quantity whether it is contained in a large or small volume of water. The British Government (Local Government Board) ordinarily requires in the case where there is no land for subsequent treatment or a large river for effective dilution, a filter 6 feet deep and one acre in area for each million gallons of sewage (dry weather flow) but when, as is the practice in America, a river is available for the ultimate oxidation of the filtrate, then the area is about one-half. It is, therefore, reasonable to postulate that for a consumption of 50 gallons per capita daily the area of filter will be about one acre per million gallons and for 150 gallons per day an area of one acre for each two million gallons, on which basis the respective areas will be about 12½ and 18¾ acres. A reserve must be added, say, ten per cent., which will increase the areas to 13.75 and 20.625 acres. Mr. Wisner estimates the cost of perco filters at about $28,000, whilst, according to the experience of other cities the average was about $38,000 (20). Basing the cost at $30,000 per acre, then, the first case will require an expenditure of $412,500 and the second $618,750, a difference of $206,250, which, at 5 per cent. interest, is equivalent to an annual burden of $10,312. The cost of operating and maintaining these filters may be placed at $2 per million gallons (21). This will amount to $12.5 \times 365 \times 2 = \$9,125$ and $37.5 \times 365 \times 2 = \$27,375$.

Sterilization of the filtrate by hypochlorite of lime costs about $1.67 per million gallons treated (22), when 4½ parts of available chlorine per million parts are applied. This for the first case would mean $7,620 and in the second case $22,860.

Summarizing the items already mentioned in the foregoing observations, the following results are obtained:

	No. 1 city. Consumption, 50 gals. per capita daily.	No. 2 city. Consumption, 150 gals. per capita daily.
Interest and depreciation on total capital on waterworks, per annum	$450,000	$525,000
Annual cost of pumping	54,750	153,250
Annual cost of filtration and sterilization	16,000	48,000
Annual cost of distribution works	11,400	34,200
Total on waterworks	$532,150	$760,450
Annual cost of sewers	.....	.....
Annual cost of operating sewage tanks, plus interest	$ 7,000	$ 19,250
Annual cost of operating perco-filters, plus interest	29,750	58,312
Sterilization of filtrate	7,620	22,860
Total	$ 44,370	$100,420

Adding the two expenditures together we arrive at a rough idea of what it means to the ratepayers:

	No. 1 City.	No. 2 City.
Waterworks	$532,150	$760,450
Sewage works	44,370	100,420
Total cost	$576,520	$860,870

The difference of $284,350, capitalized at 5 per cent., will represent a decent sum of $5,687,000.

The writer has advisedly adopted published figures and in doing so has quoted the authorities, but it is manifest that the above estimates serve only as indications, and therefore each city must be considered separately, although the foregoing statistics answer as direction posts to those who will carefully analyze the financial results to be obtained in their own cities. The foregoing will afford sufficiently safe basis to warrant a close scrutiny into the relative cost to the ratepayers of an economical versus an extravagant consumption of water. Furthermore, in those cities where the water supply is controlled by companies, the foregoing observations will suffice to show what waste means to them, and to their customers. The dividend-producing power of any franchise depends on an efficient management and this in its turn means the stoppage of all preventable waste.

(20) and (21) Engineering Record, 22nd August, 1914.
(22) Report on Plan of Sewerage, Cincinnati, 1913, page 567.

CEMENT PRODUCTION IN UNITED STATES, 1913.

A report on the cement output last year in the United States shows an increasing share of the rapidly growing consumption of cement in the United States being supplied by the domestic industry, production having risen from 8,000,000 barrels in 1890 to 93,000,000 in 1913; while imports of cement have fallen from 2,250,000 barrels in 1890 to 95,827 barrels in the fiscal year 1914; which is, with one exception, the lowest total reported in many years. The United States, according to the latest information received by the Bureau of Foreign and Domestic Commerce, Washington, leads the world in the production of cement, its output being approximately four times as much as that of England and nearly three times that of Germany.

The total quantity of Portland, natural, and puzzolan cement produced in the United States last year was the greatest in the history of the cement industry, according to a recent government report. The total amount was 92,949,102 barrels, valued at $93,001,169, compared with 83,351,191 barrels valued at $67,461,513 in 1912.

The total production of Portland cement in 1913, as reported to the Geological Survey, was 92,097,131 barrels, valued at $92,557,617; the production for 1912 was 82,438,096 barrels, valued at $67,016,928.

Of the 113 producing plants in the United States in 1913, 23 were in the State of Pennsylvania, whose output was 28,701,845 barrels of Portland cement, the largest quantity produced by any one state. The second greatest production came from Indiana, with 10,872,574 barrels, and California was third, with 6,159,182 barrels.

The natural cement produced in the United States in 1913 amounted to 744,658 barrels of 265 lbs. each, valued at $345,889, compared with an output of 821,231 barrels, valued at $367,222, in 1912. Puzzolan cement was manufactured in 1913 at three plants in the United States, in Alabama, Ohio, and Pennsylvania. The output of puzzolan and Collos cements in 1913 was 107,313 barrels valued at $97,663, compared with 91,864 barrels, valued at $77,363 in 1912.

The United States has a comparatively small export trade in cement. In 1913 the total quantity exported was only 2,964,358 barrels, most of which was Portland cement, valued at $4,270,666, compared with 4,215,232 barrels, valued at $6,160,341, in 1912.

In 16 years the United States office of public roads constructed 343 object-lesson and experimental roads. The cost has been borne by the localities, and the work of the engineers sent out has proven effective in spreading information. State-aid laws had passed in only 4 states 16 years ago, but 40 states have now adopted the state-aid principle.