

## THE GRAND RIVER FLOOD CONTROL.

A preliminary report dealing with the possibility of improving the general regimen and local flow characteristics of the Grand River by means of storage and training works, has just been made to the Honorable Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario by Mr. H. G. Acres, Hydraulic Engineer to the Commission. The following is the text of the report:

Through the progressive obliteration of physical influences governing natural control, the flood flow of the Grand River has for some years past been gradually increasing in volume and destructiveness.

Consequent upon this steady increase in flood discharge, the low-water flow has been as steadily decreasing, so that in addition to a large annual loss by flood damage, there has been a material loss through shrinkage in power capacity. The realization that these conditions would tend to become worse year by year, led a number of the interested municipalities to solicit the help of the provincial government in the matter of an investigation for the purpose of devising, if possible, a feasible remedy; such remedy to serve the joint purpose of ameliorating flood conditions and of increasing the power capacity of the stream under conditions of minimum flow.

During the fall of 1912 a reconnaissance survey was made of the Grand River watershed covering the main stream from Caledonia to headwaters; also of the larger tributaries including Whiteman's Creek, and the Nith, Speed and Conestoga Rivers from their confluence with the main stream to headwaters.

The main purpose of this reconnaissance was not to furnish definite data as to the possibility or method of flood control, but rather to eliminate from the problem all portions of the watershed possessing physical characteristics of such a nature as to make more detailed examination plainly unnecessary. With the scope of the investigation thus restricted, it remained to ascertain what locations, if any, merited examination as sites for storage reservoirs and regulating works. The following locations, having the desired characteristics in varying degree, were established:

1. A site between Paris and Glenmorris where by means of a 40 foot dam a storage area of about 1,000 acres would be created. There is also in this vicinity a possibility of controlling about 1,400 acres of storage by means of a 70 foot dam. In both instances the back-water damage would be large, and in the case of the 70 foot dam, would involve the drowning out of several buildings and a considerable length of highway.

2. A site near the village of Blair where a 30 foot dam would create a storage area about 1,400 acres in extent. The flooded area in this case would be largely meadow land.

3. A site near the town of Elora where a 30 foot dam would create a storage area about 3,000 acres in extent, the back-water damage involving principally meadow land and river flats.

4. Two sites on the Conestoga River, one of which would have a storage area of about 1,200 acres with a 40 foot dam, and the other about 1,000 acres with a 30 foot dam. In the first case, the back-water damage would involve cultivated land and a number of buildings. In the second case, pasture land would be mainly involved.

5. Two sites on the Speed River, one of which would have a storage area of about 600 acres with a 30 foot dam, and the other about 800 acres with a 35 foot dam. The flooded land in both cases would be swamp and poor meadow land.

6. A site on the Nith River near Canning, where a 65 foot dam would control about 1,100 acres of storage. The back-water damage would be heavy as a number of buildings would be involved.

7. A site on Whiteman's Creek near Mount Vernon, where a 45 foot dam would control about 450 acres of storage. The topography of the dam-site in this case would allow the construction of a 60 foot dam, but the back-water damage would be very largely increased.

While it is to be understood that the above figures are superficial approximations only, it seems reasonably certain that a system of storage basins as above described would have an aggregate impounding capacity of not less than five billion cubic feet, in which event some beneficial effect through flood control might be expected.

While the information now available seems to indicate that material benefit may be derived from the construction of storage works, the extent of this benefit and the construction cost cannot be even approximately estimated without the help of instrumental surveys and comprehensive hydrographic study.

For the past eight months gauging stations have been maintained on the Grand River, at Brantford, Glenmorris, Blair and Elora. The stations have been so located as to provide information in connection with the characteristics of the main tributaries, and discharge measurements have been made periodically at each station. These measurements, besides recording the flow characteristics of the river under natural conditions and at different seasons, will provide the necessary data for forecasting the behavior of the river under future conditions of regulated flow.

The surveys necessary will involve,—

1. Instrumental determination of channel slope.
2. Detailed instrumental surveys of sites for proposed dams.
3. Surveys of storage basins to establish flood contours, and to determine the maximum possible or permissible limit of back-water.

The data derived from these surveys will provide the necessary information as to the two governing factors of artificial regulation; namely, the obtainable volume of storage capacity, and the extent of back-water damage. If this information proves that material benefit may be derived from the construction of storage works, the next step will be the exploration of foundation material by means of borings and test-pits, after which detailed construction plans will be prepared with estimates of cost.

It may here be mentioned that throughout the Grand River watershed, with the possible exception of that of the Speed River, the topographical features are unfavorable as affecting the height and length of the necessary dams, and the geological features are unfavorable as affecting their foundations. It is, therefore, certain that the creation of storage reservoirs of adequate capacity will entail a large capital expenditure. This expenditure will also be unfavorably influenced by the necessity of providing large spillway and sluice capacity for the safe passage of flood discharge.

Apart from conservation, another important element of flood control is the handling of back-water and the prevention of riparian damage due to erosion. The proper study of the problem under consideration will, therefore, necessitate the examination and survey of restricted channel sections, and of localities favorable to the formation of ice-jams; also a study of back-water effect due to existing dams.

With this information available it will be possible to determine to what extent, if any, flood damage can be reduced by means of channel improvement and the construction of training works.