

erected on the highest point in the ward at elevation 382 above the harbor. The daily average consumption is about 2½ million Imperial gallons.

The town of Cartierville, annexed in 1917, and forming part now of Ahuntsic-Bordeaux ward, has its own water supply plant of one million gallons' capacity, consisting of electrically-driven centrifugal pumps and filtration plant. This independent supply is taken from the back river at Cartierville.

The former town of Emard, annexed in 1910, and now part of St. Gabriel ward, has also an independent supply, the water being taken from the city's main supply conduit and pumped, under contract, by an outside company. The average daily consumption is about 935,000 Imperial gallons.

#### Water Distribution System

The city's distribution system of piping comprises 497.6 mi. of pipes from 4-in. to 36-in., as follows:—

Size.	Miles of pipe.	Percentage of total.
4 .....	54.	10.85
6 .....	63.	12.66
8 .....	203.75	40.95
10 .....	48.62	9.77
12 .....	79.47	15.97
16 .....	16.	3.21
20 .....	3.55	0.71
24 .....	16.6	3.34
30 .....	9.55	1.92
36 .....	3.06	0.62
	497.6	100.00

Of this total, it will be noted that the 8-in., 10-in., and 12-in. pipe make up about 332 mi. or about two-thirds of the whole. For many years past the principle has been adopted that no pipe less than 8-in. diameter shall be laid for distribution service in the streets of the city. The mileage of 4-in. and 6-in. pipes shown in the table is mostly of piping in outside wards annexed to the city within the past ten years. The smaller pipes in the system are generally well supported at intersecting streets by pipe of larger diameter, especially in the main portion of the city, thus providing for several effective hose streams in case of fire without the use of fire engines.

#### Filtration Plant

In the city plant a double system of filtration is carried out, that is, the water is first passed through roughing pre-filters before being passed through the regular filter sand beds. The raw water is taken from the main supply conduit through a 9-ft. circular conduit about 1,200 ft. from the lower end of the supply conduit, and is lifted by motor-driven low-lift pumps to the prefilters. There are 16 covered prefilters each of a net filtering area of 1,200 sq. ft. The water passes through the prefilters at a normal rate of 115 million Imperial gallons per acre per day. From the prefilters the water flows by gravity to the final filters. There are 1 final filtered covered beds with a total area of 6 acres. The water passes through the final filters at a normal rate of about 8½ million Imperial gallons per acre per day, and collects in the covered filtered water reservoir which has a capacity of 6 million Imperial gallons.

The filter plant, as already stated, has a normal capacity of but 50 million Imperial gallons per day, and, as the water consumption has reached 65 to 70 millions, it is necessary to enlarge it, and plans are under way for this, the land being available for such extension.

#### Quality of the Water

The water drawn through the intake, 1,200 ft. from shore at the head of the Lachine rapids, is mainly of St. Lawrence River origin. However, as the Ottawa River joins the St. Lawrence at the head of Montreal Island, its waters follow the shore line inside the intake, and at times the supply contains varying proportions of Ottawa water, depending on seasonal and weather conditions. The largest percentage of Ottawa water occurs in May, and its presence is always

indicated to the consumer by its characteristic brown color, but except in the months of April or May, when it carries a high turbidity, this is its only objectionable feature.

The water of the St. Lawrence, from the standpoint of household use, as tapped by the 1,200 ft. from shore intake, is superior in every respect to that found further inshore, and the bacterial content, turbidity and color increase as the shore is approached. The percentage of Ottawa water present in the city supply is indicated by the simple test, determining the alkalinity of the mixture in parts calcium carbonate per million.

The following tabulation of the physical and chemical characteristics of the water supplied during 1919 have been furnished by John H. Harrington, chemist of the water department:—

#### PHYSICAL CHARACTERISTICS, 1919

	High.	Low.	Aver.
Percentage Ottawa water	47 (May)	None (Feb.)	16
Turbidity .....	29 (Apr.)	7 (Feb.)	15
Color .....	38 (May)	6 (Feb.)	18
Bacteria per c.c., 96 hours at 20°—			
Raw .....	12,900 (Dec.)	320 (Aug.)	4,600
Chlorinated .....	57 (Mar.)	8 (Sep.)	19

#### CHEMICAL CHARACTERISTICS MONTHLY SUMMARIES, 1919

	PARTS PER MILLION		
	High	Low	Aver.
	(Feb.)	(May)	
(1) Total solids .....	150	110.2	124.5
(2) Alkalinity (calcium carbonate)..	100	62	87
(3) Magnesium carbonate .....	6.0	4.6	5.5
(4) Sulphates and chlorides of calcium and magnesium .....	16.0	9.5	13.7
(5) Oxygen absorbed, organic and other oxidizable matter ....	3.5	9.0	5.5
(6) Chlorine (combined) .....	6.0	3.7	5.2
(7) Increase of total hardness due to addition of hypochlorite..	1.2	0.24	0.70
(8) (7) expressed as % of (2).....	2.0	0.24	0.80

#### Water Consumption

The accompanying diagram has been prepared, showing the average daily consumption of water for each year for the last 20 years, the population served, the per capita daily consumption for each year, and the area of the city served with water from the city system. The average daily consumption for 1919 was 65,046,000 Imperial gallons, and the estimated population served by the city's system was 449,000, a per capita daily consumption of 145 Imperial gallons.

In the years from 1900 to 1919 the average daily consumption increased from 20,412 millions to 65,046 millions, that is 44,634 million gallons, or 218% increase. In the same period the population served increased from 266,000 to 449,000, that is 183,000, equal to 69% increase. From 1900 to 1910 the average rate of yearly increase of consumption was 1,822 million gallons per day, an average of about 6.6% increase each year. From 1910 to 1914, the average yearly rate of increase was 4.27 million gallons per day, or an average increase each year of 9.6% over the preceding year.

In 1914-15-16 the rate of consumption remained stationary at about 55½ million gallons per day, but in 1917-18, for two years, it rose again at a rate of increase of 4.76 million gallons per day per year, and in 1918 and 1919 remained stationary at about 65 million gallons for each year.

The population served from 1912 to 1919 increased 110,000, that is, from 339,000 to 449,000, an increase of 32.6%. The consumption per capita between 1910 and 1914 jumped from 115½ gallons in 1910 to 150 gallons in 1914, and it has been between 140 and 150 practically since 1912.

It is difficult to explain this increased rate of consumption of water in the past ten years. It is no doubt partly due to more ample use of water in modern house fittings, but it may also be explained by the greater use in manufacturing establishments and the greater quantities required for