IOWA GEOLOGICAL SURVEY
IOWA CITY, IOWA
ARTHUR C. TROWBRIDGE, Director and State Geologist
H. GARLAND HERSHEY, Assistant State Geologist

WATER-SUPPLY BULLETIN NO. 1

SUMMARIES OF YEARLY AND FLOOD FLOW RELATING TO IOWA STREAMS 1873-1940

Prepared under the direction of
LAWRENCE C. CRAWFORD, District Engineer

by

THE DISTRICT OFFICE, WATER RESOURCES BRANCH
U. S. GEOLOGICAL SURVEY

in cooperation with

IOWA GEOLOGICAL SURVEY
IOWA INSTITUTE OF HYDRAULIC RESEARCH
IOWA STATE CONSERVATION COMMISSION

PUBLISHED BY
THE STATE OF IOWA
DES MOINES
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W. C. Mendenhall, Director of the United States Geological Survey, kindly granted approval of the manuscript of this report for publication. The authorization was recommended by G. L. Parker, chief hydraulic engineer of the water resources branch, and R. G. Kasel, chief of the division of surface waters.

FOREWORD

This is No. 1 of a new series of water-supply bulletins. By means of cooperative programs participated in by the surface water and ground water divisions of the water resources branch of the United States Geological Survey and the Iowa Geological Survey, and with the aid and encouragement of the Iowa Institute of Hydraulic Research, the State Conservation and Highway Commissions, the State Department of Health, and other interested institutions, groups, and individuals, valuable data are collected. Information concerning flood, low water and average stream flow and lake stages; pumpages, water level fluctuations, and ground water reserves; and the geological factors involved in the drilling, construction, maintenance and use of water wells, and the quantity and quality of well water available in different rock formations at different depths in different parts of Iowa are included.

As these programs are continued data will accumulate. It seems wise to make them useful by publication from time to time. Even though some data are published in nation-wide government reports, it is thought that those pertaining particularly to Iowa assembled in State bulletins would render the data more readily available and useful to interested persons in this State.

It is hoped that water-supply bulletins to follow will appear at a rate of about one a year.

A. C. Trowbridge
Director and State Geologist

July 31, 1942

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SUMMARIES OF YEARLY AND FLOOD FLOW RELATING TO IOWA STREAMS

1873-1940

Prepared under the direction of

LAWRENCE C. CRAWFORD

ABSTRACT

As a result of the need for basic data and the lack of a current and convenient summary concerning the surface-water resources of Iowa, a synoptic inventory has been prepared as a part of the present State-wide program which is made possible by State and Federal cooperative action. These hydrologic data are assembled in abbreviated form for the convenience of the public and in order that a current State report containing stream-flow records under one cover will be more readily accessible for Iowa.

This inventory is here presented in the form of a brief compilation report which summarizes results of stream-flow measurements relating to Iowa streams throughout the years during which local, State and Federal agencies have cooperated in Iowa with the water resources branch of the United States Geological Survey.

The principal basic data consist of concise summaries for gaging stations in Iowa and certain relevant locations adjacent thereto for which records for five or more complete years have been collected. These summaries include a comprehensive description and history of each station followed by a table giving in convenient form and for general use the figures of maximum and minimum daily discharge and yearly mean discharge and runoff for the water and calendar years of record. In addition, approximately 300 miscellaneous discharge measurements, which have been made within the State of Iowa, are included in an original and convenient listing. A summary of maximum discharges at 115 places is also given together with other data pertinent to flood flow in Iowa.

References to original sources are made insofar as possible throughout the report in order to assist those making detailed studies. In general, available records have been reviewed and summarized up to September 30, 1940, with exceptions appropriately noted. An aggregate of about 950 station-years of recorded experience at 66 stations in drainage basins in or contiguous to Iowa are covered by these summaries, authenticated records for which extend back with decreasing completeness to 1873.

The basic tabulations are accompanied by a brief text outlining the need for basic facts regarding the water resources of Iowa, a resume of the Federal and State cooperative program and the related stream-flow measurement work in Iowa, and statements introductory to the presentation of the gaging-station summaries. Finding references, definition of stream-gaging terms, hydraulic conversion tables and equivalents have been made component parts of this report.

It should be emphasized that this report is primarily a condensed statistical inventory and that it has not been possible to include any daily discharge records or comprehensive analyses of the data.

INTRODUCTION

The considerate and proper use of the water of Iowa is a vital question. Adequate information on the quantities of water available and the range of stages that may be expected in surface-water courses is essential in the design and construction of hydraulic works of all kinds, including structures for flood protection, municipal supplies, power and industrial plants, disease and pollution control, drainage of lands, navigation developments, and storage of water for various purposes. Such data are also necessary for the establishment of the elevations of railroad and highway grades, the design of bridge and culvert openings, and the operation and administration of all structures and developments relating to the use and conservation of water. The cost of obtaining such basic data represents an almost negligible fraction of the expenditures for water works, sewage treatment plants, air-conditioning developments, and dams and bridges, in the successful design, operation, and maintenance of which the quantity of water available, or encountered, may be a most important factor.

Administrative, regulatory and advisory planning bodies, of local, State and Federal character are ever in need of or seeking information upon which to base their recommendations relating to the water resources of Iowa. When such planning and recommendations proceed without the benefit of stream-flow records or without an understanding of them, they become not merely difficult but often fail to serve the best interests of the commonwealth in the development, protection, and preservation of the water resources of this State. Thus, pertinent and reliable records have been in demand by numerous city, county, State, and Federal agencies and by agricultural, civic, and industrial groups as well as private individuals.

Agricultural as well as industrial expansion and development provides ample proof that water in general, and water courses in particular, are of strategic importance as a national resource. The water of this State, in addition to the land, is a valuable mineral resource to be conserved for most beneficial use. It is also, at times, a destructive agent against which protection is needed. Stream-flow records serve the same purpose with respect to water that mapping, landline surveys, and recording the transfer of title accomplish for private and public benefit with respect to land. Records of stream flow should be looked upon in the same light as the records of land which are maintained and kept in every county court house in this State. However, stream-flow data, unlike data collected in land surveys and other types of engineering work, must be collected before they are needed, and obviously cannot be obtained in a relatively short time. Floods and drouths, like fires, demand prior preparatory consideration with

scientific methods and practical works for use during their occurrence.

The conditions of stream flow in any one period are not likely to be duplicated exactly in any succeeding period, but a measurement of the regime existing for a series of years is essential. Unless systematic inventories of stream flow and various other related data are readily available, there is no real basis for any comprehensive formulation of plans for the conservation, control, and use of the water resources of Iowa.

Resume of Nation-wide Program for Water Resources Investigations

To meet the needs for stream-flow data in all parts of the country, a systematic study of the water resources of the United States was begun in 1888 by the Federal Government through what is now the water-resources branch of the United States Geological Survey, which is sometimes referred to as the Federal Survey. The work has consisted largely in the measurement of rate of flow of streams and studies of conditions affecting that flow; but special investigations have also been made of such closely allied problems as flood characteristics, water storage, water power, ground water, quality of water, and measurement of sediment loads. Most of the results of these investigations have been published in a series of water-supply papers of which over 900 have been issued. A monthly water resources review, which gives the current and outstanding ground and surface-water conditions in the United States and adjacent parts of Canada, has been of timely interest and value as a public service in connection with agricultural and industrial expansion for the National Defense effort.

In order to facilitate the investigation of surface waters, the Federal Survey has divided the United States into 14 major drainage basins, or parts, the boundaries of which coincide with natural drainage features as indicated below:

Part 1. North Atlantic slope basins (St. John River to York River).
2. South Atlantic slope and eastern Gulf of Mexico basins (James River to Mississippi River).
3. Ohio River Basin.
4. St. Lawrence River Basin.
5 Hudson Bay and upper Mississippi River Basins.
6. Missouri River Basin.
7. Lower Mississippi River Basin.
8. Western Gulf of Mexico basins.
9. Colorado River Basin.
10. The Great Basin.
11. Pacific slope basins in California.

12. Pacific slope basins in Washington and upper Columbia River Basin.
13. Snake River Basin.
14. Pacific slope basins in Oregon and lower Columbia River Basin.

Results of stream-flow measurements are now published annually in 14 water-supply papers or parts, each paper or part covering data on the indicated drainage basins. In this system, Iowa makes up a portion of parts 5 and 6 as shown on plate 1.

The field work for these investigations and reports is being conducted by 36 district offices of the Water Resources Branch which has an office in the Hydraulics Laboratory of the Iowa Institute of Hydraulic Research at the State University of Iowa, Iowa City. The measurements of flow of streams and measurements of stage and contents of lakes and reservoirs have been made at over 8,800 gaging stations in the United States and also at many stations in Hawaii and Alaska. In July 1940, about 4,700 gaging stations were being maintained by the Survey and cooperating organizations. Because of the recognized need, in the public interest, for reliable and continuous records of stream flow, the work has been carried on largely by the Federal Survey in cooperation with the several States, Corps of Engineers, U. S. Army, and other agencies. In 1940, over 45 State organizations and many municipalities as well as other federal agencies were actively cooperating in this nation-wide program, of which the work in Iowa is a part.

History of State Cooperative Stream-Flow Work in Iowa

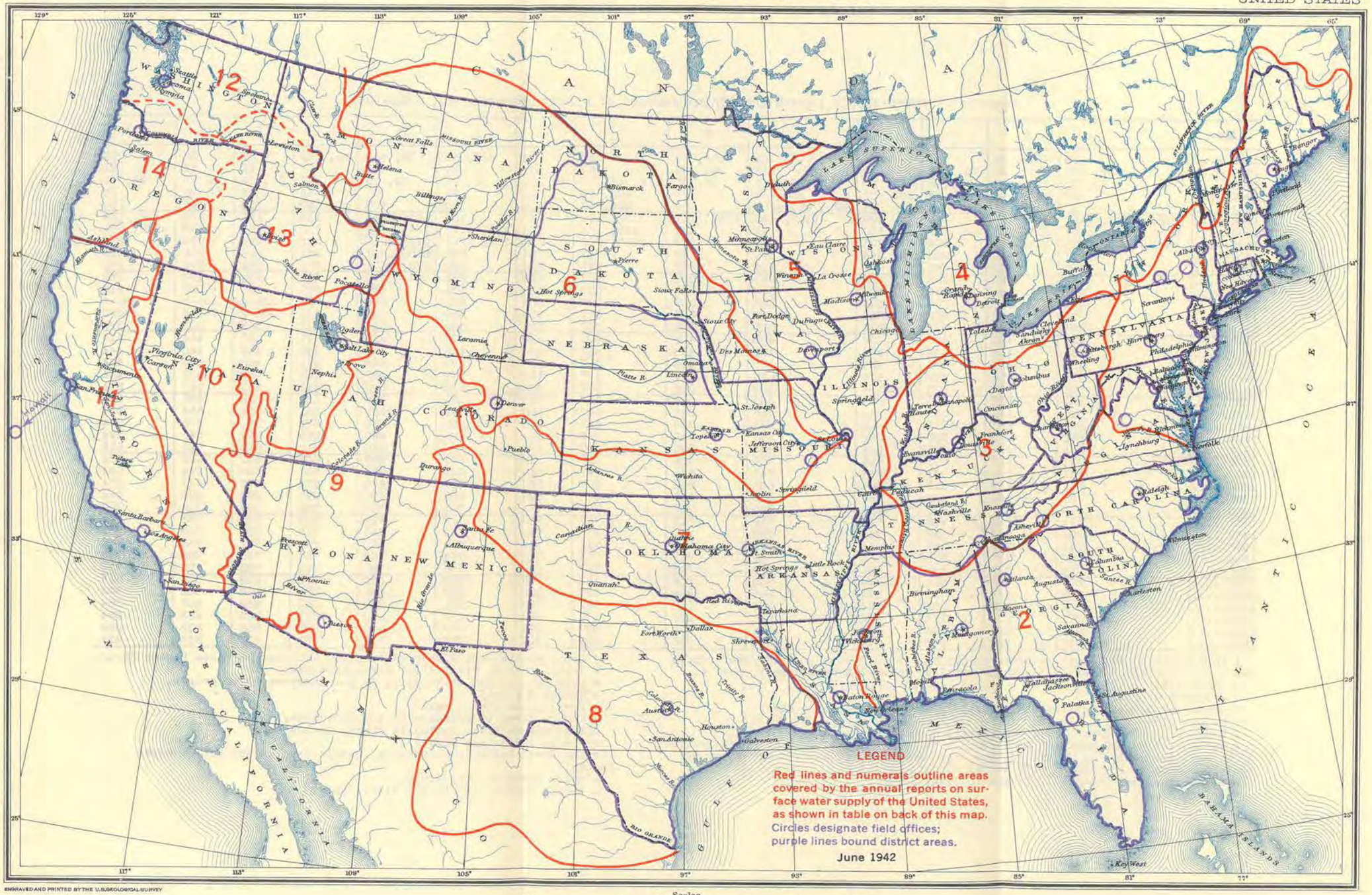
The State and Federal cooperative collection of systematic stream-flow records was initiated in Iowa in 1914. Prior to that time, a few records were obtained by special arrangements for the period 1903-06. Since 1903, an aggregate of 101 measurement stations have been established and maintained during various periods by the Federal Survey acting alone, or in cooperation with the State of Iowa or other agencies such as the Corps of Engineers, U. S. Army. During the 4 years, 1937-40, an average of about 450 current-meter discharge measurements were made each year to determine and verify the relation between stage and discharge (rating) at an average of about 65 gaging stations in Iowa. A total of 39 water-stage recorders, which make a continuous graphical record of the fluctuation in water level, were in operation on December 31, 1940. The operation of all of these stations through the cooperative program has provided some factual quantitative information and enabled the accumulation of other supplementary data, authenticated records for which extend back with decreasing completeness to 1873.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES BRANCH—DIVISION OF SURFACE WATER

CENTRAL OFFICE: North Interior Building, Wash., D. C.

UNITED STATES



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Numbers of water-supply papers containing results of stream measurements, 1899-1941

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1899 a...	35	b35, 36	36	36	36	c36, 37	37	37	d37, 38	38, e39	38, f39	38	38	38
1900 g...	47, h48	48	48, 149	49	49	49, j50	50	50	50	51	51	51	51	51
1901.....	65, 75	65, 75	65, 75	65, 75	k65, 66, 75	66, 75	k65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902.....	82	b82, 83	83	m82, 83	k83, 85	84	k83, 84	84	85	85	85	85	85	85
1903.....	97	b97, 98	98	97	k98, 99, n100	99	k98, 99	99	100	100	100	100	100	100
1904.....	o124, p125, q126	q126, 127	128	129	k128, 130	130, r131	k128, 131	132	133	133, s134	134	135	135	135
1905.....	o165, p166, q167	q167, 168	169	170	171	172	k169, 173	174	175, t177	176, s177	177	178	178	u177, 178
1906.....	o201, p202, q203	q203, 204	205	206	207	208	k205, 209	210	211, t213	212, s213	213	214	214	214
1907-8...	241	242	243	244	245	246	247	248	249	250, s251	251	252	252	252
1909.....	261	262	263	264	265	266	267	268	269	270, s271	271	272	272	272
1910.....	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911.....	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912.....	321	322	323	324	325	326	327	328	329	330	331	332-A	332-B	332-C
1913.....	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914.....	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915.....	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916.....	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917.....	451	452	453	454	455	456	457	458	459	460	461	462	463	464
1918.....	471	472	473	474	475	476	477	478	479	480	481	482	483	484
1919-20..	501	502	503	504	505	506	507	508	509	510	511	512	513	514
1921.....	521	522	523	524	525	526	527	528	529	530	531	532	533	534
1922.....	541	542	543	544	545	546	547	548	549	550	551	552	553	554
1923.....	561	562	563	564	565	566	567	568	569	570	571	572	573	574
1924.....	581	582	583	584	585	586	587	588	589	590	591	592	593	594
1925.....	601	602	603	604	605	606	607	608	609	610	611	612	613	614
1926.....	621	622	623	624	625	626	627	628	629	630	631	632	633	634
1927.....	641	642	643	644	645	646	647	648	649	650	651	652	653	654
1928.....	661	662	663	664	665	666	667	668	669	670	671	672	673	674
1929.....	681	682	683	684	685	686	687	688	689	690	691	692	693	694
1930.....	696	697	698	699	700	701	702	703	704	705	706	707	708	709
1931.....	711	712	713	714	715	716	717	718	719	720	721	722	723	724
1932.....	726	727	728	729	730	731	732	733	734	735	736	737	738	739
1933.....	741	742	743	744	745	746	747	748	749	750	751	752	753	754
1934.....	756	757	758	759	760	761	762	763	764	765	766	767	768	769
1935.....	781	782	783	784	785	786	787	788	789	790	791	792	793	794
1936.....	801	802	803	804	805	806	807	808	809	810	811	812	813	814
1937.....	821	822	823	824	825	826	827	828	829	830	831	832	833	834
1938.....	851	852	853	854	855	856	857	858	859	860	861	862	863	864
1939.....	871	872	873	874	875	876	877	878	879	880	881	882	883	884
1940.....	891	892	893	894	895	896	897	898	899	900	901	902	903	904
1941.....	921	922	923	924	925	926	927	928	929	930	931	932	933	934

a Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables of monthly discharge for 1899 in 21st Annual Report, part 4.
b James River only.
c Gallatin River.
d Green and Gunnison Rivers and Colorado River above Gunnison River.
e Mojave River only.
f Kings and Kern Rivers and south Pacific slope basins.
g Rating tables and index to Water-Supply Papers 47-52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Monthly discharge for 1900 in 22d Annual Report, part 4.
h Wissahickon and Schuylkill Rivers to James River.
i Scioto River.
j Loup, Platte, and Elkhorn Rivers and tributaries below Platte River.
k Tributaries of Mississippi River from east.
m Lake Ontario and tributaries to St. Lawrence River proper.
n Hudson Bay only.
o New England rivers only.
p Hudson River to Delaware River, inclusive.
q Susquehanna River to Yadkin River, inclusive.
r Platte and Kansas Rivers.
s The Great Basin in California, except Truckee and Carson River Basins.
t Below mouth of Gila River.
u Rogue, Umpqua, and Siletz Rivers only.

Since 1914, with the exception of the period 1928-32 various State departments, educational institutions, counties, and cities have cooperated with the water resources branch of the United States Geological Survey in a program working toward adequate and continuous records relating to the surface waters of Iowa. The engineering schools at Ames and Iowa City have always given encouragement and shown active interest in the work.

During 1928-32 the work was completely abandoned, and it has at other times been seriously handicapped by the failure of the State of Iowa to make available cooperative funds, without which Federal contribution is impracticable. In the Federal appropriation acts the availability of United States Geological Survey funds is made contingent upon the States or municipalities contributing at least half of the total cost of collecting the records. Cooperative stream gaging in Iowa was re-established in October 1932, through the facilities of the Iowa Institute of Hydraulic Research and the efforts of the late Professor F. A. Nagler in collaboration with N. C. Grover, then chief hydraulic engineer of the Federal Survey. Since 1932 the Institute of Hydraulic Research has performed an exemplary function for the State of Iowa—providing an impressive portion of the State facilities for the cooperative stream-gaging program.

Prior to 1928 the principal State cooperating agencies were the Highway Commission, Geological Survey and Engineering Experiment Station at Iowa State College. In the period 1932-39, the principal State cooperating agencies were the University of Iowa Institute of Hydraulic Research, Department of Health, Planning Board, Fish and Game and Conservation Commissions and Geological Survey. In this period, some State funds were provided by the Legislative Interim Committees as well as from the regular funds of the indicated State departments and special funds of the Institute of Hydraulic Research. While such a variety of assistance was an indication of the extent of State interest, it obviously was not conducive to continuous and systematic operation of the basic program for which a stable financial support is a prime requisite.

In recent years the sympathetic attitude of Governor George A. Wilson, Comptroller C. Fred Porter, and Legislative Interim and Senate Committees have been most helpful with some of the fiscal arrangements which, if maintained by the State, will provide Iowa with some important facts concerning its water resources. As a result of such interest, in 1939 the 48th General Assembly of Iowa recognized the desirability of some definite and regular legislative support and accordingly provided the first biennial appropriation of $4,500 to the Iowa Geological Survey for stream-gaging cooperation. This

appropriation replaced the previous intermittent contributions of several State departments, and together with the special funds of the Institute of Hydraulic Research and Conservation Commission constituted the State aid in 1940. Records of lake levels and supplementary stream measurements have been carried on as a part of the cooperative program and incident to the authorized jurisdiction of the Conservation Commission over artificial State-owned lakes, meandered streams, and natural lakes of Iowa. Through the authority of State and Federal statutes, the official stream and lake-level measurements and related publications have come to be recognized as a public necessity and an unbiased source of reference when water problems are encountered.

In 1940, the work in Iowa was done under cooperative agreements as follows: Iowa Geological Survey, Dr. A. C. Trowbridge, Director and State Geologist; State University of Iowa Institute of Hydraulic Research, F. M. Dawson, Director and Dean of College of Engineering and Professor E. W. Lane, Associate Director; and the Iowa State Conservation Commission, M. L. Hutton, Director, and his successor, F. T. Schwob.

In addition in 1940, the following cities, counties and other agencies were assisting with the work through the Institute of Hydraulic Research, or in various other ways: School of Civil Engineering at Iowa State College; Appanoose and Decatur Counties; the cities of Boone, Cedar Rapids, Clarinda, Des Moines, Red Oak, Ottumwa, Spencer and Waterloo; Des Moines Water Works; Jacob E. Decker and Sons, Central States Power and Light Corporation; Central States Electric Co.; Interstate Power Company; Iowa Electric Co.; Iowa Electric Light and Power Company; and Mississippi River Power Co.

This summary and compilation report constitutes a part of the present State-wide program which is made possible by State and Federal cooperative action as outlined in the preceding paragraphs. As the State financial cooperation in Iowa is below the requirements for the work and that provided in surrounding States, the necessity for continuing and enlarging the State facilities for the collection and publication of stream-flow data for Iowa should be emphasized. It cannot be overemphasized that such records are indispensible for the consideration of all matters relating to the utilization of the water resources of Iowa.

Previous State and Federal Publications of Stream-Flow Records

The records of the United States Geological Survey and cooperating agencies form the original source of practically all existing quantitative stream-flow information in Iowa. The annual stream-flow reports of the Federal Survey that include basic data for Iowa and the prin-

cipal earlier State reports on this subject are listed in table 1. This bibliography of hydrometric data for Iowa will be convenient as a source reference to daily discharge records and other detailed information beyond the scope of this report. The table gives by years and major drainage basins, the numbers of the surface water-supply reports published from 1899 to 1940. (See also table on back of pl. 1). In general, the data for any particular station in Iowa will be found in the reports covering the years during which the station was maintained. An index of the records obtained in the United States prior to 1904 has been published in Water-Supply Paper 119.

The records at most of the stations discussed in these water-supply papers extend over a series of years. Miscellaneous measurements at many points other than regular gaging stations have been made each year and are published under "Miscellaneous discharge measurements" at the end of each report. Records of yearly discharge and runoff for certain stations in Iowa are summarized among those of other States in convenient form in Water-Supply Papers 875 and 876 which contain stream-flow records collected in 1939.

In 1935, the Iowa State Planning Board sponsored and released a State report as shown in table 1. That report was prepared in collaboration with the Iowa Institute of Hydraulic Research, various relief administrations, and the Federal Survey. It contains records which are largely based on field data collected by the Federal Survey and previously published (some of which have been revised), as well as some records not included in the water-supply papers of that organization. It presents in one volume of 567 pages the daily stream-flow records for 37 gaging stations in Iowa up to December 31, 1932. Unfortunately, it has not been financially possible to publish a similar one-cover summary of all the daily data collected and published in the annual series of surface water-supply papers of the Federal Survey since 1932.

Concerning localized and specialized investigations for the collection of certain hydrologic information, the Iowa Engineering Experiment Station at Ames has released a rainfall and runoff report (Rainfall and Discharge Records for Northern Iowa Drainage Districts, by W. J. Schlick, Bulletin 141, Iowa State College, 1939) covering the growing season during 1920-32 in several drainage districts of northern Iowa. Some very small-scale results of runoff and erosional losses have also been published (Soil and Water Conservation Investigations, Technical Bulletin No. 558, U. S. Department of Agriculture, 1937) from the soil and water conservation investigation on the 200-acre Lawson farm near Clarinda, which has been under lease as an erosional control experimental area of the U. S. Department of Agricul-

TABLE 1.—*Publications Containing Results of Stream Measurements in Iowa*

Federal Publications

Numbers of U. S. Geological Survey water-supply papers containing results of stream-flow measurements in Iowa, 1899-1940.

Year	Part 5 Mississippi River Basin	Part 6 Missouri River Basin
1899	36	36, 37
1900	49	49, 50
1901	65, 66, 75	66, 75
1902	83, 85	84
1903	98, 99, 100	99
1904	128, 130	130, 131
1905	171	172
1906	207	208
1907-8	245	246
1909	265	266
1910	285	286
1911	305	306
1912	325	326
1913	355	356
1914	385	386
1915	405	406
1916	435	436
1917	455	456
1918	475	476
1919-20	505	506
1921	525	526
1922	545	546
1923	565	566
1924	585	586
1925	605	606
1926	625	626
1927	645	646
1928	665	666
1929	685	686
1930	700	701
1931	715	716
1932	730	731
1933	745	746
1934	760	761
1935	785	786
1936	805	806
1937	825	826
1938	855	856
1939	875	876
1940	895	896

State Publications

(1) Stream flow records of Iowa, 1873-1932: Iowa State Planning Board, Water Resources Committee, 1935. (Out of print).

(2) Rainfall and discharge records for northern Iowa drainage districts, by W. J. Schlick: Bulletin 141, Iowa Engineering Experiment Station, Ames, Iowa, 1939.

ture in cooperation with the Iowa State College. A detailed summary of the data pertaining to rainfall, runoff, and ground-water levels, as well as annual summaries of land use within the noteworthy Ralston Creek investigational area, have been published (A Summary of Hydrologic Data Ralston Creek Watershed, 1924-35, by F. T. Mavis and Edward Soucek, University of Iowa Studies, Bulletin 9, 1936) and distributed widely in the engineering profession through the facilities of the Iowa Institute of Hydraulic Research.

The reports of the Corps of Engineers, U. S. Army, to the Congress of the United States contain the results of authorized river surveys and studies which are valuable sources of reference for related technical data. In addition, a historical publication entitled "Iowa: The Rivers of Her Valleys," by William J. Petersen was issued in 1941 in the usual attractive format of the State Historical Society of Iowa. This publication includes interesting material of historical character, together with some associated technical information.

Although a source of data may sometimes be found through records kept by various commercial interests such as utilities, railroads, milling companies, and so on, such information is usually unpublished or not readily available and therefore frequently overlooked.

Some of the State and Federal publications, to which reference is given, are out of print. Those water-supply papers not out of print may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will, on application, furnish price lists. Complete sets of these publications may be consulted at the office of the Geological Survey in Iowa City, and at public libraries in the principal cities. Public libraries that do not have these reports may arrange to borrow them from the United States Geological Survey library. A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

ACKNOWLEDGMENTS

Work in this field was stimulated by the efforts of the late Professor Floyd A. Nagler, first Director of the Iowa Institute of Hydraulic Research; R. G. Kasel, district engineer of the Federal Geological Survey, 1932-40; and the subsequent interest of Dr. A. C. Trowbridge. These men more than any others, are responsible for the cooperative arrangements through which continuous and systematic collection of stream-flow records were effectively re-established in 1932 and recognized thereafter in Iowa. In later years, Dean F. M. Dawson, Professors E. W. Lane and J. W. Howe, the late M. L. Hutton, and F. T. Schwob have all given encouragement and liberally of their time in the interest of the work.

In the execution of the work resulting in the availability of the records, many private, State and Federal organizations have cooperated, either by furnishing data or by assisting in its collection. Insofar as practicable, an attempt has been made to give individual and appropriate acknowledgment throughout the report for all data or the assistance obtained from all sources throughout Iowa. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; early cooperation of the second kind and of State-wide character at the time of publication has been outlined under "History of State cooperative stream-flow work in Iowa."

Special acknowledgment is extended to the Corps of Engineers, U. S. Army, for considerable financial assistance in Iowa since 1938, published and unpublished records, and for some other information derived from their reports or special river surveys. Acknowledgment is due the United States Weather Bureau for use of certain precipitation and temperature records, more particularly, for some miscellaneous data relating to river stages at some of the stations given in this report.

The field and office data and records, from which the station histories, yearly and flood summaries, and related information were prepared for this special publication in the direct interest of the State of Iowa, were collected over a period of years under the direction of several district engineers of the Survey assisted by their staffs under the cooperative program. The district offices of the Federal Survey in Minnesota and Missouri kindly consented to the inclusion of certain station records for those States.

The outline and general plan of this report, the essential arrangements therefor, and the preparation of the records were made under the direction of L. C. Crawford, who in April 1940 succeeded R. G. Kasel as district engineer, and since that time has been in charge of

the cooperative stream-flow work in Iowa. The examination and assembly of data were supervised by W. I. Travis and G. L. Whitaker assisted by the staff of the United States Geological Survey office in Iowa City, where the records were reviewed and the manuscript assembled. G. L. Whitaker drew the tracings for the illustrations. Mrs. Carroll Mullin, State clerk-stenographer, typed the manuscript for the station histories and text, and assisted with many details of the report. Dr. H. G. Hershey, assistant State Geologist of Iowa, assisted with the manuscript for the text and gave many valuable suggestions in preparing and arranging the material for the printing.

UNITS AND DEFINITIONS

The following definitions of terms are used in connection with the presentation of these data and are taken largely from the water-supply papers of the Federal Geological Survey.

The volume of water flowing in a stream—the "runoff" or "discharge"—is expressed in various terms, each of which has become associated with a certain type of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, millions of gallons per day, discharge in second-feet per square mile, and runoff in inches of depth per acre each 24 hours—drainage modulus—and (2) those that represent the actual quantity of water, as runoff in inches of depth on the drainage basin, acre-feet, and millions of gallons. The units in which stream-flow data are given in this report and other terms of importance are defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is a rate of flow of 1 cubic foot per second, or the rate of discharge which is equivalent to a stream flowing in a pipe or open channel when the cross-sectional area is 1 square foot and the average velocity is 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that runoff is distributed uniformly both as regards time and area.

"Runoff in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were redistributed uniformly over its surface. It is principally used for comparing runoff with rainfall, which is usually expressed in inches.

"Acre-feet" is commonly used in connection with storage of water for irrigation or power. An acre-foot, equivalent to 43,560 cubic feet, is the quantity of water required to cover an acre of surface to a depth of 1 foot.

"Second-foot-day" is the volume of water represented by a flow of 1 second-foot for 24 hours. It is equivalent to 86,800 cubic feet, 1.983 acre-feet, or 646,317 gallons and represents a runoff of 0.0372 inch from 1 square mile.

"Control" is a term used to designate the natural sections or reach of the channel or artificial structure below the gage which determines the stage-discharge relation at the gage.

"Crest" is (1) the top of a dam, spillway, or weir, frequently restricted to the overflow portion; (2) the summit of a wave or the peak stage of a flood.

"Datum" is a plane of reference for gage heights.

"Drainage area" may be most appropriately used to refer to numerical units of area drained by a stream system upstream from some designated point on the stream; whereas, "drainage basin" may advantageously be used to refer in a general way to the region drained by a stream; under some usage the terms are synonymous themselves and with "catchment area."

"Gage height" is the height of water surface in relation to a datum corresponding to the zero of the staff or other type of gage from which the height is obtained; generally considered synonymous with stage.

"Stage-discharge relation" is the relation between gage height and discharge, as defined by discharge measurements, by which it is possible to obtain the discharge of a stream from the observed gage heights.

GENERAL EXPLANATION OF FIELD AND OFFICE WORK

A gaging station is a selected section in a stream channel equipped with a gage and facilities for measuring the flow of water; in other words, a place on a stream where data can be gathered from which records of discharge can be computed. The basic data systematically collected at such stream-measurement stations consists of records of stage, current-meter measurements of discharge, and related information useful in determining the instantaneous and daily mean flow. The records of stage are obtained either by direct observation on a nonrecording gage or by an automatic water-stage recorder that makes a continuous record of the water-level fluctuations.

Measurements of discharge are generally made with a United States Geological Survey Type A or other models of the small Price current meter with accessory equipment and methods perfected by the Federal Survey and outlined in standard handbooks and texts. Good results can be obtained on most streams in Iowa only by frequent discharge measurements, the frequency varying from one measurement each month to one or more each day in flood time, depending upon local

A. Iowa River near Coralville, Iowa

B. Wapsipinicon River at Independence, Iowa
(Courtesy of W. I. Travis)

RECORDING INSTALLATIONS

(Construction funds furnished by Rock Island District, Corps of Engineers, U. S. Army)

A. ARTIFICIAL CONTROL AND RECORDING GAGE INSTALLATION ON LIME CREEK AT MASON CITY, IOWA

B. HYDRAULICS LABORATORY OF IOWA INSTITUTE OF HYDRAULIC RESEARCH AND STREAM GAGING EQUIPMENT AT IOWA CITY, IOWA

(Courtesy of W. I. Travis)

conditions such as stability of the stream bed. Typical gaging-station structures are shown on plates 2 and 3.

Rating tables for each station, giving the discharge corresponding to the stage, are prepared by careful analysis of rating curves resulting from the previously mentioned discharge measurements. Daily mean discharge (midnight to midnight), from which most other flow and runoff data are computed, is determined by applying the daily mean gage height to the rating tables or by averaging the discharge for intervals of the day. In figure 4 on page 76, a number of discharge measurements made at the Keosauqua gaging station on the Des Moines River are plotted together with the rating curve, area curve, velocity curve, and mean-depth curve. Attention is called to the fact that the zero of this gage, as well as many others, is placed at an arbitrary datum and has no significant relation to zero flow or the bottom of the river. At most stations, the zero of the gage is merely located somewhat below the lowest known flow, so that negative gage readings will be avoided.

The data presented for each gaging station in the annual surface water-supply papers of the United States Geological Survey usually comprises a short description of the station, a table showing the daily flow of the stream, and a table of monthly and yearly discharge and related runoff conversions. In order to illustrate the detailed data published each year for stream-gaging stations in Iowa and other States in the Survey reports, a typical page from Water-Supply Paper 875 is reproduced in this report on page 57 in connection with the summary of such records for the gaging station at Cedar Rapids where the period of observation and daily flow records are the longest for any river within the State.

The table of daily discharge gives, for stations equipped with non-recording gages, the discharge in second-feet corresponding to once-daily readings of the gage or the mean of twice-daily readings. For flashy floods the mean daily discharge is determined from gage-height graphs based on gage readings made once or twice daily or oftener, as stated in the station description. For stations equipped with water-stage recorders, except those on streams subject to sudden or rapid fluctuation, the table gives the discharge corresponding to the mean daily gage height. For stations subject to such fluctuation the mean daily gage height may not indicate the true mean daily discharge, which must be obtained by averaging the discharge for intervals of the day or by using the discharge integrator, an instrument for obtaining the mean daily discharge from a continuous gage-height graph and containing as an essential element the rating curve of the station.

At some gaging stations the stage-discharge relation is affected by backwater from reservoirs, tributary streams, or other sources, which necessitates the use of the slope or fall in a reach of the stream as a factor in the determination of discharge. Information requisite for determining the slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage, and for them the rate of change of stage is used as a factor in the determination of discharge.

At most gaging stations in Iowa the stage-discharge relation is affected by ice during the winter, which makes it impossible to compute the discharge in the usual manner. Discharge for periods of ice effect is computed on the basis of occasional winter discharge measurements and gage heights, consideration being given to the available information on temperature and precipitation, notes by gage observers and engineers, and comparable records of discharge for stations in the same or nearby basins.

In the table of monthly discharge the column headed "Second-foot-days" gives the sum for each month of the figures for that month given in the table of daily discharge. The column headed "Maximum" gives the maximum daily discharge and not the instantaneous discharge when the water surface was at crest stage. Likewise, in the column headed "Minimum" the quantity given is the minimum daily discharge. The column headed "Mean" gives the average flow in cubic feet per second during the month.

It will be observed on the sample page of daily records that the data presented in the water-supply papers are for the water year October 1 to September 30. In Iowa, on January first of most years, much of the precipitation that fell during the preceding 3 months is stored in the form of snow or ice, or in ponds, lakes, swamps, and underground reservoirs. A large percentage of this stored water does not reach the streams until the spring break-up or late in the summer. At the end of September, on the other hand, only a small amount of ground water remains as a part of previous precipitation, and therefore, it may be assumed that practically all of the runoff for the year ending September 30 is derived from precipitation occurring within that year.

For the convenience of those using the records, however, the water-supply papers in recent years present data summarized for calendar years as well as for water years ending September 30. (See page 58).

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

The accuracy of stream-flow data depends primarily on (1) the permanency of the stage-discharge relation and (2) the accuracy and frequency of observations of stage, measurements of flow and interpretation of records. The purposes for which the records are collected and the funds available for the work determine to a large extent the accuracy of the records. For statements regarding the probable accuracy of daily discharges, which varies from within 5 per cent to 20 or a higher per cent, reference should be made to the original records in question in the water-supply papers.

Yield at some stations as indicated by monthly means may vary widely from natural yield, owing to diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or other factors. A table of monthly discharge gives a general idea of the flow at the station and should be used only for preliminary consideration; tables of daily discharge (see page 57) allow more detailed studies of the variation in flow. Practical considerations do not generally warrant refinement in computations beyond the use of three significant figures.

If errors resulting from various sources in the computation of daily discharge are compensating, the probable error in the determination of mean monthly discharge will be much less than the probable error of the associated determination of individual daily discharges. Experience with records of daily discharges and monthly means computed from them shows that large errors in the daily figures may be compensating to such extent that errors in the monthly means are small. Therefore, the monthly means and more particularly the yearly means presented in this report for many stations may represent with comparatively high accuracy the average quantity of water flowing past the gage. Even though the monthly and yearly means for any station may represent the flow past the gage with a high degree of accuracy, the figures showing discharge per square mile and depth of runoff in inches may be subject to errors owing to inaccuracies in the determination of drainage areas, or other uncertainties affecting the yield as mentioned in a preceding paragraph.

The drainage areas as given for each location have been obtained by planimeter determinations using the latest available maps from various sources and have been recently reconciled with similar determinations by other agencies, such as Corps of Engineers, U. S. Army, and the United States Weather Bureau. Through the conservation activities of the United States Department of Agriculture, the entire State of Iowa has been photographed from the air. These photographs permit stereoscopic mapping practice. Available aerial maps,

nevertheless, do not supply sufficiently accurate information in a form suited for the determination of drainage areas. Such maps, without vertical control, are inadequate and cannot be utilized for many engineering or military purposes without considerable expense. A considerable portion of Iowa is without adequate topographic maps from which accurate and convenient drainage area computations can be made.

It is often necessary to evaluate flood discharges by methods less accurate than current-meter measurement. Such methods may consist of an extension of rating curve by means of area and velocity curves, slope-area analysis, computation of flow over dams, etc. In presenting maximum discharges in this report, an attempt has been made to specifically designate the method of determination by qualifying statements. In the section "Gaging station summaries in this report" such statements appear in the station descriptions under the side headings of "stage-discharge relation," "extremes" and "historical data"; whereas, footnotes have been used for indicating only special methods in the sections "Summary of maximum discharges" and "Miscellaneous discharge measurements." Obviously it is impracticable in this compilation to indicate completely the varying degree of accuracy of the maxima and other records which have been determined over a wide range of conditions and through many years.

Records of flow as originally published in water-supply papers were based on information available at the time. Subsequent field work and office analysis have occasionally indicated the need of revising original computations. Such revised records, which are usually published in later reports, are often overlooked by the users of the data. Insofar as possible, the individual summaries and flood discharges given in this volume include all revised records. Nevertheless, the data presented should not be considered final or conclusive—each additional year's record, in conjunction with previous records, adds new information and new value to the total record.

SCOPE OF THIS REPORT

In the system of dividing the United States into major drainage basins or parts as used by the Federal Survey in publishing streamflow records, the State of Iowa is located partly in the Upper Mississippi River Basin (Part 5) and partly in the Missouri River Basin (Part 6). The divide between the two basins may be seen on plate 1 on page 10. Plate 4 shows the rivers which define the eastern and western boundaries of the State and their principal tributaries in Iowa. In each of the major drainage basins in Iowa, gaging stations on the main streams are treated first, in downstream order, and then the stations on tributaries in similar order beginning with the upper-

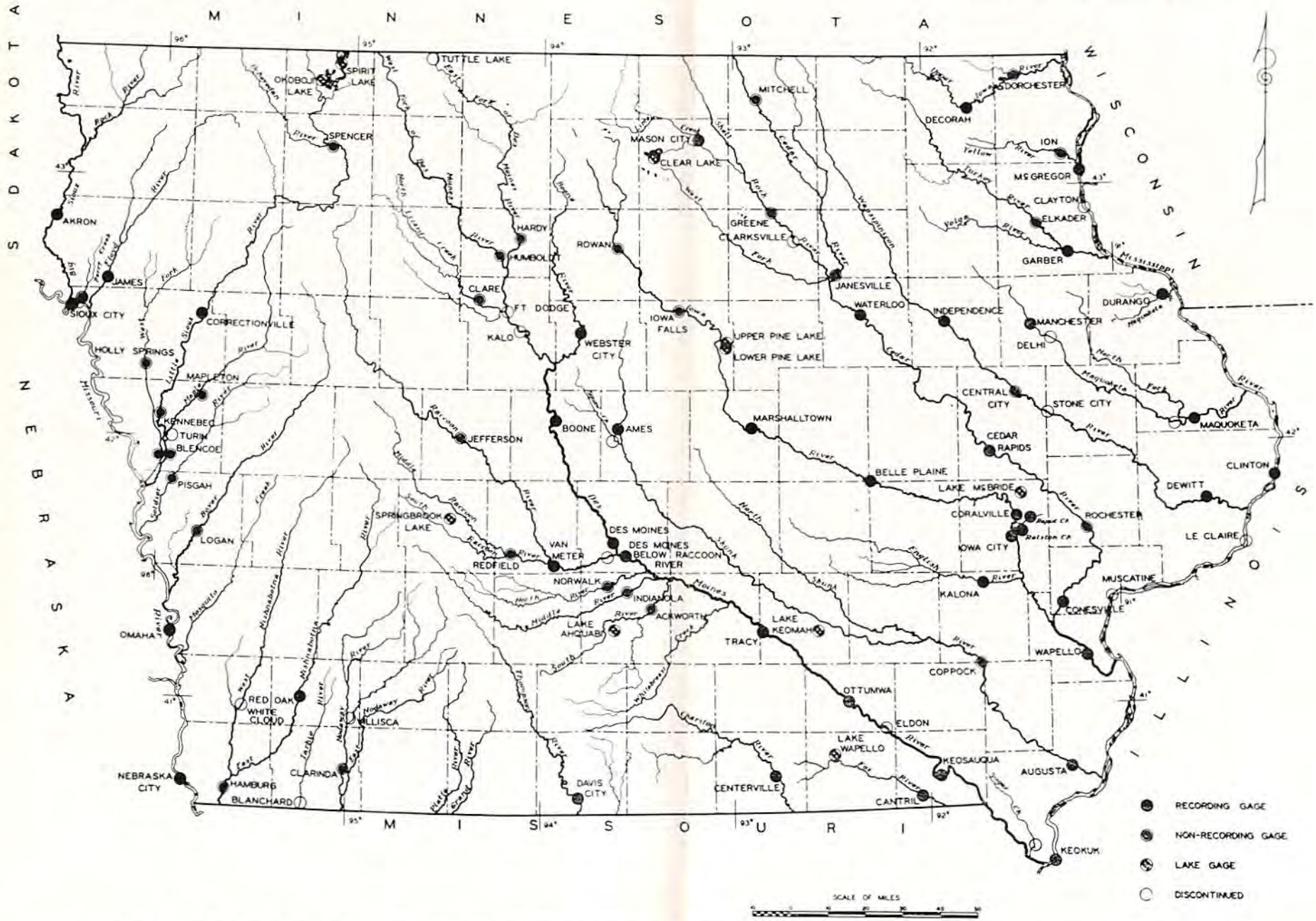

Plate 4. Map of Iowa showing locationg of stream-gaging stations and lake gages maintained by the United States Geological Survey cooperating with other agencies.

most. The gaging station records and flood discharges are presented in accordance with this regular arrangement used by the Federal Survey in its water-supply papers. The table of contents presents the stations in the order in which the gaging station summaries appear herein; the index presents all the locations alphabetically by streams and place names.

All of the stream-flow measurement stations and lake gages which have been maintained in the Mississippi River and Missouri River drainage basins at various times in Iowa are listed in table 2 showing the location at or near which the station was operated, county, type of gage, drainage area, and the period during which the station was operated. Stations with dates followed by a dash were active as of the date of this publication, and are shown, together with those discontinued, on plate 4.

The principal basic information in this volume consists of a brief station description and yearly flow data in convenient summarized form as presented in the section, "Gaging station summaries in this report." Summaries are given only for those stations shown in bold type in table 2 and other stations adjacent to Iowa near its northern and southern boundaries. However, in a subsequent section "Miscellaneous discharge measurements," results of individual measurements at many other points in Iowa and at some gaging station have been included. In addition, in the section "Summary of maximum discharges," the highest known discharges at regular gaging stations and other locations are presented, together with other data, which are apropos to the consideration of flood flow in many drainage basins in Iowa and bordering States. Sections, giving definition of some terms and units, conversion tables and equivalents have been included for the convenience of the users of the data.

The yearly flow data presented in this report are assembled for water and calendar years as explained in the section "General explanation of field and office work." In general, the available records are compiled up to September 30, 1940; however, data covering a few important floods occurring after that date are included with the appropriate notations indicating the exceptions. Examples of trend and duration studies and summaries of sediment load measurements are also given with certain records. References to original sources are made insofar as possible throughout the report. These references will be helpful to those making detailed studies. Additional data can be obtained in the office of the Geological Survey in Iowa City.

This report is an attempt to recognize the additional service to be rendered to the public by publication, under one cover, of a summary which will make the stream-flow records for Iowa more readily ac-

Table 2.—*Stream-Flow Measurement Stations and Lake Gages Maintained in Iowa by U. S. Geological Survey Cooperating with Other Agencies*

Mississippi River Basin

Stream (or Lake) Station	County	Gage (Type)	Drainage Area (Sq. Miles)	Period of Record
Boone River near Webster City	Hamilton	R	842	1940–
Cedar River at Cedar Rapids	Linn	R	6,640	1903–
Cedar River at Conesville	Muscatine	R	7,840	1939–
Cedar River at Janesville	Bremer	W	1,660	1905-6, 15-27, 32–
Cedar River at Mitchell	Mitchell	S	845	1933–
Cedar River at Rochester	Cedar	W	7,280	1940–
Cedar River at Waterloo	Black Hawk	R	5,190	1941–
Clear Lake at Clear Lake	Cerro Gordo	S	.....	1933–
Des Moines River near Boone	Boone	R	5,490	1920-27, 33–
Des Moines River at Des Moines	Polk	R	6,180	1893-94, 97-1927, 32–
Des Moines R. below Raccoon R. at Des Moines	Polk	R	9,770	1939–
Des Moines River at Eldon	Wapello	W	13,300	1930-35
Des Moines River at Fort Dodge	Webster	W	.....	1905-6, 1911-13
Des Moines River at Kalo	Webster	R	4,170	1913-27
Des Moines River at Keosauqua	Van Buren	R	13,900	1903-6, 10–
Des Moines River at Ottumwa	Wapello	R	13,200	1917–
Des Moines River at Tracy	Mahaska	R	12,400	1920-27, 33-35, 40-
E. Fork of Des Moines R. near Hardy	Humboldt	W	1,230	1940–
English River at Kalona	Washington	R	580	1939–
Fox River at Cantril	Van Buren	R	161	1940–
Iowa River near Belle Plaine	Iowa	R	2,420	1939–
Iowa River above Coralville	Johnson	R	3,060	1940–
Iowa River at Iowa City	Johnson	R	3,230	1903–
Iowa River at Iowa Falls	Hardin	W	641	1940–
Iowa River at Marshalltown	Marshall	R	1,500	1903, 15-27, 33–
Iowa River near Rowan	Wright	W	396	1940–
Iowa River at Wapello	Louisa	R	12,480	1915–
Lake Ahquabi near Indianola	Warren	S	.....	1936–
Lake Keomah near Oskaloosa	Mahaska	S	.....	1936–
Lake McBride near Solon	Johnson	F	.....	1936–
Lake Wapello near Drakesville	Davis	R	7.6	1936–
Lime Creek at Mason City	Cerro Gordo	R	535	1932–
Little Maquoketa River near Durango	Dubuque	R	130	1934–
Lower Pine Lake at Eldora	Hardin	S	.....	1936–
Maquoketa River near Delhi	Delaware	R	348	1933–
Maquoketa R. at and near Manchester	Delaware	R	306	1903, 1933–
Maquoketa River above Maquoketa	Jackson	W	957	1913-14
Maquoketa River near Maquoketa	Jackson	R	1,550	1913–
Middle River near Indianola	Warren	W	502	1940–
Mississippi River at Clayton	Clayton	S	79,200	1930-36
Mississippi River at Clinton	Clinton	R	85,600	1939–
Mississippi River at Keokuk	Lee	R	119,000	1878–
Mississippi River at LeClaire	Scott	R	88,600	1873–
Mississippi River at McGregor	Clayton	R	67,500	1936–
Mississippi River at Muscatine	Muscatine	R	99,400	1939–
North River near Norwalk	Warren	W	348	1940–
North Lizard Creek near Clare	Webster	W	257	1940–
Raccoon River near Jefferson	Greene	W	1,610	1940–
Raccoon River at Van Meter	Dallas	R	3,410	1915–
Raccoon River at Des Moines	Polk	S	3,590	1902-3

Note: Summaries of stream-flow records are given in this report for stations in bold type. Dash following the date indicates that the station was being maintained Sept. 30, 1940.

Table 2.—Mississippi River Basin—Continued

Stream (or Lake) Station	County	Gage (Type)	Drainage Area (Sq. Miles)	Period of Record
Ralston Creek at Iowa City	Johnson	R	3.01	1924–
Rapid Creek near Iowa City	Johnson	R	24.5	1938–
Shell Rock River near Clarksville	Butler	W	1,660	1915-27, 1932-34
Shell Rock River at Greene	Butler	S	1,375	1933–
Skunk River near Ames	Story	R	320	1920-27, 33–
Skunk River at Augusta	Des Moines	R	4,290	1913, 15–
Skunk River at Coppock	Jefferson	W	2,890	1913–
South River near Ackworth	Warren	W	475	1940–
South Raccoon River at Redfield	Dallas	W	995	1940–
Springbrook Lake near Guthrie Center	Guthrie	S	.....	1936–
Squaw Creek at Ames	Story	W	210	1919-27
Sugar Creek near Keokuk	Lee	R	113	1922-26
Turkey River at Elkader	Clayton	W	892	1933–
Turkey River at Garber	Clayton	R	1,530	1913-16, 19-27, 29-30, 32–
Tuttle Lake near Dolliver	Emmet	S	.....	1933-34
Upper Iowa River near Decorah	Winneshiek	R	560	1913, 14, 19-27, 33–
Upper Iowa River near Dorchester	Allamakee	W	761	1936–
Upper Pine Lake at Eldora	Hardin	S	.....	1936–
Wapsipinicon River at Central City	Linn	W	1,270	1940–
Wapsipinicon River near DeWitt	Clinton	R	2,300	1934–
Wapsipinicon River at Independence	Buchanan	R	1,060	1933–
Wapsipinicon River at Stone City	Jones	W	1,310	1903-14
W. Fork of Des Moines R. at Humboldt	Humboldt	W	2,295	1940–
Yellow River at Ion	Allamakee	W	224	1934–
Missouri River Basin				
Big Sioux River at Akron	Plymouth	R	8,851	1928–
Boyer River at Logan	Harrison	W	810	1918-25, 37–
Chariton River near Centerville	Appanoose	R	727	1938–
East Nishnabotna River at Red Oak	Montgomery	R	890	1918-25, 36–
Floyd River at James	Plymouth	R	918	1934–
Little Sioux River near Blencoe	Monona	W	(a) 4,470	1939–
Little Sioux River at Correctionville	Woodbury	R	2,450	1918-25, 28-32, 36–
Little Sioux River near Kennebec	Monona	W	2,730	1939–
Little Sioux River at Spencer	Clay	W	1,030	1936–
Maple River at Mapleton	Monona	W	661	1941–
Maple River at Turin	Monona	W	725	1939-41
Missouri River at Sioux City	Woodbury	R	314,600	1928-31, 38–
Monona-Harrison Ditch near Blencoe	Monona	W	(a) 4,470	1939–
Nishnabotna R. near & above Hamburg	Fremont	W	2,800	1922, 23, 1928–
Nodaway River at Clarinda	Page	W	740	1918-25, 36–
Okoboji Lake at Arnolds Park & near Milford	Dickinson	R	.....	1933–
Perry Creek at Sioux City	Woodbury	W	69	1939–
Soldier River at Pisgah	Harrison	W	417	1940–
Spirit Lake at Orleans	Dickinson	F	.....	1933–
Tarkio River at Blanchard	Page	R	200	1934-40
Thompson (Grand) River at Davis City	Decatur	W	702	1918-25, 1941–
West Fork Ditch at Holly Springs	Woodbury	W	395	1939–
W. Nishnabotna River at White Cloud	Mills	W	920	1918-24
West Nodaway at Villisca	Montgomery	W	360	1918-25

a) Combined areas above stations on Monona-Harrison Ditch and Little Sioux River.

Note: R, S, W, and F indicate, respectively, recorder, staff, chain or wire-weight, and float gage. The U. S. Weather Bureau and Corps of Engineers have maintained a few gages, principally on the Mississippi and Missouri Rivers, for the determination of stage.

cessible to a larger number of interested departments, organizations and individuals. These hydrologic data are presented in this abbreviated form for the convenience of the public and with the hope and expectation that such facts will aid in the proper development of the water resources of the State.

It should be emphasized that this report is primarily a statistical inventory and it is not possible to include a comprehensive discussion or analysis of the results in such condensed form.

GAGING STATION SUMMARIES IN THIS REPORT

The information presented in this section is intended primarily for statistical purposes, and for use in preliminary studies and consists of gaging station descriptions and yearly summaries for all gaging stations, both active and discontinued, at which five or more complete years of discharge record have been collected and published, together with some miscellaneous data, as noted hereinafter. The presentation of the records and other information has been systematized as much as practicable and the following explanation pertains to the standardized form.

In general, the form includes the designation of the major drainage basin, and the name and description of the station which gives information with respect to the location and type of gage, the area of the drainage basin above the gage and where relevant at the mouth of the river and within the State, the sources of data, and the period during which the gage-height and discharge records are available. Under "Stage-discharge relation" is given a brief statement regarding the conditions affecting the definition of the rating curve. Under "Average discharge" is given the average discharge which is based upon the available complete water years of record. Under "Extremes" are given the maximum discharge and gage height; the minimum discharge if there is little or no regulation; the minimum daily discharge if there is extensive regulation, and also the minimum discharge if useful; and the minimum gage height except where it is of no importance. Unless otherwise qualified, the maximum discharge corresponds to the crest stage obtained by the use of a water-stage recorder or a nonrecording gage read at the time of the crest. Likewise, the minimum represents the lowest discharge, unless otherwise qualified. Information antedating the period of continuous record is given under "Historical data." Miscellaneous notes and comments essential or helpful to understanding the record are included under "Remarks."

The tables show yearly figures of maximum and minimum daily discharge, mean discharge, discharge in second-feet per square mile and runoff either in acre-feet or in inches or both. (An exception to

this procedure occurs in the records on page 52 for Ralston Creek,) The figures for the water years prior to 1913-14 and figures for the calendar years 1913-14 to 1933 have only recently become available in the water-supply papers for 1939 and separates reprinted therefrom. The number of the water-supply paper in which the figures of daily and monthly discharge, as well as yearly discharge, are published, is shown in the column headed "Water-supply paper (no. and page)." References are also given in this column to certain records or parts thereof which were obtained from other important sources.

The discharge per square mile and runoff, in inches, in the following tables, in general, represent computations according to the latest figure for the drainage area. Drainage areas, of course, have been remeasured and revised from time to time as more accurate maps and other information have become available.

It will be noted that the records for a few stations, where considered equivalent, have been combined into one presentation, such as those for Des Moines River at Ottumwa and Eldon, Nishnabotna River near and above Hamburg, Fox River at and near Wayland, etc. If the entire name of a station has been changed, the superseded name and years when it was used are given in parenthesis beneath the later name.

The maximum discharges at the stream-gaging stations and at other places on these streams, with other related information, are listed in table 6 on page 116. The stations are identified on plate 5 on page 114 by means of index numbers shown in the first column of table 6.

Mississippi River at La Crosse, Wis.

LOCATION.—Lat. 43°48'45", long. 91°15'25", in sec. 31, T. 16 N., R. 7 W., at La Crosse, a third of a mile upstream from bridge on U. S. Highway No. 14. Auxiliary slope recorder, lat. 43°51'50", long. 91°18'25", in sec. 28, T. 105 N., R. 4 W., at navigation dam 7, 4.7 miles upstream.

DRAINAGE AREA.—62,800 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record prior to November 1934 collected in cooperation with U. S. Weather Bureau and Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—June 1929 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once or twice daily prior to November 1934; water-stage recorder thereafter. Datum of gage is 626.32 feet above mean sea level, adjustment of 1912. Prior to Feb. 18, 1933 at datum 0.11 foot higher; Nov. 17 to Aug. 16, 1939, at datum 0.18 foot lower.

STAGE-DISCHARGE RELATION.—Affected by backwater from dam 8 except at very high stages.

AVERAGE DISCHARGE.—10 years, 19,840 second-feet.

EXTREMES.—1930-40: Maximum discharge, 101,000 second-feet May 23, 1938; maximum gage height, 12.09 feet Sept. 15, 1938, present datum; minimum daily discharge, 3,300 second-feet Dec. 30, 31, 1933; minimum gage height, —2.70 feet Aug. 19, 20, 1936.

HISTORICAL DATA.—Maximum stage known, 16.0 feet June 19, 1880 (discharge, 190,000 second-feet, computed by Corps of Engineers, U. S. Army).

REMARKS.—Flow regulated by reservoirs and power plants and, since 1936, by navigation dams.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1930	700- 61	52,300	.....	.....	.....	.....	52,300	.....	.....	.....	.....
1931	715- 65	31,300	7,600	12,600	0.201	2.72	31,300	7,600	13,320	0.212	2.87
1932	730- 71	64,800	8,040	18,800	.299	4.07	64,800	6,790	17,170	.273	3.73
1933	745- 81	45,900	6,400	15,300	.244	3.30	45,900	3,300	15,060	.240	3.25
1934	760-105	69,800	3,300	11,300	.180	2.43	69,800	3,660	13,860	.221	2.99
1935	785- 95	78,200	9,080	22,930	.365	4.96	78,200	9,080	22,150	.353	4.79
1936	805- 90	100,000	5,750	23,570	.375	5.12	100,000	5,750	22,180	.353	4.81
1937	825-101	54,500	6,110	17,580	.280	3.81	54,500	6,840	17,840	.284	3.87
1938	855- 99	100,000	6,540	30,390	.484	6.56	100,000	6,540	33,720	.537	7.28
1939	875- 96	97,000	8,000	28,420	.453	6.14	97,000	8,000	25,430	.405	5.49
1940	895-	54,400	7,000	17,470	.278	3.79	.....	.....	.....	.....	.....

Mississippi River at Clayton, Iowa

LOCATION.—Lat. 42°54'15", long. 91°08'40", in NE¼ sec. 1, T. 93 N., R. 3 W., about a quarter of a mile downstream from railroad station in Clayton. Prior to December 27, 1932, gage in Wyalusing Slough about a quarter of a mile upstream from railroad station.

DRAINAGE AREA.—79,200 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records collected in co-operation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—April 1930 to June 1936 in reports of U. S. Geological Survey. Station discontinued because of backwater from dam 10.

GAGES.—Nonrecording gage read twice daily to December 1932 and once daily thereafter with extra readings during high stages. Prior to Dec. 27, 1932, datum of gage was 602.63 feet above mean sea level; thereafter, 602.60 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 137,000 second-feet. Seriously affected by ice. Channel control subject to some shifting. Installation of wing dams for channel improvement caused some shifting.

AVERAGE DISCHARGE.—5 years, 25,620 second-feet.

EXTREMES.—1930-36: Maximum discharge, 137,000 second-feet Apr. 2, 3, 1936 (gage height, 15.36 feet); minimum, 5,540 second-feet Dec. 14, 1933.

HISTORICAL DATA.—Maximum discharge between 1838 and 1905 reported by Wisconsin Survey Bulletin No. 36, p. 141, to have been 179,000 second-feet. Maximum discharge of record is reported in House Document No. 669, 76th Congress, 3d Session to be 226,300 second-feet.

REMARKS.—Flow regulated by reservoirs and power plants. Station known as "Mississippi River at McGregor, Iowa" established August 1936 using recording gages at McGregor and in tailwater of dam 9 to determine slope.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1930	700- 63	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1931	715- 67	40,100	11,800	18,900	0.239	3.24	48,700	11,800	20,870	0.264	3.58
1932	730- 72	95,200	13,200	29,900	.378	5.15	95,200	10,700	27,020	.341	4.64
1933	745- 82	77,700	10,700	24,900	.314	4.28	77,700	5,540	24,610	.311	4.22
1934	760-106	82,500	5,540	17,400	.220	2.96	82,500	9,860	21,740	.274	3.72
1935	785- 96	129,000	15,200	37,000	.467	6.35	129,000	10,400	35,260	.445	6.05
1936	805- 91	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....

Mississippi River at LeClaire, Iowa

LOCATION.—Lat. 41°35'45", long. 90°20'40", at foot of Dodge Street in LeClaire, 7 miles downstream from Wapsipinicon River and 15 miles upstream from Davenport.

DRAINAGE AREA.—88,600 square miles.

SOURCES OF DATA.—Records of U. S. Weather Bureau and its predecessor the U. S. Signal Service; Corps of Engineers, U. S. Army; Mississippi River Power Company; and U. S. Geological Survey.

RECORDS AVAILABLE.—October 1932 to September 1939 in reports of U. S. Geological Survey; June 1873 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 83-131. Record at Clinton, Iowa, October 1939 to September 1940 in report of U. S. Geological Survey; records equivalent except for inflow from Wapsipinicon River.

GAGES.—Nonrecording gage read once daily prior to June 1934; recording gage thereafter. Datum of gages is 562.61 feet above mean sea level, datum of 1929, and 563.18 feet above mean sea level, adjustment of 1912. For the record at Clinton, recording gages in the tailwater of dam 13 and at Camanche are used. Datum of these gages are 568.70 feet and 563.21 feet, respectively, above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Well defined at LeClaire by current-meter measurements below 200,000 second-feet. LeClaire rapids formed a stable control until it was affected by backwater from dam 14 beginning in 1938. Discharge at Clinton computed by using fall as a factor, as determined by auxiliary gage; relation defined by current-meter measurements below 150,000 second-feet.

AVERAGE DISCHARGE.—66 years (1873-1939), 47,780 second-feet.

EXTREMES.—1873-1939: Maximum discharge, 250,000 second-feet June 25, 1880 (gage height, 14.5 feet); minimum, 6,500 second-feet Dec. 25-27, 1933. A gage height of —1.2 feet on Jan. 4, 1890, reported by U. S. Weather Bureau is probably the minimum of record.

REMARKS.—Gage-height record only obtained at this station beginning October 1939 due to backwater from dam 14. Clinton station operated in cooperation with Corps of Engineers, U. S. Army.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1874	.....	98,400	18,000	48,680	0.549	7.47	98,400	18,000	50,700	0.572	7.81
1875	.....	167,000	18,000	57,730	.652	8.86	167,000	14,000	55,200	.623	8.48
1876	.....	165,000	14,000	67,450	.761	10.36	165,000	16,000	68,500	.773	10.52
1877	.....	104,000	16,000	44,950	.507	6.88	104,000	17,000	45,000	.508	6.88
1878	.....	80,800	23,000	43,580	.492	6.71	80,800	11,000	43,500	.491	6.68
1879	.....	96,800	11,000	40,910	.462	6.26	96,800	18,000	40,700	.459	6.24
1880	.....	250,000	20,000	63,750	.720	9.79	250,000	16,000	62,500	.705	9.59
1881	.....	174,000	16,000	58,190	.657	8.92	237,000	20,000	85,800	.968	13.20
1882	.....	237,000	24,600	94,640	1.07	14.49	186,000	15,000	71,400	.806	10.95
1883	.....	174,000	15,000	65,520	.740	10.04	174,000	14,000	61,800	.698	9.48
1884	.....	144,000	14,000	56,750	.641	8.70	146,000	18,000	66,400	.749	10.19
1885	.....	146,000	18,000	67,700	.764	10.36	120,000	15,000	57,900	.653	8.88
1886	.....	157,000	15,000	49,870	.563	7.64	157,000	12,000	49,500	.559	7.60
1887	.....	149,000	12,000	45,230	.510	6.93	149,000	12,000	43,200	.488	6.62
1888	.....	248,000	12,000	67,450	.761	10.36	248,000	12,000	67,800	.765	10.43
1889	.....	64,300	12,000	35,040	.395	5.38	64,300	10,000	32,800	.370	5.04
1890	.....	142,000	8,000	42,780	.483	6.57	142,000	8,000	47,300	.534	7.27
1891	.....	130,000	14,000	40,570	.458	6.20	130,000	10,000	36,400	.411	5.57
1892	.....	238,000	10,000	60,360	.681	9.24	238,000	12,000	61,000	.688	9.38
1893	.....	174,000	13,000	51,930	.586	7.95	174,000	10,000	51,400	.580	7.89
1894	.....	157,000	10,000	43,420	.490	6.65	157,000	11,000	43,100	.486	6.62
1895	.....	70,000	9,000	29,220	.330	4.49	70,000	8,000	29,200	.330	4.49
1896	.....	148,000	8,000	40,280	.455	6.19	148,000	8,000	41,700	.471	6.42
1897	.....	198,000	11,000	57,140	.645	8.75	198,000	10,000	56,100	.633	8.62
1898	.....	88,800	10,000	35,690	.403	5.49	88,800	10,000	35,300	.398	5.42
1899	.....	149,000	9,000	47,130	.532	7.24	149,000	9,000	50,100	.565	7.69

(Concluded on next page)

Summary of yearly discharge, in second-feet, of Mississippi River at LeClaire, Iowa, 1873-1939—Continued

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1900	.....	100,000	14,000	40,510	0.457	6.21	142,000	14,000	49,000	0.553	7.53
1901	.....	142,000	16,000	52,400	.591	8.04	106,000	9,000	41,600	.470	6.40
1902	.....	123,000	9,000	41,280	.466	6.34	123,000	14,000	43,000	.485	6.63
1903	.....	176,000	15,000	66,520	.751	10.23	176,000	16,000	75,800	.856	11.64
1904	.....	174,000	16,000	59,950	.677	9.21	113,000	14,000	54,600	.616	8.39
1905	.....	172,000	14,000	67,710	.764	10.38	172,000	20,000	67,500	.762	10.38
1906	.....	169,000	21,000	69,770	.787	10.70	169,000	26,000	70,600	.797	10.82
1907	.....	171,000	26,000	64,820	.732	9.94	171,000	13,000	61,600	.695	9.46
1908	.....	134,000	13,000	55,140	.622	8.47	134,000	11,000	51,000	.576	7.83
1909	.....	123,000	11,000	45,930	.518	7.03	123,000	17,000	49,300	.556	7.55
1910	.....	73,100	16,400	34,890	.394	5.33	73,100	7,000	29,900	.337	4.57
1911	.....	84,000	7,000	25,390	.287	3.92	120,000	11,000	35,700	.403	5.47
1912	.....	120,000	20,000	52,000	.587	7.99	104,000	14,000	44,300	.500	6.81
1913	.....	123,000	14,000	40,430	.456	6.19	123,000	14,000	41,400	.467	6.35
1914	.....	111,000	14,000	41,730	.471	6.40	111,000	10,000	41,500	.468	6.37
1915	.....	92,000	10,000	48,460	.547	7.44	92,000	15,000	51,800	.585	7.96
1916	.....	195,000	18,000	67,300	.760	10.35	195,000	12,000	64,500	.728	9.93
1917	.....	142,000	12,000	48,880	.552	7.49	142,000	10,000	46,600	.526	7.13
1918	.....	123,000	10,000	38,820	.438	5.94	123,000	15,000	39,800	.449	6.10
1919	.....	166,000	7,000	52,640	.594	8.06	166,000	7,000	55,400	.625	8.49
1920	.....	222,000	21,000	57,650	.651	8.84	222,000	11,000	54,500	.615	8.35
1921	.....	85,300	11,000	37,050	.418	5.66	85,300	14,000	36,900	.416	5.64
1922	.....	212,000	14,000	46,470	.524	7.11	212,000	10,000	45,300	.511	6.93
1923	.....	106,000	10,000	31,820	.359	4.88	106,000	14,000	31,400	.354	4.82
1924	.....	106,000	8,000	36,550	.413	5.63	106,000	8,000	38,500	.435	5.94
1925	.....	93,900	11,000	32,030	.362	4.92	93,900	11,000	30,900	.349	4.74
1926	.....	83,600	11,000	32,690	.369	5.03	97,500	15,000	40,100	.453	6.16
1927	.....	133,000	17,000	55,380	.625	8.48	133,000	15,000	51,200	.578	7.85
1928	.....	116,000	15,000	50,640	.572	7.77	116,000	26,000	56,500	.638	8.66
1929	.....	146,000	22,000	56,680	.640	8.70	146,000	10,000	47,700	.538	7.31
1930	.....	83,600	10,000	32,480	.367	4.97	83,600	12,000	31,500	.356	4.82
1931	.....	40,700	12,000	21,000	.237	3.22	59,700	13,600	24,400	.275	3.74
1932	.....	97,500	15,700	36,600	.413	5.62	97,500	7,500	32,400	.366	4.97
1933	805–92	92,100	7,500	30,620	.346	4.71	92,100	6,500	29,940	.338	4.61
1934	760–107	81,400	6,500	18,870	.213	2.90	81,400	9,000	23,700	.267	3.63
1935	785–97	123,000	18,400	41,820	.472	6.40	123,000	12,000	39,880	.450	6.10
1936	805–92	133,000	10,800	37,390	.422	5.74	133,000	7,000	35,320	.399	5.44
1937	825–104	95,800	7,000	33,160	.374	5.09	95,800	11,000	33,360	.377	5.11
1938	855–101	167,400	11,100	49,770	.562	7.62	167,400	12,000	55,880	.631	8.56
1939	875–98	144,900	12,000	44,570	.503	6.85	.....	.....	.....	.....	.....

Summary for period 1874-1932 from report "Stream Flow Records of Iowa, 1873-1932."

Mississippi River at Keokuk, Iowa

LOCATION.—Lat. 40°23'35", long. 91°22'25", at Mississippi River Power Co's. dam and power plant at Keokuk, 2.8 miles upstream from Des Moines River. Prior to 1913 at Galland (formerly called Nashville), 8 miles upstream.

DRAINAGE AREA.—119,000 square miles.

SOURCES OF DATA.—Records of Mississippi River Power Co.; Corps of Engineers, U. S. Army; U. S. Geological Survey; and U. S. Weather Bureau.

RECORDS AVAILABLE.—October 1932 to September 1940 in reports of U. S. Geological Survey. January 1878 to December 1932 in reports of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 132-175.

GAGES.—Nonrecording gage read twice daily prior to 1913; thereafter daily discharges computed from records of operation of turbines in power plant and spillway gates in dam. Datum of Galland gage was at low-water mark of 1864.

STAGE-DISCHARGE RELATION.—At Galland, well defined by current-meter measurements between 60,000 and 220,000 second-feet and by float measurements down to 20,000 second-feet. Galland rating seriously affected by ice. Excellent ratings of the wheels and spillways at the dam are available. The spillway ratings were accurately determined by current-meter measurements supplemented by model tests in the Hydraulics Laboratory of the State University of Iowa as reported by Floyd A. Nagler and Albion Davis in *Transactions* of the American Society of Civil Engineers, volume 94 pp. 777-820, 1930.

AVERAGE DISCHARGE.—62 years, 60,320 second-feet.

EXTREMES.—1878-1940. Maximum discharge, 314,000 second-feet May 18, 1888; minimum daily discharge, 5,000 second-feet Dec. 27, 1933.

HISTORICAL DATA.—Flood of June 6, 1851, reached a stage estimated at 13.5 feet at Galland (discharge, 360,000 second-feet).

REMARKS.—Records for period May 1913, when Keokuk dam was completed, to September 1937 adjusted for change in contents in Keokuk Reservoir, those after September 1937 unadjusted. Subsequent to 1934 the U. S. Geological Survey has made periodic current-meter measurements to check spillway and turbine ratings. Since 1913 daily discharge, based on plant records, furnished by Mississippi River Power Co.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1878	.....	.....	.....	.....	.....	.....	150,000	16,000	60,900	0.512	6.96
1879	.....	110,000	16,000	49,500	0.416	5.64	110,000	20,000	48,000	.403	5.49
1880	.....	271,000	20,000	75,800	.637	8.67	271,000	18,000	75,100	.631	8.59
1881	.....	241,000	18,000	79,700	.670	9.09	293,000	22,000	115,000	.966	13.19
1882	.....	293,000	38,000	127,000	1.07	14.50	230,000	18,000	95,600	.803	10.92
1883	.....	201,000	18,000	82,700	.695	9.42	201,000	18,000	79,700	.670	9.11
1884	.....	236,000	18,000	69,700	.586	7.98	236,000	24,000	81,600	.686	9.34
1885	.....	170,000	24,000	89,700	.754	10.23	150,000	19,000	78,700	.661	8.99
1886	.....	212,000	19,000	69,000	.580	7.87	212,000	14,000	66,200	.556	7.57
1887	.....	156,000	14,000	53,800	.452	6.14	156,000	14,000	51,600	.434	5.88
1888	.....	314,000	14,000	83,500	.702	9.54	314,000	16,000	84,000	.706	9.61
1889	.....	84,200	16,000	42,600	.358	4.85	84,200	18,000	40,700	.342	4.65

(Concluded on next page)

Summary of yearly discharge, in second-feet, of Mississippi River at Keokuk, Iowa, 1878-1940—Continued

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1890	.....	178,000	9,000	50,500	0.424	5.75	178,000	9,000	54,000	0.454	616
1891	.....	141,000	18,000	50,200	.422	5.73	141,000	16,000	46,300	.389	5.29
1892	.....	306,000	15,000	78,300	.658	8.95	306,000	15,000	79,200	.666	9.07
1893	.....	203,000	15,000	63,600	.534	7.26	203,000	11,000	62,900	5.29	7.20
1894	.....	158,000	11,000	48,600	.408	5.56	158,000	11,000	48,300	.406	5.53
1895	.....	59,200	10,000	31,200	.262	3.56	59,200	9,000	30,400	.255	3.49
1896	.....	161,000	9,000	44,500	.374	5.08	161,000	10,000	47,300	.397	5.41
1897	.....	230,000	19,000	70,200	.590	8.01	230,000	11,000	68,000	.571	7.77
1898	.....	108,000	11,000	42,600	.358	4.87	108,000	13,000	42,500	.357	4.87
1899	.....	159,000	10,000	55,600	.467	6.34	159,000	10,000	58,100	.488	6.65
1900	.....	124,000	14,000	47,600	.400	5.42	138,000	15,000	57,400	.482	6.55
1901	.....	150,000	17,000	60,700	.510	6.93	150,000	10,000	48,500	.408	5.55
1902	.....	181,000	10,000	55,000	.462	6.28	181,000	16,000	61,900	.520	7.12
1903	.....	270,000	25,000	86,800	.729	9.91	270,000	16,000	93,900	.789	10.73
1904	.....	186,000	16,000	73,800	.620	8.44	171,000	14,000	65,500	.550	7.49
1905	.....	212,000	14,000	81,000	.681	9.24	212,000	22,000	82,600	.694	9.44
1906	.....	192,000	38,000	87,700	7.37	10.01	192,000	28,000	87,100	.732	9.94
1907	.....	178,000	28,000	80,800	.679	9.21	178,000	26,900	78,900	.663	9.01
1908	.....	178,000	20,000	77,000	.647	8.81	178,000	16,000	71,500	.601	8.19
1909	.....	181,000	14,000	67,700	.569	7.71	181,000	14,000	73,400	.617	8.36
1910	.....	124,000	19,600	49,600	.417	5.64	124,000	9,000	41,600	.350	4.74
1911	.....	156,000	9,000	35,500	.298	4.05	156,000	14,000	50,500	.424	5.75
1912	.....	220,000	23,000	72,300	.608	8.27	220,000	21,800	62,200	.523	7.10
1913	.....	169,000	14,000	54,100	.455	6.16	169,000	14,000	53,300	.448	6.07
1914	.....	122,000	15,600	49,500	.416	5.64	122,000	11,500	50,100	.422	5.77
1915	.....	142,000	11,500	69,600	.585	7.97	142,000	18,800	75,500	.635	8.62
1916	.....	213,000	22,000	88,400	.743	10.10	213,000	14,300	82,300	.692	9.41
1917	.....	163,000	14,300	62,000	.521	7.06	163,000	9,300	59,200	.498	6.76
1918	.....	192,000	9,300	51,300	.431	5.86	192,000	15,500	52,300	.439	5.96
1919	.....	205,000	14,000	65,800	.553	7.50	205,000	14,000	71,000	.597	8.11
1920	.....	230,000	21,300	71,500	.601	8.18	230,000	10,300	66,100	.555	7.55
1921	.....	108,000	10,300	46,300	.389	5.27	108,000	17,400	48,100	.404	5.48
1922	.....	240,000	17,400	59,700	.502	6.83	240,000	10,500	56,400	.474	6.44
1923	.....	148,000	10,500	39,000	.328	4.47	148,000	14,300	39,300	.330	4.48
1924	.....	160,000	8,600	51,300	.431	5.85	160,000	8,600	52,700	.443	6.03
1925	.....	112,000	12,400	37,400	.314	4.27	112,000	13,300	37,000	.311	4.21
1926	.....	146,000	13,300	45,400	.382	5.17	147,000	18,600	56,000	.470	6.38
1927	.....	175,000	18,600	75,300	.633	8.58	175,000	17,800	69,400	.583	7.92
1928	.....	150,000	17,800	63,700	.535	7.28	150,000	25,000	71,400	.600	8.17
1929	.....	247,000	25,000	80,700	.678	9.23	247,000	12,500	67,800	.570	7.77
1930	.....	163,000	12,500	40,900	.344	4.67	163,000	13,500	39,200	.329	4.47
1931	.....	52,500	13,500	24,700	.208	2.82	105,000	14,000	31,800	.267	3.62
1932	.....	106,000	18,500	51,500	.433	5.88	106,000	8,300	44,100	.370	5.04
1933	785- 98	160,000	8,300	42,480	.357	4.84	160,000	5,000	41,160	.346	4.70
1934	785- 98	83,500	5,000	21,540	.181	2.46	85,000	10,100	27,380	.230	3.12
1935	785- 98	138,000	20,000	57,260	.481	6.53	138,000	14,300	55,350	.465	6.31
1936	805- 94	148,000	11,000	47,680	.401	5.46	148,000	9,200	46,040	.387	5.28
1937	825-105	190,000	9,200	49,900	.419	5.70	190,000	8,800	48,680	.409	5.56
1938	855-102	193,800	8,800	65,520	.551	7.47	193,800	11,300	74,540	.626	8.50
1939	875- 99	159,100	15,900	58,650	.493	6.68	155,800	11,000	50,520	.425	5.75
1940	895-	81,700	8,900	34,830	.293	3.97	.....	.....	.....	.....	.....

Summary for period 1873-1932 from report "Stream Flow Records of Iowa, 1873-1932," p. 132.

NOTE.—The accompanying illustration (fig. 1) on the next page shows the mean annual temperature, rainfall, runoff and water loss data for the drainage area of the Mississippi River above Keokuk during the period of daily discharge record at Keokuk. This material and other similar figures and tables are taken from "Precipitation and Temperature Trends in Iowa With Special Reference to Stream Flow," by Lawrence C. Crawford; a thesis presented to Purdue University in 1942, in partial fulfillment of the requirements for the degree of Professional Civil Engineer.

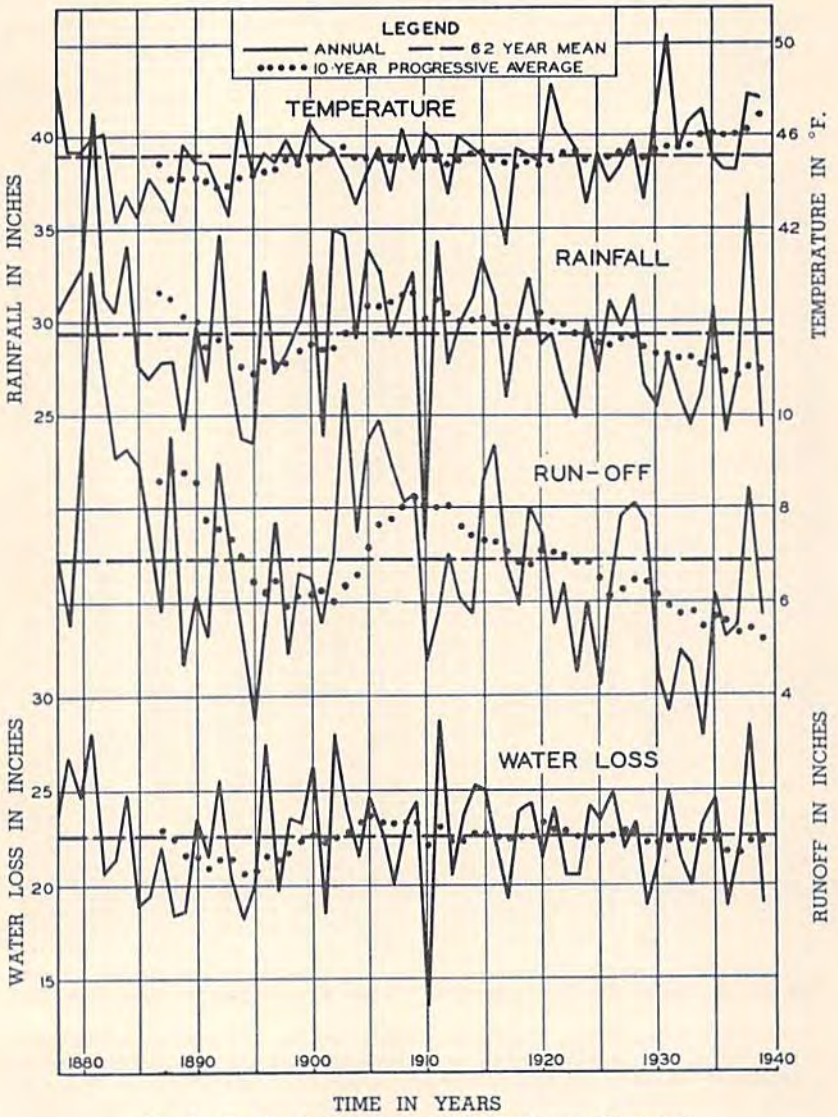

Fig. 1.—Graphs of climatological and runoff data, Mississippi River Basin above Keokuk, Iowa.

Upper Iowa River near Decorah, Iowa

LOCATION.—Lat. 43°18'20", long. 91°44'50", in E ½ sec. 14, T. 98 N., R. 8 W., about 500 feet upstream from highway bridge in village of Freeport, 1.4 miles downstream from Trout Run, and 3 miles downstream from Decorah. From July 1933 to September 1936, at upper power plant of Interstate Power Co. 4 miles downstream.

DRAINAGE AREA.—560 square miles above gage; 576 square miles at site used July 1933 to September 1936.

SOURCES OF DATA.—U. S. Geological Survey records. Interstate Power Co. assisted with collection of gage-height record and maintenance of station.

RECORDS AVAILABLE.—August 1913 to November 1914, May 1919 to June 1927, July 1933 to September 1936 (at site 4 miles downstream; records equivalent); October 1936 to September 1940 in water-supply papers of U. S. Geological Survey. August 1913 to November 1914, May 1919 to June 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 176-185.

GAGES.—Nonrecording gage read twice daily 1913-14, May 1919 to August 1920 and hourly July 1933 to September 1936; recording gage August 1920 to June 1927 and subsequent to October 1936.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements. Not seriously affected by ice. Control rapids formed by rock ledge at site of old mill dam and is fairly stable. Left bank high; right bank overflows and roadway at right end of bridge below gage is flooded during high stages.

AVERAGE DISCHARGE.—14 years (1919-26, 1933-40), 281 second-feet.

EXTREMES.—1913-14, 1919-27, 1933-40: Maximum discharge, 10,500 second-feet Feb. 22, 1922 (gage height, 10.42 feet); minimum daily discharge, 10 second-feet, regulated, at numerous times during 1933-34.

REMARKS.—Slight regulation by grist mill in Decorah.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1920	505–132	4,040	.....	414	0.739	10.06	4,040	.....	395	0.705	9.60
1921	525– 81	9,040	123	440	.786	10.64	9,040	51	408	.729	9.89
1922	545– 79	4,600	.....	300	.536	7.72	4,600	.....	293	.523	7.10
1923	565– 72	6,650	21	196	.350	4.75	6,650	21	192	.343	4.63
1924	585– 75	4,950	40	294	.525	7.15	4,950	.....	318	.568	7.72
1925	605– 69	6,270	.....	190	.340	4.62	6,270	.....	172	.307	4.16
1926	625– 65	2,480	.....	149	.266	3.61	2,480	.....	147	.262	3.54
1934	760–156	3,600	10	124	.215	2.94	3,600	10	163	.283	3.85
1935	785–153	5,950	57	414	.719	9.75	5,950	76	399	.693	9.39
1936	805–145	8,640	39	339	.589	8.00	8,640	39	330	.573	7.79
1937	825–194	5,490	54	225	.455	6.17	5,490	54	247	.441	5.97
1938	855–209	4,640	37	381	.680	9.24	4,640	39	442	.789	10.72
1939	875–208	4,000	62	304	.543	7.37	4,000	45	244	.436	5.92
1940	895–	2,830	34	134	.239	3.26	.....	.....	.....	.....	.....

NOTE.—While this report was in the process of publication, the discharge records at this station became available for the record-breaking flood resulting from unusually heavy rains on May 29, 1941, in Winneshiek and adjacent counties. At Decorah, 7.70 inches in less than 24 hours was reported, and at Waukon 5.98 inches was measured by U. S. Weather Bureau observers.

Extremes.—1913-14, 1919-27, 1933-41: Maximum discharge, 28,500 second-feet May 29, 1941, (gage height, 15.19 feet, from floodmarks), by slope-area method.

Yellow River at Ion, Iowa

LOCATION.—Lat. 43°06'35", long. 91°15'45", in SE¼ SW¼ sec. 24, T. 96 N., R. 4 W., at highway bridge at Ion, about 7½ miles northwest of McGregor and 8 miles upstream from mouth.

DRAINAGE AREA.—224 square miles above gage; 245 square miles at mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Collection of data partly financed by Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—October 1934 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Nonrecording gage read once daily with occasional extra readings during rises. Datum of gage is 664.65 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 4,000 second-feet. Moderately affected by ice. Controlling rapids below gage is composed of gravel and boulders and subject to frequent shifts. Right bank high; left bank and road fill overflow at about gage height 12 feet.

AVERAGE DISCHARGE.—5 years, 93.4 second-feet.

EXTREMES.—1934-40: Maximum discharge observed, 5,400 second-feet Mar. 4, 1935 (gage height, 10.95 feet), from rating curve extended above 4,000 second-feet; minimum observed, 14 second-feet Dec. 30, 1939.

HISTORICAL DATA.—Highest known stage, about 14.0 feet, date and discharge not determined.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1935	785–154	.....	.....	.....	.....	.....	2,600	24	104	0.464	6.27
1936	805–146	3,220	21	99.0	0.442	6.01	3,220	15	97.9	.437	5.95
1937	825–195	2,440	15	88.7	.396	5.39	2,440	15	85.2	.380	5.17
1938	855–210	2,730	15	128	.571	7.75	2,730	17	139	.621	8.43
1939	875–210	908	25	81.3	.363	4.93	908	14	71.3	.318	4.33
1940	895–	2,220	14	69.8	.312	4.25	.....	.....	.....	.....	.....

NOTE.—While this report was in the process of publication, the discharge record at this station became available for the record-breaking flood resulting from unusually heavy rains on May 29, 1941 in Winneshiek and adjacent counties. At Decorah, 7.70 inches in less than 24 hours was reported, and at Waukon 5.98 inches was measured by U. S. Weather Bureau observers.

Extremes.—1934-41: Maximum discharge, 18,500 second-feet May 29, 1941, (gage height, 15.2 feet, from floodmarks), by slope-area method.

Turkey River at Elkader, Iowa

LOCATION.—Lat. 42°51'15", long. 91°24'15", in sec. 23, T. 93 N., R. 5 W., in tailrace of Central States Power & Light Corporation's hydroelectric plant in Elkader.

DRAINAGE AREA.—892 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records. Gage-height record furnished by Central States Power and Light Corporation.

RECORDS AVAILABLE.—July 1933 to September 1940 in reports of U. S. Geological Survey.

GAGES.—Nonrecording gage read hourly. Due to turbulence at gage in tailrace, readings of head gage are ordinarily used for discharges above about 5,000 second-feet when flash boards are not in place. Datum of gages is 701.61 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 10,000 second-feet for tailrace gage and between 1,000 and 19,000 second-feet for head gage. Both banks high immediately below dam. Right bank overflows above dam at high stages. Stream bed composed of boulders and coarse gravel. Not usually affected by ice.

AVERAGE DISCHARGE.—7 years, 414 second-feet.

EXTREMES.—1933-40: Maximum discharge, 19,000 second-feet July 27, 1940 (head gage height, 29.1 feet); minimum daily discharge, 21 second-feet Jan. 23, 26, 29, 31, 1940.

HISTORICAL DATA.—The flood of June 1916 reached a stage of 34.3 feet on head gage, from flood mark. A discharge of 25,200 second-feet is reported on March 16, 1929, from records of Management & Engineering Corporation, Chicago, Illinois.

REMARKS.—Diurnal fluctuation caused by operation of power plant at gage. The Central States Power and Light Corporation furnished gage-height record and preliminary computation of daily discharge based upon U. S. Geological Survey rating curves. Daily discharges July 1928 to November 1930 published in House Document No. 98, 73rd Congress, 1st Session; from records collected by Management & Engineering Corporation.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	760–169	2,080	25	137	0.154	1.69	2,080	25	191	0.214	2.93
1935	785–165	3,650	92	520	.583	7.92	3,650	71	488	.547	7.43
1936	805–158	8,250	40	431	.483	6.57	8,250	40	429	.481	6.55
1937	825–212	11,700	54	508	.570	7.71	11,700	31	488	.547	7.41
1938	855–225	4,340	26	572	.641	8.71	4,340	26	676	.758	10.29
1939	875–233	3,680	53	407	.456	6.18	3,680	37	304	.341	4.62
1940	895–	9,110	21	320	.359	4.88	.....	.....	.....	.....	.....

Turkey River at Garber, Iowa

LOCATION.—Lat. 42°44'25", long. 91°15'45", in sec. 36 T. 92 N., R. 4 W., at highway bridge at Garber, about 800 feet upstream from Wayman Creek, 2,000 feet downstream from Elk Creek, and about one mile downstream from Volga River.

DRAINAGE AREA.—1,530 square miles above gage; 1,696 (a) square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Data collected in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—August 1913 to November 1916, May 1919 to September 1927, November 1932 to September 1940 in reports of U. S. Geological Survey. August 1913 to December 1916, May 1919 to September 1927, April 1929 to September 1930 in reports of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 186-198.

GAGES.—Nonrecording gage prior to February 1935 read twice daily except during period April 1915 to September 1920 when gage was read once daily. Water-stage recorder subsequent to February 1935. Datum of gage is 635.34 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 27,000 second-feet. Affected by ice. Stream bed composed of sand and mud and is unstable. Right bank high; left bank overflows at about gage height 13 feet. Roadway left of gage overflows at high stages.

AVERAGE DISCHARGE.—19 years (1913-16, 1919-27, 1929-30, 1933-40), 784 second-feet.

EXTREMES.—1913-16, 1919-27, 1929-30, 1932-40: Maximum discharge observed 26,600 second feet Feb. 23, 1922 (gage height, 28.06 feet, from flood marks), from rating curve extended above 11,000 second-feet; minimum observed, 46 second-feet June 29, 1934.

REMARKS.—Monthly discharges 1913-30 and daily discharges April 1929 to September 1930 published in House Document No. 98, 73rd Congress, 1st Session. Record for 1920-30 collected by Management & Engineering Corporation, Chicago, Illinois.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1914	*505-168	8,600	.....	504	0.329	4.47	8,600	.....	537	0.351	4.76
1915	*505-168	.....	.....	1,096	.716	9.76	.....	.....	1,160	.758	10.29
1916	*505-168	17,200	.....	1,243	.812	11.07	17,200	.....	1,150	.752	10.23
1920	*505-168	8,700	.....	1,046	.684	9.30	8,700	.....	1,000	.654	8.90
1921	525-103	8,720	290	1,030	.673	9.11	8,720	.....	1,010	.660	8.96
1922	*545-102	25,300	.....	1,121	.733	9.97	25,300	.....	1,100	.719	9.76
1923	*565- 92	19,300	.....	690	.451	6.14	19,300	.....	659	.431	5.85
1924	*585- 95	8,980	.....	807	.527	7.19	8,980	.....	835	.546	7.43
1925	*605- 90	10,500	150	613	.401	5.44	10,500	150	606	.396	5.37
1926	*625- 84	6,250	160	591	.386	5.24	6,580	160	696	.455	6.17
1927	*645- 55	9,940	154	1,005	.657	8.93	.....	.....	.....	.....	.....
1930	*.....	10,000	75	573	.375	5.09	.....	.....	.....	.....	.....
1933	745-138	.....	.....	.....	.....	.....	19,800	90	709	.463	6.30
1934	760-171	5,670	55	249	.163	2.20	5,670	55	317	.207	2.79
1935	785-166	15,500	103	844	.552	7.48	15,500	160	815	.533	7.24
1936	805-159	14,300	79	656	.429	5.84	14,300	79	649	.424	5.77
1937	825-213	18,000	106	768	.502	6.83	18,000	70	739	.483	6.57
1938	855-226	7,590	65	912	.596	8.11	7,590	100	1,044	.682	9.28
1939	875-234	6,500	95	624	.408	5.57	6,500	95	490	.320	4.38
1940	895-	20,800	49	532	.348	4.74	.....	.....	.....	.....	.....

*Stream-flow records as originally published in the annual surface-water reports of the U. S. Geological Survey were incomplete either because of cessation of gage readings during ice periods or because complete basic data were unavailable during the year. However, to make the records continuous for some uses, such as for preliminary investigations, very rough estimates for some periods of missing record were made in 1935 and published in the report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," which was prepared in cooperation with the U. S. Geological Survey and the Iowa Institute of Hydraulic Research, Iowa City, Iowa.

a) Information by Corps of Engineers, U. S. Army.

Little Maquoketa River near Durango, Iowa

LOCATION.—Lat. 42°33'20", long. 90°44'40", in NE¼ sec. 5, T. 89 N., R. 2 E., at bridge on country road, 500 feet southwest of U. S. Highway 52, 1½ miles east of Durango, 5 miles northwest of Dubuque, and 7.5 miles upstream from mouth.

DRAINAGE AREA.—130 square miles above gage; 156 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Collection of data partly financed by Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—October 1934 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once daily prior to January 1939; recording gage thereafter. Datum of gage is 612.62 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 5,000 second-feet. Not seriously affected by ice. Low-water control is a riffle formed by ledge rock and boulders a short distance below gage.

AVERAGE DISCHARGE.—5 years, 68.7 second-feet.

EXTREMES.—1934-40: Maximum discharge, 14,800 second-feet June 21, 1937 (gage height, 20.75 feet, from floodmarks), from rating curve extended above 5,000 second-feet on basis of velocity-area and slope-area studies; minimum discharge observed, 5 second-feet July 12, 13, 1936; minimum gage height observed, 2.64 feet Dec. 10, 1937.

HISTORICAL DATA.—Flood of June 1925 reached a stage of about 22.1 feet, from information furnished by Corps of Engineers, U. S. Army.

REMARKS.—Bank-full stage, about 14 feet.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1935	785–169	.....	.....	.....	.....	.....	2,360	10	64.9	0.499	6.79
1936	805–162	791	5	36.6	0.282	3.84	791	5	37.8	.291	3.95
1937	825–217	4,270	9	107	.823	11.13	4,270	7	105	.808	10.93
1938	855–229	2,900	7	94.0	.723	9.82	2,900	9	102	.785	10.70
1939	875–238	1,770	11	62.8	.483	6.53	1,770	11	55.0	.423	5.72
1940	895–	1,990	8	42.9	.330	4.51	1,990	.....	.....	.....	.....

Maquoketa River near Manchester, Iowa

LOCATION.—Lat. 42°27'20", long. 91°25'50", in sec. 9, T. 88 N., R. 5 W., 2 miles southeast of Manchester and 5 miles downstream from Honey Creek and Prairie Creek.

DRAINAGE AREA.—306 square miles.

SOURCES OF DATA.—U. S. Geological Survey records. Iowa Electric Co. assisted with collection of gage-height record.

RECORDS AVAILABLE.—April 1933 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Water-stage recorder. Datum of gage is 895.06 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 7,200 second-feet. Control dam constructed in May 1935. Stream bed composed of ledge rock below control; filling and scouring of sand deposit above control causes slight shifts at low and medium stages, otherwise relation is stable.

AVERAGE DISCHARGE.—7 years, 124 second-feet.

EXTREMES.—1933-40: Maximum discharge, 8,150 second-feet Mar. 4, 1937 (gage height, 14.20 feet); minimum discharge, 3 second-feet numerous times during May and June 1934 (gage height, 2.90 feet, prior to construction of control dam, caused by regulation); minimum daily discharge, 6 second-feet June 8, 29, 1934.

Minimum stage since construction of control dam, 3.72 feet Feb. 15, 1940.

REMARKS.—Diurnal fluctuation caused by operation of power plant of Iowa Electric Co. about 2 miles above station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	760-172	480	6	42.7	0.140	1.91	480	6	56.2	0.184	2.50
1935	805-164	4,070	13	163	.533	7.25	4,070	22	155	.507	6.88
1936	805-164	2,850	.....	102	.333	4.52	2,850	.....	105	.343	4.67
1937	825-219	6,290	27	186	.608	8.24	6,290	27	179	.585	7.92
1938	855-231	4,000	25	160	.523	7.13	4,000	25	181	.592	8.04
1939	875-240	1,370	15	126	.412	5.61	1,370	15	106	.346	4.69
1940	895-	1,590	22	91.8	.300	4.08	.....	.....	.....	.....	.....

Maquoketa River near Delhi, Iowa

LOCATION.—Lat. 42°24'40", long. 91°20'40", in NW¼ sec. 29, T. 88 N., R. 4 W., in tailrace of Interstate Power Co.'s hydroelectric plant, 1½ miles south of Delhi and 6 miles upstream from Plum Creek.

DRAINAGE AREA.—348 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Interstate Power Co. furnished gage-height record and preliminary computations of daily discharge based on U. S. Geological Survey rating curves.

RECORDS AVAILABLE.—July 1933 to September 1940 in water-supply papers of U. S. Geological Survey. (Station discontinued).

GAGE.—Water-stage recorder. Datum of gage is 774.32 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 7,000 second-feet. Stream bed composed of small boulders and gravel and is subject to gradual scouring. Flow is confined between high banks.

AVERAGE DISCHARGE.—7 years, 136 second-feet.

EXTREMES.—1933-40: Maximum discharge, 6,130 second-feet Mar. 4, 1937 (gage height, 89.2 feet); minimum 5 second-feet at various times with plant shut down; minimum daily discharge, 5 second-feet Apr. 16, Aug. 27, Sept. 10, 17, 1939 (gage height, 80.40 feet).

HISTORICAL DATA.—A discharge of 7,360 second-feet was measured by F. A. Nagler on Mar. 14, 1929.

REMARKS.—Flow regulated by reservoir appurtenant to power plant.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	760–174	495	8	49.4	0.142	1.92	495	8	61.3	0.176	2.39
1935	785–171	4,050	11	183	.526	7.14	4,050	11	174	.500	6.81
1936	805–166	2,840	9	110	.316	4.28	2,840	9	113	.325	4.41
1937	825–220	4,660	8	190	.546	7.41	4,660	8	183	.526	7.15
1938	855–232	3,790	5	173	.497	6.75	3,790	5	193	.555	7.52
1939	875–241	1,040	5	135	.388	5.28	1,040	5	115	.330	4.49
1940	895–	1,750	7	111	.319	4.34	.....	.....	.....	.....	.....

Maquoketa River near Maquoketa, Iowa

(Published as Maquoketa River below North Fork of Maquoketa River near Maquoketa, Iowa, prior to 1940)

LOCATION.—Lat. 42°05'10", long. 90°38'20", in SW¼NE¼ sec. 17, T. 84 N., R. 3 E., at Bridgeport Bridge, 1,200 feet upstream from Mill Creek, about 2 miles downstream from North Fork of Maquoketa River and 3 miles northeast of Maquoketa.

DRAINAGE AREA.—1,550 square miles above gage; 1,900 square miles at mouth.

SOURCES OF DATA.—U. S. Geological Survey records, except gage-height record October 1927 to September 1932 furnished by Iowa Electric Co. Discharge measurements 1929 to 1931 by Corps of Engineers, U. S. Army; records collected in cooperation with that agency beginning in 1935.

RECORDS AVAILABLE.—September 1913 to September 1940 in water-supply papers of U. S. Geological Survey. September 1913 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 199-214.

GAGES.—Nonrecording gage read once daily prior to July 1924; water-stage recorder thereafter. Gage-height record discontinued during ice periods prior to about 1927. Datum of gage is 636.52 feet above mean sea level, adjustment of 1912.

AVERAGE DISCHARGE.—27 years, 900 second-feet.

EXTREMES.—1913-40: Maximum discharge, 27,500 second-feet Mar. 6, 1937, from curve defined by current-meter measurements below 26,000 second-feet; maximum gage height, 22.18 feet Feb. 21, 1937 (affected by ice); minimum discharge, 39 second-feet (regulated) Sept. 15, 1931 (gage height, 0.81 foot); minimum daily discharge, about 105 second-feet Feb. 11-20, 1936.

REMARKS.—Diurnal fluctuation caused by regulation at power plant of Iowa Electric Co. and about 4 miles above station except during period March 1937 to January 1940, when the plant was not operating.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1914	*405-147	11,200	.....	602	0.388	5.25	11,200	.....	673	0.434	5.89
1915	*405-147	13,800	.....	1,010	.652	8.87	13,800	.....	1,060	.684	9.31
1916	435-146	18,700	.....	1,110	.716	9.72	18,700	.....	984	.635	8.62
1917	455-130	11,200	.....	659	.425	5.78	11,200	.....	650	.419	5.70
1918	*475- 93	.....	.....	749	.483	6.55	.....	.....	770	.497	6.74
1919	505-173	10,400	245	1,230	.794	10.79	10,400	.....	1,510	.974	13.24
1920	*505-173	9,690	.....	1,400	.903	12.31	8,400	.....	1,150	.742	10.05
1921	525-105	7,500	315	831	.536	7.27	7,500	315	949	.612	8.31
1922	545-104	14,200	460	1,170	.755	10.24	14,200	.....	1,060	.684	9.27
1923	*565- 93	18,300	.....	794	.512	6.96	18,300	.....	799	.515	6.99
1924	*585- 96	17,000	.....	1,010	.652	8.87	17,000	.....	998	.644	8.76
1925	*605- 92	18,000	.....	788	.508	6.89	18,000	.....	815	.526	7.12
1926	*645- 56	7,180	.....	924	.596	8.07	7,180	.....	1,080	.697	9.45
1927	*645- 56	10,400	381	1,480	.955	12.91	10,400	381	1,490	.961	13.04
1928	*700-102	12,200	.....	1,200	.774	10.53	12,200	.....	1,230	.794	10.81
1929	*700-102	21,000	375	1,510	.974	13.18	21,000	.....	1,260	.813	11.01
1930	*700-102	6,760	.....	648	.418	5.70	6,760	.....	619	.399	5.41
1931	745-139	4,080	112	386	.249	3.40	7,820	112	622	.401	5.47
1932	745-139	7,820	264	939	.606	8.25	7,040	254	754	.486	6.63
1933	745-139	7,580	222	679	.438	5.94	7,580	179	613	.395	5.36
1934	760-176	6,920	.....	344	.222	3.02	6,920	130	426	.275	3.73
1935	785-172	11,400	224	856	.552	7.50	11,400	190	796	.514	6.98
1936	805-167	8,710	105	554	.357	4.87	8,710	105	572	.369	5.02
1937	825-221	25,500	220	1,224	.790	10.73	25,500	200	1,190	.768	10.43
1938	855-233	12,500	200	898	.579	7.87	12,500	265	987	.637	8.65
1939	875-243	6,040	244	765	.494	6.70	6,040	114	674	.435	5.90
1940	895-	8,760	114	540	.348	4.73	.....	.....	.....	.....	.....

*See page 40.

Wapsipinicon River at Independence, Iowa

LOCATION.—Lat. 42°28'10", long. 91°53'40", in SW¼SE¼ sec. 34, T. 89 N., R. 9 W., in tailrace of Interstate Power Co.'s hydroelectric plant at Independence, three-quarters of a mile downstream from Harte Creek and 4¼ miles downstream from Otter Creek.

DRAINAGE AREA.—1,060 square miles at gage.

SOURCES OF DATA.—U. S. Geological Survey records. Interstate Power Co. furnished gage-height record and preliminary computations of daily discharge based on U. S. Geological Survey rating curves.

RECORDS AVAILABLE.—July 1933 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Nonrecording gage read hourly. Datum of gage is 802.85 feet above mean sea level, datum of 1929, and 47.63 feet below City datum.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 7,000 second-feet. Not usually affected by ice. Stream bed composed of coarse gravel and boulders and is stable.

AVERAGE DISCHARGE.—7 years, 360 second-feet.

EXTREMES.—1933-40: Maximum discharge, 7,900 second-feet Mar. 8, 1937 (gage height, 93.2 feet); minimum, about 7 second-feet at numerous times during 1933-34, caused by regulation.

HISTORICAL DATA.—Reports of important floods noted from miscellaneous references in 1858, 1865, 1871, 1892, 1902, and 1903.

REMARKS.—Bank-full stage, about 93 feet. Point of zero flow, about 84.0 feet. Flow regulated by power plant.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	760-177	845	7	74.5	0.070	0.94	845	7	130	0.123	1.66
1935	785-175	6,230	8	506	.477	6.50	6,230	8	466	.440	5.97
1936	805-170	6,410	9	412	.389	5.28	6,410	9	423	.399	5.42
1937	825-224	7,570	9	478	.451	6.14	7,570	9	450	.425	5.79
1938	855-236	3,640	9	513	.484	6.59	3,640	9	619	.584	7.94
1939	875-246	2,470	8	357	.337	4.58	1,920	8	255	.241	3.27
1940	895-	2,220	10	180	.170	2.31	.....	.....	.....	.....	.....

Wapsipinicon River at Stone City, Iowa

LOCATION.— Lat 42°07'00", long. 91°21'20", in E½ sec. 6, T. 84 N., R. 4 W., at highway bridge at Stone City, just upstream from Chicago, Milwaukee & St. Paul Railway bridge and 3½ miles upstream from Buffalo Creek.

DRAINAGE AREA.—1,310 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage heights furnished by Frank Dearborn, Stone City.

RECORDS AVAILABLE.—August 1903 to December 1913, May to September 1914 (gage heights only) in water-supply papers of U. S. Geological Survey. August 1903 to December 1913 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 215-224.

GAGE.—Nonrecording gage read once daily.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 11,000 second-feet. Control formed by remains of a loose-rock dam under the railway bridge; practically permanent. Seriously affected by ice. Construction of new bridge piers during the spring of 1904 affected stage-discharge relation. Construction of a dam at Anamosa caused backwater at gage after June 1914.

AVERAGE DISCHARGE.—10 years, 691 second-feet.

EXTREMES.—1903-13: Maximum discharge observed, 10,400 second-feet Apr. 2, 1912 (gage height, 14.9 feet); minimum discharge observed, 39 second-feet Nov. 30, 1904 (gage height, 2.15 feet).

On July 13, 1903, a discharge of 10,500 second-feet was measured by current meter (gage height, 15.2 feet).

HISTORICAL DATA.—Maximum gage height known, 28 feet July 1892, probably correct within 0.5 foot according to observers. Various sources have estimated a discharge varying from 20,000 to 30,000 second-feet for this flood.

REMARKS.—During 1912, power development installed at Central City about 20 miles upstream, causing some diurnal fluctuation at gage.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1904	*130- 55	6,250	68	539	0.411	5.60	6,250	39	485	0.370	5.04
1905	*171- 73	6,860	39	651	.497	6.74	6,860	.....	699	.534	7.25
1906	*207- 65	8,740	.....	757	.578	7.85	8,740	.....	767	.585	7.95
1907	*265-160	.....	.....	933	.712	9.67	.....	.....	954	.728	9.88
1908	*265-160	4,340	.....	763	.582	7.93	4,340	.....	710	.542	7.37
1909	*265-160	8,190	.....	943	.720	9.77	8,190	.....	1,120	.855	11.61
1910	*285-261	5,830	.....	650	.496	6.74	5,830	.....	448	.342	4.65
1911	*305-136	8,220	.....	366	.279	3.79	8,220	.....	510	.389	5.29
1912	*325-139	10,400	.....	663	.506	6.89	10,400	.....	556	.424	5.78
1913	*355-163	5,070	.....	648	.495	6.72	.....	.....	.....	.....	.....

*See page 40. Daily discharge records for some periods are very rough estimates and possibly unreliable.

Wapsipinicon River near Dewitt, Iowa

LOCATION.—Lat. 41°46′, long. 90°32′, in sec. 31, T. 81 N., R. 4 E., at bridge on U. S. Highway 61, 3 miles south of Dewitt and 18 miles upstream from mouth.

DRAINAGE AREA.—2,300 square miles above gage (does not include Silver Creek area); 2,560 square miles at mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Records collected in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—June 1934 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Water-stage recorder. Datum of gage is 599.73 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 11,000 second-feet. Seriously affected by ice. Stream bed composed of sand and shifts frequently. Both banks low. Stream confined by highway fill to about gage height 13 feet. Auxiliary channel about half a mile north of gage carries some overflow during high stages.

AVERAGE DISCHARGE.—6 years, 1,040 second-feet.

EXTREMES.—1934-40: Mavimum discharge, 12,900 second-feet Mar. 6, 1937; maximum gage height, 11.65 feet Feb. 21, 1937 (affected by ice); minimum discharge, 70 second-feet Jan. 17-24, 1940; minimum gage height, 0.94 foot Oct. 3, 1937.

REMARKS.—Bank-full stage, about 8 feet. The highest floods of recent years, according to local residents, have barely overtopped the highway fill. Silver Creek, which formerly entered above the gage site, was artificially diverted through an overflow channel of the river, so that it enters below gage. This change was made prior to establishment of the station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1935	785-176	7,860	220	1,325	0.576	7.81	7,860	182	1,251	0.544	7.38
1936	805-171	6,690	85	890	.387	5.27	6,690	85	914	.397	5.40
1937	825-225	12,000	127	1,358	.590	8.01	12,000	122	1,272	.553	7.50
1938	855-237	7,210	122	1,215	.528	7.17	7,210	140	1,419	.617	8.38
1939	875-247	8,030	141	982	.427	5.78	8,030	90	772	.336	4.54
1940	895-	3,250	70	471	.205	2.79	.....	.....	.....	.....	.....

Iowa River at Marshalltown, Iowa

LOCATION.—Lat. 42°04′, long. 92°54′, in SW¼ sec. 24, T. 84 N., R. 18 W., in city park at Marshalltown, 500 feet downstream from Third avenue bridge on State Highway 14. Prior to August 1903 at highway bridge 50 feet upstream from old flour mill dam and about one mile upstream from Third Avenue bridge; May 1915 to August 1934, at Third Avenue bridge.

DRAINAGE AREA.—1,500 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—February to August 1903 (gage heights only) May 1915 to September 1927, February 1933 to September 1940 in water-supply papers of U. S. Geological Survey. May 1915 to September 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 229-240.

GAGES.—Nonrecording gage prior to September 1934; read once daily until October 1921 and twice daily thereafter (in general, readings were discontinued during ice periods). Recording gage subsequent to September 1934. Datum of gage is 853.06 feet above mean sea level, datum of 1929 (levels by Corps of Engineers, U. S. Army); prior to August 1903, gage at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 18,700 second-feet. Moderately affected by ice. Fairly stable below about gage-height 8 feet due to concrete control. Appreciable shifts at higher stages.

AVERAGE DISCHARGE.—19 years, 621 second-feet.

EXTREMES.—1915-27, 1933-40: Maximum discharge observed, 42,000 second-feet June 4, 1918 (gage height, 17.74 feet), from rating curve extended above 18,700 second-feet; minimum, about 2 second-feet (regulated) Nov. 24, 1917.

HISTORICAL DATA.—Flood of June 4, 1918, highest stage recorded at Marshalltown, was caused by excessive rains the latter part of May followed by another storm on June 3-5. A total of more than 10 inches of precipitation in 13 days was measured at the watershed boundary east of Iowa Falls.

REMARKS.—Bank-full stage, about 15 feet. Some diurnal fluctuation during low water caused by power plant operation at Iowa Falls.

Levee on right bank subject to overflow at stage of about 16 feet.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	*435–160	4,380	.....	1,090	0.727	9.96	4,290	.....	832	0.555	7.59
1917	*455–143	9,640	.....	718	.479	6.51	9,640	2	715	.477	6.48
1918	*475–104	39,400	2	1,030	.687	9.37	39,400	.....	1,120	.747	10.19
1919	505–191	6,670	80	898	.599	8.14	6,670	80	945	.630	8.56
1920	505–191	4,870	130	819	.546	7.44	3,420	130	826	.551	7.50
1921	525–115	7,820	80	683	.455	6.18	7,820	80	588	.392	5.32
1922	545–114	4,790	50	465	.310	4.18	4,790	.....	420	.280	3.79
1923	565–102	3,480	.....	264	.176	2.40	3,480	.....	279	.186	2.53
1924	585–105	7,440	.....	842	.561	7.62	7,440	.....	873	.582	7.93
1925	*605–101	2,440	.....	302	.201	2.77	3,840	.....	370	.247	3.34
1926	*625– 96	5,970	.....	575	.383	5.19	5,970	.....	581	.387	5.26
1927	*645– 65	5,230	.....	786	.524	7.12	.....	.....	.....	.....	.....
1934	760–187	1,160	12	77.3	.052	.70	1,160	12	96.8	.065	.88
1935	785–185	8,970	50	659	.439	5.95	8,970	78	725	.483	6.54
1936	805–204	8,190	32	636	.424	5.77	8,190	32	577	.385	5.24
1937	825–240	7,850	45	693	.462	6.27	7,850	21	667	.445	6.03
1938	855–251	4,180	21	627	.418	5.67	4,180	29	685	.457	6.19
1939	875–260	8,610	17	454	.303	4.12	8,610	17	391	.261	3.55
1940	895–	1,480	9	172	.115	1.55	.....	.....	.....	.....	.....

*See page 40.

Iowa River at Iowa City, Iowa

LOCATION.—Since November 1921, lat. 40°39'30", long. 91°32'20", in SE¼ sec. 9, T. 79 N., R. 6 W., in Iowa City, 25 feet downstream from hydraulics laboratory, at the State University of Iowa, 175 feet downstream from University dam and a quarter of a mile downstream from Iowa Avenue. Prior to July 1906 at Iowa Avenue Bridge; October 1913 to November 1921 at Benton Street Bridge 500 feet downstream from Chicago, Rock Island & Pacific Railroad bridge and three quarters of a mile downstream from Iowa Avenue.

DRAINAGE AREA.—3,230 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records June 1903 to July 1906, October 1913 to September 1940; from University of Iowa hydroelectric plant records January 1907 to December 1913, except for June, July 1907 which were taken from House Document 134, 71st Congress, 2nd Session. Discharges for all periods for which records are missing in water-supply papers were estimated by engineering research assistants who have for several years assisted with the operation of this station as part of the activity of the Iowa Institute of Hydraulic Research.

RECORDS AVAILABLE.—June 1903 to July 1906, October 1913 to September 1940 in water-supply papers of U. S. Geological Survey; June 1903 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 241-264; December 1907 to March 1918 (incomplete), gage heights and discharges for July 1881, and gage heights March to August 1893 in House Document No. 134 71st Congress, 2nd Session.

GAGES.—Nonrecording gage read once daily June 1903 to July 1906, October 1916 to November 1921 and twice daily October 1913 to September 1916. Recording gage subsequent to December 1921. Datum of gage 42.05 feet 1903-6, about 39.00 feet October 1913 to November 1921, 40.00 feet December 1921 to September 1928, and 39.00 feet thereafter, Iowa City datum. Datum of gage subsequent to September 1928, 627.27 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 26,000 second-feet. Subject to changes at all stages. Affected by ice at extremely low temperatures.

AVERAGE DISCHARGE.—37 years (1903-40) 1,424 second-feet.

EXTREMES.—1903-40: Maximum discharge, 36,200 second-feet June 7, 1918 (gage height, 19.45 feet, site and datum then in use), from rating curve extended above 26,000 second-feet; minimum daily discharge, about 10 second-feet Dec. 26, 1916; practically no flow September 3, 1925, caused by regulation.

HISTORICAL DATA.—The flood of June 7, 1918 was caused by heavy rains May 27, 28 with still heavier rains June 3-5 at and above Marshalltown. This flood has been exceeded in historic times only by the summer floods of 1851 and 1881. Discharge of flood of 1851, 50,000 second-feet (estimated): G. H. Hickox, University of Iowa thesis, 1926.

REMARKS.—Bank-full stage, about 12 feet. Some regulation of flow at low stages by power plants at Coralville and Iowa City. Flood stages and discharges for period 1851 to 1934 are listed in Water-Supply Paper 771, pp. 263-264.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1904	*130- 59	8,410	150	1,230	0.381	5.17	8,410	150	1,090	0.337	4.62
1905	*171- 83	8,710	170	1,520	.471	6.42	8,710	230	1,700	.526	7.17
1906	*207- 71	.....	.....	1,970	.610	8.25	.....	.....	2,000	.619	8.40
1907	*.....	.....	.....	2,490	.771	10.42	.....	.....	2,410	.746	10.13
1908	*.....	.....	.....	1,200	.368	5.05	5,850	85	1,040	.322	4.41
1909	*.....	12,400	58	1,740	.539	7.32	12,400	58	1,950	.604	8.20
1910	*.....	9,520	70	1,010	.313	4.24	9,520	48	773	.239	3.25

(Concluded on next page)

Summary of yearly discharge, in second-feet, of Iowa River at Iowa City, Iowa, 1904-1940—Continued

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1911	*.....	9,680	43	564	0.175	2.37	9,680	43	755	0.234	3.19
1912	*.....	20,000	64	1,390	.430	5.84	20,000	64	1,220	.378	5.13
1913	*.....	7,030	70	944	.292	3.99	7,030	70	963	.298	4.07
1914	*385–212	8,000	100	834	.258	3.51	8,000	181	1,050	.325	4.42
1915	405–162	20,000	300	2,960	.916	12.44	20,000	300	3,010	.932	13.93
1916	*435–162	10,900	38	2,250	.697	9.46	10,500	10	1,650	.511	6.93
1917	*455–144	17,500	10	1,290	.399	5.44	17,500	80	1,300	.402	5.48
1918	*475–106	35,300	38	1,950	.604	8.19	35,300	38	2,060	.638	8.64
1919	505–193	12,800	79	2,070	.641	8.71	12,800	79	2,430	.752	10.23
1920	505–193	8,130	280	2,130	.659	8.98	8,130	264	1,830	.567	7.71
1921	525–117	14,300	190	1,390	.430	5.86	14,300	190	1,470	.455	6.16
1922	545–116	5,780	158	1,320	.409	5.58	5,780	158	1,130	.350	4.74
1923	565–104	8,420	.....	800	.248	3.36	8,420	153	877	.272	3.69
1924	585–107	19,100	61	2,000	.619	8.29	19,100	61	1,960	.607	8.26
1925	605–102	1,510	48	514	.159	2.18	3,160	48	564	.175	2.37
1926	625– 97	17,400	111	1,210	.375	5.05	17,400	111	1,430	.443	6.00
1927	645– 66	9,310	274	1,720	.533	7.26	9,310	258	1,630	.505	6.85
1928	665– 75	8,820	258	1,550	.480	6.51	8,820	290	1,790	.554	7.52
1929	685–111	21,900	512	2,710	.839	11.40	21,900	320	2,280	.706	9.59
1930	700–110	11,300	92	1,020	.316	4.29	11,300	92	932	.289	3.91
1931	730–133	2,790	48	312	.097	1.32	7,750	48	811	.251	3.42
1932	730–133	7,750	200	2,090	.647	8.82	5,400	83	1,690	.523	7.14
1933	745–151	8,700	83	1,180	.365	4.95	8,700	88	1,050	.325	4.41
1934	760–188	1,840	30	204	.063	.86	1,840	30	246	.076	1.04
1935	785–186	8,550	73	1,474	.456	6.20	8,550	179	1,631	.505	6.85
1936	805–205	12,900	59	1,388	.430	5.83	12,900	59	1,282	.397	5.39
1937	825–241	16,800	88	1,581	.489	6.64	16,800	56	1,494	.463	6.27
1938	855–252	4,600	56	1,260	.390	5.29	4,600	126	1,398	.433	5.87
1939	875–261	8,860	74	1,056	.327	4.45	8,860	74	912	.282	3.85
1940	895–	2,800	32	352	.109	1.49	.....	.....	.....	.....	.....

*See page 40.

Iowa River at Wapello, Iowa

LOCATION.—Lat. 41°11′, long. 91°11′, in sec. 27, T. 74 N., R. 3 W., at bridge on State Highway 99 at Wapello, 13 miles downstream from Cedar River and 15.4 miles upstream from mouth.

DRAINAGE AREA.—12,480 square miles above gage; 12,600 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record 1927-33 furnished by Mississippi River Power Co. Records for several years collected in cooperation with Corps of Engineers, U. S. Army, Mississippi River Power Co., and U. S. Weather Bureau.

RECORDS AVAILABLE.—February 1915 to September 1940 in water-supply papers of U. S. Geological Survey; February 1915 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 265-279.

GAGES.—Nonrecording gage read once daily February 1915 to September 1934 except during high stages, when gage was read several times daily, and (prior to winter of 1920-21) during periods when river was frozen over, when gage was read two or three times a week; recording gage thereafter. Datum of gage is 548.98 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 56,000 second-feet. Seriously affected by shifting control and ice.

AVERAGE DISCHARGE.—25 years, 5,644 second-feet.

EXTREMES.—1915-40: Maximum discharge observed, 67,500 second-feet Mar. 19, 1929 (gage height, 16.22 feet), from rating curve extended above 56,000 second-feet; minimum, about 400 second-feet Dec. 15-17, 1916; minimum gage height, probably 1.38 feet July 5, 1934.

HISTORICAL DATA.—Floods of major proportions in Iowa River Basin reported in March 1840, June 1851, June 1858, July 1881, June 1892, and recorded June 1903, June 1918 and March 1929, the last of which was caused primarily by melting snow. The flood of June 1851 apparently was the greatest known.

REMARKS.—Flood stage, about 10 feet. Slight diurnal fluctuation at low stages caused by power plant operation at Iowa City and Cedar Rapids. Flood stages and discharges, 1915-34, listed in Water-Supply Paper 771, p. 265.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	435–164	48,300	1,100	8,020	0.643	8.75	48,300	400	6,440	0.516	7.04
1917	455–146	48,300	400	5,690	.456	6.20	48,300	600	5,750	.461	6.25
1918	*475–107	60,300	.....	6,510	.522	7.07	60,300	.....	7,000	.561	7.60
1919	505–196	37,400	620	8,140	.652	8.84	37,400	620	8,920	.715	9.69
1920	505–196	32,200	1,800	7,260	.582	7.92	32,200	1,800	6,400	.513	6.98
1921	525–118	31,900	1,420	5,360	.429	5.83	31,900	1,420	5,690	.456	6.21
1922	545–118	26,500	1,050	5,350	.428	5.80	26,500	600	4,570	.366	4.95
1923	565–105	30,700	570	3,210	.257	3.49	30,700	570	3,630	.291	3.94
1924	585–108	34,700	1,000	7,260	.581	9.14	34,700	.....	7,380	.591	8.04
1925	605–104	12,500	700	3,060	.245	3.33	12,500	.....	2,980	.239	3.24
1926	625– 99	43,500	1,090	5,080	.407	5.53	43,500	.....	6,170	.494	6.72
1927	645– 67	33,700	1,800	8,380	.671	9.11	33,700	1,300	7,850	.629	8.54
1928	730–135	28,800	1,300	7,220	.579	7.86	28,000	2,300	8,650	.693	9.41
1929	730–135	63,400	1,940	11,000	.881	11.96	63,400	800	8,690	.696	9.42
1930	730–135	51,200	800	4,160	.333	4.53	51,200	750	4,010	.321	4.37
1931	730–135	6,740	570	1,490	.119	2.43	27,800	570	3,110	.249	3.37
1932	730–135	27,800	1,160	8,310	.666	9.04	25,600	.....	7,060	.566	7.69
1933	745–152	60,800	.....	5,180	.415	5.64	60,800	600	4,710	.377	5.11
1934	760–189	7,230	531	1,210	.097	1.31	7,360	531	1,434	.115	1.56
1935	785–187	35,500	800	5,622	.450	6.12	35,500	1,000	5,961	.478	6.49
1936	805–206	36,000	609	4,961	.398	5.41	36,000	609	4,827	.387	5.27
1937	825–242	53,200	800	6,654	.533	7.25	53,200	840	6,388	.512	6.85
1938	855–253	19,000	840	5,139	.412	5.61	19,000	900	5,808	.465	6.33
1939	875–262	36,100	884	4,809	.385	5.23	36,100	610	4,099	.328	4.46
1940	895–	7,780	430	2,029	.163	2.22	.....	.....	.....	.....	.....

*See page 40.

Ralston Creek at Iowa City, Iowa

LOCATION.—Lat. 41°40'10", long. 91°30'40", in SE¼ sec. 11, T. 79 N., R. 6 W., at bridge on State Highway 1 at east edge of Iowa City, 2.8 miles upstream from mouth.

DRAINAGE AREA.—3.01 (a) square miles.

SOURCES OF DATA.—September 1924 to September 1932, records collected by Department of Mechanics and Hydraulics, University of Iowa; October 1932 to September 1940, Iowa Institute of Hydraulic Research records collected in cooperation with U. S. Geological Survey.

RECORDS AVAILABLE.—October 1932 to September 1940 in water-supply papers of U. S. Geological Survey, September 1924 to December 1935 in State University of Iowa Engineering Bulletin No. 9. January 1936 to December 1940 in mimeographed reports, Iowa Institute of Hydraulic Research, University of Iowa.

GAGES.—Recording gage.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements. Seriously affected by ice. Rating for artificial control subject to shifts due to debris lodging above and below gage at medium and high stages.

AVERAGE DISCHARGE.—16 years, 1.56 second-feet (1,010,000 gallons per day).

EXTREMES.—1924-40: Maximum discharge, 851 second-feet Aug. 1, 1932 (gage height, 8.18 feet); no flow at times during most years.

The flood on Aug. 1-3, 1932 resulted from an average rainfall of more than 4 inches in Iowa City and vicinity.

REMARKS.—Bank-full stage, about 6 feet. Left bank subject to overflow above bridge, right bank below. Through the cooperative efforts of the College of Engineering and the Iowa Institute of Hydraulic Research of the State University of Iowa, Bureau of Agricultural Engineering of the U. S. Department of Agriculture, and the U. S. Geological Survey, continuous records of precipitation, stream-flow and ground-water levels have been collected in the Ralston Creek drainage basin since 1924.

Summary of yearly yield, in millions of gallons per square mile; precipitation and runoff, in inches

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year					(b) Precipitation**
		Maximum day	Minimum day	Mean	Runoff		Maximum day	Minimum day	Mean	Runoff		
					Total	Inches				Total	Inches	
1925..	**	6.70	0	0.122	44.7	2.52	6.70	0	0.129	47.0	2.71	28.96
1926..	.....	12.45	0	.335	122.3	6.96	12.45	0	.399	145.8	8.40	35.60
1927..	.....	19.75	.002	.556	203.0	11.67	19.75	.002	.633	231.2	13.33	39.76
1928..	.....	16.32	.002	.487	178.4	10.27	13.74	.001	.475	173.7	9.99	39.97
1929..	.....	14.64	0	.636	232.0	13.43	14.64	0	.511	186.5	10.72	33.53
1930..	.....	21.04	0	.329	119.9	6.75	21.04	0	.313	114.4	6.59	31.80
1931..	.....	4.66	0	.122	44.7	2.56	9.94	0	.180	65.8	3.80	31.22
1932..	.....	17.82	0	.337	123.4	7.15	17.82	0	.313	114.7	6.64	33.27
1933..	745-153	7.21	0	.199	72.6	4.20	3.01	0	.140	51.1	2.95	25.44
1934..	760-190	5.02	0	.033	12.1	.68	5.02	0	.052	18.8	1.06	29.01
1935..	785-188	15.44	0	.389	141.9	8.18	15.46	0	.397	145.0	8.38	35.99
1936..	805-246	7.94	0	.260	95.1	5.39	7.94	0	.283	103.7	5.95	30.25
1937..	825-246	37.58	0	.691	252.4	14.55	37.58	0	.644	235.1	13.55	31.33
1938..	855-258	27.91	0	.395	144.2	8.30	27.91	0	.432	157.5	9.08	37.46
1939..	875-263	16.53	0	.335	122.3	7.06	16.53	0	.292	106.6	6.16	29.33
1940..	895-	6.44	0	.133	48.6	2.80	.....	.....	.....	.....	.....	.....

a) Used as a basis of computation in table of yield. b) Weighted.
**Record translated from State University of Iowa Engineering Bulletin No. 9, for period 1925-32, subsequent unpublished manuscripts, and water-supply papers as indicated.

NOTE.—While this report was in the process of publication, the discharge records at this station became available for the record-breaking highwater resulting from a maximum measured daily rainfall of 3.56 inches in the drainage area on June 27, 1941. Of this total about 1.75 inches fell in one hour.

Extremes.—1924-41. Maximum discharge, 1,360 second-feet 7:10 p.m. June 27, 1941 (gage height, 8.25 feet).

Cedar River near Austin, Minnesota

LOCATION.—In sec. 15, T. 102 N., R. 18 W., below dam of Red Cedar Mill, 1 mile downstream from Turtle Creek and 2 miles south of Austin, Minnesota.

DRAINAGE AREA.—425 Square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—May 1909 to September 1914.

GAGES.—Prior to May 1913 nonrecording gage in tailrace read 5 times daily; thereafter, nonrecording gage on bridge 100 yards downstream from power house read 3 times daily when Red Cedar Mill was in operation and twice daily at other times.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measursements below 4,000 second-feet. Slightly affected by ice; seriously affected by aquatic vegetation during summer. Channel somewhat shifting.

AVERAGE DISCHARGE.—5 years, 145 second-feet.

EXTREMES.—1909-14: Maximum daily discharge, 5,230 second-feet Nov. 14, 1909; no flow on several days in 1911.

REMARKS.—Some diurnal fluctuation during low water caused by operation of power plant immediately below station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1909	265–170	.....	.....	.....	.....	Incomplete					
1910	285–267	5,230	20	207	0.488	6.63	2,070	14	110	0.260	3.56
1911	305–146	3,200	0	74.7	.176	2.38	3,880	0	136	.320	4.36
1912	325–146	4,180	4.0	227	.535	7.33	4,180	4.2	167	.393	5.34
1913	355–167	1,450	4	116	.273	3.70	1,450	4	116	.273	3.73
1914	385–216	1,330	.....	100	.235	3.21	.....	.....	Incomplete	.....	.....

Cedar River at Mitchell, Iowa

LOCATION.—Lat. 43°19', long. 92°52', in sec. 8, T. 98 N., R. 17 W., in tailrace of hydroelectric plant of Central States Power and Light Corporation at Mitchell, 8 miles downstream from Deer Creek and 10 miles upstream from Rock Creek.

DRAINAGE AREA.—845 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record furnished by Central States Power and Light Corporation.

RECORDS AVAILABLE.—July 1933 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Nonrecording gage read hourly.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 7,000 second-feet. Affected by ice at extremely low temperatures; otherwise reasonably permanent because stream bed is composed of rock and gravel and is relatively free from vegetation. Right bank is a high rock cliff; left bank subject to overflow below highway bridge several hundred feet below gage.

AVERAGE DISCHARGE.—7 years, 239 second-feet.

EXTREMES.—1933-40: Maximum discharge observed, 13,000 second-feet Apr. 4, 1934 (gage height, 89.7 feet); minimum, about 5 second-feet at numerous times during 1933-35 when power plant was shut down.

REMARKS.—Flow regulated at medium and low stages by power plant at gage.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	855-259	12,400	5	149	0.176	2.38	12,400	5	151	0.179	2.42
1935	855-259	6,710	5	239	.283	3.84	6,710	5	247	.292	3.97
1936	855-259	7,990	15	307	.363	4.97	7,990	15	301	.356	4.87
1937	855-259	6,500	20	272	.322	4.37	6,500	20	269	.318	4.33
1938	855-259	8,580	31	323	.382	5.18	8,580	42	345	.408	5.53
1939	875-265	5,920	12	256	.303	4.12	5,920	12	236	.279	3.80
1940	895-	2,940	12	126	.149	2.03	.....	.....	.....	.....	.....

Cedar River at Janesville, Iowa

LOCATION.—Lat. 42°39′, long. 92°28′, in sec. 35, T. 91 N., R. 14 W., at highway bridge at Janesville, 3 miles upstream from Shell Rock River.

DRAINAGE AREA.—1,660 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—April 1905 to September 1906, May 1915 to September 1927, November 1932 to September 1940 in water-supply papers of U. S. Geological Survey. April 1905 to September 1906, May 1915 to September 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 280-292.

GAGE—Nonrecording gage read once daily April 1905 to September 1906, May 1915 to September 1922, October 1923 to September 1927; twice daily October 1922 to September 1923, November 1932 to September 1940.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 18,000 second-feet. Affected by ice, otherwise fairly permanent. Control is remains of an old rock mill dam. Stream-bed composed of sand, gravel and boulders.

AVERAGE DISCHARGE.—20 years (1906, 1915-27, 1933-40), 667 second-feet.

EXTREMES.—1905-6, 1915-27, 1932-40: Maximum discharge observed, 27,700 second-feet Apr. 1, 1933 (gage height, 15.43 feet); minimum observed, 28 second-feet Oct. 21, 1922.

REMARKS.—Bank-full stage, about 13 feet. Some diurnal fluctuation during low water caused by power plant at Waverly, 9 miles upstream.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1906	*207- 74	22,600	.....	1,480	0.892	12.04	.....	.....	.....	.....	.....
1916	*435-165	8,740	.....	1,040	.627	8.47	8,740	.....	970	0.584	7.90
1917	*455-147	21,200	.....	884	.533	7.23	21,200	.....	890	.536	7.28
1918	*475-109	.....	.....	734	.442	5.98	.....	.....	810	.488	6.58
1919	*505-199	.....	.....	929	.560	7.60	.....	.....	900	.542	7.35
1920	*505-199	.....	.....	750	.452	6.16	.....	.....	760	.458	6.22
1921	525-120	25,500	122	761	.458	6.21	25,500	122	720	.434	5.91
1922	*545-119	.....	.....	610	.367	4.99	.....	28	580	.349	4.77
1923	*565-107	.....	28	344	.207	2.82	.....	.....	370	.223	3.05
1924	*585-110	.....	.....	603	.363	4.96	.....	.....	610	.367	5.01
1925	*605-105	.....	.....	421	.254	3.42	.....	.....	390	.235	3.14
1926	*625-100	.....	.....	376	.227	3.08	.....	.....	420	.253	3.42
1927	*645- 68	4,560	145	642	.387	5.25	.....	.....	.....	.....	.....
1933	745-154	.....	.....	.....	.....	.....	26,600	.....	618	.372	5.05
1934	760-193	10,100	48	187	.113	1.52	10,100	48	194	.117	1.59
1935	785-190	8,330	66	570	.343	4.67	8,330	90	593	.357	4.85
1936	805-209	10,700	67	608	.366	4.97	10,700	67	621	.374	5.08
1937	825-248	11,700	130	718	.433	5.87	11,700	70	690	.416	5.64
1938	855-263	8,740	70	779	.469	6.38	8,740	70	886	.534	7.26
1939	875-266	7,000	123	613	.369	5.00	7,000	123	504	.304	4.11
1940	895-	3,970	65	296	.178	2.41	.....	.....	.....	.....	.....

*See page 40.

Cedar River at Cedar Rapids, Iowa

LOCATION.—Lat. 41°58'15", long. 91°40'05", in sec. 28, T. 83 N., R. 7 W., in Cedar Rapids, 500 feet upstream from Eighth Avenue Bridge and 2.7 miles upstream from Prairie Creek.

DRAINAGE AREA.—6,640 square miles above gage, about 1,060 of which are in Minnesota; 7,870 square miles above confluence with Iowa River.

SOURCES OF DATA.—U. S. Geological Survey records, except gage-height observations by U. S. Weather Bureau April 1909 to August 1920. Subsequently, recorder record collected for many years in cooperation with that organization, and in 1940 with City of Cedar Rapids. Some discharge measurements made by Corps of Engineers, U. S. Army, 1929-31.

RECORDS AVAILABLE.—February 1903 to September 1940.

GAGES.—Nonrecording gage read once daily prior to August 1920; recording gage thereafter. Datum of gage is 700.33 feet above mean sea level, datum of 1929 (levels by Corps of Engineers, U. S. Army).

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 60,000 second-feet. Affected by ice in severe winters and possibly by artificial restrictions during high stages, otherwise reasonably permanent, the stream bed being composed of rock and gravel and free of vegetation.

AVERAGE DISCHARGE.—37 years, 2,931 second-feet.

EXTREMES.—Maximum discharge, 72,000 second-feet Mar. 19, 1929 (gage height 20.1 feet); minimum, 178 second-feet, Sept. 25, 1935 (gage height, 2.24 feet); minimum daily discharge, 236 second-feet July 1, 1934.

HISTORICAL DATA.—Flood of March 1929 is greatest known. The next highest, which reached a stage of about 20 feet, occurred in June 1851; discharge, estimated about 65,000 second-feet. Gage heights for the two floods probably not comparable owing to artificial changes in cannel cross-section.

REMARKS.—Flood stage, about 13 feet. Some diurnal fluctuation caused by operation of power plant half a mile above station. Flood stages and discharge, 1903 to 1934, listed in Water-Supply Paper 771, p. 266.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1904	*130- 63	11,600	.....	2,700	0.407	5.53	11,600	.....	2,200	0.331	4.49
1905	*171- 86	22,800	.....	3,250	.489	6.62	22,800	.....	3,410	.514	6.97
1906	*207- 72	50,500	660	3,800	.572	7.76	50,500	660	4,020	.605	8.23
1907	*245-110	19,400	1,110	4,520	.681	9.25	19,400	1,110	4,400	.663	9.00
1908	*245-110	20,400	790	3,510	.529	7.18	20,400	790	3,290	.495	6.72
1909	*305-146	21,000	840	4,090	.616	8.35	21,000	810	5,160	.777	10.55
1910	*305-146	23,700	580	3,290	.495	6.71	23,700	580	2,100	.316	4.27
1911	*305-146	13,100	.....	1,300	.196	2.65	13,100	410	1,780	.268	3.63
1912	325-147	54,100	810	3,570	.538	7.33	54,100	580	3,200	.482	6.56
1913	355-168	21,400	580	2,410	.363	4.90	21,400	490	2,370	.357	4.84
1914	385-217	16,600	490	1,680	.253	3.44	16,600	490	1,950	.294	3.99
1915	405-166	32,400	.....	5,490	.827	11.24	32,400	1,200	5,940	.895	12.13
1916	435-167	25,300	800	4,440	.669	9.07	25,300	.....	3,710	.559	7.59
1917	455-149	52,600	.....	3,070	.462	6.29	52,600	.....	3,050	.459	6.22
1918	*475-110	26,200	.....	3,190	.480	6.51	26,200	.....	3,680	.554	7.51
1919	505-202	29,700	775	4,420	.666	9.03	29,700	775	4,480	.675	9.16
1920	505-202	14,400	550	3,490	.526	7.14	14,400	550	3,330	.502	6.80
1921	525-122	16,300	788	2,880	.434	5.86	16,300	788	2,750	.414	5.61
1922	545-121	28,300	810	2,670	.402	5.47	28,300	597	2,470	.372	5.06
1923	565-109	15,700	554	1,610	.242	3.28	15,700	554	1,760	.265	3.61
1924	585-111	24,500	.....	3,240	.488	6.66	24,500	.....	3,260	.491	6.70
1925	605-107	12,200	.....	1,740	.262	3.58	12,200	620	1,700	.256	3.48
1926	625-102	9,450	620	1,890	.285	3.86	9,450	680	2,150	.324	4.39
1927	*645- 69	11,500	950	3,170	.477	6.46	11,500	660	2,990	.450	6.11
1928	745-155	28,500	660	3,270	.492	6.70	28,500	.....	4,140	.623	8.47
1929	745-155	67,200	1,080	5,300	.798	10.82	67,200	.....	4,220	.636	8.63
1930	745-155	12,200	.....	1,790	.270	3.67	12,200	.....	1,730	.261	3.52
1931	745-155	3,020	.....	795	.120	1.62	16,300	.....	1,460	.220	2.97
1932	745-155	18,600	760	3,900	.587	7.99	18,600	.....	3,410	.514	6.97
1933	745-155	63,300	.....	2,640	.398	5.38	63,300	284	2,429	.366	4.95
1934	760-194	8,440	236	689	.104	1.41	8,440	236	769	.116	1.57
1935	785-191	25,800	460	2,571	.387	5.27	25,800	460	2,682	.404	5.51
1936	805-210	22,700	418	2,559	.385	5.26	22,700	418	2,562	.386	5.26
1937	825-249	36,300	580	3,340	.503	6.83	36,300	418	3,187	.480	6.51
1938	855-264	12,800	418	2,718	.409	5.55	12,800	490	3,114	.469	6.37
1939	.....	18,800	426	2,341	.353	4.80	18,800	346	1,912	.288	3.91
1940	.....	5,150	280	1,143	.172	2.33	.....	.....	.....	.....	.....

*See page 40.

Cedar River at Cedar Rapids, Iowa

(Reproduction of page 267 in Water-Supply Paper 875, which contains daily discharge records in the Hudson Bay and Upper Mississippi River Basins).

LOCATION.—Water-stage recorder, lat. 41°58'15", long. 91°40'05", in sec. 28, T. 83 N., R. 7 W., in Cedar Rapids, 500 feet upstream from Eighth Avenue Bridge and 2.7 miles upstream from Prairie Creek.

DRAINAGE AREA.—6,640 square miles.

RECORDS AVAILABLE.—February 1903 to September 1939.

AVERAGE DISCHARGE.—36 years, 2,981 second-feet.

EXTREMES.—Maximum discharge during year, 19,700 second-feet Mar. 18 (gage height, 8.67 feet); minimum, 285 second-feet (regulated) Sept. 25 (gage height, 2.31 feet); minimum daily discharge, 426 second-feet Sept. 25.

1903-39: Maximum discharge, 72,000 second-feet Mar. 19, 1929 (gage height, 20.1 feet); minimum, 178 second-feet Sept. 25, 1935; minimum daily discharge, 236 second-feet July 1, 1934.

Flood of June 1851 reached a stage of about 20 feet.

REMARKS.—Records good except those for periods of ice effect, Dec. 27 to Jan. 2, Jan. 27 to Feb. 22, Mar. 7, 8, which were computed on basis of one discharge measurement, gage heights, weather records, observer's notes, and records for station at Janesville and are fair. Diurnal fluctuation caused by operation of power plant half a mile above station.

Rating table, water year 1938-39 except periods of ice effect (gage height, in feet, and discharge, in second-feet)

2.4	346	3.6	2,050	7.0	13,200
2.6	518	4.0	2,990	8.0	17,040
2.8	735	4.5	4,390	9.0	21,030
3.0	995	5.0	6,000		
3.3	1,470	6.0	9,520		

Discharge—In second-feet, water year October 1938 to September 1939.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
1	3,470	1,450	2,500	1,600	1,350	1,580	5,900	2,860	1,490	2,030	873	913
2	3,280	1,400	2,620	1,500	1,400	1,510	5,470	2,670	1,420	1,710	822	900
3	3,090	1,300	2,690	1,440	1,300	1,200	5,120	2,480	1,300	1,540	886	859
4	2,860	1,610	2,340	1,400	1,200	1,280	4,860	2,320	1,270	1,450	785	785
5	2,740	1,820	2,180	1,470	1,100	1,610	4,510	2,230	1,160	1,240	712	747
6	2,500	2,570	2,160	1,510	1,100	1,840	4,180	2,030	1,080	1,140	772	822
7	2,320	4,890	2,250	1,510	1,150	2,000	3,940	1,940	1,170	1,370	785	712
8	2,250	5,870	2,180	1,610	1,050	2,000	3,860	2,010	1,100	4,430	809	655
9	2,090	5,470	2,090	1,800	1,100	2,050	3,740	1,940	1,140	3,090	809	701
10	1,900	5,080	2,200	1,990	1,000	2,380	3,550	1,860	1,350	1,730	785	667
11	2,010	4,960	2,270	2,180	950	3,070	3,360	1,730	1,110	1,320	1,630	689
12	1,880	4,990	2,140	2,600	1,000	6,000	3,170	1,710	1,020	1,140	1,630	724
13	1,820	4,890	1,820	2,740	1,100	7,730	2,990	1,650	1,010	1,040	1,140	667
14	1,800	4,510	1,710	2,940	1,300	11,500	2,740	1,580	981	981	1,100	689
15	1,820	4,090	1,540	2,940	1,800	12,100	2,670	1,450	995	995	968	590
16	1,840	3,830	1,350	2,990	2,000	14,200	2,620	1,420	954	1,010	968	500
17	1,820	3,520	1,400	1,760	1,800	16,100	2,790	1,420	968	8,470	941	549
18	1,840	3,300	1,320	1,580	1,600	18,800	3,220	1,280	941	8,760	1,040	570
19	1,730	3,120	1,300	1,350	1,800	17,700	3,360	1,420	968	3,020	1,050	570
20	1,650	3,020	1,130	1,420	2,200	13,200	3,690	1,300	968	1,940	1,190	580
21	1,630	2,890	1,520	1,450	2,680	8,910	4,240	1,350	1,050	1,560	1,050	528
22	1,520	2,840	1,600	1,630	2,800	7,730	4,480	1,400	1,070	1,270	1,100	490
23	1,580	2,790	1,240	2,180	2,840	7,480	4,700	1,440	1,130	1,140	1,040	500
24	1,610	2,550	1,250	1,240	2,620	7,800	4,920	1,270	981	1,100	1,050	539
25	1,610	2,050	1,200	1,560	2,180	8,510	4,960	1,170	886	1,010	1,200	426
26	1,560	1,670	1,400	1,470	1,860	9,560	4,540	1,370	1,040	1,100	1,320	490
27	1,690	1,370	1,500	1,600	1,580	9,560	4,090	1,580	995	981	1,250	518
28	1,610	1,110	1,300	1,550	1,450	8,620	3,630	1,400	1,110	1,040	1,220	611
29	1,560	1,440	1,000	1,500	.....	7,800	3,330	1,400	1,720	1,240	1,080	570
30	1,510	2,030	1,500	1,600	.....	7,340	2,990	1,420	2,180	1,080	995	528
31	1,470	.....	2,000	1,500	.....	6,440	.....	1,690	.....	927	913	.....

(Concluded on next page)

Discharge—In second-feet, water year October 1938 to September 1939—Continued

Month	Second-foot-days	Maximum	Minimum	Mean	Per square mile	Runoff in inches
October	62,060	3,470	1,470	2,002	0.302	0.35
November	92,430	5,870	1,110	3,081	.464	.52
December	54,700	2,690	1,000	1,765	.266	.31
Calendar year 1938	1,136,638	12,800	490	3,114	.469	6.37
January	55,610	2,990	1,240	1,794	.270	.31
February	45,310	2,840	950	1,618	.244	.25
March	227,600	18,800	1,200	7,342	1.11	1.28
April	117,620	5,900	2,620	3,921	.591	.66
May	52,790	2,860	1,170	1,703	.256	.30
June	34,557	2,180	886	1,152	.173	.19
July	60,854	8,760	927	1,963	.296	.34
August	31,913	1,630	712	1,029	.155	.18
September	19,089	913	426	636	.096	.11
Water year 1938-39	854,533	18,800	426	2,341	.353	4.80

Peak discharge.—Mar. 14 (5 p.m.) 14,700 sec-ft.; Mar. 18 (10 p.m.) 19,700 sec.-ft.; July 8 (6 p.m.) 5,670 sec.-ft.; July 17 (10 p.m.) 12,200 sec.-ft.

TABLE 3.—*Precipitation, temperature, runoff, and water loss data for Cedar River Basin above Cedar Rapids, Iowa*

Year	Precipitation (inches)		Temperature (°F.)		Runoff Cedar Rapids (inches)		Water Loss (inches)	
	Annual	Moving 10-year average	Annual	Moving 10-year average	Annual	Moving 10-year average	Annual	Moving 10-year average
1895	24.59	.....	46.5	.....	.....	.....	.....	.....
1896	35.20	.....	49.0	.....	.....	.....	.....	.....
1897	26.59	.....	47.5	.....	.....	.....	.....	.....
1898	28.70	.....	48.0	.....	.....	.....	.....	.....
1899	28.84	.....	47.5	.....	.....	.....	.....	.....
1900	34.84	.....	47.5	.....	.....	.....	.....	.....
1901	24.82	.....	47.5	.....	.....	.....	.....	.....
1902	45.79	.....	47.2	.....	.....	.....	.....	.....
1903	33.12	.....	47.0	.....	.....	.....	.....	.....
1904	25.96	30.84	44.2	47.2	4.49	.....	21.47	.....
1905	34.56	31.84	45.4	47.1	6.97	.....	27.59	.....
1906	34.14	31.74	46.8	46.8	8.23	.....	25.91	.....
1907	32.92	32.37	45.5	46.6	9.00	.....	23.92	.....
1908	33.75	32.87	47.9	46.6	6.72	.....	27.03	.....
1909	35.15	33.50	45.6	46.4	10.55	.....	24.60	.....
1910	17.84	31.80	46.6	46.4	4.27	.....	13.57	.....
1911	33.51	32.67	47.4	46.4	3.63	.....	29.88	.....
1912	29.00	31.00	44.3	46.1	6.56	.....	22.44	.....
1913	31.34	30.82	48.0	46.2	4.84	6.53	26.50	24.29
1914	34.70	31.69	47.4	46.5	3.99	6.48	30.71	25.22
1915	38.77	32.11	46.1	46.6	12.13	6.99	26.64	25.12
1916	29.22	31.62	45.3	46.4	7.59	6.93	21.63	24.69
1917	28.73	31.20	42.6	46.1	6.22	6.65	22.51	24.55
1918	36.99	31.52	47.2	46.0	7.51	6.73	29.48	24.80
1919	34.56	31.47	47.5	46.2	9.16	6.59	25.40	24.88
1920	33.19	33.00	47.3	46.3	6.80	6.84	26.39	26.16
1921	29.77	32.63	51.0	46.7	5.61	7.04	24.16	25.59
1922	28.38	32.56	48.9	47.1	5.06	6.89	23.32	25.67
1923	30.37	32.47	47.8	47.1	3.61	6.77	26.76	25.70
1924	33.18	32.32	44.9	46.9	6.64	7.03	26.54	25.28
1925	27.72	31.21	47.1	47.0	3.48	6.17	24.24	25.04
1926	29.24	31.21	46.4	47.1	4.39	5.85	24.85	25.36
1927	29.12	31.25	47.0	47.5	6.11	5.84	23.01	25.42
1928	36.67	31.22	47.8	47.6	8.47	5.93	28.20	25.29
1929	28.43	30.61	44.6	47.3	8.63	5.88	19.80	24.73
1930	29.15	30.20	48.4	47.4	3.52	5.55	25.63	24.65
1931	32.15	30.44	52.4	47.5	2.97	5.29	29.18	25.15
1932	31.34	30.74	46.8	47.3	6.97	5.48	24.37	25.26
1933	25.62	30.26	48.8	47.4	4.95	5.61	20.67	24.65
1934	29.03	29.85	49.2	47.8	1.57	5.11	27.46	24.74
1935	32.10	30.28	46.6	47.8	5.51	5.31	26.59	24.98
1936	28.99	30.26	46.0	47.8	5.26	5.40	23.73	24.86
1937	30.08	30.36	45.7	47.6	6.51	5.44	23.57	24.92
1938	39.33	30.62	49.6	47.8	6.37	5.23	32.96	25.40
1939	24.42	30.21	49.3	48.3	3.91	4.75	20.51	25.47
1940	34.94	38.00	46.6	48.1	2.99	4.70	31.95	26.10

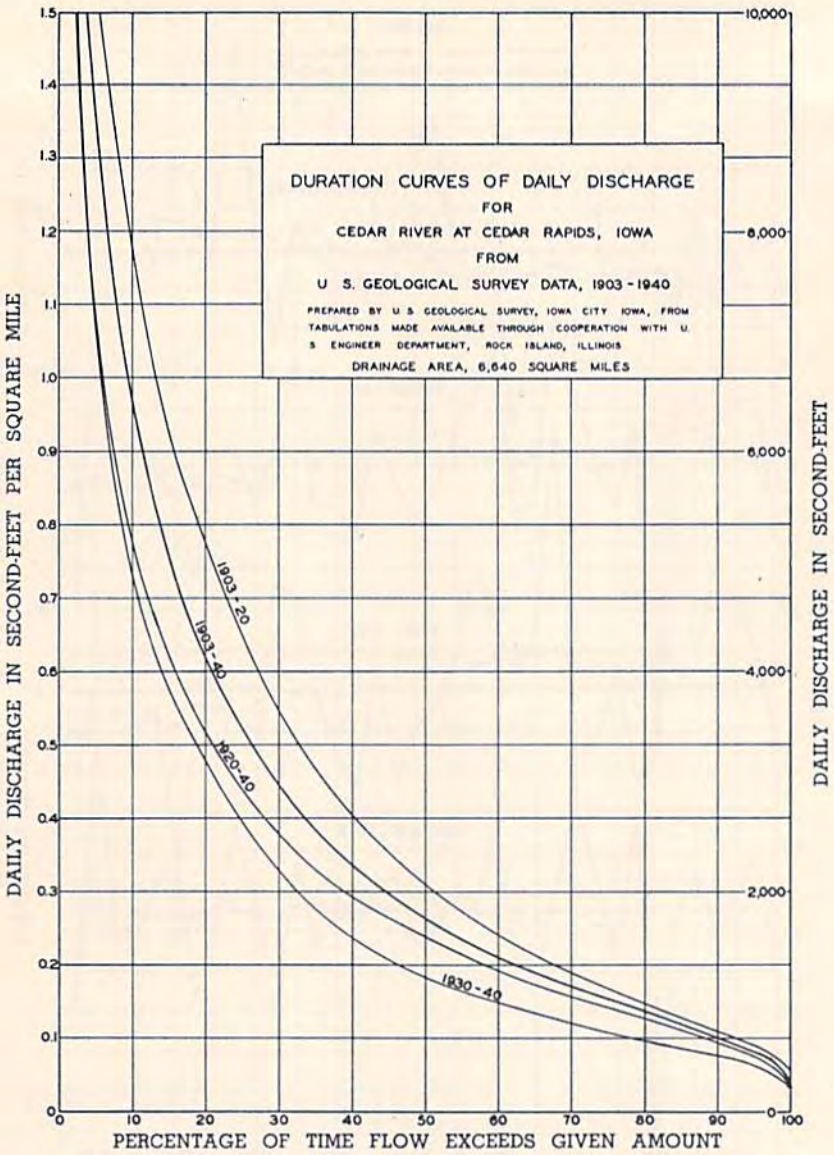

Fig. 2.—Duration curves of daily discharge for Cedar River at Cedar Rapids, Iowa.

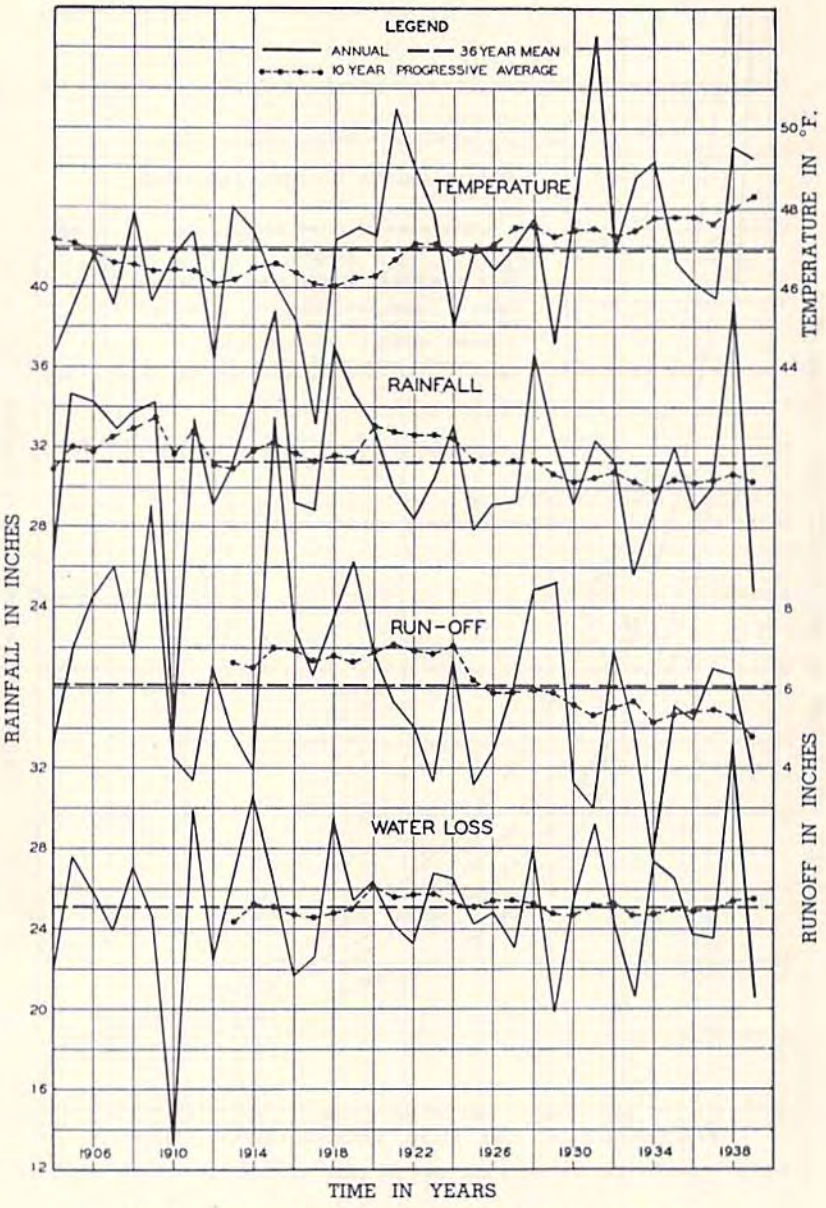

Fig. 3.—Graphs of climatological and runoff data, Cedar River at Cedar Rapids, Iowa.

Shell Rock River at Greene, Iowa

LOCATION.—Lat. 42°54′, long. 92°48′, in sec. 1, T. 93 N., R. 17 W., in tailwater of Central States Power and Light Corporation's hydroelectric plant at Greene, about 5 miles upstream from Coldwater Creek.

DRAINAGE AREA.—1,375 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record furnished by Central States Power and Light Corporation. Several years of gage-height and discharge records were collected by the Corporation prior to July 1933.

RECORDS AVAILABLE.—July 1933 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Nonrecording gage read hourly.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 7,000 second-feet. Affected by ice at extreme low temperatures. Stream bed composed of sand, gravel, and small boulders. Left bank high and wooded; right bank subject to overflow.

AVERAGE DISCHARGE.—7 years, 390 second-feet.

EXTREMES.—1933-40: Maximum discharge, 12,000 second-feet June 25, 1938 (gage height, 101.7 feet), from rating curve extended above 7,000 second-feet; minimum, about 6 second-feet on many days during 1935-36 when power plant was shut down.

REMARKS.—Bank-full stage, about 104 feet. Flow regulated at medium and low stages by power plant at station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1934	760-195	3,600	14	105	0.076	1.03	3,600	14	108	0.079	1.06
1935	785-192	6,660	6	287	.209	2.83	6,660	6	300	.218	2.96
1936	805-211	6,360	20	478	.348	4.72	6,360	20	499	.363	4.93
1937	825-250	9,660	20	502	.365	4.94	9,660	25	477	.347	4.70
1938	855-265	8,630	25	680	.495	6.70	8,630	25	768	.559	7.57
1939	875-268	7,770	42	474	.345	4.68	7,770	39	383	.279	3.78
1940	895–	2,600	15	207	.151	2.05	.....	.....	.....	.....	.....

Shell Rock River near Clarksville, Iowa

LOCATION.—Lat. 42°47′, long. 92°41′, on line between secs. 12 and 13, T. 92 N., R. 16 W., at highway bridge 1¼ miles northwest of Clarksville, 5 miles downstream from Flood Creek and 25 miles upstream from Cedar River.

DRAINAGE AREA.—1,660 square miles above gage; 2,680 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—May 1915 to September 1927, November 1932 to September 1934 in water-supply papers of U. S. Geological Survey; May 1915 to September 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 317-328.

GAGE.—Nonrecording gage read once daily. In general, gage readings were discontinued or intermittent during ice periods.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 10,000 second-feet. Affected by ice; otherwise fairly permanent, the stream bed being composed of gravel and small boulders. Right bank high; left bank subject to overflow at extremely high stages.

AVERAGE DISCHARGE.—13 years (1915-27, 1933-34), 558 second-feet.

EXTREMES.—1915-27, 1932-34: Maximum discharge observed, 19,800 second-feet Mar. 31, 1933 (gage height, 16.7 feet), from rating curve extended above 10,000 second-feet; minimum discharge observed, 10 second-feet Aug. 2, 1934.

REMARKS.—Bank-full stage, about 11 feet. Some diurnal fluctuation caused by power plant at Greene about 10 miles upstream.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	*435–169	.....	.....	1,040	0.627	8.53	.....	.....	930	0.560	7.62
1917	*455–151	.....	.....	774	.466	6.32	.....	.....	780	.470	6.38
1918	*475–112	.....	.....	627	.378	5.13	.....	.....	810	.488	6.62
1919	*505–205	.....	.....	1,130	.681	9.24	.....	.....	980	.590	8.01
1920	505–205	.....	.....	611	.368	5.01	.....	.....	690	.416	5.66
1921	525–124	7,280	140	651	.392	5.31	.....	.....	558	.336	4.56
1922	*545–123	.....	.....	447	.269	3.65	.....	.....	420	.253	3.43
1923	*565–110	.....	.....	203	.122	1.66	.....	.....	249	.150	2.04
1924	*585–113	.....	.....	447	.269	3.66	.....	.....	426	.257	3.50
1925	*605–109	.....	.....	331	.199	2.70	.....	.....	340	.205	2.78
1926	*625–103	.....	.....	369	.222	3.01	.....	.....	320	.193	2.62
1927	*645– 70	.....	.....	606	.365	4.95	.....	.....	.....	.....	.....
1933	745–160	.....	.....	.....	.....	.....	16,800	30	531	.320	4.35
1934	760–197	3,160	10	112	.067	.90	.....	.....	.....	.....	.....

*See page 40.

Lime Creek at Mason City, Iowa

LOCATION.—Lat. 43°10′, long. 93°11′, in sec. 3, T. 97 N., R. 20 W., at Fourteenth Street bridge in Mason City, about half a mile upstream from Willow Creek.

DRAINAGE AREA.—535 square miles.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—December 1932 to September 1940 in water-supply papers of the U. S. Geological Survey.

GAGES.—Nonrecording gage December 1932 to October 1934 read once daily except during periods of high runoff, when more frequent readings were made. Recording gage thereafter. Datum of recording gage is 6.45 feet lower than that of former gage.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 7,000 second-feet. Affected by ice at extremely low temperatures; otherwise reasonably permanent due to a concrete control for low stages and a stream bed composed of rock and gravel.

AVERAGE DISCHARGE.—7 years, 136 second-feet.

EXTREMES.—1932-40: Maximum discharge, about 9,400 second-feet Mar. 30, 1933 (gage height, 15.70 feet, recorder datum, from gage reading at flood crest); practically no flow Aug. 30 to Sept. 1, 1933.

REMARKS.—Top of dike near gage on right bank at gage height 17 feet. Some water diverted above gage for industrial use with resultant sewage and some additional water being returned to stream above gage.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1933	745-161	.....	.....	.....	.....	.....	7,500	1	178	0.333	4.52
1934	760-198	845	2.5	26.4	0.049	.67	845	2.5	29.2	.055	.74
1935	825-251	2,100	5.0	99.4	.186	2.52	2,100	8.5	101	.189	2.56
1936	825-251	2,450	6.9	137	.256	3.50	2,450	6.9	144	.269	3.68
1937	825-251	3,940	13	171	.320	4.33	3,940	11	161	.301	4.09
1938	855-266	3,910	10.5	269	.503	6.83	3,910	10.5	307	.574	7.80
1939	875-269	2,760	9.1	190	.355	4.81	2,760	9.1	152	.284	3.84
1940	895-	800	7.7	59.3	.111	1.49	.....	.....	.....	.....	.....

NOTE.—On plate 3-A is shown a photograph of the gaging-station structure at Mason City. Also, on the next page is given a frequency analysis of the daily discharge records which have been collected at this station.

TABLE 4.—*Days of deficiency in discharge of Lime Creek at Mason City, Iowa, during the period of record for the years ending Sept. 30, 1933-40*

Discharge		Number of days when discharge was less than that shown in first two columns and equal to or greater than that shown on preceding line									Period of Record		
											Deficiency		Duration
Sec.-ft. per sq. mi.	Sec.-ft.	1933 (a)	1934	1935	1936	1937	1938	1939	1940	Total	Days	Percent of time	Percent of time
0.002	1	0	....	....	....	....	....	....	....	0	0	0	100
.004	2	3	0	....	....	....	....	....	....	3	3	.1	99.9
.006	3	1	4	....	....	....	....	....	....	5	8	.3	99.7
.007	4	1	20	....	....	....	....	....	....	21	29	1.0	99.0
.009	5	2	22	0	0	....	....	....	....	24	53	1.9	98.1
.013	7	2	75	8	3	....	....	0	0	88	141	4.9	95.1
.019	10	6	64	21	38	....	0	1	24	154	295	10.3	89.7
.026	14	31	56	51	55	0	37	6	53	289	584	20.4	79.6
.036	19	32	32	43	57	27	51	16	62	320	904	31.7	68.3
.050	27	48	44	37	39	76	34	20	80	378	1,282	44.9	55.1
.069	37	38	14	40	26	48	8	16	33	223	1,505	52.7	47.3
.097	52	17	9	32	28	40	18	41	23	208	1,713	60.0	40.0
.131	70	16	8	17	29	18	10	50	20	168	1,881	65.9	34.1
.187	100	26	5	14	21	19	23	52	18	178	2,059	72.1	27.9
.262	140	17	2	29	12	17	30	51	12	170	2,229	78.0	22.0
.374	200	18	2	25	9	26	32	27	16	155	2,384	83.5	16.5
.505	270	11	2	13	10	32	20	20	10	118	2,502	87.6	12.4
.710	380	5	1	16	7	20	28	20	7	104	2,606	91.2	8.8
.972	520	7	1	6	8	19	16	15	5	77	2,683	93.9	6.1
1.33	710	3	1	8	4	10	21	8	0	55	2,738	95.9	4.1
1.87	1,000	2	3	3	7	7	18	10	3	53	2,791	97.7	2.3
2.62	1,400	3	0	0	4	1	9	8	0	25	2,816	98.6	1.4
3.74	2,000	2	....	1	4	2	4	2	....	15	2,831	99.1	.9
5.05	2,700	3	....	1	5	1	2	1	....	13	2,844	99.6	.4
7.10	3,800	1	....	0	0	1	3	1	....	6	2,850	99.8	.2
9.72	5,200	1	....	....	....	1	1	0	....	3	2,853	99.9	.1
13.3	7,100	2	....	....	....	0	0	....	....	2	2,855	100.0	.0
18.7	10,000	1	....	....	....	....	....	....	....	1	2,856	100.0	.0
26.2	14,000	0	....	....	....	....	....	....	....	0	.....	.....	.....

a) Period Dec. 6, 1932 to Sept. 30, 1933.

NOTE.—The deficiency table 4 shows the number of days in each year on which the mean daily discharge was less than the discharge given in the table. By subtraction the table gives the number of days each year that the mean daily discharge was between the discharges given in the table and, also by subtraction, the number of days that the mean daily discharge was equal to or greater than the discharge given.

"Flow-duration curve" is an accumulative frequency curve showing the length or percent of time during which given limits of flow are equalled or exceeded. A "Deficiency curve" can be obtained directly from a flow-duration curve by simply reversing the time scale of the duration curve. Both curves are prepared from tables similar to that given above.

Skunk River near Ames, Iowa

LOCATION.—Lat. 42°04'06", long. 93°37'02", in SW¼ sec. 23, T. 84 N., R. 24 W., 2½ miles north of Ames, 3½ miles downstream from Keigley Branch and 5 miles upstream from Squaw Creek.

DRAINAGE AREA.—320 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. For several years gage-height record collected in cooperation with Iowa State College.

RECORDS AVAILABLE.—July 1920 to August 1927, March 1933 to September 1940 in water-supply papers of U. S. Geological Survey. July 1920 to August 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 329-335.

GAGES.—Nonrecording gage read once daily to August 1921; recording gage thereafter.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 2,900 second-feet. Reinforced concrete artificial control with 90° V-notch weir forms low water-control. Stream bed composed of ledge rock overlain in most places by sand and silt. Both banks high but right bank will overflow at extremely high stages. Point of zero flow at gage height 1.31 feet.

AVERAGE DISCHARGE.—13 years (1920-26, 1933-40), 97.9 second-feet.

EXTREMES.—1920-27, 1933-40: Maximum discharge, 3,540 second-feet Sept. 17, 1921 (gage height, 9.2 feet), from rating curve extended above 2,500 second-feet; no flow at times during June, July and August 1934, and Jan. 25, 1937.

REMARKS.—Bank-full stage, about 8 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1921	525–126	2,910	1.5	161	0.503	6.84	2,910	1.5	143	0.447	6.06
1922	545–124	2,420	6	115	.359	4.88	2,420	6	89.6	.280	4.57
1923	565–112	1,460	2	80.7	.252	3.43	1,460	2	94.3	.295	4.00
1924	585–114	2,440	.....	202	.631	8.59	2,440	.....	195	.609	8.30
1925	605–110	370	2	39.0	.122	1.65	394	2	36.1	.113	1.52
1926	625–105	2,850	.....	93.8	.293	3.97	2,850	1	119	.372	5.03
1934	760–200	420	.....	11.3	.035	.48	420	0	20.5	.064	.87
1935	785–198	2,790	1.4	156	.488	6.63	2,790	5.7	173	.541	7.34
1936	805–117	2,520	.18	118	.369	5.02	2,520	.18	93.5	.292	3.97
1937	825–258	2,000	.3	73.5	.230	3.12	2,000	.20	71.8	.224	3.05
1938	855–271	2,360	.15	110	.344	4.66	2,360	.15	117	.366	4.98
1939	875–277	2,420	.21	72.2	.226	3.06	2,420	.21	64.9	.203	2.74
1940	895–	1,000	.10	39.8	.124	1.67	.....	.....	.....	.....	.....

Skunk River at Coppock, Iowa

LOCATION.—Lat. 41°09'26", long. 91°43'05", in sec. 1, T. 73 N., R. 8 W., at bridge on State Highway 78 half a mile west of Coppock, and about three quarters of a mile upstream from Crooked Creek. Prior to Oct. 1, 1937, at site an eighth of a mile upstream.

DRAINAGE AREA.—2,890 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records, except October 1927 to October 1932, when station was operated by Mississippi River Power Co. Beginning in October 1932 station operated through cooperation with Mississippi River Power Co.

RECORDS AVAILABLE.—October 1913 to September 1940 in water-supply papers of U. S. Geological Survey. October 1913 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 336-351.

GAGES.—Nonrecording gage read once daily, except prior to winter of 1920-21 when readings were made once a week or oftener while the river was frozen over. Subsequent to 1917, several readings daily during rapidly changing stage. Prior to Oct. 1, 1937, gage was at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 19,000 second-feet. Seriously affected by ice and, at times, by backwater from Crooked Creek. Stream bed composed of sand and silt, subject to minor shifts. Banks subject to overflow, but highway fill confines flow to one channel at gage.

AVERAGE DISCHARGE.—26 years (1914-40), 1,292 second-feet.

EXTREMES.—1913-40: Maximum discharge observed, 25,200 second-feet June 15, 1930 (gage-height, 22.13 feet, site and datum then in use), from rating curve extended above 10,300 second-feet; minimum daily discharge, 8 second-feet (estimated) Jan. 27, 28, 1940.

HISTORICAL DATA.—Flood of June 15, 1930 reached the highest stage known. A stage of about 22.0 feet occurred on or about May 31, 1903.

REMARKS.—Bank-full stage, about 8 feet. Flood stages and discharges, 1914-34, listed in Water-Supply Paper 771, p. 267.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1914	*385-219	.....	.....	.....	.....	.....	6,430	.....	629	0.218	2.95
1915	405-169	13,700	.....	2,520	0.872	11.75	13,700	.....	2,880	.997	13.52
1916	435-170	15,000	105	1,890	.654	8.90	15,000	52	1,350	.467	6.36
1917	*455-152	15,400	.....	1,374	.475	6.44	15,400	.....	1,360	.471	6.39
1918	*475-113	18,800	.....	998	.345	4.68	18,800	.....	1,020	.353	4.78
1919	505-209	11,500	82	1,390	.481	6.48	11,500	82	1,830	.633	8.59
1920	505-209	12,200	246	1,970	.682	9.28	12,200	178	1,570	.543	7.40
1921	525-128	11,000	168	1,080	.374	5.07	11,000	168	1,240	.429	5.84
1922	545-126	5,910	200	1,260	.436	5.72	5,910	160	1,090	.377	5.15
1923	565-113	5,260	150	831	.288	3.91	5,580	150	972	.336	4.56
1924	585-116	18,000	200	1,760	.609	8.29	18,000	180	1,640	.567	7.76
1925	605-112	4,360	79	480	.166	2.27	4,360	79	501	.173	2.37
1926	625-106	17,900	146	1,660	.574	7.77	17,900	146	2,110	.730	9.91
1927	645- 72	11,600	76	1,810	.626	8.50	11,600	76	1,370	.474	6.43
1928	730-139	10,600	100	1,430	.495	6.72	10,600	200	1,880	.651	8.86
1929	730-139	16,000	232	2,270	.785	10.68	16,000	200	1,780	.616	8.35
1930	730-139	22,200	68	982	.339	4.60	22,200	20	905	.313	4.25
1931	730-139	3,360	20	303	.105	1.41	12,100	20	1,050	.363	4.92
1932	730-139	12,100	311	2,390	.827	11.25	8,540	197	1,780	.616	8.36
1933	745-163	9,960	67	1,110	.384	5.20	9,960	20	957	.331	4.48
1934	760-201	1,640	18	111	.038	.51	1,640	18	138	.048	.65
1935	785-199	7,740	25	1,269	.439	5.98	7,740	50	1,406	.487	6.61
1936	805-218	11,200	49	1,120	.388	5.29	11,200	49	999	.346	4.72
1937	825-259	17,700	54	1,163	.402	5.49	17,700	14	1,112	.385	5.24
1938	855-272	8,500	14	1,010	.349	4.74	8,500	48	1,083	.375	5.08
1939	875-278	15,500	79	971	.336	4.54	15,500	38	905	.313	4.23
1940	895-	3,230	8	449	.155	2.12	.....	.....	.....	.....	.....

*See page 40.

Skunk River at Augusta, Iowa

LOCATION.—Lat. 40°46′, long. 91°17′, in NE¼ sec. 26, T. 69 N., R. 4 W., on left bank, 300 feet upstream from bridge on former State Highway 16 at Augusta, 2 miles upstream from Long Creek and 12.2 miles upstream from mouth.

DRAINAGE AREA.—4,290 square miles above gage; 4,350 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records, except September to November 1913 from records of Hydraulic Engineering Co. of Maine and 1927-32, when station was operated by Mississippi River Power Co. Beginning in 1932 station operated through cooperation with Mississippi River Power Co. and since 1935 in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—September to November 1913, May 1915 to September 1940 in water-supply papers of U. S. Geological Survey. September to November 1913, May 1915 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 352-367.

GAGES.—Nonrecording gage read once daily prior to Jan. 15, 1935; recording gage thereafter. Datum of gage is 521.69 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 46,000 second-feet; relation fairly permanent. Stream-bed composed of sand, low-water control formed by rocks in channel at downstream side of bridge below gage.

AVERAGE DISCHARGE.—25 years (1915-40), 1,999 second-feet.

EXTREMES.—1913, 1915-40: Maximum discharge observed, 44,500 second-feet June 17, 1930 (gage-height, 22.55 feet); minimum observed, 7 second-feet Aug. 27 to Sept. 1, 1934 (gage-height, 1.0 foot).

HISTORICAL DATA.—The flood of about June 1, 1903 reached a stage of approximately 21.0 feet; that of June 17, 1930 is the maximum stage known.

REMARKS.—Bank-full stage, about 13 feet, and flood stage about 15 feet. U. S. Weather Bureau uses readings from this gage. Some regulation during low water caused by operation of power plant of Iowa Electric Co. at Oakland Mills about 26 miles above station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	505–212	30,800	150	3,030	0.706	9.60	30,800	57	2,420	0.564	7.66
1917	505–212	27,000	57	2,030	.473	6.42	27,000	60	2,000	.466	6.32
1918	505–212	25,600	.....	1,430	.333	4.53	25,600	.....	1,470	.343	4.65
1919	505–212	21,400	27	1,990	.464	6.31	21,400	27	2,600	.606	8.23
1920	505–212	24,300	244	2,870	.669	9.12	24,300	73	2,280	.531	7.27
1921	525–130	11,500	73	1,490	.347	4.72	11,500	252	1,740	.406	5.51
1922	545–128	10,100	250	1,750	.408	5.54	10,100	90	1,520	.354	4.80
1923	565–115	8,320	80	1,030	.240	3.27	8,320	80	1,210	.282	3.83
1924	585–118	26,000	250	2,640	.615	8.39	26,000	210	2,520	.587	7.97
1925	605–114	12,000	62	1,000	.234	3.16	12,000	62	1,170	.273	3.69
1926	625–108	30,100	137	2,890	.674	9.14	30,100	137	3,560	.830	11.23
1927	645–73	23,400	75	3,420	.797	10.82	23,400	75	2,720	.634	8.62
1928	730–143	19,400	88	2,280	.531	7.21	25,000	250	3,180	.741	10.06
1929	730–143	26,000	218	3,960	.923	12.53	26,000	218	2,960	.690	9.37
1930	730–143	43,300	26	1,610	.375	5.09	43,300	20	1,480	.345	4.67
1931	730–143	12,700	20	694	.162	2.19	17,600	30	1,860	.434	5.87
1932	730–143	18,700	385	3,840	.895	12.18	18,700	.....	3,030	.706	9.63
1933	745–164	19,200	62	2,080	.485	6.58	19,200	20	1,693	.395	5.35
1934	760–202	1,960	7	152	.035	.49	3,740	7	230	.054	.74
1935	785–200	16,300	16	2,168	.505	6.86	16,300	60	2,326	.542	7.35
1936	805–219	15,000	52	1,634	.381	5.18	15,000	52	1,543	.360	4.88
1937	825–260	18,700	66	2,010	.469	6.32	18,700	16	1,857	.433	5.85
1938	855–273	17,600	16	1,681	.392	5.33	17,600	50	1,789	.417	5.66
1939	875–279	27,400	96	1,648	.384	5.21	27,400	27	1,549	.361	4.90
1940	895–	9,450	13	654	.152	2.07	.....	.....	.....	.....	.....

Squaw Creek at Ames, Iowa

LOCATION.—Lat. 42°01′, long. 93°38′, in sec. 3, T. 83 N., R. 24 W., at Lincoln Highway bridge in Ames, about 2 miles upstream from junction with Skunk River. Prior to Mar. 10, 1925 at foot-bridge 1,700 feet upstream from Chicago & Northwestern Railway bridge in Ames.

DRAINAGE AREA.—210 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. For a few years, records collected in cooperation with the Engineering Experiment Station of Iowa State College.

RECORDS AVAILABLE.—May 1919 to April 1927 in water-supply papers of U. S. Geological Survey and in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 368-376.

GAGES.—Nonrecording gages at both sites, read twice daily and oftener during high stages. Observations discontinued during some winters.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 2,500 second-feet. Channel control subject to shifting.

AVERAGE DISCHARGE.—5 years (1919-24), 110 second-feet.

EXTREMES.—1919-1927: Maximum discharge, 3,920 second-feet July 17, 1922 (gage-height, 10.4 feet); no flow August 26 to September 17, 1919.

HISTORICAL DATA.—The flood of June 4, 1918 reached a stage of about 14.5 feet (discharge about 6,900 second-feet, from rating curve extended above 5,500 second-feet), and is the highest stage known.

REMARKS.—Bank-full stage, about 11 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1919	505–218	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1920	505–218	1,720	2.9	141	0.671	9.12	1,570	2.9	110	0.524	7.14
1921	525–132	1,520	4.2	104	.495	6.74	1,520	4.2	96.8	.461	6.24
1922	545–130	3,220	4	100	.476	6.46	3,220	.....	95.7	.456	6.18
1923	565–117	1,110	1	60.3	.281	3.89	.....	.....	71.5	.340	4.62
1924	585–120	2,180	.....	144	.686	9.28	.....	.....	.....	.....	.....
1925	605–115	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1926	625–109	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1927	645– 74	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....

West Fork of Des Moines River near Jackson, Minn.

(Published as Des Moines River near Jackson, Minn. prior to 1936)

LOCATION.—Lat. 43°42′, long. 95°03′, in sec. 28, T. 103 N., R. 35 W., 6 miles northwest of Jackson. Prior to December 1913, at site 8 miles downstream.

DRAINAGE AREA.—1,170 square miles above upper gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—May 1909 to December 1913 (at site 8 miles downstream), August 1930 to September 1940, in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once daily, with additional readings during high stages. Prior to 1936, readings were discontinued during ice periods. Datum of gage is 1,304.85 feet above mean sea level, datum of 1929; gage at former site at different datum.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 2,400 second-feet. Seriously affected by ice. Stream bed composed of sand and gravel.

AVERAGE DISCHARGE.—5 years (1935-40), 160 second-feet.

EXTREMES.—1909-13, 1930-40: Maximum discharge observed, 2,320 second-feet March 22, 1936 (gage height, 9.60 feet); maximum gage height observed, 10.05 feet June 30, 1909, site and datum then in use; no flow at times.

HISTORICAL DATA.—Highest stage observed at present site, 10.01 feet July 9, 1938 (discharge, 2,200 second-feet).

REMARKS.—Bank-full stage, about 10.5 feet. Flow partly regulated by Yankton, Long, Shetek, and Heron Lakes.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1909	265–172										
1910	285–270										
1911	305–153										
1912	325–150										
1913	355–171										
1930	715–127	.....	.....	.....	.....	Incom	plete	.....	.....	.....	.....
1931	715–127										
1932	730–147										
1933	745–165										
1934	760–203										
1935	785–201										
1936	805–220	2,270	0	142	0.121	1.65	2,270	0	142	0.121	1.65
1937	825–262	1,150	0	142	.121	1.64	1,150	0	143	.122	1.66
1938	855–275	2,200	.....	396	.338	4.59	2,200	.....	415	.355	4.81
1939	875–281	524	.....	87.5	.075	1.03	474	1.0	68.7	.059	.80
1940	895–	449	0	35.0	.030	.41	.....	.....	.....	.....	.....

Des Moines River at Kalo, Iowa

LOCATION.—Lat. 42°26′, long. 94°08′, in sec. 17, T. 88 N., R. 28 W., at highway bridge at Kalo, 1½ miles east of Otho, 1½ miles upstream from Holiday Creek, and 7 miles downstream from Fort Dodge. October 1921 to June 1927, at site 300 feet downstream.

DRAINAGE AREA.—4,170 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—October 1913 to September 1927 in water-supply papers of U. S. Geological Survey and in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 383-395. Also in same reports, fragmentary records in Fort Dodge April 1905 to July 1906 below mouth of Lizard Creek, and August 1911 to October 1913 above Lizard Creek.

GAGES.—Nonrecording gage read once daily prior to October 1921, and also June to September 1927 (in general, readings were discontinued during ice periods); recording gage October 1921 to June 1927.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 16,000 second-feet. Seriously affected by ice. Stream bed composed of sand and gravel.

AVERAGE DISCHARGE.—13 years (1914-27), 1,451 second-feet.

EXTREMES.—1913-27: Maximum discharge observed, 18,500 second-feet May 30, 1915 (gage height, 14.0 feet); minimum recorded, 14 second-feet (regulated) several times Oct. 9-15, 1922, Sept. 13, 1925; minimum gage height recorded, —0.15 foot (regulated) Oct. 15, 1922.

HISTORICAL DATA.—The flood of May 30, 1915 was a typical early summer flood, resulting from a succession of heavy rains over a large part of the basin. The amount of rainfall received decreased with the distance upstream so that the Minnesota Lake region was a negligible factor in regulating the flow, and the peak was correspondingly sharp and well defined. Other notable floods occurred at Kalo on Mar. 22, 1917, and July 9, 1920.

REMARKS.—Diurnal fluctuation at low stages caused by operation of City power plant at Fort Dodge, about 7 miles above station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1914	*385-221	.....	.....	.....	.....	.....	.....	.....	958	0.230	3.12
1915	*405-172	.....	.....	3,530	0.847	11.52	.....	.....	3,870	.928	12.62
1916	*435-173	.....	.....	2,370	.568	7.76	.....	.....	1,890	.453	6.20
1917	*455-155	.....	.....	1,550	.372	5.05	.....	.....	1,560	.374	5.06
1918	*475-116	.....	.....	961	.230	3.11	.....	.....	1,200	.288	3.89
1919	*505-221	10,200	.....	2,440	.585	7.92	10,200	.....	2,220	.532	7.22
1920	*505-221	13,700	28	1,970	.472	6.44	13,700	28	2,160	.518	7.06
1921	525-133	6,600	210	1,400	.336	4.56	6,600	210	1,290	.309	4.19
1922	545-132	7,340	48	907	.218	2.94	7,340	30	796	.191	2.58
1923	565-119	4,160	.....	356	.085	1.17	4,160	.....	465	.112	1.52
1924	585-121	3,300	.....	822	.197	2.68	3,300	.....	764	.183	2.50
1925	*605-117	.....	.....	470	.113	1.55	.....	.....	456	.109	1.51
1926	*625-111	.....	.....	441	.106	1.43	.....	.....	554	.133	1.79
1927	*645- 75	.....	.....	1,650	.396	5.36	.....	.....	.....	.....	.....

*See page 40.

Des Moines River near Boone, Iowa

LOCATION.—Lat. 42°04'40", long. 93°55'55", in NE¼ sec. 24, T. 84 N., R. 27 W., above dam of Boone Water Department, 2 miles northwest of Boone and 2.2 miles upstream from Bluff Creek; October 1924 to September 1927, at highway bridge 0.3 mile upstream. Prior to Oct. 9, 1924 at S. E. corner Sec. 12, T. 84 N., R. 27 W., at highway bridge at Centerville, 1.3 mile upstream.

DRAINAGE AREA.—5,490 square miles above gage; above site 1.3 mile upstream, 5,480 square miles.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record October 1924 to September 1927 collected in cooperation with U. S. Weather Bureau, and, since October 1933, in cooperation with City of Boone.

RECORDS AVAILABLE.—April 1920 to September 1927, October 1933 to September 1940 in water-supply papers of U. S. Geological Survey. April 1920 to September 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 396-402.

GAGES.—Nonrecording gage read once daily prior to October 1924, twice daily thereafter to September 1927, and October 1933 to February 1935, with additional readings during the entire period on days of rapidly changing stage. Recording gage subsequent to February 1935. Datum of recording gage (crest of dam) is 871.52 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 23,000 second-feet. Both banks are high. Reinforced concrete dam of Boone Water Department forms control at low and medium stages; seldom affected by ice.

AVERAGE DISCHARGE.—14 years, 1,240 second-feet.

EXTREMES.—1920-27, 1933-40: Maximum discharge, 24,500 second-feet Sept. 18, 1938 (gage height, 16.00 feet); no flow for a short time Jan. 9, 25, 1938, caused by manipulation of gates in control dam; minimum daily discharge, about 17 second-feet Jan. 28, 1940.

HISTORICAL DATA.—Highest stage observed at recording gage site, 17.03 feet Apr. 2, 1933 (control dam destroyed, discharge not determined). A stage of about 20.5 feet, from floodmarks, occurred June 6, 1918, at site 1.3 miles upstream (discharge, 32,000 second-feet, estimated, from rating curve extended above 17,000 second-feet). A stage of 23.6 feet occurred in 1903 at site 2.5 miles downstream (discharge, 32,000 second-feet, estimated, from rating curve extended above 28,000 second-feet).

REMARKS.—Slight diurnal fluctuation at low stages caused by power plants above station. Intermittent gage-height observations by U. S. Weather Bureau 1905 to 1919 (at Chicago & Northwestern Railway bridge about 2.5 miles below recording gage site) and 1927 to 1929, 1933, 1936 to 1940 (at highway bridge 0.3 mile above recording gage site). Zero of U. S. Weather Bureau gage reported 864.83 feet above mean sea level; flood stage, 20 feet.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1921	525–135	10,400	265	2,090	0.381	5.18	10,400	175	1,860	0.339	4.60
1922	545–134	11,200	68	1,260	.230	3.12	11,200	.....	1,120	.204	2.77
1923	*565–121	6,520	.....	553	.101	1.34	6,520	.....	712	.130	1.73
1924	*585–123	7,350	.....	1,370	.250	3.41	7,350	.....	1,270	.232	3.18
1925	*605–119	4,150	.....	662	.121	1.62	6,080	.....	736	.134	1.80
1926	*625–112	6,080	.....	730	.133	1.80	4,980	.....	778	.142	1.92
1927	*645– 76	10,100	88	2,030	.370	5.00	.....	.....	.....	.....	.....
1934	760–204	6,290	40	294	.054	.73	6,290	51	326	.059	.82
1935	785–202	16,300	77	1,386	.252	3.42	16,300	84	1,383	.252	3.41
1936	805–221	12,200	40	1,223	.223	3.03	12,200	40	1,235	.225	3.06
1937	825–263	17,700	55	1,611	.293	3.99	17,700	55	1,591	.290	3.93
1938	855–276	24,300	40	2,396	.436	5.92	24,300	40	2,755	.502	6.81
1939	875–282	12,700	54	1,360	.248	3.36	12,700	46	971	.177	2.41
1940	895–	4,270	17	388	.071	.96	.....	.....	.....	.....	.....

*See page 40.

Des Moines River at Des Moines, Iowa

LOCATION.—Lat. 41°35'30", long. 93°37'05", in sec. 4, T. 78 N., R. 24 W., above dam of Des Moines Electric Co. at Center Street in Des Moines, one mile upstream from Raccoon River. Prior to Oct. 1, 1938, at Walnut Street bridge a quarter of a mile downstream.

DRAINAGE AREA.—6,180 square miles above gage; 9,770 square miles below mouth of Raccoon River.

SOURCES OF DATA.—U. S. Geological Survey and U. S. Weather Bureau records with supplementary miscellaneous references. Gage-height record prior to October 1938 furnished in part by U. S. Weather Bureau; October 1938 to September 1940 obtained through arrangement with Des Moines Electric Co.

RECORDS AVAILABLE.—October 1902 to August 1903 (gage heights only), May 1905 to July 1906, October 1914 to February 1915 (gage heights only), March 1915 to September 1927, and October 1932 to September 1940 in water-supply papers of U. S. Geological Survey; 1893, 1894, 1897 to 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 403-420.

GAGES.—Recording gage January 1912 to September 1938; nonrecording gage read twice daily thereafter. Datum of gage is 786.05 feet above mean sea level, datum of 1929, or 12.21 feet, City datum; prior to October 1938, at datum 12.31 feet lower.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 22,000 second-feet. Affected by ice and sometimes by backwater from Raccoon River at former site; very little ice effect at Center Street dam.

AVERAGE DISCHARGE.—20 years (1915-27, 1932-40), 1,823 second-feet.

EXTREMES.—1915-27, 1932-40: Maximum discharge, about 41,500 second-feet June 7, 1918 (gage height, 16.5 feet, site and datum then in use); minimum unregulated discharge, 24 second-feet Jan. 29, 30, 1940 (gage height, —0.90 foot); no flow during brief periods due to operation of sluice gates in dam at gage. Maximum stage known, about 23 feet, site and datum then in use, May 31, 1903, caused by backwater from Raccoon River; peak discharge probably occurred June 1, 1903 (estimates vary from 35,000 to 49,000 second-feet).

HISTORICAL DATA.—Since Mar. 10, 1893, and prior to installation of recording gage, nonrecording gages were maintained at several locations by U. S. Weather Bureau. July 1897 to January 1912 gage was at Locust Street, 300 feet above Walnut Street. U. S. Geological Survey maintained a gage at Walnut Street October to December 1902, and at interurban bridge near suburb of Highland Park, about 5 miles above Walnut Street, May 1905 to July 1906.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	*545-136	18,000	.....	3,740	0.605	8.25	18,000	.....	2,880	0.466	6.34
1917	*545-136	36,900	.....	2,680	.434	5.89	36,900	.....	2,660	.430	5.86
1918	*545-136	41,000	.....	1,580	.256	3.49	41,000	.....	1,880	.304	4.16
1919	545-136	15,300	260	3,500	.566	7.71	15,300	350	3,460	.560	7.61
1920	545-136	18,200	350	3,100	.502	6.84	18,200	350	3,260	.528	7.18
1921	545-136	11,400	275	2,330	.377	5.11	11,400	275	2,120	.343	4.65
1922	545-136	11,500	150	1,610	.261	3.55	11,500	40	1,420	.230	3.13
1923	*565-123	8,000	.....	827	.134	1.80	8,000	.....	1,010	.163	2.22
1924	585-125	7,570	35	1,610	.261	3.55	7,570	35	1,490	.241	3.28
1925	*605-121	4,360	.....	917	.148	2.01	4,730	.....	962	.156	2.12
1926	625-114	12,000	70	970	.157	2.11	12,000	70	1,130	.183	2.47
1927	645- 77	12,500	174	2,430	.393	5.34	.....	.....	.....	.....	.....
1933	745-166	34,400	128	1,340	.217	2.95	34,400	60	1,290	.209	2.84
1934	760-205	5,140	56	324	.052	.72	5,140	56	355	.057	.79
1935	785-203	17,200	97	1,712	.277	3.78	17,200	100	1,750	.283	3.86
1936	805-222	13,100	66	1,499	.243	3.30	13,100	66	1,463	.237	3.22
1937	825-264	15,300	103	1,780	.288	3.92	15,300	85	1,764	.285	3.88
1938	855-277	24,400	80	2,492	.403	5.47	24,400	80	2,870	.464	6.30
1939	875-283	13,400	85	1,459	.236	3.20	13,400	63	1,050	.170	2.31
1940	895-	6,320	24	860	.091	1.25	.....	.....	.....	.....	.....

*See page 40.

Des Moines River near Tracy, Iowa

LOCATION.—Lat. 41°16'55", long. 92°51'30", in SE¼ sec. 19, T. 75 N., R. 17 W., at old Bellfontaine highway bridge, a third of a mile downstream from bridge on State Highway 92, 1 mile east of Tracy, 3 miles upstream from Cedar Creek, and 6 miles downstream from English Creek.

DRAINAGE AREA.—12,400 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records and supplementary miscellaneous references. Station operated in 1940 by financial cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—March 1920 to September 1927 (winter records fragmentary), March 1933 to December 1935, February to September 1940 in water-supply papers of U. S. Geological Survey. March 1920 to September 1927 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 421-427. Gage-height records collected at same site by Corps of Engineers, U. S. Army, April to December 1910. Intermittent gage-height observations since March 1920 obtained during months of March through August by U. S. Weather Bureau.

GAGES.—Nonrecording gage read twice daily March 1920 to September 1927, October 1933 to December 1935, and February to June 1940. Recording gage thereafter. Datum of gage is 671.78 feet above mean sea level, adjustment of 1912.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 52,000 second-feet. Seriously affected by ice. Stream bed composed of solid rock overlain in places with sand and gravel. Right bank high; left bank subject to overflow at high stages.

AVERAGE DISCHARGE.—9 years (1920-27, 1933-35), 3,202 second-feet.

EXTREMES.—1920-27, 1933-35, 1940: Maximum discharge, 54,600 second-feet June 28, 1935 (gage height, 20.20 feet, from gage reading at crest of flood); minimum, about 95 second-feet Feb. 28, 1940; minimum gage height observed, 1.98 feet June 7, 8, 1934. Maximum stage since 1851, about 25 feet May 31, 1903 (discharge about 100,000 second-feet).

HISTORICAL DATA.—The flood of May 31, 1903 was caused by heavy rainfall on May 24-31 that followed a month of extremely wet weather.

REMARKS.—Flood stage, about 14 feet.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1921	*525-137	26,500	.....	4,314	0.348	4.71	26,500	.....	4,229	0.341	4.61
1922	*545-143	25,200	.....	3,627	.292	3.95	25,200	.....	3,390	.273	3.70
1923	*565-124	25,900	.....	2,523	.203	2.77	25,900	.....	2,969	.239	3.25
1924	*585-126	37,500	.....	4,563	.368	5.01	37,500	.....	4,076	.329	4.48
1925	*605-122	11,000	.....	1,472	.119	1.61	11,000	.....	1,491	.120	1.63
1926	*625-116	37,100	.....	2,585	.208	2.83	37,100	.....	3,184	.257	3.49
1927	*645- 78	34,800	.....	5,023	.405	5.51	.....	.....	.....	.....	.....
1934	760-206	4,760	125	550	.044	.59	4,760	125	635	.051	.69
1935	785-204	51,600	164	4,160	.335	4.56	51,600	330	4,451	.359	4.88

*See page 40.

Des Moines River at Ottumwa and Eldon, Iowa

LOCATION.—Lat. 41°00′, long. 92°24′, in NE¼ sec. 25, T. 72 N., R. 14 W., at Vine Street Bridge in Ottumwa, 5½ miles upstream from Village Creek and 10 miles downstream from South Avery Creek. Prior to Mar. 19, 1935, at Market Street Bridge half a mile upstream. Oct. 1, 1930 to Mar. 31, 1935, records from gage at highway bridge at Eldon, 15 miles downstream, records considered equivalent.

DRAINAGE AREA.—13,200 square miles; 13,300 square miles at Eldon.

SOURCES OF DATA.—U. S. Geological Survey records, except gage readings furnished by U. S. Weather Bureau March 1917 to September 1930. Since March 1935, gage-height record collected in cooperation with U. S. Weather Bureau.

RECORDS AVAILABLE.—March 1917 to September 1927, January 1929 to September 1940 in water-supply papers of U. S. Geological Survey. March 1917 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 428-443.

GAGES.—Nonrecording gage read once daily prior to 1930, twice daily thereafter to March 1935; recording gage subsequent to March 1935. Datum of gage is 622.77 feet above mean sea level, datum of 1929; prior to Mar. 19, 1935 at datum 0.05 foot higher; gage at Eldon at different datum.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 55,000 second-feet at recording gage. Affected by ice. Stream bed composed of ledge rock and gravel. Right bank subject to overflow at high stages.

AVERAGE DISCHARGE.—23 years (1917-40), 3,865 second-feet.

EXTREMES.—1917-40: Maximum discharge observed, 58,700 second-feet June 11, 1917 (gage height, 16.5 feet, former site); minimum daily discharge, about 30 second-feet (regulated) Jan. 27-29, 31, Feb. 2, 3, 5-7, 1940.

HISTORICAL DATA.—Gage-height records at Ottumwa since May 23, 1894 published in annual reports of U. S. Weather "Daily River Stages of Principal Rivers of the United States." Greatest flood since about 1850 occurred May 31, 1903; estimated discharge, 100,000 second-feet.

REMARKS.—Flood stage, about 9 feet. Diurnal fluctuation at medium and low stages caused by city power plant above station. Station operated by financial assistance with City of Ottumwa under provisions of Federal Power Commission Project No. 925.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1918	*525-138	42,900	.....	2,660	0.202	2.72	42,900	.....	3,020	0.229	3.09
1919	525-138	44,700	525	7,240	.548	7.44	44,700	525	7,750	.587	7.97
1920	*525-138	34,000	.....	7,420	.562	7.64	34,000	.....	7,100	.538	7.34
1921	525-138	31,200	.....	4,700	.356	4.82	31,200	.....	4,590	.348	4.72
1922	545-145	26,100	.....	4,160	.315	4.28	26,100	.....	3,990	.302	4.10
1923	565-126	26,900	405	2,870	.218	2.96	26,900	405	3,280	.248	3.38
1924	585-128	37,600	.....	4,930	.374	5.09	37,600	.....	4,420	.335	4.57
1925	605-124	13,900	.....	1,780	.135	1.84	13,900	.....	1,840	.139	1.89
1926	625-117	35,300	405	3,110	.236	3.17	35,300	405	3,800	.288	3.89
1927	645- 79	37,200	585	5,740	.435	5.90	37,200	.....	4,910	.372	5.05
1928	*	18,800	.....	2,930	.222	3.01	22,200	.....	4,150	.314	4.27
1929	*685-112	46,700	.....	6,620	.502	6.80	46,700	.....	5,350	.405	5.50
1930	700-111	27,700	195	2,120	.161	2.17	27,700	190	2,013	.152	2.07
1931	715-129	10,800	89	815	.061	.85	35,100	89	2,686	.202	2.76
1932	730-148	35,100	870	7,780	.585	7.97	31,400	370	6,172	.464	6.32
1933	745-168	35,000	64	2,610	.196	2.65	35,000	64	2,341	.176	2.37
1934	760-207	4,840	46	578	.043	.59	4,840	46	711	.053	.72
1935	785-206	51,300	156	4,946	.373	5.08	51,300	397	5,234	.396	5.39
1936	805-223	27,800	80	3,720	.282	3.85	27,800	80	3,387	.257	3.51
1937	825-265	47,500	80	3,762	.285	3.87	47,500	90	3,680	.279	3.78
1938	855-278	24,900	75	3,712	.281	3.80	24,900	75	4,303	.326	4.41
1939	875-284	39,200	92	3,318	.251	3.42	39,200	38	2,694	.204	2.78
1940	895-	12,800	30	1,382	.105	1.42	12,800	30	1,624	.123	1.66

*See page 40.

Des Moines River at Keosauqua, Iowa

LOCATION.—Lat. 40°44', long. 91°57', in sec. 36, T. 69 N., R. 10 W., at bridge on State Highway 1 at Keosauqua, 4 miles downstream from Chequest Creek and 51 miles upstream from mouth.

DRAINAGE AREA.—13,900 square miles above gage; 14,500 square miles above mouth.

SOURCES OF DATA—U. S. Geological Survey records, except gage-height observations by Mississippi River Power Co. October 1927 to December 1932. Records, for several years, collected in cooperation with Corps of Engineers, U. S. Army and Mississippi River Power Company.

RECORDS AVAILABLE.—May 1903 to July 1906, April 1910 to September 1940 in water-supply papers of U. S. Geological Survey. May 1903 to July 1906, April 1910 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 444-465.

GAGES.—Nonrecording gage read once daily prior to April 1916, daily except Sundays, April 1916 to December 1929, and daily January 1930 to December 1933; recording gage thereafter. In general, gage readings discontinued or intermittent during ice periods. Datum of gage is 558.10 feet above mean sea level, adjustment of 1912 (by levels of Corps of Engineers, U. S. Army).

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 55,000 second-feet. Affected by ice.

AVERAGE DISCHARGE.—31 years, (1903-05, 1911-40), 4,641 second-feet.

EXTREMES.—1903-06, 1910-40: Maximum discharge, about 97,000 second-feet June 1, 1903, (gage height, 27.85 feet); minimum daily, about 40 second-feet Jan. 30, 1940.

HISTORICAL DATA.—So far as definitely known, the flood of June 1, 1903 was largest ever experienced on the Des Moines River below Des Moines. Flood of June 1, 1851 reached a stage of about 24 feet (discharge estimated about 80,000 second-feet).

REMARKS.—Flood stage, about 20 feet. U. S. Weather Bureau uses readings from this gage. Some diurnal fluctuation below medium stages caused by city power plant at Ottumwa. Flood stages and discharges, 1903-34, listed in Water-Supply Paper 771, pp. 268-269.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1904	*130- 65	43,300	.....	6,010	0.432	5.86	43,300	.....	5,110	0.368	5.00
1905	*171- 94	78,200	.....	6,260	.450	6.13	78,200	.....	7,230	.520	7.07
1912	*325-153	54,700	.....	4,360	.314	4.28	54,700	.....	4,380	.315	4.31
1913	*355-173	26,200	.....	4,380	.315	4.28	26,200	.....	4,180	.301	4.08
1914	*385-223	31,900	.....	2,770	.199	2.71	31,900	.....	3,330	.240	3.25
1915	*405-176	59,200	.....	11,300	.813	11.10	59,200	.....	12,600	.906	12.32
1916	525-142	42,600	358	7,420	.534	7.26	42,600	.....	5,560	.400	5.44
1917	525-142	57,800	.....	5,450	.392	5.33	57,800	.....	5,420	.390	5.30
1918	*525-142	40,000	.....	2,970	.214	2.90	40,000	.....	3,330	.240	3.24
1919	525-142	43,700	448	7,510	.540	7.34	43,700	510	8,140	.586	7.96
1920	525-142	44,100	1,000	7,650	.550	7.49	44,100	750	7,210	.519	7.08
1921	525-142	26,900	750	4,880	.351	4.77	26,900	700	4,840	.348	4.73
1922	545-147	26,900	600	4,450	.320	4.34	26,900	300	4,230	.304	4.13
1923	565-128	26,200	300	2,920	.210	2.85	26,200	400	3,340	.240	3.25
1924	585-130	40,000	400	5,240	.377	5.14	40,000	400	4,740	.341	4.65
1925	605-126	19,800	335	2,020	.145	1.98	19,800	335	2,170	.156	2.12
1926	625-119	34,800	570	3,760	.271	3.65	34,800	570	4,520	.325	4.41
1927	645- 80	43,700	460	6,280	.452	6.16	43,700	125	5,340	.384	5.23
1928	730-149	19,500	125	3,160	.227	3.10	31,200	150	4,520	.325	4.42
1929	730-149	41,800	581	7,100	.511	6.92	41,800	300	5,730	.412	5.59
1930	730-149	28,300	190	2,400	.173	2.34	28,300	142	2,210	.159	2.16
1931	730-149	17,800	115	1,170	.084	1.15	34,800	115	3,340	.240	3.26
1932	730-149	34,800	760	8,880	.639	8.68	31,200	440	7,020	.505	6.87
1933	745-169	33,300	150	2,910	.209	2.83	33,300	80	2,590	.186	2.52
1934	760-208	8,740	72	607	.044	.60	8,740	72	746	.054	.74
1935	785-208	53,000	198	5,288	.380	5.18	53,000	340	5,563	.400	5.43
1936	805-224	26,600	108	3,823	.275	3.75	26,600	108	3,539	.255	3.47
1937	825-266	46,000	130	4,216	.303	4.12	46,000	100	4,082	.294	4.00
1938	855-279	25,100	100	3,675	.264	3.59	25,100	120	4,285	.308	4.18
1939	875-285	44,600	150	3,534	.254	3.43	44,600	100	2,902	.209	2.81
1940	895-	12,400	40	1,469	.106	1.45	.....	.....	.....	.....	.....

*See page 40.

NOTE.—A rating curve for this station shown in figure 4.

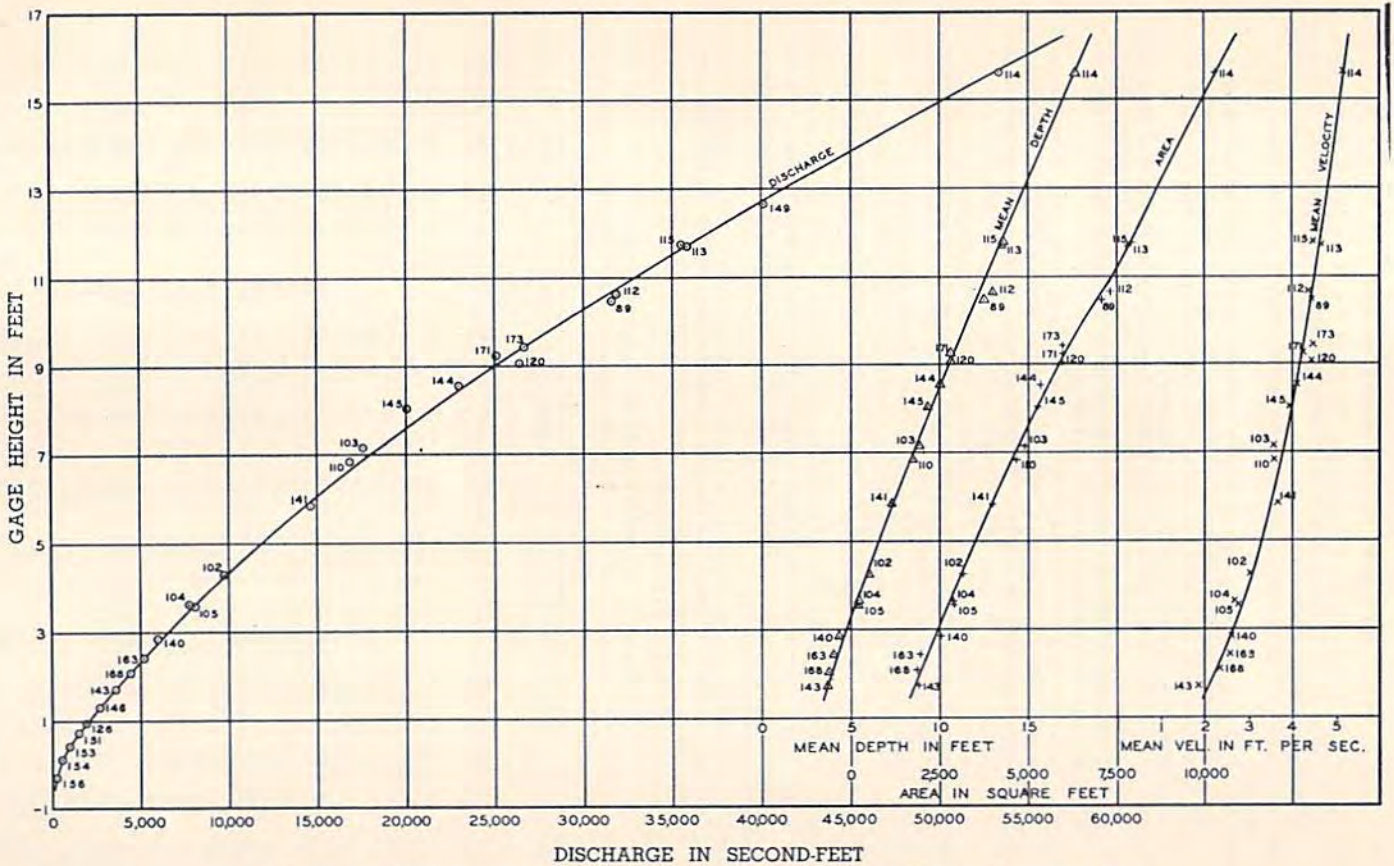

Fig. 4.—Rating, area, mean depth, and velocity curves for Des Moines River at Keosauqua, Iowa.
(For illustrative purposes only)

Heron Lake outlet near Heron Lake, Minn.

LOCATION.—Lat. 43°48′, long. 95°16′, on line between secs. 21 and 22, T. 104 N., R. 37 W., half a mile downstream from dam that controls Heron Lake, 2 miles east of village of Heron Lake, and 12 miles upstream from Des Moines River. Prior to May 17, 1934, at site half a mile downstream.

DRAINAGE AREA.—457 square miles above upper gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—August 1930 to September 1933 (winter records incomplete), October 1934 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGE.—Nonrecording gage read once daily. Gage at former site at different datum.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements. Affected by ice and aquatic vegetation.

AVERAGE DISCHARGE.—7 years (1932-33, 1934-40), 56.1 second-feet.

EXTREMES.—1930-33, 1934-40: Maximum discharge observed, 1,660 second-feet July 5, 1938 (gage height, 8.53 feet); no flow during several periods in 1931, 1933-40.

REMARKS.—Flow regulated by Heron Lake.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1931	715–130	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1932	730–153	.....	.....	.....	.....	Incomplete	.....	.....	.....	.....	.....
1933	745–170	53	0	6.36	0.014	0.19	.....	Incomplete		.....	.....
1934	.....	.....	No Record	.....	.....	.....	.....	Incomplete		.....	.....
1935	785–209	226	0	26.5	.058	.79	226	0	26.5	0.058	0.79
1936	805–225	960	0	68.1	.149	2.03	960	0	68.1	.149	2.03
1937	825–267	392	0	30.6	.067	.91	392	0	30.7	.067	.91
1938	855–281	1,660	0	198	.433	5.88	1,660	0	210	.460	6.24
1939	875–286	422	2.2	47.1	.103	1.40	323	0	35.2	.077	1.04
1940	895–	184	0	16.3	.036	.49	.....	.....	.....	.....	.....

Raccoon River at Van Meter, Iowa

LOCATION.—Lat. 41°32'00", long. 93°56'50", in SW¼ sec. 22, T. 78 N., R. 27 W., at highway bridge a third of a mile from railroad station at Van Meter, Dallas County, 1 mile downstream from South Raccoon River, and 30 miles upstream from mouth.

DRAINAGE AREA.—3,410 square miles above gage; 3,590 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record November 1927 to August 1934 by U. S. Weather Bureau and subsequent thereto collected in cooperation with that agency. For several years, station operated through financial cooperation with City of Des Moines Water Works.

RECORDS AVAILABLE.—April 1915 to November 1927 and October 1932 to September 1940 in water-supply papers of U. S. Geological Survey. April 1915 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 466-480.

GAGES.—Nonrecording gage read once daily prior to May 1923 and November 1927 to August 1934 (in general, readings were discontinued during ice periods); recording gage May 1923 to November 1927 and subsequent to August 1934. Datum of gage is 841.12 feet above mean sea level, adjustment of 1912.

AVERAGE DISCHARGE.—24 years (1915-32, 1933-40), 1,003 second feet.

EXTREMES.—1915-40: Maximum discharge, 40,000 second-feet Sept. 20, 1926 (gage height, 18.96 feet), from rating curve extended above 22,000 second-feet; minimum daily discharge, 10 second-feet Jan. 22-31, 1940; minimum gage height, probably 1.38 feet Aug. 29, 1934 and Sept. 1, 1936.

HISTORICAL DATA.—The flood of September 20, 1926, highest stage recorded at Van Meter, was caused by a single heavy rain, amounting to as much as 5 inches at several stations, and falling on ground already saturated by an unusual September rainfall. A greater flood may have occurred May 31, 1903.

REMARKS.—Flood stage, about 13 feet. Some diurnal fluctuation during low water caused by operation of power plant of Iowa Power and Light Co. at Adel, 10 miles above station. Flood stages and discharges, 1915-34, listed in Water-Supply Paper 771, pp. 269-270.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1916	*435-178	14,800	.....	1,590	0.466	6.35	.....	.....	988	0.290	3.93
1917	*455-160	31,800	.....	1,340	.393	5.36	31,800	.....	1,340	.393	5.35
1918	*475-121	14,600	.....	706	.207	2.80	14,600	.....	726	.213	2.87
1919	*505-232	12,000	.....	1,450	.425	5.77	12,000	.....	1,730	.507	6.90
1920	505-232	9,000	200	1,730	.507	6.93	9,000	200	1,570	.460	6.27
1921	525-149	9,510	194	1,180	.346	4.73	9,510	194	1,170	.343	4.69
1922	545-149	11,200	.....	1,050	.308	4.19	11,200	.....	980	.287	3.89
1923	*565-130	9,780	.....	1,020	.299	4.04	9,780	.....	1,370	.402	5.46
1924	*585-131	16,300	.....	1,970	.578	7.85	16,300	.....	1,620	.475	6.45
1925	*605-127	5,640	.....	534	.157	2.12	5,640	.....	510	.150	2.03
1926	*625-120	34,800	.....	989	.290	3.95	34,800	.....	1,190	.349	4.72
1927	*645- 81	5,850	.....	1,210	.355	4.80	5,850	.....	1,010	.269	4.00
1928	*.....	8,090	.....	691	.203	2.75	8,090	.....	927	.272	3.69
1929	*.....	22,600	.....	1,620	.475	6.45	22,600	.....	1,370	.402	5.48
1930	*.....	5,870	.....	564	.165	2.24	5,870	.....	536	.157	2.13
1931	*.....	5,030	.....	234	.069	.93	12,300	.....	584	.171	2.32
1932	*.....	14,800	.....	1,940	.569	7.76	14,800	.....	1,650	.484	6.61
1933	745-172	.....	.....	.....	.....	.....	Incomplete		.....	.....	.....
1934	760-211	2,020	21	182	.053	.72	2,020	21	191	.056	.76
1935	785-211	8,820	49	751	.220	2.98	8,820	59	779	.228	3.09
1936	805-227	11,200	16	731	.214	2.91	11,200	16	690	.202	2.76
1937	825-269	10,800	18	670	.196	2.67	10,800	18	659	.193	2.62
1938	855-283	7,630	22	734	.215	2.92	7,630	32	847	.248	3.36
1939	875-287	12,000	24	736	.216	2.93	12,000	24	625	.183	2.50
1940	895-	5,200	10	452	.133	1.82	.....	.....	.....	.....	.....

*See page 40.

Fox River at and near Wayland, Mo.

LOCATION.—Lat. 40°23'45", long. 91°35'50", in NW¼ sec. 31, T. 65 N., R. 6 W., at bridge on State Highway 4, three quarters of a mile west of Wayland and 5 miles downstream from Brush Creek. Prior to Oct. 1, 1929, at site 2 miles upstream.

DRAINAGE AREA.—400 square miles above gage, about 215 of which are in Iowa; 392 square miles at site 2 miles upstream, and 502 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records; Corps of Engineers, U. S. Army furnished results of several discharge measurements during 1935-40. Station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—February 1922 to September 1929 (at site 2 miles upstream), October 1929 to September 1940 in water supply papers of U. S. Geological Survey. February 1922 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 32-37; October 1926 to September 1929 (at site 2 miles upstream), October 1929 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 29-36.

GAGES.—Nonrecording gage read once daily below 8 feet, twice daily above, prior to June 1936; recording gage thereafter. Datum of gage is 501.52 feet above mean sea level, datum of 1929. Gage at former site at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 24,000 second-feet. Affected by ice. No well defined control. Left bank rocky and fairly permanent; bed composed of gravel and mud, subject to shifting.

AVERAGE DISCHARGE.—18 years, 224 second-feet.

EXTREMES.—1922-40: Maximum discharge recorded, 25,000 second-feet June 29, 1933 (gage-height, 21.53 feet); no flow on many days in 1930, 1934, 1936, 1939, 1940.

HISTORICAL DATA.—The flood of June 29, 1933, recorded as highest stage known. Other floods occurred in June 1905, on June 6, 1917, and on Nov. 18, 1928.

REMARKS.—Bank-full stage, about 15 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1923	565–133	1,700	1.0	62.9	0.160	2.19	1,700	1.1	64.8	0.165	2.24
1924	585–135	3,030	1.1	180	.459	6.23	3,030	1.1	182	.464	6.32
1925	605–130	3,720	1	183	.467	6.34	3,720	1	277	.707	9.60
1926	625–124	6,100	2	367	.936	12.69	6,140	2	387	.987	13.38
1927	645– 82	6,140	2	377	.962	13.05	6,700	2	354	.903	12.28
1928	665– 76	6,700	3	371	.946	12.90	15,200	3	494	1.26	17.13
1929	685–113	15,200	3	572	1.46	19.73	.....	.....	.....	.....	.....
1930	700–112	3,340	0	135	.338	4.57	3,340	0	92.5	.231	3.13
1931	715–132	8,700	.2	191	.478	6.46	8,700	.4	330	.825	11.19
1932	730–155	6,440	5	318	.795	10.86	5,210	4.4	225	.562	7.67
1933	745–173	14,700	1.0	244	.610	8.26	14,700	1.0	197	.492	6.69
1934	785–212	1,470	0	27.0	.068	.923	2,260	0	63.3	.158	2.14
1935	785–212	12,900	.5	364	.910	12.32	12,900	1.8	339	.848	11.49
1936	805–228	7,400	0	123	.308	4.17	7,400	0	145	.362	4.91
1937	825–273	3,200	.1	223	.558	7.56	3,200	.1	188	.470	6.36
1938	855–287	2,380	.1	81.1	.203	2.75	2,380	.2	87.4	.218	2.97
1939	875–293	8,650	0	162	.405	5.48	8,650	0	156	.390	5.27
1940	895–	1,380	0	46.0	.115	1.58	.....	.....	.....	.....	.....

Wyaconda River above and near Canton, Mo.

LOCATION.—Lat. 40°08'30", long. 91°33'55", in SE¼ sec. 28, T. 62 N., R. 6 W., at bridge on State Highway 96, one mile upstream from Sugar Creek and 2 miles west of Canton. Prior to Oct. 1, 1932, at site 2 miles downstream.

DRAINAGE AREA.—393 square miles above gage, about 99 of which are in Iowa; 447 square miles above site 2 miles downstream, and 462 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Corps of Engineers, U. S. Army furnished results of several discharge measurements during 1935-40. Station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—February 1922 to September 1932 (at site 2 miles downstream, records not equivalent), October 1932 to September 1940 in water-supply papers of U. S. Geological Survey. February 1922 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 37-42; October 1926 to September 1932 (at site 2 miles downstream), October 1932 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 37-47.

GAGES.—Nonrecording gage read once daily below 10 feet, twice daily above, prior to May 1939; recording gage thereafter. Datum of gage is 515.32 feet above mean sea level, datum of 1929. Gage at former site at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 17,000 second-feet. Affected by ice. Channel control at medium and high stages. Stream bed composed of sand and gravel. Right bank high and rocky in vicinity of gage; left bank subject to overflow.

AVERAGE DISCHARGE.—8 years (1932-40), 197 second-feet; at former site, 10 years (1922-32), 315 second-feet.

EXTREMES.—1922-40: Maximum discharge, 17,700 second-feet June 30, 1933 (gage height, 30.00 feet, from floodmarks); no flow on many days during 1934, 1936, and 1940.

HISTORICAL DATA.—The flood of June 30, 1933 reached the highest stage ever recorded at Canton. A stage of about 26.5 feet occurred on July 8, 1909, and one of about 29.0 feet on Nov. 18, 1928. Channel has been dredged in places to reduce flood damage.

REMARKS.—Bank-full stage, about 18 feet. No regulation or diversion.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1923	565-135	2,550	0.8	92.9	0.208	2.85	2,550	0.8	119	0.266	3.62
1924	585-137	3,390	.5	231	.517	7.06	3,390	.5	207	.461	6.31
1925	605-132	2,550	2	165	.369	5.01	2,950	2	255	.570	7.74
1926	625-125	5,180	3	435	.973	13.18	6,640	3	494	1.04	14.96
1927	645- 83	6,640	1	483	1.08	14.66	6,920	1	426	.953	12.93
1928	665- 77	6,920	2	306	.685	9.29	12,500	2	410	.917	12.45
1929	685-114	12,500	4	696	1.56	21.14	7,380	4	559	1.25	16.98
1930	700-113	3,000	.2	170	.380	5.16	3,000	.2	109	.244	3.31
1931	715-133	7,220	.5	240	.537	7.30	7,220	1.3	358	.801	10.87
1932	730-156	4,830	1.6	336	.752	10.24	.....	.....	.....	.....	.....
1933	785-214	15,400	1.0	324	.824	11.20	15,400	1.0	257	.654	8.87
1934	785-214	1,200	0	24.4	.062	.84	3,140	0	94.9	.241	3.28
1935	785-214	13,900	2.2	502	1.28	17.37	13,900	2.2	442	1.12	15.29
1936	805-229	6,460	0	127	.323	4.38	6,460	0	142	.361	4.91
1937	825-274	3,050	.1	221	.562	7.64	3,050	.1	193	.491	6.66
1938	855-288	4,180	.3	123	.313	4.25	4,180	.3	133	.338	4.59
1939	875-294	8,760	.3	199	.506	6.86	8,760	.2	189	.481	6.52
1940	895-	2,020	0	52.0	.132	1.81	.....	.....	.....	.....	.....

North Fabius River at Monticello, Mo.

LOCATION.—Lat. 40°06'30", long. 91°42'35", in SW¼ SE¼ sec. 6, T. 61 N., R. 7 W., at bridge on State Highway 96, 1 mile south of Monticello and about 19 miles upstream from Middle Fabius River. Prior to Nov. 6, 1930, at site 400 feet downstream.

DRAINAGE AREA.—452 square miles above gage, about 101 of which are in Iowa; 940 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—February 1922 to September 1940 in water-supply papers of U. S. Geological Survey. February 1922 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 42-47; February 1922 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 47-57.

GAGE.—Nonrecording gage read once daily below 10 feet, twice daily above. Datum of gage is 540.73 feet above mean sea level, datum of 1929. Prior to Nov. 6, 1930, at datum 0.03 foot lower.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 14,000 second-feet. Affected by ice. Streambed composed of rock, sand, and silt; clean and fairly permanent. Right bank high and rocky; left bank subject to overflow.

AVERAGE DISCHARGE.—17 years (1923-40), 280 second-feet.

EXTREMES.—1922-40: Maximum discharge, 17,400 second-feet June 30, 1933 (gage-height, 30.8 feet, from flood marks), from rating curve extended above 14,000 second-feet; no flow on many days during 1934, 1936, 1937 and 1940.

HISTORICAL DATA.—The flood of June 30, 1933, reached the highest stage ever recorded at Monticello, including the flood of 1875.

REMARKS.—Bank-full stage, about 22 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30					Calendar year				
		Maximum day	Minimum day	Mean	Per square mile	Runoff in inches	Maximum day	Minimum day	Mean	Per square mile	Runoff in inches
1924	585–138	6,370	4	234	0.518	7.05	6,370	2	215	0.476	6.46
1925	605–134	4,250	2	155	.343	4.65	4,250	2	237	.524	7.13
1926	625–127	5,680	2	459	1.02	13.79	6,070	2	506	1.12	15.20
1927	645– 84	8,760	3	465	1.03	13.95	8,760	2	425	.940	12.78
1928	665– 78	10,300	2	334	.739	10.07	13,600	7	427	.945	12.86
1929	685–115	13,600	4	617	1.37	18.54	10,500	4	496	1.10	14.90
1930	700–114	5,880	1.2	189	.418	5.68	5,340	1.2	119	.263	3.58
1931	715–134	7,100	1.3	196	.434	5.89	7,100	1.7	347	.768	10.40
1932	730–157	7,020	4.8	389	.861	11.68	8,220	3.9	313	.692	9.41
1933	745–174	13,600	2.9	327	.723	9.83	13,600	.7	251	.555	7.56
1034	760–213	1,270	0	21.9	.0485	.66	2,600	0	109	.241	3.26
1935	785–217	12,700	0	567	1.25	17.00	12,700	1.2	491	1.09	14.73
1936	805–230	10,600	0	159	.352	4.80	10,600	0	178	.394	5.34
1937	825–275	5,500	0	250	.553	7.50	5,500	0	221	.489	6.63
1938	855–289	3,360	.4	116	.257	3.46	3,360	.7	133	.294	3.97
1939	875–295	9,680	1.1	218	.482	6.54	9,680	1.2	201	.445	6.06
1940	895–	1,780	0	61.7	.137	1.85	.....	.....	.....	.....	.....

Missouri River at Yankton, S. Dak.

LOCATION.—Lat. 42°52′, long. 97°24′, between sec. 18, T. 93 N., R. 55 W., and sec. 13, T. 93 N., R. 56 W., at Meridian Highway Bridge in Yankton, 7 miles upstream from James River and 849 miles above mouth.

DRAINAGE AREA.—279,500 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record collected in cooperation with U. S. Weather Bureau. Station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—November 1930 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once daily prior to September 1932; recording gage thereafter. Datum of gage is 1,159.75 feet above mean sea level, datum of 1929; prior to August 1934, at datum 0.11 foot lower.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 170,000 second-feet. Affected by ice. Stream bed composed of sand. No definite control.

AVERAGE DISCHARGE.—9 years (1931-40), 20,600 second-feet.

EXTREMES.—1930-40: Maximum discharge, 176,000 second-feet Apr. 1, 1939; maximum gage height, 10.30 feet, present datum, March 3, 1934; minimum discharge, about 2,900 second-feet Jan. 10, 11, 1940; minimum gage height, —0.67 foot Dec. 29, 1939.

HISTORICAL DATA.—Maximum stage known, 30.5 feet, present datum, Apr. 5, 1881 (caused by ice jam). Daily gage-height records from March 1873 to November 1886 published in report of Mississippi River Commission, "Stages of the Mississippi River and its Principal Tributaries for the Period 1860-1889." U. S. Weather Bureau obtained fragmentary gage-height records from March 1905 to May 1908 and daily readings except during winter months from August 1921 to November 1930.

REMARKS.—Bank-full stage, about 12 feet. Flow regulated by Fort Peck Reservoir since completion of that project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30				Calendar year			
		Maximum day	Minimum day	Mean	Runoff in acre-feet	Maximum day	Minimum day	Mean	Runoff in acre-feet
1931	716–35	46,100	.....	.....	Incomplete	.....	.....	.....	.....
1932	731–24	123,000	.....	25,400	18,500,000	123,000	.....	25,580	18,586,000
1933	746–23	106,000	.....	24,300	17,600,000	106,000	.....	24,850	17,978,000
1934	761–44	70,000	3,800	15,810	11,450,000	70,000	3,500	15,000	10,860,000
1935	786–31	126,000	3,500	19,620	14,210,000	126,000	3,700	19,500	14,120,000
1936	806–31	86,500	3,700	18,060	13,110,000	86,500	4,700	18,430	13,380,000
1937	826–26	107,000	4,700	19,040	13,780,000	107,000	3,200	18,810	13,620,000
1938	856–26	132,000	3,200	23,770	17,210,000	132,000	5,100	25,430	18,410,000
1939	876–28	167,000	6,740	24,360	17,630,000	167,000	4,600	23,190	16,830,000
1940	896–	46,000	2,900	15,000	10,890,000	.....	.....	.....	.....

Missouri River at Sioux City, Iowa

LOCATION.—Lat. 42°29′, long. 96°25′, in sec. 17, T. 29 N., R. 9 E., Sixth principal meridian, at bridge on U. S. Highway 77 in Sioux City, just upstream from Perry Creek, 1¾ miles upstream from Floyd River, and 2½ miles downstream from Big Sioux River.

DRAINAGE AREA.—314,600 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Station operated in cooperation with Corps of Engineers, U. S. Army. Gage-height record collected in cooperation with U. S. Weather Bureau.

RECORDS AVAILABLE.—September 1928 to September 1931, October 1938 to September 1940 in water-supply papers of U. S. Geological Survey. September 1928 to September 1931 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 11-14. January 1879 to December 1891 (estimated monthly discharge) in House Document No. 238, 73rd Congress, p. 631.

GAGES.—Nonrecording gage read once daily prior to February 1935; recording gage thereafter. Datum of gage is 1,076.96 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 166,000 second-feet. Seriously affected by ice. Stream bed composed of sand. No definite control.

AVERAGE DISCHARGE.—5 years, 23,400 second-feet.

EXTREMES.—1928-31, 1938-40: Maximum discharge observed, 190,000 second-feet April 1, 1929; maximum gage height, 14.35 feet Apr. 3, 1939; minimum discharge, about 3,050 second-feet Jan. 11, 1940; minimum gage height, —0.97 foot Dec. 30, 1939.

HISTORICAL DATA.—Maximum stage observed, 22.5 feet Apr. 23, 1881. Gage-height records from September 1878 to December 1899 published in report of Missouri River Commission, "Stages of the Missouri River for the Period 1872-1899." Fragmentary gage-height records from July 1889 to October 1938 published in annual reports of U. S. Weather Bureau, "Daily River Stages of Principal Rivers of the United States." From Oct. 27, 1888 to Dec. 31, 1899, gage was located at Chicago, St. Paul, Minneapolis and Omaha Railroad bridge about 2 miles downstream, at datum 411.86 feet above mean sea level, datum of 1929.

REMARKS.—Flow regulated by Fort Peck Reservoir since completion of that project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30				Calendar year			
		Maximum day	Minimum day	Mean	Runoff in acre-feet	Maximum day	Minimum day	Mean	Runoff in acre-feet
1929	716-36	178,000	.....	34,900	25,300,000	178,000	.....	34,210	24,776,000
1930	716-36	83,800	.....	25,500	18,500,000	83,800	.....	25,470	18,452,000
1931	716-36	53,600	5,510	15,700	11,400,000	.....	.....	.....	.....
1939	876-29	166,000	6,800	25,330	18,340,000	166,000	5,000	24,040	17,410,000
1940	896-	52,400	3,100	15,550	11,299,000	.....	.....	.....	.....

Missouri River at Omaha, Nebr.

LOCATION.—Lat. 41°15'40", long. 95°55'15", in sec. 23, T. 15 N., R. 14 E., at Aksarben Bridge (formerly Douglas Street Bridge) in Omaha. Prior to Mar. 26, 1930, at Illinois Central Railroad bridge 2 miles upstream; from Oct. 19, 1931 to Sept. 30, 1936 (except winter of 1931-32), at Nebraska Power Company's intake pier about 1,900 feet downstream.

DRAINAGE AREA.—322,800 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record collected in cooperation with U. S. Weather Bureau. Station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—September 1928 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once daily with additional readings during high stages, prior to Oct. 19, 1931 and during winter of 1931-32; recording gage thereafter. Datum of gage is 958.24 feet above mean sea level, datum of 1929; prior to Mar. 26, 1930, at datum 2.97 feet higher.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 140,000 second-feet. Channel composed of sand and silt. No well-defined control. Right bank high; left bank subject to overflow at high stages.

AVERAGE DISCHARGE.—12 years, 23,030 second-feet.

EXTREMES.—1928-40: Maximum discharge, 198,000 second-feet June 7, 1929; maximum gage height, 19.30 feet Apr. 6, 1939; minimum discharge, about 2,200 second-feet Jan. 6, 1937; minimum gage height observed, 1.65 feet Jan. 7, 1940.

HISTORICAL DATA.—Maximum stage known, 24.65 feet, present datum, Apr. 25, 1881 (caused by ice jam). A stage of 24.1 feet occurred sometime in May 1844. Gage-height records from April 1872 to December 1899 published in report of Missouri River Commission, "Stages of the Missouri River for the Period 1872-1899," and from January 1900 to September 1928 in annual reports of U. S. Weather Bureau, "Daily River Stages of Principal Rivers of the United States." Gages were at or near present site.

REMARKS.—Flow regulated by Fort Peck Reservoir since completion of that project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30				Calendar year			
		Maximum day	Minimum day	Mean	Runoff in acre-feet	Maximum day	Minimum day	Mean	Runoff in acre-feet
1929	686-24	198,000	.....	36,700	26,500,000	198,000	5,720	35,700	25,900,000
1930	701-25	84,400	5,720	26,300	19,000,000	84,400	5,750	26,400	19,100,000
1931	716-39	51,700	.....	16,100	11,600,000	51,700	4,940	15,000	10,900,000
1932	731-25	129,000	4,940	27,200	19,800,000	129,000	.....	27,300	19,800,000
1933	746-24	95,800	.....	24,600	17,800,000	95,800	3,500	25,000	18,100,000
1934	761-45	85,900	3,500	16,210	11,740,000	85,900	3,600	15,480	11,210,000
1935	786-32	97,100	3,600	20,260	14,660,000	97,100	3,700	20,150	14,590,000
1936	806-32	84,100	4,200	19,330	14,030,000	84,100	4,600	19,670	14,280,000
1937	826-27	109,000	2,200	21,130	15,300,000	109,000	2,200	20,920	15,140,000
1938	856-27	116,000	2,500	26,280	19,030,000	116,000	5,900	28,260	20,460,000
1939	876-30	140,000	5,300	25,990	18,820,000	140,000	5,300	24,620	17,830,000
1940	896-	53,100	3,000	16,280	11,820,000	.....	.....	.....	.....

Missouri River at Nebraska City, Nebr.

LOCATION.—Lat. 40°40'35", long. 95°50'10", in SW¼ sec. 10, T. 8 N., R. 14 E., At Waubonsie Highway Bridge at Nebraska City, about 28 miles downstream from Platte River. Prior to Oct. 22, 1931, at Chicago, Burlington & Quincy Railroad Bridge 50 feet downstream.

DRAINAGE AREA.—414,400 square miles above gage; 529,400 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record collected in cooperation with U. S. Weather Bureau. Station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—August 1929 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read once daily, with additional readings during high stages, prior to October 1931. Recording gage thereafter. Datum of gage is 903.94 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 149,000 second-feet. Stream bed composed of sand and silt. No well-defined control. Right bank high; left bank subject to overflow at high stages.

AVERAGE DISCHARGE.—11 years, 26,930 second-feet.

EXTREMES.—1929-40: Maximum discharge, 149,000 second-feet Apr. 6, 1939; maximum gage height, 17.90 feet July 12, 1938; minimum discharge, 3,230 second-feet Dec. 13, 14, 1932; minimum gage height observed, 1.2 feet Jan. 1, 1940.

HISTORICAL DATA.—Maximum stage known, 18.0 feet Apr. 27, 1881. Gage-height records from August 1878 to October 1888 at site 2,750 feet downstream, and from October 1888 to December 1899 at Chicago, Burlington & Quincy Railroad bridge 50 feet downstream published in report of Missouri River Commission, "Stages of the Missouri River for the Period 1872-1899." From November 1917 to August 1929 gage-height records were collected by Chicago, Burlington & Quincy Railroad Company from gage at its bridge.

REMARKS.—Bank-full stage, about 15 feet. Flow regulated by Fort Peck Reservoir since completion of that project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30				Calendar year			
		Maximum day	Minimum day	Mean	Runoff in acre-feet	Maximum day	Minimum day	Mean	Runoff in acre-feet
1930	701–26	93,000	4,500	34,900	25,300,000	93,000	9,000	35,500	25,700,000
1931	716–40	56,200	9,200	22,200	16,100,000	56,200	8,700	20,200	14,600,000
1932	731–26	138,000	7,800	34,200	24,800,000	138,000	3,230	34,100	24,800,000
1933	746–25	105,000	3,230	30,200	21,900,000	105,000	4,000	30,800	22,300,000
1934	761–46	78,000	4,000	20,000	14,480,000	78,000	3,910	18,840	13,640,000
1935	786–33	106,000	3,910	26,400	19,110,000	106,000	5,070	26,450	19,150,000
1936	806–33	108,000	5,070	23,270	16,890,000	108,000	4,400	23,320	16,930,000
1937	826–28	109,000	3,600	25,020	18,110,000	109,000	3,600	24,890	18,020,000
1938	856–28	125,000	3,800	30,960	22,410,000	125,000	7,600	33,150	24,000,000
1939	876–31	148,000	6,600	29,720	21,520,000	148,000	6,350	27,990	20,270,000
1940	896–	61,100	3,700	19,360	14,050,000	.....	.....	.....	.....

Big Sioux River at Akron, Iowa

LOCATION.—Lat. 42°49'40", long. 96°33'50", in W½ sec. 31, T. 93 N., R. 48 W., 300 feet downstream from county highway bridge in Akron and 2¾ miles upstream from Union Creek. Prior to Dec. 3, 1934, at bridge 300 feet upstream.

DRAINAGE AREA.—8,851 square miles above gage; 9,415 square miles at mouth.

SOURCES OF DATA.—U. S. Geological Survey records. For several years, station operated through financial cooperation with Corps of Engineers, U. S. Army, and gage-height record collected in cooperation with U. S. Weather Bureau.

RECORDS AVAILABLE.—October 1928 to September 1940 in water-supply papers of U. S. Geological Survey. Intermittent gage-height observations obtained by U. S. Weather Bureau during 1927 to 1929.

GAGES.—Nonrecording gage read twice daily, with additional readings during high stages, prior to December 1934; recording gage thereafter. Datum of gages is 1,118.90 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 10,500 second-feet. Seriously affected by ice. Left bank is high, right bank low. Stream bed composed of silt and rocks.

AVERAGE DISCHARGE.—12 years, 539 second-feet.

EXTREMES.—1928-40: Maximum discharge, 14,000 second-feet Mar. 15, 1929; maximum gage height, 18.63 feet Mar. 15, 1929, Mar. 12, 1936; minimum discharge, 7 second-feet Feb. 26-28, 1936.

HISTORICAL DATA.—A stage of 19.4 feet, from floodmarks, occurred on Sept. 18, 1926.

REMARKS.—Bank-full stage, about 12 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1929	686-164	13,200	.....	787	0.089	1.21	574,000	.....	.....	.....	.....	.....	.....
1930	701-168	3,660	.....	431	.049	.66	312,000	3,660	.....	403	0.046	0.62	291,300
1931	716-186	1,260	26	120	.014	.19	86,700	1,260	26	121	.014	.19	87,390
1932	731-180	13,300	58	752	.085	1.16	546,000	13,300	.....	739	.083	1.13	536,400
1933	746-129	10,700	.....	367	.041	.56	266,000	10,700	.....	381	.043	.58	275,500
1934	761-157	10,300	41	250	.028	.38	181,000	10,300	35	240	.027	.37	173,700
1935	786-156	2,960	35	297	.034	.44	215,100	2,960	36	286	.032	.43	207,300
1936	806-164	13,300	7	708	.080	1.10	513,800	13,300	7	712	.080	1.10	516,700
1937	826-153	5,550	13	694	.078	1.06	502,700	5,550	13	693	.078	1.06	502,000
1938	856-185	10,800	38	1,046	.118	1.60	757,300	10,800	40	1,095	.124	1.68	792,400
1939	876-204	6,000	70	593	.067	.92	429,700	6,000	55	548	.062	.85	396,600
1940	896-	9,670	35	424	.048	.65	307,900	.....	.....	.....	.....	.....	.....

NOTE.—While this report was in the process of publication the discharge records at this station became available for the flood of June 1942 along the lower Big Sioux River. A series of discharge measurements during the high stage has served to define the stage-discharge relation to 20,000 second-feet.

Extremes.—1928-42: Maximum discharge, 21,400 second-feet June 4, 1942 (gage height, 19.23 feet at water-stage recording gage).

Floyd River at James, Iowa

LOCATION.—Lat. 42°34'40", long. 96°18'40", in NW¼NW¼ sec. 32, T. 90 N., R. 46 W., at highway bridge at James, 9.5 miles upstream from mouth and 14 miles downstream from West Floyd River.

DRAINAGE AREA.—918 square miles above gage; 935 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—December 1934 to September 1940 in water-supply papers of U. S. Geological Survey.

GAGES.—Nonrecording gage read twice daily, with additional readings during high stages prior to September 1938; recording gage thereafter.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 2,500 second-feet. Seriously affected by ice. Stream bed composed of sand and soft mud; both banks overflow at high stages.

AVERAGE DISCHARGE.—5 years, 101 second-feet.

EXTREMES.—1934-40: Maximum discharge observed, 3,160 second-feet May 27, 1937; maximum gage-height observed, 18.10 feet Mar. 10, 1936 (ice jam); minimum discharge observed, 1 second-foot Aug. 20, 27, 1936; minimum gage height observed, 4.74 feet June 12, 1935.

HISTORICAL DATA.—Severe floods with maximum flow greatly in excess of that observed during 1935-40 reported to have occurred on Floyd River in 1876, 1881, 1892 and 1934.

REMARKS.—Bank-full stage, about 13 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1935	786-157	.....	.....	.....	.....	.....	.....	1,170	3	71.2	0.078	1.06	51,530
1936	806-165	2,560	1	107	0.117	1.59	77,330	2,560	1	108	.118	1.60	78,190
1937	826-154	2,930	3	134	.146	1.96	97,050	2,930	3	136	.148	1.99	98,470
1938	856-186	1,790	8	152	.166	2.25	110,000	1,790	8	159	.173	2.34	114,800
1939	876-206	1,200	5	71.5	.078	1.04	51,790	1,200	3	60.4	.066	.88	43,770
1940	896–	1,330	2	41.3	.045	.61	30,000	.....	.....	.....	.....	.....	.....

NOTE.—While this report was in process of publication the discharge records at this station became available for the flood of June 1942 along the lower reaches of the river. Discharge measurements during the flood have defined the stage-discharge relation to 6,000 second-feet.

Extremes.—1934-42: Maximum discharge, 6,280 second-feet June 4, 1942 (gage height, 18.75 feet).

Little Sioux River at Correctionville, Iowa

LOCATION.—Lat. 42°28′, long. 95°47′, in N½ sec. 1, T. 88 N., R. 43 W., at bridge on U. S. Highway 20, 0.2 mile upstream from Bacon Creek, half a mile west of Correctionville, three quarters of a mile downstream from Pierson Creek and about 54 miles upstream from mouth. Prior to July 16, 1929, at Illinois Central Railroad bridge 0.2 mile downstream.

DRAINAGE AREA.—2,450 square miles above upper gage; 2,490 square miles at former site, and 4,550 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—May 1918 to July 1925, October 1928 to July 1932, June 1936 to September 1940, in water-supply papers of U. S. Geological Survey. May 1918 to July 1925, October 1928 to July 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 21-32.

GAGES.—Nonrecording gage prior to November 1938, recording gage thereafter. Gage read once daily with additional readings on days of rapidly changing stage prior to July 1925, twice daily October 1928 to July 1932 (readings were intermittent or discontinued during periods of ice cover), and once daily with additional readings during periods of high water June 1936 to November 1938. Datum of present gage is 1,096.49 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 7,000 second-feet. Seriously affected by ice and occasionally by backwater from Bacon Creek. Stream bed composed of silt, sand and gravel. Right bank high, left bank subject to overflow at high stages.

AVERAGE DISCHARGE.—8 years (1918-20, 1929-31, 1936-40), 618 second-feet.

EXTREMES.—1918-25, 1928-32, 1936-40: Maximum discharge, about 10,700 second-feet (revised) June 12, 1919 (gage height, 19.57 feet, site and datum then in use); minimum observed, 2.6 second feet July 17, 25, 1936 (gage height, 2.14 feet), caused by temporary construction dam above gage.

HISTORICAL DATA.—Flood of 1891 reached a stage of 29.3 feet gage datum, from marks on G. A. R. hall in Correctionville. The breaking of a mill dam on Bacon Creek which enters 0.2 miles downstream from gage caused backwater during this flood.

REMARKS.—Bank-full stage, about 13 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1919	506-248	10,200	69	1,440	0.578	7.84	1,043,000	10,200	230	1,440	0.578	7.84	1,043,000
1920	506-248	8,230	.....	1,140	.458	6.22	827,600	.....	.....	.....	.....	.....	.....
1930	701-169	2,520	.....	271	.111	1.51	196,200	2,520	.....	258	.105	1.42	186,800
1931	716-187	2,530	9	53.3	.022	.30	38,590	2,530	.....	82.0	.033	.45	59,370
1937	826-157	6,320	6	538	.220	2.98	389,600	6,320	12	551	.225	3.06	399,200
1938	856-188	7,230	30	873	.356	4.84	632,000	7,230	30	984	.402	5.45	712,300
1939	876-208	1,900	47	451	.184	2.48	326,900	1,900	28	328	.134	1.79	237,400
1940	896-	2,590	18	175	.071	.96	126,800	.....	.....	.....	.....	.....	.....

Boyer River at Logan, Iowa

LOCATION.—Lat. 41°38′, long. 95°47′, in W½ sec. 19, T. 79 N., R. 42 W., at highway bridge 300 feet downstream from Illinois Central Railroad bridge in Logan, 10½ miles upstream from Willow Creek, and 16 miles upstream from mouth. From April 17, 1925 to July 1, 1925, at site 300 feet downstream.

DRAINAGE AREA.—810 square miles above gage; 1,093 (a) square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Since 1939, station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—May 1918 to July 1925, November 1937 to September 1940 in water-supply papers of U. S. Geological Survey. May 1918 to July 1925 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 33-39.

GAGES.—Nonrecording gage read once daily prior to May 1922, twice daily May 1922 to July 1925 (readings were intermittent or discontinued during ice periods), and once daily subsequent to November 1937, with additional readings during periods of high water. Datum of gage is 1,009.38 feet above mean sea level (Chicago and North Western Railway bench mark).

STAGE-DISCHARGE RELATION.—Fairly well defined by current-meter measurements below 11,000 second-feet. Seriously affected by ice. Channel is dredged, with both banks steep and fairly high. Stream bed composed of sand and silt with occasional boulders, and an outcrop of ledge rock about 600 feet below gage.

AVERAGE DISCHARGE.—5 years (1918-20, 1922-23, 1938-40), 257 second-feet.

EXTREMES.—1918-25, 1937-40: Maximum discharge observed, 13,600 second-feet July 9, 1940 (gage height, 19.17 feet); no flow Sept. 27-29, 1918.

HISTORICAL DATA.—A stage of about 25 feet occurred in May 1881; however, this was before channel was dredged and straightened, and is therefore not comparable with present conditions.

REMARKS.—Bank-full stage, about 19 feet. No regulation or diversions. Point of zero flow, about gage height 0.5 foot.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff Inches	Runoff Acre-feet	Maximum day	Minimum day	Mean	Per square mile	Runoff Inches	Runoff Acre-feet
1919	506-251	4,320	3	335	0.414	5.62	242,300	4,320	.....	360	0.444	6.03	260,500
1920	506-251	2,390	43	332	.410	5.58	241,200	2,390	.....	319	.394	5.36	231,400
1923	566-209	3,680	.....	307	.379	5.15	222,300	3,680	.....	368	.454	6.16	266,400
1938	856-191	.....	.....	.....	.....	.....	.....	6,950	1.5	170	.210	2.83	123,100
1939	876-211	2,990	8	160	.198	2.70	115,800	2,990	6	151	.186	2.54	109,000
1940	896-	7,830	2	155	.191	2.60	112,700	.....	.....	.....	.....	.....	.....

a) From House Document No. 238, 73d Congress, 2d Session. Since publication of the cited document, Allen Creek has been diverted to enter Missouri River directly, a short distance above Boyer River, hence, it is no longer tributary to Boyer River, thus reducing the contributing area above the mouth of that stream a corresponding amount.

Nishnabotna River near and above Hamburg, Iowa

LOCATION.—Lat. 40°38′, long. 95°37′, in SW¼SE¼ sec. 11, T. 67 N., R. 42 W., 1¼ miles downstream from confluence of East and West Forks, 2 miles northeast of Hamburg, 3.6 miles upstream from Iowa-Missouri State line, and 16 miles upstream from mouth. Prior to October 1928, at highway bridge 6 miles downstream; from Oct. 5, 1928 to Sept. 6, 1929, at railroad bridge 1,000 feet upstream.

DRAINAGE AREA.—2,800 square miles above gage; 2,925 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. For several years, station operated in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—March 1922 to September 1923 (at site 6 miles downstream), October 1928 to September 1940 in water-supply papers of U. S. Geological Survey. March 1922 to September 1923, October 1928 to December 1932 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 47-53; March 1922 to September 1923, in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri," pp. 65-66; October 1928 to September 1939, in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri," pp. 235-244.

GAGES.—Nonrecording gage read once daily, with additional readings during medium and high stages subsequent to October 1928. Datum of gage is 894.17 feet above mean sea level, datum of 1929; gage used October 1928 to September 1929 was at datum 0.42 foot higher.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 21,000 second-feet. Seriously affected by ice, and occasionally by backwater from Missouri River. Stream bed composed of sand and silt. Channel is dredged, with fairly high, steep banks.

AVERAGE DISCHARGE.—12 years (1928-40), 626 second-feet.

EXTREMES.—1922-23, 1928-40: Maximum discharge, 24,600 second-feet Mar. 12, 1939 (gage height, 23.0 feet, from floodmarks); minimum observed, 4.5 second-feet Aug. 30, 1934 (gage height, 1.58 feet).

HISTORICAL DATA.—The Nishnabotna River and its two forks have been dredged and straightened throughout most of their lengths, the work beginning in about 1906.

REMARKS.—Bank-full stage, about 19 feet at gage. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1929	731-250	11,800	219	1,210	0.432	5.87	876,000	11,800	214	1,125	0.402	5.49	818,600
1930	731-250	2,580	54	420	.150	2.05	304,000	2,580	54	335	.120	1.61	239,100
1931	731-250	6,790	20	342	.122	1.66	248,000	9,410	20	699	.250	3.39	506,200
1932	731-250	9,410	201	1,860	.664	9.06	1,350,000	9,410	193	1,596	.570	7.76	1,158,000
1933	746-199	5,480	63	474	.169	2.31	343,000	5,480	42	385	.138	1.88	278,100
1934	786-270	3,320	4.5	172	.061	.83	124,800	3,320	4.5	191	.068	.92	138,400
1935	786-270	7,400	9	362	.129	1.76	262,000	7,400	9	362	.129	1.76	261,900
1936	806-281	19,100	10	683	.244	3.31	495,600	19,100	10	675	.241	3.27	490,300
1937	826-287	6,920	19	599	.214	2.88	433,400	6,920	15	566	.202	2.73	409,400
1938	856-323	7,400	15	331	.118	1.62	239,500	7,400	24	349	.125	1.71	252,800
1939	876-338	18,600	46	629	.225	3.04	455,400	18,600	30	615	.220	2.97	445,300
1940	896-	6,760	15	434	.155	2.11	314,700						

East Nishnabotna River at Red Oak, Iowa

LOCATION.—Lat. 41°00'55", long. 95°14'30", in sec. 20, T. 72 N., R. 38 W., at bridge on U. S. Highway 34, half a mile west of Red Oak, 28 miles downstream from Indian Creek, and 49 miles upstream from confluence with West Nishnabotna River. Prior to July 1925, at site half a mile downstream.

DRAINAGE AREA.—890 square miles above gage; 1,070 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. For several years, gage-height record collected in cooperation with City of Red Oak.

RECORDS AVAILABLE.—May 1918 to July 1925 (at site half a mile downstream, records equivalent), May 1936 to September 1940 in water-supply papers of U. S. Geological Survey. May 1918 to July 1925 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 61-67.

GAGES.—Nonrecording gage read once daily, with additional readings during high stages, prior to July 1939; recording gage thereafter. In general, readings were discontinued during ice periods prior to July 1925. Datum of gage is 1,010.45 feet above mean sea level, unadjusted; prior to July 1925, at datum 0.40 foot lower.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 7,600 second-feet. Seriously affected by ice. Stream bed composed of sand and silt. Channel is dredged, with fairly high steep banks.

AVERAGE DISCHARGE.—7 years (1918-20, 1921-22, 1936-40), 252 second-feet.

EXTREMES.—1918-25, 1936-40: Maximum discharge observed, 9,600 second-feet Mar. 4, 1937 (gage height, 18.50 feet, from floodmarks); minimum discharge, 6 second-feet (estimated) Aug. 18, 1936.

HISTORICAL DATA.—Channel straightened or dredged throughout most of its length by work beginning about 1906. A stage of about 21.7 feet, former site and datum, occurred sometime in 1916.

REMARKS.—Bank-full stage, about 14 feet at gage. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1919	506-334	3,140	15	369	0.415	5.63	267,100	3,140	.....	434	0.488	6.62	314,200
1920	506-334	2,810	.....	411	.462	6.29	298,400	2,810	.....	343	.385	5.24	249,000
1922	546-278	3,300	....	301	.338	4.59	217,900	.....	.....	.....	.....	.....	.....
1937	826-288	8,070	12	223	.251	3.39	161,200	8,070	7	210	.236	3.21	152,200
1938	856-324	3,370	7	91.5	.103	1.40	66,240	3,370	10	98.0	.110	1.49	70,960
1939	876-339	7,610	16	204	.229	3.11	147,700	7,610	12	199	.224	3.04	143,840
1940	896-	4,180	9	162	.182	2.48	117,562	.....	.....	.....	.....	.....	.....

Tarkio River at Blanchard, Iowa

(Published as East Tarkio Creek at Blanchard, Iowa prior to 1938)

LOCATION.—Lat. 40°35'40", long. 95°13'25", on line between SE¼ sec. 20 and NE¼ sec. 29, T. 67 N., R. 38 W., at bridge on State Highway 333, 1 mile north of Blanchard and 8¼ miles downstream from Snake Creek.

DRAINAGE AREA.—200 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Station operated in cooperation with U. S. Department of Agriculture, Soil Conservation Service.

RECORDS AVAILABLE.—March 1934 to June 1940 (discontinued) in water-supply papers of U. S. Geological Survey. March 1934 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 244-249. March 1934 to June 1940 in compilation report of Department of Agriculture, Soil Conservation Service, "Hydrologic Studies at the West Tarkio Creek Demonstration Project, SCS-IA-1, Shenandoah, Iowa."

GAGES.—Nonrecording gage read once daily or oftener prior to August 1934; recording gage thereafter. Datum of gage is 940.32 feet above mean sea level, datum of 1929; prior to Mar. 5, 1940 at datum 5.00 feet higher.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 3,200 second-feet. Seriously affected by ice. A V-shaped artificial control built of timber acts as control below stages of about 9 feet; channel control at higher stages. Channel is a dredged ditch; both banks are high.

AVERAGE DISCHARGE.—5 years, 43.0 second-feet.

EXTREMES.—1934-40: Maximum discharge, 9,980 second-feet Mar. 12, 1939 (gage height, 23.12 feet, present datum), by slope-area method; no flow July 25, 1934, Nov. 20, Dec. 10, 11, 1937, Feb. 11, 12, 1939.

REMARKS.—Bank-full stage, about 29 feet. No regulation or diversions. Station operated in connection with U. S. Soil Conservation Service demonstration project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1934	761–261	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete		.....	.....
1935	786–272	655	0.19	25.7	0.128	1.73	18,640	655	0.46	27.5	0.138	1.85	19,930
1936	806–282	1,180	.36	48.7	.244	3.32	35,370	1,180	.36	49.4	.247	3.36	35,820
1937	826–290	2,050	.03	64.1	.320	4.36	46,380	2,050	0	59.5	.298	4.05	43,080
1938	856–325	724	0	18.7	.094	1.27	13,500	724	.07	19.0	.095	1.29	13,770
1939	876–340	4,790	.02	58.0	.290	3.94	41,970	4,790	.02	57.6	.288	3.92	41,740
1940	896–	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete		.....	.....

Month	Suspended sediment load transported by stream (tons per month)						
	1934	1935	1936	1937	1938	1939	1940
January	.....	14,015	3.31	188	0.06	5.15	0.22
February	.....	11,471	25,156	82,576	14.7	2,583	2.07
March	.....	1,986	198,365	268,760	7.46	497,554	5,706
April	.....	1,737	147,668	99,952	47,812	2,138	6,654
May	.....	62,598	122,768	573,846	152,719	257	336
June	2,610	138,651	75,168	177,322	81,098	471,957	5,096
July	62.0	21,548	11.9	133,080	363	182,650	.....
August	43.1	5.68	104	6.76	111,430	41,602	.....
September	2,112	724	55,425	.28	56,515	.67	.....
October	7,140	3,695	68,164	.49	1.00	.21	.....
November	1,377	7,359	1,086	.31	809	.06	.....
December	22.7	37.9	38,735	.04	2.17	.08	.....
Year	13,367	263,828	732,654	1,335,732	450,771	1,198,747	17,794

Maximum daily sediment load, 298,000 tons May 21, 1937.

Tarkio River at Fairfax, Mo.

LOCATION.—Lat. 40°21′, long. 95°25′, on line between SE¼ NE¼ and NE¼ SE¼ sec. 21, T. 64 N., R. 40 W., at county highway bridge 0.5 mile west of Fairfax and 2 miles downstream from unnamed creek.

DRAINAGE AREA.—508 square miles above gage, 290 of which are in Iowa; 721 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—March 1922 to September 1940 in water-supply papers of U. S. Geological Survey. March 1922 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 67-72, October 1926 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 249-259.

GAGE.—Nonrecording gage read once daily below 8 feet, twice daily above. Datum of gage is 872.44 feet above mean sea level, datum of 1929; prior to Oct. 1, 1931, at datum 2 feet higher.

STAGE-DISCHARGE RELATION.—Well defined by current-meter measurements below 7,500 second-feet. Affected by ice. Stream bed composed of silt and sand; no permanent control. Channel is a dredged ditch with levees on both banks.

AVERAGE DISCHARGE.—18 years, 133 second-feet.

EXTREMES.—1922-40: Maximum discharge, about 15,000 second-feet July 7, 1929 (gage height, 22.23 feet, present datum, from floodmark), from rating curve extended above 7,500 second-feet; no flow on several days in July and August 1934.

REMARKS.—Levels on banks extended to about gage height 28 feet, but farmer on left bank has cut two openings about 700 and 1,000 feet above gage, which allow overflow at gage height 17 feet.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1923	566-278	1,030	1.5	83.6	0.165	2.23	60,500	1,030	1.5	46.6	0.092	1.24	33,800
1924	586-267	6,090	2	143	.281	3.82	104,000	6,090	1	144	.283	3.85	104,000
1925	606-174	4,530	1	75.9	.149	2.02	55,000	4,530	1	84.6	.167	2.25	61,300
1926	626-168	6,960	3	193	.380	5.13	139,000	6,960	3	224	.441	5.96	162,000
1927	646-161	1,740	5	141	.278	3.79	102,000	1,360	5	111	.218	2.98	80,200
1928	686-158	7,090	9	152	.299	4.04	110,000	7,090	9	204	.402	5.46	148,000
1929	686-220	9,000	48	459	.904	12.25	332,000	9,000	51	443	.872	11.84	321,000
1930	701-225	1,560	18	138	.272	3.69	100,000	1,560	18	97.8	.193	2.60	70,800
1931	716-257	2,140	6	57.9	.114	1.54	42,000	5,180	6	116	.228	3.10	84,100
1932	731-254	5,500	29	282	.555	7.56	205,000	5,500	11	230	.453	6.15	166,810
1933	746-200	2,170	7	72.4	.143	1.93	52,400	2,170	7	61.5	.121	1.63	44,490
1934	761-262	710	0	23.6	.046	.62	17,070	3,980	0	38.6	.076	1.03	27,970
1935	786-273	3,980	.7	95.1	.187	2.56	68,850	2,960	3.2	86.7	.171	2.33	82,790
1936	806-283	1,790	2.0	106	.209	2.83	77,020	1,790	2.0	103	.203	2.75	74,790
1937	826-291	3,890	2.4	125	.246	3.34	90,400	3,890	1.0	118	.232	3.15	85,170
1938	856-326	2,120	1.0	52.2	.103	1.40	37,820	2,120	1.0	52.7	.104	1.41	38,150
1939	876-341	9,330	.4	114	.224	3.04	82,220	9,330	.4	112	.220	3.01	81,400
1940	896-	4,300	.2	74.2	.146	1.99	53,890						

West Tarkio Creek near Westboro, Mo.

LOCATION.—Lat. 40°32'30", long. 95°23'00", in NW¼ sec. 13, T. 66 N., R. 40 W., at bridge on County Highway C, 3½ miles west of Westboro and 6 miles upstream from Middle Tarkio Creek.

DRAINAGE AREA.—105 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Station operated in cooperation with U. S. Department of Agriculture, Soil Conservation Service.

RECORDS AVAILABLE.—March 1934 to June 1940 (discontinued) in water-supply papers of U. S. Geological Survey. March 1934 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 259-264. March 1934 to June 1940 in compilation report of Department of Agriculture, Soil Conservation Service, "Hydrologic Studies at the West Tarkio Creek Demonstration Project, SCS-IA-1, Shenandoah, Iowa."

GAGES.—Nonrecording gage read once daily or oftener prior to July 19, 1934; recording gage thereafter. Datum of gage is 926.80 feet above mean sea level, datum of 1929; prior to July 19, 1934, at datum 0.04 foot higher.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 2,000 second-feet. Affected by ice. A V-shaped artificial control built of timber acts as control at low stages; relation affected by filling or scouring above control. Channel is a dredged ditch with high banks.

AVERAGE DISCHARGE.—5 years, 23.4 second-feet.

EXTREMES.—1934-40: Maximum discharge, 8,720 second-feet July 29, 1937 (gage height, 22.10 feet), by slope area-method; no flow Dec. 9, 10, 1938, Feb. 11, 1939; minimum gage height observed, 0.73 foot Sept. 13, 14, 1939.

REMARKS.—Bank-full stage, about 25 feet. No regulation or diversions. Station operated in connection with U. S. Soil Conservation Service demonstration project.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1934	761-263	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete			
1935	a786-274	666	0.06	16.5	0.157	2.14	11,980	666	0.21	16.5	0.157	2.13	11,950
1936	a806-284	723	.35	26.5	.252	3.43	19,200	723	.35	26.7	.254	3.46	19,380
1937	826-292	821	.05	34.4	.328	4.45	24,940	821	.01	32.4	.309	4.19	23,480
1938	856-328	692	.01	11.2	.107	1.44	8,085	692	.05	11.4	.109	1.47	8,280
1939	876-342	2,020	.01	28.2	.269	3.64	20,380	2,020	.01	27.9	.266	3.61	20,200
1940	896-	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete		.....	.....

a) Revised figures of discharge in second-feet per square mile and runoff in inches appear in Water-Supply Paper 826, p. 293.

Month	Suspended sediment load transported by stream (tons per month)						
	1934	1935	1936	1937	1938	1939	1940
January	.....	5,663	3,48	212	0.11	3.86	2.11
February	.....	918	12,509	37,136	17.2	30.8	3.26
March	.....	356	41,570	99,437	19.3	272,413	1,128
April	.....	2.31	141,782	46,742	11,419	1,637	2,182
May	.....	53,799	104,189	109,411	33,913	32,153	1,093
June	3,831	148,916	45,460	41,252	125,192	202,125	196
July	.66	5,991	1,91	205,019	892	32,291	.....
August	.18	2.65	29.6	1,558	47,984	5,463	.....
September	2,591	295	9,405	.85	30,078	.29	.....
October	24,517	4,235	13,996	1.07	1.21	.24	.....
November	730	4,759	11.5	.56	278	.04	.....
December	8.85	18.5	2,195	.21	3.00	.18	.....
Year	31,679	224,955	371,152	540,769	249,797	546,117	4,604

Maximum daily sediment load, 163,000 tons July 29, 1937.

Nodaway River at Clarinda, Iowa

LOCATION.—Lat. 40°44'10", long. 95°00'30", in sec. 32, T. 69 N., R. 36 W., at bridge on State Highway 3, half a mile downstream from Neele Branch, 1.2 miles east of city square of Clarinda, and 7½ miles upstream from East Nodaway River.

DRAINAGE AREA.—740 square miles above gage; 1,190 square miles in Iowa.

SOURCES OF DATA.—U. S. Geological Survey records. For several years, gage-height record collected in cooperation with City of Clarinda.

RECORDS AVAILABLE.—May 1918 to July 1925, May 1936 to September 1940 in water-supply papers of U. S. Geological Survey. May 1918 to July 1925 in report of Iowa State Planning Board, "Stream Flow Records of Iowa, 1873-1932," pp. 68-74.

GAGE.—Nonrecording gage read once daily with additional readings on days of rapidly changing stage.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 12,500 second-feet; subject to large shifts at all stages. Affected by ice. Stream bed composed of gravel and sand; channel is dredged, with fairly high, steep banks, which overflow at high stages.

AVERAGE DISCHARGE.—6 years (1920-21, 1922-23, 1936-40), 145 second-feet.

EXTREMES.—1918-25, 1936-40: Maximum discharge observed, 14,000 second-feet May 21, 1937, from rating curve extended above 5,000 second-feet on basis of partly completed discharge measurement at gage-height 12.1 feet (discharge, about 7,400 second-feet); maximum gage height observed, 17.60 feet Mar. 12, 1939; practically no flow Aug. 25, 1919.

HISTORICAL DATA.—Maximum stage known, 25.4 feet, from floodmarks, in August 1903.

REMARKS.—Bank-full stage, about 14 feet at gage. Channel dredged or straightened in places. No regulation. Diversion by City of Clarinda for municipal supply about a half a mile above station; average consumption during period 1933 to 1940 was reported to be about 371,000 gallons per day (0.573 second-foot).

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1921	526-280	1,960	10	101	0.136	1.84	73,120	1,960	.....	104	0.141	1.91	75,290
1923	566-279	1,250	.....	102	.133	1.87	73,840	1,250	1	101	.136	1.85	73,120
1937	826-294	12,400	6	255	.345	4.67	184,400	12,400	5	242	.327	4.43	174,900
1938	856-329	4,120	5	94.7	.128	1.72	68,860	4,120	6	95.7	.129	1.74	69,310
1939	876-343	11,700	6	186	.251	3.40	134,300	11,700	6	186	.251	3.41	134,400
1940	896-	4,380	5	130	.176	2.38	94,000	.....	.....	.....	.....	.....	.....

Nodaway River near Burlington Junction, Mo.

LOCATION.—Lat. 40°26′, long. 95°05′, in NW¼ sec. 17, T. 65 N., R. 37 W., at bridge on State Highway 4, a quarter of a mile upstream from Mill Creek, 0.5 mile downstream from Wabash Railroad bridge, and 1½ miles west of Burlington Junction. From Oct. 26, 1928 to June 9, 1929, at railroad bridge half a mile upstream.

DRAINAGE AREA.—1,240 square miles above gage, 1,190 of which are in Iowa; 1,780 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—March 1922 to September 1940 in water-supply papers of U. S. Geological Survey. March 1922 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 72-77. October 1926 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 264-274.

GAGES.—Nonrecording gage read once daily below 8 feet, twice daily above, prior to June 30, 1939; recording gage thereafter. Datum of gage is 896.17 feet above mean sea level, datum of 1929. Prior to June 10, 1929, gages at different datums.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 14,000 second-feet. Affected by ice. Stream bed composed of sand and silt; no well-defined control.

AVERAGE DISCHARGE.—18 years, 361 second-feet.

EXTREMES.—1922-40: Maximum discharge, 21,000 second-feet July 6, 1929, from rating curve extended above 8,000 second-feet; maximum gage height, 19.5 feet, from floodmark, Sept. 3, 1926; minimum discharge, 1.1 second-feet Aug. 7, 1934; minimum gage height, 1.23 feet Oct. 7, 1937.

HISTORICAL DATA.—The channel has been dredged and straightened, thereby materially reducing flood damages.

REMARKS.—Bank-full stage, about 18 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1923	566-281	3,000	16	204	0.165	2.23	148,000	3,000	16	193	0.156	2.10	140,000
1924	586-271	8,400	20	566	.456	6.20	410,000	8,400	7	563	.454	6.17	408,000
1925	606-177	2,370	6	154	.124	1.68	112,000	2,370	6	153	.123	1.66	110,000
1926	626-170	15,600	12	395	.319	4.33	286,000	15,600	18	460	.363	4.93	326,000
1927	646-162	5,990	8	265	.214	2.92	192,000	3,000	8	228	.184	2.51	165,000
1928	666-159	11,800	11	416	.335	4.58	302,000	11,800	11	669	.540	7.36	486,000
1929	686-221	14,000	46	1,110	.895	12.13	803,000	14,000	43	896	.723	9.80	649,000
1930	701-226	4,600	15	325	.262	3.56	236,000	4,600	15	262	.211	2.88	190,000
1931	716-258	4,100	7	132	.106	1.43	95,300	13,200	7	413	.335	4.51	299,000
1932	731-255	13,200	25	944	.761	10.36	685,000	9,970	61	703	.567	7.71	509,890
1933	746-201	1,750	21	198	.160	2.18	143,000	1,750	11	160	.129	1.77	116,120
1934	761-264	2,150	1.1	66.2	.053	.72	47,920	5,680	1.1	93.7	.076	1.02	67,860
1935	786-275	6,170	17	335	.270	3.66	242,500	6,170	17	332	.268	3.63	240,500
1936	806-285	6,520	6	295	.238	3.24	214,100	6,520	6	286	.231	3.15	207,600
1937	826-296	15,700	4	388	.313	4.26	281,100	15,700	4	384	.294	3.98	263,500
1938	856-330	5,400	4.8	160	.129	1.74	116,700	5,400	7	162	.131	1.77	177,200
1939	876-344	18,000	4.6	344	.277	3.77	249,100	18,000	4.6	344	.277	3.76	248,700
1940	896-	5,720	7	206	.166	2.27	149,800	.....	.....	.....	.....	.....	.....

Platte River near and at Agency, Mo.

LOCATION.—Lat. 39°41'20", long. 94°42'15", in NE¼ NW¼ sec. 10, T. 56 N., R. 34 W., at bridge on U. S. Highway 169, 1½ miles downstream from Third Fork and 3½ miles northeast of Agency. Prior to 1933, at site 4 miles downstream.

DRAINAGE AREA.—1,760 square miles above gage, 800 of which are in Iowa; 1,790 square miles above former site, and 2,440 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—May 1924 to August 1930 (at site 4 miles downstream), May 1932 to September 1940 in water-supply papers of U. S. Geological Survey, May 1924 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 82-85. October 1926 to August 1930, May 1932 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 281-290.

GAGE.—Nonrecording gage read once daily below 10 feet, twice daily above. Datum of gage is 807.38 feet above mean sea level, datum of 1929; gage at former site at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 21,000 second-feet. Affected by ice. Stream bed composed of mud; control is rock ledge ¼ mile below gage; fairly permanent. Left bank high in vicinity of gage; right bank subject to overflow.

AVERAGE DISCHARGE.—13 years (1924-29, 1932-40), 648 second-feet.

EXTREMES.—1924-30, 1932-40: Maximum discharge, 22,600 second-feet Sept. 18, 1926 (gage height, 25.5 feet, from flood mark, present site and datum); no flow on several days in July and August 1934.

HISTORICAL DATA.—Especially disastrous floods occurred in July 1915 (gage height, 29.1 feet) and September 1926 (gage height, 25.5 feet), the latter causing damage estimated at more than half a million dollars. A stage of 24.3 feet occurred in November 1931.

REMARKS.—Bank-full stage, about 20 feet. Much of the channel has been dredged and straightened. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1925	606-181	14,000	34	484	0.270	3.67	350,000	14,000	34	591	0.330	4.49	428,000
1926	626-171	21,600	39	1,120	.626	8.53	813,000	21,600	39	1,370	.765	10.39	990,000
1927	646-164	14,500	25	1,070	.598	8.07	773,000	10,600	24	753	.421	5.69	546,000
1928	666-161	15,000	24	834	.466	6.36	605,000	15,200	24	1,290	.721	9.87	940,000
1929	686-223	21,200	55	2,110	1.18	15.99	1,530,000	21,200	39	1,690	.944	12.85	1,224,000
1933	761-265	5,560	6	279	.159	2.15	202,200	5,560	6	238	.135	1.83	172,600
1934	761-265	1,020	0	67.4	.038	.51	48,820	4,700	0	167	.095	1.28	120,900
1935	786-276	21,500	4.1	873	.496	6.75	632,300	21,500	18	790	.449	6.11	572,100
1936	806-286	6,150	1.4	392	.223	3.03	284,400	6,150	1.4	384	.218	2.97	278,900
1937	826-297	10,600	6	541	.307	4.18	391,800	10,600	1.4	518	.294	4.00	375,200
1938	856-331	4,450	1.4	140	.080	1.08	101,200	4,450	1	140	.080	1.08	101,000
1939	876-345	8,210	1	359	.204	2.76	260,100	8,210	2	358	.203	2.76	260,100
1940	896-	4,160	2	160	.091	1.23	116,000						

One Hundred and Two River near Maryville, Mo.

LOCATION.—Lat. 40°23′, long. 94°50′, in SE¼ SW¼ sec. 34, T. 65 N., R. 35 W., on county highway bridge 2½ miles northeast of Maryville and 5 miles downstream from Norvey Creek.

DRAINAGE AREA.—500 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—June 1934 to September 1940 in water-supply papers of U. S. Geological Survey. June 1934 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 291-295.

GAGE.—Nonrecording gage read once daily below 10 feet, twice daily above. Datum of gage is 969.90 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 8,000 second-feet. Affected by ice. Stream bed composed of silt and sand; no permanent control. Banks are fairly clean and subject to overflow at high stages.

AVERAGE DISCHARGE.—6 years, 110 second-feet.

EXTREMES.—1934-40: Maximum discharge, 12,600 second-feet Mar. 13, 1939 (gage height, 20.4 feet, from graph based on gage readings), from rating curve extended above 8,000 second-feet; no flow July 25, 26, 1940.

HISTORICAL DATA.—Maximum stage known, about 21.2 feet, from floodmarks, date unknown. Records collected at site one mile east of Maryville, about 4 miles downstream from present site, from October 1932 to September 1934; gage at datum 5.78 feet lower than that of present gage.

REMARKS.—Bank-full stage, about 19 feet. Diversion by City of Maryville for municipal supply about three miles below station. No regulation.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1934	761-267	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete		.....	.....
1935	786-277	5,180	0.1	189	0.378	5.11	136,900	5,180	3.6	179	0.358	4.81	129,300
1936	806-287	3,310	1.0	82.5	.165	2.23	59,920	3,310	1.0	77.0	.154	2.09	55,890
1937	826-298	3,940	1.1	115	.230	3.12	83,400	3,940	1.3	111	.222	3.00	80,520
1938	856-332	3,420	.8	57.2	.114	1.55	41,440	3,420	.8	57.3	.115	1.56	41,520
1939	876-346	9,970	1	167	.334	4.51	120,700	9,970	1	166	.332	4.49	120,400
1940	896-	2,140	0	51.8	.104	1.41	37,570	.....	.....	.....	.....	.....	.....

Grand River near Gallatin, Mo.

LOCATION.—Lat. 39°55'35", long. 93°56'35", in SW¼ NW¼ sec. 16, T. 59 N., R. 27 W., at bridge on State Highway 6, 100 feet downstream from Chicago, Rock Island & Pacific Railway bridge, 1 mile northeast of Gallatin, and 6 miles upstream from Honey Creek. Prior to Jan. 31, 1922, at railway bridge 100 feet upstream; thereafter to Nov. 16, 1936, at site 1,100 feet upstream.

DRAINAGE AREA.—2,250 square miles above gage; 7,900 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record collected in cooperation with U. S. Weather Bureau.

RECORDS AVAILABLE.—June 1921 to September 1940 in water-supply papers of U. S. Geological Survey. June 1921 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 86-91. October 1926 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 303-313.

GAGES.—Nonrecording gage read once or twice daily prior to Nov. 15, 1937; recording gage thereafter. Datum of gage is 712.56 feet above mean sea level, datum of 1929; prior to Nov. 16, 1936, at datum 0.17 foot higher.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 40,000 second-feet; relation fairly permanent. Affected by ice. Stream bed composed of sand, gravel and silt. Both banks fairly high and wooded.

AVERAGE DISCHARGE.—19 years, 969 second-feet.

EXTREMES.—1921-40: Maximum discharge observed, 56,800 second-feet June 2, 1929 (gage height, 37.02 feet, present site and datum), from rating curve extended above 40,000 second-feet; minimum, 2.4 second-feet Oct. 24, 25, 1938 (gage height, 0.76 foot).

HISTORICAL DATA.—Maximum stage known, about 40 feet, from floodmarks, July 8, 1909. Other disastrous floods occurred in 1915, 1922, and 1926. Gage readings during high stages obtained by U. S. Weather Bureau from June 1917 to June 1921.

REMARKS.—Bank-full stage, about 28 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1922	546-312	33,900	20	850	0.378	5.12	615,000	33,900	20	1,220	0.542	7.39	887,000
1923	566-312	19,000	77	830	.369	5.00	601,000	10,500	77	504	.224	3.04	365,000
1924	586-302	22,200	10	935	.438	5.96	714,000	22,200	10	954	.424	5.76	692,000
1925	606-209	20,400	33	843	.375	5.07	610,000	20,400	33	1,110	.493	6.72	806,000
1926	626-190	49,600	39	1,840	.818	11.09	1,330,000	49,600	39	2,150	.956	12.95	1,550,000
1927	646-182	36,600	35	1,660	.738	10.03	1,200,000	25,800	24	1,140	.507	6.88	827,000
1928	666-180	31,600	24	1,090	.484	6.55	788,000	47,800	24	1,960	.871	11.84	1,420,000
1929	686-255	51,400	37	3,040	1.35	18.36	2,200,000	51,400	33	2,160	.960	13.02	1,560,000
1930	701-261	6,800	25	525	.233	3.18	380,000	6,800	23	466	.207	2.83	337,000
1931	716-298	12,300	18	360	.160	2.18	261,000	31,600	18	1,343	.597	8.10	972,000
1932	731-300	31,600	50	1,970	.876	11.90	1,430,000	23,000	28	1,035	.460	6.26	749,400
1933	786-315	16,000	23	506	.225	3.05	366,000	16,000	23	465	.207	2.79	336,500
1934	786-315	6,080	3	149	.066	.90	108,000	13,500	3	464	.206	2.81	336,200
1935	786-315	39,300	12	1,763	.784	10.65	1,276,000	39,300	17	1,464	.651	8.85	1,060,000
1936	806-331	16,000	4.3	478	.212	2.89	346,900	16,000	4	470	.209	2.83	340,900
1937	826-340	15,200	4	693	.308	4.18	502,100	15,200	8	660	.293	3.98	478,000
1938	856-381	3,550	7	129	.057	.77	93,460	3,550	2.6	126	.056	.76	91,540
1939	876-387	17,200	2.6	444	.197	2.68	321,400	17,200	3	445	.198	2.69	322,200
1940	896–	7,010	3	261	.116	1.57	189,100						

East Fork of Big Creek near Bethany, Mo.

LOCATION.—Lat. 40°17'50", long. 94°01'55", in SE¼ sec. 34, T. 64 N., R. 28 W., at bridge on U. S. Highway 69, 2 miles north of Bethany and 4 miles upstream from confluence with West Fork.

DRAINAGE AREA.—95 square miles above gage.

SOURCES OF DATA.—U. S. Geological Survey records. Station operated in cooperation with Corps of Engineers, U. S. Army; prior to June 30, 1938, in cooperation with U. S. Department of Agriculture, Soil Conservation Service.

RECORDS AVAILABLE.—March 1934 to September 1940 in water-supply papers of U. S. Geological Survey. March 1934 to September 1938 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 323-327.

GAGES.—Nonrecording gage read twice daily prior to June 1934; recording gage thereafter. Datum of gage is 854.74 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 2,500 second-feet. Affected by ice. Stream bed composed of sand and silt. Low-water control is small V-shaped concrete dam about 300 feet below gage. Channel control for high stages, fairly permanent. Both banks are lightly timbered.

AVERAGE DISCHARGE.—6 years, 36.3 second-feet.

EXTREMES.—1934-40: Maximum discharge, 3,500 second-feet May 31, 1935; maximum gage height, 12.10 feet Feb. 13, 1937 (caused by ice jam); no flow on many days.

HISTORICAL DATA.—Highest stage known, 23.8 feet, from high-water mark, July 6, 1909.

REMARKS.—Bank-full stage, about 13 feet. Diversion by City of Bethany for municipal supply about a mile below station.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1934	761-304	.....	0	.....	.....	.....	.....	.....	0	.....	.....	.....	.....
1935	786-319	1,940	0	83.0	0.874	11.88	60,090	1,940	0	63.2	0.665	9.04	45,740
1936	806-333	808	0	20.0	.211	2.87	14,500	808	0	21.0	.221	3.02	15,240
1937	826-342	1,350	0	68.4	.720	9.78	49,480	1,350	0	66.1	.696	9.46	47,880
1938	856-383	107	0	2.27	.024	.32	1,640	107	0	2.27	.024	.32	1,640
1939	896-	1,440	0	26.5	.279	3.78	19,160	1,440	0	26.5	.279	3.78	19,160
1940	896-	1,400	0	17.4	.183	2.49	12,620	.....	.....	.....	.....	.....	.....

Month	Suspended sediment load transported by stream (tons per month)			
	1934	1935	1936	1937
January	.....	323	1.09	951
February	.....	6,325	7,431	(a) 2,377
March	.....	1,076	5,725	(b) 31,854
April	505	111	2.13	56,386
May	1,193	163,682	8,669	30,137
June	13,568	122,122	8.94	299
July	1.09	50.8	0	44,753
August	1,043	.06	0	23.4
September	3,254	29.8	4,769	0
October	13,622	.32	3,708	0
November	52,317	1,106	1.26	0
December	369	33.3	60.1	0
Year	85,872	294,859	30,376	166,780

Maximum daily sediment load, 44,700 tons Apr. 30, 1937.
a) Feb. 1-13. b) Mar. 2-31.

NOTE.—No sediment samples collected Feb. 14 to Mar. 1, 1937.

Thompson River at Trenton, Mo.

LOCATION.—Lat. 40°04', long. 93°38', in SE¼ sec. 20, T. 61 N., R. 24 W., at county highway bridge, 1 mile south of Trenton and 4 miles downstream from Weldon River. Prior to Oct. 1, 1930, at site 2 miles upstream.

DRAINAGE AREA.—1,680 square miles above gage; 1,670 square miles above former site, and 2,200 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Gage-height record collected in cooperation with U. S. Weather Bureau.

RECORDS AVAILABLE.—August 1928 to September 1940 in water-supply papers of U. S. Geological Survey. August 1928 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 327-336.

GAGE.—Nonrecording gage read once daily below 10 feet, twice daily above. Datum of gage is 718.12 feet above mean sea level, datum of 1929. Former gage at different datum.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 20,000 second-feet. Affected by ice. Stream bed composed of sand. Channel is dredged, with fairly high banks. No permanent control.

AVERAGE DISCHARGE.—12 years, 729 second-feet.

EXTREMES.—1928-40: Maximum discharge observed, 26,700 second-feet Nov. 18, 1928, Dec. 31, 1931; maximum gage height observed, 22.31 feet Nov. 18, 1928, site and datum then in use; minimum discharge, 1.1 second-feet Aug. 10, 1934.

HISTORICAL DATA.—Maximum stage known, 30.7 feet July 6, 1909, former site and datum, before new channel was dredged. Records collected at sites near Hickory, Mo. June 1921 to August 1923, and May to September 1924. The U. S. Weather Bureau has obtained gage-height records at various sites near Trenton since Feb. 15, 1910.

REMARKS.—Bank-full stage, about 24 feet. Diversion by City of Trenton for municipal supply. No regulation.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1929	686-257	26,500	53	1,830	1.10	14.89	1,330,000	24,600	53	1,360	0.810	11.02	981,000
1930	701-263	5,980	24	499	.299	4.06	361,000	5,980	15	374	.223	3.05	271,000
1931	716-300	5,100	15	273	.162	2.22	198,000	24,700	17	1,070	.637	8.63	771,000
1932	731-302	24,700	57	1,900	1.13	15.39	1,380,000	20,100	38	1,170	.696	9.49	850,000
1933	746-235	6,590	29	339	.202	2.74	245,000	6,590	12	288	.171	2.32	208,000
1934	761-305	3,940	1.1	117	.070	.94	84,510	11,700	1.1	322	.192	2.60	233,200
1935	786-320	24,000	15	1,592	.948	12.86	1,153,000	24,000	19	1,404	.836	11.33	1,016,000
1936	806-334	5,280	3.6	286	.170	2.31	207,900	5,280	3.6	282	.168	2.28	204,600
1937	826-343	13,400	6	728	.430	5.81	523,200	13,400	6	692	.412	5.56	501,200
1938	856-384	4,970	6	168	.100	1.34	121,900	4,970	4.6	166	.099	1.33	120,400
1939	876-389	20,700	4.6	556	.331	4.50	402,400	20,700	7	557	.332	4.51	403,600
1940	896-	12,300	4	470	.280	3.80	341,200						

Weldon River at Mill Grove, Mo.

LOCATION.—Lat. 40°18′, long. 93°36′, in SE¼ SE¼ sec. 28, T. 64 N., R. 24 W., at county highway bridge in Mill Grove, 8¼ miles upstream from West Muddy Creek.

DRAINAGE AREA.—494 square miles above gage.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—April 1929 to September 1940 in water-supply papers of U. S. Geological Survey. April 1929 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 336-345.

GAGE.—Nonrecording gage read once daily below 8 feet, twice daily above. Datum of gage is 785.94 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 12,000 second-feet. Affected by ice. Stream bed composed of rock and silt. Left bank high in vicinity of gage; right bank subject to overflow. Remains of old log dam 150 feet below gage forms control for low stages.

AVERAGE DISCHARGE.—11 years, 188 second-feet.

EXTREMES.—1929-40: Maximum discharge observed, 14,200 second-feet June 2, 1929 (gage height, 20.6 feet), from rating curve extended above 10,000 second-feet; minimum, 0.2 second-foot Aug. 29, 1936, Dec. 11-13, 1937; minimum gage height, 0.89 foot Oct. 7-9, 1937.

HISTORICAL DATA.—Maximum stage known, 23.9 feet sometime in July 1909.

REMARKS.—Bank-full stage, about 15 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1930	716-301	2,540	1.6	108	0.219	2.97	78,300	1,330	1.6	68.3	0.138	1.88	49,400
1931	716-301	3,270	1.6	53.6	.109	1.46	38,800	10,900	1.8	299	.605	8.20	216,000
1932	731-303	10,900	4.4	585	1.18	16.09	424,000	7,530	2.0	367	.743	10.08	266,000
1933	746-236	4,970	2.0	98.1	.199	2.71	71,000	4,970	2.6	78.7	.159	2.18	57,000
1934	761-306	1,650	.3	40.6	.082	1.12	29,360	2,680	.3	108	.219	2.96	78,000
1935	786-321	11,700	.8	472	.956	12.96	341,400	11,700	3.3	408	.826	11.22	295,500
1936	806-335	2,880	.2	96.5	.195	2.66	70,080	2,880	.2	91.7	.186	2.53	66,570
1937	826-344	5,000	.5	217	.439	5.97	157,300	5,000	.2	211	.427	5.79	152,400
1938	856-385	1,600	.2	42.7	.086	1.15	30,880	1,600	.9	42.8	.087	1.16	30,980
1939	876-390	8,710	.9	208	.421	5.71	150,500	8,710	1.0	208	.421	5.72	150,800
1940	896-	5,250	1	143	.289	3.95	104,200						

Medicine Creek near Galt, Mo.

LOCATION.—Lat. 40°07'58", long. 93°21'50", in NW¼ sec. 34, T. 62 N., R. 22 W., at bridge on State Highway 6, 125 feet upstream from Quincy, Omaha & Kansas City Railroad bridge, 1½ miles upstream from West Medicine Creek, and 1½ miles east of Galt. Prior to Dec. 3, 1934, at railroad bridge 125 feet downstream.

DRAINAGE AREA.—225 square miles above gage; 512 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—July 1921 to September 1940 in water-supply papers of U. S. Geological Survey. July 1921 to September 1926 in report of Missouri Bureau of Geology and Mines, "Water Resources of Missouri, 1857-1926," pp. 100-105. October 1926 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-39," pp. 345-355.

GAGE.—Nonrecording gage read once daily. Datum of gage is 769.21 feet above mean sea level, datum of 1929; prior to Dec. 3, 1934, at datum 0.03 foot lower.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 4,500 second-feet. Affected by ice. Stream bed composed of silt and sand. No well-defined control.

AVERAGE DISCHARGE.—17 years (1921-24, 1925-28, 1929-40), 118 second-feet.

EXTREMES.—1921-40: Maximum discharge, 12,300 second-feet Mar. 12, 1939, from rating curve extended above 4,500 second-feet; maximum gage height observed, 15.60 feet Apr. 20, 1929; no flow on many days in 1934 and 1936, and on Nov. 22, 23, 1937, Jan. 4-31, Feb. 5-9, 1940.

HISTORICAL DATA.—Channel was straightened in 1923.

REMARKS.—Bank-full stage, about 17 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1922	546-317	2,960	1	155	0.684	9.31	112,000	2,960	1	187	0.831	11.23	135,000
1923	566-318	2,230	1.8	101	.449	6.05	72,000	1,240	1.8	71.1	.316	4.28	51,500
1924	586-307	3,170	2	127	.564	7.67	92,000	3,170	1	120	.533	7.28	87,300
1926	626-193	4,640	2	216	.960	13.03	165,000	4,640	2	213	.947	12.87	163,000
1927	646-185	3,720	2	160	.711	9.64	116,000	3,720	1	124	.551	7.46	89,400
1928	686-183	6,260	1	135	.600	8.19	98,200						
1929	686-258							6,600	3	227	1.01	13.68	164,000
1930	701-264	1,890	1.2	95.9	.426	5.78	69,400	855	1.2	56.2	.250	3.40	40,700
1931	716-303	3,910	1.6	58.3	.259	3.53	42,200	6,160	1.6	209	.929	12.62	152,800
1932	731-304	6,160	3.2	331	1.47	19.97	240,000	6,000	2.0	191	.849	11.58	139,000
1933	746-237	1,660	1.7	65.1	.289	3.92	47,200	1,660	1.2	53.5	.238	3.22	38,790
1934	761-307	369	0	9.25	.0411	.54	6,700	1,880	0	47.3	.210	2.85	34,260
1935	786-322	4,440	.8	259	1.15	15.64	187,600	4,440	2.0	223	.991	13.43	161,100
1936	806-336	1,210	0	31.9	.142	1.94	23,120	1,210	0	31.0	.138	1.88	22,600
1937	826-345	3,560	.6	103	.458	6.21	74,610	3,560	0	102	.453	6.15	73,880
1938	856-396	926	0	11.4	.051	.69	8,220	926	.1	10.8	.048	.66	7,800
1939	876-391	7,220	.1	89.6	.398	5.40	64,890	7,220	.1	89.8	.399	5.41	65,030
1940	896-	2,390	0	51.4	.228	3.12	37,340						

Locust Creek near Linneus, Mo.

LOCATION.—Lat. 39°53′, long. 93°14′, in NE¼ sec. 34, T. 59 N., R. 21 W., at county highway bridge 3 miles northwest of Linneus and 4 miles downstream from confluence of East and West Locust Creeks.

DRAINAGE AREA.—550 square miles above gage; 631 square miles above mouth.

SOURCES OF DATA.—U. S. Geological Survey records. Prior to 1933, station maintained in cooperation with Corps of Engineers, U. S. Army.

RECORDS AVAILABLE.—April 1929 to September 1940 in water-supply papers of U. S. Geological Survey. April 1929 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 365-373.

GAGES.—Nonrecording gage read once daily, more often during periods of high water. Datum of gage is 692.61 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 14,000 second-feet. Affected by ice. Stream bed composed of rock; control formed by rocks and shale, fairly permanent. Right bank high; left bank subject to overflow at high stages.

AVERAGE DISCHARGE.—11 years, 263 second-feet.

EXTREMES.—1929-40: Maximum discharge, 14,900 second-feet June 21, 1939 (gage height, 21.3 feet, from graph based on gage readings); no flow July 17 to Aug. 11, 1934.

REMARKS.—Bank-full stage, about 20 feet. No regulation or diversions. Parts of channel have been dredged and straightened.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1929	686-260	13,700	.....	.....	.....	.....	.....	13,700	.....	.....	.....	.....	.....
1930	701-266	5,730	4	310	0.564	7.63	224,000	5,460	3.6	183	0.333	4.52	133,000
1931	716-307	7,940	3.6	276	.502	6.79	200,000	8,040	3.8	566	1.02	13.97	410,000
1932	731-307	8,040	12	696	1.27	17.21	504,000	6,420	7	438	.796	10.82	317,000
1933	746-240	4,390	3.8	180	.327	4.46	131,000	2,610	2.8	130	.236	3.22	94,100
1934	761-308	900	0	21.4	.039	.53	15,490	3,350	0	116	.211	2.86	83,790
1935	786-323	10,400	2.1	709	1.29	17.50	513,600	10,400	5	629	1.14	15.53	455,600
1936	806-337	3,100	.2	104	.189	2.56	75,220	3,100	.2	97.2	.177	2.39	70,560
1937	826-346	5,110	1.9	215	.391	5.30	155,800	5,110	1.3	206	.375	5.07	149,100
1938	856-387	639	.6	23.5	.043	.58	17,030	639	.6	26.2	.048	.64	19,010
1939	896-421	12,800	1.1	263	.478	6.48	190,500	12,800	1.3	261	.475	6.44	189,000
1940	896-	2,340	1	96.9	.176	2.38	70,320	.....	.....	.....	.....	.....	.....

Chariton River at Novinger, Mo.

LOCATION.—Lat. 40°14', long. 92°41', in SE¼ NW¼ sec. 27, T. 63 N., R. 16 W., at bridge on State Highway 6, 1,000 feet downstream from Chicago, Burlington & Quincy Railroad bridge, three quarters of a mile east of Novinger, and 2 miles upstream from Spring Creek.

DRAINAGE AREA.—1,370 square miles above gage, 920 of which are in Iowa; 3,040 square miles above mouth.

SOURCE OF DATA.—U. S. Geological Survey records.

RECORDS AVAILABLE.—January 1931 to September 1940 in water-supply papers of U. S. Geological Survey. January 1931 to September 1939 in report of Missouri Geological Survey and Water Resources, "Surface Waters of Missouri, 1927-1939," pp. 377-384.

GAGES.—Nonrecording gage read once daily below 10 feet, twice daily above, prior to December 21, 1939; recording gage thereafter. Datum of gage is 737.65 feet above mean sea level, datum of 1929.

STAGE-DISCHARGE RELATION.—Defined by current-meter measurements below 16,000 second-feet. Affected by ice. Stream bed composed of sand and silt; no permanent control. Left bank high; right bank subject to overflow.

AVERAGE DISCHARGE.—9 years, 583 second-feet.

EXTREMES.—1931-40: Maximum discharge, 15,400 second-feet Nov. 25, 1931 (gage height, 26.03 feet); minimum, 0.1 second-foot Aug. 31, Sept. 1, 1936; minimum gage height, 1.84 feet Jan. 19, 1931.

HISTORICAL DATA.—Maximum stage known, 28.6 feet sometime in June 1917. Flood losses, which were rather large, have been reduced materially by dredging and straightening the channel in some places.

REMARKS.—Bank-full stage, about 20 feet. No regulation or diversions.

Summary of yearly discharge, in second-feet

Year	Water supply paper (No. and page)	Water year ending Sept. 30						Calendar year					
		Maximum day	Minimum day	Mean	Per square mile	Runoff		Maximum day	Minimum day	Mean	Per square mile	Runoff	
						Inches	Acre-feet					Inches	Acre-feet
1931	731-309	.....	.....	Incomplete		.....	.....	.....	.....	Incomplete		.....	.....
1932	731-309	15,400	22	1,530	1.12	15.26	1,110,000	13,700	15	935	0.682	9.29	679,100
1933	746-241	6,200	11	426	.311	4.22	308,000	4,710	4	335	.245	3.31	242,200
1934	761-309	3,130	.5	89.5	.065	.89	64,770	3,130	.3	185	.135	1.85	134,100
1935	786-324	12,600	.3	1,371	1.00	13.58	992,400	12,600	12	1,296	.946	12.83	938,300
1936	806-338	4,000	.1	257	.188	2.55	186,400	4,000	.1	255	.186	2.54	185,300
1937	826-347	6,820	2.0	528	.385	5.23	382,400	6,820	1.8	499	.364	4.94	361,300
1938	856-388	1,660	1.8	125	.091	1.26	90,770	1,660	2.8	150	.109	1.51	108,500
1939	876-395	12,600	2.8	715	.522	7.11	517,500	12,600	4	691	.504	6.86	500,400
1940	896-	3,450	3	202	.147	2.00	146,700	.....	.....	.....	.....	.....	.....

MISCELLANEOUS DISCHARGE MEASUREMENTS

In addition to the continuous records of stream flow covered in the preceding pages for certain gaging stations in Iowa and adjoining states, current-meter discharge measurements of miscellaneous character at many points have been made by engineers of the United States Geological Survey or its cooperating agencies throughout the years. The results of many such measurements have been published annually under "Miscellaneous discharge measurements," in water-supply papers of the Federal Geological Survey.

Space will not permit the presentation of the results of a large number of these current-meter discharge measurements which have been made on the boundary rivers of Iowa, particularly the Mississippi. Many of these determinations on the Mississippi River have been made by the Corps of Engineers, U. S. Army, especially until recent years, when the Federal Geological Survey has cooperated with the Army Engineers in the determination of continuous and systematic records of daily discharge at certain locations on the Mississippi and Missouri Rivers.

However, a compendium of many miscellaneous discharge measurements, which have been made within the State of Iowa, is given in the following original list in table 5. These individual measurements have usually been made with current meters, and at locations where gaging stations were not being operated at the time of the measurement. The streams and points of measurement appear in alphabetical order by important drainage basins and thereunder in chronological order.

Additional information concerning the details of miscellaneous discharge measurements can be obtained in the Iowa City office of the Survey. Also, the results of the miscellaneous measurements on the Mississippi and Missouri Rivers can be secured from the U. S. Engineer offices which have jurisdiction over the work on those rivers.

Table 5—Miscellaneous Measurements of Streams in Iowa

MISSISSIPPI RIVER BASIN

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
		Catfish Creek Basin		
505	July 24, 1919	Catfish Creek	Rockdale	25.8
		Des Moines River Basin		
875	July 7, 1939	Beaver Creek	Des Moines	152
895	May 28, 1940	Beaver Creek	Des Moines	39.7
895	July 9, 1940	Beaver Creek	Des Moines	1.14
.....	July 26, 1940	Beaver Creek	Des Moines	0
895	July 31, 1940	Beaver Creek	Des Moines	573
895	Aug. 14, 1940	Beaver Creek	Des Moines	1,190
785	July 30, 1935	Boone River	Webster City	258
405	May 30, 1915	Des Moines River	Boone	27,500
405	June 5, 1915	Des Moines River	Boone	13,200
745	Mar. 16, 1933	Des Moines River	Boone	542

TABLE 5.—*Miscellaneous measurements of streams in Iowa—Continued*

MISSISSIPPI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
745	April 5, 1933	Des Moines River	Boone	14,400
745	April 8, 1933	Des Moines River	Boone	7,910
745	June 12, 1933	Des Moines River	Boone	359
745	June 22, 1933	Des Moines River	Boone	140
745	Aug. 25, 1933	Des Moines River	Boone	117
99	Oct. 20, 1902	Des Moines River	Des Moines	5,796
99	Nov. 12, 1902	Des Moines River	Des Moines	1,714
99	Nov. 15, 1902	Des Moines River	Des Moines	3,417
99	Mar. 16, 1903	Des Moines River	Des Moines	8,550
99	May 21, 1903	Des Moines River	Des Moines	6,752
99	June 3, 1903	Des Moines River	Des Moines	22,101
99	July 9, 1903	Des Moines River	Des Moines	4,042
171	May 28, 1904	Des Moines River	Des Moines	4,852
171	Nov. 13, 1904	Des Moines River	Des Moines	74
——	Sept. 17, 1938	Des Moines River	Des Moines	(a) 18,200
——	Sept. 19, 1938	Des Moines River	Des Moines	(a) 27,200
——	May 11, 1939	Des Moines River	Des Moines	(a) 2,180
——	June 24, 1939	Des Moines River	Des Moines	(a) 1,450
——	July 6, 1939	Des Moines River	Des Moines	(a) 3,430
——	Aug. 8, 1939	Des Moines River	Des Moines	(a) 380
——	Feb. 19, 1940	Des Moines River	Des Moines	(a) 81.4
171	June 6, 1904	Des Moines River	Fort Dodge	2,729
99	Sept. 17, 1903	Des Moines River	Ottumwa	14,913
385, 455	Sept. 18, 1914	Des Moines River	Ottumwa	24,400
405, 455	June 1, 1915	Des Moines River	Ottumwa	56,300
585	April 29, 1924	E. Fork of Des Moines River (b)	Dolliver	30.3
585	April 29, 1924	E. Fork of Des Moines River (b)	Dolliver	30.1
730	April 13, 1932	E. Fork of Des Moines River (b)	Dolliver	112
730	May 13, 1932	E. Fork of Des Moines River (b)	Dolliver	27.1
730	July 13, 1932	E. Fork of Des Moines River (b)	Dolliver	24.4
730	Aug. 11, 1932	E. Fork of Des Moines River (b)	Dolliver	(c) .04
745	May 16, 1933	E. Fork of Des Moines River (b)	Dolliver	31.5
760	May 18, 1933	E. Fork of Des Moines River (b)	Dolliver	55.9
745	Aug. 23, 1933	E. Fork of Des Moines River (b)	Dolliver	(c) .05
——	Aug. 24, 1933	E. Fork of Des Moines River (b)	Dolliver	(c) .5
——	Mar. 15, 1934	E. Fork of Des Moines River (b)	Dolliver	0
——	May 1, 1935	E. Fork of Des Moines River (b)	Dolliver	.2
——	June 18, 1935	E. Fork of Des Moines River (b)	Dolliver	6.94
——	July 30, 1935	E. Fork of Des Moines River (b)	Dolliver	.5
805	June 12, 1936	E. Fork of Des Moines River (b)	Dolliver	60.0
825	April 6, 1937	E. Fork of Des Moines River (b)	Dolliver	31.9
825	June 25, 1937	E. Fork of Des Moines River (b)	Dolliver	13.3
825	July 11, 1937	E. Fork of Des Moines River (b)	Dolliver	(c) 5
825	July 12, 1937	E. Fork of Des Moines River (b)	Dolliver	2.61
825	Sept. 20, 1937	E. Fork of Des Moines River (b)	Dolliver	0
855	June 2, 1938	E. Fork of Des Moines River (b)	Dolliver	137
855	July 7, 1938	E. Fork of Des Moines River (b)	Dolliver	214
855	July 28, 1938	E. Fork of Des Moines River (b)	Dolliver	89.7
855	Sept. 15, 1938	E. Fork of Des Moines River (b)	Dolliver	298
875	April 3, 1939	E. Fork of Des Moines River (b)	Dolliver	43.6
875	April 3, 1939	E. Fork of Des Moines River (b)	Dolliver	65.4
875	July 11, 1939	E. Fork of Des Moines River (b)	Dolliver	2.68
875	Aug. 8, 1939	E. Fork of Des Moines River (b)	Dolliver	14.7
875	Sept. 13, 1939	E. Fork of Des Moines River (b)	Dolliver	1.23
385	Oct. 17, 1913	Lizard Creek	Fort Dodge	69.6
760	Aug. 19, 1934	Middle Raccoon River	Carroll	0
99	Mar. 17, 1903	Raccoon River	Des Moines	6,082
171	Nov. 14, 1904	Raccoon River	Des Moines	199
760	May 21, 1934	Raccoon River	Des Moines	74.2
760	May 21, 1934	Raccoon River	Des Moines	56.9
760	Aug. 19, 1934	Raccoon River	Jefferson	50.4
——	May 18, 1927	Sugar Creek	Keokuk	(d) 27.8
685	Oct. 26, 1929	Sugar Creek	Keokuk	26.0
		Fox River Basin		
875	Mar. 13, 1939	Fox River	Cantril	(e) 829

a) Below mouth of Raccoon River.
b) Measurement of Tuttle Lake Outlet.
c) Discharge estimated.
d) Measurement by engineers of Mississippi River Power Co.
e) Measurement by Corps of Engineers.

TABLE 5—*Miscellaneous measurements of streams in Iowa—Continued*

MISSISSIPPI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
		Iowa River Basin		
825	June 15, 1937	Cedar River	Gilbertville	(e) 23,900
—	May 18, 1933	Clear Creek (f)	Clear Lake	6.06
475	June 5, 1918	Iowa River	Belle Plaine	38,600
625	Oct. 13, 1925	Iowa River	Belmond	67.4
99	Mar. 7, 1903	Iowa River	Marshalltown	1,325
99	Mar. 23, 1903	Iowa River	Marshalltown	1,964
99	April 24, 1903	Iowa River	Marshalltown	1,150
99	June 4, 1903	Iowa River	Marshalltown	4,790
625	Oct. 13, 1925	Lime Creek	Mason City	53.6
525	Sept. 26, 1921	Pine Creek	Eldora	6.7
		Maquoketa River Basin		
665	Sept. 11, 1928	Maquoketa River	Delhi	1,170
685	Nov. 24, 1928	Maquoketa River	Delhi	490
685	Mar. 14, 1929	Maquoketa River	Delhi	7,360
685	Mar. 14, 1929	Maquoketa River	Delhi	7,130
685	Mar. 16, 1929	Maquoketa River	Delhi	1,370
685	Mar. 16, 1929	Maquoketa River	Delhi	1,710
685	Mar. 16, 1929	Maquoketa River	Delhi	1,430
685	May 17, 1929	Maquoketa River	Delhi	271
685	Sept. 5, 1929	Maquoketa River	Delhi	233
700	April 12, 1930	Maquoketa River	Delhi	(e) 14.6
700	June 4, 1930	Maquoketa River	Delhi	(e) 243
355	Aug. 20, 1913	Maquoketa River	Fulton	202
99	June 6, 1903	Maquoketa River	Manchester	245
665	Sept. 10, 1928	Maquoketa River	Manchester	339
665	Sept. 10, 1928	Maquoketa River	Manchester	254
665	Sept. 11, 1928	Maquoketa River	Manchester	1,448
685	Nov. 24, 1928	Maquoketa River	Manchester	285
685	May 17, 1929	Maquoketa River	Manchester	270
685	May 18, 1929	Maquoketa River	Manchester	215
685	May 18, 1929	Maquoketa River	Manchester	197
685	Sept. 5, 1929	Maquoketa River	Manchester	18.2
700	April 12, 1930	Maquoketa River	Manchester	(e) 14.5
700	June 4, 1930	Maquoketa River	Manchester	(e) 17.6
355	Aug. 21, 1913	Maquoketa River	Maquoketa	564
505	July 23, 1919	Maquoketa River	Maquoketa	364
505	Sept. 11, 1919	Maquoketa River	Maquoketa	309
99	July 1903	Maquoketa River	Monticello	878
—	May 5, 1931	Maquoketa River	Sprague ville	394
99	July 1903	N. Fork of Maquoketa River	Cascade	152
355	Aug. 20, 1913	N. Fork of Maquoketa River	Fulton	304
685	April 17, 1929	N. Fork of Maquoketa River	Fulton	413
685	May 1, 1929	N. Fork of Maquoketa River	Fulton	572
685	May 16, 1929	N. Fork of Maquoketa River	Fulton	417
685	May 18, 1929	N. Fork of Maquoketa River	Fulton	332
685	July 5, 1929	N. Fork of Maquoketa River	Fulton	225
685	July 8, 1929	N. Fork of Maquoketa River	Fulton	516
685	Sept. 5, 1929	N. Fork of Maquoketa River	Fulton	152
700	April 12, 1930	N. Fork of Maquoketa River	Fulton	(e) 134
700	May 17, 1930	N. Fork of Maquoketa River	Fulton	(e) 164
700	June 6, 1930	N. Fork of Maquoketa River	Fulton	(e) 501
700	Sept. 3, 1930	N. Fork of Maquoketa River	Fulton	(e) 158
700	Sept. 17, 1930	N. Fork of Maquoketa River	Fulton	(e) 100
700	Sept. 27, 1930	N. Fork of Maquoketa River	Fulton	(e) 281
715	Oct. 18, 1930	N. Fork of Maquoketa River	Fulton	177
715	Nov. 15, 1930	N. Fork of Maquoketa River	Fulton	140
—	Mar. 21, 1931	N. Fork of Maquoketa River	Fulton	122
—	Aug. 28, 1931	N. Fork of Maquoketa River	Fulton	2,080
—	Aug. 28, 1931	N. Fork of Maquoketa River	Fulton	1,540

e) Measurement by Corps of Engineers.
f) At Clear Lake Outlet.

TABLE 5—*Miscellaneous measurements of streams in Iowa—Continued*

MISSISSIPPI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
805	July 30, 1936	Spring Branch Creek	Manchester	1.86
805	July 31, 1936	Spring Branch Creek	Manchester	4.44
825	May 8, 1937	Spring Branch Creek	Manchester	8.13
		Skunk River Basin		
505	Oct. 5, 1919	Skunk River	Ames	942
505	Nov. 10, 1919	Skunk River	Ames	2,090
505	Nov. 11, 1919	Skunk River	Ames	1,700
405	Feb. 24, 1915	Skunk River	Augusta	12,100
385	Oct. 8, 1913	Skunk River	Coppock	57
505	June 4, 1918	Squaw Creek	Ames	5,470
505	April 30, 1919	Squaw Creek	Ames	506
		Turkey River Basin		
855	April 6, 1938	Big Spring	Elkader	11.9
855	May 27, 1938	Big Spring	Elkader	58.4
355	Aug. 8, 1913	Elk Creek	Elkport	8.2
355	Aug. 29, 1913	Elk Creek	Elkport	5.1
385	May 20, 1914	Elk Creek	Elkport	17
545	April 26, 1922	Elk Creek	Elkport	48
355	Aug. 8, 1913	Turkey River	Garber	181
785	April 2, 1935	Turkey River	Guttenburg	1,170
805	April 25, 1936	Turkey River	Millville	526
355	Aug. 8, 1913	Volga River	Elkport	48.5
355	Aug. 29, 1913	Volga River	Elkport	50
385	May 20, 1914	Volga River	Elkport	83.7
505	Aug. 30, 1920	Volga River	Elkport	118
		Upper Iowa River Basin		
825	Oct. 1, 1936	Bear Creek	Dorchester	34.0
——	Mar. 16, 1938	Bear Creek	Dorchester	75.3
855	Sept. 9, 1938	Bear Creek	Dorchester	65.7
875	Mar. 21, 1939	Bear Creek	Dorchester	156
875	Sept. 13, 1939	Bear Creek	Dorchester	33.2
895	Oct. 21, 1939	Bear Creek	Dorchester	37.9
895	Dec. 13, 1939	Bear Creek	Dorchester	32.5
895	Jan. 11, 1940	Bear Creek	Dorchester	12.5
895	Mar. 7, 1940	Bear Creek	Dorchester	42.3
895	Mar. 31, 1940	Bear Creek	Dorchester	96.7
895	May 23, 1940	Bear Creek	Dorchester	34.4
895	July 3, 1940	Bear Creek	Dorchester	28.4
——	Aug. 19, 1940	Bear Creek	Dorchester	41.8
——	Aug. 26, 1940	Bear Creek	Dorchester	54.8
855	Aug. 19, 1938	Sievert Spring	Decorah	11.5
855	Aug. 19, 1938	Twin Spring	Decorah	9.11
855	Aug. 19, 1938	Unnamed Creek	Decorah	13.8
355	Aug. 6, 1913	Upper Iowa River	Decorah	171
355	Aug. 6, 1913	Upper Iowa River	Decorah	72.8
355	Aug. 6, 1913	Upper Iowa River	Decorah	g 17.4
895	Oct. 13, 1939	Upper Iowa River	Decorah	46.5
825	Oct. 1, 1936	Upper Iowa River	Dorchester	230
825	Mar. 6, 1937	Upper Iowa River	Dorchester	8,290
825	Mar. 8, 1937	Upper Iowa River	Dorchester	5,760
825	Mar. 9, 1937	Upper Iowa River	Dorchester	2,110
825	Mar. 10, 1937	Upper Iowa River	Dorchester	1,360
825	April 1, 1937	Upper Iowa River	Dorchester	1,320
825	April 26, 1937	Upper Iowa River	Dorchester	398

g) Represents leakage through tainter gates, wheels and fishway.

TABLE 5—*Miscellaneous measurements of streams in Iowa—Continued*

MISSISSIPPI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
825	July 21, 1937	Upper Iowa River	Dorchester	91.0
855	Mar. 16, 1938	Upper Iowa River	Dorchester	1,150
855	July 13, 1938	Upper Iowa River	Dorchester	904
855	Aug. 10, 1938	Upper Iowa River	Dorchester	502
855	Sept. 9, 1938	Upper Iowa River	Dorchester	1,080
855	Sept. 11, 1938	Upper Iowa River	Dorchester	1,870
895	Oct. 21, 1939	Upper Iowa River	Dorchester	158
895	Dec. 13, 1939	Upper Iowa River	Dorchester	80.4
895	Jan. 11, 1940	Upper Iowa River	Dorchester	99.6
895	Mar. 7, 1940	Upper Iowa River	Dorchester	100
895	Mar. 31, 1940	Upper Iowa River	Dorchester	3,520
895	April 2, 1940	Upper Iowa River	Dorchester	840
895	May 23, 1940	Upper Iowa River	Dorchester	162
895	July 3, 1940	Upper Iowa River	Dorchester	90.8
895	Aug. 19, 1940	Upper Iowa River	Dorchester	127
895	Aug. 26, 1940	Upper Iowa River	Dorchester	701
730	Sept. 10, 1932	Upper Iowa River	Eitzen	174
745	Dec. 1, 1932	Upper Iowa River	Eitzen	217
745	April 25, 1933	Upper Iowa River	Eitzen	264
730	June 22, 1932	Upper Iowa River	New Albin	800
730	July 21, 1932	Upper Iowa River	New Albin	364
785	Mar. 20, 1935	Upper Iowa River	New Albin	2,940
785	Mar. 25, 1935	Upper Iowa River	New Albin	1,870
785	Mar. 28, 1935	Upper Iowa River	New Albin	1,270
785	April 4, 1935	Upper Iowa River	New Albin	758
785	April 6, 1935	Upper Iowa River	New Albin	717
785	April 11, 1935	Upper Iowa River	New Albin	704
785	Sept. 11, 1935	Upper Iowa River	New Albin	276
805	Oct. 25, 1935	Upper Iowa River	New Albin	245
805	Mar. 19, 1936	Upper Iowa River	New Albin	5,720
805	Mar. 20, 1936	Upper Iowa River	New Albin	5,560
805	Mar. 28, 1936	Upper Iowa River	New Albin	1,520
805	April 3, 1936	Upper Iowa River	New Albin	711
805	April 15, 1936	Upper Iowa River	New Albin	617
805	June 10, 1936	Upper Iowa River	New Albin	870
825	Mar. 6, 1937	Upper Iowa River	New Albin	12,100
825	Mar. 9, 1937	Upper Iowa River	New Albin	2,640
825	Mar. 10, 1937	Upper Iowa River	New Albin	1,520
825	April 1, 1937	Upper Iowa River	New Albin	1,410
825	May 20, 1937	Upper Iowa River	New Albin	400
825	July 28, 1937	Upper Iowa River	New Albin	248
855	Nov. 4, 1937	Village Creek	Lansing	20.4
		Wapsipinicon River Basin		
—	Aug. 3, 1931	Wapsipinicon River	Big Rock	64.4
685	April 3, 1929	Wapsipinicon River	Folletts	4,860
785	April 12, 1935	Wapsipinicon River	Folletts	(d) 2,100
99	July 1903	Wapsipinicon River	Independence	2,423
405	April 3, 1915	Wapsipinicon River	Massillon	2,770
585	July 16, 1924	Wapsipinicon River	McCausland	(d) 829
—	April 15, 1925	Wapsipinicon River	McCausland	(d) 633
—	Sept. 3, 1925	Wapsipinicon River	McCausland	(d) 267
745	Aug. 18, 1933	Wapsipinicon River	McCausland	260
760	April 15, 1934	Wapsipinicon River	McCausland	549
—	Oct. 26, 1938	Wapsipinicon River	McCausland	(e) 599
—	Oct. 26, 1938	Wapsipinicon River	McCausland	(e) 631
—	Oct. 27, 1938	Wapsipinicon River	McCausland	(e) 592
585	Aug. 26, 1924	Wapsipinicon River	Noel	(d) 7,190
685	April 30, 1929	Wapsipinicon River	Oxford Mills	3,200

d) Measurement by engineers of Mississippi River Power Co.
e) Measurement by Corps of Engineers.

TABLE 5—*Miscellaneous measurements of streams in Iowa—Continued*

MISSISSIPPI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
685	May 17, 1929	Wapsipinicon River	Oxford Mills	1,860
685	July 5, 1929	Wapsipinicon River	Oxford Mills	425
685	July 8, 1929	Wapsipinicon River	Oxford Mills	928
685	Sept. 5, 1929	Wapsipinicon River	Oxford Mills	8.7
700	April 12, 1930	Wapsipinicon River	Oxford Mills	(e) 373
700	May 17, 1930	Wapsipinicon River	Oxford Mills	(e) 1,250
700	June 5, 1930	Wapsipinicon River	Oxford Mills	(e) 850
700	Aug. 14, 1930	Wapsipinicon River	Oxford Mills	(e) 23.8
700	Sept. 3, 1930	Wapsipinicon River	Oxford Mills	(e) 7.78
——	Sept. 17, 1930	Wapsipinicon River	Oxford Mills	(e) 8.01
505	Sept. 10, 1919	Wapsipinicon River	Quasqueton	49.7
505	Nov. 18, 1919	Wapsipinicon River	Quasqueton	1,030
525	June 1, 1921	Wapsipinicon River	Quasqueton	2,890
99	July 13, 1903	Wapsipinicon River	Stone City	10,471
385	June 23, 1914	Wapsipinicon River	Stone City	2,150
385	Sept. 28, 1914	Wapsipinicon River	Stone City	630
700	June 5, 1930	Wapsipinicon River	Waubeek	(e) 413
700	Aug. 14, 1930	Wapsipinicon River	Waubeek	(e) 112
700	Aug. 14, 1930	Wapsipinicon River	Waubeek	(e) 182
700	Sept. 3, 1930	Wapsipinicon River	Waubeek	(e) 37.0
700	Sept. 17, 1930	Wapsipinicon River	Waubeek	(e) 33.3
700	Sept. 26, 1930	Wapsipinicon River	Waubeek	(e) 110
715	Oct. 18, 1930	Wapsipinicon River	Waubeek	116
715	Nov. 15, 1930	Wapsipinicon River	Waubeek	50.6
——	May 7, 1931	Wapsipinicon River	Waubeek	238
——	Aug. 4, 1931	Wapsipinicon River	Waubeek	47.5
		Yellow River Basin		
785	Mar. 6, 1935	Yellow River	Harpers Ferry	638
785	Sept. 11, 1935	Yellow River	Harpers Ferry	43.6

MISSOURI RIVER BASIN

		Boyer River Basin		
——	Sept. 23, 1917	Boyer River	Woodbine	91.9
761	Aug. 17, 1934	Boyer River	Logan	11.3
786	July 26, 1935	Boyer River	Logan	37.1
		Chariton River Basin		
761	Aug. 15, 1934	Chariton River	Centerville	.6
786	July 24, 1935	Chariton River	Centerville	867
		Floyd River Basin		
761	Aug. 18, 1934	Floyd River	Merrill	33.9
		Grand River Basin		
——	Aug. 16, 1934	Little River	Davis City	0
476	Sept. 27, 1917	Thompson Grand River	Davis City	12.2
761	Aug. 16, 1934	Thompson Grand River	Davis City	0
786	July 24, 1935	Thompson Grand River	Davis City	792

e) Measurement by Corps of Engineers.

TABLE 5—*Miscellaneous measurements of streams in Iowa—Continued*

MISSOURI RIVER BASIN—Continued

Water supply paper	Date	Stream	Locality	Discharge (Sec.-ft.)
		Little Sioux River Basin		
172	June 5, 1904	Little Sioux River	Cherokee	2,558
476	Sept. 22, 1917	Little Sioux River	Correctionville	167
761	Aug. 18, 1934	Little Sioux River	Correctionville	78.9
786	July 26, 1935	Little Sioux River	Correctionville	300
		Maple River Basin		
761	Aug. 18, 1934	Maple River	Mapleton	21.6
786	July 26, 1935	Maple River	Mapleton	30.5
		Nishnabotna River Basin		
476	Sept. 25, 1917	E. Nishnabotna River	Red Oak	78.4
761	Aug. 17, 1934	E. Nishnabotna River	Red Oak	16.0
786	July 25, 1935	E. Nishnabotna River	Red Oak	98.4
——	Sept. 25, 1917	E. Nishnabotna River	Shenandoah	98.5
546	Feb. 21, 1922	Nishnabotna River	Hamburg	399
761	Aug. 17, 1934	W. Nishnabotna River	Hastings	5.9
786	July 25, 1935	W. Nishnabotna River	Hastings	26.2
476	Sept. 27, 1917	W. Nishnabotna River	White Cloud	70.6
		Nodaway River Basin		
761	Aug. 16, 1934	Middle Nodaway River	Villisca	0
506	Mar. 24, 1920	Nodaway River	Braddyville	764
476	Sept. 26, 1917	Nodaway River	Clarinda	13.0
761	Aug. 16, 1934	Nodaway River	Clarinda	4.8
786	July 25, 1935	Nodaway River	Clarinda	48.7
786	July 25, 1935	Nodaway River	Villisca	14.1
476	Sept. 26, 1917	West Nodaway River	Villisca	6.2
761	Aug. 16, 1934	West Nodaway River	Villisca	6.3
		Rock River Basin		
826	Sept. 15, 1937	Rock River	Rock Rapids	.94
		Soldier River Basin		
761	Aug. 17, 1934	Soldier River	Mondamin	(c) 7.5
786	July 26, 1935	Soldier River	Mondamin	10.6

c) Discharge estimated.

SUMMARY OF MAXIMUM DISCHARGES

In the last ten years there has been a great increase in the quantity and accuracy in records relating to flood discharges for streams in Iowa. It is the purpose of this section to present the available and significant records in a readily usable form. In order to compare and evaluate the more recent flood data from gaging stations on streams in the United States and Canada, a large number of separate flood events in Iowa were analyzed and tabulated in 1938 in connection with another report.[1]

Subsequently, and since 1940 while this report was in the process of being prepared, checked and reviewed, several record-breaking floods have occurred and additional data were obtained as well as first records at recently established gaging stations. In order to include those maxima thus established it was deemed appropriate to extend the coverage of certain records for this report. This section, therefore for the most part, embodies all available flood records up to the time of publication, July 1942.

The results of the determinations of maximum flood flows and crest stages that have occurred at stream-gaging stations and other places on streams over the entire State are summarized and presented in table 6. For general information and comparative value, some discharges are presented for places on streams in basins which lie partly in or near to Iowa. Except as otherwise noted the entries in the table are taken from the records of the United States Geological Survey. The table includes a few records which are in different stages of progress with respect to complete analysis. Any revisions found necessary in the light of further information will be published in subsequent water-supply papers. The determinations are arranged in downstream order by drainage basins. The information in the table is described by the following outline:

1. Map reference or serial number, applicable to plate 5, to aid in indicating the location where the discharge was determined.

2. Name of stream, county, and town at or near the place of determination of discharge.

3. Drainage area, in square miles, tributary to the stream at the place of determination of discharge.

4. The elevation of the zero of the gage above mean sea level, where available.

5. Period of record, generally given for only regular or existing station at which continuous or practically continuous discharge records have been collected, and is the same as the period of operation of the

[1] "Maximum Discharges at Stream-Measurement Stations Through December 31, 1937," by Gordon R. Williams and Lawrence C. Crawford, with a supplement including additions and changes through Sept. 30, 1938, by William S. Eisenlohr, Jr., Water-Supply Paper No. 847, U. S. Geological Survey, 1940.

station rather than the period of historical knowledge of flood stages.

6. The date of occurrence, stage, and magnitude in second-feet of the maximum momentary or daily discharge.

All stages, or gage-heights, are referred to arbitrary gage datum but, where the mean sea level elevation of the zero of the gage is available, can be transferred into a general reference plane if desired. For miscellaneous discharge determinations, a gage height is not particularly useful and is usually not available. Also, the maximum stage is omitted for locations where it occurred at a different time than the maximum discharge as given in the table. If the maximum discharge listed in main part of the table is known to have been exceeded at some time antedating the period of record, or the data are relatively uncertain, references are made by footnotes giving available information concerning the greater flood. The discharges in second-feet per square mile are computed from the drainage areas given in the table unless otherwise indicated. The computations have been made to three significant figures above 10 second-feet per square mile. Many base data or their uses may not warrant such refinement in computation and an accuracy to this degree is not necessarily implied.

For many of the earlier reports only daily discharges were determined and published, and it was impracticable to make a study of the original records to determine the stage, or peak discharge. Where continuous records have not been kept, only maximum flows can be determined from a study of high-water marks and cross-sectional areas. At certain other places where a miscellaneous current-meter discharge measurement constitutes the maximum known discharge, the determination with appropriate footnotes has been given in the table for its intrinsic value, although the figure is very likely not the maximum. For flood records during the recent years, however, the maximum discharges are the result of computations based on graphs made by automatic water-stage recording gages or gage-height graphs constructed from several nonrecording gage readings each day.

The discharges for regular stream-gaging stations were determined by methods briefly outlined in the section, "General explanation of field and office work" with supplementary information given in the description for those stations included in the section, "Gaging station summaries in this report." Comprehensive studies of such determinations, are, of course, continuously conducted at regular gaging stations. Footnotes are used to indicate those discharges which have been estimated or obtained by some methods other than the stage-discharge relation commonly used for determination of flow. Space will not permit an exhaustive explanation as to such methods of determination.

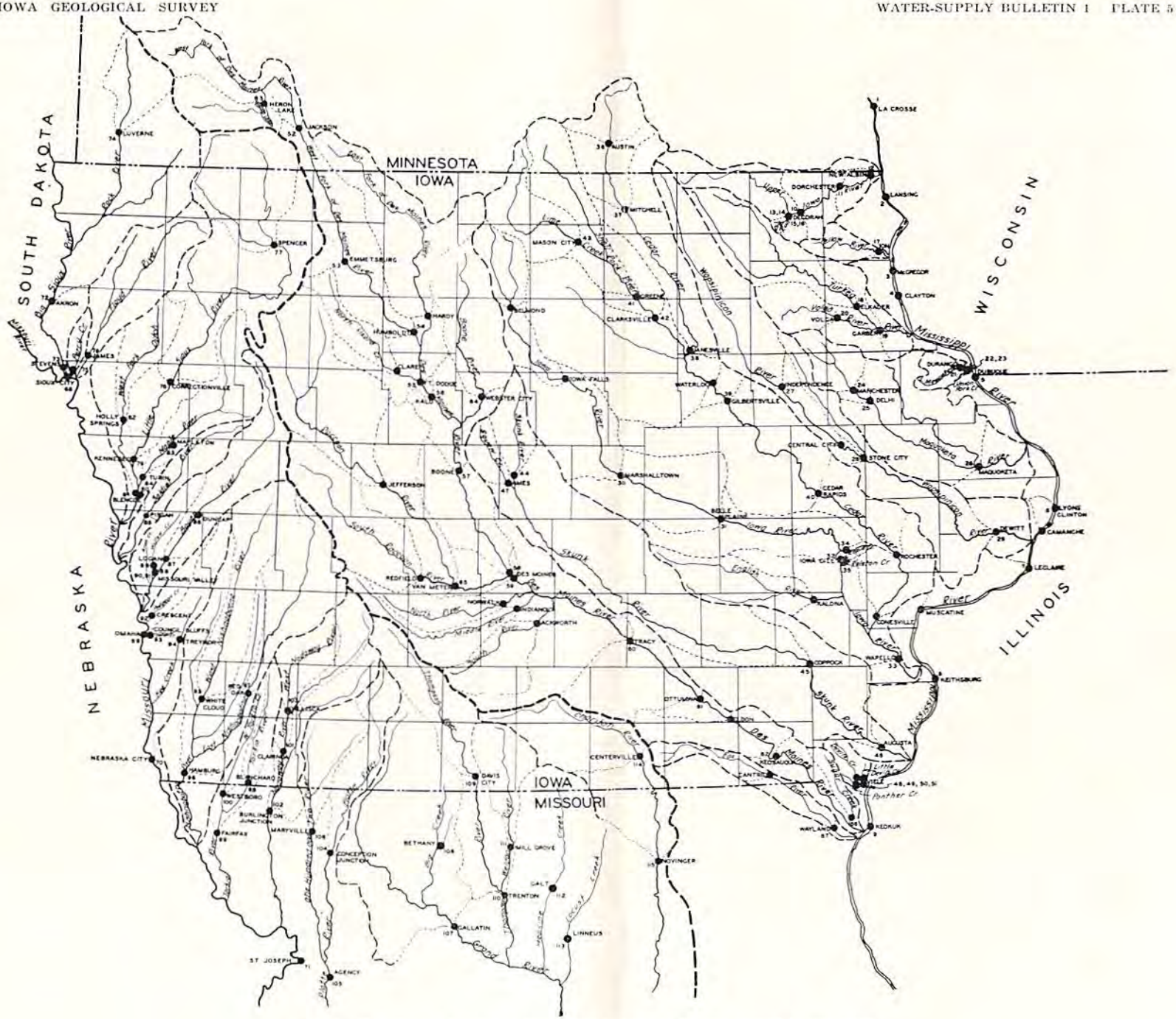

Plate 5. Map showing location of flood determinations in the area covered by this report.

It has not been possible to include a presentation concerning the relationship of discharge per square mile to drainage area although some studies [2] in this connection have been made with interesting results. In conclusion, it is emphasized that drainage area is one of many factors (one investigator has enumerated 23) controlling maximum discharges, and that the flood potentialities of a drainage basin may not, for a variety of reasons, be adequately represented in the comparatively short records that have been obtained in many drainage basins. The application of the data in table 6 must be made with appropriate discrimination and judgment. In any study of these determinations and in the comparison of one with another consideration should be given to the type of drainage area above the point of measurement and to the precipitation characteristics of the storm producing the runoff.

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2 Paper entitled "Some Recent Flood-Flow Determinations in Iowa," by L. C. Crawford and G. L. Whitaker for the Highway Section at the Fifty-Fourth Annual Meeting of the Iowa Engineering Society in Cedar Rapids, Iowa, February 12-13, 1942.

TABLE 6.—*Summary of Maximum Discharges*

MISSISSIPPI RIVER BASIN

No. on Map pl. 5	Stream and place of determination	County	Drainage area in square miles	Elevation of zero of gage[1]	Period of Record	Maximum gage height and discharge			
						Date	Gage height in feet	Discharge	
								Second-feet	Sec.-ft. per sq. mi.
1	2	3	4	5	6	7	8	9	10
	Mississippi River Main Stem								
1	Mississippi River at La Crosse, Wis.	La Crosse	62,800	626.32	1929–	June 19, 1880	16.0	190,000[2]	3.0
2	Mississippi River at Lansing	Allamakee	.....	.....	.....	Mar. 28, 1936	.....	96,600[2,3]	.....
3	Mississippi River at McGregor	Clayton	67,500	605.30	1936–	May 27, 1938	.....	101,400[3]	1.5
4	Mississippi River at Clayton	Clayton	79,200	602.60	1930–36	.....	.....	226,300[4]	2.9
5	Mississippi River at Dubuque[4]	Dubuque	82,200	.....	.....	Sept. 21, 1938	.....	175,000[2,3]	1.6
6	Mississippi River at Clinton	Clinton	85,600	(5)	1939–	Sept. 21, 1938	.....	149,200[2, 3]	1.7
7	Mississippi River at LeClaire	Scott	88,600	562.61	1873–1939	June 25, 1880	14.5	250,000	2.8
8	Mississippi River at Keithsburg, Ill.	Mercer	113,000	.....	.....	.....	.....	301,500[4]	2.7
9	Mississippi River at Keokuk[6]	Lee	119,000	.....	1878–	May 18, 1888	.....	314,000[7]	2.6
	Upper Iowa River Basin								
10	Upper Iowa River near Decorah	Winneshiek	560[8]	.....	1913, 14, 1919–27, 33–	May 29, 1941	15.19	28,500[9]	50.9
11	Upper Iowa River near Dorchester	Allamakee	761	.....	1936–	May 30, 1941	81.53	30,400[9]	39.9
12	Upper Iowa River near New Albin	Allamakee	.....	.....	.....	Mar. 6, 1937	.....	12,100[2]	.....
13	Dry Run near Decorah	Winneshiek	20.1	.....	.....	May 29, 1941	.....	14,000[9]	697
14	Dry Run at Decorah[10]	Winneshiek	22.3	.....	.....	Mar. 15, 1919	.....	16,000	717
15	Trout Run near Decorah	Winneshiek	37.8	.....	.....	May 29, 1941	.....	20,000[9]	529
16	East Branch Trout Run near Decorah	Winneshiek	11.6	.....	.....	May 29, 1941	.....	10,300[9]	888
	Yellow River Basin								
17	Yellow River at Ion	Allamakee	224	664.65	1934–	May 29, 1941	15.2	18,500[9]	82.6
	Turkey River Basin								
18	Turkey River at Elkader	Clayton	892	701.61	1928–30,[11] 1933–	Mar. 16, 1929	.....	25,200[11-12]	28.3
19	Turkey River at Garber	Clayton	1,530	635.34	1913–30, 1932–	Feb. 23, 1922	28.06	26,600	17.4
20	Volga River at Volga[11]	Clayton	264	.....	1929–30	Mar. 13, 1929	.....	3,740[11-12]	14.2

MISSISSIPPI RIVER BASIN (Continued)

	Little Maquoketa River Basin								
21	Little Maquoketa River near Durango	Dubuque	130	612.62	1934–	June 21, 1937	20.75	14,800[9]	114
22	Union Park Creek near Dubuque	Dubuque	1[13]	.....	.....	July 9, 1919	.....	3,000[9]	3,000[13]
	Catfish Creek Basin								
23	Catfish Creek near Dubuque	Dubuque	40[13]	.....	.....	Aug. 16-17, 1918	.....	28,000[13]	700[13]
	Maquoketa River Basin								
24	Maquoketa River near Manchester	Delaware	306	895.06	1933-	Mar. 4, 1937	14.20	8,150	26.6
25	Maquoketa River near Delhi	Delaware	348	774.32	1933–40	Mar. 14, 1929	.....	7,360[2]	21.1
26	Maquoketa River near Maquoketa	Jackson	1,550	636.52	1913-	Mar. 6, 1937	.....	27,500	17.7
	Wapsipinicon River Basin								
27	Wapsipinicon River at Independence	Buchanan	1,060	802.85	1933–	Mar. 8, 1937	93.2	7,900	7.5
28	Wapsipinicon River at Stone City	Jones	1,310	.....	1903–14	July 13, 1903	15.2	10,500[2, 14]	8.0
29	Wapsipinicon River near DeWitt	Clinton	2,300	599.73	1934–	Mar. 6, 1937	.....	12,900	5.6
	Iowa River Basin								
30	Iowa River at Marshalltown	Marshall	1,500	853.06	1903, 1915–27, 1933–	June 4, 1918	17.74	42,000	28.0
31	Iowa River near Belle Plaine	Iowa	2,420	.....	1939–	June 5, 1918	.....	38,600[2]	16.0
32	Iowa River at Iowa City	Johnson	3,230	627.27	1903–	June 7, 1918	19.45[15]	36,200[16]	11.2
33	Iowa River at Wapello	Louisa	12,480	548.98	1915–	Mar. 19, 1929	16.22	67,500	5.4
34	Rapid Creek near Iowa City	Johnson	24.5	.....	1938–	June 27, 1941	12.54	3,390	138
35	Ralston Creek at Iowa City	Johnson	3.01	.....	1924–	June 27, 1941	8.25	1,360	452
36	Cedar River near Austin, Minn.	Mower	425	.....	1909–14	Nov. 14, 1909	.....	5,230[12]	12.3
37	Cedar River at Mitchell	Mitchell	845	.....	1933–	April 4, 1934	89.7	13,000	15.4
38	Cedar River at Janesville	Bremer	1,660	.....	1905–06, 15–27, 1932–	April 1, 1933	15.43	27,700	16.7
39	Cedar River at Gilbertville	Black Hawk	.....	.....	.....	June 15, 1937	.....	23,900[2]	.....
40	Cedar River at Cedar Rapids	Linn	6,640	700.33	1903–	Mar. 19, 1929	20.1	72,000	10.8
41	Shell Rock River at Greene	Butler	1,375	.....	1933–	June 25, 1938	97.5	12,000	9.0
42	Shell Rock River near Clarksville	Butler	1,660	.....	1915–27, 1932–34	Mar. 31, 1933	16.7	19,800	11.9
43	Lime Creek at Mason City	Cerro Gordo	535	.....	1932–	Mar. 30, 1933	15.70	9,400[13]	17.6
	Skunk River Basin								
44	Skunk River near Ames	Story	320	.....	1920–27, 1933-	Sept. 17, 1921	9.2	3,540	11.1
45	Skunk River at Coppock	Jefferson	2,890	.....	1913–	June 15, 1930	22.13[15]	25,200	8.7
46	Skunk River at Augusta	Des Moines	4,290	521.69	1913, 1915–	June 17, 1930	22.55	44,500	10.4
47	Squaw Creek at Ames	Story	210	.....	1919–27	June 4, 1918	14.5	6,900	32.9

See footnotes at end of table.

TABLE 6.—*Summary of Maximum Discharges*—Continued

MISSISSIPPI RIVER BASIN (Continued)

No. on Map pl. 5	Stream and place of determination	County	Drainage area in square miles	Elevation of zero of gage[1]	Period of Record	Maximum gage height and discharge			
						Date	Gage height in feet	Discharge	
								Second-feet	Sec.-ft. per sq. mi.
1	2	3	4	5	6	7	8	9	10
	Devils Creek Basin								
48	Devils Creek near Viele	Lee	108	.....	.....	June 10, 1905	.....	60,000[17]	556
49	Devils Creek at Santa Fe Bridge near Viele	Lee	143	.....	.....	June 10, 1905	.....	80,000[17]	559
50	Panther Creek near Viele	Lee	14	.....	.....	June 10, 1905	.....	7,300[13]	521
51	Little Devils Creek near Viele	Lee	19	.....	.....	June 10, 1905	.....	10,700[13]	563
	Des Moines River Basin								
52	West Fork of Des Moines River at and near Jackson, Minn.[18]	Jackson	1,170	1,304.85	1909–13, 1930–	Mar. 22, 1936	.....	2,320	2.0
53	West Fork of Des Moines River at Emmetsburg[19]	Palo Alto	2,190	.....	1920–32	April 1919	.....	3,600	1.6
54	West Fork of Des Moines River at Humboldt	Humboldt	2,295	.....	1940–	.....	.....	11,100[20]	4.8
55	Des Moines River at Fort Dodge	Webster	.....	.....	1905–06, 1911–13	Mar. 26, 1906	.....	12,000[12-13]	.....
56	Des Moines River at Kalo	Webster	4,170	.....	1913–27	May 30, 1915	14.0	18,500[12]	4.4
57	Des Moines River near Boone	Boone	5,490	871.52	1920–27, 1933–	June 6, 1918	20.5[15]	32,000[21]	5.8
58	Des Moines River at Des Moines	Polk	6,180	786.05	1893, 94, 1897–1927[22] 1932–	June 7, 1918	16.5[15]	41,500[23]	6.7
59	Des Moines Riv. below Raccoon Riv. at Des M.	Polk	9,770	773.74	1940–	May 31, 1903	.....	70,000[9]	7.2
60	Des Moines River near Tracy	Mahaska	12,400	671.78	1920–27, 1933–35, 1940–	May 31, 1903	25.0	100,000[13-24]	8.1
61	Des Moines River at Ottumwa and Eldon	Wapello	13,200	.....	1917–	May 31, 1903	.....	100,000[13-24]	7.6
62	Des Moines River at Keosauqua	Van Buren	13,900	558.10	1903–06, 1910–	June 1, 1903	27.85	97,000[24]	7.0
63	Heron Lake Outlet near Heron Lake, Minn.	Jackson	457	.....	1930–33,[22] 1934–	July 5, 1938	8.53	1,660	3.6
64	Boone River near Webster City	Hamilton	842	.....	1940–	May 1903	.....	7,000[9, 25]	8.8
65	Raccoon River at Van Meter	Dallas	3,410	841.12	1915–	Sept. 20, 1926	18.96	40,000	11.7
66	Sugar Creek near Keokuk	Lee	113	.....	1922–26	June 9, 1905	.....	15,000[13]	133
	Fox River Basin								
67	Fox River at and near Wayland, Mo.	Clark	400[26]	501.52	1922–	June 29, 1933	21.53	25,000	62.5

MISSOURI RIVER BASIN

	Missouri River Main Stem								
68	Missouri River at Sioux City	Woodbury	314,600	1,076.96	1928–31, 1938–	April 1, 1929	.....	190,000[27]	0.6
69	Missouri River at Omaha, Nebr.	Douglas	322,800	958.24	1928–	June 7, 1929	.....	198,000[12-27]	.6
70	Missouri River at Nebraska City, Nebr.	Otoe	414,400	903.94	1929–	April 6, 1939	.....	149,000[27]	.4
71	Missouri River at St. Joseph, Mo.	Buchanan	424,300	788.19	1928–	June 4, 1929	.....	196,000[12-27]	.5
	Big Sioux River Basin								
72	Big Sioux River at Akron	Plymouth	8,850	1,118.90	1928–	June 4, 1942	19.23	21,400	2.4
73	Big Sioux River at Stevens, S. Dak.	Union	.....	.....	.....	Mar. 3, 1932	.....	18,900[28]	.....
74	Rock River at Luverne, Minn.	Rock	440	.....	1911–14	June 13, 1914	.....	11,200[12]	25.5
	Perry Creek Basin								
75	Perry Creek at Sioux City	Woodbury	69	.....	1939–	June 4, 1940	.....	4,680[9]	67.8
	Floyd River Basin								
76	Floyd River at James	Plymouth	918	.....	1934–	June 4, 1942	18.75	6,280	6.8
	Little Sioux River Basin								
77	Little Sioux River at Spencer	Clay	1,030	1,294.56	1936–	Sept. 16, 1938	.....	5,000	4.9
78	Little Sioux River at Correctionville	Woodbury	2,450	1,096.49	1918–25, 1928–32, 1936–	June 12, 1919	19.57[15]	10,700	4.4
79	Little Sioux River at Kennebec	Monona	2,730	1,027.89	1939–	June 6, 1942	21.60	4,380	1.6
80	Little Sioux River near Blencoe	Monona	4,470[29]	1,010.26	1939–	June 4, 1940	.....	2,820[9]	} 1.7
81	Monona-Harrison Ditch near Blencoe	Monona	4,470[29]	1,009.60	1939–	June 4, 1940	.....	4,820[9]	}
82	West Fork Ditch at Holly Springs	Woodbury	395	.....	1939–	June 4, 1940	.....	3,360[9]	8.5
83	Maple River at Mapleton	Monona	661	1,085.86	1941–	June 30, 1942	20.30	4,950	7.5
84	Maple River at Turin	Monona	725	1,028.45	1939–41	June 4, 1940	.....	2,920[9]	4.0
	Soldier River Basin								
85	Soldier River at Pisgah	Harrison	417	1,033.68	1940-	June 28, 1942	26.10	17,800	42.7
	Boyer River Basin								
86	Boyer River at Dunlap[30]	Harrison	654	.....	.....	June 9, 1917	.....	4,450	6.8
87	Boyer River at Logan	Harrison	810	1,009.38	1918–25, 1937-	July 9, 1940	19.17	13,600	16.8
88	Boyer River at Missouri Valley[30]	Harrison	900	.....	.....	June 4, 1917	.....	4,960	5.5
89	Willow Creek at Calhoun	Harrison	.....	.....	.....	July 9, 1940	.....	11,300[9]	.....
90	Willow Creek at Missouri Valley[30]	Harrison	143	.....	.....	June 4, 1917	.....	1,520	10.6
91	Allen Creek at Missouri Valley[30]	Harrison	59	.....	.....	June 4, 1917	.....	930	15.8

See footnotes at end of table.

TABLE 6.—*Summary of Maximum Discharges*—Continued

MISSOURI RIVER BASIN (Continued)

No. on Map pl. 5	Stream and place of determination	County	Drainage area in square miles	Elevation of zero of gage[1]	Period of Record	Maximum gage height and discharge			
						Date	Gage height in feet	Discharge	
								Second-feet	Sec.-ft. per sq. mi.
1	2	3	4	5	6	7	8	9	10
	Council Bluffs Area								
92	Pigeon Creek at Crescent[30]	Pottawattamie.	148	.....	.....	June 4, 1917	.....	3,025	20.4
93	Indian Creek at Council Bluffs[4]	Pottawattamie.	7.3	.....	.....	June 20, 1942	.....	9,200[13]	1,260
94	Keg Creek near Treynor	Pottawattamie.	.....	.....	.....	July 9, 1940	.....	4,200[9]	.....
	Nishnabotna River Basin								
95	West Nishnabotna River at White Cloud	Mills	920	.....	1918–24	April 19, 1920	.....	12,000	13.0
96	Nishnabotna River near or above Hamburg	Fremont	2,800	894.17	1922–23, 1928–	Mar. 12, 1939	23.0	24,600	8.8
97	East Nishnabotna River at Red Oak	Montgomery	890	1,010.45	1918–25, 1936–	Mar. 4, 1937	18.50	9,600	10.8
	Tarkio River Basin								
98	Tarkio River at Blanchard[21]	Page	200	940.32	1934–40	Mar. 12, 1939	23.12	9,980[9]	49.9
99	Tarkio River at Fairfax, Mo.	Atchison	508	872.44	1922–	July 7, 1929	22.33	15,000[12]	29.5
100	West Tarkio Creek near Westboro, Mo.	Atchison	105	926.80	1934–40	July 29, 1937	22.10	8,720[9]	83.0
	Nodaway River Basin								
101	Nodaway River at Clarinda	Page	740	.....	1918–25, 1936–	May 21, 1937	.....	14,000	18.9
102	Nodaway River near Burlington Junction, Mo.	Nodaway	1,240	896.17	1922–	July 6, 1929	.....	21,000[12]	16.9
103	West Nodaway River at Villisca	Montgomery	360	.....	1918–25	June 9, 1924	.....	6,200	17.2
	Platte River Basin								
104	Platte River at Conception Junction, Mo.	Nodaway	492	.....	1921–25, 1928–32	July 6, 1929	.....	12,000	24.4
105	Platte River at and near Agency, Mo.	Buchanan	1,760	807.38	1924–30, 1932–	Sept. 18, 1926	25.5	22,600	12.8
106	One Hundred and Two River at and near Maryville, Mo.	Nodaway	500	969.90	1932–	Mar. 13, 1939	20.4	12,600	25.2

MISSOURI RIVER BASIN (Continued)

	Grand River Basin								
107	Grand River near Gallatin, Mo.	Daviess	2,250	712.56	1921–	June 2, 1929	37.02	56,800[32]	25.2
108	East Fork Big Creek near Bethany, Mo.	Harrison	95	854.74	1934–	May 31, 1935	.....	3,500	36.8
109	Thompson (Grand) River at Davis City	Decatur	702	.....	1918–25, 1941–	Aug. 8, 1885	.....	17,600	25.1
110	Thompson (Grand) River at Trenton, Mo.	Grundy	1,680	718.12	1928–	Nov. 18, 1928 Dec. 31, 1931	22.31[13]	26,700[32]	15.9
111	Weldon River at Mill Grove, Mo.	Mercer	494	785.94	1929–	June 2, 1929	20.6	14,200[32]	28.7
112	Medicine Creek near Galt, Mo.	Grundy	225	769.21	1921–	Mar. 12, 1939	.....	12,300	54.7
113	Locust Creek near Linneus, Mo.	Linn	550	692.61	1929–	June 21, 1939	21.3	14,900	27.1
	Chariton River Basin								
114	Chariton River near Centerville	Appanoose	727	.....	1938–	Mar. 13, 1939	.....	16,500	22.7
115	Chariton River at Novinger, Mo.	Adair	1,370	737.65	1931–	Nov. 25, 1931	26.03	15,400	11.2

1. Feet above mean sea level.
2. Current-meter measurement, probably not the maximum.
3. Greater flood occurred in 1880; discharge not determined.
4. Information from reports by Corps of Engineers, U. S. Army.
5. See p. 32, "Mississippi River at LeClaire" for description of gages.
6. Records from Mississippi River Power Co.
7. Greater flood occurred June 6, 1851, discharge estimated 360,000 second-feet.
8. Area was 576 square miles at site used July 1933 to September 1936.
9. Result of slope-area study.
10. Computed by Alvord & Burdick, Consulting Engineers, Chicago, Ill.
11. Published in House Document No. 98, 73rd Congress, 1st Session; from records collected by Management & Engineering Corporation, Chicago, Ill.
12. Mean daily discharge.
13. Estimated.
14. Greater flood occurred July 1892; discharge estimates vary from 20,000 to 30,000 second-feet.
15. Former site and datum.
16. Discharge of flood of June 1851, 50,000 second-feet (estimated): G. H. Hickox, University of Iowa thesis, 1926.
17. Based on rainfall and slope-area analyses.
18. Published as Des Moines River prior to 1936.
19. From Iowa Engineering Experiment Station Bulletin 141, page 44.
20. From report of the Iowa State Drainage Waterways and Conservation Commission, 1910, page 74 (higher stage has occurred; discharge not determined).
21. Estimated at former site; drainage area, 5,480 square miles.
22. Incomplete record.
23. Higher stage occurred May 31, 1903, caused by backwater; estimates of discharge vary from 35,000 to 49,000 second-feet.
24. Maximum discharge since 1851.
25. From report of the Iowa State Drainage Waterways and Conservation Commission, 1910, p. 137 (higher stage occurred in 1918; discharge not determined).
26. Drainage area 392 square miles prior to October 1929.
27. Greater flood occurred April 1881; discharge not determined.
28. Float measurement, Corps of Engineers, U. S. Army.
29. Combined drainage areas for Monona-Harrison Ditch near Blencoe & Little Sioux River near Blencoe.
30. From report by C. E. Ramser, Dep't. of Agriculture, Bureau of Public Roads, 1919.
31. Published as East Tarkio Creek at Blanchard prior to 1938.
32. Higher stage occurred July 1907; discharge not determined.

HYDRAULIC CONVERSION TABLES

(Taken from U.S.G.S., Paper 425-C)

Conversion from one unit to another is a simple arithmetical process. The following tables afford a ready means of conversion between terms commonly used in hydraulic computations. Figures may be chosen from the tables for units, tens, hundreds, etc., and then combined to get the desired results. Attention is called to the fact that although the tables will give results to more than three significant figures, it is seldom that the base data or the requirements for which the records are collected will justify the use of more than three significant figures.

Table for converting discharge, in second-feet per square mile, into runoff depth, in inches, over the area

[1 second-foot for 1 day = 86,400 cubic feet = $\frac{86,400 \times 12}{27,878,400}$ = 0.03719 inch deep on 1 square mile.]

Discharge (second-feet per square mile)	Runoff (depth in inches)				
	1 day	28 days	29 days	30 days	31 days
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For part of month multiply runoff for 1 day by number of days.

Table for converting discharge in second-feet into runoff in acre-feet

[1 second-foot for 1 day = 86,400 cubic feet = $\frac{86,400}{43,560}$ = 1.983471 acre-feet.]

Discharge (second-feet)	Runoff (acre-feet)				
	1 day	28 days	29 days	30 days	31 days
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For part of month multiply runoff for 1 day by number of days.

Table for converting discharge in second-feet into runoff in millions of gallons

[1 second-foot for 1 day = 86,400 cubic feet = $\frac{86,400 \times 1,728}{231}$ = 646,317 gallons = 0.646317 million gallons.]

Discharge (second-feet)	Runoff (millions of gallons)				
	1 day	28 days	29 days	30 days	31 days
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.170	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of month multiply runoff for 1 day by number of days.

Table for converting runoff in millions of gallons into runoff in acre-feet

[1 million United States liquid gallons or 231 million cubic inches = 133,680.555 cubic feet, or $\frac{133,680}{43,560}$ = 3.0689 acre-feet.]

Tens	Units									
	0	1	2	3	4	5	6	7	8	9
0	.....	3.07	6.14	9.21	12.28	15.34	18.41	21.48	24.55	27.62
1	30.69	33.76	36.83	39.90	42.96	46.03	49.10	52.17	55.24	58.31
2	61.38	64.45	67.52	70.58	73.65	76.72	79.79	82.86	85.93	89.00
3	92.07	95.14	98.20	101.27	104.34	107.41	110.48	113.55	116.62	119.69
4	122.76	125.82	128.89	131.96	135.03	138.10	141.17	144.24	147.31	150.38
5	153.44	156.51	159.58	162.65	165.72	168.79	171.86	174.93	178.00	181.06
6	184.13	187.20	190.27	193.34	196.41	199.48	202.55	205.62	208.68	211.75
7	214.82	217.89	220.96	224.03	227.10	230.17	233.24	236.30	239.37	242.44
8	245.51	248.58	251.65	254.72	257.79	260.86	263.92	266.99	270.06	273.13
9	276.20	279.27	282.34	285.41	288.48	291.54	294.61	297.68	300.75	303.82

Table for converting discharge in gallons per minute into discharge in second-feet

[1 gallon per minute = $\frac{231}{60}$ cubic inches per second = $\frac{231}{60 \times 1,728}$ = 0.0022278 second-foot.]

Tens	Units									
	0	1	2	3	4	5	6	7	8	9
0	.....	0.0022	0.0045	0.0067	0.0089	0.0111	0.0134	0.0156	0.0178	0.0201
1	0.0223	.0245	.0267	.0290	.0312	.0334	.0356	.0379	.0401	.0423
2	.0446	.0468	.0490	.0512	.0535	.0557	.0579	.0602	.0624	.0646
3	.0668	.0691	.0713	.0735	.0757	.0780	.0802	.0824	.0847	.0869
4	.0891	.0913	.0936	.0958	.0980	.1003	.1025	.1047	.1069	.1092
5	.1114	.1136	.1158	.1181	.1203	.1225	.1248	.1270	.1292	.1314
6	.1337	.1359	.1381	.1404	.1426	.1448	.1470	.1493	.1515	.1537
7	.1559	.1582	.1604	.1626	.1649	.1671	.1693	.1715	.1738	.1760
8	.1782	.1805	.1827	.1849	.1871	.1894	.1916	.1938	.1960	.1983
9	.2005	.2027	.2050	.2072	.2094	.2116	.2139	.2161	.2183	.2206

Table for converting velocity in feet per second into velocity in miles per hour

[1 foot per second = 0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour = 1.4666 feet per second. In computing the table the values 0.68182 and 1.4667 were used.]

Feet per second (units)	Miles per hour for tenths of foot per second									
	0	1	2	3	4	5	6	7	8	9
0	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1	.682	.750	.818	.886	.995	1.02	1.09	1.16	1.23	1.30
2	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

CONVENIENT EQUIVALENTS

(Taken from U. S. G. S. Paper 425-C)

The following is a list of convenient equivalents for use in hydraulic computations:

1 United States gallon of water weighs 8.34 pounds avoirdupois.

1 cubic foot of water weighs 62.5 pounds avoirdupois.

1 second-foot = 7.48 United States gallons per second = 448.8 United States gallons per minute = 26,929.9 United States gallons per hour = 646,317 United States gallons per day.

1 second-foot = 60 cubic feet per minute = 3,600 cubic feet per hour = 86,400 cubic feet per day = 31,536,000 cubic feet per year = 0.000214 cubic inches per year.

1 second-foot = 0.9917 acre-inch per hour = 1.983471 acre-feet per day = 723.966942 acre-feet per year (= 725.950413 acre-feet per year of 366 days).

1 second-foot = 0.028317 cubic meter per second = 1.699 cubic meters per minute = 101.941 cubic meters per hour = 2,446.58 cubic meters per day.

1 second-foot for 1 year (365 days) will cover 1 square mile 1.1312 feet or 13.5744 inches deep.

1 inch deep on 1 square mile = 2,323,200 cubic feet = 0.0737 second-foot for 1 year.

1,000,000,000 (1 United States billion) cubic feet = 11,570 second-feet for one day = 413 second-feet for one 28-day month = 399 second-feet for one 29-day month = 386 second-feet for one 30-day month = 373 second-feet for one 31-day month.

100 United States gallons per minute = 0.223 second-foot = 0.442 acre-foot in one day.

1 foot deep (head of 1 foot) = 0.434 pound pressure on 1 square inch.

1 cubic meter per minute = 0.5886 second-foot = 4.403 United States gallons per second = 1.1674 acre-feet per day.

1 cubic meter, stere, or kiloliter = 1,000,000 cubic centimeters = 1,000 liters = 61,023.4 cubic inches = 264.17 United States gallons = 35.3145 cubic feet = 1.30794 cubic yards = 0.000810708 acre-foot.

1 acre-foot = 325,851 United States gallons = 43,560 cubic feet = 1,613⅓ cubic yards = 1,233.49 cubic meters.

1 million gallons per day = 1.55 second-feet = 3.07 acre-feet per day = 2.629 cubic meters per minute.

1 second-foot falling 8.81 feet = 1 horsepower.

1 second-foot falling 10 feet = 1.135 horsepower.

1 second-foot falling 11 feet = 1 horsepower, 80 per cent efficiency.

1 horsepower = 5,694,120 foot-gallons per day = 550 foot-pounds per second = 33,000 foot-pounds per minute = 1,980,000 foot-pounds per hour = 2,545 British thermal units per hour = 76 kilogrammeters per second = 1.27 kilogrammeters per minute = 746 watts.

1 horsepower, boiler rating, requires the evaporation of 34½ pounds per hour of water at 212°F. to dry steam at the same temperature; or the expenditure of 33,317 British thermal units; and in practice is developed by burning 3¼ to 4¾ pounds per hour of coal under 10 to 12 square feet of heating surface.

1 British thermal unit = 778 foot-pounds.

1 pound of bituminous coal contains about 14,100 British thermal units, or 11,000,000 foot-pounds of energy.

To calculate water power quickly: $\frac{\text{Second-feet} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 percent of theoretical power.

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