

fillers suitably printed and ruled for transit, stadia and level work were provided. The loose leaves lent themselves readily to a simple filing system on which the records of the survey were properly grouped and were at all times available for instant reference.

The finished tracings were forwarded to Ottawa as completed, where immediate study was given to the design of a comprehensive power system utilizing the river's possibilities to maximum advantage.

Upon the completion of the tentative study of the layouts, a further reconnaissance was made of the actual sites selected, and additional details as to rock surface, etc., were secured.

General Conclusions.—The general conclusions reached as a result of the entire investigation are that full realization of the power resources of the Winnipeg River in Manitoba is possible only through an exhaustive measure of run-off control, and feasible only through the establishment of storage reservoirs in the upper watershed. Due to the conflicting requirements of the lumber, fishing, navigation and power interests represented in the watershed, a proper run-off control satisfactory to all can best be insured by some central governmental authority possessing the full confidence of all interests affected, and having entire authority over all questions affecting lake, reservoir and pond levels, and over all questions of river flow and of discharge requirements.

This authority can only be properly exercised through government-owned or operated storage reservoirs. In conjunction with this control, full realization of the power resources of the Winnipeg River in Manitoba is only attainable by a power system in which each developed site forms a component link in a comprehensive scheme looking to the development of the entire river reach. Due to the interdependence of a series of hydro-electric plants, such as is proposed, and to the conflict of head and tailwater elevations, satisfactory operation can only be realized through an independent supervised control over local pond regulation. The full conservation of the power resources of the watershed requires also the institution throughout the watershed of a systematic policy looking to a proper preservation of the forest cover which now so effectively assists in the natural regulation of the river flow. Consistent steps to these ends have already been taken by the Dominion Water Power Branch.

In laying down a complete system of hydro-electric development for the power reach, two outstanding features compel first consideration, *i.e.*, the existence of the two hydro-electric undertakings of the Winnipeg Electric Railway Co., and of the city of Winnipeg, respectively. With these two plants already in existence, and after fully protecting their interests in all respects, it has been possible to divide the remainder of the river drop into seven concentrations for power development, having a total possible output of 175,000 continuous 24-hour horse-power available at 75 per cent. efficiency under the present unregulated minimum flow, and 313,000 continuous 24-hour horse-power available from the proposed 20,000 second-foot dependable minimum flow under regulated conditions.

Including the two existing developments, the total resources of the power reach at nine sites are 249,000 and 418,000 continuous 24-hour horse-power under the above respective conditions of flow.

As these totals are given in terms of 24-hour power, they give a rather limited estimate of the river's resources, particularly in view of the fact that each proposed plant has ample pondage facilities to handle any peak load which may be anticipated. What

may be called commercial output might, therefore, be considered as very greatly in excess of the above figures.

[NOTE.—The reader's attention is called to the brief advance review of this report that was published in the June 1st, 1916, issue of *The Canadian Engineer*, containing some data to which the above is supplementary; also to the seven-page article in the February 12th, 1914, issue of *The Canadian Engineer*, in which was included a plan of the existing sites and possible sites on the Winnipeg river, a profile of the river, and views of the following falls: Seven Sisters, Second McArthur, Pine, Silver, and Grand du Bonnet.—EDITOR.]

TESTS OF FLAT SLAB CONSTRUCTION.

W. W. Pearse, city architect and superintendent of building of the city of Toronto, will co-operate with Prof. Peter Gillespie, of the University of Toronto, in conducting a test of the flat slab construction at the new Simpson warehouse, Toronto. The test will be quite extensive and will cost approximately \$1,000. An endeavor will be made to determine accurately the stresses in the concrete and in the reinforcing steel.

The Simpson building is designed according to the Chicago by-law. The test will be completed in August, 1916, and later in the year a similar test will be conducted in connection with the new factory building for the T. Eaton Co., Toronto, which has been designed in accordance with the Philadelphia by-law. These two tests should give a most interesting series of comparable results.

SHIPBUILDING IN BRITISH COLUMBIA.

The British Columbia Legislature is considering a bill to aid the development of the shipbuilding and shipping industries in the province. Two schemes are embodied, one providing for assistance in the building of wooden ships, and the other a bonusing of cargoes taken from British Columbia ports for ten years after the conclusion of the war. A commission of three is to be appointed for the administration of the act, one of whom is to be the Minister of Finance, who will be unpaid, the other two being salaried. The scheme for providing financial assistance for shipbuilding covers advances to the extent of 55 per cent. of the value of the plant and of whatever ships may be built, and will be for a period to be determined by the commissioners, who will exercise considerable control over the construction and subsequent operations of vessels so built, which will remain under the commissioners' control in the same manner until the loans are repaid in full. The second form of assistance is designed to keep the vessels under the commissioners' control returning to British Columbia, to ensure an outlet for British Columbia products. It is proposed to grant a bonus of \$5 a ton for ten years on all cargoes, based on the dead weight, taken from British Columbia ports. The administration of the act, when it becomes effective, will be almost solely under the Government control, as practically every act of the commissioners is subject to an order-in-council.

An immense amount of construction work is going on behind the French lines. All old highways are kept in perfect repair and thousands of miles of new roads are constructed. In the region called the Champagne Pouilleuse the road question was a particularly difficult one. Loads of stones were swallowed up without much effect. So logs are laid side by side and corduroy roads built. There are hundreds of miles of these corduroy roads and over them pass heavy artillery, motor trucks filled with shells and other large vehicles. In this district the military engineers have had to bore hundreds of wells, for good water is a rarity. To do this, gangs of professional well sinkers were selected from the mobilized soldiers, and the country is now covered with their cases.