months and during the past winter had, in some instances, to haul water for very long distances, owing to the failure of their water supply at certain tanks. Records of the discharge of all the streams in these localities, even though very small, are very valuable during both summer and winter.

Many engineers make their estimates of stream flow from precipitation records. It should, however, be pointed out that precipitation records gathered at a few isolated points are of very little value in estimating the probable discharge of the streams in Alberta and Saskatchewan and very often are misleading. The physical features and the precipitation are so varied within the same drainage basin that no reliable estimates can be made. Streams, such as Bow River, for instance, very often have a comparatively large run-off during a comparatively hot, dry summer, due to the fact that a much larger quantity of snow and ice is melted in the mountains in a hot, dry summer than in a cold, wet summer. In a cold, wet summer the precipitation in the mountains often falls as snow and is stored instead of coming down to still further swell the already high streams. This same condition is found on the North Saskatchewan and all other large streams whose main sources are in the mountains. It is, for instance, impossible to estimate the probable discharge of the North Saskatchewan River at Prince Albert from precipitation records and the only reliable data to use are the records of stream flow.

To arrive at anything approaching a reliable estimate of the flow of a stream at different stages and the duration of those stages, a series of continuous records of discharge extending over a considerable period is absolutely necessary. George W. Rafter, in Water Supply Paper No. 80, published by the United States Geological Survey, says: "Further, it can be stated that for records from twenty years to thirty-five years in length the error may be expected to vary from 3.25 per cent. down to 2 per cent., and that, for the shorter periods of five, ten and fifteen years the probable extreme deviation from the mean would be 15 per cent., 8.25 per cent., and 4.75 per cent. respectively.

Mr. Rafter says, further, that with less complete records "Mr. Henry reached the conclusion that at least 35 to 40 years' observations are required to obtain a result that will not depart more than 5 per cent. from the true normal. The average variation of a 35-year period was found to be 5 per cent., and for a 40-year period 3 per cent."

The records of this office do not extend over a period of more than five years on any stream, and during that period interruptions have occurred, due to lack of funds and staff. Proper provision should be made so that this work will not in future be subject to these interruptions.

The water supply is one of the most important resources of a country, and an accurate knowledge of the flow of water in nearly all important streams is essential for the solution of many problems in connection with navigation, water-power, irrigation, domestic and industrial water supplies, sewage disposal, mining, bridge building, river-channel protection, flood prevention, and storage for conservation of flood waters. The records are being used quite extensively now by engineers and the field of operations should be extended to include other parts, if not the whole of Canada.

The work is in charge of P. M. Sauder, C.E., Chief Hydrographer. His first assistant since January 1st, 1913, has been G. H. Whyte, B.A.Sc., and his second assistant, G. R. Elliott, B.A.Sc.

PRESENT DAY WATER FILTRATION PRACTICE.

THE two methods of water filtration; namely, by slow sand and by rapid sand filters, English and American types respectively, are traced in their development, are compared as to their relative applicability to meet varying sets of conditions and are discussed as to the features of operation upon which the efficiencies of both depend, in a paper to be presented by Mr. George A. Johnson, Consulting Engineer, New York City, at the coming meeting of the American Water-Works Association in Philadelphia. The writer dwells also to some extent upon the questions of comparative cost of filtered water as obtained by the two methods.

According to Mr. Johnson, the first municipal water filter was built at London 85 years ago. It was built to perform only the functions of a mechanical strainer for the removal of suspended matter. At that time the two most important water-borne diseases (typhoid fever and cholera) had not then been discovered, and the germ theory of diseases was not advanced until some 20 years later. The first official recognition of water filtration as a means of reducing the dangers in impure drinking water took the form of an Act of Parliament in 1852, which made compulsory the filtration of the entire water supply of the metropolitan district of London.

This filter, as well as all those which followed during the succeeding 50 years, was of the slow sand type. After considerable scientific investigation, particularly in Germany, this type found its way to America and appeared at Poughkeepsie, N.Y., about 1875, as the first municipal water filtration plant in America. Its adoption was slow, however, and, in 1890, only 35,000 people in America were being served with water so filtered.

A patent for a process in which a coagulant was added to the raw water before filtration was granted in 1884, and with the use of coagulating chemicals the mechanical or rapid sand filter developed.

Up to January, 1914, some 30 slow sand filtration plants were put in operation, or were at that date under construction in the United States. They have a daily filtration capacity of 840,000,000 gallons and are designed to serve a total population of 5,500,000. Of this population 73% is served by the filter plants installed in eight cities, while the remaining population is widely scattered through some twenty cities.

Mr. Johnson's paper takes into consideration the operation and efficiency of the plants at Lawrence, Mass.; Albany, N.Y.; Washington, D.C.; Philadelphia, Pa., and Pittsburgh, Pa., showing the difficulties under which filters of this type are obliged to work when called upon to treat muddy waters. It is noted that in every instance, with the sole exception of Lawrence, the original design has been improved upon and the preparatory treatment of the work made more complete. This preparatory treatment consisted in some instances of roughing filters, the use of coagulant, or both, while at practically all slow sand filter plants in the United States the final filtered product is sterilized with hypochlorites. Mr. Johnson states that with the exception of Lawrence, Providence and New Haven, it is becoming difficult to locate the slow sand filter plant which does not in some important respect depart from the original ideas of what constituted that system of water purification or which does not in some way make use of certain inherent ideas upon which are based the rapid sand system of water filtration.