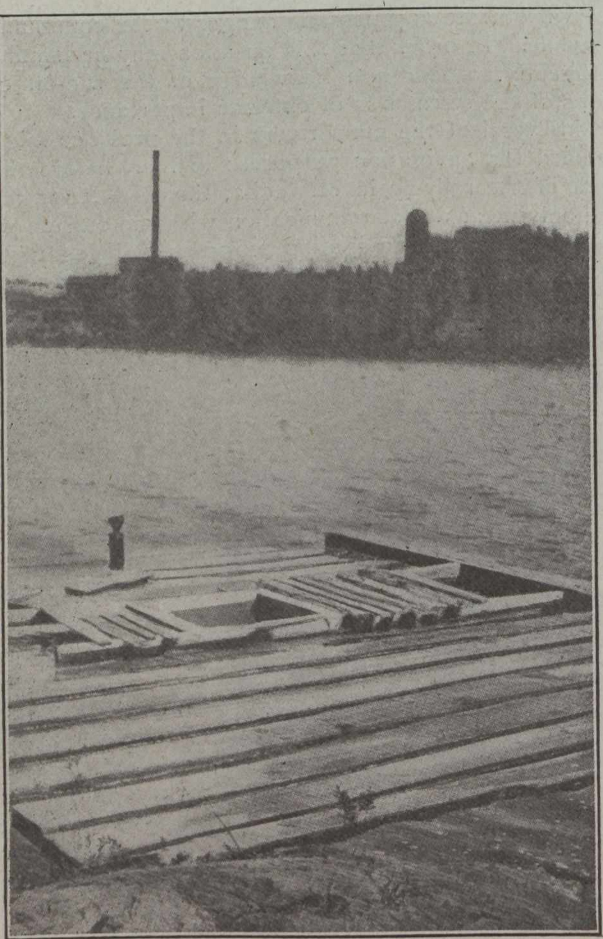
closely following the practice of the United States engineers.

The different streams to be studied were investigated and suitable locations selected for the establishment of metering stations, the selection of the stations depending upon the physical features and the need of data in that particular locality. At these metering stations, gauges were also established and the services of some person living in the locality were secured to read the gauge daily. These daily observations are recorded in a book provided for the purpose and examined by the engineer on each of his trips to the station. The readings as entered in the book are transferred to cards by the gauge reader, and are forwarded weekly to the chief engineer. From a study of these readings and the meterings, the daily discharges are arrived at.



Keewatin, M.H.S. Evaporation Station.

On the organization of the Manitoba Hydrometric Survey the work of the Winnipeg River Power Survey was merged with it. Since then all investigations, whether hydrometric, storage, power or river improvement, have been carried on under the one central control. By this arrangement the work naturally falling within the scope of the survey has been carried on efficiently and systematically. Conservation investigations for power and storage are being dealt with in a comprehensive manner with a view to determining the best use of the available water supply.

In gathering the stream flow data it is believed that the results obtained are sufficiently accurate for all practical purposes; the aim being not so much to concentrate on a few streams and so obtain records of extreme accuracy, but rather to spread the effort over a wide territory and so serve as many purposes as possible without unduly sacrificing the accuracy of results. In this connection it is essential that the records, in order that they may properly cover all possible range in stage of the rivers investigated, should extend over a considerable term of years. On some streams this term should be from five to ten years, while in other cases it should extend over a much longer period, say, from ten to twenty years. The length of term will depend largely on the character and relative importance of the stream and the possibility of estimating the discharge by comparison with records of other streams in the vicinity. To quote from an authority on this subject, "the object should be to gauge a certain number of streams at all seasons of the year so as to ascertain their total discharge and its seasonal distribution, also to gauge others at certain stages which have been determined to be critical points in their regimen." It may be stated here that the standpoint taken by the United States Geological Survey is, that owing to the constantly changing flow of the streams, data of reasonable accuracy showing the distribution of flow over several consecutive years, are of more importance than very accurate measurements covering short periods of time.

In dealing with the work of the survey, the territory covered, due principally to geographic conditions, falls naturally into several main divisions. From time to time the work in these several divisions may be extended, since up to the present time only the principal streams have been examined. The divisions may be enumerated as follows: (1) Lake of the Woods tributaries and outlet; (2) Winnipeg River and tributaries; (3) Red River and tributaries; (4) Assiniboine River and tributaries; (5) the district to the west of Lake Winnipegosis, including the Saskatchewan River and its tributaries; (6) the east shore of Lake Winnipeg; (7) the Nelson River.

Methods of Determining Discharge.—Three separate methods are commonly followed in the determination of discharge of streams, and these methods involve the use of certain formulæ based on physical data more or less easily ascertained. The three methods referred to are: (1) The slope method; (2) the weir method; (3) The mean velocity method.

The Slope Method.—In the slope method of determining the discharge, the fact that the slope of the bed of the stream, and consequently the surface slope bears some definite relation to the discharge is made use of. A number of empirical formulæ have been deduced from time to time in an effort to express this relationship, and among these in most common use are the Chezy, the Kutter, and the Bazin formulæ.

What is known as the Chezy formula was deduced by a French engineer of that name about the year 1775, and takes the form of:—

$V = C \sqrt{rs}$ in which V is the velocity, C a coefficient depending upon the slope, the roughness of the channel and the wetted perimeter; r is the hydraulic radius, being the cross-sectional area divided by the wetted perimeter, and s the slope, being the head or fall in the section divided by the length of the section. This formula: $V = C \sqrt{rs}$ may be considered the fundamental slope formula. Various modifications of it have been deduced from time to time depending upon values of C obtained from formulæ based upon experiments and observations. The Kutter and Bazin formulæ belong to this class, and the former is perhaps the better known, taking the form