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Streamflow Statistics for Selected Streams in North Dakota, Minnesota, Manitoba, and Saskatchewan

Open-File Report 2012–1147

U.S. Department of the Interior
U.S. Geological Survey

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By Tara Williams-Sether

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U.S. Department of the Interior
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U.S. Department of the Interior
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Horizontal coordinate information is referenced to the "North American Datum of 1983 (NAD 83)."

Water year, 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

Streamflow Statistics for Selected Streams in North Dakota, Minnesota, Manitoba, and Saskatchewan

By Tara Williams-Sether

Abstract

Statistical summaries of streamflow data for the periods of record through water year 2009 for selected active and discontinued U.S. Geological Survey streamflow-gaging stations in North Dakota, Minnesota, Manitoba, and Saskatchewan were compiled. The summaries for each streamflow-gaging station include a brief station description, a graph of the annual peak and annual mean discharge for the period of record, statistics of monthly and annual mean discharges, monthly and annual flow durations, probability of occurrence of annual high discharges, annual peak discharge and corresponding gage height for the period of record, and monthly and annual mean discharges for the period of record.

Introduction

Knowledge of the magnitude and time distribution of streamflow is essential for all aspects of water management and environmental planning. Federal, State, and local agencies responsible for the development and management of North Dakota's surface-water resources use this information for making safe, economical, and environmentally sound water-resource planning decisions.

At streamflow-gaging stations, a continuous record of discharge (streamflow) is developed by creating a relation between continuously recorded water level, or stage, and periodic measurements of discharge throughout the range in water level (Rantz and others, 1982). Streamflow statistics published in annual state water reports by the U.S. Geological Survey (USGS) include records of daily mean discharge, annual high and low discharge, and annual mean discharge. Water resource managers may go to various Federal and State agencies or Universities to obtain necessary statistics, but sources may only include active streamflow-gaging stations listed in the most recent annual report and, thus, overlook information available for many discontinued streamflow-gaging stations.

The purpose of this report is to provide a comprehensive publication summarizing streamflow statistics for the periods of record through water year 2009 for selected active and discontinued streamflow-gaging stations that are operated in or adjacent to North Dakota. The term "water year" in this report is defined as the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 2009 is called the 2009 water year. Operating streamflow-gaging stations that have at least 10 years of discharge record through water year 2009 are listed in table 1 and their locations are shown in figure 1. Operating peak streamflow-gaging stations that have at least 10 years of discharge record through water 2009, operating streamflow-gaging stations that have 5–9 years of discharge record through water year 2009, and streamflow-gaging stations that were discontinued since water year 2000 are listed in table 2 and their locations are shown in figure 2.

History of the Streamflow-Gaging Program in North Dakota

Much of the history of the streamflow-gaging program in North Dakota outlined in this report was originally presented by Crosby (1970). The collection of systemic streamflow data began in 1882 when a stage-gaging station was established on the Red River of the North at Grand Forks (Crosby, 1970). Infrequent discharge measurements were made at this station for navigational purposes. The Missouri River Commission obtained stage data on the Missouri River at Bismarck in 1881–82 and in 1886–89. As a result of the National Reclamation Act of 1902 and the disastrous flood in 1897 in the Red River of the North Basin, the USGS, in cooperation with the State of North Dakota, established and operated streamflow-gaging stations from 1901 through 1909 (Crosby, 1970). The diversion of water along the international boundary created interest from Canada, and resulted in the formation of the International Joint Commission in 1912. State cooperation was discontinued in 1925 when eight streamflow-gaging stations were in operation (Crosby, 1970). Only five federally operated streamflow-gaging stations were continued. State cooperation resumed in 1931, but funds were limited from 1934 through 1938. However, the Rivers and Harbors Act of 1927 and the Flood Control Acts of 1928 and 1936 resulted in the

Table 1. List of operating streamflow-gaging stations with 10 or more years of discharge record through water year 2009 for which streamflow statistics are published in this report and links to streamflow statistics.

[Water year, the 12-month period October 1, for any given year through September 30, of the following year; Y, yes; N, no]

Map identifier (fig. 1)	Station number (with link to streamflow statistics)	Station name	Regulation (Y/N)
1	*05051500*	Red River of the North at Wahpeton, N. Dak.	Y
2	*05051522*	Red River of the North at Hickson, N. Dak.	Y
3	*05051600*	Wild Rice River near Rutland, N. Dak.	N
4	*05052500*	Antelope Creek at Dwight, N. Dak.	N
5	*05053000*	Wild Rice River near Abercrombie, N. Dak.	Y
6	*05054000*	Red River of the North at Fargo, N. Dak.	Y
7	*05054500*	Sheyenne River above Harvey, N. Dak.	N
8	*05056000*	Sheyenne River near Warwick, N. Dak.	N
9	*05056060*	Mauvais Coulee Tributary No. 3 near Cando, N. Dak.	N
10	*05056100*	Mauvais Coulee near Cando, N. Dak.	N
11	*05056200*	Edmore Coulee near Edmore, N. Dak.	N
12	*05056215*	Edmore Coulee Tributary near Webster, N. Dak.	N
13	*05056239*	Starkweather Coulee near Webster, N. Dak.	N
14	*05056340*	Little Coulee near Leeds, N. Dak.	N
15	*05057000*	Sheyenne River near Cooperstown, N. Dak.	N
16	*05057200*	Baldhill Creek near Dazey, N. Dak.	N
17	*05058000*	Sheyenne River below Baldhill Dam, N. Dak.	Y
18	*05058700*	Sheyenne River at Lisbon, N. Dak.	Y
19	*05059000*	Sheyenne River near Kindred, N. Dak.	Y
20	*05059300*	Sheyenne River above Sheyenne River Diversion near Horace, N. Dak.	Y
21	*05059310*	Sheyenne River Diversion near Horace, N. Dak.	Y
22	*05059480*	Sheyenne River Diversion at West Fargo, N. Dak.	Y
23	*05059500*	Sheyenne River at West Fargo, N. Dak.	Y
24	*05059600*	Maple River near Hope, N. Dak.	N
25	*05059700*	Maple River near Enderlin, N. Dak.	N
26	*05060000*	Maple River near Mapleton, N. Dak.	Y
27	*05060100*	Maple River below Mapleton, N. Dak.	Y
28	*05060500*	Rush River at Amenia, N. Dak.	N
29	*05064500*	Red River of the North at Halstad, Minn.	Y
30	*05066500*	Goose River at Hillsboro, N. Dak.	N
31	*05070000*	Red River of the North near Thompson, N. Dak.	Y
32	*05082500*	Red River of the North at Grand Forks, N. Dak.	Y
33	*05082625*	Turtle River at Turtle River State Park near Arvilla, N. Dak.	Y
34	*05084000*	Forest River near Fordville, N. Dak.	N
35	*05085000*	Forest River at Minto, N. Dak.	N

Table 1. List of operating streamflow-gaging stations with 10 or more years of discharge record through water year 2009 for which streamflow statistics are published in this report and links to streamflow statistics.—Continued

[Water year, the 12-month period October 1, for any given year through September 30, of the following year; Y, yes; N, no]

Map Identifier (fig. 1)	Station number (with link to streamflow statistics)	Station name	Regulation (Y/N)
36	*05090000*	Park River at Grafton, N. Dak.	Y
37	*05092000*	Red River of the North at Drayton, N. Dak.	Y
38	*05099100*	Snowflake Creek near Snowflake, Manitoba, Canada	N
39	*05099150*	Mowbray Creek near Mowbray, Manitoba, Canada	N
40	*05099300*	Pembina River near Windygates, Manitoba, Canada	N
41	*05099400*	Little South Pembina River near Walhalla, N. Dak.	Y
42	*05099600*	Pembina River at Walhalla, N. Dak.	N
43	*05100000*	Pembina River at Neche, N. Dak.	N
44	*05101000*	Tongue River at Akra, N. Dak.	Y
45	*05102500*	Red River of the North at Emerson, Manitoba, Canada	Y
46	*05113360*	Long Creek at west crossing of International Boundary, Saskatchewan, Canada	N
47	*05113600*	Long Creek near Noonan, N. Dak.	N
48	*05114000*	Souris River near Sherwood, N. Dak.	Y
49	*05116000*	Souris River near Foxholm, N. Dak.	Y
50	*05116500*	Des Lacs River at Foxholm, N. Dak.	Y
51	*05117500*	Souris River above Minot, N. Dak.	Y
52	*05120000*	Souris River near Verendrye, N. Dak.	Y
53	*05120500*	Wintering River near Karlsruhe, N. Dak.	Y
54	*05122000*	Souris River near Bantry, N. Dak.	Y
55	*05123400*	Willow Creek near Willow City, N. Dak.	N
56	*05123510*	Deep River near Upham, N. Dak.	N
57	*05124000*	Souris River near Westhope, N. Dak.	Y
58	*06329597*	Charbonneau Creek near Charbonneau, N. Dak.	N
59	*06331000*	Little Muddy River below Cow Creek near Williston, N. Dak.	N
60	*06332515*	Bear Den Creek near Mandaree, N. Dak.	N
61	*06332523*	East Fork Shell Creek near Parshall, N. Dak.	N
62	*06332770*	Deepwater Creek at mouth near Raub, N. Dak.	N
63	*06335500*	Little Missouri River at Marmarth, N. Dak.	N
64	*06336000*	Little Missouri River at Medora, N. Dak.	N
65	*06336600*	Beaver Creek near Trotters, N. Dak.	N
66	*06337000*	Little Missouri River near Watford City, N. Dak.	N
67	*06338490*	Missouri River at Garrison Dam, N. Dak.	Y
68	*06339100*	Knife River at Manning, N. Dak.	N
69	*06339500*	Knife River near Golden Valley, N. Dak.	N
70	*06340000*	Spring Creek at Zap, N. Dak.	N

Table 1. List of operating streamflow-gaging stations with 10 or more years of discharge record through water year 2009 for which streamflow statistics are published in this report and links to streamflow statistics.—Continued

[Water year, the 12-month period October 1, for any given year through September 30, of the following year; Y, yes; N, no]

Map Identifier (fig. 1)	Station number (with link to streamflow statistics)	Station name	Regulation (Y/N)
71	*06340500*	Knife River at Hazen, N. Dak.	N
72	*06342260*	Square Butte Creek below Center, N. Dak.	Y
73	*06342450*	Burnt Creek near Bismarck, N. Dak.	N
74	*06342500*	Missouri River at Bismarck, N. Dak.	Y
75	*06344600*	Green River near New Hradec, N. Dak.	N
76	*06345500*	Heart River near Richardton, N. Dak.	Y
77	*06345780*	Heart River above Lake Tschida near Glen Ullin, N. Dak.	Y
78	*06347000*	Antelope Creek near Carson, N. Dak.	N
79	*06347500*	Big Muddy Creek near Almont, N. Dak.	N
80	*06348300*	Heart River at Stark Bridge near Judson, N. Dak.	Y
81	*06348500*	Sweetbriar Creek near Judson, N. Dak.	Y
82	*06349000*	Heart River near Mandan, N. Dak.	Y
83	*06349500*	Apple Creek near Menoken, N. Dak.	N
84	*06350000*	Cannonball River at Regent, N. Dak.	N
85	*06352000*	Cedar Creek near Haynes, N. Dak.	N
86	*06353000*	Cedar Creek near Raleigh, N. Dak.	N
87	*06354000*	Cannonball River at Breien, N. Dak.	N
88	*06354580*	Beaver Creek below Linton, N. Dak.	N
89	*06468170*	James River near Grace City, N. Dak.	N
90	*06468250*	James River above Arrowwood Lake near Kensal, N. Dak.	N
91	*06469400*	Pipestem Creek near Pingree, N. Dak.	N
92	*06470000*	James River at Jamestown, N. Dak.	Y
93	*06470500*	James River at LaMoure, N. Dak.	Y
94	*06470800*	Bear Creek near Oakes, N. Dak.	N
95	*06470878*	James River at North Dakota-South Dakota State line	Y
96	*06471200*	Maple River at North Dakota-South Dakota State line	N

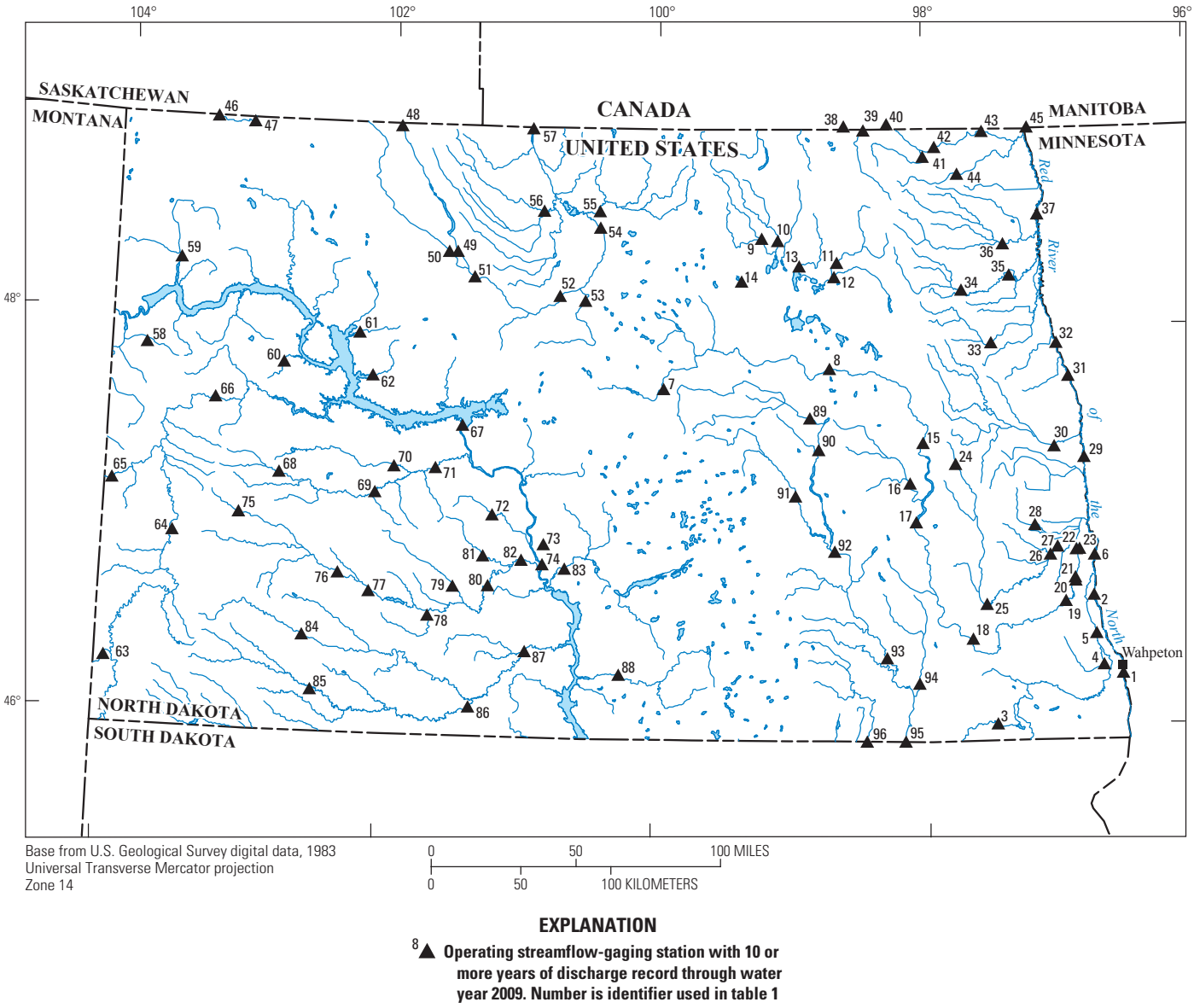

Figure 1. Locations of operating streamflow-gaging stations with 10 or more years of discharge record through water year 2009.

U.S. Army Corps of Engineers (USACOE) supporting a large expansion of the streamflow-gaging program (Crosby, 1970). The North Dakota-South Dakota USGS Office was created on October 16, 1944 and 41 streamflow-gaging stations were in operation at that time. Plans for the coordinated development of the waters of the Missouri River Basin, with respect to flood control, navigation, power, and irrigation, were formulated in 1943–44 by the USACOE, the U.S. Bureau of Reclamation, and the States in the basin. These plans resulted in a rapid expansion of the streamflow-gaging program, and by 1947, 64 gaging stations were in operation in North Dakota (Crosby, 1970). The number of streamflow-gaging stations increased steadily from the late 1940s until the late 1960s, and by 1969, 109 streamflow-gaging stations were in operation.

During 1969–76, the number of streamflow-gaging stations in operation remained relatively stable. During the 1970s, the USGS established 25 additional streamflow-gaging stations to monitor the quantity and quality of streamflow in drainage basins underlain by strippable lignite deposits (Haffield, 1981). By 1979, about 145 streamflow-gaging stations were in operation in North Dakota. During 1981–83, the number of streamflow-gaging stations in operation declined rapidly, and, during 1984–87, the number declined slowly to about 110. Since 1987, the number of streamflow-gaging stations in operation has been relatively stable ranging from about 100 to 110 stations.

Table 2. List of operating peak streamflow-gaging stations with 10 or more years of discharge record through water year 2009, operating streamflow-gaging stations with 5–9 years of discharge record through water year 2009, and streamflow-gaging stations discontinued since water year 2000 for which streamflow statistics are published in this report and links to streamflow statistics.

[Water year, the 12-month period October 1, for any given year through September 30, of the following year; Y, yes; N, no]

Map identifier (fig. 2)	Station number (with link to streamflow statistics)	Station name	Regulation (Y/N)
		Operating peak streamflow-gaging stations with 10 or more years	
97	*05056017*	Mauvais Coulee Tributary above Brumba Pool near Rock Lake, N. Dak.	N
98	*05056900*	Sheyenne River Tributary near Cooperstown, N. Dak.	N
99	*05057100*	Baldhill Creek near Binford, N. Dak.	N
100	*05058500*	Sheyenne River at Valley City, N. Dak.	Y
101	*05060400*	Sheyenne River at Harwood, N. Dak.	Y
102	*05060470*	Rush River near Hunter, N. Dak.	N
103	*05065810*	Middle Branch Goose River Tributary near Pickert, N. Dak.	N
104	*05083500*	Red River of the North at Oslo, Minn.	Y
105	*05083580*	Middle Branch Forest River Tributary near Adams, N. Dak.	N
106	*05090025*	Willow Creek near Hensel, N. Dak.	N
107	*05099340*	Unnamed Tributary near Langdon, N. Dak.	N
108	*05100450*	Tongue River near Osnabrock, N. Dak.	N
109	*05102490*	Red River of the North at Pembina, N. Dak.	Y
110	*05113520*	Long Creek Tributary near Crosby, N. Dak.	N
111	*05113800*	Short Creek below International Boundary near Roche Percee, Saskatchewan, Canada	Y
112	*05116135*	Tasker Coulee Tributary near Kenaston, N. Dak.	N
113	*05119410*	Bonnes Coulee near Velva, N. Dak.	N
114	*05120180*	Wintering River Tributary near Kongsberg, N. Dak.	N
115	*05121000*	Souris River west outfall at Eaton Dam near Towner, N. Dak.	Y
116	*05121001*	Souris River east outfall at Eaton Dam near Towner, N. Dak.	Y
117	*05123300*	Oak Creek Tributary near Bottineau, N. Dak.	N
118	*06332150*	White Earth River Tributary near White Earth, N. Dak.	N
119	*06336300*	Little Missouri River Tributary near Medora, N. Dak.	N
120	*06337080*	Cherry Creek Tributary near Arnegard, N. Dak.	N
121	*06337900*	Snake Creek Tributary near Garrison, N. Dak.	N
122	*06339890*	North Creek near Werner, N. Dak.	N
123	*06343000*	Heart River near South Heart, N. Dak.	N
124	*06347090*	Tavis Creek near Glen Ullin, N. Dak.	N
125	*06349083*	Southeast Branch Little Heart River at St. Anthony, N. Dak.	N
126	*06349580*	Hay Creek at 43rd Avenue near Bismarck, N. Dak.	N
127	*06349590*	Hay Creek at Divide Avenue in Bismarck, N. Dak.	N
128	*06351630*	Middle Fork Cedar Creek Tributary near Amidon, N. Dak.	N
129	*06352380*	Timber Creek Tributary near New Leipzig, N. Dak.	N
130	*06354450*	Beaver Creek Tributary near Linton, N. Dak.	N
131	*06469100*	Pipestem Creek near Heaton, N. Dak.	N
132	*06470200*	Beaver Creek Tributary near Eldridge, N. Dak.	N
133	*06471100*	Maple Creek Tributary near Edgeley, N. Dak.	N
134	06471150	South Fork Maple River Tributary near Merricourt, N. Dak.	N

Table 2. List of operating peak streamflow-gaging stations with 10 or more years of discharge record through water year 2009, operating streamflow-gaging stations with 5–9 years of discharge record through water year 2009, and streamflow-gaging stations discontinued since water year 2000 for which streamflow statistics are published in this report and links to streamflow statistics.—Continued

[Water year, the 12-month period October 1, for any given year through September 30, of the following year; Y, yes; N, no]

Map identifier (fig. 2)	Station number (with link to streamflow statistics)	Station name	Regulation (Y/N)
		Operating streamflow-gaging stations with 5–9 years	
135	*05055300*	Sheyenne River above Devils Lake State outlet near Flora, N. Dak.	N
136	*05055400*	Sheyenne River below Devils Lake State outlet near Bremen, N. Dak.	N
137	*06349600*	Hay Creek at Main Avenue in Bismarck, N. Dak.	N
138	*06351200*	Cannonball River near Raleigh, N. Dak.	N
		Streamflow-gaging stations discontinued since water year 2000	
139	*05056410*	Channel A near Penn, N. Dak.	Y
140	*05056636*	Devils Lake outlet to Stump Lake near Lakota, N. Dak.	N
141	*05064900*	Beaver Creek near Finley, N. Dak.	Y
142	*05123500*	Stone Creek near Kramer, N. Dak.	N
143	*05123750*	Cut Bank Creek at Upham, N. Dak.	N
144	*05123900*	Boundary Creek near Landa, N. Dak.	Y
145	*06341410*	Turtle Creek above Washburn, N. Dak.	N
146	*06349215*	Long Lake Creek above Long Lake near Moffit, N. Dak.	N

Explanation of Station Summaries

Station summaries are presented so that each station description and tables of streamflow statistics and probabilities of occurrence are presented in the same order and format for each streamflow-gaging station. The station summaries can be found by following the provided links listed in tables 1 and 2. Because the information and statistics in the tables were created by retrievals from the USGS National Water Information System (NWIS) database (*http://water.usgs.gov/nwis/nwis*) (U.S. Geological Survey, 2011) or statistical program results, significant figures were not rounded to USGS standards. The order of presentation is as follows:

1. station description;
2. graph of annual peak and annual mean discharges;
3. table of statistics of monthly and annual mean discharges;
4. table of monthly and annual flow durations;
5. table of probability of occurrence of annual high discharges;
6. table of annual peak discharge and corresponding gage height for the period of record; and
7. table of monthly and annual mean discharges for the period of record.

Where pre-regulated and post-regulated statistics are presented for a streamflow-gaging station, the respective tables for the pre-regulated and post-regulated data are presented in the same format as non-regulated streams with pre-regulated statistics being listed before post-regulated statistics. Monthly and annual statistics computed using daily mean discharge values were not generated for peak streamflow-gaging stations (table 2), unless daily mean discharge values existed.

Station Description

The location, drainage area, period of record, and other general information about each streamflow-gaging station are included in the station description (Station Info tab). This information was retrieved from the USGS NWIS database.

Statistics of Monthly and Annual Mean Discharges

Statistics of monthly and annual mean discharges presented for each streamflow-gaging station include the maximum, minimum, and mean monthly discharges and the maximum, minimum, and mean annual discharges (Statistics of discharge tab). The water years (October 1 through September 30) in which the maximum and minimum discharges occurred are listed with the respective values, and the standard deviation and coefficient of variation of the monthly and annual mean discharges are listed with the respective values. The percentage of the annual discharges computed using monthly mean discharges are also listed.

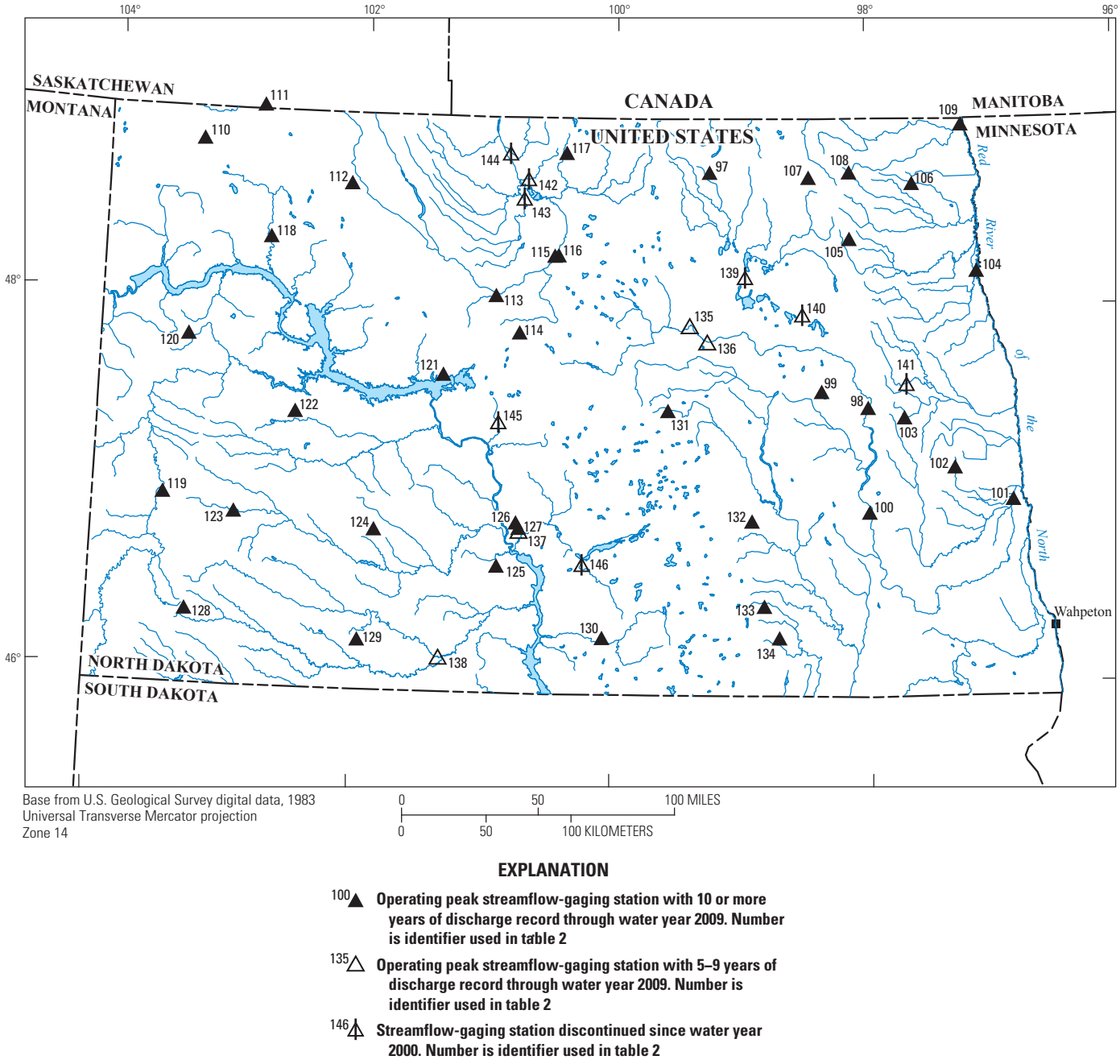

Figure 2. Locations of operating peak streamflow-gaging stations with 10 or more years of discharge record through water year 2009, operating streamflow-gaging stations with 5–9 years of discharge record through water year 2009, and streamflow-gaging stations discontinued since water year 2000.

Each of the statistics is explained in the following paragraphs. As an aide to the readers' understanding of how the monthly mean and annual mean discharges are determined, data for the streamflow-gaging station Red River of the North at Wahpeton, N. Dak. (05051500) are used as an example. The monthly mean value is the average of the daily mean values for the month. The annual mean value is the average of the daily mean values for the year. Months or years for which all daily mean values are not available are not included in the compilation of statistics.

The maximum monthly mean discharge is the maximum value of all the monthly mean values for a given month. The maximum mean value for October was 1,712 cubic feet per second (ft^3/s), which occurred during water year 2005. Similarly, the minimum monthly mean discharge is the minimum value of all the monthly mean values for a given month. The minimum mean value for October was 5.72 ft^3/s, which occurred during water year 1977. The maximum and minimum monthly mean values are documented in the linked tables of

statistics of monthly and annual mean discharges (Statistics of discharges tab).

The mean monthly discharge is the mean of all the monthly mean discharges for a given month, and the standard deviation is a measure of the variability of the values. The mean monthly discharge for October was 389.31 ft^3/s, and the standard deviation was 339.92 ft^3/s. The monthly mean discharge for October (mean of the mean monthly values) is the same as the mean of all October daily values for the period of record used. However, the standard deviation is smaller than the standard deviation obtained using all daily values. The standard deviation is smaller because the monthly values have less variability than the daily values.

The coefficient of variation is the ratio of the standard deviation to the mean. The coefficient of variation is dimensionless. Because monthly mean discharges are generally greater in spring than in winter, the standard deviations also are generally greater in spring than in winter. However, dividing the standard deviation by the mean monthly discharge tends to equalize the measures for all months so a more meaningful comparison among months can be made.

The percentage of the annual discharge is the percent of the annual discharge that occurred during each month. It is calculated by dividing the mean discharge for the month by the total of the 12 monthly mean discharges and multiplying by 100. Because of rounding of the monthly percentage, the sum of the 12 percentages may not equal 100 percent.

The maximum, minimum, and mean annual discharges are selected or computed from the annual mean discharges for the period of record used. The water years of occurrence of the maximum and minimum values are listed with the respective values, and the standard deviation of the mean of the annual mean values are listed with the mean value. The minimum annual mean discharge of 54.0 ft^3/s occurred in 1977, and the maximum annual mean discharge of 1,838 ft^3/s occurred in 2009. The mean annual discharge for the period of record used is 687.60 ft^3/s.

Monthly and Annual Flow Durations

The monthly and annual flow durations table is a magnitude and frequency analysis of daily mean discharge values (Flow durations tab). It is computed by tabulating the number of daily mean discharge values that fall within pre-selected class limits, computing the percentage of values within each class, and interpolating discharge values for the percentages shown in the table. Monthly values are calculated from daily mean values in all complete months in the record, and annual values are calculated for all complete water years. For example, if the 90-percent flow duration value for October is 87.2 ft^3/s, then 90 percent of all October daily mean discharge values for the period of record used were equal to or greater than 87.2 ft^3/s.

Probability of Occurrence of High Discharges

The probability of occurrence of annual high discharges is presented in a table for each streamflow-gaging station (Annual high discharges tab). The probability of occurrence is an estimate of the likelihood that a particular discharge in a stream will be equaled or exceeded in one year. The probability of occurrence of a high flow is called the exceedance probability. For example, if the maximum instantaneous discharge for the 0.20 exceedance probability is listed as 4,450 ft^3/s, then a 20 percent chance exists that a discharge equal to or greater than 4,450 ft^3/s will occur once during the year.

The table of probability of occurrence of annual high discharges for each streamflow-gaging station lists the maximum instantaneous discharge and the maximum mean discharge for the 3, 7, 15, and 30 consecutive-day periods for selected exceedance probabilities. Values for the maximum instantaneous discharges were computed using peak streamflow record according to the guidelines established by the Hydrology Subcommittee of the Interagency Advisory Committee on Water Data (1982). No adjustments were made for length of record, high or low outliers and a generalized skew was used in the computations unless the peak streamflow was regulated; then a station skew was used instead of a generalized skew.

Values for the maximum mean discharges for the 3, 7, 15, and 30 consecutive-day periods were computed from the annual high mean values of the corresponding periods. The computations were based on the log-Pearson Type III distribution using values obtained for the water year. If the log-Pearson Type III distribution curve for the high discharges failed to fit the data at the upper or lower ends, graphical interpretations were not made. Cautionary notes are provided for the user in these instances.

Annual Peak Discharge and Corresponding Gage Height and Monthly and Annual Mean Discharges

The annual peak discharge and corresponding gage height for the period of record is presented in a table for each streamflow-gaging station (Annual peak discharges tab). Also, a table of monthly and annual mean discharges is presented for each streamflow-gaging station that had daily mean values (Mean discharges tab). The values for each of these tables are presented by water year for the period of record.

Data Considerations

The reliability of statistical data is related to the length of the period of record for a streamflow-gaging station. The Hydrology Subcommittee of the Interagency Advisory committee on Water Data (1982) recommends that at least 10 years of record be used for computing flood frequency estimates.

Therefore, the length of record criterion for inclusion of a streamflow-gaging station in this report was at least 10 years. Even with this criterion, the lengths and continuity of record for the streamflow-gaging stations varied substantially. The 10-year requirement was relaxed to a minimum of 5 years for some sites listed in table 2 in order to include streamflow-gaging stations that had been discontinued since water year 2000 and those operating through water year 2009 but have less than 10 years of data. The relaxed 10-year requirement was only used to compute statistics of monthly and annual mean discharges and monthly and annual flow durations. Probability of occurrence of annual high discharges was not computed if the record length was less than 10 years. Longer record lengths for many of the streamflow-gaging stations in this report may result in different streamflow statistics when comparing data in this report with data in previous publications. Differences in statistical data for pre- and post-regulation periods may not be caused solely by regulation. Differences also can be attributed to the length of record and climatic variability as expressed by hydrologic variability.

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Glossary

C

cubic foot per second (ft^3/s) Rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

D

discharge Volume of water in the "natural" channel of a stream that passes a given point within a given period of time. Discharge often is used interchangeably with the term "streamflow".

drainage area Area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream upstream from the station.

drainage basin Part of the surface of the Earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

E

exceedance probability Probability that a specified discharge will be exceeded.

G

gage height Water-surface elevation referred to some arbitrary gage datum. Gage height often is used interchangeably with the more general term "stage", although gage height is more appropriate when used with a reading on a gage.

gaging station Particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

H

hydrologic unit Geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an 8-digit number.

I

instantaneous discharge Discharge at a particular instant of time.

M

mean Arithmetic average of a list of values.

mean discharge Arithmetic mean of individual discharges during a specific period.

N

NAD27 North American Datum of 1927; a horizontal control datum for the United States that was defined by location and azimuth on the Clarke spheroid of 1886, with its origin at Meades Ranch, Kansas.

NGVD29 National Geodetic Vertical Datum of 1929; a vertical control datum established in 1929.

P

period of record Time during which a streamflow-gaging station is in operation and for which the records are published.

probability of occurrence Likelihood that an event will occur. Probabilities generally are expressed as a decimal number between 0 and 1. If the probability is 0, the event will not occur; if the probability is 1, the event will occur absolutely. Probability also can be expressed as a percent, where 0 percent corresponds to 0 probability and 100 percent corresponds to a probability of 1.

R

regulation Artificial manipulation of the flow of a stream.

S

stage *see* "gage height"

stage-gaging station Gaging station where a record of gage height is obtained.

standard deviation Measure of the variability of the values in a list of values.

streamflow-gaging station Gaging station where a record of discharge of a stream is obtained.

streamflow *see* "discharge".

surface water Water on the surface of the Earth.

W

water year 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

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