The coagulation basins are provided with a two-fold purpose, namely, to furnish a period for the reaction of the coagulant in the water, and for partial sedimentation of the suspended matter. The chemicals generally used as coagulants are alum and copperas. Alum, or aluminum sulphate, is readily soluble in water and if applied in proper proportion to the ordinary surface water will form a sticky gelatinous precipitate called the floc, which in its formation collects the suspended matter and bacteria into heavy masses which readily precipitate. The action of copperas, or sulphate of iron, is quite similar, but this compound requires the addition of lime or soda ash to bring about coagulation. Where alum or copperas are used a portion of the coagulant will pass through the coagulation basins to be removed from the water at the surface of the sand in the filters. Coagulation basins are designed to furnish an ample period for the formation of the floc and an additional period for its partial settling. The necessary time required for this purpose varies with the character of the water to be treated. The modern plants which have been installed in Ohio provide periods ranging from three to twelve hours in the coagulation basins.

The water containing a small portion of the floc next passes through the filters. These are generally constructed as rectangular concrete boxes. A 1,000,000-gallon per day unit will have an area of about 360 square feet. Large plants are laid out with units having a capacity of from 2,000,000 to 5,000,000 gallons. The bottom of the unit is covered with a strainer system over which is placed a layer of graded gravel which supports the sand layer with a thickness from 30 inches to 3 feet. The water is applied at the surface of the sand over which it stands to a depth of two to four feet. It passes downward at the rate of 16 feet per hour, which is equivalent to 2,880 gallons per square foot per day or 125,000,000 gallons per acre per day. The rate of passage of the water through the filter is of prime importance in securing proper efficiency. This rate is regulated and controlled by the use of apparatus which prevents excessive rates of filtration, still permitting the use of the head necessary for operation. The efficiency of the rapid sand filter depends largely upon the collection of the floc at the surface of the sand. This gelatinous substance forms a mesh through which the suspended matter and bacteria contained in the water cannot pass. The resultant effluent from the filter is therefore purified, clear and sparkling. After the filter has been in operation for a certain length of time, depending upon the condition of the applied water, it becomes clogged and will no longer pass the proper quantity of water without excessive loss of head. It is then necessary to wash the filter. This is accomplished by passing purified filtered water through the strainer system and upward through the sand at a velocity of vertical rise of 15 inches or more per minute, the overflow being carried from the filter box through a gutter and connection to the sewer. The washing requires about five minutes and in large plants entails a loss of water of about two per cent. of the water filtered.

Whatever method of filtration is used, the purified water must be stored in covered and watertight receptacles to protect it from secondary pollution. It is customary to construct a clear water reservoir adjacent to and as a portion of the filter plant, where the purified water may be stored before it is pumped into the mains. The size of these clear wells is dependent upon (1) the relation between the capacity of the filter plant and the daily consumption, (2) the period of pumping, and (3) the storage provided on the distributing system.

What Filtration Accomplishes.—The filtration of a public water supply accomplishes beneficial results which can be with difficulty measured. The apparent result, which is appreciated by the citizens of a community in general, is the greatly improved appearance of the water. Instead of a muddy and often foul liquid a clear and sparkling fluid is drawn from the tap. The ordinary operations of the household are facilitated and the people are generally well satisfied, whereas frequent complaints against the previous condition of the water had been received. The most important result of filtration of a public water supply is the improvement in health conditions. Normally it may be expected that the introduction of a filtration plant will accomplish a reduction of 75 per cent. in the mortality from typhoid fever. The reduction at Cincinnati has been over 90 per cent. and at Columbus over 80 per cent. Accompanied with the reduction in deaths from typhoid fever there is also a noticeable reduction in deaths from general causes. It has been universally observed that the reduction of typhoid fever immediately follows the installation of a filtration plant.

Of lesser importance than the benefit to public health the financial advantage resulting from the purification of a water supply receives some recognition. With a water supply of good appearance and of satisfactory quality the inhabitants of a city will use it universally. This will increase the income of the waterworks department and will in turn decrease the cost of furnishing water. Each individual who uses a purified water supply will derive a financial advantage over the use of a polluted and muddy water. The saving resulting from the improvement of the physical quality of the water is also important and will in time assist in paying for the treatment of the supply. It has been previously shown that the saving of lives by the reduction of typhoid fever is amply sufficient to pay for the cost of purifying the water. Considering the question from a financial aspect alone and without regard to humanitarian considerations, a city provided with a water supply of poor quality can ill afford to maintain it without improvement.

SOOKE LAKE WATER SUPPLY.

The engineering staff of the Sooke Lake waterworks project for Victoria (see *The Canadian Engineer*, July 23rd, 1914), reports that a length of 6 miles of the 10¼-mile steel pressure pipe line has been laid, and that the most difficult portion of the route has been dealt with. It is expected that the whole pressure main from Humback reservoir to Smith's Hill service reservoir in the city will be completed in January.

The reinforced concrete flow line, 27.3 miles in length, has been laid for a length of 14 miles, or over half its distance. By the end of the year it is expected that the contractors, The Pacific Lock Joint Pipe Co., will have another four or five miles in position. To date the rate of laying has averaged 3½ miles per month.

The tunnel work within the city limits has progressed very favorably, the third tunnel being practically completed.

REPAIRS TO RIDEAU CANAL.

The Deputy Minister of Railways and Canals has announced that improvements to the extent of $50,000 will be made by the government on the banks of the Rideau Canal. The canal will be unwatered at an early date for this purpose.