

ment of the aqueduct in accordance with his previous remarks. Over his signature he stated: "I recommend the adoption of project D at an approximate cost of \$1,900,000, to produce a minimum of 10,000 h.p. at all seasons, that is 7,000 more horse-power than provided for at the beginning of the project, of which 3,000 h.p. would be applied to pump an extra 50 million gallons of water, leaving 4,000 h.p. which could be utilized for other municipal requirements (lighting buildings, streets, parks, etc.) and can be considered worth \$25 per h.p. per annum, whilst the cost of production would not cost over \$12.62 per horse-power as established in my estimate hereto annexed."

It was decided to adopt Mr. Janin's suggestion, and new tenders were called for the further excavation work required. The Cook Construction Company were the low bidders, and started work in July, 1913. The amount of their contract was \$2,232,000, or \$332,000 more for the excavation work than Mr. Janin had estimated. But this was only the beginning of the expansion of the cost, which is now estimated by the city at \$8,000,000 and by other engineers at various sums ranging as high as \$10,000,000 to \$12,000,000. A resumé of the gradual growth of the costs on this work is interesting.

Estimated Costs.—According to Mr. Janin's report of February 27, 1905, and March 18, 1907, \$2,132,000 was required in order to develop 2,000 h.p. at low water in the winter season, or 5,000 h.p. in the summer. (Mr. Janin later on refers to this scheme as a 3,000-h.p. development.) This was made up of the following items:

Conduit	\$ 660,000
Suction well	20,000
Intake pipes and pier	75,000
Excavation, stop gates, bridges, fences, etc...	817,000
Purchase of land	20,000
Widening and deepening tailrace	45,000
Wheel house, new pumping machinery, buildings, etc.	300,000
Unforeseen expenditures, superintendence, expropriations, surveying, etc.	100,000
Increased cost of pumping by steam water now pumped by water wheels, during three years of construction	95,000
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	\$2,132,000

In November, 1910, after \$2,000,000 had been appropriated to carry out the above work, Mr. Janin asked for another \$675,000. As the original appropriation was \$132,000 short of his requirements, and as \$60,000 of the appropriation was spent for a new steam pumping engine, Mr. Janin was really increasing his original estimate by only \$483,000 in asking for this vote of \$675,000. Mr. Janin said this additional sum was required on account of purchase of land at \$4,000 an acre instead of \$1,000 an acre, as previously estimated; Hering & Fuller's consultation charges, \$12,000; double line of pipe from intake out into the St. Lawrence River, etc.

In this same report Mr. Janin again urges the development of another 7,000 h.p., and says: "Cost of producing 7,000 h.p. more than provided for in present project, as follows:

"Enlargement of aqueduct	\$1,900,000
"Enlargement of tailrace	50,000
"Machinery, turbines, pumps, etc.	250,000
"Buildings, foundations, weirs, etc.	100,000
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	\$2,300,000

Thus, the estimate at that date for the 10,000-h.p. development was \$2,132,000 plus \$483,000 plus \$2,300,000, or a total cost of \$4,915,000.

By 1913, however, this figure had grown considerably. The purchase of property by expropriation was estimated at \$175,000. The estimated cost of enlargement of aqueduct and tailrace was increased by no less than \$850,000. An item of \$50,000 was added for direction and superintendence of the work. Bridges, fences, etc., required an additional \$175,000. Regulating gates, deepening approach channel and further jetty construction, etc., added \$450,000. The item for power house and equipment, however, seemed to be reduced by \$100,000. This all meant an addition of \$1,600,000 to the previously admitted cost of \$4,915,000, or a total cost of \$6,515,000.

City Engineer Janin went to the war, as an officer in the engineering corps, and his work is being carried on by Mr. Paul E. Mercier, deputy chief engineer of public works. Mr. Mercier reported to the Board of Commissioners on June 16, 1915, that still further outlays would be required on account of the aqueduct enlargement.

A retaining wall at Bond Street would cost \$25,000. Purchase of property required an additional \$25,000. The cost of enlargement of the aqueduct was increased by \$212,562. Direction of the work was increased by \$37,864. To prevent flooding of the property adjacent to the aqueduct, it would be necessary to construct drainage ditches costing \$25,000. Surface drainage would have to be carried across and under the head of the canal by culverts, costing \$15,000. Fences required \$35,000. Eleven concrete bridges were found to be necessary, at an increased cost, for this item, of \$370,000. The jetty construction cost was raised by \$25,000. To regulate and control the flow of water into the aqueduct, it was found that entrance gates must be provided at a cost of \$100,000. The item for power house and machinery was re-estimated at \$1,500,000, an increase of \$950,000. A new item—boulevards—appears in the cost sheet at \$125,000. Thus a total of \$1,945,426 was again added to the proposed expenditure, making the total admitted cost \$8,460,426.

At the present time it is stated at the city hall that the boulevards will cost \$200,000, or \$75,000 more than estimated last June, and Mr. Mercier states in his June report that a necessary change in strength and design of the walls of the aqueduct will cost an additional \$565,000. Yet the amount added to the 1913 estimate for this work falls short of this \$565,000 by the sum of \$352,438. Adding these items to the total cost, brings the sum to \$8,887,864. It is also stated that further land is required on account of moving the centre line of the aqueduct further away from the conduit, but it is unknown just how much this land will cost.

Claims have been filed with the city by the Cook Construction Company for rental of machinery which has been idle for upwards of two years on account of the city not obtaining certain rights of way. These claims total about \$250,000.

In December, 1913, a section of the conduit broke owing to the work being done in enlarging the aqueduct. The cost of repairing this break and safeguarding this conduit for about 2,000 feet, and the cost of an extra intake from the Lachine Canal, which had to be constructed for auxiliary supply, were paid for by the city and are understood to have amounted to about \$400,000. Adding these items, both of which are directly chargeable to the