DISCHARGE AND WATER QUALITY OF HORSE CREEK, SOUTHEASTERN WYOMING, MAY-NOVEMBER, 1985

U.S. GEOLOGICAL SURVEY
Open-File Report 86-69

Prepared in cooperation with the
WYOMING WATER DEVELOPMENT COMMISSION

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By J. F. Meyer and L. W. Lenfest, Jr.

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1986

UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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CONVERSION FACTORS

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

Multiply	By	To obtain
mile	1.609	kilometer
cubic foot per second	0.02832	cubic meter per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°F = 9/5(°C) + 32$$

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ABSTRACT

This report presents stream-discharge and water-quality data collected at five sites in the lower Horse Creek drainage of southeastern Wyoming, May through November, 1985. Data include stream-discharge measurements; field measurements of specific conductance, pH, and water temperature; and computed changes in stream discharge. Measured discharge in Horse Creek ranged from 0.91 to 172 cubic feet per second. Values of pH averaged 8.4. Water temperature ranged from 0 to 27 degrees Celsius. The data are presented in graphs and tables. A map of the study reach shows the location of the data-collection sites.

INTRODUCTION

Stream-discharge and water-quality data were collected in the lower Horse Creek drainage basin in cooperation with the Wyoming Water Development Commission. Data were collected to define stream-discharge and water-quality changes in Horse Creek, May through November, 1985.

The Horse Creek study reach (fig. 1) begins at site 1, just upstream of the Fort Laramie Canal siphon, and extends about 15 miles downstream to the Wyoming-Nebraska State line. Dry Creek is the only significant natural tributary along the study reach and is located about 5 miles downstream from the Fort Laramie Canal siphon. Along the study reach, land is irrigated by water diverted from Horse Creek; and water from the Fort Laramie Canal is added to Horse Creek.

DATA COLLECTION

Stream-discharge and water-quality measurements were made at four sites on Horse Creek and at one site on Dry Creek. Dry Creek was measured to define inflow to Horse Creek. The five sites (fig. 2-6, at end of report) were photographed on October 21, 1985 and are identified as follows:

Site 1 - Horse Creek at siphon near Yoder, Wyoming
Site 2 - Dry Creek near Huntley, Wyoming
Site 3 - Horse Creek below Dry Creek near Huntley, Wyoming
Site 4 - Horse Creek above South Horse Creek lateral near Huntley, Wyoming
Site 5 - Horse Creek near Lyman, Nebraska

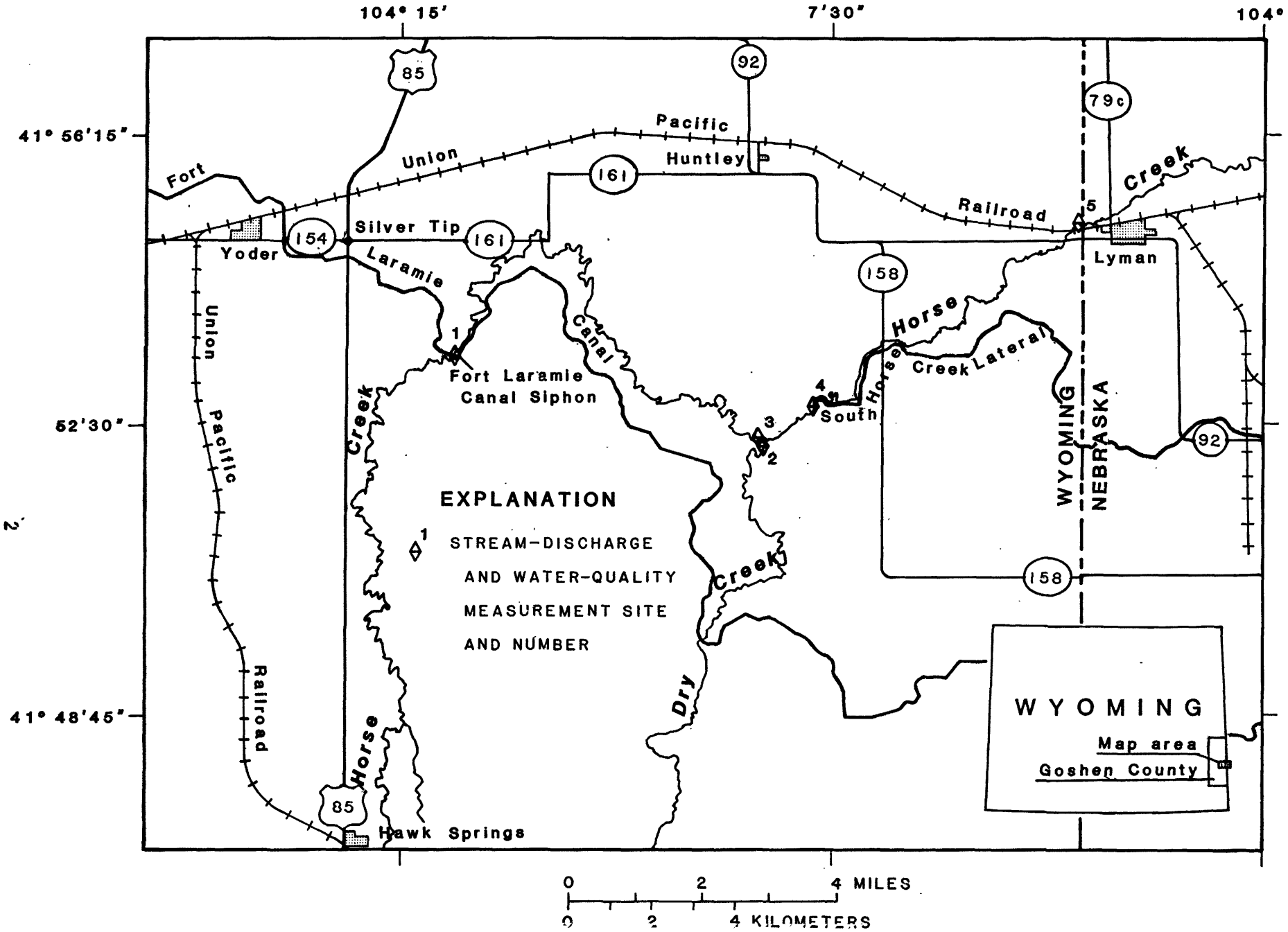

Figure 1.--Study reach of Horse Creek and location of stream-discharge and water-quality measurement sites.

Measurements of stream discharge, specific conductance, pH, and water temperature were made at the five sites during the reconnaissance of the area, May 9-10, 1985, and then were made twice-a-month from June 5 through November 21, 1985. Measurements are listed in tables 1-5 (at end of report) and are shown graphically in figures 7-11.

Changes in stream discharge were calculated for three stream reaches between measurement sites on Horse Creek. The change in stream discharge given in table 6, at end of report (and shown graphically in figure 12), is the mathematical difference between streamflow measured at adjacent sites. Water that may have been diverted from, or added to, streamflow in Horse Creek between sites was not measured or identified. No precipitation occurred during the measurements. The change between site 1 and site 3 was calculated by considering the discharge from Dry Creek (site 2) as inflow. Because all stream-discharge measurements were not made on the same day, no stream-discharge changes were computed from data collected on the initial reconnaissance of May 9-10, 1985.

Accuracy of discharge measurements can be affected by the condition of the measurement equipment, characteristics of the measurement section, changes in stage, and other factors (Rantz and others, 1982, p. 179). Stream-discharge measurements in this report are rated good, having an error of less than 5 percent.

Specific conductance and pH of composite water samples were measured at each site, and water temperature was measured at a single point in the discharge-measurement section. The composite water samples consisted of water collected at points along the cross section of the creek and at different depths at each point. These depth-integrated water samples were collected using the EWI (equal width increment) method, formerly known as ETR (equal transit rate) method (Guy and Norman, 1970, p. 32), and were composited in a churn sample splitter. Specific conductance is a measure of the ability of water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25° Celsius. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids concentration of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is between 55 and 75 percent of the specific conductance; however, this relation varies significantly according to the actual constituents in the water (Hem, 1985, p. 66-67).

REFERENCES CITED

Guy, H. P., and Norman, V. W., 1970, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter C2, 59 p.

Hem, J. D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 264 p.

Rantz, S. E., and others, 1982, Measurement and computation of streamflow; Volume 1, Measurement of stage and discharge: U.S. Geological Survey Water-Supply Paper 2175, 284 p.

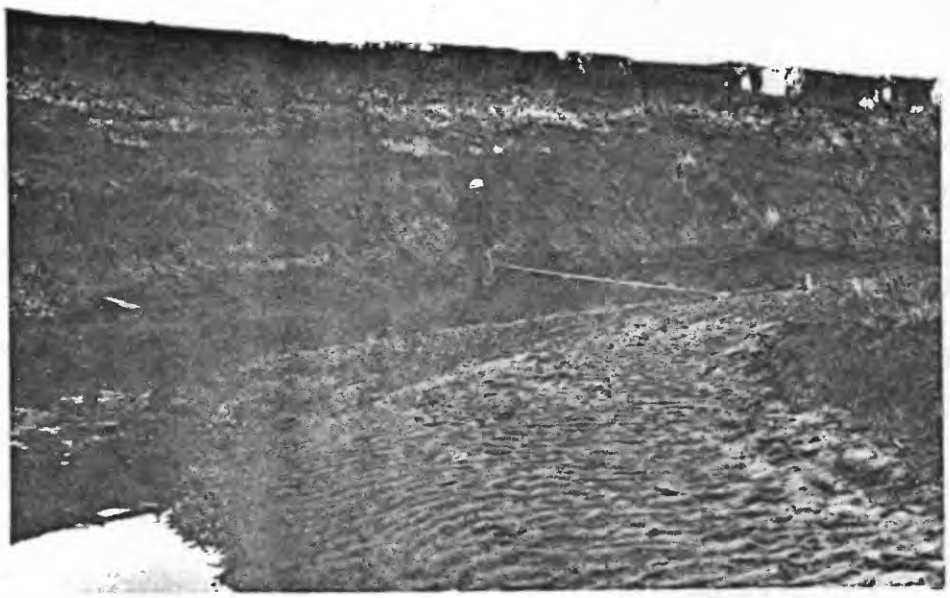

Figure 2.--Upstream view of Horse Creek at siphon near Yoder, Wyoming (site 1), October 21, 1985.

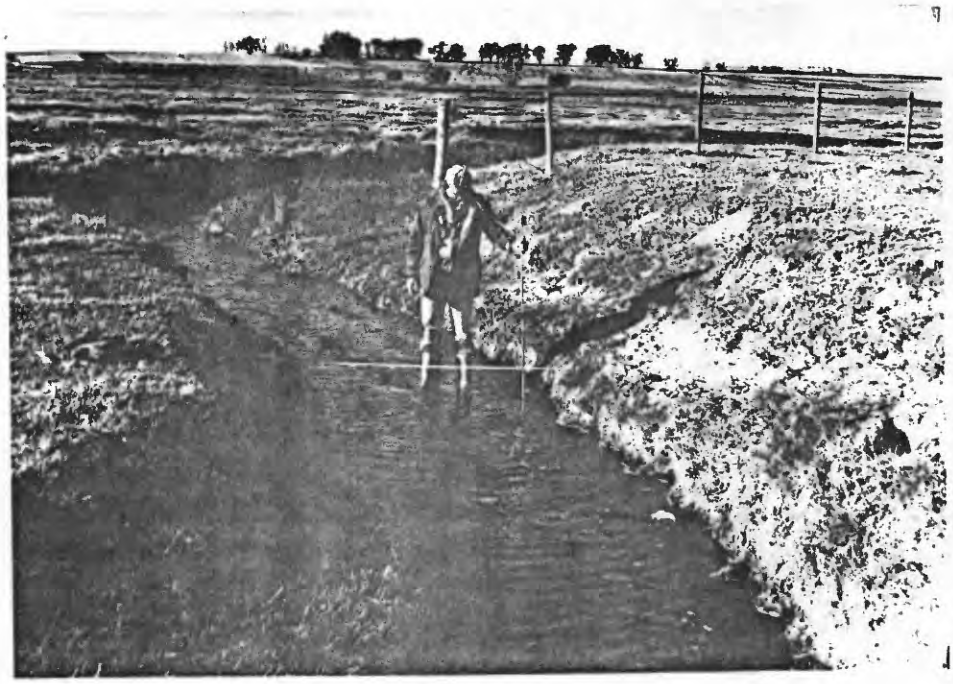

Figure 3.--Downstream view of Dry Creek near Huntley, Wyoming (site 2), October 21, 1985.

Figure 4.--Upstream view of Horse Creek below Dry Creek near Huntley, Wyoming (site 3), October 21, 1985.

Figure 5.--Downstream view of Horse Creek above South Horse Creek lateral near Huntley, Wyoming (site 4), October 21, 1985.

Figure 6.--Downstream view of Horse Creek near Lyman, Nebraska (site 5), October 21, 1985.

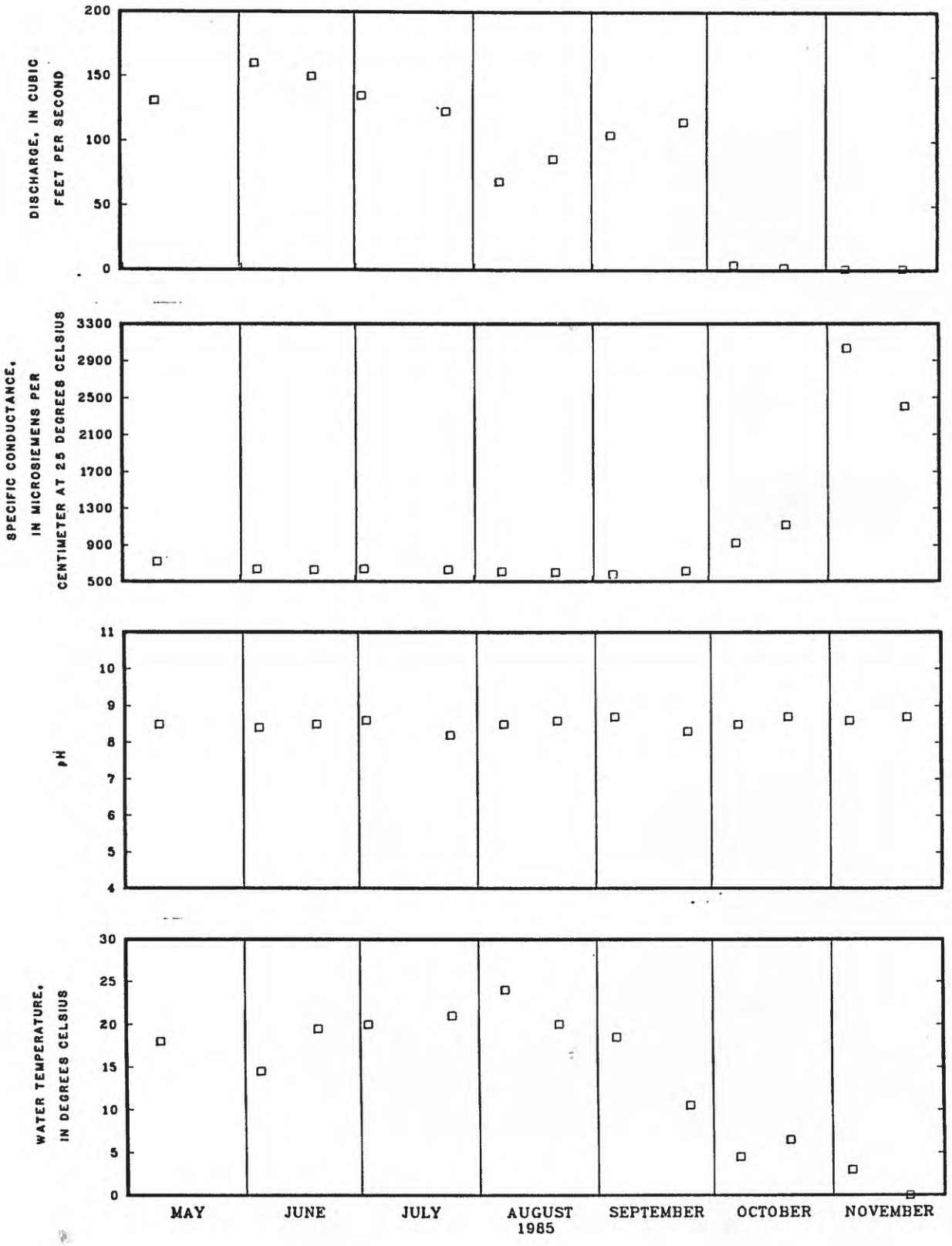

Figure 7.--Stream discharge, specific conductance, pH, and water temperature at Horse Creek at siphon near Yoder, Wyoming (site 1).

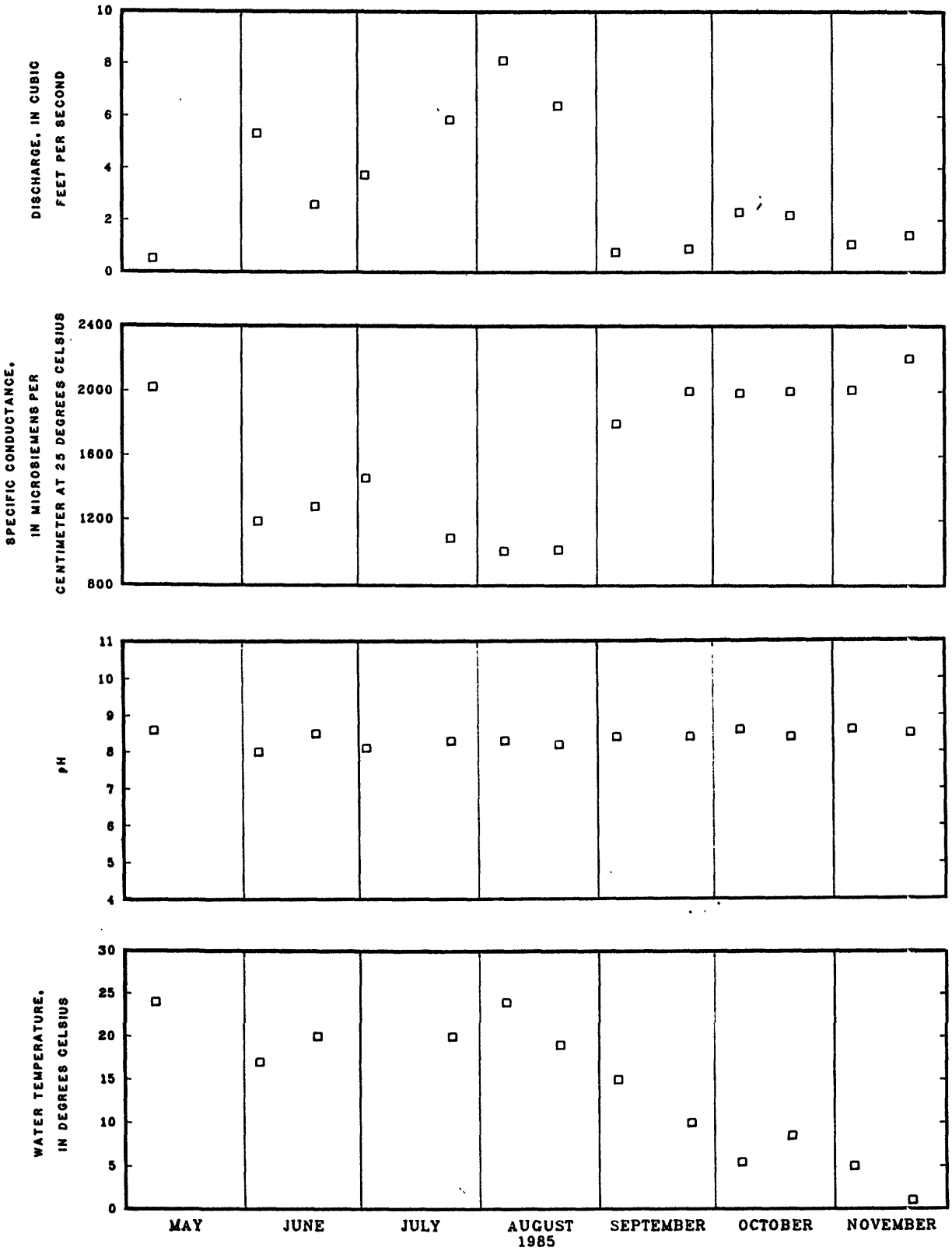

Figure 8.--Stream discharge, specific conductance, pH, and water temperature at Dry Creek near Huntley, Wyoming (site 2).

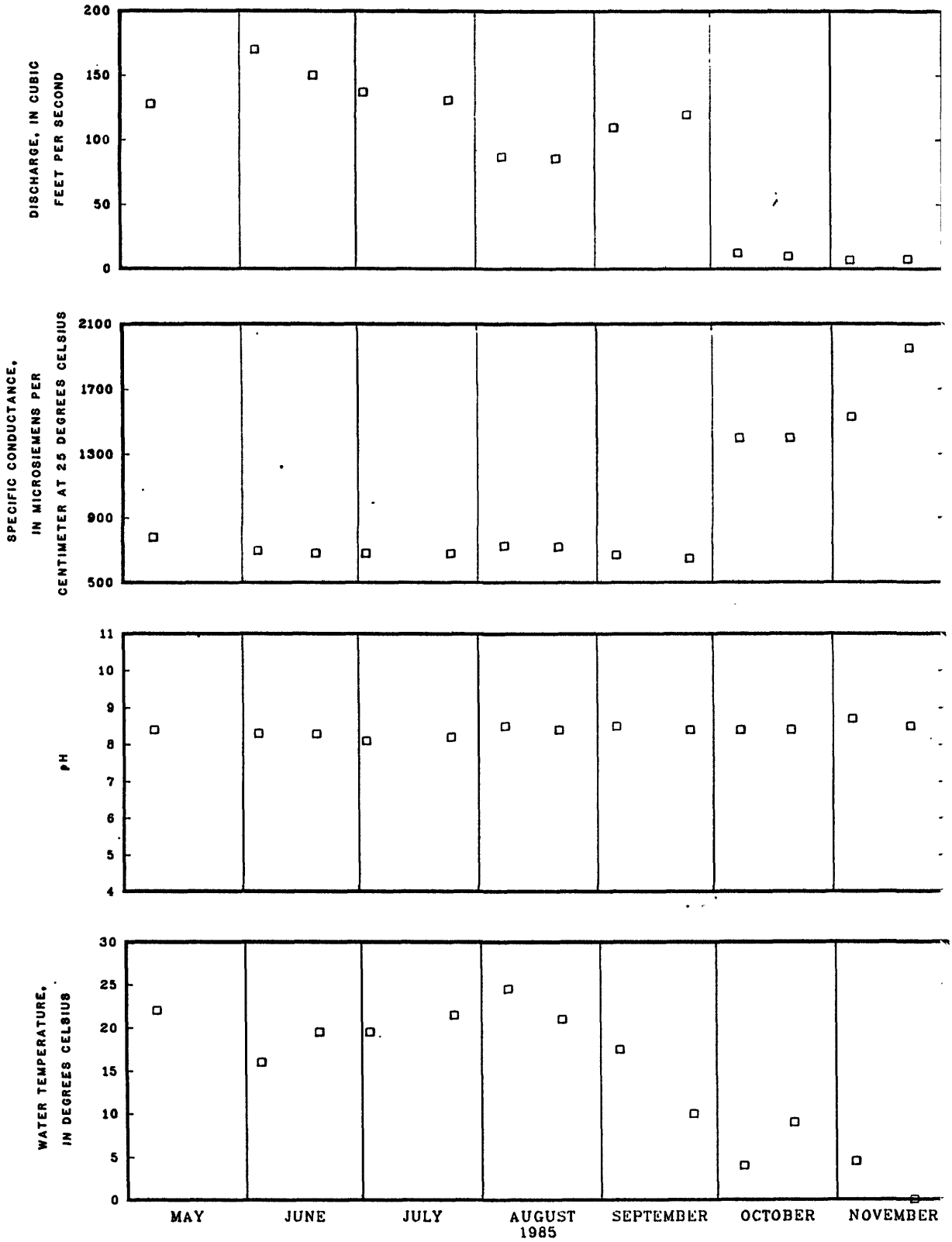

Figure 9.--Stream discharge, specific conductance, pH, and water temperature at Horse Creek below Dry Creek near Huntley, Wyoming (site 3).

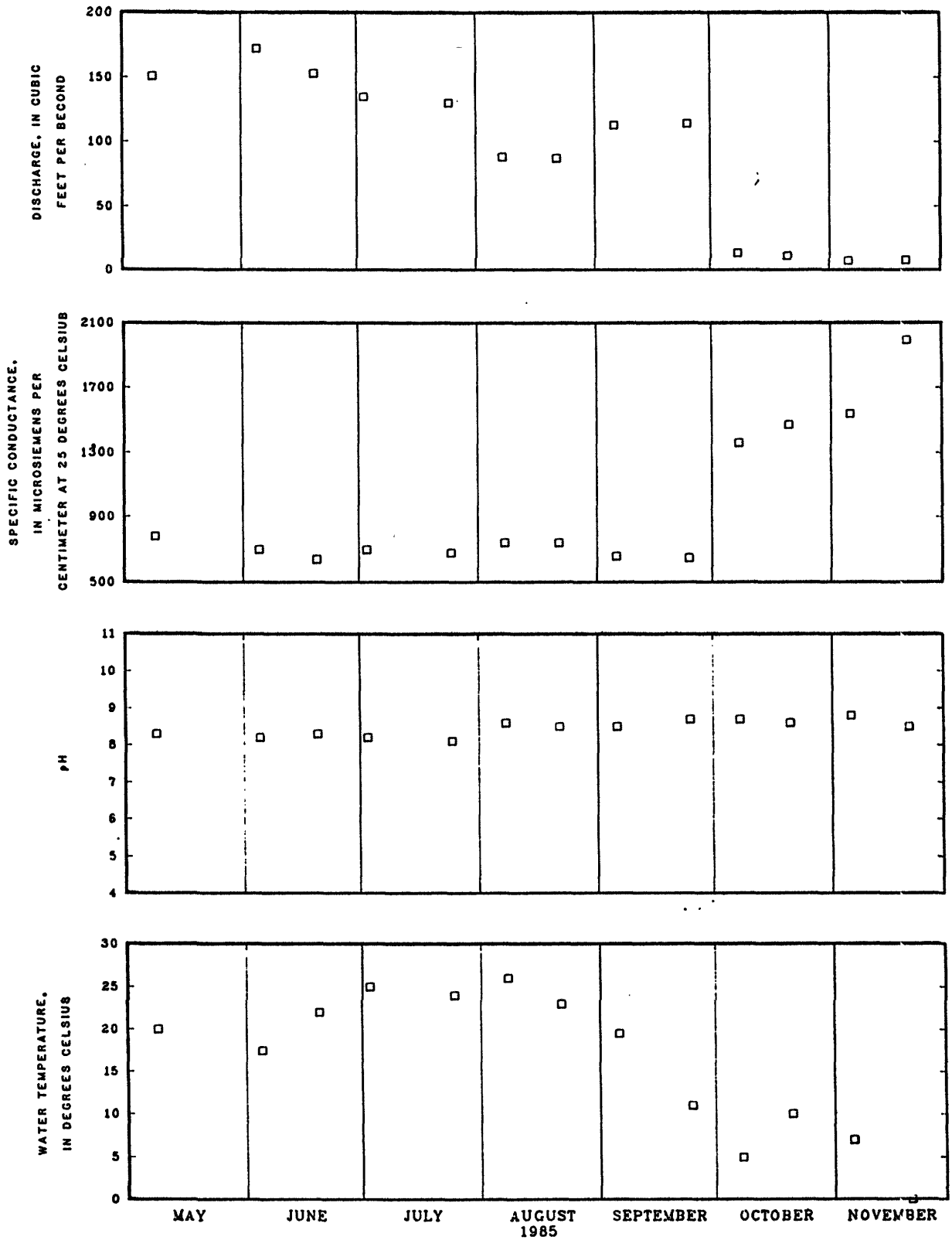

Figure 10.--Stream discharge, specific conductance, pH, and water temperature at Horse Creek above South Horse Creek lateral near Huntley, Wyoming (site 4).

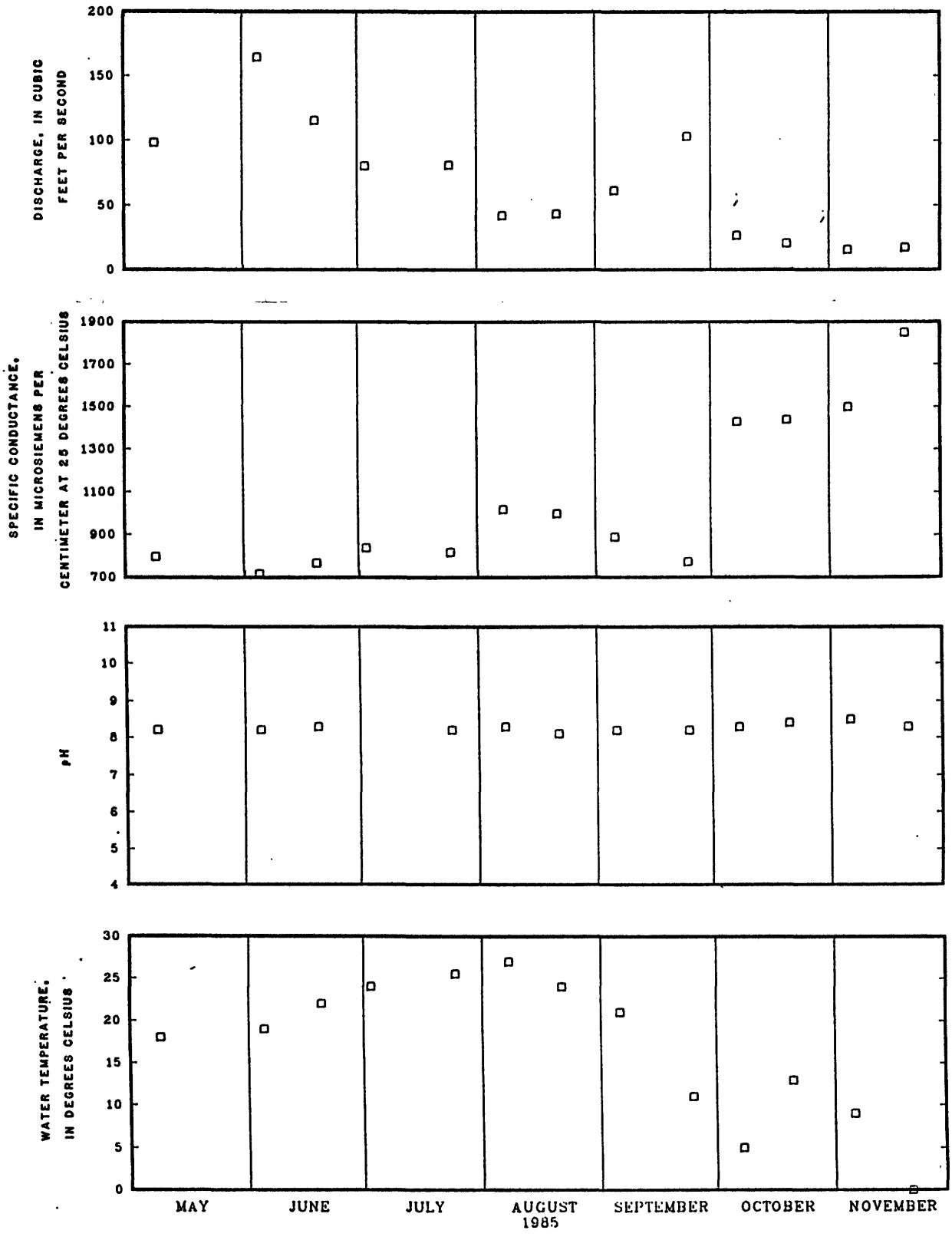

Figure 11.--Stream discharge, specific conductance, pH, and water temperature at Horse Creek near Lyman, Nebraska (site 5).

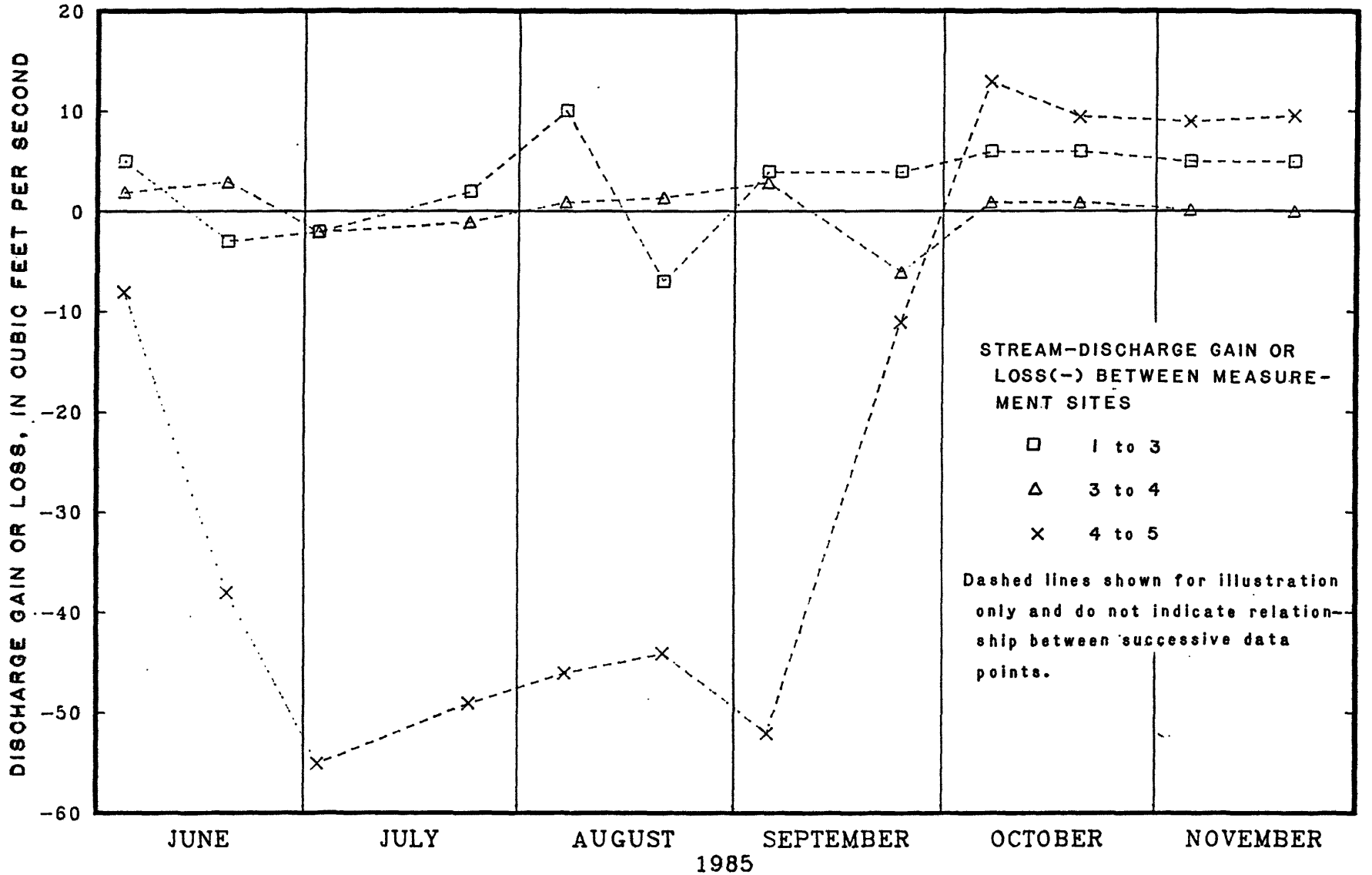

Figure 12.--Stream-discharge gain or loss between measurement sites on Horse Creek.

Table 1.--*Stream-discharge and water-quality measurements made during 1985 of Horse Creek at siphon near Yoder, Wyoming (site 1)*

Date	Time	Discharge (cubic feet per second)	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	pH	Water temper-ature (degrees Celsius)
May 10	0945	131	720	8.5	18.0
June 5	0740	160	640	8.4	14.5
June 20	0750	150	630	8.5	19.5
July 3	0800	135	640	8.6	20.0
July 25	0800	123	630	8.2	21.0
August 8	1020	69.0	610	8.5	24.0
August 22	0900	86.6	600	8.6	20.0
September 6	0815	105	580	8.7	18.5
September 25	0900	115	615	8.3	10.5
October 8	0800	4.35	920	8.5	4.5
October 21	0810	2.21	1120	8.7	6.5
November 6	0810	0.91	3030	8.6	3.0
November 21	0910	1.06	2400	8.7	0.0

Table 2.--*Stream-discharge and water-quality measurements made during 1985 of Dry Creek near Huntley, Wyoming (site 2)*

Date	Time	Discharge (cubic feet per second)	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	pH	Water temper-ature (degrees Celsius)
May 9	1740	0.52	2020	8.6	24.0
June 5	0910	5.32	1190	8.0	17.0
June 20	1020	2.58	1280	8.5	20.0
July 3	1100	3.73	1460	8.1	--
July 25	1100	5.86	1090	8.3	20.0
August 8	1330	8.11	1010	8.3	24.0
August 22	1200	6.41	1020	8.2	19.0
September 6	1045	.78	1800	8.4	15.0
September 25	1145	.90	2000	8.4	10.0
October 8	1100	2.31	1990	8.6	5.5
October 21	0920	2.19	2000	8.4	8.5
November 6	1030	1.08	2010	8.6	5.0
November 21	1120	1.42	2200	8.5	1.0

Table 3.--*Stream-discharge and water-quality measurements made during 1985 of Horse Creek below Dry Creek near Huntley, Wyoming (site 3)*

Date	Time	Discharge (cubic feet per second)	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	pH	Water temperature (degrees Celsius)
May 9	1640	128	780	8.4	22.0
June 5	0955	170	700	8.3	16.0
June 20	1030	150	680	8.3	19.5
July 3	1000	137	680	8.1	19.5
July 25	1115	131	680	8.2	21.5
August 8	1310	87.0	725	8.5	24.5
August 22	1145	85.7	720	8.4	21.0
September 6	1030	110	670	8.5	17.5
September 25	1200	120	650	8.4	10.0
October 8	1045	12.4	1400	8.4	4.0
October 21	0930	10.0	1400	8.4	9.0
November 6	1010	6.78	1530	8.7	4.5
November 21	1130	7.44	1950	8.5	0.0

Table 4.--*Stream-discharge and water-quality measurements made during 1985 of Horse Creek above South Horse Creek lateral near Huntley, Wyoming (site 4)*

Date	Time	Discharge (cubic feet per second)	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	pH	Water temperature (degrees Celsius)
May 9	1440	151	780	8.3	20.0
June 5	1115	172	700	8.2	17.5
June 20	1235	153	640	8.3	22.0
July 3	1200	135	700	8.2	25.0
July 25	1310	130	680	8.1	24.0
August 8	1500	88.2	740	8.6	26.0
August 22	1345	87.2	740	8.5	23.0
September 6	1230	113	660	8.5	19.5
September 25	1350	114	650	8.7	11.0
October 8	1215	13.3	1360	8.7	5.0
October 21	1035	11.0	1470	8.6	10.0
November 6	1210	7.12	1540	8.8	7.0
November 21	1300	7.55	1990	8.5	0.0

Table 5.--*Stream-discharge and water-quality measurements made during 1985 of Horse Creek near Lyman, Nebraska (site 5)*

Date	Time	Discharge (cubic feet per second)	Specific conductance (microsiemens per centimeter at 25 degrees Celsius)	pH	Water temperature (degrees Celsius)
May 9	1110	98.0	800	8.2	18.0
June 5	1300	164	720	8.2	19.0
June 20	1420	115	770	8.3	22.0
July 3	1400	80.0	840	--	24.0
July 25	1515	80.9	820	8.2	25.5
August 8	1645	42.0	1020	8.3	27.0
August 22	1530	43.2	1000	8.1	24.0
September 6	1415	61.1	890	8.2	21.0
September 25	1545	103	775	8.2	11.0
October 8	1350	26.4	1430	8.3	5.0
October 21	1240	20.5	1440	8.4	13.0
November 6	1340	15.7	1500	8.5	9.0
November 21	1445	17.2	1850	8.3	0.0

Table 6.--*Stream-discharge changes for three stream reaches located between measurement sites on Horse Creek*

Date	Discharge change, in cubic feet per second, between measurement sites (+, gain; -, loss)		
	Site numbers		
	1 to 3	3 to 4	4 to 5
June 5	+5	+2	-8
June 20	-3	+3	-38
July 3	-2	-2	-55
July 25	+2	-1	-49
August 8	+9.9	+1.2	-46.2
August 22	-7.3	+1.5	-44
September 6	+4	+3	-52
September 25	+4	-6	-11
October 8	+5.7	+0.9	+13.1
October 21	+5.6	+1	+9.5
November 6	+4.79	+0.24	+8.6
November 21	+4.96	+0.11	+9.6