to be secured in the channels connecting the Great Lakes, and only the most important harbors can dock vessels of this draught. It will be noted that the locks are designed to handle self-propelling vessels rather than tows; and in their proportions they are in marked contrast to the St. Lawrence River locks, which were designed by the Canal Commission of 1870. The latter are 270 feet by 45 feet in plan, and Mr. T. C. Keefer has suggested that they were especially intended to provide for Noah's Ark, no other vessel of his knowledge having the same relative dimensions.

Forty-five main dams will be required in all, not including those that may be built for regulating the discharge of tributary streams. Where the river flow is abundant it is proposed to adopt the rock-fill type of dam, but the economic value of power has been advancing so rapidly during the last fifteen years that it is questionable whether the use of so wasteful a device will be permitted. The regulated water levels in the pools will be maintained by the use of stop logs as is customary in Canadian practice. In a few places the Stony patent sluices may be introduced.

Both from the standpoint of navigation and for the development of power the regulation of the discharge of the Ottawa River is most desirable. The units involved in its control are startling. The records show that the minimum discharge near Ottawa in recent years has not been much greater than 10,000 cubic feet per second, and that maxima as high as 250,000 cubic feet per second have been reached. It is hoped that the discharge may be so effectively controlled that it will never be less at this point than 90,000 cubic feet per second and never more than 120,000 cubic feet per second. The economic value of this regulation is effectively set forth in the interim report by the remark that the potential low-water horse-power on the two main rivers will be increased by it from about 150,000 horse-power to nearly 1,000,000 horse-power.

It is not easy at this date to grasp the fact that the watershed of the Ottawa River is an almost unknown and uninhabited land. It is mainly in the Province of Quebec and far to the north of the river itself, which in reality skirts its southern edge; its northern boundary is the height of land between Hudson's Bay and the St. Lawrence River waters. For at least three generations this district has been given over to the lumberman, and few and limited in area are the farm clearings in it. Engineering data for the design of the regulating works on the tributaries of the main river are. therefore, not in existence, and exhaustive surveys such as are needed to secure these data cannot now be conducted at reasonable expense except, perhaps, in the depth of winter. This difficulty will, however, be very greatly reduced when the National Transcontinental Railway, now building, is opened to traffic, as its location crosses the head waters of nearly all the principal tributaries of the Ottawa. It will provide a convenient base for the carrying out of a hydrographic and topographic survey of the upper watershed.

Much attention has already been given to the general hydrography of the river, and it is estimated that at a cost of less than \$500,000 the well-known lakes, Temiscamingue, Keepawa, Quinze, Barrière, Kinejiskaskatic, Turn Back, Askikwaj and Grand Lake Victoria, might be converted into storage reservoirs, and a storage of, perhaps, 150 billion cubic feet of water obtained. The regulative effect of these great storage basins and the ease with which the discharge of the waters from them can be controlled are too obvious to call for comment. A more picturesque suggestion has been made for the control of the flood discharge, based on the fact that the head waters of the Ottawa itself lie far to the eastward, where the stream flows in a bed of high elevation between the two great ridges which form the height of land between the St. Lawrence River and Hudson's Bay. It is suggested that a large portion of the flood waters should be diverted across the height of land and into the streams discharging into Hudson's Bay. Pending the opening up and further survey of the watershed such a proposal may be regarded as an interesting speculation.

Settlement and investment have rendered impracticable here the bold projects of the earlier engineers, and it is not

now proposed to make any material change in the existing hydrography. The study of the engineers has instead been directed to the estimation of the available water supply in the summit watershed and to the possible means of supplementing it. The district with its large forest areas, its severe climate and late spring, and its feeble evaporation, is well suited to a conservation of the natural rainfall and in this respect the location is most advantageous. It is intended to make a deep-water summit reach by flooding the series of small lakes, Troutt, Talon, and Turtle, that lie at the headwaters of the Mattawa River, and to design the summit locks so that this reach can be drawn down 6 ft, below normal level without interference with navigation. It is estimated that the watershed tributary to these lakes will furnish a supply sufficient to allow 24 lockages to be made daily through the summit reach. This should be ample to handle all the traffic for many years to come, provided that some arrangement is made for an economical locking of the smaller craft that are sure in season to throng such a waterway.

When the demand of the traffic is such that the existing watershed cannot provide for the lockages, the flow of the Amable du Fond River will be diverted into the summit reach. The Amable du Fond is a small stream lying to the south of the canal, and it is estimated that its discharge will more than double the supply available for the summit reach; at present it empties well to the eastward into the Mattawa waters. The generally unsettled and undeveloped condition of the district makes such a diversion possible without the legal conflicts and costly compensations that would be necessary in older countries.

The total lockage from the Georgian Bay up to the summ't level is 99 feet and the lockage down to Montreal 659 feet, 27 locks in all being required if the Lake St. Louis location is adopted; the lock lifts will vary from 5 to 50 feet. As has already been stated the locks will be of the usual type, but unusual care has been taken to secure the most advantageous locations for them. The estimates are made for locks with chambers 650 by 65 by 22 feet, but the possibility of an increase both in length and width has been discussed. Where possible and as a measure both of safety and of economy the locks are placed in rock cuttings, and the character of the rock encountered is such that little more than a facing of the sides with concrete will be necessary. The locks will be provided with two pairs of steel gates at each end, so that the waters of the upper reach cannot break loose if by any accident a vessel should chance to run into one pair of gates. With modern power machinery there will be little difficulty in operating the two pairs of gates simultaneously. The locks are also by preference located so that the necessary water may be drawn directly from and discharged into th: main river near the centre of the lock. All culverts and sluices and valves in the vicinity of the gates are avoided as far as possible. Guide piers for incoming vessels will be run far out on one side, and on the line of the lock, so as to avoid all difficulty at entrance. The rivers will provide abundant power for the lighting and working of the whole plant.

No provision has been made in the estimates for terminals at either end. The intention of the canal being to avoid transhipment until Montreal is reached, no provision other than a protection harbour is requisite at the western entrance; and at the eastern end there is already Montreal with its wharves, sheds, elevators, tracks, and machinery for handling bulk freight. Two routes have been surveyed near Montreal, but if the teachings of history are to be regarded, the route by Lake St. Louis, which enables all existing facilities and the sites of the manufacturing and trading companies to be reached to the best advantage, will unquestionably be adopted. The Back River may subsequently be opened up to furnish facilities and accommodation for manufacturing concerns of great magnitude that may in the future desire to establish themselves near this commercial centre.

The canal location near Montreal is necessarily affected by the greater engineering problems of the city, of which