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Department for Supplying the City with Water.

REPORT

UPON THE

EXTENSION OF THE WATER WORKS

OF THE

CITY OF PHILADELPHIA.

Presented to Councils March 31st, 1864.

BY HENRY P. M. BIRKINBINE,

CHIEF ENGINEER.

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1864.

REPORT.

To the Select and Common Councils
of the City of Philadelphia.

GENTLEMEN : The Committee on Water have directed me to examine and make an estimate, for a loan to extend the Water Works.

In compliance with this, the Department would submit the following report :

The City has increased much more rapidly than the water supply has been extended. The works were deficient in capacity in 1858, when first I had the honor of reporting to Councils upon their requirements. A number of extensions were recommended at that time, viz. : an increase of the pumping machinery, storage capacity, and distributing mains. Some of these suggestions have since been carried out. The new mill-house at Fairmount, raising the Corinthian avenue reservoir and the thirty-inch main from the Corinthian avenue reservoir to Washington street. These extensions have been valuable to the City, not only in increasing the water supply, but also in a pecuniary point of view.

The new mill-house was at first intended to have but two wheels, with a daily pumping capacity of four million gallons. The works, as constructed, have three turbines, and a daily capacity of sixteen million gallons. It was estimated that the new mill-house would save 9,215 dollars per annum, in the expense of pumping water. Had it been necessary to pump by steam, the water supplied by the new works in 1863, it would have been at an additional cost of \$21,684 95, thus showing a saving of that amount of money, in the running expenses of the works. The revenue derived from the districts supplied by the thirty-inch main, viz: the First,

Second, Third, and Fourth Wards, has already increased one hundred per cent., and is now \$100,000 per annum.

The value of the increased storage capacity, created by raising the Corinthian avenue reservoir, cannot be determined by dollars and cents; but a moment's reflection will show that the expenditure was a judicious one, for it has increased the storage capacity of the works, from 66 to 93 millions of gallons. The total amount expended upon all these improvements, and for which a loan has been created, is \$353,063 92, while the gross annual income from the works has increased from \$457,518 48, in 1858, to \$568,740 60, in 1863—an increase of \$111,222 12.

The net earnings of the works, after deducting all expenses, in the these six years, from 1858 to 1864, has been \$2,048,401 87, being \$1,696,337 95 more than the entire amount expended, in extending the works in the same time. Thus it will be seen, that the water supply of the city has been materially increased, and that the amount expended has yielded a large profit in the increased revenue and decreased cost of pumping. The saving produced by the new mill-house, will alone pay the interest of all the money expended on the extensions. The accompanying paper, marked A, will show the receipts, expenditures, and net income of the Department since consolidation, 1855. There are still many of the extensions recommended in my report of 1858, which Councils have never deemed it expedient to undertake; these have, however, lost none of their importance by the time which has intervened, and the necessity of them is even more apparent now, than when first urged upon your consideration. The Department would respectfully urge them upon you again, with other extensions, which the rapid growth of the City has made necessary. It would not be practicable to undertake all these extensions at once, nor would it be policy, although they are all demanded to make the supply of the City perfect. The Department would respectfully suggest that some of the most essential be undertaken now, and the others undertaken as fast as proper arrangements can be made, viz.: surveys, detailed plans and specifications, and the necessary real estate procured, and as you may deem it expedient.

One consideration, of which, perhaps, it is unnecessary to remind you, is the increased cost of labor and materials.

How far such considerations should influence you, when an interest so vital, as an abundant supply of salubrious water, is a question, you alone must decide.

At this time, when prices are so fluctuating, it is hardly possible to make a reliable estimate, of the cost of these extensions, but the Department would recommend making a loan of one million of dollars, for the purpose of extending the Water Works, to be appropriated to such of the improvements, as you may think the interest of the City will demand, from time to time. An inspection of the accompanying statements of the requirements of the works, will convince you that even this large sum, will not be sufficient to bring the works up to the necessities of the City. It is believed, that if this sum be judiciously expended, it will be a profitable investment to the City, and will yield a direct return, in increased water rents, above the interest of their entire cost.

The following extensions the Department deem necessary :

PUMPING MACHINERY.

First. At Fairmount, substituting turbine-wheels for the old breast-wheels, would increase the capacity of these works ten million gallons per day, and make the total pumping capacity of Fairmount, during ten months of the year, thirty-eight millions per day, and for the remaining two months, sixteen million gallons per day. To take out the eight wheels, and substitute turbines and new pumps, will cost \$160,000; alterations to the mill-house, \$40,000; making a total of \$200,000. With this alteration, the pumping facilities of Fairmount, would be greatly in excess of the present requirements of the City.

One set of pumps, could be arranged to supply the Twenty-fourth Ward, thus dispensing with the use of the steam engines, a greater part of the year.

With proper connections to the Schuylkill and Delaware works, all the steam engines could be stopped, for at least eight months of the year. This would effect a large reduction, in the running expenses of the works, equal to many times the interest of the cost of the alterations.

The dilapidated condition of the old works at Fairmount,

makes it necessary to do something at once. It is almost impossible to keep them in running order.

An examination of Fairmount Dam, at the present stage of the water, is impossible, but as soon as the condition of the river, will admit of its being done, a thorough and careful examination will be made, and its condition and what is necessary to its permanency reported to you.

Second. A large Cornish pumping-engine, with a pumping capacity of ten million gallons per day. The location of this engine will be determined by other extensions, to be hereafter considered. If the improvements be made at Fairmount, as above suggested, this engine will only be required for a few months of the year. Such an engine will cost now, with engine-house, forty-eight-inch pumping main, say 3,000 feet, \$160,000.

Third. At Kensington works; by erecting a stand-pipe, both of the engines could be used at the same time. This would cost, with the necessary connections, extending the wharf to Port Wardens line, and laying a thirty-inch suction main, \$30,000. See Report upon this subject in full, Appendix to Journal of Select Councils, No. 63.

The extension of the wharf to the Port Wardens line, and laying a suction main to that point, will enable the Department to furnish water of much better character. Erecting a stand-pipe, will double the pumping capacity of the works, by enabling both engines to be used at the same time, and the ascending main can then be used as a distributing main, thus increasing the facilities for distributing the water.

Fourth. A forty-eight-inch main, from Fairmount works to Corinthian avenue reservoir, \$125,000. This main will be necessary, as soon as the old works are rebuilt. At present, all the water pumped by the new wheels, is forced through one thirty-inch main, which is not of sufficient capacity to vent it properly, and any increase in the amount to be delivered at Corinthian avenue reservoir, will require an additional main.

Fifth. A thirty-inch main, from the Corinthian avenue reservoir, to the Kensington reservoir, \$175,000.

This will dispense with the use of the steam engines, at the Delaware works, for nine months in the year, and will save, in running expenses, about \$15,000 per annum. Should you

determine to lay the main, the Department would not recommend the abandoning of the Delaware works, but that they be kept in repair, and ready for any contingency that may occur requiring their use; at least until some other means of supplying the City is resorted to, than Fairmount dam.

Sixth. A thirty-six-inch main on Poplar street, from Nineteenth street to Ridge avenue, to connect the thirty-inch main from the Spring Garden reservoir, with the two sixteen-inch mains on Ridge avenue from the same reservoir, which will cost \$12,000.

This will afford great relief to higher parts of the Twentieth Ward. The most of this district lies too high, to be satisfactorily supplied by any of the existing reservoirs.

Seventh. A thirty-inch main, on Twenty-second street, to connect the ascending main, from Fairmount to the Corinthian avenue reservoir, with the thirty-inch main on Poplar street, from the Spring Garden reservoir. This will cost \$80,000, and enable the Works at Fairmount to pump directly into the Spring Garden reservoir.

Eighth. A twenty-inch main from the Kensington reservoir to Frankford road and Lehigh avenue. A sixteen-inch main, from this point to Westmoreland street and Frankford road, and another to Lehigh and Richmond avenues. This will cost \$150,000, and will insure a supply to Richmond, Frankford, and vicinity, where a large amount of water could now be sold, if the Department could furnish it. This entire district is without a single large main, and is supplied entirely through the service mains. There is but one main leading from the Kensington reservoir, of eighteen inches in diameter, and from the district furnished by this, the Department now receives \$86,000 water rent. A full supply of salubrious water, would no doubt add twenty-five per cent. to this gross income in a single year.

Ninth. A sixteen-inch main on Washington street, from Fifth to Front street, which will cost \$16,000.

The district lying east of Fifth street and south of South street, is now without any supply, except that received through the ordinary service mains.

Tenth. A twenty-inch main on Twenty-second street, to

South street, from Fairmount reservoir. This will cost \$80,000.

The district south of Walnut and west of Broad street, is now but indifferently supplied.

Eleventh. Should one of the wheels at Fairmount, be arranged to supply the Twenty-fourth Ward, a sixteen-inch main would be necessary from Fairmount across the river, and on Haverford street to Thirty-fifth street, which will cost \$30,000.

RESERVOIRS.

Twelfth. The surface of the water in the Kensington reservoir, is now seven and a half feet below that in the Spring Garden and Corinthian avenue reservoirs. By raising this reservoir to the height of the latter, its capacity will be materially increased, and its depth will add much to the salubrity of the water. This will cost \$70,000.

Upon examining the deed, for the property upon which this reservoir is located, I find the City has sufficient ground adjoining it to construct a reservoir of nearly the same capacity as that on Corinthian avenue. The Survey Department is now preparing a plan of the property, and as soon as possible the detailed plans and specifications for a reservoir to occupy the entire property, will be submitted. It will always be desirable, to have a distributing reservoir at this point, as it is three miles distant, from any of the other reservoirs, and the centre of a large and rapidly increasing population.

Thirteenth. A large store reservoir, should be constructed in some eligible situation, with a capacity of at least five hundred millions of gallons. The surface of the water in this reservoir, should be two hundred feet above the City datum; this would command the entire City, with but few exceptions. For such a reservoir the Department has examined several sites—west of Columbia Bridge, in the Twenty-fourth Ward, and south of Green Tree Run, in the Twenty-first Ward. The Twenty-fourth Ward is nearest to the centre of the City; a good location for the pumping machinery suggested in the second recommendation; is near the Columbia Bridge. The water in the river is deep at this point, and of as good quality as that at Fairmount. The reservoir, if constructed

here, would obviate the necessity of one, for the Twenty-fourth Ward.

The location near Green Tree Run, would be farther from the centre of the City, and would require a large and expensive main, but the necessary real estate could be procured at a much less price. The pumping engine, would be located so as take the water from Flatrock Dam, which is free from contamination, and fully equal in quality to that taken from other parts of the river.

Roxborough and Germantown, could be furnished by pumping from this reservoir, which would lessen the expense of supplying them. Such a store reservoir is of great importance, as a source to draw from in times of emergency and as a means of equalizing the demands upon the pumping machinery. It would also insure pellucid water at all times, by allowing thorough subsidence, and the pumping machinery to be stopped, when the water in the river is turbid. The entire storage capacity of the City Works, is now less than one hundred millions gallons—but three days' supply in seasons of the greatest demand. The store reservoir recommended would contain fifteen days' supply.

The entire cost of the reservoir, would not compensate for the trouble, confusion, and expense that would be occasioned, by the interruption, of the water supply to the City for a single day. Without knowing the exact location of this reservoir, the price of real estate, and the distance from the centre of distribution, to which a forty-eight-inch main will be required, it will be impossible for the Department to make any reliable estimate.

The Department is not prepared to recommend either of the above locations at this time.

If the construction of this reservoir be determined upon, there are other localities which should be examined. The location must be fixed, and surveys and detailed plans made, before an estimate can be offered of the cost of the reservoir and the main, to bring the water to the required distributing point.

Fourteenth. Works for supplying Germantown and Roxborough. If the vicinity of Green Tree be selected for the large store reservoir, the pumping engine will take its

supply from it. These Works will cost, with the necessary engines, mains, and reservoirs, \$250,000.

Fifteenth. A reservoir for Twenty-fourth Ward, with the necessary mains, which will cost \$150,000. If the Twenty-fourth Ward is selected as the location for the store reservoir, it will only be necessary to lay a distributing main, which will cost \$80,000. In that case the expense of supplying Roxborough and Germantown will be increased, so that the gross amount required for the two will be the same.

The extensions which are most essential now, and which demand immediate attention, are the following:

The extension of the wharf at Kensington Works to the Port Wardens' line, laying a thirty-inch suction main to take the water from the end of the pier, and the erection of a stand-pipe at the Works; which will cost, with the necessary connections, (see third recommendation,) - -	\$30,000
A thirty-inch main on Poplar street, to connect the thirty-inch main from Spring Garden reservoir, to the two sixteen-inch mains on Ridge avenue from the same reservoir, (see sixth recommendation,) -	12,000
A sixteen-inch main on Washington street, from Fifth to Front street, (as per the ninth recommendation above,) - - - - -	16,000
To take out two of the old wheels at Fairmount, and substitute turbines and pumps, (as per first recommendation,) - - - - -	50,000
Total, - - - - -	\$108,000

The Department will mature the plans and specifications for the other Works recommended, as fast as possible, and present them for your approval. It will require some time to execute all of the Works above recommended. The delays incident upon procuring the necessary legislation, real estate, &c., and the time required to do the whole work, will be at least five years, when the demands upon the Works will be fully equal to their enlarged capacity. The daily average amount supplied by all the Works when first consolidated, was twelve millions gallons, and in 1863 twenty-six millions gallons; and, with the same ratio of increase, the water supply of the City will be about in the same position then as now.

At the present prices of material and labor, the entire cost of the work recommended above, would probably reach two millions of dollars.

It is obvious that at no distant day, other sources and other means of supplying the City with water than those now in use, must be resorted to. Allow me to call your attention to an extract, from a report I had the honor to make to Councils on October 28th, 1858, (see "Appendix of Select Council," page 442 :)

"There are sources not yet examined, and the subject of a more abundant supply of unobjectionable water, is one of sufficient importance, to call for a most careful and complete investigation. The Department would suggest the propriety of Councils appropriating, say \$2,000, for the purpose of making preliminary surveys and examinations. A source of supply has been overlooked, viz.: the system of surface drainage and store reservoirs, which is so successfully carried out in some of the cities of the Old World, particularly Liverpool and Manchester, in England, where an abundant supply of most excellent water has been procured, by the above system. That we have as well-fitted and as accessible, and in all points as desirable, sources of supply as those of either of the above cities, needs but a careful examination to demonstrate. An average supply, say, of thirty to fifty millions of gallons per day, brought by its own gravity and delivered into the City, at an elevation of about one hundred and fifty feet above tide, by an aqueduct of but from twenty-five to thirty miles in length, is a possibility, which the expenditure of a sum not greater than the above indicated, will most probably demonstrate to your entire satisfaction."

Such Work look to the future, but the necessities of the City, call for an immediate extension and enlargement of the present Works. During the six years that have intervened, this subject has not been forgotten, as the frequency with which it has been urged upon you will indicate. The Department would again present it to your consideration.

Should the project be found inexpedient, the amount necessary to make the preliminary surveys, is so small that the loss would be very trifling; but if it prove expedient, all the

extensions of the Works should be made with such a change in view, so that when the mode of supply is changed, the loss to the old Works would be as small as possible.

HENRY P. M. BIRKINBINE,
Chief Engineer.

EXHIBIT A.

STATEMENT

of Receipts, Expenditures, and Net Income of the Department from Consolidation.

	Receipts.	Expenditures.	Net Income.	
1855...	\$382,036 72	\$250,895 37	\$131,141 35	
1856 ..	351,936 49	188,954 85	212,981 64	
1857...	425,426 11	200 605 82	224,820 29	568,943 28
1858...	457,518 48	187,978 09	269,540 39	
1859...	551,180 08	225,082 08	326,098 05	
1860...	558,531 53	198,269 18	360,262 35	
1861...	533,980 06	162,724 94	371,255 12	1,827,155 91
1862...	544,767 25	177,271 69	366,495 56	
1863...	568,740 60	213,750 20	354,750 40	721,245 96
	\$1,374,117 32	\$1,755,532 72	\$2,617,345 15	\$2,617,345 15