MONTREAL AQUEDUCT REPORT

Steam Plant Would Have Been Better Than Enlargement—Report by Messrs. Vautelet, St. Laurent and McRae

(Continued from last week's issue.)

IN the case of abandoning the power development, there is no land available for boulevards and the aqueduct is used only to bring water to the pumphouse of Atwater Avenue.

We have, however, included the cost of finishing the south wall to the rock cut to correspond to the north wall ($43,300) to allow of the completion of the aqueduct at some future time, if it is ever deemed advantageous.

We have also included an arbitrary amount of $279,575, being 15 per cent. of the cost of the uncompleted part of the contract. This amount may be increased or decreased in the final settlement with the contractor.

We have included, as we have done in all cases, the interest until the completion of the work, although the city is not allowed to charge interest to capital account. In this case it amounts to $1,072,948. We have estimated the cost of abandoning the work at $5,895,000.

Scheme 1.

Present city scheme, but with mean velocity in headrace limited to 1.5 feet per second.

From the preceding considerations in studying the power obtainable, as based on the present plans, under winter and summer conditions, leaving out the question of frazil, we have assumed the mean velocity at 1.5 feet per second (1.02 miles per hour) in the headrace, on account of the nature of the earth bottom.

As it is intended to provide a substantial paving for the bottom of the tailrace, a velocity of 8 feet per second (5½ miles per hour) will not be excessive, and we have adopted this figure as the maximum mean velocity in the tailrace.

It is assumed that in winter there will be an ice covering of two feet in the headrace, though it is possible that during excessively cold winters, a slightly greater thickness of ice may form.

In the tailrace, on account of velocities being higher than 3.5 feet per second (2.4 miles per hour) there will be no ice covering in winter.

This power has been calculated for normal conditions, winter and summer respectively. Floods and frazil will cause unfavorable conditions from time to time, probably every year, either on account of loss of head or decreased flow, and it is to be distinctly understood that at such times the power stated will be considerably reduced. The only remedy against floods and frazil troubles is an auxiliary steam plant which must form a necessary adjunct to the water power scheme under consideration.

We find that for the limiting velocity of 1.5 feet per second (1.02 miles per hour) in the headrace, and under other conditions mentioned above, the power available, as based on the lowest winter month, and the lowest summer month average gauge readings respectively, at both entrance and outlet gauges, is as follows:—

Winter	7,445 h.p.	5,600 e.h.p.
Summer	11,900 h.p.	8,900 e.h.p.

The headrace is the controlling factor in both cases; that is, the tailrace, as designed and paved all through, is large enough to pass all the flow of the headrace, with velocities well under the limit of 8 feet per second as fixed. In fact, the highest velocity produced in the tailrace under this scheme will not be over 6.2 feet per second.

We have assumed that the summer power of 11,900 h.p. will be available for 7 months, so that during the 5 winter months the power of 7,445 h.p. will be available, say, for 2.6 months, and that there will be no water power available for the balance of the 2.4 winter months, pumping during the periods of deficiencies being done by the auxiliary steam plant.

We have shown before that the city will, in the near future, need to pump a daily average of 100 million Imperial gallons of water for domestic supply. The power required for pumping this quantity of water will be 8,570 h.p.

In this scheme there is no paving provided for the headrace and as paving will certainly be required in a good many places, the velocity could then be increased. If this were done, Scheme 1 would practically become Scheme 2.

The filtration plant at its present capacity of 50,000,000 Imperial gallons per day when placed in operation will require 2,960 h.p. for pumping and for electric heating, as at present installed. When it is increased to a daily capacity of 100 million gallons, the power required for both pumping and heating will be 3,270 horse-power. The filtration plant could be heated by exhaust steam from the auxiliary plant at a greatly reduced cost, as compared with electrical heating.

With this change in the heating system the filtration plant will require 1,910 h.p. for pumping when the capacity is increased to 100 million gallons per day. The plant under Scheme 1 must then produce power as follows:—

Needed for pumping 100 M. I. G. per day...	8,570 h.p.
Needed for elec. current for filtration per day	1,910 h.p.
Total	10,480 h.p.

During the summer period, say, for 7 months, the water power development will take care alone of the above requirements. During the winter period the development will require the help of a steam auxiliary, and our estimate for the scheme to meet all conditions is given below:

	Total cost.	Operation cost.
Actual needs	$8,537,000	$590,000
Future needs	9,177,000	679,000

The amounts charged for interest are, in the first case $1,200,744, and in the second case $1,231,234. This project includes the cost of land for boulevards and the cost of Lasalle Bridge.

Scheme 2.

Winter power, 13,000 h.p.; summer power, 24,500 h.p.

In Scheme 2 we have considered possible improvements to the present scheme, and have studied the conditions which will give a maximum practical hydraulic development for the city. This scheme is based on the following assumption and alterations to the present scheme:—

The headrace remains the same, excepting that the earth sections are paved with concrete and the sides of the rock cut below the gravity walls given a straight and smooth concrete facing instead of the irregular concrete finish called for by the specifications.