

of the hill is 152 feet above the general elevation of the city. This pinnacle, however, is limited in area, and slopes rapidly in every direction. The hill is of sand, and reservoirs and other works erected upon it would demand careful construction.

In this project it was proposed to locate the pumping station on the Prison Farm (Sec. 33) or in that vicinity, pump the raw water to Rabbit Hill, where sedimentation basins and filtration works were to be constructed, also a clear water reservoir, the clear water to flow by gravity to the city. In his criticism, Mr. Chipman refers to several weak points in this proposition. In the first place, turbid water should not be pumped through a long pipe line. The sedimentation basins and filtration plant should be located as near the pumping station as possible, and such works will occupy a considerable area of ground, when the city attains 200,000 population. The elevation of the ground at the Prison Farm does not furnish an ideal pumping site, the flats below the escarpment being below flood level. The pumping station might be constructed near the river at a point above flood level, the water pumped to basins on the plateau above, treated there and returned to the pump-house below.

From the pump-house the water would then be pumped to a clear water basin on Rabbit Hill, with not less than five millions of gallons capacity. The topography of the hill is such that it would be practically impossible to construct a reservoir of more than ten millions of gallons capacity. From the reservoir, the water would flow to the city by gravity. The static pressure on the north side of the city from the reservoir would be 130 feet or 56 pounds, but with ten million gallons flowing through one 36-inch main, the friction loss would be 16 pounds at the centre of the city. In the outlying sections the loss would be from 20 pounds upwards, depending upon the consumption and the size of the mains. With twenty millions discharging through one pipe, the friction loss would exceed the head from gravity. Three conduits would be then required—two for constant service, one for reserve—in order that 30 pounds to 40 pounds might be available for average domestic supply, as pointed out previously. The maximum rate may double the average and the fire supply must also be provided; that is, with a population of slightly over 100,000 the capacity of the conduits should approximate twenty million gallons.

The elevation of Rabbit Hill would not be sufficient to give a proper pressure or supply when the population exceeds 100,000, without additional conduits to the city, each of which would cost about half a million dollars. Better service can be given with much less expenditure by direct pumping, the pressure on the pumps being increased or decreased in proportion to the demands for water.

In the Rabbit Hill scheme, also, about two and one-half miles of conduits would be required between the pumping station and the river, the friction loss in which would increase the operating expenses. Assuming this system in operation, with three conduits leading from the reservoir, the pressure might be increased by one or more booster pumping stations located within the city, but this would be an expensive and complicated arrangement.

**Criticism of the Beaver Hills Project.**—The Beaver Hills are situated to the southeast of the city, distant approximately eight miles from the Parliament Buildings. These hills extend for some miles from northeast to southwest and on Section 16, Twp. 52, R. 23, the elevation of ponds near the summit of the enclosing ridges is about

200 feet above the city. A previous report suggested this location as a suitable reservoir site.

In this proposition raw water was to be pumped to large open reservoirs to be constructed among the hills, the natural ponds to be excavated, cleaned out and embanked where necessary. The first reservoir would act as a sedimentation basin from which the water would flow by gravity to filters thence to large open clear water reservoirs. Hundreds of millions of gallons of pure water stored at an elevation of 200 feet above the city appeals to the average citizen as an admirable waterworks scheme, eliminating for the present the matter of cost. There are, however, many points to be taken cognizance of that are not apparent to the layman. First, as stated under the Rabbit Hill scheme, turbid water cannot be pumped through long mains without causing trouble, sooner or later. Secondly, in open storage reservoirs, vegetable growths will cause offensive odors and tastes at certain seasons. Thirdly, the static pressure of 86 pounds would be reduced materially by friction loss, and the head required for filtration; and fourthly, the cost would exceed that of the Rabbit Hill scheme.

If this project were carried out, the raw water should be sedimented and filtered at the pumping station, then pumped to clear water reservoirs in the hills. The distance from a suitable pumping station site above the city to the proposed reservoir would not be less than eleven miles, and in addition conduits would be required leading from this conduit line or from the reservoirs to the city. The cost of the pumping station, filtration work, etc., would be practically the same as in the Rabbit Hill scheme, also the cost of the reservoirs, but the conduit lines would be about double the length and, therefore, double the cost.

**Cost of Extensions to Existing System.**—An estimate of the cost of the improvement proposed in the report is as follows:

First outlay at pumping station (new works necessary to guarantee a continuous service for a population of 100,000 people) .....	\$ 330,000
Large distributing mains (also necessary for present requirements) .....	550,000
Second outlay at pumping station (additional works to provide for a population of 150,000) .....	460,000
Third outlay at pumping station (further additions to provide for 200,000 population) ..	390,000
Total .....	\$1,730,000

**Cost of New Works.**—On the assumption that the city decide to locate a new pumping station at some point southwest of the city limits, the capital expenditure is estimated to be as follows:

Outlay at existing station (immediately required, as in alternate case) .....	\$ 330,000
Large distributing mains (also required forthwith) .....	550,000
Outlay at new station, and one conduit pipe to city .....	980,000
Second outlay for 150,000 population .....	800,000
Third outlay for 200,000 population .....	250,000
Total .....	\$2,910,000

The proposed new station, with its equipment, and the additions necessary to the present system, would