Minister of the Interior and the Power Company, that this water so stored on Lake Minnewanka will be used jointly by the Calgary Power Company and the various other power users on the Bow River which may be established under future agreements with the department, the Minister having the right to control the operation of the dam.

As to the actual water supply available for power purposes, the department has taken advantage of the construction of the storage dam to secure therefrom a

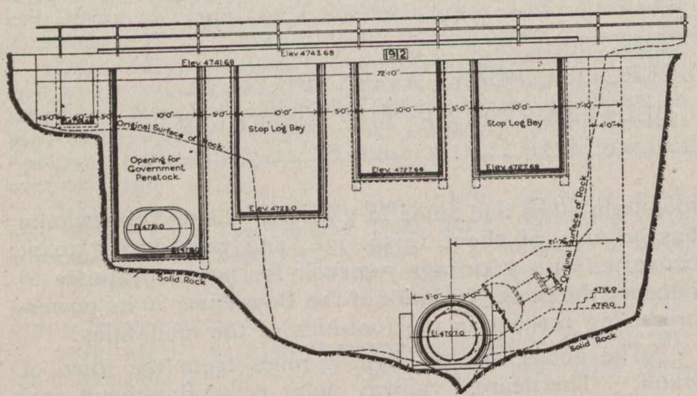


Fig. 3.—Upstream Elevation of Dam.

continuous supply of at least 150 cu. ft. per sec. throughout the year.

At those seasons of the year when the river is naturally in flood, the dam would be impounding water, but it is expected that the lake reservoir would be full to its allowable height, usually by July 15 at the latest; after that date there would be water wasted over the spillways of the dam, gradually diminishing in quantity to the end of the summer. Measurements over several years during July, August and September, indicate that at least 200 sec.-ft. can be obtained for power purposes, independently of the storage process. During the early summer this amount can readily be made available during the filling process. In the autumn months a natural supply of practically 200 cu. ft. per sec. can be depended upon, while in winter, when the storage is called upon to supply water for deficiencies, the available water under the agreement mentioned above can be increased from 150 to 200 sec.-ft. by increasing the height of the storage or lowering the level of the draw-off. Thus 200 sec.-ft. would be continuously available for 24-hour use, and the proposed works are designed for the possible use, during peak requirements for short periods under exceptional conditions, of 330 cu. ft. per sec.

Power Obtainable.—The storage dam now built has been arranged so as to provide a headworks dam and intake for securing the water for power purposes, and provides about half the total head of water contemplated in the development. The other half is in the natural fall of the river itself in the intervening distance between the dam and power station sites.

The nature of the dam, being primarily for storage, provides for the necessary fluctuation of Lake Minnewanka levels. This fluctuation, while varying the head available for power purposes, does not unfavorably affect the power to be obtained when considering the commercial side of the undertaking, because the low-water level, and consequently the low working head will occur in the winter and spring periods when the demand for power is less than at midsummer. On the other hand, when the demand will be at a maximum for this plant in the tourist season, say, during July and August, the storage basin will be filled to its maximum, and the head, and consequently the power, to be obtained will be at a maximum. As both the head obtainable and the amount of water available will both be at a maximum in July and August, when most needed, the obvious type and design is one which would have a capacity utilizing the maximum head and 200 cu. ft. of water per sec., with provision for over-development in capacity capable of using up to 330 cu. ft. per sec., as stated.

The gross head of the development with the storage basin filled to its highest level, is about 64 feet, of which we compute 60 feet may be taken as the effective head on the turbines. Under these conditions, at least 1,800 h.p. can be obtained in electrical output at the power station as a maximum capacity such as might be required at "peak load" periods. This power, after transmission to Banff, will be reduced to about 1,500 h.p. net, ready for delivery to the consumers.

In order to secure this capacity of plant, it is proposed to at first construct all the general works, including the power station, to the full ultimate capacity. As, however, it is anticipated that this total amount of power will not be required in Banff in the early stages of the undertaking, it is proposed herein to place power equipment in the power station for only 2/3 of the above capacity—that is, to install only two of the three power units at present. The initial development will, therefore, provide about 1,000 h.p. in Banff.

Method of Development.—The head dam, already constructed, is at the head of the rocky canyon and is a solid concrete structure, having facilities for discharging water either over its crest through stop-log spillways or through a low level in a sluiceway closed by a gate valve. It is also provided with an intake, a stop-log opening and a forebay into which a steel penstock thimble, 5 ft. in diam., is inserted ready for connecting in the future to a penstock or flume to lead the water to the power station. This thimble has an up-stream size of 8 x 5 feet, to serve as an intake, and reduces to 5 feet in diameter, which will enable a species of Venturi water meter to be established for measuring the water used. The necessary works for the development of power commence, therefore, at the outer end of this thimble which is already in place. The intake and penstock are set at a sufficiently low level to accommodate any level of water between the limits in which the storage basin will fluctuate.

It is to be noted that with the drawing down of the water above the dam the head will be reduced, but this will occur at a season when the demand for power will not be great.

Penstock and Flume.—It is proposed to lead a 7-ft. steel pipe from the present thimble along the cliff a short distance and then enter a 7 x 8-ft. tunnel cut in the rock on the south side of the river, and emerging at the lower end of the canyon. It is not anticipated that this tunnel will need to be lined except in the bottom and sides to offer a smooth course for the water flow.

The penstock is proposed to span the canyon as a 7-ft. diam. steel pipe, supporting itself at a height about 15 ft. above the water. From this point it is proposed to carry the penstock down the north bank as a wooden stave flume of 7-ft. diam. under pressure, and set in a partial excavation. At one point this will require to be supported for about 150 ft. on concrete piers. At the lower end the flume would be buried beneath the station yard.

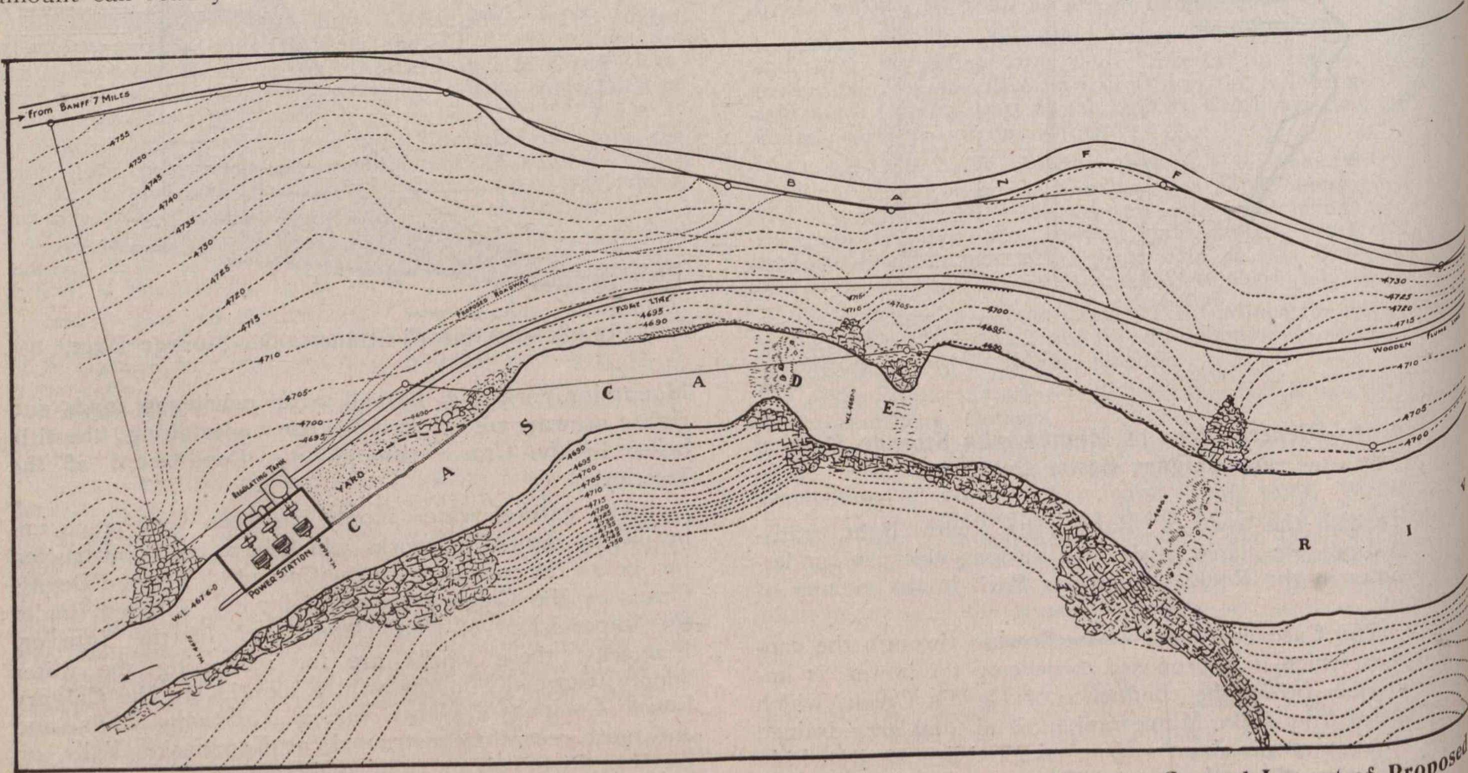
The lower end of the flume would consist of steel, 7-ft. diam., and would have three 48-in. steel feed pipes fitted with valves leading to the three power units in the power station.

In order to secure adequate hydraulic regulation through the long penstock a surge tank, 14 ft. in diam. and 55 ft. high, is proposed, having its top at about 8 ft. above the highest storage water level in the lake. It is proposed to house this tank for protection against freezing, as well as for architectural appearance.

Power Station* and Equipment.—This station is proposed to be of either concrete or brick set on concrete foundations, built entirely fireproof and adapted to continuous operation at all seasons. It is necessary to construct river walls on the outside of the station, the lower to protect the tail-race and the upper to afford a station yard and protection from any high water in the river.

It is proposed to ultimately install three power units, each consisting of a 600-h.p. turbine and a 350-kw. generator, together with an exciter unit direct connected. In the initial development it is proposed to install only two power units and the exciter unit capable of gen-

* In *The Canadian Engineer* for May 7th, 1914, there appeared four competitive architectural designs of this power station.



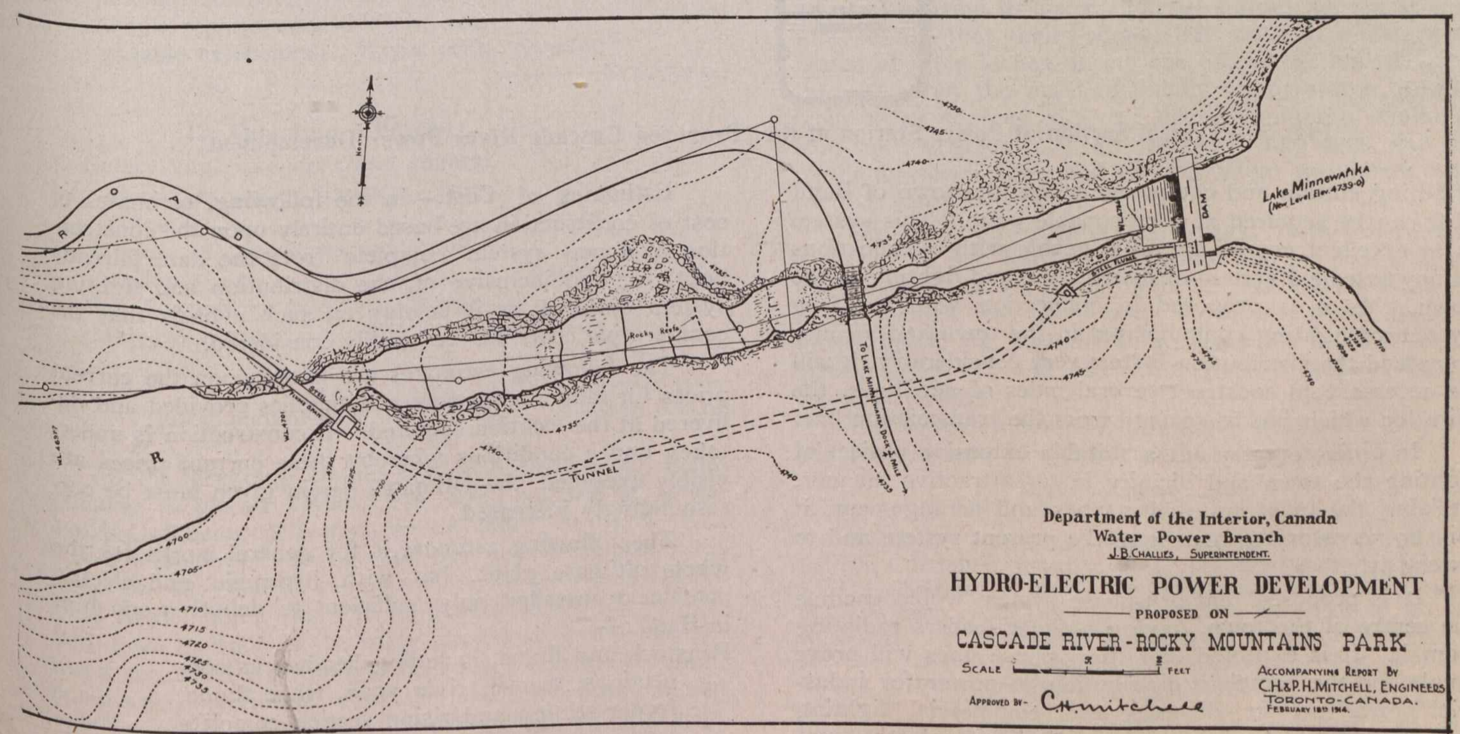


Fig. 4.—General Layout of Proposed Development on the Cascade River.