INVESTIGATION OF METHODS OF OPERATING THE PITTSBURGH SLOW SAND WATER FILTRATION WORKS.

In July, 1910, George A. Johnson, consulting engineer of New York, was engaged by Hon. W. A. Magee, mayor of Pittsburgh, Pa., to make an investigation of certain features of construction and existing methods of operation of the slow sand water filtration works completed by that city in 1908 at a total cost of some \$6,000,000. Mr. R. S. Weston, of Boston, Mass., was associated with Mr. Johnson on studies relating to the chemical phases of the problem.

The practical result of Mr. Johnson's investigation are set forth in the last annual report of Mr. Chas. A. Finley, superintendent of the Water Bureau. Abstracts from Mr. Finley's report follow:-

"It is noted with satisfaction that the total operating and maintenance charge for the year is almost \$50,000 less than the cost of last year's operations. The total for the past year was \$818,626.12; for the previous year \$868,141.07. Most of this saving is due to the improved methods of operating the filtration plant, the saving in operation at this plant during the last year being about \$40,000."

"The operation of the filtration plant for the past year has been attended with gratifying results from a financial and sanitary point of view, due to the fact that, with the improved methods of sand handling instituted last year, we were able to operate the plant about \$40,000 cheaper than the cost of operating by the methods previously employed."

"It appeared, from an examination of the records, that the operating cost of our plant was unnecessarily high. It also appeared that, at certain seasons, we got unusually small yields from filters between cleanings."

"The question thus naturally divided itself along two lines:

"ist. A study of the actual operating conditions within the filters, such as methods employed for sand handling, etc.

"2nd. A study of the physical and chemical properties of the river water, for the purpose of devising methods of eliminating from the river water the causes of the excessive clogging, prior to its application to the sand filters.

"The first question has been handled and investigated by Mr. Johnson

"The second question has been handled and investigated by Mr. L.

by Mr. Johnson and Mr. Weston, acting in conjunction. "These investigations began in July, 1910, and extended over above investigations began in July, 1912.

over about eighteen months' time, to January, 1912. "The principal changes in operating conditions within the filters were the introduction of the process of 'raking' the filters between 'scrapings,' thereby securing additional yields from the filters at less expense than by continuous scraping, and a change in the process of restoring sand from restoring by machine to restoring from open hose lines under water '

"The study of the physical and chemical properties of the river water was of necessity complicated and protracted, due to wide variation in the character of the water on account of seasonal and other changes. The investigations were continued until all the different types of water had been encountered, a large amount of data was compiled, from.",

"In line with the conclusions, a system for the preliminary treatment of the river water was designed, and the necessary contract plans prepared for the construction of the same" "The result of these investigations indicates that the daily capacity of the plant can be increased from one hundred and twenty-five million gallons to two hundred million gallons without the construction of additional sand filters. The amount of water yielded by a filter between cleanings is an essential factor in the increased capacity of the plant. The prime object of preliminary treatment is the assurance of the necessary field between cleanings. With this yield assured, the rate of filtration, or the amount of water filtered daily through each filter, can be increased so as to produce a total daily yield of two hundred million gallons, and still maintain the economy of operation in sand handling."

"To arrive at this total daily capacity by slow sand filters, without preliminary treatment, under the present conditions, would require the construction of about thirty additional slow sand filters of one acre each. The approximate cost of this installation would be over two million dollars, not including the necessary land."

"The annual saving in sand handling alone is \$40,000, with the plant as it now stands, and if we consider the difference in cost between the extension of the present sand filters, without preliminary treatment, and the introduction of preliminary treatment, without extending the sand filters, as developed by the investigation, said differences being, in round numbers, about \$1,600,000, exclusive of land, and allow 5 per cent. annually on this saving, it amounts to \$80,-000, which, with the \$40,000 saved in operation, makes a total of \$120,000."

TRACK CONSTRUCTION ON PAVED STREETS.

At the recent convention of the American Railway Engineering Association one of the committees recommended the following practice on paved street construction:---

They recommended that treated ties should be used and should be laid on a bed of crushed rock, gravel or other suitable material, not less than 8 in. nor more than 12 in. in depth, placed in about 3-in. layers, each to be thoroughly rammed to compact it.

Vitrified tile drains were recommended to be not less than 6 in. in diameter, with open joints and leading to nearest point from which efficient drainage might be obtained or with sufficient outlets to reach sewers or drainage basins. These should be laid on either side of and between tracks, parallel with ballast line and outside of ties.

It was recommended that a 141-lb. girder rail of 9-in. depth, or one of similar section, with suitable tie-plates and screw spikes, should be used. The track should be filled in with crushed rock, gravel or other suitable material, allowing for a 2-in. cushion of sand to support the finished pavement.

Ballast for paving foundation should be well rammed as it is installed. Two inches of good, sharp sand should be placed on top of the ballast. Paving should conform with municipal requirements, granite or trap rock blocks preferred. Hot tar and gravel should be poured into joints as a binder.

A test which may be of interest was one on cleaning stone ballast by the use of screens. The results of this test tended to show that a gang of twelve men, properly equipped with tools, would cover about 165 ft. of double track per day of ten hours, making the cost per mile of double track \$640. This cost included the work of cleaning the ballast, dressing the track and disposing of the dirt. The labor charge included a foreman at \$2.40 and eleven laborers at \$1.60 each.