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## MOSQUITO EXTERMINATION

**New Jersey Appropriates \$350,000 to Drain Breeding Areas—Public Health Endangered—Newark First to Act—Elizabeth Also in Line—Methods and Results**

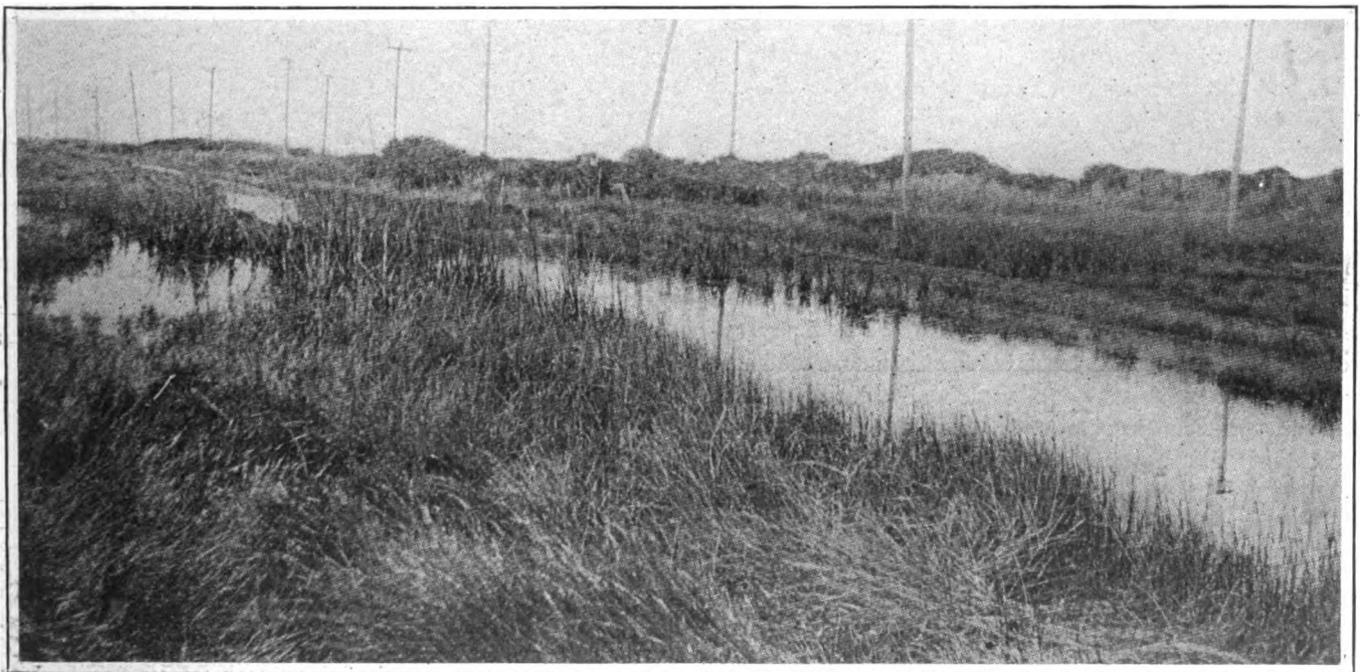
By JOHN B. SMITH, Sc.D.,  
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MOSQUITOES as nuisances have been known for many years; as dangers to public health their recognition is comparatively recent. Stretches of seashore and other localities otherwise desirable as places of residence have been rendered uninhabitable by the insects and property values reduced to nothing. So long as their annoying features only were recognized the pest was borne with such philosophy as could be mustered as something unavoidable, and the suggestion that it might be mitigated or entirely removed was ridiculed when first timidly put forth.

When it became known generally that there was another feature—that the insects were really dangerous to the public health and that not only malarial but pernicious fevers were transmitted by them, this attitude changed and those interested in sanitary matters began to consider whether or not matters might not after all be at least improved. And then it was found by the entomologists

who looked into the subject that our knowledge of mosquitoes and their habits was of the scantiest and not altogether accurate.

The writer was one of the first of those who took up the systematic study of the life habits of the insects with the object of applying the knowledge practically, and the Legislature of the State of New Jersey was the first to provide for a systematic survey of the State to determine the feasibility of lessening the mosquito pest. Ten thousand dollars were provided for that purpose and expended under the writer's direction; afterward twenty thousand dollars were provided under a scheme for aiding individual communities. But this did not produce satisfactory results, and only a small part of the money was expended. At the last session a careful estimate was presented by me and it was shown that a total expenditure of \$350,000 would be sufficient to clear the entire shore line of the mosquito breeding areas that were re-



SALT MARSH BREEDING AREA—NATURAL DRAINAGE CUT BY A ROAD

# WILMINGTON, DEL., WATER SUPPLY

## City Plant One of Oldest Under Municipal Ownership—Borough and Legislative Management—Success in Operation—Source of Supply and Treatment—Improvements Planned

By THEODORE A. LEISEN, Chief Engineer, Board of Water Works

IN Wilmington, Del., as in many of the other older cities of the country, the water supply was derived originally from a number of wells with wooden pumps, and the first movement for concerted action tending toward a general system took place in 1796, when the Borough Council appointed a committee "to inquire of the inhabitants of the Borough who own the pumps which stand in the streets, whether they will be willing to give them up to the Corporation, who will take care to have them kept in order."

This committee evidently fulfilled its mission, but four years later the growing importance of the borough demanded some better system, and another committee submitted a report and estimate for piping the water from a certain spring. The estimate was as follows:

	£	s.	d.
835 feet of Pump Logs (for mains) .	57	8	½
Digging and Laying " ..	7	1	10½
Cistern to contain 30 Hhds.....	48	0	0
<hr/>			
Total .....	112	9	11

Owing, probably, to the apparent extravagance of the estimate, the project failed to materialize, and no progress was made until 1804, when the "Wilmington Spring Water Company" was incorporated and continued to exist as a private company until 1810, when the plant was purchased by the borough. This marks the incipency of the Wilmington Water Department under municipal ownership, and ranks it as one of the earliest of the municipal water plants of the country.

### BOARD CREATED BY LEGISLATURE

The Department remained under the direct control of Council, and under the management of a Water Committee, until 1883, when the State Legislature, at the behest of a number of citizens of Wilmington, created the "Board of Water Commissioners," to which was intrusted the care and management of the Water Department, and improvement of the water supply system. This Board, under which the control of the Department still continues, consists of three members, the original ones having been named in the bill creating the commission, and their successors appointed by the Mayor, one member being appointed every two years, for a term of six years. The duties of the Board are legislative, the executive management being in the hands of the Chief Engineer.

Since the creation of the Commission, the affairs of the Department have been conducted on strictly business principles, with results eminently satisfactory to the large majority of the inhabitants of the city. Its efforts have been subjected to considerable criticism at times; occasionally the censure may have merited, but more fre-

quently it was the carping animadversions of political antagonism.

Under the new régime the gross and surplus earnings of the Department systematically and steadily increased, and from being a burden of expense, it has become a source of considerable revenue to the city. During the nineteen years ending January 1, 1905, after paying for all expenses of maintenance, improvements, extensions, and interest, \$775,162.37 of surplus revenue was turned into the coffers of the city treasury. The total receipts for the corresponding term were \$3,018,545.50, and the expenditures for extension, permanent improvements, real estate, interest on bonds, and surplus paid over to Council, amounted to \$2,250,944.24, and for all operating expenses \$767,601.26. It will thus be seen that the surplus revenue for the period mentioned was greater than the total expense of operation.

### SOURCE OF SUPPLY

The source of supply is Brandywine Creek, with a drainage area of 320 square miles, mostly in Pennsylvania. The water in its natural state is a good, soft water, free from any objectionable mineral matter, but owing to its drainage area embracing a fairly populous section of Chester County, Pa., including several towns of considerable size, the stream is highly contaminated with sewage.

The water powers along the stream have been fully developed, and the high values in which these water-rights have been held has militated against the efforts of the city to obtain its source of supply farther up the creek, at a higher elevation. There is a fall of 130 feet in the bed of the stream in the five miles above tide water, and a considerable saving in pumpage could be effected if advantage could be taken thereof, but the repeated efforts to do so have ended in failure.

The city is the owner of one-half of the water-rights in the stream from an elevation of 26.7 feet to tide water, thereby controlling one-half of the normal stream flow for power or other purposes. A race-way about a mile long conveys the water from the dam to the pumping station, whence it is pumped to the distributing reservoirs.

The main pumping station is equipped with one Corliss pump of ten million gallons capacity, one seven million gallon Worthington pump, and a water-power pump capable of a maximum pumpage of three million gallons. The water is pumped from here to Cool Spring Reservoir, at an elevation of 144 feet above city datum (tide water). This reservoir has a capacity of 38,000,000 gallons, and is used as a source of distribution and supply for the low service. A second pumping station at Cool Spring con-

taining two 3,000,000-gallon pumping engines, is utilized for raising the water to the high service reservoir at an elevation of 245 feet, and to the extreme high service of Rockford tower at 310 feet maximum elevation.

#### CONSUMPTION AND REVENUE

There are 117 feet of water mains in the city, varying from 3 inches to 30 inches in diameter, 51 per cent. of which is 8 inches and over. Gates are placed at every street intersection, so that with a few exceptions any block can be cut out without interfering with the supply in other sections. There are 867 fire hydrants and 16,311 services to dwellings, factories, etc.

The total average daily consumption for the year 1905 was 8,573,000 gallons, which, with an estimated population of 86,000, gives a per capita consumption of 99.6 gallons of which 48.8 per cent. was used by manufactories, and 51.2 per cent. was consumed by residences, schools, hotels, and for fire purposes, representing what may be termed domestic consumption. This makes the per capita consumption for domestic service 51 gallons, and in view of the large proportion of water used by manufacturing industries, the total rate is a very favorable showing, and is due largely to a judicious use of meters. All water supplied to factories, railroads, hotels, and saloons is furnished on meter measurement, and in addition about 2,400 dwellings are metered.

The revenues of the Department for the year 1905 amounted to \$206,191.36, and the disbursements along the line of usual expenditures, including extensions and various other permanent improvements, \$112,354.36. The balance, or \$93,837.00, which under ordinary conditions would have been classified as surplus, and turned into the city treasury, was devoted to defraying the cost of the new water supply system.

As all water used for fire purposes, sprinkling streets and parks, flushing sewers, and for all schools, public buildings, and swimming pools, is furnished free of charge, the value of this service, which is estimated at \$36,000, should be credited as additional surplus revenue.

#### PLANS FOR IMPROVEMENT

The question of improving the water supply system, both by increasing the capacity of the plant, and by filtering the supply, had agitated the Department for several years, and the first definite steps in the accomplishment of this object were inaugurated during the past year.

The plans which have been prepared by the writer provide for a general system capable of gradual extension, to supply eventually 40,000,000 gallons of filtered water per diem, with a total storage capacity for raw and filtered water of about one hundred million gallons.

Briefly, the work now contracted for and under way, includes the following: One pumping station with provisions for three vertical pumping engines whose combined capacity would be upwards of forty million gallons daily; two 12,000,000-gallon vertical triple expansion pumping engines now being built, to be erected during the course of the year, with space remaining for a third pumping engine, which may have a capacity of anywhere

from twelve to twenty million gallons; two 300-horsepower Edgemoor water-tube boilers; a 43-inch diameter forcing main to the new reservoir, and a 48-inch diameter distributing main from the reservoir to Cool Spring, connecting there with Cool Spring Reservoir, and the other distributing mains, and one 35,000,000-gallon storage or sedimentation reservoir on the Weldin Farm, known as the "William T. Porter" Reservoir.

#### FILTERS AND EXTENSIONS

In addition to the work now under construction, detail plans are now on file, or are being prepared, for the following described works: A reinforced-concrete bridge of ornamental design, consisting of three 50-foot spans, and four 28-foot spans to carry the 48-inch distributing main across the Brandywine Creek at Van Buren street.

A preliminary filter with a daily capacity of 16,000,000 gallons is to be located near the new pumping station, through which the water from the race will pass before reaching the pumps. This filter is a modification of the Maignen system, and from the results obtained at the experimental laboratory, it is believed that it will remove from 60 to 80 per cent. of the turbidity, and a corresponding quantity of other impurities.

Slow sand filters are to be provided for the final purification of the water. These will be located adjacent to the new reservoir on the Weldin Farm. There will be eight covered filters having a combined filtering area of about three and one-half acres, and also one 10,000,000-gallon covered filtered water reservoir.

With the completion of the works enumerated above, Wilmington will have a water supply equal to the best in the country. The extensions which will become necessary can be carried on from time to time, as occasion demands, everything having been provided for such extensions up to the final limit of the plant.

## PAVING IN ALEXANDRIA

Virginia City Spends \$50,000 a Year to Improve Streets—  
Vitrified Brick Popular—Civic Pride Aroused  
[ and Better Conditions Result

LIKE most old cities, Alexandria, Va., was paved many years ago with cobble, and also, like most old cities, it seemed almost impossible to persuade the citizens that the cobble had long outlived its usefulness and more modern pavement was needed. There was violent opposition from the staid, conservative element for two reasons: first, the city was heavily bonded with old railroad and sewer bonds, the carrying of which was a burden that taxed its revenues heavily. There was over \$800,000 of these bonds. Secondly, real estate was at a standstill; there was no market, and nothing by which to gauge values, so the property owner had to pay one-half the cost of paving; he felt it an added burden on his property with no increase in value. Finally, however, five years ago, the progressive element succeeded in getting one block in the business district paved with brick. It was no sooner laid than from all sides rose a clamor for paving. Real