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in the heat of the summer it was too warm to be palatable. As ice-houses were then unknown, wells were the only sources of cool water.

Water Works, City.-In the year 1829 the city of St. Louis contracted with Messrs. John C. Wilson and Abraham Fox for the building and operating of a water works to supply "clarified" water for a term of twentyfive years: the works to belong to the City at the expiration of the contract.

This contract gave the contractors the exclusive right to supply water for public and private purposes; the charges being limited to \$20 per year for families and \$100 per year for hotels and manufactories. The city further conceded a bonus of \$3,000 cash on the completion of the works; a lot of ground 40 feet by 125 feet on the river bank and a half acre of ground for a reservoir site.

In 1830 the city purchased of William H. Ashley a lot of ground 170 feet by 160 feet on the "little mound" located at the corner of Ashley and Collins streets for a reservoir site, and a lot 250 feet by 250 feet from the United States Government for a pumping site.

The contractors were to supply, free of charge, water to twelve fire hydrants, the hospital of the Sisters of Charity and a fountain on the grounds of William Ashley. The water was to be distributed through cast-iron pipes laid not less than three and one-half feet under ground. Water was to be delivered to the reservoir in one year and to the hydrants in eighteen months.

But little progress was made under this contract, notwithstanding the fact that the then Mayor, Daniel D. Page, gave his private note to secure payment for water pipe ordered of Vanleer & Company. The contractors were forced by want of capital to suspend work, and the city was forced into a new contract, dated April 2, 1831, with Mr. Fox, in which he was released from all the conditions of the first contract except the fountain for Mr. Ashley; this fountain being a part of the consideration in the purchase of the reservoir site. In this contract the city agreed to assume three-fourths of all expenses and take charge of and complete the works.

The city borrowed \$25,000 in 1831 in order to proceed with the works. The supply of water was in all probability begun in the fall of 1831. Old reports refer to this date, but positive statements of water supply do not appear until the summer of 1832.

The early management was under the care of a committee of the City Council, and it appears that the work was carefully conducted. Until 1847 plumbing and all work connected with the supply of private houses was conducted solely by the city, which manufactured its own lead pipe and fixtures.

In July, 1835, the city purchased the interest of Mr. Fox in the works, paying \$18,-000 therefor.

The total cost of the works to this time was about \$54,000, not including interestbearing notes given in pay for pipe. The city then became sole owner of its water works.

The first pumping engine was built for the works by Francis Pratt, of Pittsburg. The steam cylinder was 10 inches in diameter by four feet stroke. The pump was double-acting, and the piston was 6 inches in diameter and of 4 feet stroke. This engine proved to be a failure and was replaced by two rotary pumps which the city had purchased for fire engines. These rotaries were set up in a small building at the foot of Smith street. The water was delivered into a reservoir at the corner of Bates and Collins streets. This was the first reservoir used by this city. The reservoir was 62 feet by 55 feet, with a depth of 15 feet. The flow line was 90 feet above the city directrix. The walls were of masonry, lined with brick, and the bottom was paved with brick on a tight plank floor.

These facilities supplied sufficient water for ordinary uses, but failed to give an adequate fire supply on account of the smallness of the distribution pipes. Although a settling basin was constructed near the engine house it does not appear to have been used, all evidence going to show that water was pumped direct to the city reservoir without settling.

In 1836 a new pump main 10-in. in diameter was laid, and in 1839 a new engine was started. It was direct acting. The steam cylinder was thirteen inches and the water cylinder was thirteen inches in diameter, and both were of six feet stroke.

In 1838 a new pump main twelve inches in diameter was laid and a new reservoir was decided upon, but the project was abandoned.

In 1845 a new reservoir was erected on the site of the old one. It was a wooden tank one hundred feet square by twelve feet deep. The walls of the old reservoir were used as a support for the middle part of the bottom, and a dry stone wall was laid up to carry the edges of the tank. The tank rested on these walls and on intermediate posts. It was built of oak, framed and spiked, and the seams were caulked with oakum.

The use of both reservoirs was continued, the upper one being used for supplying the higher districts. It seems that the city was at one time didvided into two districts.

After a few years' use of the double system, the old, or lower level, reservoir was abandoned and the distribution was thrown onto the upper reservoir. By the year 1849 frequent repairs to the wooden tank became necessary, and in 1852 it was abandoned.

In 1846 the superintendent of the works first suggested that the supply of water for the city be drawn from the Meramec River. The discussion on this question continued until 1854 when the then superintendent reported against the scheme.

In 1846 the third pumping engine was erected. The machine was of the crank and fly-wheel type. The steam cylinder was 20 inches in diameter by seven and one-halt feet stroke, the pump was double-acting, filteen inches diameter and of the same stroke as the steam engine. The engine gave trouble on account of bad foundation, and in 1847 it "laid down" and was rebuilt. In 1852 the fourth engine, costing twenty-five thousand dollars, was erected; steam cylinder, twentysix inches diameter by ten feet stroke; pump, double-acting, piston, twenty-two inches diameter by ten feet stroke. It was originally started as a condensing engine, but the condenser was abandoned in 1852.

In 1847 the third reservoir was begun. This was the old Benton Street Reservoir. It was 250 feet square with a working depth of fifteen feet. Elevation of flow line, 115 1-2 feet above datum, cost \$74,000 (approximate). The pump main for this reservoir was a twenty inch cast iron pipe and was laid up Mullanphy Street. The reservoir was finished in 1849. It was provided with a sloping bottom and a system of flushing sewers for the purpose of removing sediment, but the scheme was a failure.

In 1854 the fourth reservoir was begun, the claim being that the flow through a large reservoir would be at a low velocity, and that the sedimentation would be correspond-

ingly good. This reservoir had a bottom laid out in the shape of a nest of very flat inverted pyramids, the bottoms being divided with valves, and a system of flushing sewers. The reservoir was 527 feet by 237 feet, with a depth of 47^{1/2} feet. The cost was about \$200,000.00 and water was first pumped into it in 1855. This reservoir gave the city a great deal of trouble; the cleaning scheme proved a failure, and the walls required constant repair and careful watching. The water line was carried 138 feet above datum. This reservoir, after many vicissitudes, was finally abandoned and removed, and the site divided up. part being retained for public purposes and the remainder sold.

During the building of the new works, or from 1867 to 1872, a temporary reservoir on Gamble Street near Garrison Avenue was built and was used in conjunction with the old reservoir. In 1867 the sediment in the old reservoir was twenty feet deep.

The fifth pumping engine, with steam cylinder thirty inches diameter, stroke ten feet, pump double-acting, piston twenty-two inches diameter, stroke ten feet was put in to keep up with the demand for water. In 1858 a new pump main 30 inches diameter was laid up Cass Avenue, and the 20-inch main was turned in on the distribution system. The old pumping engines, Nos. 2 and 3, were sold for scrap in 1857, and the Benton Street reservoir was abandoned in 1855.

At the old pumping station an engine with steam cylinder 34 1-2 inches diameter by ten feet stroke, and double-acting pump 28 1-2 inches by ten feet stroke, was put in to keep up the supply during the building of the new works (1865-'72). This old station, with its pumps and piping, was operated until 1871, at which time the Bissell's Point works started. A break-down at this High Service Station necessitated starting the Bates Street engines again, but on June 19, 1871, they were shut down for the last time.

This station was wrecked and the machinery sold at auction, and after its removal the location was used for a pipe yard. The property was subsequently turned over to the Harbor Department for wharf purposes.

This is briefly the history of the St. Louis water works from the time of their inception up to 1867, for the old works; and up to 1871 for such temporary work in connection with the old works as was necessary during the building of the new works.

The new water works date from 1863, when the General Assembly of this State passed an act entitled "An Act to enable the City of St. Louis to extend the Water Works thereof and for other purposes." This act authorized the city to construct works to take water from any point on the Mississippi River and conduct it to the city. It also created a board of four commissioners to be elected by the Common Council of the City, to carry out the provisions of the act. It further provided for an issue of bonds for the purpose of constructing the new works, limiting the amount to \$3,000,000.00.

The City Council, at its May session, 1864, passed Ordinance No. 5339, establishing and regulating the Board of Water Commissioners, in conformity with the general act of 1863. But, owing to general dissatisfaction no action was taken under this ordinance, and, in January 1865, the General Assembly amended the Act of 1803, placing the appointment of the Commissioners with the Governor of the State, who appointed Messrs. Dwight Durkee, Dr. Philip Weigel, N. C. Chapman and Stephen D. Barlow.

This Board organized on March 18th, 1865, and, on the 27th, submitted to the City Council the appointment of James P. Kirkwood as Chief Engineer, which was approved.

On May 11th, 1865, the Board directed the Chief Engineer to proceed with the surveys and plans for a system of water works. The plans and estimates were submitted on August 20th, 1865, adopted by the Board October 6th and forwarded to the City Council for its action on October 12th, 1865.

This scheme contemplated the location of the Low Service works at the Chain of Rocks; the work to consist of a pumping station, settling basins and filter beds; the filtered water to be conducted by gravity flow in a conduit to Baden, and there pumped by the High Service Plant to a reservoir to be built at Rinkels with a high water line 204 feet above datum; an auxiliary reservoir to be built on Compton Hill to furnish full supply for the southern part of the city. The works were designed for an ultimate capacity of forty million U. S. gallons per day. This scheme was rejected by the City Council in March, 1866. The Council recommended, after report by sub-committee, that the filter

beds be abandoned and the works located at Bissell's Point.

During the consideration of this report by the Council, Mr. Kirkwood was sent to Europe to examine and report upon methods, there in use for filtering water.

In April, 1866, the first Board of Commissioners resigned and a second board was appointed. This board organized in August, 1866, with Geo. K. Budd as president and C. S. Solomon as secretary.

In November of the same year it submitted to the Council plans for extending the old works, prepared by Freeman J. Homer, City Engineer. In December, 1866, another plan was submitted, prepared by Mr. Kirkwood in accordance with the following:

Resolved, That the Engineer be directed to prepare a general plan of works, founded on the following basis, to wit;

That the water be taken from the Mississippi River, in the neighborhood of Bissell's Point.

That settling basins be established there without the accompaniment of filtering works.

That a small storage reservoir be constructed on the City Commons.

And that the whole be arranged, so far as practicable, so as to admit hereafter of the convenient addition of whatever further works may then become expedient or necessary, and that the engineer be instructed to report the estimated cost of the works in question.

The plan reported by Mr. Kirkwood, in answer to the above resolutions, is substantially the one upon which the new works were constructed.

In February, 1867, an ordinance looking to the enlargement of the old works and authorizing the issue of \$275,000.00 in bonds, was passed. In March, 1867, the Board of Water Commissioners made a demand on the Comptroller for the bonds, appointed Mr. Homer superintendent, and instructed him to proceed to carry out the plan proposed by him in November, 1866. This scheme fell through and no work was done. The report and plan were printed in the second report of the Board of Water Commissioners.

On March 13th, 1867, the General Assembly passed an Act authorizing the issue of bonds to the amount of \$3,000,000.00 and appointing a new commission.

This commission, after it got into working shape, consisted of Geo. K. Budd, Alexander Crozier and Henry Flad, and under this board the works were built.

The Commission organized March 22nd, 1867, and on the 23rd the former board turned over to them the old records belonging to the department.

On the 26th Mr. Kirkwood was requested to resume the duties of Chief Engineer from which he had been relieved by the former board on March 18th.

Mr. Kirkwood declined further service as Chief Engineer, and recommended Mr. Thomas J. Whitman for that position. Mr. Whitman reported for duty May 7th, 1867.

Mr. Whitman was in favor of the Chain of Rocks location for the low service works, adding his opinion to that of Mr. Kirkwood and all other engineers who had examined the situation carefully. He found, however, that the exigencies of the supply and the limitation of the law left but one thing to do, viz., to go ahead with the work on the Bissell's Point plan. The works, thus built, with which most people are familiar, consist of af inlet tower, or intake, on the river bank at Bissell's Point; a low service pumping plant; settling basins; a high service plant; a stand pipe; large extensions of the old pipe system; and a storage reservoir on Compton Hill. These works, extended up to 1872 by the addition of two pumping engines, had a working capacity of about thirty-two million U. S. gallons per twenty-four hours.

In must be borne in mind that all water furnished to the city is pumped twice; first, from the river into settling basins by the low service plant: and second, from the basins into the distribution system and reservoir by the high service plant.

In 1876, the city of St. Louis adopted a charter and changed its system of local government; the water works, with the exception of the collection of the revenue, being placed in the hands of the Water Commissioner, who acts as Chief Engineer and executive head of the department.

Additions to the high service pumping plant were begun in 1881, and continued up to 1804. A new pumping station, complete, with pump mains and stand pipe being completed, making the total high service capacity from sixty to sixty-five million U. S. gallons per day (twenty-four hours). To keep up the supply of water to the high service plant, a temporary low service plant was put in, having a capacity of thirty million gallons per day. This plant, built on an inclined way, moved on wheels up and down the incline according to the stage of water in the river. The general scheme of this plan has been followed by the city of Cincinnati to afford temporary pumping facilities.

After several ineffectual attempts to secure the necessary legislation authorizing the extension of the low service works, the City Council passed Ordinance No. 14212, approved Sept. 7th, 1887, establishing a low service station at the Chain of Rocks. This station consisted of an intake tower, an intake tunnel, a pumping plant and a system of settling basins.

The works were designed for a capacity of one hundred million U. S. gallons of settled water per day. This work was put into operation during 1894.

On December 26th, 1893, Ordinance No. 17339 was approved authorizing the further extension of the High Service Pumping Plant. This work is located at Baden and is now nearing completion. When put into operation it will supply water to the high districts of the city that are at an elevation beyond the reach of the Bissell's Point works.

M. L. HOLMAN.

Waterworth, James Alexander, was born in the County Down, Ireland, near the City of Belfast, in the year 1846. He is of English descent, his ancestors having emigrated from Yorkshire, England, to the north of Ireland about the middle of the eighteenth century, where they have been engaged for the most part in agricultural pursuits. His father John Waterworth, was a highly respected citizen whose memory and virtues his fellow townsmen have commemorated by a mural tablet erected in the Presbyterian church, Downpatrick, of which he was for fifty years a venerated elder. His son, the subject of this sketch, received a good education qualifying him for professional life; but having a strong liking for business he entered a mercantile house, where he served a three vears apprenticeship. At the close of his apprenticeship his ambition led him to seek the wider and more renumerative field of employment offered by the United States, and he came direct to St. Louis in November

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