before they melt in the area in the vicinity of Winnipeg. This has the tendency to congest the flow of the water and to bring the flood waters from the south to the mouth of the river just as those in that vicinity are commencing to discharge. This is shown graphically by Fig. 1.

With Lake Winnipeg, the outlet of the Red River, only 40 miles distant from the city, one must look for other causes than the superabundance of water and the flat slopes of the river, to account for such widespread and sustained flooding as ocurred in 1826 and 1852. An examination of the river bed shows that a contracted channel between St. Andrews and Lower Fort Garry is responsible for the holding up of the water. This is shown graphically by Fig. 2. Rock outcrops in the bed of the river at Listers Rapids, 12 miles below the city, and at St. Andrews Lock and Dam, precluding any natural deepening of the channel, while the firm and unyielding nature of the banks through the Parish of St. Andrews to below lower Fort Garry prevent any practical change in the sectional area.

Thus, with the above natural conditions still in operation, the ordinary course of nature may be depended upon to again cause floods of great magnitude.

Frequency

Before the question of controlling these floods to protect the city of Winnipeg can be considered from an economic standpoint, it is necessary to know how often they may be expected to occur. Table 1 gives a record of the flood heights at Winnipeg from the year 1776 to date. In the early years, the great floods were all that were recorded, but later, as the country became developed, records were taken of the height of every spring freshet. Fig. 4 has been prepared from these records to show the probable average frequency of the different floods. This frequency and the amount of probable damage will determine the expenditure that may be economically made to safeguard the city of Winnipeg.

TABLE 1—RED RIVER OF THE NORTH, HIGH WATER ELEVATIONS AT WINNIPEG

Year	Elevation	Year	Elevation	Year	Elevation
1776	761+	1885	742.4	1906	740.4
1790	761.0	1892	750.4	1907	743.5
1809	761.0	1893	750.0	1908	741.4
1826	766.0	1894	745.4	1909	737.4
1852	764.0	1895	741.9	1910	742.2
1861	762.0	1896	748.6	1911	734.3
1875	747.0	1897	750.3	1912	737.5
1876	740.3	1898	746.9	1913	744.3
1877	742.4	1899	733.9	1914	735.4
1878	734.5	1900	733.7	1915	733.9
1880	744.2	1901	742.1	1916	751.9
1881	745.3	1902	746.4	1917	743.3
1882	753.9	1903	740.4	1918	729.9
1883	746.5	1904	752.5	1919	738.7
1884	745.8	1905	737.9		

Records from 1776 to 1875, inclusive, from Sir Sanford Fleming's C.P.R. report. Records from 1876 to 1919, inclusive, by city engineer of Winnipeg

Methods of Flood Control

There are four separate methods of controlling the floods at Winnipeg: (1) Reservoirs in the upper valley of the Red River, in the U.S.A.; (2) improvement of the river channel; (3) reservoirs on the Assiniboine River; (4) dykes.

Reservoirs in Upper Valley, Red River

A $25,000,000 project for the control of the floods in the United States portion of the Red River drainage basin, by means of reservoirs, is now under consideration. Reservoirs of ample capacity, under international control, might do much to protect the city of Winnipeg, but there is also the danger that such works might only retard the flood crest until such time as the flood waters from the Assiniboine were arriving at the city. In the flood of 1882, the Red River crested before the Assiniboine had risen to flood height. If both rivers had reached flood stage at the same time, the waters would have overflowed the banks of the Red and covered the streets of the city.

On the portion of the river above Winnipeg, such reservoirs would probably be of very material benefit in reducing the height of the floods.

Improvement of River Channel

By deepening the river channel and improving its carrying capacity below the city, particularly at the control section shown on Fig. 2, it would be possible to confine even the largest floods within bank level from the city down to the mouth of the river at Lake Winnipeg. This method of improvement and control would necessitate the movement of very large quantities of material from the river bed and would only benefit that portion of the river about Winnipeg.

Reservoirs on Asiniboine River

By holding back the Assiniboine River flood, the Red River would be deprived of a large quantity of flood water at critical periods and the high water could be reduced to such heights as would be contained within the river banks at Winnipeg.

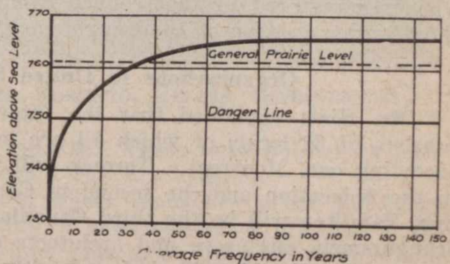

FIG. 4—AVERAGE FREQUENCY OF THE RED RIVER FLOODS AT WINNIPEG

One of the most ambitious of the control schemes contemplates carrying the surplus Assiniboine flood waters into Lake Manitoba west of Portage la Prairie and, by improvements to the Fairford River, discharging this surplus water into Lake Winnipeg via the Dauphin River.

Dykes

Large areas of the city might safely be protected by means of dykes, but the cost of right-of-way and the danger of sliding banks if these were carried close to the river's edge, restrict such means of protection to local areas.

A combination of a number of these different types of works will probably afford the most efficient and most economical means of providing the necessary protection.

The following resolution was adopted without discussion at a recent meeting of the Toronto Branch of the Engineering Institute of Canada: "Be it resolved that this branch of the Engineering Institute request the special committee of the council of the institute to bring their influence and acquired knowledge to bear with the Civil Service Commission to have the minimum salaries of the responsible officers of the engineering staffs made commensurate with those received by responsible officers in equivalent positions in private corporations."

Capt. F. M. Dawson, of Montreal, who is a member of the firm of Monks, Manhard & Dawson, engineers and contractors, Montreal, addressed a joint meeting of the Queen's University Engineering Society and the Kingston Branch of the Engineering Institute of Canada, March 19th, on the "Microscopic Study of Cement." Capt. Dawson claimed that a large percentage of cement does not combine with the mixing water, and that from 70 to 80% of the cement in any concrete mixture does not act as a binder. Alcohol, ether and soap have been added to cement in efforts to improve hydration, but the most successful product for this purpose is one which has a catalytic action between cement and water. This product is a chemical which is added to the clinker before grinding; cement produced by this process is called "super-cement." Capt. Dawson said that the hydration of "super-cement" is more perfect than of Portland cement, and that its concrete is stronger and denser.