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UNITED STATES DEPARTMENT OF THE INTERIOR

NATURAL WATER LOSS IN SELECTED DRAINAGE BASINS

Prepared in cooperation with the

RESEARCH AND STATISTICAL DIVISION OF THE
WORKS PROGRESS ADMINISTRATION FOR NEW YORK CITY
and the SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

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UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Water-Supply Paper 846

NATURAL WATER LOSS IN SELECTED DRAINAGE BASINS

BY

G. R. WILLIAMS AND OTHERS

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CONTENTS

ILLUSTRATIONS

TABLES

NATURAL WATER LOSS IN SELECTED DRAINAGE BASINS

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ABSTRACT

Determinations of areal rainfall, run-off, and water loss, comprising largely evaporation from land surfaces and transpiration by vegetation, are essential in indicating the hydrologic characteristics of river basins.

This report is primarily a statistical study that presents the results of computations of annual water loss, or annual rainfall minus annual run-off, for river basins in the humid or semiarid regions east of the Rocky Mountains. The basic period for which the computations are made is the water year, or year ending September 30.

As it is impractical to present in this report all the basic data used in arriving at the results, only sample computations are given. The various steps in the computations and the probable accuracy of the results are discussed.

The drainage areas for which data are presented are those above river-measuring stations that have records for 3 years or more. For each area there are determinations of annual rainfall, annual run-off, and annual water loss for each year of record as well as the means for the period of record. Results are given for about 200 drainage areas with an aggregate period of record of more than 2,000 years. As an illustration of the magnitude involved, the annual water loss from the eastern streams draining directly into the Atlantic Ocean varies more or less closely with latitude from about 20 inches as an average in northern New England to about 30 inches in Georgia.

As the annual water loss from a basin is affected by the temperature, a supplemental study was made of the relation between water loss and temperature. For 28 drainage areas selected in various parts of eastern and central United States, average temperatures were computed for each year of the period shown in table 1. The results indicate a relation between average annual water loss and average annual temperature.

INTRODUCTION

ADMINISTRATION AND SUPERVISION

A project for studies of floods and other hydrologic phenomena was undertaken in November 1935 by the Research and Statistical Division of the Works Progress Administration for New York City. The project was sponsored by the College of Engineering, New York University. Technical direction and guidance were furnished by the Geological Survey, United States Department of the Interior, and the Soil Conservation Service, United States Department of Agriculture, the Survey furnishing supervisory personnel. The project was terminated June 30, 1936.

The Works Progress Administration for New York City operated during this project under the general direction of V. F. Ridder, administrator. Thorndike Saville, Dean of the College of Engineering, New York University, director, and G. R. Williams, of the Geological Survey, vice director of the project, supervised the research and investigation. Mr. Williams maintained close and continuous contact with the project under the general direction of N. C. Grover, chief hydraulic engineer, and R. W. Davenport, chief of the division of water utilization, Geological Survey.

The material presented in this report constitutes the results of one of the items of this project, which included a study of natural water loss for drainage basins selected with a view to the sufficiency of rainfall and run-off records to produce reasonably reliable results. The word "basin" is used at many places in this report to refer to the area upstream from the gaging station at which the run-off is measured. Therefore, under this usage the reference is to the entire basin of any given stream only when the gaging station is located near the mouth.

The results of the original computations were later summarized and arranged for publication together with explanatory text. The study of the relation between water loss and temperature was not part of the original project but was made in the Washington office by the division of water utilization in 1937.

It should be emphasized that this report is primarily a statistical study and that no attempt has been made to include a comprehensive discussion or analysis of the results.

ACKNOWLEDGMENTS

Members of the staff of the Water Resources Committee of the National Resources Committee arranged for the participation in the project by the Geological Survey and the Soil Conservation Service. Thorndike Saville, dean of the College of Engineering, New York University, maintained a stimulating and sympathetic relationship in the supervision of the project. C. S. Jarvis, hydraulic engineer, Soil Conservation Service, served as a consultant and from the background of his extensive knowledge of hydrology rendered valuable assistance.

The success of the project was due in large part to the cooperative attitude of the administrative officials of the Works Progress Administration, and especially of R. C. Urban, the administrative project supervisor.

Acknowledgment is due the technical and clerical personnel for its help and cooperation.

Some results of the work of other investigators have been included in this report, and appropriate footnotes have been added to the tables to indicate the sources of the data. H. B. Kinnison, district engineer, Geological Survey, Boston, Mass., furnished results of studies made in

his office for drainage areas on the Swift and Westfield Rivers in Massachusetts. The records of rainfall and run-off for river basins in Pennsylvania were taken from the publications of the Pennsylvania Department of Forests and Waters, which since 1921 have presented the mean annual rainfall as well as the mean annual run-off for the tributary basins above all river-measurement stations in the State. The data for river basins in Ohio were obtained from a study of the Miami, Scioto, and Raccoon River Basins by J. C. Prior.[1]

The detailed study of the area on West River in Vermont incorporated the results of a study by Barrows.[2] Figures taken from the above reports have been presented to the nearest tenth of an inch in accordance with the degree of refinement used in this study.

SIGNIFICANCE OF WATER LOSS

As used in this study, the water loss of a drainage basin is the difference between the average rainfall over the basin and the run-off from the basin for a given period. The basic period used is in general the water or hydrologic year, which ends September 30. At that time there is over most of the country a smaller quantity of water held in surface-water channels, in ground water, in soil moisture, in lakes, and in the form of ice or snow than at any other time of the year. Obviously, the water loss for a given year determined as indicated above may be affected by the differences in the quantities of water held in the basin in the above-mentioned ways at the beginning and end of the year. By the selection of the general reference date of September 30, these discrepancies are reduced to a minimum, and the water loss is essentially the precipitation that passes into the air through evaporation and transpiration. In this study, the effect of differences in inventories of water held in a drainage basin at the beginning and end of a year is further reduced by using the mean annual water loss of several years.

An additional factor affecting the validity of the calculation of the water loss in the way described relates to the adjustments for the deep movement of water in the ground into and out of drainage basins, without regard to watershed lines. There is little, if any, information on which to base a definite estimate of the magnitude of this factor, other than the certainty that apparently it cannot be generally large in the basins presented in this report. The latter decision is reached because of the widely varying ground formations underlying the basins studied herein. Opportunity is thus afforded for display of the influence of deep ground-water movement in accordance with the magnitudes associated with such varying conditions. The general

[1] Prior, J. C., Run-off formulae and methods applied to selected Ohio streams: Ohio State Univ., Eng. Exper. Sta., Bull. 49, 1929.

[2] Barrows, H. K., Precipitation and run-off and altitude relations for Connecticut River: Am. Geophys. Union, Sec. Hydrology, Trans., pp. 396–406, 1933.

uniformity and systematic relations shown by the data, irrespective of such conditions, seem to preclude the effect of deep ground-water movement as a factor of substantial magnitude.

Run-off or stream flow represents the part of the precipitation that remains after the demands of evaporation, transpiration, and deep ground-water flow have been satisfied. Therefore run-off is appropriately considered in the hydrologic cycle a residual component of precipitation rather than a percentage assessment on precipitation.

In this report the term "rainfall" is used to include all forms of precipitation and is interchangeable with the term "precipitation."

The relation between rainfall and water loss and between rainfall and run-off varies from season to season and even from day to day within the same season and is dependent upon rainfall intensity, the condition of the vegetation, soil moisture, temperature, snow cover, relative humidity, and wind velocity. The conception of water loss and stream flow as certain percentages of the rainfall may be seriously misleading.

In hydrologic studies where drainage-basin characteristics are to be examined and compared, water loss and run-off may conveniently be expressed as depth in inches on the basin area. When considering individual storms it is a common practice to compute in percentage the rainfall that appears as run-off, but for monthly, seasonal, or yearly comparisons the run-off and water-loss components of rainfall are preferably expressed in inches.

On the basis of the treatment herein run-off and water loss must together equal the rainfall. In humid or subhumid regions a knowledge of any two of the three elements involved in the relation makes it possible to determine the third. For example, if the run-off from a basin has been measured and the water loss in a region of similar characteristics respecting the occurrence of evaporation and transpiration has been determined the two may be combined to give an indication of the rainfall on the basin.

PREVIOUS STUDIES

Several investigators in the field of hydrology during the past four decades have considered determinations of water loss of major importance and have made studies relating thereto. One of the pioneers in this work was Henry Gannett, of the Geological Survey. Gannett was one of the first to get away from the method of using percentages to express the relative magnitude of rainfall and run-off and to adopt instead the actual magnitudes expressed as depth in inches over an area. He was also one of the first to consider run-off as a residual of rainfall after losses. He prepared maps [3] showing mean annual rain-

[3] Gannett, Henry, Distribution of rainfall, Papers on the conservation of water resources: U. S. Geol. Survey Water-Supply Paper 234, pp. 7–9, 1909. Also in Surface water supply of the United States, 1911, pts. 1–12, pls. 1, 2, U. S. Geol. Survey Water-Supply Papers 301–312, 1912.

fall and mean annual run-off in the United States and in doing so made use of water-loss and run-off information to determine precipitation in areas where there were few if any rainfall stations. In an unpublished manuscript Gannett wrote that he considered the term "water loss" a misnomer, as the so-called loss really supports vegetation.

Another early study of interest was made by J. C. Hoyt,[4] of the Geological Survey. It contained information on monthly and yearly rainfall, run-off, and water loss for 15 river basins in the northeastern United States. In this study water loss was given in inches as well as in percentages of rainfall.

Other more recent studies containing water-loss computations are available. One of these is a report by W. G. Hoyt and others [5] which contains annual water-loss computations for seven of the longest run-off records in the humid regions of central and eastern United States. Some of the results of that study are presented in this report.

METHOD OF DETERMINATION

The fundamental procedure in making water-loss computations is merely to subtract the known values of run-off from a drainage basin from the known volume of rainfall which fell on the same drainage basin in a corresponding period of time. However, numerous considerations enter into the application of the procedure, and many complications arise. The number of drainage basins which through sufficient basic information and otherwise are suited to water-loss studies is comparatively small. The considerations and processes of treatment that have been applied are described in the following sections.

SELECTION OF SUITABLE DRAINAGE BASIN

An important requisite is to select a river basin for which there are sufficient reliable data to insure the determination of dependable results. If the investigator has the choice of several basins in a given region, as in this study, the problem of satisfying this requisite is simplified.

There must be at least 3 years of run-off records. That condition being met the adequacy of the number and distribution of rainfall observation stations usually determines whether or not a given area is selected for study. It is necessary that the rainfall stations be well distributed over the drainage area, but what is more important in hilly regions is that they be so distributed in altitude that the mean altitude of the rainfall stations approximates the mean altitude

[4] Hoyt, J C., Comparison between rainfall and run-off in the northeastern United States: Am. Soc. Civil Eng. Trans., vol. 59, pp. 431–520, 1907.

[5] Hoyt, W. G., and others, Studies of relations of rainfall and run-off in the United States: U. S. Geol. Survey Water-Supply Paper 772, 1936.

of the basin, thereby tending to compensate for the variation of rainfall with altitude. Because of the relative scarcity of rainfall stations, the latter requirement practically eliminates from the study all basins in mountainous regions, and accordingly the computations are for the most part confined to basins in rolling country or plains. Exceptions to this are the computations made for one drainage area in Vermont and several in Pennsylvania and northern Georgia.

The period of record for which computations can be made is determined by the years of available run-off records. Therefore, the first step is to determine the location of available stream-gaging stations—points where run-off has been measured. The drainage areas above these stations are then outlined, and the rainfall stations within or adjacent to the area are plotted, on standard Geological Survey base maps on a scale of 1:500,000. The lengths of all records are noted on these maps, as well as the elevations of the rainfall stations.

SOURCES OF DATA

In general, the equivalent run-off depths, in inches, for water years were taken directly from the records of surface water supply in the water-supply papers of the Geological Survey. The annual depths of rainfall at individual stations for water years corresponding to the stream-flow records were computed from the monthly totals published by the Weather Bureau.

COMPUTATION OF AREAL RAINFALL

After the annual rainfall depths at the available stations within and adjacent to the selected drainage basin were compiled, the average rainfall on the basin for each year was computed. Three methods were available for combining the individual station records into an areal average, (1) computing the arithmetic mean of the rainfall stations; (2) drawing isohyetal lines and computing a weighted average; (3) weighting the rainfalls at individual stations by geometrically constructed areas, commonly known as the Thiessen method.[6]

The first method was used where the rainfall observations were of comparatively uniform magnitude, or where the weights of the respective observations would be about equal. In such basins it became evident by inspection that the arithmetic average of the station rainfalls would give practically the same result as a weighted average.

The second or isohyetal method is more laborious than the other methods, is dependent on individual judgment in drawing isohyetal lines, and is no more accurate than the other methods, especially if the data are meager. Consequently it was discarded.

[6] Monthly Weather Review, p. 1082, July 1911.

The third method is quicker than the second and is less dependent on individual judgment. Its application is developed more fully below. Other studies have tended to show that where the rainfall observations are not favorably distributed the isohyetal method may have no advantage in accuracy over the Thiessen method. In this study the basin rainfalls were computed by the Thiessen method or by taking an arithmetic mean of the station rainfalls.

A comparison of the isohyetal method with the Thiessen method was made for the record of the 1933 water year for that part of the West River Basin above the gaging station at Newfane, Vt. The computations by the two methods are given below, and the corresponding diagrams are shown in figures 1 and 2.

Computation of mean rainfall by Thiessen method

Rainfall station 1	Measured rainfall (inches) 2	Area of basin nearest to rainfall station (square miles) 3	Column 2 times column 3 4
Cavendish	45.90	16.6	762
Somerset	59.84	19.9	1,191
Newfane	48.36	46.1	2,229
South Londonderry	48.09	225.4	10,840
Total	202.19	308.0	15,020
Mean rainfall, in inches	50.55		48.8

Computation of mean rainfall by isohyetal method

Average rainfall between isohyetals (inches) 1	Area of basin between isohyetals (square miles) 2	Column 1 times column 2 3
43.5	1.9	83
44.5	18.6	828
45.5	30.7	1,397
46.5	35.2	1,637
47.5	72.3	3,434
48.5	34.6	1,678
49.5	28.2	1,396
50.5	21.8	1,101
51.5	22.4	1,154
52.5	19.2	1,008
53.5	12.2	653
54.5	7.7	420
55.5	3.2	178
Total	308.0	14,967
Mean rainfall, in inches		48.6

The result obtained by the isohyetal method was very close to that obtained by the Thiessen method. In this example, partly due to the fact that of the eight basic rainfall stations, only one was within the basin and the other seven were outside of it, the isohyetal lines may not have conformed to the variations associated with the topography within the basin. For example, according to the isohyetal lines shown on figure 2 the rainfall decreases upstream from South Londonderry. This may be contrary to fact, as the basin rises in this region to a relatively high altitude, which is usually associated with greater rainfall. If an altitude-rainfall relation could be determined for individual years, the position of the isohyetal lines might, by the use of a topographic map, be altered to conform

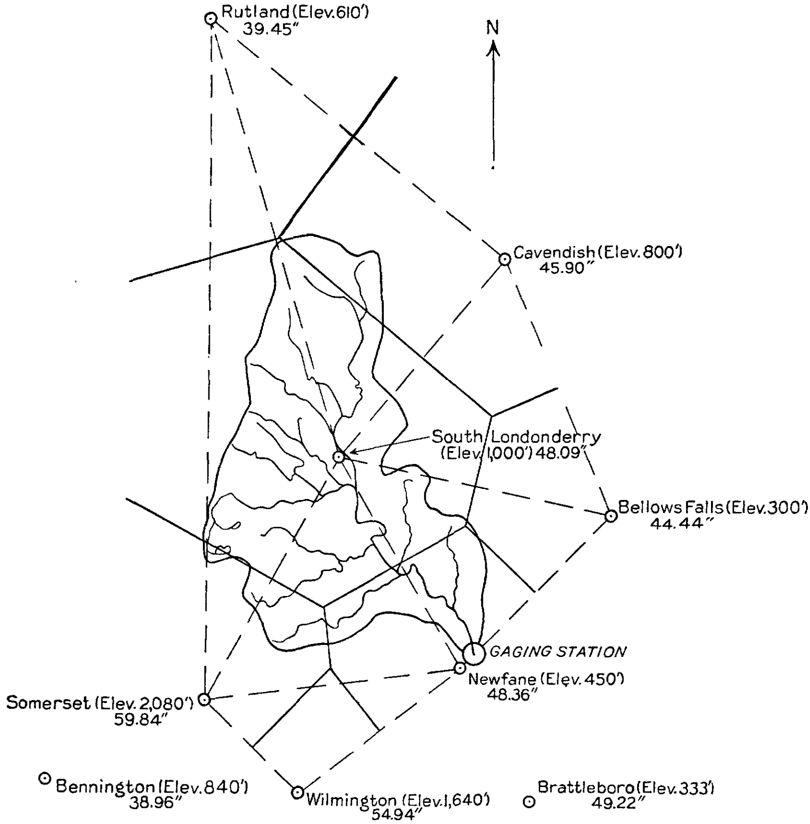

FIGURE 1.—Sketch of West River Basin showing location of adjacent rainfall stations, measured rainfall for the 1933 water year, and diagram for computing areal rainfall by the Thiessen method.

to the changes of rainfall with topography. The Thiessen method may not have produced greater accuracy in this respect, but it had the advantage of being less laborious.

ADJUSTMENTS TO COMPUTED RAINFALL

As previously stated it is desirable in computations of the mean rainfall of a drainage basin in which rainfall varies with altitude that the mean altitude of the rainfall stations correspond closely to that of the basin. In mountainous regions this requirement is rarely satisfied, as the available rainfall stations are usually located at low altitudes—often in the valleys. In order that the computation of average rainfall for a mountainous basin may even approximate actual conditions over the entire area, it is necessary to make adjustments to the rainfall data. Such adjustments have been applied in the study of the area on the West River above Newfane, Vt.

The first step is to derive an altitude-rainfall relation. (See fig. 3.) In many basins this cannot be done with any degree of success, as

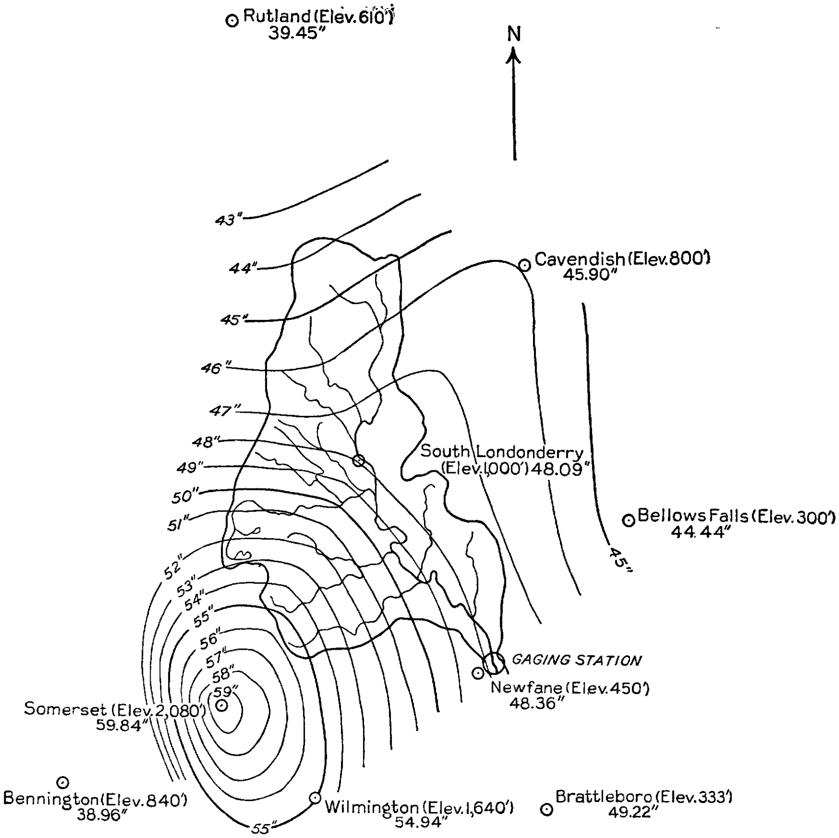

FIGURE 2.—Sketch of West River Basin showing location of adjacent rainfall stations, measured rainfall for the 1933 water year, and isohyetal lines for computing areal rainfall.

the influence of altitude is obscured by that of variable exposure and air currents in different parts of the basin. Moreover, for shorter periods, as a year or less, there may be, in a limited sense, the fortuitous areal distribution characteristic of individual storms. Usually such a relation can be reliable only when determined on the basis of the means over several years.

In this example the mean annual rainfall for the stations in and adjacent to the basin for the total period under consideration (1919–23, 1929–33) were plotted against altitude as shown in figure 3. It is evident that although the mean annual rainfalls at the lower altitudes are somewhat scattered, only one of the station records used in the computations deviated more than 4 percent from the mean curve.

The weighted mean altitude of the rainfall stations was taken as 1,020 feet, using weightings obtained by the Thiessen method. The

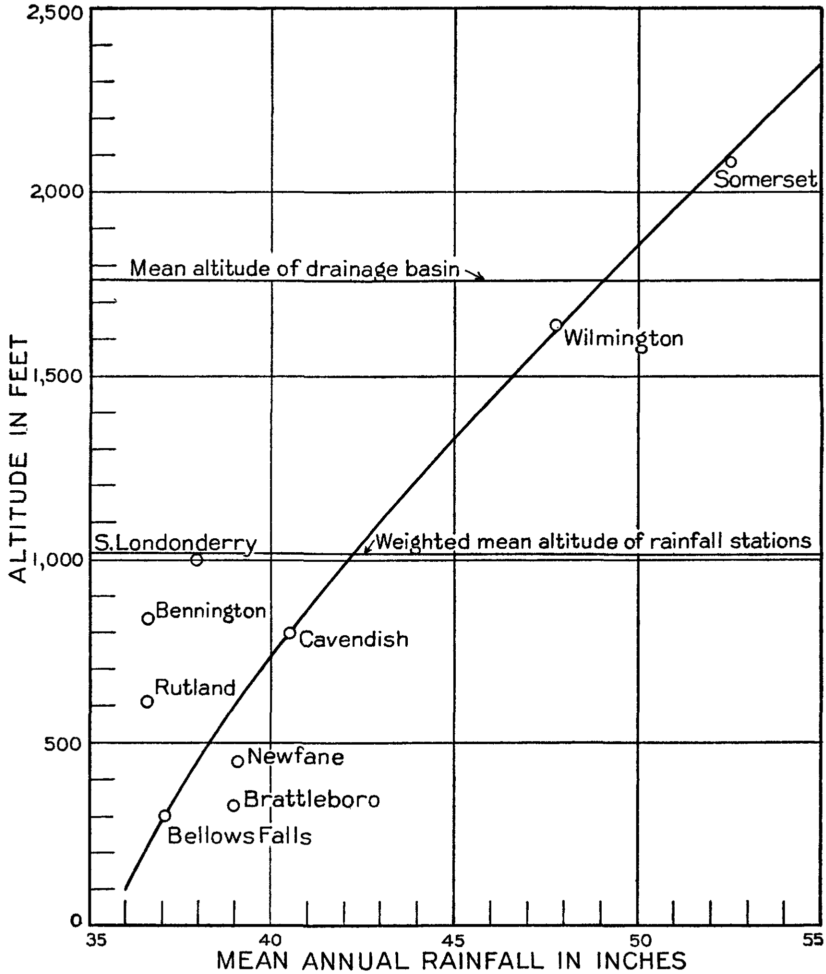

FIGURE 3.—Rainfall-altitude relation for the period 1919–23, 1929–33, for rainfall stations in and adjacent to the West River Basin, Vt.

weighted mean altitude of the drainage basin is 1,760 feet.[7] The difference in mean rainfall between these two altitudes was 6.8 inches as indicated by the curve. This figure was applied as a positive correction to the mean rainfall, resulting in an adjustment of 17 percent. The mean water loss for the period was increased 46 percent. These results are illustrative of the errors that may be encoun-

[7] Am. Geophys. Union Trans., 1933, p. 402.

tered in determining areal rainfall in mountainous regions, where the data are insufficient to adjust for altitude.

ADJUSTMENTS TO COMPUTED WATER LOSS

The purpose of this study is to determine water loss for land areas only. The water loss from a prevalent water surface is, of course, entirely an evaporation loss and in general over periods of time of a year or more, and except under certain conditions favorable for excessive evaporation from vegetation, it is believed to be greater than the combination of losses that occur from land.

Three of the drainage areas selected in Massachusetts include the surfaces of large reservoirs, and it is thought that the computations do not give a reliable figure for the loss from the land area without appropriate adjustment therefor. Accordingly, adjustments to the mean annual water loss were computed. An example of the determination of the adjustment for the drainage area on the South Branch of the Nashua River above Wachusett Dam at Clinton, Mass., is given below.

Drainage area = 108.84 square miles.
Water surface = 4,735 acres = 7.40 square miles.
Mean annual water loss for total area = 22.03 inches.
Approximate mean annual evaporation from water surface = 25 inches.

$$\binom{\text{Water loss}}{\text{from total area}} \times \binom{\text{total}}{\text{area}} = \binom{\text{water loss from}}{\text{land area}} \times \binom{\text{land}}{\text{area}} + \binom{\text{evaporation from}}{\text{water area}} \times \binom{\text{water}}{\text{area}}$$

Let x = water loss from land area.

$$x = \frac{(22.03)\ (108.84) - (25)\ (7.4)}{101.44}$$
$$= \frac{2{,}398 - 185}{101.44} = \frac{2{,}213}{101.44}$$
$$= 21.8 \text{ inches.}$$

The mean annual evaporation of 25 inches is not exact but was selected after an examination of the scant information available.[8]

This example shows that when the percentage of water area is small and evaporation differs slightly from the water loss from the land area the amount of the adjustment is comparatively negligible. The need for such correction can usually be determined only by trial.

ACCURACY OF RESULTS

From the foregoing it is evident that there are decided practical limitations to the accuracy of results of studies of water loss. Even though refinement is attempted, little faith can be put in the results if the rainfall observations are not adequately distributed. Moreover, rainfall records at individual stations may be unrepresentative owing to exposed or unduly sheltered positions of rain gages, inability to make accurate measurements of snowfall, and shortcomings of the observers. The records of yearly run-off may also be subject to slight

[8] Am. Soc. Civil Eng. Trans., vol. 99, p. 708, 1934.

inaccuracy, but it is believed to be relatively negligible compared with the inaccuracy inherent in computations of areal rainfall.

PRESENTATION OF RESULTS

MEAN ANNUAL WATER LOSS

Table 1 (pp. 13–18) presents the mean annual precipitation, mean annual run-off, and mean annual water loss for the years of record covered in this study.

The drainage areas in table 1 are presented in the same geographic order that is followed in the Geological Survey water-supply papers and are grouped according to the following order and arrangement: North Atlantic basins, South Atlantic basins, Ohio River Basin, St. Lawrence River Basin, Hudson Bay Basin, upper Mississippi River Basin, Missouri River Basin, lower Mississippi River Basin, and eastern Gulf of Mexico basins. No computations were made for basins west of the 104th meridian.

The first column in table 1 gives the drainage area, which is designated by the name of the gaging station at which the run-off is measured. A few of the drainage areas represent only that portion of the total drainage area that lies between two or more main-stream or tributary gaging stations. These were selected only if rainfall observations were not available over the entire drainage area. The run-off for such restricted drainage areas is the difference between the run-offs at appropriate groups of the several gaging stations and is, of course, because of accumulated errors in the difference, subject to greater inaccuracy than a single observed record.

The second column gives the period studied in water years, which end September 30. The period does not necessarily represent and should not be confused with the period of available record of run-off at the gaging station. For reasons previously stated the period studied is generally less than that of the record of run-off. No period extends beyond 1934 because more recent run-off records had not been published at the time the basic computations were made (1935–36). Where data were taken from other published records the period corresponds to that used in those records. For example, for basins in Pennsylvania, the period studied begins in 1921, as that was the first year for which basin rainfalls were published by the Department of Forests and Waters. Other periods to be studied were determined by the availability of rainfall records.

The remaining columns in table 1 give the mean annual precipitation, mean annual run-off, and mean annual water loss for the periods listed in the second column. The results are usually the arithmetical averages of the individual values for each year, given in table 2, computed to the nearest tenth.

The mean annual water loss is shown graphically in plate 1, where each value is plotted approximately in the center of the basin studied.

TABLE 1.—*Summary of precipitation, run-off, and water loss*

Merrimack River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
South Branch of Nashua River at Clinton, Mass.[1]	1904–33	43.8	21.8	22.0
Sudbury River at Framingham Center, Mass.[1]	1902–33	43.0	18.5	24.5
Lake Cochituate outlet at Cochituate, Mass.[1]	1904–33	41.9	18.7	23.2

Connecticut River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
West River at Newfane, Vt.[2]	1920–23; 1929–33	46.5	25.0	21.5
Swift River at West Ware, Mass.[3]	1920–34	45.4	22.4	23.1
Middle Branch of Westfield River at Goss Heights, Mass.[3]	1920; 1922–34	45.6	25.9	19.6

Delaware River Basin [4]

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
Delaware River at Port Jervis, N. Y.	1921–34	41.9	24.6	17.3
Delaware River at Belvidere, N. J.	1924–34	42.8	23.6	19.3
Delaware River at Riegelsville, Pa.	1921–34	42.7	23.2	19.5
Delaware River at Trenton, N. J.	1924–34	43.2	23.1	20.1
Lackawaxen River at West Hawley, Pa.	1925–34	43.6	22.4	21.2
Wallenpaupack Creek at Wilsonville, Pa.	1921–22; 1926–34	42.1	21.3	20.8
Bushkill Creek at Shoemakers, Pa.	1921–34	44.2	26.1	18.0
McMichaels Creek at Stroudsburg, Pa.	1921–34	45.6	22.7	22.9
Lehigh River at Tannery, Pa.	1921–26; 1928–34	43.6	26.7	16.9
Lehigh River at Bethlehem, Pa.	1929–34	41.3	20.4	20.9
Neshaminy Creek at Rushland, Pa.	1932–34	46.9	18.2	28.7
Schuylkill River at Pottstown, Pa.	1929–34	41.1	18.2	22.9
Little Schuylkill River at Tamaqua, Pa.	1921–34	45.9	28.2	17.7
Perkiomen Creek at Graters Ford, Pa.	1927–34	44.0	18.9	25.1
Crum Creek at Woodlyn, Pa.	1932–34	46.4	16.4	30.0
Ridley Creek at Moylan, Pa.	1932–34	48.4	17.0	31.4
Chester Creek near Chester, Pa.	1932–34	48.3	15.5	32.8
Brandywine Creek at Chadds Ford, Pa.	1921–34	43.2	17.0	26.2

Susquehanna River Basin [4]

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
Susquehanna River at Towanda, Pa.	1921–34	35.9	17.3	18.6
Susquehanna River at Wilkes-Barre, Pa.	1921–34	36.3	17.2	19.1
Susquehanna River at Danville, Pa.	1921–31; 1933–34	37.3	17.6	19.70
Susquehanna River at Harrisburg, Pa.	1921–34	38.3	17.6	20.8
Susquehanna River at Marietta, Pa.	1932–34	38.8	15.7	23.1
Towanda Creek near Monroeton, Pa.	1921–34	36.4	16.8	19.6
Tunkhannock Creek at Dixon, Pa.	1921–34	40.5	18.4	22.1
Lackawanna River at Moosic, Pa.	1921–28	40.9	27.5	13.5
Wapwallopen Creek near Wapwallopen, Pa.	1921–34	44.6	17.8	26.8
Nescopeck Creek near St. Johns, Pa.	1921–26	45.4	24.9	20.5
Fishing Creek at Bloomsburg, Pa.	1921–28	43.4	27.3	16.1
West Branch of Susquehanna River at Bower, Pa.	1921–34	41.4	23.0	18.3
West Branch of Susquehanna River at Renovo, Pa.	1921–34	40.2	20.6	19.6
West Branch of Susquehanna River at Williamsport, Pa.	1921–34	38.4	20.1	18.3
Clearfield Creek at Dimeling, Pa.	1921–34	42.0	20.2	21.8
Driftwood Branch of Sinnemahoning Creek at Sterling Run, Pa.	1921–34	42.0	22.1	19.8
North Bald Eagle Creek at Milesburg, Pa.	1921–28; 1934	39.8	20.8	19.0
North Bald Eagle Creek at Beech Creek Station, Pa.	1921–34	37.9	17.8	20.1

[1] Rainfall and run-off data of the water division of the Metropolitan District Commission.
[2] Results adjusted on basis of altitude-rainfall relation. See p. 10.
[3] Data compiled by H. B. Kinnison, district engineer, Geological Survey, Boston, Mass.
[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

TABLE 1.—*Summary of precipitation, run-off, and water loss*—Continued

Susquehanna River Basin—Continued

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
Pine Creek at Cedar Run, Pa.	1921–34	33.2	16.7	16.5
Lycoming Creek near Trout Run, Pa.	1921–34	37.9	19.0	19.0
Loyalsock Creek at Loyalsock, Pa.	1926–34	39.4	21.4	18.0
Penn Creek at Penns Creek, Pa.	1930–31 1933–34	41.9	17.2	24.7
Mahantango Creek East near Dalmatia, Pa.	1930–34	40.7	14.9	25.8
Frankstown Branch of Juniata River at Williamsburg, Pa.	1921–34	40.2	17.0	23.2
Juniata River at Newport, Pa.	1921–34	38.9	16.2	22.8
Shaver Creek near Petersburg, Pa.	1931–34	36.9	13.1	23.8
Standing Stone Creek near Huntingdon, Pa.	1931–34	39.2	13.1	26.1
Raystown Branch of Juniata River at Saxton, Pa.	1921–34	38.4	15.0	23.4
Dunning Creek at Yount, Pa.	1931–34	38.0	13.3	24.6
Brush Creek at Gapsville, Pa.	1932–34	36.4	15.3	21.0
Great Trough Creek near Marklesburg, Pa.	1931–34	38.1	12.7	25.4
Aughwick Creek near Orbisonia, Pa.	1932–34	39.5	15.8	23.7
Tuscarora Creek near Port Royal, Pa.	1921–34	39.6	16.3	23.3
Cocolamus Creek near Millerstown, Pa.	1931–34	40.9	14.9	26.0
Sherman Creek at Shermandale, Pa.	1930–34	41.7	15.1	26.6
Conodoguinet Creek near Hogestown, Pa.	1930–34	40.2	12.9	27.3
Swatara Creek at Harper Tavern, Pa.	1921–34	42.7	21.2	21.5
Upper Little Swatara Creek at Pine Grove, Pa.	1921–32	42.0	21.3	20.7
West Conewago Creek near Manchester, Pa.	1930–34	39.8	12.6	27.2
Codorus Creek at Spring Grove, Pa.	1930–34	42.1	14.4	27.7
South Branch of Codorus Creek near York, Pa.	1928–29 1933–34	50.0	20.0	30.0
Conestoga Creek at Lancaster, Pa.	1929–31 1934	36.7	12.4	24.3
Muddy Creek at Castle Fin, Pa.	1930–34	39.7	13.7	26.0
Savannah River Basin				
Broad River near Carlton, Ga.	1903–12	52.5	23.9	28.6
Altamaha River Basin				
Ocmulgee River near Jackson, Ga.	1907–15	48.6	18.3	30.3
Oconee River near Greensboro, Ga.	1904–13 1915–23	50.7	20.5	30.2
Suwannee River Basin				
Suwannee River at Fargo, Ga.	1928–31	54.8	23.0	31.9
Apalachicola River Basin				
Chattahoochee River near Norcross, Ga.	1905–23	58.2	28.2	30.0
Flint River near Woodbury, Ga.	1903–15 1917–20	48.4	19.0	29.4
Flint River between Culloden and Woodbury, Ga.	1914–15 1917–20	48.8	16.0	32.8
Choctawhatchee River Basin				
Choctawhatchee River near Newton, Ala.	1923–24 1926–27	57.1	18.2	38.9
Escambia River Basin				
Conecuh River near Andalusia, Ala.	1905–19 1930–33	53.3	19.4	33.9

TABLE 1.—*Summary of precipitation, run-off, and water loss*—Continued

Mobile River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
Alabama River near Montgomery, Ala., minus Coosa River near Wetumpka and Tallapoosa River below Tallassee.	1929–33	49.6	21.1	28.5
Etowah River near Ball Ground, Ga.	1908–15	55.5	29.6	25.9
Tallapoosa River at Wadley, Ala.	1924–33	52.6	20.2	32.4
East Fork of Tombigbee River near Fulton, Miss.	1929–33	58.6	19.0	39.6
Mulberry Fork of Black Warrior River near Garden City, Ala.	1929–31, 1933	56.8	25.5	31.2
Sipsey Fork of Mulberry Fork of Black Warrior River near Sipsey, Ala.	1929–31, 1933	54.8	23.9	30.9

Pearl River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
Pearl River at Edinburg, Miss.	1929–33	55.5	16.6	38.8
Strong River at Dlo, Miss.	1929, 1931–33	55.7	23.7	32.0

Ohio River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
ALLEGHENY RIVER BASIN [4]				
Allegheny River at Larabee, Pa.	1926–34	40.1	20.2	19.9
Allegheny River at Franklin, Pa.	1921–34	39.8	21.8	18.0
Allegheny River at Kittanning, Pa.	1921, 1923–28	40.7	24.1	16.6
Brokenstraw Creek at Youngsville, Pa.	1921–34	41.9	23.5	18.4
Tionesta Creek at Nebraska, Pa.	1926–32, 1934	41.8	24.9	16.8
Oil Creek near Rouseville, Pa.	1921–30	43.2	21.8	21.4
French Creek at Carters Corners (Kimmeytown), Pa.	1921–28	40.4	25.4	15.0
French Creek at Saegerstown, Pa.	1922–34	38.8	23.9	14.9
Cussewago Creek near Meadville, Pa.	1921–34	38.8	19.9	19.0
Clarion River near Piney, Pa.	1925–34	38.9	20.9	18.0
Red Bank Creek at St. Charles, Pa.	1921–34	39.5	20.2	19.4
Mahoning Creek near Dayton, Pa.	1921–34	40.7	23.1	17.6
Crooked Creek near Ford City, Pa.	1921–34	42.9	20.2	22.7
Kiskiminetas River at Avonmore, Pa.	1921–34	43.8	22.3	21.6
Stony Creek at Johnstown, Pa.	1921–34	42.8	22.6	20.3
Blacklick Creek at Blacklick, Pa.	1921–34	44.0	21.0	23.0
Loyalhanna Creek at New Alexandria, Pa.	1921–22, 1927–34	45.9	22.2	23.8
MONONGAHELA RIVER BASIN [4]				
Youghiogheny River at Friendsville, Md.	1927–30	47.7	26.0	21.7
Youghiogheny River at Connellsville, Pa.	1921–34	45.9	24.1	21.9
Youghiogheny River at Sutersville, Pa.	1921–29, 1932–34	45.6	22.8	22.7
Casselman River at Markleton, Pa.	1921–34	45.7	22.2	23.5
Laurel Hill Creek at Ursina, Pa.	1921–34	46.1	30.5	15.6
Turtle Creek at Trafford, Pa.	1921–34	37.0	19.4	17.6
CHARTIERS CREEK BASIN [4]				
Chartiers Creek at Carnegie, Pa.	1921–30, 1933	39.5	17.7	21.8
BEAVER RIVER BASIN [4]				
Shenango River near Jamestown, Pa.	1921–33	38.6	16.7	21.9
Shenango River at Sharon, Pa.	1921–34	37.0	14.7	22.3
Shenango River at New Castle, Pa.	1921–34	37.0	14.1	22.9
Little Shenango River at Greenville, Pa.	1921–22, 1927–34	38.5	17.7	20.8
Pymatuning Creek near Orangeville, Pa.	1921–22, 1927–34	35.9	16.8	19.0
Slippery Rock Creek at Wurtemburg, Pa.	1921–32, 1934	39.4	17.7	21.7
Connoquenessing Creek near Hazen, Pa.	1921–34	38.4	18.3	20.1
RACCOON CREEK BASIN [5]				
Raccoon Creek at Adamsville, Ohio	1916–27	41.9	19.9	22.0

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.
[5] Data compiled in Ohio State University Engineering Experiment Station Bull. 49, 1929.

TABLE 1.—*Summary of precipitation, run-off, and water loss*—Continued

Ohio River Basin—Continued

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
SCIOTO RIVER BASIN [5]				
Scioto River at Grigg's Dam and at Dublin, Ohio	1911–18, 1922–24	39.6	12.6	26.2
Scioto River ta Columbus, Ohio	1899–1908	36.7	11.2	25.5
MIAMI RIVER BASIN [5]				
Miami River at Dayton, Ohio	1894–1918	37.7	11.9	25.8
WABASH RIVER BASIN				
Wabash River at Logansport, Ind	1924–33	38.3	13.7	24.6
Salamonie River at Dora, Ind	1931–33	37.0	11.6	25.4
Mississinewa River at Marion, Ind	1931–33	39.7	10.7	29.0
Eel River at North Manchester, Ind	1931–33	31.8	9.8	22.0
West Fork of White River near Noblesville, Ind	1916–21, 1930–33	37.5	13.3	24.2
Fall Creek at Millersville, Ind	1931–33	37.0	12.0	25.0
East Fork of White River at Seymour, Ind	1928–33	41.7	15.2	26.5
Flatrock Creek at St. Paul, Ind	1931–33	42.0	12.4	29.5
St. Lawrence River Basin				
STREAMS TRIBUTARY TO LAKE MICHIGAN				
Thornapple River near Caledonia, Mich	1932–34	32.0	9.3	22.7
Muskegon River at Newaygo, Mich	1932–34	30.1	10.2	19.9
STREAM TRIBUTARY TO LAKE HURON				
Tittabawassee River at Freeland, Mich	1913–14, 1916–20, 1932–34	29.7	9.3	20.4
STREAMS TRIBUTARY TO LAKE ERIE				
River Rouge at Detroit, Mich	1932–34	28.6	6.0	22.6
Huron River at Barton, Mich	1915–20	31.7	9.2	22.5
Hudson Bay Basin				
Red River at Fargo, N. Dak	1919–23, 1925–33	20.8	0.6	20.3
Red River at Grand Forks, N. Dak.[6]	1882–1934	20.9	1.2	19.7
Red Lake River at Crookston, Minn	1922–24, 1926–33	19.5	1.6	17.9
Upper Mississippi River Basin				
CHIPPEWA RIVER BASIN				
Jump River at Sheldon, Wis	1916–34	30.5	12.9	17.6
TREMPEALEAU RIVER BASIN				
Trempealeau River at Dodge, Wis	1915–19	29.5	8.3	21.2
BLACK RIVER BASIN				
Black River at Neillsville, Wis	1915–34	31.1	9.6	21.5
LA CROSSE RIVER BASIN				
La Crosse River near West Salem, Wis	1915–34	30.3	10.0	20.4
WISCONSIN RIVER BASIN				
Rib River at Rib Falls, Wis	1926–34	30.1	12.4	17.7
Yellow River at Sprague, Wis	1927–34	28.8	6.3	22.5
Kickapoo River at Gays Mills, Wis	1915–33	31.6	9.3	22.3
ROCK RIVER BASIN				
Sugar River near Brodhead, Wis	1915–34	32.5	9.2	23.3

[5] Data compiled in Ohio State University Engineering Experiment Station Bull. 49, 1929.
[6] Data compiled in Geological Survey Water-Supply Paper 772, 1936.

TABLE 1.—*Summary of precipitation, run-off, and water loss*—Continued

Missouri River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
GRAND RIVER BASIN				
Grand River near Wakpala, S. Dak	1931–33	14.9	0.3	14.5
MOREAU RIVER BASIN				
Moreau River at Promise, S. Dak	1931–33	14.6	.4	14.1
WHITE RIVER BASIN				
White River near Oacoma, S. Dak	1929–33	17.8	.6	17.2
NIOBRARA RIVER BASIN				
Niobrara River near Spencer, Nebr	1928–33	18.6	1.6	17.0
JAMES RIVER BASIN				
James River at Jamestown, N. Dak	1929–32	15.1	.1	15.0
James River near Scotland, S. Dak	1931–33	17.3	.1	17.3
PLATTE RIVER BASIN				
Middle Loup River at St. Paul, Nebr	1929–33	22.4	2.3	20.0
North Loup River near St. Paul, Nebr	1929–33	22.1	3.3	18.8
Elkhorn River at Waterloo, Nebr	1930–33	24.5	1.9	22.6
KANSAS RIVER BASIN				
Republican River between Wakefield and Scandia, Kans.	1920–24, 1929–33	24.8	1.4	23.4
Kansas River at Wamego, Kans., minus Kansas River at Ogden and Big Blue River at Randolph.	1920–25, 1930–33	29.8	3.8	27.2
Kansas River between Topeka and Wamego, Kans	1920–33	33.4	4.9	28.5
Smoky Hill River between Lindsborg and Ellsworth, Kans.	1931–33	24.0	.5	23.5
South Fork of Solomon River at Alton, Kans	1920–24, 1929–31	21.9	.5	21.4
Solomon River between Niles and Beloit, Kans	1930–33	23.4	.9	22.6
North Fork of Solomon River at Kirwin, Kans	1920–24, 1929–31	22.2	.6	21.6
Soldier Creek at Topeka, Kans	1930–33	34.5	5.5	29.0
Delaware River at Valley Falls, Kans	1923–28, 1930–33	34.6	4.9	29.7
Wakarusa River near Lawrence, Kans	1930–33	32.7	2.6	30.2
Stranger Creek near Tonganoxie, Kans	1930–33	34.9	5.1	29.8
GRAND RIVER BASIN				
Grand River near Gallatin, Mo	1922–33	35.3	7.2	28.0
Thompson River at Trenton, Mo	1929–33	32.9	7.9	25.0
Locust Creek near Milan, Mo	1922–33	37.3	9.2	28.1
CHARITON RIVER BASIN				
Chariton River atElmer, Mo	1922, 1924–30	36.2	9.5	26.7
LAMINE RIVER BASIN				
Blackwater River at Blue Lick, Mo	1923–33	38.6	7.8	30.9
OSAGE RIVER BASIN				
Osage River near Ottawa, Kans	1920–33	34.4	4.4	30.0
Sac River near Stockton, Mo	1926–32	43.9	14.8	29.1
South Grand River near Brownington, Mo	1922–33	38.0	7.5	30.5

TABLE 1.—*Summary of precipitation, run-off, and water loss*—Continued

Lower Mississippi River Basin

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
MERAMEC RIVER BASIN				
Meramec River near Steelville, Mo	1924–34	41.0	9.4	31.6
Bourbeuse River at Union, Mo	1922–34	39.4	11.2	28.2
ST. FRANCIS RIVER BASIN				
St. Francis River near Patterson, Mo	1922–34	42.4	15.6	26.9
WHITE RIVER BASIN				
James River at Galena, Mo	1923–34	42.7	13.6	29.1
ARKANSAS RIVER BASIN				
Pawnee River near Larned, Kans	1926–33	20.6	.2	20.4
Little Arkansas River at Valley Center, Kans	1923–33	29.0	1.6	27.4
Walnut River at Winfield, Kans	1923–33	32.4	4.6	27.8
Neosho River near Iola, Kans.[6]	1896–1903, 1918–34	33.3	4.9	28.4

Western Gulf of Mexico basins

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual run-off (inches)	Mean annual water loss (inches)
NECHES RIVER BASIN				
Neches River near Rockland, Tex	1924–34	42.8	9.0	33.8
Angelina River near Lufkin, Tex	1924–34	43.8	10.6	33.2
Angelina River between Horger and Lufkin, Tex	1929–34	48.9	11.5	37.4
TRINITY RIVER BASIN				
Clear Fork of Trinity River at Fort Worth, Tex	1926–34	31.1	1.8	29.3
Mountain Creek near Grand Prairie, Tex	1926–32	35.1	3.9	31.2
Elm Fork of Trinity River near Carrollton, Tex	1925–34	31.9	3.3	28.6
East Fork of Trinity River near Rockwall, Tex	1925–34	37.5	6.5	31.0
SAN JACINTO RIVER BASIN				
San Jacinto River near Humble, Tex	1930–34	40.8	6.1	34.8
BRAZOS RIVER BASIN				
San Gabriel River at Circleville, Tex	1925–34	28.6	3.1	25.5
Yegua Creek near Somerville, Tex	1925–34	34.6	4.4	30.1
Navasota River near Easterly, Tex	1925–34	36.6	5.7	31.0
COLORADO RIVER BASIN				
Pedernales River at Stonewall, Tex	1925–34	27.0	1.3	25.8
Pedernales River between Spicewood and Stonewall, Tex.	1925–34	28.4	1.6	26.9
GUADALUPE RIVER BASIN				
Guadalupe River near Spring Branch, Tex	1923–34	30.1	2.1	28.0
Blanco River at Wimberley, Tex	1929–34	30.4	3.3	27.2
Plum Creek near Luling, Tex	1931–34	30.6	2.4	28.1
Sandies Creek near Westhoff, Tex	1931–34	28.7	1.6	27.1
Coleto Creek near Schroeder, Tex	1931–33	32.9	2.5	30.4
Medina River near Pipe Creek, Tex	1924–34	30.1	3.4	26.7
NUECES RIVER BASIN				
Nueces River at Laguna, Tex	1925–34	24.1	2.1	22.0

[6] Data compiled in Geological Survey Water-Supply Paper 772, 1936.

ANNUAL WATER LOSS

The annual precipitation, annual run-off, and annual water loss for each area for each year in the period studied are given in table 2. The areas listed are those given in table 1 and the explanation of the first two columns of table 1 given under "Mean annual water loss" applies also to the first two columns of table 2. The interpretation of water losses computed for short periods is discussed in the section on "Significance of water loss" (pp. 3–4). The rainfall and water-loss data given for the area on the West River above Newfane, Vt., have not been adjusted on the basis of the altitude-rainfall relation described under "Method of determination" (pp. 8–11).

TABLE 2.—*Precipitation, run-off, and water loss, by water years*

Merrimack River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
South Branch of Nashua River at Clinton, Mass.[1]	1904	47.6	23.6	24.0
	1905	41.7	18.2	23.5
	1906	46.7	21.5	25.2
	1907	40.4	18.1	22.3
	1908	47.4	27.0	20.4
	1909	43.3	18.7	24.6
	1910	37.3	17.7	19.6
	1911	34.2	10.8	23.4
	1912	41.1	21.3	19.8
	1913	41.4	16.8	24.6
	1914	41.1	22.4	18.7
	1915	42.1	17.1	25.0
	1916	47.3	27.9	19.4
	1917	34.4	16.9	17.5
	1918	41.0	17.6	23.4
	1919	47.0	23.5	23.5
	1920	54.0	33.1	20.9
	1921	45.7	26.6	19.1
	1922	53.9	29.0	24.9
	1923	38.8	22.5	16.3
	1924	49.3	26.0	23.3
	1925	36.6	14.2	22.4
	1926	37.3	19.0	18.3
	1927	50.1	21.5	28.6
	1928	56.5	36.3	20.2
	1929	36.8	22.5	14.3
	1930	34.4	11.6	22.8
	1931	47.0	20.3	26.7
	1932	42.6	18.2	24.4
	1933	56.8	33.1	23.7
Sudbury River at Framingham Center, Mass.[1]	1902	49.2	25.5	23.7
	1903	48.0	27.3	20.7
	1904	46.0	20.8	25.2
	1905	41.0	15.7	25.3
	1906	41.5	17.9	23.6
	1907	40.2	15.4	24.8
	1908	44.2	22.6	21.6
	1909	39.9	13.1	26.8
	1910	35.7	11.9	23.8
	1911	35.0	8.2	26.8
	1912	41.5	18.4	23.1
	1913	44.1	13.5	30.6
	1914	41.5	18.7	22.8
	1915	40.7	13.2	27.5
	1916	43.8	20.8	23.0
	1917	38.7	14.2	24.5
	1918	42.8	14.8	28.0
	1919	43.1	19.1	24.0
	1920	46.9	27.5	19.4
	1921	43.7	17.4	26.3
	1922	50.2	21.1	29.1
	1923	37.4	18.6	18.8

[1] Rainfall and run-off data of the water division of the Metropolitan District Commission.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Merrimack River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Sudbury River at Framingham Center, Mass.[1]	1924	49.1	23.5	25.6
	1925	36.6	12.6	24.0
	1926	41.7	17.8	23.9
	1927	44.9	18.2	26.7
	1928	55.3	34.0	21.3
	1929	37.1	21.3	15.8
	1930	33.0	8.4	24.6
	1931	45.6	19.3	26.3
	1932	44.0	13.2	30.8
	1933	52.7	28.0	24.7
Lake Cochituate outlet at Cochituate, Mass.[1]	1904	45.2	19.3	25.9
	1905	39.6	14.6	25.0
	1906	38.5	16.6	21.9
	1907	38.0	13.8	24.2
	1908	40.4	19.0	21.4
	1909	38.4	13.1	25.3
	1910	34.8	13.3	21.5
	1911	34.9	9.0	25.9
	1912	40.5	28.9	11.6
	1913	44.1	15.4	28.7
	1914	39.4	19.4	20.0
	1915	40.9	14.5	26.4
	1916	42.5	23.9	18.6
	1917	38.0	14.1	23.9
	1918	42.3	15.8	26.5
	1919	42.9	20.0	22.9
	1920	48.3	30.9	17.4
	1921	46.6	21.4	25.2
	1922	51.2	23.8	27.4
	1923	36.4	19.6	16.8
	1924	49.1	21.4	27.7
	1925	35.0	12.8	22.2
	1926	41.4	18.8	22.6
	1927	45.7	18.1	27.6
	1928	48.9	27.3	21.6
	1929	35.6	20.6	15.0
	1930	32.2	8.7	23.5
	1931	47.8	21.4	26.4
	1932	43.6	13.3	30.3
	1933	54.7	31.2	23.5

Connecticut River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
West River at Newfane, Vt.[2]	1920	36.9	29.4	7.5
	1921	38.8	25.0	13.8
	1922	41.6	26.8	14.8
	1923	31.7	18.8	12.9
	1929	42.1	27.3	14.8
	1930	38.7	21.2	17.5
	1931	43.5	25.9	17.6
	1932	34.9	23.0	11.9
	1933	48.8	27.4	21.4
Swift River at West Ware, Mass.[3]	1920	51.5	30.2	21.3
	1921	50.2	29.3	20.9
	1922	52.9	28.6	24.3
	1923	38.2	22.9	15.3
	1924	44.9	23.2	21.7
	1925	38.7	15.2	23.5
	1926	36.8	19.1	17.7
	1927	49.1	20.7	28.4
	1928	59.6	33.3	26.3
	1929	37.6	20.8	16.8
	1930	35.7	10.8	24.9
	1931	42.4	14.4	28.0
	1932	41.0	16.5	24.5
	1933	53.1	24.6	28.5
	1934	50.0	26.0	24.0
Middle Branch of Westfield River at Goss Heights, Mass.[3]	1920	53.3	32.4	20.9
	1922	48.6	29.4	19.2
	1923	37.3	20.1	17.2
	1924	49.9	29.5	20.4
	1925	42.0	21.4	20.6

[1] Rainfall and run-off data of the water division of the Metropolitan District Commission.
[2] No altitude-rainfall adjustment applied to data for individual years. See p. 10 and table 1 for results of adjustment to mean rainfall and mean water loss.
[3] Data compiled by H. B. Kinnison, district engineer, Geological Survey, Boston, Mass.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Connecticut River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Middle Branch of Westfield River at Goss Heights, Mass.	1926	39.1	24.0	15.1
	1927	45.8	21.8	24.0
	1928	65.2	46.8	18.4
	1929	35.6	25.5	10.1
	1930	38.9	16.0	22.9
	1931	41.1	18.6	22.5
	1932	34.3	18.4	15.9
	1933	60.8	33.0	27.8
	1934	46.1	26.2	19.9

Delaware River Basin [4]

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Delaware River at Port Jervis, N. Y.	1921	40.0	26.8	13.2
	1922	44.9	28.0	16.9
	1923	36.9	18.8	18.1
	1924	42.7	23.8	18.9
	1925	37.2	21.4	15.8
	1926	38.9	23.2	15.7
	1927	45.0	28.9	16.1
	1928	59.4	43.9	15.5
	1929	39.3	22.3	17.0
	1930	38.0	20.0	18.0
	1931	38.3	18.6	19.7
	1932	36.0	20.1	15.9
	1933	50.2	27.7	22.5
	1934	39.4	20.3	19.1
Delaware River at Belvidere, N. J.	1924	44.0	23.6	20.4
	1925	37.8	20.3	17.5
	1926	39.8	21.3	18.5
	1927	45.8	28.4	17.4
	1928	60.4	42.3	18.1
	1929	38.6	21.5	17.1
	1930	37.8	19.3	18.5
	1931	38.6	17.2	21.4
	1932	34.7	17.4	17.3
	1933	53.4	28.5	24.9
	1934	40.3	19.4	20.9
Delaware River at Riegelsville, Pa.	1921	42.1	25.0	17.1
	1922	44.1	25.0	19.1
	1923	36.7	16.8	19.9
	1924	45.4	24.2	21.2
	1925	38.4	20.4	18.0
	1926	41.1	21.3	19.8
	1927	45.3	27.6	17.7
	1928	60.1	41.6	18.5
	1929	38.5	20.6	17.9
	1930	37.9	19.5	18.4
	1931	37.9	16.5	21.4
	1932	34.0	16.4	17.6
	1933	55.8	30.0	25.8
	1934	41.0	19.9	21.1
Delaware River at Trenton, N. J.	1924	46.1	22.8	23.3
	1925	38.0	20.1	17.9
	1926	41.2	20.9	20.3
	1927	45.0	27.0	18.0
	1928	60.0	39.8	20.2
	1929	38.2	20.8	17.4
	1930	37.6	19.6	18.0
	1931	37.9	16.2	21.7
	1932	33.8	16.2	17.6
	1933	56.4	30.1	26.3
	1934	41.2	20.4	20.8
Lackawaxen River at West Hawley, Pa.	1925	37.7	18.1	19.6
	1926	41.3	24.2	17.1
	1927	44.9	28.4	16.5
	1928	62.0	40.1	21.9
	1929	35.2	19.0	16.2
	1930	39.5	15.5	24.0
	1931	39.5	16.0	23.5
	1932	38.0	17.1	20.9
	1933	54.3	25.6	28.7
	1934	43.5	20.2	23.3
Wallenpaupack Creek at Wilsonville, Pa.	1921	38.9	26.2	12.7
	1922	42.7	23.7	19.0
	1926	40.8	19.2	21.6
	1927	46.5	27.0	19.5

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

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TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Delaware River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Wallenpaupack Creek at Wilsonville, Pa.	1928	59.7	38.9	20.8
	1929	31.5	15.3	16.2
	1930	39.6	17.8	21.8
	1931	35.1	12.8	22.3
	1932	35.5	12.5	23.0
	1933	55.1	26.4	28.7
	1934	37.6	14.0	23.6
Bushkill Creek at Shoemakers, Pa.	1921	45.3	29.0	16.3
	1922	47.0	27.6	19.4
	1923	40.0	17.3	22.7
	1924	48.5	25.0	23.5
	1925	35.4	24.0	11.4
	1926	40.5	24.0	16.5
	1927	48.8	34.2	14.6
	1928	65.0	47.5	17.5
	1929	36.3	24.0	12.3
	1930	41.2	24.7	16.5
	1931	37.0	17.0	20.0
	1932	32.9	16.2	16.7
	1933	58.9	34.6	24.3
	1934	41.6	20.9	20.7
McMichaels Creek at Stroudsburg, Pa.	1921	48.2	28.3	19.9
	1922	43.5	24.3	19.2
	1923	38.3	16.5	21.8
	1924	51.2	20.9	20.3
	1925	43.0	22.5	20.5
	1926	47.6	19.7	27.9
	1927	47.9	23.1	24.8
	1928	66.0	39.8	26.2
	1929	38.5	16.8	21.7
	1930	37.2	20.4	16.8
	1931	38.7	13.4	25.3
	1932	30.5	14.6	15.9
	1933	64.5	38.5	26.0
	1934	44.0	19.4	24.6
Lehigh River at Tannery, Pa.	1921	45.3	31.5	13.8
	1922	45.1	33.3	11.8
	1923	41.7	22.4	19.3
	1924	47.3	32.7	14.6
	1925	38.2	24.4	13.8
	1926	44.8	26.5	18.3
	1928	60.0	42.9	17.1
	1929	35.3	21.3	14.0
	1930	42.6	23.2	19.4
	1931	37.2	15.6	21.6
	1932	32.8	16.8	16.0
	1933	55.8	34.9	20.9
	1934	41.1	21.5	19.6
Lehigh River at Bethlehem, Pa.	1929	37.7	20.1	17.6
	1930	38.5	21.4	17.1
	1931	35.6	13.4	22.2
	1932	32.1	13.7	18.4
	1933	61.9	34.5	27.4
	1934	42.1	19.6	22.5
Neshaminy Creek at Rushland, Pa.	1932	32.2	8.0	24.2
	1933	62.8	29.6	33.2
	1934	45.6	16.9	28.7
Schuylkill River at Pottstown, Pa.	1929	38.3	17.0	21.3
	1930	34.7	16.9	17.8
	1931	36.1	10.7	25.4
	1932	35.6	12.9	22.7
	1933	61.2	33.0	28.2
	1934	40.8	18.6	22.2
Little Schuylkill River at Tamaqua, Pa.	1921	48.8	34.4	14.4
	1922	49.2	36.2	13.0
	1923	32.7	17.4	15.3
	1924	53.6	40.5	13.1
	1925	39.3	32.4	6.9
	1926	42.6	26.7	15.9
	1927	46.2	34.2	12.0
	1928	65.1	44.0	21.0
	1929	44.5	18.5	26.0
	1930	37.6	22.0	15.6
	1931	37.6	13.3	24.3
	1932	33.8	14.5	19.3
	1933	70.3	41.9	28.4
	1934	41.6	19.0	22.6

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Delaware River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Perkiomen Creek at Graters Ford, Pa.	1927	41.1	19.1	22.0
	1928	59.2	33.8	25.4
	1929	37.4	17.5	19.9
	1930	34.9	14.7	20.2
	1931	40.1	9.1	31.0
	1932	34.8	11.1	23.7
	1933	62.8	28.7	34.1
	1934	41.9	17.3	24.6
Crum Creek at Woodlyn, Pa.	1932	35.0	7.6	27.4
	1933	63.6	24.0	39.6
	1934	40.6	17.5	23.1
Ridley Creek at Moylan, Pa.	1932	34.7	9.9	24.8
	1933	66.6	23.7	42.9
	1934	43.8	17.4	26.4
Chester Creek near Chester, Pa.	1932	35.5	8.6	26.9
	1933	65.7	22.1	43.6
	1934	43.8	15.7	28.1
Brandywine Creek at Chadds Ford, Pa.	1921	35.0	13.5	21.5
	1922	39.1	14.1	25.0
	1923	36.7	11.3	25.4
	1924	55.4	24.7	30.7
	1925	32.6	14.7	17.9
	1926	42.9	13.3	29.6
	1927	41.4	19.1	22.3
	1928	61.4	30.1	31.3
	1929	41.0	18.3	22.7
	1930	37.7	14.0	23.7
	1931	38.2	11.0	27.2
	1932	33.9	10.5	23.4
	1933	65.7	25.6	40.1
	1934	44.1	17.7	26.4

Susquehanna River Basin [4]

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Susquehanna River at Towanda, Pa.	1921	33.5	15.7	17.8
	1922	42.1	21.9	20.2
	1923	30.1	12.1	18.0
	1924	39.1	16.9	22.2
	1925	32.0	16.0	16.0
	1926	34.2	18.9	15.3
	1927	35.5	21.9	13.6
	1928	45.8	28.1	17.7
	1929	35.9	19.0	16.9
	1930	35.3	15.0	20.3
	1931	32.5	11.2	21.3
	1932	32.5	16.0	16.5
	1933	41.7	16.9	24.8
	1934	32.9	12.8	20.1
Susquehanna River at Wilkes-Barre, Pa.	1921	34.1	15.8	18.3
	1922	41.9	20.8	21.1
	1923	30.6	11.6	19.0
	1924	39.4	16.4	23.0
	1925	32.0	15.0	17.0
	1926	34.6	17.8	16.8
	1927	36.1	21.8	14.3
	1928	47.8	28.8	19.0
	1929	35.0	17.9	17.1
	1930	35.9	15.8	20.1
	1931	32.8	11.6	21.2
	1932	32.2	15.9	16.3
	1933	43.0	18.1	24.9
	1934	33.4	14.0	19.4
Susquehanna River at Danville, Pa.	1921	35.2	16.7	18.5
	1922	42.3	21.5	20.8
	1923	31.6	12.0	19.6
	1924	40.5	17.1	23.4
	1925	32.3	15.3	17.0
	1926	35.5	17.8	17.7
	1927	37.0	22.2	14.8
	1928	48.5	28.7	19.8
	1929	35.1	17.7	17.4
	1930	36.1	15.7	20.4
	1931	32.7	11.6	21.1
	1933	44.4	19.0	25.4
	1934	34.2	13.8	20.4

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Susquehanna River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Susquehanna River at Harrisburg, Pa	1921	37.8	17.2	20.6
	1922	40.2	20.2	20.0
	1923	33.7	12.1	21.6
	1924	44.8	21.1	23.7
	1925	31.3	13.7	17.6
	1926	37.6	16.2	21.4
	1927	39.9	23.7	16.2
	1928	51.3	28.5	22.8
	1929	35.4	17.9	17.5
	1930	35.5	16.7	18.8
	1931	34.3	11.4	22.9
	1932	32.2	13.9	18.3
	1933	47.7	20.7	27.0
	1934	34.9	12.7	22.2
Susquehanna River at Marietta, Pa	1932	32.2	13.4	18.8
	1933	48.8	20.9	27.9
	1934	35.5	12.8	22.7
Towanda Creek near Monroeton, Pa	1921	25.6	16.2	9.4
	1922	39.4	19.6	19.8
	1923	29.2	8.2	21.0
	1924	43.3	19.8	23.5
	1925	32.7	12.5	20.2
	1926	36.4	13.7	22.7
	1927	37.2	27.6	9.6
	1928	50.0	31.7	18.3
	1929	32.7	15.0	17.7
	1930	37.8	13.1	24.7
	1931	34.1	11.4	22.7
	1932	29.6	10.0	19.6
	1933	48.3	23.6	24.7
	1934	33.0	12.4	20.6
Tunkhannock Creek at Dixon, Pa	1921	37.0	19.7	17.3
	1922	44.7	21.5	23.2
	1923	34.5	11.1	23.4
	1924	39.8	18.2	21.6
	1925	35.2	15.6	19.6
	1926	39.0	19.5	19.5
	1927	42.1	26.0	16.1
	1928	59.9	30.6	29.3
	1929	35.0	15.2	19.8
	1930	39.8	13.8	26.0
	1931	36.7	12.9	23.8
	1932	35.2	15.5	19.7
	1933	49.9	23.7	26.2
	1934	37.6	14.1	23.5
Lackawanna River at Moosic, Pa	1921	36.8	24.4	12.4
	1922	42.4	28.7	13.7
	1923	37.6	17.1	20.5
	1924	40.5	24.8	15.7
	1925	32.9	21.4	11.5
	1926	39.0	23.8	15.2
	1927	41.9	32.4	9.5
	1928	56.4	47.1	9.3
Wapwallopen Creek near Wapwallopen, Pa	1921	44.8	17.9	26.9
	1922	46.8	21.8	25.0
	1923	41.0	15.1	25.9
	1924	49.3	20.5	28.8
	1925	36.9	13.8	23.1
	1926	44.7	17.5	27.2
	1927	46.9	22.0	24.9
	1928	60.9	31.4	29.5
	1929	39.9	14.0	25.9
	1930	42.1	15.0	27.1
	1931	37.0	9.8	27.2
	1932	32.1	10.9	21.2
	1933	58.3	24.2	34.1
	1934	44.3	15.6	28.7
Nescopeck Creek near St. Johns, Pa	1921	47.1	28.0	19.1
	1922	47.8	31.9	15.9
	1923	40.8	18.3	22.5
	1924	48.4	27.2	21.2
	1925	40.0	18.0	22.0
	1926	48.2	26.1	22.1
Fishing Creek at Bloomsburg, Pa	1921	42.6	23.6	19.0
	1922	43.9	29.0	14.9
	1923	38.5	18.6	19.9
	1924	50.9	29.2	21.7
	1925	34.3	22.2	12.1

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Susquehanna River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Fishing Creek at Bloomsburg, Pa	1926	43.6	29.5	14.1
	1927	42.7	30.5	12.2
	1928	50.8	36.1	14.7
West Branch of Susquehanna River at Bower, Pa	1921	42.8	22.1	20.7
	1922	39.7	24.7	15.0
	1923	39.2	19.5	19.7
	1924	50.8	34.0	16.8
	1925	31.1	14.4	16.7
	1926	46.0	24.7	21.3
	1927	43.2	33.7	9.5
	1928	53.6	40.9	12.7
	1929	38.9	22.4	16.5
	1930	33.9	20.0	13.9
	1931	36.3	12.7	23.6
	1932	33.8	18.1	15.7
	1933	46.8	20.5	26.3
	1934	42.8	14.7	28.1
West Branch of Susquehanna River at Renovo, Pa	1921	43.6	20.4	23.2
	1922	37.9	21.6	16.3
	1923	35.5	16.7	18.8
	1924	47.8	28.5	19.3
	1925	30.2	14.3	15.9
	1926	41.8	19.8	22.0
	1927	42.4	29.5	12.9
	1928	53.0	34.5	18.5
	1929	42.3	21.8	20.5
	1930	36.6	19.3	17.3
	1931	38.7	13.3	25.4
	1932	30.6	17.2	13.4
	1933	45.8	19.8	26.0
	1934	36.0	11.8	24.2
West Branch of Susquehanna River at Williamsport, Pa.	1921	40.6	20.0	20.6
	1922	37.5	21.9	15.6
	1923	33.1	15.3	17.8
	1924	45.8	26.0	19.8
	1925	30.0	13.8	16.2
	1926	39.4	19.2	20.2
	1927	39.7	28.6	11.1
	1928	51.4	33.7	17.7
	1929	37.8	20.6	17.2
	1930	34.5	19.1	15.4
	1931	37.0	13.1	23.9
	1932	30.6	15.9	14.7
	1933	45.7	21.4	24.3
	1934	34.9	12.8	22.1
Clearfield Creek at Dimeling, Pa	1921	46.5	20.3	26.2
	1922	38.1	21.9	16.2
	1923	38.3	16.0	22.3
	1924	53.7	30.2	23.5
	1925	30.7	13.5	17.2
	1926	43.6	20.4	23.2
	1927	44.6	30.0	14.6
	1928	53.3	33.8	19.5
	1929	40.4	18.1	22.3
	1930	37.7	18.6	19.1
	1931	37.8	11.4	26.4
	1932	35.7	15.8	19.9
	1933	50.5	20.1	30.4
	1934	36.6	12.6	24.0
Driftwood Branch of Sinnemahoning Creek at Sterling Run, Pa.	1921	40.4	17.4	23.0
	1922	38.8	26.1	12.7
	1923	36.1	19.9	16.2
	1924	44.4	26.5	17.9
	1925	32.0	17.1	14.9
	1926	41.7	22.0	19.7
	1927	44.6	31.9	12.7
	1928	55.5	32.0	23.5
	1929	48.4	27.9	20.5
	1930	39.8	20.6	19.2
	1931	41.6	15.3	26.3
	1932	41.7	22.4	19.3
	1933	45.7	19.5	26.2
	1934	36.9	11.4	25.5
North Bald Eagle Creek at Milesburg, Pa	1921	42.1	18.8	23.3
	1922	36.8	20.2	16.6
	1923	35.0	16.3	18.7
	1924	47.3	29.8	17.5
	1925	28.9	9.1	19.8
	1926	40.0	17.5	22.5

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Susquehanna River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
North Bald Eagle Creek at Milesburg, Pa	1927	43.1	28.2	14.9
	1928	50.2	34.4	15.8
	1934	34.8	12.7	22.1
North Bald Eagle Creek at Beech Creek Station, Pa	1921	40.9	20.3	20.6
	1922	36.7	19.8	16.9
	1923	33.9	13.8	20.1
	1924	46.9	23.9	23.0
	1925	28.9	11.8	17.1
	1926	39.9	15.8	24.1
	1927	41.5	25.3	16.2
	1928	48.5	29.8	18.7
	1929	31.3	17.0	14.3
	1930	28.5	15.8	12.7
	1931	38.8	12.3	26.5
	1932	31.9	12.3	19.6
	1933	47.7	18.9	28.8
	1934	35.0	12.2	22.8
Pine Creek at Cedar Run, Pa	1921	32.7	13.8	18.9
	1922	34.2	18.6	15.6
	1923	26.5	10.9	15.6
	1924	38.2	17.4	20.8
	1925	27.5	11.5	16.0
	1926	33.1	15.3	17.8
	1927	31.7	21.6	10.1
	1928	46.2	28.4	17.8
	1929	35.3	21.1	14.2
	1930	28.3	18.1	10.2
	1931	31.7	12.7	19.0
	1932	27.5	14.8	12.7
	1933	38.9	18.3	20.6
	1934	32.9	11.5	21.4
Lycoming Creek near Trout Run, Pa	1921	38.0	15.1	22.9
	1922	39.1	22.7	16.4
	1923	29.2	12.5	16.7
	1924	44.4	22.4	22.0
	1925	35.6	12.1	23.5
	1926	37.2	16.2	21.0
	1927	38.6	29.1	9.5
	1928	54.1	33.3	20.8
	1929	35.8	18.4	17.4
	1930	31.3	16.4	14.9
	1931	34.8	14.7	20.1
	1932	29.6	14.1	15.5
	1933	49.3	24.2	25.1
	1934	34.1	14.2	19.9
Loyalsock Creek at Loyalsock, Pa	1926	41.6	19.6	22.0
	1927	41.5	28.6	12.9
	1928	54.0	33.4	20.6
	1929	35.2	17.6	17.6
	1930	30.4	19.3	11.1
	1931	31.7	14.9	16.8
	1932	31.5	14.7	16.8
	1933	51.6	27.9	23.7
	1934	36.8	16.3	20.5
Penn Creek at Penns Creek, Pa	1930	38.5	17.0	21.5
	1931	43.9	12.8	31.1
	1933	48.6	24.1	24.5
	1934	36.7	15.1	21.6
Mahantango Creek East near Dalmatia, Pa	1930	38.8	19.7	19.1
	1931	31.5	5.9	25.6
	1932	32.7	10.9	21.8
	1933	60.7	26.0	34.7
	1934	39.7	11.8	27.9
Frankstown Branch of Juniata River at Williamsburg, Pa.	1921	41.3	17.7	23.6
	1922	37.3	17.3	20.0
	1923	41.0	12.0	29.0
	1924	52.9	26.3	26.6
	1925	29.6	11.2	18.4
	1926	41.5	15.3	26.2
	1927	46.0	24.3	21.7
	1928	48.3	27.0	21.3
	1929	34.6	15.8	18.8
	1930	34.8	16.9	17.9
	1931	37.8	10.7	27.1
	1932	32.8	13.5	19.3
	1933	50.4	19.7	30.7
	1934	35.0	10.4	24.6

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Susquehanna River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Juniata River at Newport, Pa	1921	40.0	16.9	23.1
	1922	36.4	16.7	19.7
	1923	38.5	11.7	26.8
	1924	49.9	25.5	24.4
	1925	30.2	10.6	19.6
	1926	38.5	13.1	25.4
	1927	44.0	23.2	20.8
	1928	48.1	27.1	21.0
	1929	32.7	13.8	18.9
	1930	33.2	14.3	18.9
	1931	37.0	10.4	26.6
	1932	31.1	11.2	19.9
	1933	51.2	21.9	29.3
	1934	34.2	9.8	24.4
Shaver Creek near Petersburg, Pa	1931	32.9	9.5	23.4
	1932	28.6	12.2	16.4
	1933	50.7	21.0	29.7
	1934	35.4	9.8	25.6
Standing Stone Creek near Huntingdon, Pa	1931	38.5	11.2	27.3
	1932	31.3	10.3	21.0
	1933	50.9	21.2	29.7
	1934	35.9	9.5	26.4
Raystown Branch of Juniata River at Saxton, Pa	1921	38.7	15.0	23.7
	1922	36.0	16.2	19.8
	1923	42.4	10.6	31.8
	1924	49.4	26.0	23.4
	1925	36.0	9.6	26.4
	1926	39.0	13.0	26.0
	1927	41.1	22.2	18.9
	1928	44.2	23.5	20.7
	1929	31.8	14.2	17.6
	1930	30.1	12.0	18.1
	1931	38.0	9.9	28.1
	1932	30.3	11.2	19.1
	1933	47.0	18.1	28.9
	1934	32.8	8.4	24.4
Dunning Creek at Yount, Pa	1931	38.6	10.4	28.2
	1932	30.8	12.9	17.9
	1933	47.8	19.8	28.0
	1934	34.7	10.2	24.5
Brush Creek at Gapsville, Pa	1932	30.2	10.4	19.8
	1933	46.7	23.8	22.9
	1934	32.2	11.8	20.4
Great Trough Creek near Marklesburg, Pa	1931	38.0	10.4	27.6
	1932	30.7	11.6	19.1
	1933	51.1	21.2	29.9
	1934	32.5	7.5	25.0
Aughwick Creek near Orbisonia, Pa	1932	30.6	12.0	18.6
	1933	50.8	24.6	26.2
	1934	37.1	10.8	26.3
Tuscarora Creek near Port Royal, Pa	1921	40.7	16.4	24.3
	1922	37.4	16.8	20.6
	1923	38.3	11.9	26.4
	1924	52.0	25.7	26.3
	1925	27.0	9.0	18.0
	1926	37.1	12.1	25.0
	1927	47.0	24.2	22.8
	1928	53.1	29.8	23.3
	1929	32.9	13.7	19.2
	1930	33.4	14.8	18.6
	1931	34.1	9.1	25.0
	1932	31.1	9.9	21.2
	1933	57.2	25.3	31.9
	1934	33.5	9.4	24.1
Cocolamus Creek near Millerstown, Pa	1931	30.8	8.3	22.5
	1932	32.7	10.0	22.7
	1933	64.4	28.4	36.0
	1934	35.6	12.9	22.7
Sherman Creek at Shermandale, Pa	1930	31.7	14.0	17.7
	1931	32.6	8.3	24.3
	1932	33.2	9.7	23.5
	1933	73.4	30.7	42.7
	1934	37.7	12.9	24.8
Conodoguinet Creek near Hogestown, Pa	1930	31.0	11.0	20.0
	1931	33.7	6.8	26.9
	1932	32.0	9.2	22.8
	1933	64.5	25.5	39.0
	1934	39.8	11.8	28.0

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Susquehanna River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Swatara Creek at Harper Tavern, Pa	1921	40.2	21.1	19.1
	1922	43.2	21.9	21.3
	1923	33.7	13.4	20.3
	1924	54.7	30.7	24.0
	1925	35.7	20.4	15.3
	1926	45.8	25.5	20.3
	1927	43.5	25.7	17.8
	1928	54.4	31.4	23.0
	1929	41.2	16.9	24.3
	1930	34.8	19.3	15.5
	1931	30.8	8.2	22.6
	1932	34.0	11.8	22.2
	1933	65.3	33.9	31.4
	1934	40.0	15.9	24.1
Upper Little Swatara Creek at Pine Grove, Pa	1921	43.1	24.2	18.9
	1922	44.5	23.1	21.4
	1923	35.0	15.0	20.0
	1924	56.6	31.8	24.8
	1925	36.2	20.0	16.2
	1926	47.0	25.6	21.4
	1927	42.4	26.5	15.9
	1928	56.7	32.4	24.3
	1929	42.0	17.5	24.5
	1930	35.8	17.2	18.6
	1931	29.8	9.5	20.3
	1932	34.3	12.6	21.7
West Conewago Creek near Manchester, Pa	1930	32.1	11.6	20.5
	1931	30.3	4.1	26.2
	1932	31.7	7.0	24.7
	1933	61.3	26.3	35.0
	1934	43.6	13.8	29.8
Codorus Creek at Spring Grove, Pa	1930	33.3	12.3	21.0
	1931	32.4	7.1	25.3
	1933	58.5	22.4	36.1
	1934	44.0	15.8	28.2
South Branch of Codorus Creek near York, Pa	1928	56.3	24.0	32.3
	1929	37.5	14.9	22.6
	1933	62.5	26.2	36.3
	1934	43.7	14.8	28.9
Conestoga Creek at Lancaster, Pa	1929	34.0	13.7	20.3
	1930	31.5	11.8	19.7
	1931	36.0	7.0	29.0
	1934	45.3	17.1	28.2
Muddy Creek at Castle Fin, Pa	1930	31.3	13.6	17.7
	1931	36.5	7.3	29.2
	1934	32.3	8.6	23.7
	1933	57.6	23.1	34.5
	1934	40.7	15.9	24.8

Savannah River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Broad River near Carlton, Ga	1903	60.2	32.3	27.9
	1904	34.7	14.0	20.7
	1905	43.2	14.5	28.7
	1906	69.2	30.2	39.0
	1907	44.0	18.1	25.9
	1908	59.8	30.8	29.0
	1909	58.7	32.6	26.1
	1910	47.8	20.8	27.0
	1911	37.6	14.8	22.8
	1912	69.7	30.5	39.2

Altamaha River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Ocmulgee River near Jackson, Ga	1907	45.3	16.7	28.6
	1908	49.8	23.8	26.0
	1909	56.3	22.9	33.4
	1910	43.5	16.5	27.0
	1911	34.7	8.6	26.1
	1912	71.1	29.1	42.0
	1913	48.1	18.5	29.6
	1914	33.8	8.9	24.9
	1915	54.5	19.4	35.1

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Altamaha River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run off (inches)	Annual water loss (inches)
Oconee River near Greensboro, Ga	1904	31.5	10.8	20.7
	1905	39.7	11.2	28.5
	1906	64.6	24.4	40.2
	1907	43.3	16.0	27.3
	1908	58.8	26.5	32.3
	1909	54.4	23.3	31.1
	1910	46.6	18.3	28.3
	1911	37.0	11.7	25.3
	1912	68.3	28.6	39.7
	1913	48.3	19.4	28.9
	1915	54.0	20.0	34.0
	1916	50.7	18.2	32.5
	1917	51.1	18.2	32.9
	1918	40.4	12.2	28.2
	1919	60.7	25.6	35.1
	1920	63.0	34.7	28.3
	1921	39.6	17.6	22.0
	1922	57.1	24.8	32.3
	1923	54.1	28.2	25.9
Suwannee River Basin				
Suwannee River at Fargo, Ga	1928	69.0	17.6	51.4
	1929	62.4	31.5	30.9
	1930	56.8	31.5	25.3
	1931	31.2	11.2	20.0
Apalachicola River Basin				
Chattahoochee River near Norcross, Ga	1905	49.3	20.1	29.2
	1906	71.8	35.5	36.3
	1907	44.9	28.7	16.2
	1908	56.4	31.4	25.0
	1909	65.7	34.8	30.9
	1910	50.8	24.2	26.6
	1911	43.4	18.0	25.4
	1912	76.7	35.5	41.2
	1913	54.2	25.1	29.1
	1914	37.0	13.0	24.0
	1915	64.6	26.6	38.0
	1916	64.4	32.5	31.9
	1917	62.0	30.6	31.4
	1918	45.1	18.8	26.3
	1919	63.3	34.4	28.9
	1920	79.8	40.9	38.9
	1921	52.8	27.7	25.1
	1922	64.6	31.9	32.7
	1923	59.5	27.0	32.5
Flint River near Woodbury, Ga	1903	56.7	27.0	29.7
	1904	30.1	12.4	17.7
	1905	36.2	10.3	25.9
	1906	53.6	22.4	31.2
	1907	43.2	17.4	25.8
	1908	52.5	24.2	28.3
	1909	55.8	25.8	30.0
	1910	41.7	14.9	26.8
	1911	35.4	8.7	26.7
	1912	64.3	26.0	38.3
	1913	48.8	18.4	30.4
	1914	35.2	8.2	27.0
	1915	51.5	15.9	35.6
	1917	56.5	21.6	34.9
	1918	35.4	13.1	22.3
	1919	56.7	33.9	22.8
	1920	69.4	22.8	46.6
Flint River between Culloden and Woodbury, Ga	1914	35.3	7.5	27.8
	1915	49.5	15.5	34.0
	1917	47.2	14.0	33.2
	1918	32.3	7.3	25.0
	1919	65.2	22.2	43.0
	1920	63.3	29.5	33.8

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TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Choctawhatchee River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Choctawhatchee River near Newton, Ala	1923	64.5	21.1	43.4
	1924	53.5	17.9	35.6
	1926	71.8	21.5	50.3
	1927	38.6	12.2	26.4

Escambia River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Conecuh River near Andalusia, Ala	1905	45.8	11.6	34.2
	1906	54.4	16.5	37.9
	1907	46.7	19.6	27.1
	1908	65.4	33.2	32.2
	1909	56.9	20.2	36.7
	1910	42.5	12.2	30.3
	1911	44.5	9.2	35.3
	1912	70.8	28.0	42.8
	1913	60.3	29.0	31.3
	1914	37.9	9.5	28.4
	1915	52.1	17.6	34.5
	1916	51.5	20.7	30.8
	1917	57.5	19.7	37.8
	1918	36.2	14.3	21.9
	1919	70.0	31.2	38.8
	1930	54.1	22.7	31.4
	1931	53.4	17.6	35.8
	1932	53.5	13.2	40.3
	1933	58.8	22.9	35.9

Mobile River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Alabama River near Montgomery, Ala., minus Coosa River near Wetumpka and Tallapoosa River below Tallassee.	1929	61.3	28.6	32.7
	1930	51.3	29.0	22.3
	1931	38.1	14.2	23.9
	1932	43.8	16.2	27.6
	1933	53.5	17.4	36.1
Etowah River near Ball Ground, Ga	1908	54.8	37.2	17.6
	1909	67.3	38.4	28.9
	1910	48.8	23.7	25.1
	1911	44.5	18.9	25.6
	1912	77.8	42.8	35.0
	1913	53.1	30.8	22.3
	1914	37.0	15.6	21.4
	1915	60.6	29.1	31.5
Tallapoosa River at Wadley, Ala	1924	51.3	15.3	36.0
	1925	36.3	14.6	21.7
	1926	59.1	18.3	40.8
	1927	44.1	15.3	28.8
	1928	62.8	19.8	43.0
	1929	57.8	27.6	30.2
	1930	51.0	21.8	29.2
	1931	36.1	12.1	24.0
	1932	61.7	24.1	37.6
	1933	65.4	32.8	32.6
East Fork of Tombigbee River near Fulton, Miss	1929	56.2	15.3	40.9
	1930	45.0	14.6	30.4
	1931	43.2	10.1	33.1
	1932	80.5	25.7	54.8
	1933	68.1	29.3	38.8
Mulberry Fork of Black Warrior River near Garden City, Ala.	1929	62.5	28.0	34.5
	1930	64.9	29.5	35.4
	1931	40.6	11.5	29.1
	1933	59.0	33.0	26.0
Sipsey Fork of Mulberry Fork of Black Warrior River near Sipsey, Ala.	1929	60.7	26.7	34.0
	1930	59.7	25.6	34.1
	1931	40.7	12.6	28.1
	1933	58.1	30.8	27.3

Pearl River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Pearl River at Edinburg, Miss	1929	43.5	12.2	31.3
	1930	51.2	15.9	35.3
	1931	45.3	9.1	36.2
	1932	67.2	16.8	50.4
	1933	70.1	29.2	40.9
Strong River at Dlo, Miss	1929	53.4	17.0	36.4
	1931	47.6	19.4	28.2
	1932	55.3	22.6	32.7
	1933	66.4	35.9	30.5

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
ALLEGHENY RIVER BASIN [4]				
Allegheny River at Larabee, Pa	1926	41.1	18.2	22.9
	1927	39.5	25.1	14.4
	1928	50.9	27.3	23.6
	1929	44.2	22.9	21.3
	1930	36.6	22.3	14.3
	1931	38.7	14.4	24.3
	1932	35.6	19.2	16.4
	1933	40.8	19.3	21.5
	1934	33.5	13.3	20.2
Allegheny River at Franklin, Pa	1921	40.7	19.7	21.0
	1922	40.1	22.5	17.6
	1923	33.5	16.9	16.6
	1924	45.4	22.4	23.0
	1925	33.5	17.7	15.8
	1926	42.0	24.8	17.2
	1927	42.6	29.8	12.8
	1928	48.0	30.8	17.2
	1929	46.3	28.5	17.8
	1930	37.3	23.1	14.2
	1931	35.5	14.6	20.9
	1932	38.0	20.9	17.1
	1933	41.3	17.9	23.4
	1934	32.9	15.5	17.4
Allegheny River at Kittanning, Pa	1921	40.8	19.6	21.2
	1923	34.1	17.5	16.6
	1924	45.6	24.4	21.2
	1925	32.2	16.9	15.3
	1926	42.3	24.5	17.8
	1927	42.9	31.9	11.0
	1928	47.3	33.9	13.4
Brokenstraw Creek at Youngsville, Pa	1921	44.0	23.2	20.8
	1922	39.7	24.2	15.5
	1923	35.7	20.3	15.4
	1924	47.8	26.5	21.3
	1925	36.5	19.5	17.0
	1926	44.8	27.4	17.4
	1927	49.0	33.8	15.2
	1928	51.1	35.1	16.0
	1929	46.6	27.4	19.2
	1930	38.2	23.4	14.8
	1931	35.0	14.4	20.6
	1932	39.2	21.4	17.8
	1933	43.3	16.8	26.5
	1934	35.9	15.3	20.6
Tionesta Creek at Nebraska, Pa	1926	42.6	24.4	18.2
	1927	42.1	33.9	8.2
	1928	49.4	34.6	14.8
	1929	48.9	30.9	18.0
	1930	37.5	25.1	12.4
	1931	40.8	13.8	27.0
	1932	40.1	22.0	18.1
	1934	32.8	14.8	18.0
Oil Creek near Rouseville, Pa	1921	43.9	20.1	23.8
	1922	39.2	20.4	18.8
	1923	36.5	16.6	19.9
	1924	48.0	20.8	27.2
	1925	35.9	15.1	20.8
	1926	45.2	21.9	23.3
	1927	48.0	31.2	16.8
	1928	50.4	25.8	24.6
	1929	47.7	26.0	21.7
	1930	37.3	19.9	17.4
French Creek at Carters Corners (Kimmeytown), Pa	1921	42.4	25.8	16.6
	1922	37.4	22.8	14.6
	1923	32.6	17.5	15.1
	1924	43.6	23.9	19.7
	1925	32.1	17.6	14.5
	1926	41.1	27.3	13.8
	1927	46.0	33.9	12.1
	1928	47.6	34.5	13.1
French Creek at Saegerstown, Pa	1922	38.0	22.6	15.4
	1923	34.1	17.5	16.6
	1924	46.0	23.7	22.3
	1925	32.5	19.0	13.5

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
ALLEGHENY RIVER BASIN—Continued				
French Creek at Saegerstown, Pa	1926	43.1	27.3	15.8
	1927	45.2	34.0	11.2
	1928	47.3	33.0	14.3
	1929	42.0	32.6	9.4
	1930	36.6	26.9	9.7
	1931	32.9	16.7	16.2
	1932	36.4	22.9	13.5
	1933	38.3	17.7	20.6
	1934	32.0	17.3	14.7
Cussewago Creek near Meadville, Pa	1921	45.6	20.6	25.0
	1922	42.8	18.8	24.0
	1923	32.8	14.8	18.0
	1924	46.5	21.0	25.5
	1925	30.3	16.0	14.3
	1926	43.1	26.2	16.9
	1927	42.4	28.3	14.1
	1928	43.7	25.5	18.2
	1929	44.1	22.3	21.8
	1930	38.8	20.3	18.5
	1931	35.5	15.4	20.1
	1932	35.4	19.7	15.7
	1933	34.2	14.4	19.8
	1934	28.6	14.9	13.7
Clarion River near Piney, Pa	1925	30.6	15.6	15.0
	1926	40.6	20.6	20.0
	1927	39.4	27.6	11.8
	1928	50.9	28.2	22.7
	1929	46.1	27.5	18.6
	1930	37.7	22.8	14.9
	1931	37.1	12.9	24.2
	1932	35.4	20.6	14.8
	1933	38.6	20.1	18.5
	1934	32.8	13.2	19.6
Red Bank Creek at St. Charles, Pa	1921	41.1	19.0	22.1
	1922	36.6	21.7	14.9
	1923	35.4	17.1	18.3
	1924	45.3	25.4	19.9
	1925	27.6	13.0	14.6
	1926	41.7	19.6	22.1
	1927	43.1	29.0	14.1
	1928	51.6	32.2	19.4
	1929	44.4	25.6	18.8
	1930	37.9	19.9	18.0
	1931	35.5	11.6	23.9
	1932	36.1	17.8	18.3
	1933	41.0	19.6	21.4
	1934	36.2	11.0	25.2
Mahoning Creek near Dayton, Pa	1921	40.9	19.8	21.1
	1922	37.9	21.2	16.7
	1923	36.1	16.4	19.7
	1924	49.1	31.6	17.5
	1925	28.6	16.6	12.0
	1926	46.3	27.8	18.5
	1927	43.9	37.0	6.9
	1928	52.5	32.9	19.6
	1929	41.4	26.4	15.0
	1930	33.3	23.5	9.8
	1931	37.3	13.6	23.7
	1932	35.9	18.8	17.1
	1933	44.6	24.7	19.9
	1934	41.8	12.9	28.9
Crooked Creek near Ford City, Pa	1921	42.3	20.6	21.7
	1922	39.1	22.4	16.7
	1923	42.6	16.8	25.8
	1924	57.4	33.0	24.4
	1925	30.5	13.6	16.9
	1926	49.3	24.1	25.2
	1927	48.5	30.2	18.3
	1928	56.2	34.6	21.6
	1929	40.0	16.0	24.0
	1930	34.8	16.0	18.8
	1931	34.0	8.6	25.4
	1932	34.9	12.3	22.6
	1933	47.8	20.4	27.4
	1934	42.8	14.2	28.6

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
ALLEGHENY RIVER BASIN—Continued				
Kiskiminetas River at Avonmore, Pa	1921	44.7	20.8	23.9
	1922	41.1	23.4	17.7
	1923	43.9	19.4	24.5
	1924	55.7	32.2	23.5
	1925	34.9	15.0	19.9
	1926	44.2	22.4	21.8
	1927	50.4	30.5	19.9
	1928	53.4	35.4	18.0
	1929	41.6	21.0	20.6
	1930	37.9	18.8	19.1
	1931	38.8	14.1	24.7
	1932	34.7	17.9	16.8
	1933	49.6	23.3	26.3
	1934	42.8	17.8	25.0
Stony Creek at Johnstown, Pa	1921	45.5	21.7	23.8
	1922	38.9	25.4	13.5
	1923	44.1	16.7	27.4
	1924	56.5	34.8	21.7
	1925	36.4	16.2	20.2
	1926	40.3	20.8	19.5
	1927	49.4	34.0	15.4
	1928	48.6	35.5	13.1
	1929	40.8	21.1	19.7
	1930	35.2	17.6	17.6
	1931	40.5	15.3	25.2
	1932	33.1	18.1	15.0
	1933	49.0	23.6	25.4
	1934	41.6	15.2	26.4
Blacklick Creek at Blacklick, Pa	1921	43.5	20.5	23.0
	1922	42.9	21.3	21.6
	1923	42.5	16.3	26.2
	1924	55.4	29.0	26.4
	1925	33.5	13.2	20.3
	1926	48.1	20.9	27.2
	1927	47.8	29.5	18.3
	1928	56.5	35.4	21.1
	1929	42.5	18.6	23.9
	1930	39.9	19.0	20.9
	1931	37.4	12.6	24.8
	1932	34.8	16.8	18.0
	1933	47.6	22.3	25.3
	1934	43.6	18.3	25.3
Loyalhanna Creek at New Alexandria, Pa	1921	47.6	21.8	25.8
	1922	43.8	25.8	18.0
	1927	52.8	29.0	23.8
	1928	55.8	34.4	21.4
	1929	44.0	19.8	24.2
	1930	39.2	17.1	22.1
	1931	43.8	15.1	28.7
	1932	36.9	16.9	20.0
	1933	52.5	23.6	28.9
	1934	43.1	18.0	25.1
MONONGAHELA RIVER BASIN [4]				
Youghiogheny River at Friendsville, Md	1927	52.9	21.4	31.5
	1928	54.6	35.1	19.5
	1929	44.1	26.0	18.1
	1930	39.2	21.4	17.8
Youghiogheny River at Connellsville, Pa	1921	49.1	24.3	24.8
	1922	42.0	26.7	15.3
	1923	43.6	19.4	24.2
	1924	56.3	32.7	23.6
	1925	35.8	12.6	23.2
	1926	49.8	29.2	20.6
	1927	51.8	32.7	19.1
	1928	52.9	33.1	19.8
	1929	43.0	22.3	20.7
	1930	38.6	19.8	18.8
	1931	43.0	17.2	25.8
	1932	41.6	22.7	18.9
	1933	53.4	26.1	27.3
	1934	42.2	18.0	24.2

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
MONONGAHELA RIVER BASIN—Continued				
Youghiogheny River at Sutersville, Pa	1921	48.0	22.0	26.0
	1922	41.8	24.4	17.4
	1923	42.2	17.7	24.5
	1924	54.8	28.4	26.4
	1925	34.9	12.1	22.8
	1926	47.9	27.5	20.4
	1927	50.4	29.6	20.8
	1928	52.4	31.4	21.0
	1929	42.3	20.2	22.1
	1932	39.6	20.5	19.1
	1933	51.6	23.9	27.7
	1934	41.0	16.4	24.6
Casselman River at Markleton, Pa	1921	50.6	24.2	26.4
	1922	41.8	24.6	17.2
	1923	44.1	18.0	26.1
	1924	58.6	34.3	24.3
	1925	37.6	12.5	25.1
	1926	47.8	25.8	22.0
	1927	49.2	28.5	20.7
	1928	51.3	28.5	22.8
	1929	41.6	19.9	21.7
	1930	38.1	18.5	19.6
	1931	42.8	16.9	25.9
	1932	39.2	19.0	20.2
	1933	53.6	23.8	29.8
	1934	43.8	16.0	27.8
Laurel Hill Creek at Ursina, Pa	1921	52.7	29.2	23.5
	1922	43.0	31.5	11.5
	1923	44.0	26.4	17.6
	1924	59.0	43.2	15.8
	1925	39.1	22.5	16.6
	1926	46.5	35.5	11.0
	1927	51.0	41.0	10.0
	1928	53.2	42.1	11.1
	1929	43.8	29.1	14.7
	1930	38.1	25.1	13.0
	1931	42.7	18.5	24.2
	1932	38.9	26.3	12.6
	1933	52.2	31.0	21.2
	1934	41.3	25.1	16.2
Turtle Creek at Trafford, Pa	1921	40.6	20.2	20.4
	1922	40.6	23.3	17.3
	1923	38.7	14.3	24.4
	1924	45.4	27.6	17.8
	1925	27.6	9.7	17.9
	1926	35.8	18.2	17.6
	1927	40.2	22.5	17.7
	1928	47.2	36.4	10.8
	1929	33.9	20.4	13.5
	1930	28.1	18.7	9.4
	1931	34.5	11.2	23.3
	1932	29.1	13.1	16.0
	1933	41.1	21.2	19.9
	1934	35.3	14.4	20.9
CHARTIERS CREEK BASIN [4]				
Chartiers Creek at Carnegie, Pa	1921	40.5	15.0	25.5
	1922	37.4	18.5	18.9
	1923	35.9	11.9	24.0
	1924	46.5	25.6	20.9
	1925	29.5	11.1	18.4
	1926	40.4	18.4	22.0
	1927	43.5	23.2	20.3
	1928	48.2	27.6	20.6
	1929	34.6	15.0	19.6
	1930	34.5	12.4	22.1
	1933	44.0	16.2	27.8
BEAVER RIVER BASIN [4]				
Shenango River near Jamestown, Pa	1921	42.6	16.3	26.3
	1922	38.8	17.1	21.7
	1923	30.2	10.7	19.5
	1924	47.0	20.4	26.6
	1925	29.6	13.7	15.9
	1926	42.0	20.7	21.3
	1927	39.0	22.2	16.8

[4] Rainfall and run-off data compiled by Pennsylvania Department of Forests and Waters.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
BEAVER RIVER BASIN—Continued				
Shenango River near Jamestown, Pa	1928	41.1	20.0	21.1
	1929	46.1	21.6	24.5
	1930	38.6	19.2	19.4
	1931	35.9	9.5	26.4
	1932	33.8	14.6	19.2
	1933	37.0	11.3	25.7
Shenango River at Sharon, Pa	1921	39.3	14.1	25.2
	1922	36.0	14.9	21.1
	1923	31.1	9.3	21.8
	1924	45.4	18.3	27.1
	1925	29.7	12.1	17.6
	1926	41.6	18.3	23.3
	1927	38.3	20.4	17.9
	1928	42.8	21.2	21.6
	1929	43.8	20.9	22.9
	1930	36.4	16.2	20.2
	1931	32.0	7.9	24.1
	1932	35.3	12.6	22.7
	1933	35.6	12.1	23.5
	1934	31.2	8.1	23.1
Shenango River at New Castle, Pa	1921	37.6	12.8	24.8
	1922	35.6	13.7	21.9
	1923	30.8	8.6	22.2
	1924	45.4	15.4	30.0
	1925	29.2	11.4	17.8
	1926	42.4	17.2	25.2
	1927	39.1	20.9	18.2
	1928	43.3	21.1	22.2
	1929	44.1	20.5	23.6
	1930	35.9	16.8	19.1
	1931	32.0	7.6	24.4
	1932	35.4	12.5	22.9
	1933	35.1	11.8	23.3
	1934	31.7	7.0	24.7
Little Shenango River at Greenville, Pa	1921	44.4	15.8	28.6
	1922	36.8	16.4	20.4
	1927	39.3	23.2	16.1
	1928	46.0	26.7	19.3
	1929	44.0	24.3	19.7
	1930	35.8	20.8	15.0
	1931	31.1	8.3	22.8
	1932	37.8	16.0	21.8
	1933	38.5	15.4	23.1
	1934	31.4	10.4	21.0
Pymatuning Creek near Orangeville, Pa	1921	35.2	16.5	18.7
	1922	34.6	16.8	17.8
	1927	36.3	26.3	10.0
	1928	39.6	24.1	15.5
	1929	44.6	27.2	17.4
	1930	37.3	18.5	18.8
	1931	31.3	7.8	23.5
	1932	35.6	12.7	22.9
	1933	34.0	12.4	21.6
	1934	30.0	6.0	24.0
Slippery Rock Creek at Wurtemburg, Pa	1921	38.5	13.1	25.4
	1922	36.8	18.0	18.8
	1923	33.5	12.4	21.1
	1924	48.7	23.5	25.2
	1925	28.6	12.4	16.2
	1926	43.8	20.8	23.0
	1927	46.7	26.3	20.4
	1928	50.3	28.6	21.7
	1929	47.1	24.1	23.0
	1930	34.3	18.5	15.8
	1931	32.4	7.2	25.2
	1932	35.7	15.5	20.2
	1934	35.2	9.1	26.1
Connoquenessing Creek near Hazen, Pa	1921	37.3	15.2	22.1
	1922	35.6	19.8	15.8
	1923	33.7	12.0	21.7
	1924	47.3	27.4	19.9
	1925	28.8	14.6	14.2
	1926	41.3	20.2	21.1
	1927	48.1	28.6	19.5
	1928	45.8	31.2	14.6
	1929	43.1	18.4	24.7
	1930	39.1	19.7	19.4

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
BEAVER RIVER BASIN—Continued				
Connoquenessing Creek near Hazen, Pa	1931	34.5	8.4	26.1
	1932	35.0	14.8	20.2
	1933	36.6	16.2	20.4
	1934	31.4	9.5	21.9
RACCOON CREEK BASIN [5]				
Raccoon Creek at Adamsville, Ohio	1916	49.4	27.6	21.8
	1917	40.7	20.1	20.6
	1918	33.4	13.9	19.5
	1919	44.5	13.8	30.7
	1920	52.6	26.8	25.8
	1921	38.7	20.5	18.2
	1922	40.5	21.8	18.7
	1923	37.5	18.3	19.2
	1924	44.8	21.7	23.1
	1925	29.6	10.1	19.5
	1926	48.6	18.8	29.8
	1927	42.7	25.2	17.5
SCIOTO RIVER BASIN [5]				
Scioto River at Griggs Dam and at Dublin, Ohio	1911	39.4	10.0	29.4
	1912	44.8	17.5	27.3
	1913	45.4	19.6	25.8
	1914	34.4	8.4	26.0
	1915	44.0	10.8	33.2
	1916	37.4	18.9	18.5
	1917	34.4	8.3	26.1
	1918	32.5	7.3	25.2
	1922	45.9	14.5	31.4
	1923	33.8	8.5	25.3
	1924	39.5	14.7	24.8
Scioto River at Columbus, Ohio	1899	33.9	10.0	23.9
	1900	33.9	6.0	27.9
	1901	30.4	5.3	25.1
	1902	33.4	3.6	29.8
	1903	35.3	16.1	19.2
	1904	41.8	19.3	22.5
	1905	38.8	7.8	31.0
	1906	34.1	9.5	24.6
	1907	47.4	19.0	28.4
	1908	37.7	15.3	22.4
MIAMI RIVER BASIN [5]				
Miami River at Dayton, Ohio	1894	30.6	4.9	25.7
	1895	23.7	3.7	20.0
	1896	45.7	8.1	37.6
	1897	34.5	12.8	21.7
	1898	44.9	14.7	30.2
	1899	32.9	9.7	23.2
	1900	34.2	6.6	27.6
	1901	29.8	5.6	24.2
	1902	32.5	3.8	28.7
	1903	37.4	12.6	24.8
	1904	39.6	13.1	26.5
	1905	39.1	7.1	32.0
	1906	33.7	9.2	24.5
	1907	45.4	17.2	28.2
	1908	39.9	17.7	22.2
	1909	39.5	13.1	26.4
	1910	37.3	15.1	22.2
	1911	42.0	13.9	28.1
	1912	43.5	23.1	20.4
	1913	42.5	24.4	18.1
	1914	33.4	8.3	25.1
	1915	42.0	12.1	29.9
	1916	42.0	19.2	22.8
	1917	36.0	11.4	24.6
	1918	40.7	9.4	31.3
WABASH RIVER BASIN				
Wabash River at Logansport, Ind	1924	42.5	20.0	22.5
	1925	33.8	11.1	22.7
	1926	43.0	17.3	25.7
	1927	40.0	20.0	20.0
	1928	36.6	12.9	23.7

[5] Data compiled in Ohio University Engineering Experiment Station Bull. 49, 1929.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Ohio River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
WABASH RIVER BASIN—Continued				
Wabash River at Logansport, Ind	1929	40.1	13.1	27.0
	1930	37.5	14.4	23.1
	1931	29.3	3.0	26.3
	1932	35.7	8.7	27.0
	1933	44.1	16.2	27.9
Salamonie River at Dora, Ind	1931	30.5	3.2	27.3
	1932	34.9	11.7	23.2
	1933	45.6	19.9	25.7
Mississinewa River at Marion, Ind	1931	33.9	3.6	30.3
	1932	37.3	10.2	27.1
	1933	48.0	18.3	29.7
Eel River at North Manchester, Ind	1931	25.7	3.6	22.1
	1932	30.8	9.3	21.5
	1933	39.0	16.6	22.4
West Fork of White River near Noblesville, Ind	1916	37.0	16.0	21.0
	1917	37.0	13.2	23.8
	1918	31.1	7.3	23.8
	1919	31.6	12.1	19.5
	1920	37.4	16.6	20.8
	1921	40.9	13.8	27.1
	1930	42.3	18.6	23.7
	1931	31.4	4.3	27.1
	1932	41.3	11.2	30.1
	1933	44.6	19.9	24.7
Fall Creek at Millersville, Ind	1931	27.9	3.1	24.8
	1932	40.2	11.9	28.3
	1933	42.8	20.9	21.9
East Fork of White River at Seymour, Ind	1928	38.1	16.2	21.9
	1929	51.9	19.8	32.1
	1930	35.1	15.6	19.5
	1931	31.9	3.5	28.4
	1932	45.8	12.9	32.9
	1933	47.3	23.3	24.0
Flatrock Creek at St. Paul, Ind	1931	30.2	3.2	27.0
	1932	44.5	12.1	32.4
	1933	51.2	22.0	29.2

St. Lawrence River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
STREAMS TRIBUTARY TO LAKE MICHIGAN				
Thornapple River near Caledonia, Mich	1932	35.6	8.9	26.7
	1933	33.8	10.7	23.1
	1934	26.6	8.3	18.3
Muskegon River at Newaygo, Mich	1932	31.6	11.1	20.5
	1933	30.7	10.5	20.2
	1934	27.9	9.0	18.9
STREAM TRIBUTARY TO LAKE HURON				
Tittabawassee River at Freeland, Mich	1913	32.8	9.0	23.8
	1914	32.2	7.8	24.4
	1916	28.0	15.0	13.0
	1917	29.2	10.0	19.2
	1918	26.9	9.2	17.7
	1919	34.2	11.2	23.0
	1920	30.3	7.7	22.6
	1932	30.7	7.8	22.9
	1933	28.2	9.5	18.7
	1934	24.7	6.2	18.5
STREAMS TRIBUTARY TO LAKE ERIE				
River Rouge at Detroit, Mich	1932	36.6	5.6	31.0
	1933	28.9	8.8	20.1
	1934	20.3	3.5	16.8
Huron River at Barton, Mich	1915	32.4	8.9	23.5
	1916	30.3	12.8	17.5
	1917	37.5	7.9	29.6
	1918	24.6	9.6	15.0
	1919	33.1	9.0	24.1
	1920	32.4	7.0	25.4

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Hudson Bay Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
Red River at Fargo, N. Dak.	1919	22.9	0.5	22.4
	1920	25.7	1.3	24.4
	1921	23.7	.8	22.9
	1922	18.5	1.2	17.3
	1923	23.1	.6	22.5
	1925	22.1	.4	21.7
	1926	17.6	.3	17.3
	1927	25.1	.7	24.4
	1928	23.2	.6	22.6
	1929	15.5	.6	14.9
	1930	18.3	.4	17.9
	1931	20.3	.2	20.1
	1932	19.6	.1	19.5
	1933	16.5	.1	16.4
Red River at Grand Forks, N. Dak.[6]	1882	27.4	3.1	24.3
	1883	18.7	2.2	16.5
	1884	25.3	1.6	23.7
	1885	18.7	1.7	17.0
	1886	18.8	1.0	17.8
	1887	21.8	.6	21.2
	1888	17.1	1.5	15.6
	1889	15.3	.4	14.9
	1890	20.3	.4	19.9
	1891	25.6	.7	24.9
	1892	21.0	2.0	19.0
	1893	20.4	1.9	18.5
	1894	19.3	1.2	18.1
	1895	19.6	.4	19.2
	1896	27.2	1.8	25.4
	1897	22.3	3.0	19.3
	1898	19.8	.9	18.9
	1899	20.6	1.1	19.5
	1900	23.8	1.0	22.8
	1901	26.0	1.7	24.3
	1902	22.5	1.7	20.8
	1903	21.8	1.6	20.2
	1904	22.1	2.6	19.5
	1905	26.9	2.1	24.8
	1906	25.0	2.5	22.5
	1907	18.5	1.9	16.6
	1908	21.8	1.6	20.2
	1909	22.2	1.4	20.8
	1910	12.2	1.3	10.9
	1911	22.2	.4	21.8
	1912	22.6	.5	22.1
	1913	19.5	.7	18.8
	1914	24.2	.9	23.3
	1915	23.1	1.6	21.5
	1916	27.8	3.1	24.7
	1917	13.4	1.2	12.2
	1918	19.6	.5	19.1
	1919	23.0	1.2	21.8
	1920	18.8	1.7	17.1
	1921	22.4	.8	21.6
	1922	22.5	1.3	21.2
	1923	18.8	.7	18.1
	1924	20.7	.4	20.3
	1925	22.8	.7	22.1
	1926	18.7	.6	18.1
	1927	22.5	1.4	21.1
	1928	21.3	1.0	20.3
	1929	15.8	.8	15.0
	1930	18.0	.6	17.4
	1931	19.7	.2	19.5
	1932	17.9	.3	17.6
	1933	16.5	.2	16.3
	1934	14.7	.1	14.6
Red Lake River at Crookston, Minn.	1922	20.6	2.1	18.5
	1923	18.7	1.4	17.3
	1924	18.0	.8	17.2
	1926	18.3	2.0	16.3
	1927	23.6	3.6	20.0
	1928	25.3	2.8	22.5
	1929	13.5	2.5	11.0
	1930	19.4	1.2	18.2
	1931	19.4	.4	19.0
	1932	20.3	.5	19.8
	1933	17.2	.2	17.0

[6] Data compiled in Geological Survey Water-Supply Paper 772, 1936.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Upper Mississippi River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
CHIPPEWA RIVER BASIN				
Jump River at Sheldon, Wis	1916	32.9	19.4	13.5
	1917	25.8	9.6	16.2
	1918	29.7	12.9	16.8
	1919	38.4	16.7	21.7
	1920	29.8	17.8	12.0
	1921	33.2	11.6	21.6
	1922	29.0	11.6	17.4
	1923	31.1	13.5	17.6
	1924	31.6	14.7	16.9
	1925	25.1	7.5	17.6
	1926	36.3	14.9	21.4
	1927	31.9	18.2	13.7
	1928	32.6	16.4	16.2
	1929	32.4	17.3	15.1
	1930	26.2	9.9	16.3
	1931	29.6	7.2	22.4
	1932	26.5	10.5	16.0
	1933	26.3	8.5	17.8
	1934	31.1	7.5	23.6
TREMPEALEAU RIVER BASIN				
Trempealeau River at Dodge, Wis	1915	30.2	8.7	21.5
	1916	29.5	10.2	19.3
	1917	27.1	7.6	19.5
	1918	29.0	7.8	21.2
	1919	31.8	7.4	24.4
BLACK RIVER BASIN				
Black River at Neillsville, Wis	1915	31.8	9.6	22.2
	1916	36.1	15.9	20.2
	1917	29.5	9.1	20.4
	1918	28.8	8.3	20.5
	1919	36.6	11.5	25.1
	1920	31.7	13.4	18.3
	1921	30.2	8.2	22.0
	1922	31.0	8.8	22.2
	1923	27.9	6.7	21.2
	1924	31.2	10.0	21.2
	1925	29.9	5.9	24.0
	1926	36.1	12.9	23.2
	1927	30.7	11.8	18.9
	1928	38.1	15.0	23.1
	1929	31.7	11.8	19.9
	1930	27.6	6.3	21.3
	1931	26.3	2.8	23.5
	1932	31.5	10.7	20.8
	1933	24.2	6.2	18.0
	1934	30.7	6.2	24.5
LA CROSSE RIVER BASIN				
La Crosse River near West Salem, Wis	1915	32.4	10.1	22.3
	1916	31.6	11.4	20.2
	1917	35.8	11.1	24.7
	1918	28.6	11.9	16.7
	1919	28.9	10.3	18.6
	1920	31.3	10.4	20.9
	1921	30.0	8.7	21.3
	1922	30.4	10.2	20.2
	1923	25.5	8.6	16.9
	1924	34.4	10.3	24.1
	1925	30.0	10.5	19.5
	1926	30.8	10.7	20.1
	1927	30.5	9.1	21.4
	1928	36.2	11.4	24.8
	1929	31.9	11.3	20.6
	1930	25.4	9.1	16.3
	1931	22.6	7.3	15.3
	1932	34.2	10.4	23.8
	1933	28.9	9.1	19.8
	1934	27.5	7.2	20.3

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Upper Mississippi River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
WISCONSIN RIVER BASIN				
Rib River at Rib Falls, Wis	1926	35.4	16.5	18.9
	1927	31.3	16.1	15.2
	1928	36.9	18.7	18.2
	1929	33.1	18.7	14.4
	1930	27.2	8.6	18.6
	1931	25.3	4.4	20.9
	1932	29.3	12.1	17.2
	1933	23.4	8.4	15.0
	1934	29.0	7.9	21.1
Yellow River at Sprague, Wis	1927	29.1	9.9	19.2
	1928	35.1	11.0	24.1
	1929	28.8	10.3	18.5
	1930	24.9	4.3	20.6
	1931	25.2	1.2	24.0
	1932	33.1	7.1	26.0
	1933	26.7	4.7	22.0
	1934	27.4	2.1	25.3
Kickapoo River at Gays Mills, Wis	1915	33.2	8.2	25.0
	1916	31.6	10.1	21.5
	1917	40.0	11.1	28.9
	1918	30.0	10.7	19.3
	1919	32.6	8.2	24.4
	1920	34.4	9.9	24.5
	1921	34.8	8.3	26.5
	1922	30.1	9.9	20.2
	1923	26.5	9.0	17.5
	1924	38.4	9.7	28.7
	1925	29.3	8.8	20.5
	1926	32.2	7.6	24.6
	1927	32.2	10.0	22.2
	1928	31.2	12.0	19.2
	1929	29.6	11.0	18.6
	1930	25.0	8.1	16.9
	1931	22.6	6.0	16.6
	1932	35.0	8.4	26.6
	1933	31.8	9.0	22.8
ROCK RIVER BASIN				
Sugar River near Brodhead, Wis	1915	40.9	11.9	29.0
	1916	34.0	12.8	21.2
	1917	31.4	9.1	22.3
	1918	27.3	10.0	17.3
	1919	36.9	8.4	28.5
	1920	31.2	10.9	20.3
	1921	34.6	7.2	27.4
	1922	34.0	10.2	23.8
	1923	31.1	8.6	22.5
	1924	34.0	9.3	24.7
	1925	28.8	6.7	22.1
	1926	31.1	6.9	24.2
	1927	36.0	10.3	25.7
	1928	36.3	12.9	23.4
	1929	37.6	13.3	24.3
	1930	28.5	7.2	21.3
	1931	27.0	5.0	22.0
	1932	29.2	8.5	20.7
	1933	36.9	10.5	26.4
	1934	22.7	4.4	18.3

Missouri River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
GRAND RIVER BASIN				
Grand River near Wakpala, S. Dak	1931	15.7	0.2	15.5
	1932	16.9	.6	16.3
	1933	12.0	.2	11.8
MOREAU RIVER BASIN				
Moreau River at Promise, S. Dak	1931	13.4	.2	13.2
	1932	16.7	.7	16.0
	1933	13.6	.4	13.2

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Missouri River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
WHITE RIVER BASIN				
White River near Oacoma, S. Dak	1929	20.2	0.8	19.4
	1930	20.4	.8	19.6
	1931	14.8	.4	14.4
	1932	17.8	.9	16.9
	1933	16.0	.4	15.6
NIOBRARA RIVER BASIN				
Niobrara River near Spencer, Nebr	1928	16.3	1.5	14.8
	1929	22.6	1.6	21.0
	1930	20.2	1.8	18.4
	1931	16.5	1.5	15.0
	1932	18.2	1.6	16.6
	1933	17.7	1.4	16.3
JAMES RIVER BASIN				
James River at Jamestown, N. Dak	1929	9.9	.1	9.8
	1930	14.9	.2	14.7
	1931	17.8	0	17.8
	1932	17.7	.1	17.6
James River near Scotland, S. Dak	1931	16.8	0	16.8
	1932	20.2	.1	20.1
	1933	14.9	0	14.9
PLATTE RIVER BASIN				
Middle Loup River at St. Paul, Nebr	1929	22.3	2.3	20.0
	1930	25.0	2.5	22.5
	1931	19.5	2.2	17.3
	1932	23.4	2.6	20.8
	1933	21.6	2.1	19.5
North Loup River near St. Paul, Nebr	1929	23.8	3.4	20.4
	1930	23.6	3.4	20.2
	1931	19.4	3.2	16.2
	1932	21.2	3.5	17.7
	1933	22.6	2.9	19.7
Elkhorn River at Waterloo, Nebr	1930	24.0	2.0	22.0
	1932	28.5	2.3	26.2
	1933	21.1	1.4	19.7
KANSAS RIVER BASIN				
Republican River between Wakefield and Scandia, Kans.	1920	22.6	1.4	21.2
	1921	23.4	.6	22.8
	1922	22.1	.8	21.3
	1923	33.6	3.5	30.1
	1924	19.6	1.0	18.6
	1929	27.1	3.0	24.1
	1930	25.1	2.2	22.9
	1931	24.5	.6	23.9
	1932	29.4	.9	28.5
	1933	20.5	−.1	20.6
Kansas River at Wamego, Kans., minus Kansas River at Ogden and Big Blue River at Randolph.	1920	25.1	3.5	21.6
	1921	30.3	3.9	26.4
	1922	29.1	1.9	27.2
	1923	33.9	1.9	32.0
	1924	27.2	2.0	25.2
	1925	30.5	1.6	28.9
	1928	31.8	3.1	28.7
	1930	33.6	5.8	27.8
	1931	32.6	3.2	29.4
	1932	31.7	2.7	29.0
	1933	23.4	.8	22.6
Kansas River between Topeka and Wamego, Kans	1920	29.4	2.4	27.0
	1921	38.4	3.4	35.0
	1922	31.8	5.2	26.6
	1923	34.3	5.1	29.2
	1924	30.0	1.1	28.9
	1925	33.8	6.9	26.9
	1926	26.7	3.4	23.3
	1927	45.2	8.0	37.2
	1928	31.9	5.5	26.4
	1929	34.1	9.5	24.6
	1930	34.4	4.6	29.8
	1931	35.9	3.0	32.9
	1932	38.5	8.9	29.6
	1933	23.6	1.5	22.1

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Missouri River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
KANSAS RIVER BASIN—Continued				
Smoky Hill River between Lindsborg and Ellsworth, Kans.	1931	22.8	0.7	22.1
	1932	28.6	−.1	28.7
	1933	20.7	1.0	19.7
South Fork of Solomon River at Alton, Kans.	1920	20.6	.8	19.8
	1921	22.2	.3	21.9
	1922	16.6	.2	16.4
	1923	28.8	.6	28.2
	1924	15.7	.2	15.5
	1929	21.1	.6	20.5
	1930	25.1	.6	24.5
	1931	25.2	.8	24.4
Solomon River between Niles and Beloit, Kans.	1930	25.5	1.5	24.0
	1931	23.0	.4	22.6
	1932	26.8	1.2	25.6
	1933	18.5	.5	18.0
North Fork of Solomon River at Kirwin, Kans.	1920	20.5	.8	19.7
	1921	21.7	.6	21.1
	1922	17.7	.4	17.3
	1923	28.4	1.1	27.3
	1924	17.5	.3	17.2
	1929	21.3	.8	20.5
	1930	25.5	.6	24.9
	1931	25.3	.6	24.7
Soldier Creek at Topeka, Kans.	1930	36.2	5.4	30.8
	1931	38.9	5.8	33.1
	1932	39.4	9.8	29.6
	1933	23.4	1.0	22.4
Delaware River at Valley Falls, Kans.	1923	33.3	1.6	31.7
	1924	30.7	2.2	28.5
	1925	43.8	7.5	36.3
	1926	24.5	2.5	22.0
	1927	44.9	8.6	36.3
	1928	32.1	6.6	25.5
	1930	35.5	4.4	31.1
	1931	38.3	4.4	33.9
	1932	39.2	10.2	29.0
	1933	23.9	1.3	22.6
Wakarusa River near Lawrence, Kans.	1930	28.6	.6	28.0
	1931	34.0	1.3	32.7
	1932	40.2	6.5	33.7
	1933	28.0	1.8	26.2
Stranger Creek near Tonganoxie, Kans.	1930	32.3	4.2	28.1
	1931	39.8	3.6	36.2
	1932	40.5	11.2	29.3
	1933	27.0	1.4	25.6
GRAND RIVER BASIN				
Grand River near Gallatin, Mo.	1922	36.3	5.1	31.2
	1923	35.9	5.0	30.9
	1924	31.8	6.0	25.8
	1925	35.9	5.1	30.8
	1926	37.9	11.1	26.8
	1927	33.7	10.0	23.7
	1928	34.9	6.6	28.3
	1929	40.4	18.4	22.0
	1930	28.6	3.2	25.4
	1931	33.7	2.2	31.5
	1932	43.8	11.9	31.3
	1933	31.1	2.4	28.7
Thompson River at Trenton, Mo.	1929	36.7	14.9	21.8
	1930	26.4	4.1	22.3
	1931	31.1	2.2	28.9
	1932	43.6	15.4	28.2
	1933	26.5	2.7	23.8
Locust Creek near Milan, Mo.	1922	35.4	7.5	27.9
	1923	30.0	5.2	24.8
	1924	30.2	7.3	22.9
	1925	39.4	6.4	33.0
	1926	44.0	11.8	32.2
	1927	35.0	11.6	23.4
	1928	41.9	8.4	33.5
	1929	44.0	19.2	24.8
	1930	28.0	6.2	21.8
	1931	39.6	4.7	34.9
	1932	49.2	18.3	30.9
	1933	31.2	4.0	27.2

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Missouri River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
CHARITON RIVER BASIN				
Chariton River at Elmer, Mo	1922	36.6	6.5	30.1
	1924	31.3	5.0	26.3
	1925	34.9	3.8	31.1
	1926	41.8	12.9	28.9
	1927	33.2	13.8	19.4
	1928	40.6	9.7	30.9
	1929	43.6	18.9	24.7
	1930	27.3	5.3	22.0
LAMINE RIVER BASIN				
Blackwater River at Blue Lick, Mo	1923	38.7	5.3	33.4
	1924	40.3	7.8	32.5
	1925	32.3	3.2	29.1
	1926	42.4	7.6	34.8
	1927	50.6	15.8	34.8
	1928	38.7	10.0	28.7
	1929	54.9	23.0	31.9
	1930	27.0	2.3	24.7
	1931	30.8	1.6	29.2
	1932	38.0	4.8	33.2
	1933	31.4	3.9	27.5
OSAGE RIVER BASIN				
Osage River near Ottawa, Kans	1920	36.3	2.5	33.8
	1921	38.8	5.3	33.5
	1922	34.8	5.3	29.5
	1923	34.0	3.9	30.1
	1924	34.1	1.8	32.3
	1925	28.2	1.4	26.8
	1926	29.4	1.6	27.8
	1927	46.1	11.5	34.6
	1928	32.6	5.0	27.6
	1929	41.0	13.0	28.0
	1930	26.6	1.8	24.8
	1931	31.3	.8	30.5
	1932	39.4	6.8	32.6
	1933	29.4	1.3	28.1
Sac River near Stockton, Mo	1926	39.8	9.0	30.8
	1927	64.2	33.6	30.6
	1928	48.2	19.8	28.4
	1929	43.3	16.7	26.6
	1930	34.7	6.2	28.5
	1931	37.3	8.0	29.3
	1932	39.8	10.6	29.2
South Grand River near Brownington, Mo	1922	38.9	12.6	26.3
	1923	35.0	4.6	30.4
	1924	41.0	7.9	33.1
	1925	35.7	4.9	30.8
	1926	36.0	6.0	30.0
	1927	50.0	15.3	34.7
	1928	41.5	8.0	33.5
	1929	50.2	20.4	29.8
	1930	29.7	1.8	27.9
	1931	31.5	1.6	29.9
	1932	34.3	4.0	30.3
	1933	32.0	2.7	29.3

Lower Mississippi River Basin

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
MERAMEC RIVER BASIN				
Meramec River near Steelville, Mo	1924	49.1	10.8	38.3
	1925	36.9	5.7	31.2
	1926	38.4	6.6	31.8
	1927	56.1	20.4	35.7
	1928	47.7	16.2	31.5
	1929	44.7	11.1	33.6
	1930	35.9	10.3	25.6
	1931	32.9	4.1	28.8
	1932	34.3	4.2	30.1
	1933	38.0	8.5	29.5
	1934	37.2	5.7	31.5

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Lower Mississippi River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
MERAMEC RIVER BASIN—Continued				
Bourbeuse River at Union, Mo	1922	40.4	13.8	26.6
	1923	41.5	7.2	34.3
	1924	45.8	13.4	32.4
	1925	34.7	7.2	27.5
	1926	38.4	9.5	28.9
	1927	52.6	22.3	30.3
	1928	48.1	19.2	28.9
	1929	40.3	14.3	26.0
	1930	32.3	9.3	23.0
	1931	34.8	5.0	29.8
	1932	30.9	5.3	25.6
	1933	34.8	11.5	23.3
	1934	37.4	7.6	29.8
ST. FRANCIS RIVER BASIN				
St. Francis River near Patterson, Mo	1922	40.0	18.1	21.9
	1923	45.9	19.8	26.1
	1924	48.9	12.7	36.2
	1925	38.1	6.7	31.4
	1926	42.4	15.6	26.8
	1927	54.4	31.9	22.5
	1928	50.8	26.2	24.6
	1929	48.9	21.3	27.6
	1930	25.2	10.4	14.8
	1931	32.7	5.6	27.1
	1932	36.2	7.6	28.6
	1933	52.2	20.2	32.0
	1934	36.2	6.5	29.7
WHITE RIVER BASIN				
James River at Galena, Mo	1923	39.3	10.3	29.0
	1924	50.5	16.2	34.0
	1925	35.2	7.0	28.2
	1926	39.4	9.3	30.1
	1927	60.1	34.0	26.1
	1928	54.2	25.3	28.9
	1929	44.1	16.3	27.8
	1930	33.4	7.8	25.6
	1931	37.4	8.9	28.5
	1932	39.6	10.5	29.1
	1933	48.5	13.1	35.4
	1934	30.3	4.1	26.2
ARKANSAS RIVER BASIN				
Pawnee River near Larned, Kans	1926	17.3	.1	17.2
	1927	21.9	.2	21.7
	1928	24.2	.2	24.0
	1929	24.1	.3	23.8
	1930	18.0	.1	17.9
	1931	22.9	.3	22.6
	1932	19.8	.1	19.7
	1933	16.5	.5	16.0
Little Arkansas River at Valley Center, Kans	1923	34.7	3.2	31.5
	1924	26.0	1.9	24.1
	1925	26.0	.4	25.6
	1926	23.6	.3	23.3
	1927	43.4	3.1	40.3
	1928	28.4	2.0	26.4
	1929	34.2	3.1	31.1
	1930	28.9	1.0	27.9
	1931	23.7	.4	23.3
	1932	29.4	1.1	28.3
	1933	20.7	.8	19.9
Walnut River at Winfield, Kans	1923	35.2	5.9	29.3
	1924	32.8	3.4	29.4
	1925	25.8	.9	24.9
	1926	29.9	1.6	28.3
	1927	49.6	12.2	37.4
	1928	31.0	7.7	23.3
	1929	41.0	10.6	30.4
	1930	28.0	1.8	26.2
	1931	29.8	2.4	27.4
	1932	31.6	3.5	28.1
	1933	22.0	1.0	21.0

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Lower Mississippi River Basin—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
ARKANSAS RIVER BASIN—Continued				
Neosho River near Iola, Kans.[6]	1896	34.1	4.7	29.4
	1897	24.8	1.5	23.3
	1898	42.5	8.0	34.5
	1899	32.5	4.0	28.5
	1900	38.8	5.7	33.1
	1901	23.7	3.6	20.1
	1902	47.1	12.3	34.8
	1903	40.8	12.4	28.4
	1918	31.3	1.5	29.8
	1919	26.8	4.4	22.4
	1920	31.6	1.4	30.2
	1921	28.6	1.8	26.8
	1922	39.1	6.7	32.4
	1923	34.8	5.5	29.3
	1924	30.2	2.7	27.5
	1925	29.7	2.0	27.7
	1926	36.1	6.1	30.0
	1927	42.9	11.5	31.4
	1928	41.1	8.8	32.3
	1929	34.9	7.1	27.8
	1930	27.7	2.1	25.6
	1931	32.3	2.9	29.4
	1932	29.4	3.2	26.2
	1933	25.9	1.4	24.5
	1934	26.8	1.0	25.8

Western Gulf of Mexico basins

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
NECHES RIVER BASIN				
Neches River near Rockland, Tex	1924	45.6	16.1	29.5
	1925	21.2	.9	20.3
	1926	53.2	13.3	39.9
	1927	46.2	11.6	34.6
	1928	38.9	3.3	35.6
	1929	48.3	9.8	38.5
	1930	42.8	7.2	35.6
	1931	42.0	7.9	34.1
	1932	51.2	13.6	37.6
	1933	44.5	7.4	37.1
	1934	37.3	8.2	29.1
Angelina River near Lufkin, Tex	1924	45.2	16.7	28.5
	1925	22.6	1.3	21.3
	1926	52.0	16.1	35.9
	1927	44.8	10.5	34.3
	1928	38.5	4.7	33.8
	1929	47.5	9.1	38.4
	1930	44.8	9.1	35.7
	1931	42.3	9.3	33.0
	1932	54.5	21.3	33.2
	1933	50.2	10.0	40.2
	1934	39.1	8.6	30.5
Angelina River between Horger and Lufkin, Tex	1929	51.6	14.5	37.1
	1930	45.0	9.9	35.1
	1931	45.0	10.7	34.3
	1932	52.1	7.5	44.6
	1933	53.6	12.5	41.1
	1934	46.3	14.0	32.3
TRINITY RIVER BASIN				
Clear Fork of Trinity River at Fort Worth, Tex	1926	32.5	1.5	31.0
	1927	26.8	.9	25.9
	1928	33.2	1.6	31.6
	1929	31.1	2.4	28.7
	1930	27.6	1.1	26.5
	1931	31.9	1.5	30.4
	1932	46.4	4.9	41.5
	1933	30.8	2.3	28.5
	1934	19.8	.4	19.4

[6] Data compiled in Geological Survey Water-Supply Paper 772, 1936.

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Western Gulf of Mexico basins—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
TRINITY RIVER BASIN—Continued				
Mountain Creek near Grand Prairie, Tex	1926	35.8	2.4	33.4
	1927	32.5	1.6	30.9
	1928	33.9	3.3	30.6
	1929	36.3	6.1	30.2
	1930	31.3	4.7	26.6
	1931	31.5	2.2	29.3
	1932	44.2	7.1	37.1
Elm Fork of Trinity River near Carrollton, Tex	1925	19.5	.9	18.6
	1926	38.4	4.1	34.3
	1927	39.8	5.0	34.8
	1928	31.9	2.1	29.8
	1929	33.1	3.6	29.5
	1930	27.0	2.1	24.9
	1931	32.5	3.2	29.3
	1932	40.4	7.3	33.1
	1933	34.0	3.5	30.5
	1934	22.8	1.4	21.4
East Fork of Trinity River near Rockwall, Tex	1925	21.6	1.0	20.6
	1926	45.9	8.8	37.1
	1927	50.7	11.5	39.2
	1928	37.4	6.5	30.9
	1929	45.3	10.0	35.3
	1930	27.4	3.1	24.3
	1931	29.0	2.5	26.5
	1932	51.4	11.7	39.7
	1933	36.7	6.6	30.1
	1934	30.0	3.6	26.4
SAN JACINTO RIVER BASIN				
San Jacinto River near Humble, Tex	1930	37.6	6.0	31.6
	1931	42.5	7.2	35.3
	1932	47.4	7.2	40.2
	1933	37.2	2.7	34.5
	1934	39.4	7.2	32.2
BRAZOS RIVER BASIN				
San Gabriel River at Circleville, Tex	1925	15.2	.8	14.4
	1926	38.5	7.0	31.5
	1927	34.3	4.0	30.3
	1928	28.0	2.6	25.4
	1929	25.6	3.6	22.0
	1930	26.7	3.7	23.0
	1931	33.0	4.5	28.5
	1932	35.0	2.0	33.0
	1933	25.4	1.0	24.4
	1934	24.0	1.5	22.5
Yegua Creek near Somerville, Tex	1925	13.2	0	13.2
	1926	48.3	11.7	36.6
	1927	38.0	3.9	34.1
	1928	30.1	.4	29.7
	1929	39.3	5.7	33.6
	1930	35.2	2.8	32.4
	1931	36.8	5.2	31.6
	1932	43.4	7.7	35.7
	1933	30.6	2.2	28.4
	1934	30.6	4.9	25.7
Navasota River near Easterly, Tex	1925	19.3	.4	18.9
	1926	43.1	7.8	35.3
	1927	43.2	6.1	37.1
	1928	36.1	4.2	31.9
	1929	39.6	8.4	31.2
	1930	35.7	5.4	30.3
	1931	38.9	5.6	33.3
	1932	54.5	12.1	42.4
	1933	28.8	2.6	26.2
	1934	26.9	4.0	22.9
COLORADO RIVER BASIN				
Pedernales River at Stonewall, Tex	1925	15.7	.4	15.3
	1926	27.2	1.5	25.7
	1927	38.4	1.8	36.6
	1928	29.1	.6	28.5
	1929	25.8	1.9	23.9
	1930	22.1	1.0	21.1
	1931	35.6	1.9	33.7
	1932	36.2	2.2	34.0
	1933	17.5	1.0	16.5
	1934	22.8	.4	22.4

TABLE 2.—*Precipitation, run-off, and water loss, by water years*—Continued

Western Gulf of Mexico basins—Continued

Gaging station	Water year	Annual precipitation (inches)	Annual run-off (inches)	Annual water loss (inches)
COLORADO RIVER BASIN—Continued				
Pedernales River between Spicewood and Stonewall, Tex.	1925	12.0	0	12.0
	1926	37.6	.5	37.1
	1927	30.9	2.0	28.9
	1928	30.0	.5	29.5
	1929	33.2	6.0	27.2
	1930	26.2	1.4	24.8
	1931	38.9	2.8	36.1
	1932	32.4	1.1	31.3
	1933	21.4	.2	21.2
	1934	21.9	1.1	20.8
GUADALUPE RIVER BASIN				
Guadalupe River near Spring Branch, Tex	1923	29.5	1.4	28.1
	1924	35.7	4.2	31.5
	1925	13.1	.6	12.5
	1926	33.5	2.0	31.5
	1927	33.5	1.8	31.7
	1928	28.6	.7	27.9
	1929	29.4	1.8	27.6
	1930	27.8	1.0	26.8
	1931	43.0	3.8	39.2
	1932	41.8	4.9	36.9
	1933	21.8	1.7	20.1
	1934	23.0	.8	22.2
Blanco River at Wimberley, Tex	1929	36.3	6.7	29.6
	1930	26.9	1.8	25.1
	1931	39.4	6.4	33.0
	1932	33.2	1.9	31.3
	1933	22.7	.9	21.8
	1934	24.2	2.1	22.1
Plum Creek near Luling, Tex	1931	30.8	3.7	27.1
	1932	35.6	3.3	32.3
	1933	28.2	1.1	27.1
	1934	27.6	1.7	25.9
Sandies Creek near Westhoff, Tex	1931	25.9	.4	25.5
	1932	32.8	2.4	30.4
	1933	29.4	1.4	28.0
	1934	26.6	2.0	24.6
Coleto Creek near Schroeder, Tex	1931	36.0	2.5	33.5
	1932	32.6	3.2	29.4
	1933	30.2	1.8	28.4
Medina River near Pipe Creek, Tex	1924	35.3	5.8	29.5
	1925	13.3	.7	12.6
	1926	32.4	3.1	29.3
	1927	34.0	3.3	30.7
	1928	28.4	.9	27.5
	1929	28.4	2.0	26.4
	1930	27.7	1.5	26.2
	1931	43.2	8.0	35.2
	1932	43.8	8.0	35.8
	1933	21.8	3.4	18.4
	1934	22.9	.7	22.2
NUECES RIVER BASIN				
Nueces River at Laguna, Tex	1925	21.3	1.8	19.5
	1926	21.5	2.4	19.1
	1927	22.4	1.2	21.2
	1928	25.0	1.3	23.7
	1929	21.2	1.2	20.0
	1930	22.4	1.7	20.7
	1931	36.2	3.9	32.3
	1932	40.3	5.2	35.1
	1933	14.9	2.0	12.9
	1934	15.9	.5	15.4

DISCUSSION OF RESULTS

There are many factors that cause variations in the annual water loss from a given basin from year to year and still other factors that cause variations in the annual water loss between basins in the same or similar regions. The following are some of the factors that cause variations in annual water loss from year to year in the same basin:

(*a*) Annual rainfall, its distribution among seasons, and the volumes and intensities associated with individual storms. This factor is of major importance in arid and semiarid regions.
(*b*) Sequence of wet and dry years and associated hydrologic and ecologic conditions.
(*c*) Temperature, wind, sunshine, humidity, and other factors that influence evaporation and transpiration.

Variations in annual water loss between basins in the same or similar regions may be caused by differences in the following factors:

(*a*) Topography.
(*b*) Soil.
(*c*) Vegetal cover.
(*d*) Rainfall.
(*e*) Temperature and other climatic factors.

The lack of comparability of the results in this report is due not only to the natural conditions listed above but to inadequacies in the basic information and to the possibility that the records are perhaps too short to assure satisfactory elimination of errors resulting from differences in the volume of water held in the basins at the beginning and end of the periods studied. Furthermore each value was independently determined from periods of record many of which differed from those used for nearby basins, and hence offered opportunity for the magnification of variations due to the vagaries of weather. Considering all the possible causes of differences in natural water loss, the consistency shown in the values for the mean annual water loss, as listed in table 1 and plotted in plate 1, is perhaps surprising.

RELATION BETWEEN WATER LOSS AND TEMPERATURE

Of all the factors affecting the mean annual water loss from a river basin in a humid region, the temperature is perhaps the most significant. Accordingly, it was thought desirable to expand this study to explore the relation between water loss and temperature.

In attempting to examine such a relation the first problem is to determine the manner in which the temperature data should be expressed in order to disclose effectively the correlation between temperature and water loss. At least two methods of expressing mean temperature are available, (1) as mean temperature in degrees and (2) as total degree-days of the mean daily temperature above some base temperature selected in relation to the effectiveness in producing evaporation. Inasmuch as little or no water loss, which is made up of evaporation and transpiration, takes place below 32° F., the base temperature in the second method might at first thought be taken as 32°. However, in dealing with mean temperatures for periods of a day or more having minimum temperatures below 32°, a base temperature of less than 32° probably should be used, because with a mean temperature of 32° there will necessarily be significant periods in which the temperature is above 32°. Thornthwaite indicates that a month in which the mean temperature is 28.4° has negligible periods above 32°.[9] Because this study is confined to annual water loss and annual temperature, it is not considered necessary to attempt such refinement in the selection of a suitable base temperature.

To give some indication of the characteristics of the two methods of expressing temperature, both annual mean temperatures and total degree-days above 32° were compiled for several temperature stations and years of record selected at random. The results of the compilation are shown in table 3 and are illustrated graphically in figure 4.

If degree-days above 32° could be computed precisely for days in which the minimum temperature was less than 32°, the total degree-days above 32° would be increased by relatively small amounts. No attempt was made to apply this refinement. Assuming that the number of degree-days above 32° as computed is a fair index of evaporation, figure 4 seems to indicate that the annual mean temperature is also a fair index of the influence of temperature on evaporation. Since the annual mean temperature was much more readily obtained, it was used to show the relation between temperature and water loss.

As facilities were not available for compiling temperatures for all the areas listed in the preceding sections of this report, representative areas in different parts of the country were selected for study. In making the selection the points considered were length of record of water loss and number of available temperature stations and length of record at each.

The areal temperatures for the areas were obtained by taking the arithmetic mean of the records at the temperature stations in and adjacent to the area. After preliminary examination it was not considered as warranted or feasible to determine weighted mean temperatures or to attempt to adjust the mean temperatures by the application of altitude-temperature relations. The annual mean temperatures for water-years at the temperature stations were obtained by taking the mean of the monthly temperatures as given in the publications of the Weather Bureau.

[9] Thornthwaite, C. W., Climates of North America: Geog. Rev., p. 633, October 1931.

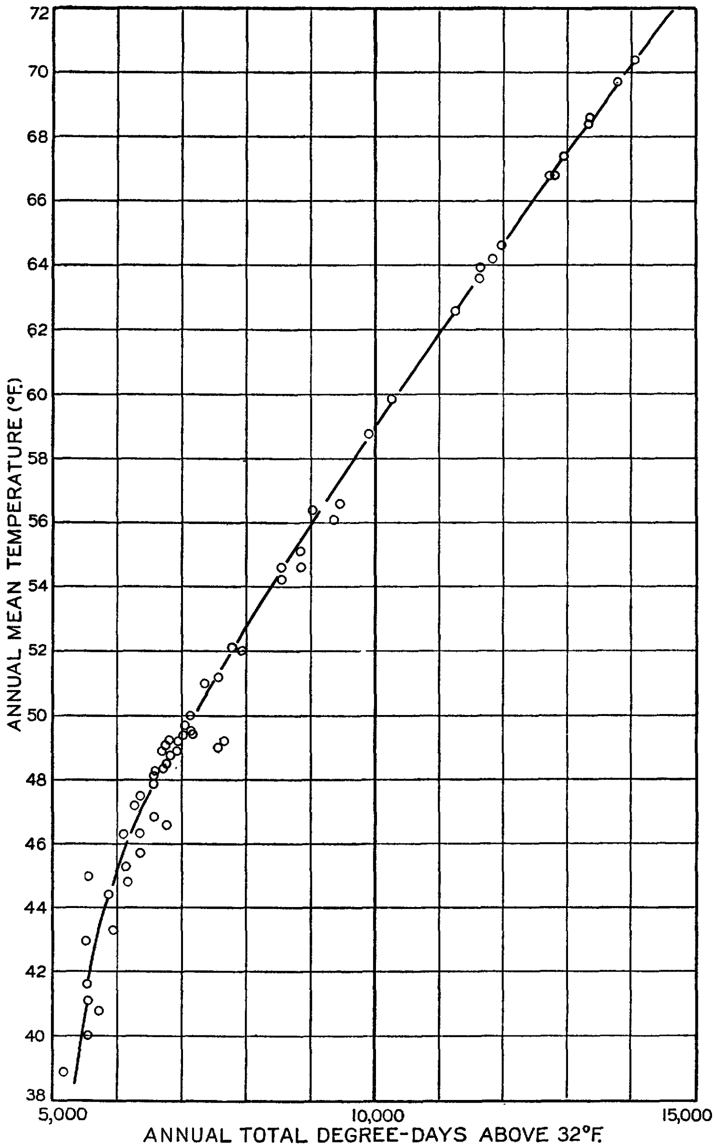


FIGURE 4.—Graph showing comparison of annual mean temperature and annual total degree-days above 32° F. for selected temperature stations.

TABLE 3.—*Annual mean temperature and total degree-days above 32° F. for selected stations*

Temperature station	Year	Mean temperature (°F.)	Total degree-days above 32° F.
Concord, Mass	1905	44.4	5,876
	1906	47.2	6,286
	1931	48.3	6,619
	1932	48.9	6,705
	1933	49.0	6,735
Worcester, Mass	1905	46.3	6,380
	1906	49.5	7,014
	1927	46.1	5,944
	1928	47.5	6,364
	1929	48.0	6,567
	1930	48.4	6,713
	1931	48.3	6,606
	1932	49.1	6,751
	1933	49.0	6,716
Fitchburg, Mass	1905	45.3	6,132
	1906	48.4	6,712
	1927	48.1	6,547
	1928	48.8	6,830
	1929	49.4	7,023
	1930	49.4	7,151
	1931	49.2	6,976
	1932	49.7	7,039
	1933	48.9	6,927
Amherst, Mass	1905	44.8	6,174
	1906	47.9	6,542
	1927	46.3	6,118
	1928	48.2	6,622
	1929	48.3	6,693
	1930	48.5	6,767
	1931	48.4	6,716
	1932	49.2	6,802
	1933	48.9	6,912
Hamburg, Pa	1928	51.0	7,346
Catawissa, Pa	1922	51.2	7,575
Brookville, Pa	1927	45.0	5,548
Dahlonega, Ga	1907	59.9	10,263
Talbotton, Ga	1915	64.2	11,850
	1918	62.6	11,246
Ozark, Ala	1923	67.4	12,945
	1927	68.5	13,343
Jackson, Miss	1929	66.8	12,763
	1931	63.9	11,654
Marion, Ohio	1907	50.0	7,114
	1908	52.1	7,795
Ivan, Mich	1905	41.6	5,555
	1915	43.0	5,508
Marshfield, Wis	1929	41.1	5,561
	1934	43.3	5,957
La Crosse, Wis	1916	46.6	6,797
	1928	45.7	6,360
Fessenden, N. Dak	1929	38.9	5,167
	1932	40.8	5,717
	1933	40.0	5,590
Murdo, S. Dak	1930	49.0	7,559
	1932	49.2	7,670
Ellsworth, Kans	1932	56.6	9,471
	1933	56.1	9,371
Garden City, Kans	1927	55.1	8,836
	1930	54.6	8,851
Grant City, Mo	1923	54.2	8,552
	1928	52.0	7,985
Springfield, Mo	1926	54.6	8,548
	1931	56.4	9,035
Sabinal, Tex	1925	70.4	14,054
	1932	69.7	13,794
	1933	68.4	13,342
Nacogdoches, Tex	1924	64.6	11,961
	1932	66.8	12,731
	1933	63.6	11,644

Table 4 gives the mean annual precipitation, mean annual water loss, and mean annual temperature for all the areas for which temperatures were computed. It should be noted that for seven of the stations listed the periods studied differ slightly from those given in table 1, and for that reason the mean annual precipitation and mean annual water loss differ from the corresponding values in table 1. The changes in the period studied were necessary because adequate temperature records were not available for the entire period for which the water loss was initially determined.

The yearly values used in computing the averages given in table 4 are listed in table 5.

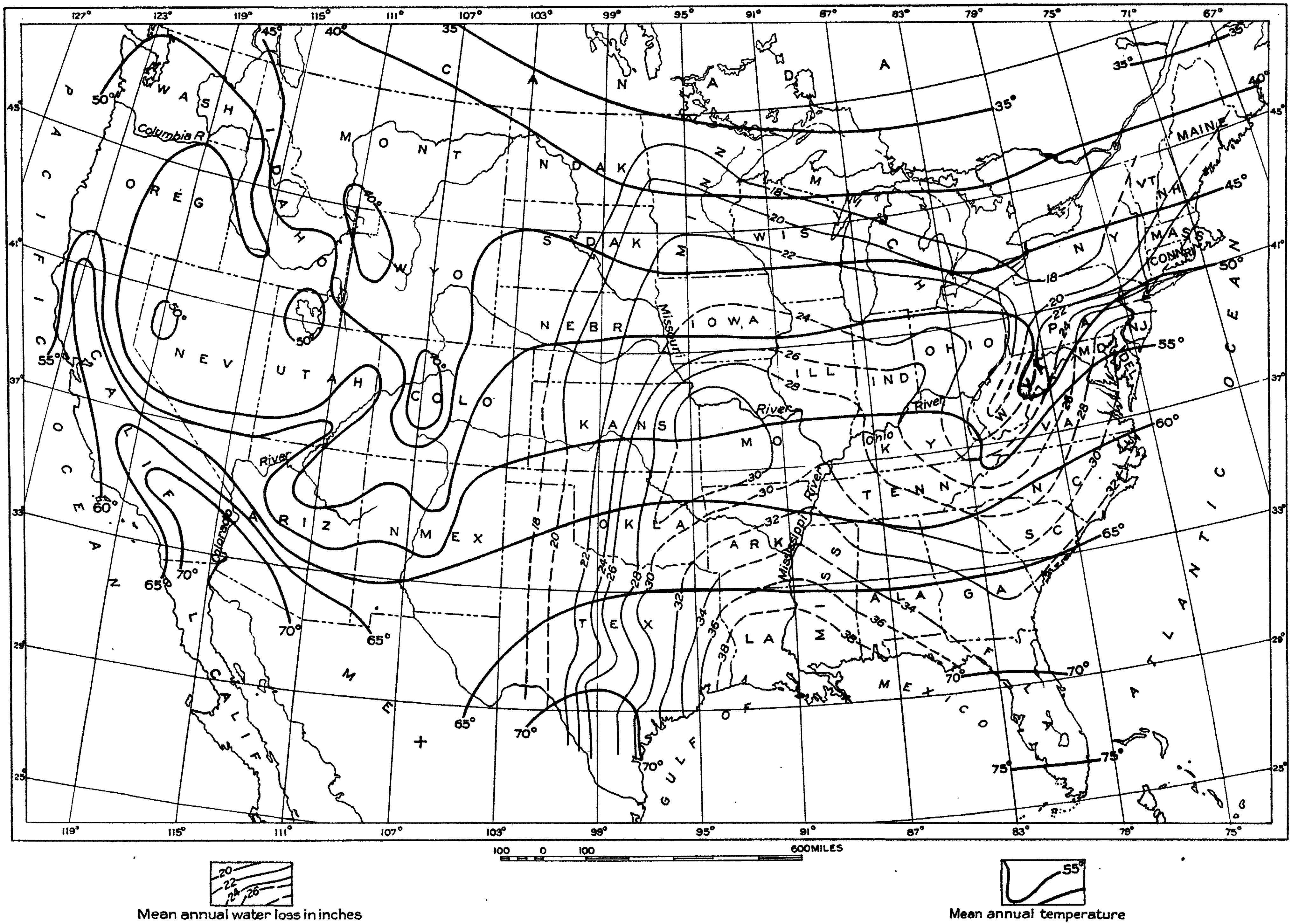
It becomes evident from a casual examination of table 4 that the annual water loss from a drainage area is related to the annual temperature. To illustrate this graphically, the mean water loss and mean temperature for each of the areas listed in table 4 were plotted against each other as shown in figure 5. There is a wide scattering of the points, but there is nevertheless a well-defined trend in their general relation. Short records and inadequate data may contribute somewhat to the scattering. If the water-loss data had been plotted against total degree-days above 32° F., there would probably have been a closer correlation, especially for those points for lower prevailing temperature near the left side of the graph.

TABLE 4.—*Summary of precipitation, water loss, and temperature for selected areas.*

Gaging station	Period studied (water years)	Mean annual precipitation (inches)	Mean annual water loss (inches)	Mean annual temperature (°F.)
South Branch of Nashua River at Clinton, Mass	1904–33	43.8	22.0	47.8
Sudbury River at Framingham Center, Mass	1903–33 [1]	42.8	24.5	47.9
Lake Cochituate outlet at Cochituate, Mass	1904–33	41.9	23.2	47.9
West River at Newfane, Vt	1920–23 1929–33	46.5	21.5	42.3
Swift River at West Ware, Mass	1920–34	45.4	23.1	47.9
Middle Branch of Westfield River at Goss Heights, Mass.	1920 1922–34	45.6	19.6	46.8
Clearfield Creek at Dimeling, Pa	1921–34	42.0	21.8	50.1
Swatara Creek at Harper Tavern, Pa	1921–34	42.7	21.5	50.7
Upper Little Swatara Creek at Pine Grove, Pa	1921–32	42.0	20.7	50.8
Oconee River near Greensboro, Ga	1904–13 1915–23	50.7	30.2	61.1
Chattahoochee River near Norcross, Ga	1905–23	58.2	30.0	58.9
Conecuh River near Andalusia, Ala	1910–19 [1] 1931–33	53.0	34.1	65.7
East Fork of Tombigbee River near Fulton, Miss	1929–33	58.6	39.6	63.0
Pearl River at Edinburg, Miss	1929–33	55.5	38.8	64.8
Red Bank Creek at St. Charles, Pa	1921–34	39.5	19.4	46.4
Miami River at Dayton, Ohio	1894–1918	37.7	25.8	51.2
West Fork of White River near Noblesville, Ind	1916–21 1930–33	37.5	24.2	52.6
Tittabawassee River at Freeland, Mich	1913–14 1916–20 1932–34	29.7	20.4	45.0
Red River at Fargo, N. Dak	1919–23 1925–33	20.8	20.3	42.4
Red River at Grand Forks, N. Dak	1917–34 [1]	20.9	19.7	40.6
La Crosse River near West Salem, Wis	1915–19 [1] 1922–25 1928–34	30.3	20.3	44.8
Kickapoo River at Gays Mills, Wis	1915–19 [1] 1922–25 1928–33	31.1	21.8	43.8
Blackwater River at Blue Lick, Mo	1923–33	38.6	30.9	55.3
South Grand River near Browningtn, Mo	1922–33	38.0	30.5	56.1
Little Arkansas River at Valley Center, Kans	1923–33	29.0	27.4	56.4
Walnut River at Winfield, Kans	1923–33	32.4	27.8	57.2
Neches River near Rockland, Tex	1926–34 [1]	44.9	35.8	66.2
Angelina River near Lufkin, Tex	1926–34 [1]	46.0	35.0	65.4

[1] Period studied differs from that in tables 1 and 2.

MAP OF THE UNITED STATES SHOWING DETERMINATIONS OF MEAN ANNUAL WATER LOSS, IN INCHES, FOR SELECTED RIVER BASINS.



MAP OF THE UNITED STATES SHOWING GENERALIZED LINES OF MEAN ANNUAL WATER LOSS AND LINES OF MEAN ANNUAL TEMPERATURE.

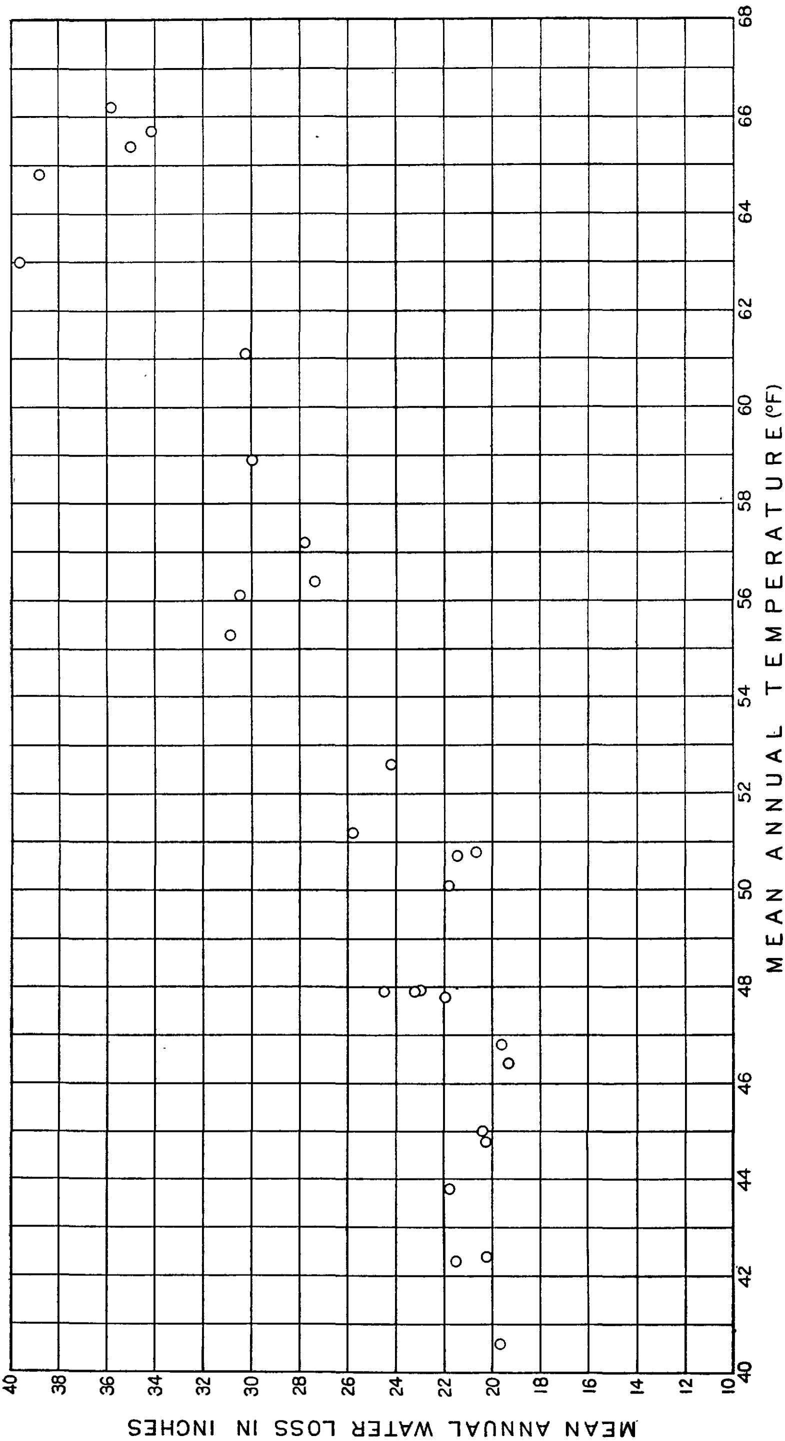


FIGURE 5.—Comparison of mean annual water loss and mean annual temperature for selected basins with mean annual precipitation in excess of 20 inches.

TABLE 5.—*Precipitation, water loss, and temperature, by water years*

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
South Branch of Nashua River at Clinton, Mass	1904	47.6	24.0	45.8
	1905	41.7	23.5	45.8
	1906	46.7	25.3	48.6
	1907	40.4	22.3	44.7
	1908	47.4	20.4	48.3
	1909	43.3	24.6	47.8
	1910	37.3	19.6	48.7
	1911	34.2	23.4	47.6
	1912	41.1	19.8	47.2
	1913	41.4	24.6	49.8
	1914	41.1	18.7	48.1
	1915	42.1	25.0	48.4
	1916	47.3	19.4	47.5
	1917	34.4	17.5	46.7
	1918	41.0	23.4	46.1
	1919	47.0	23.5	49.7
	1920	54.0	20.9	46.8
	1921	45.7	19.1	50.8
	1922	53.9	24.9	48.2
	1923	38.8	16.3	47.0
	1924	49.3	23.3	47.9
	1925	36.6	22.4	48.1
	1926	37.3	18.3	45.0
	1927	50.1	28.6	47.1
	1928	56.5	20.2	48.3
	1929	36.8	14.3	48.8
	1930	34.4	22.8	48.9
	1931	47.0	26.7	48.6
	1932	42.6	24.4	49.5
	1933	56.8	23.7	49.0
Sudbury River at Framingham Center, Mass.[1]	1903	48.0	20.7	48.1
	1904	46.0	25.2	45.7
	1905	41.0	25.3	45.5
	1906	41.5	23.6	48.2
	1907	40.2	24.8	44.6
	1908	44.2	21.6	47.9
	1909	39.9	26.8	47.9
	1910	35.7	23.8	48.6
	1911	35.0	26.8	47.6
	1912	41.5	23.1	47.3
	1913	44.1	30.6	49.8
	1914	41.5	22.8	48.1
	1915	40.7	27.5	48.3
	1916	43.8	23.0	47.5
	1917	38.7	24.5	46.9
	1918	42.8	28.0	46.2
	1919	43.1	24.0	49.8
	1920	46.9	19.4	47.0
	1921	43.7	26.3	50.4
	1922	50.2	29.1	48.8
	1923	37.4	18.8	47.1
	1924	49.1	25.6	47.9
	1925	36.6	24.0	48.7
	1926	41.7	23.9	45.8
	1927	44.9	26.7	47.1
	1928	55.3	21.3	48.5
	1929	37.1	15.8	49.1
	1930	33.0	24.6	48.9
	1931	45.6	26.3	48.8
	1932	44.0	30.8	49.7
	1933	52.7	24.7	49.6
Lake Cochituate outlet at Cochituate, Mass	1904	45.2	25.9	45.7
	1905	39.6	25.0	45.5
	1906	38.5	21.9	48.2
	1907	38.0	24.2	44.6
	1908	40.4	21.4	47.9
	1909	38.4	25.3	47.9
	1910	34.8	21.5	48.6
	1911	34.9	25.9	47.6
	1912	40.5	11.6	47.3
	1913	44.1	28.7	49.8
	1914	39.4	20.0	48.1
	1915	40.9	26.4	48.3
	1916	42.5	18.6	47.5
	1917	38.0	23.9	46.9
	1918	42.3	26.5	46.2
	1919	42.9	22.9	49.8
	1920	48.3	17.4	47.0
	1921	46.6	25.2	50.4
	1922	51.2	27.4	48.8

[1] Period studied differs from that in tables 1 and 2.

TABLE 5.—*Precipitation, water loss, and temperature, by water years*—Continued

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
Lake Cochituate outlet at Cochituate, Mass.	1923	36.4	16.8	47.1
	1924	49.1	27.7	47.9
	1925	35.0	22.2	48.7
	1926	41.4	22.6	45.8
	1927	45.7	27.6	47.1
	1928	48.9	21.6	48.5
	1929	35.6	15.0	49.1
	1930	32.2	23.5	48.9
	1931	47.8	26.4	48.8
	1932	43.6	30.3	49.7
	1933	54.7	23.5	49.6
West River at Newfane, Vt.	1920	36.9	7.5	38.9
	1921	38.8	13.8	46.0
	1922	41.6	14.8	41.5
	1923	31.7	12.9	39.0
	1929	42.1	14.8	42.2
	1930	38.7	17.5	42.4
	1931	43.5	17.6	43.2
	1932	34.9	11.9	43.4
	1933	48.9	21.5	44.2
Swift River at West Ware, Mass.	1920	51.5	21.3	46.6
	1921	50.2	20.9	50.7
	1922	52.9	24.3	48.0
	1923	38.2	15.3	46.6
	1924	44.9	21.7	47.8
	1925	38.7	23.5	47.9
	1926	36.8	17.7	44.8
	1927	49.1	28.4	46.8
	1928	59.6	26.3	48.2
	1929	37.6	16.8	48.6
	1930	35.7	24.9	48.8
	1931	42.4	28.0	48.6
	1932	41.0	24.5	49.3
	1933	53.1	28.5	48.9
	1934	50.0	24.0	46.5
Middle Branch of Westfield River at Goss Heights, Mass.	1920	53.3	20.9	45.0
	1922	48.6	19.2	46.9
	1923	37.3	17.2	45.2
	1924	49.9	20.4	46.2
	1925	42.0	20.6	47.2
	1926	39.1	15.1	44.4
	1927	45.8	24.0	45.2
	1928	65.2	18.4	47.0
	1929	35.6	10.1	47.5
	1930	38.9	22.9	47.8
	1931	41.1	22.5	47.8
	1932	34.3	15.9	41.0
	1933	60.8	27.8	48.5
	1934	46.1	19.9	45.2
Clearfield Creek at Dimeling, Pa.	1921	46.5	26.2	53.0
	1922	38.1	16.2	51.0
	1923	38.3	22.3	49.8
	1924	53.7	23.5	48.0
	1925	30.7	17.2	50.6
	1926	43.6	23.2	47.3
	1927	44.6	14.6	48.6
	1928	53.3	19.5	49.8
	1929	40.4	22.3	50.4
	1930	37.7	19.1	50.6
	1931	37.8	26.4	50.6
	1932	35.7	19.9	52.2
	1933	50.5	30.4	50.9
	1934	36.6	24.0	48.9
Swatara Creek at Harper Tavern, Pa.	1921	40.2	19.1	53.6
	1922	43.2	21.3	51.1
	1923	33.7	20.3	50.1
	1924	54.7	24.0	49.3
	1925	35.7	15.3	50.4
	1926	45.8	20.3	48.2
	1927	43.5	17.8	48.8
	1928	54.4	23.0	50.5
	1929	41.2	24.3	51.2
	1930	34.8	15.5	51.8
	1931	30.8	22.6	51.4
	1932	34.0	22.2	53.3
	1933	65.3	31.4	51.6
	1934	40.0	24.1	49.0
Uperp Little Swatara Creek at Pine Grove, Pa.	1921	43.1	18.9	53.6
	1922	44.5	21.4	51.1
	1923	35.0	20.0	50.1
	1924	56.6	24.8	49.3
	1925	36.2	16.2	50.4

TABLE 5.—*Precipitation, water loss, and temperature, by water years*—Continued

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
Upper Little Swatara Creek at Pine Grove, Pa	1926	47.0	21.4	48.2
	1927	42.4	15.9	48.8
	1928	56.7	24.3	50.5
	1929	42.0	24.5	51.2
	1930	35.8	18.6	51.8
	1931	29.8	20.3	51.4
	1932	34.3	21.7	53.3
Oconee River near Greensboro, Ga	1904	31.5	20.7	59.6
	1905	39.7	28.5	60.4
	1906	64.6	40.2	60.4
	1907	43.3	27.3	61.8
	1908	58.8	32.3	60.6
	1909	54.4	31.1	61.8
	1910	46.6	28.3	60.1
	1911	37.0	25.3	62.0
	1912	68.3	39.7	59.9
	1913	48.3	28.9	61.1
	1915	54.0	34.0	59.5
	1916	50.7	32.5	61.1
	1917	51.1	32.9	60.3
	1918	40.4	28.2	59.4
	1919	60.7	35.1	62.7
	1920	63.0	28.3	61.8
	1921	39.6	22.0	63.5
	1922	57.1	32.3	62.9
	1923	54.1	25.9	62.7
Chattahoochee River near Norcross, Ga	1905	49.3	29.2	58.0
	1906	71.8	36.3	58.5
	1907	44.9	16.2	59.6
	1908	56.4	25.0	58.2
	1909	65.7	30.9	59.4
	1910	50.8	26.6	58.1
	1911	43.4	25.4	59.8
	1912	76.7	41.2	58.0
	1913	54.2	29.1	59.4
	1914	37.0	24.0	59.0
	1915	64.6	38.0	57.9
	1916	64.4	31.9	59.2
	1917	62.0	31.4	58.4
	1918	45.1	26.3	57.4
	1919	63.3	28.9	59.5
	1920	79.8	38.9	58.6
	1921	52.8	25.1	60.3
	1922	64.6	32.7	60.6
	1923	59.5	32.5	59.6
Conecuh River near Andalusia, Ala.[1]	1910	42.5	30.3	65.1
	1911	44.5	35.3	67.0
	1912	70.8	42.8	65.1
	1913	60.3	31.3	66.1
	1914	37.9	28.4	65.5
	1915	52.1	34.5	64.8
	1916	51.5	30.8	66.0
	1917	57.5	37.8	65.8
	1918	36.2	21.9	64.3
	1919	70.0	38.8	65.7
	1931	53.4	35.8	64.4
	1932	53.5	40.3	68.4
	1933	58.8	35.9	66.5
East Fork of Tombigbee River near Fulton, Miss	1929	56.2	40.9	62.8
	1930	45.0	30.4	62.9
	1931	43.2	33.1	61.1
	1932	80.5	54.8	65.2
	1933	68.1	38.8	63.2
Pearl River at Edinburg, Miss	1929	43.5	31.3	64.9
	1930	51.2	35.3	64.6
	1931	45.3	36.2	62.9
	1932	67.2	50.4	66.9
	1933	70.1	40.9	64.5
Red Bank Creek at St. Charles, Pa	1921	41.1	22.1	49.3
	1922	36.6	14.9	47.2
	1923	35.4	18.3	45.8
	1924	45.3	19.9	44.3
	1925	27.6	14.6	45.7
	1926	41.7	22.1	43.5
	1927	43.1	14.1	44.9
	1928	51.6	19.4	46.2
	1929	44.4	18.8	46.1
	1930	37.9	18.0	46.4
	1931	35.5	23.9	46.6

[1] Period studied differs from that in tables 1 and 2.

TABLE 5.—*Precipitation, water loss, and temperature, by water years*—Continued

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
Red Bank Creek at St. Charles, Pa	1932	36.1	18.3	48.6
	1933	41.0	21.4	48.6
	1934	36.2	25.2	46.9
Miami River at Dayton, Ohio	1894	30.6	25.7	53.5
	1895	23.7	20.0	50.5
	1896	45.7	37.6	51.4
	1897	34.5	21.7	51.3
	1898	44.9	30.2	53.3
	1899	32.9	23.2	51.0
	1900	34.2	27.6	52.0
	1901	29.8	24.2	51.5
	1902	32.5	28.7	50.1
	1903	37.4	24.8	52.4
	1904	39.6	26.5	48.3
	1905	39.1	32.0	49.9
	1906	33.7	24.5	51.6
	1907	45.4	28.2	50.8
	1908	39.9	22.2	52.2
	1909	39.5	26.4	51.8
	1910	37.3	22.2	51.1
	1911	42.0	28.1	52.1
	1912	43.5	20.4	49.3
	1913	42.5	18.1	52.5
	1914	33.4	25.1	52.0
	1915	42.0	29.9	50.5
	1916	42.0	22.8	51.6
	1917	36.0	24.6	49.3
	1918	40.7	31.3	48.8
West Fork of White River near Noblesville, Ind	1916	37.0	21.0	51.8
	1917	37.0	23.8	49.5
	1918	31.1	23.8	49.7
	1919	31.6	19.5	53.8
	1920	37.4	20.8	50.7
	1921	40.9	27.1	56.0
	1930	42.3	23.7	52.2
	1931	31.4	27.1	53.2
	1932	41.3	30.1	55.0
	1933	44.6	24.7	53.7
Tittabawassee River at Freeland, Mich	1913	32.8	23.8	45.8
	1914	32.2	24.4	45.6
	1916	28.0	13.0	45.0
	1917	29.2	19.2	42.0
	1918	26.9	17.7	42.2
	1919	34.2	23.0	47.4
	1920	30.3	22.6	42.8
	1932	30.7	22.9	48.2
	1933	28.2	18.7	47.0
	1934	24.7	18.5	44.4
Red River at Fargo, N. Dak	1919	22.9	22.4	43.9
	1920	25.7	24.4	39.0
	1921	23.7	22.9	45.2
	1922	18.5	17.3	42.0
	1923	23.1	22.5	41.6
	1925	22.1	21.7	43.0
	1926	17.6	17.3	41.7
	1927	25.1	24.4	41.1
	1928	23.2	22.6	40.6
	1929	15.5	14.9	41.0
	1930	18.3	17.9	42.6
	1931	20.3	20.1	46.0
	1932	19.6	19.5	43.8
	1933	16.5	16.4	42.8
Red River at Grand Forks, N. Dak.[1]	1917	13.4	12.2	36.9
	1918	19.6	19.1	38.3
	1919	23.0	21.8	42.4
	1920	18.8	17.1	37.3
	1921	22.4	21.6	43.7
	1922	22.5	21.2	40.8
	1923	18.8	18.1	40.2
	1924	20.7	20.3	40.6
	1925	22.8	22.1	41.1
	1926	18.7	18.1	40.4
	1927	22.5	21.1	39.2
	1928	21.3	20.3	39.3
	1929	15.8	15.0	39.7
	1930	18.0	17.4	41.2
	1931	19.7	19.5	44.5
	1932	17.9	17.6	42.7
	1933	16.5	16.3	41.4
	1934	14.7	14.6	41.2

[1] Period studied differs from that in tables 1 and 2.

TABLE 5.—*Precipitation, water loss, and temperature, by water years*—Continued

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
La Crosse River near West Salem, Wis.[1]	1915	32.4	22.3	43.7
	1916	31.6	20.2	44.6
	1917	35.8	24.7	40.5
	1918	28.6	16.7	41.8
	1919	28.9	18.6	47.4
	1922	30.4	20.2	44.7
	1923	25.5	16.9	44.4
	1924	34.4	24.1	42.8
	1925	30.0	19.5	45.6
	1928	36.2	24.8	44.2
	1929	31.9	20.6	44.0
	1930	25.4	16.3	45.5
	1931	22.6	15.3	48.4
	1932	34.2	23.8	47.6
	1933	28.9	19.8	45.9
	1934	27.5	20.3	45.9
Kickapoo River at Gays Mills, Wis.[1]	1915	33.2	25.0	42.4
	1916	31.6	21.5	43.3
	1917	40.0	28.9	39.2
	1918	30.0	19.3	40.7
	1919	32.6	24.4	46.2
	1922	30.1	20.2	44.1
	1923	26.5	17.5	43.7
	1924	38.4	28.7	41.9
	1925	29.3	20.5	44.8
	1928	31.2	19.2	43.5
	1929	29.6	18.6	43.0
	1930	25.0	16.9	44.6
	1931	22.6	16.6	47.3
	1932	35.0	26.6	46.5
	1933	31.8	22.8	45.7
Blackwater River at Blue Lick, Mo	1923	38.7	33.4	55.5
	1924	40.3	32.5	53.0
	1925	32.3	29.1	56.3
	1926	42.4	34.8	53.7
	1927	50.6	34.8	54.6
	1928	38.7	28.7	55.1
	1929	54.9	31.9	54.2
	1930	27.0	24.7	55.3
	1931	30.8	29.2	56.8
	1932	38.0	33.2	57.8
	1933	31.4	27.5	55.9
South Grand River near Browningtor, Mo	1922	38.9	26.3	56.9
	1923	35.0	30.4	56.3
	1924	41.0	33.1	54.5
	1925	35.7	30.8	57.7
	1926	36.0	30.8	54.8
	1927	50.0	34.7	55.5
	1928	41.5	33.5	55.4
	1929	50.2	29.8	54.9
	1930	29.7	27.9	56.1
	1931	31.5	29.9	56.6
	1932	34.3	30.3	58.2
	1933	32.0	29.3	56.4
Little Arkansas River at Valley Center, Kans	1923	34.7	31.5	57.0
	1924	26.0	24.1	54.7
	1925	26.0	25.6	57.5
	1926	23.6	23.3	55.3
	1927	43.4	40.3	55.6
	1928	28.4	26.4	55.9
	1929	34.2	31.1	55.3
	1930	28.9	27.9	56.4
	1931	23.7	23.3	57.5
	1932	29.4	28.3	57.6
	1933	20.7	19.9	57.4
Walnut River at Winfield, Kans	1923	35.2	29.3	57.6
	1924	32.8	29.4	55.2
	1925	25.8	24.9	58.6
	1926	29.9	28.3	56.0
	1927	49.6	37.4	56.4
	1928	31.0	23.3	57.0
	1929	41.0	30.4	56.3
	1930	28.0	26.2	57.1
	1931	29.8	27.4	58.1
	1932	31.6	28.1	59.2
	1933	22.0	21.0	58.2

[1] Period studied differs from that in tables 1 and 2.

TABLE 5.—*Precipitation, water loss, and temperature, by water years*—Continued

Gaging station	Water year	Annual precipitation	Annual water loss	Annual temperature
Neches River near Rockland, Tex.[1]	1926	53.2	39.9	65.2
	1927	46.2	34.6	67.9
	1928	38.9	35.6	66.0
	1929	48.3	38.5	65.4
	1930	42.8	35.6	65.0
	1931	42.0	34.1	64.5
	1932	51.2	37.6	68.1
	1933	44.5	37.1	65.9
	1934	37.3	29.1	68.1
Angelina River near Lufkin, Tex.[1]	1926	52.0	35.9	64.4
	1927	44.8	34.3	67.1
	1928	38.5	33.8	65.2
	1929	47.5	38.4	64.7
	1930	44.8	35.7	64.8
	1931	42.3	33.0	64.0
	1932	54.5	33.2	67.0
	1933	50.2	40.2	64.5
	1934	39.1	30.5	67.2

[1] Period studied differs from that in tables 1 and 2.

To illustrate further the relation between water loss and temperature, generalized lines of mean annual water loss were drawn through the water-loss data plotted in plate 1. These lines are shown in plate 2. The solid lines are defined by data given in this report, and the dashed lines are based on interpolations or on mean water loss as determined from published maps showing mean annual precipitation and mean annual run-off.[10]

Superimposed on plate 2 are heavier lines showing mean annual temperature as compiled by the Weather Bureau. The increase in annual water loss with an increase in average temperature is clearly indicated from this comparison.

It is interesting to note that the water-loss lines shown in plate 2 turn at about 95° west longitude and cut the temperature lines practically at right angles. This is due to the fact that the rainfall decreases westward and hence fails by notably increasing margins to satisfy the evaporation losses that otherwise would take place at the prevailing temperatures.

[10] National Resources Board Report, pt. 3, Report of the Water Planning Committee, pp. 292, 300, 1934.

INDEX

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