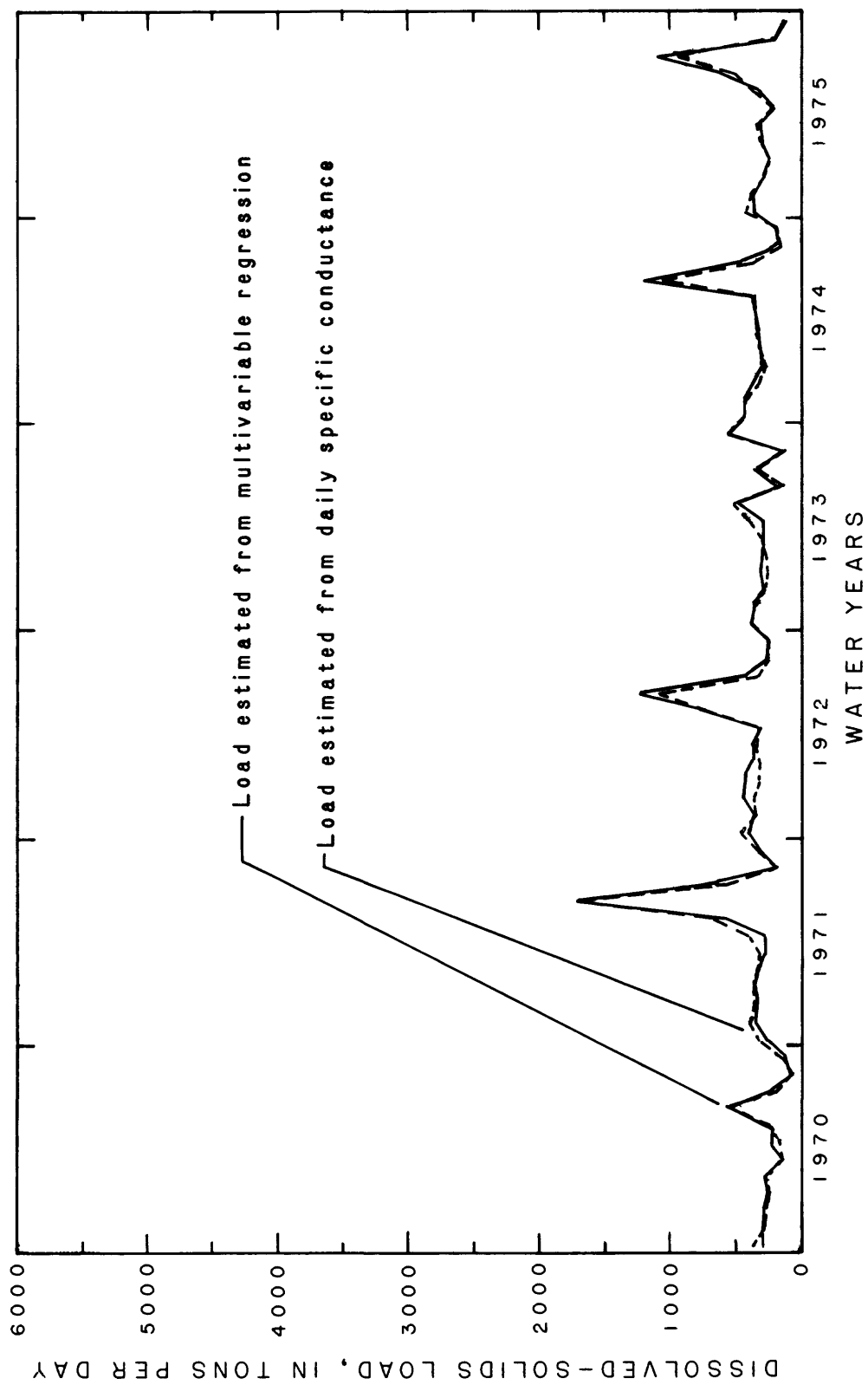
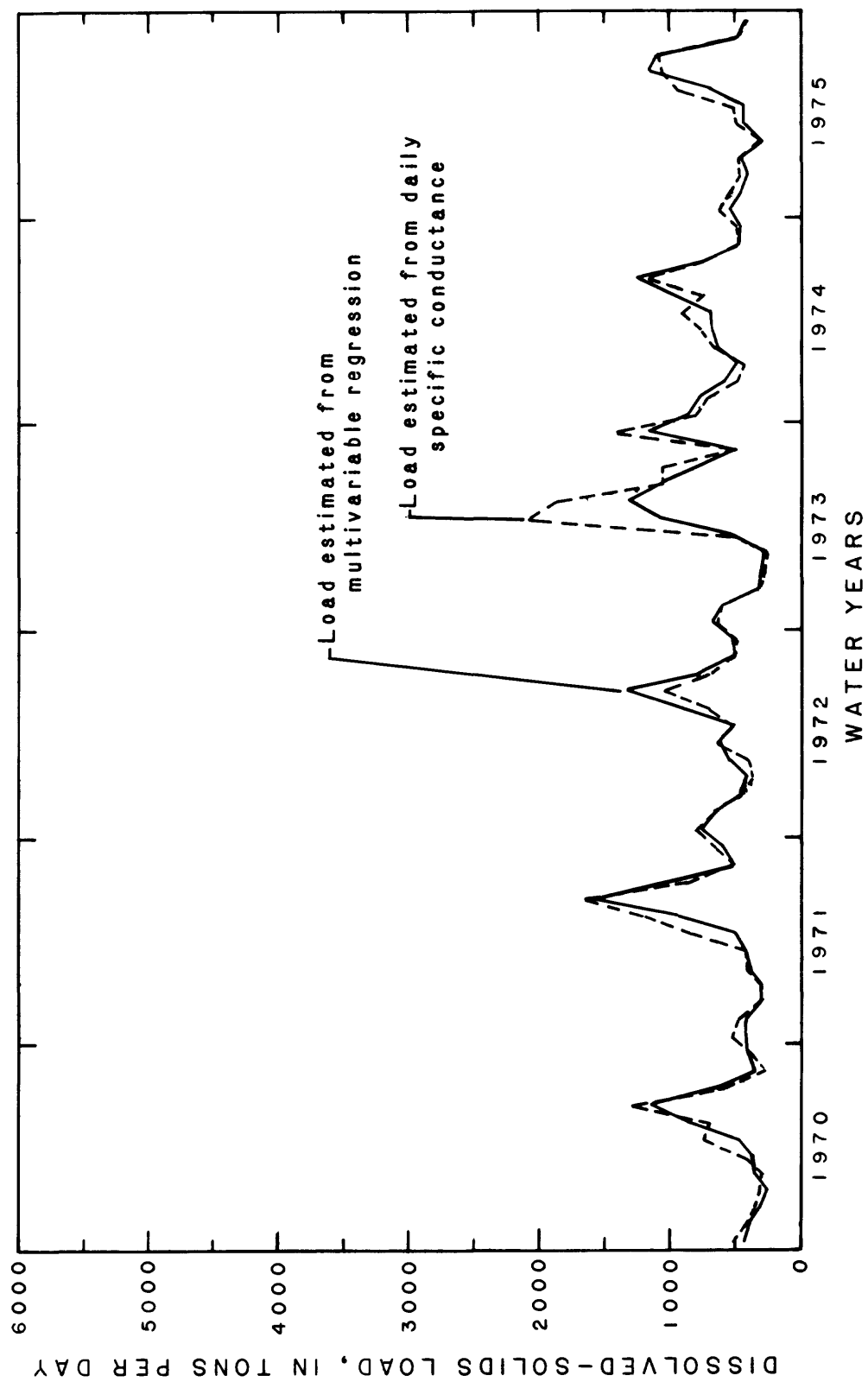
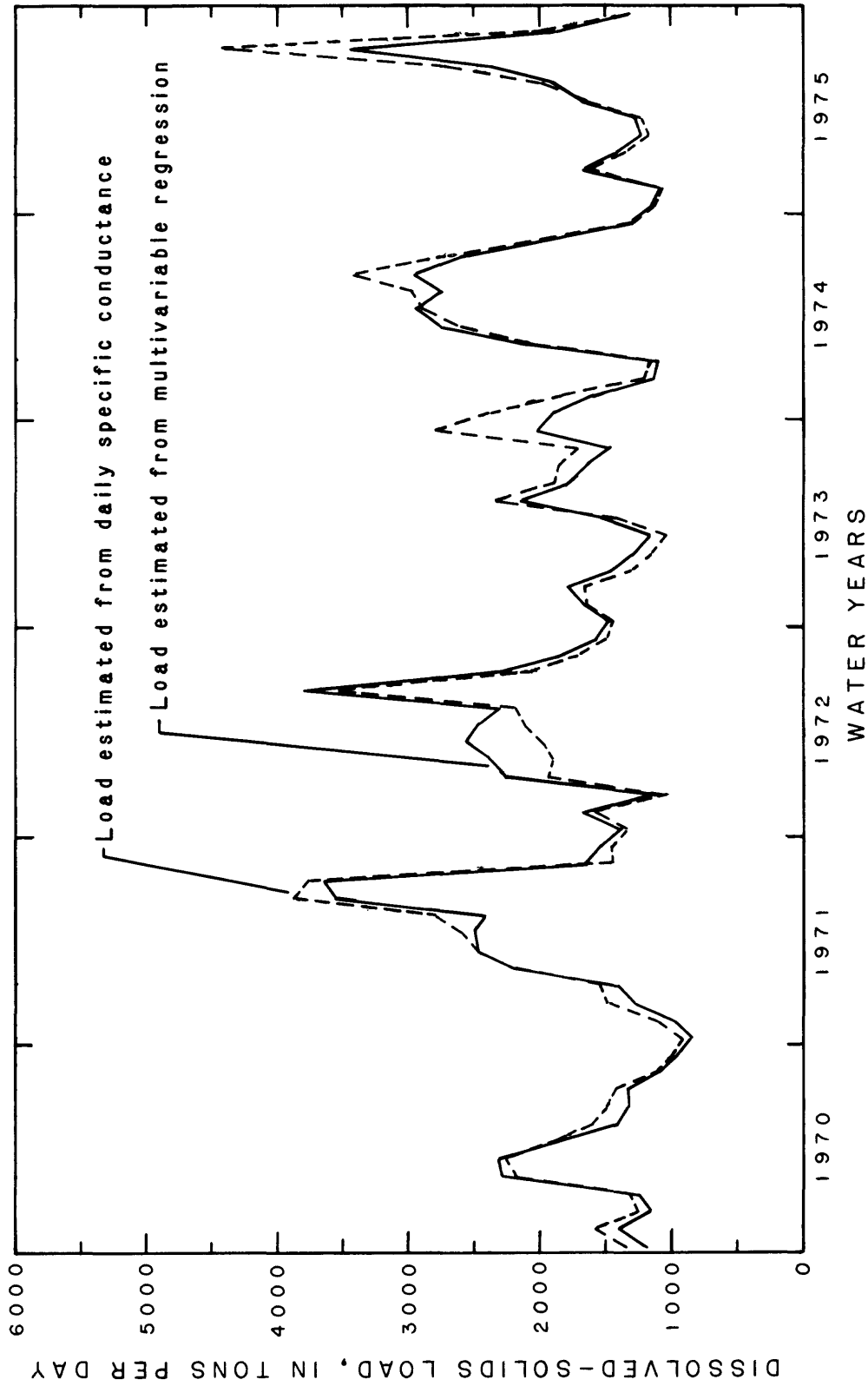


Figure 2.--Monthly mean dissolved-solids loads at station 06228000, Wind River at Riverton, Wyoming.





**Figure 3.--Monthly mean dissolved-solids loads at station 06235500, Little Wind River near Riverton, Wyoming.**



**Figure 4.--Monthly mean dissolved-solids loads at station 06259000, Wind River below Boysen Reservoir, Wyoming.**

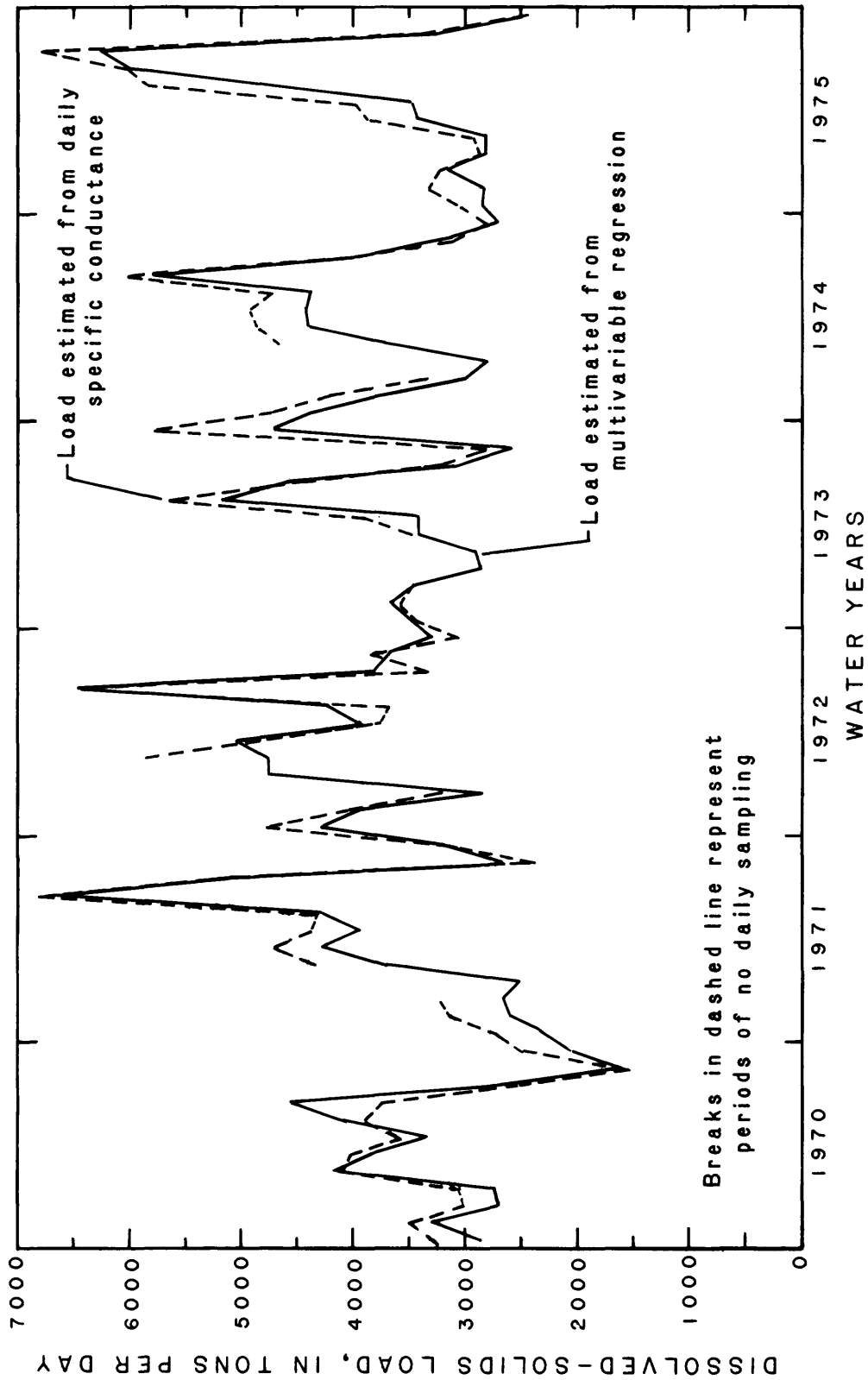


Figure 5.--Monthly mean dissolved-solids loads at station 06279500, Bighorn River at Kane, Wyoming.

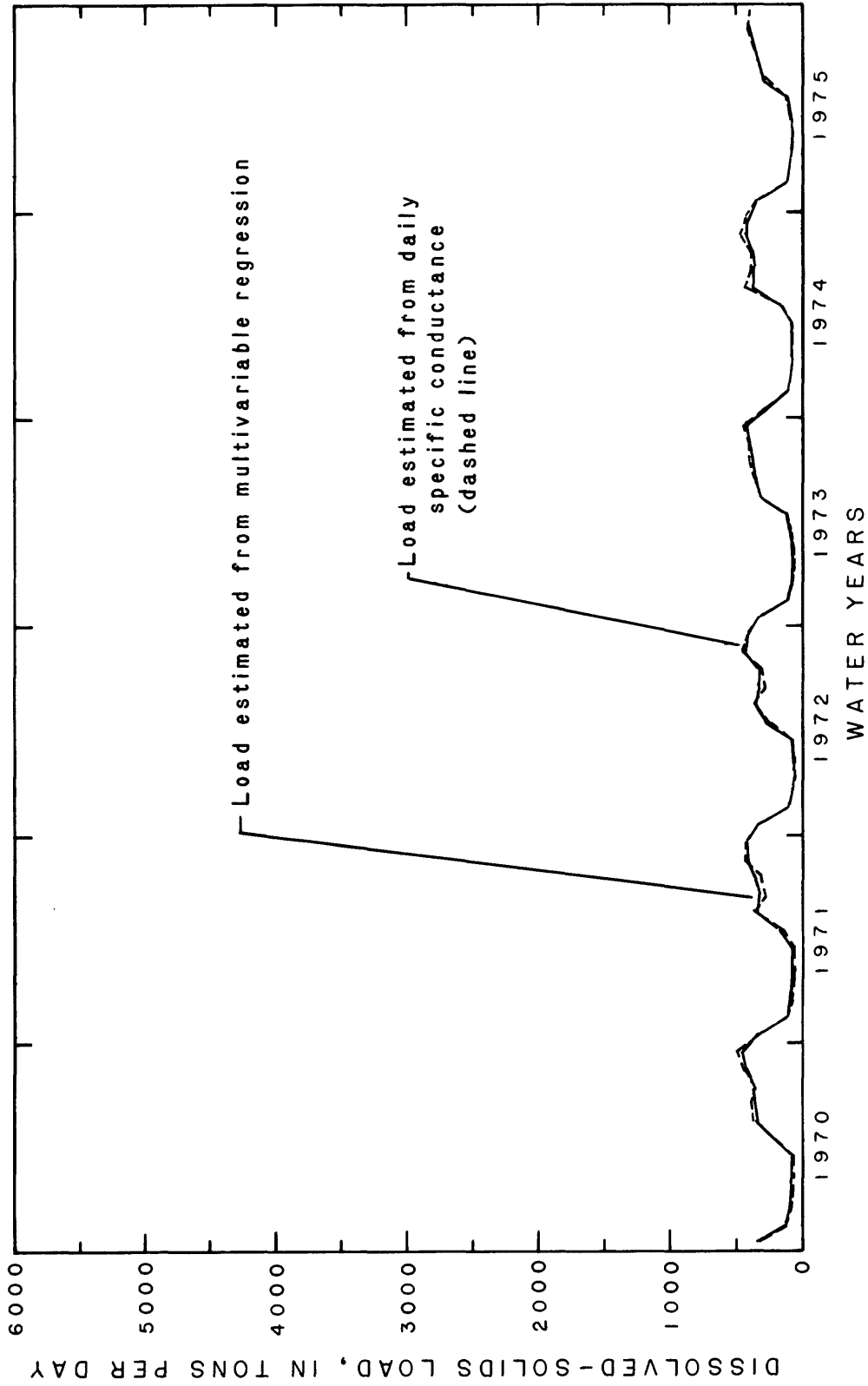


Figure 6.--Monthly mean dissolved-solids loads at station 06284500, Bitter Creek near Garland, Wyoming.

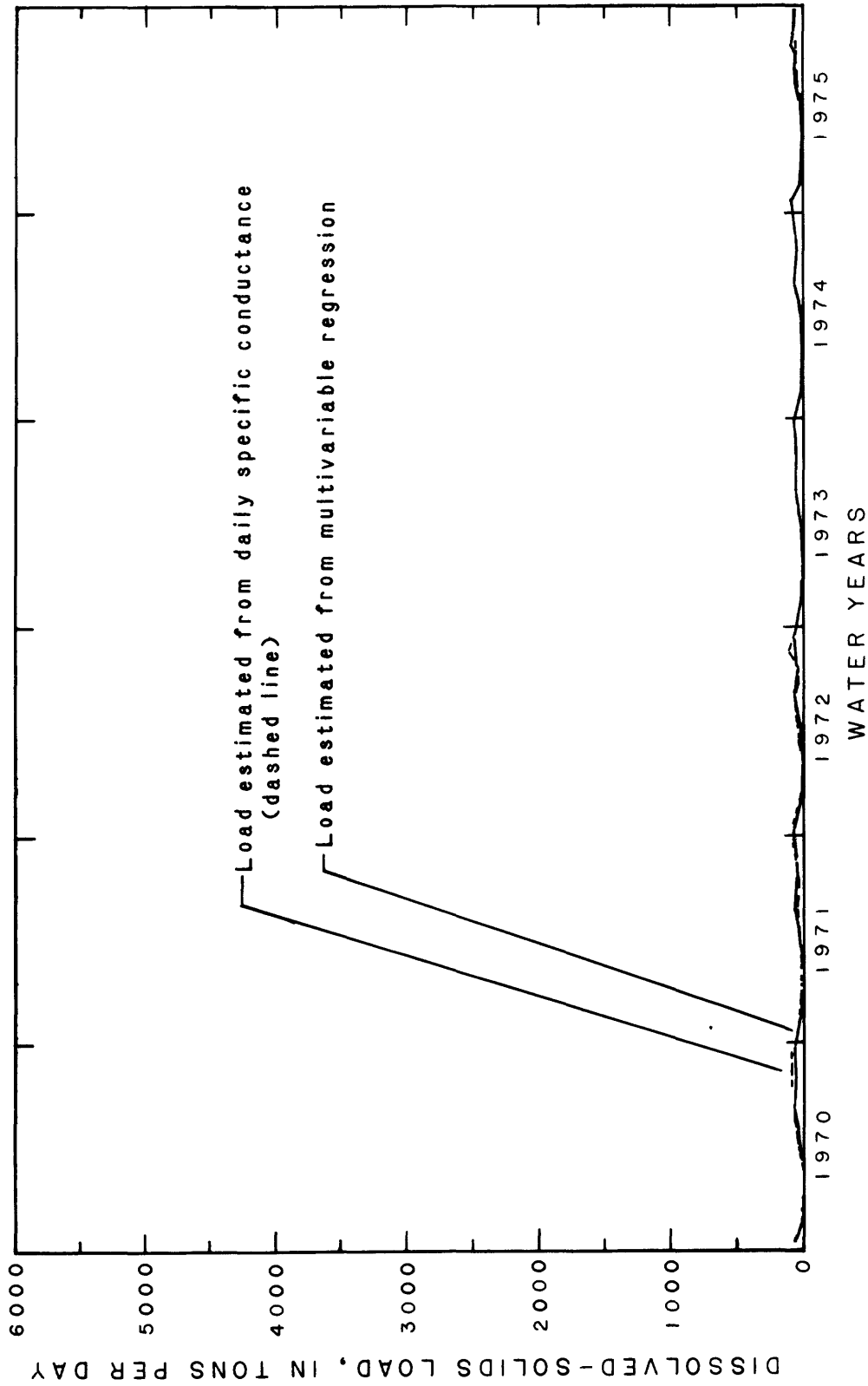


Figure 7.--Monthly mean dissolved-solids loads at station 06284800, Whistle Creek near Garland, Wyoming.

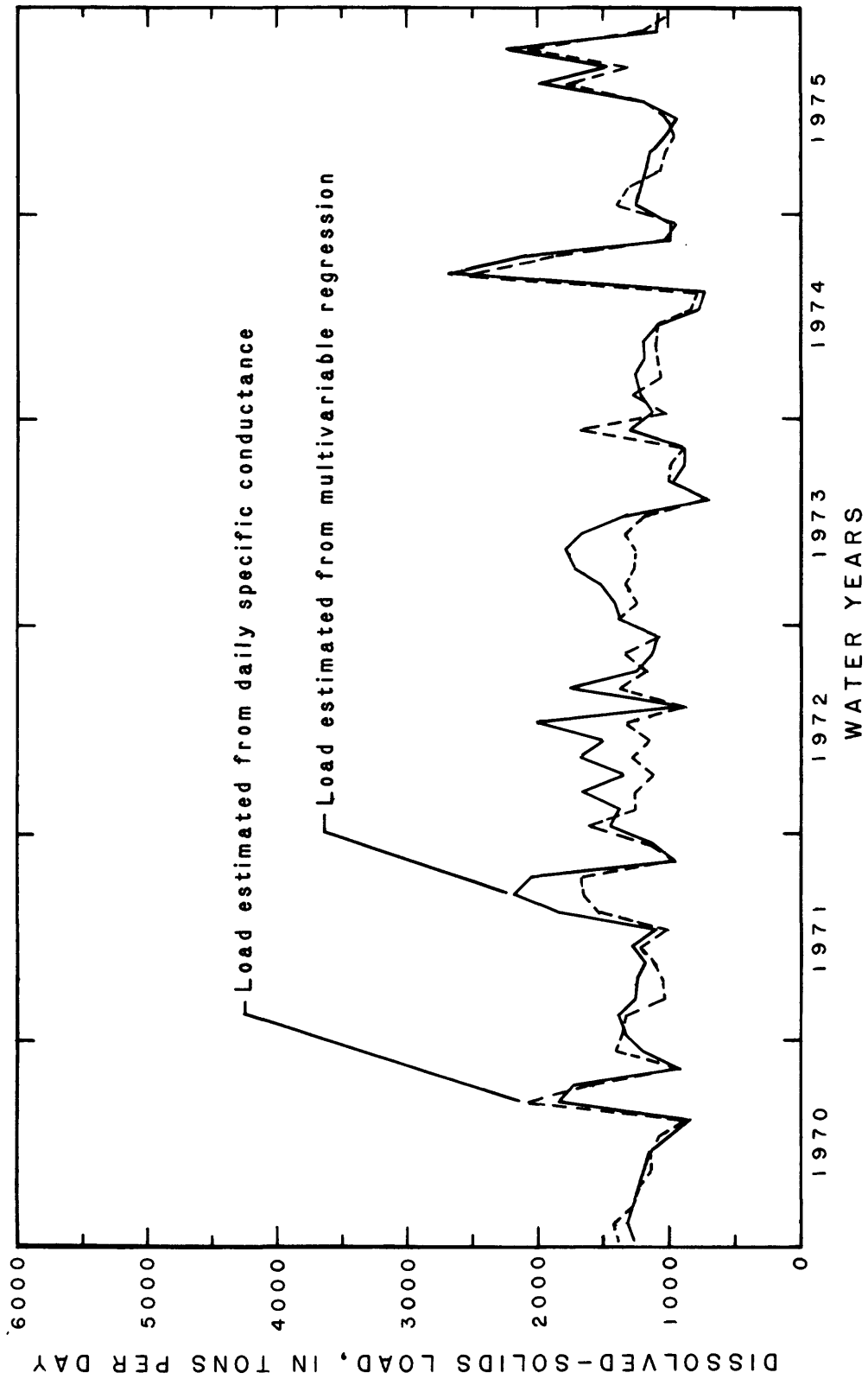


Figure 8.--Monthly mean dissolved-solids loads at station 06285100, Shoshone River near Lovell, Wyoming.

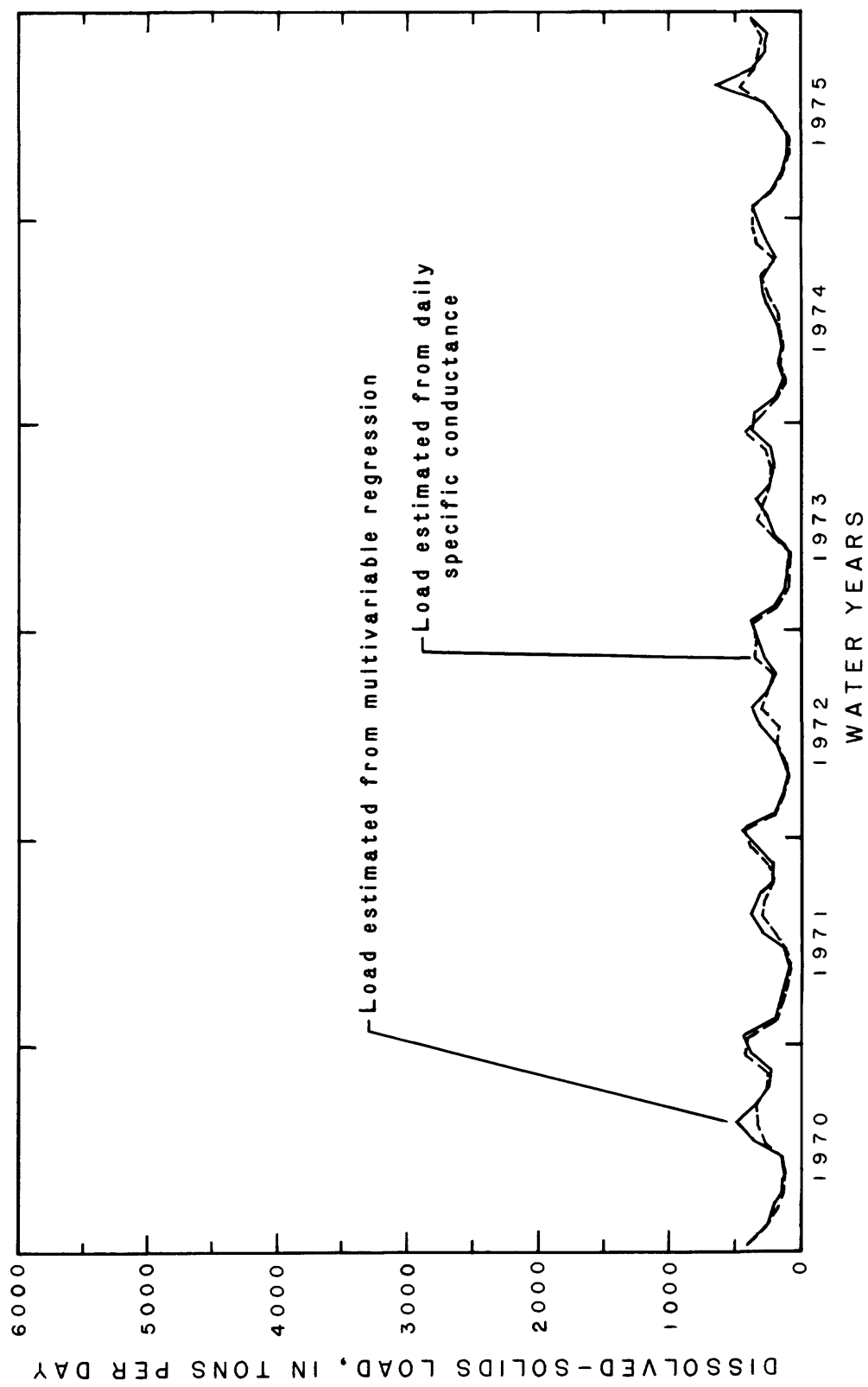


Figure 9.--Monthly mean dissolved-solids loads at station 06285400, Sage Creek at Sidon Canal, near Deaver, Wyoming.

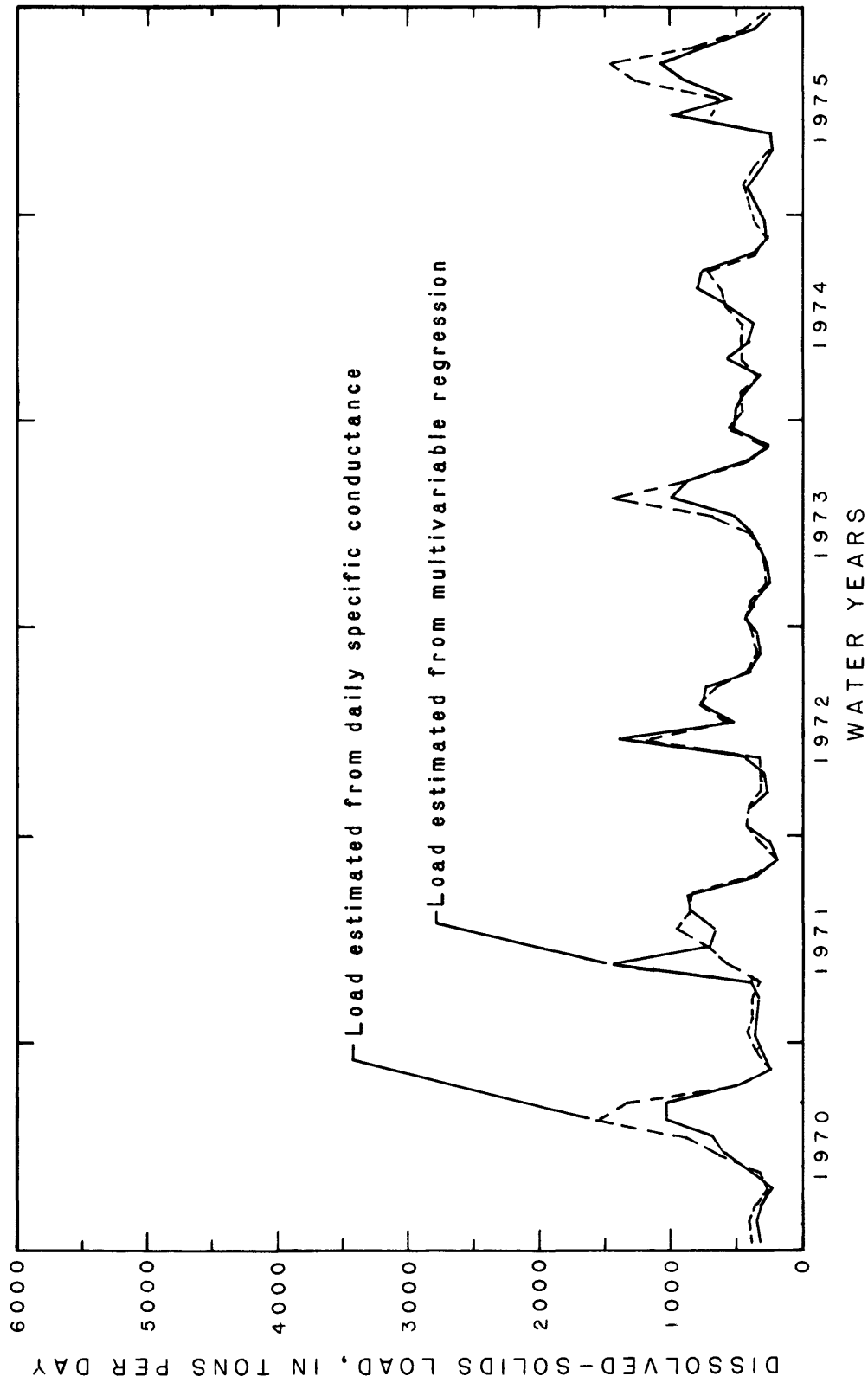


Figure 10.--Monthly mean dissolved-solids loads at station 06306300, Tongue River at State line, near Decker, Montana.



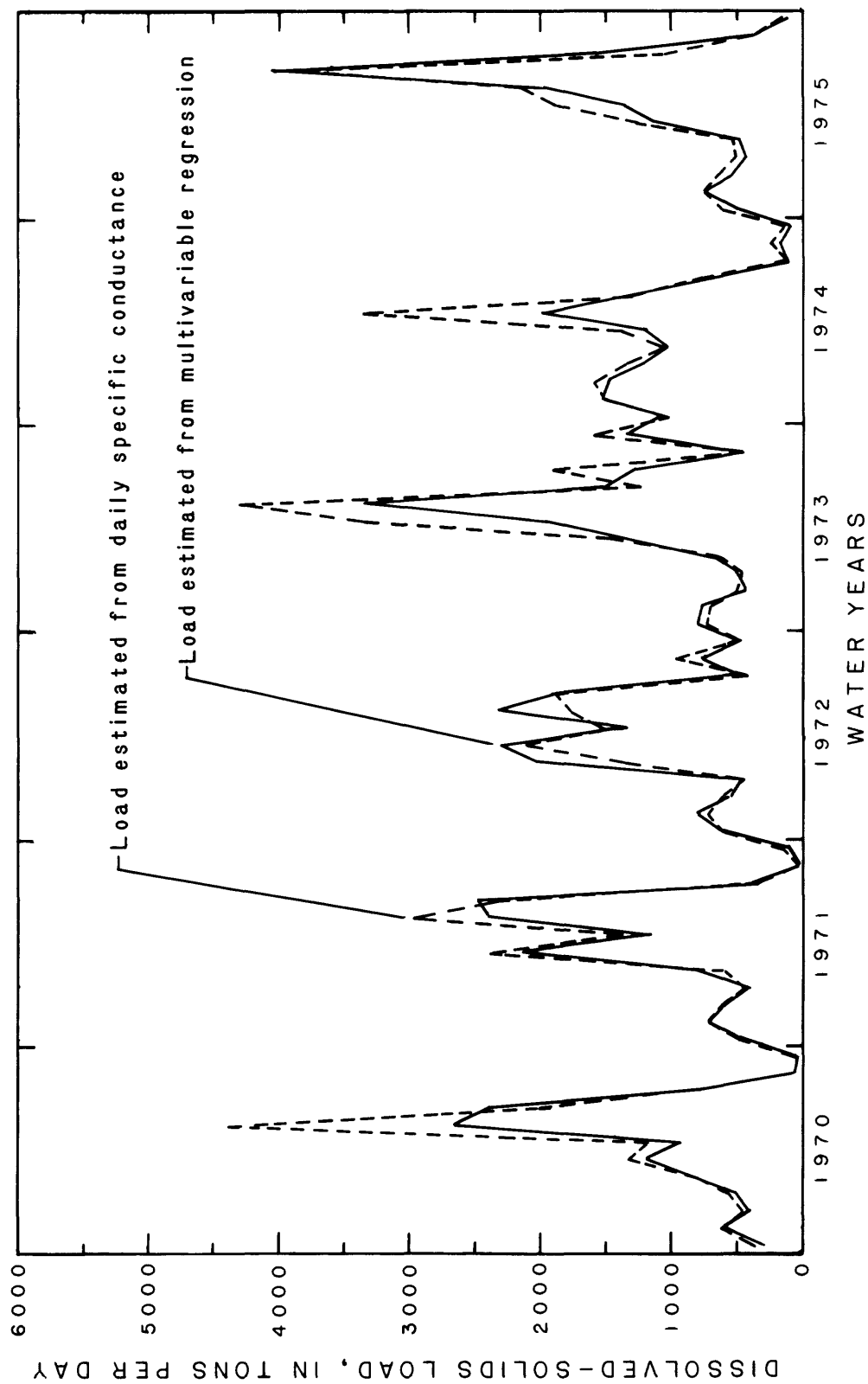


Figure 11.--Monthly mean dissolved-solids loads at station 06317000, Powder River at Arvada, Wyoming.

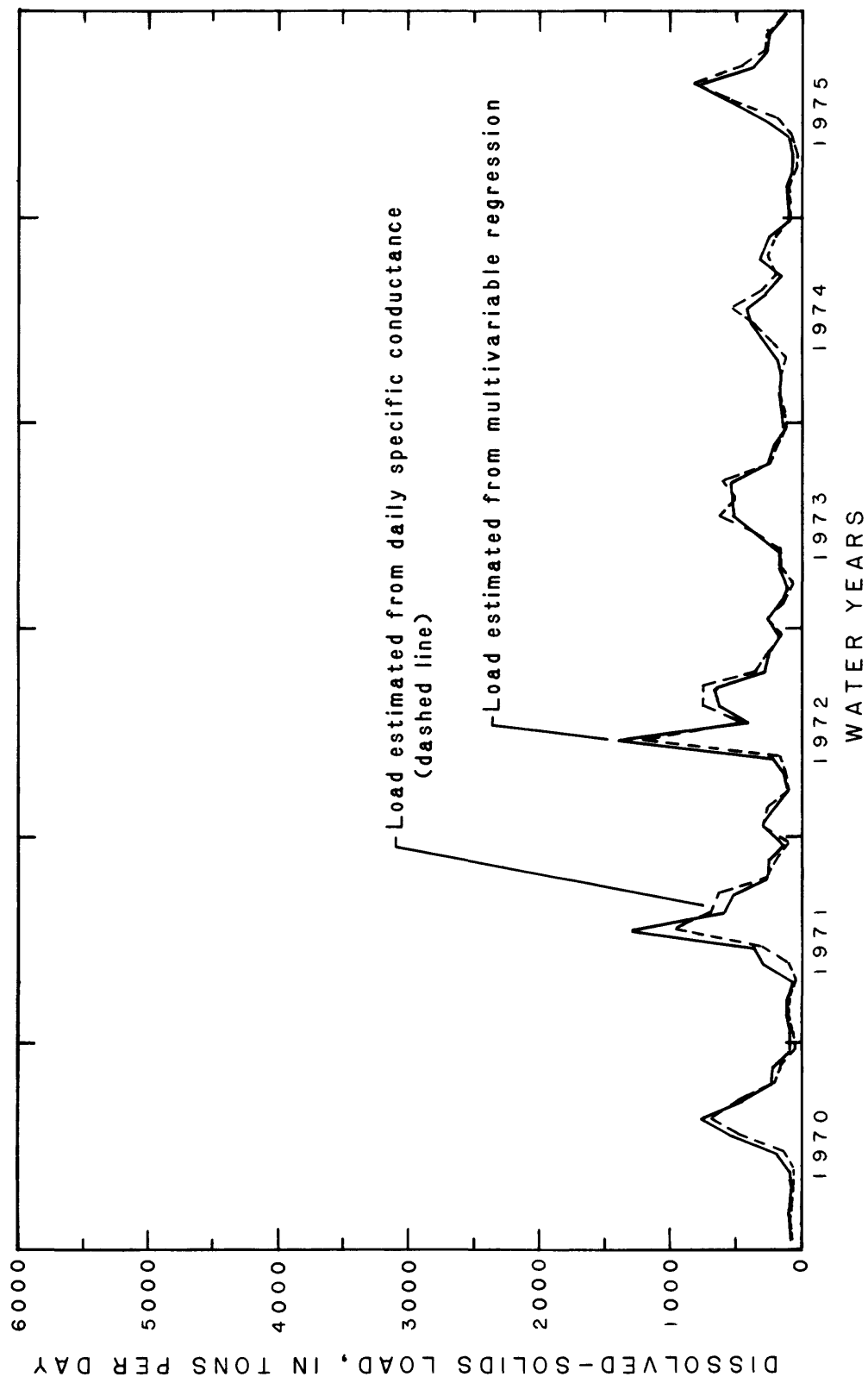


Figure 12.--Monthly mean dissolved-solids loads at station 06428500, Belle Fourche River at Wyoming-South Dakota State line.

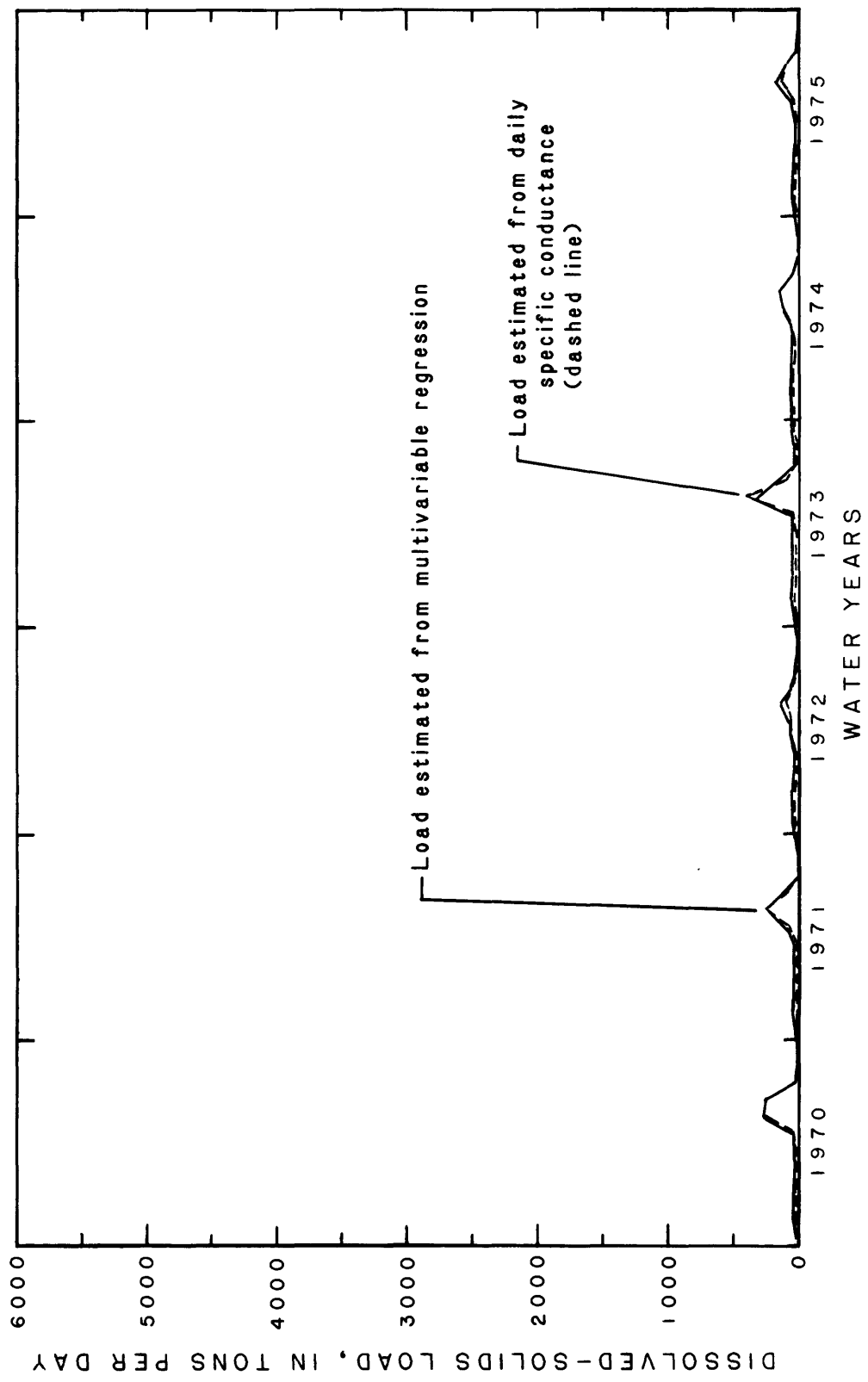
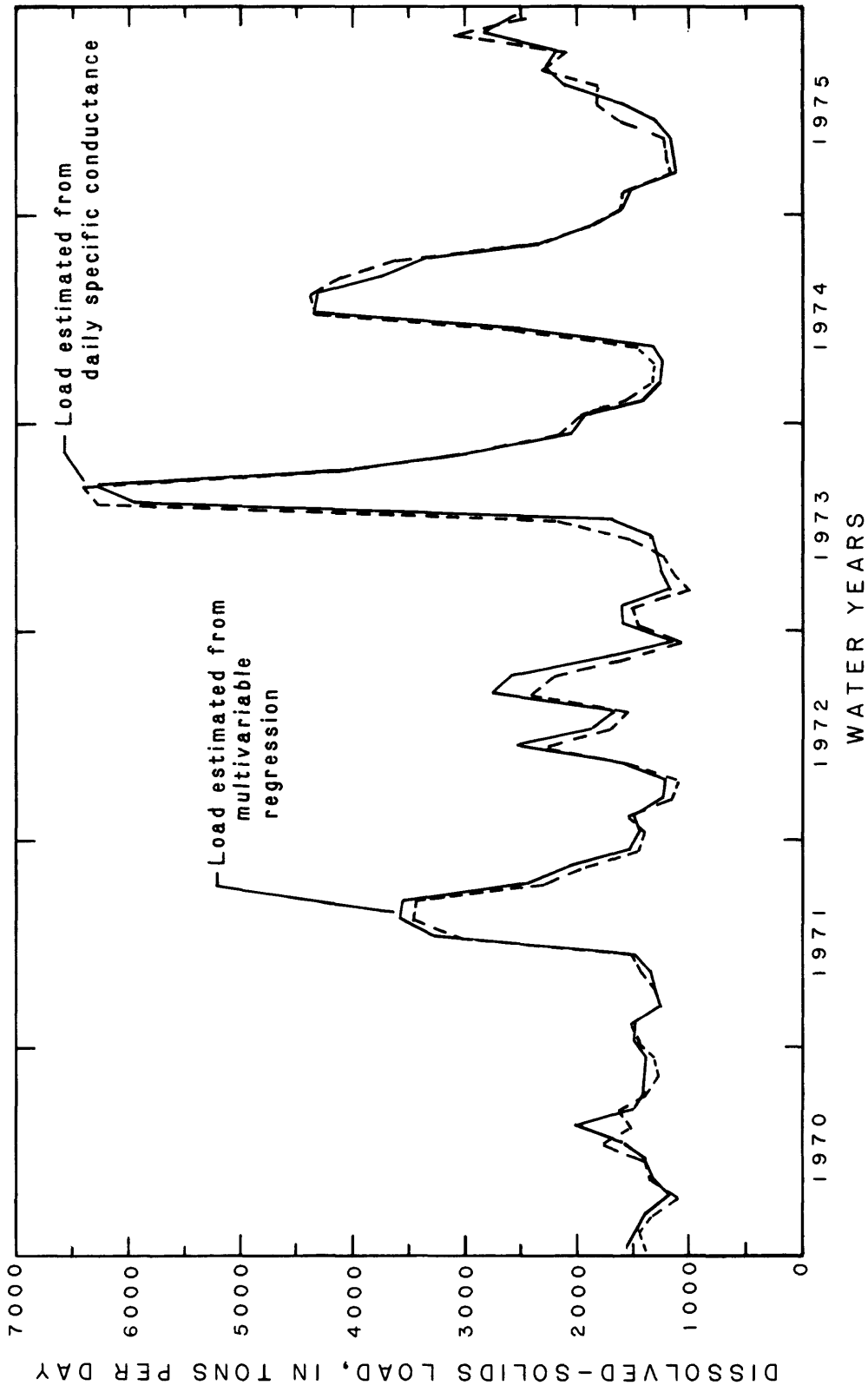


Figure 13.--Monthly mean dissolved-solids loads at station 06646600, Deer Creek below Millar Wasteway, at Glenrock, Wyoming.



**Figure 14.--Monthly mean dissolved-solids loads at station 06646800, North Platte River near Glenrock, Wyoming.**

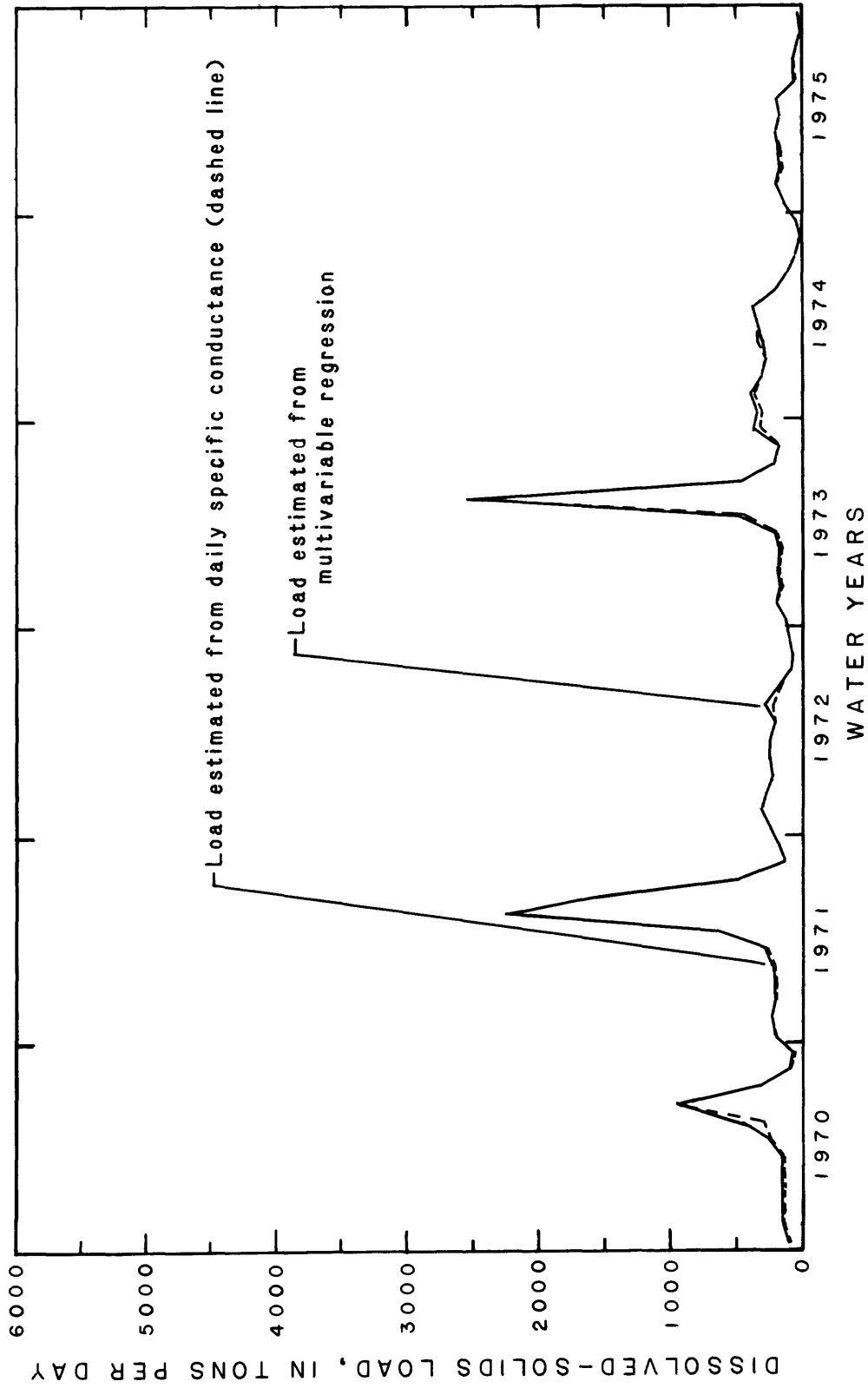


Figure 15.--Monthly mean dissolved-solids loads at station 06670500, Laramie River near Fort Laramie, Wyoming.

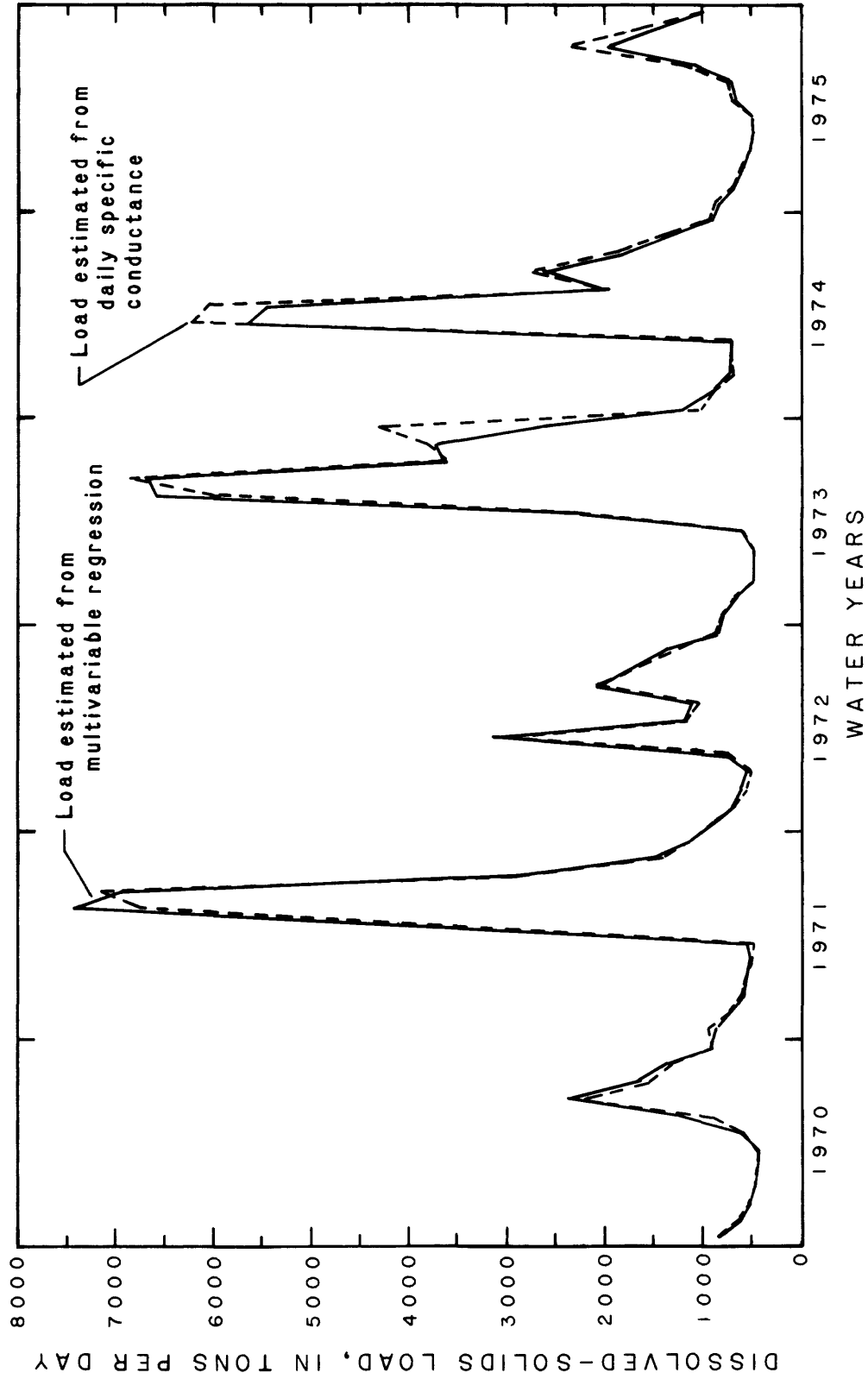


Figure 16.--Monthly mean dissolved-solids loads at station 06674500, North Platte River at Wyoming-Nebraska State line.

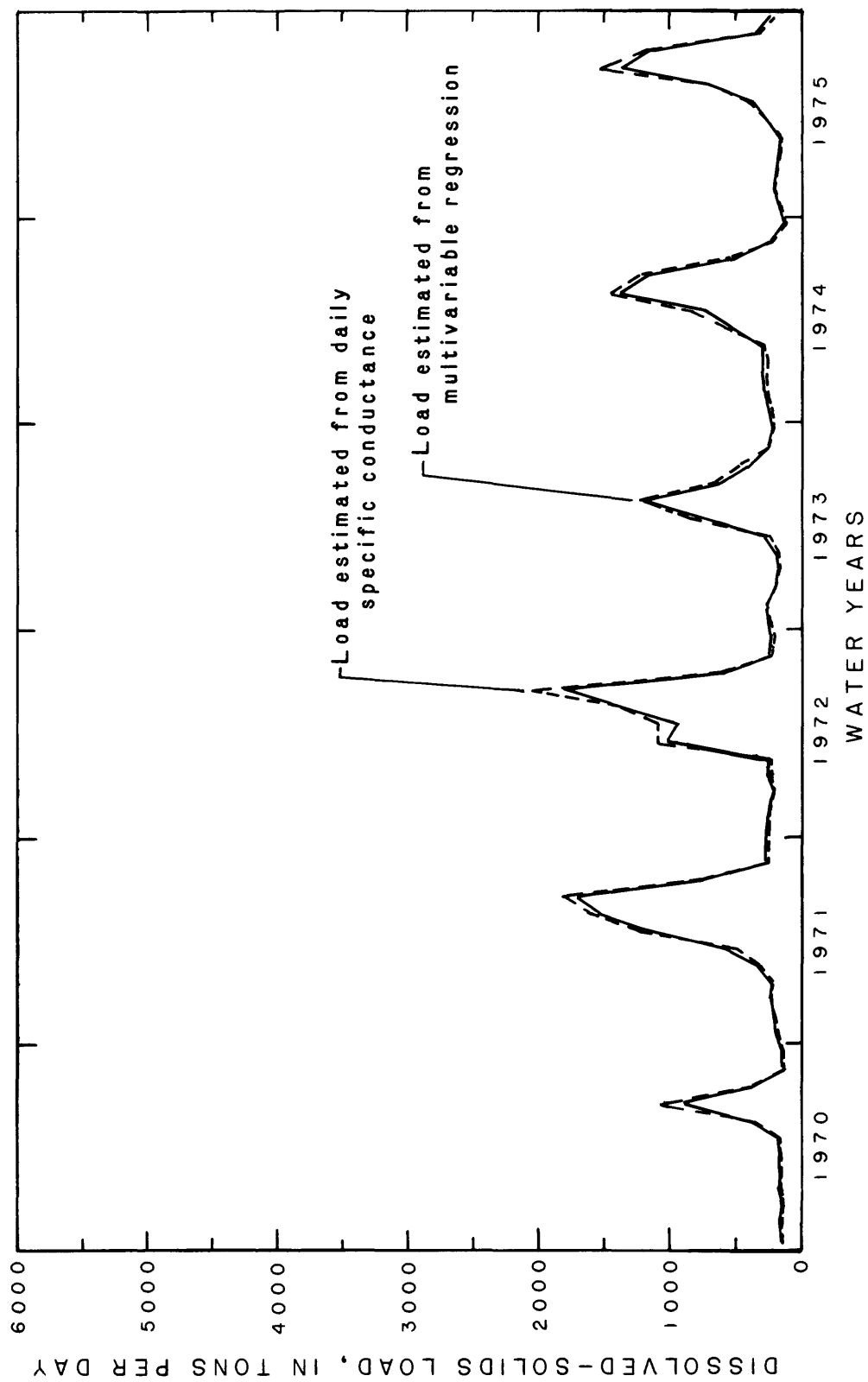


Figure 17.--Monthly mean dissolved-solids loads at station 10039500, Bear River at Border, Wyoming.

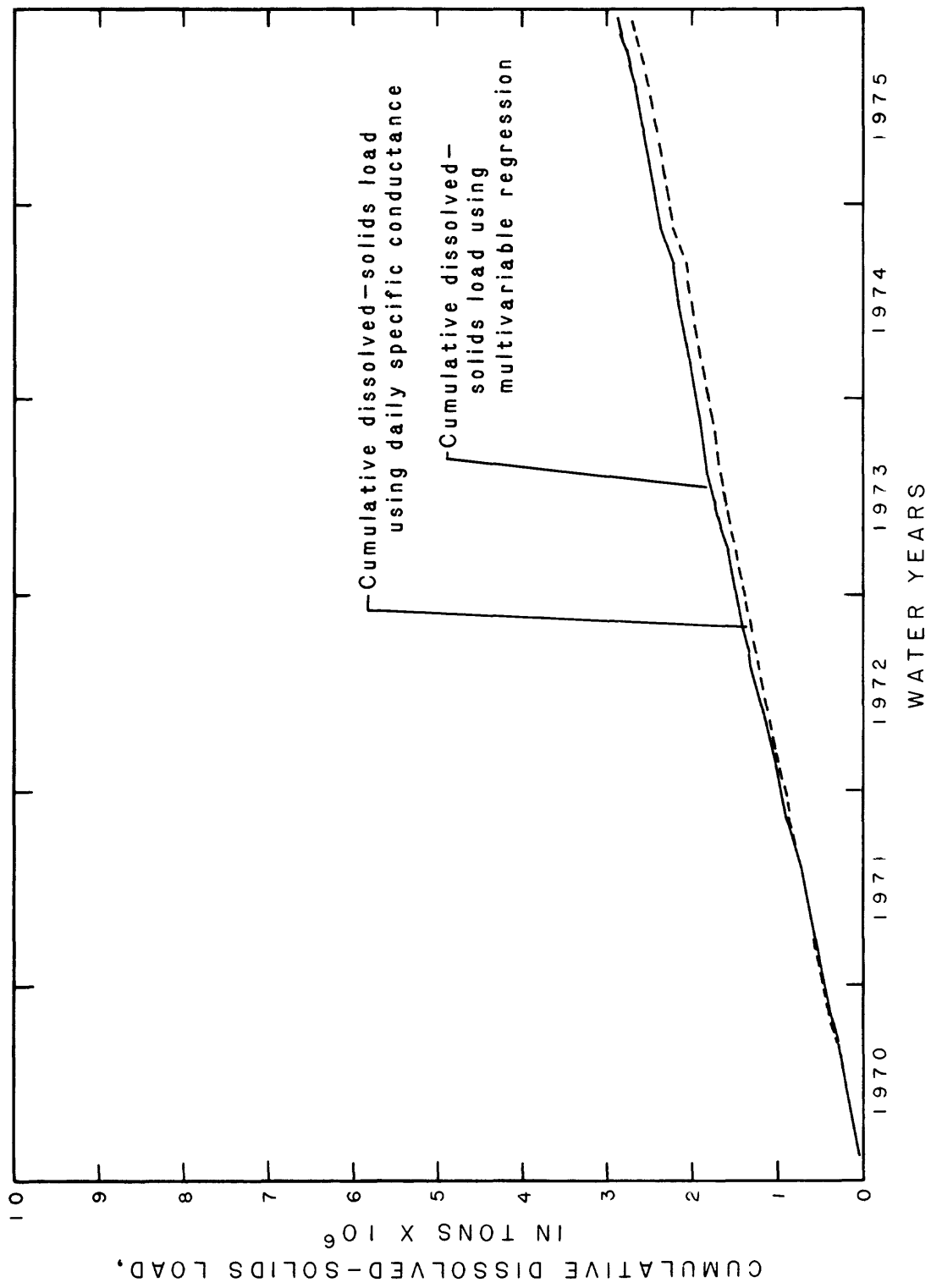


Figure 18.--Cumulative dissolved-solids load at station 06285100, Shoshone River near Lovell, Wyoming.



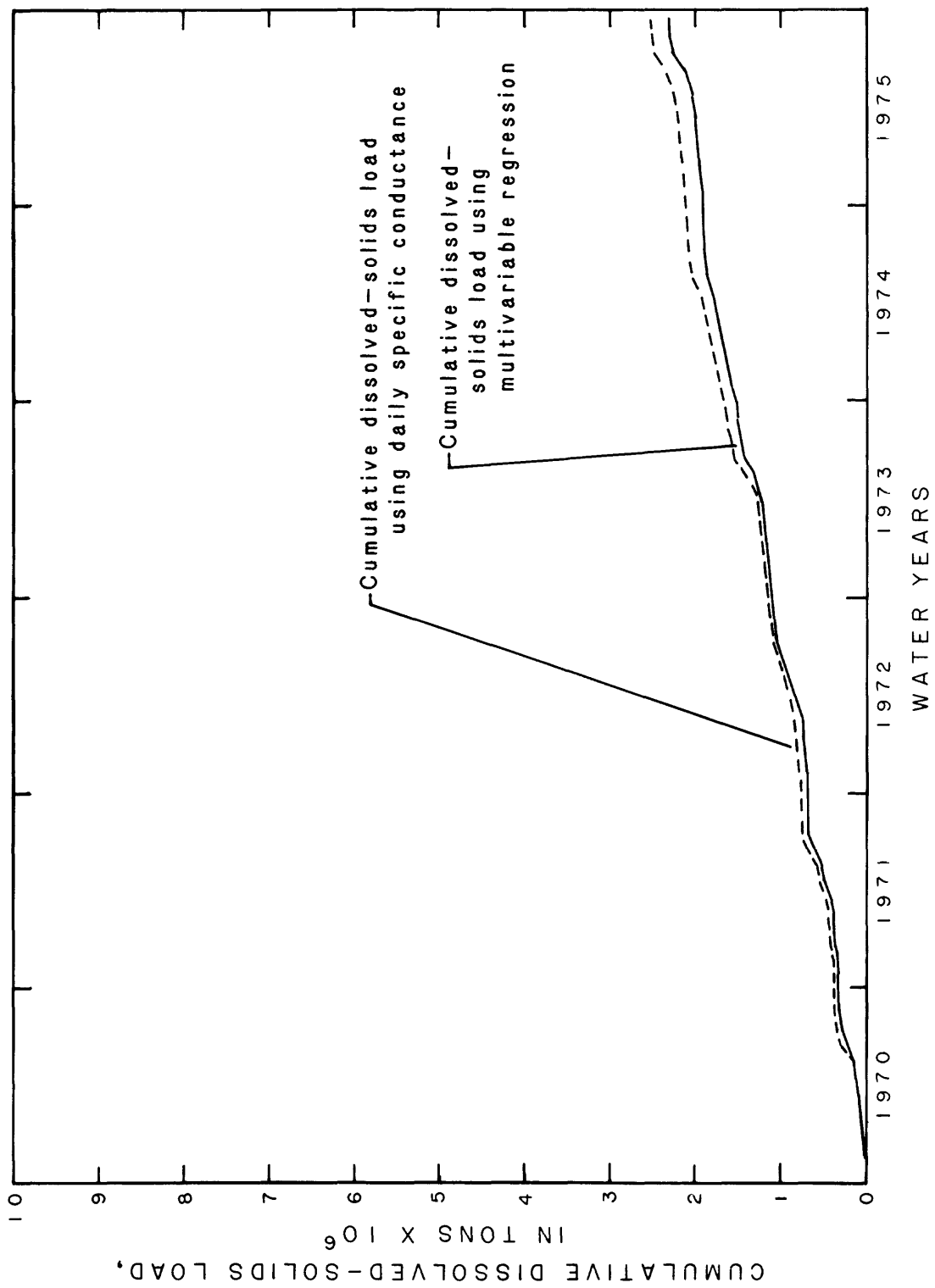
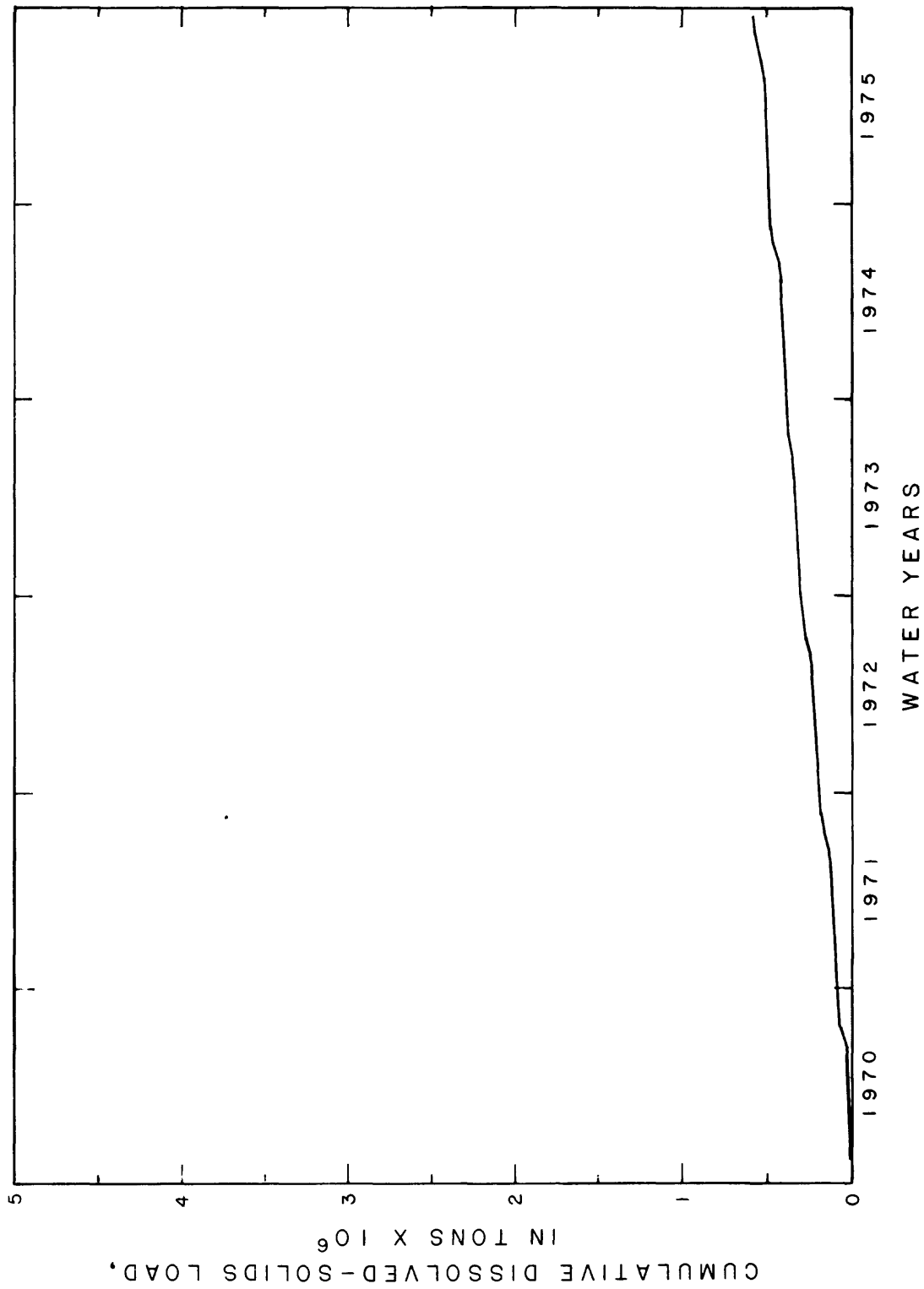


Figure 19.--Cumulative dissolved-solids load at station 06317000, Powder River at Arvada, Wyoming.



**Figure 20.--Cumulative dissolved-solids load at station 06207500, Clarks Fork Yellowstone River near Belfry, Montana.**

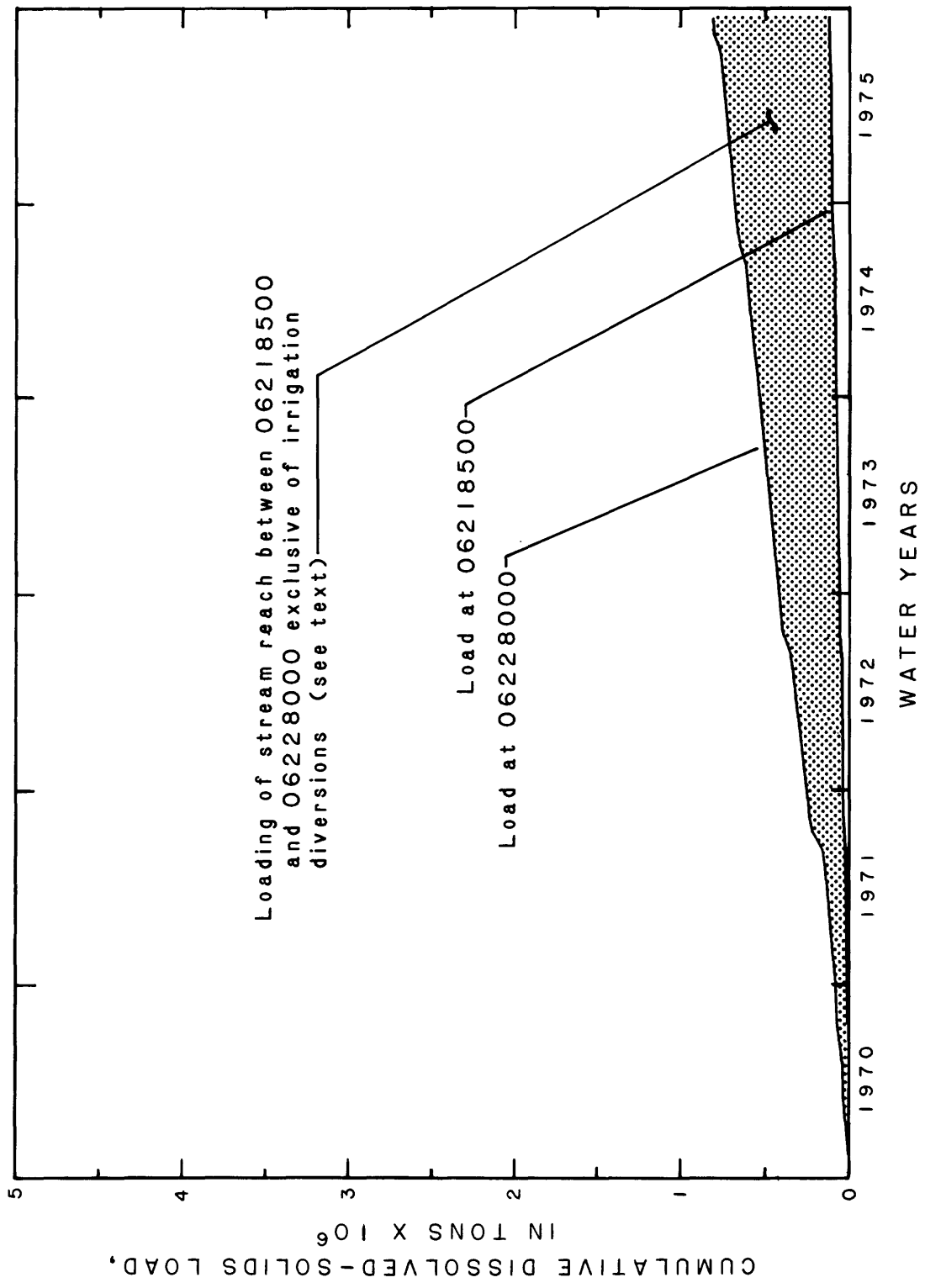


Figure 21.--Cumulative dissolved-solids loading in a reach of the Wind River between stations 06218500, Wind River near Dubois, Wyoming, and 06228000, Wind River at Riverton, Wyoming.

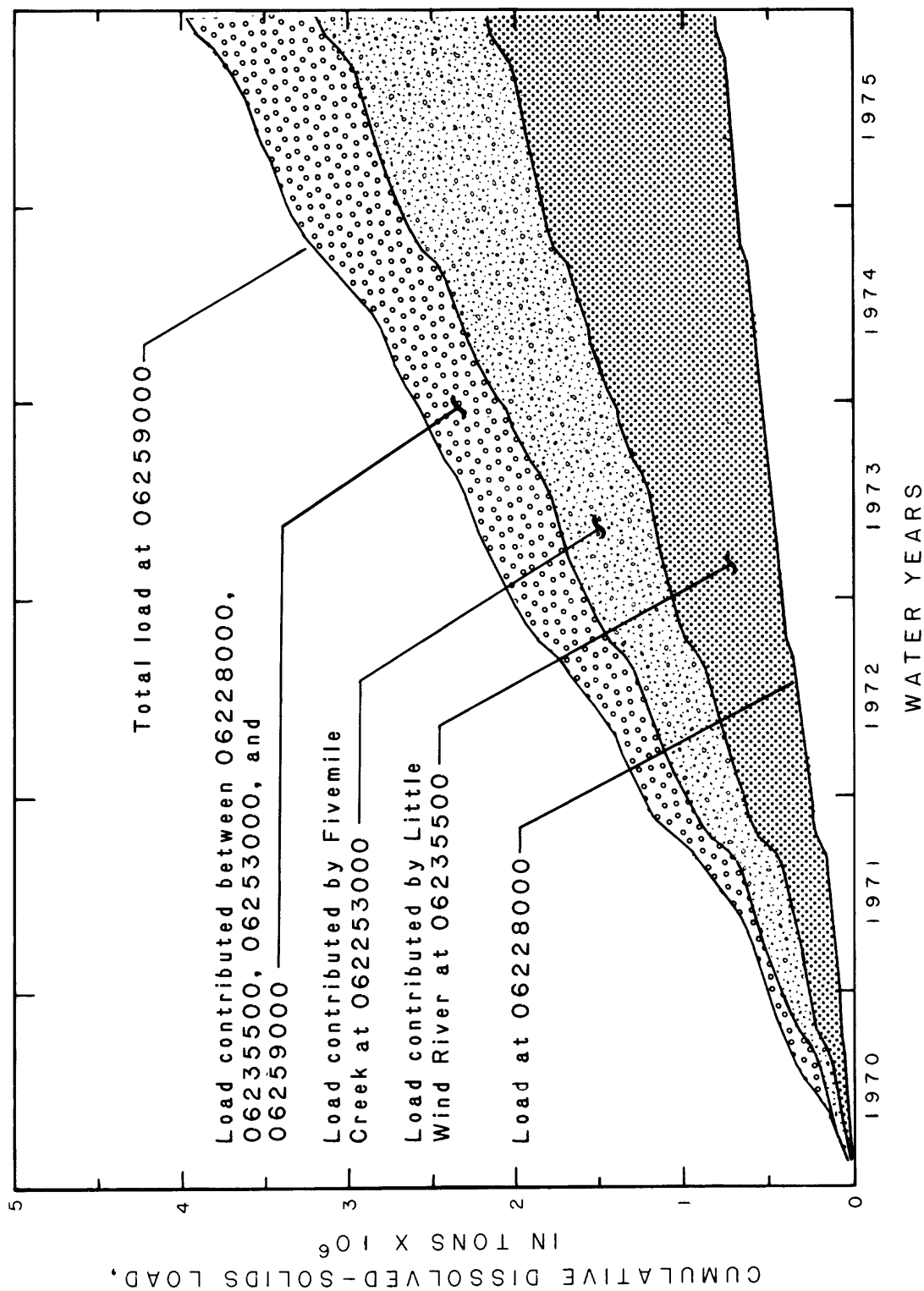


Figure 22.--Cumulative dissolved-solids load at stations 06228000, Wind River at Riverton, Wyoming; 06235500, Little Wind River near Riverton, Wyoming; 06253000, Fivemile Creek near Shoshoni, Wyoming; and 06259000, Wind River below Boysen Reservoir, Wyoming.

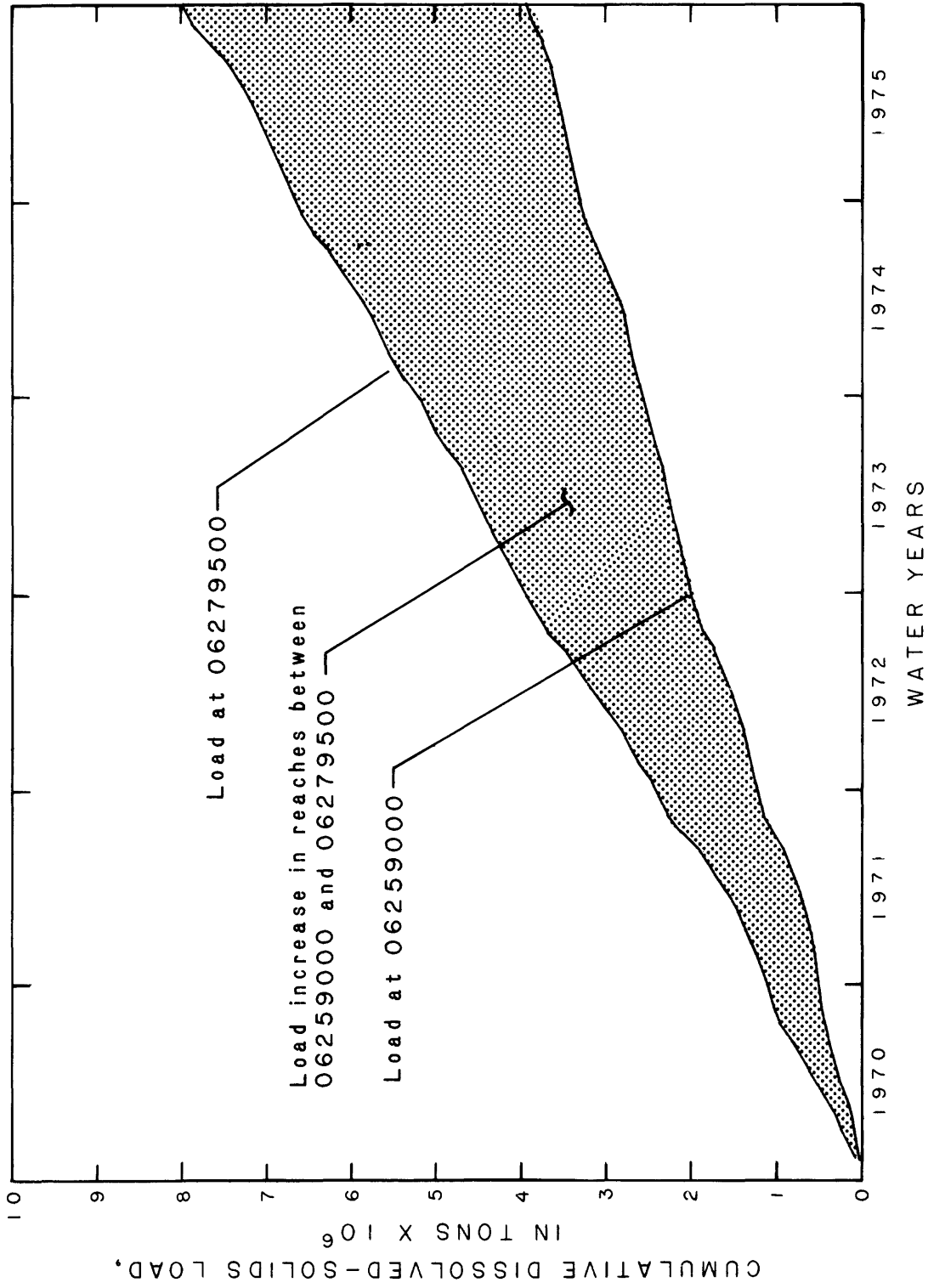


Figure 23.--Cumulative dissolved-solids load in reaches delimited by stations 06259000, Wind River below Boysen Reservoir, Wyoming, and 06279500, Bighorn River at Kane, Wyoming.

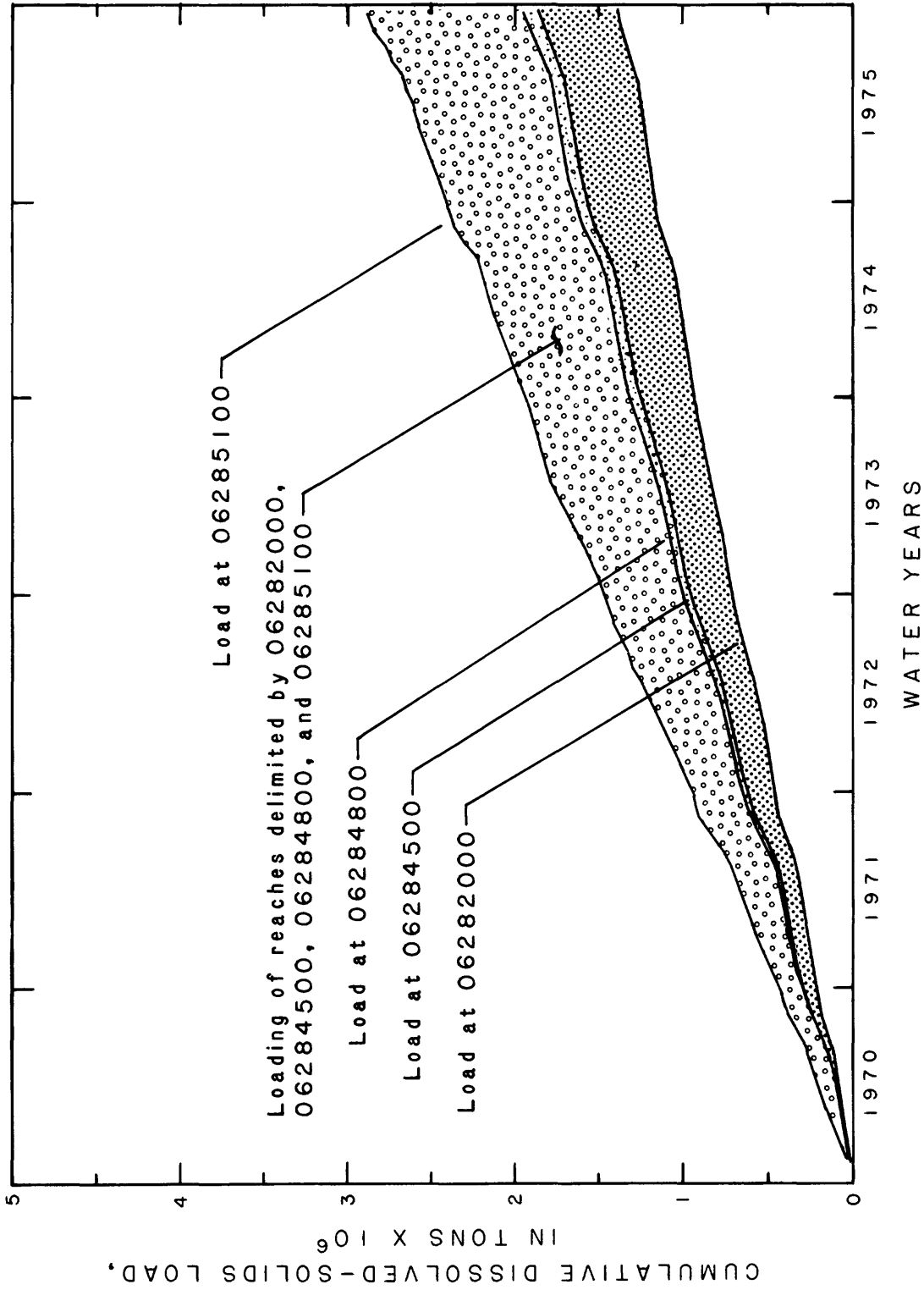


Figure 24.--Cumulative dissolved-solids load in reaches delimited by stations 06282000, Shoshone River below Buffalo Bill Reservoir, Wyoming, 06284500, Bitter Creek near Garland, Wyoming, 06284800, Whistle Creek near Garland, Wyoming, and 06285100, Shoshone River near Lovell, Wyoming.

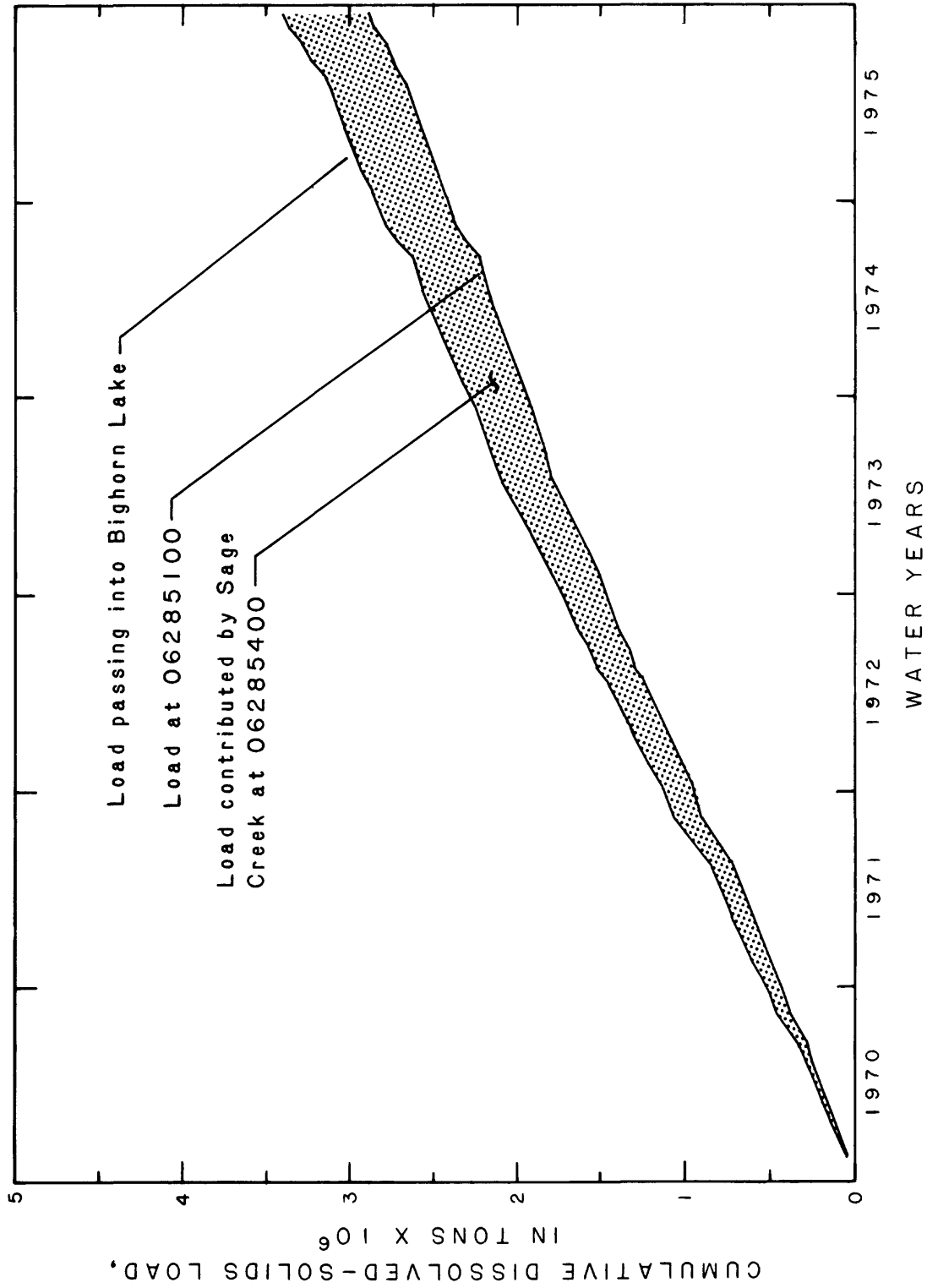


Figure 25.--Cumulative dissolved-solids load entering Bighorn Lake past stations 06285100, Shoshone River near Lovell, Wyoming, and 06285400, Sage Creek at Sidon Canal, near Deaver, Wyoming.

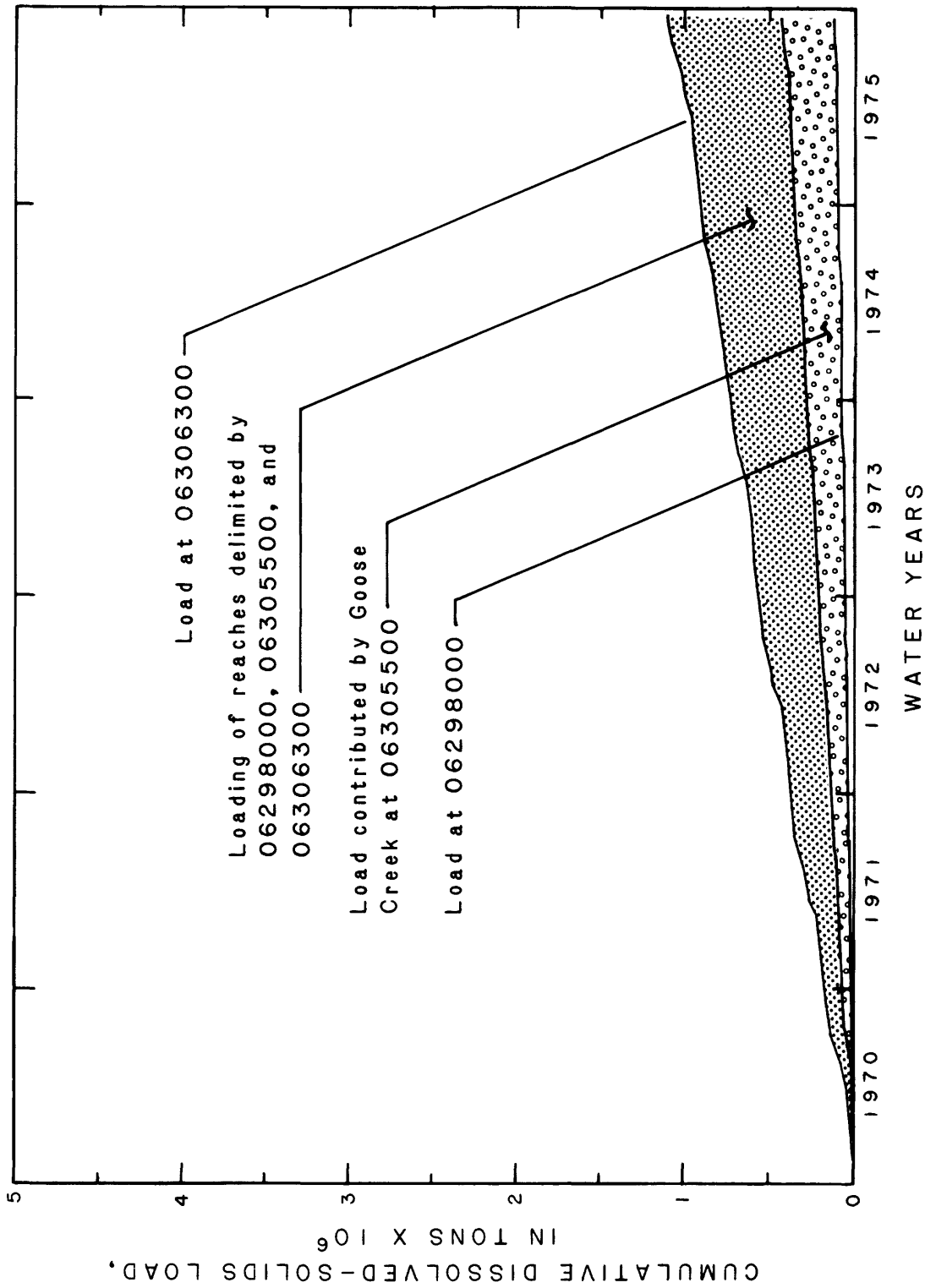


Figure 26.--Cumulative dissolved-solids load in reaches delimited by stations 06298000, Tongue River near Dayton, Wyoming; 06305500, Goose Creek below Sheridan, Wyoming; and 06306300, Tongue River at State line, near Decker, Montana.



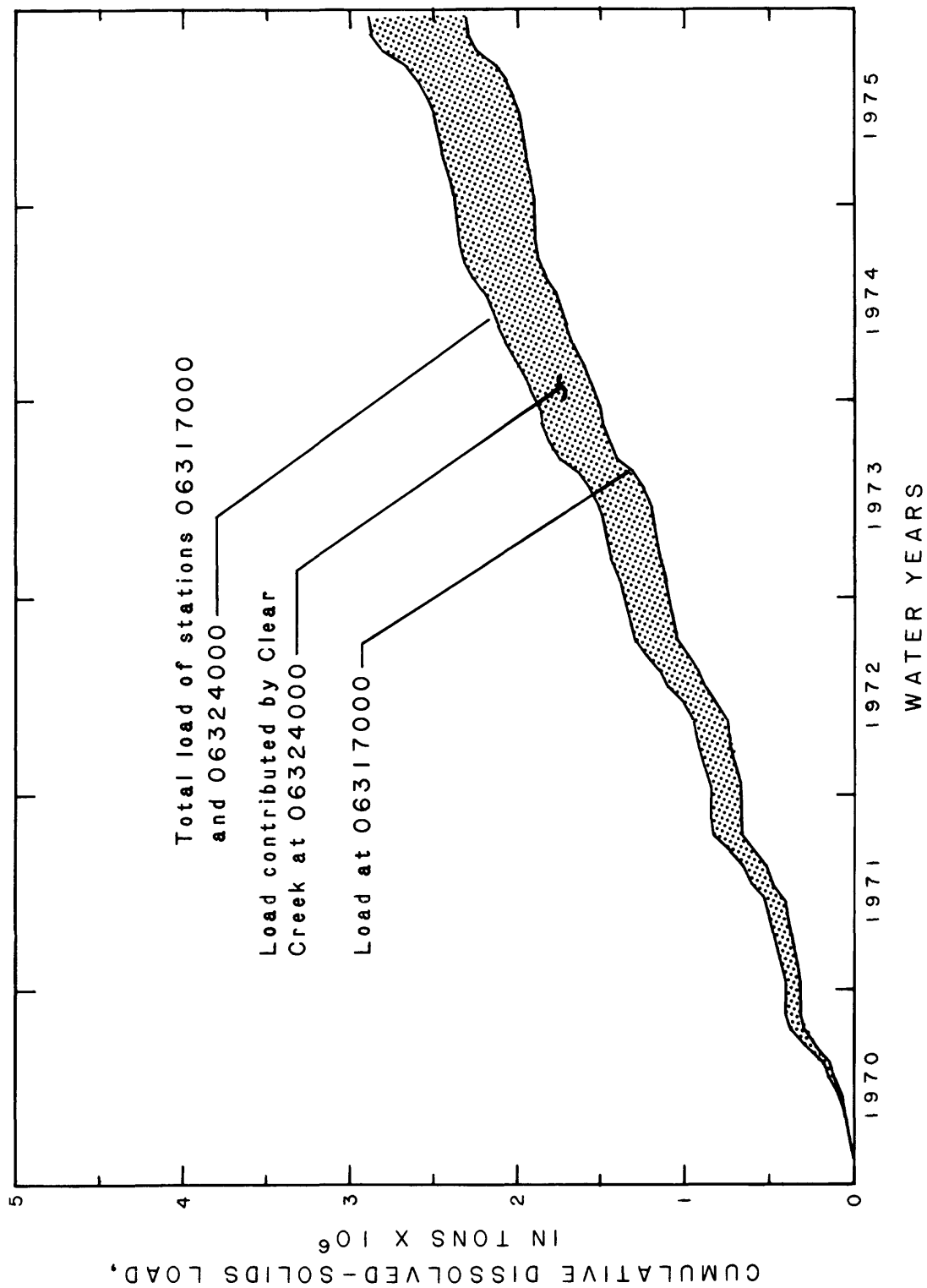
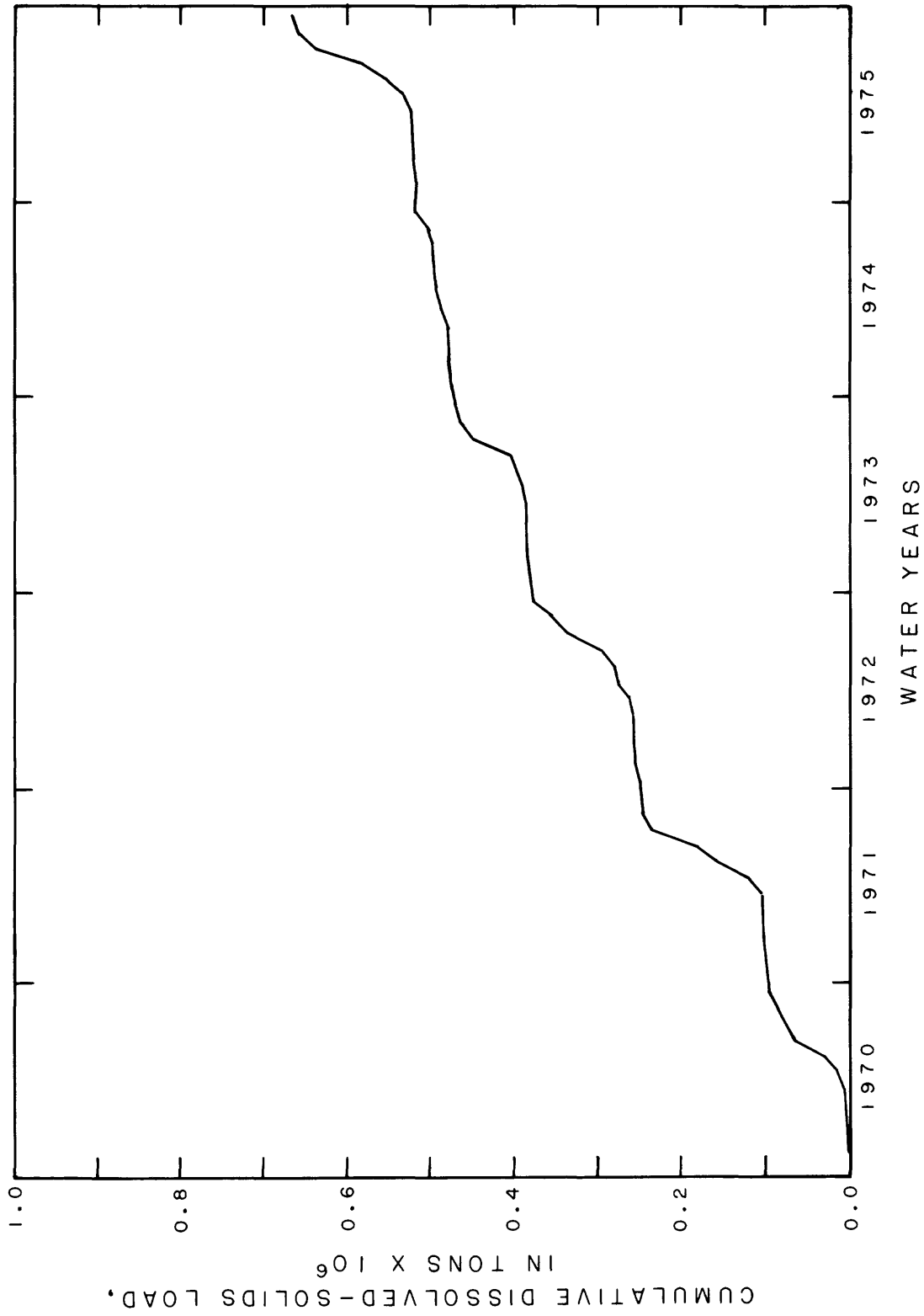
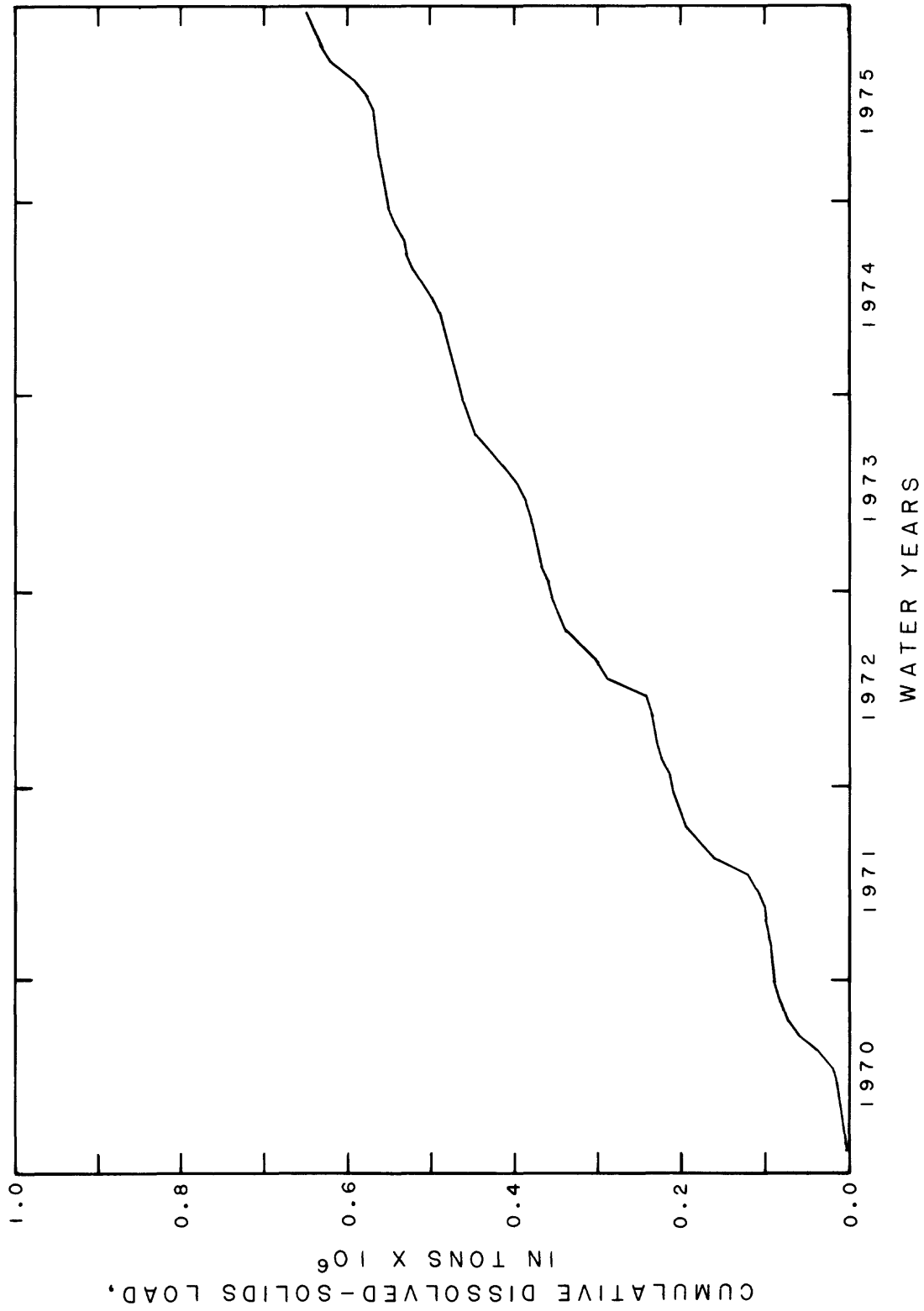


Figure 27.--Cumulative dissolved-solids load at stations 06317000, Powder River at Arvada, Wyoming, and 06324000, Clear Creek near Arvada, Wyoming.



**Figure 28.--Cumulative dissolved-solids load at station 06394000, Beaver Creek near Newcastle, Wyoming.**



**Figure 29.--Cumulative dissolved-solids load at station 06428500, Belle Fourche River at Wyoming-South Dakota State line.**

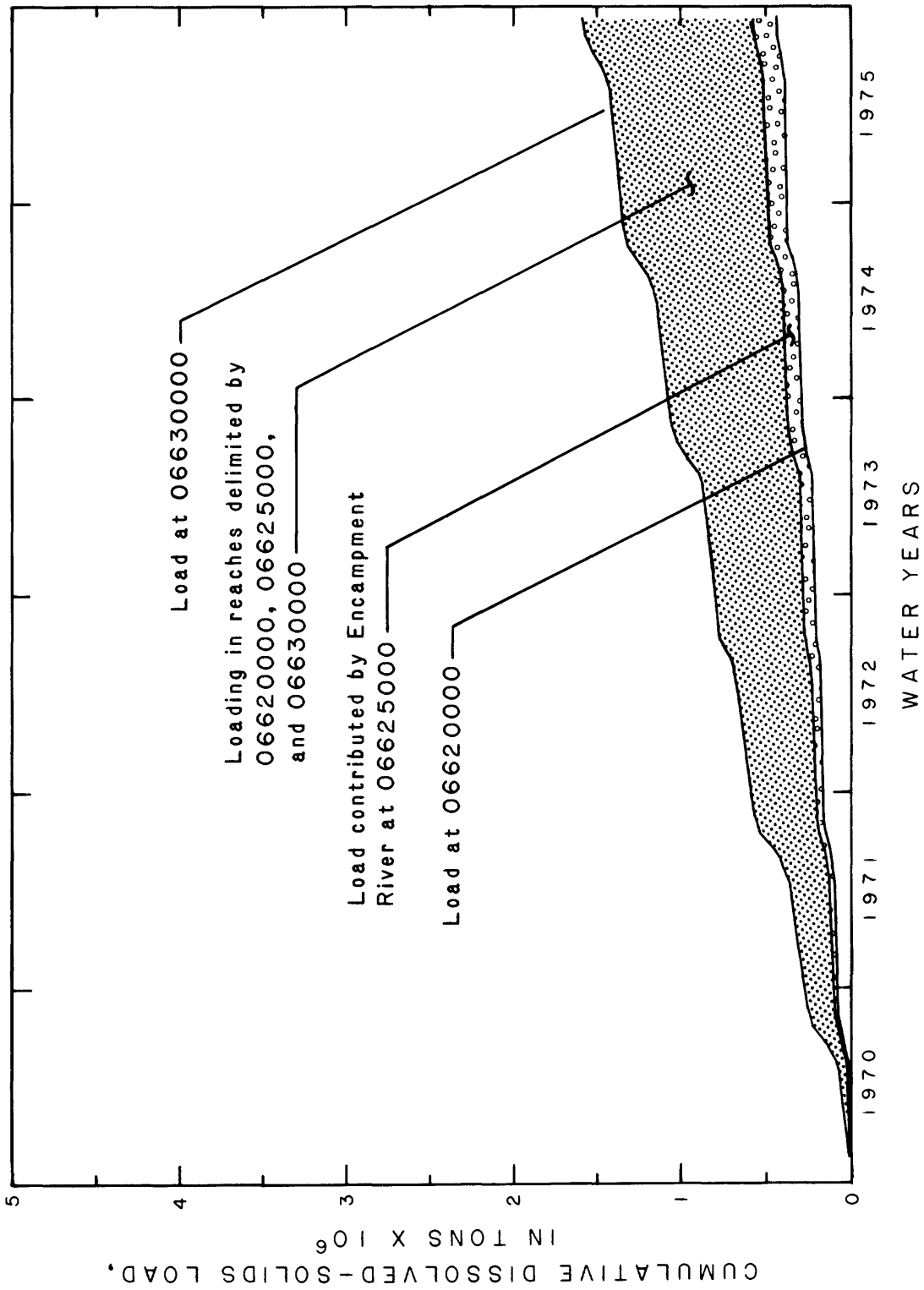


Figure 30.--Cumulative dissolved-solids loading in reaches delimited by stations 06620000, North Platte River near Northgate, Colorado; 06625000, Encampment River at mouth, near Encampment, Wyoming; and 06630000, North Platte River above Seminole Reservoir, near Sinclair, Wyoming.

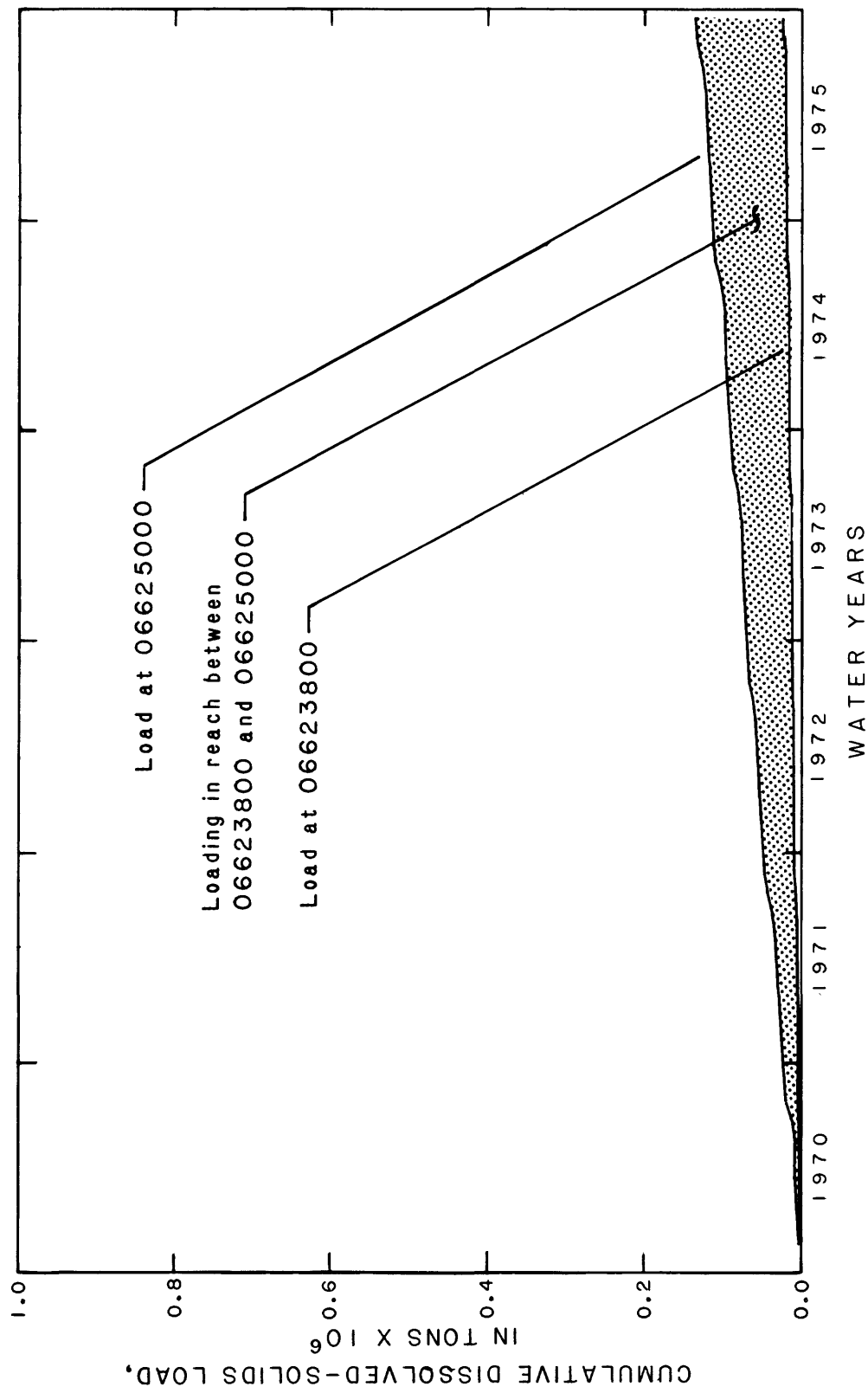
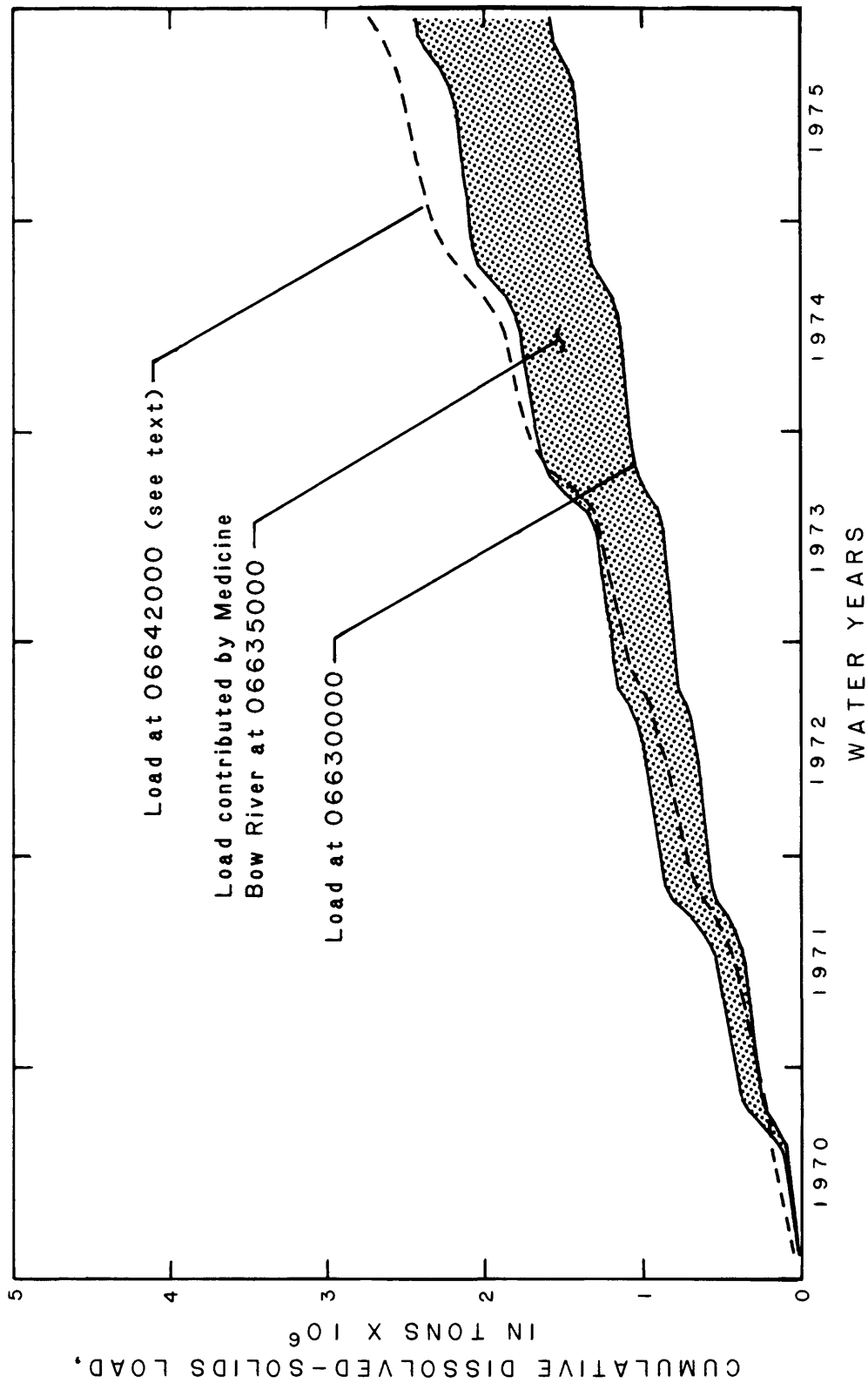


Figure 31.--Cumulative dissolved-solids loading in a reach of the Encampment River between stations 06623800, Encampment River above Hog Park Creek, near Encampment, Wyoming, and 06625000, Encampment River at mouth, near Encampment, Wyoming.



**Figure 32.--Cumulative dissolved-solids load in reaches delimited by stations 06630000, North Platte River above Seminoe Reservoir, near Sinclair, Wyoming; 06635000, Medicine Bow River above Seminoe Reservoir, near Hanna, Wyoming; and 06642000, North Platte River at Alcova, Wyoming.**

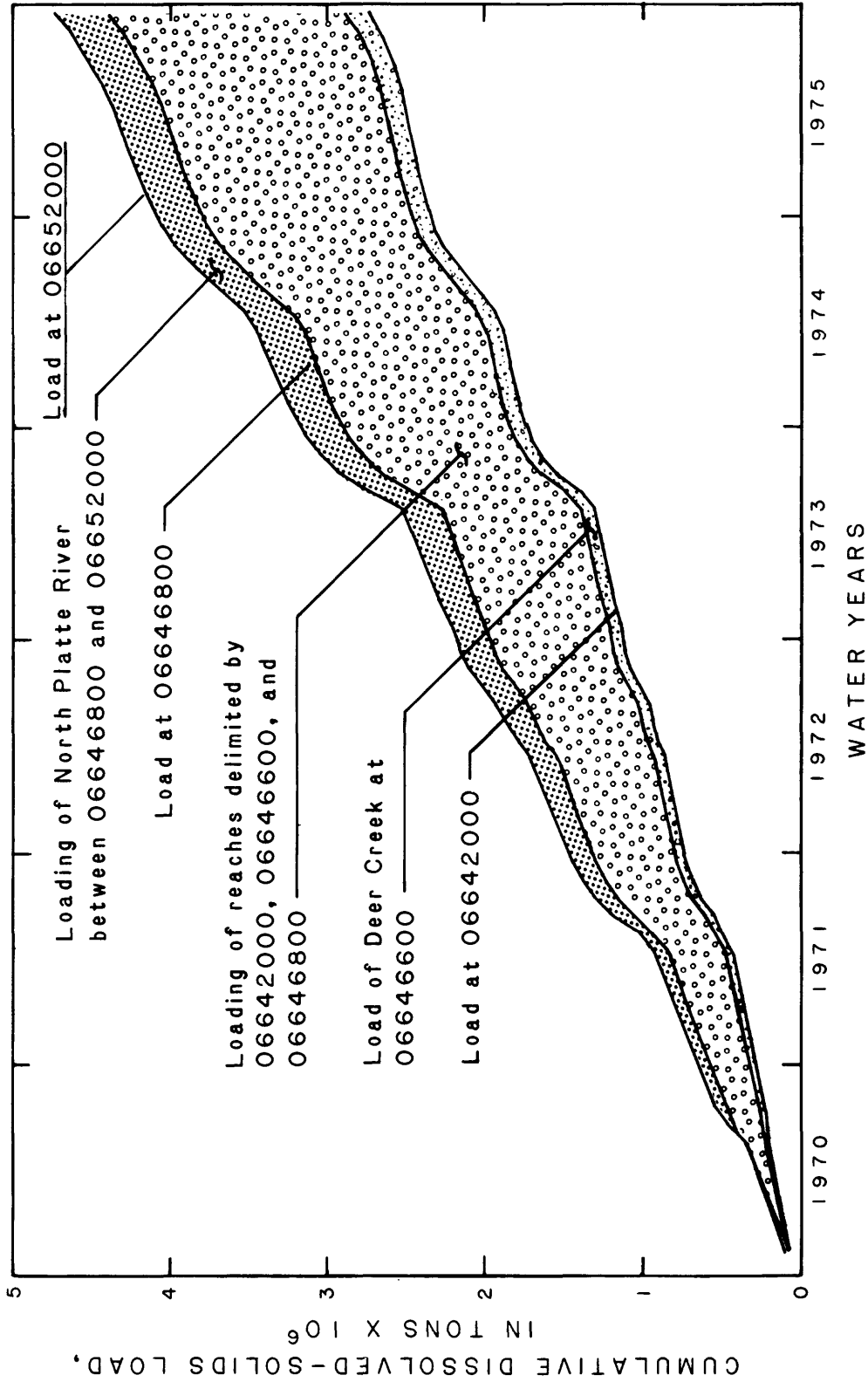
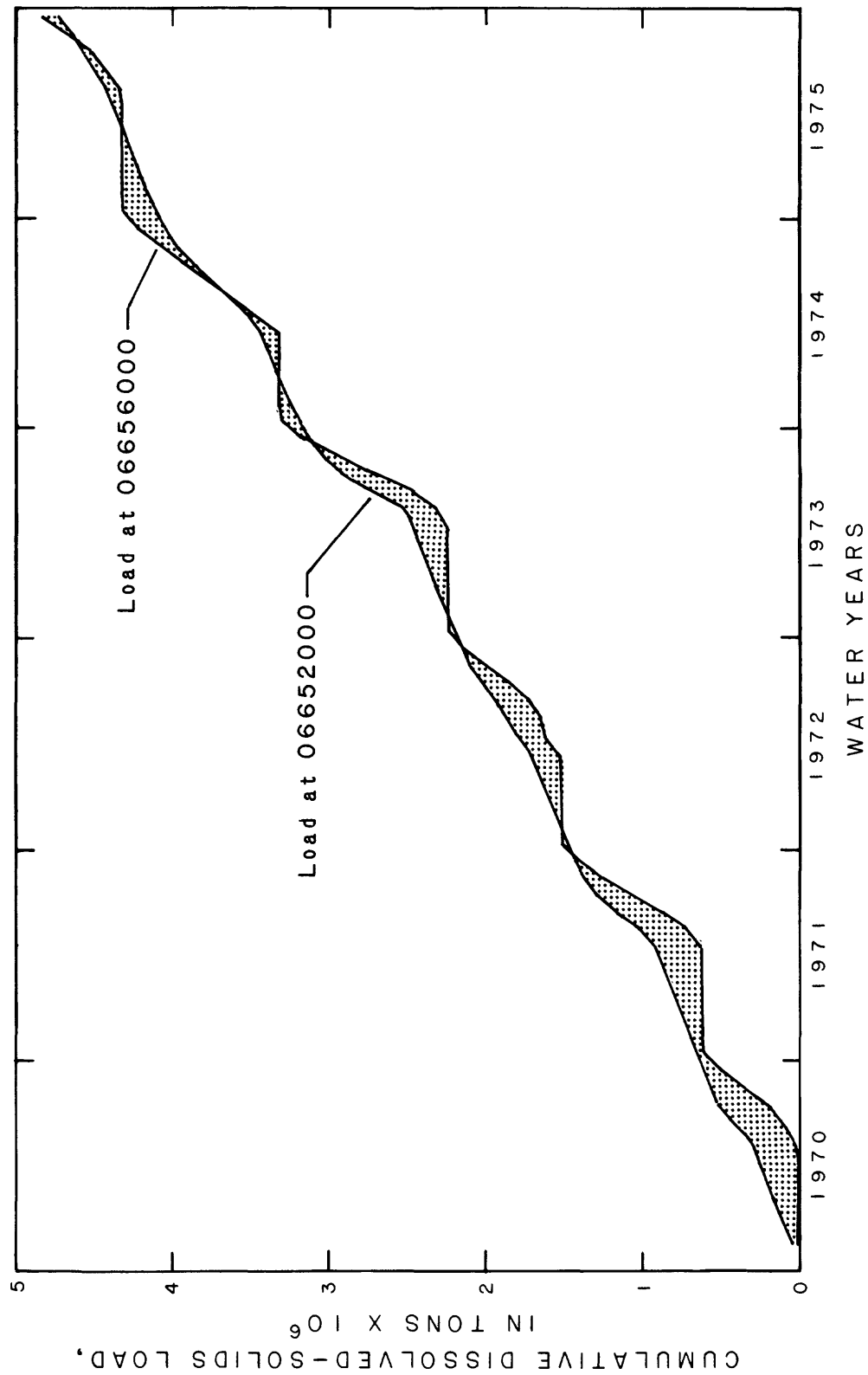


Figure 33.--Cumulative dissolved-solids loading in reaches delimited by stations 06642000, North Platte River at Alcova, Wyoming; 06646600, Deer Creek below Millar Wasteway, at Glenrock, Wyoming; 06646800, North Platte River near Glenrock, Wyoming; and 06652000, North Platte River at Orin, Wyoming.



**Figure 34.--Cumulative dissolved-solids loading in a reach of the North Platte River between stations 06652000, North Platte River at Orin, Wyoming, and 06656000, North Platte River below Guernsey Reservoir, Wyoming.**



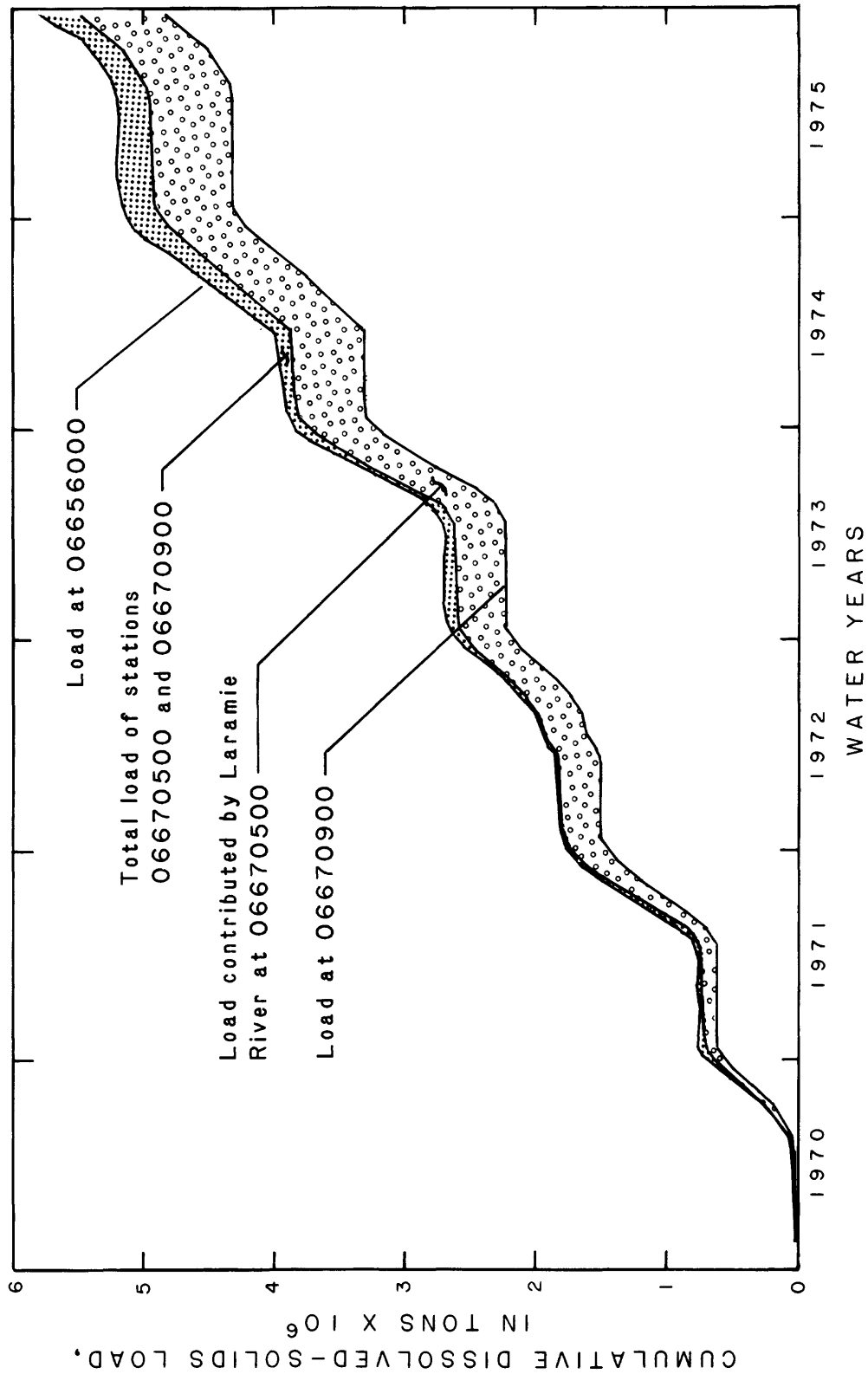
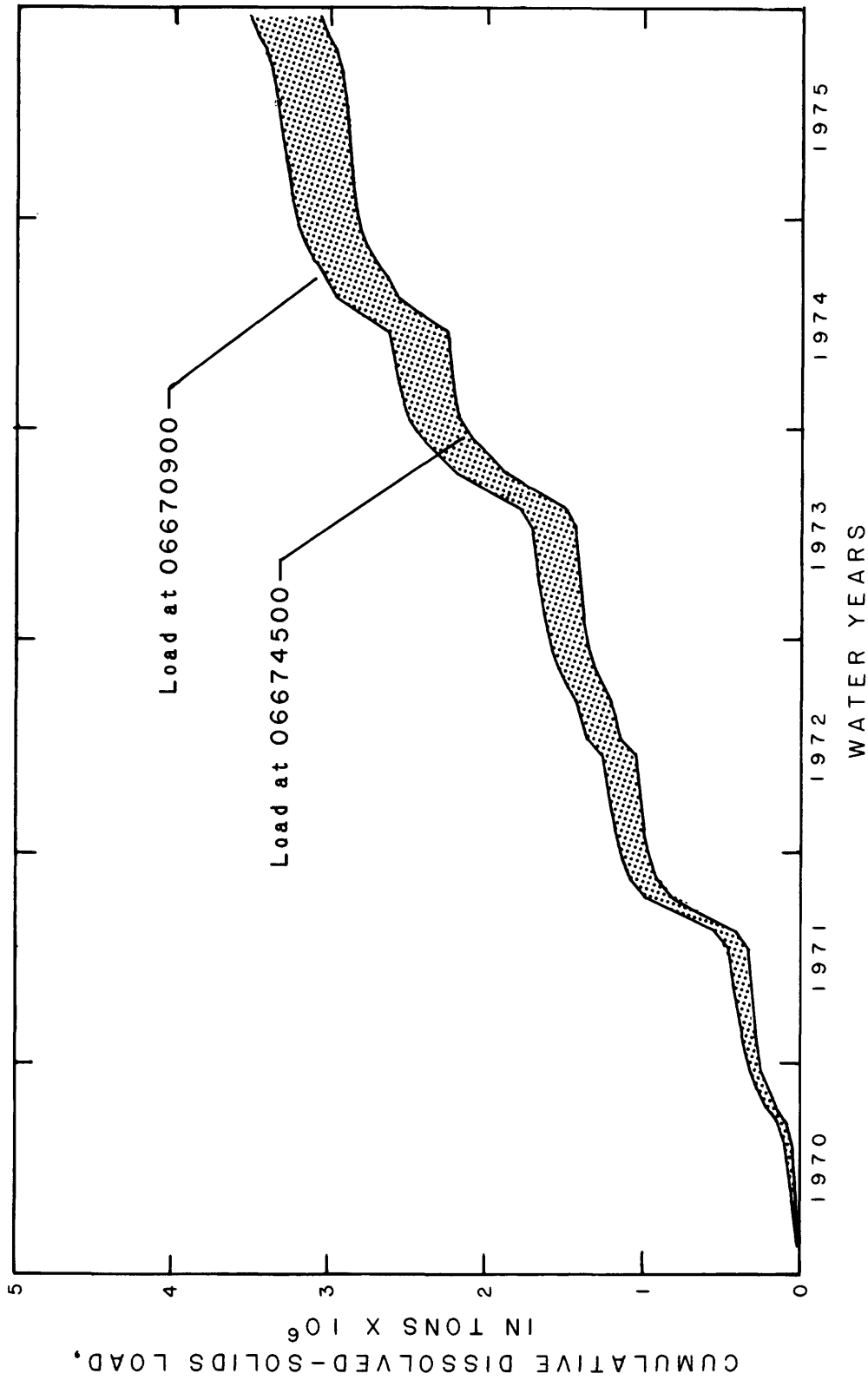


Figure 35.--Cumulative dissolved-solids load at stations 06656000, North Platte River below Guernsey Reservoir, Wyoming; 06670500, Laramie River near Fort Laramie, Wyoming; and 06670900, North Platte River near Lingle, Wyoming.



**Figure 36.--Cumulative dissolved-solids load at stations 06670900, North Platte River near Lingle, Wyoming, and 06674500, North Platte River at Wyoming-Nebraska State line.**

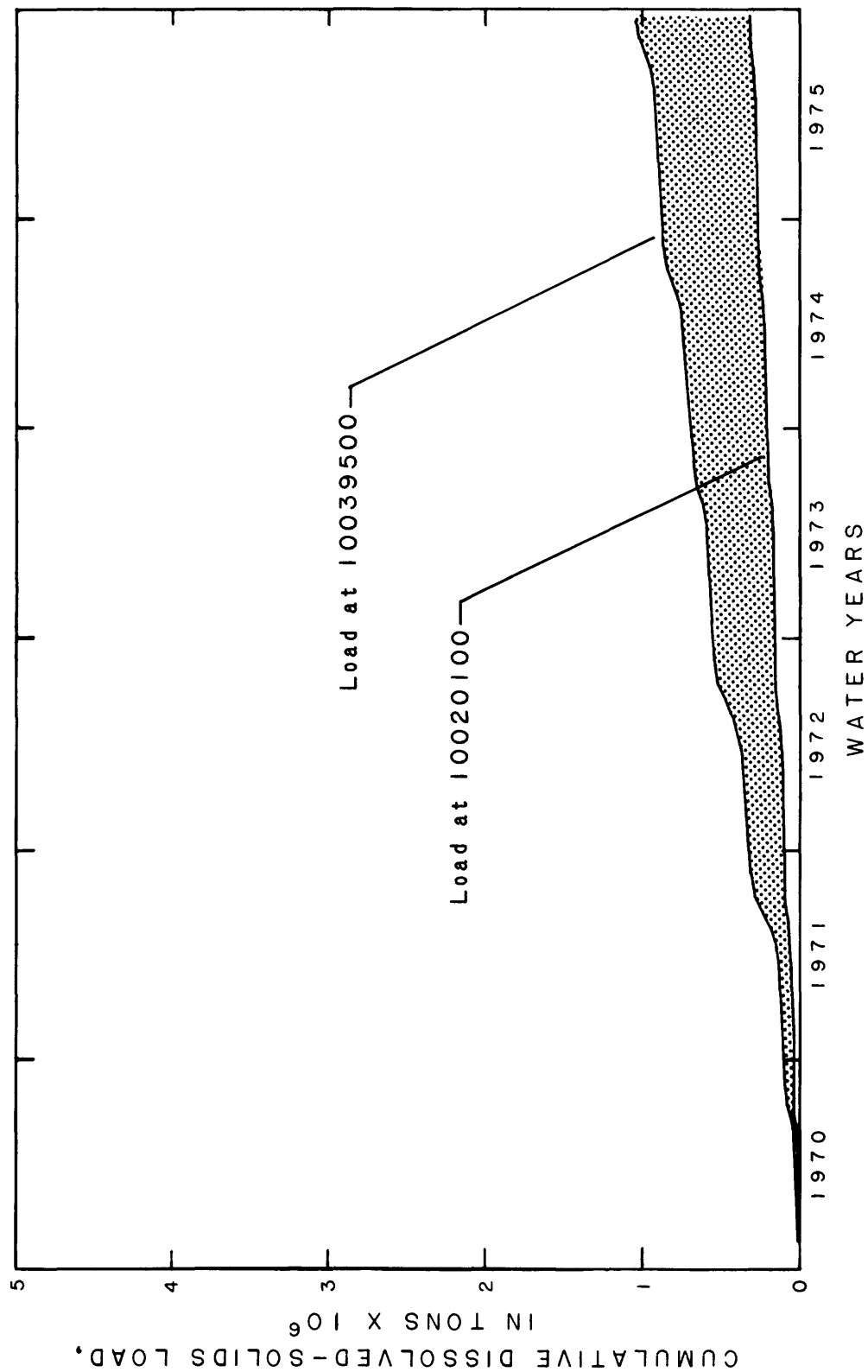
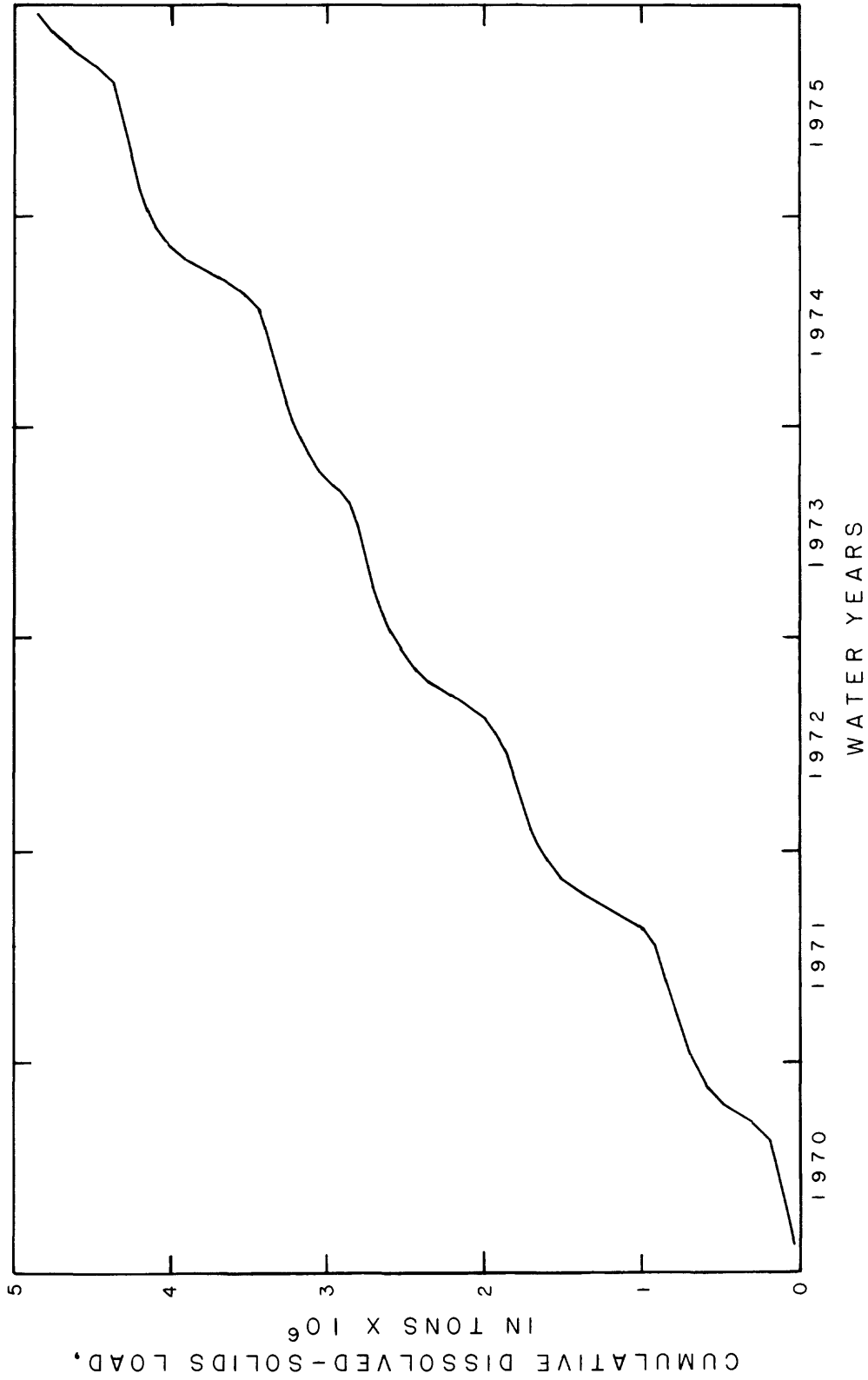


Figure 37.--Cumulative dissolved-solids load at stations 10020100, Bear River above reservoir, near Woodruff, Utah, and 10039500, Bear River at Border, Wyoming.



**Figure 38.--Cumulative dissolved-solids load at station 13022500, Snake River above reservoir, near Alpine, Wyoming.**

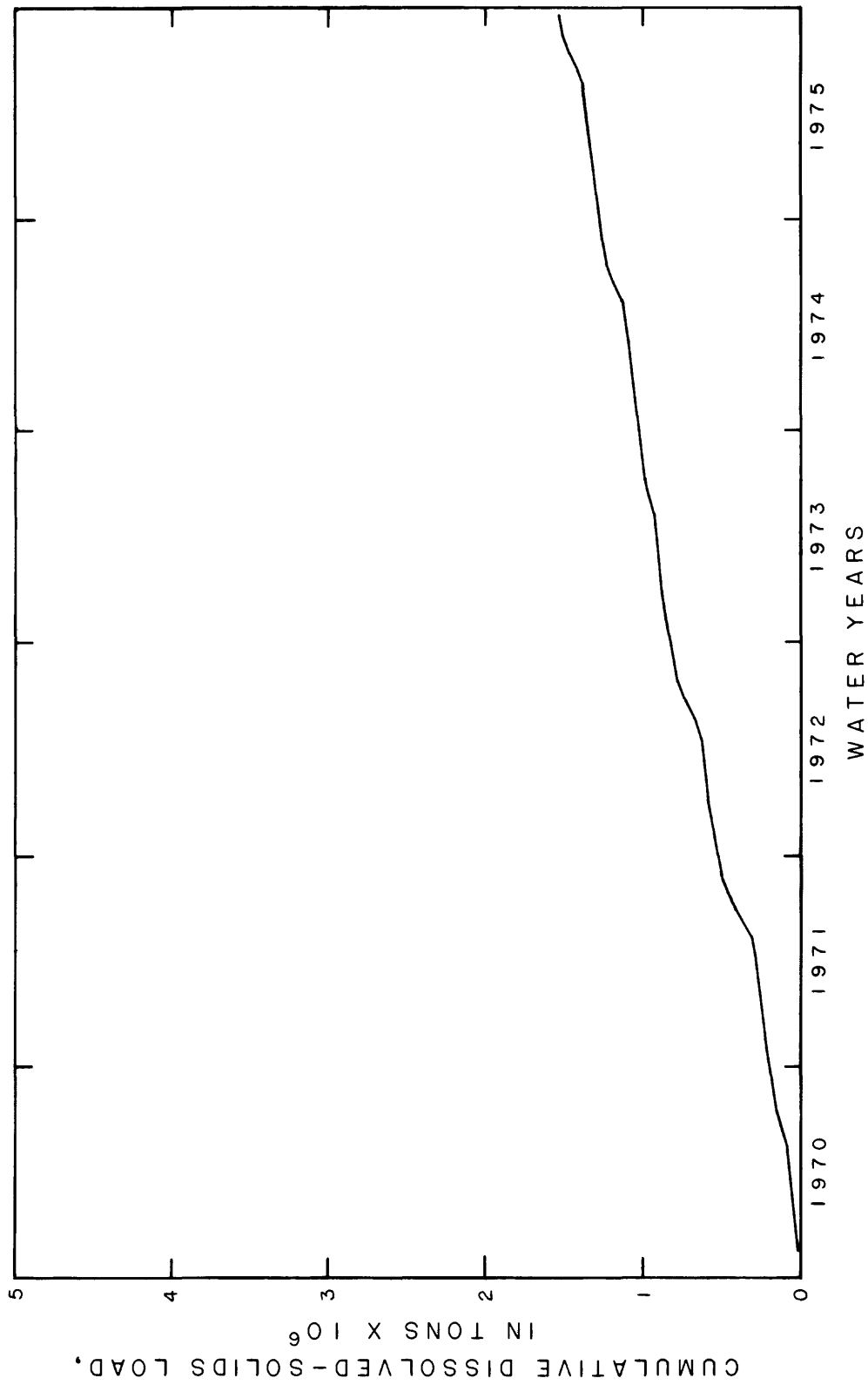


Figure 39.--Cumulative dissolved-solids load at station 13027500, Salt River above reservoir, near Etna, Wyoming.

Accumulated loads for the stations during 1970-75 water years were approximately as follows:

| Station<br>number | Tons                |
|-------------------|---------------------|
| 06228000          | 0.8x10 <sup>6</sup> |
| 06235500          | 1.4x10 <sup>6</sup> |
| 06253000          | 1.0x10 <sup>6</sup> |
| 06259000          | 4.0x10 <sup>6</sup> |

The dissolved-solids loading of the Bighorn River between Boysen Reservoir and Kane, Wyo. is shown in figure 23. There are no gaging stations on tributaries to the Bighorn River with which water-quality data can be closely associated. Therefore, loads of the individual tributaries cannot be estimated. The load contribution of tributaries and return flows for the 6 years is approximately 4x10<sup>6</sup> tons. The contribution to load from tributaries and return flows between stations 06259000 and 06279500 is as much as that contributed by the area upstream of station 06279500.

The loading of the Shoshone River between Buffalo Bill Reservoir (station 06282000) and Lovell (station 06285100) is shown in figure 24. Approximately 32 percent of the 2.9x10<sup>6</sup> tons passing the Shoshone River near Lovell is contributed by tributaries and return flows not monitored by the surface-water-quality network.

The load entering Bighorn Lake via the Shoshone River is shown in figure 25. Sage Creek at Sidon Canal (station 06285400) is approximately 8 miles upstream from the confluence of Sage Creek and the Shoshone River, and some return flows probably are not accounted for by this station. Approximately 59 percent of the load entering Bighorn Lake through the Shoshone River originates downstream from Buffalo Bill Reservoir.

The loading of the Tongue River between Dayton (station 06298000) and the State line (station 06306300) is illustrated in figure 26. Approximately 68 percent of the dissolved-solids load originates downstream from the Goose Creek below Sheridan station (06305500) and the Dayton station.

The loading of the Powder River (station 06317000) at Arvada and the load contributed to the Powder River by Clear Creek (station 06324000) is shown in figure 27. The total of these two loads approximates the cumulative load at the State line (2.8x10<sup>6</sup> tons) for the 6 water years.

The loading at Beaver Creek near Newcastle (station 06394000) is shown in figure 28 and at Belle Fourche River at Wyoming-South Dakota State line (station 06428500) in figure 29.

The dissolved-solids load in the reach of the North Platte River between Northgate (station 06620000 near the Colorado State line) and Seminoe Reservoir (station 06630000) is illustrated in figure 30. Many tributaries enter the river in this reach but only the Encampment River is measured. The source of approximately 63 percent of the load is not shown in the hydrograph. The dissolved-solids loading in a reach of the Encampment River between station 06623800 (above Hog Park Creek) and station 06625000 (at mouth) is depicted in figure 31.

The dissolved-solids loading in a reach of the North Platte River between Seminoe Reservoir (station 06630000) and Alcova Reservoir near Alcova (station 06642000) is shown in figure 32. The only tributary with a complete record for the 1970-75 water years is the Medicine Bow River above Seminoe Reservoir (station 06635000). The reach of the North Platte River between stations 06630000 and 06642000 contains four reservoirs. Three of them, Seminoe, Pathfinder, and Alcova gained approximately 1,120,000 acre-feet of storage during the 1970-72 water years. This accounts for the apparent loss of dissolved-solids load during this period as illustrated in the load hydrograph (dashed line). The loss (or deficiency) is reflected through the entire hydrograph, and the dissolved-solids loading of the sections of the stream, as illustrated, need to be interpreted with caution. Conversely, as the reservoirs are emptied during years when more water is required downstream, an equally cautious approach needs to be used because an apparent gain probably will be observed in dissolved-solids loading. This effect will be present at all downstream locations.

Dissolved-solids loadings for the North Platte River near Alcova (station 06642000), near Glenrock (station 06646800), and at Orin Junction (station 06652000), and for Deer Creek at Glenrock (station 06646600) are shown in figure 33. Numerous tributaries enter this reach. Bates Creek and Casper Creek are two of the larger tributaries for which no records exist to define the loading.

Dissolved-solids loading for the North Platte River between Orin Junction (station 06652000) and Guernsey (station 06656000) is shown in figure 34. This reach includes the Glendo and Guernsey Reservoirs. Glendo Reservoir records show a net increase in storage of approximately 86,000 acre-feet during 1970-71, which probably explains why the load hydrograph indicates a net decrease in load for that period. Subsequent releases and storage tend to offset each other for the remainder of the indicated period, as shown by the load hydrograph. It is interesting to note the indication that during the period shown there seems to be little or no net increase in loading in this reach of the river.

The sum of dissolved-solids loadings for the North Platte River below Guernsey (station 06656000) and the Laramie River near Ft. Laramie (station 06670500) is depicted in figure 35. The maximum cumulative load for the North Platte River in Wyoming is at station 06656000. Large irrigation diversions take place downstream from this station, and the diverted loads are not measured.

The dissolved-solids load at the State-line station (06674500) is shown as less than at station 06670900 20 miles upstream at Lingle in figure 36. Again, consideration of diversions needs to be made to properly evaluate loads in this reach of the North Platte River.

The accumulated dissolved-solids loading of the Bear River near Woodruff, Utah (station 10020100) and at Border, Wyo. (station 10039500) is shown in figure 37. The dissolved-solids load for the Snake River near Alpine (station 13022500) is shown in figure 38 and for the Salt River near Etna (station 13027500) in figure 39.

#### Evaluation of Sampling

The stations listed below are very near the heads of streams:

06218500 Wind River near Dubois, Wyo.;  
06298000 Tongue River near Dayton, Wyo.;  
06620000 North Platte River near Northgate, Colo.; and  
13018300 Cache Creek near Jackson, Wyo.

Ground-water discharge, with fairly constant concentrations of constituents, is the major part of the streamflow at these stations except during periods of snowmelt or precipitation. Although the data are not significantly correlated, application of the models yields regression equations with reasonably acceptable standard errors of estimate (less than 10 percent). Because the chemical quality is relatively constant for these stations, the load figures probably are representative and the frequency of sampling for salinity can be decreased.

The following stations are immediately downstream from reservoirs and present the same situation as those in headwaters; the chemical quality varies little with the volume of flow:

06259000 Wind River below Boysen Reservoir, Wyo.;  
06642000 North Platte River at Alcova, Wyo.;  
06652800 North Platte River below Glendo Reservoir, Wyo.; and  
06656000 North Platte River below Guernsey Reservoir, Wyo.

Correlation coefficients may be poor but the standard error of estimate is less than 10 percent. The loads can be predicted adequately, and frequency of salinity sampling can be decreased.

The data already collected at the stations listed in the following table provide reasonable estimates of the dissolved-solids loads and most of the major constituents. A decreased sampling schedule would provide the information required to describe water quality in the future.



| Station number | Station name  |
|----------------|---|
| 06207500       | Clarks Fork Yellowstone River near Belfry, Montana              |
| 06228000       | Wind River at Riverton, Wyo.                                    |
| 06235500       | Little Wind River near Riverton, Wyo.                           |
| 06253000       | Fivemile Creek near Shoshoni, Wyo.                              |
| 06270000       | Nowood River near Ten Sleep, Wyo.                               |
| 06279500       | Bighorn River at Kane, Wyo.                                     |
| 06282000       | Shoshone River below Buffalo Bill Reservoir, Wyo.               |
| 06305500       | Goose Creek below Sheridan, Wyo.                                |
| 06306300       | Tongue River at State line, near Decker, Montana                |
| 06317000       | Powder River at Arvada, Wyo.                                    |
| 06324000       | Clear Creek near Arvada, Wyo.                                   |
| 06394000       | Beaver Creek near Newcastle, Wyo.                               |
| 06428500       | Belle Fourche River at Wyoming-South Dakota State line          |
| 06623800       | Encampment River above Hog Park Creek, near Encampment, Wyo.    |
| 06625000       | Encampment River at mouth, near Encampment, Wyo.                |
| 06630000       | North Platte River above Seminoe Reservoir, near Sinclair, Wyo. |
| 06634600       | Little Medicine Bow River near Medicine Bow, Wyo.               |
| 06635000       | Medicine Bow River above Seminoe Reservoir, near Hanna, Wyo.    |
| 06639000       | Sweetwater River near Alcova, Wyo.                              |
| 06646600       | Deer Creek below Millar Wasteway, at Glenrock, Wyo.             |
| 06652000       | North Platte River at Orin, Wyo.                                |
| 06670500       | Laramie River near Fort Laramie, Wyo.                           |
| 06674500       | North Platte River at Wyoming-Nebraska State line               |
| 10020100       | Bear River above reservoir, near Woodruff, Utah                 |
| 13022500       | Snake River above reservoir, near Alpine, Wyo.                  |

The following stations do not have streamflow gages:

06235000 Beaver Creek near Arapahoe, Wyo. ;  
06273500 Paint Rock Creek near mouth, below Hyattville, Wyo. ;  
06274220 Nowood River at Manderson, Wyo. ;  
06277500 Greybull River near Basin, Wyo. ;  
06279090 Shell Creek near Greybull, Wyo. ;  
06313000 South Fork Powder River near Kaycee, Wyo. ;  
06316400 Crazy Woman Creek at upper station, near Arvada, Wyo. ;  
06427850 Belle Fourche River at Devils Tower, Wyo. ;  
06645000 North Platte River below Casper, Wyo. ; and  
06660500 Laramie River at Two Rivers, Wyo.

Correlation with instantaneous streamflow data is satisfactory, but, because daily streamflow records are not available, dissolved-solids loads cannot be calculated with the methods used. Sampling has been conducted at these stations for a reasonable period of time (6 to 10 years at the time of this report). Little information about the solute loads at these stations can be derived without streamflow data.

The chemical quality of the water at the stations listed in the table below have poor correlation with streamflow, probably because of large upstream diversions close to the stations. Daily sampling in addition to operating streamflow gages would be required to provide information about loads.

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| Station number | Station name   |
|----------------|--|
| 06264700       | Bighorn River at Lucerne, Wyo.                         |
| 06268600       | Bighorn River at Worland, Wyo.                         |
| 06312500       | Powder River near Kaycee, Wyo.                         |
| 06661500       | Little Laramie River at Two Rivers, Wyo.               |
| 10039500       | Bear River at Border, Wyo. (has gage)                  |
| 13027500       | Salt River above reservoir, near Etna, Wyo. (has gage) |

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#### SUMMARY AND CONCLUSIONS

Data from 56 surface-water-quality stations were analyzed. Monthly mean and cumulative dissolved-solids loads were computed at 16 stations using daily specific conductance and streamflow records. These were compared with those computed by the multivariable regression equation using monthly samples and streamflow records. Agreement was statistically significant. Cumulative dissolved-solids loads were then calculated and hydrographs made for all stations which were sampled monthly and where streamflow records were available.

Regression results were statistically significant for 33 stations, indicating that the data provides reasonable load estimates as well as descriptions of the chemical quality. Sampling at these stations can be decreased or eliminated depending on future goals.

Regression results were unsatisfactory for 6 stations, and 13 stations have no streamflow gages. If information on dissolved-solids loads is required at these stations, additional sampling or regionalized estimates will be needed.

The network operated under this quality-of-water program has become a base for other programs. This will need to be considered if sampling is discontinued or the frequency decreased.

Most of the stations have very limited value for identifying point sources of dissolved-solids load. Caution needs to be used when evaluating loads because diversions are being made upstream from almost every station, and generally few data are available on the volume of returned water or the dissolved-solids concentration present.

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HYDROLOGIC DATA

Table 4.--Regression results, concentration versus discharge and time

$$C_i = 10 [B_0 + B_1 \sin(\alpha t) + B_2 \cos(\alpha t)]_i Q [B_3 + B_4 \sin(\alpha t) + B_5 \cos(\alpha t)]_i$$

where

- C = constituent concentration, in milligrams per liter;
- i = index for individual constituents;
- B<sub>0</sub> through B<sub>5</sub> = regression coefficients
- α = 0.987 degrees per day or 0.0172 radians per day;
- t = day of water year; and
- Q = discharge, in cubic feet per second.

Constituents (concentrations are in milligrams per liter)

- Ca = calcium
- Mg = magnesium
- Na = sodium
- K = potassium
- HCO<sub>3</sub> = bicarbonate
- SO<sub>4</sub> = sulfate
- Cl = chloride
- TH = total hardness
- DS = dissolved solids (sum of constituents)

- R = multiple correlation coefficient
- SE = standard error of estimate, in log units
- N = number of samples

| Con-stitu-ent   | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|---|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06207500 Clarks Fork Yellowstone River near Belfry, Mont. 1970-75 water years |                |                |                |                |                |                |       |       |    |
| Ca  | 2.0183         | -0.3992        | 0.2140         | -0.1787        | 0.1884         | -0.0903        | 0.955 | 0.062 | 67 |
| Mg  | 2.1917         | -.2323         | -.1295         | -.4729         | .1165          | .0530          | .904  | .150  | 67 |
| Na  | 1.4590         | -.6113         | .0465          | -.1784         | .2562          | -.0307         | .937  | .076  | 67 |
| K   | .5050          | -.2447         | -.1458         | -.1636         | .1198          | .0637          | .686  | .179  | 67 |
| HCO <sub>3</sub>  | 2.8470         | -.1278         | .2446          | -.2856         | .0678          | -.0925         | .965  | .051  | 67 |
| SO <sub>4</sub>   | 1.9652         | -1.107         | -.0623         | -.1428         | .4944          | -.0042         | .967  | .091  | 67 |
| Cl  | .2307          | -.5452         | -.4944         | -.0184         | .2329          | .1355          | .420  | .349  | 58 |
| TH  | 2.8485         | -.2440         | .2024          | -.2843         | .1263          | -.0806         | .964  | .062  | 67 |
| DS  | 2.8188         | -.3521         | .1542          | -.2244         | .1666          | -.0682         | .973  | .050  | 67 |
| 06218500 Wind River near Dubois, Wyo. 1968-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca  | 1.7710         | -0.0981        | 0.1518         | -0.1979        | 0.0589         | -0.0922        | 0.875 | 0.051 | 88 |
| Mg  | 1.5833         | .1052          | .4829          | -.4801         | -.0658         | -.2636         | .601  | .178  | 88 |
| Na  | .9735          | .4719          | .4196          | -.0264         | .2510          | -.2480         | .793  | .070  | 88 |
| K   | .3027          | -.3741         | .1312          | .0283          | .2050          | -.0814         | .656  | .065  | 88 |
| HCO <sub>3</sub>  | 2.3250         | -.3432         | .2863          | -.1505         | .1914          | -.1605         | .668  | .123  | 88 |
| SO <sub>4</sub>   | 1.0139         | -.5877         | .5311          | -.0089         | .3488          | -.3431         | .649  | .200  | 86 |
| Cl  | 1.8984         | 1.218          | .4922          | -.8750         | -.6590         | -.2603         | .381  | .344  | 82 |
| TH  | 2.3993         | -.0447         | .2049          | -.2542         | .0280          | -.1193         | .927  | .040  | 88 |
| DS  | 2.4025         | -.1206         | .1682          | -.1507         | .0724          | -.0992         | .914  | .035  | 87 |
| 06228000 Wind River at Riverton, Wyo. 1971-75 water year                      |                |                |                |                |                |                |       |       |    |
| Ca  | 2.1707         | 0.3046         | -0.2410        | -0.2069        | -0.0696        | 0.0776         | 0.909 | 0.061 | 58 |
| Mg  | 1.2735         | -.1635         | .5709          | -.1024         | .1577          | -.2192         | .808  | .157  | 58 |
| Na  | 2.3684         | -.0156         | .1419          | -.3801         | .0384          | -.0604         | .938  | .073  | 58 |
| K   | .9076          | .4744          | -.1392         | -.2027         | .1642          | .0419          | .731  | .065  | 58 |
| HCO <sub>3</sub>  | 2.6970         | .2990          | -.0683         | -.1907         | .0622          | .0162          | .920  | .056  | 58 |
| SO <sub>4</sub>   | 2.6165         | -.1378         | .0626          | -.3170         | .1012          | -.0332         | .907  | .097  | 58 |
| Cl  | 1.7148         | .4342          | .0948          | -.3916         | -.1203         | -.0631         | .774  | .149  | 57 |
| TH  | 2.7070         | .2631          | -.1131         | -.2034         | -.0448         | .0324          | .923  | .061  | 57 |
| DS  | 3.0339         | .1986          | -.0721         | -.2492         | -.0309         | .0181          | .931  | .057  | 58 |
| 06235000 Beaver Creek near Arapahoe, Wyo. 1968-75 water years                 |                |                |                |                |                |                |       |       |    |
| Ca  | 2.2481         | 0.0573         | -0.0061        | -0.1045        | 0.0555         | 0.0488         | 0.880 | 0.090 | 62 |
| Mg  | 1.7473         | -.0133         | -.0506         | -.1966         | .1147          | .0616          | .900  | .106  | 62 |
| Na  | 2.3583         | -.0083         | -.0131         | -.1774         | .1423          | .0443          | .899  | .111  | 62 |
| K   | 1.0248         | -.0923         | -.0120         | -.1152         | .0965          | .0385          | .806  | .081  | 62 |
| HCO <sub>3</sub>  | 2.4204         | .0467          | -.0234         | -.0598         | .0224          | .0521          | .804  | .078  | 62 |
| SO <sub>4</sub>   | 2.8727         | .0092          | -.0260         | -.1638         | .1258          | .0627          | .904  | .105  | 62 |
| Cl  | 2.1853         | -.0227         | -.0118         | -.2378         | .1556          | .0450          | .930  | .107  | 61 |
| TH  | 2.8320         | .0334          | -.0276         | -.1329         | .0751          | .0598          | .923  | .076  | 62 |
| DS  | 3.1822         | .0123          | -.0215         | -.1498         | .1041          | .0540          | .915  | .088  | 62 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent  | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N   |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|-----|
| 06235500 Little Wind River near Riverton, Wyo. 1971-75 water years   |                |                |                |                |                |                |       |       |     |
| Ca   | 2.6015         | -0.3368        | 0.0679         | -0.2808        | 0.1421         | -0.0251        | 0.962 | 0.045 | 55  |
| Mg   | 2.3451         | -1.264         | .0580          | -.3150         | .4998          | -.0176         | .929  | .106  | 56  |
| Na   | 2.5594         | -1.128         | .1042          | -.3059         | .4437          | -.0391         | .963  | .068  | 55  |
| K  | .4660          | -.9827         | .2670          | -.0110         | .3905          | -.1308         | .711  | .119  | 56  |
| HCO <sub>3</sub>   | 3.0553         | -.2460         | .1199          | -.3044         | .1007          | -.0442         | .960  | .043  | 56  |
| SO <sub>4</sub>  | 3.1961         | -1.202         | .0671          | -.2889         | .4728          | -.0249         | .953  | .078  | 56  |
| Cl   | 1.4021         | -.6843         | -.4549         | -.1554         | .3015          | .1449          | .821  | .141  | 56  |
| TH   | 3.2673         | -.6549         | .0529          | -.2900         | .2632          | -.0183         | .966  | .051  | 56  |
| DS   | 3.4902         | -.8282         | .0864          | -.2849         | .3286          | -.0342         | .963  | .057  | 56  |
| 06253000 Fivemile Creek near Shoshoni, Wyo. 1968-75 water years      |                |                |                |                |                |                |       |       |     |
| Ca   | 2.7576         | 0.0506         | -0.1389        | -0.3386        | 0.0088         | 0.0563         | 0.937 | 0.068 | 102 |
| Mg   | 2.4034         | -.2814         | -.2580         | -.3937         | .1935          | .1305          | .886  | .129  | 103 |
| Na   | 3.3900         | -.1176         | -.0146         | -.4668         | .0922          | .0290          | .964  | .061  | 102 |
| K  | .6091          | -.0030         | -.0256         | -.0030         | .0284          | .0003          | .501  | .094  | 103 |
| HCO <sub>3</sub>   | 2.7661         | .0992          | -.0392         | -.1851         | -.0199         | .0261          | .957  | .031  | 103 |
| SO <sub>4</sub>  | 3.8778         | -.1361         | -.1088         | -.4792         | .1079          | .0632          | .963  | .069  | 102 |
| Cl   | 1.6802         | -.1343         | .0014          | -.1580         | .1523          | -.0254         | .798  | .157  | 103 |
| TH   | 3.3593         | -.0536         | -.1709         | -.3411         | .0706          | .0747          | .954  | .064  | 103 |
| DS   | 4.0211         | -.0886         | -.0788         | -.4280         | .0810          | .0480          | .967  | .058  | 103 |
| 06259000 Wind River below Boysen Reservoir, Wyo. 1971-75 water years |                |                |                |                |                |                |       |       |     |
| Ca   | 1.8707         | -0.4249        | 0.2736         | -0.0417        | 0.1377         | -0.1085        | 0.722 | 0.062 | 58  |
| Mg   | 1.0953         | -.2567         | .5799          | .0333          | .0855          | -.2071         | .535  | .105  | 58  |
| Na   | 1.9720         | -.3126         | .7359          | -.0726         | .1071          | -.2545         | .721  | .073  | 58  |
| K  | .6089          | -.0112         | .0209          | -.0727         | .0023          | -.0117         | .311  | .059  | 58  |
| HCO <sub>3</sub>   | 2.4654         | -.1139         | .2446          | -.0861         | .0392          | -.0946         | .735  | .048  | 58  |
| SO <sub>4</sub>  | 2.3382         | -.4384         | .6081          | -.0262         | .1435          | -.2158         | .634  | .087  | 57  |
| Cl   | .9043          | .3606          | .5218          | -.0051         | -.1061         | -.2008         | .609  | .120  | 57  |
| TH   | 2.4079         | -.3209         | .3333          | -.0313         | .1055          | -.1282         | .742  | .058  | 58  |
| DS   | 2.7620         | -.3801         | .5033          | -.0488         | .1248          | -.1802         | .717  | .065  | 58  |
| 06264700 Bighorn River at Lucerne, Wyo. 1968-75 water years          |                |                |                |                |                |                |       |       |     |
| Ca   | 2.2606         | -0.0282        | 0.4341         | -0.1503        | 0.0095         | -0.1536        | 0.662 | 0.052 | 86  |
| Mg   | 1.9156         | -.7084         | .7436          | -.2062         | .2212          | -.2521         | .539  | .115  | 86  |
| Na   | 2.2940         | -.4790         | .9725          | -.1588         | .1498          | -.3260         | .719  | .066  | 86  |
| K  | 1.1461         | .1538          | .0706          | -.2107         | -.0512         | -.0280         | .520  | .054  | 86  |
| HCO <sub>3</sub>   | 2.6231         | -.0439         | .3196          | -.1261         | .0169          | -.1148         | .786  | .032  | 86  |
| SO <sub>4</sub>  | 2.8461         | -.4237         | .8774          | -.1690         | .1296          | -.2965         | .708  | .066  | 86  |
| Cl   | 1.8583         | .5075          | -.3895         | -.2670         | -.1404         | .0904          | .354  | .246  | 86  |
| TH   | 2.8836         | -.1844         | .5274          | -.1654         | .0572          | -.1831         | .775  | .042  | 86  |
| DS   | 3.1632         | -.2799         | .6937          | -.1597         | .0869          | -.2362         | .749  | .050  | 86  |
| 06268600 Bighorn River at Worland, Wyo. 1970-75 water years          |                |                |                |                |                |                |       |       |     |
| Ca   | 2.2280         | 0.1458         | -0.0143        | -0.1316        | -0.0424        | -0.0140        | 0.614 | 0.064 | 63  |
| Mg   | 1.7309         | -.0622         | .1940          | -.1293         | .0412          | -.0780         | .590  | .096  | 63  |
| Na   | 2.4797         | .1513          | .1105          | -.1934         | -.0366         | -.0560         | .708  | .068  | 63  |
| K  | 1.2141         | .3152          | -.0962         | -.2142         | -.0873         | .0190          | .701  | .062  | 63  |
| HCO <sub>3</sub>   | 2.6739         | .1491          | .0520          | -.1364         | -.0376         | -.0295         | .745  | .041  | 63  |
| SO <sub>4</sub>  | 2.8524         | .0725          | .0849          | -.1487         | -.0139         | -.0494         | .689  | .066  | 63  |
| Cl   | 2.0502         | .3304          | -.2081         | -.2817         | -.0778         | .0434          | .724  | .096  | 63  |
| TH   | 2.8301         | .1020          | .0374          | -.1367         | -.0227         | -.0297         | .762  | .046  | 63  |
| DS   | 3.2105         | .1247          | .0736          | -.1570         | -.0302         | -.0424         | .736  | .053  | 63  |
| 06270000 Nowood River near Ten Sleep, Wyo. 1968-75 water years       |                |                |                |                |                |                |       |       |     |
| Ca   | 2.4597         | -0.3739        | -0.2269        | -0.2032        | 0.1961         | 0.1206         | 0.931 | 0.047 | 87  |
| Mg   | 2.1664         | -.3232         | -.2301         | -.3359         | .1567          | .1329          | .883  | .084  | 88  |
| Na   | 1.7208         | -1.060         | .0890          | -.2150         | .4771          | -.0224         | .897  | .099  | 88  |
| K  | .4038          | -.4250         | .1887          | -.0387         | .1817          | -.0916         | .595  | .101  | 88  |
| HCO <sub>3</sub>   | 2.7571         | -.0037         | -.1809         | -.2212         | .0101          | .0927          | .940  | .030  | 88  |
| SO <sub>4</sub>  | 2.8976         | -.6967         | -.1110         | -.2389         | .3450          | .0886          | .821  | .123  | 88  |
| Cl   | .5596          | .1173          | -.2519         | -.1090         | -.0630         | .1294          | .192  | .200  | 84  |
| TH   | 3.1015         | -.3680         | -.2023         | -.2431         | .1897          | .1118          | .964  | .036  | 88  |
| DS   | 3.2307         | -.4527         | -.1479         | -.2419         | .2241          | .0856          | .957  | .041  | 88  |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent  | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06273500 Paint Rock Creek near mouth, below Hyattville, Wyo. 1968-75 water years |                |                |                |                |                |                |       |       |    |
| Ca   | 2.8338         | -0.1837        | 0.1362         | -0.4644        | 0.1058         | -0.0237        | 0.951 | 0.086 | 84 |
| Mg   | 2.2491         | -.4445         | .0348          | -.4406         | .2640          | .0145          | .954  | .098  | 88 |
| Na   | 2.5035         | -.4508         | .2757          | -.5440         | .2364          | -.1019         | .969  | .082  | 88 |
| K  | 1.0005         | -.0797         | .0892          | -.3889         | .0140          | .0104          | .892  | .093  | 88 |
| HCO <sub>3</sub>   | 2.8371         | -.2128         | .1021          | -.2975         | .1374          | -.0327         | .970  | .050  | 88 |
| SO <sub>4</sub>  | 3.4241         | -.4662         | .1099          | -.5585         | .2522          | .0014          | .977  | .076  | 88 |
| Cl   | .8628          | .0338          | .1896          | -.2731         | -.0184         | -.1166         | .457  | .221  | 85 |
| TH   | 3.3345         | -.3198         | -.1140         | -.4265         | .1843          | -.0193         | .977  | .059  | 88 |
| DS   | 3.5481         | -.3511         | .1670          | -.4507         | .1956          | -.0446         | .976  | .062  | 88 |
| 06274220 Nowood River at Manderson, Wyo. 1968-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca   | 2.5862         | -0.4017        | 0.2110         | -0.2425        | 0.2048         | -0.0824        | 0.944 | 0.068 | 80 |
| Mg   | 2.4474         | -.4763         | .2651          | -.4046         | .2465          | -.0976         | .814  | .200  | 81 |
| Na   | 2.2851         | -1.000         | .7003          | -.3224         | .4099          | -.2717         | .913  | .114  | 81 |
| K  | .7353          | -.5978         | 1.043          | -.1653         | .2560          | -.4334         | .810  | .110  | 81 |
| HCO <sub>3</sub>   | 2.8526         | .0206          | .0964          | -.2510         | .0274          | -.0375         | .948  | .048  | 80 |
| SO <sub>4</sub>  | 3.2325         | -.8465         | .3826          | -.3235         | .3796          | -.1414         | .945  | .093  | 81 |
| Cl   | 1.2959         | -.2255         | .4697          | -.3233         | .1039          | -.2021         | .696  | .157  | 79 |
| TH   | 3.2800         | -.4237         | .2553          | -.2933         | .2121          | -.0968         | .958  | .063  | 81 |
| DS   | 3.4666         | -.5489         | .3843          | -.3005         | .2564          | -.1478         | .953  | .070  | 81 |
| 06277500 Greybull River near Basin, Wyo. 1968-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca   | 2.1324         | -0.0106        | 0.0123         | -0.1518        | 0.0575         | -0.0218        | 0.894 | 0.055 | 83 |
| Mg   | 1.7882         | -.2087         | .0504          | -.1938         | .1845          | -.0482         | .905  | .083  | 83 |
| Na   | 2.5844         | -.2893         | .2154          | -.3158         | .1597          | -.1000         | .952  | .061  | 83 |
| K  | .7205          | -.1126         | .2399          | -.1193         | .0466          | -.1080         | .621  | .098  | 83 |
| HCO <sub>3</sub>   | 2.7601         | .0000          | .1014          | -.1718         | .0432          | -.0485         | .921  | .045  | 83 |
| SO <sub>4</sub>  | 2.9404         | -.3233         | .1572          | -.2824         | .2047          | -.0923         | .942  | .068  | 83 |
| Cl   | 1.3667         | -.2096         | .0093          | -.2606         | .1159          | -.0114         | .722  | .129  | 82 |
| TH   | 2.7654         | -.0570         | .0387          | -.1634         | .0888          | -.0388         | .930  | .048  | 82 |
| DS   | 3.2385         | -.1687         | .1239          | -.2361         | .1204          | -.0679         | .950  | .048  | 83 |
| 06279090 Shell Creek near Greybull, Wyo. 1968-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca   | 2.5168         | -0.2906        | 0.0958         | -0.2487        | 0.1495         | -0.0164        | 0.949 | 0.058 | 86 |
| Mg   | 2.3070         | -.2113         | .0367          | -.3930         | .1119          | .0044          | .941  | .078  | 90 |
| Na   | 2.2586         | -.9375         | .0527          | -.2263         | .4580          | .0011          | .942  | .093  | 89 |
| K  | .6005          | -.2959         | .1740          | -.1522         | .1074          | -.0522         | .785  | .094  | 90 |
| HCO <sub>3</sub>   | 2.6559         | -.1000         | -.0328         | -.1632         | .0716          | .0234          | .955  | .035  | 90 |
| SO <sub>4</sub>  | 3.2274         | -.6186         | .0376          | -.3464         | .2999          | .0218          | .954  | .082  | 90 |
| Cl   | .8644          | .1320          | -.1590         | -.1894         | -.0464         | .0734          | .428  | .180  | 89 |
| TH   | 3.1999         | -.2298         | .0542          | -.2995         | .1180          | .0016          | .956  | .053  | 89 |
| DS   | 3.3972         | -.4513         | .0708          | -.2856         | .2232          | .0056          | .956  | .063  | 89 |
| 06279500 Bighorn River at Kane, Wyo. 1971-75 water years                         |                |                |                |                |                |                |       |       |    |
| Ca   | 2.5463         | -0.5310        | 0.0374         | -0.1989        | 0.1631         | -0.0167        | 0.855 | 0.043 | 55 |
| Mg   | 2.6076         | -.7660         | .2576          | -.3600         | .2394          | -.0823         | .743  | .109  | 55 |
| Na   | 2.5345         | -1.173         | -.0353         | -.1919         | .3514          | .0023          | .829  | .067  | 54 |
| K  | 1.2077         | -.3855         | -.3974         | -.1914         | .1187          | .1097          | .646  | .079  | 55 |
| HCO <sub>3</sub>   | 3.1386         | -.1269         | -.1091         | -.2528         | .0453          | .0290          | .893  | .034  | 55 |
| SO <sub>4</sub>  | 3.2034         | -1.181         | .1027          | -.2252         | .3546          | -.0369         | .835  | .069  | 55 |
| Cl   | 2.2511         | -.5300         | -.0896         | -.3310         | .1768          | -.0105         | .778  | .100  | 55 |
| TH   | 3.3522         | -.5245         | .1490          | -.2635         | .1645          | -.0499         | .868  | .050  | 55 |
| DS   | 3.5213         | -.8063         | .0360          | -.2246         | .2448          | -.0167         | .850  | .055  | 55 |
| 06282000 Shoshone River below Buffalo Bill Reservoir, Wyo. 1968-75 water years   |                |                |                |                |                |                |       |       |    |
| Ca   | 3.3938         | 0.1579         | 0.4404         | -0.5765        | -0.0412        | -0.1686        | 0.947 | 0.058 | 84 |
| Mg   | 3.2072         | -.3718         | .0610          | -.7425         | .1291          | -.0374         | .880  | .114  | 84 |
| Na   | 1.9208         | -.2900         | .7401          | -.2319         | .1176          | -.2976         | .893  | .073  | 84 |
| K  | 2.1029         | .6214          | .0264          | -.5830         | -.1979         | -.0148         | .910  | .072  | 84 |
| HCO <sub>3</sub>   | 3.7070         | .2278          | .3470          | -.5121         | -.0646         | -.0137         | .973  | .036  | 84 |
| SO <sub>4</sub>  | 3.5158         | -.4630         | .5114          | -.5661         | .1642          | -.2036         | .911  | .084  | 83 |
| Cl   | 1.8509         | .8961          | 1.253          | -.4732         | -.2727         | -.4567         | .812  | .127  | 81 |
| TH   | 4.0002         | .0446          | .3438          | -.6025         | -.0043         | -.1336         | .970  | .044  | 82 |
| DS   | 3.7975         | .0095          | .3885          | -.4762         | .0091          | -.1545         | .963  | .042  | 84 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent   | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|---|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06284500 Bitter Creek near Garland, Wyo. 1974-75 water years              |                |                |                |                |                |                |       |       |    |
| Ca  | 1.9044         | 0.0154         | -0.1649        | -0.0407        | 0.0513         | 0.0631         | 0.952 | 0.040 | 24 |
| Mg  | 1.7136         | .0496          | -.1729         | -.1809         | .0130          | .0818          | .977  | .037  | 24 |
| Na  | 3.0954         | .0190          | .0200          | -.4959         | -.0119         | -.0005         | .979  | .059  | 24 |
| K   | .6655          | -.1132         | -.1754         | -.0435         | .0837          | .0698          | .789  | .065  | 24 |
| HCO <sub>3</sub>  | 2.7306         | .0800          | -.1307         | -.1647         | -.0274         | .0619          | .970  | .031  | 24 |
| SO <sub>4</sub>   | 3.2180         | -.0631         | -.0903         | -.3709         | .0700          | .0361          | .982  | .053  | 24 |
| Cl  | 1.7176         | .2696          | -.1697         | -.3972         | -.1268         | .0706          | .965  | .073  | 24 |
| TH  | 2.6124         | .0234          | -.1581         | -.0976         | .0388          | .0655          | .974  | .033  | 24 |
| DS  | 3.4681         | .0067          | -.0816         | -.3149         | .0206          | .0381          | .982  | .042  | 24 |
| 06284800 Whistle Creek near Garland, Wyo. 1974-75 water years             |                |                |                |                |                |                |       |       |    |
| Ca  | 2.4232         | -0.0863        | 0.1155         | -0.3834        | 0.1266         | -0.0356        | 0.978 | 0.082 | 23 |
| Mg  | 2.3686         | -.3352         | .1560          | -.7103         | .2233          | .0188          | .972  | .141  | 23 |
| Na  | 3.0681         | -.0519         | .1329          | -.5942         | .1501          | -.1632         | .977  | .139  | 23 |
| K   | .9896          | .0081          | .0473          | -.2133         | .0765          | -.0520         | .959  | .078  | 23 |
| HCO <sub>3</sub>  | 2.6177         | .0562          | -.0027         | -.1685         | .0627          | -.0303         | .947  | .086  | 23 |
| SO <sub>4</sub>   | 3.5565         | -.1385         | .1507          | -.6548         | .1791          | -.1088         | .988  | .099  | 23 |
| Cl  | 1.9963         | -.3137         | .2437          | -.7001         | .1839          | -.1698         | .968  | .144  | 23 |
| TH  | 3.1521         | -.1443         | .1229          | -.4790         | .1555          | -.0247         | .981  | .089  | 23 |
| DS  | 3.7204         | -.0817         | .1241          | -.5448         | .1467          | -.1026         | .985  | .097  | 23 |
| 06285100 Shoshone River near Lovell, Wyo. 1974-75 water years             |                |                |                |                |                |                |       |       |    |
| Ca  | 2.4618         |                | -0.2010        | -0.2117        | 0.0478         | 0.0663         | 0.975 | 0.040 | 22 |
| Mg  | 2.4763         | 0.0996         | -.0118         | -.3903         |                | .0076          | .976  | .043  | 22 |
| Na  | 3.3073         |                | 1.614          | -.4991         | .0070          | -.5559         | .947  | .057  | 22 |
| K   | 1.2713         |                | .3466          | -.2142         | .0392          | -.1523         | .741  | .151  | 22 |
| HCO <sub>3</sub>  | 2.9579         |                | .1571          | -.2115         | .0301          | -.0576         | .966  | .036  | 22 |
| SO <sub>4</sub>   | 3.6758         |                | .9085          | -.4584         | .0301          | -.3158         | .985  | .036  | 22 |
| Cl  | 2.3634         |                | .8579          | -.4756         | .0326          | -.3120         | .938  | .080  | 22 |
| TH  | 3.1882         |                | -.0809         | -.2623         | .0437          | .0258          | .974  | .042  | 22 |
| DS  | 3.7070         |                | .6353          | -.3385         | .0295          | -.2215         | .982  | .032  | 22 |
| 06285400 Sage Creek at Sidon Canal, near Deaver, Wyo. 1974-75 water years |                |                |                |                |                |                |       |       |    |
| Ca  | 2.4809         | 0.0585         | 0.1375         | -0.1588        | 0.0354         | -0.0885        | 0.967 | 0.040 | 21 |
| Mg  | 2.2495         | .0309          | .1733          | -.1835         | .0805          | -.1537         | .967  | .058  | 22 |
| Na  | 2.6510         | .0080          | .4730          | -.1170         | .1092          | -.3349         | .939  | .083  | 22 |
| K   | .7994          | -.1915         | .0381          | -.0135         | .1480          | -.0422         | .640  | .076  | 22 |
| HCO <sub>3</sub>  | 2.7393         | .0814          | .0393          | -.1537         | -.0003         | -.0272         | .976  | .027  | 22 |
| SO <sub>4</sub>   | 3.2812         | .0468          | .3223          | -.1536         | .0817          | -.2420         | .959  | .067  | 22 |
| Cl  | 1.3596         | .0071          | .3130          | -.0369         | .0940          | -.2613         | .908  | .091  | 22 |
| TH  | 3.1595         | .0733          | .1271          | -.1646         | .0411          | -.1037         | .973  | .043  | 22 |
| DS  | 3.4929         | .0303          | .2910          | -.1416         | .0830          | -.2159         | .956  | .062  | 21 |
| 06298000 Tongue River near Dayton, Wyo. 1968-75 water years               |                |                |                |                |                |                |       |       |    |
| Ca  | 1.8151         | -0.1475        | 0.0436         | -0.0735        | -0.0167        | 0.0417         | 0.853 | 0.040 | 97 |
| Mg  | 1.2580         | -.1263         | -.1043         | -.1470         | .0708          | .0738          | .721  | .091  | 97 |
| Na  | .4085          | -.0870         | -.3995         | .1327          | .1672          | -.0721         | .378  | .143  | 99 |
| K   | -.0906         | -.0141         | -.1536         | .4278          | .0578          | -.2254         | .249  | .175  | 98 |
| HCO <sub>3</sub>  | 2.4243         | -.1317         | .0104          | -.1181         | .0034          | .0630          | .933  | .026  | 99 |
| SO <sub>4</sub>   | 1.4520         | -.3641         | -.3419         | .7500          | .1750          | -.3943         | .579  | .233  | 98 |
| Cl  | 1.3386         | -.6254         | 1.101          | .3507          | -.5780         | -.2087         | .311  | .375  | 93 |
| TH  | 2.3525         | -.1226         | -.0363         | -.0060         | .0308          | .0024          | .866  | .040  | 99 |
| DS  | 2.4053         | -.1390         | -.0037         | -.0729         | .0089          | .0390          | .947  | .023  | 99 |
| 06305500 Goose Creek below Sheridan, Wyo. 1968-75 water years             |                |                |                |                |                |                |       |       |    |
| Ca  | 2.2099         | -0.4583        | -0.0565        | -0.2135        | 0.2445         | 0.0206         | 0.934 | 0.067 | 88 |
| Mg  | 2.2223         | -.7047         | -.2650         | -.3105         | .3713          | .1303          | .925  | .111  | 88 |
| Na  | 2.1255         | -.6060         | -.0290         | -.3494         | .3059          | .0179          | .951  | .080  | 88 |
| K   | .8167          | -.6392         | .1351          | -.1709         | .3117          | -.0771         | .753  | .140  | 88 |
| HCO <sub>3</sub>  | 2.8590         | -.4154         | -.1414         | -.2193         | .2314          | .0757          | .949  | .063  | 88 |
| SO <sub>4</sub>   | 2.8446         | -.7850         | .0043          | -.3462         | .4003          | -.0141         | .943  | .095  | 88 |
| Cl  | 1.7123         | .1280          | -.0376         | -.5169         | -.0402         | -.0094         | .699  | .214  | 88 |
| TH  | 3.0148         | -.5593         | -.1025         | -.2564         | .2975          | .0460          | .951  | .069  | 88 |
| DS  | 3.1819         | -.5334         | -.0463         | -.2778         | .2815          | .0198          | .952  | .068  | 88 |



Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stituent   | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06306300 Tongue River at State line, near Decker, Mont. 1971-75 water years        |                |                |                |                |                |                |       |       |    |
| Ca   | 2.1405         | -0.7816        | -0.1433        | -0.1154        | 0.3256         | 0.0407         | 0.902 | 0.070 | 56 |
| Mg   | 1.8083         | -1.595         | -.5316         | -.0585         | .6737          | .2077          | .833  | .174  | 56 |
| Na   | 1.8732         | -1.519         | -.1776         | -.1283         | .6227          | .0497          | .963  | .067  | 56 |
| K  | .7841          | -.7956         | .2992          | -.0968         | .3324          | -.1383         | .817  | .097  | 56 |
| HCO <sub>3</sub>   | 2.6367         | -.7748         | -.1888         | -.0778         | .3353          | .0710          | .953  | .045  | 55 |
| SO <sub>4</sub>  | 2.4551         | -1.753         | -.0856         | -.0598         | .7275          | .0134          | .960  | .075  | 56 |
| Cl   | 1.1738         | -.4624         | -.4198         | -.2098         | .2109          | .0953          | .684  | .199  | 55 |
| TH   | 2.7994         | -1.063         | -.1609         | -.0944         | .4508          | .0517          | .961  | .050  | 55 |
| DS   | 2.9355         | -1.169         | -.1389         | -.0907         | .4894          | .0401          | .964  | .053  | 56 |
| 06312500 Powder River near Kaycee, Wyo. 1968-75 water years                        |                |                |                |                |                |                |       |       |    |
| Ca   | 2.3354         | 0.1552         | -0.1331        | -0.1634        | -0.0287        | 0.0661         | 0.887 | 0.058 | 78 |
| Mg   | 2.0238         | .2049          | -.1482         | -.2211         | -.0414         | .0742          | .871  | .085  | 80 |
| Na   | 2.3531         | .0236          | -.1818         | -.2405         | .0499          | .0968          | .862  | .122  | 79 |
| K  | .5119          | -.1307         | .0208          | -.0449         | .0721          | -.0011         | .753  | .077  | 80 |
| HCO <sub>3</sub>   | 2.5402         | .1019          | -.1261         | -.1050         | -.0127         | .0576          | .896  | .037  | 80 |
| SO <sub>4</sub>  | 2.8956         | .0386          | -.0989         | -.1859         | .0411          | .0653          | .855  | .101  | 79 |
| Cl   | 2.2947         | .2730          | -.2430         | -.2589         | -.0691         | .1173          | .808  | .161  | 80 |
| TH   | 2.9679         | .1527          | -.1257         | -.1768         | -.0244         | .0638          | .901  | .059  | 80 |
| DS   | 3.2305         | .0902          | -.1279         | -.1885         | .0085          | .0681          | .888  | .077  | 80 |
| 06313000 South Fork Powder River near Kaycee, Wyo. 1968-75 water years             |                |                |                |                |                |                |       |       |    |
| Ca   | 2.5446         | 0.0283         | -0.0512        | -0.0762        | 0.0028         | 0.0440         | 0.670 | 0.085 | 71 |
| Mg   | 1.9717         | .0133          | -.0368         | -.0854         | .0163          | .0078          | .445  | .150  | 71 |
| Na   | 2.6212         | -.0518         | .0379          | -.1038         | -.0167         | -.0612         | .667  | .099  | 71 |
| K  | .9415          | -.0821         | .0040          | -.0726         | -.0295         | .0376          | .608  | .132  | 71 |
| HCO <sub>3</sub>   | 2.3227         | .0832          | -.0443         | -.0792         | -.0293         | -.0086         | .708  | .083  | 71 |
| SO <sub>4</sub>  | 3.2555         | -.0229         | .0001          | -.0872         | -.0023         | -.0117         | .710  | .068  | 71 |
| Cl   | 2.1712         | .0352          | -.0422         | -.1863         | .0336          | .0312          | .692  | .183  | 71 |
| TH   | 3.1079         | .0256          | -.0323         | -.0812         | .0043          | .0259          | .707  | .079  | 69 |
| DS   | 3.4731         | -.0122         | .0007          | -.0920         | -.0023         | -.0137         | .731  | .068  | 71 |
| 06313400 Salt Creek near Sussex, Wyo. 1968-75 water years                          |                |                |                |                |                |                |       |       |    |
| Ca   | 1.8640         | 0.2548         | 0.0979         | 0.0235         | -0.1262        | -0.1598        | 0.567 | 0.180 | 85 |
| Mg   | 1.7122         | -.0360         | -.0329         | .0413          | .0142          | -.0424         | .408  | .164  | 86 |
| Na   | 3.5588         | -.1314         | .0258          | -.2694         | .0860          | -.0223         | .879  | .044  | 86 |
| K  | 1.5746         | .0800          | -.4572         | -.2129         | -.0782         | .3396          | .582  | .145  | 86 |
| HCO <sub>3</sub>   | 3.1791         | -.0075         | -.0720         | -.2051         | .0391          | .0501          | .625  | .101  | 86 |
| SO <sub>4</sub>  | 3.1513         | -.0400         | .1242          | -.0462         | .0109          | -.1280         | .570  | .066  | 85 |
| Cl   | 3.6797         | -.2172         | -.1120         | -.4017         | .1494          | .0860          | .915  | .062  | 86 |
| TH   | 2.5957         | .1175          | .0085          | .0455          | -.0644         | -.0745         | .557  | .125  | 86 |
| DS   | 3.9468         | -.0616         | .0411          | -.1973         | .0362          | -.0408         | .842  | .034  | 86 |
| 06316400 Crazy Woman Creek at upper station, near Arvada, Wyo. 1968-75 water years |                |                |                |                |                |                |       |       |    |
| Ca   | 2.4820         | -0.0304        | -0.0809        | -0.2399        | 0.0136         | 0.0441         | 0.829 | 0.111 | 83 |
| Mg   | 2.2355         | .0563          | -.3601         | -.2615         | -.0380         | .2433          | .612  | .199  | 82 |
| Na   | 2.4894         | -.0214         | -.2297         | -.3504         | -.0146         | .1346          | .842  | .137  | 80 |
| K  | .6936          | -.0974         | .1147          | -.0924         | .0327          | -.0808         | .677  | .130  | 83 |
| HCO <sub>3</sub>   | 2.6214         | .0641          | -.1356         | -.1956         | -.0239         | .0948          | .877  | .068  | 83 |
| SO <sub>4</sub>  | 3.2269         | -.0362         | -.1582         | -.2978         | -.0029         | .1021          | .746  | .169  | 83 |
| Cl   | 1.3203         | .1087          | -.2201         | -.2659         | -.0602         | .1267          | .701  | .154  | 83 |
| TH   | 3.1877         | .0127          | -.1635         | -.2645         | -.0123         | .1001          | .829  | .109  | 83 |
| DS   | 3.4415         | -.0088         | -.1628         | -.2798         | -.0042         | .0993          | .840  | .113  | 83 |
| 06317000 Powder River at Arvada, Wyo. 1971-75 water years                          |                |                |                |                |                |                |       |       |    |
| Ca   | 2.3425         | -0.0899        | -0.1534        | -0.0742        | 0.0519         | 0.0712         | 0.575 | 0.084 | 51 |
| Mg   | 2.1529         | -.0067         | .0059          | -.1769         | .0215          | .0164          | .747  | .108  | 52 |
| Na   | 3.0474         | -.1610         | -.1608         | -.2223         | .1007          | .0693          | .851  | .092  | 52 |
| K  | 1.0680         | -.1420         | .0326          | -.1119         | .0563          | -.0030         | .782  | .070  | 52 |
| HCO <sub>3</sub>   | 2.8478         | .2447          | -.2000         | -.1789         | -.0558         | .0666          | .890  | .064  | 52 |
| SO <sub>4</sub>  | 3.1468         | -.2698         | -.0136         | -.1070         | .1207          | .0201          | .762  | .090  | 51 |
| Cl   | 3.1443         | .0092          | -.4412         | -.3540         | .0483          | .2194          | .800  | .181  | 52 |
| TH   | 3.0501         | -.0673         | -.0838         | -.1169         | .0445          | .0471          | .752  | .074  | 52 |
| DS   | 3.6183         | -.1417         | -.1052         | -.1637         | .0819          | .0524          | .836  | .076  | 52 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent   | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|---|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06324000 Clear Creek near Arvada, Wyo. 1968-75 water years                                |                |                |                |                |                |                |       |       |    |
| Ca  | 2.4803         | -0.1213        | -0.1015        | -0.2416        | 0.0965         | 0.0515         | 0.868 | 0.094 | 79 |
| Mg  | 2.2984         | -.2838         | -.1194         | -.2969         | .1862          | .0586          | .839  | .144  | 81 |
| Na  | 2.3799         | -.4210         | .0213          | -.2831         | .2345          | -.0146         | .859  | .133  | 81 |
| K   | .5479          | -.6354         | .3118          | .0295          | .3408          | -.1343         | .787  | .114  | 81 |
| HCO <sub>3</sub>  | 2.7030         | -.1198         | -.1762         | -.1716         | .0997          | .0845          | .877  | .074  | 81 |
| SO <sub>4</sub>   | 3.2173         | -.3304         | -.0610         | -.3090         | .2010          | .0277          | .869  | .130  | 81 |
| Cl  | 1.0216         | .1547          | .0679          | -.2141         | -.0140         | -.0552         | .561  | .207  | 81 |
| TH  | 3.1934         | -.1901         | -.0998         | -.2653         | .1342          | .0485          | .875  | .104  | 81 |
| DS  | 3.4128         | -.2483         | -.0430         | -.2695         | .1594          | .0120          | .876  | .108  | 81 |
| 06394000 Beaver Creek near Newcastle, Wyo. 1969-75 water years                            |                |                |                |                |                |                |       |       |    |
| Ca  | 2.7374         | 0.0394         | -0.1277        | -0.1250        | 0.0349         | 0.1768         | 0.817 | 0.122 | 93 |
| Mg  | 2.2839         | -.0482         | -.1516         | -.1842         | .0387          | .1455          | .740  | .160  | 93 |
| Na  | 2.7824         | -.2433         | -.0797         | -.1326         | .0899          | .1137          | .754  | .165  | 93 |
| K   | .7900          | -.1368         | .0041          | -.0358         | .0134          | -.0166         | .760  | .083  | 94 |
| HCO <sub>3</sub>  | 2.3852         | .2357          | -.2006         | -.1323         | .0912          | .0482          | .812  | .102  | 94 |
| SO <sub>4</sub>   | 3.3874         | -.0266         | -.1112         | -.1654         | .0123          | .1319          | .834  | .106  | 93 |
| Cl  | 2.8430         | -.2192         | -.1796         | -.1394         | .1603          | .2568          | .680  | .270  | 93 |
| TH  | 2.2270         | .0037          | -.1487         | -.1490         | .0442          | .1672          | .805  | .127  | 94 |
| DS  | 3.6667         | -.0770         | -.1140         | -.1481         | .0460          | .1455          | .802  | .124  | 94 |
| 06427850 Belle Fourche River at Devils Tower, Wyo. 1968-75 water years                    |                |                |                |                |                |                |       |       |    |
| Ca  | 2.6796         | -0.1088        | -0.1520        | -0.2994        | 0.1159         | 0.0045         | 0.836 | 0.125 | 88 |
| Mg  | 2.1922         | -.1119         | -.1682         | -.2988         | .1062          | .0477          | .843  | .111  | 88 |
| Na  | 2.1091         | .1466          | -.0147         | -.1551         | -.0778         | .0637          | .841  | .082  | 86 |
| K   | .8496          | -.0555         | -.0124         | -.0097         | .0431          | .0227          | .370  | .057  | 88 |
| HCO <sub>3</sub>  | 2.5437         | .1630          | -.1296         | -.1502         | -.0928         | .0592          | .820  | .065  | 88 |
| SO <sub>4</sub>   | 3.2427         | -.1244         | -.1292         | -.2888         | .1223          | .0256          | .864  | .102  | 87 |
| Cl  | .8084          | .0440          | -.1742         | .0200          | .0533          | .1540          | .574  | .147  | 88 |
| TH  | 3.2698         | -.1047         | -.1588         | -.3041         | .1043          | .0181          | .850  | .113  | 85 |
| DS  | 3.4168         | -.0641         | -.1288         | -.2542         | .0773          | .0352          | .880  | .083  | 88 |
| 06428500 Belle Fourche River at Wyoming-South Dakota State line 1971-75 water years       |                |                |                |                |                |                |       |       |    |
| Ca  | 2.8488         | 0.0976         | -0.0648        | -0.3023        | -0.0302        | 0.0028         | 0.913 | 0.077 | 55 |
| Mg  | 2.3224         | .0964          | .2427          | -.3243         | -.0548         | -.1288         | .827  | .105  | 55 |
| Na  | 2.3630         | -.0988         | -.1063         | -.2398         | .0500          | .0806          | .878  | .084  | 53 |
| K   | 1.2060         | -.0722         | .0778          | -.1795         | .0089          | -.0594         | .690  | .056  | 56 |
| HCO <sub>3</sub>  | 2.7936         | .1362          | .0379          | -.2936         | -.0966         | -.0687         | .828  | .083  | 56 |
| SO <sub>4</sub>   | 3.3467         | -.2486         | .0576          | -.2540         | .1480          | -.0272         | .663  | .158  | 56 |
| Cl  | 1.1168         | .0130          | .0915          | -.1780         | .0036          | -.0526         | .664  | .108  | 56 |
| TH  | 3.4314         | .0978          | .0285          | -.3134         | -.0378         | -.0385         | .910  | .077  | 53 |
| DS  | 3.6101         | .0428          | -.0329         | -.2892         | -.0110         | .0072          | .934  | .061  | 55 |
| 06620000 North Platte River near Northgate, Colo. 1968-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca  | 1.5459         | 0.1695         | -0.1051        | -0.0334        | -0.0629        | 0.0486         | 0.542 | 0.056 | 83 |
| Mg  | .9021          | -.0090         | -.1219         | -.0213         | .0185          | .0533          | .309  | .143  | 83 |
| Na  | 1.0062         | -.2072         | -.0641         | .0677          | .1016          | .0199          | .303  | .081  | 83 |
| K   | .2633          | -.2775         | .3681          | .0186          | .1274          | -.2118         | .693  | .117  | 83 |
| HCO <sub>3</sub>  | 2.2173         | .1555          | -.1098         | -.0517         | -.0661         | .0531          | .559  | .052  | 83 |
| SO <sub>4</sub>   | 1.3192         | -.3570         | .1237          | .0420          | .1730          | -.0678         | .412  | .130  | 83 |
| Cl  | .0645          | -.5953         | -.0928         | .2102          | .3190          | -.0104         | .495  | .220  | 82 |
| TH  | 2.1344         | .1449          | -.1029         | -.0496         | -.0526         | .0460          | .614  | .054  | 75 |
| DS  | 2.1923         | .0334          | -.0632         | .0018          | -.0002         | .0228          | .455  | .052  | 83 |
| 06623800 Encampment River above Hog Park Creek, near Encampment, Wyo. 1968-75 water years |                |                |                |                |                |                |       |       |    |
| Ca  | 1.1439         | -0.0448        | -0.0546        | -0.1617        | 0.0403         | 0.0329         | 0.936 | 0.042 | 71 |
| Mg  | .3387          | -.1343         | .0724          | -.1083         | .1116          | -.0577         | .701  | .116  | 71 |
| Na  | .5084          | -.0817         | -.0596         | -.0921         | .0857          | .0396          | .606  | .147  | 71 |
| K   | .5982          | .5235          | .0265          | -.4585         | -.3662         | .0344          | .504  | .181  | 71 |
| HCO <sub>3</sub>  | 1.8017         | -.1431         | .0606          | -.1658         | .0976          | -.0352         | .942  | .044  | 71 |
| SO <sub>4</sub>   | .8451          | .1704          | .4762          | -.2087         | -.1184         | -.3441         | .325  | .232  | 70 |
| Cl  | .1794          | .2264          | .5314          | -.2683         | -.1707         | -.4146         | .303  | .351  | 70 |
| TH  | 1.6487         | -.0547         | -.0271         | -.1540         | .0496          | .0130          | .949  | .037  | 71 |
| DS  | 1.8871         | -.0542         | .0472          | -.1427         | .0446          | -.0377         | .943  | .033  | 71 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent  | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06625000 Encampment River at mouth, near Encampment, Wyo. 1968-75 water years                |                |                |                |                |                |                |       |       |    |
| Ca   | 2.3279         | -0.2769        | -0.1684        | -0.3871        | 0.1322         | 0.1125         | 0.950 | 0.090 | 88 |
| Mg   | 1.6626         | .0108          | -.1020         | -.5429         | -.0208         | .0911          | .771  | .242  | 88 |
| Na   | 1.9506         | -.4067         | -.0738         | -.3906         | .1990          | .0631          | .945  | .102  | 88 |
| K  | 1.0640         | -.2592         | -.0948         | -.3488         | .1069          | .0756          | .844  | .144  | 88 |
| HCO <sub>3</sub>   | 2.8565         | -.1168         | -.1935         | -.4145         | .0346          | .1372          | .979  | .052  | 88 |
| SO <sub>4</sub>  | 2.5984         | -.4932         | .1754          | -.5218         | .2514          | -.0899         | .937  | .130  | 85 |
| Cl   | 1.4416         | -.4794         | -.4082         | -.2411         | .2733          | .2144          | .894  | .149  | 88 |
| TH   | 2.9211         | -.1040         | -.2111         | -.4511         | .0388          | .1415          | .968  | .074  | 82 |
| DS   | 3.0965         | -.1794         | -.0857         | -.4225         | .0827          | .0683          | .957  | .080  | 88 |
| 06630000 North Platte River above Seminoe Reservoir, near Sinclair, Wyo. 1970-75 water years |                |                |                |                |                |                |       |       |    |
| Ca   | 1.9418         | -0.2001        | -0.2544        | -0.0865        | 0.1017         | 0.0929         | 0.926 | 0.054 | 69 |
| Mg   | 1.3343         | -.1096         | -.0379         | -.0983         | .0932          | .0125          | .555  | .251  | 69 |
| Na   | 1.7299         | -.6730         | -.1291         | -.1057         | .2680          | .0429          | .887  | .091  | 69 |
| K  | .3175          | -.5596         | .2399          | .0348          | .2227          | -.0957         | .565  | .119  | 69 |
| HCO <sub>3</sub>   | 2.4308         | -.1334         | -.2587         | -.0960         | .0624          | .0987          | .864  | .060  | 69 |
| SO <sub>4</sub>  | 2.0746         | -.7410         | -.0226         | -.0296         | .3251          | .0062          | .886  | .110  | 68 |
| Cl   | 1.7648         | -.0317         | -.3531         | -.2723         | .0479          | .1097          | .796  | .157  | 69 |
| TH   | 2.5385         | -.2320         | -.2110         | -.1027         | .1134          | .0764          | .914  | .062  | 68 |
| DS   | 2.7153         | -.3208         | -.1576         | -.0910         | .1479          | .0568          | .911  | .066  | 69 |
| 06634600 Little Medicine Bow River near Medicine Bow, Wyo. 1968-75 water years               |                |                |                |                |                |                |       |       |    |
| Ca   | 2.0505         | -0.0152        | -0.0796        | -0.1283        | 0.0171         | 0.0791         | 0.885 | 0.077 | 80 |
| Mg   | 1.4586         | .0396          | -.0315         | -.1535         | -.0248         | .0828          | .837  | .122  | 81 |
| Na   | 1.9897         | -.1409         | -.0838         | -.1492         | .1658          | .1280          | .936  | .095  | 81 |
| K  | .6360          | -.0750         | .0478          | -.0388         | .0548          | -.0072         | .627  | .083  | 81 |
| HCO <sub>3</sub>   | 2.3043         | -.0275         | -.0924         | -.0381         | .0282          | .1025          | .833  | .061  | 81 |
| SO <sub>4</sub>  | 2.6345         | -.0525         | -.0597         | -.1958         | .0764          | .0960          | .925  | .100  | 81 |
| Cl   | 1.1801         | -.0561         | -.0109         | -.1746         | .0856          | .0335          | .847  | .125  | 81 |
| TH   | 2.6034         | .0076          | -.0596         | -.1362         | .0010          | .0774          | .905  | .075  | 81 |
| DS   | 2.9004         | -.0376         | -.0633         | -.1425         | .0514          | .0906          | .937  | .069  | 81 |
| 06635000 Medicine Bow River above Seminoe Reservoir, near Hanna, Wyo. 1968-75 water years    |                |                |                |                |                |                |       |       |    |
| Ca   | 2.3429         | -0.0353        | -0.0409        | -0.1621        | 0.0428         | 0.0367         | 0.932 | 0.056 | 80 |
| Mg   | 2.0634         | -.2419         | -.0931         | -.1751         | .1534          | .0757          | .874  | .111  | 81 |
| Na   | 2.1406         | -.4304         | -.1336         | -.0753         | .2394          | .1063          | .863  | .104  | 80 |
| K  | .5551          | -.2381         | .2233          | -.0340         | .1195          | -.0924         | .630  | .102  | 81 |
| HCO <sub>3</sub>   | 2.4018         | .0224          | -.2692         | -.0691         | -.0064         | .1426          | .794  | .061  | 81 |
| SO <sub>4</sub>  | 2.9943         | -.3080         | -.0313         | -.1534         | .1887          | .0471          | .918  | .086  | 81 |
| Cl   | 1.9950         | -.1800         | .0328          | -.3017         | .1178          | .0004          | .896  | .120  | 81 |
| TH   | 3.0156         | -.1254         | -.0606         | -.1692         | .0892          | .0521          | .924  | .067  | 80 |
| DS   | 3.2222         | -.2320         | -.0637         | -.1399         | .1424          | .0591          | .920  | .072  | 81 |
| 06639000 Sweetwater River near Alcova, Wyo. 1968-75 water years                              |                |                |                |                |                |                |       |       |    |
| Ca   | 1.8696         | 0.0076         | -0.1214        | -0.1365        | 0.0175         | 0.0700         | 0.838 | 0.059 | 88 |
| Mg   | 1.1584         | -.0248         | .0101          | -.1705         | .0328          | -.0069         | .534  | .155  | 88 |
| Na   | 1.8426         | -.1967         | -.0960         | -.1911         | .1255          | .0686          | .875  | .078  | 88 |
| K  | .8588          | -.1446         | .0323          | -.0836         | .0934          | -.0156         | .731  | .066  | 88 |
| HCO <sub>3</sub>   | 2.4462         | .0312          | -.1247         | -.1334         | -.0009         | .0738          | .877  | .046  | 88 |
| SO <sub>4</sub>  | 2.0083         | -.2871         | -.0369         | -.1586         | .1917          | .0307          | .837  | .098  | 88 |
| Cl   | 1.6967         | -.1583         | -.0645         | -.2717         | .1086          | .0547          | .859  | .105  | 88 |
| TH   | 2.4075         | .0196          | -.1017         | -.1511         | .0110          | .0599          | .894  | .048  | 87 |
| DS   | 2.7092         | -.0469         | -.0714         | -.1635         | .0473          | .0475          | .903  | .052  | 88 |
| 06642000 North Platte River at Alcova, Wyo. 1970-75 water years                              |                |                |                |                |                |                |       |       |    |
| Ca   | 1.6612         | -0.0845        | 0.0934         | 0.0152         | 0.0299         | -0.0332        | 0.266 | 0.037 | 73 |
| Mg   | 1.4666         | .2506          | -.4817         | -.1044         | -.0766         | .1664          | .553  | .081  | 73 |
| Na   | 1.4817         | -.0930         | -.1743         | -.0064         | .0286          | .0569          | .401  | .035  | 73 |
| K  | .4576          | .0723          | -.1410         | .0072          | -.0186         | .0460          | .181  | .070  | 73 |
| HCO <sub>3</sub>   | 2.1841         | .0226          | -.1042         | -.0058         | -.0033         | .0334          | .467  | .023  | 73 |
| SO <sub>4</sub>  | 2.1262         | -.0135         | -.1584         | -.0225         | .0020          | .0546          | .379  | .040  | 64 |
| Cl   | 1.6819         | .3134          | -.0327         | -.2298         | -.0984         | -.0033         | .509  | .107  | 73 |
| TH   | 2.2826         | -.0065         | -.0651         | -.0037         | .0055          | .0219          | .386  | .024  | 73 |
| DS   | 2.5542         | .0088          | -.1048         | -.0226         | -.0024         | .0346          | .430  | .024  | 73 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent  | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N   |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|-----|
| 06645000 North Platte River below Casper, Wyo. 1968-75 water years               |                |                |                |                |                |                |       |       |     |
| Ca   | 2.3164         | -0.0657        | 0.1872         | -0.1699        | 0.0200         | -0.0616        | 0.734 | 0.040 | 102 |
| Mg   | 2.1651         | -.4783         | -.0389         | -.2694         | .1491          | .0106          | .659  | .099  | 102 |
| Na   | 2.6906         | -.5128         | .1263          | -.3155         | .1544          | -.0492         | .838  | .063  | 96  |
| K  | .8183          | -.1005         | -.0274         | -.0918         | .0312          | .0086          | .429  | .057  | 94  |
| HCO <sub>3</sub>   | 2.4874         | .0695          | -.0069         | -.0905         | -.0197         | .0027          | .645  | .028  | 98  |
| SO <sub>4</sub>  | 3.2899         | -.4796         | .3029          | -.3197         | .1424          | -.1036         | .823  | .064  | 103 |
| Cl   | 2.1950         | -.0170         | .0266          | -.3429         | .0074          | -.0138         | .701  | .091  | 102 |
| TH   | 3.0161         | -.1682         | .1443          | -.2034         | .0506          | -.0486         | .845  | .035  | 101 |
| DS   | 3.4465         | -.2800         | .1327          | -.2571         | .0820          | -.0468         | .845  | .046  | 90  |
| 06646600 Deer Creek below Millar Wasteway, at Glenrock, Wyo. 1971-75 water years |                |                |                |                |                |                |       |       |     |
| Ca   | 2.2370         | 0.1236         | -0.2845        | -0.2286        | -0.0697        | 0.2403         | 0.960 | 0.069 | 63  |
| Mg   | 2.1895         | .3264          | -.3614         | -.4230         | -.1808         | .2958          | .961  | .101  | 66  |
| Na   | 2.3370         | .1809          | -.2158         | -.5052         | -.1417         | .2225          | .985  | .074  | 66  |
| K  | .4354          | -.0966         | .0488          | -.0688         | .0567          | .0288          | .769  | .116  | 66  |
| HCO <sub>3</sub>   | 2.8200         | .1077          | -.2293         | -.2566         | -.0559         | .1968          | .975  | .056  | 66  |
| SO <sub>4</sub>  | 3.0054         | .3261          | -.3823         | -.4834         | -.2162         | .3369          | .986  | .066  | 65  |
| Cl   | 1.4127         | .1012          | .1618          | -.4332         | -.0171         | -.1119         | .816  | .249  | 66  |
| TH   | 3.0021         | .2089          | -.2969         | -.3072         | -.1198         | .2497          | .980  | .056  | 64  |
| DS   | 3.2054         | .1740          | -.2286         | -.3366         | -.1063         | .2144          | .985  | .053  | 66  |
| 06646800 North Platte River near Glenrock, Wyo. 1971-75 water years              |                |                |                |                |                |                |       |       |     |
| Ca   | 2.0417         | -0.0076        | 0.1561         | -0.0813        | 0.0088         | -0.0466        | 0.698 | 0.038 | 55  |
| Mg   | 1.9635         | -.4008         | .2884          | -.1930         | .1297          | -.0885         | .709  | .075  | 55  |
| Na   | 2.4272         | -.4804         | .5021          | -.2295         | .1447          | -.1567         | .723  | .071  | 55  |
| K  | .7240          | .1477          | .0849          | -.0588         | -.0407         | -.0244         | .433  | .054  | 55  |
| HCO <sub>3</sub>   | 2.4222         | .0809          | -.1074         | -.0655         | -.0225         | .0339          | .575  | .033  | 55  |
| SO <sub>4</sub>  | 2.9318         | -.4489         | .4641          | -.2017         | .1428          | -.1424         | .781  | .063  | 55  |
| Cl   | 1.9410         | .0508          | .1469          | -.2663         | -.0174         | -.0518         | .411  | .150  | 55  |
| TH   | 2.8000         | -.1405         | .1880          | -.1293         | .0492          | -.0572         | .823  | .035  | 55  |
| DS   | 3.1484         | -.2433         | .3102          | -.1590         | -.0783         | -.0955         | .790  | .045  | 55  |
| 06652000 North Platte River at Orin, Wyo. 1968-75 water years                    |                |                |                |                |                |                |       |       |     |
| Ca   | 2.3378         | 0.2780         | -0.0446        | -0.1721        | -0.0818        | 0.0137         | 0.704 | 0.046 | 91  |
| Mg   | 2.0355         | -.3043         | -.1688         | -.2246         | .1089          | .0600          | .735  | .087  | 91  |
| Na   | 2.7514         | -.0848         | .1278          | -.3290         | .0283          | -.0355         | .857  | .053  | 91  |
| K  | .9479          | .0072          | -.0503         | -.1232         | -.0011         | .0182          | .466  | .065  | 91  |
| HCO <sub>3</sub>   | 2.6585         | .1557          | -.1795         | -.1332         | -.0449         | .0572          | .806  | .029  | 91  |
| SO <sub>4</sub>  | 3.2864         | .0386          | .0570          | -.3182         | -.0065         | -.0134         | .872  | .050  | 91  |
| Cl   | 2.1747         | .2771          | .1507          | -.3306         | -.0757         | -.0427         | .772  | .078  | 91  |
| TH   | 3.0065         | .1464          | -.0591         | -.1961         | -.0379         | .0212          | .877  | .033  | 91  |
| DS   | 3.4252         | .0836          | .0113          | -.2464         | -.0212         | -.0004         | .897  | .033  | 91  |
| 06652800 North Platte River below Glendo Reservoir, Wyo. 1968-75 water years     |                |                |                |                |                |                |       |       |     |
| Ca   | 1.7683         | 0.0848         | -0.0257        | 0.0125         | -0.0058        | -0.0021        | 0.583 | 0.064 | 85  |
| Mg   | 1.4960         | .0851          | -.0247         | -.0488         | -.0026         | -.0026         | .816  | .093  | 85  |
| Na   | 1.8040         | .0392          | .0127          | -.0252         | .0041          | -.0176         | .875  | .044  | 85  |
| K  | .6712          | .9774          | -.0091         | -.0231         | -.0113         | .0028          | .864  | .043  | 85  |
| HCO <sub>3</sub>   | 2.2561         | .1418          | -.0432         | -.0037         | -.0256         | .0093          | .896  | .037  | 85  |
| SO <sub>4</sub>  | 2.3669         | .0571          | .0017          | -.0227         | .0017          | -.0150         | .888  | .043  | 85  |
| Cl   | 1.2563         | .0402          | -.0144         | -.0366         | .0033          | -.0096         | .772  | .077  | 85  |
| TH   | 2.4388         | .0961          | -.0253         | -.0116         | -.0083         | -.0026         | .904  | .037  | 85  |
| DS   | 2.7053         | .0774          | -.0105         | -.0149         | -.0046         | -.0080         | .911  | .034  | 85  |
| 06656000 North Platte River below Guernsey Reservoir, Wyo. 1969-75 water years   |                |                |                |                |                |                |       |       |     |
| Ca   | 1.8896         | -0.0273        | 0.0122         | -0.0211        | 0.0273         | -0.0105        | 0.782 | 0.044 | 77  |
| Mg   | 1.4526         | -.0501         | -.0415         | -.0339         | .0569          | .0142          | .622  | .125  | 77  |
| Na   | 1.6840         | -.0245         | .0024          | .0086          | .0350          | -.0100         | .662  | .047  | 77  |
| K  | .6963          | -.0028         | -.0034         | -.0301         | .0160          | .0031          | .789  | .050  | 77  |
| HCO <sub>3</sub>   | 2.4300         | -.0163         | -.0204         | -.0515         | .0209          | .0079          | .941  | .034  | 77  |
| SO <sub>4</sub>  | 2.1992         | -.0014         | .0082          | .0286          | .0310          | -.0122         | .676  | .046  | 77  |
| Cl   | 1.0787         | .0610          | -.0508         | .0134          | .0280          | .0127          | .369  | .187  | 77  |
| TH   | 2.4799         | -.0135         | -.0099         | -.0218         | .0286          | -.0011         | .904  | .031  | 77  |
| DS   | 2.6801         | -.0116         | -.0018         | -.0064         | .0289          | -.0051         | .844  | .031  | 77  |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent  | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|--|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 06660500 Laramie River at Two Rivers, Wyo. 1968-75 water years                 |                |                |                |                |                |                |       |       |    |
| Ca   | 2.1801         | -0.1480        | 0.0238         | -0.1699        | 0.0390         | 0.0238         | 0.852 | 0.075 | 86 |
| Mg   | 1.8993         | -.2761         | .0689          | -.2101         | .1007          | .0410          | .875  | .108  | 86 |
| Na   | 2.1010         | -.3063         | .1112          | -.2483         | .0835          | .0063          | .881  | .111  | 86 |
| K  | .6573          | -.0469         | .0393          | -.1237         | -.0010         | .0153          | .769  | .077  | 86 |
| HCO <sub>3</sub>   | 2.4847         | -.0293         | -.0797         | -.1540         | -.0155         | .0627          | .841  | .053  | 86 |
| SO <sub>4</sub>  | 2.7958         | -.3395         | .1224          | -.2159         | .1155          | .0140          | .879  | .114  | 86 |
| Cl   | 1.7463         | -.3488         | .0963          | -.2792         | .1647          | -.0098         | .824  | .150  | 86 |
| Th   | 2.8466         | -.2047         | .0461          | -.1846         | .0664          | .0283          | .884  | .080  | 86 |
| DS   | 3.0803         | -.2367         | .0750          | -.1986         | .0744          | .0181          | .885  | .088  | 86 |
| 06661500 Little Laramie River at Two Rivers, Wyo. 1968-75 water years          |                |                |                |                |                |                |       |       |    |
| Ca   | 1.6786         | 0.1008         | -0.1341        | -0.0009        | -0.0256        | -0.0230        | 0.522 | 0.095 | 87 |
| Mg   | 1.2349         | .2017          | .1722          | -.0179         | -.0921         | -.1468         | .560  | .119  | 87 |
| Na   | 1.3570         | .1819          | .2078          | .0102          | -.0828         | -.1887         | .546  | .126  | 87 |
| K  | .2959          | .1618          | .1279          | -.0197         | -.0674         | -.1208         | .486  | .129  | 87 |
| HCO <sub>3</sub>   | 2.2408         | .1061          | -.0129         | -.0111         | -.0553         | -.0014         | .477  | .070  | 87 |
| SO <sub>4</sub>  | 1.9518         | .1826          | .1943          | -.0169         | -.0352         | -.1956         | .542  | .184  | 86 |
| Cl   | .7339          | .3118          | .2418          | -.0402         | -.0880         | -.2446         | .599  | .200  | 87 |
| TH   | 2.2858         | .1531          | .0587          | -.0106         | -.0581         | -.0700         | .634  | .081  | 87 |
| DS   | 2.4432         | .1659          | .0979          | -.0022         | -.0648         | -.1061         | .602  | .096  | 87 |
| 06670500 Laramie River near Fort Laramie, Wyo. 1971-75 water years             |                |                |                |                |                |                |       |       |    |
| Ca   | 2.2658         | 0.3181         | -0.1981        | -0.1551        | -0.1416        | 0.0940         | 0.680 | 0.059 | 56 |
| Mg   | 1.4927         | -.0063         | -.2361         | -.0473         | .0256          | .1283          | .675  | .086  | 58 |
| Na   | 2.0585         | .1739          | -.2453         | -.1522         | -.0660         | .1313          | .856  | .053  | 59 |
| K  | .8456          | .0659          | .0197          | -.0749         | -.0282         | .0049          | .633  | .054  | 59 |
| HCO <sub>3</sub>   | 2.7217         | .2133          | -.2363         | -.1289         | -.0854         | .1137          | .897  | .031  | 59 |
| SO <sub>4</sub>  | 2.5438         | .1891          | -.1825         | -.1347         | -.0767         | .0100          | .827  | .046  | 58 |
| Cl   | 1.5982         | .2689          | -.2939         | -.1564         | -.1035         | .1438          | .810  | .059  | 59 |
| TH   | 2.7658         | .2052          | -.2238         | -.1211         | -.0818         | .1101          | .906  | .029  | 58 |
| DS   | 3.0073         | .2007          | -.1959         | -.1308         | -.0781         | .1009          | .896  | .033  | 59 |
| 06670900 North Platte River near Lingle, Wyo. 1969-75 water years              |                |                |                |                |                |                |       |       |    |
| Ca   | 2.1119         | 0.0029         | 0.0221         | -0.0862        | 0.0215         | -0.0128        | 0.971 | 0.021 | 84 |
| Mg   | 1.4660         | -.1826         | -.0118         | -.0428         | .0796          | -.0042         | .881  | .032  | 84 |
| Na   | 1.9679         | -.1645         | .1057          | -.0805         | .0702          | -.0412         | .904  | .032  | 84 |
| K  | .8091          | -.1106         | .0316          | -.0366         | .0549          | -.0156         | .775  | .043  | 84 |
| HCO <sub>3</sub>   | 2.5592         | .0492          | -.0265         | -.0732         | .0083          | .0059          | .972  | .021  | 84 |
| SO <sub>4</sub>  | 2.3930         | -.1826         | .0786          | -.0448         | .0768          | -.0334         | .834  | .035  | 84 |
| Cl   | 1.4446         | -.1038         | .0282          | -.0982         | .0606          | -.0224         | .928  | .040  | 84 |
| TH   | 2.6393         | -.0653         | .0103          | -.0702         | .0438          | -.0095         | .967  | .020  | 84 |
| DS   | 2.8774         | -.0733         | .0391          | -.0670         | .0452          | -.0188         | .969  | .019  | 84 |
| 06674500 North Platte River at Wyoming-Nebraska State line 1971-75 water years |                |                |                |                |                |                |       |       |    |
| Ca   | 2.0927         | 0.0407         | 0.0275         | -0.0737        | 0.0056         | -0.0160        | 0.936 | 0.026 | 58 |
| Mg   | 1.7219         | -.4035         | .2490          | -.1378         | .1311          | -.0945         | .671  | .061  | 56 |
| Na   | 2.3799         | -.0895         | .1703          | -.1850         | .0498          | -.0566         | .961  | .031  | 58 |
| K  | 1.1299         | -.0606         | .0232          | -.1312         | .0340          | .0048          | .784  | .068  | 56 |
| HCO <sub>3</sub>   | 2.8765         | .0651          | .1346          | -.1705         | -.0065         | -.0469         | .980  | .019  | 56 |
| SO <sub>4</sub>  | 2.5746         | -.2485         | .1580          | -.0910         | .0914          | -.0612         | .862  | .031  | 58 |
| Cl   | 1.5387         | -.0043         | -.0501         | -.1076         | .0292          | .0112          | .894  | .050  | 58 |
| TH   | 2.7072         | -.0736         | .0970          | -.0918         | .0361          | -.0403         | .940  | .021  | 56 |
| DS   | 3.0821         | -.0924         | .1030          | -.1213         | .0462          | -.0388         | .973  | .018  | 56 |
| 10020100 Bear River above reservoir, near Woodruff, Utah 1969-75 water years   |                |                |                |                |                |                |       |       |    |
| Ca   | 1.6615         | -0.2360        | -0.0415        | 0.0183         | 0.1543         | -0.0035        | 0.751 | 0.079 | 51 |
| Mg   | 1.3733         | -.6448         | .0440          | -.0476         | .3508          | -.0401         | .821  | .137  | 52 |
| Na   | 1.2657         | -.7561         | .3110          | -.0892         | .3926          | -.1767         | .932  | .091  | 52 |
| K  | .2929          | -.7382         | .4043          | .0141          | .3368          | -.1994         | .880  | .094  | 52 |
| HCO <sub>3</sub>   | 2.3740         | -.3387         | .0515          | -.0033         | .2196          | -.0391         | .835  | .069  | 51 |
| SO <sub>4</sub>  | .9125          | -1.040         | .4777          | .1586          | .5505          | -.2419         | .782  | .162  | 51 |
| Cl   | 1.3335         | -.6175         | .3675          | -.1369         | .3516          | -.2257         | .826  | .170  | 52 |
| TH   | 2.3254         | -.3667         | .0567          | -.0088         | .2164          | -.0490         | .860  | .067  | 51 |
| DS   | 2.4112         | -.4324         | .1121          | -.0160         | .2442          | -.0770         | .889  | .067  | 52 |

Table 4.--Regression results, concentration versus discharge  
and time--Continued

| Con-<br>stitu-<br>ent   | B <sub>0</sub> | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> | B <sub>5</sub> | R     | SE    | N  |
|---|----------------|----------------|----------------|----------------|----------------|----------------|-------|-------|----|
| 10039500 Bear River at Border, Wyo. 1971-75 water years                     |                |                |                |                |                |                |       |       |    |
| Ca  | 1.9927         | 0.9838         | -0.0433        | -0.0741        | -0.0318        | -0.0133        | 0.650 | 0.037 | 61 |
| Mg  | 1.4349         | -.2979         | -.1315         | -.0232         | .1095          | .0541          | .461  | .071  | 61 |
| Na  | 1.4737         | -.5741         | -.2018         | -.0301         | .2167          | .0748          | .595  | .077  | 61 |
| K   | -.0064         | -.5933         | .0097          | .1396          | .2319          | -.0293         | .617  | .084  | 61 |
| HCO <sub>3</sub>  | 2.5181         | .0183          | -.1061         | -.0384         | -.0108         | .0416          | .448  | .033  | 61 |
| SO <sub>4</sub>   | 2.1001         | -.4683         | .1054          | -.1294         | .1934          | -.0476         | .799  | .064  | 61 |
| Cl  | 1.6695         | -.4996         | -.2513         | -.1061         | .1883          | .0864          | .619  | .091  | 61 |
| TH  | 2.5698         | -.0228         | -.0815         | -.0623         | .0106          | -.0306         | .684  | .032  | 61 |
| DS  | 2.6772         | -.1439         | -.0817         | -.0582         | .0575          | .0290          | .695  | .036  | 61 |
| 13018300 Cache Creek near Jackson, Wyo. 1968-75 water years                 |                |                |                |                |                |                |       |       |    |
| Ca  | 1.6351         | -0.0812        | 0.0244         | 0.0658         | 0.1111         | -0.0694        | 0.777 | 0.023 | 87 |
| Mg  | 1.2157         | .0067          | -.0157         | -.0759         | -.0088         | .0304          | .631  | .038  | 87 |
| Na  | .4199          | -.2558         | .1864          | .0210          | .2819          | -.3408         | .793  | .077  | 87 |
| K   | -.2428         | -.1123         | .0745          | .0854          | .1535          | -.1712         | .352  | .161  | 87 |
| HCO <sub>3</sub>  | 2.3007         | -.0456         | .0063          | .0414          | .0756          | -.0324         | .786  | .016  | 87 |
| SO <sub>4</sub>   | .8263          | -.3546         | .0550          | .1157          | .4723          | -.1976         | .641  | .145  | 87 |
| Cl  | -.5596         | -.2689         | -.0854         | .5744          | .5005          | -.0333         | .309  | .268  | 87 |
| TH  | 2.2366         | -.0555         | .0076          | .0250          | .0764          | -.0345         | .816  | .014  | 87 |
| DS  | 2.2405         | -.0724         | .0174          | .0447          | .1027          | -.0523         | .858  | .015  | 87 |
| 13022500 Snake River above reservoir, near Alpine, Wyo. 1968-75 water years |                |                |                |                |                |                |       |       |    |
| Ca  | 2.3969         | 0.1691         | 0.3725         | -0.2218        | -0.0442        | -0.1116        | 0.891 | 0.042 | 89 |
| Mg  | 1.6900         | -.4933         | .2730          | -.2010         | .1607          | -.0863         | .835  | .092  | 89 |
| Na  | .3019          | -1.204         | -.0196         | .1807          | .3702          | -.0045         | .529  | .100  | 89 |
| K   | -.3527         | -.9701         | -.1423         | .1865          | .3009          | .0312          | .489  | .084  | 89 |
| HCO <sub>3</sub>  | 2.7373         | .0367          | .3565          | -.1760         | -.0098         | -.1080         | .935  | .024  | 88 |
| SO <sub>4</sub>   | 2.1326         | -.7170         | .0493          | -.1329         | .2432          | -.0213         | .899  | .084  | 89 |
| Cl  | 1.0971         | -.3262         | -.0492         | -.1239         | .1021          | .0000          | .368  | .220  | 87 |
| TH  | 2.8492         | -.0806         | .3151          | -.1947         | .0325          | -.0955         | .938  | .034  | 84 |
| DS  | 2.8397         | -.1429         | .2371          | -.1590         | .0520          | -.0734         | .948  | .030  | 89 |
| 13027500 Salt River above reservoir, near Etna, Wyo. 1968-75 water years    |                |                |                |                |                |                |       |       |    |
| Ca  | 1.8487         | -0.1611        | -0.0929        | -0.0188        | 0.0554         | 0.0341         | 0.420 | 0.036 | 91 |
| Mg  | 1.6227         | -.0273         | -.4536         | -.1351         | .0120          | .1735          | .570  | .104  | 91 |
| Na  | -.0454         | -1.360         | -1.129         | .3962          | .5011          | .3579          | .571  | .129  | 91 |
| K   | -.4627         | -.7062         | -.2005         | .1963          | .2583          | .0521          | .346  | .112  | 91 |
| HCO <sub>3</sub>  | 2.5396         | -.0731         | -.0331         | -.0565         | .0233          | .0160          | .784  | .016  | 91 |
| SO <sub>4</sub>   | .9721          | -.0407         | -1.375         | .1753          | .1648          | .4831          | .631  | .098  | 91 |
| Cl  | .1985          | -1.570         | -1.333         | .3439          | .5846          | .4112          | .644  | .158  | 91 |
| TH  | 2.4745         | -.1657         | -.2129         | -.0401         | .0591          | .0783          | .869  | .018  | 91 |
| DS  | 2.4481         | -.2607         | -.3062         | -.0055         | .0952          | .1051          | .864  | .018  | 91 |