a cut-off is made 10 feet deep across the upper face and another 5 feet deep across the lower side. In addition, a concrete apron, 25 feet wide, protects the bottom from scouring under the driving water at entry, and a 50 foot wide apron below prevents wearing away of material by the rapidly leaving flow.

The Ontario bed is boulder strewn with hard material beneath, but the work done in the Quebec channel, before the cofferdam failed (May, 1911), indicates a sand, hard, but easily saturated. Through this material, the seepage

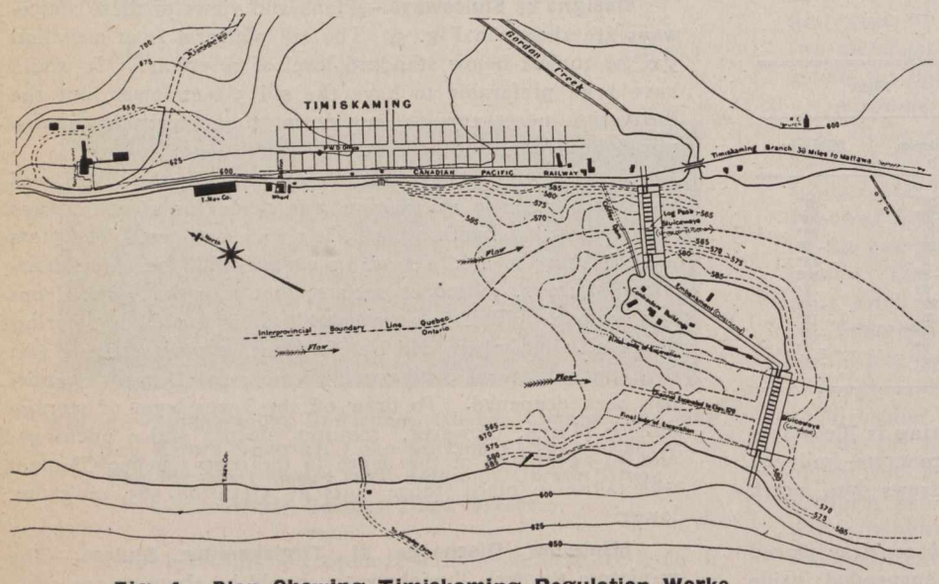

Fig. 4.—Plan Showing Timiskaming Regulation Works.

was all that four large pumps could conveniently manage. The foundation for the Quebec side will consequently be modified and include sheet piling beneath the cut-off wall. In fact, it proved impracticable to excavate the cut-off trench 10 feet deep in the sand, although the boring pipes were broken in piercing the undisturbed bed.

The depth to which a cut-off should extend in sand is debatable, but accepted practice is to go as far below the bed as the water surface is above.

Head water will soak the foundation, but cannot move the sand so long as it is boxed in or held by friction. If head water penetrates beneath the dam, then it buoys up the sand below and the tail water carries it away so rapidly that a cellar is formed.

Cofferdam, Quebec Channel.—After the middle of September, 1910, practically all the work was in connection with the cofferdam across the Quebec channel.

The type decided upon by the contractors was stone filled cribwork sunk to place and sheeted along the upstream face with plank. Round timber was procured from the Hawkesbury and Edwards limits near the work, and by the 17th October, the dam was half way across (210 feet). It was intended to unwater only half the channel and about 30 feet of cribwork was built down stream, but heavy rains caused an unusual rise of 5 feet and work had to cease. This brought most of the work on the dam to a stand-still, but sand was hauled and stone crushed which still remain stored upon the ground. The cable way was moved to the Quebec channel and put in working order by the middle of November, thus obviating the use of scows to cross material to the island. With a view to laying concrete during cold weather, arrangements were made to build a shed, 400 long and 60 wide, enclosing all the piers. Lumber was delivered for this, but owing to delays with unwatering, the shed could not be erected

To ensure immediate excavation of the foundation, orders were given to bring the steam shovel across the island. This machine had been left in the water since the Ontario cofferdam was cut in November.

Excavation continued in the island abutment, but leakage from the river through the fine sand stopped work several times, although a sheet pile bulk head was built, and a steam pump installed. Slips constantly occurred from the sides of the pit till finally, on 20th November, the river side burst in, when the excavation was to grade and only the cut-off trenches remained to be dug.

Lake Timiskaming continued extraordinarily high for the season, although the Kipawa River flow was shut flow was shut off by the Department's dam at that place. On 18th November, the Ontario cofferdam was blown out and the lake surface began to fall 2 inches per day. This had not been opened before, because the contractors were tendering for the excavation in the channel. The current soon scoured out between the south end of the dredge cut and the north end of the contractors' work passing a good flow through the sluiceways for the first time.

It was January, 1911, before the cofferdam was put under way again, when it was raised about two feet and track laid on top to carry stone filling and other material.

The lake had by then lowered three feet, so with a falling river, it was decided to cofferdam the whole channel and cribwork was begun from the Quebec shore. The advantage is that this method allows the foundation slab and cut-off walls to be built without joint. With a cofferdam half way across, the part parallel to the current requires to be a double crib with clay in the middle. Otherwise, the current will scour away staunching material from the exposed face, and in this case a boulder bottom prevents the driving of sheet piles.

An inexperienced force, cold windy weather, and the swift current made crib setting very slow and several cribs were lost by upsetting or breaking away of tackle.

By the first week of February, the new cribwork was connected to that built in October, and by the middle of the

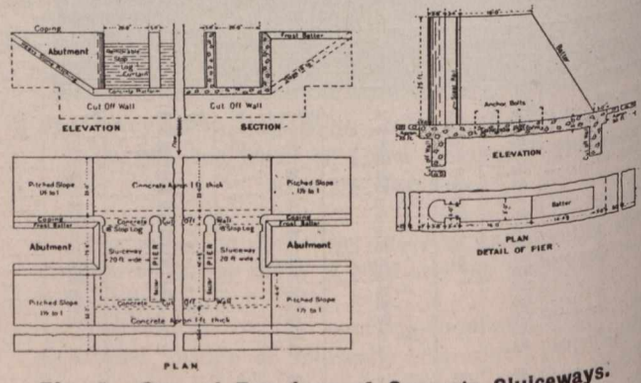

Fig. 5.—General Drawings of Concrete Sluiceways.

month the upstream face was sheeted with two thicknesses of boards. Large boulders upon the river bed made it difficult to closely fit the cofferdam to the bottom and cribs sometimes came to rest with one corner tilted over. No trench was dug in the river bottom into which to bury the ends of the face plank, because a diver could not work in the strong current. Instead, a bank was deposited along the front of the cofferdam, but the only earth available was fine sand that made a slurry in water.