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REPORT

MADE TO THE

COMMISSIONERS

OF THE

MANAYUNK AND ROXBOROUGH WATER COMPANY,

ON A SUPPLY OF WATER FOR THE DISTRICT EMBRACED UNDER THEIR CHARTER,

IN THE CITY OF

PHILADELPHIA.

BY

HENRY P. M. BIRKINBINE,
ENGINEER.

PHILADELPHIA :

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1863.

PHILADELPHIA, *Manayunk*, March 19th, 1863.

H. P. M. BIRKINBINE, *Engineer*.

DEAR SIR:

At a Meeting of the Corporators of the MANAYUNK AND ROXBOROUGH WATER COMPANY, held at the Masonic Hall, Manayunk, the following Resolution was passed.

Resolved, That Mr. Henry P. M. Birkinbine be directed to make the necessary examinations, and report a plan and estimate for a Water Works to supply the District embraced under the Charter of the Company.

JAMES SHAW,

Secretary.

J. L. OGDEN,
Secretary

REPORT.

JOSEPH RIPKA, ESQ.,

Chairman of the Corporators of the

Manayunk and Roxborough Water Company.

DEAR SIR :

In answer to the above Resolution, the following Report upon a supply of Water for Manayunk and Roxborough, also with reference to a supply for Germantown, is respectfully submitted.

Perhaps it is unnecessary to present any arguments to show the importance of an adequate supply of good water in this District, as the subject has been long before you, and the pressing necessity of it deeply felt, as evinced by numerous petitions to Councils for relief, as well as by your own efforts.

It is now conceded that an adequate supply of good wholesome water is so indispensable to towns of any considerable size, that where it is neglected, Legislatures should interfere to force them to procure a supply, and also to arrange sufficient drainage, as upon these essentials the health of towns very much depends.

In the consideration of a water supply, the first and that of paramount importance, is quality; second, that of quantity, which is almost as essential; and, last, that of the expense incident upon the procuring and maintaining the supply: Indeed, almost any amount, if judiciously expended, in procuring and distributing a copious supply of good water, would be prudent in a district, parts of which are as crowded with inhabitants as that contemplated by your charter. The health, the prosperity, the safety from fire, and the comfort and convenience of all, are involved in this question.

Remuneration for the capital invested, is a subject that will only interest those who enlist in the enterprise simply as an investment, for the purpose of making money upon it. Although this is an important question when individuals are called upon to use their personal means for a public good, it is the consideration of least importance when the interest of the district to be benefited, is taken in consideration. This enterprise, however, it is believed, holds out reasonable inducements in regard to remuneration; and of the safety of the investment there is no room for doubt.

QUALITY OF WATER.

Where population becomes crowded, it is impossible to keep the water in springs, wells, or even cisterns, free from contamination. This is caused by infiltration of impurities from cess-pools, gutters, streets and other sources, and impure and obnoxious substances which find their way, or which often are thrown directly into it. Water from such sources is prejudicial to health, and in many cases unfit for any use, as has been found to be the case with the many desirable wells and springs at one time used in the old city proper, all of which are now abandoned. Sometimes very pernicious impurities do not affect the appearance of the water, but seem to add to its desirableness for drinking, as they give a certain *sweetness, sprightliness, and coolness* to its taste, which make the injurious effects of such water more dangerous, particularly in warm weather. In fact, very many diseases have been traced to the use of water from wells in crowded localities. This has been shown to be the case by the patient and thorough investigations of the English Government into the causes of disease in particular localities, where wells (that were highly esteemed by those using them for their supposed excellency of water,) were found upon analysis to contain over eighty-four grains of impurities to the gallon, and as a consequence the persons using such water were particularly liable to ordinary and infectious diseases. The analysis of the water from a well in a crowded part of this city, showed over one hundred grains of impurities to the gallon. The water of the

Schuylkill, in Fairmount Dam, has been found by analysis to contain about six grains of impurities to the gallon. By Clark's soap test, the water in Flat Rock Dam is perceptibly softer than that in Fairmount Dam. There are few springs, and perhaps no wells, the water of which is so pure and desirable for drinking, culinary, and manufacturing purposes, as that of the Schuylkill, in either of these dams. It will also compare favorably with the water supplied to any of the cities in this country.

The only objection than can be urged to the Schuylkill water is, the fact that it becomes turbid in times of freshets. This can be obviated by subsiding reservoirs and filter beds.

It is therefore proposed to take the water for the supply of the District contemplated by your charter, from the river Schuylkill, at some point in the vicinity of Green Tree Run. Several other sources have been examined, but to all within reasonable distance, there are objections.

The character of the water in Flat Rock Dam is better than at any other point in the Schuylkill; the river is deep, the shores in this vicinity principally of rock, and the banks high and precipitous.

QUANTITY OF WATER REQUIRED.

There are few towns so favorably situated, that an adequate supply of water can be procured from springs and wells within reasonable distance, even for culinary and drinking purposes; and when our peculiar habits of bathing, washing, &c., are taken into consideration, hardly any towns so situated, can be found. To the requirements for manufacturing, and also the important considerations of protection from fire and other like purposes, such means of supply are wholly inadequate.

Were it the case that a supply of unobjectionable water could be procured within reasonable distance for domestic purposes alone, the trouble and expense attendant upon procuring it without Works, would more than pay for a well-constructed Water Works, with all its convenience, safety and advantages, as they are now arranged.

The quantity of water supplied per individual inhabitant, varies very much in the different cities of this country, and is from forty to nearly one hundred gallons per day. Philadelphia, although it was the first city in this country that constructed Water Works, now furnishes the smallest amount per inhabitant. The reasons for this are obvious—some of the districts are but scantily supplied, in others the character of the water is objectionable, and a large portion of the city is without any supply. The important District embraced under your charter is wholly without any supply from the Public Works, nor is it possible to furnish it from any of the Works now constructed.

As it is probable that water will be taken largely for manufacturing purposes, it is difficult to form an estimate of the amount required for the present supply of your District. Much will depend upon the price at which it is furnished, and the facilities which the Company afford for using it. One million gallons will probably furnish an abundant supply at present, say seven hundred thousand for Manayunk, three hundred thousand for Roxborough, and if a supply for Germantown is taken into consideration, four hundred thousand gallons must be added, making, say one million five hundred thousand gallons. Works that will supply two million gallons per day are therefore recommended, so arranged that they may be duplicated whenever the necessities of the District demand it, without the sacrifice of any of the Works now contemplated.

MANNER OF SUPPLYING THE DISTRICT.

It is proposed to divide the District into two separate systems, at different elevations above the river, supplied from separate reservoirs, and by separate mains and service pipes. First, a system for the supply of Manayunk, in which the water in the reservoir will be one hundred and sixty-eight feet above Flat Rock Dam, (two hundred feet above Fairmount Dam.) This will have sufficient head to furnish a supply to all parts of Manayunk, where much the larger portion of the water will be

required; and it will furnish all the low parts of the Twenty-first Ward, to its southern boundary, (Columbia avenue,) as this ground lies too high to procure a supply from any of the Works now constructed by the City.

Second, for Roxborough. In this reservoir the water will be three hundred and sixty-eight feet above Flat Rock Dam, (four hundred feet above Fairmount Dam.) This will give a head of water of one hundred and sixty-three feet at Ridge Road and Hermit's Lane, and forty-eight feet head at Ridge Road and Livezey's Lane. The water in this reservoir will be twenty-three and a-half feet above the water in the reservoir of the Germantown Company, at Mount Airy.

The reasons for recommending two lifts and two separate systems of supply for your District, are the facts, that the greater portion of the water will be required for the lower or Manayunk lift, and to raise the whole amount to the great height required for the second, would involve a large amount of unnecessary expense for fuel, repairs, &c., and the whole work would be subjected to a great and unnecessary strain, making it almost impossible to construct it of sufficient strength. The first cost, and the expense of keeping the works in repair, would also be greatly augmented.

PUMPING MACHINERY.

When water is to be forced to as great an elevation as the requirements of this District make it necessary, the kind and character of machinery employed to pump it, becomes a question of great importance. Many forms of pumping engines have been used, with various results as to economy. Of the eight pumping engines now in use in the Water Works of this City, six are of forms of construction differing one from another, and of course their efficiency differs materially. One gives a duty of but one hundred and fifty thousand foot pounds per pound of coal, while another will give a duty of four hundred thousand foot pounds per pound of coal—that is, one hundred and fifty thousand pounds of water, or four hundred thousand pounds, as the case may be, are raised

one foot high by the consumption of one pound of anthracite coal. From the experience of the City Water Works, and indeed wherever they have been brought into competition, the kind of engine known as the Cornish Pumping Engine has been found not only the most efficient, but that which requires the least repair. Engines of this description, after having been in use for over fifty years, in some instances produce even better results than the best engine now forcing water in the Works supplying the City. This class of engine is single-acting, the steam being used only to lift the plunger, which is made sufficiently heavy to overcome the weight of water in the ascending main; the water is forced into the reservoir by the weight of the plunger.

It is therefore proposed to use a Cornish Engine which will have a capacity of two million gallons per day, (say in twenty hours' pumping,) taking the water from Flat Rock Dam and forcing it to the first reservoir, one hundred and sixty-eight feet high. To do this will require a steam cylinder of fifty inches diameter, and a pump of twenty inches diameter, with nine feet stroke of piston. The first cost of such an engine is frequently urged as an objection, but, when the economy of fuel and repairs is taken into account, this objection will disappear. The difference in the amount of coal required to raise one million gallons into the first reservoir, by an engine giving a duty of four hundred thousand foot pounds, and one giving a duty of but one hundred and fifty thousand foot pounds, would be five thousand eight hundred and forty-three pounds of coal, which, at a cost of four dollars per ton, would be ten dollars and forty cents, or more than the interest of the entire cost of an engine and pump of the best construction.

An engine of similar construction, it is proposed to use for pumping the water from the first to the second reservoir, at an elevation of two hundred feet. This will require an engine that will pump one million gallons per day. If the supply for Germantown is not taken into consideration, the engine for the first lift will require only a daily capacity of one million five hundred thousand, and the engine for the second reservoir five hundred

thousand gallons. A twenty inch pumping main will be required between the large engine and the first reservoir, and a sixteen inch pumping main between the first reservoir and the second.

RESERVOIRS.

The first reservoir it is proposed to construct in the ordinary manner of earth embankments, puddled and lined with brick, to contain eight million gallons. For this reservoir there are many eligible sites in the immediate neighborhood of the pumping machinery, and its construction will be attended with no extraordinary difficulty. It will require an area of two hundred and sixty-five feet square at the surface of the water, (when full,) by twenty feet deep.

The second reservoir, or highest, it is proposed to construct in the same manner, with a storage capacity of four million gallons. This will require an area of one hundred and ninety-five feet square at the surface of the water, and twenty feet deep. There will be some difficulty in finding an eligible site for it, within convenient distance, on account of its height.

If no provisions are made for the supply of Germantown, the storage capacity of each of these reservoirs may be two millions less.

DISTRIBUTION.

From the first, or low level reservoir, it is proposed to start with a sixteen inch main, reduced to twelve, and again to ten inches, at the extreme southern end of Manayunk. This main to be laid along Washington and Main streets, from which six and four inch service mains are to be laid in the different streets.

From the second, or high level reservoir, it is proposed to start with an eight inch main, and reduce to six inch, and branch with six and four inch service mains.

If a main is required for Germantown, it should be at least eight inches, to supply five hundred thousand gallons per day to the reservoir of that Company, under the head which there will

be in the high level reservoir above that of the Germantown Company. As water can no doubt be sold along the route of this pipe, a still larger main should be laid.

The following will be about the amount of main that will be necessary to lay at the present time, the connection with Germantown excepted:

4,000	feet of	16	inch,
5,000	“	12	“
6,000	“	10	“
5,000	“	8	“
15,000	“	6	“
15,000	“	4	“

50,000 feet of pipe, with the necessary branches, turns, &c. To control this pipe, fifty street-stops will be necessary; and, for protection against fire, at least fifty fire-plugs will be required.

The distribution, as described above, is open to some objection; the pipes are not so large as the prospective requirements of the District demands: nor is the distribution as complete as it should be. There will be some unimportant points that will not be reached by the service mains; but the answer to this objection is, that the cost of the Works must be kept as low as possible to insure a reasonable remuneration for the capital invested. Much larger mains, and more complete distribution would be recommended to a Corporation with unlimited means, and not under the necessity of looking for immediate or direct returns for its capital.

COST OF WORKS.

Until the surveys and measurements are completed, and details, plans, and specifications are prepared, it will be impossible to make an estimate that will be correct in every particular, but, at the present prices of labor and material, the following general estimate will be found sufficiently correct for the present purposes of the Company.

In the plans above suggested, care has been taken to recommend such Works as will be necessary and truly economical, without sacrificing their permanency or efficiency, and keeping in view the fact that large increase will be made in the demands upon the Works from time to time. They are not constructed to look many years ahead, as it is believed it will be better policy to duplicate them when the demands upon them exceed their capacity. This will greatly reduce the first cost, and make them more reliable and remunerative to the stockholders.

The Low Level Pumping Engine, Engine House, Connections with the Reservoir, Stops, Ascending Main, etc., will cost	- -	\$52,000 00
The High Level Pumping Engine, Engine House, Stops, Ascending Main, etc., will cost	- - - - -	23,000 00
Two Reservoirs, one to contain eight millions, and the other four millions of gallons,	-	53,000 00
Fifty Thousand feet of Distributing Mains, Stop-cocks, and Fire-plugs, complete,	-	86,000 00
		<hr/>
		\$214,000 00
		<hr/>

say two hundred and thirty thousand dollars to construct and put into operation the Works as above described. If no provision be made for Germantown, the Works may be constructed for two hundred thousand dollars.

This does not take into account the cost of real estate. It will require about two acres of land at the river, say fourteen acres for the low level reservoir, and eight acres for the high level reservoir. This will allow room for duplicating the Works.

PROBABLE INCOME OF THE WORKS.

Without thoroughly canvassing the District it will be impossible to come at the precise amount of the water that will be taken when the Works are first started; but founding our estimate upon selling one million of gallons of water per day, at the same price

as the City now charges, (including charges for municipal uses,) viz., seventy-two dollars and twenty-two cents, (\$72 22,) per million gallons, there will be a gross income of twenty-six thousand three hundred and sixty dollars (\$26,360) per annum.

The average amount of water rent paid per taxable inhabitant of the twenty-one Wards of the City supplied with water in 1859, was four dollars and eighty-five cents, (\$4 85.) The number of taxables in the twenty-first Ward is four thousand two hundred and thirteen (4,213,) which would make a gross revenue of twenty thousand four hundred and thirty-three dollars, (\$20,433,) from this Ward alone. This does not include any charge for municipal uses which, at the price paid the Germantown Water Company, (\$25 per fire-plug,) would make an addition of twenty-five hundred dollars, (\$2,500,) and for other municipal purposes one thousand dollars, (\$1,000) or nearly the same as the above estimate made upon supplying a million gallons per day. This large income would not be realized immediately.

It will be, perhaps, safe to estimate an annual gross income from these Works of twenty thousand dollars, (\$20,000.) Of this, the water rents for household purposes would be about ten thousand dollars, (\$10,000.)

As an evidence of the rapid increase of revenue from Water Works, the Schuylkill (formerly Spring Garden Works,) may be instanced. The gross revenue from these in 1854, was thirty-nine thousand six hundred and eighty dollars, (\$39,680,) in 1859 it was one hundred and forty-two thousand nine hundred dollars, (\$142,900.)

RUNNING EXPENSES.

The running expenses of all kinds,—engineers, firemen, coal, oil, and repairs, estimating them the same as the Twenty-fourth Ward Works are, *i. e.* nine and three-tenth cents, ($9\frac{3}{10}$) per million gallons raised one foot high, or twenty-one dollars and eighty-two cents per million gallons supplied by your Works, would leave a net profit on a million gallons of fifty dollars and

forty cents, (\$50 40.) The average net profit realized by the City on all the water supplied by the different Works is fifty-five dollars and forty-five cents (\$55 45,) per million gallons, including charges for municipal use. At the above rates, the Works will pay a dividend of six per cent. on two hundred and fifty thousand dollars, when two hundred and ninety-eight millions of gallons of water are furnished annually. The Works, as above described, can be constructed to supply water at a less cost than the average of the City Works, now in operation, for much of the machinery employed in them is very imperfect.

If the charges for frontage are made the same as those of the City, for pipe laid in front of property, viz. seventy-five cents per foot, this will make a return of from fifty to sixty thousand dollars of the capital stock invested in constructing the Works, which if invested again in extending them, will add much to their value and income.

If the main be laid to Germantown, (say ten-inch pipe,) it will add thirty-five thousand dollars, (\$35,000,) to the expense of constructing the Works, and will add about eight thousand dollars to the net income of the Works.

All the above estimates are made upon the supposition that the charges for water will be the same as those of the City of Philadelphia. These rates are much lower than in any other city in this country.

It will be necessary to locate the Engine House and Reservoirs, and secure the necessary real estate, before detailed plans and specifications for them can be made. The plans and specifications for the Pumping Machinery, and the specifications for pipes, stops, fire-plugs, etc., will be ready as soon as the necessary surveys and measurements can be completed.

Yours, respectfully,

HENRY P. M. BIRKINBINE,

Engineer.

AN ACT

TO INCORPORATE THE MANAYUNK & ROXBOROUGH WATER COMPANY.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same,* That Joseph Ripka, William B. Stephens, John F. Preston, Christian B. Miller, J. Towers Ogle, Archibald Campbell, James B. Winpenny, Daniel Arbuckle, David Wallace, Bernard McCain, William McGlinchey, John Bromly, John Adams, William Dawson, (waterman,) Charles Thomson Jones, Charles E. Graeff, Michael Blinn, George W. Davis, Israel V. James, John Harris, Jr., James Shaw, James Bowker, William McFadden, and Edward Strause, and their associates, successors and assigns, and other persons who shall become stockholders, be and they are hereby made and created a body politic and corporate, by the name and style of the MANAYUNK AND ROXBOROUGH WATER COMPANY, and by the said name they shall and may have perpetual succession, and shall be in law capable of suing and being sued, pleading and being impleaded, in all courts and judicatories whatsoever, and also of contracting and being contracted with, relative to the business and objects of the said Corporation; and they may have a common seal, and may change and alter the same at pleasure; and they shall have power to lease or purchase, in fee simple or otherwise, such real estate as may be necessary for carrying on the business of said Corporation, not exceeding forty acres, and in their

corporate name to make and execute obligations for their liabilities created for the purchase money for the same, and other necessary effects of said Corporation, as they may deem expedient: *Provided*, That such liabilities shall be created only for the purposes stated in this Act.

SECT. 2. That the said Company shall have power to provide, erect and maintain all works, machinery, fixtures or engines necessary or proper for raising, introducing and distributing into the Districts of Manayunk and Roxborough, in the Twenty-first Ward of the Consolidated City of Philadelphia, a sufficient supply of pure water, and for that purpose may provide, erect and maintain all proper buildings and reservoirs for the reception of the water to be introduced; and for this purpose they are authorized and empowered, by themselves, their agents, engineers and workmen, to take water from any stream, and with their tools, carts, wagons and horses, to enter upon lands and enclosures, streets, lanes and alleys, roads, highways and bridges, as may be necessary to occupy or to obtain necessary materials for the construction of the said Works, and to occupy, ditch and lay pipes, and from time to time to repair the same; and if any injury shall be done to private property, the said Company shall make compensation therefor, in the manner hereafter provided.

SECT. 3. That if, in the location of said Works, an injury shall be done to private property, and the parties cannot agree upon the amount of compensation to be made to the owner, they may refer the same to men mutually chosen by them, or either party may apply to the Court of Common Pleas of the County, and make report to the Court, whose award shall be subject to the right of appeal by either party; and when appealed from, to be tried as if an original action had been brought in said Court; and if no appeal be entered within twenty days after the said report shall have been filed, it shall have the effect of a judgment, and be collected in like manner.

SECT. 4. That the capital stock of said Company shall be one hundred and fifty thousand dollars, to be divided into six

thousand shares of twenty-five dollars each; and the said Company shall have the right to increase their said capital stock from time to time, as the Board of Directors may deem necessary: *Provided*, That the whole capital stock shall not exceed two hundred and fifty thousand dollars.

SECT. 5. That the stockholders shall annually, on the first Monday in June of each year, elect a President, twelve Managers, Secretary and Treasurer, for said Company.

SECT. 6. That said Company shall have authority to make and adopt such By-Laws, Rules and Regulations for the government of the same, as they may deem proper: *Provided*, That the same do not conflict with the Laws of this Commonwealth.

SECT. 7. That the President and Managers shall procure certificates of stock, which, signed by the President and Treasurer, and sealed with the corporate seal, shall be delivered to each stockholder, and which shall be transferable at his pleasure in the presence of the President, Treasurer, or other person appointed by the Company for that purpose; subject, however, to all payments due and to become due thereon; and when such assignment shall have been made and entered upon the books of said Company, the holder shall be a member of the said Company; and in every election or meeting the stockholders of the said Company shall be entitled to one vote for each stock by him or them held.

SECT. 8. That if any subscriber for stock, or his assignee, shall refuse or neglect to pay any instalment called for by the said Company at the place appointed, and the same shall remain unpaid for thirty days after the time appointed, he shall, in addition to the instalment called in, pay at the rate of five per centum per month for delay; and if the same shall remain unpaid so long as that this penalty shall amount to the sum actually paid in by the said stockholders, it shall be in the power of the said Company to forfeit the said stock, and the amount paid thereon, to be disposed of by the said Company as will best promote their objects and interests.

SECT. 9. That the said Company, if necessity requires, shall have power at any time to borrow any sum of money, not

exceeding one hundred thousand dollars, to be applied to the prosecution or improvement of the said work or works, and to pledge their goods and chattels, property, franchises and effects, by mortgage or otherwise, for the security and repayment of the same: *Provided*, That no bond or other security for such loan shall be for a less sum than one hundred dollars.

SECT. 10. That the powers, privileges, &c., granted to the City of Philadelphia, for the introduction of water, be and the same are hereby extended to the Manayunk and Roxborough Water Company; also, that in case the Councils of Philadelphia should at any time desire to own or obtain the Works of the Manayunk and Roxborough Water Company, the same may be done by mutual agreement by the City Councils and the Manayunk and Roxborough Water Company.

W. C. A. LAWRENCE,

Speaker of the House of Representatives.

JNO. CRESSWELL, JR.,

Speaker of the Senate.

APPROVED the ninth day of April, Anno Domini one thousand eight hundred and fifty-nine.

WM. F. PACKER.