

filtration. The capital cost of the project would be excessive. Further, it would only be a waste of time and money to investigate the possibility of securing a water supply from small streams and lakes or from deep wells. The city requires an unlimited supply of water, suitable for domestic and industrial purposes, delivered at a reasonable cost. This can only be supplied by the Saskatchewan River which flows through the city.

Quality.—Above the city the river water is free from sewage pollution, and there is no immediate prospect of cities or towns springing up upon the main stream or any of its tributaries between the city and the Rockies. The most serious objection to the river water is its turbidity, in which respect it resembles the Missouri at St. Louis, the Ohio at Cincinnati, and the Red River at Winnipeg.

During the months of May, June and July, 1911, the turbidity ranged from 5 to 850, and the solids in suspension from 167 to 2,260. During the same months in 1913, the turbidity ranged from 40 to 950, the average being 215.

The melting snow in the mountains during hot days or heavy rains produces great fluctuation in the river, from ten to twenty feet being the difference between low-water and high-water. In 1899 a level of 35 feet above low-water was attained, the highest observed since a traditional flood about sixty years ago.

High water is invariably accompanied by high turbidity, due to the caving in of cut banks. But during the late autumn and winter months, when the river is ice-bound, the water is clear, and for a month or more after the ice leaves the turbidity is low.

By the simple process of sedimentation, 95% of the solids may be removed, and the remaining 5% by filtration, the effluent being clear and sparkling. With a turbidity approaching 1,000 in July, 1913, the effluent from the filters was perfectly clear.

The hardness varies from 50 to 100 in the summer months, and the alkalinity from 100 to 200.

Recently bacteriological examinations of the river water have been made at the Provincial Laboratory, and show a high bacterial count. Sedimentation and filtration remove a large percentage of these bacteria, but treatment by hypochlorite of lime is relied upon to destroy those remaining.

The typhoid outbreak which occurred in September, 1912, was not attributed to the public water supply by the health authorities. The cause, however, has not been determined, and there is a likelihood that the water supply may have been contaminated, as the filtration plant was not working satisfactorily at all times. This season, however, the treatment of the supply is receiving more careful attention and the typhoid rate is below the normal.

Quantity.—The average quantity of water required for all purposes in cities of 100,000 population is about one hundred gallons per capita, where the services are unmetered. In metered cities the consumption varies from fifty to seventy-five gallons, the average being about sixty-six gallons; that is, by metering the capacity of the entire plant is increased by fifty per cent. As Edmonton is now an unmetered city, the consumption may be taken at one hundred gallons per capita.

At the present time about 40,000 people are supplied from the waterworks system, which is approximately sixty per cent. of the population. The maximum daily consumption frequently exceeds the average by fifty per cent., and the maximum rate of consumption may be double that of the average for the year.

The approximate quantities of water necessary for a city supply is presented below in tabular form, for different populations, where the supply is by the direct pumping:

Population	70,000	100,000	150,000	200,000
Gallons, daily average	4,000,000	6,000,000	9,000,000	12,000,000
Gallons, maximum average	8,500,000	12,000,000	18,000,000	24,000,000
Fire streams required	21	25	31	35
Rate for fire supply	6,000,000	7,000,000	9,000,000	10,000,000
Total rate	14,000,000	10,000,000	27,000,000	34,000,000
Underwriters' requirements	14,000,000	17,500,000	24,500,000	30,000,000

River Pollution.—The Saskatchewan, like all rivers in an agricultural country, is polluted to a certain degree by surface drainage, and in the growing district surrounding Edmonton, this pollution will increase until the country is fully settled. This surface pollution cannot be prevented. Further, the April break-up of ice in the river, which has served as a highway during the winter months, produces a serious pollution for some weeks. This cannot be prevented, either. Both of these sources of pollution are more intense at the present waterworks intake than at points farther up the river, outside the city limits.

The greatest danger from pollution, however, is from storm water discharging directly into the river, conveying into it street washings, catch basin contents, etc. Likewise, domestic sewage may find its way into the river. Such dangers will increase annually. Disease germs therefrom cannot be entirely eliminated by sedimentation and filtration, although those remaining after such process may be destroyed by hypochlorite treatment. Not being in accord with the theory advanced recently that because it is possible to sterilize an impure water, it is therefore perfectly safe to adopt a cheap polluted water supply and trust to filtration and chemical treatment to insure safety, Mr. Chipman recommends that the future water supply for Edmonton be taken from the river at some point above the city limits. This conclusion is based upon a preference to secure the purest water obtainable, whereby less trust need be placed upon the efficiency of purifying apparatus, and chemicals, and the skill of employees.

New Works.—If new works be decided upon they will be of such magnitude that it may require three years for their completion after construction has commenced, while fully one year may be necessary in making surveys, in locating on and securing the land and right-of-way. Preliminary engineering work of this character is frequently so hurried that the best results are not obtained. It will also take time to provide transportation for building materials, plant, machinery, supplies, etc., and the fuel problem must also be satisfactorily solved before proceeding with construction.

To meet the demand for water during the period the new works are under construction, and until they are completed the existing pumping plant must be maintained and extended. The report deals fully with these extensions, a cost summary of which appears in a later paragraph.

Criticism of the Rabbit Hill Project.—Considerable space is given to the consideration of the Rabbit Hill scheme, as described in the previous report of a board of engineers. This hill is situated on Sec. 36, Twp. 52, R. 25, distant about six and one-fourth miles in a straight line from the Parliament Buildings and two and one-half miles east of the river. The elevation of the extreme top