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THE PORTLAND WATER WORKS SYSTEM

The water works system of Portland, Me., is gravity and the supply which is taken from Sebago Lake is of unexceptional purity. The historical sketch of the plant published by the Public Utilities Commission which is reprinted herewith will prove interesting as showing how



President William L. Blake, of the Portland, Me., Water Company.

successful the system has been from its inception to the present time.

Historical Sketch.

The first water pipe in Portland was laid by Mr. William Freeman, probably in 1811. It was a lead pipe and only lasted a short time. Afterwards water was brought in log aqueducts from a brook near the head of Hancock Street to families on Federal, Middle, Fore and other streets in the lower part of the City. These works were owned by Captain Wm. Woodbury and others who leased them to the Atlantic & St. Lawrence Railroad Company in 1847. Families in other parts of the City depended on wells and cisterns. The City built reservoirs in different localities for the use of the fire department, depending upon the rains to keep them full and at times of drought the scarcity of water was a source of serious concern. The first action taken by the City Government towards a better supply of water was in 1849, when a committee was appointed to inquire into the matter but no action was taken. On September 17, 1854, a petition was presented by Mr. Woodbury Storer and others requesting the City Government to inquire into the cost of bringing water from Sebago Lake. At this time it was estimated that the cost would be nearly four million dollars which was thought to be more than the city could afford. The next proposition was from F. O. J. Smith who offered to bring water from Sebago Lake by the Cumberland and Oxford Canal, but this was deemed impracticable owing to the impossibility of delivering the water in a pure state. Another proposition made by Mr. Smith was to take water from the lower falls of the Presumpscot River and force it into

a reservoir on Graves' Hill or Munjoy Hill. All of these propositions were carefully investigated and rejected as unsatisfactory.

In February, 1866, a petition was sent to the State Legislature for authority to bring water into the City from Long Creek and the Portland Water Company was incorporated February 23, 1866, for that purpose. The fire of July 4, 1866, which destroyed a great part of the City, while interrupting the plans for building the water works, furnished a strong argument for building the works at once. The charter of the Portland Water Company was amended February 26, 1867, granting authority to go to Sebago Lake for water. The Water Company then submitted a proposition to the City that the City should aid the Company by paying \$50,000 annually for ten years for water required for public uses. This request was referred to a committee which made an



Superintendent Milton Thorne, of Portland, Me.

elaborate investigation of the different methods of supplying the City with water. They examined all the plans, and after deliberating nearly two months, made a divided report. The discussion was continued in the City Government, in the newspapers and among the citizens for nearly six months. Finally in January, 1868, the City Government decided to contract with the Portland Water Company, and on March 3, 1868, Mayor A. E. Stevens signed the contract. April 29, 1868, work was commenced on the conduit. May 4th, ground was broken at Saccarappa for laying the twenty inch main. August 11th, the first distribution pipe was laid in the City on Cumberland Street, Ex-Mayor McLellan throwing out the first shovel of earth. May 19, 1869, work was commenced on the reservoir on Bramhall Hill. On Thanksgiving Day, 1869, water began to flow into the reservoir, and on November 26th, water was let into the street mains and filled all the pipes in the city. July 4, 1870, four years from the time of the great fire, the water works were completed with a twenty inch cement main from

the Lake at Portland, a reservoir on Bramhall Hill, and distribution pipes through the principal streets of the city. In 1876, a new cement main twenty-six inches in diameter was built from the lower gate house and connected with the old main at Ward's Hill. In 1878, another section of cement main twenty-four inches in diameter was laid from Ward's Hill to Cloudman's Hill, and in 1879, the third section of the twenty-four inch main was laid to the City. In 1866, the water pipes were extended through the Deering District over eight miles being laid, about half of which were in solid ledge. The construction of the second main did not meet the requirements of the growth of the City, the higher levels on Bramhall and Munjoy Hills at times being poorly supplied, and on the recommendation of Engineer J. Herbert Shedd, the Water Company in 1888, constructed an additional reservoir on Munjoy Hill of the capacity of twenty million gallons. With the construction of this reservoir, the Company was enabled to divide the supply of the City into a high and low service. All that part of the City lying below an elevation of ninety feet above tide water was fed from the two reservoirs which in turn were supplied directly from the Lake by the new twenty-four inch main, leaving the twenty inch main to supply all that part of the city lying above the elevation of ninety feet by direct gravity from the Lake. Later, these pipes were reversed, the twenty inch being used to supply the reservoirs and the twenty-



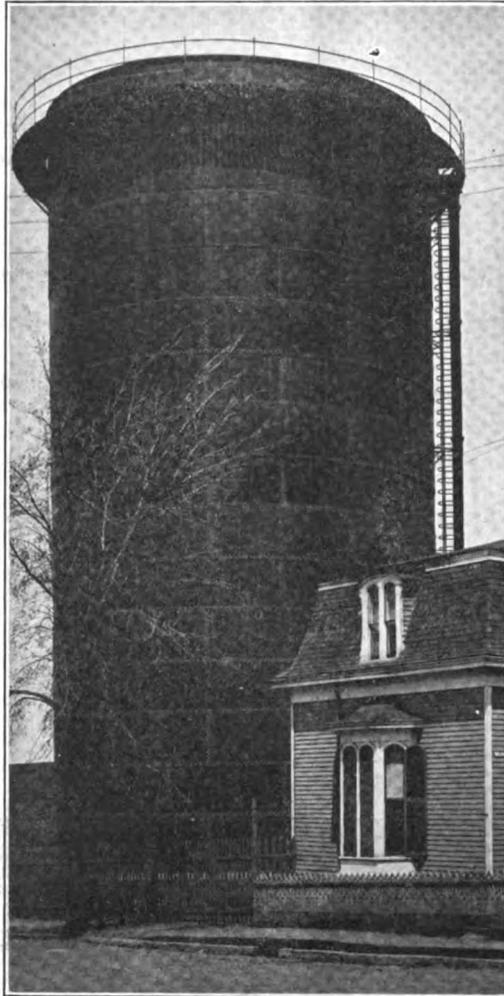
James W. Graham, Treasurer and General Manager, Portland Water Company

four inch to supply the high services. In 1901, in order to improve the hydraulic grade between the Lake and the City, a thirty inch cast iron main was built from the lower gate house by a better grade than the earlier pipes, to Ward's Hill, where it was connected to the old mains. These pipes made it possible to furnish a continuous supply to the City, in case of accidents to one of the mains, but did not provide for the contingency of an accident to the conduit. In 1902, the Water Company built a reservoir at the lower end of the

conduit of sufficient capacity for a day's supply to the City. This acted both as a storage reservoir and a settling basin for the deposit of any sediment that might come into the system through the screens at the upper gate house, and the stored water was available to supply the City in case temporary repairs were needed in the conduit. In 1903, a standpipe of 500,000 gallons capacity was constructed on Munjoy Hill and used in connection with the high service system to accumulate a reserve to help out the supply from the Lake at times of extreme draft. In 1893, the Standish Water and Construction Company was formed and by legislative authority purchased the Deering and Westbrook systems from the Portland Water Company. The new company also extended the water mains into South Portland Water Company. The new Portland Water District was created by Chapter 433 of the Private and Special laws of Maine for the purpose of taking over the properties of the Portland Water Company and Standish Water and Construction Company. The District is made up of the City of Portland (exclusive of the islands) and the City of South Portland, the City of Westbrook declining to become a part of the corporation. On July 11, 1908, the Trustees of the Portland Water District having been unable to agree with the Water Companies as to the value of their properties, filed a petition to take them by eminent domain. At that time the two Water Companies had about one mile of conduit, 78,500 feet of 24 inch main, 77,000 feet of twenty inch main, 26,700 feet of 30 inch main, reservoirs on Bramhall and Munjoy Hills, standpipes on Munjoy Hill and on Meeting House Hill, South Portland, together with distribution pipes in Portland, Westbrook, South Portland, South Windham, and Cape Elizabeth, aggregating with the mains nearly two hundred miles. They also owned the entire stock of the Foreside Water Company supplying Falmouth and Cumberland, and the Gorham Water Company supplying the town of Gorham. There were 12,059

the high levels on Munjoy Hill were supplied through a twenty inch main, increasing the pressure of the high service mains about thirty pounds. In 1914, a twenty inch connection was made with the new forty-two inch main near Nason's Corner, thence by Warren Avenue to Morrill's Corner, reinforcing the distribution pipes in the centre of the Deering District. In 1915, a contract was made with the Town of Scarborough, by which the water was extended to Harmon's Corner, through an eight inch pipe and from Oak Hill to Dunstan by a six inch pipe. A new twelve inch main

Lake Sebago is located near the centre of the Presumpscot River Basin lying between the Saco and Androscoggin Rivers. The total area of its water shed is over 500 square miles and the discharge of water from Sebago Lake is more than 400,000,000 gallons per day, or fifty times the amount required for the Water District. With its tributary lakes there are more than 100 square miles of water surface. The District has purchased or condemned all the land lying between the highway and the Lake from the Maine Central Railroad to a point about one-half a mile beyond the intake. It has also purchased the greater part of Indian Island, the whole of Little Indian Island, the point of land near the DuPont Powder Works at Smith's Mills, the islands near the ice house, and the old Diamond Match Property on the shore of Sticky River, and now controls practically the entire shore of the Lower Bay, preventing the erection of cottages or other structures near the shore. In 1913, the District constructed at the Lower Gate House at Sebago Basin, a modern hypochlorite plant for the purification of the entire water supply. It also installed a laboratory wherein daily bacteriological examinations are made of the water from all parts of the system. In 1915, to protect the water from possible pollution, through the drainage from Sebago Lake Village, a hypo-chlorite plant was constructed over the brook which drains the entire village, so that its waters may be sterilized before entering the Lake. During the summer months, the shores of the Lake throughout the Lower Bay are patrolled daily, while a rigid inspection of all cottages about the Lake is maintained. Under the laws of 1913, no building can be erected within 200 feet of the shore of the lake without the approval of the Sanitary Inspector of the District, as to drainage and sewage. The water of the Lake in its natural state is clear and unpolluted and the control which the District has secured of the water front, the precautions against chance pollution which are af-



Munjoy Standpipe, Portland, Me.



Assistant Superintendent William G. Newhall, Portland, Me.



David E. Moulton, Clerk and Attorney, Portland Water Company.

was also laid in the Deering District, from Morrill's Corner to North Deering and an eight inch main from North Deering to the dead end on Summit Street, reinforcing the supply in that section. Dean ends along the Eastern Promenade were also connected, thus reinforcing the gridiron system. On January 1st, 1916, the total mileage of main and distribution pipes in the entire system was 252 miles and the plant, property and franchise account had reached a total of over six million dollars. The number of services increased from 12,058 in 1908 to 14,657 in 1916.

The Present Supply.

The present supply is Sebago Lake, which has an elevation of 262 feet above sea level, an intake pipe, 48 inches in diameter extending 450 feet into the Lake. This pipe, at the present time, is covered by about twenty feet of water. The water then flows into the chamber where it passes through screens, and from this into a conduit, which is 550 feet in length. This conduit varies in size, but the greater part of it is pear shape, about 5 feet high, and 3 feet at the bottom. Part of this is constructed of brick and part of it through ledge remains as it was blasted out. At the outlet of the conduit, the water flows into the settling basin, and is then distributed to the various mains leading to the City.

services in the combined system. After an exhaustive hearing, the referees fixed the valuation of the Portland Water Company, its property and franchises at \$2,536,235.50, and the Standish Water and Construction Company at \$1,313,798.76, making a total of \$3,850,034.26. The expense of the hearing was \$152,643.88, making the total cost of the Portland Water District as of January 1st, 1908, \$4,005,678.14. Finding that the growth of the City had outstripped the capacity of the mains, the Trustees in 1910 awarded a contract for the construction of a forty-two inch cast iron main from Sebago Basin to the City. This main was completed in 1912, at a cost of \$862,844. The South Portland system was connected with this main through a sixteen inch pipe and

fording by the two hypochlorite plants and the daily examination of the water from all parts of the system, insure a supply unsurpassed by any city in the country.

Chemical Analysis.

	Parts Per Million.
Color	5.0
Total Solids	10.0
Solids Fixed	10.0
Solids Volatile	9.0
Free Ammonia	0.010
Albuminoid Ammonia	0.120
Nitrogenous Nitrates	Trace
Nitrogenous Nitrates	0.00

Oxygen Consumed.....	1.7
Chlorine	2.0
Hardness	11.0
Alkalinity	2.0
Iron	0.17
Lead	0.00

Bacteriological Analysis.

Bacteria per c. c. 20 C.....	6.8
Bacteria per c. c. 37.5 C.....	3.
B. Coli-presumptive test.....	0.
B. Coli.....	0.

State of Maine, Laboratory of Hygiene, Augusta, January 31, 1916. Portland Water District, Portland, Me. Gentlemen:—Analysis of the winter sample of water from your public supply, sent to me on the 22nd instant, shows this water to be in first-class condition to use for drinking, and for all domestic purposes at this time. The water is free from evidence of contact with sewage wastes of all kinds, or with polluted surface wash. In spite of the recent thaws the water is in its normal condition for this season of the year, and it is safe and satisfactory water in every way. Yours very truly, H. D. Evans, Director.

The City is divided into high and low service. The high service is the regular lake pressure, and varies from thirty-five to one hundred pounds according to elevation. The low pressure supplies the low levels of the City, being supplied from reservoirs on the Eastern and Western Promenades. The average pressure low service is forty-five pounds. No pressure regulating valves are used on the line.

At the Gate House the hypochlorite plant is located, and at the present time it uses ten

Joint Meeting of Iowa and Illinois Sections of American Water Works Association

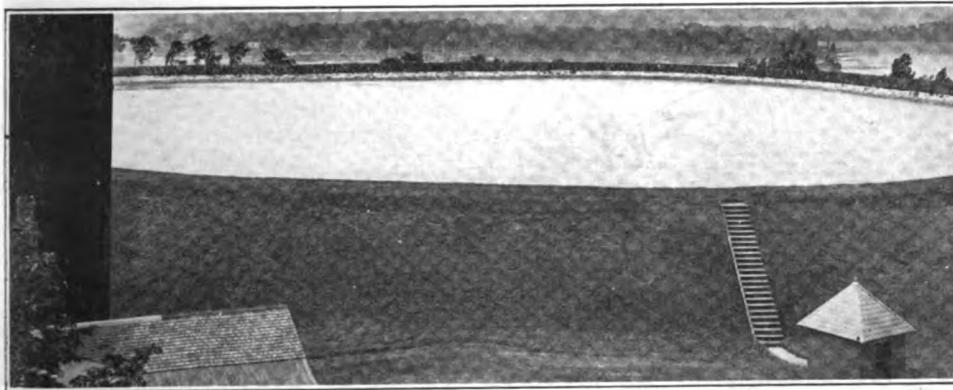
A joint meeting of the Iowa and Illinois Sections of the American Water Works Association is to be held at Davenport, Iowa, on October 10 and 11. The program arranged is as follows:

October 10—Meeting of Iowa Section; 10 A. M., Registration at Headquarters, Hotel Black Hawk, Davenport; Address of Welcome; Round Table Discussion—Topics; 1:30 P. M., Reading of Papers; 4:30 P. M., Business Session, Iowa Section; Reports of Committees; Election of Officers; General Business; 7:30 P. M., Reading of Papers; 9:00 P. M., Smoker.

October 11—Joint Meeting of Iowa and Illinois Sections; 9:30 A. M., Members of Both Sections will assemble at the Filter Plant, Rock Island Arsenal; Inspection of Filter Plant; Inspection of Arsenal (if permission can be obtained); 11:15 A. M., Leave Arsenal in Special Trolley Cars. Trip to Bettendorf, Iowa, arriving at Main Pumping Station Davenport Water Company at 12:30 P. M.; Luncheon at Pumping Station—Guests of Davenport Water Company; 2:00 P. M., Automobile Trip, Visit to Reservoir Pumping Station, Davenport Water Company; Visit to Pumping Station Rock Island Water Works; Visit to Pumping Station and Filter Plant Moline Water Works; 6:00 P. M., Dinner in Moline—one dollar per plate; 8:00 P. M., Two

Decision Affecting Sources of Water Supply for New Hampshire Cities

A decision of important and far-reaching effect touching the waters of the State of New Hampshire which are used for the domestic water supply of cities and towns has been rendered by Chief Justice Robert J. Pike of the New Hampshire Superior Court. The case grew out of an effort on the part of the city of Concord to prohibit boating on Lake Penacook, which is that city's source of water supply for domestic purposes. The proprietor of a passenger launch plying on the lake, took exceptions to the mandate of the authorities of Concord and brought suit against the city to compel it to restore his rights of boating and wharfage on the lake. The court finds that the order prohibiting boating on the lake was within the authority of the Concord board of water commissioners to make and enforce, and that there is no redress for the plaintiff other than to carry the case up to the supreme court. In speaking of the decision a Manchester, N. H., newspaper stated that Manchester is in the same situation as Concord in regard to boating on Lake Massabesic and that the water commissioners have long regarded with disfavor public boating on the lake, because of the danger attendant upon such to the source of water supply. Greater safeguards are being thrown about Lake Massabesic this season than ever before, and yet, with the health of 85,000 people at stake, the Manchester commissioners are said to feel that they must go further still, and it may be that the present is the last season that boating will be allowed on the lake. It is argued that the waters of Lake Massabesic are for the city's domestic supply, and it is important to throw every possible safeguard around them for fear of contamination.



View of the Munjoy Reservoir, Portland, Me.

pounds of hypochlorite of lime to a million gallons. It is only operated in the summer time, as during the winter months tests show it is not necessary to use this treatment.

Portraits of the officers at present in charge of the plant are given herewith, illustrations of the Murphy standpipe and the Munjoy reservoir.

St. Louis County Water

Believing that the drinking of well water in St. Louis County, Mo., may be partly responsible for the large number of typhoid fever cases which have developed there recently, Dr. G. A. Jordan, Assistant Health Commissioner of the city of St. Louis, has written a letter to Dr. C. G. Eggers, Health Commissioner of St. Louis County, asking the county official to co-operate with the St. Louis Health Department in testing the water. Dr. Jordan said that a large number of St. Louisans who motor into the county are in the habit of stopping at various places to drink well or cistern water. The same applies to canoeists and pleasure seekers who visit the Meramec River resorts. At some of these places water comes from springs, but many club houses and camps depend upon wells for their water. At this time of the year, Dr. Jordan said, there is a tendency to drink too much water without finding out whether the water is good. Dr. Jordan wrote that if the County Health Commissioner did not have the necessary facilities for making the tests, the city of St. Louis would supply chemicals.

Illustrated Papers—One of the papers on October 11 is to be by President Leonard Metcalf, of the Association.

The plans to be inspected are: Davenport Water Company, Main Pumping Station, pumping capacity in two stages 27,000,000 gallons per 24 hours; Filters Pressure, mechanical, 8,000,000 gallons capacity; Reservoir Pumping Station, capacity 12,000,000 gallons; Rock Island U. S. Arsenal, Gravity Mechanical Filters, capacity 1,000,000 gallons; Pumping Station, capacity 18,000,000 gallons; Gravity Mechanical Filters, capacity 6,000,000 gallons; Moline Water Works, Pumping Station, capacity 20,000,000 gallons; Gravity Mechanical Filters, capacity 5,000,000 gallons.

Iowa Section—R. N. Kinnaird, Chairman, Des Moines; Jack J. Hinman, Jr., Secretary-Treasurer, Iowa City. Social Committee—J. P. Donahue, Davenport; C. R. Henderson, Davenport; D. G. Fisher, Davenport.

Illinois Section—Paul Hansen, Chairman, Urbana; Edward Bartow, Secretary, Urbana. Local Committee—Hon. Martin R. Carlson, Moline; Hon. J. A. Murrin, Rock Island; Mr. L. A. Fritze, Moline.

Chairman Nathan Matthews, of the Water Supply Commission, of Salem and Beverly, Mass., recently urged the adoption of the meter system for the joint water works system of the towns of Salem and Beverly, Mass., as a means of decreasing the cost and conserving the supply. He stated that in Boston meters had resulted in the saving of 25 per cent. of the water formerly consumed.

New Law in Virginia Affects Plans for Installation of Water Works

Under a law recently passed in the State of Virginia, which requires that all plans for the installation of new water works shall be approved by the State Board of Health before work can be commenced, the Board has begun to receive applications for water permits. The new act is designed to protect water users from the possible use of dangerous water supplies, and provides that the State Board of Health shall pass on all plans and order their modification where necessary. In towns where the water supplies are known to be polluted, the Board has authority to order changes required for the protection of the public health, with due appeal to the courts in cases where the orders of the Board are disputed. Under the regulations adopted by the Board, as required by law, an application blank for the installation of water works must be filled out and certified to by the Board and must be accompanied by maps, etc., explaining the nature of the proposed system or change in an existing system. No permit is required for laying distribution mains from existing systems. Health officers regard the law as a distinct advance in the protection of the public health, but point out that its penalties will seldom have to be invoked where plans are carefully drawn.

The Dayton Water Supply

City Manager H. M. Waite, of Dayton, O., has recently issued a statement to the citizens of Dayton relative to the purity of the water furnished consumers in that city, part of which follows: "Due to certain rumors that have reached the city government that the water supply is impure, we feel that it is due you to state that the supply of water being furnished to the citizens of Dayton is absolutely pure. Due to the fact that a great many changes are being made from time to time in the system, additional precautions have been taken in having the water analyzed daily. The results of these analyses, as well as the analysis which the State Board of Health has made, show that the water is as pure as it ever has been."