Fiftieth Annual Report

of the

BUREAU OF WATER

of the

City of Schenectady
New York

November 1, 1934
to
November 1, 1935

Franklin Print Shop

HISTORICAL SKETCH
OF SCHENECTADY'S WATER SYSTEM

1799 - 1922

In reviewing the history of Schenectady's water systems many interesting facts have been brought to light.

It is found that as far back as May 7, 1799, a firm composed of Wright Tryar, James Case and Oliver Bull applied to the Common Council for consent to supply the City with water by aqueducts. On July 6, the same year, the Common Council passed the following resolution:

> RESOLVED, That Henry R. Teller, Richard Rosa and Remsen R. Teller be permitted to lead water works through any of the city lands from a certain spring, which heads at the road leading to Garrit S. Veeder's, upon condition that the Board shall have the use of the tubes to be made of by them in case they should at any time be necessary for the purpose of conducting water to the city for public use, the said persons, however, in such cases to have the use of water so to be conducted to the City in common with other citizens. Adopted.

No trace of these works can be found, but the spring mentioned in this resolution was afterward utilized in filling tanks of engines that were employed to help the trains up the steep grade of what then was called "Engine Hill," and was in actual use up to the time of the elimination of our grade crossings.

However, we find that Oliver Bull, one of the original company—and he must have been a promoter in his day—two years later, on September 1, 1801, applied to St. George's Lodge, F. & A. M., for a loan of $100.00 for one year, to enable him to make the necessary extensions to convey water to the old Masonic Temple, which then stood on the south side of State Street, near the site of the present Levi Building.

In the following month, October 5, 1801, a committee from the lodge, consisting of Messrs. Adams, Teller and Ross, conferred with Mr. Bull, the "proprietor of the Water Works," who made a "Durable" lease to the lodge and received the loan of L 34—16 (York pounds) on October 12, 1801. On November 15, 1801, the lodge also paid to Mr. Bull L 3—15 for "bringing water to the lodge." Just what became of the water works or proposed water works is not recorded, but extracts from the lodge minutes show that it must have been a bad business venture for the lodge, as judgment was finally taken for the amount put into the project, and the sum of L 15—14, or about one-half of the original loan, was recovered on July 23, 1803, after two years' litigation.

No definite information can be found for the period between 1803 and 1835, but in Howell and Tenney's "History of Albany and Schenectady Counties" and Hon. Austin A. Yates' "History of Schenectady County," we find that in 1835 one Jabez Ward established a water delivery by tapping springs along Veeder Avenue, then a highway which extended from the head of Crescent Park southerly along the base of what was then called the Bowery Woods. The water was conducted by gravity system through logs of white pine, about one foot in diameter, the water being conveyed through a bore not more than two or three inches in diameter. These wooden mains were laid to State Street, down State Street to Washington Avenue, with a branch at Ferry Street, thence to Union Street. It seems also to have been carried past Front Street into North Ferry Street, as quantities of the logs have been unearthed during recent years, while constructing sewers and modern water mains. The tubes or logs were connected by means of iron ferrules of an ingenious construction, some of which are in the possession of our Historical Society.

In the early 40's Union College had a private water system: a hydraulic ram, fed by a spring located somewhere above Nott Terrace and north of Vale Cemetery, forced water through a glass pipe to the college. This glass pipe was about one inch in diameter and covered with a cement or mortar jacket about two inches thick. Pieces of this pipe are also to be found in the rooms of our Historical Society and in the Water Office.

Just when the "Water Works" ceased to exist is not known, but it is supposed that its source of supply would not permit of necessary exten-

sions to supply the growing city and that its earnings were so small that it was finally forced to suspend business.

That a proper water supply was a crying need is shown by the fact that in 1866 an act was passed by the legislature incorporating the Schenectady Water Company. The capital stock was limited to $50,000. This amount was not readily subscribed, so that in 1867 a few citizens believing that the city should own its own water works, secured the passage of an act which created Wm. Van Vranken, Hon. John C. Ellis, G. G. Maxon and Andrew McMillen, water commissioners. These commissioners agreed upon a plan for constructing a water works which was submitted to and approved by the Common Council, but when the subject came before the taxpayers some time in May, 1867, it was overwhelmingly defeated.

The failure of the people's consent to the construction of a city water works again brought into active existence the company formed in 1865. This company, which had not forfeited its corporate rights, in 1869 reorganized by election of Charles Stanford as President and Wm. Van Vranken as Secretary and Treasurer. At the reorganization all the capital stock was subscribed and the following year the construction of the works commenced and was completed in 1871. Mr. John McEncore, still hale and hearty, was the builder of the Pumping Station, then located at the north end of North Ferry Street, abutting on the river front, from which the water was taken. It is htre that stove-pipe first came into use as a conveyor of water. This pipe was cemented on the inside, laid in an then covered by the same mixture. These pipes, especially in the lower portion of the city, are found from time to time while laying modern mains. In 1872 the works were in active operation, with about nine miles of pipe laid and 100 fire hydrants installed. The system adopted was known as the Holly system. The pumping equipment consisted of one Dean and one Holly or Gaskill pump, with one vertical boiler and one horizontal locomotive boiler. The water was pumped from a well 114 feet long by 6 feet wide near the margin of the river. This well was walled with brick and had an arched brick cover. The water from the river filtered through the walls into the well and the surrounding sand and gravel aided in the purification.

But troubles had just commenied, for sand, silt and grit of all kinds cut the machinery, pipes leaked, causing stoppage and delays, and the well became inadequate to supply the ever-increasing demand for water.

On November 4, 1885, the city took over this plant, for which the Schenectady Water Company received $90,000. On November 1, 1886, the first annual report of the Water Board, composed of Peter Van Dyck, E. Nott Schemerhorn and J. Andrew Barhydt, commissioners, and M. O. Caldwell, superintendent, was issued. The city immediately proceeded to enlarge and improve the system. A new Gaskill high-duty pump was installed, an additional boiler set and the station rearranged. Two intake or supply pipes were laid, one 24-inch to the east end of the second pier—from the Scotia side—of the old bridge at the foot of Washington Avenue, and one 20-inch to an intake built in the river below the pumping station. Several miles of mains were also laid. These improvements increased the capacity and improved pumping conditions generally, but the river became the common outlet for the sewage from all the cities up the valley and the water became so polluted that a new source of supply was imperative. The search for water then began. Wells were dug on Van Slyck's Island at the foot of Water Street and Thompson Lake, Warner's Lake, Mariaville Pond, and even Ballston Lake, were suggested as sources of supply and measurements and estimates were made, but a sufficient and suitable water supply could not be found for the fast-growing city.

All this time the Hon. Simon Schermerhorn and other prominent citizens of Rotterdam, who knew the lay of the land and underlying waters in the vicinity of the present wells on River Road, insisted that sufficient water to supply the city could be obtained from dug wells, but it was not until 1889-90 that the authorities were induced to investigate this contention. Wells were dug and relief came at last. It would seem that an underground river had been tapped, the supply was so abundant and so cold and pure. At the site of these wells on River Road, about 1.5 miles beyond the present city line, a new pumping station was erected in 1894-96, and put into regular service in April, 1897. The pumping equipment in this station consisted of two Dean duplex vertical triple expansion steam pumps of 6,000,000 gallons capacity each, and four horizontal tubular boilers. The supply came from a well (No. 1 well, which is still in use) 60 feet long by 8 feet wide by 43 feet deep, through two 24-inch suction pipes. These suctions were also connected with an elaborate intake built in the middle of the Mohawk River by means of two 24-inch pipes, but fortunately it never became necessary to make use of this intake. A 24-inch force main was laid along River Road to carry water to the city and a 1,000,000 gallon water tower erected on Albany Street for an emergency supply. With this equipment in operation, Schenectady had one of the best water works systems in the country, but the march of progress made it necessary that the pumping

capacity be increased and that higher pressure be maintained to supply the higher districts and afford better fire protection, so in 1903-04 a new station was built adjacent to the above mentioned station, in which induction motor-driven turbine centrifugal pumps were installed. This installation was about the first of its kind in the country, for the use of centrifugal pumps under such conditions was a new departure and considered at the time, an experiment. However, their continued service has proven their superiority over the older equipment, and those familiar with the two installations can hardly believe that one of the present pumps, occupying but a small percentage of the amount of space required by the old equipment, has more than doubled the capacity of the entire steam plant.

Two Worthington pumps were originally installed in this station with a rated capacity of 12,000,000 gallons each, but as they never came up to their rating were later rebuilt and an additional 8,000,000 gallon I. P. Morris pump installed. Two additional wells, 47 feet in diameter by approximately 42 feet deep, were constructed at the time of the erection of the new station and a 36-inch main laid to the city. An additional water tower of 2,000,000 gallons capacity was erected on Rugby Road. From 1904 to 1914 this station furnished the city's water supply, but owing to the rapid growth of the city in population and area, and the necessity for an emergency supply in case of breakdowns, a more flexible system generally became necessary.

The most extensive improvements undertaken in the history of the department were therefore made commencing in 1914. An additional 36-inch force main was laid to the city. The pumping station was entirely rebuilt and a new 20,000,000 gallon reservoir constructed in the Town of Niskayuna near the intersection of Van Antwerp and Balltown Roads. This is known as "The Bevis Hill Reservoir." With the completion of the new reservoir, the water towers on Albany Street and Rugby Road became unnecessary and were dismantled.

1922 - 23

In 1922 the 36-inch steel main which was laid in 1904 was found to be badly corroded in certain sections and plans were made to replace it with a cast iron main. The first step of this replacement was finished in 1923; an additional section was completed in 1924, and plans are now under way to complete the entire replacement during the summer of 1925.

1923 - 24

In December, 1923, the Adirondack Power and Light Corporation, which furnished the current to operate the Rotterdam Pumping Station, advised that within a very short period of time no 40-cycle current would be available in this section. This made it necessary to plan a complete change-over of the electrical equipment and pumps in the station to conform with the new arrangement. In 1924 one of the 12,000,000 gallon Alberger pumps, operated by a General Electric 40-cycle motor, was replaced with a new 12,000,000 gallon Worthington pump adapted to 60-cycle apparatus. Arrangements are being made to complete the change-over during 1925, and at the same time increase the pumping capacity of the station to meet the requirements of the constantly growing population of the City. This installation consisted of two additional Worthington pumps; one of 12,000,000 and one of 18,000,000 gallon per day capacity, replacing the I. P. Morris 8,000,000 gallon and the Alberger 12,000,000 gallon pumps then in operation. Upon the completion of this installation the pumping capacity of the station was increased to 42,000,000 per 24 hours, which will be sufficient to meet the requirements for many years to come.

1924 - 25

During 1925 another section of the 36-inch riveted steel main laid in 1903 was replaced with 36-inch cast iron pipe from the end of Jerome Avenue to a 36-inch valve on Crane Street, just north of Sixth Avenue. In performing this work it was necessary to lay the pipe under the four main line tracks of the New York Central Railroad. To accomplish this installation the Railroad Company drove piles and timbered up their tracks, for which work the City paid the New York Central directly. The Contractor then excavated beneath the tracks, laid in the main and encased the pipe with reinforced concrete. The pipe on the Railroad Embankment slopes was also embedded in reinforced concrete.

At Crane Street and Sixth Avenue, a 36x24-inch tee was installed,

and a length of 24-inch pipe with a 24-inch valve laid from this 24-inch tee. The connection was made in anticipation of laying a 24-inch main south in Crane Street to Norwood Avenue, thence over Norwood Avenue to California Avenue, thence to Altamont Avenue, Watt Street, Albany Street, Chester Street, State Street, Eastholm Boulevard and Balltown Road to the Bevis Hill Reservoir. This would make a second feeder main to the Reservoir as well as providing a large main for the recently annexed Woodlawn Section.

1925 - 26

During 1925 and 1926, the change-over at the Rotterdam Pumping Station from 40-cycle equipment to 60-cycle equipment was completed. The Pumping Station is now equipped with two 12,000,000 Worthington pumps and one 18,000,000 gallon Worthington pump, giving the City a combined pumping capacity of 42,000,000 gallons per 24 hours. The City at present has an average consumption of approximately 16,600,000 gallons per 24 hours.

1926 - 27

February 15, 1927, the Common Council passed an Ordinance authorizing and directing the making of a geological survey in the vicinity of the Rotterdam Pumping Station. With the completion of this survey a report will be submitted showing the extent of the gravel bed from which the water is taken and also will determine the maximum rate at which water from this gravel bed may be drawn.

1927 - 28

In a report to the Common Council July 17, 1928, Frank R. Lanagan, City Engineer, gave the following data in regard to the Geological Survey of the district surrounding the Rotterdam Pumping Station.

The first object of the work was to determine the thickness and lateral extent of the water-bearing formation. Two series of borings were planned and carried out. One series was across the broad valley or basin of the Mohawk, beginning at a point a short distance up river from the wells, and the other series was borings in the vicinity of the wells.

The cross-section borings showed that the body of sand and gravel from which the wells derive their water extends across the entire valley including the broad expanse of gravels northwest of Scotia. The first boring, located about 300 feet from the river on the north side, penetrated 223 feet of sand, gravel and clay before striking bed rock. This shows the depth below the surface of the rock valley, which is filled with deposits.

From the borings of the cross-section and from the records of deep well borings at various points in the valley from Hoffmans eastward it is estimated that the average thickness of the sand and gravel bed is 66 feet. The areal extent of the formation is 15.28 square miles. This gives as the volume of the sand and gravel bed 27,967,610,800 cubic feet. The capacity of sand and gravel for holding water has been accurately determined and may be taken as applied to the Mohawk deposits as 30 per cent. This gives 8,390,283,264 cubic feet of water, or multiplying by 7½, the number of gallons contained in one cubic foot, 62,927,124,460 gallons. Thus we get the conception of the general formation as constituting a reservoir containing in round numbers 63 billions of gallons of water. The total amount pumped from the city wells for the year ending November 1, 1927, was 5,200,406,000 gallons.

The source of the water contained in the gravel is primarily that of rainfall. Calculating the rainfall for the 15.25 square miles of the Schenectady basin and making due deductions for loss by run-off and evaporation, we have 3,661,214,514 gallons as the amount of water derived from rainfall on the surface annually stored in the gravel beds. To this we must add the flowage from the slopes bordering the basin. The popular idea that much of the water in the bottom lands comes from the surrounding hills is true in fact. If we estimate that 20 per cent of the rainfall of the valley slopes enters the gravels, this added to the above gives 8,411,693,874 gallons as the annual replenishment by rainfall to the reservoir of water contained in the gravel formation.

The water contained in the valley fillings is not stationary (as the use of the term reservoir might seem to imply), but has a slow movement. The rate of flow has been measured in a number of cases reported in the water supply papers published by the U. S. Geological Survey. Based on these and other data, it is estimated that the rate of flow in the Mohawk river basin gravels may be taken at 18 feet per day. This would give as the daily underflow in the cross-section immediately up river from the city wells, some 12,000,000 gallons. The wells are further supplied from the underflow of the Rotterdam watershed to the west and, when the pumps are at work, from the gravel extending for a limited distance down valley from the wells.

The first four borings made in the vicinity of the wells were located symmetrically about the wells at a distance of about 190 feet. The borings between the wells and the river penetrated gravel and underlying blue clay to a depth of 170 feet, when rock was struck. No free flow of water was met within this boring. In the other borings a free flow of water was met within the gravels at depths below the surface of from 38 to 50 feet. In all four borings and in the twelve other borings subsequently made farther out from the wells, the gravels were underlaid by the impervious blue clay stratum. The general slope of the blue clay surface was toward the wells, favoring the flow of the underground water toward the wells.

Readings have been taken of the levels of the water in the wells and in the casings of the borings in the vicinity of the wells. It is found that when the pumps are shut down, after an interval of three to four hours, the water in the wells and in the casings is practically at the same level, and as compared with the water surface of the river, somewhat less than one foot higher. When the pumps have been in operation 15 hours, the level in the wells has lowered about 4½ feet and that in the casings 190 feet from the wells about two feet. In the casings farther out from the wells, the water is lowered to a less extent and it is estimated that the effect of prolonged pumping is to lower the water plane in the gravels for a radius not more than 350 feet from the wells.

The river flows over the surface of the body of gravel deposits, occupying a shallow channel compared to the thickness of the deposits. The flow of water in the deposits is an underflow, independent of the flow in the river. In general, interposed between the water in the river and that of the gravel beds underneath, is a layer of silt which is only lowly permeable to water. There is, however, hydrostatic continuity between the water in the river and that in the gravels, so that there is correspondence in the rise and fall of levels in the two. The temperature of the water in wells Nos. 2 and 3 is about 52 degrees throughout the year, indicating that the water comes from a depth below the surface unaffected by seasonal changes. This depth is stated to be about 55 feet.

A chemical analysis of the water of the wells and, for comparison, the water of the river, made by Morris M. Cohn, shows contrasting qualities between the two. A bacteriological analysis made by Dr. Kellert gave a similiar result. The well water was found to be pure and that of the river polluted.

On September 7, 1926, the Common Council passed an ordinance authorizing the purchase of 70.43 acres of land in the vicinity of the Rotterdam wells, as a protection against possible contamination of our water supply. This land, with several farm houses, was acquired during 1926, 1927 and 1928, at a total cost of $99,191.22.

On November 28, 1928, a new five-year contract was made with the New York Power and Light Corporation for furnishing power at the Rotterdam Pumping Station. This supersedes a contract expiring November 2, 1928, which was originally made between the Schenectady Railway Company and the City, December 21, 1903, and later taken over by the present New York Power and Light Corporation. Under the terms of the original contract, payment for power was made on the basis of a million gallons pumped at a certain pressure at the pumps. The cost per kilowatt hour on this basis was approximately $.0052. Under the terms of the new contract, payment for power is as follows: $.0075 per kw. hr. for off peak pumping; $.01 per kw. hr. for intermediate peak pumping and $.035 per kw. hr. for peak period pumping. With the present consumption of water by the City the cost per kilowatt hour is approximately $.0082.

At a meeting of the Public Health Council held November 12, 1925, Chapter VII of the Sanitary Code was amended by adding thereto three new regulations to be known as Regulations 15-A, 15-B and 15-C, to take effect July 1, 1926. These regulations governed the elimination of cross connections between potable public water supplies and auxiliary industrial or fire supplies. At a meeting held later the date of discontinuance was extended to July 1, 1928. In a later letter dated June 29, a time extension of

six months was allowed. Supplementing the letter of June 29, the State Department of Health on July 3, issued a circular letter permitting the use of cross connections between potable public water supplies and auxiliary industrial or fire supplies, providing chlorination equipment approved by the State Department be installed.

Schenectady has but one condition where cross connections exist between non-potable and potable supplies. This connection is in the local plant of the American Locomotive Company. Therefore, in accordance with the provisions of the July 3 letter, the American Locomotive Company made application to the State Department of Health for permission to install the necessary chlorination equipment. This permit was issued on August 14, 1928, signed by Paul S. Brooks, State Deputy Commissioner of Health; R. H. White, Engineer of Construction at the American Locomotive Company, and Charles L. Wick, Superintendent of Water, and a copy is on file in the office of the Bureau of Water.

We are informed by the American Locomotive Company that Wallace and Tiernan Chlorinators are being installed and will be in operation January 1, 1929.

The responsibility of the proper operation of these chlorinators rests with the American Locomotive Company and they will submit reports to the Bureau of Water periodically. Inspection will also be made by the water Department from time to time.

1928 - 29

The Wallace and Tiernan Chlorinators which were installed on the fire pump lines of the American Locomotive Company were put into operation shortly after January 1, 1929. Rather than abandon their double checked cross-connections between their fire lines and the city water system, chlorination was resorted to, so that the Company might retain the auxiliary fire protection. The new type chlorinators used were approved by the State Department of Health. From reports submitted each month by the Company it has been found that the machines function properly and remove any hazard of contamination, due to their cross-connections with the city water mains.

For better control over our large feeder mains, two new 36-inch gate valves were installed; one at Eastern Parkway and Palmer Avenue, the other at Palmer Avenue and Grand Boulevard.

On account of two breaks occuring in the 36-inch Reservoir main on Eastern Parkway, it was decided that surges in the line were undoubtedly causing this condition. Consequently an eight-inch Ross Surge Relief Valve was installed June 1, 1929, at Eastern Parkway and McClellan Street. This valve opens and closes automatically when excess pressure from any cause is exerted on the mains.

On May 9, 1929, a 20-inch pressure reducing valve was cut into the 24-inch main at the Pumping Station. This main supplies the business district. After the new power contract went into effect, November 28, 1928, it was found that our pumping rate must be increased considerably for economical operation. This consequently raised the pressure excessively on the mains in the business district during the night hours of low consumption. By the introduction of the new valve at the Pumping Station our pressure down-town is now held constant between 85 and 90 pounds per square inch.

1930

In the preceding paragraph mention is made of a new power contract between the New York Power and Light Corporation and the City. The intermittent pumping schedule under this contract proved unsatisfactory and after conference with the Power Officials a modification was made on May 1, 1929, which allowed twenty-four hours pumping. This revision was a decided improvement to the City and effected a saving in power cost of approximately $7,044.50 annually.

During 1930 new Rules, Regulations and Rates for the use and supply of water were adopted. The meter rates became effective as of May 1, 1930, and the flat rates as of January 1, 1931.

1933

Five-year contract between the City and New York Power and Light Corporation expired November 28, 1933.

1935

Contract for power at the Rotterdam Pumping Station was renewed for a five year period from November 28, 1933. An amendment to this contract effecting rates only was executed in November 1935.