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FOR THE YEAR 1920

VOLUME 2

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FIRST ANNUAL REPORT

OF THE

Maine Water Power Commission

Augusta, Maine

1920

MAINE WATER POWER COMMISSION

Commission

Edward P. Ricker, Poland, Chairman.
Arthur Chapin, Bangor.
*Bion Bradbury, Jr., Portland.
Charles H. Hanson, Saco.
Alfred K. Ames, Machias.
Charles F. Flagg, Portland.
William J. Crawshaw, Auburn.
Edward Evans, Belfast.
J. Frank Partridge, Waterville.

George C. Danforth, Chief Engineer.
Member American Society Civil Engineers.
Miner R. Stackpole, Assistant Engineer.
In charge of hydrographic work.
Howard J. Williams, Assistant Engineer.
Freeman F. Burr, Geologist.
Lena R. Pierce, Clerk.
Harold K. Barrows, Consulting Engineer.
Dam and Reservoir Estimates.
Member American Society Civil Engineers.

Cooperating Agency.

U. S. Geological Survey.
Dr. George Otis Smith, Director.

* Deceased.

CONTENTS

LIST OF PLATES

CHAPTER 132, LAWS OF 1919

An Act to Create the Maine Water Power Commission

Sec. 1. The governor shall appoint ten citizens of the state as hereinafter provided, who shall constitute a commission to be known as the Maine Water Power Commission. Three of the commissioners shall be appointed with the advice and consent of the council; one commissioner shall be a member of the senate of the seventy-ninth legislature, to be appointed upon recommendation of the president of the senate; two commissioners shall be members of the house of representatives of the seventy-ninth legislature, to be appointed upon recommendation of the speaker of the house; one commissioner shall be a member of the Maine State Board of Trade, to be appointed upon recommendation of said board; one commissioner shall be a member of the Maine State Grange, to be appointed upon recommendation of the said grange; one commissioner shall be a member of the Maine State Federation of Labor, to be appointed upon recommendation of the said federation; and one commissioner shall be a member of the Savings Bank Association of Maine, to be appointed upon recommendation of said association. The members of the commission shall be appointed within thirty days after this act shall take effect; they shall hold office for two years and the chairman of the commission shall be designated by the governor. Any vacancy occurring in said commission shall be filled in the same manner as by original appointment and recommendation, but such appointment shall be only for the unexpired portion of the term in which such vacancy occurs. The members of said commission shall each receive five dollars per day while engaged upon work of the commission, and they shall also be paid their actual and necessary expenses incurred in the performance of their duties, except that the members of the legislature, serving hereon, shall receive no per diem compensation. Should either the Maine State Board of Trade, Maine State Grange, Maine State Federation of Labor or Savings Bank Association of Maine fail to recommend a member within thirty days after this act shall take effect, or if after appointment in accordance with the terms of this act a vacancy should occur with reference to one or more of the representatives of the within named organizations, and such organization whose representation has become vacant shall fail within thirty days thereafter to recommend one of its members for such vacancy, the governor shall, with the advice and consent of the council, within thirty days thereafter appoint a citizen of the state to fill such vacancy. No member or employee of said commission shall have any official or professional connection or relation with, or hold any interest in, or stock or securities in any water power or water storage reservoir company operating within the State of Maine. No commissioner shall hold any other office of profit or trust under the government of the United States or of this state, except that members of the seventy-ninth legislature may be appointed to serve on this commission as herein provided, but such members shall not be candidates for re-election to the state legislature while serving as commissioners hereunder; nor shall any commissioner serve on or under any committee of any political party. Commissioners under this act may hold the office of justice of the peace and notary public. Any wilful violation of the provisions of this act by any commissioner shall constitute sufficient cause for his removal by the governor with the advice and consent of the council.

Sec. 2. The commission may employ a competent engineer with the title of chief engineer, who shall have charge, under the direction of the commission of the operations under this act. The chief engineer is hereby authorized and empowered to employ, subject to the approval of the commission, such engineers, stenographers, clerks and other subordinates as he may find necessary to carry out the provisions of this act, but he shall not incur any expense in excess of the amounts annually appropriated by the state for this purpose.

Sec. 3. The commission shall adopt and have a seal and shall be provided with a suitable office at the state house in which its records shall be kept. On or before January first, nineteen hundred and twenty-one the commission shall render, to the governor and council, a report showing the progress made in its investigations and this report shall be transmitted to the next legislature. If the commission is unable to render a complete report with its final recommendations thereunder on the date herein specified, it shall give the reasons therefor together with an estimate as to what further time will be needed to complete its work and render a complete report.

Sec. 4. The commission shall preserve all information heretofore collected by the state water storage commission and public utilities commission and shall thoroughly investigate the water power resources within the State of Maine, the flow of rivers and their drainage area, the location, nature and size of the lakes and ponds in the state and their respective value and capacity as storage reservoirs and such other hydrographic data as they shall deem of value in determining the best methods for the immediate improvement and development of water power resources within the state.

Sec. 5. The commission shall investigate and report upon what rights remain to the state in the storage reservoirs and basins and in the developed and undeveloped water powers within the state, and whether these rights are in any respect being curtailed or otherwise being adversely affected by any person, firm or corporation, and, if it deems it advisable to do so, shall investigate the present ownership of the water power resources within the state and describe each water power whether developed or undeveloped within the state to which the state has title, complete or partial.

Sec. 6. The commission shall investigate and report upon the question of the transmission beyond the confines of the state of electric current generated within the limits of the state; it shall render an account of all corporations having the right to so transmit electric current and of the amount thereof now being so transmitted by any and all such corporations and by individuals; and they shall investigate and report upon any and all violations of section one, chapter sixty of the revised statutes of Maine. The attorney general shall act as counsel for the commission.

Sec. 7. The commission shall investigate the present water power developments within the state with the view to determine whether it is for the interest of the state that the storage reservoirs and basins and the undeveloped water powers within the state be acquired and developed by the state or by private enterprise. If the commission is of the opinion that it is for the best interests of the people of the state to have the storage reservoirs and basins and the undeveloped water powers developed by private enterprise, as had been done in the past, the commission shall, if practicable, report some plan whereby the present owners of these storage reservoirs and basins and undeveloped water powers may be encouraged to immediately develop them for the best interests of all the people of the state. If the commission is of the opinion that the state itself should acquire and develop these storage reservoirs and basins and undeveloped water powers, the commission shall report a plan for the same.

Sec. 8. The commission is hereby given full power and authority to administer oaths, compel the attendance of witnesses, the production of books and papers, to punish for contempt and to do everything necessary and proper to secure all the facts required to properly place before the people of the state, the true situation in regard to the present status and future possibilities of the water power resources of the state, and at as early a date as possible the commission shall present a comprehensive and practicable plan whereby the water power resources of the state may be conserved, used and developed for the benefit of all the people of Maine.

Sec. 9. Every person, firm or corporation before commencing the erection of a dam for the purpose of developing any water power in this state, or the creation or improvement of a water storage basin or reservoir for the purpose of controlling the waters of any of the lakes or rivers of the state, shall file with said commission for its information and use copies of plans for the construction of any such dam or storage basin or reservoir, and a statement giving the location, height and nature of the proposed dam and appurtenant structures and the estimated power to be developed thereby; and in case a dam is to be constructed solely for the purpose of water storage and not for the development of a water power at its site, plans and statements shall be filed with the commission showing the extent of the land to be flowed, the estimated number of cubic feet of water that may be stored and the estimated effect upon the flow of the streams to be affected thereby.

Sec. 10. The commission is hereby authorized and directed to confer with the director or the representative of the United States Geological Survey and to accept its cooperation with this state in the prosecution of hydrographic and geological surveys and the preparation of a contour topographical survey and map of this state, which are hereby authorized to be made.

Sec. 11. The public utilities commission is hereby directed to turn over to the Maine Water Power Commission all records, maps, papers, instruments and property that were transferred to it by authority of chapter one hundred and twenty-nine of the public laws of nineteen hundred and thirteen, and also all records, maps and papers that it has since compiled and collected in carrying out the provisions of law directing it to continue the work of the former water storage commission.

Sec. 12. Sections nine, ten, twelve, thirteen and fourteen of chapter fifty-five of the revised statutes are hereby repealed.

Sec. 13. The sum of fifteen thousand dollars for the year nineteen hundred and nineteen, and fifteen thousand dollars for the year nineteen hundred and twenty, or so much as may be necessary is hereby appropriated out of any fund in the treasury of the state not otherwise appropriated, to carry out the provisions of sections one to eleven, inclusive, of this act and any portion of said first mentioned sum of fifteen thousand dollars remaining unexpended on January first, nineteen hundred and twenty shall be available for use by the commission during the year nineteen hundred and twenty and the additional sum of five thousand dollars for the year nineteen hundred and nineteen, and five thousand dollars for the year nineteen hundred and twenty, or so much as may be necessary, is hereby appropriated out of any fund in the treasury of the state not otherwise appropriated to carry out the provisions of section ten of this act relating to the hydrographic and geological surveys to be made in connection with the United States Geological Survey.—(Approved March 29.)

REPORT OF COMMISSION

To the Honorable the Governor and Council of Maine:

Pursuant to the provisions and requirements of Section 3 of Chapter 132 of the Public Laws of the State of Maine for the year 1919, the Maine Water Power Commission herewith respectfully submits its report as follows:

In accordance with the provisions of said chapter, the Commission was constituted by appointment by the Governor of the following members:

EDWARD P. RICKER ARTHUR CHAPIN BION BRADBURY, JR.	Appointed with the advice and consent of the Council.
ALFRED K. AMES	Appointed from the Senate of the Seventy-ninth Legislature upon recommendation of the President of the Senate.
ARTEMUS WEATHERBEE CHARLES H. HANSON	Appointed from the House of Representatives of the Seventy-ninth Legislature upon recommendation of the Speaker of the House.
CHARLES F. FLAGG	Member Maine State Board of Trade, appointed on recommendation of said Board.
EDWARD EVANS	Member State Grange, appointed on recommendation of said Grange.
J. FRANK PARTRIDGE	Member Maine State Federation of Labor, appointed on recommendation of said Federation.
WILLIAM J. CHAWSHAW	Member Savings Bank Association of Maine appointed on recommendation of said Association.

All the above members of the Commission duly qualified with the exception of Mr. Weatherbee and such qualifying members (with the exception of Mr. Bradbury, deceased, June, 1920) have continued to serve since their appointment and qualification.

Mr. Edward P. Ricker was designated by the Governor as Chairman. The Commission was duly organized on the 14th day of August, 1919, with offices at the State House furnished to it in accordance with the provisions of the Act.

As provided in Section 11 of said Act, the Public Utilities Commission turned over to this Commission all the records, maps, papers, instruments and property in its possession relating to the subject matter over which jurisdiction was given to this Commission, and all such documents and property together with all records, maps, papers, instruments and similar property acquired and accumulated by this Commission are properly on file in its office.

Pursuant to the provisions of Section 2 of the Act creating this Commission, at a meeting of said Commission held on August 14, 1919, it selected and employed Mr. George C. Danforth of Augusta, Maine, to act as Chief Engineer of the Commission, in which capacity he has since continued to act. As such Chief Engineer, Mr. Danforth has been in charge under the Commission of its operations and investigations and in the accumulation and tabulation of its data, employing such subordinates as in the opinion of the Commission were necessary for the work and obtainable within the limits of the appropriation provided for the Commission.

In the clerical department there have been employed on the average by the Commission one clerk, and in the engineering and outside investigating force in addition to the Chief Engineer two assistant engineers, one of whom has been employed entirely in connection with the river gaging stations.

Of the general appropriation of $15,000 made for the uses of the Commission for the year 1919, and of a like appropriation for the year 1920, the expenditures were made up as follows (December, 1920, estimated):

	1919	1920
Commissioners	$ 295.00	$ 500.00
Engineers	1,795.41	5,986.74
Observers	504.06	1,177.50
Geologist	25.04	150.00
Special Surveys	333.40	4,828.81
Clerk	285.00	1,219.74
Postage, Tel. and Tel.	56.53	497.18
Printing and Binding	333.15	2,866.84
Travel Expenses	688.07	3,354.35
Equipment and Supplies	1,930.08	3,152.18
Total	$6,245.74	$23,733.34

Of the special appropriation of $5,000 for each of the years 1919 and 1920 for use in carrying on the hydrographic and geological surveys in connection with the United States Geological Survey, there were expended the sum of $5,000 for the year 1919 and the sum of $4,965.08 for the year 1920; such amounts were turned over to the United States Geological Survey and expended by it on areas suggested by the Engineer of this Commission.

The Commission, recognizing the fact that, with the force at its command under the appropriation granted to it by the legislature it would not be enabled to thoroughly investigate the water power and resources of the entire State including the flow of its rivers and the drainage areas and the other matters mentioned in Section 4 of said Act, considered it wiser to confine its attentions more particularly to an investigation of these matters pertaining to the Kennebec River drainage area, with reference to which river there was not in existence any such comprehensive storage system as was in effect under private development on the Androscoggin and Penobscot Rivers. The extent to which the investigations of the Commission have been made and the results thereof appear more in detail in the report of the Chief Engineer to this Commission, a copy of which is attached to and made a part of this report. Reference is also made to said Engineer's report covering the matter of transmission of electric current outside the State as required under Section 6 of the Act.

The Commission has been unable to ascertain that the State at present has any rights in the storage reservoirs and basins and in the developed and undeveloped waters within the State except that limited right of control of the waters in the great ponds within the State stated in the Answers of the Justices of the Supreme Judicial Court to the questions propounded by the House of Representatives under House Order of February 27, 1919, and except such rights as may be vested in the State on account of the control of certain public lots and lands held in trust.

In view of the above-mentioned Answers of the Justices of the Supreme Judicial Court, it has seemed impracticable, if not legally impossible, for the Commission to work out a satisfactory plan for State control of storage reservoirs unless by some proper amendment to the Constitution of the State such work could be legally recognized as a public purpose in the accomplishment of which the State could exercise the right of eminent domain or some special method of assessment of the particular interests to be benefited.

While the Commission has in fact devoted no small amount of time and labor to the consideration and formulation of a definite plan for the development and control of reservoirs and water powers, it has deemed it unwise to undertake to make recommendations in the nature of any definite plan which in the present state of the constitution and laws as judicially construed could not be put in practical operation. If the Constitution should be amended so as to make possible State control in the matters referred to, it has seemed to the Commission that such control could be best applied and most effectively worked out by the creation of certain River Regulating Districts, each of which districts should include at least the whole or definite constituent part of the drainage area of one of the principal rivers of the State. The conditions affecting each of said separate drainage areas would thus be more effectively dealt with and much confusion and conflict of interest which would arise under State-wide control would be avoided. It is the opinion, however, of the Commission that any reasonable or practical attempt to adopt a plan must await a removal of the legal obstacles with which the project is at present confronted. Such a plan has been prepared and it is our intention to submit this plan to the legislature should the necessary constitutional amendment be presented.

The duties devolving upon this Commission by the Act creating it are largely of a technical character presenting intricate legal questions and engineering problems. The interests involved are of great magnitude and scope and if the Commission is to justify its existence it must be made a more compact working body, acting under competent and continuous legal direction. It seems plain to this Commission that a Maine Water Power Commission should be continued for the further investigation and study of the questions committed to this Commission by the Act Creating it. A Commission constituted and directed as we have above suggested we feel confident would justify its creation and the expense of its maintenance. The subject is too large and too intricate to be dealt with by a more or less perfunctory commission whose labors are neither wholly in the nature of a competent, public-spirited gratuity nor of an adequate service adequately paid for.

The interests of the State are greater than those of any person or corporation within it. Why then should it be expected that these greater interests of the State can be properly and effectively administered by methods which private interests would consider wholly inadequate for successful management of their lesser interests?

The Commission desires to express its appreciation of the assistance rendered it from time to time by the Attorney General and his assistant and by the other departments of the State with which it has come in contact, and to express to your Honorable Body its readiness to present for its consideration and for the consideration of the incoming legislature any details of information which it possesses as a result of its labors and investigations.

Respectfully submitted,

EDWARD P. RICKER,

January 1, 1921. Chairman.

REPORT OF CHIEF ENGINEER

Hon. E. P. Ricker, Chairman,
Maine Water Power Commission,
Augusta, Maine.

Dear Sir:

I herewith submit for your consideration a report of the work of this Commission on the topographic, geologic, and hydrographic work in this State since the organization of the Commission August 14, 1919.

Special reports in regard to storage and power surveys, recommended legislation and river discharge data as well as the report of the geologist of the Commission, Mr. Freeman F. Burr, are attached hereto. Particular attention is called to the river discharge work and the radical departure from previous methods of publishing data, also to recommendations in regard to the river and topographic map work and legislation designed to promote the development of water storage reservoirs.

Respectfully submitted,

GEORGE C. DANFORTH,
Chief Engineer.

December 30, 1920.

WATER POWER

WATER POWER

At the time of the writer's appointment as Chief Engineer of this Commission, with the duty of studying a comprehensive plan for the conservation and development of the water powers of the State, the information at hand in regard to these powers was inadequate and the time available for obtaining such information, if a report was to be rendered on January 1, 1921, seemed to be insufficient. As Engineering Council have stated in their report (appended hereto), "We must first know what these resources are." The particular lines of information needed may be summarized as the topographic map of the State, knowledge of the flow of rivers, the location and extent of undeveloped power sites and a census of developed power.

The topographic map work has been continued in so far as the small appropriation permitted and is discussed elsewhere in this report.

The river gaging work has been continued with such improvement of existing stations and addition of new stations as was possible with the funds at hand. This data is of absolutely fundamental importance to engineers and others interested in water power development, and there are large sections of the State where power is available but where sufficient knowledge of the river flow to estimate its amount and value is not available. As several years are required before the data obtained becomes of great value, it is felt that the work should be extended to include these areas.

Surveys of storage and power sites have been carried on during the past year in so far as this was permitted by available funds. Several years will be required to obtain adequate data concerning the more important areas of the State. Certain important sites in the Kennebec basin have, however, been surveyed, data obtained on capacity and effect of the storage on powers below and costs estimated. Surveys and computations of the available power and storage at Long Falls on Dead River have been made, this site being on public lots and, so long as the township remains unorganized, under the control of the State. The results of these surveys appear elsewhere.

A water power census is now being prepared and the data placed on cards which are filed in accordance with the location of the development. When completed it will be in such form as to be kept up to date with a minimum of labor and expense and will furnish data of incalculable value concerning available power, its location and use and possibility of improvement.

The obtaining of the information outlined above is a well-defined function of the State, and the State is the only agency (excluding the Federal government) which can carry on this work on the scale required. If the State is to take place in the industrial and economic world to which it is entitled by its natural resources, this information should be made available with the least possible delay.

POWER DEVELOPMENT

Any policy tending to promote the development of Maine's water power must have a far-reaching effect on the industrial development of the State. Considering power development (as distinct from storage) it is not believed that sufficient knowledge is available, either of our resources, or of the effect on Maine of the Federal power law, for the State to commit itself to a course which if in error would be difficult to retrace.

Further information should be obtained in regard to developed powers and the possibility of improvement. The location, extent, and relation to possible market of undeveloped power sites should also be investigated. Of even greater importance is the present uncertainty in regard to the effect of the Federal Power Law of 1920 on developments in this State. At the time of the passage of this law it was felt that certain of its provisions were dangerous for Maine and an unsuccessful attempt was made to have them changed. As it is probable that certain amendments will be made during the coming year, Maine should have an opportunity to be heard in regard to these amendments, and every effort possible should be made to retain within our own borders the control of our own resources.

It is also probable that the policy of the Federal Commission (at the present time unannounced and probably unformed) will be so clarified during the coming year as to enable recommendations to be made as to a State policy which will not be at variance with the Federal law.

The one outstanding fact in regard to the country's increasing power needs is the necessity for conserving its exhaustible resources such as coal and oil and using its inexhaustible resource—water. With the present methods of developing isolated water power plants the full power of the river cannot get into the system because at times there is more power than the system can absorb. With suitable interconnection there will always be an available reservoir for this surplus power and an enormous source of waste eliminated.

Mr. W. S. Murray, chairman of the Superpower Survey (U. S. Geological Survey) has estimated that the load factor of New England (the ratio between the average load carried and the maximum load) can be increased by means of interconnection and high tension trunk lines from 15% to about 50%. His survey has already elicited some very interesting facts. He states that the average capacity of a central station in the zone surveyed is only 3,200 kilowatts and that the coal consumption is 4.7 lbs. per kilowatt hour. The proposed stations will produce one kilowatt hour for about 2 lbs. of coal. It is also of interest to note that the average steam locomotive uses about 9 lbs. per kilowatt hour and that the average factory is using more, some of them more than 20 lbs. And the average Maine water power is probably a more inefficient development than Mr. Murray's average factory.

A further point to consider is the railroad electrification which should follow the development of the central station interconnected system. Due to the greater efficiency of the electric locomotive, about two-thirds of the coal now used on our railroads would be saved. Nearly as important is the consequent conservation of transportation facilities. Forty per cent of railroad tonnage today is coal, a large amount of which is carried by the road for its own use. Mr. Murray has estimated that in electrifying 20% of the total trackage there would be eliminated the haulage and use of 75% of the total coal of the zone.

In considering future power demands, with even the large amounts of water power undeveloped in Maine, it will be necessary to consider the continued use of coal. There is not enough water power available to fill this future demand and the future must inevitably bring interconnection of tidewater coal stations and hydro-electric stations in systems large enough to eliminate the waste of low capacity, low efficiency plants, the water power being used at high efficiency and the steam plants carrying the peak load.

Wishing to adequately check our conclusions on a matter of such far-reaching importance to the State, it was felt that specialists in engineering and in the application of engineering principles to hydraulic and electrical development should be consulted. It is believed that no higher engineering authority exists today than Engineering Council, the central organization representing the four great national Engineering Societies, which was created to give advice and counsel in public matters relating to engineering. Our opinions were submitted to the Council with a request that they approve or disapprove and make such further suggestions as seemed to them desirable. The matter was then referred to the Committee on Water Conservation, composed of the following men, for study and investigation:

Calvert Townley, Chairman, New York City, President, American Institute of Electrical Engineers.

Charles T. Main, Boston, Past President American Society of Mechanical Engineers.

Allen Hazen, New York City, Consulting Engineer.

Arthur E. Morgan, Dayton, Ohio, Chief Engineer Miami Conservancy District.

M. O. Leighton, Washington, D. C., Consulting Engineer, formerly in charge Water Resources Branch, U. S. Geological Survey.

H. Hobart Porter, New York City, President American Water Works and Electrical Company.

Arthur P. Davis, Washington, D. C., President American Society Civil Engineers; Chief Engineer U. S. Reclamation Service.

Frederick W. Scheidenhelm, New York City, Consulting Engineer.

The reply of the Council is appended hereto in full and is believed to be worthy of careful consideration by the Commission and the legislature.

WATER STORAGE

The Conservation Commission of New York have well stated: "One of the greatest needs of the reconstruction period, as it was in the war period, is for power—actual kinetic energy, and not potential undeveloped power sites." And the first essential in the development of water power is regulation of the stream flow in order that the enormous quantities of water now wasted may be held for use during periods of drought. Power companies already established on our rivers have insufficient water during dry periods to supply their demands without resorting to steam. The equalization of flow by storage reservoirs will immediately effect more efficient operation of existing plants and in addition will encourage further building of hydro-electric plants and transmission lines.

LEGISLATION

Study has been made in so far as the short time at our disposal has allowed of the engineering and economic features involved, and tentative legislation to provide for the development of water storage reservoirs has been framed which is believed to be practical. It is believed, however, that submission of this legislation at the present time would be useless in consideration of the attitude of the Maine courts on the question of public use. In order that this legislation or any alternative plan may accomplish the purpose desired, there seem to be two fundamental requirements—the right of eminent domain for such storage developments, and the right to assess those benefiting by the increased power a sum sufficient to defray the costs of construction and operation.

We believe that the construction of storage reservoirs by the State or by authority delegated by the State for the purpose of improving navigation, preventing floods and forest fires, and for increasing primarily the low water power of such hydro-electric stations as may furnish power for light, heat, electric railroads and (an important future requirement) the electrification of steam railroads, although incidentally furnishing power to other industries, is essentially and in fact a public use. Other states have so held and the Supreme Court of the United States in the case of Mt. Vernon-Woodberry Cotton Duck Co. et al. v. Alabama Interstate Power Co. (No. 200, Oct. term, 1915) in its opinion delivered by Mr. Justice Holmes in regard to the right of eminent domain of the power company states as follows:

"The principal argument presented that is open here, is that the purpose of the condemnation is not a public one. The purpose of the Power Company's incorporation and that for which it seeks to condemn property of the plaintiff in error is to manufacture, supply and sell to the public, power produced by water as a motive force. In the organic relations of modern society it may sometimes be hard to draw the line that is supposed to limit the authority of the legislature to exercise or delegate the power of eminent domain. But to gather the streams from waste and to draw from them energy, labor without brains, and so to save mankind from toil that it can be spared, is to supply what, next to intellect, is the very foundation of all our achievements and all our welfare.

If that purpose is not public we should be at a loss to say what is. The inadequacy of use by the general public as a universal test is established. Clark v. Nash, 198 U. S. 361; Strickley v. Highland Boy Mining Co., 200 U. S. 527, 531. The respect due to the judgment of the State would have great weight if there were a doubt. Hairston v. Danville & Western Ry. Co., 208 U. S. 598, 607. O'Neill v. Leamer, 239 U. S. 244, 253. But there is none. See Otis Co. v. Ludlow Manufacturing Co., 201 U. S. 140, 151."

The opinions and decisions of the Maine Court, however, in particular in the case of Brown v. Gerald (100 Me. 352) and in the answers of the Justices of the Supreme Court to the questions propounded by the House of Representatives on Feb. 27, 1919 (118 Me. 503) lead to the belief that the court would decide adversely on this right of eminent domain, for it has stated that "The great public benefit which is supposed to follow the exercise of this power is not a public use."

While it is believed that sufficient data is at hand to recommend definite legislation for the development of water storage reservoirs and that such legislation will not be inconsistent with the federal laws, it is not felt that this should be submitted to the legislature until the constitution is so amended as to make its passage possible and the legislation can be examined together with such constitutional amendment as may be passed. It is therefore being withheld subject to further direction of the Commission.

REPORT OF ENGINEERING COUNCIL

29 West Thirty-ninth Street, New York.
September 16, 1920.

Maine Water Power Commission,
Augusta, Maine.

Attention of Mr. George C. Danforth,
Chief Engineer.

Gentlemen:

Engineering Council, through its Water Conservation Committee, makes the following reply to the questions which you have placed before it.

You have informed us that, among other things, the Maine Water Power Commission is required by law to investigate and report on:

A. The water power resources of the State.

B. A water power development policy for the State.

A

In order to answer any question about the State's water power resources, it is first necessary to know what those resources are. You have informed us that while it is common knowledge that they are of great magnitude, detailed information regarding them is fragmentary and in many respects incomplete. We advise against attempting to deal finally with the matter of water power resources prior to obtaining more complete information.

The following comments indicate the kinds and extent of the information needed:

Maps

You have informed us that approximately 33% of the State has been mapped by the U. S. Geological Survey working in cooperation with the State. The U. S. Geological Survey's topographical map is one of the most useful types of maps yet devised, showing, as it does, in addition to the information supplied by ordinary maps, the extent of drainage area, the configuration of the land, the fall in streams, the location of reservoir sites and many other data valuable in the consideration of water power. Many of the more important preliminary questions affecting proposed water power developments can be answered at once by the aid of such topographical maps. They are in fact essential to an adequate treatment of water power problems.

If any doubt exists as to the justification of appropriating sufficient State funds to complete the topographical mapping, it should be dispelled by the fact that the value of such maps is by no means confined to water power developments. They are serviceable and effect economies for other purposes important to the welfare of the State.

They are useful and result in economies in locating highways, in designing water supply systems of cities, in swamp drainage and for forestry. Moreover, and by no means of least importance, they are a valuable aid in education and in promoting recreation. The State of Maine is becoming a more and more important vacation ground and the use of topographical maps to further so lucrative a development might alone justify the entire proposed expenditure to complete the mapping.

We are informed that if the State will appropriate the sum of $50,000 per year, it is probable that an equal sum will be contributed by the Federal government for continuing the preparation and publication of topographical maps. It is estimated that by this expenditure the topographical mapping of the State can be completed in eight years. We believe that before a final analysis of the water power resources can be properly formulated by your Commission, a considerably greater part of the State should be mapped. We therefore advise that your Commission support this view and recommend a continuing State appropriation of $50,000 per year for that purpose until the mapping is completed.

Records of Stream Flow

Knowledge of the amount of water available for power development is an essential. To be relied upon the records must be averaged over many years. We recommend the continuation of the daily measurements of stream flow by means of gaging stations maintained in the principal streams by the State in cooperation with the U. S. Geological Survey. Where possible the measuring equipment and the number of gaging stations should be increased, so that information may be recorded not only for the larger, but also for the smaller streams offering possibilities of development, to the end that the information may ultimately be both accurate and complete.

Storage Reservoirs

Storage of flood water for use in dry times is important. You have informed us that the locations and capacities of the large lakes and ponds have been determined, but that the possibilities of additional storage in them above the present high water levels are not known. No doubt there are in addition many storage sites where now no dams or natural ponds or lakes exist. The possession of complete information as to the storage possibilities is essential for the purposes of the Commission. We recommend that surveys necessary to complete the pertinent information be undertaken and carried forward as rapidly as the resources of the Commission will permit.

Progress Report

You have informed us that the Maine Water Power Commission is directed, by the law creating it, to report the progress of its work on or before January 1, 1921.

The State of Maine possesses unusual water power resources. Many of these are but little known and even more are undeveloped. Should the State adopt a policy intended to stimulate development it is obvious that some agency would have to be entrusted with the duty of carrying out that policy. There will be a continuing need for such service. Inasmuch as the State has seen fit to create a Water Power Commission, it would seem appropriate to continue that Commission in order that it may act as such agency in administering water power affairs.

The Commission should properly supervise the making and recording of stream measurements, the investigation, and, when undertaken, the detailed survey of storage possibilities—in fact, continue to study the water power resources of the State. These are matters which cannot be completed in a year or two. The stream measurements should be continued for so long a period that their conduct in effect might be considered a permanent function. The publication of the results of the various water power investigations should likewise be a duty of such agency.

State supervision of topographic mapping and State regulation of rates and service are other essential functions. Whether the latter should be made a duty of the Water Power Commission is optional. However, the regulation of rates and service of hydro-electric companies serving the public should not be separated from that of utilities selling gas or steam-generated electric power.

It is our view that your Commission might well present its recommendations at the end of this year regarding the matters discussed herein and include estimates of cost for the undertakings recommended. Despite perhaps a natural reluctance, in our opinion the Commission should advocate its own permanence. Water power development is too important to risk neglect or failure because of the lack of a suitable fostering agency to deal with its problems.

Water Power Policy

We submit below our views as to certain controlling principles which might well serve as a basis for constructing a State water power policy. The preparation of a detailed comprehensive plan, however, is beyond the province of Engineering Council. In this latter task which may include drafting recommended legislation your Commission should have the continued intensive aid of experts, both legal and technical.

The controlling principles referred to are:

1. The development of the water power resources of the State should be encouraged as true conservation.

The principle is axiomatic. Water power is continually being renewed by precipitation. Coal, oil and gas, on the other hand, cannot be replaced. It is therefore a duty of the present generation, wherever practicable, to utilize this renewable energy and as far as possible to conserve for the future those sources of energy which are not replenishable.

2. In general, development by private capital is preferable to development by the State.

The constitutional competency of the State to engage in the business of developing water powers is a legal question and not within our province. If we may consider only the economic aspects of the question, we believe it to be undesirable to invest public funds in commercial enterprises, but that prosperity is best promoted when the State encourages and protects alike both private initiative and the public interest. There may be an occasional exception to this general rule, and further a State may usually take over any development within its borders at any time by the exercise of the dominant right of eminent domain while the matter of rates and service of corporations is controllable by regulation.

3. In this connection it should not be forgotten that the development of hydro-electric power requires the right of eminent domain. Moreover, this right should in general be paramount to the eminent domain rights of other public utilities. Only with eminent domain can the good of the many prevail over the good of the individual, and since the exercise of this right presupposes public benefit or use, it follows that in the case of water power developments intended to supply the public with electricity, the

public itself will be the gainer. Excessive prices mean higher investment and are reflected in higher rates.

A water power development site may not be changed to avoid an obstacle. Were prior dedication to public use to prevent the exercise of the right of eminent domain many valuable developments would be impracticable if not impossible. By reason of this fact the water power right of eminent domain should be paramount to that of other public utilities. The exercise of the right, however, against another utility should be subject to the prior approval of some public agency, competent and empowered to decide which of two conflicting uses is the higher use.

4. The construction of storage reservoirs intended to equalize the flow of streams should be encouraged.

The effect of reducing the seasonal variations in stream flow is to increase the water power resources commercially available. Benefits may also accrue to navigation, water supply and flood control.

Profits from Water Power

There is a widespread, misleading impression that all water power is cheap and therefore that the profits to be derived from its operation are comparable to those received from the best gold mines. The real facts are quite the reverse. It is true that certain water powers possessing favorable physical conditions and well located as to their markets have been profitable enterprises. On the other hand, the fact is too frequently forgotten that many large developments have been disastrous investments.

The risks involved are unknown to the general public. They range from those of overestimated stream flow and underestimated construction costs through flood damage to that of a too slowly developing market and disastrous steam electric competition. In view of these risks, capital will not be attracted to water power projects unless the investors may expect and may be legally entitled to receive a higher return than they would obtain where great security is afforded, as for example, from real estate mortgages.

Further, a large proportion of the water powers of the United States are not commercial projects because the high fixed charges on the necessarily large investment plus even the resulting low operating costs total more than the sum of the much higher operating costs plus the lower fixed charges of corresponding steam-electric plants. Only a detailed study of each project can determine its commercial feasibility. It has been the experience of the Nation that legislation predicated upon the erroneous ideas above pointed out has resulted merely in stifling or absolutely preventing water power development.

Storage Reservoirs

You have asked us to specify ways and means to secure the construction of storage reservoirs and as to the advisability of State control of such reservoirs. The fourth principle recited above applies to this topic. The details of any plan you may adopt should have the study of your technical and legal experts.

It is pertinent to point out that by granting the right of eminent domain to water power companies, when their output is intended for public use, Maine will materially encourage the construction of storage reservoirs. Greedy property owners would then no longer be able by extortionate demands, to delay or prevent the development of an otherwise commercial project.

Similarly the right of eminent domain would facilitate water storage and river regulation wherever a group might wish to combine and apportion the cost among themselves. However, the refusal to participate by one or more holders of important privileges might require too great an investment by the others and still prevent development. Whether just but compelling legislation covering such cases can be enacted in Maine is a question outside our province. Examples of attempts which have been made to deal with this, as well as other but allied questions, are given by the Conservation Law of New York amended at the last legislative session and the Conservancy Law of Ohio, the latter intended primarily to provide means for flood control. Irrigation laws in some of the arid States and drainage laws in a number of the southern and Mississippi Valley States also indicate possible legal methods of procedure. Whether or not any of these measures will prove effective as aids to water power development is yet to be determined.

State Ownership or Control

Engineering opinion is divided as to the wisdom of State ownership or control and as to its possible extent, therefore, as we conceive our advice to be valuable, if at all, only in so far as it voices the consensus of the views of our profession on non-controversial questions, we refrain from advising you either for or against State ownership or control. Certainly there should be a suitable agency or tribunal to which users of water or of water power might appeal when aggrieved, and if under the present Maine laws the courts do not constitute such a tribunal and court procedure is therefore either slow, cumbersome or ineffective and if this condition would not be corrected by giving power companies the dominant right of eminent domain, then the Water Power Commission might well be authorized to deal with certain phases of the question either as supplementing court procedure or as independent thereof but subject to appeal to the courts by any aggrieved party.

Financing

The method necessary for financing will depend on the policy adopted and perhaps needs to be considered only should State development be decided upon. A fundamental principle in either case, however, is that any financial burden created should be borne by the beneficiaries. In any specific undertaking these might include both the State and private interests as well. While some water power projects will be sufficiently profitable to justify this assumption of considerable burdens and still be attractive to capital, in a large percentage of them the margins of cost by which water power can prevail against steam competition are so small that even comparatively small additional expenses may turn the scale adversely. Inasmuch as the State's interest will be best served by the development of the maximum amounts of power, great caution must be observed in the imposition of financial burdens lest the development of these vast resources shall be retarded or throttled instead of encouraged.

On this account Engineering Council is reluctant to suggest any generally applicable financial policy and believes that if eminent domain be provided by law and the Water Power Commission be given certain powers as before recited, the questions of a State financial policy may well be deferred for later action if and when found desirable.

Log Driving

The use of water for log driving is, generally speaking, no longer a higher use than the use of water for the development of power. In this respect values have been reversed since electricity made water power available at points so remote from its source. The provision of chutes or sluices at dams will reconcile some opposing needs of the two interests, but when vested rights interfere with the use of water for power purposes, the case can be always suitably dealt with through the exercise of the paramount right of eminent domain, under which the logging interests would be properly compensated.

Legislation

You have further asked our opinion as to the practicability of recommending suitable legislation in your progress report to be made by the end of the present year.

We advise the following order of procedure:

1. Adopt a policy.
2. Construct a comprehensive plan for making that policy effective.
3. Obtain advice of counsel as to any constitutional question involved and any necessary legislation.
4. Prepare a draft of any new law desired and submit it as a part of your report.

Should a constitutional amendment be necessary the legislation would have to be deferred, but in that event a draft of such constitutional amendment might be itself submitted with your report. Although the time may be short, a sustained, concentrated effort should accomplish the desired result.

Publication of River Discharge Data

River gagings, studies of reservoir sites, as well as other important data, may wisely be published in your reports. This will draw attention to the resources of the State and give correct information regarding them, thereby aiding the wise development of all resources that can be profitably used.

We regard your proposed form of publication of river discharge data as a distinct improvement over past publications, in that it includes duration tables for each year and for the average of the entire reliable record of each station. Further the distribution of flow throughout the year is to be indicated by mean monthly and annual stream discharges, all on a unit basis. Data omitted because not sufficiently accurate for power studies or for other reasons may be dealt with by appropriate references.

Respectfully submitted,

(Signed) ALFRED D. FLINN,
Secretary.

CALVERT TOWNLEY,
Chairman, Water Conservation Committee.

HEATING BY ELECTRICITY

There seems to be a widespread opinion throughout the State that when our water powers are fully developed, heating of houses by electricity will be not only possible, but economical. It is desirable that this opinion be corrected. Assuming for the moment that the amount of power required could be made available for this purpose, electricity would have to be furnished at a far lower cost than seems to be possible for the cost to be in any way comparable with even the present high price of coal. Anthracite coal is usually taken at about 13,000 British thermal units per pound. If we assume that the average house heating apparatus is 60% efficient, one pound of coal would produce 7,800 effective heat units. Assume also that one kilowatt-hour of electricity contains 3411 B. T. U., and can be used at 100% efficiency. One pound of coal would therefore equal for heating purposes 2.28 kilowatt-hours of electricity. With electricity at 1 cent per kilowatt-hour, the comparative cost of coal would be $45.60 per ton. Electricity today costs about 3 cents per kilowatt-hour in central Maine.

A further consideration in the use of electricity for heating would be the large electric equipment required with the resulting high overhead costs. Unless industries should develop calling for large amounts of power during the warm months, this equipment would lie idle during a large part of the year.

There should also be considered the amount of power required for heating the 160,000 odd homes in Maine. Assuming that these homes use 10 tons of coal each during the seven winter months, one house would use 45,600 kilowatt-hours in seven months, an average demand of 9 kilowatts. For 160,000 homes this would total about 1,500,000 kilowatts, or roughly, 2,000,000 H. P. Due to lack of maps and information for use in forming an estimate, no accurate figure on the total power is available. It is not, however, believed that the total developed and undeveloped power of the State will exceed 1,500,000 H. P. If all industrial needs were neglected this would be insufficient as a general source of heat.

It may be pertinent to mention the fact that although as a source of general heating electricity cannot be considered at the present time, it has a definite value under certain conditions. As an auxiliary to other systems for certain rooms which need more heat than is supplied by the primary heating installation, the electric radiator may be economically used. During spring and fall it will be far more convenient and probably fully as economical to use electric radiators, provided the need is for an hour or two in the morning or evening.

Attention may be called to the fact that luminous radiators which throw off radiant heat warm only objects which are opaque to the rays, without heating the air through which the rays pass. Radiators should preferably be arranged to warm air passing over the heated surfaces.

For use in cooking it will be found that electricity, although of considerably greater first cost, is often more economical than coal. Carpenter states that probably less than 1% of the heat units burned in a coal range are usefully applied in cooking, the remainder being radiated into the room and diffused. On the contrary the heat from the electrical current can be utilized without appreciable loss.

It has been stated that some unforeseen improvement in generating or transmitting equipment might so cheapen electricity as to make it economically possible for heating. Even were a sufficient amount available for such use, however, it would be proportionately cheapened for power purposes and the demand for power would be the governing factor. Our efforts should be directed toward the development of electric power, not toward the visionary project of electric heating.

WATER POWER AND STORAGE INVESTIGATIONS

During the summer and fall of 1920 a considerable amount of work was done in connection with possible storage developments on the upper Kennebec waters and storage and power possibilities at Long Falls on Dead River, the latter site being on public lots and under State control.

The following surveys and maps were made:

1. Proposed dam site Long Falls, 1:600; 5 ft. contours.
2. Flowage map Long Falls, 1:24,000; 2 ft. contours.
3. Proposed dam site at West Outlet, Moosehead Lake, 1:1200; 1 ft. contours.
4. East Outlet, Moosehead Lake, 1:1200; 1 ft. contours.
5. Proposed dam site, East Outlet, 1:1200; 2 ft. contours.
6. Flowage map from plan No. 5 to Lake, 1:20,000; 5 ft. contours.
7. Brassua Lake outlet to Gaging Station, 1:20,000; 5 ft. contours.
8. Proposed dam site Brassua Lake outlet, 1:1200; 2 ft. contours.
9. Brassua Lake, 1:48,000.

All the proposed dam sites were visited by the geologist of the Commission in company with the writer and his report appears in the following pages.

In October, 1920, all available information, maps and river discharge data were turned over to Mr. H. K. Barrows, Consulting Engineer, and he was requested to study the question of storage, suitable dam types, costs and damages due to flowage at specified elevations. This information is incorporated in the following report. It is to be regretted that funds were not available for making borings at the dam sites, but it is believed that the information at hand is sufficient for preliminary study.

Special attention may be called to the table on effect and cost of storage on the Kennebec, in particular to the increase in low water horsepower. At Waterville, for instance, on the 23 ft. Hollingsworth & Whitney dam there is an increase of low water power from 3580 H. P. to 7140 H. P.; at Skowhegan from 4600 H. P. to 9200 H. P.; at Bingham from 8120 H. P. to 21,950 H. P., the whole averaging in cost for developed and undeveloped power .07c per kilowatt hour of increase in the total power.

The investigation of the suggested Long Falls development was not undertaken in the belief that it would be of great value as an isolated development, but it was felt that it would be of considerable value if interconnected with trunk lines that will eventually follow the course of the Kennebec River.

We regret our inability to report in full on the Saco River storage. The need of storage is great and studies of the proposed developments should be made at the earliest possible date. Although the relatively large cost of necessary surveys and the lack of time at our disposal has prevented such studies during the past year, it is hoped to have them available for the next report.

December 24, 1920.

Mr. George C. Danforth, Chief Engineer,
Maine Water Power Commission,
Augusta, Maine.

Dear Sir:—

In accordance with your direction I submit the following report upon storage developments on the Kennebec River.

SCOPE OF REPORT

Since my report upon the water power resources of the Kennebec River in 1918, a considerable amount of additional information has been obtained by the Maine Water Power Commission with particular reference to storage projects on the Kennebec River.

It is the purpose of this report to utilize the additional information now available in a more specific report with reference to the development of storage in Moosehead Lake and lakes above that point, giving revised cost estimates based upon the better information now available.

The effect of storage upon the various water power plants now developed on the Kennebec River, as well as upon future developments, will also be discussed and an estimate given showing, as far as this is practicable, what the cost of storage would be at each site on the river and the benefits that would be obtained thereby at these sites.

BASIS FOR FLOW AND POWER ESTIMATES

The investigations made in 1918 on the Kennebec River were based fundamentally on data of flow of the river, (1) at The Forks, (2) at Waterville for the period 1902-16, inclusive, which was the length of period then available for the record at The Forks. Since 1918 additional data of flow at both Waterville and The Forks, and also a year's record of flow on Moose River at Rockwood and the Kennebec River at East Outlet near Moosehead Lake have been obtained. The inclusion of these additional records would however but slightly modify the results of power estimates and effect of storage as prepared for the 1918 report. It has not been thought worth while, therefore, to revise these studies as the amount of work involved is quite large, until flow data are extended over several more years and better information obtained, particularly with respect to the yield of Moose River and from the outlet of Moosehead Lake.

BASIS FOR COST ESTIMATES

The estimates of cost made for the 1918 report were on the basis of approximately normal or pre-war costs. As the time of recurrence of such normal costs now appears to be rather remote and there is a serious question whether the former cost basis will eventually be reached, the estimates of cost prepared for this report are based on the approximate normal or pre-war costs plus about 25%, which would seem to be a reasonable cost basis to assume as likely to occur in the course of a few years.

While a considerable amount of specific information is now available on which to base cost estimates, this report must still be of a preliminary nature, as will be noted, awaiting the results of test borings at the several dam sites for which surveys have been made, as well as surveys of certain details not yet completed.

BRASSUA LAKE

General Statement

Brassua Lake on Moose River affords an excellent opportunity for additional storage on the Upper Kennebec as it lies in a practically uninhabited district, so that the cost of the project will be very largely construction work.

In the 1918 report the location of a dam about 700 feet below the outlet of the lake was suggested, with spillway level at Elev. 1061, or practically 20 ft. above low water level of the lake, affording a storage capacity of about five billion cubic feet at a total cost of $200,000, or about $40 per million cubic feet of storage. On the basis of 25% additional cost, this figure would now be revised to a total cost of $250,000, or $50 per million cubic feet of storage.

During the present season a survey has been made to cover such a dam for a distance of about 2000 feet from the outlet of the lake and up to a height covering any probable construction limits.

The plan of Brassua Lake made in 1905 by the U. S. Geological Survey, in cooperation with the State, enabled accurate computations of storage capacity to be made up to about Elev. 1060. A careful reconnoissance has been made to give an approximation of storage capacity to higher elevations, the results of this reconnoissance being shown on Fig. 1 hereto appended, on which is shown an approximate contour line at Elev. 1090. On the easterly shore of the lake, north of Moose River, the divide between Brassua Lake and Moosehead Lake reaches a height of at least Elev. 1100, and probably somewhat higher, and it is safe to say that there would be no limitation in height of dam, on account of this divide, up to a spillway level of at least Elev. 1085, which, as will be further noted, is probably as high a dam as is likely to be built.

Other features affected by this storage project are (1) the Canadian Pacific R. R. and (2) a proposed state highway from Jackman to Rockwood, the location of which runs along the southerly end of the lake, but on which as yet no construction work has been done.

Storage Capacity

The available storage in Brassua Lake is large, as will be noted by reference to Fig. 2, on which are shown area and capacity curves for different elevations up to Elev. 1090 and as shown briefly in the following table:

Brassua Lake—Area and Capacity

Eleva. Ft.	Area Sq. Mi.	Total Capacity above El. 1041 Bill. Cu. Ft.
1060	11.2	4.4
1065	12.3	6.0
1070	13.1	7.8
1075	13.9	9.7
1080	14.5	11.7
1085	15.1	13.8
1090	15.5	15.8

As will be further noted, Brassua Lake when developed for storage will afford an effective means of reducing the flood flow into Moosehead Lake or, to put it another way, the regulation of Moosehead Lake during the flood season will be simpler when the Brassua Lake storage is completed.

Dam Site

A careful survey of Moose River outlet has been made, on a scale of 100 feet to the inch, with a contour interval of 2 feet, showing accurately the topographic conditions at the proposed dam site, which is about 1500 ft. below the lake outlet. Unfortunately, available funds have not yet permitted the necessary work of test borings at the dam site, which must be made before recommendation can be made as to the best type of dam to construct at this point as well as accurate estimates of cost. A few test pits have been dug to a depth of 6 to 8 feet and these indicate, as far as they go, the probability of a fairly impervious underlying soil, consisting of gravel and sand with a considerable percentage of clay. No data are available however as to the position of ledge rock in the immediate vicinity of the dam site, although it appears in the form of outcrop on the higher ridges northerly from the dam site.

Basis for Cost Estimates

Cost estimates have been made for a dam with solid concrete spillway section 250 ft. long, with heavy concrete mat extending downstream about 50 ft., flanked by an additional bulkhead section of concrete 120 ft. long, in which would be a gate house with three gates, each 6 ft. x 8 ft., and a log sluice about 6 ft. wide in the clear, so arranged that logs can be sluiced at varying levels of the reservoir and running downstream a distance of about 200 ft. The remaining portion of the dam is estimated on the basis of an earth fill structure with concrete core. The overall length for a dam with spillway at Elev. 1080 is about 2400 ft. and its maximum height about 40 ft. It is likely that a dam of different type may be more advantageous, but lacking the information from test borings and an accurate location of the underlying ledge rock, if any, it was deemed wise to assume a type of dam not necessarily the most economical. Liberal cost estimates have also been made covering the possibility of unfavorable foundation conditions. For study purposes estimates of cost for this project have been made for three different levels of spillway of the dam, viz., 1070, 1075 and 1080.

Effect on Canadian Pacific R. R.

The only portion of the Canadian Pacific R. R. affected by a dam on Brassua Lake would be at a low point in the railroad about 2 miles northwest of Misery Stream and about half way to Brassua Station. At this low point the base of rail is now about Elev. 1082, and for any dam at Brassua Lake with spillway level above about Elev. 1075 the railroad will have to be raised more or less. For a dam with spillway level at Elev. 1080 the length of railroad affected is about 2000 ft., with a maximum raise of tracks of about 7 ft. At present there is no culvert under the railroad at this low point, and in the estimates of cost that have been made a concrete culvert has been assumed, as well as slope paving on both sides of the railroad.

State Highway

The location of the proposed state highway from Jackman to Rockwood crosses the railroad near Tarratine Station and runs in a northeasterly direction around the easterly end of Brassua Lake toward Rockwood. For the greater part of this distance as laid out according to plans furnished by the State Highway Commission, this highway is below Elev. 1090 and a considerable length is below Elev. 1080. In its lowest portion near Brassua Lake, it is at about Elev. 1065. Consequently for any one of the levels of spillway above mentioned, viz., 1070 to 1080, a new location of this highway would be necessary, which will involve moving its location to a sufficient elevation above any proposed reservoir level. No allowance of cost on account of this change of location of the highway has been included, because as yet no construction work has been done and there should be no special difficulty in changing the road location.

Cost Estimates

In the following table are given the general features of cost for the three different assumed levels of reservoir, which, as will be noted, vary from about $547,000 with the spillway level at Elev. 1070 to $827,000 with spillway level at Elev. 1080. Storage capacities above Elev. 1041 are also given and the resulting cost per million cubic feet of capacity. It will be noted that this increases slightly between Elev. 1070 and 1080. The cost per million cubic feet of storage, ranging from about $70 to $71, is however low and there appears to be little question but that the development of Brassua Lake for storage, when made, should be to about Elev. 1080 and possibly somewhat further, depending upon the foundation conditions at the dam site as disclosed by future borings. As will be noted, the cost of changes in the Canadian Pacific Railroad increases rather rapidly with the dam in the vicinity of Elev. 1080, and this would become an item of increasing importance with a still higher dam.

Brassua Lake Storage Project—Cost Estimates

Item	El. of Spillway Level, Ft.		
	El. 1070	El. 1075	El. 1080
Dam	$433,000	$550,000	$675,000
C. P. R.	14,000	20,000	42,000
Land and camps	100,000	104,000	110,000
Total	$547,000	$674,000	$827,000
Storage capacity Bill. Cu. Ft.	7.8	9.7	11.7
Cost of storage per mill. cu. ft.	$70	$70	$71

In these estimates the cost of land has been assumed at $10 per acre. No allowance has been included for clearing the reservoir site of trees and brush, which may be a considerable item if completely carried out.

Effect of Brassua Lake on Flood Discharge at Moosehead Lake Outlet

One of the valuable features of a storage reservoir at Brassua Lake, as previously noted, would be its effect in reducing the flood flow into Moosehead Lake, thereby making possible a closer regulation of the latter and requiring considerably less provision in the way of gates at the East Outlet of Moosehead Lake to handle such flood discharge. To determine the extent of regulation thus afforded by Brassua Lake a careful study has been made, with results as shown on Fig. 3 appended.

As a general basis for flood conditions, data available from the flood on the Kennebec River December, 1901, have been used, this flood being the greatest during a period of at least a hundred years. Data of flood discharge in December, 1901, are available for Waterville, Madison and The Forks, although it must be kept in mind that during this flood the gates at Moosehead Lake were practically all closed, so that little, if any, flood waters came from the 1240 square miles tributary to Moosehead Lake. On the basis therefore of drainage area below Moosehead Lake the maximum flood discharge recorded was as follows:

The Forks	68 sec. ft. per sq. mile
Madison	53.6 sec. ft. per sq. mile
Waterville	51.6 sec. ft. per sq. mile

A study of the data for this period indicates that the observed discharge at The Forks may have been somewhat high, particularly during the latter part of this flood, due to backwater conditions affecting the gage reading. Nevertheless a flood run-off of 68 sec. ft. per square mile has been assumed as possible for any of the streams entering Moosehead Lake. The time distribution of this flood run-off has been assumed similar to that at Waterville, where the record for December, 1901, is much more complete than at the other points, and on this basis the flow into Brassua Lake determined for such a flood period, assuming at the beginning of the flood water to be at the crest level of the dam at Brassua Lake. As the area of Brassua Lake will be about 13 square miles at Elev. 1070 and nearly 15 square miles at Elev. 1080, it is obvious that there will be a marked retardation in flow out of Brassua Lake while the lake level is rising; during which period a considerable portion of the crest of the flood from the remaining area tributary to Moosehead Lake Outlet may be passing off. Evidently, too, the extent of this retardation will be affected considerably by the length of spillway assumed at Brassua Lake dam.

The results of these studies as shown on Fig. 3, assuming, for illustration, a 250 ft. spillway at Brassua Lake, show a maximum depth over the spillway of from 7 to 7.5 feet (depending upon its elevation) and a flood discharge out of Moosehead Lake of from 49,000 to 50,000 sec. ft., as compared to about 85,000 sec. ft. without the retardation effect of Brassua Lake. Moosehead Lake has been assumed to be at high water level at the beginning of the flood and not to be allowed to rise above this level.

The assumption made that the water level in Brassua Lake is at the level of the spillway at the beginning of the flood is a severe one, and in many cases the lake would undoubtedly be only partly filled and therefore a much greater retardation effect obtained.

General Conclusions—Brassua Lake

The results of the studies made indicate that a dam with spillway level at Elev. 1080—possibly somewhat higher—is probably desirable for the Brassua Lake storage project. This level cannot however be fixed definitely in advance of the results of test borings, which should be made as soon as practicable in order that this project may be more definitely laid out and, in advance of its construction, limitations be made of any further road or other construction at any elevation below the limit in level of the necessary land takings for the reservoir. The specific item of importance in this regard at present is the state highway, as previously described.

In the studies of the effect of storage made in this report it will be assumed that Brassua Lake would be raised to about Elev. 1081, affording about 12 bill. cu. ft. of storage at a cost of about $860,000 or $72 per mill. cu. ft.

MOOSEHEAD LAKE

General Statement

Moosehead Lake, with its great water area, is of most importance in the general problem of regulating the flow of the Kennebec River by storage. It has, in fact, been used for this purpose for many years; at first primarily for log driving and later with a view to improving water power on the river by the Kennebec Water Power Co. In the following table are given details of area and storage capacity up to a level 2.0 ft. above the present high water level.

Moosehead Lake—Area and Capacity

Drainage area at outlet 1240 sq. miles.

Gage Ht. feet (Lake datum) (a)	Area of Water surface sq. miles	Total capacity above Gage ht. 10 Bill cu. ft.	Remarks
10.0	111.3	—	Approx. level of gate sills
11.0	111.9	3.11	
12.0	112.4	6.24	
13.0	113.0	9.38	
14.0	113.6	12.54	
15.0	114.3	15.71	
16.0	114.9	18.91	
17.0	115.6	22.12	
17.5	116.0	23.74	Present high water level
18.5	116.8	26.98	
19.5	117.6	30.25	

(a) Gage ht. zero of lake datum = El. 1011.24 mean sea level (revised).

The Kennebec Water Power Co. made investigations in 1905, with estimate of costs covering damages due to raising the lake level 2 ft., which were summarized as follows:

"Estimate of Damage for Rise of Two Feet of Water in Moosehead Lake"

Greenville	$14,200
Greenville Junction	6,150
Kineo	14,700
Around the Lake	25,500
General land damage	20,000
East Outlet dam	11,000
Total	$91,550

Since 1905 a considerable amount of new construction around the lake has occurred, particularly at Rockwood and Kineo, and it has therefore been necessary to extend the surveys and obtain additional information covering conditions as they are at the present time.

Surveys have accordingly been made at Rockwood, Kineo, Greenville and Greenville Junction and the plans at these localities revised or in some cases new plans made. Much additional information has also been obtained at these localities bearing on the matter of probable damages or cost of new construction due to raising the lake.

As will be further noted, the cost of storage in Moosehead Lake is likely to be less per million cubic feet than in practically any other case considered. On the other hand, considerable flowage of existing structures and land would result, which has in the past caused some opposition to the project. In considering this project, therefore, at the present time, estimates have been made as far as practicable covering a raising of the lake level either 1 or 2 ft., as well as a consideration of the effect of somewhat lowering the minimum level (and thus utilizing more storage capacity), in order to consider the project from its several different possible methods of solution.

East Outlet Dam

The present East Outlet dam is a timber crib structure built in 1901 at a cost of about $52,000, located about 1000 ft. upstream from the Canadian Pacific R. R. bridge over the East Outlet. It is nearly 1000 ft. long and portions of it are in need of repairs; in fact, the whole dam will have to be rebuilt before many years. The dam site is not well adapted for a permanent concrete structure on account of its length and foundation conditions.

Surveys have been made at a location about a mile below the present dam, where a fairly good dam site exists and ledge outcrop is found in the bed of the river and on both sides. This site is also well adapted for a future power development, as further noted. Core borings are perhaps desirable before deciding the exact location and arrangement of this dam, but reasonably good cost estimates can now be made owing to the fact that the ledge is visible to a considerable extent.

Details of the study made for this dam are given on a plan accompanying this report. As planned, the structure will be of solid concrete, with the exception of a short earth wing on the easterly end of the dam. Its extreme length would be about 550 ft. and its maximum height about 40 ft. As the high water level of Moosehead Lake must be maintained closely, control of flood water by spillway is impracticable for this dam and must be accomplished by gates. In the study made, 22 such gates have been assumed, each 6 ft. 3 in. x 14 ft. high in the clear, which will take under flood conditions about 50,000 sec. ft. The general arrangement of these gates is shown on the plan, the gate hoists being arranged to be operated either by a mechanical drive or auxiliary hand operation. A vertical water turbine of about 50 HP. capacity is located approximately in the center of the dam, operating through suitable gears and reduction pulleys a drive shaft which, by a clutch mechanism, can be utilized in operating any of the gates individually.

A log sluice 8 ft. wide in the clear is provided on the easterly side, so arranged as to be adjusted by suitable lifts to a range in lake level of about 5 ft. below high water level. The gate lifts and log sluice control will be housed in a gate house with concrete walls and wooden and slate roof.

The dam is so laid out that a future power development can be made with head gates and intake on the westerly bank, as there would be available at this dam a head of 25 to 30 ft., depending upon the level of Moosehead Lake.

The dam has been assumed with its top at Elev. 1036 and it is of sufficient height to be utilized for any likely change in level of Moosehead Lake. There would be some saving in cost in case the present high water level was not changed, by building a dam of slightly less height. This does not seem wise however for the permanent structure suggested.

The estimated cost of this dam and its appurtenances is about $180,000.

West Outlet Dam

The present West Outlet dam was built in 1901 at a cost of about $12,000. It is at present in bad condition and will soon have to be rebuilt. A survey of this site has been made and studies made for a new dam consisting of an earth fill structure with top at Elev. 1038 and concrete core and a single 6 ft. x 6 ft. gate, in a small gate house, controlling the flow through a concrete conduit. The extreme length of this dam would be about 1200 ft. and its maximum height about 25 ft.

The conditions at this dam site are rather unfavorable, the underlying material consisting of gravel and sand, with ledge probably at a considerable depth, and here again it is probably desirable to have some borings to give a better idea of foundation conditions before a definite design for the dam is adopted. It is possible that a reinforced concrete dam might be more economical for this site, but in estimating the cost the desire has been to make these estimates somewhat liberal, to provide for the contingencies of poor foundations.

The control of Moosehead Lake level would be practically entirely at the East Outlet dam, the provision for the gate at the West Outlet being simply to provide some flow of water down this outlet when necessary. If the latter could be dispensed with and the conduit, gate house, etc., omitted there would be some saving in cost.

The total estimated cost of the West Outlet dam is about $60,000.

Rockwood

At Rockwood the principal structures affected by any change in lake level consist of the railroad station, freight shed, platforms, wharf, etc., and the storehouse of the Hollingsworth & Whitney Co.

The top of the present wharf at the lake end is just about 2 ft. above the present high water level of the lake or about Elev. 1030.8. The level of the platform near the station and freight shed is a little higher. It has been assumed that all of these structures would have to be raised the same amount as any proposed raising of high water level of the lake. An estimate of the cost of necessary changes has been made based upon the plan now available and additional notes made with reference to the structures. There are no large single items of expense. The total estimated cost covering a raising of the lake level 2 ft. is about $11,000; for a raising of the lake 1 ft., about $8,000.

Kineo

At Kineo there have been very considerable changes since the 1905 Report of the Kennebec Water Power Company, consisting principally of the yacht club building, a new power house and a road around the cliff nearly 2 miles long. Unfortunately none of the new work has taken into account possible raising of lake level, so that the damages here will be much greater than in 1905.

The yacht club building is a 2-story wooden frame building set on field-stone walls approximating 80 x 40 ft. in area, with a large veranda on one side. The general ground level at the building is a little over 2 ft. above present high water level, so that, as with most of the other features at Kineo requiring change, the amount of raising must be substantially equal to the assumed rise in high water level of the lake. The store and post office is another good-sized wooden frame building requiring raising and treatment in a similar manner.

The power house is a brick building with its concrete floor level about a foot above present high water level. This is however a building of good height and it appears to be practicable to raise the general floor level, lifting the boilers, engine and generator, pumps, etc., a corresponding amount.

The breakwater and piers and wharves in its general vicinity, as well as the wall near the yacht club house, will all have to be raised and filling made to a corresponding level in the general vicinity of all these buildings.

Somewhat northeasterly from the power house is the "Bowl" used for a recreation field, golf course, etc., the general level of which is at just about present high water level or a little higher. A considerable amount of filling will be required here, as well as raising of the two drainage sumps in this vicinity.

The road around the cliff will have to be raised and additional riprap provided on the banks in places for a considerable distance.

Some of the other less important items are shore protection at the cottages on the west shore, the raising in level of two cottages on the neck of land northeast of the power house, as well as provision to take account of interference with piping, sewers, drains, etc.

The estimated cost of changes at Kineo is as follows:

Item	Cost for raise in lake level of	
	2 ft.	1 ft.
Buildings, raising and changing	$20,000	$18,000
Filling	30,000	16,000
Road around cliff	18,000	9,000
Miscellaneous	7,000	7,000
Total	$75,000	$50,000

Greenville Junction

At Greenville Junction the wharf at the lake end is approximately 2 ft. above the present high water level and in general the changes required are similar to those at Rockwood, consisting of raising the wharf, the station platform, etc., and railroad tracks from a maximum amount at the lake end of the assumed general rise in lake level, running back for the necessary distance to obtain suitable grades.

Other features affected at Greenville Junction are the Coburn Steamboat Co. storehouse and Machine shops, the Hollingsworth & Whitney and Crafts storehouses, with a number of other buildings and boat houses. Flowage from the lake extends up the small stream back of the Hollingsworth & Whitney Y. M. C. A. building, etc., where some slight changes will be required. The largest single item of expense would be that of earth fill, amounting to about $12,000. The total estimated cost on the basis of raising the lake level 2 ft. is about $20,000; for a 1 ft. rise in level about $12,000.

Greenville

At Greenville there are about 32 buildings (including boat houses) adjacent to or near the lake that would be affected by a raise of lake level of 2 ft. These are however all wooden frame buildings, many of which are low in value. The more substantial buildings consist of some 10 stores, a new post office, a new schoolhouse, two clubhouses of recent construction and several dwellings.

A railroad siding to the lumber mills, with several spur tracks aggregating a length of about 1500 ft. will also require raising. The mill of the Veneer Products Co. about a mile northerly from the village will require some filling and wharf changes, as well as raising of the boiler house. The highway near the post office for a distance of about 700 ft. must also be raised, as a considerable portion of it is only about 1.7 ft. above present high water level.

The additional area flowed near the village by an increase in lake level of 2 ft. is about 8 acres, and to fill this entire area to a height of 2 ft. above the new high water line, and also extend this filling somewhat at the edges, would involve much cost. Doubtless some of the properties of lesser value could better be purchased or the right to flow obtained.

What is needed at this place is a carefully worked out plan for wharf lines, grading, etc., and a scheme of treatment that can be followed at least in the case of any further new structures.

Estimates have been made as far as practicable for the cost of work at Greenville and it is believed that an amount of $40,000 will suffice for a raise in lake level of 2 ft. If raised 1 ft. this might be reduced to perhaps $25,000.

Canadian Pacific Railroad

Near Moosehead Station. The present grade of the base of rail of the C. P. R. at the bridge over the East Outlet is approx. Elev. 1035.4. This bridge consists of a single through truss 154 ft. span and two deck girders, each 57 ft. span. The bottom of the main truss is about Elev. 1030.7 or just about the H. W. level of Moosehead, if raised 2 ft. The bottom of the girders is at about Elev. 1028.6.

To accord with an increase in lake level of 2 ft. it has been assumed that the main truss and track level be raised 3 ft. and the girders raised and made through instead of deck.

About 7200 feet of track will be affected by this raise of level and the fill at and near the track and the cost of raising the bridge are the chief items of expense.

Near Squaw Brook the track would also have to be raised about 2 ft. and about 3000 ft. of track regraded. Between Moosehead Sta. and Greenville Jct. a considerable amount of riprap or rough paving will be required for the railroad slopes adjacent to the lake.

The **total** cost of changes along the C. P. R. is estimated at about $70,000 for a raise of 2 ft. in lake level, and about $60,000 for a raise of 1 ft. in level.

Miscellaneous

In addition to the larger items of cost previously given there are a considerable number of changes that would be required at points around the lake such as Lily Bay, North East and North West Carry, Moose River, etc. Allowance must also be made for land flowage, considerable of which is not of much value.

Considering the number of these lesser items and such information as is available for estimate purposes it seems desirable to allow about $50,000 to cover this item for a raising of lake level of 2 ft., and perhaps $40,000 for a rise of 1 ft.

Summary

The estimated costs for the different items for Moosehead Lake may be summarized as follows:

Moosehead Lake—Cost of Storage

Item	Estimated Cost for raising above present H. W. level of	
	2 ft.	1 ft.
New E. Outlet dam	$180,000	$160,000±
New W. Outlet dam	60,000	55,000±
Rockwood	11,000	8,000
Kineo	75,000	50,000
Greenville Jc.	20,000	12,000
Greenville	40,000	25,000
C. P. R.	70,000	60,000
Miscellaneous	50,000	40,000
Total	$506,000	$410,000
Increase in storage—bill. cu. ft.	6.5	3.2
Cost of increased storage—per mill. cu. ft.	$78	$128

The above cost estimates are preliminary only as considerable further details must be obtained and surveys made, as well as borings at the dam sites, before definite plans and estimates are possible. They show for the 2 ft. raise a cost of about $78 per mill. cu. ft. of storage increase, or a little more than that for Brassua Lake. It must be kept in mind however that for Moosehead Lake the cost of entirely new dams at the two outlets has been assumed, a large part of which cost is not fairly chargeable to **increased** storage.

The cost for a 1 ft. raise in level is about $128 per mill. cu. ft. or considerably higher as a unit cost, indicating the advantage of the greater raise in level.

Another possible solution for Moosehead Lake would be say a raising in level of 1 ft. together with an additional draft below present low water level of a little over a foot, which would accomplish practically the same total increase in storage capacity. By limiting the draft below present low water level to the winter months no injury to navigation or camping interests would result and the cost of this combination method would be materially less. Careful study should be made of this possible method of procedure when better data are available of the flow of Moose River and at Moosehead Outlet, taking into consideration the additional storage planned for in Brassua Lake and at any other sites above Moosehead.

For purposes of discussion in this report it will be assumed that Moosehead Lake level will be raised 2 ft., affording about 6.5 bill. cu. ft. of additional storage at a cost of about $506,000 or $78 per mill. cu. ft.

WOOD AND ATTEAN PONDS

No additional information is now available for these ponds beyond what was given in the 1918 report. It was there suggested that a dam at the outlet of Wood Pond, raising the water level of both ponds 10 ft., would afford additional storage capacity of about 2.3 bill. cu. ft. at a total cost of about $130,000 or $56 per mill. cu. ft. With the revised cost basis used in this report the cost would be about $160,000 or about $70 per mill. cu. ft.

Further information should be obtained at this site as regards foundations. It affords an excellent opportunity for obtaining additional storage at low cost.

SUMMARY OF STORAGE

A summary of revised figures for storage in Moosehead Lake and above that point is as follows:

SUMMARY OF STORAGE — MOOSEHEAD LAKE AND ABOVE

RESERVOIR	D. A. sq. mi.	Present Storage to this point bill. cu. ft.	Increased Storage bill. cu. ft.	Total Storage to point bill. cu. ft.	Total Storage mill. cu. ft. per sq. mi. of D. A.	Cost of additional Storage	
						Total	Per mill. cu. ft. of Storage
Wood & Attean Pond	320	0.3	2.3	2.6	8.1	$160,000	$70
Brassua Lake	675	0.9	12.0	15.2	22.5	860,000	72
Moosehead Lake	1240	26.0	6.5	46.8	37.7	506,000	78
Total	....	....	20.8	....	....	$1,526,000	$73

Reference to this table indicates that the storage per sq. mile of tributary drainage area tends to become less for the reservoirs more distant from Moosehead Lake. From this point of view a large storage development as suggested for Brassua Lake is an advantage, tending, as it does, to better distribute the available storage in the total drainage area above Moosehead.

The storage per sq. mile at Moosehead of nearly 38 mill. cu. ft. is not however beyond a reasonable amount, although it represents a degree of storage development greater than that on the Upper Androscoggin River at present, but not greatly different from the full storage development suggested for the latter river in the 1918 report.

While the total cost of $1,526,000 is large, it is relatively low cost storage with an average cost of $73 per mill. cu. ft. Thus, for comparison, on the Androscoggin the Aziscohos Reservoir constructed in 1911, cost about $105 per mill. cu. ft.

The table shows an approximation of the requirements for **ultimate** storage development on the headwaters of the Kennebec River.

There are numerous smaller reservoirs below Moosehead Lake which would be of importance in regulating the flow of the river. These are as follows:

Storage Below Moosehead Lake

Reservoir	Present Storage Bill. Cu. Ft.	Proposed Storage Bill. Cu. Ft.
Indian Pond	0.53	0.53
Moxie	0.70	1.00
Pleasant	0.18	0.18
Pierce	0.62	0.62
Chain	0.15	0.15
Jim	0.07	0.07
Tim	0.08	0.08
Flagstaff	0.47	0.90
Spencer	0.87	1.50
W. Carry	0.36	0.36
Total	4.03	5.39

These additional storage reservoirs, most of which are now in use, would add about 5.4 bill. cu. ft. to the 46.7 bill. cu. ft. existing and proposed in Moosehead Lake and above, making a grand total of about 52 bill. cu. ft. for the river as a whole.

In this report however the discussion of effects is limited to that of storage in Moosehead and above—of 46.8 bill. cu. ft.

It should be further noted that the effect of storage is based upon a comparison of present conditions (with present storage not utilized to best advantage for power) with conditions after regulation by a total storage of 47 bill. cu. ft. to obtain fundamentally the best power output near Bingham—the approx. centre of gravity of the total power on the river. Some of the increase in power due to storage is therefore due to a better assumed regulation of **all** storage, including that now available, and this increase in power is therefore somewhat larger than due to the added storage alone.

With respect to the cost of power due to increased storage however over that now available, the assumption in regard to two new dams at Moosehead Lake offsets somewhat any increase in power effect due to the method used in estimating the effect of storage.

EFFECT OF STORAGE

In the accompanying table is given in some detail the effect of increased storage capacity of about 20.8 bill. cu. ft. in Moosehead Lake and above that point on the basis previously explained. This will be discussed in some detail by columns as numbered:

Cols. 1-3. The list of developed and undeveloped power sites, head and present wheel capacity are as in the 1918 report, except that at Skowhegan a development now under construction by the Central Maine Power Co. with head of 32 ft. requires a slight change in the data.

Col. 4. Low water flow is the flow available 95% of the time as shown by the flow duration curves for the several stations used or substantially the amount of **primary** power, under present conditions.

Col. 5. The assumed HP. capacity of turbines is based upon the flow available 50% of the time on the duration curve (with 100% L.F.) instead of 60% of the time as in the 1918 report. Either basis gives in many cases much more HP. than the **present** wheel capacity. For the ultimate development however, with storage regulation the 50% basis is if anything conservative.

In this connection it is of interest to note that the new development at Skowhegan, assuming a 55% load factor (about that obtained by the Central Maine Power Co.'s system) is approximately at the 55% flow point, when adjusted to a 100% load factor.

Col. 6. The HP. available in the average year, due to the falling off of the duration curve for the higher percentages, is considerably less than that of the 50% flow basis assumed. For the total HP. these figures are 219,180 HP. of assumed capacity against 181,380 HP. available or a 17% reduction, as will be noted.

Col. 7 is the estimated present available power in mill. k.w. hrs. annually based upon the figures in Col. 6 and assuming a 75% utilization factor (or 25% waste of water). Wheel efficiency 80%; generator effic. 93%.

Cols. 8 **and** 10 **to** 12 **incl.** are similar to Cols. 4 to 7 inclu.—but **after** storage regulation.

Col. 9 shows the increase in low water or primary power due to storage regulation, totalling 31,620 HP. at developed sites and 85,450 HP. for all sites.

Cols. 13 and 14 show the annual increase in total power and primary power, in mill. k.w. hrs. due to storage regulation, which are respectively 216 and 389.5 mill. k.w. hrs. for the whole river.

Cols. 15 and 16 show the annual cost of storage for each site and as a whole (1) when distributed over **developed** sites only and (2) when distributed at **all** sites on the river.

The annual cost of $152,600 is 10% of the total assumed cost of additional storage of $1,526,000 and covers all fixed and operating charges.

Summary

(1) On the basis of increase in **total** k.w. hrs. due to storage (Col. 13):

Present developments would gain about 62.9 mill. k.w. hrs. annually at a cost of **0.24c** per k.w. hr. if they assumed the entire cost.

Present developments and undeveloped sites together would gain about 216 mill. k.w. hrs. annually at a cost of 0.07c per k.w. hr.

(2) On the basis of increase in **primary** power (Cols. 9 and 14):

Present developments now have available about 285 mill. k.w. hrs. annually of total power of which about 45% or 127 mill. k.w. hrs. are primary power. After regulation primary power would total about 271 mill. k.w. hrs. out of 348 mill. k.w. hrs. of total power or about 78% of the power would be **primary** power.

Present developments and undeveloped sites together now have available about 827 mill. k.w. hrs. annually of total power of which about 42% or 347 mill. k.w. hrs. are **primary** power. After regulation primary power would total about 736 mill. k.w. hrs. out of 1043 mill. k.w. hrs. of total power or about 71% of the power would be primary power.

Expressed as a gain in **primary** power the effect of increased storage is even more striking than for total power increase.

CONCLUDING

It must be kept in mind that the present power developments on the Kennebec River utilize only 197 ft. of head out of a total of 882 ft. Furthermore, they are in only a few cases developed to full wheel capacity.

It is only as more complete and additional developments are made that the large storage projects outlined can be carried out, although the regulation of flow by the present available storage can be improved as the demand for power increases.

With full capacity developments, even with developed sites alone bearing the cost of storage as outlined, the estimated cost of about ¼c per k.w. hr. is low, keeping in mind that the cost of coal at a good-sized steam plant is about 0.6c per k.w. hr. with coal at $5 per ton, and correspondingly greater as the cost of coal increases.

Ultimately the Kennebec River can be developed for storage with great resulting economy, particularly if comprehensive plans are made for these storage projects, and limits in elevation set for the future construction of any railroads, highways, building or other structures in their vicinity.

A large portion (roughly one-half) of the undeveloped water power of the State of Maine is on the Kennebec River. Furthermore, its possibilities for a large and economical storage development are unusually good, and with comprehensive treatment and control it should become one of the great power streams of the country.

Respectfully submitted,

(Sgd.) H. K. BARROWS,

Consulting Engineer.

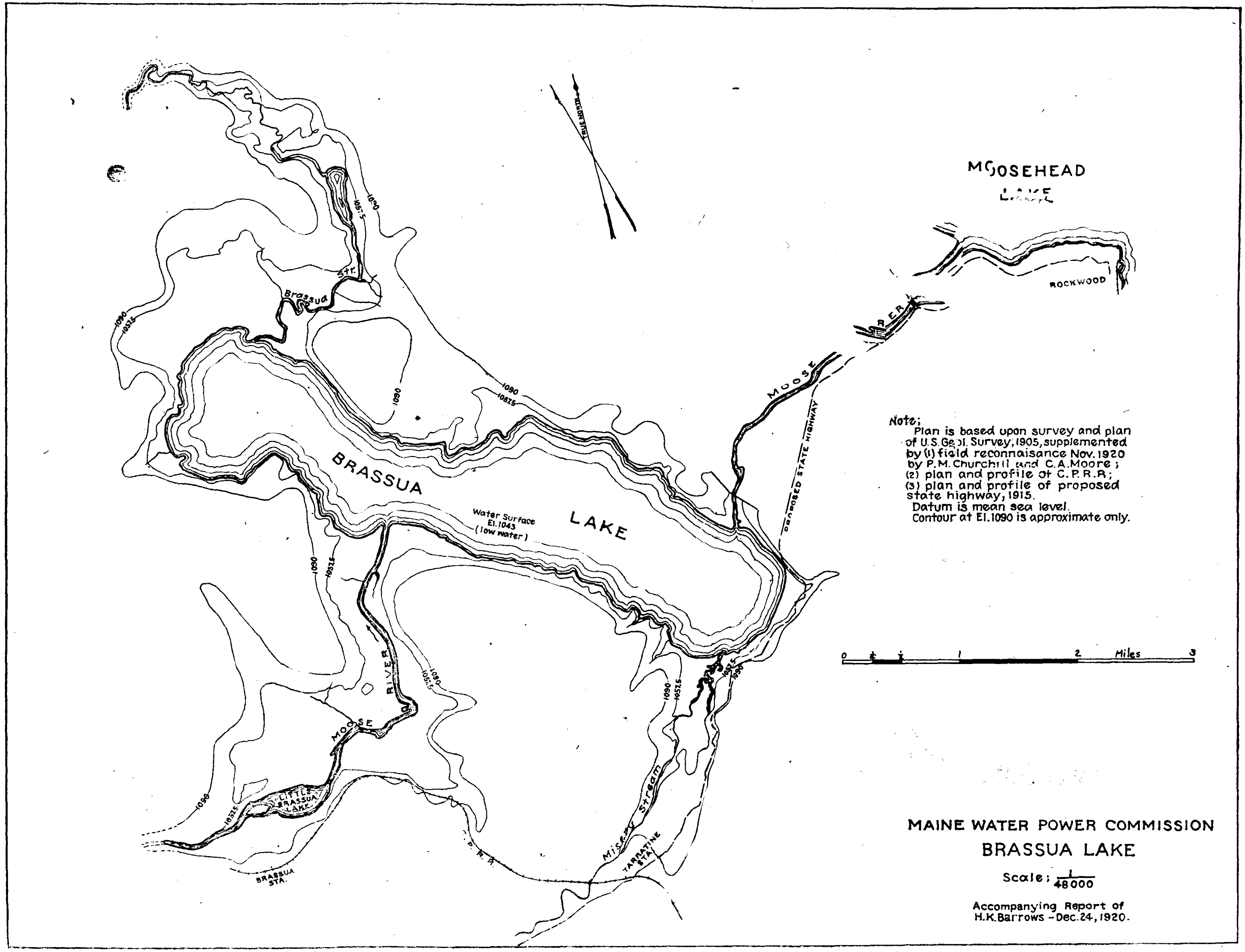
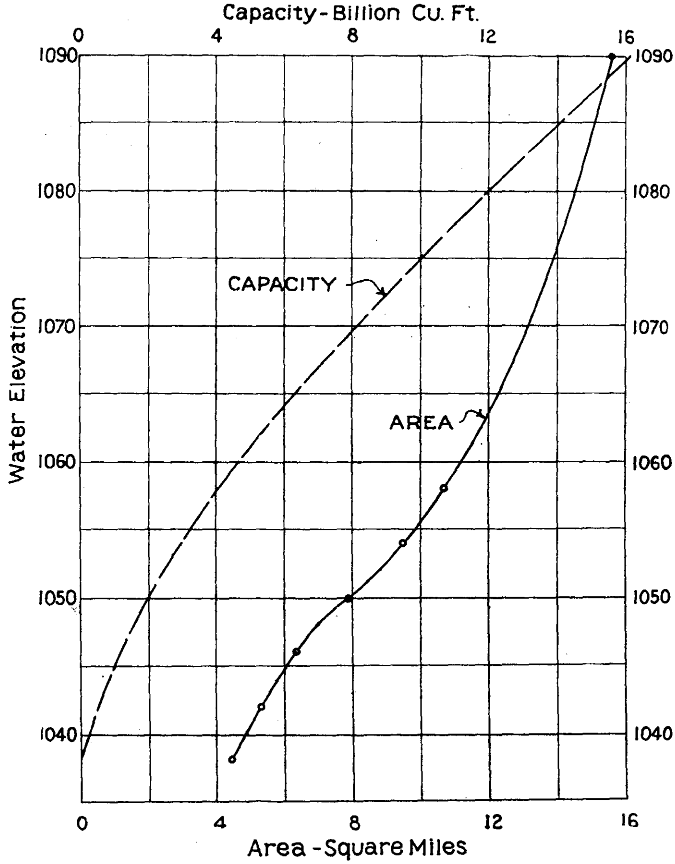

MOOSEHEAD LAKE
ROCKWOOD
TRUE NORTH
Brassua Str.
BRASSUA LAKE
Water Surface El. 1043 (low water)
MOOSE RIVER
PROPOSED STATE HIGHWAY
Misery Stream
TARRATINE STA.
LITTLE BRASSUA LAKE
BRASSUA STA.
1090
1052.5
Note;
Plan is based upon survey and plan of U.S. Geol. Survey, 1905, supplemented by (1) field reconnaisance Nov. 1920 by P.M. Churchill and C.A. Moore; (2) plan and profile of C.P.R.R.; (3) plan and profile of proposed state highway, 1915.
Datum is mean sea level.
Contour at El. 1090 is approximate only.
0 1 2 Miles 3
MAINE WATER POWER COMMISSION
BRASSUA LAKE
Scale: 1/48000
Accompanying Report of H.K. Barrows - Dec. 24, 1920.

PLATE 2



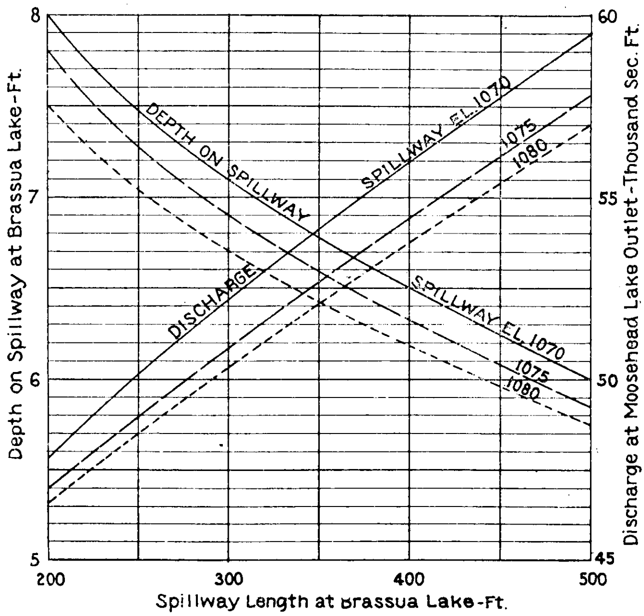
MAINE WATER POWER COMMISSION

BRASSUA LAKE

AREA-CAPACITY CURVES

Accompanying Report of H. K. Barrows-Dec. 24, 1920.

PLATE 3



MAINE WATER POWER COMMISSION

EFFECT OF STORAGE IN BRASSUA LAKE
ON FLOW AT MOOSEHEAD LAKE OUTLET.

Accompanying Report of
H. K. Barrows, Dec. 24, 1920

KENNEBEC RIVER—EFFECT AND COST OF STORAGE

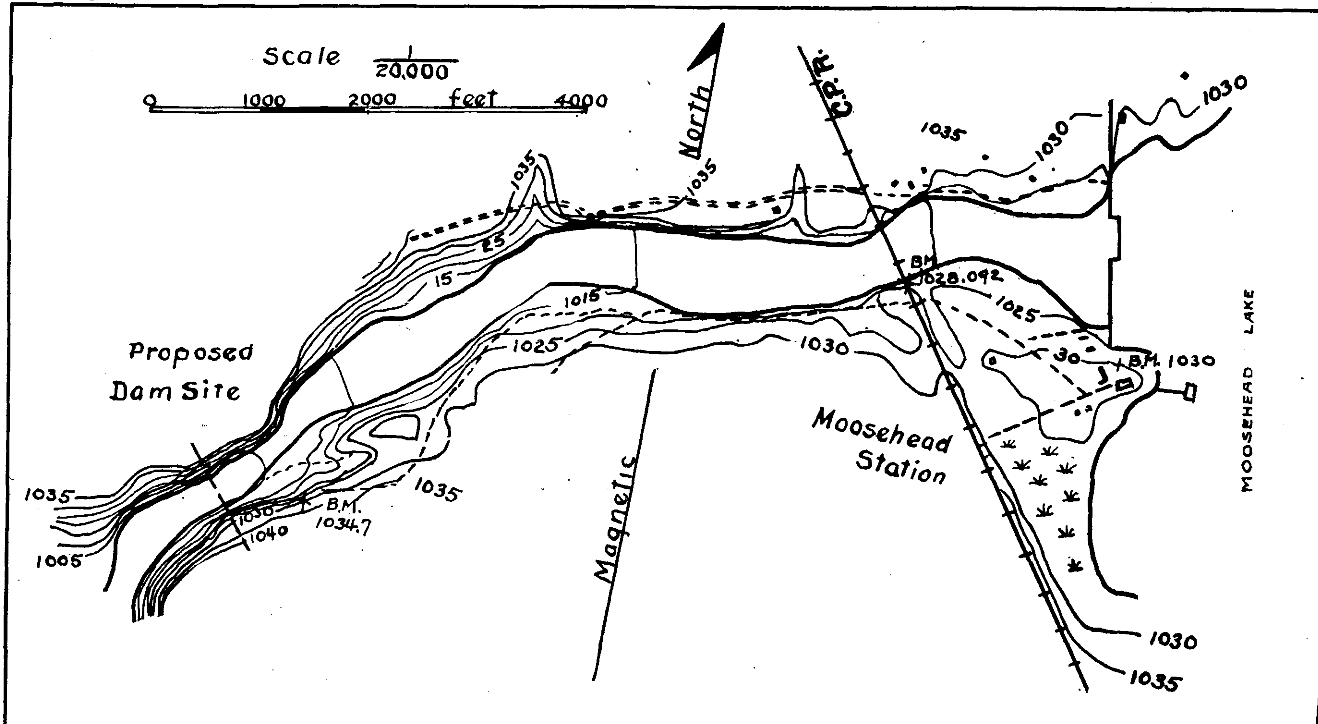
	LOCATION (1)	Head Ft. (2)	PRESENT CONDITION: Present Wheel Capacity HP. (3)	HP. Available with Low Water Flow (4)	HP. Capacity of Turbines 24 Hr. Power 50 per cent Flow Pt. 100 per cent L. F. (5)	Available HP. for Capacity in Col. 5 (6)	Mill. K.W. Hrs. Annually at Switchboard (75 per cent Utilization) From Col. 6 (7)	AFTER REGULATION: HP. Available with Low Water Flow (8)	Increase in Low Water HP. (9)	HP. Capacity of Turbines 24 Hr. Power 50 per cent Flow Pt. 100 per cent L. F. (10)	Available HP. for Capacity in Col. 10 (11)	Total Power Output: Mill. K.W. Hrs. Annually at Switchboard (75 per cent Utilization) From Col. 11 (12)	Total Power Output: Increase in Mill. K.W. Hrs. Annually Col. 12–Col. 7 (13)	95 per cent or Primary Power: Increase in Mill. K.W. Hrs. Annually (14)	Annual Cost of Increased Storage†: For Developed Power Alone (15)	Annual Cost of Increased Storage†: For Developed and Undeveloped Power (16)
DEVELOPED	Solon	27	3,423	2,780	8,260	6,760	30.8	7,450	4,670	8,620	8,260	37.7	6.9	21.3	$16,800	$4,900
	Madison	19	6,778	2,280	6,870	5,640	25.7	5,300	3,020	6,930	6,430	29.3	3.6	13.8	8,700	2,600
	Madison (Hollingsworth & Whitney)	28	7,700	3,360	10,100	8,300	37.8	7,810	4,450	10,200	9,470	43.2	5.4	20.3	13,100	3,800
	Skowhegan	32	21,000*	4,600	11,730	9,900	45.1	9,200	4,600	13,650	12,310	56.1	11.0	21.0	26,700	7,800
	Shawmut	19	4,000	2,940	7,500	6,300	28.7	5,870	2,930	8,750	7,860	35.8	7.1	13.3	17,100	5,000
	Fairfield	11	1,683	1,700	4,350	3,660	16.7	3,410	1,710	5,070	4,560	20.8	4.1	7.8	9,900	2,900
	Waterville (Hollingsworth & Whitney)	23	6,000	3,580	9,130	7,670	35.0	7,140	3,560	10,620	9,560	43.6	8.6	16.2	20,900	6,100
	Waterville (Lockwood)	21	3,434	3,260	8,340	7,000	31.9	6,520	3,260	9,700	8,730	39.8	7.9	14.9	19,200	5,700
	Augusta	17	3,668	3,430	8,750	7,360	33.6	6,850	3,420	10,220	9,180	41.9	8.3	15.6	20,200	5,800
	Total (Developed)	197	57,686	27,930	75,030	62,590	285.3	59,550	31,620	83,760	76,360	348.2	62.9	144.2	$152,600	$44,600
UNDEVELOPED	Moosehead Outlet	30	....	1,390	4,200	3,430	15.6	2,120	730	5,400	4,710	21.5	5.9	3.3	....	4,100
	Ledge Falls } Indian Pond	40	....	1,890	5,640	4,610	21.0	2,840	950	7,230	6,330	28.9	7.9	4.3	....	5,700
	Boar Hog Eddy	80	....	4,030	12,080	9,920	45.2	6,080	2,050	15,570	13,530	61.6	16.4	9.3	....	11,600
	Chase Stream	115	....	5,860	17,060	14,400	65.5	8,900	3,040	22,600	19,750	90.2	24.7	13.9	....	17,400
	Steepside	155	....	9,020	27,040	22,200	101.1	13,700	4,680	34,800	30,400	138.6	37.5	21.3	....	26,300
	The Forks	60	....	5,500	16,540	13,590	62.0	14,900	9,400	17,300	16,500	75.3	13.3	42.8	....	9,500
	Carrying Place	80	....	7,560	22,700	18,630	85.0	20,500	12,940	23,600	22,700	103.5	18.5	59.0	....	13,100
	Bingham	85	....	8,120	24,340	20,000	91.2	21,950	13,830	25,300	24,400	111.2	20.0	63.1	....	14,000
	Sandy River	30	....	3,620	10,890	8,930	40.8	8,400	4,780	10,800	10,150	46.3	5.5	21.8	....	3,800
	Skowhegan	10	....	1,440	3,660	3,080	14.1	2,870	1,430	4,270	3,840	17.5	3.4	6.5	....	2,500
	Total (Undeveloped)	685	....	48,430	144,150	118,790	541.5	102,260	53,830	166,870	152,310	694.6	153.1	245.3	....	$108,000
	Grand Total (Developed & Undeveloped)	882	....	76,360	219,180	181,380	826.8	161,810	85,450	250,630	228,670	1042.8	216.0	389.5	....	$152,600

* Plant now under construction.

† Based on 10 per cent annual charge on **$1,526,000**.

Cost per K.W. Hr. of increased total power if paid for on basis of increase at each plant for developed power only = 0.24c.

Cost per K.W. Hr. of increased total power if paid for by total developed and undeveloped power = 0.07c.



PROPOSED DAM SITE ~ MOOSEHEAD LAKE AT EAST OUTLET

REPORT ON POWER DEVELOPMENT ON DEAD RIVER AT LONG FALLS

General Statement

The site of Long Falls on Dead River is about 17 miles downstream from the village of Flagstaff, where the river falls abruptly over ledge rock about 45 feet in a distance of about 700 feet. The drainage area at this point is about 500 sq. miles.

A survey of this dam site on a scale of 50 feet to the inch was made during 1920 and the location of all ledge outcrop near the site determined. Ledge appears in the bed and on the banks of the river on both sides for the entire length of the falls and is apparently at no great depth below the surface on the river banks in the general vicinity of the site. Some additional information in the way of test pits and borings is desirable however before a definite layout and estimates of cost for this development can be made.

Basis for Flow and Power Estimates

Measurements of flow of Dead River at The Forks, where the drainage area is 878 sq. miles, are available for the years 1905 to 1907, and 1910 to 1920 inclusive. Considering the continuous record by months for the last ten years, the flow duration curve shows the following:

Dead River at The Forks—Flow Duration Table 1910-20

Per Cent of Time	Discharge Sec. Ft. per Sq. Mi.
100	0.10
95	0.23
90	0.34
80	0.46
70	0.56
60	0.69
50	0.92
40	1.22
30	1.68
20	2.53
10	4.26
5	5.80
Mean	1.64

As will be noted by comparison of the above data with similar data for the Kennebec River at The Forks, the low water yield of Dead River is very much less than that of the Kennebec, owing to lack of storage.

The opportunities for increased storage on Dead River above Long Falls appear to be meagre, as will be noted by reference to the discussion of this subject in the 1918 Special Report on Water Power of the Public Utilities Commission. With Flagstaff Lake somewhat increased in capacity, the total available amount will not be over one billion cubic feet. A high dam at Long Falls would afford some additional storage, but any raising of water level more than about 20 ft. above the present level at the head of Long Falls will begin to affect the State road running near the river in the upper part of this reservoir site, as well as causing some flowage at Flagstaff and its vicinity. In the preliminary studies made as a basis for this report, therefore, a dam with spillway level about 19 ft. above the present water level at the head of the Falls has been assumed, laid out in such a manner that flashboards 3 ft. in height or perhaps a little more, can be carried in the low water season. This would provide a means of utilizing about 300 mill. cu. ft. of storage during the low water season and would incidentally furnish excellent pondage to meet fluctuations in daily load at a power plant.

Description of Proposed Power Development

The most economical location for a dam appears to be near the head of the Falls and such a layout has been made, consisting of a solid concrete spillway section 300 ft. long, flanked by bulkhead sections of concrete on either bank, the extreme length of the dam being about 600 ft. and the maximum height of the spillway section about 22 ft.

A small gate house with two head-gates, racks, etc., would be located on the westerly shore and water conveyed by an 8-ft. steel penstock a distance of about 900 ft. to a power house located on the westerly bank a short distance below the foot of the rapids, developing a net head of about 63 ft. It is possible that some further amount of head could be utilized as a part of this development, but information is not available to ascertain this.

A total wheel capacity of 4200 H. P. in three units has been assumed, each unit being connected with the large main penstock by 5-ft. individual penstock lines. This development would require three 1000 K. W. generators and would afford in the average year, based on the flow duration table previously given, an output of about 9 mill. k.w. hrs. at the switchboard. The 95% or primary power available even with additional storage at Flagstaff, and such amount of storage as can be obtained at the development itself, would be only about one-third of the average output, or perhaps about 3 mill. k.w. hrs. annually.

Cost of Development

The estimated cost of this development is about $370,000 (based upon costs about 25% above the pre-war normal), this being divided approximately as follows:

Dam, Reservoir, etc.	$170,000
Penstocks, equipment, power house, etc......	200,000
	$370,000

The annual fixed charges for this development would be about 10% or $370,000 or $37,000, which for the 9 mill. k.w. hrs. available would be about 0.41c per k.w. hr. To this would be added operating costs of perhaps 0.15c per k.w. hr., depending upon the manner in which this plant is tied in with other plants and also transmission costs, which again are uncertain, depending on the method of disposing of this power. It is likely that the total cost per kilowatt-hour would be in the vicinity of 0.7 of a cent.

Concluding

As previously noted, more specific information in regard to the foundation conditions at the dam site and in the river at the power house location is desirable before anything other than a preliminary statement is made with regard to this power site. Better information and more detailed surveys are also needed with reference to the State highway and conditions at Flagstaff, to ascertain more exactly to what extent these will limit or affect any power development at this point.

The development can undoubtedly be made at reasonable cost. On the other hand, the fluctuations in yield of Dead River are such that its output will be more variable and not compare as favorably as that for plants on the main river, particularly after storage developments have been made on the latter. Its location is, however, adjacent to some of the large possible power developments on the main river and it may be therefore of value in connection therewith.

REPORT ON STORAGE DEVELOPMENT ON SACO RIVER

General Statement

The present available storage on Saco River totals a little over 3 bill. cu. ft., as noted in detail in the 1918 Special Report on Water Power, most of which is in the State of New Hampshire. The reservoir site of chief importance in the State of Maine is the Hiram Reservoir site, described in some detail in this report, which will afford a large amount of additional storage at reasonable cost.

The proposed dam site for this reservoir is located about 2 miles above Hiram, where it is planned to build an earth dam with concrete spillway, raising the present water level about 35 ft. or to Elev. 380, and creating a water area of about 35 sq. miles. This high water level would reach nearly to the tailrace level of the Swans Falls plant and would require the raising of the Maine Central Railroad in places, as well as the relocation of a number of highways.

Cost and Effect of Hiram Reservoir Development

Data for the estimated cost of this reservoir and resulting damages were furnished by Mr. Walter H. Sawyer for the 1918 Report, as follows:

Construction cost	$329,000
Real estate, flowage, etc.	440,000
Railroads, highways, bridges, etc.	188,000
Total	$957,000

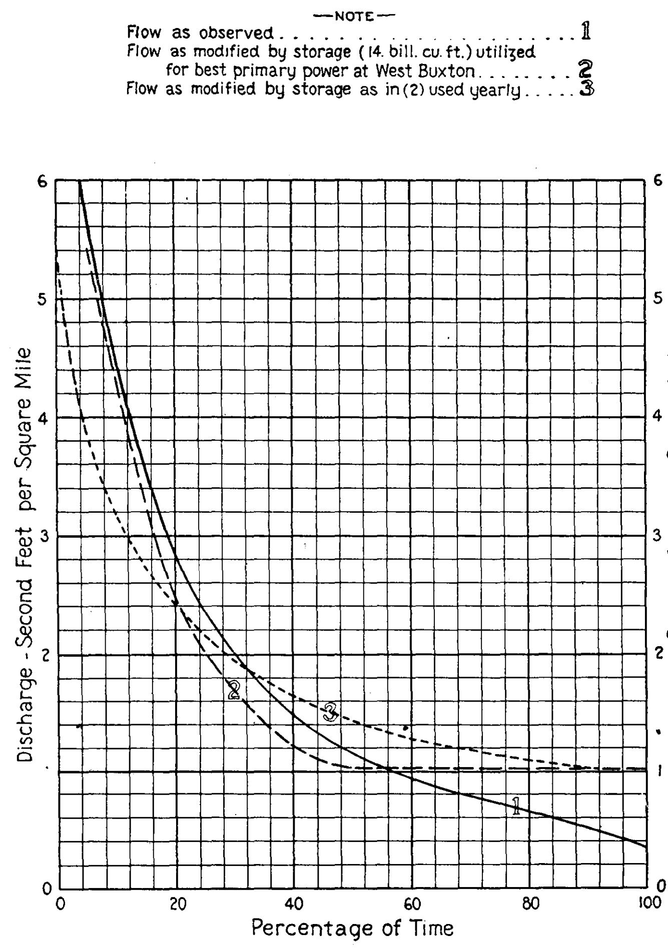
These estimates were based upon surveys of the dam site, but information in regard to the reservoir site was based largely upon the U. S. Geological Survey map.

To make comparable the cost of this project with cost estimates made in the report upon the Kennebec River Storage Development, just completed, which were on the basis of normal costs plus about 25 per cent, would add somewhat to the above figures, making the total about $1,100,000. The total storage capacity at this site is estimated at about 10 bill. cu. ft., although there would be a considerable amount of ground storage in addition to this figure.

The cost per million cubic feet of storage on the basis of a total storage capacity of 10 bill. cu. ft. would be, as revised, about $110. This is somewhat greater than the cost of storage per unit of storage capacity on the Kennebec River. Furthermore, on the Saco River there is available at developed sites below the Hiram Reservoir a total head of 207 feet, at undeveloped sites 105 feet, or a total amount of 312 feet, which is much less than the total available head on the Kennebec River, so that the cost of storage on the Saco to power plants on the river would be considerably greater in proportion than on the Kennebec.

On the other hand, the natural yield of the Saco River is materially greater than that of the Kennebec, due to the fact that its headwaters, in the White Mountain district, receive a much greater rainfall. On the accompany-

PLATE 6



SACO RIVER AT WEST BUXTON
FLOW DURATION CURVES
1908 — 1916

Accompanying Report of
H.K. Barrows - Dec. 24, 1920.

ing figure, flow-duration curves for the Saco River at West Buxton show (1) the flow as observed during the period 1908-1916 inclusive; (2) as modified by a total storage capacity of 14 bill. cu. ft, which would include practically all possible storage on the Saco River, when operated for best primary power at West Buxton; (3) flow as modified by this storage when used yearly, the mean of the last two curves representing fairly well what would probably be obtained with this total storage development, most of which is in the proposed Hiram reservoir. The effect of this storage on the flow of the river is very marked, particularly with the increase in primary power.

Concluding

The Saco River is more closely adjacent to a good power market than the other larger rivers of the State and the importance of the proposed reservoir development at Hiram is obvious. The conditions are somewhat analogous to those with respect to Moosehead Lake on Kennebec River in that definite plans for this storage development should be made and the location of any future railroads, highways or other structures limited in elevation in accord with these plans. In order to more definitely lay out and estimate the cost of this project, test borings should be made at the dam site, as well as some investigation to serve as a better basis for estimating the probable amount of ground storage at this site, which is an important feature. A considerable amount of investigation and surveys with reference to railroads, highways, etc., is also needed before definite plans can be made.

REPORT ON GEOLOGICAL INVESTIGATIONS

East and West Outlets Moosehead Lake, Moose River and Brassua Lake

F. F. Burr, Geologist

I. General Considerations

The lakes of Maine in general constitute an abnormal drainage feature, due chiefly to the action of the ice of the Glacial Period in transporting and depositing large masses of unconsolidated rock material. There is abundant evidence that the lakes occupy portions of former river valleys across which have been thrown dams of glacial drift.

Moosehead Lake is an excellent illustration of the condition suggested. Its elongated and irregular shape is almost sufficient proof of its origin. It is, however, probable that this lake occupies not one continuous river valley, but two or more; possibly one main valley and several tributaries which formerly came together at some distance to the southward.

The general topography of the region is such as to indicate that the stream erosion, just prior to the glacial disturbance, had reached a point at which at least the main rivers occupied broad open valleys, extending, at a comparatively gentle gradient, and with no decided interruptions, from the mountainous regions of the State to the sea.

It is quite obvious that if the present outlets of Moosehead were drained dry, a lake would still remain, very little smaller in area than the present one. It follows then, if the premises briefly outlined are tenable, that there exists somewhere a valley which was formerly deep enough to drain the lake, but which is now filled with sufficient detrital material to form a dam and hold back the water of the lake.

It is my opinion that there is evidence of such a valley, and that the present West Outlet, at least approximately, marks its position.

II. East Outlet

At the dam site the stream narrows rather abruptly, becomes rapid, and is bordered on both sides by rock outcrops. Above this point, to the head of the outlet, and below as far as examined, outcrops are lacking and the bed-rock is covered to an unknown depth by loose material (sand, gravel, clay, etc.). The presence of outcrops at the point mentioned, with the fact that the land rises rather abruptly on both sides, may be taken as indicating no great depth of cover along the course of this stream. It is probable that test pits from ten to twenty feet deep would reach ledge, on the banks or in the bed of the stream at most localities within a hundred yards of the dam site, up or down stream.

At the dam site, the country rock is a very friable, blue to green slate which splits easily into thin laminations. No indications of true bedding were found. The slaty structure is, however, the critical feature of the rock, and this has a strike nearly east and west and a vertical dip. Reference to the map will show that the strike practically parallels the course of the stream. On the north bank the rock forms a distinct bluff.

At the narrowest point, where the stream makes a slight bend, there is a dike of fine dark rock, essentially trap. This strikes North 60 degrees East, and dips vertically. Under existing conditions the dike could be traced only a few feet along the strike, and one contact with the slate was somewhat obscure. It measured a little less than ten feet in width.

On the south bank of the stream the rock is of essentially the same character as that on the north bank, but rises only from a foot to five feet above the water. Nearly in line with the dike already mentioned is a smaller dike, three feet wide, containing the same type of rock as the first one, and having the same strike and dip. The two are probably parts of one continuous dike, although this could not be proved.

At the dam site, and for some distance above and below, the sides of the valley rise abruptly enough to form a ravine. Except on the immediate shores no outcrops of bedrock were found; the slopes are formed of glacial till which carries numerous boulders ranging in diameter from a few inches to several feet. Many of the boulders are of trap, and there would seem to be abundant material for crushed rock in the immediate vicinity.

About a half mile below the railroad bridge, on the southerly side of the stream, the current has cut into the bank and formed a bluff of gravelly material. A close examination shows this to consist largely of clay with numerous pebbles but very little sand; it is not promising as a source of aggregate for concrete work. In fact, no indication was found in this locality of good deposits of sand or gravel. The possibility of crushed rock material seems much more favorable.

The slate at the dam site is a very weak rock, not capable in itself of obstructing the erosive action of the stream. The small trap dike is undoubtedly the competent member of the structure at this point, and may be held accountable for the existence of the bluff, and for the narrowing and partial obstruction of the stream. The statement that the slate is weak is not to be taken as implying that it is in any way likely to give inadequate support to a dam; it is fully capable of sustaining any stress that will be put upon it.

So far as the geological conditions are concerned, it may be stated with confidence that the site is well suited to the purpose of erecting a dam of moderate height.

III. West Outlet

No outcrops of bedrock were found in any part of the area investigated. For at least several hundred yards on both sides of the stream the surface appears to be underlain with a considerable depth of boulder clay, an intimate mixture of clay, sand, gravel and boulders of various sizes. This material is usually hard packed and resistant to the movement of ground water. It is not likely to contain large bodies of loose sand or gravel.

As suggested above, the conditions here indicate that the loose rock material forms at this point a very deep deposit, presumably 100 feet or more in thickness, filling an ancient stream valley. The opinion is advanced that it would be entirely useless to seek a bedrock foundation in this vicinity.

As in the case of the East Outlet, large bodies of good sand or gravel are not indicated. Abundant boulders of trap and other hard rock occur, and it should not be difficult to find sufficient material for crushing.

IV. Moose River and Brassua Lake

Moose River was given at least a cursory examination throughout its entire length, from Moosehead to Brassua Lake. Particular attention was given to the conditions existing at two localities—the vicinity of the Scott Camp, and the outlet of Brassua Lake.

The Scott Camp is located at the foot of the second series of rips, and a little way above the first rips, on the southerly bank of the stream.

The stream at this point occupies the north side of a comparatively wide valley, bordered by high ridges which show rock outcrops along the tops. Bed-rock is exposed on the north bank here, and at several points down stream. Near the mouth outcrops appear on both banks.

The outcrops opposite the Camp show a succession of beds of shale and slightly altered fine sandstone (the graywacke of the older geologists). On the south shore the bed-rock is hidden by some depth of loose material which contains flakes and slabs of shale and sandstone, some of the masses showing fairly well-preserved fossils. The condition of these rocks is such that they would not have endured transportation over great distances, and the assumption is permissible that the ledge is not deeply buried. Strike of rock, East-West, dip 80 degrees, toward the south. Upstream from the Scott Camp no outcrops were found, although the impression still holds that the bed-rock is only a few feet, say 5 to 20, below the surface.

On the shore of the lake (Brassua), only one outcrop was found. This was 100 yards to the southward of the outlet. The rock here is a very thin-bedded, fissile shale, striking nearly East and West, and with a vertical dip.

There are no indications of extensive beds of sand or gravel. Abundant pebbles and boulders of hard rock occur in the stream bed and in the loose material on the banks.

There is nothing to warrant the expectation of trap dikes in the rocks of this locality. The rocks here are undoubtedly of much later origin than the slates farther south, and the igneous activities which produced the trap seem to have ceased before the deposition of the muds and sands from which the Moose River and Brassua rocks were formed. The Kineo hornstone also appears to belong to an earlier period.

Report on Geology at Long Falls on Dead River

On June 17, 1920, I visited Long Falls on Dead River, in company with Major George C. Danforth, Chief Engineer of the Commission.

In the course of the day I had an opportunity to make a fairly complete examination of the rocks in the neighborhood of the falls, and to form some opinion as to the conditions back from the river on either side.

The falls are located at a point where the river has cut through a high ridge of hard rock which has up to the present offered enough resistance to down-cutting to form a partial bar across the stream. This has dammed the river to such an extent that for several miles above the current is scarcely perceptible.

The rock at the head of the falls is a granite of medium grain, which contains abundant crystals of white feldspar about ¼ inch in length, with quartz and black mica as the other principal minerals. This rock forms a dike approximately 150 feet wide, striking North 30 degrees East and with a Northwesterly dip of about 85 degrees. A prominent system of joints strikes North 60 degrees East; this and minor joint systems give the rocks a tendency to break into large blocks of nearly cubical shape.

Altogether this rock forms a hard, resistant barrier to the stream. It would, however, appear to be rather inferior material for crushing, as the feldspar crystals which form its chief ingredient give it a tendency to crumble, under impact, into a mass of fine granular particles.

At three lower stages of the falls occur granite dikes 10 feet or more in width. The two intermediate ones contain numerous inclusions of dark rock which evidently once formed parts of a dike, or dikes, of trap which were caught up by the molten granite as it forced its way through the rock. The trap is fine-grained, compact and tough, and will make excellent crushing material if enough can be found for the purpose. The existence of numerous trap boulders up to several tons in weight on the slope back from the river suggests that the original dike was of considerable size, and that it may run out of the granite at no great distance from the falls. To verify this it would be necessary to strip the loose bouldery material from a considerable part of the slope.

Associated with the dikes, as the country rock through which they have been intruded, is a distinctly bedded rock dark in color and fine-grained and compact. This has the general appearance of quartzite; as it effervesces in warm acid, it apparently contains some lime carbonate and may be classed either as an extremely impure limestone, or better, a somewhat calcareous quartzite or metamorphosed sandstone. The bedded rock strikes North 70 degrees

East, and dips Northwesterly at an angle of 60 degrees. It is highly probable that it forms part of a series of metamorphic rocks which may include slates, schists, quartzite and more or less impure limestone; this is, however, hardly more than conjecture, as the heavy cover of loose rock material on the slopes of the ridge effectually hides all but the exposures of ledge immediately adjacent to the falls.

To recapitulate, the bed-rock conditions at the falls are substantially as follows:

The oldest rock shown is part of a series of sediments which have in the course of time become altered until they are essentially crystalline, and tilted at a high angle from their original position. Into these have been injected, first one or more dikes of trap, then a series (or more probably several series) of granite intrusions, at least two of which caught up masses of the trap in passing.

The hard and resistant granites form the chief factor in the ridge and the chief cause of the falls. It should be noted that the bedded rocks dip approximately upstream, a condition decidedly favorable to dam construction.

Away from the immediate banks of the river at the falls, and even at the river bank above and below, the bed-rock is completely hidden by a cover of loose rock material. The exact depth at which the ledge occurs can be determined only by actual exploration; it is, however, fairly safe to predict that the ledge surface will be found to be approximately parallel to the ground surface, and at no extraordinary depth, on the slopes on either side of the falls. It is highly probable that actual outcrops occur on the top or on the slopes of the ridge, but the time at my disposal would not permit of investigation in this direction.

Respectfully submitted,

FREEMAN F. BURR,

Geologist to the Commission.

July 27, 1920.

CORPORATIONS TRANSMITTING ELECTRICITY BEYOND THE STATE BOUNDARIES

In accordance with the provisions of Sec. 6, Chapter 132, Laws of 1919, the following list of corporations transmitting electricity beyond the state boundaries is submitted. This list is tentative and subject to future revision as only in a few cases has correspondence with the companies elicited a reply, giving the information requested.

Conway Electric Light & Power Co., Conway, N. H. Power obtained from Swan's Falls Power Co., Fryeburg, Maine, and distributed to Conway, Albany, Madison and Sandwich, N. H. Voltage 11,000. Average power transmitted, 24,000 kilowatt hours per month.

International Power Co., Calais, Maine. Power supplied to Calais Street Railway Co. for use in Maine and Canada. Average amount transmitted, 52,000 kilowatt hours per month.

St. Croix Gas Light Co., Calais, Maine. Serves Calais, Maine, Milltown, N. B., St. Stephen, N. B., steam auxiliary to water power plant in New Brunswick. 150 H. P., occasional use only. No record kept of output. Voltage 2,300.

Calais Street Ry. Co., Calais, Maine; street railway in Calais, Maine, and St. Stephen, N. B. 400 H. P. 7 miles.

Great Falls Mfg. Co., Berwick, Maine. Power used in mill at Somersworth, N. H. 1,000 H. P. Voltage 3,300. 1.1 mile.

Atlantic Shore Line R. R., Sanford, Maine. Four miles street railway in New Hampshire.

Twin State Gas & Electric Co., South Berwick, Maine. Serves West Lebanon and Lebanon, Maine; Milton and other towns in New Hampshire. Average power transmitted, 75,000 kilowatt hours per month. Voltage 11,500.

Maine & New Brunswick Power Co., Aroostook Falls, N. B. Power generated in New Brunswick transmitted into Maine and over transmission lines of Gould Electric Co. is again transmitted into New Brunswick to serve towns of Grand Falls, 3 miles, Andover and Perth, 7 miles. Voltage 11,000.

We have obtained no evidence of violation of Chapter 60, Section 1, Revised Statutes, 1916.

TOPOGRAPHY

TOPOGRAPHIC WORK

Five thousand dollars a year was appropriated for the years 1919 and 1920. Previous to the organization of this Commission on August 14, 1919, no arrangements had been made for continuing this work. Owing to the lateness of the season it was difficult to arrange for a field party. A party was, however, sent out in September and some work done on the Farmington quadrangle.

During 1920 work was continued on the Farmington quadrangle, although without completing the sheet. Work was also started in 1920 on the Brassua and Moosehead quadrangles. Primary levels and triangulation were extended to both sheets and the field work of the Moosehead sheet was completed.

The drafting and engraving has been completed on the Cutler, Machias and Winn sheets and the maps published; and resurveys of the York and Dover sheets were published. Advance copies of the Columbia Falls and Great Wass Island sheets have been issued.

At the present time 66 sheets for the State have been issued,—34.4% of the total of 192 sheets required to cover the State. Those States which have been quick to realize the vital need of these maps in connection with the development of their natural resources have been completely mapped, while in but a very few of the Western States is the ratio of completion less than that for Maine.

In connection with this work, Dr. George Otis Smith, Director of the U. S. Geological Survey, writes us as follows:

"The value of these topographic maps to various States during the next ten years, when internal improvements and rapid developments are in progress, is incalculable. Some State officials have stated that the value of these surveys to the Highway Commissions alone is greater than the entire cost of the maps.

"The investment of funds in the execution of these topographic surveys has been fully justified by the results obtained, but the additional advantage in obtaining such maps in time for their use in planning for State development needs to be brought to the attention of the public and to all citizens in authority. If topographic maps for the entire State of Maine were today available, I believe that their value to each State organization interested in the internal development of the State would be far greater than the actual cost of such surveys.

"It would seem advisable under the circumstances if the State of Maine is desirous of completing its area in the shortest possible time that it take advantage of this opportunity and cooperate for $25,000 or $50,000 per annum, to be met by an equal sum from the Federal appropriation.

"It is very difficult to estimate the cost of topographic work at the present time, owing to the continued increase in prices, but it is thought that the average quadrangle in Maine could be surveyed for about $8,000 if a fund of $25,000 to $100,000 per annum were available. On an allotment of the amount mentioned above a better organized topographic party could be placed in the State than would be possible on a smaller fund."

Major General Lansing H. Beach, Chief of Engineers, U. S. Army, has written us as follows:

"The lack of such maps in many parts of the United States seriously interferes with the development of the country and with the preparation of plans for the national defense. We will never be fully prepared for all eventualities until the topographic map of the entire United States is completed. An army without accurate maps of the territory in which it is operating is sadly handicapped.

"Besides the military need for accurate maps, they are of great value to the United States in other ways, to States, to municipalities and to private interests in the enterprises which they undertake. Such maps are particularly necessary for the location of railroads and roads, the study of irrigation, water supply, lumbering and mining projects."

There is developing throughout the United States a movement to ensure the completion of this map for the use of this generation. The present rate of progress in Maine will complete the work in about 85 years or in 2005. In the meantime industries which might come to Maine if we had accurate information of our resources will too often go to States where such information is available.

An appropriation by the State of $45,000 a year is recommended subject to the condition that the Federal government add a similar amount. This will insure the completion of the work in about ten years, at the rate of eleven or twelve quadrangles per year. In doing the work under the increased appropriation there will be a very material saving. The work could be planned in advance on a large scale, the triangulation and levels could be kept well ahead of the topography and large parties could be organized and kept at work during the longer field seasons. There would also be a considerable saving in the purchase of camp equipment by being able to anticipate future needs and buying equipment in larger quantities under more favorable prices. It is estimated that an actual saving of from 5% to 10% on the cost of the work could be made, amounting to probably about $80,000. More specifically, the work will cost about $80,000 more if the present program is continued than under the plan proposed.

The work now being carried on in this State is by agreement between this Commission and the U. S. Geological Survey, the areas to be mapped being usually selected by the State and the maps sent to the State Commission for examination and approval by its engineer before publication. The actual field work, however, is done entirely by the specially trained engineers of the Geological Survey, working under standards which ensure uniformity and the same high grade of work in every State in the Union.

While of peculiar importance to the work of this Commission as stated in the report of Engineering Council which is appended hereto, the maps are of great importance to other State departments and to the State in general in its desire for industrial development. It is to be hoped that, following the lead of the Federal government and other States, Maine will take a more progressive attitude in regard to appropriations for this work and provide at least for maps of its more important areas during the next five or six years.

AGREEMENT between the Director of the United States Geological Survey and the Water Power Commission of the State of Maine for the continuation of the cooperative topographic survey of Maine, as provided for in an Act of the State Legislature, 79th session, passed and signed by the Governor, March 29th, 1919.

1. The preparation of the map shall be under the supervision of the Director of the United States Geological Survey, who shall determine the methods of survey and map construction.

2. The order in which, in point of priority, different parts of the State shall be surveyed shall be agreed upon in detail by the Maine Water Power Commission and the Director of the United States Geological Survey, or their respective representatives.

3. The survey shall be executed in a manner sufficiently elaborate to prepare a map upon a scale of 1:62,500, exhibiting the hydrography, hypsography, and public culture, and all town and county boundary lines, township and section lines, as marked upon the ground at the time of its completion, in form similar to sheets already completed in the State of Maine. The preliminary field maps shall be on such scale as the Director of the United States Geological Survey shall select to secure accuracy in the construction of the final map.

4. The hypsography shall be shown by contour lines, with vertical intervals of 10 or 20 feet, as may hereafter be mutually agreed upon.

5. The heights of important points shall be determined and furnished to the Maine Water Power Commission.

6. The outlines of wooded areas shall be represented upon proofs of the engraved maps and furnished to the Maine Water Power Commission.

7. Under ordinary conditions the salaries of permanent employees doing field work shall be paid by the United States Geological Survey, while the traveling expenses, including actual cost of subsistence or a per diem in lieu of subsistence in camp, and field expenses for the same time, shall be paid by the State. During the office

season the salaries shall be divided between the two agreeing parties in such a way as to equalize all expenses, provided that the total cost to the State of Maine for field and office work shall be not less than five thousand dollars ($5,000.00), and provided that the United States Geological Survey shall expend an equal amount upon the work before June 30, 1920, the Federal allotment to bear an approximate charge of 12½ per cent for the necessary expenses in connection with the proper execution of the field and office work. All accounts shall be approved by a representative of the United States Geological Survey before payment.

8. During the progress of the work, free access to the field sheets and records of the topographers and draftsmen shall be afforded by the Water Power Commission of Maine, or its representatives, for examination and criticism; and should the said Commission deem that the work is not being executed in a satisfactory manner, then it may, on formal notice, terminate this agreement.

9. The resulting maps shall fully recognize the cooperation of the State of Maine.

10. When the work is completed, the Water Power Commission of Maine shall be furnished by the United States Geological Survey with photographic copies of the manuscript sheets; and when the engraving is completed, and at all times thereafter when desired, it shall be furnished by the said Survey with transfers from copper plates of the maps, for use in printing editions of said maps.

MEMORANDUM giving areas proposed for survey under this agreement by the Topographic Branch of the United States Geological Survey in cooperation with the Water Power Commission of Maine, for the fiscal year ending June 30, 1920: Farmington, Brassua Lake, Moosehead quadrangles.

Washington, D. C., (Signed) GEO. OTIS SMITH,
1919. Director, U. S. Geological Survey.

Augusta, Maine, (Signed) EDWARD P. RICKER,
1919. Chairman, Maine Water Power Commission.

TOPOGRAPHIC SHEETS ISSUED

Anson
Augusta
Bangor
Bar Harbor
Bath
Belfast
Berwick
Bethel
Biddeford
Bingham
Bluehill
Boothbay
Brassua Lake (P)
Bryant Pond
Buckfield
Bucksport
Buxton
Casco Bay (resurvey)
Castine
Cherryfield
Columbia Falls (A)
Cutler
Deer Isle
Dover (resurvey)
Eastport (G)
Ellsworth
Farmington (P)
Freeport
Fryeburg
Gardiner
Gorham, N. H.
Gray
Great Wass Island (A)
Kennebunk
Kezar Falls
Lewiston
Liberty
Livermore
Machias
Matinicus
Mattawamkeag (T)
Monhegan
Moosehead (F)
Mt. Desert
Newfield
Norridgewock
No. Conway, N. H.
Norway
Orland
Orono
Passadumkeag
Penobscot Bay (1:125,000) (G)
Petit Manan
Poland
Portland (resurvey)
Rockland (G)
Sebago
Seboeis (T)
Skowhegan
Small Point
Swan Island
Tenants Harbor
The Forks
Vassalboro
Vinalhaven
Waldoboro
Waterville
Winn
Wiscasset
York (resurvey)

F Field work completed.
A Advance sheets only.
G Geologic folio and topographic sheets.
P Field work partially completed.
T Triangulation completed.

RIVER AND LAKE SURVEYS

Special river and lake surveys of many of the more important rivers and lakes in the State have been made. The river maps generally on a scale of 1 inch to 2,000 feet, show the plan of the rivers with five-foot contours along the banks, and the profiles. These maps are of great value in studying both developed water powers and undeveloped water power possibilities. From these maps can be obtained a close estimate of the total horsepower that can be developed at the various unutilized falls and rapids when studied in connection with the stream gaging work.

The special lake maps are on varying scales of one inch to 1,200 feet, 2,000 feet, 3,000 feet and 4,000 feet. Some large scale maps, one inch to 200 feet, of the outlets of a number of lakes are shown. These maps in general show the high water line, the low water line, and the five-foot contour lines from 10 to 25 feet above the lake. Soundings are often shown, and occasionally several five-foot sub-contours. These lake maps are of value in computing the capacity of the various lakes when their use as storage reservoirs is contemplated.

KENNEBEC BASIN

* 1. Kennebec River, Skowhegan to The Forks, Sheet No. 1.
2. Kennebec River, Skowhegan to The Forks, Sheet No. 2.
3. Kennebec River, Skowhegan to The Forks, Sheet No. 3.
4. Kennebec River, Skowhegan to The Forks, Sheet No. 4.
5. Kennebec River, The Forks to Moosehead Lake.
6. Kennebec River, Profile, Augusta to Moosehead Lake.
* 7. Brassua Lake and plan of outlet.
* 8. Wood Pond and plan of outlet.
* 9. Attean Pond.
*10. Long Pond; Holeb Pond; Moose River, Moosehead Lake to Brassua Lake.
*11. Flagstaff Lake; West Carry Pond; Spring Lake; Spencer Ponds; Middle Roach Pond; Lower Roach Pond.

PENOBSCOT BASIN

*12. Penobscot River, Bangor to North Twin Lake, Sheet No. 1.
13. Penobscot River, Bangor to North Twin Lake, Sheet No. 2.
14. Penobscot River, Bangor to North Twin Lake, Sheet No. 3.
15. Penobscot River, Bangor to North Twin Lake, Sheet No. 4.
16. Penobscot River, Bangor, to North Twin Lake, Sheet No. 5.
17. West Branch Penobscot River, Chesuncook Lake to Ambejejus Lake, Sheet 1.
18. West Branch Penobscot River, Chesuncook Lake to Ambejejus Lake, Sheet 2.
19. West Branch Penobscot River, Chesuncook Lake to Ambejejus Lake, Sheet 3.
20. East Branch Penobscot River, First Grand Lake to Medway, Sheet No. 1.
21. East Branch Penobscot River, First Grand Lake to Medway, Sheet No. 2.
22. East Branch Penobscot River, First Grand Lake to Medway, Sheet No. 3.
23. Chamberlain, Telos, and Webster Lakes and Round Pond.
24. Baskahegan, First and Second Grand and Allagash Lakes.
25. Mattawamkeag River, mouth to No. Bancroft, Sheet No. 1.
26. Mattawamkeag River, mouth to No. Bancroft, Sheet No. 2.
27. Mattawamkeag River, mouth to No. Bancroft, Sheet No. 3.
28. Schoodic, Sebois, Endless and Mattawamkeag Lakes and Pleasant Pond.
29. West Branch Penobscot River, Chesuncook Lake to Seeboomook, Sheet No. 1.
30. West Branch Penobscot River, Chesuncook Lake to Seeboomook, Sheet No. 2.

ANDROSCOGGIN BASIN

31. Androscoggin River, Brunswick to Umbagog Lake, profile only, Sheet 1.
32. Androscoggin River, Brunswick to Umbagog Lake, profile only, Sheet 2.
33. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 3.
34. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 4.
35. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 5.
36. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 6.
37. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 7.

38. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 8.
39. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 9.
40. Androscoggin River, Brunswick to Umbagog Lake, plan and profile, Sheet 10.
41. Umbagog, Lower and Upper Richardson Lakes, Sheet No. 1.
42. Mooselucmeguntic Lake, Sheet No. 2.
43. Mooselucmeguntic and Richardson Lakes, Outlet plans, Sheet No. 3.

UNION RIVER BASIN

44. Abraham, Scammons and Molasses Ponds and Webbs Pond Outlet, Sheet 1.
45. Alligator, Rocky and Spectacle Ponds, Sheet 2.
46. Great Pond, Green Lake Outlet and Branch Lake Outlet, Sheet 3.
47. Union River, Ellsworth to Great Pond, Sheet 1.
48. Union River, Ellsworth to Great Pond, Sheet 2.

KENNEBEC BASIN

49. Dead River, mouth to Chain of Ponds, Sheet No. 1.
50. Dead River, mouth to Chain of Ponds, Sheet No. 2.
51. Dead River, mouth to Chain of Ponds, Sheet No. 3.
52. Dead River, mouth to Chain of Ponds, Sheet No. 4.
53. Dead River, mouth to Chain of Ponds, Sheet No. 5.
54. Dead River, Chain of Ponds and outlet; Jim Pond and outlet, Sheet 6.
55. Dead River, South Branch; Tim Pond and outlet, Sheet 7.
56. Spencer Stream; Little Spencer Stream; King and Bartlett Lake and outlet; Little Bartlett Lake and outlet; Baker Pond and outlet, Sheet 8.
57. Dead River, Long Falls, special map, Sheet 9.
58. Sandy River, mouth to Madrid, Sheet No. 1.
59. Sandy River, mouth to Madrid; Clearwater Pond and outlet, Sheet No. 2.
60. Sandy River, mouth to Madrid, Sheet No. 3.
61. Sandy River, mouth to Madrid, Sheet No. 4.
62. Sandy River, mouth to Madrid, Sheet No. 5.

PISCATAQUIS BASIN

63. Piscataquis River, mouth to Blanchard, Sheet No. 1.
64. Piscataquis River, mouth to Blanchard, and Schoodic Stream, Sheet No. 2.

65. Piscataquis River, mouth to Blanchard, Sheet No. 3.
66. Piscataquis River, mouth to Blanchard, Sheet No. 4.
67. Piscataquis River, mouth to Blanchard, Sheet No. 5.
68. Sebec River, mouth to Sebec Lake, Sheet No. 6.
69. Sebec Lake and outlet, Sheet No. 7.
70. Pleasant River, mouth to Katahdin Iron Works, Sheet No. 8.
71. Pleasant River, mouth to Katahdin Iron Works, Sheet No. 9.
72. Houston Stream, mouth to Big Houston Pond, Sheet No. 10.
73. Big Houston Pond and outlet; Silver Lake and outlet, Sheet No. 11.

ANDROSCOGGIN BASIN

74. Rangeley Lake, Sheet No. 1.
75. Rangeley Lake outlet.
76. Rangeley River; Kennebago River, Sheet No. 2.
77. Kennebago Lake; Little Kennebago Lake, Sheet No. 3.
78. Rapid River; Pond-in-River.

KENNEBEC BASIN

79. Great Moose Pond.

* Edition exhausted.

MAP OF MAINE

The efficiency and value of any serious work in connection with the investigation of the water power and storage possibilities of the State must of necessity depend largely on available maps.

The best map in existence at the time this Commission was organized was that prepared in 1910 by the State Water Storage Commission under the direction of C. C. Babb, Chief Engineer.

During the winter of 1919-1920 the map of the State was redrawn on the polyconic projection at a scale of 3.06 miles—1 inch. The topographic sheets of the U. S. Geological Survey, although comprising only 34% of the area, were used in so far as they were available. The cooperation of the State Highway Commission, the Public Utilities Commission and the Land Agent and Forest Commissioner was obtained in so far as the cost of the work was concerned, and the State Highway Commission furnished appreciable assistance in locating highways.

Many accurately located geographical positions both on the international boundary and in the interior of the State have become available during the past year through the work of the U. S. Coast and Geodetic Survey, the International Boundary Survey and the U. S. Geological Survey, and these have been of material help in increasing the accuracy of the work. Elevations are not shown and the accuracy of certain sections in the northern part of the State is in doubt owing to lack of available data. The map is not intended, however, to replace the valuable work of the U. S. Geological Survey at the larger scale (approximately 1 inch—1 mile) and it is hoped that the program outlined for increasing their work will be followed.

It is planned to have the map reduced by photo-lithographic process to a scale of 5 miles to the inch and made available for distribution. It is suggested that arrangements be made to have these maps distributed to the public at a cost sufficient to reimburse the departments for the expense of drafting and printing.

DECLINATION OF NEEDLE AND LOCATION OF TRUE MERIDIAN AT AUGUSTA

July 22, 1920, your engineer occupied the Burnt Hill triangulation station of the U. S. Coast and Geodetic Survey as established in 1868. It was found that the flag pole on the State House and the various church spires, the azimuths of which had been recorded, had been rebuilt or relocated so that only one remained as in 1868, the spire of the Baptist church. The azimuth of this spire was checked by four readings on Polaris at about 8.30 p. m., the instrument used being a Buff and Berger transit reading to minutes. It is probable that the position of this spire remains as recorded in 1868.

The following data will make it possible to place an instrument in the true meridian, or to determine the declination of the needle:

Latitude 44° 19′ 14.54″, longitude 69° 47′ 8.53″. About ¼ mile north of cemetery and 1 mile west of Kennebec river, 18 meters east of an old quarry. Two iron ring bolts 2.4 feet high are 8.05 and 4.69 meters respectively east of the station, a copper bolt set in the ledge with a standard reference mark 0.153 meters north of the station, an arrow on the reference mark pointing to the station.

The recorded azimuth of the Baptist church spire from this station is 314° 1′ 44.6″ (from the south) and the distance 929.7 meters. Supplementary azimuths were recorded as follows: Congregational church spire 298° 53′; base of flag pole on muster field 56° 15′. Declination of needle 16° 45′ W. Longitude shows station to be 4h. 39m. 8s. west of Greenwich and the correction to be added to standard time (75th meridian) to obtain local mean time to be 20m. 52s.

GEOLOGY

GEOLOGY

No geologic field work by the U. S. Geological Survey is now under way in Maine and no detailed geological examinations have been carried on during 1917-1918 and 1919. The mapping of the Portland-Casco Bay quadrangles has been nearly completed by Mr. F. J. Katz and work on the Dover-York quadrangle was started by him in 1914. Progress on this work was, however, suspended during the war and has not yet been resumed.

A handbook of the Geology and Geography of New England, to be published as a bulletin and now in preparation, will contain a topographic map of New England and important contributions to the geology of Maine.

Some general results obtained by Mr. Katz in southwestern Maine have been published in Professional Paper No. 108.

The Commission has been fortunate in obtaining the services of Mr. F. F. Burr on a part-time basis. A general study of the geology of the State is included herewith, and certain special investigations of proposed dam sites may be found elsewhere in the report. Particular attention is called to Mr. Burr's remarks on Peat, of which a large amount is available in this State. With the continued increase in cost of coal, the use of peat as a fuel will become a matter of increasing importance.

OIL REPORTS

In 1919 various reports were received in connection with oil discoveries near Dover. In our opinion this was improbable, and Mr. Burr was asked to visit the locality and report thereon.

Two localities were visited. No traces of oil were found and no indications which could lead to the conclusion that such traces had ever existed. (See Mr. Burr's report.)

FUTURE WORK

Far too little geological work has been done in this State in recent years. There is a large field for the study of minerals having an industrial value. Many inquiries have been received from industries located outside the State in regard to available raw materials concerning which little accurate data was available. Special study should be given to the location and commercial value of such deposits. Investigation of the large amounts of peat available should be continued with particular reference to its use for power and domestic purposes. Investigation of materials for use in the electro-chemical industries should be undertaken with particular attention to industries which could economically use off-peak loads.

It is recommended that a State geologist be appointed who will be able to give his entire time to the work, either independently or under the direction of this Commission.

USEFUL MINERALS IN MAINE *

Amethyst. Oxford County, gem crystals found on Deer Hill in town of Stow, and on Pleasant Mountain, in the town of Denmark.

Apatite. Androscoggin County, in transparent pink, purple, blue and green crystals, at Apatite Hill, Wade, and Pulsifer quarries in town of Auburn, Berry quarry, town of Poland; Oxford County, at Hebron.

Argentite (silver glance). Hancock County, reported from Sullivan silver mine.

Arsenopyrite (arsenical pyrite). Franklin County, Titcombs Hill, Farmington; Hancock County, occurs in Bluehill and Brooksville copper mines, and Sullivan silver mines, was prospected on Verona Island; Knox County, occurs at Owls Head, South Thomaston; Oxford County, occurs at Corinna, Greenwood, Rumford, and at Mount Rubellite in town of Hebron; Waldo County, occurs in veins in schist at Fort Point; York County, Bonds Mount and Newfield, and accompanying silver ores at Lebanon and Acton.

Beryl. Aquamarine. Kennebec County, at Winslow with mica and fluorite in casserite vein; Oxford County, French Mountain, town of Albany; Dunton mine, town of Newry; Mount Mica, town of Paris, associated with corundum, town of Greenwood; Sugar Hill and Harndon Hill, town of Stoneham.

Golden beryl. Oxford County, Edgecomb Mountain, town of Stoneham, and Speckled Mountain, town of Peru.

Caesium beryl. Androscoggin County, Berry quarry, town of Poland; Oxford County, town of Hebron; on Dudley farm, town of Buckfield.

Opaque varieties common in pegmatites, notably: Androscoggin County, Apatite Hill, town of Auburn; Hancock County, in cassiterite-bearing granite at Catharine Hill; Oxford County, Noyes mine, town of Greenwood.

Bornite (purple copper ore). Hancock County, has been mined in Ellsworth schist at Bluehill; Washington County, Lubec lead mine and Pembroke copper prospects; not abundant.

Brown Iron Ore (bog iron ore). Lincoln County, occurs on Pemaquid Ledge; Oxford County, at Rumford; Piscataquis County, Dover, several deposits of large size; Somerset County, Skowhegan, several large deposits; York County, New Limerick and Newfield.

Cassiterite. Kennebec County, occurs in 10-inch vein at Winslow; Oxford County, occasional specimens at Mount Mica and Greenwood.

* Bulletin 585, U. S. Geological Survey.

Cement Material. Knox County, limestone near Rockland suitable for Portland cement.

Cerargyrite (silver chloride). Hancock County, reported from Sullivan silver mine.

Chalcocite (copper glance). Hancock County, sparingly in chalcopyrite at Bluehill copper mines, at Douglas mine carries gold and silver.

Chalcopyrite (copper pyrites). Hancock County, important mineral of Bluehill; has been mined at Douglas, Twin Lead and other mines for gold and silver; Somerset County, has been mined at Robinson mine; Washington County, occurs in old mines at Cooper; has been mined at Cherryfield and Lubec lead mine for gold and silver, at Pembroke copper prospect.

Clay (brick). Knox County, deposits and brick works at Thomaston, South Thomaston and Rockland. Dug: Androscoggin County, at Danville, Durham, Leeds Junction and elsewhere; Aroostook County, Masardis and Presque Isle; Cumberland County, Brunswick, North Yarmouth and Portland; Hancock County, East Sullivan, Ellsworth, Orland, and elsewhere; Kennebec County, Augusta, Waterville and Winslow; Oxford County, East Bethel; Penobscot County, Bangor, Brewer and Howland; Piscataquis County, Abbot Village and East Dover; Sagadahoc County, Bath, Topsham, and Woolwich; Somerset County, Madison; Washington County, Calais and Lubec; York County, Eliot, Kennebunk, Saco and elsewhere.

Columbite. Androscoggin County, sparingly in pegmatite at Apatite Hill, town of Auburn; Cumberland County, town of Standish; Oxford County, Mount Mica, town of Paris; Sagadahoc County, Harndon Hill, town of Stoneham; Mount Ararat and Willes feldspar quarry, town of Topsham.

Copper. See Bornite, Chalcocite, and Chalcopyrite.

Epidote. Sagadahoc County, occurs at Phippsburg.

Essonite. Sagadahoc County, Phippsburg; Oxford County, at several places.

Feldspar. Extensively quarried from pegmatite deposits. Androscoggin County, quarried at Apatite Hill, town of Auburn; Berry quarry, town of Poland; Lincoln County, has been quarried in town of Edgecomb; Oxford County, has been quarried at Hibbs quarry and Mills quarry, town of Hebron, at Mount Mica, town of Paris; Piscataquis County, has been quarried at Brownsville; Sagadahoc County, quarried at Golding's quarry, Georgetown, Willes quarries, town of Topsham; has been quarried at Mount Ararat and Fisher's quarry, town of Topsham.

Flagstone. Mica schist suitable for flagging occurs in Kennebec County, at Winthrop; Sagadahoc County, at Phippsburg; York County, Acton and Lebanon; and at other localities; also sandstones in northern part of State.

Galena. Hancock County, occurs in Ellsworth schist near Bluehill and Brooksville; Oxford County, in granite at Mount Glines; Penobscot County, in thin veins near Hampden and Corinna; Piscataquis County, at Dover; Somerset County, abundant at Bingham mine, small quantity at Robinson mine has been mined; Washington County, Cherryfield, Lubec lead mine, and Pembroke copper prospect.

Garnet. See Essonite.

Gold. Franklin County, associated with pyrite-bearing slates at Strong; Hancock County, has been mined in granite with molybdenite at Catharine Hill, is sparingly present with sulphides in Bluehill mines, and in some river gravels and crevices in underlying rocks; Oxford County, has been found in some river gravels; Somerset County, occurs at Moscow, and in some river gravels; Washington County, in quartz veins at Bailey, Baring, and Cutler, and in some river gravels and in crevices in underlying rocks.

Granite. Quarried: Cumberland County, at Bridgton, Brunswick, Portland, Pownal, Westbrook and Woodfords; Franklin County, North Jay; Hancock County, Bluehill, Brooksville, Dedham, Franklin and elsewhere; Kennebec County, Augusta, Hallowell and Mainstream; Knox County, Long Cove, Pequoit, Rockland, South Thomaston, St. George, and elsewhere; Lincoln County, Round Pond and Waldoboro; Oxford County, Fryeburg and Oxford; Penobscot County, Lincoln, black granite at Hermon Hill; Piscataquis County, Guilford; Somerset County, Canaan and Norridgewock; Waldo County, Frankfort, Searsport, and Swanville; Washington County, Addison, Baileyville, Calais, Jonesboro, Marshfield and Milbridge; York County, Alfred, Biddeford and Kennebunkport.

Graphite (plumbago). Cumberland County, occurs in pegmatite dike near Yarmouth; Franklin County, in schist near Madrid; Hancock County, in pegmatite and schists near Bluehill and Brooksville; Kennebec County, at Gardiner on the Kennebec River; Oxford County, sparingly in granite and mica schist in towns of Paris, Rumford and Woodstock; Sagadahoc County, has been mined at Georgetown and Phippsburg; Waldo County, occurs at Belfast, disseminated through clay slate.

Hematite (red iron ore). Aroostook County, occurs at Curriers; Piscataquis County, has been mined at Katahdin mines.

Infusorial Earth. Hancock County, was mined at Bluehill and Surry; Washington County, was mined at Beddington.

Iron. See Brown iron ore, Hematite and Magnetite.

Kunzite (spodument). Oxford County, lilac-colored, occurs in pegmatite in town of Andover.

Lead. See Galena.

Lepidolite. Androscoggin County, in pegmatite deposits at Apatite Hill, and in the Wade and Pulsifer quarries, town of Auburn; Oxford

County, at the Dunton quarry in the town of Newry, and at Mount Mica, town of Paris; Mount Rubellite, town of Hebron.

Limestone (lime). Knox County, extensively quarried and burned in vicinity of Rockland, Rockport, Thomaston and West Warren.

Limonite. See Brown iron ore.

Magnetite (magnetic iron ore). Aroostook County, occurs at Linneus, impregnating slaty rock; Cumberland County, Raymond, in thin sheets in epidotic gneiss; Hancock County, in schist at Douglas, Twin Lead, Owen and other mines near Bluehill and Brooksville, and on Marshall Island; Knox County, Union; Oxford County, Buckfield.

Mica (biotite). Common in many pegmatite deposits of the State.

Mica (muscovite). Abundant in all of the pegmatite deposits. Oxford County, small quantities have been mined at Mount Mica, town of Paris, Bennett and Pingree farms, town of Albany, Hibbs quarry, town of Hebron, southwest part of town of Waterford.

Molybdenite (sulphide of molybdenum). Cumberland County, occurs in granite in close connection with pegmatite at a number of places in Brunswick; Hancock County, under similar conditions at Catharine Hill on Long Island in Bluehill Bay; Washington County, Cooper, 22 miles southwest of Calais, with fluorspar and bismuth in narrow pegmatite dikes cutting granite along joints, and impregnations in granite.

Ocher. Androscoggin County, has been mined at Lisbon; Cumberland County, occurs at Bridgton, Naples and Sarmonite.

Platinum. Knox County, in peridotite, East Union; Penobscot County, at Hermon; Piscataquis County, in pyrrhotite ores.

Pollucite. Oxford, found in pegmatite at Buckfield and Hebron.

Pyrargyrite (ruby silver). Hancock County, occurs at Sullivan, Franklin and Hancock, with galena, native silver, silver glance, pyrite, chalcopyrite, etc., sparingly.

Pyrite. Hancock County, Douglas, Twin Lead, Bluehill, and other mines in Bluehill and Brooksville district, and in granite at Catharine Hill; Oxford County, in granite at Mount Glines; Somerset County, has been mined at Robinson mine; Washington County, Cherryfield, has been mined at Lubec lead mine.

Pyrrhotite. Hancock County, Douglas, Twin Lead, Monmouth and other mines, have been mined; Knox County, Miller farm, East Union; Piscataquis County; Somerset County, Robinson mine.

Quartz. Abundant in all pegmatite deposits. White quartz: Androscoggin County, mined with feldspar at Apatite Hill, town of Auburn; Cumberland County, has been mined near Cumberland Mills. Rose quartz: occasionally used as a gem. Oxford County, Tubbs ledge and French Mountain, town of Norway; Mount Mica, town of Paris. Smoky quartz: Androscoggin County, occurs at Apatite Hill, town of Auburn; Oxford County, Blueberry Hill, town of Stoneham.

Rhodonite. Hancock County, was mined on Osgood farm, Bluehill, when furnace of Katahdin Iron Works was in blast.
Sand (building). Dug at many places throughout State.
Sand (glass). Knox County, Camden, abundant; not mined; Waldo County, Liberty, pure granular quartz.
Sandstone. Washington County, Devonian sandstone mostly unsuited for building purposes occurs near Perry.
Silver (native). Hancock County, reported from Eggemoggin and Sullivan mines. See also Argentite, Cerargyrite, Pyrargyrite and Stephanite.
Slate. Piscataquis County, slate region in central part of State, quarried at Barnard Plantation, Blanchard, Brownville, Monson and Williamsburg; Somerset County, prospect in southwest corner of town of Forks.
Sphalerite (zinc blende). Hancock County, occurs sparingly in Bluehill copper deposits, argentiferous in Gouldsborough mine, has been mined; also found in Eggemoggin, Deer Isle, and other mines, and at Harborside; Somerset County, has been mined at Robinson mine; Washington County, has been mined at Cherryfield, also occurs at Pembroke copper prospect.
Stephanite (silver glance). Hancock County, reported from Sullivan mine.
Talc (soapstone). Hancock County, Harpswell, Jaquish, Deer Isle; Kennebec County, Ovis Island, bed 14 feet wide; Vassalboro.
Tin. See Cassiterite.
Topaz. Oxford County, Harndon Hill, town of Stoneham.
Tourmaline. Colored tourmalines of gem quality. Androscoggin County, mined at Apatite Hill, town of Auburn; has been mined at Wade and Pulsifer quarries, town of Auburn, Berry quarry, town of Poland; Oxford County, mined at Mount Mica, town of Paris; has been mined in town of Greenwood, at Mount Rubellite, town of Hebron, Mills quarry, town of Hebron, Dunton quarry, town of Newry; Sagadahoc County, Willes feldspar quarry, town of Topsham.
Tripolite (diatomaceous earth, "fossil meal"). Hancock County, occurs abundantly in all the pond bottoms near the coast, mined to some extent. A very white, fine variety occurs in Bluehill ponds in beds from 4 to 6 feet thick.
Wad (bog manganese). Occurs in Aroostook County, at Hodgdon; Hancock County, at Bluehill; Knox County, at Thomaston, on Dodges Mount; Oxford County, at Sumner; Piscataquis County, at Dover; York County, at Mount Agamenticus.
Zinc. See Sphalerite.

GEOLOGY

Report of Mr. Freeman F. Burr

During the year many letters have been received, from outside the State as well as from within its borders, in regard to our mineral resources. The materials inquired about included the following: molybdenum; fire and other clays; bricks; molding, blast and glass sands; mica; grinding pebbles; specimen minerals; peat; fluorite; silica; graphite; feldspar; cement rock; tourmaline; gold; corundum; granite; road materials. Our State can (in many cases already does) take part in the production of all of these; and it has afforded the Geologist some satisfaction to be able to answer many of the inquiries in some detail. On the whole, there has been indicated a tendency toward a wider utilization of such minerals as Maine is able to supply.

So far the geological work has been seriously hampered by three things: (1) the fact that the records of such work as has been done on the geology of Maine are scattered among a large number of reports, bulletins, and scientific and other periodicals, many of them not readily available; (2) there are no definite means of getting at the facts regarding mineral industries already established or those in immediate prospect of being established; (3) for a large part of the State there are no accurate maps, a fact which makes it extremely difficult to determine and record rock structures in their true relations.

As regards the first, it is highly desirable that there should be made, at the earliest possible date, a compilation, in brief form, of all the known data in regard to the geology of Maine. Under present conditions much time is consumed in hunting for information and a considerable amount of duplication in field work is unavoidable.

The map question can, and it is to be hoped will be, solved by a more adequate provision for cooperation with the United States Geological Survey in extending the area covered by the topographic sheets.

A continuation of geological work in Maine is strongly urged for reasons which the writer deems amply sufficient to warrant the appropriation of sufficient money to enable at least one man to devote all his time to it. These reasons, briefly stated, follow.

In a previous report it was shown that Maine possesses, in some amounts, at least 40% of all the minerals known to exist in the United States. Of these, the following have been mined at various times in the past: (mines are at present operated for those italicised) *gold, silver, copper,* lead, zinc, tin, iron, *molybdenum,* manganese, *quartz, feldspar,* pyrite, mica, *gems,* and various rare minerals. It is probable that all of these, and others which have so far received no exploitation, could be now and in the future mined at a profit. In fact, so many formerly unused minerals have entered into commercial demand during the last few years that it has become a matter of wise policy to consider any mineral deposit, however ignored in the past, as potentially valuable; which points to the advisability of investigating all our minerals as rapidly as possible. Illustrative examples are seen in the ores of manganese, which Hitchcock, in his 1862 geological report, stated to be of little importance, and which are now absolutely indispensable to the steel makers; in molybdenite, which the same author mentions as a mineral curiosity; and in common quartz, which is perhaps even more important than manganese in the steel industries, and for which many other uses have recently been discovered.

The State contains deposits of all the useful rocks: granite, in many grades and colors, limestone in abundance, and slate of a quality second to none. We have fallen behind in the marketing of these materials, and in general the stone business here might be given much wholesome stimulation by such cooperation as the State could give through a regularly constituted department.

The geologist is convinced that Maine has failed to take its place among the mineral producing states, not because of poverty either in variety or in amounts of its minerals, but because of a lack of proper investigation of the resources and adequate encouragement to mineral industries.

A large and comparatively new field of investigation has been opened by the many and increasing applications of electricity to the production of useful materials from raw minerals.

The electric furnace, in some of its many forms, offers perhaps the best solution of the difficulty experienced by the power companies in finding suitable load for off-peak intervals. The future prosperity is in very large measure bound up in the economic development of electrical industries, and in this development our mineral deposits should be made to play an important part.

It is urged that serious attention be given to the question of establishing, as a permanent fixture, the office of State Geologist, and providing this office with means for carrying on continuous investigations. The experience of the past three years shows that the incumbent of this office could profitably devote the major part of his time to gathering information in response to definite inquiries from individuals and concerns to whom the minerals asked for are absolutely indispensable. Letters have been received from some of the largest firms in the country, embodying urgent demands for a large variety of materials, many of which this State would almost certainly be able to furnish in quantity if sufficient investigation had made the truth known. Further than this, a geologist who could devote all of his time to the service of the State might render invaluable assistance in the development of engineering projects, such as highway and railroad construction, the building of dams, etc. The connection may at first seem remote; but it may be pointed out that the records of such work in other states show the saving of many thousands of dollars by the employment of trained geologists.

In brief, then, the duties of a State Geologist should embrace the following: furnishing as much information as possible to mineral manufacturers and practical or potential producers, and putting them in direct touch with each other; investigating, as thoroughly as time and means will permit, all possible sources of useful minerals; compiling, as rapidly as possible, all data on the rocks and minerals of the State, including all industries that use native minerals in any form or to any extent; issuing educational matter in regard to the rocks and minerals of Maine.

The Fuel Question

This may fairly be said to be the most important economic topic of the day, and the Geologist feels that he would be neglecting an obvious duty did he fail at this time to take cognizance of it.

The question of the possibility of coal in Maine has agitated the public mind for a good many years, and requests for information received during the past year would seem to indicate that there are those who still hope, in spite of all that has been done to discourage any expectations in this direction. In the eastern part of the State, it is true, the earlier geologists held out some hope that coal would eventually be found; but further examination of the geologic conditions of that entire region has shown such hope to be entirely unfounded. This whole matter has been gone into so thoroughly by Dr. George Otis Smith, in his Geology of the Perry Basin (U. S. Geological Survey Professional Paper No. 35, 1905) that it is necessary merely to refer those interested to that paper. As regards the western half of Maine, it should be said that there is absolutely no possibility of finding coal anywhere, and no indication that could ever have led anybody familiar with conditions of coal formations to expect that it would be found. All rumors to the contrary are either absolutely false, or are based on the finding of lumps of coal which have been accidentally or purposely dropped where they are found.

The search for oil in this State is probably fully as hopeless as that for coal. Cases are not infrequently reported in which an irridescent, oily looking scum appears on the surface of springs and brooks; examination of this scum invariably shows it to consist of a small amount of the hydrous oxide of iron; its oily appearance is entirely deceptive. Oily material in small quantities may occasionally appear in connection with surface deposits, since such material is a product of animal and plant bodies; but the chances are almost overwhelmingly against the finding of oil in the underlying rocks, chiefly because these show abundance of evidence of having been folded and fractured to such an extent that any volatile materials would inevitably have been expelled into the atmosphere long ago. It seems best to discourage any expectation of oil anywhere in Maine.

Although the outlook for the discovery of coal or oil in the State is entirely discouraging, the attention of the public should be forcibly called to a large source of fuel which is at present practically untouched, and which, with proper management, could be made to go a long way toward the solution of the present fuel difficulty. We refer to the large deposits of peat which exist in nearly all of the thickly settled parts, and which could be made to yield, with relatively small expenditure in equipment and labor, many million tons of fuel which, if somewhat inferior to coal, has possibilities which should not be neglected. The peat question was entered into with considerable detail in the earlier report of the Geologist, (Second Annual Report, Public Utilities Commission, State of Maine, Vol. 2, 1916), and all persons so located as to be able to utilize, to any extent, the materials of a peat deposit, are urged to consult that report at the earliest opportunity.

It will be noted that there are two general methods for the utilization of peat fuel. The first requires little preliminary work, and consequently no elaborate or expensive equipment, and is adapted to domestic purposes and the needs of small manufacturing plants using steam power.

The second involves the use of peat as a source of fuel gas, with the production of by-products which can be marketed to reduce the cost of the fuel. This method necessitates the erection of more or less elaborate plants at a considerable initial outlay. It is believed that such plants could be made profitable in certain particularly favorable localities in the State; and it is highly desirable that experimentation along this line should be carried out. It is thought that the present needs can best be served by urging a wide use of peat for household purposes. With this in view, the following brief suggestive outline is given: local conditions will undoubtedly suggest variations in this program.

The deposit should first be sounded in a number of places, and if possible sampled at different depths, in order that operations may be begun under the most favorable conditions as to depth, quality of material, and moisture. A portion of the surface, the area depending on the amount of fuel needed, should then be thoroughly cleared of surface vegetation. (This should not be done by burning, as the surface peat is usually fairly dry, and a fire started in it is very persistent and hard to extinguish.) In this connection it should be borne in mind that the average production of an acre is 200 tons of air-dried peat for every foot of depth; in other words, an area one rod square will give a little more than a ton of dry fuel for every foot dug.

When a suitable area has been cleared, the peat (muck) should be shoveled into carts and hauled to some convenient dry surface to drain until the whole mass is nearly dry. This material can be used without further preparation; but in order to insure convenience in handling and the best results in burning, the nearly dry material should be pressed into small cakes and dried in the sun, on racks built for the purpose.

In order that the preparation of the fuel may be carried out as economically as possible, the arrangements for pressing and drying should be no more elaborate than is absolutely necessary. For pressing, the following simple apparatus is suggested: a hand barrow with floor 2 feet by 4 feet 2 inches and handles projecting at ends; to fit this, a frame with 60 compartments 4 inches by 5 inches between centers of partitions and 3 inches deep; a board, with handle attached, similar to a plasterer's tool. Lay the barrow on the ground by the peat pile, with the frame in place; shovel peat to the frame until the compartments are filled and the material heaped up a few inches over the top; with the board, press the peat into the compartments, using considerable force, and working until no more can be pressed in. Carry the barrow to the rack, slide the frame on to a shelf and lift carefully, forcing the cakes down to the shelf if necessary (a convenient tool for this purpose may be made from a section of 2 by 4). Repeat this process until the racks are filled. Under average summer conditions, with a fair amount of sunlight, the peat should be sufficiently dried for household purposes in a week or two, and it should then be stored under cover in convenient bins. Many of the cakes may break apart in handling, but this will do no particular harm. The drying shelves should be made of slats, with narrow spaces between, should be roofed over, and should be placed in a convenient position with regard to the peat pile. Individual experience will doubtless indicate ways of improving on the above suggestions. It is urged that trials be made during the coming open season, in as many parts of the State as possible, carried far enough to give some definite idea as to the possibilities, and the results reported. Such trials would cost little, and the experimenter can be assured of a fair return for his effort.

Limestone

This is a common mineral resource of the State which should receive more general attention and wider use. No complete record of its distribution is at hand; but it is safe to say that it occurs in considerable amounts in every county, and that the total area underlain by it is enormous.

Limestone may be described as a comparatively soft rock consisting principally of the mineral calcite, or carbonate of lime. Pure limestones are usually light in color, and may be distinguished from other materials of similar appearance by the ease with which they may be scratched, and by the fact that they effervesce when treated with strong acids. Various impurities may somewhat alter the normal character of limestone in these respects. Chief among these are: silica (quartz) which may be present in disseminated grains or in veins and irregular masses, and which makes the whole uneven in hardness and gritty; clay, which usually imparts a gray color; carbonate of magnesia, which renders it less readily attacked by acids, but may not alter its appearance; iron and organic matter, both of which tend to give it a dark color; small amounts of other mineral substances, which may give characteristic colors. Mica and other silicate minerals are frequent impurities in limsetone, sometimes to such an extent as to obscure its character.

Limestone has a very wide variety of uses, and is in constant and increasing demand for most of them. For commercial purposes in general a comparatively high degree of purity is required; but there are a number of domestic uses of limestone for which an inferior grade will serve, and it is with these uses that the present report is concerned.

The largest use of limestone is for the making of building lime, the basis of practically all mortars and plasters. Closely connected with this is its use in the manufacture of Portland cement. It also has a considerable use for agricultural purposes, in the sulphite process of paper making, as a flux in iron smelting, in making certain alloys with iron, and in the manufacture of various chemicals.

As has been said, for commercial purposes the lime should be comparatively pure; it is also necessary, as in the case of any bulky product on which the margin of profit is relatively small, that the raw material shall be present in sufficient amount to insure the successful operation of a large plant for a long term of years. At the present time, the section of country immediately about Rockland is probably the only district in the State where the proper conditions are fulfilled.

It would seem, however, a matter of distinct economy to utilize for local purposes the immense amount of relatively impure limestone that exists in many parts of Maine. For this purpose no elaborate or expensive equipment would be needed; and in many cases products could be obtained which, while not up to commercial standard, or not in sufficient amounts to warrant shipping to market, would serve domestic purposes quite as well as any.

Limestone in varying amounts exists in other parts of the State in the following localities, and probably in many more:

County	Towns
Androscoggin	Turner, Poland, Livermore, E. Livermore, Lewiston, Greene.
Aroostook	Limerick (a number of localities of fossil-bearing limestones are not taken into account).
Cumberland	Cape Elizabeth, Gorham, Brunswick, Standish, Portland, S. Portland.
Franklin	Jay, Wilton, New Sharon, Carthage, Temple, Farmington, Industry, Strong, Phillips, Kingfield, Mt. Abraham.
Hancock	Bluehill, Bucksport.
Kennebec	Augusta, Litchfield, Monmouth, Manchester, Mt. Vernon, Vienna, Waterville, Belgrade, Winslow, Winthrop, Wayne, Sidney, Hallowell, Clinton.
Knox	The Rockland region, mentioned above.
Lincoln	Dresden, Whitefield, Waldoboro.
Oxford	Norway, Dixfield, Paris, Peru, Buckfield, Rumford.
Penobscot	Dexter, Hampden, Old Town, Carroll.
Piscataquis	Dover, Guilford, Abbot, Foxcroft.
Sagadahoc	Phippsburg, Bath, West Bath.
Somerset	Norridgewock, Skowhegan, Starks, Palmyra, Harmony, Athens, New Portland, Bingham, Canaan, The Forks, Cornville, Concord, Lexington.
Waldo	Lincolnville, Brooks.
Washington	Princeton.
York	Newfield.

The question of the distribution of the limestones throughout the State cannot be entered into here in any further detail, but a brief statement of the relation of the limestone to the other rocks and to the topography in parts of Androscoggin, Kennebec and Franklin Counties may be helpful to those interested.

The region in question is divided into long parallel valleys, for the most part rather narrow and separated by ridges or series of elongated hills trending approximately north and south. The valleys contain either rivers of fair size, or long chains of lakes. Many of the hilltops are bare, and offer fine exposures of the ledge rock; the slopes are thickly covered, except for occasional limited outcrops, with loose rock material, frequently sprinkled with large boulders; and the floors of the valleys are filled with thick beds of sand, gravel and clay. The bed rock of the principal hills is invariably hard and resistant, either granite of varying coarseness, or mica schist. The limestone exposures are mostly found on the sides of the valleys, or on low hills between the main ridges. It is not meant to imply that limestone is the only rock so situated; slaty rocks or comparatively soft schists may frequently replace it; but limestone is, in this region, typically the valley rock, and it is safe to predict that it will be found somewhere in the course of every one of the valleys. The actual outcrops are usually very limited, found at widely separated points in brook beds and road cuts; they are, however, sufficiently numerous to indicate that on the whole very large areas are underlain by the limestone. It frequently happens, in places where no actual outcrops are to be found, that wells and ditches will cut into beds at no great depth below the surface.

The most extensive exposures of limestone so far seen are in Dixfield and Carthage, where the rock appears in ledges thirty feet high, and may easily be traced across country for a number of miles.

That the burning of these limestones for local purpose would constitute a revived, rather than a new, industry is indicated by the fact that small kilns for the purpose once existed in the region mentioned, and a little beyond its limits, at Athens, Carthage, Dexter, Dixfield, Farmington, Guilford, Industry, New Sharon, Norridgewock, Phillips, Rumford, Strong, Turner, Oakland, Wayne, Winslow, Winthrop, and probably other places. At many of these places are still to be found houses in the construction of which home-made mortar or plaster was used.

The question of the use of lime in agriculture is of fundamental importance. It is chiefly important as a corrective for sourness, or acidity, in soils. Besides this it improves the physical condition of "heavy" soils, and promotes the absorption by plants of certain mineral foods.

There has been a great deal of discussion as to the relative value of prepared lime and ground raw limestone. Whatever may be the true merits of the case, the evidence seems to show that the latter material performs the required work in a highly satisfactory way.

Silica

Silica, in the form of the several varieties of quartz, is the most abundant of all minerals, occurring as the chief mineral of granite, as an essential constituent of most other rocks, in all sands and gravels, and in veins and large or small masses of irregular forms inclosed in rocks of various types. In its commoner forms, it is recognized by its glassy appearance, comparative hardness, and the fact that it breaks, upon being struck with a hammer, into sharp fragments with absolutely no regularity of form. It resists the action of air and water, and therefore appears fresh and bright when surrounding minerals show signs of decay and discoloration; and frequently it is brought into relief on rock surfaces through the leaching away of more susceptible minerals.

Quartz, ground to varying degrees of fineness, is used in paints, wood fillers, scouring soaps and other abrasive agents, tooth powders, etc.; in the manufacture of sandpaper and sand belts; in sand blasts; in filters; and in the manufacture of pottery. Broken quartz is used as a filler for acid towers, and as a flux in copper smelting. Less common uses are in the manufacture of pure silicon, silicon steel, ferro-silicon and silicon copper. In recent years fused quartz has found a somewhat extensive use in the making of test-tubes, dishes, etc., for chemical laboratories; depending on the fact that such materials will stand more heat than glass, and may be plunged red-hot into cold water without cracking; also for certain types of electric lamp bulbs.

There is a constant, though limited, demand for exceptionally clear crystal quartz by the manufacturers of optical lenses. It should also be stated that large numbers of gems are cut from similar materials by the lapidaries in this State.

During the past year or two there has been an awakened interest in the mining of quartz here, largely through the demand for a large supply by the American Glue Company for its sandpaper factory at Hallowell. The comparatively clear quartz of the pegmatite deposits seems best suited to the purpose, as it is hard and breaks with a sharp fracture.

Sand

Inquiries have been received in regard to supplies of glass sands, blast sands, and molding sands.

Lack of detailed information makes it impossible to say very much about any of these; although it is probable that sands suitable for all the purposes suggested are to be found in some amounts within our territory. In the hope that any considerable deposits will be reported, brief descriptions are appended.

The chief requisite of a glass sand is that it shall consist of pure silica, preferably white. No sands that would suggest availability for this purpose have been observed, nor has it been possible to find records of any such material. It should be remarked that a deposit of glass sand would probably need to be of considerable size, in order that a plant might be profitably established in the immediate vicinity. In Hitchock's report, 1862, the author suggested the use of pure quartzite, particularly that west of Rockland, for this purpose.

Blast sands are used for scouring and cleaning metal surfaces, and for grinding glass, and for this purpose are forced from a pipe or hose under pressure. For this use it is essential that the grains shall be sharp and fairly uniform in size; pure quartz sand is preferable. Deposits of such sands doubtless exist in the State, and a limited market might be found for them.

Molding sand is used in metal casting; the principal requirements are fineness, uniformity of grain, and the admixture of enough clay so that under proper treatment it will retain the forms of patterns. It is not essential that such a sand should be pure quartz, and a certain amount of iron oxide is probably more helpful than detrimental. Good molding sands have not been obtainable in large amounts in Maine, most of such material used in our foundries being imported from Albany, N. Y., or from New Jersey. The number of foundries in the State is not large, but a limited amount of good molding sand, conveniently located, should find a ready market at a fair profit.

Core sands are similar to the above in that they should contain a sufficient amount of clay to give coherence; but they need not be so fine nor so uniform in grain. Such sands are known to be fairly abundant, but no systematic study of them has been made.

Satisfactory core sands are found in considerable amounts within easy distances from the foundries at Saco, Livermore Falls, Millinocket, and probably at other places from which no reports have been received. A deposit of molding sand is reported near Phillips but this has not been investigated.

Graphite

This mineral is known to have a fairly wide occurrence in Maine, as indicated by the following list of localities from which it has from time to time been reported:

Augusta, Bath, Bethel, Bowdoinham, Brunswick, Canton, Charlotte, Dixfield, East Sangerville, Farmington, Freeport, Georgetown, Greenwood, Hampden, Lewiston, Lincolnville, Marion, Marshfield, Monmouth, Paris, Rumford, Thomaston and Woodstock. It is impossible to state, even approximately, the amount available at any of these localities; none of them seems to have been developed to any extent as a source of graphite; and so far as known the question of the commercial production of this mineral in Maine has received little attention.

Graphite is a gray mineral with a semi-metallic lustre and a greasy feel; it is so soft as to leave a gray or black mark on the fingers or on paper. It is distinguished from molybdenite, which it resembles somewhat closely, by its usually less brilliant lustre, and by the fact that it gives no appearance of sulphur under the blow-pipe. It is found in pegmatite and in limestone; but its more common occurrence is in mica schist. In this rock it may be disseminated in fine flakes, making up a small percentage of the whole; or it may be so abundant as to constitute nearly the whole mass of the rock.

Graphite is used for making lead pencils (in which case it is called black lead); in crucibles for melting metals; for coating molds in foundries; in paints, particularly for rustproofing structural iron and steel; for electrodes in furnaces, and for many other electrical and chemical purposes; in stove polishes; and in lubricants, either alone or mixed in various oils and greases.

The natural graphite industry in the United States is said to be growing rapidly, although the domestic production of raw material is extremely unsteady, and large amounts are regularly imported from Ceylon and Mexico. Most of that mined in this country is very impure, occurring in small flakes mixed with quartz, mica and other minerals. Methods have been found, however, for successfully treating such materials, and there is good reason to expect an ever-increasing demand for the home product. Careful and conservative prospecting in some or all of the localities named might well yield interesting results, and would certainly be of value in giving us further information as to the probable amount of graphite available.

Iron Pyrites

Under this name are included the sulphides of iron, pyrite, marcasite and pyrrhotite. In one or all of these forms it is very abundant and widespread in Maine, although deposits of sufficient size and concentration for commercial purposes are not common.

Iron pyrites finds its chief use in the manufacture of sulphuric acid, a substance which is indispensable to the manufacturers of explosives and fertilizers. For this purpose the raw mineral is put through a roasting process, which renders the sulphur available for acid manufacture and leaves a residue of iron oxide. Since the pyrite minerals seldom occur as pure iron sulphides, but are likely to have a number of other substances, such as copper, arsenic, manganese, etc., closely associated with them, the development of a deposit frequently brings to light commercially important by-products.

An enumeration of all the places where pyrite occurs would probably include every town in the State, and would be of little value. There are, however, a number of localities in which a sufficient amount has been found to indicate commercial possibilities. Such deposits occur at Bluehill, Bingham, Corinna, Waterville, Benton, Troy, China, Gardiner, Pittston, Katahdin Iron Works, Sullivan, Pembroke, Lubec, Eden, Brooksville, Rumford, Farmington and Jewell's Island in Casco Bay.

The pyrite minerals decompose more or less readily under the action of the air; the sulphur passing into the air and into surface and ground water in the form of an oxide, and the iron remaining behind as a rusty red or brown stain, or as a crust of iron ore on the surface and in the crevices of the rock. Where pyrite is plentiful, enough of the iron ore is frequently taken up by drainage to form considerable deposits of bog iron on lower slopes or in neighboring low lands; the iron ore which was formerly worked at Katahdin Iron Works is an example of such a deposit, and large numbers of similar cases are to be found throughout the State.

Such investigation as has been carried out, supplemented by statements in earlier reports, would indicate that there are, on the whole, very large areas of pyrite-bearing rocks in many places. A typical occurrence of such rock is in the form of a fine mica schist which is dark brown or nearly black on the surface, and which shows strong rust stain when it is broken; such a rock, for example that at Troy, shows, on close examination, tiny cubical crystals of yellow, metallic pyrite and scattered larger masses of the pure mineral. The presence of pyrite is also frequently indicated by streaks and fine lines of a white powdery material on the surface, or by crusts of pale green crystals of iron sulphate.

Some of our deposits of arsenical pyrites should receive consideration. For many years the greater part of our supply of arsenic has been derived as a by-product from smelter fumes. Recently, however, some of the larger chemical companies have been actively seeking large deposits of minerals rich in arsenic. The development of some of our deposits such as that in Verona, might well form the basis of an important local industry.

Bog Iron Ore

This material is perhaps the chief potential source of iron in Maine. Small mines have been operated in connection with deposits in various parts of the State; the only project of this kind, however, that has at any time met with noteworthy commercial success is the one established many years ago at Katahdin Iron Works. The development of larger deposits in other states, where the fuel problem was more easily solved by the presence of extensive coal beds, has made our ores, at least temporarily, of doubtful value as a source of steel and iron in bulk. The recent great progress in the production of special alloy steels, to the extent that these are now essential to the steel industries, should renew interest in our deposits, inasmuch as these alloys frequently require small amounts of iron, and their commercial production is more definitely contingent upon the occurrence of alloying materials such as manganese, silica, molybdenum, etc. A thorough investigation of our deposits of bog iron would certainly be of future, if not of present, value.

As indicated in the section on pyrite, bog iron ore occurs in more or less extensive deposits on the slopes and in the low lands below masses of pyrite-bearing rocks; its frequent presence in boggy places gives it its name, and it undoubtedly underlies, in greater or less amount, all of our peat bogs. Amounts which may be worth considering are known to occur at or near Aroostook, Houlton, Presque Isle, Katahdin Iron Works, New Portland, Bluehill, Dover, Andover, Turner, Rumford, Liberty, China, Pittston, Clinton, Anson, Shapleigh, Saco, and a number of other places. Further information in regard to any of these deposits, or deposits in other sections of the State, would be of very great interest.

The ore appears in the form of more or less continuous layers of rusty yellow, reddish or brown, heavy material, having something the appearance of furnace clinker, and enclosing twigs, leaves and small stone. Its presence is frequently indicated by an irridescent, oily appearing yellow scum on brooks flowing out of the land where it occurs, and by rust stains on rocks along the courses of such streams.

Iron ore deposits of other types occur in Maine, some of them of sufficient importance to warrant careful investigation.

Manganese

This material has become very important during the last few years, particularly in connection with the steel industry of this and other countries; so much so that the demand in the United States is rapidly outstripping the domestic supply, and considerable effort is being made to stimulate its production. Good ore in sufficient amount to warrant working and shipping is certain to find a market.

In the steel industry manganese is used in two principal ways: first, it is mixed with steel in small percentages to give it hardness, ductility and strength, qualities very essential at the present time; second, it is used with steel in the final melting in the form of spiegeleisen (iron containing less than 20% manganese), or ferromanganese (containing 20% to 90% manganese) to reduce any remaining oxide of iron and counteract the otherwise deleterious effects of phosphorus and sulphur.

Manganese forms useful alloys with copper, zinc, aluminum, tin, lead, magnesium and silicon, and is also used in the reduction of copper and silver. It has a large use in the manufacture of chemicals, and in the work of experimental and analytical chemical laboratories.

There are a number of minerals in which manganese occurs as an essential element, and many more in which it is frequently found in minute amounts, often giving characteristic colors (as in the case of amethystine quartz). Only a few of these are likely to be found in sufficient amount to be considered as ores, the principal ones being pyrolusite, the black oxide (MnO_2); braumite, the brown oxide (Mn_2O_3); and wad, or bog manganese, a mixture, in various proportions, of the black oxide, water, iron oxide, silica and alumina. The latter varies, necessarily, in the amount of manganese present, but may contain as high as 60%. The two first have been the most important ores, but of late bog manganese has furnished a large part of the domestic supply.

Mining manganese in this State is not altogether a new proposition, as deposits have, in former years, been worked on a small scale in Knox, Hancock and Oxford Counties, particularly at Bluehill and Sumner; and in the year 1887, shipments of 50 tons were reported. It is not known, however, that any is mined at the present time. It would be well to look over the old workings carefully, and to make a systematic search for new possibilities.

It may be said in general that manganese is likely to occur in association with iron minerals, and for this reason our numerous deposits of bog iron should be carefully examined. In this connection it should be said that iron ores containing small percentages of manganese may be quite as valuable as purer manganese ores, as richer ores are likely to be discarded because of the presence of harmful percentages of phosphorus. It goes without saying that all manganese ores should be submitted to careful analysis before extensive preparations are made for working.

Mica

White mica, popularly known as isinglass, is a mineral that has become of late years increasingly important from its use as an insulating material in the electrical industries. Much of the finer grade has been imported heretofore; but with the cutting down of shipping facilities, it has become necessary to look nearer home for the requisite supplies.

Maine possesses large amounts of white mica, much of it of fine enough quality to be used for insulating discs and washers, gas-lamp shades, etc. It has, however, received practically no commercial development and the deposits need much more thorough investigation before any definite statement can be made as to extent, availability and quality.

In general, the distribution is the same as in the case of feldspar (see Report for 1916), although the good deposits are more irregular and less extensive. A few quarries have been opened in the past, notably at Waterford, Peru and Canton; but for one reason or another, chiefly failure to comply with market requirements, all of these were abandoned years ago, and no particular success resulted in any case. It is suggested that the miners of feldspar should make an effort to market the mica, sometimes in large amounts, which they have been in the habit of throwing on the dump.

It should be stated that, although only exceptionally fine, large sheets of clear, tough mica are valuable for cutting into forms, scrap mica which may be readily separated from quartz, feldspar, etc., is also marketable. This is ground up and made into various insulating compositions, and also has some use as a lubricant.

Large manufacturers of electrical goods have recently developed methods of building up mica sheets from very thin splittings. This makes possible the marketing at attractive prices of much smaller blocks of mica, and opens a possible by-product field of some importance.

RIVER DISCHARGE

RIVER DISCHARGE

Of absolutely fundamental importance to any plans for hydraulic power development is some knowledge of the dependable flow of rivers. This information is supplied by the observations at river gaging stations supplemented by the necessary discharge measurements and office work. These stations should be maintained for a sufficient period of years to furnish the information required. For occasional stations of minor importance two to five years may be sufficient, for others 15 to 20 years, the more important being permanent installations equipped with automatic recording gages. It is of the utmost importance that these records be continuous.

At the present time 28 stations are maintained. These should be increased at least 50% in the next two years. There are large amounts of undeveloped power in the northern part of the State, and the gaging stations should be extended so that accurate information may be available when the power is required. Economical design of power stations and equipment is possible only on the basis of several years' run-off data.

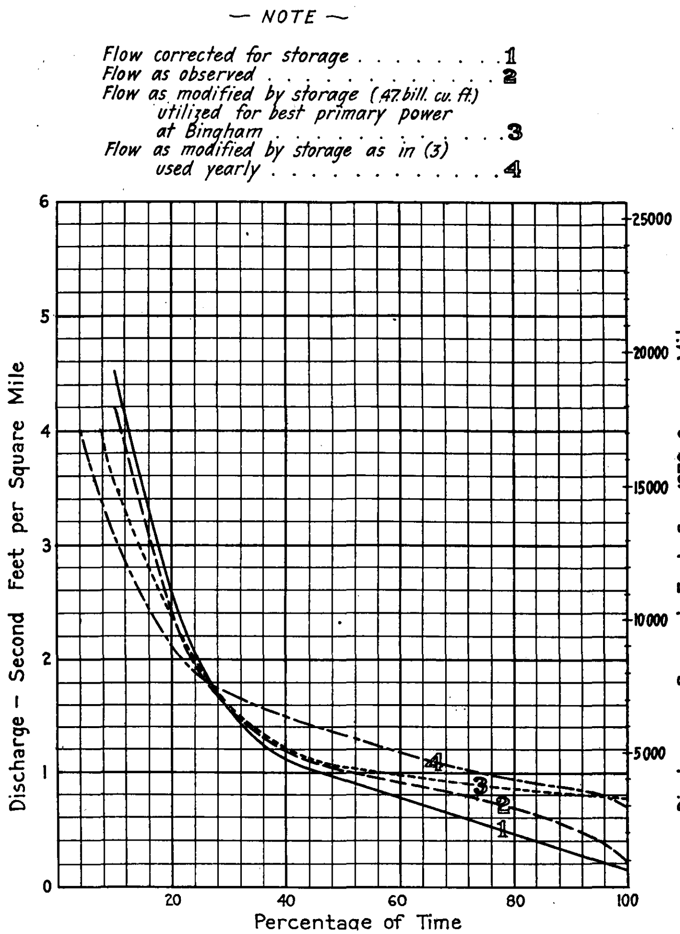
The river discharge work carried on by the State Water Storage Commission, 1909 to 1914, and by the Public Utilities Commission, 1914 to 1919, has been continued by this Commission. Improved methods have become available; certain river stations have been abandoned as poorly located or furnishing data of little value; new stations have been established insofar as funds have been available, and certain important stations where results of sufficient accuracy were not being obtained have been relocated. At a number of stations the daily fluctuation in gage height was such that results of the required accuracy could not be obtained and automatic gages have been installed.

Cooperation with the U. S. Geological Survey has been continued. This ensures the application of Geological Survey standards, uniform throughout the country, to the work in Maine; provides for approval of the work by their district engineer, Mr. C. H. Pierce, and publication in the Water Supply Papers of the Survey. It is believed that this cooperation should be permanent.

Particular attention is called to the change in form of publication of data obtained at the gaging stations. It has been customary to publish daily and monthly discharge in cubic feet per second, (also published in the Water Supply Papers of the U. S. Geological Survey). It was felt that river discharge data for use of engineers in connection with power estimates could be supplied in a form more convenient for their use, and the method of publishing duration tables in second-feet per square mile and percentage of time, together with the monthly run-off in second-feet per square mile, to show distribution of flow, has been adopted. This plan was submitted to Engineering Council (see their report) and was approved by them. Where the daily discharge of any station is desired for plotting hydrographs, it may be obtained either from the U. S. Geological Survey publications, or from this Commission.

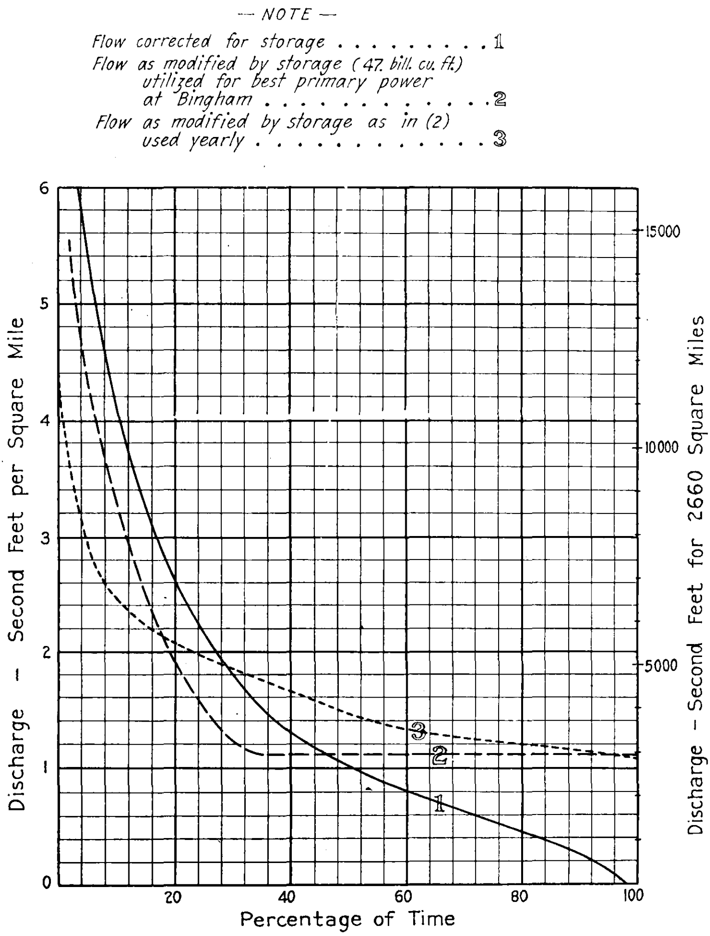
This method has enabled us to include the entire record for any station in the tables which are published as an appendix to this report. This data could be obtained previously only through consulting many different volumes, some of which are no longer available for distribution. It has also made possible the revision of a large number of records which were published before the present methods of determining discharge under ice cover were in use, and previous inaccuracies have been corrected insofar as this was possible. Years which could not be revised to the required accuracy have been omitted from the tables.

During the next two years we plan to prepare records of daily discharge for publication, bringing together in one volume the entire record for the State and using revised figures where they are available. This volume in conjunction with the tables appended to this report will furnish data of great value to engineers and others interested in the development of Maine's hydraulic power.



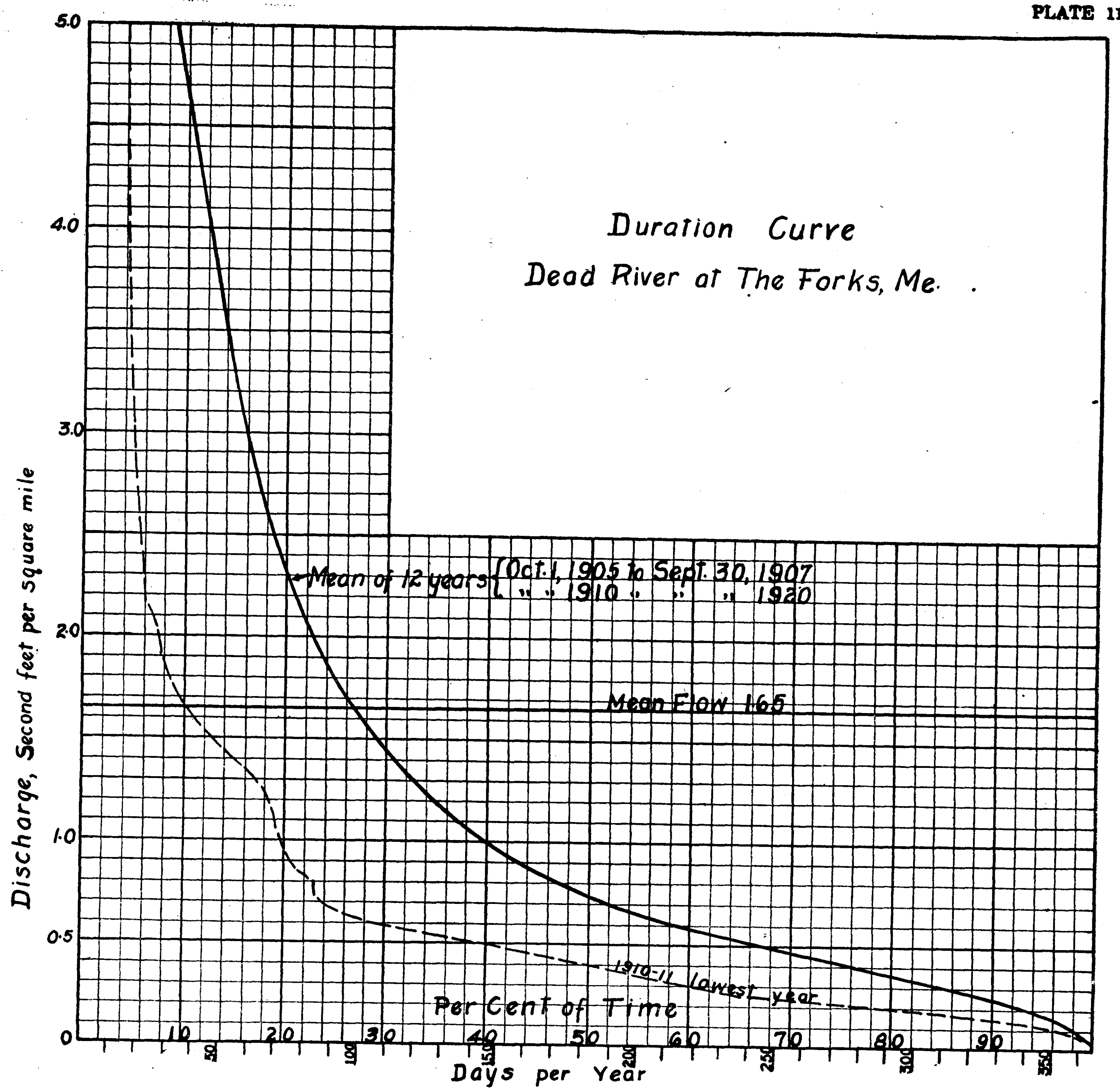
KENNEBEC RIVER AT WATERVILLE
FLOW DURATION CURVE
1902 — 1916

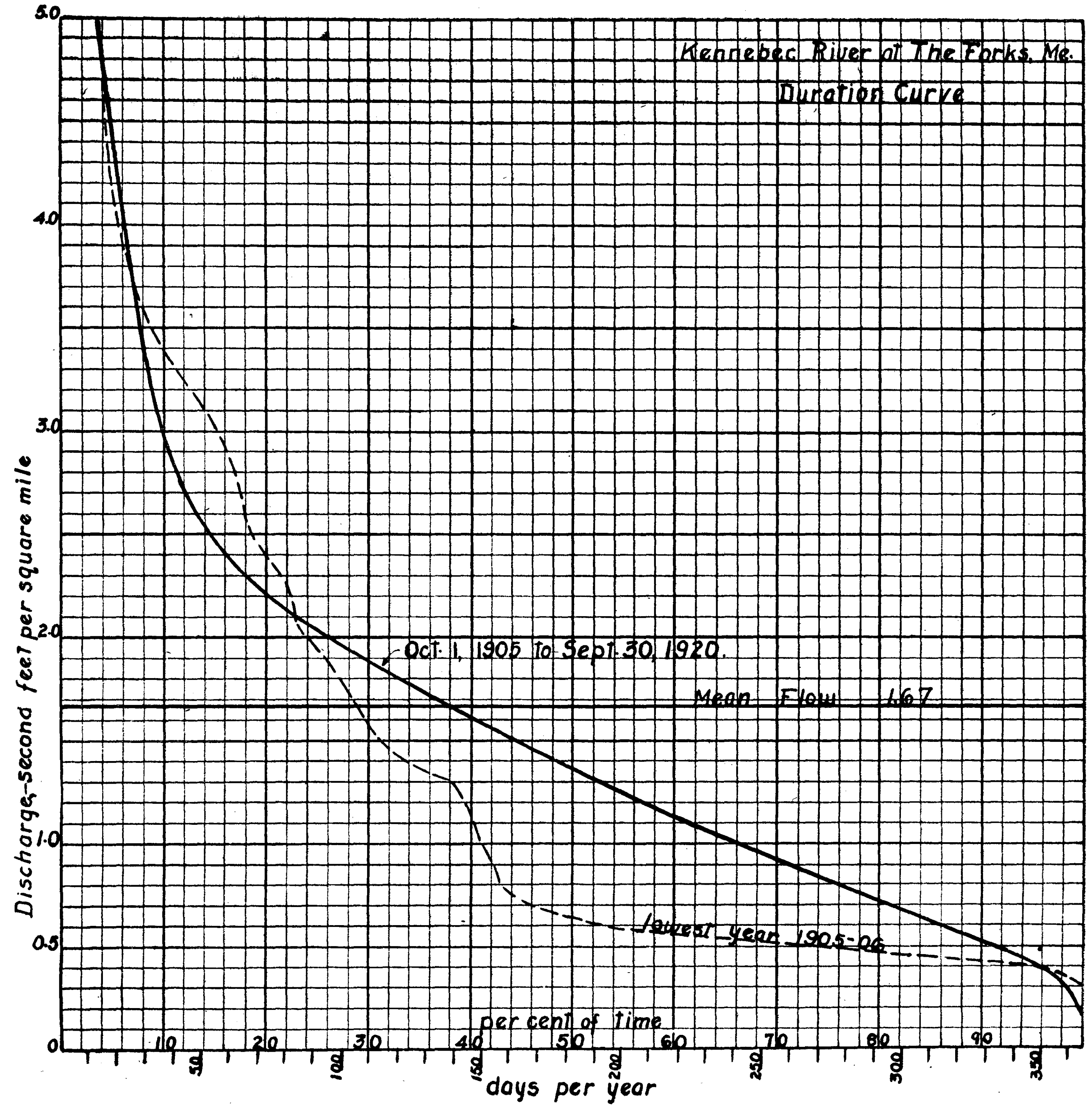
PLATE 7

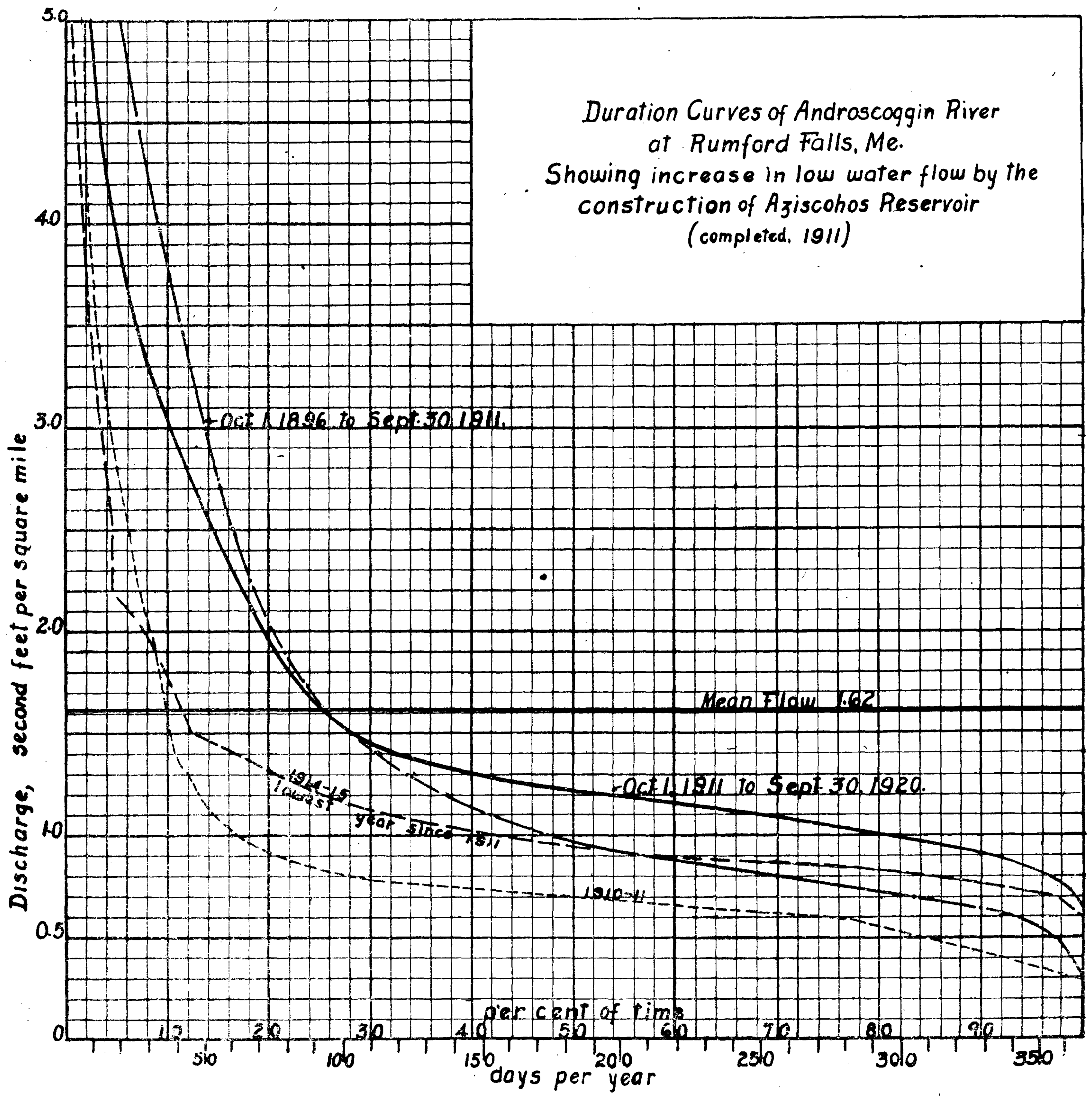


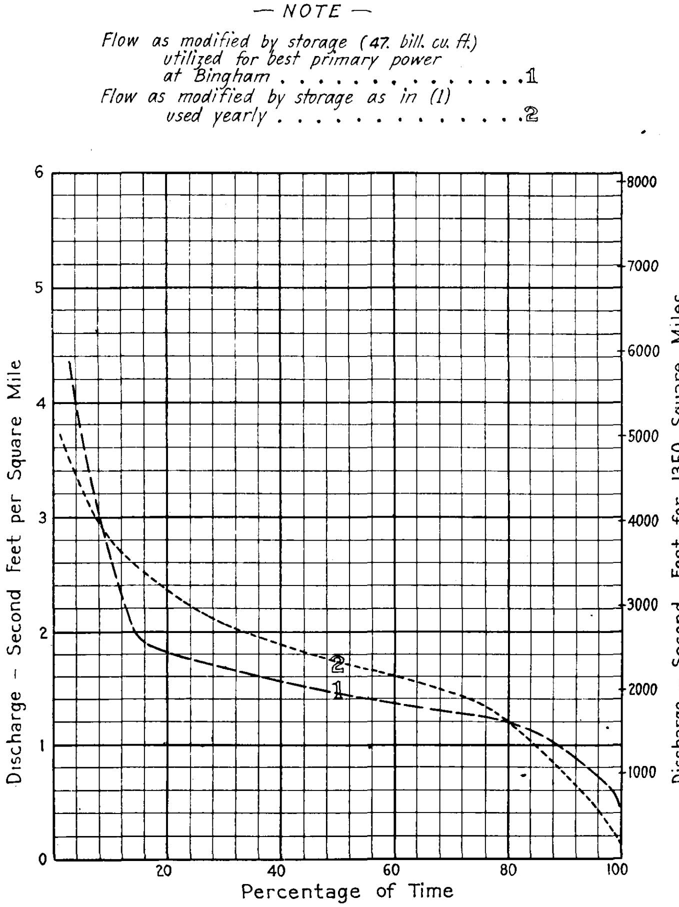
KENNEBEC RIVER AT BINGHAM
FLOW DURATION CURVE
1902 - 1916

PLATE 8


Duration Curve
Dead River at The Forks, Me.
Mean of 12 years {Oct. 1, 1905 to Sept. 30, 1907 / " " 1910 " " 1920
Mean Flow 1.65
1910-11 lowest year
Per Cent of Time
Days per Year
Discharge, Second feet per square mile
5.0
4.0
3.0
2.0
1.0
0.5
0
10
20
30
40
50
60
70
80
90
50
100
150
200
250
300
350


Kennebec River at The Forks, Me.
Duration Curve
Oct. 1, 1905 to Sept. 30, 1920.
Mean Flow 1.67
lowest year 1905-06
per cent of time
days per year
Discharge,-second feet per square mile
5.0
4.0
3.0
2.0
1.0
0.5
0
10
20
30
40
50
60
70
80
90
50
100
150
200
250
300
350


Duration Curves of Androscoggin River
at Rumford Falls, Me.
Showing increase in low water flow by the
construction of Azischos Reservoir
(completed, 1911)
Oct 1, 1896 to Sept 30, 1911.
Mean Flow 1.62
Oct 1, 1911 to Sept 30, 1920.
1914-15 (lowest year since 1911)
1910-11
Discharge, second feet per square mile
per cent of time
days per year
5.0
4.0
3.0
2.0
1.0
0.5
0
10
20
30
40
50
60
70
80
90
50
100
150
200
250
300
350



KENNEBEC RIVER AT INDIAN POND OUTLET
FLOW DURATION CURVE
1902 – 1916

PLATE 9

APPENDIX

PRECIPITATION

In the first annual report of the State Water Storage Commission, complete records of rainfall, to include 1910 for weather bureau stations in this State were published, and records for 1911 and 1912 were published in the second and third annual reports of that Commission. The records for 1913, 1914, 1915 were published in Vol. 2 of the first annual report of the Public Utilities Commission for 1915, and the records for 1916 were included in Vol. 2 of the 1916 report of that Commission. Following are the records for the years ending September 30, 1917, 1918, 1919, and 1920, arranged in the order of drainage basins.

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1917

STATION	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
COASTAL BASINS													
Bar Harbor	......	......	......	5.48	3.67	4.96	3.73	4.70	10.29	3.56	7.14	2.50	......
Mirror Lake	4.49	1.99	9.01	5.57	2.21	6.44	4.08	4.25	9.84	3.11	5.87	0.78	57.64
ST. JOHN RIVER BASIN													
Van Buren	3.27	3.36	5.61	3.39	2.01	2.93	2.53	2.18	7.86	2.74	6.02	1.70	43.60
Ashland	2.54	2.05	3.82	1.67	0.83	1.75	2.61	3.69	6.64	3.52	......	......	......
Presque Isle	2.37	2.85	5.90	4.00	2.20	2.70	2.40	3.90	7.67	2.56	5.32	1.41	43.28
Houlton	3.16	2.15	4.13	2.35	1.20	2.14	1.74	1.90	6.91	3.69	4.89	1.97	36.23
ST. CROIX RIVER BASIN													
Woodland	3.70	2.21	2.52	3.41	2.27	3.25	3.31	5.14	8.68	2.73	4.98	1.81	44.01
Eastport	2.73	2.12	3.98	3.87	2.79	2.95	3.22	1.62	7.40	1.90	4.44	1.51	38.53
Vanceboro	1.88	2.98	2.06	2.94	1.00	1.03	3.45	5.32	7.80	1.83	6.05	2.50	38.84
UNION RIVER BASIN													
Ellsworth	3.57	2.09	6.24	5.03	2.69	4.24	2.98	3.68	8.45	6.43	7.34	1.35	54.09
PENOBSCOT RIVER BASIN													
Orono	1.85	1.60	5.50	4.11	3.67	3.22	2.39	3.18	7.49	4.05	4.09	1.08	42.23
Old Town	2.41	2.30	5.94	3.51	2.39	3.71	2.92	4.43	7.92	3.94	3.26	1.44	44.17
Ripogenus	2.89	1.99	6.08	2.63	1.73	2.76	2.84	3.72	7.56	6.79	4.93	0.91	44.83
Millinocket	3.34	5.33	5.23	4.41	2.40	4.41	3.00	3.59	9.96	4.26	6.70	1.35	53.98
Patten	4.70	3.80	4.90	2.40	1.80	3.60	2.00	5.20	8.90	3.60	3.84	0.00	44.74
Wytopitlock	......	......	......	......	......	......	......	......	......	5.01	4.92	1.32	......
KENNEBEC RIVER BASIN													
Greenville	2.87	4.17	4.87	3.95	1.90	3.90	3.25	3.22	8.69	6.97	4.98	1.80	50.57
Madison	2.19	5.21	3.63	3.12	1.51	3.97	3.03	2.74	9.96	2.37	5.46	2.09	45.28
The Forks	2.00	3.75	4.29	2.68	1.20	2.33	2.18	1.84	7.68	5.90	5.51	.96	40.32
Winslow	3.17	5.11	4.12	2.88	1.61	3.44	2.09	2.17	8.23	.68	5.23	1.31	40.04

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1917 (Continued)

STATION	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Gardiner	2.59	3.44	5.71	4.24	2.57	4.79	3.04	2.22	8.88	2.25	4.80	.71	45.24
Eustis	1.66	3.42	3.56	2.21	1.70	2.17	2.16	2.65	8.12	3.15	6.75	2.10	39.65
Farmington	2.29	4.18	4.62	3.89	1.90	4.21	3.19	2.85	10.74	2.55	7.14	1.69	49.25
ANDROSCOGGIN RIVER BASIN													
Errol, N. H.	2.80	3.54	2.64	3.11	2.05	3.27	2.37	2.57	9.97	1.72	6.59	2.36	42.99
Lewiston	2.47	4.12	4.46	4.14	2.07	4.44	3.34	2.88	11.16	4.34	4.45	.62	48.49
Livermore Falls	2.31	5.06	2.85	3.23	1.47	3.29	2.01	1.99	10.75	1.70	7.27	1.73	43.66
Pontocook Dam	2.06	4.07	2.02	2.91	1.96	3.31	2.50	2.20	10.08	2.41	6.15	2.13	41.80
Rumford	1.96	3.58	3.30	3.36	1.15	3.35	2.77	2.85	10.40	1.94	7.20	1.33	43.19
Aziscohos	1.95	3.24	1.98	2.38	1.53	2.10	2.57	2.59	9.35	2.17	6.56	1.39	37.81
Upper Dam	1.83	3.11	2.31	1.94	1.50	1.68	2.13	2.16	8.77	1.40	5.44	2.28	34.55
Middle Dam	1.86	2.98	2.25	1.32	1.14	2.16	2.04	1.53	9.06	1.77	6.25	1.85	34.21
Oquossuc	2.88	3.59	2.79	1.75	1.63	2.03	2.53	2.51	9.21	2.31	6.47	3.50	41.20
PRESUMPSCOT RIVER BASIN													
North Bridgton	2.15	4.25	4.50	3.86	2.47	3.81	3.02	3.75	11.20	4.28	7.48	.52	51.29
Songo Lock	2.18	3.57	5.19	3.61	3.94	4.11	2.97	2.93	11.05	2.55	5.01	1.22	48.33
Portland	1.29	2.83	6.09	4.53	3.35	4.53	2.93	3.19	10.86	1.92	4.78	.32	46.62
SACO RIVER BASIN													
Cornish	2.62	3.73	4.76	4.34	5.02	4.26	3.34	3.02	12.26	1.48	7.21	1.18	56.90

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1918

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Coastal Basins													
Bar Harbor	6.72	2.16	3.11	4.61	4.35	2.20	4.70	1.14	4.10	2.31	3.53	9.77	48.70
Mirror Lake	6.81	1.70	2.99	3.55	3.46	1.97	2.74	1.64	3.54	4.16	4.33	8.04	44.93
St. John River Basin													
Van Buren	5.28	1.81	0.76	2.75	3.07	2.17	1.69	3.57	5.41	3.73	0.71	4.53	35.48
Ashland	......	......	......	......	......	......	1.40	4.86	3.38	5.26	......	......	......
Presque Isle	6.13	1.35	1.70	2.40	3.80	1.80	1.65	4.00	3.74	6.78	1.62	......	......
Houlton	4.97	0.90	2.80	2.40	1.75	1.70	1.23	0.39	2.00	2.86	1.51	5.15	27.66
St. Croix River Basin													
Woodland	7.22	1.94	2.58	1.81	2.85	1.31	2.66	2.16	3.57	5.38	3.82	6.78	42.08
Eastport	4.01	1.72	2.99	2.88	3.95	2.17	2.10	1.50	3.26	2.98	1.57	4.65	33.78
Vanceboro	6.97	1.87	2.30	3.20	2.40	3.10	1.23	2.43	4.19	6.11	0.88	8.82	43.50
Union River Basin													
Ellsworth	6.85	1.27	2.94	3.52	3.59	1.68	3.85	1.55	3.74	3.84	2.38	8.81	44.02
Penobscot River Basin													
Orono	5.89	1.55	3.24	3.55	2.91	1.65	2.20	1.69	2.41	6.89	2.58	4.29	38.85
Old Town	5.46	1.72	2.97	3.36	3.24	1.68	2.34	1.97	2.54	6.44	2.42	6.38	40.52
Ripogenus	6.43	1.65	1.75	2.20	2.83	1.67	1.25	3.97	3.02	7.15	2.20	6.51	40.63
Millinocket	6.78	1.98	3.74	3.10	3.03	1.94	1.85	4.08	3.45	7.73	2.28	6.23	46.19
Patten	8.20	1.20	3.50	2.10	2.60	0.30	1.00	2.80	2.80	9.60	2.50	6.00	42.60
Wytopitlock	8.02	1.06	1.69	2.69	2.86	1.06	1.11	1.72	3.46	4.03	2.02	12.92	42.64
Kennebec River Basin													
Greenville	6.40	1.26	3.62	2.49	2.47	2.19	1.66	3.37	3.38	8.25	1.42	6.52	43.03
Madison	5.10	0.28	3.08	2.65	2.42	1.82	2.81	2.32	3.93	6.19	2.36	7.13	40.09
The Forks	3.44	0.15	4.34	1.30	2.19	1.60	1.46	4.50	3.00	4.14	1.93	6.73	34.78
Winslow	5.14	0.98	2.37	1.78	2.37	0.74	1.74	1.83	2.15	6.06	3.42	6.66	35.24

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1918 (Continued)

STATION	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Gardiner	5.16	1.33	2.64	2.06	2.45	1.54	2.55	1.16	4.62	7.06	4.42	7.98	42.97
Eustis	5.32	0.97	2.81	1.81	2.18	2.28	1.22	3.65	2.35	3.74	1.95	5.98	34.26
Farmington	5.86	1.12	3.86	2.56	2.38	1.91	2.46	3.19	4.98	3.58	2.35	8.98	43.23
ANDROSCOGGIN RIVER BASIN													
Errol, N. H.	6.08	.82	2.97	1.99	3.24	1.95	1.68	2.98	3.39	3.30	4.18	7.12	39.70
Gorham, N. H.	7.39	0.31	2.40	1.77	3.19	1.27	1.66	2.54	2.78	1.39	3.42	6.51	34.63
Lewiston	6.71	1.10	4.21	3.18	2.44	1.35	2.56	2.55	3.83	6.86	4.05	7.70	46.54
Livermore Falls	5.12	1.00	3.72	2.72	1.92	1.32	2.57	2.53	3.76	4.78	3.80	8.23	41.47
Pontocook Dam	5.31	0.75	2.45	2.05	2.81	2.12	1.83	3.10	3.40	3.81	4.21	6.92	38.76
Rumford	5.24	1.06	3.26	2.77	1.99	1.39	2.23	3.30	4.30	3.76	2.62	7.74	39.66
Aziscohos	6.06	0.98	1.27	1.59	1.98	1.49	1.28	3.45	3.87	5.13	2.67	6.19	35.96
Upper Dam	5.18	0.63	2.22	2.63	2.69	1.76	0.98	2.74	3.38	3.60	2.03	6.06	33.90
Middle Dam	5.83	0.45	1.52	1.68	1.88	1.27	1.03	2.74	2.90	3.51	2.49	7.48	32.78
Oquossuc	4.27	1.87	4.28	4.50	2.73	2.20	1.00	2.46	1.82	5.40	4.84	5.97	41.34
PRESUMPSCOT RIVER BASIN													
North Bridgton	4.68	0.99	2.91	3.55	2.50	1.34	2.37	2.42	5.44	4.55	3.74	8.72	43.21
Songo Lock	4.75	1.36	2.78	2.73	1.83	0.90	1.93	2.30	4.56	2.80	3.80	4.15	33.89
Portland	4.09	0.82	4.22	3.48	2.62	1.93	2.70	1.76	2.73	2.94	4.64	5.58	37.51
SACO RIVER BASIN													
Cornish	5.25	1.17	2.75	2.72	2.89	1.32	2.91	2.47	2.83	3.52	4.86	9.02	41.71

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1919

STATION	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
COASTAL BASINS													
Bar Harbor	6.78	5.10	3.31	4.54	3.13	6.63	4.94	......	1.82	3.61	4.92	6.95	......
Mirror Lake	5.00	3.99	3.49	4.43	2.20	6.05	2.80	5.59	1.09	2.76	3.69	5.86	46.95
ST. JOHN RIVER BASIN													
Van Buren	3.40	2.47	3.50	3.03	2.63	2.88	2.00	2.55	3.08	......	......	......	......
Ashland	......	......	......	2.13	1.81	2.50	2.28	3.44	1.65	2.74	1.94	3.73	......
Presque Isle	......	......	......	2.35	3.02	2.94	2.17	3.32	1.26	3.80	1.75	4.56	......
Houlton	4.38	2.05	1.77	2.00	1.25	2.02	2.75	3.26	1.87	1.57	0.46	4.48	27.86
ST. CROIX RIVER BASIN													
Woodland	5.19	4.66	2.77	3.69	1.69	5.31	3.57	4.37	2.72	3.74	2.82	3.83	44.36
Eastport	3.33	2.00	2.31	3.06	1.86	2.67	2.15	3.98	1.25	2.82	2.98	3.85	32.26
Vanceboro	4.79	4.18	1.75*	3.65*	1.83*	2.69*	3.16*	3.85	1.49	3.63	1.98	2.96	35.96
UNION RIVER BASIN													
Ellsworth	6.84	4.14	5.10	4.02	2.04	5.17	3.82	5.19	1.55	3.79	3.07	4.71	49.44
PENOBSCOT RIVER BASIN													
Orono	5.47	2.33	4.23	3.45	1.10	2.92	2.29	3.08	1.44	4.07	0.92	3.07	34.37
Old Town	5.77	3.42	4.08	3.34	1.59	3.78	2.57	4.43	1.19	5.23	1.61	3.97	40.98
Ripogenus	5.74	3.65	3.21	3.33	2.75	4.36	3.74	4.06	3.06	2.57	3.58	3.17	42.22
Millinocket	6.03	5.25	3.24	3.06	2.68	4.59	3.74	4.07	2.60	4.01	3.47	3.32	46.06
Patten	2.85	2.70	3.20	2.40	2.50	3.40	3.30	6.80	1.20	......	......	......	......
Wytopitlock	5.94	5.41	2.20	2.47	1.51	9.62	2.52	4.86	2.70	3.77	3.15	3.35	47.50
KENNEBEC RIVER BASIN													
Greenville	5.38	3.77	3.49	2.85	2.27	4.03	2.96	4.76	2.25	5.82	3.77	3.71	45.06
Madison	5.00	4.35	4.36	2.09	1.80	4.56	3.10	4.97	1.82	3.05	2.06	3.47	40.63
The Forks	......	5.47	1.71	2.30	1.50	1.65	......	......	......	......	......	......	......
Winslow	4.84	3.26	2.96	3.36	1.42	3.93	2.27	4.15	1.93	2.80	1.79	4.41	37.12

*Note—Snow estimated

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1919 (Continued)

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Gardiner	3.99	3.46	4.13	3.99	1.61	4.90	2.37	3.92	2.07	1.84	1.92	5.06	39.26
Eustis	6.39	3.16	2.19	2.23	1.15	3.15	1.93	4.17	3.43	2.60	3.33	3.33	37.06
Farmington	5.57	4.15	3.56	2.62	1.51	5.79	2.57	5.77	3.10	2.49	2.57	5.08	44.78
Androscoggin River Basin													
Errol, N. H.	7.17	2.84	3.50	2.41	1.56	3.00	3.29	4.03	3.09	2.24	2.67	4.62	40.42
Gorham, N. H.	4.67	2.35	2.09	2.14	0.74	4.51	1.57	2.49	1.73	1.60	2.46	3.87	30.22
Lewiston	3.29	3.86	4.22	3.59	1.80	4.71	2.38	4.78	0.93	2.85	1.94	4.65	39.00
Livermore Falls	5.05	3.77	4.00	3.31	1.53	6.51	2.43	4.91	2.53	1.88	2.54	4.86	43.32
Pontocook Dam	7.33	2.65	3.17	2.48	1.57	3.09	2.77	3.26	3.47	1.57	2.53	5.36	39.25
Rumford	5.24	1.06	3.26	2.72	1.50	5.10	1.99	3.94	1.74	1.42	2.41	3.98	34.36
Aziscohos	6.83	2.49	2.55	2.20	1.08	2.45	2.68	3.81	2.47	2.53	2.59	4.26	35.94
Upper Dam	6.40	1.81	2.60	1.86	0.85	2.13	2.05	3.55	2.86	1.92	2.97	3.01	32.01
Middle Dam	6.19	1.90	1.69	2.13	0.88	2.92	2.52	3.52	4.45	2.56	2.48	3.50	34.74
Oquossuc	5.45	4.26	3.95	1.73	2.72	2.96	2.58	5.09	0.92	1.56	1.83	4.12	37.17
Presumpscot River Basin													
North Bridgton	4.11	2.70	3.84	3.70	1.80	5.12	2.05	5.24	1.61	4.03	2.25	4.52	40.97
Songo Lock	2.35	3.31	1.94	3.63	1.05	3.65	2.55	5.20	1.00	3.50	1.92	4.00	34.10
Portland	2.39	3.38	4.30	4.69	2.34	4.02	2.20	5.16	1.71	1.62	1.85	3.68	37.34
Saco River Basin													
Cornish	2.83	3.25	4.55	3.51	1.86	5.29	2.84	5.48	1.70	3.19	2.21	4.28	40.99

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1920

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Coastal Basins.													
Bar Harbor	3.85	6.05	3.30	3.16	6.67	5.23	11.05	2.33	3.13	......	......	......	......
Mirror Lake	4.99	5.31	2.14	0.92	4.19	3.61	8.38	2.53	3.30	4.02	2.13	6.91	48.43
St. John River Basin													
Van Buren	3.47	2.68	2.25	2.17	4.11	......	......	......	2.81	4.53	4.28	5.50	......
Ashland	......	2.05	0.97	1.67	3.34	......	4.03	0.78	6.07	4.20	2.76	5.14	......
Presque Isle	2.92	2.17	1.10	1.49	4.00	1.96	5.31	0.91	6.08	4.28	3.62	5.21	39.05
Houlton	2.05	2.94	1.63	2.30	3.20	2.18	2.50	......	0.60	......	......	7.96	......
St. Croix River Basin													
Woodland	4.17	4.55	1.92	0.92	5.32	3.40	7.31	1.37	2.24	2.30	2.60	6.72	42.82
Eastport	3.36	4.10	3.02	2.07	6.40	4.36	4.21	1.26	1.95	1.23	2.10	3.38	37.44
Vanceboro	3.01	4.96	3.10	0.96	4.07	3.19	5.57	1.34	1.37	3.27	3.13	3.48	37.45
Union River Basin													
Ellsworth	4.18	4.55	2.77	1.60	9.83	5.07	7.62	1.92	2.19	2.56	1.29	4.12	47.70
Penobscot River Basin													
Orono	2.31	2.61	1.42	2.55	7.75	......	4.47	1.53	2.16	3.36	2.19	5.71	......
Old Town	2.99	2.92	1.76	1.04	7.71	4.06	5.78	2.01	2.14	4.46	2.48	5.21	42.56
Ripogenus	3.91	4.05	1.26	1.74	5.09	3.19	4.96	1.17	2.49	3.74	2.67	7.80	42.07
Millinocket	4.24	5.09	1.95	1.97	6.85	3.37	7.56	1.91	2.75	3.64	3.95	8.05	51.33
Wytopitlock	4.02	3.20	1.35	0.90	2.50*	3.80	4.31	1.01	2.28	3.03	2.42	10.75	......
Kennebec River Basin													
Greenville	4.13	3.58	1.81	2.84	4.52	2.85	5.40	1.33	3.12	4.46	4.61	5.60	44.25
Madison	4.05	3.90	1.38	1.69	5.62	1.73	4.99	1.80	2.15	3.33	4.40	7.94	42.98
The Forks	......	......	......	1.76	5.42	3.00	4.99	1.25	4.25	4.60	6.40	2.91	......
Winslow	4.18	3.63	1.23	0.79	5.62	3.05	7.54	1.89	2.26	4.20	2.35	9.40	46.14
Gardiner	5.42	4.00	1.85	1.40	5.62	3.70	7.87	2.07	2.74	5.73	2.40	7.75	50.55

Precipitation in inches, at stations in Maine, during the year ending Sept. 30, 1920 (Continued)

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Eustis	4.50	3.57	1.04	1.59	3.60	2.97	3.08	1.38	4.02	4.40	3.32	4.61	38.08
Farmington	4.15	5.43	1.49	1.54	6.01	3.24	6.57	2.26	2.08	3.34	7.20	6.70	50.01
ANDROSCOGGIN RIVER BASIN													
Errol, N. H.	6.61	3.66	1.28	1.86	2.94	3.50	5.36	1.03	2.35	5.49	3.48	4.36	41.92
Gorham, N. H.	3.77	5.48	1.09	1.12	3.67	4.01	5.43	0.69	2.90	3.26	3.11	4.32	38.85
Lewiston	4.34	5.89	1.97	1.72	7.56	5.80	7.00	2.04	2.19	3.58	2.71	9.27	54.07
Livermore Falls (Livermore)	4.99	5.42	1.32	1.56	6.84	5.20	7.43	2.74	2.48	4.82	1.23	5.78	49.81
Pontocook Dam	6.20	4.13	1.73	1.82	3.62	4.66	4.90	1.14	2.26	4.30	2.38	4.74	41.88
Rumford	5.57	4.19	1.24	1.37	5.16	4.70	6.63	1.94	2.55	4.48	3.59	6.85	48.27
Aziscohos	5.10	2.68	1.28	1.09	2.38	5.25	4.44	1.35	4.67	4.55	4.29	4.34	41.42
Upper Dam	2.55	5.02	1.03	1.10	2.88	3.75	3.76	0.99	2.59	3.53	3.58	2.60	33.38
Middle Dam	3.11	5.02	1.10	0.94	2.60	3.65	3.54	1.15	2.52	5.72	4.77	3.23	37.35
Oquossuc	2.79	4.80	1.25	1.90	4.99	4.18	3.21	1.09	2.79	4.77	3.18	6.02	40.97
PRESUMPSCOT RIVER BASIN													
North Bridgton	4.29	5.19	1.49	1.51	5.38	5.06	7.28	2.51	2.48	3.69	4.99	5.90	49.77
Songo Lock	3.86	5.57	1.36	....	5.92	4.41	6.86	2.42	2.07	4.34	2.42	7.25	....
Portland	3.49	4.71	1.78	3.49	8.97	5.53	7.04	3.23	2.73	3.67	3.83	8.16	56.63
SACO RIVER BASIN													
Cornish	3.54	6.88	1.89	2.20	5.63	5.19	7.17	2.99	2.95	4.25	5.83	6.99	55.51

* 1-6th
...... No records

EVAPORATION

On June 4, 1915, an evaporation station was established near the Cobbosseecontee Stream at Gardiner. The actual evaporation from a standard U. S. Weather Bureau tank was measured, and meteorological data kept. On July 1, 1917, an auxiliary station was established 120 feet away. This latter consists of a 36″x36″x36″ pan, floated by pontons in the surface of the stream, with an anemometer 14 inches above the pan.

The records consist of observations of humidity and water temperatures at 7 A. M. and 6 P. M., anemometer, maximum and minimum air temperatures, evaporation and precipitation at 6 P. M.

Mean monthly records are published herewith, except for 1918 and 1919 which are of little value because humidity records are incomplete.

EVAPORATION AT GARDINER, MAINE

Summary Table of Monthly Figures

YEAR & MONTH	Mean Humidity	Mean Temperature			Miles per Hour Mean Wind Velocity		Monthly Precipitation in Inches	Evaporation in Inches	
		Air	Water In						
			Tank	Stream	Tank	Stream		In Standard Tank	In Floating Pan (in Stream)
1915									
June 5–30.........	72.0	57.8	68.2		1.10		2.34*	4.38*	
July..............	79.0	63.2	71.3		0.93		9.17	3.99	
August...........	82.0	61.7	69.3		0.67		3.92	3.35	
September........	88.0	58.0	64.8		1.13		1.21	3.40	
October...........	90.0	45.3	51.7		1.00		2.95	1.90	
November 1–17....	87.0	38.4	42.3		1.97		2.13*	2.10*	
1916									
May.............	79.2	54.3	58.1		1.15		4.69	4.15	
June.............	83.4	60.4	65.9		0.44		4.47	4.07	
July..............	83.5	70.4	74.1		0.97		3.33	4.52	
August...........	81.8	69.0	72.7		0.79		3.03	4.43	
September........	85.2	60.0	63.1		1.26		3.15	4.30	
October..........	85.5	50.1	51.8		1.05		2.59	2.49	
November 1–14....	88.8	38.7	40.8		0.89		1.62*	1.53*	
1917									
May.............	75.0	47.7	51.0	52.4	3.88		2.85	3.49	
June.............	81.0	61.7	67.7	64.0	2.44		12.59	3.71	
Floating pan	installed								

July.............	78.7	70.8	74.6	75.4	2.24	1.65	2.25	5.76	4.41
August...........	83.4	69.0	72.6	76.1	1.96	1.36	5.06	4.85	4.24
September........	83.0	56.4	59.3	64.9	2.08	1.60	0.71	3.17	3.55
October...........	89.4	46.2	47.6	51.8	3.39	2.17	5.18	1.68	1.91
November 1–21....	81.9	37.7	37.0	39.1	3.12	2.09	0.04	1.56*	1.49*
1920									
May........ ...	75.2	49.7	57.2	55.8	2.78	1.70	2.07	4.78	3.12
June.............	77.3	61.8	66.5	67.7	2.60	1.31	2.74	4.89	3.99
July.............	80.5	67.6	72.0	73.9	2.61	1.30	5.73	6.18	4.88
August...........	83.2	67.9	73.4	74.5	1.93	0.925	2.40	4.36	3.87
September........	87.3	57.8	62.2	65.3	2.76	1.43	7.78	3.04	2.37
October...........	86.8	49.7	54.2	57.8	2.42	1.33	2.67	2.47	2.35
November 1–13....	89.5	34.4	41.3	46.0	2.82	1.50	2.98*	1.29*	1.25*

* Partial month records of precipitation and evaporation computed for 30 days.

RIVER DISCHARGE TABLES

Descriptions, lists of discharge measurements and tables of daily and monthly discharge have been published in the Water Supply Papers of the United States Geological Survey as follows:

1898:	27	1905:	165	1913:	351
1899:	35	1906:	201	1914:	381
1900:	47	1907–8:	241	1915:	401
1901:	65, 75	1909:	261	1916:	431
1902:	82	1910:	281	1917:	451
1903:	97	1911:	301	*1918:	471
1904:	124	1912:	321	*1919:	501

* In press.

Additional data concerning work during the years 1887 to 1900 are contained in Part IV of the 19th, 20th, 21st and 22d Annual Reports of the Geological Survey. Special Reports have been issued as follows:

W. S. P. 69 Water Powers of Maine.
W. S. P. 198 Water Resources of the Kennebec River Basin.
W. S. P. 279 Water Resources of the Penobscot River Basin.

In some sections of the State information regarding topographic features is incomplete and the computed drainage areas are inaccurate. As surveys are extended these computations are checked and corrected.

Definition of Terms

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as "second-feet," "gallons per minute," "gallons per 24 hours," and "run-off in second-feet per square mile," and (2) those which represent the actual quantity of water, as "run-off in depth in inches," and "million gallons." They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 square foot in cross section at a velocity of 1 foot per second. It is generally adopted as the fundamental unit in the measurement of flowing water and is the "natural" unit, as the foot and the second are the units used in making the physical determinations. Other units may be computed from this by the use of factors given in the table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply, the United States gallon of 231 cubic inches being the unit of quantity and 1 minute the unit of time.

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

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

A unit commonly used in connection with the measurement of water is the "million gallons." This is used with two meanings—(1) to indicate a rate of flow and (2) to express an actual quantity of water. In the former sense "million gallons per 24 hours" is inferred, 1,000,000 gallons being taken as the unit of quantity, and 24 hours as the unit of time. With this meaning the term is generally used in connection with pumping and irrigation. In the latter sense "million gallons" as an absolute quantity is used in the measurement of storage capacities of reservoirs.

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

Convenient Equivalents

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge Second-feet per Square Mile	Run-off (Depth in Inches).				
	1 day.	28 days.	29 days.	30 days.	31 days
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

Note.—For partial month multiply the values for one day by the number of days.

Table for converting discharge in second-feet into run-off in millions of cubic feet.

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.02	10.37	10.71
5	.4320	12.10	12.53	12.96	13.39
6	.5184	14.51	15.04	15.55	16.07
7	.6048	16.93	17.54	18.14	18.75
8	.6912	19.35	20.05	20.74	21.42
9	.7776	21.77	22.55	23.33	24.10

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting discharge in second-feet into run-off in millions of gallons.

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

Note.—For part of a month multiply the run-off for 1 day by the number of days.

Table for converting velocity in feet per second into velocity in miles per hour.

(1 foot per second=0.681818 mile per hour, or two-thirds mile per hour, very nearly; 1 mile per hour=1,4666 feet per second. In computing the table the values 0.68182 and 1.4667 were used.)

Feet per second (units).	Miles per hour for tenths of foot per second.									
	0	1	2	3	4	5	6	7	8	9
0.......	0.000	0.068	0.136	0.205	0.273	0.341	0.409	0.477	0.545	0.614
1.......	.682	.750	.816	.886	.995	1.02	1.09	1.16	1.23	1.30
2.......	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3.......	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4.......	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5.......	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6.......	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7.......	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8.......	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9.......	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet into theoretical horsepower per foot of fall.

(1 second-foot=0.1136 theoretical horsepower per foot of fall. Weight of 1 cubic foot of water=62.5 pounds.

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0........	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1........	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2........	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3........	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4........	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5........	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6........	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7........	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8........	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9........	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot for one day equals 86,400 cubic feet.

1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.

1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.

1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.

1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.

1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.

1,000,000 United States gallons per day equals 1.55 second-feet.

100 United States gallons per minute equals 0.223 second-foot.

1 inch deep on 1 square mile equals 2,323,200 cubic feet.

1 inch deep on 1 square mile equals 0.0737 second-foot per year.

1 foot equals 0.3048 meter.

1 meter equals 3.2808 feet, equals 39.37 inches.

1 mile equals 1.60935 kilometers.

1 kilometer equals 0.62137 miles.

1 mile equals 5,280 feet, equals 63,360 inches.

1 acre equals 0.4047 hectare.

1 acre equals 43,560 square feet.

1 acre equals 209 feet square, nearly.

1 square mile equals 2.59 square kilometers, equals 27,878,400 square feet.

1 cubic foot equals 0.0283 cubic meter, equals 7.4805 U. S. gallons.

1 cubic foot of water weighs 62.4 pounds.

1 cubic meter per minute equals 0.5886 second-foot.

1 U. S. gallon equals 231 cubic inches, equals 0.1337 cubic feet.

1 lb. per square inch equals 2.304 feet head.

1 foot head equals 0.434 lbs. per square inch.

1 grain per gallon equals 17.138 parts per million.

1 part per million equals .0583 grains per gallon.

Miles per hour $\times$ 1.467 equal feet per second.

1 horsepower equals 550 foot-pounds per second.

1 horsepower equals 76.0 kilogram-meters per second.

1 horsepower equals 746 watts.

1 horsepower equals 1 second-foot falling 8.80 feet.

1.34 horsepower equals 1 kilowatt.

1 cent per kilowatt-hour equals $87.60 per kilowatt-year,—equals $65.35 per horsepower-year.

Horsepower at 80 per cent overall efficiency (approx.)

$$= \text{Sec.-ft.} \times \text{fall in feet} \times .09$$

$$= \frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$$

Kilowatts at 80 per cent overall efficiency (approx.)

$$= \text{Sec.-ft.} \times \text{fall in feet} \times .07$$

$$= \frac{\text{Sec.-ft.} \times \text{fall in feet}}{14.6}$$

Per Cent of Time Duration Tables

For all the gaging stations for which fairly accurate daily flows were available, and for those stations for which no daily discharge figures had been published for the winter periods but for which there was sufficient information available to work up mean daily discharges for the missing periods by modern methods, per cent of time duration tables based on observed flows have been prepared. The tables show for each year of the record, the per cent of time for which various flows in second-feet per square mile occurred and also in the column at the extreme right the per cent of time for the entire period of record for which those same flows in second-feet per square mile occurred.

These values can be safely used at other points on the same stream not too far distant from the gaging station by multiplying the values in second-feet per square mile by the drainage area at the point under consideration, giving due consideration to important tributaries, the flow of which may be included or excluded in the run-off at the point under consideration and which may have a higher or a lower unit run-off than the main river at the gaging station.

These tables can be shown graphically by plotting the values in the tables for any one year or the mean for the entire period of record, with values of second-feet per square mile as ordinates and per cent of time as abscissa and drawing a smooth curve through the points plotted.

Duration curves are useful in determining the amount of storage or auxiliary power needed to supply a constant demand. When plotted so that one inch vertically represents 0.5 second-feet per square mile, and one inch horizontally represents 10% of one year, then one square inch area will represent 1.58 million cubic feet per square mile of drainage area or for each foot of fall will be equivalent to 49.7 theoretical horsepower hours per square mile of drainage area. Then by plotting on the curve a horizontal line representing the desired plant capacity, and finding the square inches below this line and above the duration curve, we can find the number of million cubic feet of storage needed yearly by multiplying the square inches by 1.58 by the number of square miles of drainage area. Or if the deficiency is to be made up by steam power, multiply the number of square inches by 49.7 by the drainage area, times head utilized, times the overall efficiency of water power plant.

A few per cent of time duration curves are included in this report. Generally the mean values for the entire period of record are plotted and on the same sheet the values for the worst year from the view point of low water flow, this being determined by taking that year having the lowest flow below the point of mean flow. Thus, if 1.63 second-feet per square mile were the mean flow for the entire record, only that section of the curve falling below 1.63 would be considered in determining the worst year.

The duration curve can also be called a rearranged hydrograph, formed by cutting out all ordinates from a day-to-day flow curve and pasting them on a sheet in order of size, beginning with the largest one at the 1-day point and ending with the minimum value at the 365-day point.

Previous to the winter of 1913-14 discharge figures for ice cover were usually monthly estimates based on the observers' notes and general weather conditions prevailing. Since that time the development of the winter hydrograph with its curves of backwater, and observed and effective gage heights, based primarily on actual measurements of discharge, has resulted in great improvement of the daily figures. At certain stations it has been possible to obtain sufficient data to revise the winter figures previous to 1913 in accordance with the methods used at the present time, but in general the winter figures for these years are of questionable accuracy and the flow for individual days may vary widely from the figure used. In many cases these estimates have not been considered sufficiently accurate for use and such years have not been included in the duration tables. Such data as is available can be obtained by application to the office of the Commission.

GAGING STATIONS

Note.—Dash after a date indicates that station was being maintained September 30, 1920. Period after a date indicates discontinuance.

COASTAL BASIN, NO. 3

St. George River near Union, 1913-1915.

ST. JOHN RIVER BASIN

St. John River near Dickey, 1910-11.
St. John River at Fort Kent, 1905-16.
St. John River at Van Buren, 1908—
Allagash River near Allagash, 1910-11.
St. Francis River at St. Francis, 1910-11.
Fish River at Wallagrass, 1903-1908; 1911.
Madawaska River at St. Rose du Degele, Quebec, 1910-1911.
Aroostook River at Fort Fairfield, 1903-1910.

ST. CROIX RIVER BASIN

St. Croix River near Baileyville, 1919—
St. Croix River near Woodland, 1902-1911.
St. Croix River at Baring, 1913-1915.
West Branch, St. Croix River at Baileyville, 1910-1912.

MACHIAS RIVER BASIN

Machias River at Whitneyville, 1903—

UNION RIVER BASIN

Union River, West Branch (head of Union River), at Amherst, 1909-1919.
Union River, West Branch, near Mariaville, 1909.
Union River at Ellsworth, 1909-10.
Union River, East Branch, near Waltham, 1909.
Branch Lake Stream near Ellsworth, 1909-1915.
Branch Lake (head of Branch Lake Stream), near Ellsworth, 1909-1915. (Elev. only.)
Webbs Brook at Waltham, 1909.
Green Lake Stream at Lakewood, 1900-1913.
Green Lake (head of Green Lake Stream) at Green Lake, 1909-1912. (Elev. only.)

PENOBSCOT RIVER BASIN

Penobscot River, West Branch at Millinocket, 1901—
Penobscot River, West Branch at Medway, 1916—
Penobscot River at West Enfield, 1901—
Penobscot River at Sunk Haze rips, near Costigan, 1899-1900.

Penobscot River, East Branch, at Grand Lake Dam, 1912.
Penobscot River, East Branch, at Grindstone, 1902—
Mattawamkeag River at Mattawamkeag, 1902—
Piscataquis River near Foxcroft, 1902—
Pleasant River near Milo, 1920—
Passadumkeag River at Lowell, 1915—
Cold Stream Pond (head of Cold Stream), 1900-1911 (record of opening and closing of pond).
Kenduskeag Stream near Bangor, 1908-1919.
Cold Stream at Enfield, 1904-1906.
Phillips Lake outlets at Holden and Dedham, 1904-1908.

KENNEBEC RIVER BASIN

Moosehead Lake at East Outlet, 1895— (Elevations only.)
Kennebec River at Moosehead, 1919—
Kennebec River at The Forks, 1901—
Kennebec River at Bingham, 1907-1910.
Kennebec River at North Anson, 1901-1907.
Kennebec River at Waterville, 1892—
Kennebec River at Gardiner, 1785-1910 (record of opening and closing of navigation).
Moose River near Rockwood, 1902-1908; 1910-1912; 1919—
Roach River at Roach River, 1901-1908.
Dead River at The Forks, 1901-1907; 1910—
Carrabassett River at North Anson, 1901-1907.
Sandy River at Farmington, 1910-1916.
Sandy River at Madison, 1904-1908.
Messalonskee Stream at Waterville, 1903-1905.
Sebasticook River at Pittsfield, 1908-1917.
Cobbosseecontee Lake, 1839-1911 (dates of opening and closing).
Cobbosseecontee Stream at Gardiner, 1890—

ANDROSCOGGIN RIVER BASIN

Rangeley Lake (head of Androscoggin River), 1879-1911 (dates of opening and closing).
Androscoggin River at Errol Dam, N. H., 1905—
Androscoggin River at Berlin, N. H., 1913—
Androscoggin River at Gorham, N. H., 1903, (fragmentary).
Androscoggin River at Shelburne, N. H., 1903-1907 and 1910.
Androscoggin River at Rumford Falls, 1892—
Androscoggin River at Dixfield, 1902-1908.
Magalloway River at Aziscohos Dam, 1912—
Auburn Lake, 1890-1911 (date of opening).
Little Androscoggin River near South Paris, 1913—

PRESUMPSCOT RIVER BASIN

Presumpscot River at outlet of Sebago Lake, 1887—

SACO RIVER BASIN

Saco River near Center Conway, N. H., 1903-1912.
Saco River at Cornish, 1916—
Saco River at West Buxton, 1907—
Ossipee River at Cornish, 1916—

ST. GEORGE RIVER NEAR UNION, MAINE

Location.—200 feet below tailrace of electric plant of Dirigo Power Co., half a mile below outlet of Sennebec Lake and a mile above Union, Knox County.

Drainage Area.—116 square miles.

Records Available.—December 11, 1913, to December 31, 1914.

Gage.—Vertical staff gage bolted to tree on left bank; read once a day by G. E. Hills.

Discharge Measurements.—Made from a cable about 50 feet above gage.

Channel and Control.—Rock and gravel; shifting.

Ice.—Stage-discharge relation probably not affected by ice.

Regulation.—Dam of Dirigo Power Company is about 1,000 feet above station; since the completion of the electric plant, after this station was discontinued, the regimen of the stream is more or less affected by night storage.

Accuracy.—Rating curve used is well defined. Gage read to half-tenths once a day except from January 14 to March 2, when the gage was not read. Discharge estimated from January 15 to March 2 by hydrograph comparisons with records from similar basins.

ST. GEORGE RIVER NEAR UNION, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 116 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1914				.690	.526	3.87	6.27	1.77	.578	.345	.207	.198
1914-15	.121	.112	.353									

ST. GEORGE RIVER NEAR UNION, MAINE
Per Cent of Time Duration Table
[Drainage Area, 116 Square Miles]

Sec. Ft. per Sq. Mi.	1914	Sec. Ft. per Sq. Mi.	1914
.05	100.0	1.5	22.2
.1	97.0	1.6	21.6
0.15	79.7	1.75	21.4
0.2	72.6	1.9	20.5
0.3	60.8	2.05	18.1
0.4	54.5	2.25	16.2
0.5	45.5	2.5	14.2
0.6	35.1	2.75	13.4
0.7	31.5	3.0	12.3
0.8	28.2	3.5	11.5
0.9	24.7	4.0	10.4
1.0	23.6	4.5	9.3
1.1	22.7	5.0	7.4
1.2	22.7	7.0	4.9
1.3	22.5	10.0	0.0
1.4	22.5	15.0	0.0

Mean flow for period of duration table — 1.25 sec. ft. per sq. mi.

ST. JOHN RIVER NEAR DICKEY, MAINE

Location.—Near Dickey P. O., Maine, on the farm of L. B. Henderson, two miles above the confluence of the Allagash and St. John Rivers, and three-fourths of a mile below the mouth of the Little Black River.

Drainage Area.—2,820 square miles.

Records Available.—July 5, 1910, to November 21, 1911, when the station was discontinued.

Gage.—Staff, 32½ feet above the measuring section; zero at elevation of 584.41 feet above sea level.

Channel and Control.—Permanent; banks not subject to overflow.

Discharge Measurements.—Made at low stages by wading and at high stages from a boat.

Ice.—Stage-discharge relation affected by ice.

Regulation.—A few log driving dams above the station, probably only slightly affecting the discharge.

Accuracy.—Rating curve well defined below 15,000 second-feet. Gage read to tenths once a day except during the frozen season when the gage was not read. No discharge measurements were made during the winter.

Cooperation.—Station established by the International Commission, River St. John, which furnished the daily gage heights and discharge measurements.

ST. JOHN RIVER NEAR DICKEY, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2820 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1910										.372	.550	.369
1910-11	.500	.890						4.47	1.12	.454	.780	.667
1911-12	.599	1.05										

ST. JOHN RIVER AT FORT KENT, MAINE

Location.—At suspension foot bridge in town of Fort Kent, a short distance above Fish River and about fifteen miles below St. Francis River.

Drainage Area.—4,880 square miles (not including 270 square miles of Chamberlain Lake area which is partly tributary to Penobscot Basin; see W. S. P. 281, P. 28).

Records Available.—October 13, 1905, to December 31, 1915, when the station was discontinued.

Gage.—Inclined staff twenty-two feet long in two sections, attached to the new concrete pier nearest the New Brunswick shore of river. The lower part of the gage is placed in a curve inside of the pier; the upper part is fastened to down-stream end of same pier. The gage datum remained unchanged during the maintenance of the station.

Channel and Control.—Practically permanent; both banks high, rocky, clear and not subject to overflow except in extreme freshets.

Discharge Measurements.—Made from foot bridge.

Ice.—Stage discharge relation affected by ice.

Regulation.—Log driving dams are maintained at the outlets of several large lakes and ponds, but do not materially affect the flow.

Accuracy.—Stage discharge relation practically permanent; occasionally affected by back water from logs jammed on bridge piers, and during the winter by ice. Gage read to tenths twice daily during open water periods and once a week during the winter. Rating curve well defined below 15,000 second-feet; poorly defined between 15,000 and 90,000 second-feet. The only winter measurements of discharge were made April 1, 1908, and January 20, 1910.

ST. JOHN RIVER AT FORT KENT, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 4880 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1906–7				0.205	0.154	0.154	1.37	8.16	3.20	2.44	1.18	0.658	
1907–8	1.54	2.97	1.27	0.572	0.289	0.519	1.59	8.45	3.30	0.623	0.550	0.189	1.82
1908–9	0.215	0.169	0.246	0.879	0.406	0.646	3.04	8.48	1.47	1.77	1.01	1.98	1.69
1909–10	2.42	1.28	0.897	0.297	0.246	0.656	6.74	3.36	1.77	0.379	0.541	0.494	1.59
1910–11	0.426	1.00	0.287	0.164	0.123	0.133	1.24	5.31	1.16	0.486	0.676	0.512	0.960
1911–12	0.471	0.477	0.338	0.287	0.184	0.184	3.38	8.18	4.71	0.463	1.96	0.652	1.77
1912–13	1.55	3.03	1.13	1.04	0.595	1.31	6.54	4.38	2.05	1.26	0.390	0.326	1.97
1913–14	0.987	1.16	0.865	0.308	0.276	0.297	1.59	7.81	1.75	0.496	0.322	0.609	1.37
1914–15	1.13	1.01	1.38	0.379	0.410	1.23	4.23	4.88	1.03	0.799	0.592	0.629	1.47

8-year mean — 1.58

ST. JOHN RIVER AT VAN BUREN, MAINE

Location.—At new International Bridge at Van Buren, Aroostook County, about fourteen miles above Grand Falls.

Drainage Area.—8,270 square miles.

Records Available.—May 4, 1908, to September 30, 1920.

Gage.—Gage used since May 6, 1912; painted vertically on second pier from Van Buren end of bridge; zero gage, 407.69 feet above sea level; daily gage heights 1908-1911 read on a vertical rod attached to pier of sawdust carrier at Hàmmond's Mill, about 700 feet below International Bridge, but as published they are reduced to the datum of the bridge gage. Gage read by W. H. Scott.

Discharge Measurements.—Made from International Bridge.

Channel and Control.—Control practically permanent. Banks high, rocky, cleared, and not subject to overflow except in very high freshets.

Ice.—Stage-discharge relation seriously affected by ice, usually from December to March. Winter estimates based on gage heights at Grand Falls and rating curve derived from measurements at Van Buren.

Regulation.—The little storage above for log driving probably does not materially affect the flow.

Accuracy.—Stage-discharge relation practically permanent, except when affected by ice. Rating curve well defined. Gage read to tenths once daily.

Cooperation.—Winter gage heights at Grand Falls furnished by H. S. Ferguson, Consulting Engineer.

ST. JOHN RIVER AT VAN BUREN, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 8270 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1908									4.67	1.39	.923		
1908-9									2.33	1.92	1.19	2.18	
1909-10	2.83	1.68							2.24	0.591	0.567	0.432	
1910-11	0.415	0.852	0.218	0.162	0.122	0.129	1.56	6.47	1.60	0.654	0.706	0.469	1.11
1911-12	0.432	0.423	0.326	0.230	0.170	0.184	3.38	8.55	5.39	0.927	1.89	0.796	1.89
1912-13	1.44	3.08	1.64	0.839	0.452	1.19	5.50	4.68	2.33	1.14	0.491	0.358	1.93
1913-14	0.827	1.06	0.580	0.313	0.279	0.304	1.39	7.40	2.31	0.684	0.322	0.582	1.34
1914-15	0.866	1.17	0.764	0.366	0.405	1.01	4.70	5.74	1.49	0.998	0.522	0.631	1.56
1915-16	1.35	1.21	0.917	0.651	0.509	0.646	4.58	4.26	2.01	1.32	0.548	0.271	1.52
1916-17	0.935	0.653	1.11	0.560	0.312	0.278	3.41	7.29	5.37	1.95	0.907	0.399	1.93
1917-18	1.08	2.19	0.553	0.271	0.197	0.197	3.23	6.64	2.11	2.70	1.06	1.16	1.79
1918-19	1.43	1.73	0.955	0.707	0.430	0.600	3.56	5.66	1.72	0.701	0.612	0.659	1.57
1919-20	0.628	0.967	0.797	0.296	0.145	0.389	4.52	6.75	2.08	1.87	0.893	1.28	1.72

ST. JOHN RIVER AT VAN BUREN, MAINE

Per Cent of Time Duration Table

[Drainage Area, 8270 Square Miles]

Sec. Ft. per Sq. Mi.	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 8-yr. Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	90.2	98.8
0.2	100.0	100.0	100.0	100.0	100.0	87.7	100.0	86.3	96.8
0.3	92.6	80.0	90.4	91.3	82.2	76.2	99.5	80.6	86.6
0.4	81.6	56.7	77.5	86.9	75.3	71.0	87.4	77.0	76.7
0.5	78.9	48.2	71.2	82.5	69.0	65.8	77.8	74.3	71.0
0.6	74.8	41.6	66.6	73.8	63.6	61.6	67.7	71.6	65.2
0.7	72.3	37.5	58.6	64.8	56.7	58.9	62.2	63.7	59.3
0.8	62.2	35.9	53.4	58.2	49.3	55.3	56.2	57.1	53.4
0.9	55.1	33.4	47.9	51.9	45.2	52.9	52.1	51.6	48.8
1.0	49.0	29.3	41.1	49.2	41.4	50.4	47.4	47.5	44.4
1.1	46.3	26.6	37.5	43.2	38.1	48.2	43.8	42.3	40.8
1.2	42.7	24.4	30.7	36.6	37.3	46.0	38.9	38.3	36.9
1.3	41.4	23.6	26.8	33.6	36.4	43.6	36.7	35.0	34.6
1.4	39.5	21.4	24.4	30.1	35.1	41.1	34.0	32.0	32.2
1.5	38.4	20.8	20.5	28.4	34.0	38.9	31.0	30.1	30.3
1.6	37.5	18.9	18.1	25.7	31.2	37.8	28.8	29.0	28.4
1.75	36.2	17.5	17.0	21.9	29.3	34.8	25.2	27.9	26.2
1.9	32.9	16.4	16.4	20.5	26.0	31.2	23.3	26.2	24.1
2.05	31.5	14.5	16.2	18.6	24.1	27.1	19.7	24.6	22.0
2.25	29.3	13.2	15.1	17.2	23.3	24.4	17.8	23.0	20.4
2.5	27.1	12.6	14.0	15.0	21.9	22.5	16.2	22.1	18.9
2.75	23.6	12.3	13.2	12.6	21.4	20.0	14.5	19.1	17.1
3.0	20.5	11.8	11.8	10.1	20.3	18.4	13.7	16.7	15.4
3.5	15.6	10.7	11.0	7.4	18.6	15.6	12.9	13.9	13.2
4.0	12.6	9.6	10.4	6.6	16.4	12.3	11.8	12.3	11.5
4.5	8.2	9.3	9.0	6.3	14.5	11.0	9.9	11.2	9.9
5.0	6.6	8.8	8.8	5.7	14.0	8.5	8.5	10.1	8.9
7.0	3.3	3.3	6.3	3.8	9.6	4.4	0.0	4.1	4.4
10.0	1.6	1.9	0.5	0.5	0.5	1.1	0.0	1.1	0.9
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.67 sec. ft. per sq. mi.

ST. FRANCIS RIVER NEAR ST. FRANCIS, MAINE

Location.—1½ miles from St. Francis postoffice, Maine; 4 miles from Connors, N. B.; 1 mile from the mouth of the river, and 3 miles below Glazier Lake.

Drainage Area.—560 square miles.

Records Available.—May 11 to November 30, 1910, at the gage at the outlet of Glazier Lake; May 10 to November 30, 1911, at the regular gage near the mouth of the river. Station discontinued on latter date.

Gage.—Staff 10 feet below measuring section. Elevation of zero on gage, 528.84 feet above mean sea level. During 1910 daily gage heights were read on the staff gage at Glazier Lake, as it was impossible to obtain an observer for the regular gage near the mouth. During 1911 daily gage readings were resumed on the regular gage.

Discharge Measurements.—Made by wading and from a canoe, 10 feet above the gage.

Channel and Control.—Permanent. Banks are high and wooded and not liable to overflow.

Ice.—Stage-discharge relation not affected by ice during the period of record.

Regulation.—Large lake areas above the station, but not controlled by dams.

Accuracy.—Rating curve well defined below 10,000 second-feet. Gage read to tenths once daily. Discharge estimates for 1911 are considered fair. Gage height record during 1910 on the gage at the outlet of Glazier Lake indicates the rise and fall of the lake, and the estimates of the discharge are not considered as accurate.

Cooperation.—Station established by the International Commission, River St. John, which furnished discharge measurements and daily gage heights.

ST. FRANCIS RIVER NEAR ST. FRANCIS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 560 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1910									2.20	.612	.559	.288
1910–11	.338	.852							1.17	.621	.754	.386
1911–12	.277	.307										

ALLAGASH RIVER NEAR ALLAGASH, MAINE

Location.—About 100 feet below the ferry crossing the Allagash River, two miles below Dickey postoffice, and 1500 feet above the confluence of the Allagash and St. John Rivers.

Drainage Area.—1,240 square miles.

Records Available.—July 1, 1910, to November 30, 1911, when station was discontinued.

Gage.—Staff, located 35 feet below the measuring section. Elevation of zero gage height, 580.53 feet above mean sea level.

Discharge Measurements.—Made from a boat and by wading.

Channel and Control.—Composed of gravel and small boulders; high banks not liable to overflow.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Log driving dams at Long, Ross and Musquacook Lakes may at times hold the water back so that gage heights may indicate lower flow than the natural minimum flow of the stream.

Accuracy.—Rating curve well defined below 1000 second-feet, poorly defined between 1000 and 9000 second-feet. Gage read to hundredths once a day except from November 22 to May 4 when the gage was not read. No discharge measurements were made during the winter.

Cooperation.—Station established by the International Commission, River St. John, which furnished records of discharge measurements and daily gage heights.

ALLAGASH RIVER NEAR ALLAGASH, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1240 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1909-10										.354	.344	.741
1910-11	.287								1.37	.340	.271	.365
1911-12	.344	.455										

FISH RIVER AT WALLAGRASS, MAINE

Location.—Below the outlet of Wallagrass Stream, near Soldier Pond postoffice, about 7 miles south of Fort Kent and 4 miles below Eagle Lake.

Drainage Area.—860 square miles.

Records Available.—July 29, 1903, to December 26, 1908; May 7, 1911, to November 30, 1911, after which date this station was discontinued.

Gage.—Standard chain gage attached to trees on the bank, about 1,500 feet upstream from the cable. Gage datum remained unchanged during the maintenance of the station.

Discharge Measurements.—Made from cable.

Channel and Control.—Permanent; not liable to overflow.

Ice.—Discharge relation affected by ice.

Regulation.—A large lake area above the station has not yet been developed for storage purposes.

Accuracy.—Rating curve fairly well defined below 9000 second-feet. Gage read to tenths every two days except during the winter when it was read but once a week. Winter discharge measurements were made on the following dates: February 15, 1906, February 13 and March 28, 1907, February 18 and March 31, 1908.

Cooperation.—Station established 1911 by International Commission, River St. John, who furnished discharge measurements and daily gage heights.

FISH RIVER AT WALLAGRASS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 860 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1902–3											0.563	0.281	
1903–4	0.109							7.40	2.37	0.863	0.456	1.04	
1904–5	1.76	0.845						3.21	1.76	0.694	0.184	0.086	
1905–6	0.073			0.224	0.235	0.442	1.11	7.36	2.34	0.876	0.240	0.108	
1906–7	0.487	1.00	0.652	0.349	0.256	0.256	1.02	7.13	3.53	2.23	2.41	0.952	1.69
1907–8	1.55	2.88	1.26	0.698	0.394	0.479	2.08	8.24	2.90	0.779	0.564	0.351	1.85
1908–9	0.174	0.140	0.174				1.34	5.56	0.894				
1910–11									1.33	0.499	0.517	0.349	
1911–12	0.217	0.195											

MADAWASKA RIVER AT ST. ROSE DU DEGELE, P. Q.

Location.—At highway bridge crossing the Madawaska River, one-fifth mile from Temiscouata railroad station; two miles below the outlet of Lake Temiscouata, and 21 miles above the mouth of the river.

Drainage Area.—950 square miles.

Records Available.—May 12, 1910, to November 30, 1911, when station was discontinued.

Gage.—Staff fastened to west abutment of highway bridge. Zero on bridge at elevation 475.70 above mean sea level.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Permanent. Banks are high and not liable to overflow. Channel is of sand and gravel and slightly shifting.

Ice.—Stage-discharge relation affected by ice.

Accuracy.—Two rating curves were used, one for each year. Curve used for 1910 is poorly defined. Curve used for 1911 fairly well defined below 9000 second-feet. Gage read to hundredths once a day except during the winter when it was not read. No measurements of discharge were made during the winter.

Cooperation.—Station established by International Commission, River St. John, which furnished discharge measurements and daily gage heights.

MADAWASKA RIVER AT ST. ROSE DU DEGELE, P. Q.

Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 950 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1909 10									2.92	1.11	.759	.435
1910 11	.436	.938							2.54	1.14	.629	.448
1911-12	.395	.343										

AROOSTOOK RIVER AT FORT FAIRFIELD, MAINE

Location.—At steel highway bridge in village of Fort Fairfield, three miles above International Boundary line and about eight miles below the mouth of Little Madawaska Stream.

Drainage Area.—2,230 square miles.

Records Available.—July 31, 1903, to December 31, 1910, when station was discontinued.

Gage.—Standard chain gage installed on downstream side of highway bridge.

Discharge Measurements.—Made from downstream side of highway bridge at ordinary stages and by wading at low stages.

Channel and Control.—Permanent; banks are high and not liable to overflow.

Ice.—Stage-discharge relation affected by ice.

Accuracy.—Stage-discharge relation permanent except when affected by ice. Rating curve well defined below 20,000 second-feet. Gage read to tenths once a day except during the frozen periods when it was seldom read. Estimates for winter months of 1907 to 1910 based on climatological records, discharge measurements made February 20 and April 3, 1908, and January 18, 1910, and the run-off from similar basins.

AROOSTOOK RIVER AT FT. FAIRFIELD, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2230 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1902-3											0.287	0.212	
1903-4	0.097	0.408							1.64	0.818	0.329	1.34	
1904-5	1.50	0.604							1.18	0.352	0.130	0.083	
1905-6	0.073	0.175						8.25	1.79	0.718	0.278	0.114	
1906-7	1.40	0.780	0.839	0.359	0.224	0.314	2.08	7.76	2.76	2.40	2.32	1.03	1.86
1907-8	1.41	2.71	1.83	0.673	0.605	0.771	3.07	7.98	2.75	0.356	0.383	0.161	1.89
1908-9	0.191	0.243	0.224	0.480	0.404	0.767	6.32	7.40	1.08	1.63	1.23	2.66	1.88
1909-10	3.05	2.19	1.52	0.942	0.538	0.807	7.40	4.22	2.35	1.32	0.299	0.222	2.07
1910-11	0.187	0.592	0.157										

ST. CROIX RIVER NEAR BAILEYVILLE, MAINE

Location.—About 500 feet below the St. Croix Paper Company power plant at Grand Falls, Maine, ten miles northwest of Woodland.

Drainage Area.—1,320 square miles.

Records Available.—Station established November 24, 1919.

Gages.—Gurley 7-day graph water-stage recorder on right bank referenced to gage datum by a hook gage inside the well; an inclined staff gage is used for auxiliary readings. Recorder inspected by H. S. James.

Discharge Measurements.—Made from cable.

Channel and Control.—Channel of gravel and boulders. Control for medium and low stages, series of riffles immediately below gage; at high stages, a long stretch of smooth water.

Ice.—Probably little, if any, effect from ice during the winter.

Regulation.—The flow at the gage is under practically complete regulation, except during high stages, by the St. Croix Paper Company power plant located 500 feet upstream.

Accuracy.—Stage-discharge relation probably permanent. Rating curve well defined between 1,000 and 9,000 second-feet. Daily discharge ascertained by use of discharge integrator.

Coöperation.—Water-stage recorder inspected by an employee of the St. Croix Paper Company.

ST. CROIX RIVER NEAR BAILEYVILLE, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 1320 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919-20			1.24	0.985	0.765	1.08	7.20	4.45	1.30	1.21	1.27	1.33

ST. CROIX RIVER NEAR BARING, MAINE

Location.—At the farm of Fulton Sinclair two miles above Baring.

Drainage Area.—1,390 square miles.

Records Available.—Discharge measurements in 1914.

Gage.—Chain.

Discharge Measurements.—Made from a cable about 400 feet below gage.

Channel and Control.—Rock and gravel; discharge relation affected by backwater from Baring dam.

Regulation.—The lake system of the St. Croix above the station comprises in the aggregate 83 square miles and is under extensive control by dams used both for log driving and storage. The paper mill of the St. Croix Paper Company at Woodland, four miles above the station, is run continuously (Sundays and week days) with occasional shutdowns lasting only a few hours.

Accuracy.—The gage height record is believed to be valueless because of backwater from Baring dam.

ST. CROIX RIVER NEAR WOODLAND, MAINE

Location.—One and one-half miles below the dam of the St. Croix Paper Company; ten miles below the junction of the West Branch with the East Branch; five miles above Baring, Maine. Prior to June 8, 1905, the station was located at Sprague's Falls, about 1½ miles above the present location.

Drainage Area.—1,380 square miles.

Records Available.—December 4, 1902, to December 31, 1911, when station was discontinued.

Gage.—Vertical staff, 5½ feet long, attached to a large boulder on the left bank, 400 feet upstream from cable. A standard chain gage is attached to an old tree on the left bank 300 feet above the staff gage for use during high water.

Discharge Measurements.—Made from a cable 400 feet below the gage.

Channel and Control.—Of gravel and rock; but now gradually shifting owing to gradual filling up with sawdust pulp from the mill above.

Ice.—During many seasons the river does not freeze over, due to the operation of the mill above and the velocity of the water at the section.

Regulation.—The lake system of the St. Croix River above the station comprises in the aggregate approximately 82 square miles and it is controlled to a considerable extent by dams which are used both for log driving and for storage purposes. The paper mill above is run continuously Sundays and week days, and the occasional shut-downs last only a few hours.

Accuracy.—The relation between gage heights and discharge is materially affected by backwater from log jams that form nearly every season at the head of an island a short distance below the section. Gage heights also show fluctuations caused by operation of the mill gates. Gage read to tenths once a day except Sundays and during the winter when it was read but once a week. Daily discharge ascertained by applying daily gage heights to rating table with corrections for effect of logs and ice. The only measurement of discharge made during the winters were on March 21, 1903, and March 6, 1908.

ST. CROIX RIVER NEAR WOODLAND, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1380 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1902–3							3.50	1.60	1.83	1.96	1.33	0.525	
1903–4	0.524	0.746	1.33	1.51	0.754	1.29	4.37	5.09	1.88	2.24	1.09	0.826	1.80
1904–5	0.993	0.797	1 03	0.855	0.819	0.855	3.28	1.80	1.64	2.33	1.03	0.699	1.34
1905–6	0.398	0.548	1.16	2.01	1.96	1.04	1.72	3.38	2.24	1.75	1.52	0.833	1.55
1906–7	1.46	1.67	1.48	1.26	0.704	0.986	2.26	3.40	3.07	2.49	2.39	2.27	1.95
1907–8	1.79	1.83	2.12	1.96	1.30	1.59	2.43	3.79	2.54	1.09	1.30	1.09	1.90
1908–9	0.906	0.725	0.652	1.69	1.14	1.86	5.39	3.39	1.68	1.42	1.44	2.99	1.94
1909–10	3.18	1.87	1.56	1.67	1.64	1.94	1.93	1.76	1.91	1.65	1.42	1.44	1.83
1910–11	1.38	0.920	0.978	1.01	1.09	0.993	2.20	1.34	1.03	1.07	1.02	0.812	1.15
1911–12	0.708	0.884	1.46										

WEST BRANCH OF THE ST. CROIX RIVER NEAR BAILEYVILLE, MAINE

Location.—At highway bridge one mile from Baileyville railroad station, about four miles below Princeton, and about a half mile above the mouth of Tomah Stream.

Drainage Area.—509 square miles.

Records Available.—May 10, 1910, to October 24, 1912.

Gage.—Chain attached to the floor of the easterly span.

Discharge measurements.—Made from downstream side of bridge.

Channel and Control.—Practically permanent, broken by four piers at the bridge; during extremely high stages water is liable to flow around the abutments of the bridge. Station was flowed out by Grand Falls development of the St. Croix Paper Company in 1913.

Ice.—River generally does not freeze completely over.

Regulation.—The lake system on the West Branch is extensive and largely under artificial control. The dams are operated both for log driving and the water powers below.

Accuracy.—Relation between gage height and discharge probably somewhat affected by ice during the winter and to some extent also by backwater from log jams. Results of discharge measurement are too discordant to warrant publishing estimates of discharge based thereon. Discordant results may be due to effect of log jams, but there are no data available upon which to base an interpretation of the results.

MACHIAS RIVER AT WHITNEYVILLE, MAINE

Location.—At a wooden highway bridge in Whitneyville, Maine, Washington County, 200 feet below a storage dam, 4 miles above Machias.

Drainage Area.—465 square miles.

Records Available.—October 17, 1903, to September 30, 1920.

Gage.—Chain installed on the wooden highway bridge October 10, 1911; prior to October 3, 1905, chain gage on the Washington County railroad bridge, three-fourths of a mile downstream; October 3, 1905, to October 9, 1911, staff gage on highway bridge at datum of present chain gage. Gage read by I. S. Albee.

Discharge Measurements.—Made from railroad bridge or by wading.

Channel and Control.—Practically permanent.

Ice.—River usually remains open at the gage, but ice farther downstream occasionally affects the stage-discharge relation.

Regulation.—Opening and closing of gates in storage dam immediately above station each day during low stages of the river cause considerable fluctuation; some log driving every year and jams of short duration occasionally occur.

Accuracy.—Stage-discharge relation practically permanent except when affected by ice and log jams. Rating curve well defined between 100 and 4,000 second-feet. Gage read to half-tenths once daily.

MACHIAS RIVER AT WHITNEYVILLE, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 465 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1903-4	1.14	1.38	1.50				5.76	6.41	1.72	0.652	0.370	1.21	
1904-5	1.44	0.912	0.465				4.82	2.15	2.32	1.53	0.600	1.05	
1905-6	0.318	1.13					5.10	5.51	4.11	2.17	0.695	0.346	
1906-7	0.643	1.83	1.54	1.63	0.860	1.18	4.80	4.71	3.46	1.19	0.630	0.609	1.92
1907-8	1.52	3.01	2.90	2.56	2.97	3.57	3.76	4.06	3.33	0.843	0.865	0.531	2.49
1908-9	0.899	0.959	0.804	2.17	2.95	4.37	8.88	4.97	2.58	0.860	0.430	2.32	2.68
1909-10	2.90	3.08	2.06	2.60	2.39	3.27	3.81	4.62	2.26	1.54	0.609	0.520	2.47
1910-11	0.370	0.312	0.630	1.10	0.763	1.39	3.66	2.71	3.23	0.649	0.374	0.531	1.26
1911-12	0.492	0.991	1.93	1.58	1.65	3.85	4.17	3.74	3.96	0.686	0.867	0.705	2.05
1912-13	2.22	3.35	2.43	3.87	1.76	5.08	4.56	4.56	2.24	0.619	0.538	0.723	2.67
1913-14	2.24	1.79	1.72	1.32	1.73	4.22	6.49	4.56	2.17	0.813	0.905	0.411	2.37
1914-15	0.497	1.05	0.865	1.64	2.05	0.839	2.15	5.94	1.96	2.30	1.24	0.688	1.77
1915-16	0.708	0.946	1.74	1.05	0.964	1.52	3.91	4.60	3.10	2.17	0.938	1.33	1.91
1916-17	1.29	1.02	2.62	3.40	1.46	2.49	6.97	4.34	6.90	1.75	1.90	1.06	2.92
1917-18	2.99	2.19	0.895	0.699	0.884	1.35	6.84	5.29	2.58	1.55	0.852	2.10	2.34
1918-19	4.02	2.60	1.96	2.24	1.17	4.92	4.43	5.31	2.45	1.24	0.701	1.46	2.71
1919-20	0.895	2.02	1.51	0.561	0.505	3.85	12.6	4.47	2.30	1.28	0.538	0.652	2.58

MACHIAS RIVER AT WHITNEYVILLE, MAINE

Per Cent of Time Duration Table

[Drainage Area, 465 Square Miles]

Sec. Ft. per Sq. Mi.	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean Year
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	98.4	100.0	100.0	100.0	100.0	100.0	99.9
0.15	100.0	100.0	100.0	100.0	99.2	95.9	100.0	100.0	100.0	100.0	98.9	99.5
0.2	100.0	99.5	100.0	100.0	97.8	95.3	100.0	100.0	100.0	100.0	98.1	99.2
0.3	98.6	79.7	96.7	100.0	96.2	94.2	100.0	100.0	100.0	100.0	97.3	96.6
0.4	95.3	69.0	94.0	100.0	94.0	93.4	98.6	100.0	97.5	100.0	90.2	93.8
0.5	89.6	56.7	85.2	90.1	93.2	89.0	94.8	97.5	95.9	98.1	85.2	88.7
0.6	89.0	52.9	81.7	85.2	92.1	79.5	89.3	95.3	89.3	95.3	78.1	84.3
0.7	88.5	47.9	76.0	76.7	86.6	75.6	82.5	94.0	87.1	94.0	70.5	79.9
0.8	85.8	41.1	69.7	72.3	80.0	68.8	76.2	92.3	76.7	91.0	63.4	74.3
0.9	83.8	39.2	62.8	70.7	73.7	59.5	67.5	88.5	69.9	86.3	56.6	69.0
1.0	82.5	37.3	58.5	67.9	66.8	53.2	62.0	85.8	67.1	83.6	51.9	65.1
1.1	78.6	32.3	55.5	64.7	59.5	53.2	60.4	85.8	63.0	82.5	49.2	62.2
1.2	77.5	31.2	53.3	63.8	57.5	45.5	54.6	78.9	58.6	80.0	46.4	58.8
1.3	75.9	29.3	48.6	63.0	53.7	43.3	51.6	76.2	55.9	74.0	42.9	55.9
1.4	71.8	28.5	44.0	60.5	50.7	38.6	46.4	67.1	54.5	72.3	40.7	52.3
1.5	71.8	28.5	43.7	60.5	50.1	36.4	42.3	60.0	52.1	67.4	39.6	50.2
1.6	68.5	27.7	39.6	56.4	47.9	32.6	39.6	55.6	45.8	61.4	35.8	46.4
1.75	64.4	26.6	37.2	54.2	45.8	29.6	36.3	51.8	43.6	54.2	31.1	43.2
1.9	57.5	24.7	33.3	49.6	41.9	27.4	33.9	46.8	40.5	49.6	29.2	39.5
2.05	51.8	23.8	32.0	46.3	40.3	25.2	33.3	44.9	40.3	46.0	27.3	37.4
2.25	45.2	23.0	28.7	44.4	39.2	20.0	30.3	41.6	38.1	41.9	25.7	34.4
2.5	28.5	20.3	25.4	41.9	34.8	18.1	28.4	40.0	32.9	38.6	24.6	30.3
2.75	24.9	18.9	23.0	39.5	32.9	16.2	25.4	38.1	27.9	34.2	23.0	27.6
3.0	20.3	16.4	20.5	35.1	30.4	13.2	22.7	35.1	24.9	30.1	21.9	24.6
3.5	17.8	9.6	18.6	29.0	26.0	11.5	16.1	27.7	19.5	25.5	19.1	20.0
4.0	13.7	4.4	13.9	23.0	22.5	9.9	10.9	25.2	17.8	20.8	15.6	16.2
4.5	12.3	3.6	11.5	19.5	15.9	8.5	7.7	21.6	13.4	16.7	14.5	13.2
5.0	10.1	1.9	8.7	15.6	10.4	6.0	5.2	19.2	12.3	14.2	13.9	10.7
7.0	4.1	0.6	4.6	6.3	3.3	2.7	0.8	7.4	3.6	5.8	12.0	4.7
10.0	0.8	0.0	1.1	1.1	1.4	1.1	0.0	2.2	1.1	1.4	7.7	1.6
15.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.2
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 2.28 sec. ft. per sq. mi.

UNION RIVER, WEST BRANCH, AT AMHERST, MAINE.*

Location.—At highway bridge three-fourths mile west of Amherst postoffice on road to Bangor, about one mile below highway bridge at old tannery dam, Hancock County.

Drainage Area.—140 square miles.

Records Available.—July 25, 1909, to September 30, 1919.

Gage.—Standard chain, installed June 2, 1910, at same datum as old vertical gage nailed to a log abutment; read by Mrs. Emma Sumner.

Discharge Measurements.—Made from downstream side of bridge.

Channel and Control.—Gravel, unlikely to change except in unusual flood.

Ice.—Stage-discharge relation seriously affected by ice.

Regulation.—A few log-driving dams above the station, but the regimen of stream is only slightly affected by them.

Accuracy.—Stage-discharge relation practically permanent except as affected by ice, and occasional log jams. Rating curve well defined below 1100 second-feet. Gage read to half-tenths twice daily during open water period, and three times a week during the winter.

* Published in reports for 1912 to 1915 as "Union River at Amherst."

UNION RIVER, WEST BRANCH, AT AMHERST, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 140 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1909-10	2.66	2.32	2.14	1.43	3.21	4.02	4.07	2.23	1.04	0.536	0.624	0.269	2.05
1910-11	0.236	0.395	0.568	0.714	0.286	0.857	6.46	2.55	1.25	0.394	0.486	0.416	1.22
1911-12	0.330	0.929	2.89	2.86	1.57	4.64	6.19	3.41	3.20	0.462	0.557	0.487	2.29
1912-13	1.43	3.82	3.33	4.49	2.56	7.11	5.91	2.63	2.11	0.671	0.264	0.750	2.92
1913-14	3.88	2.99	2.48	0.843	1.31	3.16	8.28	3.76	0.971	0.428	0.186	0.193	2.30
1914-15	0.282	0.708	0.452	0.657	2.21	1.68	3.44	5.41	1.11	2.59	0.914	0.622	1.67
1915-16	0.407	1.04	2.31	2.10	0.678	1.26	4.78	2.21	1.57	1.27	0.364	0.571	1.55
1916-17	0.900	0.914	3.12	1.41	0.864	2.05	9.71	4.26	5.07	1.38	1.09	0.546	2.61
1917-18	1.76	2.30	1.38	0.821	0.475	1.47	6.71	2.76	0.659	1.89	0.576	1.71	1.88
1918-19	4.64	3.09	2.20	2.12	1.40	4.84	4.89	2.94	1.01	0.409	0.212	0.354	2.35

Mean, 10 years — 2.08

UNION RIVER, WEST BRANCH, AT AMHERST, MAINE

Per Cent of Time Duration Table

[Drainage Area, 140 Square Miles]

Sec. Ft. per Sq. Mi.	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	Mean Year
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	99.5	100.0	99.9
0.15	100.0	98.6	98.6	100.0	100.0	99.2	99.2	99.4
0.2	97.3	90.7	93.7	98.6	100.0	98.4	96.7	96.[illegible]
0.3	91.2	79.5	91.0	88.5	100.0	93.2	87.4	90.[illegible]
0.4	89.0	77.3	82.5	80.9	96.2	89.0	83.8	85.5
0.5	86.3	75.3	71.0	76.2	88.8	81.4	75.9	79.3
0.6	80.3	70.4	66.3	71.0	80.5	76.2	72.6	73.9
0.7	74.0	69.9	58.9	69.1	75.3	71.5	71.8	70.1
0.8	69.9	68.2	52.3	65.8	68.2	67.7	70.4	66.1
0.9	68.8	66.6	47.7	58.7	63.8	63.3	68.2	62.4
1.0	68.5	64.7	44.9	57.4	62.2	57.3	66.8	60.3
1.1	67.7	59.5	38.9	53.0	58.6	54.8	65.2	56.8
1.2	67.1	57.0	34.5	48.9	56.4	52.6	64.1	54.4
1.3	66.8	55.6	33.2	45.9	52.9	49.3	58.9	51.8
1.4	66.0	54.8	30.4	37.7	47.7	45.5	57.0	48.4
1.5	64.9	52.9	28.8	35.5	45.5	40.8	55.1	46.2
1.6	64.4	49.0	27.7	35.0	45.2	37.0	53.7	44.6
1.75	62.7	46.6	26.3	31.1	43.3	32.1	48.8	41.6
1.9	61.4	42.2	24.9	26.8	41.1	28.5	45.5	38.6
2.05	53.2	40.3	23.8	24.0	39.7	27.4	43.8	36.0
2.25	50.1	37.3	21.1	18.0	37.8	25.2	40.8	32.8
2.5	45.5	35.3	17.5	14.5	32.9	21.1	36.[illegible]	29.0
2.75	42.5	31.2	15.6	13.4	30.1	20.0	33.[illegible]	26.6
3.0	40.3	26.6	14.5	12.0	26.3	16.2	31.[illegible]	[illegible]
3.5	33.4	20.8	13.4	10.9	22.2	12.3	23.3	19.5
4.0	26.6	17.3	10.1	9.6	20.0	10.4	19.5	16.2
4.5	20.5	14.2	8.8	7.1	18.1	9.6	15.6	13.4
5.0	15.1	12.9	7.7	4.1	16.2	[illegible].8	11.5	10.9
7.0	6.8	7.9	4.1	0.5	9.9	4.1	4.1	5.3
10.0	4.4	2.2	1.9	0.0	3.6	0.8	0.0	1.8
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 2.18 sec. ft. per sq. mi.

BRANCH LAKE STREAM NEAR ELLSWORTH, MAINE

Location.—At small highway bridge immediately below the sawmill at outlet of Branch Lake, 5 miles from Ellsworth.

Drainage Area.—31 square miles.

Records Available.—July 1, 1909, to March 31, 1915.

Gage.—Seven-foot staff nailed to right abutment downstream side of bridge.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Gravelly and permanent in natural condition; fills up from sawmill waste, but generally clears itself during spring freshets.

Ice.—Relation between gage height and discharge usually affected by ice.

Regulation.—The flow from the lake is regulated in the interest of the sawmill and power plants of Ellsworth.

Accuracy.—Stage-discharge relation shifts occasionally. Rating curves used fairly well defined between 10 and 160 second-feet. There was considerable fluctuation at this section, but fair computations of discharge were made from detailed readings of the time of openings of the gates of the mill wheels. The mill records were used to determine the lengths of time that the readings at the bridge applied.

BRANCH LAKE STREAM NEAR ELLSWORTH, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 31 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1909–10	1.66	1.76	2.25	1.46	1.80	3.84	3.29	3.61	2.63	1.86	2.42	1.88	2.38
1910–11	1.74	2.01	1.36	.710	.281	1.46	2.09	2.06	2.19	1.57	1.80	1.62	1.58
1911–12	1.06	.771	1.00	1.12	1.00	1.50	1.34	2.12	1.78	1.24	1.30	1.36	1.30
1912–13	1.37	1.40	1.06	1.68	2.90	3.10	3.77	2.32	2.45	1.45	1.77	1.48	2.06
1913–14	1.06	1.42	1.42	1.42	1.42	1.42	2.84	3.03	1.42	.580	2.32	2.29	1.72
1914–15	1.09	.129	.580	.903	.548	.258							

BRANCH LAKE STREAM NEAR ELLSWORTH, MAINE

Per Cent of Time Duration Table

[Drainage Area, 31 Square Miles]

Sec. Ft. per Sq. Mi.	1909–10	1910–11	1911–12	1912–13	Mean 4-yr. Period
0.05	99.7	98.6	100.0	100.0	99.6
0.1	99.7	98.6	100.0	100.0	99.6
0.15	99.7	98.6	100.0	100.0	99.6
0.2	99.7	92.1	100.0	100.0	98.0
0.3	99.7	88.2	100.0	100.0	97.0
0.4	98.6	82.7	98.9	100.0	95.0
0.5	97.8	78.6	98.6	100.0	93.8
0.6	96.4	77.0	98.4	100.0	93.0
0.7	96.2	76.4	97.3	100.0	92.5
0.8	95.9	75.6	92.1	100.0	90.9
0.9	91.5	74.8	83.9	100.0	87.6
1.0	88.8	74.0	63.4	90.7	79.2
1.1	88.8	74.0	59.6	86.0	77.1
1.2	83.3	67.7	44.0	76.4	67.8
1.3	81.9	67.7	39.3	74.2	65.8
1.4	79.5	66.0	30.6	70.7	61.7
1.5	77.5	59.7	24.0	59.5	55.2
1.6	72.3	56.4	20.5	56.4	51.4
1.75	64.1	52.9	17.5	52.9	46.8
1.9	58.9	39.2	13.9	50.4	40.6
2.05	46.0	33.7	10.7	48.2	34.6
2.25	42.7	21.9	8.7	44.7	29.5
2.50	39.5	14.8	6.3	26.6	21.8
2.75	32.6	10.4	4.4	23.0	17.6
3.0	27.1	9.3	0.0	13.4	12.4
3.5	18.6	0.0	0.0	8.2	6.7
4.0	8.2	0.0	0.0	5.8	3.5
4.5	4.4	0.0	0.0	3.0	1.8
5.0	3.8	0.0	0.0	0.0	1.0
7.0	1.6	0.0	0.0	0.0	0.4
10.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.83 sec. ft. per sq. mi.

GREEN LAKE STREAM AT LAKEWOOD, MAINE

Location.—Highway bridge one-half mile below dam at outlet of Green Lake; one-half mile from Lakewood postoffice; eight miles from Ellsworth.

Drainage Area.—47 square miles.

Records Available.—July 1, 1909, to December 31, 1913, when station was discontinued.

Gage.—Seven-foot staff nailed to right-hand abutment, upstream side of bridge.

Discharge Measurements.—Made from lower side of bridge.

Channel and Control.—Permanent. Banks not subject to overflow.

Ice.—Stage-discharge relation not seriously affected by ice.

Regulation.—The dam one-half mile above the station at the outlet of the lake controls the storage of the lake and records do not show the natural flow.

Accuracy.—Rating curve well defined below 400 second-feet. Stage-discharge relation practically permanent except as affected by ice. Gage read to tenths once each day.

GREEN LAKE STREAM AT LAKEWOOD, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 47 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1909										.915	2.10	2.51	
1909-10	0.472	0.266	1.64	2.21	3.23	4.30	3.53	3.19	1.43	1.16	1.20	2.60	2.10
1910-11	1.45	0.998	1.87	0.304	2.72	1.16	0.930	0.823	0.840	1.24	2.28	2.64	1.44
1911-12	1.66	0.521	0.423	0.426	0.638	2.55	5.60	3.47	3.40	1.38	1.30	2.49	1.99
1912-13	1.69	0.489	1.07	3.36	3.77	5.88	8.11	3.02	1.96	1.21	3.04	1.76	2.95
1913	1.32	1.57	1.91										

GREEN LAKE STREAM AT LAKEWOOD, MAINE
Per Cent of Time Duration Table
[Drainage Area, 47 Square Miles]

Sec. Ft. per Sq. Mi.	1909–10	1910–11	1912–13	Mean of 3 Years
0.05				
0.1				
0.15	100.0	100.0	100.0	100.0
0.2	98.4	100.0	100.0	99.5
0.3	94.5	91.8	100.0	95.4
0.4	91.0	90.4	100.0	93.8
0.5	85.2	83.3	95.9	88.1
0.6	82.2	82.5	91.8	85.5
0.7	81.6	72.9	89.6	81.4
0.8	81.6	71.0	89.0	80.5
0.9	81.4	70.1	85.8	79.1
1.0	81.1	61.6	85.8	76.2
1.1	76.7	40.5	75.9	64.4
1.2	72.3	40.3	75.9	62.8
1.3	63.6	40.0	75.1	59.6
1.4	60.5	33.4	66.6	53.5
1.5	60.5	33.4	66.6	53.5
1.6	57.5	29.0	62.7	49.7
1.75	49.6	24.1	61.4	45.0
1.9	48.5	22.5	61.1	44.0
2.05	47.7	21.1	61.1	43.3
2.25	37.8	18.4	45.2	33.8
2.5	32.1	17.5	44.7	31.4
2.75	26.6	16.7	43.8	29.0
3.0	25.2	14.5	43.3	27.7
3.5	15.6	5.8	36.4	19.3
4.0	11.5	3.0	18.6	11.0
4.5	6.0	1.4	9.0	5.5
5.0	5.2	1.4	8.8	5.1
7.0	1.4	0.0	7.1	2.8
10.0	0.0	0.0	4.9	1.6
15.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 2.16 second feet per square mile

WEST BRANCH OF UNION RIVER NEAR MARIAVILLE, MAINE

This station was established July 7, 1909, at Goodwin's bridge one mile from Mariaville postoffice, on the road from Mariaville to Tilden Corner. As the conditions for obtaining accurate discharge data were poor, the station was discontinued on August 2, 1909.

EAST BRANCH OF UNION RIVER NEAR WALTHAM, MAINE

This station which is located at Jones' bridge, about three miles from the Waltham, postoffice on the road to Aurora, was established July 6, 1909, and discontinued November 30, 1909. An old log driving dam, half a mile below the station, backs water above the station when the gates are shut. These were open from the date of establishment until November 25, hence conditions of flow were satisfactory for the period covered by the record and the effect of the dam can be disregarded. As the rating curve is not well defined to cover the stages during the period of record no figures are published for this station.

WEBBS BROOK AT WALTHAM, MAINE

This station was established July 6, 1909, at a ford locally known as the "Board Landing," about one mile upstream from the highway bridge at Waltham. A staff gage was located just below the ford.

On November 30, 1909, the station was discontinued on account of backwater from the dam below used for storing water for log driving. Gage heights after September 25 are of no value due to backwater at the gage. Record too short to publish.

PENOBSCOT RIVER AT WEST ENFIELD, MAINE

Location.—At steel highway bridge three miles west of railroad station at Enfield, and 1,000 feet below mouth of Piscataquis River, Penobscot County.

Drainage Area.—6,600 square miles.

Records Available.—January 1, 1902, to September 30, 1920.

Gages.—Standard chain attached to highway bridge; Friez water-stage recorder installed on left bank December 11, 1912, at same datum.

Discharge Measurements.—Made from downstream side of bridge.

Channel and Control.—Practically permanent; broken by four bridge piers; banks high and rocky and not subject to overflow. The control is at Passadumkeag Rips about 5 miles below the gage; a wing dam at this point overflows at about 5.5 feet gage height.

Ice.—Stage-discharge relation seriously affected by ice; winter flow estimated by comparison with records at Sunkhaze Rips, 20 miles below.

Regulation.—Flow of river since about 1900 largely controlled by storage principally in lakes tributary to the West Branch. Variations in gate openings at dam of International Paper Co., one mile above the gage, and the Piscataquis near its mouth, cause diurnal fluctuation. Results not corrected for storage.

Accuracy.—Stage-discharge relation practically permanent, except as affected by ice and occasionally by logs. Rating curve well defined. Daily discharge ordinarily ascertained by applying rating table to average of 24 hourly gage height; at times of serious fluctuation in stage the daily discharge is ascertained by using the average discharge of 12 two-hour periods.

Cooperation.—Gage height records and several discharge measurements furnished by Thomas W. Clark, Hydraulic Engineer, Old Town, Maine; discharge measurements also made by students of the University of Maine under the direction of Prof. H. S. Boardman.

PENOBSCOT RIVER AT WEST ENFIELD, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 6600 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2			2.21	1.29			6.20	3.70	4.48	2.12	1.50	0.858	
1902–3	1.14	1.39					5.58	2.21	1.02	1.13	1.03	0.714	
1903–4	0.330	0.427						5.59	2.00	1.29	1.04	1.10	
1904–5	1.55	1.11						2.48	1.25	0.800	0.726	0.588	
1905–6	0.405	0.389						6.15	2.14	1.30	1.04	0.642	
1906–7	1.25	1.67		1.03	0.600	0.444	2.67	6.10	3.02	2.67	1.64	1.15	
1907–8	1.53	3.39	2.55	1.71	1.58	1.70	3.42	5.97	2.70	1.20	0.909	0.639	2.27
1908–9	0.523	0.612	0.600	0.718	0.498	1.10	5.61	5.86	1.98	1.29	0.774	1.61	1.76
1909–10	2.35	1.73	1.45	1.12	1.30	1.79	4.21	3.00	2.55	1.27	0.930	0.645	1.86
1910–11	0.511	0.617	0.606	0.758	0.530	0.591	3.05	2.44	1.27	0.817	0.726	0.898	1.07
1911–12	0.768	0.895	1.91	1.27	1.03	1.82	4.98	4.02	3.80	1.16	1.70	1.01	2.03
1912–13	1.94	3.86	1.71	1.85	0.894	3.00	5.05	3.14	1.95	1.11	0.733	0.767	2.17
1913–14	1.98	1.91	1.21	0.908	0.929	1.30	4.36	6.24	1.76	0.982	0.622	0.603	1.91
1914–15	0.568	0.708	0.627	0.705	1.01	1.27	2.76	3.94	1.24	1.68	1.11	0.820	1.37
1915–16	0.791	0.970	1.30	1.18	0.829	1.02	3.77	2.29	1.86	1.88	1.11	0.741	1.48
1916–17	0.959	0.882	2.17	1.39	0.914	1.18	5.56	4.12	5.86	2.15	2.14	0.982	2.36
1917–18	1.60	2.07	0.922	0.769	0.874	1.21	4.22	2.72	1.37	2.63	1.06	1.42	1.74
1918–19	2.25	3.27	1.77	1.52	1.11	2.73	5.02	4.89	1.92	0.922	0.751	0.857	2.25
1919–20	0.882	2.08	1.18	0.797	0.702	1.12	7.58	5.11	1.45	1.12	0.917	1.38	2.02

PENOBSCOT RIVER AT WEST ENFIELD, MAINE

Per Cent of Time Duration Table

[Drainage Area, 6600 Square Miles]

Sec. Ft. per Sq. Mi.	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 8-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
0.15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
0.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
0.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
0.4	100.0	100.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0
0.5	100.0	99.2	98.1	100.0	100.0	100.0	100.0	100.0	99.7
0.6	94.2	91.0	82.5	100.0	98.1	100.0	99.7	100.0	95.7
0.7	90.7	85.5	72.6	96.4	96.7	98.4	95.3	93.2	91.1
0.8	81.1	78.6	63.3	81.7	89.0	84.7	89.9	79.8	81.0
0.9	72.6	69.0	54.8	66.7	75.9	73.4	83.0	65.8	70.2
1.0	67.7	60.0	49.0	54.4	70.7	68.2	75.3	55.7	62.6
1.1	62.5	52.9	37.5	49.5	66.0	60.3	70.7	48.6	56.0
1.2	59.5	47.4	29.9	43.7	61.6	51.5	65.2	41.3	50.0
1.3	54.8	43.8	26.3	41.5	57.8	43.8	62.7	39.1	46.2
1.4	51.5	38.6	23.8	38.3	54.5	39.5	60.3	35.0	42.7
1.5	49.6	33.4	22.2	34.2	51.8	35.3	55.3	32.8	39.3
1.6	45.8	32.3	21.1	30.9	49.3	33.4	50.4	31.7	36.9
1.75	41.9	29.0	18.9	27.0	46.6	30.1	46.6	28.4	33.6
1.9	39.2	24.7	17.0	23.8	41.6	28.2	41.4	25.4	30.2
2.05	37.3	21.6	15.3	20.5	37.3	26.8	35.3	22.1	27.0
2.25	34.0	20.0	13.7	16.7	34.2	24.1	31.0	20.8	24.3
2.5	27.9	18.4	12.3	11.7	32.6	22.7	27.7	18.3	21.4
2.75	24.1	16.7	10.4	9.8	29.3	18.4	26.6	16.9	19.0
3.0	21.4	15.1	8.8	8.5	25.5	15.6	26.3	16.4	17.2
3.5	17.5	12.9	6.6	4.4	22.2	12.3	23.6	15.0	14.3
4.0	14.8	10.1	5.2	2.5	16.2	9.0	19.2	14.5	11.4
4.5	12.3	9.3	3.6	1.1	13.2	4.9	14.5	13.4	9.0
5.0	11.5	8.5	3.3	0.5	10.1	2.2	12.9	11.2	7.5
7.0	3.0	5.5	1.4	0.0	3.8	0 0	0.0	6.8	2.6
10.0	0.0	0.3	0.0	0.0	1.1	0.0	0.0	0.8	0.3
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

EAST BRANCH OF PENOBSCOT RIVER AT GRINDSTONE, MAINE

Location.—At Bangor & Aroostook Railroad bridge half a mile south of railroad station at Grindstone, one-eighth mile above Grindstone Falls, and about 8 miles above confluence with West Branch at Medway.

Drainage Area.—1,100 square miles; includes 270 square miles tributary to Chamberlain Lake.

Records Available.—October 23, 1902, to September 30, 1920.

Gage.—Chain attached to railroad bridge. Read by R. D. Porter.

Discharge Measurements.—Made from railroad bridge.

Channel and Control.—Practically permanent; stream confined by abutments of bridge and broken by one pier; velocity medium at moderate and high stages, but sluggish at low water.

Ice.—Stage-discharge relation seriously affected by ice.

Regulation.—Several dams maintained at outlets of lakes and ponds near source of river are regulated in the interests of log driving; during summer and fall gates are generally left open. The basin of the East Branch since about 1840 includes about 270 square miles of territory tributary to Chamberlain Lake that formerly drained into the St. John River basin, the diversion being made through what is known as Telos canal. Results not corrected for storage and diversions.

Accuracy.—Stage-discharge relation practically permanent except as affected by occasional backwater from log jams at station and at Grindstone Falls immediately below, and by ice during the winter. Rating curve well defined below 9,000 second-feet. Gage read to tenths twice a day in the open season and three times a week in the winter. No data are published for the winters prior to 1906 and for the winter of 1912-13 due to insufficient data concerning gage heights. The only winter measurements of discharge made before 1912 were February 21, 1908, and January 17, 1910

EAST BRANCH OF PENOBSCOT RIVER AT GRINDSTONE, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1100 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1902–3		1.05					4.19	2.86	0.909	2.44	1.53	0.562	
1903–4	0.315							6.18	2.79	2.14	1.48	0.893	
1904–5	1.58							2.49	1.85	1.95	0.745	0.828	
1905–6	0.201							7.41	3.22	2.82	0.343	0.644	
1906–7	0.945			0.727	0.318	0.273	1.79	7.27	4.55	3.26	1.36	0.725	
1907–8	0.622	3.14	2.70	0.844	0.625	0.945	2.46	6.30	2.69	2.13	0.762	0.464	1.97
1908–9	0.345	0.395	0.159	0.600	0.400	0.700	4.61	6.89	3.55	1.69	0.695	2.25	1.86
1909–10	2.62	1.75	1.34	0.973	0.537	0.603	5.01	3.62	4.43	1.46	0.463	0.240	1.92
1910–11	0.191	0.360	0.253	0.409	0.318	0.455	2.59	3.15	1.86	0.964	0.479	0.590	0.968
1911–12	0.592	0.756	1.12	0.682	0.436	0.909	4.64	4.67	4.88	1.60	1.87	1.04	1.93
1912–13	2.30	3.90	1.60				5.60	3.49	3.24	1.38	0.613	0.448	
1913–14	2.09	1.78	0.906	0.516	0.363	0.616	4.04	6.97	3.12	1.33	0.472	0.246	1.87
1914–15	0.225	0.441	0.207	0.361	1.04	0.982	3.05	4.49	2.44	1.75	0.793	0.393	1.35
1915–16	0.364	0.604	1.06	0.973	0.562	0.991	4.06	3.16	2.94	2.62	0.918	0.407	1.55
1916–17	0.591	0.489	2.10	1.12	0.580	0.885	5.11	5.04	5.72	3.65	1.90	0.863	2.35
1917–18	1.42	2.14	0.392	0.286	0.239	0.461	4.25	3.23	1.89	4.27	1.31	0.831	1.73
1918–19	1.89	2.87	1.56	1.05	0.583	1.86	5.95	6.22	2.73	1.00	0.549	0.382	2.23
1919–20	0.485	1.72	0.927	0.337	0.239	1.28	6.73	5.59	2.33	1.72	0.899	1.14	1.95

EAST BRANCH OF PENOBSCOT RIVER AT GRINDSTONE, MAINE

Per Cent of Time Duration Table

[Drainage Area, 1100 Square Miles]

Sec. Ft. per Sq. Mi.	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 7-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.15	100.0	93.7	100.0	100.0	100.0	100.0	100.0	99.1
0.2	97.0	86.0	100.0	99.5	98.1	99.2	97.3	96.7
0.3	92.9	74.2	97.0	98.9	86.8	96.2	83.6	89.9
0.4	81.9	64.4	87.4	95.1	75.1	92.9	77.9	82.1
0.5	75.6	55.6	78.1	84.1	66.8	88.5	69.4	74.0
0.6	62.2	49.0	70.8	74.2	60.3	82.5	63.9	66.1
0.7	54.8	43.3	63.4	67.4	59.5	75.1	62.6	60.9
0.8	49.3	40.8	56.8	63.0	56.4	66.0	60.9	56.2
0.9	48.5	38.9	51.4	61.1	54.0	64.1	57.7	53.7
1.0	46.3	37.8	47.0	59.2	51.8	62.2	54.6	51.3
1.1	44.4	35.6	44.5	56.4	49.3	57.8	50.5	48.4
1.2	42.5	34.8	40.4	55.3	46.8	54.5	46.4	45.8
1.3	38.6	32.6	37.7	52.6	43.3	50.4	44.8	42.9
1.4	36.2	28.2	35.5	51.5	40.3	48.5	42.3	40.4
1.5	35.9	27.9	34.7	51.5	38.9	46.6	39.6	39.3
1.6	34.0	26.8	33.1	49.6	37.8	44.4	36.6	37.5
1.75	32.1	26.8	32.5	46.0	35.9	41.6	34.2	35.6
1.9	30.1	24.4	31.4	43.3	31.5	39.7	32.0	33.2
2.05	29.0	23.6	28.7	41.1	27.9	36.4	28.1	30.7
2.25	26.8	21.6	25.7	38.6	26.6	33.4	26.0	28.4
2.5	24.9	19.7	24.6	35.6	24.1	31.2	22.4	26.1
2.75	23.3	18.1	21.9	32.9	21.1	27.9	19.9	23.6
3.0	21.6	15.1	20.8	32.1	19.5	25.8	19.4	22.0
3.5	15.3	10.7	12.0	28.2	17.5	20.3	16.7	17.2
4.0	12.1	7.7	5.7	21.6	13.4	18.1	15.8	13.5
4.5	10.4	6.3	3.8	15.3	9.3	15.9	13.1	10.6
5.0	9.6	4.9	3.0	12.9	6.0	12.9	12.0	8.8
7.0	5.2	1.4	0.0	3.3	2.5	5.2	5.7	3.3
10.0	2.2	0.0	0.0	1.1	0.3	0.0	1.1	0.7
15.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.86 second feet per square mile

WEST BRANCH OF PENOBSCOT RIVER AT MILLINOCKET, MAINE

Location.—At Quakish Lake dam and the Millinocket mill of the Great Northern Paper Company at Millinocket, Penobscot County.

Drainage Area.—1,880 square miles.

Records Available.—January 11, 1901, to September 30, 1920.

Gage.—Water-stage recorder at Quakish Lake dam and gages in forebay and tailrace at mill.

Discharge Measurements.—Flow computed by considering flow over dam, through wheels, and water used through log sluices and filters. Wheels rated at Holyoke, Mass., before being placed. As the head, averaging about 110 feet, is much greater than the head under which they were tested, numerous tube-float and current meter measurements in the channel leading to the mill have been made as a check on the wheel ratings. When flow of river is less than 2,500 second-feet, all of the water generally flows through the wheels.

Channel and Control.—Crest of concrete dam.

Ice.—Not seriously affected by ice. Ferguson Pond, just above entrance to canal, eliminates effect from anchor ice.

Regulation.—Storage dams at the outlets of North Twin and Ripogenus Lakes store water on surface of 73 square miles with a capacity of about 41.5 billion cubic feet. Except during time (usually in August) when excess water has to be supplied for log driving on the river below and for a short time during the spring freshet, run-off is regulated by storage. Results corrected for storage.

Cooperation.—Results obtained and computations made by engineers of the Great Northern Paper Company. Since 1911 the Company furnished values of monthly discharge only.

WEST BRANCH OF PENOBSCOT RIVER AT MILLINOCKET, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1880 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2	0.723	0.349	0.617	1.13	1.21	2.86	6.28	5.03	5.00	1.28	1.39	1.15	2.25
1902–3	1.22	1.30	1.41	0.862	0.989	3.07	7.07	3.43	1.13	1.29	1.77	1.02	2.05
1903–4	0.420	0.206	0.229	0.174	0.194	0.280	0.532	2.71	1 96	1.70	1.81	1.15	0.947
1904–5	1.18	1.22	1.15	1.19	1.16	0.916	1.18	3.22	1.41	1.28	1.63	1.22	1.40
1905–6	0.784	0.230	0.218	0.214	0.397	0.366	0.638	3.67	2.56	1.93	1.71	1 08	1.15
1906–7	1.09	1.10	1.08	*1.08	*0.803	0.202	*0.766	3.76	3.69	2.77	*1.85	1.14	1.61
1907–8	*1.44	*3.83	2.40	1.66	1.52	1.59	1.56	5.43	3.68	2.02	1.32	1.06	2.29
1908–9	0.942	0.915	0.973	0.739	0.432	0.723	1.30	4.97	2.46	1.76	1.23	1.21	1.47
1909–10	1.20	1.18	1.16	1.14	2.16	2.16	1.34	3.03	2.86	1.52	1.23	1.25	1.69
1910–11	1.18	1.14	1.14	1.16	0.761	0.365	.585	1.27	1.24	1.18	1.23	1.18	1.04
1911–12	1.18	1.15	1.07	1.10	1.09	1.08	1.22	3.53	3.99	1.81	1.27	1.18	1.64
1912–13	1.19	3.37	1.74	1.15	1.15	1.26	3.26	3.63	2.02	1.36	1.18	1.22	1.88
1913–14	1.23	1.24	1.24	1.37	1.44	1.53	1.80	3.68	1.76	1.69	1.66	1.35	1.66
1914–15	1.22	1.21	1.19	1.19	1.10	0.904	0.926	1.19	1.20	1.31	1.43	1.21	1.17
1915–16	1.22	1.21	1.21	1.19	1.19	1.38	1.58	1.41	1.53	1.89	1.62	1.36	1.40
1916–17	1.19	1.20	1.17	1.27	1.19	1.38	1.57	4.07	6.81	2.51	3.16	1.49	2.26
1917–18	1.55	1.83	1.54	1.48	1.84	2.10	1.80	1.58	1.56	2.55	1.64	1.50	1.75
1918–19	1.59	2.28	1.84	1.56	1.62	1.60	3.41	6.70	2.03	1.64	1.64	1.61	2.51
1919–20	1.28	1.27	1.38	1.63	1.63	1.60	1.60	3.59	1.76	1.57	1.66	1.62	1.72

Mean 19 years — 1.68

* Average for days of known discharge

WEST BRANCH OF PENOBSCOT RIVER AT MILLINOCKET, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1880 Square Miles]

Flow Corrected for Storage

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2	0.218	0.340	1.67	1.38	1.15	2.49	7.77	5.43	5.00	0.457	0.612	0.745	2.27
1902–3	1.59	1.97	1.22	0.506	0.464	2.74	9.15	4.40	0.851	0.463	0.676	0.058	2.01
1903–4	0.127	0.220	0.267	0.183	0.162	0.239	1.52	6.55	1.55	0.771	0.590	1.10	1.11
1904–5	2.30	0.963	0.394	0.372	0.182	0.197	3.15	4.64	2.08	0.867	0.176	0.053	1.28
1905–6	0.053	0.156	0.148	0.232	0.394	0.379	1.42	7.45	2.63	0.867	0.274	0.141	1.18
1906–7	0.846	0.957	0.532	0.670	0.304	0.211	1.52	8.61	3.45	3.24	1.60	0.856	1.90
1907–8	1.53	3.71	1.91	1.29	0.862	0.809	2.14	8.40	3.41	0.755	0.543	0.133	2.12
1908–09	0.165	0.128	0.176	0.431	0.399	0.564	4.39	8.10	1.92	1.22	0.495	1.03	1.58
1909–10	2.26	1.37	1.02	0.761	0.862	0.771	4.96	3.36	2.56	1.19	0.559	0.213	1.66
1910–11	0.186	0.559	0.346	0.202	0.229	0.239	1.12	4.87	1.32	0.505	0.553	0.686	0.901
1911–12	0.878	0.808	1.85	1.05	0.465	0.585	4.27	5.74	3.86	0.904	1.78	0.899	1.92
1912–13	1.56	3.01	1.28	1.05	0.559	1.38	5.10	3.71	1.91	1.01	0.548	0.601	1.81
1913–14	1.39	1.61	1.03	0.654	0.320	0.188	2.28	7.66	1.56	0.744	0.548	0.398	1.53
1914–15	0.670	0.920	0.606	0.349	0.341	0.798	2.86	4.04	1.61	1.21	0.492	0.493	1.20
1915–16	0.814	0.739	1.11	1.00	0.729	0.739	4.06	3.30	2.04	2.02	1.29	0.984	1.57
1916–17	0.952	0.968	1.89	0.883	0.440	0.872	3.86	5.64	7.04	2.25	3.15	1.22	2.43
1917–18	1.67	1.92	0.809	0.334	0.160	0.110	4.35	4.36	1.34	2.91	1.15	1.28	1.70
1918–19	1.72	3.01	1.65	1.19	0.596	1.18	5.27	6.81	1.78	1.03	0.660	0.564	2.14
1919–20	.910	2.15	0.830	0.261	0.258	0.246	6.28	5.43	1.55	1.49	0.729	1.09	1.77

Mean 19 years — 1.69

WEST BRANCH OF PENOBSCOT RIVER AT MILLINOCKET, MAINE

Per Cent of Time Duration Table

[Drainage Area, 1880 Square Miles]

Sec. Ft. per Sq. Mi.	1901–2	1902–3	1909–10	1910–11	Mean 4 Years
0.05	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100 0	100.0	100.0
0.15	100.0	100.0	100.0	99.7	99.9
0.2	99.2	100.0	100.0	99.2	99.6
0.3	93.2	99.5	100.0	96.4	97.3
0.4	90.4	97.8	100.0	86.0	93.6
0.5	86.6	96.7	100.0	85.5	92.2
0.6	83.8	95.1	100.0	83.6	90.6
0.7	82.7	90.4	100.0	80.5	88.4
0.8	81.6	87.7	99.7	77.3	86.6
0.9	79.7	84.7	99.2	77.0	85.2
1.0	75.6	78.1	97.5	71.0	80.6
1.1	63.8	72.9	92.9	65.5	73.8
1.2	50.7	58.6	67.7	52.6	57.4
1.3	46.0	45.5	42.5	14.0	37.0
1.4	35.3	25.8	39.7	12.6	28.4
1.5	33.4	23.6	35.3	0.0	23.1
1.6	31.0	22.7	32.9	0.0	21.6
1.75	28.5	21.9	31.2	0.0	20.4
1.9	27.1	21.1	30.1	0.0	19.6
2.05	26.8	20.8	29.6	0.0	19.3
2.25	25.5	20.5	23.3	0.0	17.3
2.5	24.7	19.5	13.4	0.0	14.4
2.75	24.7	18.1	9.6	0.0	13.1
3.0	23.8	16.7	7.4	0.0	12.0
3.5	21.9	14.5	4.7	0.0	10.3
4.0	21.4	14.0	1.9	0.0	9.3
4.5	19.2	13.7	1.4	0.0	8.6
5.0	17.3	12.6	0.3	0.0	7.6
7.0	5.8	3.8	0.0	0.0	2.4
10.0	1.1	2.7	0.0	0.0	1.0
15.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.76 second feet per square mile

WEST BRANCH OF PENOBSCOT RIVER AT MEDWAY, MAINE

Location.—Just above Nichatou Rapids, half a mile above mouth of East Branch of Penobscot River in town of Medway, Penobscot County, and 2 miles below East Millinocket.

Drainage Area.—2,100 square miles.

Records Available.—February 20, 1916, to September 30, 1920.

Gage.—Chain gage on left bank used February 20 to August 4, 1916; read by A. T. Reed; Gurley 7-day water-stage recorder on left bank used since August 4, 1916.

Channel and Control.—Bed fairly smooth at measuring section; cov-

Discharge Measurements.—Made from cable.

ered with rocks and boulders above and below the gage. Channel divides a few hundred feet below gage, but practically entire flow passes to left of Nichatou Rapids.

Ice.—Stage-discharge relation only slightly affected by ice.

Regulation.—Flow at ordinary stages completely regulated by dams and storage reservoirs above station.

Accuracy.—Stage-discharge relation changed occasionally during high water when debris was removed from right side on control. Rating curve used February 20, 1916, to June 20, 1917, fairly well defined below 7,000 second-feet; curve used June 21 to May 15, 1920, fairly well defined between 2,000 and 13,000 second-feet; curve used May 16 to September 30, 1920, fairly well defined between 2,000 and 14,000 second-feet.

WEST BRANCH OF PENOBSCOT RIVER AT MEDWAY, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2100 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1916–17	1.08	1.23	1.41	1.62	1.26	1.46	1.92	3.80	5.57	2.42	2.92	1.36	2.18
1917–18	1.52	2.02	1.55	1.71	2.30	2.42	2.11	1.89	1.63	2.51	1.66	1.48	1.90
1918–19	1.76	2.59	2.00	1.82	1.74	1.82	3.19	5.71	2.34	1.57	1.56	1.56	2.30
1919–20	1.34	1.54	1.49	1.69	1.70	1.57	2.35	4.13	2.13	1.57	1.61	1.62	1.90

Mean 4 years 2.07

WEST BRANCH OF PENOBSCOT RIVER AT MEDWAY, MAINE

Per Cent of Time Duration Table

[Drainage Area, 2100 Square Miles]

Sec. Ft. per Sq. Mi.	1916-17	1917-18	1918-19	1919-20	Mean 4-year Period
0.05	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0
0.15	100.0	100.0	100.0	100.0	100.0
0.2	100.0	100.0	100.0	100.0	100.0
0.3	100.0	100.0	100.0	100.0	100.0
0.4	100.0	100.0	100.0	100.0	100.0
0.5	100.0	100.0	100.0	100.0	100.0
0.6	100.0	100.0	100.0	100.0	100.0
0.7	100.0	100.0	100.0	100.0	100.0
0.8	100.0	100.0	100.0	100.0	100.0
0.9	100.0	100.0	100.0	100.0	100.0
1.0	98.4	99.7	100.0	100.0	99.5
1.1	91.5	99.7	100.0	99.7	97.7
1.2	84.1	98.9	99.5	98.1	95.2
1.3	75.6	95.6	98.9	93.7	91.0
1.4	60.3	89.6	96.7	89.9	84.1
1.5	51.0	80.5	93.2	77.0	75.4
1.6	45.2	66.0	78.1	54.6	61.0
1.75	40.8	49.6	56.7	32.0	44.8
1.9	34.2	38.4	40.0	21.3	33.5
2.05	28.2	26.6	29.0	17.5	25.3
2.25	23.0	18.9	21.1	16.4	19.8
2.5	21.1	11.0	17.8	13.4	15.8
2.75	19.7	6.6	15.9	9.0	12.8
3.0	18.6	3.6	14.2	7.4	11.0
3.5	14.2	2.7	13.2	4.4	8.6
4.0	9.3	2.2	12.6	4.4	7.1
4.5	8.2	0.8	11.0	3.8	6.0
5.0	7.7	0.3	9.0	3.3	5.1
7.0	2.7	0.0	0.3	0.0	0.8
10.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, MAINE

Location.—At Maine Central Railroad bridge at Mattawamkeag, Penobscot County, half a mile above mouth of river.

Drainage Area.—1,500 square miles.

Records Available.—August 26, 1902, to September 30, 1920.

Gage.—Chain attached to railroad bridge; read by W. T. Mincher.

Discharge Measurements.—Made from bridge; low water measurements made by wading at a point about 1 mile above the station.

Channel and Control.—Practically permanent; channel at bridge broken by two piers.

Ice.—Stage-discharge relation seriously affected by ice.

Regulation.—Dams are maintained at outlets of several large lakes and ponds above, but stored water is used only for log driving.

Accuracy.—Stage-discharge relation at times affected by backwater from log jams, and during winter by ice. Gage read to tenths twice daily in the open season and twice a week in the winter, until the winter 1919-20 when it was read daily. Rating curve fairly well defined between 500 second-feet and 15,000 second-feet. Before 1913 the only winter measurements of discharge were made in March, 1907, March and December, 1908, and March, 1912.

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1500 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901-2												0.813	
1902–03	1 39	2 00					5.81	2.05	0.571	0.667	0.434	0.222	
1903–4	0.163	0.495						7.73	2.06	0.673	0.356	0.960	
1904–5	1.81	1.16						2.60	1.13	0.401	0.167	0.139	
1905–6	.066	0.361						6.87	1.77	0.556	0.230	0.149	
1906–7	1.15	2.05		0 887	0.493	0.463	4.46	6.05	2.65	2.84	1.57	1.00	
1907–8	1.68	2.45	2.94	1.99	1.67	1.52	4.52	6.11	2.33	0.305	0.295	0.127	2.16
1908–9	0.286	0.613	0.481	0.619	0.592	1.27	8.27	6.47	1.13	0.987	0.365	1.11	1.85
1909–10	2.89	2.27	1.87	1.20	1.10	1.50	5.38	3.12	2.05	0.727	0.359	0.178	1.89
1910–11	0.095	0.469	0.432	0.733	0.533	0 800	4.35	3.03	1.27	0.218	0.305	0.542	1.06
1911–12	0.590	0.993	2.81	1.41	0.933	1.53	5.52	4.07	4.69	0.495	2.20	0.793	2.17
1912–13	1.89	4.87	1 76	2.30	0.640	4.97	10.8	3.43	1.97	0 636	0.490	0.452	2.85
1913–14	2.41	4.21	2.73	0.780	0.593	1.29	6.01	8.20	1 72	0.628	0.252	0.151	2.43
1914–15	0.197	0.657	0.373	0.343	0.840	1.60	4.21	5.67	1.47	2.05	0.653	0 505	1.55
1915–16	0.608	0.927	1.97	2.35	0.511	0.787	4.75	2.23	1.40	1.51	0.517	0.343	1.49
1916–17	0.880	0.773	2.98	1.51	0.707	0.927	8.27	5.07	6.44	2.04	1.08	6.12	2.61
1917–18	2.06	2.09	0.505	0.393	0.410	0.700	5.23	3.32	1.17	2.43	0.617	1.69	1.72
1918–19	3.05	4.12	2.07	1.20	0.611	2.40	7.20	4.81	2.32	0.511	0.356	0.609	2.44
1919–20	0.887	2.85	1.40	0.306	0.231	1.01	10.9	6.08	1.11	0.707	0.511	1.87	2.31

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, MAINE

Per Cent of Time Duration Table

[Drainage Area, 1500 Square Miles]

Sec. Ft. per Sq. Mi.	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 7-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	97.5	96.7	100.0	100.0	100.0	100.0	100.0	99.2
0.15	96.2	91.8	100.0	100.0	100.0	100.0	100.0	98.3
0.2	91.2	88.2	100.0	100.0	100.0	100.0	100.0	97.1
0.3	84.7	85.5	95.6	98.6	98.4	96.4	85.2	92.1
0.4	81.4	76.2	90.2	95.1	88.2	87.4	78.7	85.3
0.5	74.2	71.0	79.5	89.3	74.2	83.0	74.3	77.9
0.6	69.0	64.7	71.6	78.4	69.3	73.4	67.5	70.6
0.7	62.5	51.2	66.1	73.7	59.2	68.2	57.1	62.6
0.8	59.5	44.4	59.6	69.0	51.2	65.5	53.3	57.5
0.9	54.5	40.8	53.6	62.7	46.8	63.0	46.4	52.5
1.0	54.0	35.3	47.5	58.4	45.2	61.1	43.7	49.3
1.1	52.1	34.8	45.6	56.7	40.8	58.4	41.5	47.1
1.2	51.8	33.2	39.9	55.3	38.9	57.0	40.4	45.2
1.3	51.0	32.1	35.8	52.1	36.2	55.9	38.3	43.1
1.4	49.6	31.0	32.0	48.5	33.2	54.5	36.1	40.7
1.5	46.6	28.5	29.5	46.8	32.1	52.9	35.2	38.8
1.6	44.9	26.6	25.7	44.1	30.1	50.4	33.3	36.4
1.75	42.5	24.7	24.9	42.5	29.3	48.2	31.4	34.8
1.9	39.7	22.5	21.6	39.5	28.8	46.3	30.9	32.8
2.05	38.6	20.0	19.9	37.5	27.7	42.7	29.2	30.8
2.25	37.0	18.9	18.6	36.2	27.1	40.8	27.9	29.5
2.5	32.3	16.7	17.5	32.6	26.3	35.6	24.9	26.6
2.75	27.9	14.2	16.4	31.5	24.1	31.8	22.1	24.0
3.0	26.6	12.6	15.8	29.9	21.4	29.3	19.9	22.2
3.5	22.2	12.1	12.0	24.9	15.9	24.9	17.5	18.5
4.0	17.0	10.4	9.6	20.8	12.6	20.5	15.6	15.2
4.5	15.3	8.8	5.7	17.8	9.6	18.4	13.9	12.8
5.0	13.2	7.7	3.6	16.4	7.9	15.9	13.1	11.1
7.0	8.5	3.3	0.0	10.4	1.9	9.0	10.7	6.3
10.0	4.7	1.4	0.0	3.6	0.0	0.0	5.7	2.2
15.0	0.0	0.0	0.0	0.3	0.0	0.0	1.1	0.2
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean Flow for period of duration table 2.08 sec. ft. per sq. mile

PISCATAQUIS RIVER NEAR FOXCROFT, MAINE

Location.—At Low's highway bridge, between Guilford and Foxcroft, three-fourths mile above Black Stream and 3 miles below Mill Stream.

Drainage Area.—286 square miles.

Records Available.—August 17, 1902, to September 30, 1920.

Gage.—Staff attached to left abutment of bridge. Read by A. F. D. Harlow.

Discharge Measurements.—At medium and high stages made from bridge; at low stages by wading either above or below bridge.

Channel and Control.—Practically permanent; banks high and overflowed only during extreme floods.

Ice.—Stage-discharge relation usually affected by ice during winter.

Regulation.—The stream is used at several manufacturing plants above the station; distribution of flow somewhat affected by operation of wheels.

Accuracy.—Stage-discharge relation practically permanent, excepting occasional effect from backwater from log jams and by ice during winter. Considerable diurnal fluctuation caused by irregular use of water by mills above during low stages. Rating curve well defined below 5,000 second-feet, but results uncertain for higher stages. Gage read to tenths twice daily. The only winter measurements of discharge made previous to 1913 were on January 22, 1910, and March 19, 1912.

PISCATAQUIS RIVER NEAR FOXCROFT, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 286 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2												1.05	
1902–3	1.77	2.23				9.83	5.59	0.993	2.12	0.815	0.748	0.150	
1903–4	0.164	0.210	1.13	2.05	1.22	5.10	10.5	8.85	1.12	1.36	0.608	1.14	2.79
1904–5	2.05	1.38	0.955	2.76	2.36	3.92	8.60	3.00	1.38	0.699	0.337	0.360	2.32
1905–6	0.266	0.287	0.378					8.11	1.61	0.769	0.647	0.724	
1906–7	1.62	2.20	2.71	1.75	0.874	1.05	8.39	9.27	2.16	3.19	1.56	2.09	3.07
1907–8	4.16	6.57	4.16	2.87	2.78	3.08	7.66	8.29	1.43	0.238	0.598	0.332	3.51
1908–9	0.324	0.236	0.518	1.03	0.524	1.75	13.0	7.06	0.871	0.348	0.181	3.09	2.41
1909–10	2.10	1.56	1.57	1.05	1.05	2.82	7.97	2.08	2.41	0.458	0.510	0.276	1.99
1910–11	0.145	0.136	0.427	0.524	0.420	0.874	8.04	3.41	0.671	0.177	0.210	0.202	1.27
1911–12	0.437	1.87	3.64	1.57	1.12	2.27	9.16	6.40	2.79	0.430	1.28	0.483	2.79
1912–13	3.36	4.34	1.75	2.21	1.44	6.50	8.60	2.12	0.672	0.578	0.389	0.718	2.72
1913–14	4.51	3.78	1.72	1.85	1.98	3.40	9.51	8.99	0.514	0.314	0.136	0.129	3.08
1914–15	0.157	0.315	0.437	3.28	5.52	5.38	7.03	4.44	0.426	1.88	2.43	1.36	2.71
1915–16	0.727	1.63	2.56	1.99	1.02	2.33	9.90	4.65	3.64	1.84	0.710	0.496	2.62
1916–17	0.979	0.941	3.88	1.45	0.923	2.57	11.3	4.48	7.98	1.87	3.40	0.713	3.37
1917–18	2.26	2.54	0.759	0.214	0.244	0.755	6.89	3.19	1.57	2.98	0.636	1.32	1.95
1918–19	2.98	4.09	1.92	1.70	1.01	4.27	6.96	5.10	1.21	4.20	0.330	0.731	2.56
1919–20	0.955	2.76	1.63	0.293	0.183	1.40	11.2	5.70	0.815	0.346	0.566	0.654	2.20

PISCATAQUIS RIVER NEAR FOXCROFT, MAINE
Per Cent of Time Duration Table
[Drainage Area, 286 Square Miles]

Sec. Ft. per Sq. Mi.	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 8-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	99.9
0.1	100.0	96.2	92.3	100.0	99.7	94.2	100.0	96.7	97.4
0.15	100.0	87.9	91.5	100.0	99.2	92.9	98.6	92.3	95.3
0.2	96.7	83.6	87.7	100.0	98.4	90.7	96.4	89.6	92.9
0.3	88.5	76.4	78.4	99.7	94.0	82.7	91.5	74.6	85.7
0.4	77.5	70.1	74.5	95.1	84.1	75.1	86.6	66.7	78.7
0.5	72.9	68.2	71.2	90.2	81.9	72.9	80.5	63.4	75.2
0.6	67.4	66.8	67.1	82.8	78.4	68.2	76.4	58.7	70.7
0.7	64.9	63.0	64.1	77.9	73.7	64.1	71.8	54.6	66.8
0.8	60.8	60.5	61.4	71.6	66.6	59.2	66.3	51.6	62.2
0.9	57.0	60.3	60.5	68.0	64.4	57.5	61.4	48.4	59.7
1.0	54.5	59.2	57.8	64.5	62.5	52.9	58.9	41.3	56.6
1.1	53.2	58.1	56.4	62.6	60.3	50.7	58.1	39.3	54.8
1.2	51.5	57.0	53.7	58.2	56.7	49.0	57.3	37.2	52.6
1.3	50.7	56.7	51.2	56.3	55.9	46.0	56.7	35.8	51.2
1.4	48.2	54.0	47.9	53.8	52.1	40.5	54.0	30.6	47.6
1.5	47.1	51.8	47.1	49.5	50.4	39.2	52.3	29.8	45.9
1.6	45.2	50.4	45.2	44.8	48.8	35.1	49.3	28.1	43.4
1.75	44.1	47.1	43.6	43.2	48.2	32.9	47.7	28.1	41.9
1.9	34.8	42.5	38.4	40.4	44.1	28.2	43.8	26.0	37.3
2.05	31.8	38.9	36.7	37.4	42.2	26.3	39.2	24.9	34.7
2.25	27.7	33.7	33.2	34.4	34.8	21.9	31.5	22.1	29.9
2.5	24.4	31.0	29.9	29.2	31.8	19.7	29.9	22.1	27.2
2.75	23.0	28.8	26.8	25.1	28.8	18.4	26.6	20.2	24.7
3.0	22.7	27.7	26.8	24.3	28.5	17.3	25.2	18.3	23.8
3.5	19.7	21.4	22.5	20.2	25.5	16.2	23.0	16.1	20.6
4.0	17.3	20.0	19.7	16.7	22.5	14.8	21.4	15.6	18.5
4.5	14.8	18.1	17.3	15.6	19.5	13.2	20.0	13.9	16.6
5.0	13.4	15.9	15.3	14.5	17.8	10.7	17.5	12.6	14.7
7.0	8.5	12.1	9.9	7.7	11.5	7.4	11.2	10.9	9.9
10.0	6.3	7.7	5.8	4.9	6.6	1.6	3.0	4.9	5.1
15.0	3.0	4.1	2.5	1.9	3.8	0.3	0.0	1.9	2.2
20.0	2.2	2.2	1.6	0.5	3.0	0.0	0.0	0.3	1.2
25.0	1.4	0.8	0.8	0.3	1.6	0.0	0.0	0.3	0.6
30.0	0.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1
35.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean Flow for period of duration Table 2.65 sec. ft. per sq. mi.

PLEASANT RIVER AT MILO, MAINE

Location.—At what is locally known as Snow's bridge in the town of Milo, Piscataquis County.

Drainage Area.—325 square miles (measured on State Water Storage Commission map).

Records Available.—Station established June 4, 1920.

Gage.—Vertical staff on downstream side of right bridge abutment. Read twice daily by H. S. Snow.

Discharge Measurements.—Made from downstream side of bridge.

Channel and Control.—Channel of coarse gravel. Control for low stages is a well defined riffle one hundred feet below the gage; at high stages a series of riffles extending about a mile below the gage.

Ice.—Stage-discharge relation affected by ice during the winter.

Regulation.—The flow of the Pleasant River is partly regulated by a power development at Brownville and by storage dams at the head waters during the log driving season.

Accuracy.—Rating curve fairly well defined between 150 and 1,200 second-feet. Gage read to half-tenths twice a day.

PLEASANT RIVER AT MILO, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 325 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920									1.69	0.791	1.05	1.50

PASSADUMKEAG RIVER AT LOWELL, MAINE

Location.—About 400 feet below dam and highway bridge at Lowell, Penobscot County, and 10 miles above mouth of river.

Drainage Area.—301 square miles.

Records Available.—October 1, 1915, to September 30, 1920.

Gage.—Chain on north shore 20 feet below cable used October 1, 1915, to September 30, 1917; chain on south shore 400 feet below dam at Lowell used from October 1, 1917, to September 30, 1920. Staff above dam for supplementary use during winters.

Discharge Measurements.—Made from cable.

Channel and Control.—Practically permanent control about 500 feet below gage. Left bank will overflow at 5.5 feet gage height. Channel rough and somewhat irregular.

Ice.—Stage-discharge relation affected by ice from December to April.

Regulation.—Dam 400 feet above affects flow at station during part of year.

Accuracy.—Stage-discharge relation practically permanent, except when affected by backwater due to logs on control, or to ice. Gage read to half-tenths once daily. Rating curves well defined between 70 and 2,600 second-feet.

Cooperation.—The field work in carrying on this station has in large part been done by Mr. Thomas W. Clark, Hydraulic Engineer, Old Town, Maine.

PASSADUMKEAG RIVER AT LOWELL, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 301 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1915–16	1.02	0.930	1.20	0.960	0.625	0.679	2.70	1.89	2.76	1.85	0.930	0.715	**1.36**
1916–17	0.987	0.658	1.70	1.19	0.761	1.12	5.48	4.42	4.49	3.20	1.32	0.804	**2.18**
1917–18	1.54	1.62	1.03	0.598	0.678	0.817	3.36	3.32	1.95	1.85	0.781	1.33	**1.57**
1918–19	2.66	2.73	1.56	1.51	1.18	2.45	4.12	3.46	1.75	1.12	0.475	0.661	**1.98**
1919–20	0.591	1.50	0.930	0.365	0.362	1.05	7.61	5.65	2.34	1.42	0.561	1.53	**1.99**

5-year mean — 1.82

PASSADUMKEAG RIVER AT LOWELL, MAINE
Per Cent of Time Duration Table
[Drainage Area, 301 Square Miles]

Sec. Ft. per Sq. Mi.	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 5-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0
0.15	100.0	100.0	100.0	100.0	100.0	100.0
0.2	100.0	100.0	100.0	100.0	100.0	100.0
0.3	100.0	100.0	100.0	100.0	100.0	100.0
0.4	100.0	100.0	100.0	97.3	87.7	97.0
0.5	98.9	97.0	97.3	91.0	76.5	92.1
0.6	89.9	94.0	82.2	87.4	63.9	83.5
0.7	70.5	87.9	78.6	84.4	61.5	76.6
0.8	56.0	73.7	69.0	83.3	57.9	68.0
0.9	50.0	66.0	62.2	80.8	54.1	62.6
1.0	45.4	60.8	54.8	78.1	48.1	57.4
1.1	40.2	54.5	52.1	75.1	47.0	53.8
1.2	36.6	50.1	47.7	70.7	43.7	49.8
1.3	31.7	48.5	44.1	63.8	42.3	46.1
1.4	31.7	44.4	43.6	58.6	38.0	43.3
1.5	28.4	42.5	41.1	54.2	35.0	40.2
1.6	26.8	40.0	37.3	49.0	30.9	36.8
1.75	25.1	38.6	33.7	45.2	30.1	34.5
1.9	23.8	38.1	32.3	39.7	28.4	32.5
2.05	19.1	36.2	30.7	37.3	26.8	30.0
2.25	16.4	35.3	23.3	33.4	25.1	26.7
2.5	12.3	33.4	19.7	30.4	23.2	23.8
2.75	9.8	32.3	14.0	24.9	21.3	20.5
3.0	4.9	30.7	11.8	22.5	19.9	18.0
3.5	0.0	28.5	6.6	15.9	18.3	13.9
4.0	0.0	19.5	4.1	9.6	13.9	9.4
4.5	0.0	13.7	2.5	4.7	13.4	6.9
5.0	0.0	9.0	0.0	0.5	11.7	4.2
7.0	0.0	1.9	0.0	0.0	6.0	1.6
10.0	0.0	0.0	0.0	0.0	1.9	0.4
15.0	0.0	0.0	0.0	0.0	0.0	0.0

KENDUSKEAG STREAM NEAR BANGOR, MAINE

Location.—At highway bridge at Sixmile Falls, about 6 miles northwest of Bangor, and 7 miles below mouth of Black Stream.

Drainage Area.—191 square miles.

Records Available.—September 15, 1908, to September 30, 1919.

Gage.—Chain attached to bridge; read by Fred Cort.

Discharge Measurements.—Made from bridge.

Channel and Control.—Practically permanent; channel broken by one pier at the bridge.

Ice.—Stage-discharge relation seriously affected by ice.

Diversions.—A number of years ago an artificial cut was made for log driving between the Souadabscook Stream and Black Stream, the latter entering the Kenduskeag about 7 miles above the station. During high stages of the Souadabscook a portion of its waters flow into the Kenduskeag; at low stages of the Souadabscook all the flow continues down its own channel. Black Stream probably sends its waters only to the Kenduskeag.

Accuracy.—Stage-discharge relation practically permanent, except as affected by ice. Rating curve well defined below 2,600 second-feet, and fairly well defined between 2,600 and 4,000 second-feet. Gage read to tenths twice a day during open water period and twice a week during the winter. The only winter measurements of discharge previous to 1913 were made December 24, 1908, January 8, 1910, and March 11, 1912.

KENDUSKEAG STREAM NEAR BANGOR, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 191 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1908–9	0.170	0.686	0.474	2.82	1.42	5.15	13.10	3.10	0.534	0.333	0.127	1.82	2.48
1909–10	2.38	2.73	2.19	2.82	2.13	5.20	3.10	1.43	0.691	0.240	0.250	0.092	1.94
1910–11	0.081	0.147	0.592	2.39	0.906	2.54	9.32	1.59	0.623	0.330	0.448	0.421	1.61
1911–12	0.607	1.24	4.32	1.31	0.785	2.09	6.60	2.38	2.58	0.323	0.550	0.468	1.94
1912–13	2.69	4.47	3.01	6.18	1.87	8.59	7.22	1.54	0.995	0.351	0.220	0.230	3.11
1913–14	2.26	2.35	2.12	1.21	1.94	3.28	12.30	2.40	0.733	0.220	0.183	0.126	2.41
1914–15	0.106	0.308	0.247	2.40	3.18	2.39	3.45	4.32	0.639	2.83	1.71	0.775	1.86
1915–16	0.864	2.05	3.18	2.82	1.05	1.40	6.75	2.50	2.51	2.05	0.754	0.586	2.20
1916–17	0.990	1.15	4.66	1.37	0.623	3.94	9.84	2.09	6.60	1.64	3.27	0.738	3.08
1917–18	2.47	2.71	0.623	0.344	0.780	2.55	8.34	1.60	0.307	3.63	0.523	3.10	2.25
1918–19	4.78	4.26	1.73	2.29	0.921	6.91	4.12	3.55	0.743	0.404	0.110	0.325	2.53

11-year mean — 2.31

KENDUSKEAG STREAM NEAR BANGOR, MAINE

Per Cent of Time Duration Table

[Drainage Area, 191 Square Miles]

Sec. Ft. per Sq. Mi.	1908 –09	1909 –10	1910 –11	1911 –12	1912 –13	1913 –14	1914 –15	1915 –16	1916 –17	1917 –18	1918 –19	Mean 11-year Period
0.05	98.4	100.0	100.0	100.0	100.0	100.0	98.4	100.0	100.0	100.0	100.0	99.7
0.1	90.4	92.6	91.0	100.0	100.0	95.6	94.5	100.0	100.0	100.0	96.7	96.4
0.15	81.9	88.5	83.6	100.0	98.1	91.0	92.1	100.0	100.0	100.0	90.7	93.3
0.2	77.5	82.7	76.7	99.7	92.6	84.4	86.3	100.0	100.0	90.1	87.9	88.9
0.3	70.7	77.0	69.6	97.3	84.1	75.3	79.7	100.0	99.7	85.2	85.2	84.0
0.4	63.0	72.9	59.2	87.4	77.8	72.6	71.5	97.0	98.4	70.4	78.4	77.1
0.5	57.0	69.3	50.4	77.3	74.5	71.5	66.8	90.7	92.9	60.3	71.2	71.1
0.6	48.8	66.0	41.4	66.7	71.5	70.1	62.7	82.2	86.3	57.0	66.6	65.4
0.7	47.4	63.3	39.2	60.7	66.6	66.8	58.1	76.0	77.3	54.2	64.7	61.3
0.8	41.4	58.6	35.9	55.5	63.8	64.1	54.5	71.6	67.7	52.1	60.5	56.9
0.9	39.5	55.1	35.3	49.5	61.9	61.4	48.8	67.2	62.2	49.0	57.3	53.4
1.0	37.0	52.3	35.3	49.2	60.5	57.5	44.4	65.0	57.5	46.6	54.5	50.9
1.1	35.6	51.2	32.6	48.6	54.8	54.2	42.5	62.0	54.5	42.7	52.6	48.3
1.2	34.0	49.3	28.8	47.0	52.1	51.8	37.5	57.9	50.1	42.5	51.8	45.7
1.3	34.0	49.0	28.8	42.9	50.7	51.0	37.0	55.7	49.0	41.4	51.0	44.6
1.4	31.0	45.8	28.5	38.8	49.3	50.1	34.2	51.6	44.7	40.0	47.7	42.0
1.5	31.0	45.2	28.2	35.8	48.8	49.3	32.1	48.1	43.6	39.5	47.1	40.8
1.6	29.9	41.9	24.1	32.5	47.4	43.8	29.3	43.7	43.0	38.6	46.0	38.2
1.75	27.9	40.5	24.1	31.7	46.8	43.6	29.0	42.1	40.3	35.9	44.4	36.9
1.9	27.1	37.8	23.3	29.2	46.3	40.3	27.9	38.3	38.4	32.3	41.6	34.8
2.05	26.6	34.2	23.0	27.6	45.8	38.9	27.7	34.4	36.7	31.0	40.8	33.3
2.25	24.1	30.7	20.0	23.8	44.1	33.7	24.4	31.1	32.9	28.2	39.2	30.2
2.5	24.1	26.8	18.9	21.9	40.8	25.5	20.0	27.3	31.0	25.8	34.8	27.0
2.75	23.0	24.1	16.7	18.9	35.6	21.6	17.5	23.5	28.8	24.9	32.1	24.2
3.0	23.0	21.9	15.6	16.7	34.5	19.5	15.9	21.9	26.3	21.1	27.9	22.2
3.5	21.4	16.7	12.3	14.2	32.3	16.4	12.6	17.2	21.9	18.9	23.0	18.8
4.0	19.5	13.7	10.1	13.1	29.0	14.5	11.0	15.0	19.5	17.5	19.5	16.6
4.5	16.7	11.2	8.8	11.2	24.7	12.6	8.2	12.3	18.6	15.1	16.7	14.2
5.0	15.1	7.9	8.2	10.9	21.1	9.9	7.1	9.6	15.6	14.0	14.8	12.2
7.0	10.4	3.6	5.8	6.8	13.4	7.1	4.9	4.6	12.6	9.6	7.4	7.8
10.0	7.4	1.6	3.0	2.2	6.6	4.9	3.3	1.9	8.5	3.3	4.1	4.3
15.0	3.3	0.3	1.4	0.0	3.3	3.0	1.6	0.5	3.6	1.6	1.4	1.8
20.0	1.4	0.3	0.0	0.0	0.0	1.1	0.5	0.0	1.4	0.8	0.3	0.5
25.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1
30.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COLD STREAM AT ENFIELD, MAINE

Location.—At the highway about three-fourths of a mile south of Enfield on the road to Passadumkeag. On account of backwater the gage was moved, on September 12, 1904, and placed about 400 feet below the old mill near Enfield postoffice.

Drainage Area.—26 square miles.

Records Available.—June 14, 1904, to December 31, 1906.

Gage.—Chain.

Discharge Measurements.—From bridge and by wading.

Channel and Control.—Channel straight; control not permanent.

Ice.—Stage-discharge relation not seriously affected by ice.

Regulation.—No artificial regulation.

Accuracy.—Stage-discharge relation changed frequently and the changes were not sufficiently covered by discharge measurements to warrant publishing the data.

PHILLIPS LAKE AND OUTLETS IN HOLDEN AND DEDHAM, MAINE

Location.—At the northern outlet about 1¼ miles from the lake and one-fourth mile south of the village of East Holden. The gage at the southeastern outlet is located at the highway bridge about 1½ miles southeast of Lake House railroad station, and about 700 feet southeast of the Maine Central Railroad crossing. The gage on Phillips Lake was originally located at a point on the east shore of the lake about 300 feet northwest of Dr. L. S. Chilcott's cottage. On December 6, 1904, its location was changed to the Maine Central Railroad bridge over the north end of the lake, being still referred to the same datum.

Drainage Area.—12.3 square miles.

Records Available.—July 7, 1904, to July 1, 1908.

Gages.—Staffs.

Discharge Measurements.—Made by wading in the vicinity of the gage.

Ice.—Stage-discharge relation little affected by ice.

Regulation.—No artificial regulation.

Accuracy.—Conditions for obtaining accurate discharge data at the two outlets are rather poor and the results are considered only approximate and are not published.

MOOSEHEAD LAKE AT EAST OUTLET, MAINE

Location.—At wharf at east outlet of lake, about 8 miles from Kineo, Piscataquis County.

Drainage Area.—1,240 square miles.

Records Available.—April 1, 1895, to September 30, 1920.

Gage.—Staff at end of boat landing; two datums have been used at east outlet; the first (or original datum) is 1,011.30 feet above mean sea level and approximately 10 feet below sills of outlet gates; gage is read to this datum; the second, to which all gage readings published to and including 1911 have been referred, is 10 feet higher; that is, the zero is at the sill of the gates; as it is believed that low water may go below the sill of the gates (zero of second datum), gage heights since 1912 are published as read—that is, to original datum.

Regulation.—The lake is regulated to a capacity of 23,735,000,000 cubic feet. The dam at the east outlet is controlled by 39 gates; the sills of the gates being at elevations varying from 8.0 feet to 11.4 feet (original datum). At extreme low stages the flow from the lake is controlled not by the gates but by a bar above the dam at an approximate gage height of 9 feet (original datum). The records show only fluctuations in the level of the lake and are used in the studies of regulation of the lake and in computing the natural flow of the Kennebec at The Forks station.

Cooperation.—Record furnished by Hollingsworth & Whitney Co.

KENNEBEC RIVER AT MOOSEHEAD, MAINE

Location.—At the Canadian Pacific Railroad bridge ¼ mile below the East Outlet dam on Moosehead Lake and 6 miles from Somerset Junction.

Drainage Area.—1240 square miles.

Records Available.—Station established Oct. 9, 1919.

Gage.—Chain gage near middle of C. P. R. bridge on downstream side.

Discharge Measurements.—Made from bridge.

Channel and Control.—Large boulders and gravel. Control is a series of rapids practically permanent.

Ice.—Probably not affected by ice.

Regulation.—Operation of the gates at Moosehead Lake cause large diurnal fluctuations during the log driving season.

Accuracy.—Rating curve fairly well defined below 7,000 second-feet. Gage read to hundredths twice daily. Due to the operation of the gates in the dam just above some uncertainty exists in regard to the accuracy of the mean gage heights.

KENNEBEC RIVER AT MOOSEHEAD, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 1240 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1919–20	0.903	0.265	1.32	1.72	1.71	1.60	0.658	3.88	2.90	2.27	2.03	1.53	1.73

KENNEBEC RIVER AT MOOSEHEAD, MAINE
Per Cent of Time Duration Table
[Drainage Area, 1240 Square Miles]

Sec. Ft. per Sq. Mi.	1919–20	Sec. Ft. per Sq. Mi.	1919–20
0.05	100.0	1.5	63.1
0.1	99.5	1.6	60.7
0.15	92.9	1.75	30.6
0.2	89.6	1.9	25.4
0.3	86.6	2.05	19.4
0.4	86.3	2.25	15.0
0.5	84.2	2.5	9.6
0.6	84.2	2.75	9.0
0.7	84.2	3.0	9.0
0.8	82.0	3.5	7.7
0.9	77.9	4.0	7.7
1.0	75.1	4.5	7.4
1.1	71.0	5.0	5.2
1.2	70.8	7.0	0.8
1.3	68.9	10.0	0.8
1.4	65.3	15.0	0.0

KENNEBEC RIVER AT THE FORKS, MAINE

Location.—About ½ mile upstream from highway bridge and 2½ miles below mouth of Moxie Stream, town of West Forks, Somerset County.

Drainage Area.—1570 square miles.

Records Available.—September 28, 1901, to October 18, 1919, at the highway bridge; October 19, 1919, to September 30, 1920, at point about ½ mile above highway bridge.

Gages.—Chain gage on bridge, a vertical staff on left bank 75 feet above bridge. Gurley 7-day water-stage recorder at the bridge from June 21, 1912, to October 11, 1919. All to same datum. October 18, 1919, Gurley 7-day water-stage recorder installed ½ mile above highway bridge set to new datum. Observer, Scott Durgin.

Discharge Measurements.—Made from bridge.

Channel and Control.—Channel at bridge subject to slight changes, control for gages at highway bridge occasionally affected by backwater from Dead River. For new location the control is practically permanent.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Flow regulated by storage in Moosehead Lake. Operation of gates at Indian Pond usually during May, June, July and August each year for log driving causes a large diurnal fluctuation. Records of monthly discharge have been reduced to natural flow by adding or subtracting the amount of water stored in or released from Moosehead Lake.

Accuracy.—Stage-discharge relation occasionally affected by backwater from Dead River before October 19, 1919, and by ice during each winter. Rating curves used have been well defined. Records questionable during log-driving seasons before water-stage recorder was installed June 21, 1912. Before 1907 no winter discharge measurements were made.

KENNEBEC RIVER AT THE FORKS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1570 Square Miles]

Observed Discharge

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1905–6	0.554	0.537	0.534	0.550	0.441	0.435	0.987	4.13	3.30	2.61	1.71	1.03	1.40
1906–7	0.815	0.406	0.599	0.586	0.803	1.03	0.968	4.62	2.96	2.32	2.24	1.23	1.55
1907–8	0.758	3.31	1.68	1.43	1.47	2.25	1.81	5.57	3 85	1.84	1.75	1.01	2.23
1908–9	0.566	0.336	0.411	0.815	1.35	0.911	1.86	5.10	2.50	2.05	1.63	1.15	1.56
1909–10	0.790	0.879	0.619	1.42	1.06	0.930	2.59	3.81	3.02	2.04	1.55	0.892	1.64
1910–11	1.01	0.764	0.796	0.815	0.573	0.484	0.576	1.66	1.93	1.48	1.46	1.09	1.05
1911–12	0.624	0.310	0.588	0.478	0.892	0.764	1.57	5.43	3.18	1.76	1.36	1.03	1.50
1912–13	0.911	0.968	1.17	1.41	1.55	1.63	4.62	2.66	2.22	2.11	1.65	1.01	1.82
1913–14	0.694	0.543	0.834	2.18	1.22	0.758	1.65	5.21	2.21	1.94	1.76	1.07	1.68
1914–15	0.796	0.662	0.758	0.610	0.543	0.501	0.918	2.27	1.62	2.04	1.11	1.16	1.09
1915–16	1.03	0.842	1.08	1.21	1.08	1.43	1.41	2.74	2.36	2.25	1.92	1.38	1.57
1916–17	0.962	1.08	1.03	1.31	1.68	1.55	1.35	3.34	6.62	3.82	3.02	2.41	2.34
1917–18	1.49	1.32	1.93	1.61	1.26	0.911	1.46	2.04	1.78	2.09	1.85	1.48	1.61
1918–19	1.06	2.25	2.24	2.15	2.04	1.42	2.87	5.03	2.08	2.04	2.07	1.41	2.22
1919–20	1.15	0.675	1.32	1.38	1.32	1.34	2.03	4.19	2.41	2.23	2.06	1.43	1.80

Mean 15 years — 1.67

KENNEBEC RIVER AT THE FORKS, MAINE

Corrected for Storage at Moosehead Lake

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1570 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1909–10	1.40	0.962	0.656	0.994	0.930	1.12	5.34	3.96	2.99	0.847	0.560	0.191	1.66
1910–11	0.070	0.299	0.318	0.341	0.261	0.369	1.61	3.48	1.46	0.611	0.600	0.589	0.834
1911–12	0.732	0.621	1.79	0.707	0.411	0.681	4.40	5.89	2.94	0.541	1.13	0.790	1.72
1912–13	1.06	2.25	0.981	1.18	0.790	2.05	5.69	2.66	1.83	1.11	0 290	0.191	1.67
1913–14	1.45	1.44	1.13	1.31	0.427	0.682	2.94	7.26	1.54	0.911	0.363	0.255	1.65
1914–15	0.459	0.510	0.535	0.424	0.501	0.873	2.69	3.48	1.15	1.77	1.15	0.739	1.20
1915–16	0.430	0.650	1.16	1.48	0.879	1.20	4.10	3.55	2.36	1.87	1.46	0.592	1.65
1916–17	0.656	0.771	1.71	1.08	0.389	0.618	3.96	4.60	6.62	2.90	4.17	0.790	2.36
1917–18	1.22	1.95	0.866	0.401	0.350	0.465	4.42	3.64	1.38	2.01	0.701	1.01	1.54
1918–19	2.28	3.32	1.71	1.50	0.739	1.20	5.35	5.03	1.76	1.24	0.745	0.783	2.14
1919–20	0.930	2.31	1.09	0.318	0.439	0.561	5.39	5.64	2.02	1.43	1.19	0.879	1.85

KENNEBEC RIVER AT THE FORKS, MAINE

Per Cent of Time Duration Table

[Drainage Area, 1570 Square Miles]

Sec. Ft. per Sq. Mi.	1905–06	1906–07	1907–08	1908–09	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1818–19	1919–20	Mean 15-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.2	100.0	100.0	100.0	98.4	99.5	98.6	98.9	100.0	99.5	99.7	100.0	100.0	100.0	100.0	100.0	100.0
0.3	100.0	96.7	100.0	94.0	98.9	97.0	94.5	100.0	99.2	97.8	99.7	100.0	100.0	100.0	100.0	99.6
0.4	94.8	94.5	100.0	85.8	96.2	91.5	88.3	99.5	97.3	95.6	98.9	100.0	100.0	100.0	99.5	98.5
0.5	73.4	86.6	98.4	80.5	92.1	85.8	81.4	98.9	90.1	86.0	98.6	99.5	99.5	100.0	98.4	96.1
0.6	52.3	74.0	95.9	71.8	90.7	79.5	70.2	95.9	86.0	74.0	98.4	96.2	98.6	98.6	96.7	91.3
0.7	45.5	63.6	91.8	70.7	88.8	74.5	60.1	94.0	80.3	61.4	96.4	94.0	97.5	97.3	95.6	85.3
0.8	43.0	57.0	90.2	68.8	82.5	60.3	54.1	92.1	75.1	47.1	89.1	91.0	95.1	94.2	93.4	80.8
0.9	42.5	53.4	87.7	64.9	77.5	47.1	49.5	90.7	69.9	41.1	82.0	87.9	92.1	92.1	90.4	75.5
1.0	41.1	47.9	83.1	60.5	62.7	39.1	46.2	87.1	66.0	38.4	72.1	84.9	83.0	89.0	87.7	71.3
1.1	40.5	42.5	80.9	54.5	54.8	35.3	41.0	81.9	60.3	37.3	63.7	82.2	81.4	86.0	82.5	66.0
1.2	40.0	40.5	72.1	47.7	44.4	33.4	37.4	67.9	55.9	34.8	58.5	72.6	76.4	81.1	77.9	61.7
1.3	38.4	38.4	68.3	45.2	39.2	31.0	34.7	63.0	49.0	32.1	55.7	67.1	70.7	78.4	67.5	56.0
1.4	34.0	36.7	66.7	43.6	38.9	26.3	32.8	60.3	46.3	30.1	53.3	61.4	69.3	75.9	59.3	51.9
1.5	31.2	35.9	60.4	37.8	35.3	25.8	31.7	54.5	42.7	28.2	47.0	58.4	63.6	74.8	50.0	49.0
1.6	29.9	35.1	54.9	35.3	33.2	17.0	27.6	45.5	40.8	24.7	43.7	54.5	53.7	69.9	44.5	45.2
1.75	28.2	34.0	48.6	30.7	31.8	8.5	24.9	36.4	36.4	15.9	34.2	47.4	42.2	66.6	38.5	40.7
1.9	26.0	32.1	44.8	24.4	28.8	5.5	21.9	32.6	31.0	13.2	29.2	45.5	30.4	53.4	35.0	35.0

2.05	23.3	29.9	36.1	19.5	21.9	3.3	18.6	27.7	26.6	10.7	23.0	39.7	16.2	43.6	30.3	24.7
2.25	22.2	23.8	31.4	14.5	21.9	3.0	15.8	17.8	18.6	8.8	15.3	37.0	6.0	29.3	21.6	19.1
2.5	18.4	18.9	25.4	12.6	18.4	2.5	13.4	12.9	13.4	4.9	9.8	32.3	1.9	19.2	10.1	14.3
2.75	17.3	15.3	22.4	11.0	14.8	2.5	12.8	11.0	10.4	2.5	6.0	25.8	1.4	14.8	7.9	11.7
3.0	15.6	12.3	19.9	10.4	12.9	2.2	11.2	9.6	8.8	0.8	4.4	21.6	0.5	12.3	6.3	9.9
3.5	8.5	9.9	15.8	7.7	11.2	1.4	10.4	8.5	6.6	0.0	2.7	17.5	0.0	11.0	4.6	7.7
4.0	5.5	8.8	12.8	7.4	9.3	0.8	10.1	6.0	4.7	0.0	1.9	12.3	0.0	10.1	3.3	6.2
4.5	4.7	6.3	11.5	6.0	5.2	0.0	9.6	4.4	3.8	0.0	0.8	9.9	0.0	8.8	3.0	4.9
5.0	3.8	3.3	7.6	4.9	1.9	0.0	9.0	3.3	3.3	0.0	0.3	6.6	0.0	7.4	2.2	3.6
7.0	0.0	0.0	2.5	2.2	0.0	0.0	1.1	1.4	2.2	0.0	0.0	4.1	0.0	2.5	1.4	1.2
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.4	0.0	0.0	0.3	0.2
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean for period of duration table — 1.67 second feet per square mile

KENNEBEC RIVER AT BINGHAM, MAINE

Location.—Steel highway bridge about ¼ mile from Bingham; just below the mouth of Austin Stream.

Drainage Area.—2660 square miles.

Records Available.—June 22, 1907, to June 30, 1910.

Gage.—Chain; the datum of the gage remained unchanged during the maintenance of the station.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Gravel and permanent bottom; channel confined within the abutments of the bridge, broken by one pier.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Considerable fluctuation in stage caused by operation of gates at Indian Pond for log driving during May, June, July and August.

Accuracy.—Rating curve used fairly well defined for ordinary stages. Gage read to half tenths once a day except during the log driving season when it was read several times a day. During the winter months it was read once a week. Two winter discharge measurements were made for each of the years 1907, 1908, 1910.

KENNEBEC RIVER AT BINGHAM, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2660 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1907										2.24	1.71	1.18	
1907-8	1.38	3.66	2.13	1.20	0.977	1.43	2.45	5.86	3.09	1.33	1.05	0.726	2.11
1908-9	0.421	0.280	0.282	0.402	0.654	0.752	3.38	6.24	2.32	1.53	1.19	1.02	1.54
1909-10	1.03	0.846	0.609	1.22	1.09	1.28	3.84	3.75	2.79				

KENNEBEC RIVER AT BINGHAM, MAINE
Per Cent of Time Duration Table
[Drainage Area, 2660 Square Miles]

Sec. Ft. per Sq. Mi.	1907–8	1908–9	Mean 2 Years	Sec. Ft. per Sq. Mi.	1907–8	1908–9	Mean 2 Years
0.05	100.0	100.0	100.0	1.5	41.0	27.9	34.4
0.1	100.0	100.0	100.0	1.6	38.3	26.0	32.2
0.15	100.0	100.0	100.0	1.75	34.4	21.4	27.9
0.2	100.0	100.0	100.0	1.9	29.5	19.2	24.4
0.3	100.0	85.5	92.8	2.05	27.0	18.6	22.8
0.4	100.0	73.7	86.8	2.25	23.8	16.4	20.1
0.5	100.0	68.2	84.1	2.5	20.8	15.1	18.0
0.6	98.6	62.7	80.6	2.75	19.1	14.8	17.0
0.7	96.7	58.4	77.6	3.0	17.5	13.7	15.6
0.8	91.8	47.4	69.6	3.5	13.7	12.3	13.0
0.9	84.2	45.2	64.7	4.0	12.0	11.2	11.6
1.0	77.3	39.7	58.5	4.5	10.7	9.9	10.3
1.1	73.2	38.9	56.0	5.0	9.8	7.7	8.8
1.2	65.8	36.7	51.2	7.0	5.2	3.6	4.4
1.3	54.9	34.5	44.7	10.0	0.3	0.8	0.6
1.4	45.4	31.5	38.4	15.0	0.0	0.0	0.0

Mean Flow for period of duration Table — 1.82 sec. ft. per sq. mi.

KENNEBEC RIVER AT NORTH ANSON, MAINE

Location.—At the wooden highway bridge, known locally as Patterson Bridge; about one mile above the mouth of Carrabasset River, and 1½ miles east of North Anson.

Drainage Area.—2790 square miles.

Records Available.—October 18, 1901, to August 16, 1907.

Gage.—Chain for low stages and staff in two sections for medium and high stages.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Straight; broken by one pier at the bridge. The bed of the stream is rocky, with sand over a portion of the section. It is believed that the dam at Madison had no effect on the discharge at North Anson.

Ice.—Stage-discharge relation seriously affected by ice during the winters.

Regulation.—Considerable daily fluctuation occurs from about May first to August first each year due to the regulation of the flow at Indian Pond for log driving purposes, although this is not so great as at The Forks.

Accuracy.—The two rating curves developed for this station are fairly well defined at medium and low stages. Gage was read to half-tenths twice a day during the open water periods, and once a week during the winter. Winter discharge measurements were made as follows: 4 in 1904, 2 in 1905, 8 in 1906. Records questionable during the log driving season.

KENNEBEC RIVER AT NORTH ANSON, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2790 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2							5.29	4.99	4.58	2.66	1.50	1.25	
1902–3	1.31	1.30					4.22	2.62	2.06	1.45	1.31	1.00	
1903–4	0.706	0.520					2.67	5.10	2.76	1.88	1.46	1.29	
1904–5	1.46	1.09				1.47	3.74	3.12	2.52	1.97	1.04	0.706	
1905–6	0.430	0.495	0.616	0.548	0.441	0.434	2.55	4.73	2.54	1.64	1.10	0.882	**1.38**
1906–7	1.07	0.703	0.728	0.498	0.541	0.878	2.31	6.24	2.77	2.58			

KENNEBEC RIVER AT WATERVILLE, MAINE

Location.—At dam and mill of Hollingsworth & Whitney Co. at Waterville, Kennebec County, 2 miles above Sebasticook River, and about 3½ miles above Messalonskee Stream.

Drainage Area.—4,270 square miles.

Records Available.—March 22, 1892, to September 30, 1920.

Gages.—Rod gages in pond above dam and in tailrace of mill.

Discharge Measurements.—Discharge computed from flow over dam, through the logway, and through the wheels of the mill. When flow is less than about 3,500 second-feet all the water is used through the wheels.

Ice.—Stage-discharge relation not as a rule affected by ice; in most years winter flow passes through wheels of mill.

Regulation.—Numerous power plants and much storage above station; results not corrected for storage.

Accuracy.—Daily discharge values are the sums of the discharge through several wheels and over the spillway, as determined from one set of observations per day on several gages. Owing to the possibility of changes in stage, and uncertainties of ratings of the wheels, and the spillway, occasionally these values differ greatly from the true mean daily discharge.

KENNEBEC RIVER AT WATERVILLE, MAINE
Per Cent of Time Duration Table
[Drainage Area, 4270 Square Miles]

Sec. Ft. per Sq. Mi.	1893 -94	1894 -95	1895 -96	1896 -97	1897 -98	1898 -99	1899 -1900	1900 1901	1901 -2	1902 -3	1903 -4	1904 -5	1905 -6
0.05	85.8	98.1	98.4	100.0	100.0	99.7	96.2	99.7	99.7	99.7	94.8	98.9	98.6
0.1	85.8	98.1	98.4	100.0	100.0	99.5	95.9	99.7	99.5	99.5	94.0	98.9	98.6
0.15	85.5	97.5	98.4	100.0	100.0	99.2	95.6	99.7	98.9	99.2	91.5	98.9	97.8
0.2	85.5	97.5	98.4	100.0	100.0	99.2	94.5	98.9	98.6	98.4	89.3	98.4	97.8
0.3	84.9	92.9	93.7	100.0	99.2	97.0	91.0	98.4	97.8	97.8	77.0	97.8	94.0
0.4	72.6	84.4	88.8	98.6	96.7	93.4	83.0	95.9	96.4	97.3	68.3	96.4	88.2
0.5	52.3	67.7	85.8	94.5	91.8	84.4	73.2	93.2	94.2	94.8	62.6	93.7	71.2
0.6	44.4	47.4	79.0	83.8	83.3	67.1	70.4	86.6	87.1	93.2	58.7	83.0	59.2
0.7	41.4	40.0	65.8	75.6	74.8	58.9	63.0	76.2	80.0	90.1	53.6	69.0	49.9
0.8	35.1	36.7	58.5	71.8	65.2	50.7	57.3	65.2	74.8	85.5	51.1	57.0	43.8
0.9	31.0	32.6	54.1	66.8	56.7	44.9	54.0	56.4	69.9	77.3	47.0	46.3	39.5
1.0	28.8	30.1	48.6	61.6	49.0	41.9	51.8	46.0	56.7	55.9	41.8	36.7	36.4
1.1	26.8	28.2	41.8	58.4	43.8	39.7	48.2	41.1	54.0	46.8	38.5	33.4	34.2
1.2	25.5	25.5	38.5	55.3	41.4	35.9	41.9	38.1	51.0	38.6	34.7	30.1	32.6
1.3	23.3	24.9	33.3	51.8	38.4	32.3	39.7	35.6	48.2	32.9	31.1	28.5	29.9
1.4	20.8	21.6	29.5	47.7	36.7	30.1	37.8	32.3	46.3	28.8	27.6	26.8	28.5
1.5	18.1	19.7	26.5	44.7	34.8	26.6	35.9	30.7	45.2	27.9	25.4	24.4	27.4
1.6	15.6	18.6	23.8	43.0	32.6	24.1	33.7	28.2	43.3	25.2	24.0	21.4	26.6
1.75	12.9	16.4	22.4	40.3	31.2	21.1	31.5	25.5	40.8	22.7	21.9	19.2	23.0
1.9	11.8	13.4	21.6	35.6	29.9	19.2	30.1	22.7	39.5	19.2	20.8	17.5	20.5
2.05	10.4	12.3	20.5	32.1	28.8	19.2	28.5	20.0	38.1	15.9	18.0	14.5	18.9
2.25	9.3	10.7	18.9	29.6	26.6	17.8	26.3	18.9	36.2	15.1	17.2	12.9	18.1
2.50	6.8	9.6	17.8	27.1	24.7	16.4	24.1	16.4	31.8	14.8	14.5	9.9	18.1
2.75	6.3	8.5	15.0	24.7	21.9	15.1	23.0	15.6	30.7	14.2	12.6	7.1	17.3
3.0	5.5	6.8	14.5	23.6	20.0	13.2	20.8	14.2	28.2	13.4	11.2	6.0	17.0
3.5	3.3	5.8	12.0	19.7	17.0	11.8	18.6	11.5	24.1	12.6	9.0	3.8	15.6
4.0	3.0	4.9	10.4	15.6	14.0	9.3	16.4	10.7	21.9	9.6	7.4	2.5	14.0
4.5	2.7	4.7	8.7	12.9	11.5	8.2	15.1	10.1	16.7	7.1	6.6	2.2	11.0
5.0	2.2	3.8	7.9	11.8	10.4	7.4	12.3	9.9	11.8	6.3	5.2	1.6	7.4
7.0	0.5	2.2	4.6	6.8	7.7	6.0	5.5	6.0	4.9	2.5	2.2	0.3	2.2
10.0	0.0	1.1	2.5	1.9	2.5	0.8	2.5	3.0	2.7	0.0	0.0	0.0	0.0
15.0	0.0	0.5	0.5	0.3	0.0	0.0	0.0	1.1	0.3	0.0	0.0	0.0	0.0
20.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0

KENNEBEC RIVER AT WATERVILLE, MAINE
Per Cent of Time Duration Table
[Drainage Area, 4270 Square Miles]

1906 -7	1907 -8	1908 -9	1909 -10	1910 -11	1911 -12	1912 -13	1913 -14	1914 -15	1915 -16	1916 -17	1917 -18	1918 -19	1919 -20	Mean 27-yr. Period
100.0	100.0	98.1	99.5	99.2	100.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	98.7
100.0	100.0	97.0	99.2	96.7	99.5	100.0	99.7	100.0	100.0	99.7	100.0	100.0	100.0	98.5
100.0	100.0	96.7	99.2	95.6	98.6	99.7	98.6	99.2	98.9	99.7	99.7	100.0	100.0	98.1
100.0	99.5	96.2	99.2	94.2	98.6	99.5	98.6	96.7	98.1	99.7	99.7	100.0	99.7	97.6
98.9	98.9	86.3	98.6	91.0	97.5	97.5	97.3	93.4	97.3	99.2	99.7	100.0	98.1	95.4
98.4	98.4	77.5	97.5	74.2	94.3	96.4	96.2	88.8	96.4	98.4	99.7	100.0	96.2	91.6
92.1	97.8	68.5	95.3	67.4	93.2	94.5	92.1	78.9	95.6	97.8	98.4	99.7	95.6	86.2
86.0	92.6	55.9	89.6	56.2	89.1	91.0	87.7	70.4	94.3	96.7	96.7	99.2	92.9	79.3
74.5	86.9	47.9	79.2	46.0	78.7	86.3	82.2	62.7	89.9	95.1	93.4	98.1	90.2	72.2
65.8	84.2	41.9	68.8	34.0	62.0	78.9	76.2	56.7	82.5	91.8	87.7	95.9	82.2	65.2
58.6	80.1	38.4	58.1	23.6	45.4	66.8	66.3	49.6	69.9	85.8	77.8	92.9	74.6	57.9
50.7	57.4	36.4	52.1	18.1	39.3	56.7	52.1	42.2	58.2	70.4	54.5	80.8	60.1	48.7
46.3	51.9	33.4	47.7	15.3	35.8	49.0	41.1	40.3	51.6	61.6	40.0	58.9	41.8	42.6
41.6	43.7	30.4	44.1	12.9	35.2	42.5	35.6	37.5	47.5	53.4	33.4	51.2	34.7	38.3
38.9	36.3	27.1	43.0	11.0	32.5	38.4	33.4	34.0	44.3	50.4	29.9	47.1	30.1	35.0
37.3	33.3	26.3	40.0	9.6	29.5	34.2	32.1	31.2	41.3	48.2	27.9	43.0	27.6	32.4
35.9	29.5	24.7	37.5	8.5	27.0	31.5	29.9	29.3	39.9	46.8	26.0	40.8	24.6	30.3
34.2	27.3	21.9	34.8	7.7	24.9	28.5	29.0	27.9	38.8	44.7	24.9	38.4	23.8	28.4
32.1	24.0	19.2	31.8	7.4	23.8	23.8	25.8	24.7	35.8	43.0	22.7	35.6	22.1	26.0
29.6	21.6	17.8	29.6	6.6	21.0	22.2	24.4	23.3	32.5	40.5	21.4	34.8	21.6	24.0
25.2	19.9	17.0	27.4	6.6	19.7	21.1	22.5	22.5	29.5	38.9	20.0	32.6	19.7	22.2
23.6	18.0	16.2	26.0	6.0	17.8	19.7	21.4	20.0	27.9	37.0	17.8	27.7	18.6	20.6
21.4	16.7	14.8	23.8	6.0	17.5	18.1	18.1	18.4	24.9	33.7	15.9	25.5	16.4	18.6
20.5	15.0	13.4	20.5	5.5	17.2	17.0	16.2	17.3	21.3	29.9	14.2	23.8	15.8	17.0
18.6	13.4	12.6	16.2	4.9	16.9	15.3	15.1	16.7	17.8	24.7	12.1	20.8	15.6	15.4
14.0	10.1	11.8	14.0	3.8	16.1	13.7	13.2	12.9	13.1	17.8	9.3	17.5	15.3	12.9
10.1	7.7	9.3	11.0	3.0	14.5	11.5	11.5	10.7	10.7	13.7	7.4	14.8	12.0	10.7
6.8	6.3	8.2	8.2	2.5	11.5	11.0	10.1	8.2	8.5	9.9	4.9	11.0	9.8	8.7
5.5	5.7	7.4	6.6	1.6	8.2	9.6	8.2	7.1	6.0	7.9	2.7	7.7	8.2	7.1
1.9	2.2	3.0	1.6	0.0	2.2	2.7	3.6	2.7	1.6	4.7	0.8	2.2	3.6	3.1
1.1	1.1	0.3	0.0	0.0	0.3	0.3	1.4	0.3	0.3	2.2	0.3	0.0	0.5	0.9
0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

KENNEBEC RIVER AT WATERVILLE, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 4270 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1893-4	0.496	0.454	0.293	0.337	0.361	0.824	2.86	1.95	1.46	1.08	0.609	0.621	0.945
1894-95	0.822	0.881	0.412	0.478	0.407	0.468	5.60	2.24	1.51	0.824	0.630	0.405	1.22
1895-96	0.258	1.31	1.41	1.01	0.663	2.97	6.70	4.00	1.29	1.25	0.714	0.956	1.88
1896-97	0.957	2.11	0.644	0.841	0.867	0.888	5.95	6.30	3.04	3.07	1.71	1.07	2.29
1897-98	0.618	1.33	1.25	0.745	0.796	2.65	6.98	5.88	2.34	0.916	0.733	0.614	2.07
1898-99	0.946	1.21	0.609	0.553	7.87	0.754	5.62	4.99	2.07	1.19	0.773	0.422	1.66
1899-00	0.272	0.461	0.487	0.557	2.04	2.14	6.67	6.63	2.34	1.36	0.946	0.637	2.04
1900-01	0.696	1.49	0.960	0.745	0.583	1.12	9.63	3.56	1.93	1.20	0.979	0.660	1.96
1901-2	0.684	0.562	0.273	0.904	0.890	6.74	5.20	3.96	3.58	1.84	1.19	0.988	2.30
1902-3	1.23	1.07	1.02	0.939	0.909	4.54	3.86	1.70	1.57	1.22	0.909	0.586	1.63
1903-4	0.450	0.344	0.326	0.228	0.208	0.888	3.51	4.85	1.94	1.26	1.10	1.00	1.34
1904-5	1.10	0.785	0.616	0.721	0.616	1.23	3.16	2.46	1.57	1.09	0.749	0.696	1.23
1905-6	0.415	0.539	0.522	0.752	0.534	0.536	4.03	5.22	3.00	1.48	0.859	0.593	1.54
1906-7	0.890	0.803	0.597	0.681	0.681	0.956	3.93	4.61	3.79	2.09	1.25	1.10	1.70
1907-8	1.81	4.47	3.26	0.913	0.911	1.20	2.09	2.07	1.77	0.963	0.927	0.504	1.74
1908-9	0.398	0.302	0.288	0.506	0.756	0.948	3.91	4.89	1.98	1.11	0.691	0.967	1.40
1909-10	0.883	0.813	0.710	1.30	1.11	2.44	5.22	3.37	2.74	1.26	0.986	0.588	1.78
1910-11	0.597	0.590	0.452	0.473	0.323	0.330	2.81	1.82	1.00	0.681	0.761	0.656	0.874
1911-12	0.616	0.686	1.06	0.712	0.705	1.11	5.04	4.78	2.86	0.892	1.07	0.829	1.70
1912-13	1.34	1.72	1.11	1.15	0.829	3.07	5.53	2.55	1.58	1.08	0.768	0.688	1.78
1913-14	1.97	1.80	0.936	0.819	0.838	1.16	4.89	5.53	1.32	0.952	0.864	0.586	1.81
1914-15	0.513	0.503	0.513	0.600	1.13	1.63	4.17	4.90	1.10	1.96	1.41	0.770	1.60
1915-16	0.688	0.883	1.09	0.895	1.06	1.27	4.90	3.96	3.12	1.83	1.59	1.06	1.86
1916-17	0.996	0.890	1.60	1.04	0.916	1.38	4.64	3.70	7.35	2.44	2.41	1.28	2.39
1917-18	1.26	1.32	0.906	0.831	0.756	1.01	4.47	3.11	1.26	1.54	1.03	1.27	1.56
1918-19	1.89	2.95	1.60	1.21	0.988	2.83	3.98	4.71	1.74	1.01	0.991	1.03	2.08
1919-20	0.948	1.44	1.02	0.778	0.658	1.47	6.39	4.33	1.41	1.12	1.07	0.925	1.79

Mean 27 years — 1.71

MOOSE RIVER NEAR ROCKWOOD, MAINE

Location.—At deserted cabin, one-quarter mile above house of Edilbert Arsenault; two miles above the mouth of the river, in town of Rockwood, Somerset County.

Drainage Area.—729 square miles.*

Records Available.—September 7, 1902, to December 31, 1908; May 16, 1910, to December 31, 1911; and November 2, 1919, to September 30, 1920.

Gage.—Chain until December 31, 1911. Since October 8, 1919, staff gage in three sections has been used. Datum has remained unchanged during the maintenance of the station.

Discharge Measurements.—Made from cable or by wading at low stages a short distance down stream.

Channel and Control.—Channel of gravel; practically permanent.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Dams are maintained at the outlets of several of the lakes above the station for log driving and there is usually considerable fluctuation during the log driving season.

Accuracy.—Stage-discharge relation frequently affected by log jams, and by backwater from Moosehead Lake when the lake is full. Rating curves used from October 1, 1906, to December 31, 1908, and May 16, 1910, to December 31, 1911, well defined between 150 and 2,000 second-feet. No winter measurements of discharge were made previous to 1920.

* Remeasured on later maps since last published.

MOOSE RIVER NEAR ROCKWOOD, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 729 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1905-6	0.202	0.217	0.294	0.262	0.508	0.213	1.43	6.57	2.81	1.02	0.359	0.350	1.19
1906-7	0.812	1.13	0.690	0.458	0.295	0.287	1.48	6.67	2.70	2.17	1.41	0.647	1.56
1907-8	1.82	4.62	4.13	0.974	0.746	0.646	2.77	6.57	3.06	0.471	0.300	0.239	2.19
1910-11	0.324	0.595	0.464	0.258	0.167	0.054	1.03	4.35	1.23	0.882	0.613	0.786	0.896
1911-12	1.05	0.938	1.47	0.922	0.285	0.568	2.91	5.35	3.98	0.955	0.831	0.569	1.66

5-year mean — 1.50

MOOSE RIVER NEAR ROCKWOOD, MAINE
Per Cent of Time Duration Table
[Drainage Area, 729 Square Miles]

Sec. Ft. per Sq. Mi.	1905-6	1906-7	1907-8	1910-11	1911-12	5-year Mean
0.05	100.0	100.0	100.0	95.3	100.0	99.1
0.1	100.0	100.0	100.0	89.3	98.1	97.5
0.15	94.0	100.0	98.9	85.8	96.2	95.0
0.2	86.8	99.5	97.8	84.9	95.4	92.9
0.3	52.6	89.0	85.5	69.6	94.3	78.2
0.4	38.6	83.3	77.6	61.1	87.2	69.6
0.5	34.8	71.2	73.5	52.9	78.4	62.2
0.6	31.2	63.6	71.3	43.0	73.8	56.6
0.7	27.7	58.4	68.6	37.3	67.8	52.0
0.8	27.1	53.4	60.1	31.8	65.8	47.6
0.9	26.3	45.8	56.6	25.2	57.7	42.3
1.0	24.7	43.8	54.9	23.8	50.0	39.4
1.1	22.2	39.5	51.6	18.9	39.3	34.3
1.2	21.1	37.3	48.9	15.6	35.2	31.6
1.3	20.0	35.6	47.3	13.4	30.6	29.4
1.4	19.7	34.8	45.4	11.8	29.2	28.2
1.5	19.5	33.7	44.3	11.2	28.7	27.5
1.6	19.2	32.9	43.2	10.7	27.6	26.7
1.75	18.4	26.3	40.2	8.2	25.4	23.7
1.9	18.1	23.6	37.2	7.7	23.8	22.1
2.05	17.8	21.9	36.3	7.4	21.6	21.0
2.25	16.2	19.5	35.0	6.8	21.0	19.7
2.5	16.2	17.8	33.9	6.3	20.8	19.0
2.75	15.6	15.6	33.1	6.0	20.5	18.2
3.0	15.3	13.7	31.7	5.8	20.2	17.3
3.5	11.2	11.2	29.8	5.2	15.6	14.6
4.0	9.6	9.3	24.6	4.9	14.2	12.5
4.5	9.0	8.5	16.4	4.4	10.4	9.7
5.0	7.4	7.7	11.2	3.8	6.6	7.3
7.0	4.7	3.8	4.4	2.2	1.9	3.4
10.0	0.0	0.0	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration tables — 1.50 second feet per square mile

ROACH RIVER AT ROACH RIVER, MAINE

(Now Kokadjo River at Kokadjo, Maine)

Location.—About 100 feet downstream from the dam at the outlet of Roach Pond (now Kokadjo Lake), near village of Roach River (now Kokadjo), Piscataquis County.

Drainage Area.—85 square miles.

Records Available.—November 10, 1901, to June 30, 1908.

Gage.—Staff attached to timber retaining wall about 100 feet below dam, read by C. J. Sawyer.

Discharge Measurements.—Made by wading or from canoe 140 feet below gage.

Channel and Control.—Channel is straight, rocky and probably permanent.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Dams at outlets of several ponds above control to a large extent the flow.

Accuracy.—Rating curve fairly well defined below 1,000 second-feet. Gage read to tenths daily except during the winter months when it was seldom read. Daily discharge determined by applying rating table to daily gage height with corrections for effect of ice during the winter. No winter discharge measurements were made.

ROACH RIVER AT ROACH RIVER, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 85 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901-2								8.08	2.44	2.67	1.36	1.04	
1902-3	0.788	1.36						8.31	3.88	0.565	0.565	0.671	
1903-4	0.361	0.361					1.13	10.7	5.36	0.981	2.14	0.952	
1904-5	1.75	0.341					1.13	7.86	2.14	4.42	0.841	0.369	
1905-6	0.322	0.009	0.009	0.003	0.000	0.000	0.226	7.84	3.45	2.73	0.946	0.541	1.34
1906-7	1.19	0 948	0.224	0.000	0.000	0.215	1.10	11.5	6.85	1.61	2.92	2.84	2.45
1907-8	2.76	4.21					1.79	8.53	3.11				

ROACH RIVER AT ROACH RIVER, MAINE
Per Cent of Time Duration Table
[Drainage Area, 85 Square Miles]

Sec. Ft. per Sq. Mi.	1905–6	1906–7	Sec. Ft. per Sq. Mi.	1905–6	1906–7
0.05	56.2	77.3	1.6	15.3	37.5
0.1	55.9	75.1	1.75	15.3	37.5
0.15	51.0	73.4	1.9	13.7	32.9
0.2	51.0	72.9	2.05	13.7	32.9
0.3	50.7	72.3	2.25	13.7	32.3
0.4	50.4	71.0	2.5	13.7	32.3
0.5	50.1	70.7	2.75	12.6	24.7
0.6	25.5	63.8	3.0	12.3	24.7
0.7	25.5	62.7	3.5	8.8	14.5
0.8	25.5	62.7	4.0	8.8	12.9
0.9	24.4	49.6	4.5	8.8	12.3
1.0	23.0	49.6	5.0	6.6	10.4
1.1	23.0	49.6	7.0	3.8	9.0
1.2	22.5	41.6	10.0	3.0	8.2
1.3	22.5	41.6	15.0	2.5	3.8
1.4	22.5	41.6	20.0	1.1	0.3
1.5	15.3	37.5	25.0	0.0	0.0

Mean flow for period of duration table — 1.90 second feet per square mile

DEAD RIVER AT THE FORKS, MAINE

Location.—One-eighth mile above farmhouse of Jeremiah Durgin; one and one-half miles west of The Forks, Somerset County.

Drainage Area.—878 square miles.

Records Available.—September 29, 1901, to August 15, 1907; March 16, 1910, to September 30, 1920.

Gage.—Staff bolted to large boulder on left bank; read by H. J. Farley.

Discharge Measurements.—Made from cable 700 feet above gage.

Channel and Control.—Permanent; banks medium high; overflowed only at extreme high water.

Ice.—Stage-discharge relation affected by ice.

Regulation.—A number of dams on the lakes above used for log-driving during May and June.

Accuracy.—Stage-discharge relation permanent, except when affected by ice and log jams. Gage read to half-tenths twice daily in the open season and three times a week during the winter until the winter of 1920 when it was read daily. Rating curve well defined between 300 and 8,000 second-feet.

DEAD RIVER AT THE FORKS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 878 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1901–2										1.09	1.13	1.16	
1902–3	1.07	1.40								0.736	0.738	0.253	
1903–4	0.196	0.407						10.1	3.38	0.803	0.564	1.10	
1904–5	2.02	0.844					3.82	8.91	2.23	1.34	0.842	0.541	
1905–6	0.329	.535	.592	0.534	0.440	0.437	3.86	6.77	2.95	0.987	0.333	0.385	1.51
1906–7	1.07	0.806	0.797	0.437	0.230	0.663	2.80	8.48	2.66	1.94	1.17	1.21	1.86
1910–11	0.197	0.497	0.228	0.251	0.194	0.205	1.92	4.62	1.30	0.458	0.545	0.558	0.914
1911–12	0.869	0.772	1.53	0.539	0.308	0.740	4.97	6.67	2.32	0.402	1.46	0.924	1.79
1912–13	1.40	1.79	1.30	0.730	0.569	3.06	5.27	3.43	1.50	0.617	0.372	0.421	1.70
1913–14	1.96	2.16	0.864	1.66	0.434	1.86	3.41	8.19	0.994	0.329	0.443	0.263	1.88
1914–15	0.521	0.550	0.640	0.416	0.966	3.38	3.53	2.30	0.573	2.29	1.51	0.484	1.44
1915–16	0.428	0.657	1.05	0.457	0.470	1.38	3.87	4.73	2.64	1.15	1.38	0.638	1.57
1916–17	0.463	0.405	1.23	0.638	0.443	1.07	4.72	4.69	6.39	1.44	2.61	0.690	2.07
1917–18	1.41	1.86	0.433	0.415	0.572	1.24	5.34	4.26	0.793	0.707	0.177	0.845	1.50
1918–19	2.05	3.17	0.901	0.708	0.376	2.12	4.75	5.27	1.25	0.102	0.214	0.613	1.80
1919–20	0.622	1.74	0.720	0.284	0.138	1.36	5.54	5.81	2.26	0.860	0.678	0.829	1.73

DEAD RIVER AT THE FORKS, MAINE
Per Cent of Time Duration Table
[Drainage Area, 878 Square Miles]

Sec. Ft. per Sq. Mi.	1905-6	1906-7	1910 -11	1911 -12	1912 -13	1913 -14	1914 -15	1915 -16	1916 -17	1917 -18	1918 -19	1919 -20	Mean Year of 12 yrs.
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.5	100.0	100.0	097.0	100.0	99.7
0.1	100.0	100.0	97.5	100.0	100.0	100.0	100.0	98.9	100.0	93.7	94.0	97.0	98.4
0.15	100.0	100.0	90.1	100.0	100.0	98.9	98.6	97.3	96.4	91.0	91.2	92.6	96.3
0.2	99.7	96.4	80.8	100.0	97.8	93.7	94.0	94.3	91.8	88.2	88.8	89.3	92.9
0.3	92.6	91.5	59.7	91.8	94.5	81.1	91.5	90.4	88.8	84.1	81.9	83.6	86.0
0.4	67.4	84.4	49.9	82.2	83.0	75.9	86.0	84.2	81.9	70.4	73.2	79.0	76.5
0.5	46.8	82.5	39.2	78.1	78.6	68.8	65.2	71.6	75.6	58.1	66.0	72.7	66.9
0.6	38.4	72.6	28.2	71.0	67.7	64.9	53.7	60.4	63.0	52.1	62.5	68.6	58.6
0.7	37.5	66.6	23.3	59.0	54.0	58.9	46.6	54.4	53.4	46.6	54.8	57.4	51.0
0.8	33.4	57.0	23.0	54.1	51.0	57.8	44.4	52.7	50.7	45.5	52.6	50.3	47.7
0.9	28.8	52.6	20.5	46.4	45.8	54.0	38.1	48.6	45.2	41.1	47.7	43.7	42.7
1.0	26.8	51.8	19.5	42.6	43.6	51.2	37.0	45.9	43.8	38.1	44.7	38.3	40.3
1.1	24.7	46.3	19.2	37.4	38.4	47.1	34.5	42.1	43.0	33.7	39.7	33.9	36.7
1.2	22.7	42.7	18.6	35.2	37.5	45.5	33.4	40.7	42.7	33.2	39.7	32.2	35.3
1.3	22.2	39.7	17.3	31.7	31.8	43.0	32.1	37.4	40.8	29.6	38.1	28.7	32.7
1.4	21.6	37.3	14.2	30.1	31.0	41.4	31.8	35.5	40.5	28.2	37.5	28.4	31.5
1.5	21.4	35.1	12.6	28.7	28.2	38.9	29.9	31.4	39.2	25.2	36.4	26.2	29.4
1.6	20.5	32.6	11.0	26.5	23.8	38.1	26.8	27.9	37.3	23.6	34.3	24.9	27.3
1.75	19.5	25.5	8.8	23.8	22.2	31.8	26.6	27.3	36.7	23.3	33.4	24.9	25.3
1.9	18.9	22.7	7.7	23.2	20.8	28.2	24.1	25.4	34.8	21.1	31.8	24.0	23.6
2.05	18.9	21.1	7.4	20.5	20.0	25.8	22.2	23.8	33.7	19.2	28.8	22.7	22.0
2.25	17.5	18.1	5.8	19.9	18.4	21.4	21.1	23.2	30.4	18.6	26.6	22.7	20.3
2.5	17.3	16.2	5.8	18.9	17.3	17.8	19.2	22.4	28.2	17.8	25.2	21.6	19.8
2.75	17.3	15.3	5.2	17.5	16.2	13.7	14.5	19.1	26.0	15.9	23.0	20.2	17.0
3.0	16.7	14.0	4.9	15.0	15.6	12.6	13.2	18.0	24.7	15.6	21.9	19.4	16.0
3.5	14.5	10.1	4.7	13.4	14.2	11.2	11.2	13.4	22.5	14.2	18.9	18.0	13.9
4.0	14.0	10.1	4.4	11.5	13.7	11.0	9.3	10.7	17.5	13.4	16.7	16.7	12.4
4.5	12.1	8.5	4.1	9.0	11.2	9.9	7.7	9.3	13.4	12.3	14.2	14.2	10.5
5.0	11.0	7.9	3.8	7.4	10.7	8.2	6.8	6.6	10.1	9.6	10.7	12.8	8.8
7.0	4.7	6.0	3.0	4.4	3.8	5.8	0.5	1.4	4.7	2.2	3.3	3.6	3.6
10.0	0.3	1.9	1.4	1.6	1.6	2.7	0.0	0.0	3.0	0.0	0.0	0.5	1.1
15.0	0.0	1.1	0.0	0.8	0.0	1.4	0.0	0.0	0.8	0.0	0.0	0.0	0.3
20.0	0.0	0.3	0.0	0.8	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.65 second feet per square mile

CARRABASSET RIVER AT NORTH ANSON, MAINE

Location.—About 4 miles from North Anson, above Embden Brook and below Anson Brook.

Drainage Area.—340 Square Miles.

Records Available.—October 19, 1901, to April 30, 1907.

Gage.—Staff and chain set to same datum.

Discharge Measurements.—From boat or by wading.

Channel and Control.—Channel of coarse gravel and fairly permanent.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Some power plants above the station but fluctuation due to these small.

Accuracy.—Stage-discharge relation shifts occasionally. Rating curves used fairly well defined below 5,000 second-feet. Gage read once each day except during winter months when it was not read. No winter measurements of discharge were made.

CARRABASSET RIVER AT NORTH ANSON, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 340 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1901–2										1.20	2.10	2.11
1902–3	2.24	2.07					5.03	1.52	3.94	1 48	1.11	0.362
1903–4	0.638	0.521	2.27					10.5	1.19	1.29	1.19	1.11
1904–5	1.97	1.29	1.13				5.32	3.88	2.32	1.35	1.01	1.44
1905–6	0.602	1.04	1.19				8.75	5.77	2.08	1.14	0.632	0.350
1906–7	2.28	1.20	2.23	0.735	0.441	1.18	6.85					

SANDY RIVER NEAR FARMINGTON, MAINE

Location.—At Fairbanks highway bridge, 3 miles above Farmington.
Drainage Area.—270 square miles.
Records Available.—July 11, 1910, to December 31, 1916.
Gage.—Chain attached to bridge; read by L. A. Daggett.
Discharge Measurements.—Made from bridge; by wading at low stages.
Channel and Control.—Sand and gravel.
Ice.—Stage-discharge relation affected by ice.
Regulation.—No storage basins above station; the water power dam at Phillips may slightly affect flow.
Accuracy.—Rating curve well defined below 2,500 second-feet. Gage read to half-tenths once a day except during the winter when it was read once a week. No records published for period after September 30, 1914, due to uncertainty regarding gage heights. No winter measurements of discharge were made.

SANDY RIVER NEAR FARMINGTON, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 270 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1910											0.396	0.241	
1910–11	0.232	0.325	0.233	0.370	0.296	0.481	4.11	2.57	0.767	0.258	0.496	0.533	0.889
1911–12	1.13	1.39	2.01	0.630	0.481	1.11	7.00	4.93	1.60	0.218	0.670	0.393	1.80
1912–13	2.30	2.54	3.36	1.30	0.555	6.74	6.07	2.56	0.881	0.444	0.189	0.681	2.30
1913–14	3.81	3.31	1.69	1.00	0.500	1.50	7.00	5.37	0.670	0.474	0.441	0.304	2.17

4-year mean — 1.79

SANDY RIVER NEAR FARMINGTON, MAINE

Per Cent of Time Duration Table

[Drainage Area, 270 Square Miles]

Sec. Ft. per Sq. Mi.	1910-11	1911-12	1912-13	1913-14	Mean 4 Years
0.05	99 5	100.0	100.0	100.0	99.9
0.1	98.1	100.0	96.2	100.0	98.6
0.15	94.5	99.7	91.8	99.5	96.4
0.2	80.8	94.5	88.2	95.9	89.8
0.3	63.3	84.2	85.5	88.5	80.4
0.4	39.5	72.4	64.7	80.0	64.2
0.5	30.1	66.1	60.5	75.9	58.2
0.6	27.4	63.4	58.9	68.2	54.5
0.7	24.1	57.9	56.4	58.1	49.1
0.8	22.7	53.3	54.0	53.7	45.9
0.9	20.3	49.7	52.9	50.7	43.4
1.0	18.6	45.4	51.0	45.5	40.1
1.1	17.3	40.2	49.0	42.5	37.2
1.2	15.6	37.2	45.8	39.7	34.6
1.3	15.3	35.2	45.2	39.5	33.8
1.4	14 8	30.6	41.1	37.8	31.1
1.5	13.2	27.3	37.8	35.3	28.4
1.6	12.3	24.9	34.0	31.2	25.6
1.75	12.1	24.3	33.7	31.0	25.3
1.9	11 2	22.7	32.6	29.3	24.0
2.05	9.3	21.0	30.1	26.0	21.6
2.25	8.5	18.3	27.9	22.5	19.3
2.50	7.4	16.4	25.9	20.0	17.4
2.75	7.4	15.3	24.4	19.7	16.7
3.0	6.8	15.3	21.9	16.2	15.0
3.5	5.5	13.1	18.6	13.7	12.7
4.0	4.7	12.3	16.7	12.9	11 6
4.5	4.4	11.2	14.0	12.1	10.4
5.0	3.8	8.5	11.8	11.2	8.8
7.0	2.7	4.9	7.7	8.2	5.9
10.0	1.1	3.0	4.9	2.5	2.9
15.0	0.0	1.1	3.6	2.2	1.7
20.0	0.0	0.5	1.9	1.4	1.0
25.0	0.0	0.0	0.0	0.5	0.1
30.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.79 second feet per square mile

SANDY RIVER AT MADISON, MAINE

Location.—At the dam of the Madison Electric Works just over the town line in Starks, but is nearest Madison postoffice.

Drainage Area.—650 square miles.

Records Available.—March 23, 1904, to December 31, 1908.

Gage.—Staff attached to retaining wall of dam.

Discharge Measurements.—Few measurements made by wading below dam.

Discharge.—The dam has a fairly level crest 341.4 feet long. A logway 15 feet long was cut near the left end in 1906. Flashboards are used most of the time. Since 1906 values for discharge were computed from wheel gate openings and head gage readings, in addition to the amounts passing over the dam. The pair of McCormick wheels were rated at Holyoke. Before 1906 the wheels were used only at night and discharge was computed from the gage readings made during the day.

Ice.—Probably little effect from ice.

Regulation.—Pond extends back two miles, and the small powers above probably have but a slight effect on the flow at Madison.

Accuracy.—Conditions for obtaining accurate discharge data are poor owing to uncertain conditions of the flashboards, and the length of the crest which occasioned very slight depths at low stages and consequently much inaccuracy in estimating discharge.

MESSALONSKEE STREAM AT WATERVILLE, MAINE

Location.—At the dam of the Chase Manufacturing Company, in Waterville, Kennebec County.

Drainage Area.—205 square miles.

Records Available.—June 18, 1903, to November 4, 1905.

Gage.—Staff fastened to wheel pit just above the dam.

Discharge.—Generally the wheels were run only at night and the gage was read when the wheels were not running. Flashboards were maintained during low stages of the river. At other times the amount of water passing through the wheels was added to that which flowed over the dam.

Ice.—Probably little effect from ice.

Regulation.—30 square miles of lake surface and numerous power plants above regulate the flow during low and medium stages.

Accuracy.—There is some uncertainty about the accuracy of the discharge data and publication is withheld.

SEBASTICOOK RIVER AT PITTSFIELD, MAINE

Location.—At steel highway bridge just above Maine Central Railroad bridge in Pittsfield, Somerset County.

Drainage Area.—320 square miles.

Records Available.—July 27, 1908, to September 30, 1917.

Gage.—Chain attached to highway bridge. Read by C. D. Morrill.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Practically permanent; banks high and rocky and not subject to overflow.

Ice.—Stage-discharge relation not seriously affected by ice, as the proximity of the power plant above the station tends to keep the river open.

Regulation.—About 800 feet upstream from the station is the dam of the American Woolen Company (Pioneer Mills) and the Smith Textile Company; about half a mile farther upstream is the dam of the American Woolen Company's Waverly mill. Not corrected for storage.

Accuracy.—Stage-discharge relation fairly permanent; accuracy more or less affected by fluctuations in stage caused by operation of the mills above the station and night storage. Monthly means considered fair, although values for individual days may be considerably in error by reason of two daily gage heights not giving correct mean stage for 24 hours. Gage read to tenths twice daily. Rating curve well defined between 70 and 3,000 second-feet.

SEBASTICOOK RIVER AT PITTSFIELD, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 320 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1908–9	0.419	0.425	0.497	0.956	1.55	2.41	10.40	2.59	0.925	0.941	0.841	0.928	1.91
1909–10	1.29	1.50	1.71	1.48	1.63	2.48	3.59	1.87	1.08	0.831	0.853	0.644	1.58
1910–11	0.412	0.381	0.308	0.412	0.375	0.412	4.34	1.45	0.681	0.528	0.506	0.425	0.852
1911–12	0.475	0.797	1.70	1.35	0.969	2.22	7.75	2.26	2.53	0.631	0.806	0.766	1.85
1912–13	1.03	3.25	1.49	1.73	1.09	3.56	6.12	0.962	0.975	0.478	0.375	0.447	1.79
1913–14	0.800	1.58	1.28	0.860	1.00	1.47	8.50	3.33	0.416	0.340	0.162	0.137	1.65
1914–15	0.109	0.206	0.119	0.291	0.947	1.84	2.74	3.91	0.619	1.01	1.66	1.03	1.21
1915–16	0.734	1.18	1.54	1.64	1.01	1.05	6.47	2.05	2.12	1.60	0.975	0.838	1.76
1916–17	0.728	0.859	3.56	1.47	1.10	1.47	8.81	1.72	5.38	1.31	2.91	1.28	2.54

9-year mean — 1.68

SEBASTICOOK RIVER AT PITTSFIELD, MAINE
Per Cent of Time Duration Table
[Drainage Area, 320 Square Miles]

Sec. Ft. per Sq. Mi.	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	Mean of 9-yr. Period
0.05	100.0	100.0	99.7	99.7	100.0	100.0	98.9	100.0	100.0	99.8
0.1	99.7	100.0	98.1	99.2	100.0	98.1	85.5	100.0	100.0	97.8
0.15	99.7	100.0	95.9	99.2	100.0	92.6	81.1	100.0	100.0	96.5
0.2	98.1	100.0	87.9	98.9	97.3	82.7	75.9	99.7	100.0	93.4
0.3	95.1	99.7	78.9	97.8	93.2	77.8	71.2	99.7	100.0	90.4
0.4	88.0	98.6	61.4	95.1	85.5	71.8	63.6	98.9	100.0	84.8
0.5	80.8	96.2	51.2	89.6	77.8	67.4	60.8	96.7	98.6	79.9
0.6	77.3	94.2	41.6	85.0	75.6	64.9	59.2	96.4	97.8	76.9
0.7	66.9	89.0	20.8	75.1	67.7	60.3	51.8	89.9	93.4	68.3
0.8	57.5	80.8	12.1	66.7	61.9	55.3	44.1	82.8	85.5	60.7
0.9	52.3	79.2	10.7	62.8	59.2	52.3	40.8	74.6	82.5	57.2
1.0	39.2	69.6	10.7	51.6	52.9	42.7	37.3	63.4	72.1	48.8
1.1	31.2	64.1	10.4	46.7	50.4	42.5	35.9	58.7	63.6	44.8
1.2	27.9	57.0	9.9	41.3	46.6	38.1	33.7	41.5	52.6	38.7
1.3	23.8	47.9	9.9	38.5	42.7	33.4	31.5	34.7	50.7	34.8
1.4	23.8	42.2	9.6	35.0	37.5	28.2	25.5	32.5	47.7	31.3
1.5	23.0	38.1	9.3	33.3	35.3	26.6	24.7	31.7	40.3	29.1
1.6	22.5	30.4	8.8	31.1	31.2	23.6	22.5	29.5	38.9	26.5
1.75	20.8	26.8	7.9	24.6	26.3	18.1	19.2	25.4	35.1	22.7
1.9	18.1	23.0	7.1	22.1	23.3	15.6	15.9	21.3	30.1	19.6
2.05	18.1	20.0	7.1	21.6	22.7	15.1	15.1	21.0	29.6	18.9
2.25	17.3	13.7	6.8	20.2	19.5	12.3	14.0	19.1	27.7	16.7
2.5	16.2	10.1	6.8	18.0	17.8	11.8	12.1	17.2	24.1	14.9
2.75	16.2	8.2	6.3	17.2	17.0	11.5	11.0	13.4	22.2	13.7
3.0	15.1	6.8	6.0	16.1	15.1	11.0	9.6	12.6	21.6	12.7
3.5	15.1	4.4	5.5	13.9	12.9	10.7	7.7	11.7	19.7	11.3
4.0	12.6	4.1	4.7	12.0	11.8	9.9	4.7	9.6	18.4	9.8
4.5	11.8	3.8	4.1	9.6	11.2	9.3	4.1	8.7	16.7	8.8
5.0	8.2	3.0	3.3	7.9	10.4	8.2	3.3	7.6	16.4	7.6
7.0	5.5	1.6	2.2	3.6	3.8	6.0	2.2	2.7	10.7	4.3
10.0	3.6	0.0	0.0	3.0	0.5	2.5	0.3	0.0	3.0	1.4
15.0	1.6	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.8	0.4
20.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table—1.68 second feet per square mile

COBBOSSEECONTEE STREAM AT GARDINER, MAINE

Location.—At dam of Gardiner Water Power Co. in Gardiner, Kennebec County.

Drainage Area.—220 square miles.

Records Available.—June 16, 1890, to September 30, 1920.

Gages.—Staff in pond above dam and in tailrace of power house.

Discharge.—Discharge determined by considering (1) flow over dam, usually nothing except for a short time in the spring; (2) flow through two gates; (3) flow through 39-inch Victor wheel installed in 1907; and (4) flow through 39-inch Hercules wheel installed in 1895.

Ice.—Not affected by ice.

Regulation.—The many lakes in the basin are controlled and the stream affords a remarkable example of regularity of flow. Results not corrected for storage.

Accuracy.—Several current meter measurements made during 1917, 1919 and 1920, at this station by State engineers, gave larger values by amounts varying from 6 to 24 per cent, than the tables from which the daily records have been computed. Discharge data for this station are withheld from publication pending investigation.

Cooperation.—Computation of daily discharge made by engineers of the S. D. Warren Co., Cumberland Mills, Maine.

ANDROSCOGGIN RIVER AT ERROL DAM, NEW HAMPSHIRE

Location.—At Errol dam, 1 mile above Errol, Coos County.

Drainage Area.—1,095 square miles.

Records Available.—January 1, 1905, to September 30, 1920.

Gage.—Movable rod gage; readings taken daily from sill of deep gate No. 6 elevation of zero of gage (sill of gate) is 1,231.3 feet above mean sea level.

Discharge.—Computed from discharge through 14 gates in dam by means of coefficients determined from discharge measurements.

The dam is a wooden structure completely housed over, about 175 feet between abutments. Extensive repairs were made on the dam during November and December, 1912. The entire flow passes through 14 gates of different sizes, there being no provision for overflow besides the gates. Beginning at the left end, the gates are as follows: One gate 10 feet deep by 15 feet wide, seldom used; three gates 10½ feet deep by 15 feet wide, open most of the time; nine gates 15 feet deep by 7 feet wide, open a portion of the time only; one gate 15 feet deep by 5 feet wide, gristmill gate and used only occasionally. The cap of all 14 gates is one continuous beam, thus making the bottom of the various gates at different levels.

A "deadhead" of 2.66 feet exists a short distance above the present dam, this point at present controlling the low flow. The depth in the deep gates does not indicate the true height of water in Umbagog Lake on account of this "deadhead," the lowest point of which is about 4 feet above the sills.

Ice.—Stage-discharge relation little affected by ice.

Regulation.—Errol dam regulates the storage of Umbagog Lake, the lower of the Rangeley series, (the storage of which amounts to nearly 20 billion cubic feet) and also a recently developed site on Magalloway River at the Aziscohos dam, which stores about 9.6 billion cubic feet, thus making the total storage about 29.6 billion cubic feet. Errol dam is about 5 miles below the outlet of Umbagog Lake and about 3.5 miles below the mouth of Magalloway River, thus making this latter stream one of the feeders of Umbagog Lake. Results not corrected for storage.

Accuracy.—Discharge derived from coefficients applied to the various gate openings as determined from current meter gagings. Ratings, however, are not as thorough as could be desired, and results are considered roughly approximate.

Cooperation.—Records obtained and computation of daily discharge made under the direction of Mr. Walter H. Sawyer, agent for Union Water Power Company, Lewiston, Maine.

ANDROSCOGGIN RIVER AT ERROL DAM, N. H.
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 1095 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1905-6	1.23	1.26	1.06	1.06	1.03	0.836	1.27	4.62	3.32	1.42	1.21	1.13	1.62
1906-7	1.21	0.908	0.857	1.00	0.977	1.00	1.12	4.54	2.13	1.72	1.41	1.35	1.52
1907-8	1.34	3.42	1.61	1.46	1.60	1.77	2.18	5.41	2.81	1.27	1.02	1.24	2.09
1908-9	1.20	0.950	0.771	0.694	0.700	0.798	3.02	5.67	2.89	1.29	1.25	1.12	1.70
1909-10	0.859	0.978	0.986	1.02	1.08	1.05	3.10	2.56	2.52	1.11	1.02	1.08	1.45
1910-11	0.895	0.942	1.09	0.789	0.656	0.654	1.05	1.95	0.697	0.977	0.888	0.824	0.951
1911-12	0.889	0.825	1.09	1.51	1.63	1.43	1.47	1.99	3.03	1.53	1.31	1.37	1.34
1912-13	1.29	1.32	1.32	1.86	1.87	2.55	4.33	2.79	2.37	1.78	1.86	1.54	2.07
1913-14	1.19	1.11	1.63	1.68	1.68	1.51	1.05	2.13	1.40	1.42	1.52	1.61	1.50
1914-15	1.52	1.49	1.38	1.41	1.29	1.11	0.838	1.00	1.20	0.738	0.767	1.32	1.17
1915-16	1.43	1.47	1.52	1.35	1.37	1.48	1.30	1.95	4.03	1.77	1.61	1.63	1.74
1916-17	1.53	1.53	1.44	1.77	2.02	2.03	1.40	1.77	6.51	2.27	1.81	1.67	2.14
1917-18	1.62	1.76	1.95	1.84	1.84	1.93	1.82	1.36	1.35	1.63	1.80	1.27	1.68
1918-19	1.25	1.84	1.84	2.13	1.68	1.51	1.87	3.67	2.05	1.82	1.71	1.54	1.91
1919-20	1.22	1.08	1.59	1.74	1.82	1.53	1.42	2.74	1.93	1.44	1.54	1.55	1.63

15-year mean — 1.63

ANDROSCOGGIN RIVER AT ERROL DAM, N. H.

[Drainage Area, 1095 Square Miles] Per Cent of Time Duration Table

Sec. Ft. per Sq. Mi.	1905–06	1906–07	1907–08	1908–09	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 15-year Period
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1100.0	100.0	100.0	100.0	100.0	99.5	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.2	100.0	100.0	99.2	100.0	100.0	99.8
0.15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.6	100.0	100.0	99.2	100.0	100.0	99.9
0.2	100.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	98.6	100.0	100.0	98.9	100.0	100.0	99.8
0.3	100.0	100.0	100.0	100.0	100.0	98.9	100.0	100.0	100.0	97.0	100.0	100.0	98.9	100.0	100.0	99.7
0.4	100.0	100.0	100.0	100.0	100.0	98.4	99.5	100.0	99.7	96.2	100.0	100.0	98.4	100.0	99.7	99.5
0.5	99.7	100.0	100.0	99.7	100.0	97.5	98.4	100.0	99.7	94.8	100.0	100.0	98.1	100.0	99.2	99.1
0.6	99.5	100.0	100.0	95.9	99.7	94.2	98.1	100.0	97.8	92.9	100.0	100.0	97.8	99.7	97.8	98.2
0.7	97.0	99.7	100.0	86.8	99.2	74.0	94.5	99.7	96.2	91.5	100.0	100.0	97.8	99.7	96.4	95.5
0.8	92.1	98.4	99.5	73.4	96.7	58.4	91.5	99.5	94.8	87.7	99.5	99.7	96.7	99.7	95.4	92.2
0.9	86.3	86.6	97.8	62.7	86.3	43.0	86.9	99.2	93.2	80.8	98.9	98.6	94.8	99.7	94.0	87.3
1.0	82.5	65.2	94.5	54.2	72.1	29.3	82.2	98.1	91.0	74.5	96.7	97.3	93.7	99.2	92.1	81.5
1.1	63.8	51.5	88.3	51.5	46.6	19.5	77.9	97.0	87.7	65.2	93.7	96.2	91.5	96.4	89.9	74.4
1.2	48.2	48.8	81.7	43.0	30.4	10.4	71.6	94.2	84.4	55.6	90.4	94.5	90.4	94.5	86.3	68.3
1.3	32.9	42.5	77.3	30.4	25.8	6.8	64.5	86.0	75.6	44.1	87.4	92.3	87.9	89.3	79.2	61.5
1.4	21.6	32.9	71.9	26.3	24.9	6.3	55.7	81.4	65.5	28.8	78.7	87.9	84.1	86.3	70.5	54.9
1.5	20.5	27.9	59.8	22.7	23.8	6.0	46.4	75.6	53.2	13.7	59.3	81.1	76.7	83.3	61.7	47.4
1.6	20.0	24.9	53.0	22.2	23.3	6.0	32.5	67.7	37.5	4.1	35.0	71.5	72.3	75.9	53.0	39.9
1.75	19.5	21.1	38.5	20.8	22.5	5.8	17.8	55.9	6.6	0.0	21.3	48.8	56.2	50.1	36.9	28.1

1.9	19.2	17.5	30.3	19.5	20.8	5.2	11.5	36.7	3.0	0.0	15.0	34.8	27.9	32.1	14.8	19.2
2.05	18.9	14.8	27.6	18.4	19.5	4.7	9.3	24.1	2.5	0.0	12.6	25.8	7.9	23.3	11.5	14.7
2.25	18.1	11.2	24.3	17.3	17.0	3.6	5.5	18.1	1.9	0.0	11.7	17.3	1.4	15.3	6.6	11.3
2.5	15.9	8.2	19.7	16 4	14.2	2.5	4.4	15.9	1.9	0.0	10 7	8.2	0.3	7.4	5.7	8.8
2.75	14.2	7.7	16.9	15.6	11.0	1.6	4.4	14.5	1.9	0 0	8.7	7.7	0 0	4.4	4.9	7.6
3.0	13.2	7.7	14.8	12.9	6.8	1.6	4.1	14.2	1.6	0 0	6.0	7.4	0.0	4.1	3.6	6.5
3.5	9.6	6.6	13.1	11.0	3.6	0.8	2.5	11.2	1.6	0.0	4.9	6.8	0.0	3.8	1.9	5.2
4.0	8 5	6.0	10.7	10.4	1.6	0.0	2.2	8.5	1.1	0.0	3.6	6.6	0.0	3.8	0.8	4.3
4.5	7.9	5.5	9.0	9.9	1.4	0.0	1.9	6.0	0.8	0 0	3.3	5.5	0.0	3.6	0.5	3.7
5.0	3.3	2.5	7.7	8.8	1.1	0.0	1.6	3.6	0.8	0.0	2.5	4.9	0.0	1.9	0.0	2.6
7.0	0.0	0.0	1.1	3.3	0 0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.5
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 0

Mean flow for period of duration table — 1.63 second feet per square mile

ANDROSCOGGIN RIVER AT BERLIN, N. H.

Location.—At upper or sawmill dam of the Berlin Mills Co., at Berlin, Coos County.

Drainage Area.—1,350 square miles.

Records Available.—October 1, 1913, to September 30, 1920.

Gages.—Fixed gages maintained above forebay racks and in tailrace; gages are referred to same datum. A gage is also attached to each wheel gate from which the gate opening can be ascertained.

Discharge.—Computed from curves prepared from Holyoke tests of the wheel runners. Water wasted over dam computed by Francis Formula for discharge over weirs.

Ice.—Not affected by ice.

Regulation.—Under an agreement between the power users on the Androscoggin River the flow at Berlin, N. H., is maintained at a minimum of 1,550 second-feet and at such a higher point above 1,550 second-feet as is consistent with the constant maintenance of that quantity. The actual fine regulation of the river is carried on at Pontocook Dam, N. H., where there is a pond containing about one day's supply. The primary regulation is made at Errol, N. H., about 30 miles above Berlin.

In the event of rain or sudden thaw in the winter the gates at Errol are closed, and water is accumulated in Umbagog Lake. If the area between Pontocook and Berlin is supplying sufficient water to maintain the flow, the gates at Pontocook are closed and water retained above that dam. In the event of a sudden cold snap, or of a reduction of flow by evaporation, a portion of the water in Pontocook is discharged, and the gates in Errol partially opened to make up the deficiency.

Cooperation.—Records kept under the direction of Mr. John H. Wilson of the Berlin Mills Co. furnished by Mr. Walter H. Sawyer, agent for the Union Water Power Co., Lewiston, Maine.

ANDROSCOGGIN RIVER AT BERLIN, N. H.

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1350 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1913–14	1.31	1.36	1.42	1.36	1.26	1.44	2.39	3.62	1.34	1.33	1.29	1.30	1.62
1914–15	1.28	1.26	1.21	1.17	1.18	1.06	1.70	1.44	1.14	1.30	1.21	1.25	1.27
1915–16	1.29	1.30	1.38	1.36	1.33	1.37	2.38	2.78	4.94	2.20	1.75	1.51	1.97
1916–17	1.48	1.56	1.62	1.54	1.67	1.81	2.33	2.87	7.85	2.12	1.50	1.49	2.31
1917–18	1.62	1.81	1.67	1.64	1.50	1.56	2.16	1.79	1.45	1.43	1.40	1.24	1.61
1918–19	1.75	1.96	1.65	1.58	1.39	1.46	2.31	3.80	1.67	1.45	1.31	1.33	1.81
1919–20	1.31	1.39	1.41	1.35	1.40	1.44	2.19	2.50	1.76	1.41	1.41	1.44	1.59

7 Year mean — 1.74

ANDROSCOGGIN RIVER AT BERLIN, N. H.
Per Cent of Time Duration Table
[Drainage Area, 1350 Square Miles]

Sec. Ft. per Sq. Mi.	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 7–Year Period
0.05								
0.1								
0.15								
0.2								
0.3								
0.4								
0.5								
0.6								
0.7		100.0						100.0
0.8		98.6						99.8
0.9		97.0						99.6
1.0		94.5						99.2
1.1	100.0	90.4	100.0	100.0	100.0	100.0	100.0	98.6
1.2	95.9	46.3	100.0	98.9	98.4	98.1	99.7	91.0
1.3	58.1	14.8	84.7	97.5	90.4	87.7	88.3	74.5
1.4	28.8	11.0	57.7	92.3	85.2	70.1	66.1	58.7
1.5	19.2	9.9	42.1	68.2	50.7	46.6	24.9	37.4
1.6	14.2	8.2	34.2	47.9	38.4	35.9	20.5	28.5
1.75	11.2	6.0	30.3	39.2	19.7	25.2	18.0	21.4
1.9	9.6	5.8	26.2	26.6	13.7	20.0	15.6	16.8
2.05	8.5	4.4	24.0	22.5	10.1	16.4	13.1	14.1
2.25	7.9	2.2	21.9	21.6	4.9	14.5	8.7	11.7
2.5	7.4	2.2	19.4	19.7	2.5	12.6	7.9	10.2
2.75	6.8	1.6	17.2	16.4	1.1	7.9	3.8	7.8
3.0	6.0	0.3	13.9	13.2	0.3	5.8	2.5	6.0
3.5	4.4	0.0	10.1	7.7	0.3	4.9	1.4	4.1
4.0	3.8	0.0	7.7	7.4	0.3	4.4	0.5	3.4
4.5	3.0	0.0	6.0	6.6	0.3	3.6	0.0	2.8
5.0	2.7	0.0	4.9	6.0	0.0	3.0	0.0	2.4
7.0	1.4	0.0	0.5	5.5	0.0	1.1	0.0	1.2
10.0	0.5	0.0	0.0	2.5	0.0	0.0	0.0	0.4
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table — 1.74 second feet per square mile

ANDROSCOGGIN RIVER AT SHELBURNE, N. H.

Location.—At the steel highway bridge about one-half mile north of railway station at Shelburne, N. H.; 5¾ miles below mouth of Peabody River and about 6 miles above Wild River.

Drainage Area.—1500 square miles.

Records Available.—May 30, 1903, to April 30, 1907, and May 20 to December 25, 1910.

Gage.—Chain attached to bridge; datum remained unchanged during the maintenance of the station.

Discharge Measurements.—Made from highway bridge.

Channel and Control.—Channel is straight and sandy. Shifts usually during flood stages; both banks subject to overflow.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Power plants above, the nearest of which is the Lead Mine Bridge power station of the Berlin Mills Co., about two miles distant, affect the flow somewhat.

Accuracy.—Stage-discharge relation affected by ice in winter and by frequent log jams during the open water-periods. Gage read twice a day during the open water periods and only occasionally during the winter. Some doubt about the accuracy of the records and publication is withheld.

ANDROSCOGGIN RIVER AT RUMFORD FALLS, MAINE

Location.—Dam of Rumford Falls Power Company at Rumford, Oxford County.

Drainage Area.—2,090 square miles.

Records Available.—May 18, 1892, to September 30, 1920.

Gages.—Staff in pond above dam, and one in tailrace of power house.

Discharge.—Computed from discharge over dam, using Francis weir formula with modified coefficient, and quantities passing through the various wheels of the power house, which have been carefully rated.

Ice.—Stage-discharge relation little affected by ice.

Regulation.—Storage in Rangeley system of lakes at headwaters of Androscoggin River, aggregating 29.6 billion cubic feet, is largely under control. The stored water is regulated in the interests of water power users below and is under such excellent management that this is one of the best regulated streams in the country. Results not corrected for storage.

Cooperation.—Records obtained and computations made by Mr. Charles A. Mixer, engineer, Rumford Falls Power Company.

ANDROSCOGGIN RIVER AT RUMFORD FALLS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2090 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1896-97	1.00	1.46	0.962	0.871	0.809	0.866	0.378	5.55	3.35	3.16	1.12	0.761	1.69
1897-98	0.770	1.09	1.24	0.933	0.813	2.46	4.45	4.32	2.27	.900	0.813	0.933	1.75
1898-99	1.35	1.32	1.05	1.01	0.880	0.885	4.17	4.83	1.55	0.871	0.684	0.756	1.61
1899-00	0.766	0.828	0.770	0.675	1.22	1.01	4.67	6.03	1.98	1.05	0.751	0.766	1.71
1900-01	1.06	1.89	1.11	0.909	0.876	1.18	7.13	5.12	2.11	1.28	1.35	0.761	2.06
1901-02	1.06	0.770	1.80	1.22	0.981	4.17	3.77	4.04	3.16	1.39	1.42	1.17	2.08
1902-03	1.36	1.45	1.11	1.04	1.00	4.66	3.26	1.96	2.08	1.09	0.909	0.722	1.72
1903-04	0.900	0.823	0.761	0.483	0.354	0.765	2.88	4.91	1.38	0.864	0.741	0.804	1.31
1904-05	1.21	0.811	0.784	0.912	0.752	1.36	2.56	2.72	1.57	1.41	1.43	1.33	1.40
1905-06	0.961	0.985	0.974	1.12	0.885	0.651	2.59	4.27	2.85	1.16	0.856	0.732	1.50
1906-07	0.933	0.775	0.612	0.742	0.665	0.928	2.72	4.61	1.79	1.42	0.976	1.18	1.45
1907-08	2.14	3.62	1.80	1.25	1.33	1.76	3.31	4.32	2.02	0.828	0.765	0.665	1.98
1908-09	0.746	0.722	0.536	0.646	0.785	0.837	4.88	4.83	1.91	0.876	0.789	0.890	1.54
1909-10	0.780	0.847	0.761	1.28	0.940	1.88	4.03	2.11	1.76	0.803	0.847	0.802	1.40
1910-11	0.692	0.788	0.687	0.689	0.455	0.378	2.43	2.40	0.856	0.660	0.694	0.737	0.956
1911-12	0.967	1.07	1.27	1.11	1.10	1.23	3.71	2.62	2.14	0.947	1.08	1.13	1.53
1912-13	1.46	1.51	1.34	1.47	1.22	3.17	4.06	2.56	1.75	1.07	0.957	1.02	1.80
1913-14	1.77	1.92	1.21	1.13	1.03	1.51	3.31	3.26	1.07	1.02	0.956	0.876	1.59
1914-15	0.842	0.904	0.856	0.957	1.34	1.03	2.10	1.50	0.876	1.62	1.25	0.909	1.18
1915-16	0.933	1.04	1.16	1.18	1.32	1.32	3.16	2.90	4.17	1.79	1.46	1.22	1.80
1916-17	1.22	1.26	1.43	1.20	1.20	1.54	2.90	2.72	5.85	1.54	1.43	1.12	1.95
1917-18	1.56	1.43	1.21	1.14	1.20	1.50	3.12	2.12	1.29	1.21	1.20	1.36	1.53
1918-19	1.78	1.87	1.46	1.42	1.19	1.98	2.68	2.89	1.44	1.10	1.03	1.15	1.67
1919-20	1.18	1.68	1.27	1.14	1.11	1.78	3.94	3.26	1.56	1.09	1.13	1.18	1.69

24 -year mean — 1.62

ANDROSCOGGIN RIVER AT RUMFORD FALLS, MAINE

Per Cent of Time Duration Table

[Drainage Area, 2090 Square Miles]

Sec. Ft. per Sq. Mi.	1896 -97	1897 -98	1898 -99	1899- 1900	1900- 1901	1901 -2	1902 -3	1903 -4	1904 -5	1905 -6	1906 -7	1907 -8	1908 -9
0.2													
0.3								100.0					100.0
0.4				100.0				89.9	100.0		100.00		99.5
0.5	100.0	100.0	100.0	99.2		100.0	100.0	82.5	99.7	100.0	99.5	100.0	94.8
0.6	98.1	98.4	97.3	90.7	100.0	99.2	99.7	73.8	96.7	95.1	95.9	98.1	84.7
0.7	93.4	92.6	87.9	75.1	97.0	97.0	96.7	60.1	88.8	89.0	73.4	87.4	71.0
0.8	78.9	73.7	80.3	62.7	88.8	90.7	89.0	49.7	77.5	77.0	58.1	82.0	47.7
0.9	62.5	58.9	64.9	45.2	74.8	78.6	79.2	38.8	63.0	55.6	50.1	77.9	34.8
1.0	51.0	46.8	49.0	36.4	57.5	70.7	67.1	33.1	49.6	43.8	44.7	74.6	30.7
1.1	44.7	39.5	38.6	33.2	52.3	63.8	56.2	31.7	44.1	36.7	40.8	69.9	26.6
1.2	40.8	36.2	32.3	31.5	48.5	57.0	49.3	29.0	40.3	30.7	37.5	64.2	25.5
1.3	39.7	33.7	28.5	29.3	45.8	50.4	41.9	26.2	37.0	26.3	35.3	53.6	23.6
1.4	37.8	32.6	25.2	25.5	41.4	45.5	33.4	21.6	31.5	25.5	31.2	48.9	23.3
1.5	36.7	31.8	21.6	23.3	35.6	42.7	29.6	19.1	28.2	24.4	27.7	44.0	22.2
1.6	33.4	31.5	18.4	21.9	30.4	40.3	25.8	15.6	25.5	23.6	21.9	40.4	20.8
1.75	31.2	30.4	15.9	21.1	25.2	35.6	23.8	14.2	21.6	21.9	19.5	36.3	19.7
1.9	29.6	29.9	14.2	20.5	22.5	32.3	23.0	12.3	19.7	20.8	15.9	33.1	18.9
2.05	28.2	29.3	13.2	18.9	22.5	31.0	21.9	11.7	18.4	19.7	13.7	30.9	18.1
2.25	26.6	27.4	11.8	17.3	21.1	28.5	18.9	10.7	14.8	18.6	12.1	26.5	17.0
2.5	24.9	23.6	11.2	15.9	20.8	26.8	16.2	10.1	11.5	17.8	10.4	22.7	16.4
2.75	23.0	20.3	10.4	14.5	20.0	25.5	13.7	10.1	9.9	17.3	9.9	18.9	15.9
3.0	22.2	18.4	9.9	13.4	18.9	22.5	12.9	9.3	6.6	15.6	9.3	16.9	15.1
3.5	18.4	15.6	8.2	11.5	15.9	17.3	10.1	8.5	4.9	12.1	8.2	13.1	13.4
4.0	13.7	11.5	7.7	10.1	13.4	12.9	7.7	7.4	2.5	7.1	7.4	11.7	9.9
4.5	12.1	8.5	7.4	9.3	11.8	10.7	5.8	6.3	1.1	4.1	6.6	8.7	7.9
5.0	9.6	5.5	6.8	8.5	11.0	7.9	3.6	6.0	0.8	1.6	4.4	6.3	6.6
7.0	4.4	0.8	3.8	4.9	6.3	2.2	2.5	1.6	0.5	0.3	1.1	2.5	3.6
10.0	0.3	0.0	1.6	1.9	0.8	0.5	0.3	0.0	0.0	0.0	0.3	0.5	0.5
15.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANDROSCOGGIN RIVER AT RUMFORD FALLS, MAINE

Per Cent of Time Duration Table

[Drainage Area, 2090 Square Miles]

1909 -10	1910 -11	1911 -12	1912 -13	1913 -14	1914 -15	1915 -16	1916 -17	1917 -18	1918 -19	1919 -20	Mean 1897-1911	Mean 1912 -20	Mean 24-yr. Period
	100.0												
	99.7										100.0		100.0
	92.3										98.8		99.2
100.0	84.4										97.3		98.3
99.7	76.4		100.0		100.0	100.0			100.0	100.0	93.6	100.0	96.0
91.2	50.7	100.0	99.5	100.0	97.5	98.6		100.0	99.7	100.0	83.4	99.5	89.4
64.9	27.9	96.4	96.4	97.8	84.9	97.0	100.0	99.5	97.8	99.7	69.9	96.6	79.9
50.7	20.5	89.6	91.2	91.0	57.8	95.1	99.7	98.1	96.4	98.9	57.0	90.9	69.7
41.1	16.7	73.8	80.5	72.6	40.8	81.7	97.0	90.7	94.5	93.7	47.5	80.6	59.9
35.9	14.8	54.9	70.4	57.8	32.1	68.0	89.9	83.0	81.1	79.8	41.9	68.6	51.9
32.9	12.9	39.9	57.0	46.3	24.9	52.5	66.0	63.6	73.2	50.0	37.9	52.6	43.4
30.7	12.1	32.2	47.4	36.2	20.5	44.5	49.3	39.7	57.3	38.0	34.3	40.6	36.6
27.9	10.7	27.6	38.1	28.8	17.0	39.3	37.5	28.5	46.0	31.1	30.8	32.7	31.5
26.3	10.4	24.9	32.6	24.1	12.6	35.0	34.5	23.8	36.7	27.9	28.2	28.0	28.2
24.9	9.9	23.8	29.9	22.2	11.8	33.1	32.3	21.4	32.1	26.0	25.6	25.8	25.7
21.9	9.3	21.0	25.8	19.5	10.4	30.3	30.1	19.5	26.3	23.8	23.2	23.0	23.1
18.6	8.8	19.1	23.8	17.3	8.8	29.0	27.9	16.4	24.1	23.0	21.3	21.0	21.2
17.5	7.9	17.8	21.1	14.8	7.7	26.0	26.6	14.5	20.8	19.9	20.2	18.8	19.7
13.4	6.8	16.4	20.0	13.2	4.7	23.0	24.7	12.9	18.1	19.4	18.1	16.9	17.7
11.2	6.3	13.1	19.5	11.2	4.7	21.9	20.5	11.0	13.7	16.4	16.4	14.7	15.7
10.4	5.2	11.2	17.8	10.1	4.1	18.3	14.8	7.9	10.4	14.8	15.0	12.2	13.9
9.9	4.1	9.0	17.0	8.8	3.3	15.0	12.3	6.6	7.7	13.1	13.7	10.3	12.4
7.1	3.0	6.0	12.6	6.0	2.2	9.6	8.8	3.3	4.7	9.0	11.2	6.9	9.6
5.2	2.2	4.9	9.3	5.5	1.9	5.7	6.8	2.2	2.7	5.7	8.7	5.0	7.3
3.6	1.9	2.2	4.4	5.2	1.1	3.8	5.5	1.9	1.4	2.7	7.1	3.1	5.6
2.7	1.6	1.9	3.6	3.0	0.8	3.3	5.2	1.4	1.1	2.2	5.5	2.5	4.4
0.0	0.8	0.3	1.1	1.4	0.3	1.1	2.7	0.3	0.3	0.3	2.4	0.9	1.8
0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.8	0.0	0.0	0.0	0.4	0.2	0.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period 1897-1911 — 1.61 second feet per square mile

Mean flow for period 1912-1920 — 1.64 second feet per square mile

ANDROSCOGGIN RIVER AT DIXFIELD, MAINE

Location.—At highway bridge on road to West Peru, one-half mile west of Dixfield, Oxford County.

Drainage Area.—2230 square miles.

Records Available.—August 22, 1902, to July 1, 1908.

Gage.—Chain, read by S. F. Robinson.

Discharge Measurements.—At bridge and by wading.

Channel and Control.—Straight, broken at bridge by three piers; the bed is rocky and the banks are high and not liable to overflow. Control not permanent.

Ice.—Stage-discharge relation affected by ice.

Regulation.—Numerous power plants and storage reservoirs control to a large extent the flow.

Accuracy.—Rating curves for this station were well defined. Gage was read twice a day except during the winter months, when it was read but once each week. Records indicate much higher rate of run-off than those at Rumford Falls, during the open water period. No winter measurements of discharge were made.

ANDROSCOGGIN RIVER AT DIXFIELD, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 2230 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1902												1.44
1902–03	1.69	2.06				6.33	4.26	2.63	2.56	1.29	1.02	0.735
1903–4	0.964	0.870					3.68	6.06	1.61	1.10	0.804	0.857
1904–5	1.33	0.903					3.13	3.12	1.72	1.34	1.63	1.41
1905–6	0.969	1.01					3.11	4.93	3.38	1.32	0.951	0.812
1906–7	1.07	0.874		0.839	0.753	1.05	3.52	5.70	2.01	1.52	1.02	1.24
1907–8	2.44	4.35	2.15	1.42	1.51	2.03	4.17	5.29	2.40			

MAGALLOWAY RIVER AT AZISCOHOS DAM, MAINE

Location.—At Aziscohos dam, Oxford County, about 15 miles above the mouth.

Drainage Area.—215 square miles.

Records Available.—January 1, 1912, to September 30, 1920.

Gage.—Vertical cast iron staff in two sections, the upper fastened to the concrete gate tower, and the lower to one of the concrete buttresses.

Discharge Measurements.—The balanced cylinder gates are provided with scales and amount of gate opening may be determined very closely. Discharge at different gate openings ascertained by current meter measurements at a station about a mile below the dam.

Ice.—Stage-discharge relation not affected by ice.

Regulation.—The storage of about 9,593,000,000 cubic feet is wholly under control and the discharge represents such amounts as are required for the water power interests below. The operation of the gates is planned to maintain as nearly as possible a constant flow at Berlin, N. H. Results not corrected for storage.

Cooperation.—Discharge computed by Mr. Walter H. Sawyer, agent, Union Water Power Company, Lewiston, Maine.

MAGALLOWAY RIVER AT AZISCOHOS DAM, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 215 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1913-14	4.25	1.44	6.42	3.10	1.50	0.321	0.279	0.437	0.926	0.651	0.423	0.414	1.70
1914-15	1.23	4.53	3.20	5.12	5.54	5.07	2.67	0.591	3.67	0.451	0.582	0.526	2.74
1915-16	0.684	0.452	0.400	0.991	3.71	0.367	0.386	3.13	5.21	2.84	1.92	1.15	1.76
1916-17	5.67	4.40	2.39	0.851	1.67	4.45	1.12	1.29	7.67	1.88	2.55	6.53	3.37
1917-18	2.77	1.62	8.33	7.81	3.52	0.577	0.319	0.842	2.49	0.712	1.27	0.823	2.60
1918-19	1.35	0.949	3.70	2.81	1.23	1.59	1.05	3.80	2.12	1.74	6.00	2.68	2.43
1919-20	0.385	* .070	4.79	6.79	5.35	2.37	0.338	1.36	2.77	1.23	0.163	2.67	2.35

7 -year mean — 2.42

* Gates closed for repairs, estimated leakage

LITTLE ANDROSCOGGIN RIVER NEAR SOUTH PARIS, MAINE

Location.—At left end of old dam at Biscoe Falls, and 200 feet below highway bridge, 5½ miles above South Paris, Oxford County.

Drainage Area.—75 square miles.

Records Available.—September 14, 1913, to September 30, 1920.

Gage.—Chain on left bank installed April 16, 1914; original vertical staff carried out by ice March 2, 1914; from March 18 to April 9, 1914, chain gage on foot bridge was used. All gages referred to same datum and at practically same place. Gage read by G. A. Jackson.

Discharge Measurements.—Made at low stages by wading at dam; at medium and high stages from highway bridge.

Channel and Control.—At low and medium stages through opening at left of dam; opening was enlarged by flood of April 9, 1914. Water flows over dam at gage height 5.30.

Ice.—Stage-discharge relation not affected by ice.

Regulation.—Storage at Snow's Falls, 1½ miles above the station, and at West Paris, 4 miles above, has some effect on regimen of stream.

Accuracy.—Stage-discharge relation changed at time of high water, April 9, 1914; otherwise practically permanent. Rating curve well defined below 700 second-feet and fairly well defined between 700 and 1800 second-feet. Gage read to tenths once daily.

LITTLE ANDROSCOGGIN RIVER NEAR SOUTH PARIS, MAINE

Mean Monthly Discharge in Second Feet per Square Mile [Drainage Area, 75 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1913–14	1.99	2.12	1.32	0.840	0.760	3.18	7.14	2.99	0.546	0.267	0.106	0.187	1.79
1914–15	0.160	0.293	0.253	0.800	2.88	2.16	3.65	2.73	0.666	3.15	1.60	0.720	1.59
1915–16	0.706	0.893	1.15	1.19	1.56	2.19	7.40	3.80	4.21	1.87	1.21	1.67	2.32
1916–17	1.27	1.21	2.67	1.57	0.760	2.13	6.87	2.71	6.19	0.952	1.25	0.615	2.35
1917–18	1.05	0.900	0.520	0.389	0.512	1.88	5.60	2.73	1.60	0.916	1.35	2.72	1.68
1918–19	2.73	2.72	1.80	1.87	1.14	4.73	4.15	3.47	0.967	0.284	0.126	0.583	2.05
1919–20	1.09	3.92	1.93	0.501	0.035	4.00	9.60	3.87	0.881	0.504	0.515	0.565	2.28

7 -year mean — 2 01

LITTLE ANDROSCOGGIN RIVER NEAR SOUTH PARIS, MAINE

Per Cent of Time Duration Table

[Drainage Area, 75 Square Miles]

Sec. Ft. per Sq. Mi.	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	Mean 7-year Period
0.05	96.7	98.9	100.0	100.0	100.0	100.0	92.3	98.3
0.1	92.1	95.9	100.0	100.0	100.0	98.1	86.6	96.1
0.15	89.3	91.8	99.7	100.0	99.7	91.0	86.1	93.9
0.2	81.4	87.7	99.5	100.0	97.3	88.5	86.1	91.5
0.3	78.4	78.1	98.6	97.8	95.6	84.1	82.0	87.8
0.4	71.0	73.7	94.8	91.2	78.9	81.9	72.4	80.6
0.5	70.1	69.6	92.1	89.0	66.3	77.5	65.6	75.7
0.6	69.3	67.4	88.0	86.6	63.8	77.0	63.1	73.6
0.7	62.2	59.7	77.9	83.0	54.2	74.0	58.2	67.0
0.8	49.9	55.9	71.3	77.5	48.8	74.0	56.0	61.9
0.9	49.3	51.8	65.8	67.7	47.4	73.2	53.0	58.3
1.0	47.4	47.9	60.4	61.9	44.1	70.4	48.6	54.4
1.1	46.6	46.6	57.4	58.4	40.3	65.8	45.9	51.6
1.2	41.9	41.9	55.2	55.3	39.5	61.6	44.0	48.5
1.3	39.5	39.7	51.4	52.1	35.3	56.7	42.6	45.3
1.4	36.2	37.5	49.2	49.3	31.5	54.5	41.3	42.8
1.5	32.3	35.1	42.9	43.3	30.4	50.1	39.1	39.0
1.6	28.5	33.2	41.8	39.7	29.3	48.5	38.8	37.1
1.75	25.8	27.4	36.9	36.2	26.3	40.8	35.2	32.7
1.9	23.6	20.8	32.5	31.8	24.1	38.4	30.9	28.9
2.05	21.1	18.9	30.9	31.0	23.6	37.0	29.2	27.4
2.25	20.3	15.1	27.9	29.3	23.0	33.4	28.7	25.4
2.5	19.7	12.6	25.7	26.0	21.9	28.2	27.6	23.1
2.75	18.4	11.2	23.2	23.6	20.0	24.4	26.8	21.1
3.0	17.8	9.3	20.5	21.1	17.0	19.5	23.2	18.3
3.5	15.9	7.7	18.9	18.4	14.2	15.9	19.9	15.8
4.0	13.7	7.1	18.0	17.3	12.9	13.2	18.9	14.4
4.5	11.5	5.2	15.3	15.1	8.2	10.4	15.6	11.6
5.0	9.3	4.1	13.1	11.8	6.3	7.9	14.5	9.6
7.0	3.0	2.7	4.9	6.0	2.5	2.2	8.2	4.2
10.0	1.1	1.9	2.7	3.3	1.4	1.9	2.5	2.1
15.0	0.3	0.8	0.5	1.4	0.3	0.0	1.4	0.7
20.0	0.0	0.5	0.3	0.3	0.3	0.0	0.5	0.3
25.0	0.0	0.5	0.0	0.3	0.3	0.0	0.5	0.2
30.0	0.0	0.5	0.0	0.0	0.0	0.0	0.3	0.1
35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table—2.01 second feet per square mile

PRESUMPSCOT RIVER AT OUTLET OF SEBAGO LAKE, MAINE

Location.—At outlet dam at Sebago Lake and hydro-electric plant at Eel Weir Falls, 1 mile below lake outlet, Cumberland County.

Drainage Area.—436 square miles.

Records Available.—January 1, 1887, to September 30, 1920. Recomputation of data from 1887 to 1911 in second annual report Maine Water Storage Commission.

Gages.—On bulkhead of gatehouse at outlet dam and in forebay and tailrace of power plant.

Discharge.—Prior to March, 1904, discharge was determined from records of opening of gates in dam, the discharge capacity of which had been determined and tabulated by Mr. Hiram F. Mills of Lowell. Since March, 1904, discharge through the canal (about a mile long) has been recorded by three Allen meters, one on each pair of 30-inch Hercules wheels. These meters were rated by test at Holyoke, Mass., of one pair of wheels and the wheels and meters have been checked by current-meter measurements, brake tests of wheels and electrical readings of generator output. Excess of water is wasted through a pair of regulating gates at the power station. A record of the opening of these gates is kept and flow computed, using a coefficient determined from current-meter tests. At times the flow from the lake may be greater than is safe to carry through the canal, though this has not yet happened. At such times it would be necessary to waste a part of the water through the old regulating gates in the main dam.

Ice.—Stage-discharge relation not affected by ice.

Regulation.—Sebago Lake (area, 46 square miles) is under complete control. Results not corrected for storage.

Cooperation.—Records obtained and computations made by S. D. Warren Co., Cumberland Mills, Maine.

PRESUMPSCOT RIVER AT SEBAGO LAKE, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 436 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1887–88	1.80	1.85	1.90	1.86	1.70	1.82	1.74	2.94	2.48	1.70	1.67	1.68	1.93
1888–89	1.48	1.65	1.82	1.97	2.26	2.52	2.29	2.28	2.07	1.86	1.84	1.63	1.97
1889–90	1.69	1.75	1.68	1.86	1.92	1.79	2.41	3.05	1.87	1.60	1.65	1.73	1.92
1890–91	1.91	1.83	1.99	1.96	1.89	1.84	3.33	2.32	1.94	1.67	1.70	1.79	2.01
1891–92	1.82	1.66	1.52	1.52	1.60	1.54	1.44	1.41	1.44	1.52	1.66	1.48	1.55
1892–93	1.17	1.14	1.15	1.23	1.26	1.18	1.18	1.37	1.73	1.51	1.50	1.69	1.34
1893–94	1.59	1.54	1.71	1.78	1.66	1.19	1.11	1.46	1.54	1.45	1.41	1.18	1.47
1894–95	1.17	1.11	1.40	1.52	1.49	1.34	1.22	1.49	1.42	1.23	1.22	1.22	1.32
1895–96	1.06	1.06	1.02	1.09	1.13	3.07	1.48	1.82	1.87	1.77	1.60	1.44	1.53
1896–97	1.46	1.53	1.65	1.64	1.63	1.56	0.982	1.27	1.60	1.80	2.29	1.94	1.61
1897–98	1.87	1.66	1.83	1.92	2.05	1.77	2.50	2.72	2.12	2.03	2.07	1.95	2.04
1898–99	1.89	1.61	1.62	1.58	1.58	1.43	1.13	1.40	1.43	1.41	1.43	1.42	1.49
1899–00	1.35	1.38	1.32	1.06	1.14	1.34	2.04	3.07	1.80	1.65	1.44	1.37	1.58
1900–01	1.37	1.40	1.41	1.42	1.49	1.43	1.00	1.39	1.66	1.54	1.32	1.37	1.40
1901–02	1.32	1.42	1.41	1.38	1.35	1.54	9.64	2.73	1.34	1.49	1.56	1.46	2.22
1902–03	1.37	1.55	1.33	1.42	1.41	1.45	1.46	1.38	1.49	1.53	1.53	1.57	1.46
1903–04	1.56	1.48	1.40	1.29	0.977	1.08	1.31	1.37	1.52	1.37	1.40	1.48	1.35
1904–05	1.41	1.51	1.26	1.11	0.943	0.787	1.06	1.12	1.12	1.05	1.06	1.06	1.12
1905–06	1.05	0.933	0.883	1.13	1.41	1.23	1.17	1.21	1.27	1.43	1.56	1.56	1.24
1906–07	1.60	1.43	1.07	1.16	1.08	0.679	0.821	1.10	1.20	1.16	0.959	0.766	1.09
1907–08	1.12	1.36	1.40	1.55	1.76	1.27	1.20	1.28	1.46	1.29	1.56	1.65	1.41
1908–09	1.60	1.52	1.35	1.15	1.19	1.39	1.12	1.41	1.56	1.49	1.49	1.46	1.39
1909–10	1.47	1.52	1.48	1.43	1.47	1.18	1.17	1.17	1.21	1.17	1.19	1.19	1.30
1910–11	1.13	1.09	0.821	0.709	0.860	0.725	0.656	0.711	0.727	0.493	0.365	0.626	0.743
1911–12	0.725	1.12	0.878	1.14	1.12	0.821	0.791	1.08	1.08	1.13	1.32	1.38	1.05
1912–13	1.40	1.38	1.56	1.48	1.67	1.31	1.35	1.36	1.37	1.36	1.41	1.40	1.42
1913–14	1.34	1.42	1.34	1.36	1.41	1.11	1.03	1.26	1.33	1.30	1.47	1.55	1.33
1914–15	1.52	1.30	1.33	1.21	1.14	1.14	1.05	0.828	0.638	0.404	0.890	1.21	1.05
1915–16	1.24	1.28	1.32	1.29	1.26	1.26	1.06	1.23	3.72	1.88	1.74	1.66	1.58
1916–17	1.75	1.76	1.61	1.69	1.73	1.68	1.60	1.64	3.58	2.64	1.58	1.55	1.90
1917–18	1.64	1.58	1.61	1.56	1.55	1.37	1.11	1.10	1.13	1.27	1.44	1.19	1.38
1918–19	1.23	1.03	1.12	1.21	1.31	1.11	2.43	2.13	1.76	1.40	1.49	1.49	1.48
1919–20	1.56	1.39	1.53	1.70	1.67	1.40	2.50	4.33	1.72	1.55	1.60	1.57	1.88

Mean 33 years — 1.50

PRESUMPSCOT RIVER AT SEBAGO LAKE, MAINE
Per Cent of Time Duration Table
[Drainage Area, 436 Square Miles]

Sec. ft. per Sq. Mi.	1887 -88	1888 -89	1889 -90	1890 -91	1891 -92	1892 -93	1893 -94	1894 -95	1895 -96	1896 -97	1897 -98	1898 -99	1899-1900	1900-1901	1901 -2	1902 -3	1903 -4
0.05	86.9	91.8	87.4	86.0	85.8	95.1	98.6	99.5	97.5	89.3	96.4	100.0	100.0	99.2	100.0	100.0	99.7
0.1	86.9	91.8	87.4	86.0	85.8	95.1	98.6	99.5	97.5	89.3	96.4	100.0	100.0	99.2	100.0	100.0	99.7
0.15	86.9	91.8	87.4	86.0	85.8	95.1	98.6	99.5	97.5	89.3	96.4	100.0	100.0	99.2	100.0	100.0	99.7
0.2	86.9	91.8	87.4	86.0	85.8	95.1	98.6	99.5	97.5	89.3	96.2	100.0	100.0	99.2	100.0	99.2	99.5
0.3	86.9	91.8	87.4	86.0	85.8	95.1	98.1	99.5	92.6	85.8	96.2	100.0	100.0	99.2	100.0	94.8	99.5
0.4	86.9	91.8	87.4	86.0	85.8	85.8	88.8	85.2	88.5	85.8	95.6	100.0	100.0	99.2	95.9	92.3	99.5
0.5	86.9	91.8	87.4	86.0	85.8	85.8	86.0	85.2	86.3	85.8	95.6	99.2	99.7	98.4	94.8	92.3	99.5
0.6	86.9	91.8	87.4	86.0	85.8	85.8	85.8	85.2	84.4	84.1	92.1	88.5	96.2	98.4	94.5	92.1	95.9
0.7	86.9	91.8	87.4	86.0	85.8	85.8	85.8	85.2	81.4	84.1	91.8	85.8	95.6	94.8	92.1	85.2	94.0
0.8	86.9	91.8	87.4	86.0	85.8	85.8	85.2	84.4	79.8	84.1	89.9	85.8	92.6	90.4	90.4	84.9	87.4
0.9	86.9	91.8	87.4	86.0	85.8	85.8	83.8	84.4	79.8	80.8	89.9	85.8	86.8	86.8	89.6	84.9	86.1
1.0	86.9	91.8	85.8	86.0	85.8	84.1	83.0	82.5	77.3	80.5	89.3	85.8	85.8	84.9	89.3	84.9	82.2
1.1	86.9	91.8	85.8	86.0	85.8	82.5	80.5	82.5	74.3	80.5	89.3	85.8	82.2	83.6	89.3	84.1	77.6
1.2	86.9	91.8	85.8	84.9	85.8	79.2	77.8	80.0	65.0	80.5	88.8	83.8	74.0	80.8	89.0	84.1	72.7
1.3	86.9	91.8	85.8	84.9	85.8	72.6	67.1	58.4	47.5	78.9	88.8	80.8	73.7	74.8	89.0	80.5	68.0
1.4	86.9	91.8	85.8	84.9	82.5	39.7	61.6	47.7	47.0	75.6	88.8	77.5	70.1	72.6	78.9	75.3	58.7
1.5	86.8	91.8	85.8	84.9	79.2	34.8	60.0	47.7	38.8	66.8	88.8	77.5	46.0	49.0	70.7	73.2	45.9
1.6	86.9	88.5	85.8	81.9	77.9	34.5	45.2	28.8	37.7	63.6	84.7	41.4	32.1	17.5	37.8	63.8	28.1
1.75	86.9	84.9	82.5	80.3	51.6	20.5	31.5	4.9	36.1	58.6	83.0	31.0	25.5	4.9	14.8	11.2	3.3
1.9	81.1	82.7	80.8	79.5	27.0	8.2	14.0	0.0	23.0	27.9	80.8	5.2	14.0	1.6	14.8	1.6	0.0
2.05	53.0	71.8	54.8	74.8	8.5	3.3	0.0	0.0	16.4	16.4	72.3	5.2	10.7	1.6	14.8	0.8	0.0
2.25	10.1	34.5	21.6	29.0	0.0	0.0	0.0	0.0	1.9	6.6	37.3	4.9	7.4	1.6	13.2	0.0	0.0
2.5	6.3	1.9	12.6	10.1	0.0	0.0	0.0	0.0	1.9	3.3	3.6	0.0	7.4	0.0	13.2	0.0	0.0
2.75	6.3	1.9	12.6	9.3	0.0	0.0	0.0	0.0	0.0	3.3	3.6	0.0	4.1	0.0	13.2	0.0	0.0
3.0	6.3	1.9	11.2	9.3	0.0	0.0	0.0	0.0	0.0	1.6	3.6	0.0	4.1	0.0	11.2	0.0	0.0
3.5	6.3	0.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	4.1	0.0	11.2	0.0	0.0
4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	4.1	0.0	7.7	0.0	0.0
4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	7.4	0.0	0.0
5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0
7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0
10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0

PRESUMPSCOT RIVER AT SEBAGO LAKE, MAINE

Per Cent of Time Duration Table

[Drainage Area, 436 Square Miles]

04 -5	1905 -6	1906 -7	1907 -8	1908 -9	1909 -10	1910 -11	1911 -12	1912 -13	1913 -14	1914 -15	1915 -16	1916 -17	1917 -18	1918 -19	1919 -20	Mean 33-yr. Period
00.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.6	99.7	100.0	100.0	99.5	99.7	97.3
00.0	100.0	100.0	99.7	99.7	100.0	99.7	99.7	100.0	100.0	98.6	99.7	100.0	100.0	99.5	99.7	97.3
00.0	100.0	100.0	99.2	99.7	100.0	98.4	99.7	100.0	100.0	97.0	99.7	99.7	100.0	99.5	99.5	97.1
00.0	100.0	100.0	98.6	99.7	100.0	97.5	99.7	99.7	100.0	95.6	99.7	99.7	99.7	99.5	98.9	97.0
00.0	100.0	100.0	98.1	99.7	100.0	93.7	97.8	99.7	99.5	93.2	98.9	99.7	99.5	97.8	97.8	96.2
00.0	100.0	99.2	96.2	99.5	100.0	84.1	95.9	99.5	97.8	90.7	97.0	99.7	97.0	96.7	97.0	94.1
99.7	100.0	98.6	94.5	98.4	99.5	78.6	88.5	98.4	95.9	84.9	94.3	98.6	93.2	91.0	94.3	92.6
99.5	99.5	97.8	92.1	97.8	98.9	75.1	85.8	90.1	92.3	80.8	89.6	95.3	88.8	89.9	91.5	90.5
98.9	98.4	89.9	87.7	95.6	98.1	64.7	83.1	88.8	90.7	75.9	88.3	91.2	86.6	86.8	89.9	88.3
90.1	97.0	81.6	84.4	90.4	93.7	28.2	72.4	87.4	86.3	71.5	87.2	87.7	85.2	84.9	88.3	84.7
82.2	90.1	75.1	82.8	87.7	90.1	26.6	70.8	86.0	83.0	67.7	86.1	86.6	84.4	84.7	86.3	82.8
75.6	73.7	57.0	80.6	82.7	86.3	12.3	62.3	84.4	80.5	58.4	84.4	86.3	82.5	84.1	86.1	79.5
51.2	64.7	51.2	78.1	81.1	84.7	11.8	59.0	84.1	76.2	53.7	82.5	86.3	79.7	81.4	86.1	77.0
22.5	55.1	30.7	76.8	80.0	82.5	11.5	56.3	83.8	72.3	46.8	79.5	86.0	73.7	77.3	86.1	73.1
9.5	33.7	14.2	65.0	66.3	37.5	0.5	15.0	79.5	67.1	35.6	74.0	85.8	64.1	68.5	84.7	64.4
6.4	30.4	12.6	63.1	58.6	35.3	0.3	8.5	76.7	61.1	29.0	62.8	85.8	54.5	57.0	81.4	59.4
3.2	20.5	12.1	59.0	48.2	30.7	0.0	8.2	68.5	49.0	16.4	40.2	84.7	46.3	46.8	76.8	53.0
2.7	15.3	8.2	41.5	36.2	15.9	0.0	0.0	17.5	18.6	4.7	29.5	82.2	40.0	36.4	72.1	41.1
0.3	2.5	1.6	27.0	6.8	0.0	0.0	0.0	16.2	2.5	1.4	25.7	64.4	26.6	21.9	53.8	29.2
0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.0	17.8	34.2	1.9	15.1	17.8	19.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	7.4	0.8	8.8	9.6	13.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	6.8	0.0	5.8	9.3	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	6.3	0.0	3.8	9.0	2.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	6.3	0.0	3.6	8.5	2.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	6.3	0.0	3.3	8.5	2.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	6.3	0.0	2.7	6.8	1.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	6.0	0.0	1.9	6.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	5.8	0.0	1.1	5.7	0.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	5.8	0.0	0.8	5.7	0.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table—1.50 second feet per square mile

SACO RIVER NEAR CENTER CONWAY, N. H.

Location.—At the wooden highway bridge between Center Conway and Redstone, N. H., about 2 miles from each place; about 3 miles below the mouth of Swift River.

Drainage Area.—385 square miles.

Records Available.—August 26, 1903, to June 30, 1912.

Gage.—Chain attached to bridge; datum unchanged during the maintenance of the station.

Discharge Measurements.—Made from the bridge or by wading.

Channel and Control.—Channel is straight; broken by one pier at the bridge, and the banks are high and not liable to overflow. Bed is of sand and gravel and shifting.

Ice.—Stage-discharge relation affected by ice.

Accuracy.—Conditions for obtaining accurate discharge data were good during open water periods, and a good rating curve was developed except for extreme high stages. No values for discharge are published after the year 1909 because of a shift in the control which was not covered by discharge measurements. Gage read to hundredths once a day except during the winter when it was seldom read. Monthly estimates for winters of 1907 and 1908 are based on the run-off at West Buxton. No winter measurements of discharge were made.

Cooperation.—Established in cooperation with the New Hampshire Forestry Commission.

SACO RIVER NEAR CENTER CONWAY, N. H.
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 385 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1902–3												0.686	
1903–4	1.43						7.31	9.56	1.17	0.649	0.717	1.07	
1904–5	1.96						5.42	3.15	2.13	2.17	2.01	3.98	
1905–6	1.68	1.51					5.07	5.57	3.43	1.35	0.678	0.408	
1906–7	1.05	0.943		0.883	0.416	2.08	5.25	6.83	1.95	1.16	0.629	1.44	
1907–8	3.35	6.47	3.01	1.36	2.01	2.29	5.95	6.05	1.71	0.943	1.45	0.452	2.92
1908–9	0.478	0.548	0.434				9.06	6.70	1.79	0.694	0.416	0.784	
1909–10	0.847	0.849	0.712										

SACO RIVER AT CORNISH, MAINE

Location.—At highway bridge near Cornish, railroad station; one-half mile below mouth of Ossipee River, town of Baldwin, Cumberland County.

Drainage Area.—1300 square miles.

Records Available.—June 4, 1916, to September 30, 1920.

Gage.—Chain attached to bridge. Automatic water-stage recorder installed on left bank 300 feet above bridge, October 30, 1919. Referenced to gage datum by hook gage inside the well. Observer, H. Guimont.

Discharge Measurements.—Made from bridge.

Channel and Control.—Gravel and boulders; channel broken by one pier.

Ice.—Stage-discharge relation affected by ice.

Regulation.—The flow is somewhat affected by dams at Kezar Falls and at outlet of Great Ossipee Lake.

Accuracy.—Rating curves used well defined. Gage read to half-tenths twice daily during open water period and three times a week during the winter, before the water-stage recorder was installed October 30, 1919.

SACO RIVER AT CORNISH, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1300 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1916-17	1.11	1.09	2.09	1.32	0.985	1.54	6.00	4.50	6.72	2.38	1.13	0.923	2.48
1917-18	0.892	1.45	0.598	0.502	0.473	1 26	4.60	2.77	1.26	1.26	0.938	1.32	1.45
1918-19	2.34	2.32	2.13	2.00	1.23	3.47	4 69	3.88	1.81	0.900	0.666	0.915	2.20
1919-20	1.12	2 57	1.96	0.992	0.885	2.88	8.69	5.63	2.16	0.938	0.862	0.785	2.45

4-year mean —2.14

SACO RIVER AT CORNISH, MAINE
Per Cent of Time Duration Table
[Drainage Area, 1300 Square Miles]

Sec. Ft. per Sq. Mi.	1916-17	1917-18	1918-19	1919-20	Mean 4-year Period
0.05	100 0	100.0	100.0	100.0	100.0
0.1	100 0	100.0	100.0	100 0	100.0
0.15	100 0	100.0	100.0	100.0	100.0
0.2	100.0	100.0	100.0	100.0	100.0
0.3	100.0	98.6	100.0	100.0	99.6
0.4	100.0	96.7	100.0	100.0	99.2
0.5	99.7	91.5	99.2	100 0	97.6
0.6	99.2	82.2	95.3	99.7	94.1
0.7	96.4	74.2	92.3	98.4	90 3
0.8	93.2	63.3	87.9	86.3	82.7
0.9	86.8	57.0	83.6	75.1	75.6
1.0	76.2	48.2	79.5	63.7	66.9
1.1	68.2	44.7	75.6	55.2	60.9
1.2	61.6	35.3	70.1	51.4	54.6
1.3	50.4	32.6	67.1	46.2	49.1
1.4	46.0	29.3	65.2	43.4	46.0
1.5	41.4	26.3	63.6	42.9	43.6
1.6	40.0	23.0	60.8	41.3	41.3
1.75	36.2	20.8	53.2	39.9	37.5
1.9	34.8	19.5	46.6	38.0	34.7
2.05	34.2	17.3	39.7	35.8	31.8
2.25	33.2	16.2	34.2	32.2	29.0
2.5	32.1	15.1	30.7	28.4	26.6
2.75	31.2	13.7	26.8	26.2	24.5
3.0	30.7	12.3	20.3	22.4	21.4
3.5	26.6	12.1	14.2	20.2	18.3
4.0	20.5	9.3	11 0	18.0	14.7
4.5	18.4	3.0	6.8	16.9	11.3
5 0	12.3	2.5	5.8	15.6	9.0
7.0	5.8	0 0	1.6	8.5	4.0
10 0	1.4	0.0	0 5	1.6	0.9
15 0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table—2.14 second feet per square mile

SACO RIVER AT WEST BUXTON, MAINE

Location.—At hydro-electric plant of Cumberland County Power and Light Company at West Buxton, Maine.
Drainage Area.—1,550 square miles.
Records Available.—October 19, 1907, to September 30, 1920.
Gages.—Staff in pond above dam and in tailrace of power house.
Discharge.—Flow over dam and through rated wheels of power plant determined by means of readings every hour of gages and gate openings.
Channel and Control.—Crest of concrete dam, about 300 feet long.
Ice.—Stage-discharge relation not affected by ice.
Regulation.—Dams on numerous but comparatively small lakes in basin above station; storage probably affects regimen of stream, but not to extent that obtains in other basins in Maine where natural storage facilities are better and more fully developed.
Accuracy.—Little change in gate openings; fluctuations in load taken up at Bonney Eagle development above; S. Morgan Smith wheels with Holyoke rating under similar head are used. Records from August 1, 1917, to December 31, 1918, are reported seriously in error and are withheld from publication pending recomputation.
Cooperation.—Records furnished by Cumberland County Power and Light Company, Portland, Maine.

SACO RIVER AT WEST BUXTON, MAINE

Mean Monthly Discharge in Second Feet per Square Mile

[Drainage Area, 1550 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1908–09	0.450	0.412	0.433	0.865	0.910	1.80	7.74	4.83	1.86	0.781	0.515	0.443	1.75
1909–10	0.813	0.564	0.729	0.755	0.748	3.65	5.28	3.22	2.00	0.671	0.755	0.600	1.65
1910–11	0.457	0.655	0.511	0.916	0.568	0.642	4.28	3.52	1.21	0.577	0.409	0.372	1.18
1911–12	0.729	1.08	1.39	0.890	0.716	1.94	6.27	3.95	2.23	0.794	0.903	0.723	1.80
1912–13	1.00	1.90	1.18	1.83	1.26	4.01	5.25	2.39	1.55	0.645	0.440	0.601	1.84
1913–14	2.13	2.97	1.59	1.09	1.23	3.71	6.62	4.59	1.32	0.896	0.696	0.594	2.28
1914–15	0.446	0.556	0.586	0.891	1.79	3.04	3.30	2.50	0.865	2.74	1.82	1.10	1.64
1915–16	1.00	1.15	1.23	1.54	1.79	2.23	6.25	5.28	5.45	3.06	1.28	1.12	2.62
1916–17	1.07	1.03	1.93	1.33	1.02	1.65	5.92	4.22	6.34	2.30			
1918–19				1.90	1.28	3.73	4.97	3.99	1.91	0.839	0.613	0.910	
1919–20	1.06	2.36	1.94	0.903	0.788	3.37	9.35	5.84	2.40	0.948	0.877	0.865	2.55

SACO RIVER AT WEST BUXTON, MAINE
Per Cent of Time Duration Table
[Drainage Area, 1550 Square Miles]

Sec. Ft. per Sq. Mi.	1908–09	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1919–20	Mean 9 years
0.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.15	100.0	100.0	99.5	100.0	100.0	100.0	100.0	100.0	100.0	99.9
0.2	99.7	100.0	98.4	99.7	99.5	100.0	100.0	100.0	100.0	99.7
0.3	96.2	99.5	94.2	99.5	97.0	100 0	99.5	100.0	100.0	98.4
0.4	87.1	96.7	84.1	98.6	91.5	99.7	95.1	100.0	99.5	94.7
0.5	67.9	90.7	67.7	95.1	87.9	97.3	85.2	99.7	98.9	87.8
0.6	56.7	73.7	51.8	89.6	80.5	91.5	80.3	99.7	96.2	80.0
0.7	52.6	62.5	40 8	83.3	75.9	86.6	73.7	98.9	91.8	74.0
0.8	45.5	50.7	34.5	71.9	71.8	81.4	68.2	95.1	84.7	67.1
0.9	40.3	44.1	30.4	59.3	66 6	73.7	62 5	93.4	71.6	60.2
1.0	37.0	40.3	27.9	49.7	63.6	66.0	59.2	87.2	62 8	54.9
1.1	35.1	38.4	24.7	44.0	57.3	61.6	53.2	79.0	56.6	50.0
1.2	32.1	36.7	22.2	38.5	53.7	57.5	49.3	71.3	52.7	46.0
1.3	29.9	35.1	20.0	32.8	48.5	55.3	45.8	66.4	49.7	42.6
1.4	28 5	33.2	18.9	30.9	46.8	53.2	43.0	60.1	46.7	40.1
1.5	26.3	32.6	17.8	29.8	43.6	51.2	41.1	55.5	44.0	38.0
1.6	24.9	31.8	17.5	29.0	39.2	48.2	37.3	52.2	42.3	35.8
1.75	22.7	29.6	14.8	27.6	32.9	42.2	33.4	48.9	41.8	32.7
1 9	21.4	27.4	13.2	26.5	29.3	39.7	28.5	43.7	39.3	29 9
2.05	20.8	26.8	12.6	26.0	26.8	37.3	24.7	38.0	36.9	27.8
2.25	20.3	23.6	11.5	24.3	22.7	34.5	21.9	34.4	32.8	25.1
2.5	19.7	21.1	11.2	23.0	19.5	31.8	18.4	32.2	28.4	22.8
2.75	18.9	20.0	10.7	22.1	17.5	29.9	17.0	30.6	27.0	21.5
3.0	18.6	18.6	10.4	20.5	14.8	26.8	15.3	30.3	24.3	20 0
3.5	18.1	13.2	9.9	17 2	11.5	21.6	11.8	27.0	20.5	16.8
4.0	16.2	10.4	7.4	12.8	9 3	17.5	8.5	22.7	18.6	13.7
4.5	13.7	8.8	6.8	9.3	7.7	14.5	5 5	20.8	16.9	11.6
5.0	10.7	7.1	5.8	8 2	5.5	13.2	3.0	16.9	15.8	9.6
7.0	3.8	1.4	0.8	2.5	4.1	3.0	0.0	6.0	10.4	3.6
10.0	2.2	0.0	0.0	0.0	0.8	0.5	0.0	0.0	3.0	0.7
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 0

Mean flow for period of duration table — 1.92 second feet per square mile

OSSIPEE RIVER AT CORNISH, MAINE

Location.—At highway bridge in Cornish, York County, 1¼ miles from mouth.

Drainage Area.—448 square miles.

Records Available.—July 5, 1916, to September 30, 1920.

Gage.—Chain attached to bridge; read by O. W. Adams.

Discharge Measurements.—Made from bridge.

Channel and Control.—Sand and gravel, possibly shifting. Channel broken by one pier at bridge.

Ice.—Stage-discharge relation seriously affected by ice.

Regulation.—Flow affected by dams at Kezar Falls and at outlet of Great Ossipee Lake; not corrected for storage.

Accuracy.—Rating curves used well defined between 350 and 5,000 second-feet. Gage read to half-tenths once a day except during the winter when it was read three or four times a week, until September 17, 1919, and from then to September 30, 1920, twice a day.

OSSIPEE RIVER AT CORNISH, MAINE
Mean Monthly Discharge in Second Feet per Square Mile
[Drainage Area, 448 Square Miles]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean for Year
1916-17	1.05	1.17	2.06	1.41	1.04	1.82	5.92	3.42	5.87	1.99	1.19	0.944	2.32
1917-18	0.897	0.987	0.681	0.587	0.571	1.39	4.26	2.21	1.10	0.980	0.993	1.32	1.33
1918-19	1.88	2.15	2.46	2.88	1.48	4.04	4.31	3.86	1.54	0.940	0.786	0 882	2.28
1919-20	1.23	2.75	2.25	1.10	0.917	3.71	8.55	4.84	1.92	0.973	1.12	0.824	2.52

4-year mean — 2.11

OSSIPEE RIVER AT CORNISH, MAINE
Per Cent of Time Duration Table
[Drainage Area, 448 Square Miles]

Sec. Ft. per Sq. Mi.	1916–1917	1917–1918	1918–1919	1919–1920	Mean 4-year Period
0.05	100.0	100.0	100.0		
0.1	100.0	100.0	100.0		
0.15	100.0	100.0	100.0		
0.2	100.0	100.0	100.0		
0.3	100.0	100.0	100 0		
0.4	100.0	100.0	100.0	100.0	100.0
0.5	100.0	100.0	99.7	99.7	99.8
0 6	100.0	88.2	98.4	98.4	96.2
0.7	99.5	77.0	93.2	97.5	91.8
0.8	96.2	67.4	92.1	94.0	87.4
0.9	86.6	48.5	88.2	79.0	75.6
1.0	79 5	38.1	80.5	68.9	66.8
1.1	69.9	31.8	73.2	62.0	59.2
1.2	61.4	27.1	68.2	57.4	53.5
1.3	55.3	23.8	67.1	51.4	49.4
1.4	52.1	21.9	64.7	49.7	47.1
1 5	44.7	20.8	60.5	46.4	43.1
1.6	40.8	20.0	59.5	42.6	40.7
1.75	37.8	18.1	50.4	40.2	36.6
1.9	34.5	16.4	47.4	39.1	34.4
2.05	32.9	16.4	46.3	36.9	33.1
2.25	30.7	13.7	39.5	34.4	29.6
2.5	26.8	13.4	35.1	32.0	26.8
2.75	24.4	12.9	28.8	29.0	23.8
3.0	21.6	11.0	22.5	24.9	20.0
3.5	19.2	8.5	15 6	20.2	15.9
4.0	17.5	5.5	13.7	18.6	13.8
4.5	16.2	2.5	7.1	14.2	10.0
5.0	11.8	1.4	5.2	12.8	7 8
7.0	5 2	0.0	2.2	9.3	4.2
10.0	1.1	0.0	0.5	1.4	0.8
15.0	0.0	0.0	0.0	0.0	0.0

Mean flow for period of duration table—2.11 second feet per square mile

ACCURACY RATINGS

The following tentative system of rating stations for accuracy was adopted after a conference with members of the Run-off Committee of the Boston Society of Civil Engineers in February, 1921:

DEDUCTIONS FROM TOTAL OF 100 POINTS

Rating Curve, definition within limits of discharge measurements	0 to 20
Limits of discharge measurements compared with maximum and minimum recorded flows	0 to 3
Backwater effect (ice, weeds, logs, etc.)	0 to 20
Adequacy of records of stage	0 to 30

The stations are graded in accordance with the following scale:

A: 92—100		A—: 89—91
B+: 87— 88	B: 84—86	B—: 80—83
C+: 77— 79	C: 74—76	C—: 70—73
D+: 67— 69	D: 64—66	D—: 60—63

RATINGS OF MAINE STATIONS

	Station	Period	Grade
1.	St. George R. at Union	1913-14	B+
2.	St. John R. at Fort Kent	1905-15	D
3.	St. John R. at Van Buren	1908-20	A—
4.	Aroostook R. at Fort Fairfield	1903-10	C—
5.	St. Croix R. near Woodland	1902-11	D—
6.	Machias R. at Whitneyville	1903-15	C
		1916-20	B—
7.	W. Branch of Union R. at Amherst	1909-13	B—
		1914-19	B
8.	Branch L. Str. near Ellsworth	1909-15	D
9.	Green L. Stream	1900-13	C
10.	Penobscot R. at West Enfield	1902-13	B—
		1914-20	A
11.	E. Branch Penobscot R. at Grindstone	1902-13	B—
		1914-20	A—
12.	Penobscot, W. Br. at Millinocket	1901-20	B
13.	Penobscot, W. Br. near Medway	1916-20	A—
14.	Mattawamkeag R. at Mattawamkeag	1902-13	B—
		1914-20	A—
15.	Piscataquis R. near Foxcroft	1902-15	D
		1916-20	C+

	Station	Period	Grade
16.	Passadumkeag R. at Lowell..........	1915-20	B—
17.	Kenduskeag Stream near Bangor.....	1908-13	C+
		1914-19	B+
18.	Kennebec R. at Moosehead...........	1919-20	B—
19.	Kennebec R. at The Forks...........	1902-12	D
		1913-20	B+
20.	Kennebec R. at Bingham.............	1907-10	C—
21.	Kennebec R. at North Anson.........	1901-07	C—
22.	Kennebec R. at Waterville...........	1892-1920	C
23.	Moose R. near Rockwood............	1902-08 } 1910-12 }	C—
24.	Roach R. at Roach R................	1901-08	D
25.	Dead R. at The Forks...............	1901-07 } 1910-14 }	B—
		1915-20	B+
26.	Sandy R. near Farmington...........	1910-16	B—
27.	Sebasticook R. at Pittsfield..........	1908-17	C
28.	Cobbosseecontee Str. at Gardiner.....	1890-1920	D
29.	Androscoggin R. at Errol Dam, N. H.	1905-20	B—
30.	Androscoggin R. at Berlin, N. H.....	1913-20	B
31.	Androscoggin R. at Rumford.........	1892-1920	A
32.	Magalloway R. at Aziscohos Dam....	1912-20	B—
33.	Little Androscoggin R. near So. Paris	1913-20	A
34.	Presumpscot R. at Outlet Sebago Lake	1887-1903	B—
		1904-20	A
35.	Saco R. near Center Conway.........	1903-12	D+
36.	Saco R. at Cornish..................	1916-18	B
		1919-20	A
37.	Saco R. at W. Buxton...............	1907-20	B+
38.	Ossipee R. at Cornish...............	1916-20	B+

INDEX