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THE WATERPROOFING OF SEWERS

The subject of ground water infiltration into sewers is an exceedingly important one where it is necessary to pump and purify a large part of the effluent. A topical discussion of the subject is published in the proceedings of the National Association of Cement Users, for 1911, from which the following is abstracted.

Mr. George T. Hammond, designing engineer of the Brooklyn Bureau of Sewers, presented the following data:

New Orleans, La.—The plan provided for the removal of 0.003 cu. ft. per sec. per acre of ground water, or 1,250,000 gals. per sq. mile per day. In 1909 one sewage pumping station had an average dry weather discharge of 20,000,000 gals per day, of which "probably 15,000,000 gals. is ground water, which is being absorbed continuously from the soil of the city, lowering its moisture line in the soil and vastly improving its sanitary condition."

The sewers of New Orleans were constructed with great care, on the separate system, and Mr. Hammond considers the system one of the finest in the world. It is so located that the pumping of ground water is a distinct advantage to the city. Therefore, no waterproofing was undertaken, but the joints were all made as tight, and the work was constructed as water-tight, as such work can be made without special provision for waterproofing. The surface of the city is lower than the surface of the Mississippi River, except along the levees. However, the result well illustrates the freedom with which ground water enters well constructed sewers that have not been specially waterproofed.

The pipe sewers, from the smallest size up to 36 ins. in diameter, are of the very best quality of vitrified stoneware pipe. The main sewers are principally of brick, although there are also several miles of concrete sewer of sizes from 3 ft. 9 in. to 5 ft. 9 in. in diameter.

Brooklyn, N.Y.—The portions of the system in low ground admit considerable ground water. In one section of the city which contains about 200,000 population, and in which the dry weather flow is pumped and treated, from 5 to 20 per cent. of the flow, in accordance with the season, is estimated to be ground water. The total dry flow varies from 15,000,000 to 20,000,000 gals. per day. The system consists of brick main sewers, and of vitrified and concrete pipe collectors. The two kinds of pipe are used in about equal quantities. The maintenance cost per mile per year is about equal on each kind of pipe and is very low. Maintenance cost of brick sewers per mile is about four times as great. At Coney Island the leakage into sewers ranges from 20 to 50 per cent. of the flow, all of which has to be pumped. The Sewer Bureau is relaying much of this leaky system with sewers having carefully waterproofed joints.

Reading, Pa.—The water supply is 127 gals. per capita. The sewage is 163 gals. per capita. The infiltration of ground water amounts to 5,172 gals. per mile per day. The system is practically new and is constructed of vitrified pipe, and brick and concrete mains.

Providence, R.I.—The amount of sewage pumped in 1905 was as follows: Daily average for the year, 21,706,889 gals.;

daily average for wet weather, 32,131,655 gals. This was an increase of about one-half in wet weather. The system is a separate system. The sewers, from 16 ins. in diameter up to the largest size, are brick. The pipe sewers range in size from 6 to 15 ins., and are partly iron and partly vitrified pipe.

Baltimore, Md.—In the new system being installed, notwithstanding careful waterproofing of interceptors, and the use of waterproofed joints, provision is being made in the size of the sewers for the entrance of some ground water. The Board of Consulting Engineers say, in their report to the sewerage commission (1906):

From our experience with this subject in other places, it is our opinion that in the earlier years of the new works, the total amount of the sewage would not exceed the water supply. In subsequent years, when the sewers are extended into less thickly populated portions of the city, and buildings are more generally connected with the sewers, the sewage increased by ground water will be materially in excess of the water supply.

The board advised providing for 150 gals. of flow per capita with sewers designed to flow half full with this quantity. The system is separate. Vitrified clay pipe is used for all pipe sewers.

Columbus, O.—Ground water entering sewers, when ground is wet after storms, is about 100 per cent. of the dry weather flow; during storms it ranges from 100 to 296 per cent. of the dry weather flow. System is built of brick, vitrified clay and concrete.

Kalamazoo, Mich.—Ground water entering sewers is about 20 per cent. of their capacity. System formed mainly of vitrified clay pipe.

Norfolk, Va.—Ground water forms 60 per cent. of the pumping. Sewers are brick, vitrified clay and iron pipe.

Canton, O.—Main sewer admits ground water at the rate of 70,000 gals. per mile per day.

Brockton, Mass.—The ground water flow is said by reports to have been 400,000 gals. per day from 16 miles of sewers, or 25,000 gals. per mile per day.

Red Bank, N.J.—Strictly separate system. No storm water is supposed to enter, but after a shower the flow quickly doubles in quantity. Vitrified clay and iron pipe are in use.

Vineland, N.J.—Strictly separate system of sewers constructed of vitrified pipe. The flow in wet weather is nearly double that in dry.

Westfield, N.J.—Strictly separate system of sewers constructed of vitrified clay pipe. There are about 15 miles of sewers 8 ins. to 24 ins. in size. The ground water entering the sewers increases the ordinary flow about 50 per cent.

Further interesting data on the amount of ground water infiltration are given by Mr. Kenneth Allen, chief engineer of the Metropolitan Sewerage Commission of New York. The following figures are from Mr. Allen's discussion: