DATA USES AND FUNDING OF THE STREAMFLOW-GAGING PROGRAM IN NORTH DAKOTA

By Gerald L. Ryan

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SELECTED FACTORS FOR CONVERTING INCH-POUND UNITS TO THE INTERNATIONAL SYSTEM (SI) OF UNITS

For those readers who may prefer to use the International System (SI) of units rather than inch-pound units, the conversion factors for the terms used in this report are given below.

Multiply inch-pound unit	By	To obtain SI unit
Cubic foot	0.02832	cubic meter
Cubic foot per second	0.02832	cubic meter per second
Foot	0.3048	meter
Mile	1.609	kilometer
Square mile	2.590	square kilometer

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By Gerald L. Ryan

ABSTRACT

This report documents the uses, funding, and availability of the streamflow data currently collected in North Dakota. Presently (1984), 94 streamflow-gaging stations are operated in North Dakota on a budget of $663,000. Station type, data uses, and funding sources are identified for each of the 94 stations. Data from all stations have multiple uses. All stations have sufficient justification for continuation, but five stations primarily are used in short-term research studies. Those five stations are scheduled to be discontinued at the end of the 1985 water year.

INTRODUCTION

The U.S. Geological Survey is the principal Federal agency collecting surface-water data in the Nation. The collection of these data is a major activity of the Water Resources Division of the U.S. Geological Survey. The data are collected in cooperation with State and local governments and other Federal agencies. The U.S. Geological Survey presently (1984) is operating approximately 8,000 continuous-record gaging stations throughout the Nation. Some of these records extend back to the turn of the century. Any activity of long standing, such as the collection of surface-water data, should be reexamined at intervals, if not continuously, because of changes in objectives, technology, or external constraints. The last systematic nationwide evaluation of the streamflow-information program was completed in 1970 and is documented by Benson and Carter (1973). The U.S. Geological Survey presently (1984) is undertaking another nationwide analysis of the streamflow-gaging program that will be completed over a 5-year period (1983-87) with 20 percent of the program being analyzed each year. The objective of this analysis is to define and document cost-effective means of furnishing streamflow information.

This report documents the first phase of this analysis in North Dakota. The principal uses of the data are identified and related to funding sources. In addition, gaging stations are categorized as to whether the data are available to users in a real-time sense, on a periodic basis, or at the end of the water year. The historical information presented is based primarily on the last major evaluation of the streamflow program in North Dakota (Crosby, 1970).

The second and third phases of this analysis are summarized in the following two paragraphs. They will be detailed in a future report.

The second phase of the analysis is to identify less costly alternate methods of furnishing the needed information; among these are flow-routing models and statistical methods. Today streamflow-gaging activity can no longer be considered a network of observation points but rather an integrated information system in which data are provided both by observation and synthesis.

The third phase of the analysis involves the use of Kalman-filtering and mathematical-programming techniques to define strategies for the operation of the necessary stations that minimize the uncertainty in the streamflow records for given operating budgets. Kalman-filtering techniques are used to compute uncertainty functions (relating the standard errors of computation or estimation of streamflow records to the frequencies of visits to the stream gages) for individual stations. A steepest descent optimization program uses these uncertainty functions, information on practical streamflow-gaging routes, the various costs associated with streamflow gaging, and the total operating budget to identify the visit frequency for each station so that total uncertainty in the overall network is minimized.

This report is patterned after a pilot study for the State of Maine (Fontaine and others, 1984). It is organized into three sections, the first being an introduction to the streamflow-gaging activities in North Dakota and to the study itself. The middle section documents the uses, funding, and availability of the streamflow data collected in the State. The final section summarizes this first phase of the analysis.

History of Streamflow Gaging in North Dakota

The streamflow program of the U.S. Geological Survey in North Dakota has evolved through the years as the Federal and State interests in surface-water resources have increased and as funds for operating the streamflow-gaging station network have become available. The collection of streamflow information in a systematic fashion began in 1882 with the establishment of a gaging station on the Red River of the North at Grand Forks. This was a stage station with infrequent discharge measurements maintained for navigational purposes. Streamflow-gaging stations were established and operated by the U.S. Geological Survey in the years 1901-09 in cooperation with the State as a result of the disastrous floods of 1897 in the Red River basin and the National Reclamation Act of 1902. Additional interest in the streamflow program was created as problems occurred with Canada concerning the division of waters along the international boundary. As a result of these problems, the International Joint Commission was formed in 1912.

In 1924, 11 streamflow-gaging stations were being operated when State cooperation was discontinued. Only six Federally operated streamflow-gaging stations were continued. Cooperation resumed in 1931, but funds were very limited from 1934 to 1938.

The Rivers and Harbors Act of 1927 and the Flood Control Acts of 1928 and 1936 resulted in the U.S. Army Corps of Engineers supporting a considerable expansion of the streamflow-gaging program. The U.S. Biological Survey cooperated in establishing five stations in 1937. There were 48 streamflow-gaging stations in the State when the Bismarck District (North Dakota-South Dakota) was created on October 16, 1944.

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 U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the states in the basin. These plans resulted in a rapid increase in the streamflow-gaging program, and by 1947 there were 60 streamflow-gaging stations in operation. From 1947 through 1967, there was a gradual increase to 114 stations. From 1967 through 1973, the number of streamflow-gaging stations declined slightly to 106, then increased to 111 by 1975. In 1977, a large increase in the number of streamflow-gaging stations began and continued through 1980 when there were 137 in operation. This increase was mainly due to increased funding from the Office of Surface Mining and occurred in the western part of the State. In 1981, the number of streamflow-gaging stations decreased slightly to 133. In 1982, 24 stations were cut from the program; in 1983, 7 more were cut; and in 1984, 8 more were cut. Currently, there are 94 streamflow-gaging stations in North Dakota where daily-discharge data are computed. Of these, 20 are operated seasonally in the spring and summer months. The historical number of streamflow-gaging stations operated within the State of North Dakota is given in figure 1.

Besides the stations where discharge data have been collected, there have been many other sites across the State where other types of surface-water data have been collected. Many years of stage records are available for several lakes, reservoirs, and streams.

In 1954, a crest-stage network was established to define peak-flow characteristics in small drainage areas. A supplementary program to establish the role of basin characteristics was added in 1965. There were as many as 92 crest-stage gages in this program. Subsequent to the publication of "Magnitude and Frequency of Floods in Small Drainage Basins in North Dakota" by Crosby (1975), operation of this network was terminated. At present, only four crest-stage gages are operated in the State.

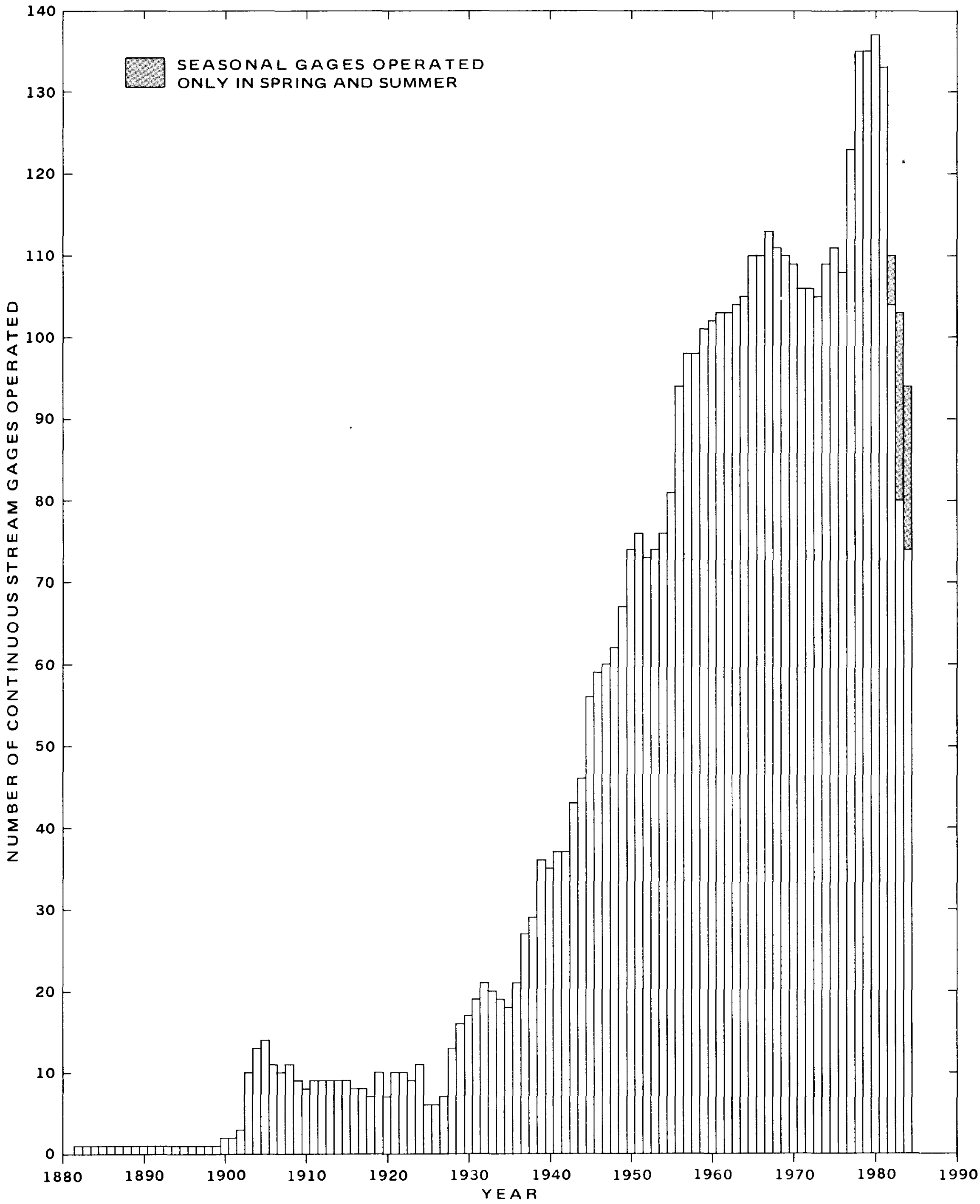


Figure 1.—History of continuous streamflow gaging in North Dakota.

A network of 30 low-flow partial-record stations was operated from 1954 through 1956.

Water-quality data have been collected in the State as early as 1946. Data currently are available for a variety of water-quality parameters at surface-water sites throughout the State.

Current North Dakota Streamflow-Gaging Program

For convenience, North Dakota can be divided into five major drainage basins as shown in figure 2. Two of these, the Red River of the North and the Souris River, drain north to Hudson Bay. The Devils Lake basin is a closed basin embedded within the Hudson Bay drainage system. The Missouri River and James River drain to the south.

Currently (1984), there are 94 streamflow-gaging stations in North Dakota. Of the 94 streamflow-gaging stations, 40 are located in the Red River of the North basin, 6 are in the Devils Lake basin, 10 are in the Souris River basin, 31 are in the Missouri River basin, and 7 are in the James River basin. Locations of the 94 streamflow-gaging stations are shown in figure 3.

Selected hydrologic data, including drainage area, period of record, and mean annual flow for the 94 stations, are given in table 1. Station identification numbers used throughout this report are the U.S. Geological Survey's eight-digit downstream-order station numbers. Table 1 lists the official name of each streamflow-gaging station.

USES, FUNDING, AND AVAILABILITY OF CONTINUOUS STREAMFLOW DATA

The relevance of a streamflow gage is defined by the uses made of the data produced from the gage. The uses of the data from each gage in the North Dakota program were identified by a survey of known data users. The survey documented the importance of each gage and identified gaging stations that may be considered for discontinuation.

Data uses identified by the survey were categorized into nine classes defined below. The sources of funding for each gage and the frequency at which data are provided to the users also were compiled and are defined later.

Data-Use Classes

The following definitions were used to classify each known use of streamflow data for each gaging station.

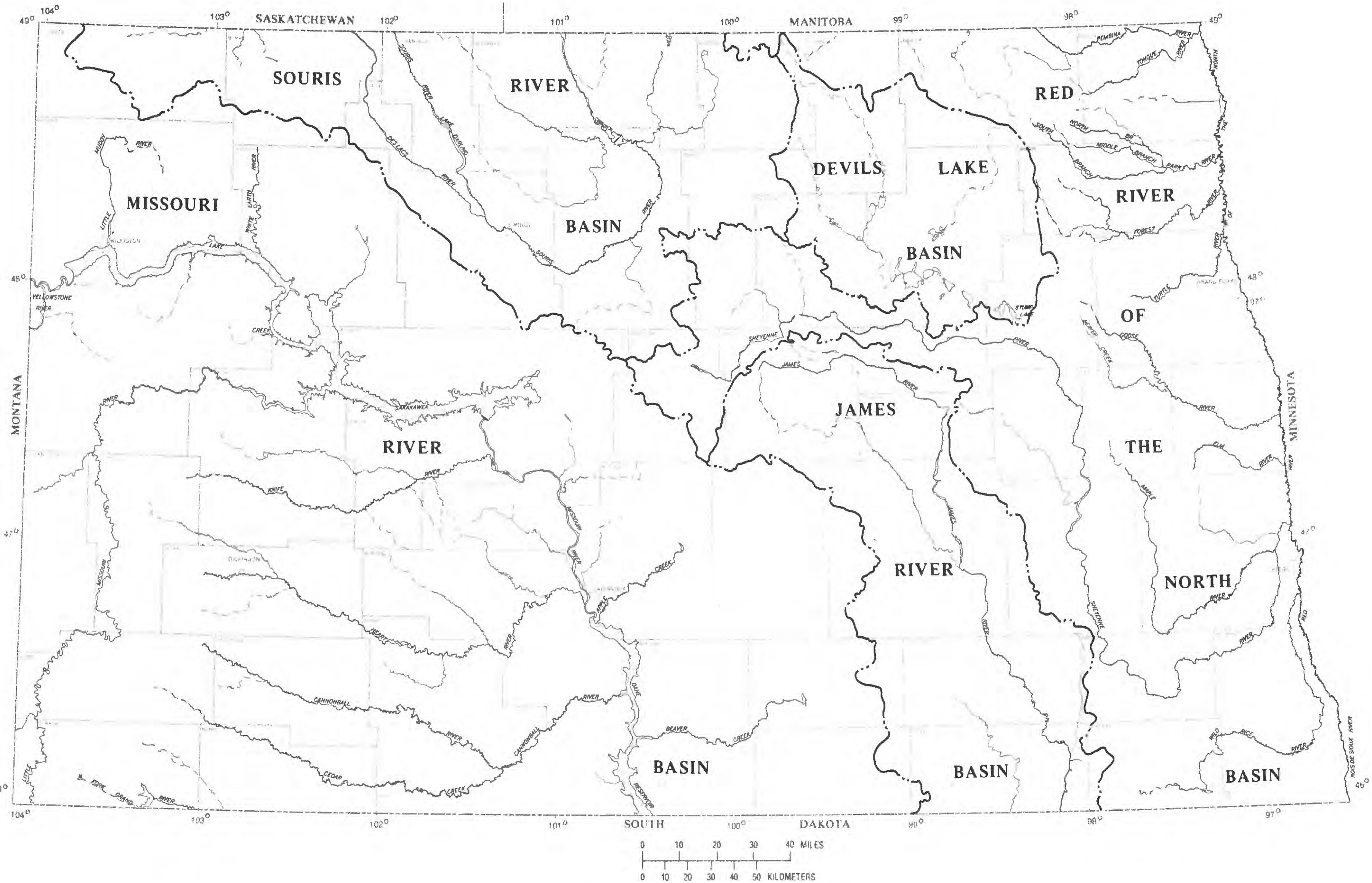
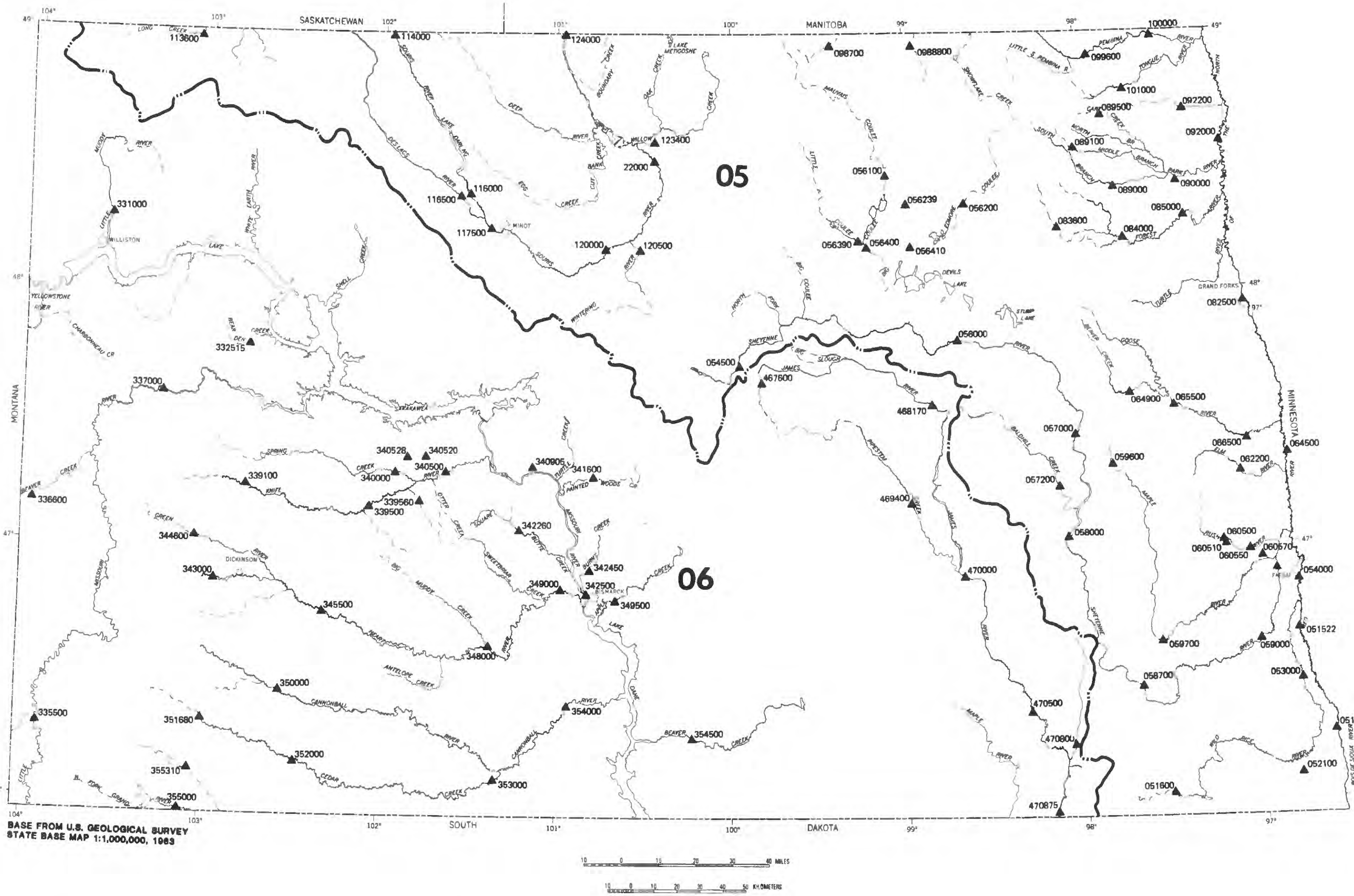


Figure 2.—Major drainage basins in North Dakota.



EXPLANATION

▲ GAGING STATION

053000 ABBREVIATED STATION NUMBER—Complete number includes the pert number

Figure 3.—Locations of streamflow-gaging stations in North Dakota.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program

[Mean annual flow computed on basis of continuous streamflow data available through September 30, 1983]

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05051500	Red River of the North at Wahpeton	1/4,010	April 1942-	519
05051522	Red River of the North at Hickson	1/4,300	October 1975-	479
05051600	Wild Rice River near Rutland	546 (250)	October 1959-2/	8.08
05052100	Richland County Drain 65 near Great Bend	38	October 1980-2/	(3/)
05053000	Wild Rice River near Abercrombie	2,080 (590)	April 1932-	72
05054000	Red River of the North at Fargo	1/6,800	May 1901-4/	552
05054500	Sheyenne River above Harvey	424 (270)	September 1955-	7.68
05056000	Sheyenne River near Warwick	1/2,070 (1,310)	October 1949-	56.2

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05056100	Mauvais Coulee near Cando	387 (10)	May 1956-2/	19.2
05056200	Edmore Coulee near Edmore	382 (100)	April to June 1956, June 1957-2/	13.7
05056239	Starkweather Coulee near Webster	1/310 (100)	October 1979-	(3/)
05056390	Little Coulee near Brinsmade	350 (160)	October 1975-2/	7.02
05056400	Big Coulee near Churchs Ferry	1/2,510 (690)	March 1950-5/	42.1
05056410	Channel A near Penn	Indeterminate	September 1983-	(3/)
05057000	Sheyenne River near Cooperstown	1/6,470 (5,200)	October 1944-	104
05057200	Baldhill Creek near Dazey	691 (340)	March 1956-	15.5
05058000	Sheyenne River below Baldhill Dam	1/7,470 (5,560)	October 1949-	6/124

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05058700	Sheyenne River at Lisbon	1/8,190 (5,700)	September 1956-	157
05059000	Sheyenne River near Kindred	1/8,800 (5,780)	July 1949-	199
05059500	Sheyenne River at West Fargo	1/8,870 (5,780)	April 1903 to October 1905, March to August 1919, September 1929-7/	8/176
05059600	Maple River near Hope	20.2 (2.8)	October 1964-2/	2.82
05059700	Maple River near Enderlin	843 (47)	May 1956-	37.4
05060500	Rush River at Amenia	116	July 1946-	9.22
05060510	Cass County Drain 52 near Amenia	13.5	October 1980-2/	(3/)
05060550	Rush River near Prosper	170	October 1980-2/	(3/)
05060570	Lower Branch Rush River near Prosper	35.8	October 1980-2 9/	(3/)

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05062200	Elm River near Kelso	199	December 1955 to September 1963, October 1980-[2]	2.22
05064500	Red River of the North at Halstad, Minnesota	[1]21,800 (3,800)	April 1936 to June 1937, April 1942 to September 1960, May 1961-	1,740
05064900	Beaver Creek near Finley	[1]160	October 1964-	9.09
05065500	Goose River near Portland	517 (110)	October 1939 to September 1975, October 1980-[2]	29.8
05066500	Goose River at Hillsboro	1,203 (110)	March 1931-	68
05082500	Red River of the North at Grand Forks	[1]30,100 (3,800)	April 1882-	2,558
05083600	Middle Branch Forest River near Whitman	47.7 (8.8)	October 1960-	3.14
05084000	Forest River near Fordville	456 (120)	April 1940-	38.7

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05085000	Forest River at Minto	740 (120)	April 1944-	50.8
05089000	South Branch Park River below Homme Dam	226	October 1949-	27.2
05089100	Middle Branch Park River near Union	15.3	October 1965-2/	2.18
05089500	Cart Creek at Mountain	16.9	June 1954-	2.85
05090000	Park River at Grafton	695	April 1931-	58.7
05092000	Red River of the North at Drayton	1/34,800 (3,800)	April 1936 to June 1937, April 1941-	3,797
05092200	Pembina County Drain 20 near Glasston	80	October 1971-2/	2.29
05098700	Hidden Island Coulee near Hansboro	38	October 1961-	3.68
05098800	Cypress Creek near Sarles	71	May 1961-10/	6.16
05099600	Pembina River at Walhalla	3,350	October 1939-11/	235

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05100000	Pembina River at Neche	1/3,410	May 1903 to September 1908, June 1909 to September 1915, April 1919-	192
05101000	Tongue River at Akra	160	April to June 1950, October 1951-2/	21.4
05113600	Long Creek near Noonan	1/1,790 (1,160)	October 1959-	54.2
05114000	Souris (Mouse) River near Sherwood	1/8,940 (5,900)	March 1930-	143
05116000	Souris (Mouse) River near Foxholm	1/9,470 (6,200)	June 1904 to November 1905, March to July 1906, October 1936-	149
05116500	Des Lacs River at Foxholm	939 (400)	June 1904 to July 1906, October 1945-	31.5
05117500	Souris (Mouse) River above Minot	1/10,600 (6,700)	May 1903-	171

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
05120000	Souris (Mouse) River near Verendrye	1/11,300 (6,900)	February to June 1933, April 1937-	220
05120500	Wintering River near Karlsruhe	705 (420)	March 1937-	13.1
05122000	Souris (Mouse) River near Bantry	1/12,300 (7,600)	March 1937-	239
05123400	Willow Creek near Willow City	1/1,160 (430)	August 1956-	46.3
05124000	Souris (Mouse) River near Westhope	1/16,900 (10,300)	July to October 1929, April 1930-	263
06331000	Little Muddy River below Cow Creek near Williston	1/875 (100)	May 1954-2/	38.8
06332515	Bear Den Creek near Mandaree	74	June 1966-	9.24
06335500	Little Missouri River at Marmarth	1/4,640	March 1938-	334
06336600	Beaver Creek near Trotters	616	October 1977-2/	33.3
06337000	Little Missouri River near Watford City	1/8,310	October 1934-	593

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
06339100	Knife River at Manning	1/205	July 1967-	23.6
06339500	Knife River near Golden Valley	1/1,230	May 1903 to November 1906, April 1907 to November 1915, April 1916 to October 1919, October 1921 to September 1924, April 1943-12/	98
06339560	Brush Creek near Beulah	1/22	October 1974-	1.78
06340000	Spring Creek at Zap	549	March to September 1924, October 1945-	43.5
06340500	Knife River at Hazen	1/2,240	October to November 1928, March 1929 to September 1933, August 1937-	181
06340520	Antelope Creek above Hazen	47.2	October 1977-	4.43
06340528	West Branch Antelope Creek Number 4 near Zap	8.46	October 1976-13/	.77

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
06340905	Coal Lake Coulee near Hensler	7.5	October 1977-	2.83
06341800	Painted Woods Creek near Wilton	427	October 1957 to September 1981, 1983-	8.07
06342260	Square Butte Creek below Center	146	May 1965-	12.1
06342450	Burnt Creek near Bismarck	108	October 1967-2/	8.03
06342500	Missouri River at Bismarck	1/186,400	October to November 1927, April 1928-	22,740
06343000	Heart River near South Heart	311	June 1947 to September 1970, October 1977-	29.7
06344600	Green River near New Hradec	1/152	February 1964-	18.3
06345500	Heart River near Richardton	1/1,240	May 1903 to September 1922, April 1943-	108
06348000	Heart River near Lark	1/2,750	June 1946-2/	225

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
06349000	Heart River near Mandan	1/3,310	April to September 1924, March 1928 to June 1933, August 1937-14/	267
06349500	Apple Creek near Menoken	1/1,680 (500)	March to June 1905, October 1945-15/	33.7
06350000	Cannonball River at Regent	1/580	September 1950-	48.7
06351680	White Butte Fork Cedar Creek near Scranton	42.9	March 1965-2/	4.45
06352000	Cedar Creek near Haynes	553	October 1950-	37.6
06353000	Cedar Creek near Raleigh	1/1,750	April to September 1939, March 1962-	104
06354000	Cannonball River at Breien	1/4,100	August 1934-	256
06354500	Beaver Creek at Linton	717 (100)	August 1949-	40.9
06355000	North Fork Grand River at Haley	509	May 1908 to September 1917, October 1945-	28.2

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
06355310	Buffalo Creek Tributary near Gascoyne	15.7	October 1974-	1.31
06467600	James River near Manfred	253 (197)	September 1957-2/	3.52
06468170	James River near Grace City	1/1,060 (650)	June 1968-	33
06469400	Pipestem Creek near Pingree	700 (440)	October 1973-	27.9
06470000	James River at Jamestown	1/2,820 (1,650)	June 1928 to September 1934, March to May 1935, August 1937 to September 1939, March 1943-	62.2
06470500	James River at LaMoure	1/4,390 (2,600)	April to July 1903, April 1950-	98
06470800	Bear Creek near Oakes	437	October 1976-	8.54

Footnotes at end of table.

Table 1.--Selected hydrologic data for stations in the North Dakota surface-water program--Continued

Station number	Station name	Drainage area in square miles (noncontributing)	Period of record	Mean annual flow in cubic feet per second
06470875	James River at Dakota Lake Dam near Ludden	5,480 (3,300)	October 1981-	(3/)

1/Approximately.

2/Presently operated as a seasonal site (spring and summer months).

3/No mean annual flow published, less than 5 years of streamflow record.

4/Published as "at Moorhead, Minn.," 1901.

5/Prior to October 1960, published as Mauvais Coulee near Churchs Ferry.

6/Unadjusted for change in storage of Lake Ashtabula.

7/Published as "at or near Haggart" 1902-07, 1919.

8/Adjusted for bypass flow and diversions for municipal uses.

9/Prior to October 1981, published as Lower Branch Rush River near Amenia.

10/Prior to October 1973, published as Long River near Sarles.

11/Prior to October 1963, published as "near Walhalla."

12/Prior to April 1943, published as "at or near Broncho."

13/Prior to October 1978, published as Antelope Creek Tributary No. 4 near Zap.

14/Published as "at Sunny" 1924, 1928-33.

15/Published as "near Bismarck" 1905.

Regional Hydrology

For data to be useful in defining regional hydrology, a stream must be largely unaffected by manmade storage or diversion. In this class of use, the effects of man on streamflow are not necessarily small, but the effects are limited to those caused primarily by land-use and climatic changes. Large amounts of manmade storage may exist in the basin providing the outflow is uncontrolled. Streamflow-gaging stations in this class are useful in developing regionally transferable information about the relationship between basin characteristics and streamflow.

In the North Dakota network, 40 stations are classified in the regional hydrology data-use class. Of these 40 stations, 4 are special cases: 2 are designated hydrologic bench-mark stations and 2 are index stations. Hydrologic bench-mark stations are part of a national network of 57 stations operating on watersheds that are relatively free from manmade alteration. This network is intended to define long-term trends. Index stations are used to prepare a national monthly summary of regional water conditions.

Hydrologic Systems

Stations that can be used for accounting, that is, to define current hydrologic conditions and the sources, sinks, and fluxes of water through hydrologic systems, including regulated systems, are designated as hydrologic systems stations. They include diversions and return flows and stations that are useful for defining the interaction of water systems.

Many streamflow-gaging stations across the State are included in this class because they are used by the North Dakota State Water Commission for accounting purposes. Also included in this class are streamflow-gaging stations used for accounting of flows in U.S. Bureau of Reclamation irrigation project areas and in U.S. Army Corps of Engineers flood control projects. The Minnesota Department of Natural Resources also uses several of the stations along the main stem of the Red River of the North for accounting purposes.

The bench-mark and index stations are included in the hydrologic systems category because they are accounting for current and long-term conditions of the hydrologic systems that they gage.

Many rivers throughout the State are controlled or partially controlled, and stations on these streams are also in this category.

Legal Obligations

Some stations provide records of flows for the verification or enforcement of existing treaties, compacts, and decrees. This category contains those stations that the U.S. Geological Survey operates to satisfy legal responsibilities. Since North Dakota shares a common border with Canada, several rivers and streams in both the Red River of the North and Souris River basins cross international boundaries. The Boundary Waters Treaty of 1909 and the formation of the International Joint Commission in 1912 led to the operation of international gaging stations on both sides of the border. Presently there are six gaging stations in the State that are used for this purpose. Three of these are in the Souris River basin and three are in the Red River of the North basin. All six of these sites are included in this category.

Planning and Design

Gaging stations in this category of data use are used for the planning and design of a specific project (for example, a dam, levee, floodwall, navigation system, water-supply diversion, hydropower plant, or waste-treatment facility) or group of structures. The planning and design category is limited to those stations that were instituted for such purposes and where this purpose is still valid.

In this class, six stations are funded through the Missouri River Basin Program and are used for planning and design of irrigation projects by the U.S. Bureau of Reclamation. Also included in this class are five stations used by the U.S. Army Corps of Engineers for a project, investigating flood protection alternatives in the Devils Lake and the Souris River basins.

Project Operation

Stations in the project operation class are used on an ongoing basis to assist water managers in making operational decisions such as reservoir releases, hydropower operations, or diversions. The project operation use generally implies that the data routinely are available to the operators on a rapid-reporting basis. For projects on large streams, data may only be needed every few days.

Many stations are included in this class: those used by the U.S. Bureau of Reclamation and irrigation districts in project areas, those used by the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation in reservoir operations, those used by the U.S. Fish and Wildlife Service for refuge management, and so forth.

Hydrologic Forecasts

Gaging stations in this category are regularly used to provide information for hydrologic forecasting. This information might be used for flood forecasts for a specific river reach or periodic (daily, weekly, monthly, or seasonal) flow-volume forecasts for a specific site or region. The hydrologic forecast use generally implies that the data routinely are available to the forecasters on a rapid-reporting basis.

Stations in the North Dakota program included in this class are those that have been designated by the National Weather Service as being needed for flood forecasting. In addition to the National Weather Service, other agencies may use the information from the stations during flooding events, particularly the U.S. Army Corps of Engineers and the Provinces of Saskatchewan and Manitoba in Canada. Fifty-three stations are in this class. Four of these stations have direct access through satellite telemetry equipment.

Water-Quality Monitoring

Stations where regular water-quality or sediment-transport monitoring is being conducted and where the availability of streamflow data contribute to the utility or are essential to the interpretation of the water-quality or sediment data are designated as water-quality monitoring stations.

Two stations in the water-quality monitoring class are designated bench-mark stations and eight are National Stream-Quality Accounting Network (NASQAN) stations. Water-quality samples from bench-mark stations are used to indicate water-quality characteristics of streams that have been and probably will continue to be relatively free of manmade influence. NASQAN stations are operated to define both areal variability and trends in stream quality.

Other stations in this class are stations where water-quality monitoring is being conducted to aid the U.S. Bureau of Reclamation in project planning and stations that are part of the monitoring network for the North Dakota State Water Commission. The North Dakota State Health Department uses the data from sites in this class to support information collected within their independent water-quality monitoring program.

Research

Gaging stations in this class are operated for a particular research or water-investigations study. Typically, these are only operated for a few years. Five stations in the North Dakota program are in this class. All five stations are in intense agricultural production areas where the U.S. Army Corps of Engineers is involved in watershed studies.

Other

In addition to the eight data-use classes described above, many stations across the State are used by the North Dakota Department of Parks and Recreation to provide streamflow information to canoeists.

Funding

The four sources of funding for the streamflow-gaging program are:

1. Federal program.--Funds that have been directly allocated to the U.S. Geological Survey;
2. Other Federal Agency (OFA) program.--Funds that have been transferred to the U.S. Geological Survey by other Federal agencies;
3. COOP program.--Funds that come jointly from U.S. Geological Survey cooperative-designated funding and from a non-Federal cooperating agency. Cooperating agency funds may be in the form of direct services or cash; and
4. Other non-Federal.--Funds that are provided entirely by a non-Federal agency and are not matched by U.S. Geological Survey cooperative funds.

In all four categories, the identified sources of funding pertain only to the collection of streamflow data. Sources of funding for other activities, particularly collection of water-quality samples that might be carried out at the site, may not be the same as those identified herein.

Frequency of Data Availability

Frequency of data availability refers to the timeframe within which the users may receive streamflow data. Three categories of timeliness exist. Data can be furnished by direct-access telemetry equipment for immediate use (includes both telephone-accessed equipment and satellite data-collection platforms), by periodic release of provisional data, or in publication format through the annual data report for North Dakota published by the U.S. Geological Survey. These three categories are designated T, P, and A, respectively, in table 2. In the current North Dakota program, data from 34 stations are available on an immediate use basis. Data from three stations are released regularly on a provisional basis, and provisional streamflow data for many other stations are released upon request. Data for all 94 stations are made available through the annual report.

Data-Use Presentation

Data-use and ancillary information are presented for each streamflow-gaging station in table 2, which is replete with footnotes to expand the information conveyed. The entry of an

Table 2.--Data-use, funding, and data availability for streamflow-gaging stations in the surface-water program

Station number	Data use									Funding				Frequency of data availability (A, annually; T, telemetry; P, provisionally)
	Regional hydrology	Hydrologic systems	Legal obligations	Planning and design	Project operation	Hydrologic forecasts	Water-quality monitoring	Research	Other	Federal program	OFA program	Coop program	Other non-Federal	
05051500		1, 2			2	3	4, 5		6		2			A, T
05051522		1		7, 8		3	7, 8		6	7				A
05051600		9				3	4					9		A
05052100							4	2			2			A
05053000	*	1, 9				3	4, 5					9		A, T
05054000		1, 9				3, 10	4, 5, 11					9		A, T, P
05054500	*	9		7, 8			5, 7, 8			7				A
05056000	*	2, 9			2	3	4, 5		6		2			A, T
05056100		9			12	3	4					9		A
05056200		9			12	3	4					9		A
05056239		9			12	3	4					9		A
05056390		9				3	4					9		A
05056400		2, 9		2	12	3	2, 4					9		A
05056410		2, 9		2	12	3	2, 4					9		A
05057000	*	2, 9			2	3	4, 5		6		2			A, T
05057200	*	2, 9			2	3	4				2			A, T
05058000		2			2		4, 5		6		2			A
05058700		2, 9		7, 8	2	3	5, 7, 8		6	7				A, T
05059000		2, 9			2	3	5, 13		6		2			A, T
05059500		2			2	3	4, 5					9		A, T

1. Minnesota Department of Natural Resources.
2. Flood control; U.S. Army Corps of Engineers; St. Paul, Minnesota.
3. Flood forecasting; National Weather Service; Bismarck, North Dakota.
4. Semiannual sampling to detect water-quality degradation; North Dakota State Water Commission; Bismarck, North Dakota.
5. North Dakota State Health Department.
6. North Dakota Department of Parks and Recreation, Data requests for canoeing.
7. Missouri River Basin Program, Garrison Diversion.
8. U.S. Bureau of Reclamation.
9. North Dakota State Water Commission, Assessment of surface-water conditions.
10. Flood forecasting, Province of Manitoba.
11. Minnesota Pollution Control Agency.
12. U.S. Fish and Wildlife Service.
13. NASQAN station.

Table 2.--Data-use, funding, and data availability for streamflow-gaging stations in the surface-water program--Continued

Station number	Data use: Regional hydrology	Hydrologic systems	Legal obligations	Planning and design	Project operation	Hydrologic forecasts	Water-quality monitoring	Research	Other	Funding: Federal program	OFA program	Coop program	Other non-Federal	Frequency of data availability (A, annually; T, telemetry; P, provisionally)
05059600		9					4					9		A
05059700	*	9				3	4, 5					9		A, T
05060500	*	9					4, 5					9		A
05060510							4, 5	2			2			A
05060550							4, 5	2			2			A
05060570							4, 5	2			2			A
05062200							4	2			2			A
05064500		1, 2			2	3, 10	5, 10		6		2			A, T
05064900	14	14					14			14				A
05065500		2					4		6		2			A
05066500	*	1, 9				3	4, 5		6			9		A, T
05082500	15	1, 2, 9, 15			2	3, 10	4, 5, 11		6		2, 16			A, T, P
05083600		9, 17					4				17			A
05084000	*	9				3	4					9		A
05085000		1, 9				3, 10	4					9		A
05089000		2			2	3	4				2			A, T
05089100		9					4					9		A
05089500	*	9, 17					4				17			A
05090000		1, 9				3, 10	4, 5					9		A

1. Minnesota Department of Natural Resources.
2. Flood control; U.S. Army Corps of Engineers; St. Paul, Minnesota.
3. Flood forecasting; National Weather Service; Bismarck, North Dakota.
4. Semiannual sampling to detect water-quality degradation; North Dakota State Water Commission; Bismarck, North Dakota.
5. North Dakota State Health Department.
6. North Dakota Department of Parks and Recreation, Data requests for canoeing.
9. North Dakota State Water Commission, Assessment of surface-water conditions.
10. Flood forecasting, Province of Manitoba.
11. Minnesota Pollution Control Agency.
14. Hydrologic bench-mark station.
15. Index station, U.S. Geological Survey, Water Resources Review.
16. International Joint Commission (State Department).
17. Soil Conservation Service, Basin runoff studies.

Table 2.--Data-use, funding, and data availability for streamflow-gaging stations in the surface-water program--Continued

Station number	Data use									Funding				Frequency of data availability (A, annually; T, telemetry; P, provisionally)
	Regional hydrology	Hydrologic systems	Legal obligations	Planning and design	Project operation	Hydrologic forecasts	Water-quality monitoring	Research	Other	Federal program	OFA program	Coop program	Other non-Federal	
05092000		1				3, 10	4, 5				16			A, T
05092200		9					4					9		A
05098700	*	9, 18	18				4				16			A
05098800	*	9, 18	18				4				16			A
05099600	*	2, 9				3	4, 5				2			A, T
05100000	*	1, 9, 18	18			3, 10	4, 5		6		16			A, T
05101000		1, 9					4		6			9		A
05113600	*	18	19		19, 20	2, 20, 21	4				16			A, T, P
05114000		18	19	2	12	2, 3	7, 8		6		16			A, T, P
05116000		9		2	12	3	4, 5				2	9		A, T, P
05116500		9			12	3	4, 5					9		A, T, P
05117500		9			2	3	4, 5		6			9		A, T, P
05120000				2	12		7, 8				2			A, P
05120500					12	3	4				12			A, P
05122000					12	3, 10	4, 5		6		12			A, T, P

1. Minnesota Department of Natural Resources.
2. Flood control; U.S. Army Corps of Engineers; St. Paul, Minnesota.
3. Flood forecasting; National Weather Service; Bismarck, North Dakota.
4. Semiannual sampling to detect water-quality degradation; North Dakota State Water Commission; Bismarck, North Dakota.
5. North Dakota State Health Department.
6. North Dakota Department of Parks and Recreation, Data requests for canoeing.
7. Missouri River Basin Program, Garrison Diversion.
8. U.S. Bureau of Reclamation.
9. North Dakota State Water Commission, Assessment of surface-water conditions.
10. Flood forecasting, Province of Manitoba.
12. U.S. Fish and Wildlife Service.
16. International Joint Commission (State Department).
18. International gaging station, Boundary Waters Treaty of 1909.
19. Souris River Board of Control.
20. Province of Saskatchewan, Department of Environment.
21. Water Survey of Canada.

Table 2.--Data-use, funding, and data availability for streamflow-gaging stations in the surface-water program--Continued

Station number	Data use: Regional hydrology	Data use: Hydrologic systems	Data use: Legal obligations	Data use: Planning and design	Data use: Project operation	Data use: Hydrologic forecasts	Data use: Water-quality monitoring	Data use: Research	Data use: Other	Funding: Federal program	Funding: OFA program	Funding: Coop program	Funding: Other non-Federal	Frequency of data availability (A, annually; T, telemetry; P, provisionally)
05123400		9			12	3	4				12	9		A, P
05124000		18	19		12	3, 10	5, 13				16			A, T, P
06331000		9			22		4					9		A
06332515	14	9, 14					14			14				A
06335500	*	9			22, 23	3	4, 5		6		23	9		A
06336600		9			22		4					9		A
06337000	*	9			22, 23	3, 22	5, 13		6	13	23			A
06339100	*	9					4					9		A
06339500	*	9				3	4, 5					9		A, T
06339560					22, 24, 25		24, 25					24		A
06340000	*	9			22	3	4, 5					9		A
06340500	*	9			22, 23	3, 22	5, 13		6		23	9		A, T
06340520					22, 24, 26		24, 26					24		A
06340528		24			22		24					24		A
06340905					24, 26		24, 26					24		A
06341800	*	9			7, 8		5, 7, 8			7				A
06342260	*				22, 27		4					27		A
06342450	*	9					4					9		A
06342500		9			22, 23	3, 22	4, 5		6	28	23			A, T

3. Flood forecasting; National Weather Service; Bismarck, North Dakota.
4. Semiannual sampling to detect water-quality degradation; North Dakota State Water Commission; Bismarck, North Dakota.
5. North Dakota State Health Department.
6. North Dakota Department of Parks and Recreation, Data requests for canoeing.
7. Missouri River Basin Program, Garrison Diversion.
8. U.S. Bureau of Reclamation
9. North Dakota State Water Commission, Assessment of surface-water conditions.
10. Flood forecasting, Province of Manitoba.
12. U.S. Fish and Wildlife Service.
13. NASQAN station.
14. Hydrologic bench-mark station.
16. International Joint Commission (State Department).
18. International gaging station, Boundary Waters Treaty of 1909.
19. Souris River Board of Control.
22. U.S. Bureau of Land Management.
23. Flood control; U.S. Army Corps of Engineers; Omaha, Nebraska.
24. North Dakota Public Service Commission.
25. Knife River Coal Mining Company.
26. North American Coal Corporation.
27. Oliver County.
28. U.S. Geological Survey, Federal hydrologic interest.

Table 2.--Data-use, funding, and data availability for streamflow-gaging stations in the surface-water program--Continued

Station number	Data use: Regional hydrology	Data use: Hydrologic systems	Data use: Legal obligations	Data use: Planning and design	Data use: Project operation	Data use: Hydrologic forecasts	Data use: Water-quality monitoring	Data use: Research	Data use: Other	Funding: Federal program	Funding: OFA program	Funding: Coop program	Funding: Other non-Federal	Frequency of data availability (A, annually; T, telemetry; P, provisionally)
06343000		9			8, 22		4					9		A
06344600	*	9			22		4					9		A
06345500	*	9					4, 5					9		A
06348000	*	9				3	4		6			9		A
06349000	*				22, 23	3, 22	5, 13		6		23			A, T
06349500	*	9				3	4					9		A
06350000	*	9			22	3	5		6			9		A
06351680		9			22		4					9		A
06352000	*	9			22		4					9		A
06353000	*	9					4					9		A
06354000	15	9, 15			22, 23	3	5, 13		6	13				A, T, P
06354500	*	9			23		4				23			A
06355000	*	9			23						23			A
06355310					22, 24, 25		24, 25					24		A
06467600		9					4					9		A
06468170	*	9			12, 23	3	4				23			A, T
06469400					23	3	4, 5				23			A, T
06470000		9		7	12	3	4, 5		6			9		A, T
06470500		9		7	7, 12	3	5, 7, 8		6		23			A, T
06470800	*	9		7	7		4					9		A
06470875					7, 8, 12	3	7, 8			7				A, T

3. Flood forecasting; National Weather Service; Bismarck, North Dakota.
4. Semiannual sampling to detect water-quality degradation; North Dakota State Water Commission; Bismarck, North Dakota.
5. North Dakota State Health Department.
6. North Dakota Department of Parks and Recreation, Data requests for canoeing.
7. Missouri River Basin Program, Garrison Diversion.
8. U.S. Bureau of Reclamation.
9. North Dakota State Water Commission, Assessment of surface-water conditions.
12. U.S. Fish and Wildlife Service.
13. NASQAN station.
15. Index station, U.S. Geological Survey, Water Resources Review.
22. U.S. Bureau of Land Management.
23. Flood control; U.S. Army Corps of Engineers; Omaha, Nebraska.
24. North Dakota Public Service Commission.
25. Knife River Coal Mining Company.

asterisk in the table indicates that the data are or may be used by the U.S. Geological Survey for regional hydrologic analyses.

SUMMARY

Currently (1984), 94 streamflow-gaging stations are being operated by the U.S. Geological Survey in North Dakota at a cost of $663,000. Funding from 11 separate sources contributes to the program. Data from all stations in the North Dakota network have multiple uses. All the gages are presently (1984) justified for continued operation.

Although stations may have been established for one specific purpose, the availability of the data has, in itself, produced other uses for the data. For example, stations that are used for planning and design of a specific project often are continued after the project is completed in order to monitor a changed hydrologic condition.

Five stations are used primarily for research or short-term investigation: Richland County Drain 65 near Great Bend (05052100), Cass County Drain 52 near Amenia (05060510), Rush River near Prosper (05060550), Lower Branch Rush River near Prosper (05060570), and Elm River near Kelso (05062200). These five stations could be discontinued at the end of the projects; however, because of the possible importance of the data currently being collected, the continued operation of these stations should be evaluated when the research projects end.

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