

A DISCUSSION  
OF THE  
ECONOMIC VALUE  
AND  
ENGINEERING MISMANAGEMENT  
OF THE  
FAIRMOUNT WATER WORKS  
OF  
PHILADELPHIA.  
BY  
JAMES HAWORTH.

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PHILADELPHIA, 1878.



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## P R E F A C E.

To secure an abundant and permanent water supply, has, with all the large cities of the United States, become of late years a problem of urgent importance. In a sanitary, as well as in a material point of view, few subjects can claim priority of moment. Although the rapid and general increase of the population may have served to explain, in certain cases, how the demand may have temporarily outstripped the supply; yet nothing can extenuate the gross engineering incapacity which for the most part has every where been displayed in connexion with this subject. This is peculiarly true of Philadelphia. No city of its size in the world has been so abundantly endowed with natural facilities for a perpetual and prodigal water supply. Indeed it is scarcely too much to say, that the difficulty of its acquisition,—(which is the all-prevailing difficulty elsewhere)—becomes at Philadelphia almost the reverse: and that *to prevent a prodigality of supply* is the great question which has taxed to exhaustion the whole engineering capacity of its Water Department. The bed and banks of the Schuylkill river—the extent of its water shed—the volume of its current and its proximity to the city—unite to render it especially well-fitted by nature for a cheap and enduring water supply. That supply, both for its purity and economic value, might be made an inestimable advantage to our city. It ought also to be a source of marked and permanent income. Instead of all this, the dirty demagogues who for many years have domineered over this question, have made its history a mass of dirty jobs;—its supply a mass of unwholesome dirty water;—and its financial record, a mass of the dirtiest rascality in the history of Philadelphia. Instead of a source of income, it has become a source of large indebtedness, amounting to many millions of dollars. And instead of promoting—it has operated to retard many of the business interests of Philadelphia. To unveil some of this villainy, and to point out some of the remedial measures, of which the city stands in urgent and imperative need, is the object of the present pamphlet.

# PROFLIGACY

OF THE

## PHILADA. WATER DEPARTMENT.

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During the present unprecedented depression in the money market, when, for non-payment of taxes, a long list of real property is being sold monthly by the Sheriff, it behooves all citizens of good conscience to arrest, if possible, the prodigality of our municipal government. If official negligence, speculation, and malfeasance, are ever reprehensible, they are peculiarly so now, when necessity and tribulation are seated at every man's hearth-stone. In this spirit, the following facts are laid before the public:

Some years ago, a memorial was submitted by the undersigned, to the City Councils, proposing by a plan therein detailed, to secure to the City Treasury, a net annual income of Half a Million of Dollars from the Water Department. In the same memorial, were specific charges of negligence and downright abuses in the department, some of which were too gross for the semblance of a justification. So much pressure

was brought to bear upon Councils—urging an inquest in the matter—that at length, a committee was raised, with instructions to look into the proposition of the undersigned, and to ascertain through the aid of a Commission of Engineers,—what, if any thing—could be done, to plant the administration of the Water Department upon a wholesome foundation.

The result of this very expensive Commission, was to utterly ignore the project of the undersigned, without inquiry; and instead of showing any fault or error in the Water Department,—or advising any economy or retrenchment in its administration,—actually went to the length of recommending to it, the additional expenditure of over Eighteen Millions of Dollars!

In order that the very reprehensible course of their proceedings should be generally understood, the following illustrative facts are submitted to the public:

In response to his written intimation, that he desired to confer with the Board of Commissioners, two of them left word at the residence of the undersigned, that they would meet him that evening at the Franklin Institute, which proved to be a secret meeting. On his appearance before them their first question was—“What have you to report?” He answered,—“Not much, that was not embodied in his pamphlets,—already laid before them.” But “expressed a desire to meet them at Fairmount, where he would demonstrate that—except a few hundred dollars, for repair of machinery—he could without any expense to the city, (at a yearly average) throw into the Basins, Twenty Millions of Gallons more water *daily* than the works then supplied.” This was one full half of the average

annual consumption of the entire community! And for nothing! As this reformation would put no money in the pockets of the Ring it was of course repudiated.

The Commissioners further inquired,—“How were these twenty millions to be realized?” He replied,—“He would prefer to answer that question at Fairmount by a clear demonstration of the plan, if they would meet him there.”

Evidently averse to going as proposed to Fairmount they insisted upon being advised at once, whereupon they were informed,—“That the Pumps being habitually out of order did not furnish one-half of the amount they registered: and if run at full speed, would nearly double their performance. That the pumps of wheels Nos. I and II had been running for years without pumping any water!”

Being asked—“How he knew that?” He replied—“By examination,—by the Department Reports,—and by the absence of the agitation on the surface of the Basin which is always occasioned by the inflowing current. Also, that six of the largest pumps delivered into the Basin but one-third of the amount of water they registered.”

The Commissioners inquired,—“How he would measure the water pumped?” He replied—“By noting the number of strokes made by the Pumps without pumping water.” This, at first, they acquiesced in, but in their Report, declared their inability to measure the water, and subsequently went to work, at great expense, and built a weir, which showed, the six pumps in the new wheelhouse, which had been repaired lately, to be wasting 20 per cent. of the water.

The Commission were informed that in the neglected condition of the Pumps it required seventy-five gallons to pump one into the Basins! Although they avowed in their Report, [p. 25] that it ought to require only fifteen! Except the few which have been since repaired, the Pumps are now (1877) in a worse condition than they were then. And thus, half the consumption of the city (which could be had for nothing, as above stated), is utterly lost, and is pumped by steam-power, at a wonton expense of more than *four hundred dollars per day!!*

The undersigned, also informed the Commission, that two of the Basins—the Corinthian Avenue and the Spring Garden—“were not kept full by nearly twelve feet;” and this, even when water in the river was plenty and the people suffering for it.

Mr. McFadden, the Chief Engineer of the Water Department, who was then present, inquired—“When that was?” When informed that it was but a few days before, he acquiesced, admitting “that the Basins were down *then* nearly twelve feet.” This admission that they were down “about that time,” implied, that the circumstance was casual; whereas for a long time previously, and almost uninterruptedly since, they have been in the same condition.

When the Chief was asked—“Why, with so much pumping capacity he pumped so little water?” He replied—“Because they had no place to put it!!” Let it be remembered in this connexion, that the quantity of water in one foot of depth at the top of the Basin is nearly equivalent to two feet of depth at the bottom, owing to its greatly increased narrowness below.



Furthermore, the attention of the Commission was called to a passage in an Official Report of the Chief, (then lately published in the papers), which not only avowed the habitual low water in the Basins, but justified it, as a necessary means of preventing a conflict between the City of Philadelphia and the Schuylkill Navigation Company!!

The most inexperienced person is probably aware, that the cost of pumping water by steam is enormously greater than by water-power. If this be generally true, it is exceptionally so at Fairmount where the water-power literally costs nothing. And yet the Water Department unnecessarily and culpably stops these wheels and employs steam engines almost exclusively for pumping the city's supply!

In the Annual Report of the Department for 1875, the number of hours, during which the respective wheels at Fairmount were stopped in that year, and for what reasons, are set forth.

For example—Wheel No. I was stopped during that year for 6,470 hours, or over 275 days! Wheel No. II was stopped the same year 8,195 hours, or over 341 days!

Six other wheels mentioned, were stopped, collectively, 8,680 hours, or over 361 days, or 60 days for each wheel. The reason assigned for the stoppage, being, that the Reservoirs were full:—(filled by steam-power of course.)

That the cost of steam-power is vastly greater than that of water may be readily demonstrated by reference to the data officially supplied by the Water Department itself.

In the year 1871, pursuant to the Report of Mr. Graff, then Chief Engineer, the cost to the city of raising water into the Basins at Fairmount, by water-power, per million gallons was less than . . . \$1.39.  
 For 1874, it was less than . . . . . 2.02.  
 The average cost for the same two years by steam was, per million gallons, over . . . 20.00.

From the foregoing figures, it will be arithmetically apparent, that the Philadelphia Water Department has reprehensibly dis-used the enormous water-power of the Fairmount works almost entirely; and actuated by a spirit of wanton hostility to the interests of the city, has, for years past, unnecessarily and wickedly employed steam-power at a cost exceeding four hundred dollars per day, or a hundred and forty-six thousand dollars per annum—to do what the Fairmount works would do for nothing!

[At \$20.00 per million, twenty million gallons per day pumped by steam-power, equal \$400.00 per day, or \$146,000 per annum.] This villainy, glaring as it is, is only one of many which should be dragged to light and laid before the people for their better government in the reformation of this department.

From the exhibit made by the foregoing facts and figures, it is not surprising, perhaps, that this Commission of distinguished Engineers (the creatures of a predatory Ring) should have averted their virtuous eyes from these enormities; well-knowing that if justice were done, it must inevitably have consigned their authors to the penitentiary! Thus it is, that the city is habitually and persistently pillaged, and that taxation steadily increases, in equal ratio with the public debt.

Every citizen should know that the City Water Department instead of paying a net annual income to the public treasury of over half a million of dollars, which it could readily pay, is made the toy and spoil of an unprincipled Ring who are annually adding to the public debt.

A rigorous investigation, by a disinterested tribunal, will disclose much more malfeasance in the Department than has here been charged against it.

Amongst other persistent, wilful, and conscious frauds, perpetrated upon the public, is that of quoting the present consumption of water by the city, as averaging fifty millions of gallons daily. This is arrived at by taking as a guide, the Registers attached to the machinery of the Pumps, which record every pump-stroke at its full capacity; whilst it is perfectly well known that, through the criminal negligence of the Department, the Fairmount Pumps have been for years so fearfully out of order as not to pump one-half of their proper amount!

The real consumption of Philadelphia, is not over thirty millions of gallons per day, on a yearly average: the amount in summer being naturally greater than in the winter months.

### *The True Cause of the Water Famine of 1869.*

Perhaps the most atrocious rascality of the City Water Department, is that which is connected with the, so-called, Water Famine of 1869. And it is much to be regretted that the perpetrators, in addition to public infamy, should not have been overtaken by condign punishment.

The Water Famine of 1869, was not caused by an unusually dry season; but the Department had an object to accomplish, which was, the Building of the East Park Reservoir.

About the 10th of August, 1869, it was announced through the newspapers, that the navigation was stopped, by drawing down the level of the water in the Schuylkill Dam.

In consequence of seeing these statements, the undersigned went to Fairmount, and observed that the dam was drawn down about 16 inches. This would entail a loss of about  $\frac{1}{6}$  of the power, even if the machinery were in good condition, but being in a very bad condition, the loss must have been twice as much.

On looking round, he saw all the Turbine wheels running during high tide, and still drawing the dam down lower.

Amazed to witness such a scene of corruption, and deeming it a duty to administer an immediate correction if possible, the undersigned waited upon Mr. Graff the following morning, being introduced by E. Shallcross, one of the Water Committee.

When told that they were losing a great deal of power at Fairmount by drawing the dam down and losing the fall, he said—"We could not help it." Mr. Graff was then told that all the Turbine wheels were running during high tide. He answered, "We had to do so." Here the interview ended, without any satisfaction.

After this, a close watch upon the works, revealed the fact that they still continued to draw the dam down, more and more, by systematically running all

the Turbine wheels at high tide, and stopping them all at low tide, including also the old Bucket wheel.

In a few days the water in the dam got down three feet below the point of running over, and so low that the Pumps *could no longer get a supply of water*: their lowest point being in the air!

The fall of water was so low at this time, that they had no more than two feet of available fall, on an average.

The fall at Fairmount, at low tide, is 14 feet. The tide rises 6 feet, thus leaving 8 feet fall at high tide, or an average fall of 11 feet. By drawing the dam down 3 feet, this average is reduced to 8 feet. Of this 8 feet, 3 feet is lost by friction and the movement of the water; and another 3 feet is lost by running the wheels at high tide and stopping them at low tide, thus leaving only 2 feet of actual fall as the average working power of the wheels at that period.

With this limited amount of fall, there could be scarcely any available power left. Indeed, there was only one wheel out of the six wheels that pumped a drop of water. This was a new wheel, just started, but it only ran about six strokes per minute, and pumped less than half a million gallons per day.

To establish and consummate the Water Famine, they had to destroy the water-power, by drawing the dam down and stopping the navigation, notwithstanding that it resulted in a cost to the city of about half a million dollars.

By keeping the dam full and allowing the navigation to go on, and keeping the machinery in a good condition and running the wheels at low tide, and

stopping them at high tide, the pumps would have been able to have pumped fifteen million gallons per day, in place of less than one million, and the Water Famine avoided.

We might ask, what their object could possibly have been in perpetrating this enormous crime, unless it was to get the contract for building the Reservoir in the East Park, and other subsequent jobs?

Before the Joint Committee of Councils, appointed in 1870, when the petition and proposition of the undersigned were presented, he offered Mr. Graff, (then Chief Engineer of the Water Department, who was present) five hundred dollars, if he could possibly show how they could destroy the water-power more completely, or pump less water, than they did during four weeks in the time of the Water Famine. It is not necessary to say, that he made no reply.

There is no Department in the city by whose proceedings the people can be more completely deceived and imposed upon than in the Water Department. The crowds visiting Fairmount and beholding all the machinery running smoothly, are not aware that at the same time the pumps may not be pumping a drop of water! A circumstance which, through a most culpable legerdemain, is very often times the fact, which is not surprising when the officials are so deeply interested in practising this deception.

Amongst the various methods which have been resorted to by the Water Department, and the deceptions which have been, and still may be, practised, without the casual observer being able to detect the evil, the following may be mentioned:

Keeping the outside gates too low, and not admitting a full supply of water to the wheels, thereby diminishing the head or fall, and thus destroying the power.

The undersigned has also witnessed on several occasions, the wheels stopping from the partial closing of the inner gates, and yet nearly as much water running through as would have been required to run them. This was more especially the case during the Water Famine.

Letting the packing and piston-heads of the Fairmount Pumps continually remain in such a disordered state, that although the Pumps are in full play, they give little or no water.

Intentionally depriving people of water in their bath-rooms during the heats of summer, and falsely alarming them with cries of Water Famine.

With a daily pumping power of [120,000,000] a hundred and twenty million gallons per day—allowing the people only twenty or thirty millions—and that, of bad quality.

### *On Supplying Germantown with Water.*

It can scarcely be termed any thing less than a criminal offence to supply Germantown from the Schuylkill river by steam-power. During the five years from 1869 to 1874, inclusive, the cost of supplying Germantown and Roxborough with water, averaged \$48.00 per million gallons.

Instead of going to this expense, a water wheel and pumps could be placed on the Wissahickon, near the

Iron Pipe Bridge which crosses the Wissahickon, and be connected with the present mains for supplying Germantown and Roxborough. The creek, at this point, is from 80 to 100 feet higher than the Schuylkill. The cost of replacing the injured pipe at the bridge is estimated by the Commission at \$40,000; which sum would be amply sufficient to build the water-works.

We have stated the present cost of steam-power at \$48.00;—whereas the expense of pumping by water-power at these works would be only \$2.00 per million gallons.

We have the authority of the late John Agnew, fire engine builder, Vine street, Philada., who informed us of the method of supplying water to New Brunswick. That city is supplied by one water wheel and pumps, which are attended by one man. It is self-lubricating, and only requires his brief attention in the morning and evening. We cite this as an example of what could be done on the Wissahickon and at Manayunk.

This pumping capacity can be increased at any time in the future by adding more wheels; but it is expected that these works would be only temporary.

Whenever the city wishes to utilize all the water in the Wissahickon, these works should be removed to a point six miles above the mouth of the Wissahickon, and after supplying Germantown and Roxborough by water-power, the water used as power, after passing over the wheels, could be brought down to the city by gravitation. By these means, the Wissahickon could supply sixty million gallons per day, which is about twice as much as the city is consuming at the present time.



*On Supplying West Philadelphia with Water.*

The first attempt at supplying West Philadelphia with water, was by building steam works on the bank of the Schuylkill, and erecting a large and costly Stand Pipe. All this has since been removed, or is useless. But the Water Department, being always on the look out for more contracts, went to work and built expensive steam water-works and an artificial basin on George's Hill.

In place of these, a natural basin on George's Run, close by, could have been built at far less expense than the present basin, and which would have held over a thousand million gallons, or ten times as much as the artificial one. It could have been at the same height, although much lower would do.

George's Run flows near two million gallons per day, on an average, through the year, and is about as high as the highest curbs in West Philadelphia, and by gravitation only, without a dollars' expense for power, would have supplied all West Philadelphia with water nearly up to the present time.

This proposed George's Run Reservoir can be supplied from Fairmount or Flat Rock, or from the lower part of Manayunk, or the west bank of the river near Flat Rock Dam, by putting in wheels on the west side of the river, and the Reservoir will be large enough to hold five months' supply; consequently the wheels only need to run when there is an abundance of clear water in the river. An additional supply for this Reservoir could be obtained from the lower part of Manayunk, and the water carried across the river if requisite.

*Plan for Supplying Manayunk with Water.*

A Natural Basin could be built on the hillside, at an elevation of 150 feet above the river, in some of the Ravines, of sufficient size, so that the pumps could be stopped for two or three days, in case of muddy water.

For supplying this Reservoir, a Pitch-back water-wheel could be advantageously employed and driven by water taken from the canal. A Pitch-back has great advantage over a Turbine for pumping water, on account of the slow speed required, so that the pumps can be driven direct from the axle, or shaft, of the water wheel; thus avoiding the great amount of friction caused by the intermediate counter-shafts and heavy gear wheels, which the reduction from the rapid speed of a Turbine wheel necessitates.

For an illustration, we refer to the complicated gearing of the Turbine wheels at Fairmount water-works with the simplicity of arrangement which the old water-wheel there presents. But it must be said in favor of the Turbines at Fairmount, that in consequence of back water, caused by the tides, they perhaps answer as good a purpose there as the bucket wheel.

We here again remark, that such an addition of wheels should be made that all, or a chief portion of the water stored in the dam, could be used and drawn down during the intervals when the tides are at the lowest, and consequently when the wheels would have the greatest effective power. This important advantage has not, hitherto, been utilized.

The estimated cost of supplying Manayunk with water would be about one dollar per million gallons for the running expenses.

### *Frankford Water Works.*

When there can be over twenty-five million gallons per day, on an average, pumped at Fairmount, more than they are pumping at present, without any extra cost, and this pumping power, if insufficient for Frankford, be still further increased by putting in a few additional wheels, what need is there for the new steam works either at Frankford, in Kensington or elsewhere? Until the supply by water-power proves insufficient, it is wanton extravagance to have expended hundreds of thousands of dollars upon such costly steam pump works.

A full supply of water for the daily consumption of Frankford can be pumped at Fairmount, or Flat Rock, in the night time, and can be had by building a small Reservoir at the corner of Leiper and Oxford streets, in Frankford, which is as high as the Kensington or Corinthian Basins, which are five feet higher than the highest curb in Frankford; and by thus filling it at night, a full supply could be kept up.

There can be a Natural Basin built in Philadelphia, of a greater capacity than the East Park Reservoir, and not far from it, and at a less cost than it will take to finish that Reservoir. This, moreover, could be conveniently supplied from water-power at the lower part of Manayunk, derived from the Flat Rock Dam. The altitude of this Natural Basin would supply a great

portion of the higher ground lying between Ridge avenue and Germantown road. For the last mentioned district the East Park Reservoir is not high enough.

The Water Department has studiously kept the water in the Kensington Basin, on an average, about six feet too low, besides stopping the water on its way to Frankford by a stop-cock, depriving the citizens of Frankford of water in the day time, and by continuously keeping up a complaint, this served as a plea for building the Frankford steam works at Lardner's Point. This wanton expenditure of money, (a wicked crime), was forcibly taken out of the pockets of the needy tax-payer.

*The Cost of Pumping Water, by Water-Power, at  
Flat Rock Dam.*

By putting in five Pitch-back Bucket wheels, driven from the lower end of the canal, (whose first cost, and cost of repairing would not be the one-half of Turbines), and the pumping capacity of each of which would be ten million gallons—fifty million gallons per day—could easily and economically be realized at Manayunk. And more water wheels could be put in, and the water carried across the river, to supply "George's Run" Reservoir.

The size of wheels should be 20 feet diameter and 20 feet wide on the breast; the pumps 3 feet diameter and 8 feet stroke, with metallic packing. To prevent wear, the pistons should be supported by the rods passing through the end of the pump.

Two hands would be able to take charge of these wheels, but, to meet contingencies, we might say three hands at a cost in wages of \$5.00 per day. Oil, fire for warming, etc., \$2.00, and other contingencies, \$3.00, or, say the total cost, \$10.00 per day.

The Bucket wheels would not require half the attention of Turbines, and would want no repairs for twelve or fifteen years. Bucket wheels are preferable to Turbines, on account of the slow speed which the pumps require, as above stated, thus dispensing with the extra shaft and gearing, excepting at such places as Fairmount, where the tide interferes. But yet, very probably, Bucket wheels would still be preferable at Fairmount, if advantage was taken of running them only at low tide.

McFadden, Chief Engineer, has taken great pains, in his last Report, to show that water-power costs more than steam-power, although he admits, on page 15, of his last Report, for 1876, that steam-power costs nine times as much as water-power. To supply the city by water-power in the future, no additional expense need be incurred. The dams are already made, and the expense is already incurred, and nothing remains to be done at Fairmount and Flat Rock but to add more wheels.

The Commissioners, in 1875, estimated the cost of building the Perkiomen Reservoir at \$800,000, but it could be built at the present time for \$600,000, on account of real estate and wages being so much lower. The interest on \$600,000 is only \$36,000, but this interest ought not to be included in the cost of the *running expenses* for pumping the water, as the interest

on the cost of the steam engines is not included in McFadden's Report. The water in this Reservoir would run down its usual natural channel to Flat Rock and Fairmount dams—all ready for the wheels—without any expense.

It would not take more than six months to construct this Reservoir, and by repairing the pumps at Fairmount, all the steam engines on this side of the Schuylkill could be stopped at once, (excepting those at Roxborough and Chestnut Hill), and the Roxborough steam works could be stopped when the proposed water works on the Wissahickon are erected. The saving effected by stopping the steam engines would go a great way in defraying the expense of building this Reservoir, or, the Wissahickon works.

By the water-power system, the supply of water could be increased by making more natural Reservoirs and adding more wheels, at any time in the future. The gravitation plan would not allow of this gradual increase.

To show how much more water, by means of these Reservoirs can be supplied into the City Basins, by water-power, than by gravitation, and estimating the dry season at ten weeks, and allowing 150 million gallons per day, on an average, for the first five weeks, to be drawn out of the Reservoir, to keep up a sufficient volume of water in the river, and 300 million gallons per day for the *last five weeks*, it would still leave 4250 million gallons in the Reservoir. The water supplied by this Reservoir, together with the regular flow of the Schuylkill, is believed to be capable of pumping 100 million gallons per day, *by water-power*.

Now, with all the above items included, and so far as regards Flat Rock, we cannot make the cost more than 25 cents per million gallons, or, even if we allow the cost to be 50 cents per million gallons;—we ask, “How does this compare with the cost of steam-power at \$20.00 per million gallons?” This being the average of the two years mentioned above, viz: 1871 and 1874, as copied from the Department Reports, and we have no other Reports to refer to.

The above statement, of undeniable facts, removes all doubt as to the superior economy of water-power over steam-power, and also over “the gravitation plan.”

*The Great Benefit of Impounding Dams on the Schuylkill River.*

It is easy to show that great benefits would result to the Schuylkill Navigation Company, as well as to the City of Philadelphia, by the use of Impounding Dams, for promoting our water supply.

In the first place, it would afford an opportunity for the water confined by the dams to purify itself, by settling, and also give a full supply to the navigation.

2nd.—It will save the Navigation Company the great expense of cleaning out the canal all the way down to the city; also, save the city the expense of cleaning out the city basins, whilst at the same time it would give the people clean water.

3rd.—It would give to each water-power on the Schuylkill river more than four times the power they now have.

4th.—It would prevent the mischief occasioned by all large freshets, and the disastrous results which occur to mills, etc., on the river side, and also would rescue hundreds of acres of the rich lands along the river banks from inundation.

5th.—It would be the means of supplying the city with 300 million gallons, per day, of pure water.

6th.—This water would supply ten Bucket wheels on the east side of the river at the lower part of Manayunk, and also ten wheels on the west side, which, together, would supply 200 millions of gallons per day throughout the year; and in addition to the above 100 million gallons could be supplied from Fairmount, and the above arrangement would not interfere with the navigation or the power required by the mills.

The volume of water in the Schuylkill, under the system of Impounding Dams, would flow over 2,500 million gallons per day, on an average. That this is a correct statement of the volume of water in the Schuylkill, it is only requisite to consult the statistics of Mr. Birkinbine, who surveyed the water shed of the Schuylkill while he was Chief Engineer of the City Water Department in 1866, and found that it contained 1942 square miles. The average annual rain fall for the last twenty years would, in round numbers, be about 800 million gallons per square mile.

Sixty per cent. of this water can be utilized for water-power, according both to the Commission of Engineers' Report, and also to tables of Mr. Birkinbine, page 18.

It may here be asked, "Was there ever any necessity of using steam-power for supplying the city with:



water, when there is so much water-power which could be easily utilized running to waste?

We may here state for the information of the people, that there are fifteen steam engines in operation for supplying the city with water; all these costly engines and the enormous expense of running them, could be completely dispensed with by the substitution of water-power, as above suggested.

From the last Report of the Chief Engineer, we find that the cost of coal for raising steam for supplying the city with water is \$77,003 for the year 1876. Now, to think of the wanton prodigality of spending the above amount for coal, which ought, in preference, to be distributed among the needy poor. In addition to this, a large sum in wages is paid to men for thus needlessly burning it.

If good citizens would take the trouble to investigate the Reports of the Chief Engineer, they would see such glaring corruption as would be sufficient cause for bringing the parties to justice, and putting a stop to the criminal acts of these conspirators against the welfare of the city.

For instance, we refer to the Report for 1876, wherein it is shown that wheel No. 1 was stopped 269 days, and wheel No. 2 was stopped 341 days. The lame excuse for stopping the wheels was, "*The Basins being full.*" But, the most casual observer knows well that the three principal Basins, namely—the Corinthian, Spring Garden and Kensington Basins, are never kept, on an average, the two former, not within seven feet, and the last, within six feet of being full. The little water that was in them was chiefly supplied by steam-

power, and at the same time could have been pumped by these wheels that were stopped, without the least additional cost to the city.

### *Water Power versus Gravitation.*

The Commission of Engineers, and Dr. McFadden, appointed by the members of the Franklin Institute, in the year 1875, proposed to supply Philadelphia with water by Gravitation, at a cost of ten million dollars—the interest on which would be \$600,000. The supply was to be drawn from a large Reservoir on the Perkiomen, that would hold twenty thousand million gallons of water. They calculated only to utilize one-half of this water, the other half being unavailable, as it would be too low to afford the requisite head.

But by using the contents of this Reservoir for aiding the water-power at Flat Rock and Fairmount, it would be the means of supplying [ $\frac{4}{5}$ ] four-fifths as much water as this Reservoir will hold into the City Basins, say [16,000,000,000] sixteen thousand million gallons during the year, (whereas, *only* [10,000,000,000] ten thousand millions could be supplied by Gravitation), and with the aid of the regular flow of the Schuylkill, would keep up the power of supplying the city with 100 million gallons per day, on an average, by water-power uninterruptedly.

The obvious certainty of this will be apparent when it is stated, that this water will only be wanted for 70 days in the year.

The effect of these Impounding Dams would be similar to the fly-wheel of a steam engine, which carries

the crank over the centres, and gives a uniform speed to the engine, and by using these Impounding Dams for ten weeks, in the dry season, would also be the means of maintaining a uniform power throughout the year.

It is proposed to pump 60 million gallons per day at Fairmount, by putting in four more wheels, and 50 millions per day more by putting in five Bucket wheels at the lower part of Manayunk, the water for which can be supplied from the canal.

It would be advisable to raise the canal bank some two feet, so as to keep the water at the same height as that in the dam. This would give ten per cent. more power to the mills at Manayunk, which would richly repay the cost of raising the embankment.

When the memorial of the undersigned was placed before the City Councils, for their consideration and approval, Col. T. Jones opposed it, saying that it would stop all the mills in Manayunk, when it was manifest, that five times as much water-power could be supplied,—in the dry season,—as there is at present.

By thus enlarging the canal—it would lessen the rapidity of the current, so as not to interfere with the navigation—sufficient power would be obtained to run ten wheels, and thereby pump 100 million gallons per day for city use and motive power. To utilize *all* the water, ten more wheels might be put on the west bank of the river, thus supplying 200 million gallons per day. It appears that the Commission of Engineers do not appreciate the great importance of Impounding Dams.

The Commission, and Mr. Smith in his Report on building Impounding Dams, to hold 4,600 millions of gallons of water, say they would pump only 13 million gallons per day for seventy days.

It should be borne in mind that these Impounding Dams would be only required to keep up the volume of water-power in the river one-fifth of the year; the other four-fifths can be supplied by the natural flow of the river.

It is thus shown that these Impounding Dams would be the means of pumping five times as much water as the Commissioners have stated, by still maintaining the water-power of the river; and thus proving that they did not understand the real benefits of Impounding Dams. This is not surprising, when it is well known by *whom* these Commissioners were appointed.

To show the unfairness of the Commissioners in comparing the cost of water and steam-power, in the proposition of putting in two wheels at Flat Rock, they have included the rentals of all the mills in Manayunk, in the expense of running these two wheels, to say nothing of other glaring misrepresentations.

*Answer to a Communication which appeared in the New York Sunday Herald, on*

### THE CROTON WATER SUPPLY.

*To the Editor of the New York Sunday Herald.*

In the New York Herald, Sunday, Nov. 25th we find a lengthy communication on the Croton Water Supply. According to the statements of the writer, the com-

munity of New York is likely to suffer from the corruption of their Water Department.

The object of the writer of the above article seems to be to disparage the Croton supply, and proposes plans for immense outlays, involving an almost infinite number of contracts.

He estimates the daily average supply, to be obtained from the Croton valley, at only 175 million gallons, per day, obtained from an area of over 300 square miles.

In the editorial comment on the above article, in the same issue, it is stated that the area is 338 square miles. The rainfall may be stated as averaging 45 inches.

If the editor will take the trouble to make a calculation from the above data, he will find that the daily average flow of the Croton river would be 435 million gallons, instead of 175 million gallons, as the writer has stated; a difference of 260 million gallons.

It will appear from the difference of the two statements that there is a great leak somewhere, or, that the writer has some selfish object in view.

This is not in the least surprising, so long as *such* Engineers are employed as W. Milnor Roberts, of New York, who was one of the five Commission of Engineers, appointed by the most corrupt of Rings, the particulars of which will be shown in a pamphlet which will shortly be issued, exposing the corruption of the Water Department of Philadelphia, for the last thirty years.

To show the difference of consumption of water, between Philadelphia and New York, the former only actually consumes 30 million gallons daily, but the De-

partment makes the consumption 50 million gallons. To account for this difference, as regards Philadelphia, some of the pumps, though constantly running, have supplied very little or no water for years, and others, none. They count every stroke of the pump as delivering its full capacity, when the pumps, on an average, do not deliver more than one-half of what they register.

It is true that New York has a greater population than Philadelphia, but Philadelphia is so much more largely engaged in manufacturing pursuits, that it is natural to presume, they would consume nearly as much water as New York.

The writer states the consumption of New York as [120,000,000] one hundred and twenty million gallons, daily, while Philadelphia only consumes 30 million gallons. It may be fair to presume that the consumption of New York does not exceed 50 million gallons. Do not these facts plainly show that there is great corruption somewhere?

For the benefit and information of the people of New York, will not these statements be sufficient to secure an insertion in the columns of the "New York Sunday Herald?" This request has not, hitherto, been complied with.

Are there not good and honest people in New York, sufficiently interested in its welfare, to make the public acquainted with the above facts.

### *The Schuylkill Water Shed.*

About the year 1865, Mr. Birkenbine, being then Chief Engineer of the Water Department, had a sur-

vey made of the Schuylkill Water-shed, and found it contained 1942 square miles. Taking the average of the last twenty years, it has been found that the depth of rainfall is about 45 inches. This rainfall would amount to within a small fraction of 800 million gallons on every square mile.

On 1942 square miles, this amount of rainfall would yield a daily average flow, of the Schuylkill river, throughout the year, of [2,500] two thousand five hundred million gallons, which can be utilized for water-power, and this amount is only 60 per cent. of the rainfall.

The Commission of Engineers made the daily average flow throughout the year, at only [1,500] fifteen hundred million gallons, or, 1,000 million gallons less than the actual flow. They, (as also Mr. Smith, Engineer of the Schuylkill Navigation Co.,) make the daily *minimum* flow at only 245 millions, whereas, the *actual daily minimum* flow would be 400 million gallons.

It may be here stated, and we quote the language of James F. Smith, Chief Engineer of Canals, to be found on page 113, in the Commission of Engineers' Report, "that on the 29th of August, 1816, a measurement was made at "*the Narrows*," now Flat Rock Dam, by a Committee of the Schuylkill Navigation Company, when the water was said to have been as low as at any time for the then previous twenty years, and that Committee stated the minimum flow, in round numbers, was 500,000,000 gallons per 24 hours." \* \* \*

"About the year 1825, the minimum flow was estimated at 440,000,000 gallons per day, and, in later years, 400,000,000 gallons per day has been the usual estimate."

Now, taking the statement of the above Committee to be correct, viz, 500,000,000 gallons as the minimum flow per day, does it look reasonable that the minimum flow of the Schuylkill river has diminished more than one-half in 61 years?

Probably they made the same mistake in the minimum flow as they had done in the average flow.

The Commission of Engineers, in their late Report to the Councils, have stated, that 8 gallons will pump *one* gallon at Flat Rock into the city basins. Fairmount water-power is estimated to be [ $\frac{1}{3}$ ] one-third of the Flat Rock power, and by adding the two falls, or powers—Flat Rock and Fairmount together—it will take less than  $5\frac{1}{2}$  gallons to pump one gallon into the city basins.

To maintain an abundant supply of pure water to the city, two plans are herein proposed, viz: one is by adopting the plan of the Perkiomen Reservoir, and using it as *water-power* supply merely; the other is by building a Natural Storage Basin, as has been described in a previous article. Neither of these plans would interfere, in the least, either with the power of the mills at Manayunk, or the navigation of the river, but on the contrary, would be a great advantage to both.

When such an abundance of cheap, pure water, can be brought to the city, why are not these plans adopted, whereby the streets and sewers could be flooded, and Philadelphia would become the cleanest, most healthy, and prosperous city in the Union.

The people have the choice before them, whether they shall inaugurate this reign of prosperity, or, by



allowing the continuous corruption of a cruel Ring power, see the destruction of the city's comfort and credit completed.

It is an impossibility for Philadelphia ever to expect to become prosperous under the present system of the Department, whose whole aim is to rob the people.

In plain language, they pay the highest wages for the least and worst work, and the lowest wages for the most and best work, thus willfully deprive the city of water, and persist in furnishing muddy water in limited quantities so as to cause the people to complain, and then use their complaints as a plea for procuring additional prodigal and profitable contracts.

*A Plan for Purifying the Water in the Schuylkill River.*

By making two sluices, each of sufficient capacity to hold the sewage, and while one of these is filled, the other could be cleaned out, and its contents used for manure. This system could be adopted at all the populous settlements on the banks of the river.

The chief nuisance arises between Flat Rock Dam and Fairmount, which would require a sewer along the main street of Manayunk, and, to catch the sewage from the factories, and iron pipe could be carried along the margin of the river, and this combined sewage could be taken across the river in a pipe and emptied into a sewer on the west bank of the river, which could be connected with the sewer already made and completed to the Zoological Gardens. A pipe could be thrown across the river at the Falls of Schuylkill, and also another pipe across the river at Girard Bridge.

Or, the water in Fairmount Dam, with its present impurities, could be used altogether for water-power, and the city supplied with pure water from Flat Rock. This water-power would be very valuable if the river was always full of water, which would be rendered the case if a judicious system of impounding dams were employed.

There is no need whatever for any muddy water being supplied to the city. Mr. McFadden knows this well. If they did not fill the basins with muddy water, the contractors would lose the job of cleaning them out.

For the first year that McFadden had control of the Water Department we had plenty of clear water. This was accomplished by filling up the basins nearly full, so that they could stop the pumps for two days while the muddy water passed by. This fact will be remembered by all the citizens who were residing here at that time. This same policy can be continued without any additional cost whatever to the city.

This plan would necessitate the basins being kept full, and thereby giving the citizens no chance for complaining for want of water. But this would not suit the Department, as they could then get no more appropriations or contracts.

*Estimated Size and Cost of a Natural Reservoir at  
Nicetown.*

The estimated size of this Reservoir would cover in the neighborhood of 200 acres. The depth about nine [9] feet, eight of which could be drawn off when necessary.

Its capacity would be 500,000,000 gallons, all of which could be drawn off, but it could be made to hold nearly 1,000,000,000 gallons, if deemed necessary, and if there were natural basins built that would hold 4,000,000,000 gallons, they could all be filled from Fairmount without any extra cost for the running expenses.

There would be no need of using a brick, or a stone, or puddle, in building this Reservoir, as it would be located in a valley well soaked with water. The leakage will be very trifling, when the shallowness of the Reservoir is considered. This plan of locating and building a Reservoir would not suit the policy of the Ring, as they would prefer making an East Park Reservoir job out of it.

Another chief consideration is the merely nominal cost of filling it—only \$1.00 per million gallons, as compared with \$20.00 per million when pumped by steam-power, therefore, any loss from leakage, scarcely need to be considered.

The advantages of location of this Natural Reservoir may be contrasted with the location of Artificial Basins, which are built on hills, as for instance the East Park Reservoir, which, being 25 feet deep, induces a pressure which cannot be overcome, and would require a steam engine to make good the leakage.

### MUDDY WATER.

*To the Editor of the Press:*

SIR: Day after day we see muddy water placed upon our tables, almost continuously; and, although the peo-

ple loudly complain, yet no steps are taken to effect a change. The statement of the following facts will, it is trusted, be quite sufficient to induce the people to insist upon having clean water, which can be easily supplied without cost.

With a daily pumping capacity of one hundred and twenty-four million gallons, the basins are kept, on an average, only about half full. The daily pumping capacity of the Fairmount Water Works is forty-four million gallons, yet only twenty-two million gallons are registered, according to the Department reports, and not one-half of this is supplied into the basins on account of the pumps being in a very bad condition, some of them not having pumped any water for years. Although they charge us with fifty millions as the average daily consumption of the city, yet not more than thirty millions, on an average, is actually supplied. The reason for this difference is, they make their calculations from what the pumps register, not what they actually pump. To explain this matter more fully, some of the large pumps make 24 strokes per minute without pumping any water.

We ask is it not time to give the parties justice, who have charge of these works, and place them where they can do no more harm? We will show that there is no reason whatever to pump any muddy water into the basins.

The storage capacity of all the basins in use is one hundred and fifty-two million gallons. In the winter season the daily consumption will not exceed twenty millions, but, to be on the safe side, we will say twenty-five millions. Three days' consumption would be

seventy-five million gallons, or one-half of the whole contents; but two days' consumption, or fifty million gallons, would only be one-third of the contents. In case of muddy water, the pumps could be stopped for three days, although two days would often be sufficient time to let the muddy water pass. But if the pumps were stopped one day, or twenty-four hours, what an immense amount of mud it would prevent from getting into the basins! But as they do not stop them twelve hours, or six hours, or even one hour, what interest, it may be asked, does the Department take in the welfare of the people? Is it not a matter of the greatest astonishment that the people have so long quietly submitted to these abuses, well knowing there can be no chance of improvement until honest people come forward and insist upon a change of policy before the Sheriff gets hold of all our property, and the city becomes involved in complete ruin.

Philadelphia, Jan. 23, 1878.

J. H.

*The Destruction of the Water Power at Fairmount.*

The following statement will show how studiously the Water Department have persistently endeavored to destroy the water-power.

The undersigned visited Fairmount, and the Corinthian avenue and other Basins, as given below, with the following result, during 1870.

Sept. 3, Corinthian avenue basin down 10 feet; 3 wheels stopped at low tide.

Sept. 7, Fairmount basin down 6 ft.; 3 wheels running at low tide.

“ 8, “ “ “ “ 6 ft.; 4 “ “ at high tide.

Sept. 9,	Fairmount basin down 6 ft.;	5 wheels running at high tide.
" 10,	" " " 7 ft.;	5 " " "
" 11,	" " " 7 ft.;	5 " " "
" 12,	" " " 7 ft.;	6 " " "
" 13,	" " " 7 ft.;	2 " stopped at low tide.
" 15,	" " " 7 ft.;	5 " running at high tide.
" 18,	" " " 7 ft.;	3 " stopped at low tide.
" 21,	" " " 7 ft.;	2 " " "
" 22,	" " " 7 ft.;	6 " running at high tide.
" 24,	" " " 7 ft.;	6 " " "
" 27,	" " " 7 ft.;	6 " " "
" 28,	" " " 7 ft.;	6 " " "

He, also, further visited said basins and water works in the year 1871, with the result as stated in the following table:

Aug. 6,	3 wheels stopped at low tide, the rest running at half speed.
" 19,	2 " " "
" 22,	6 " running at high tide.
Sept. 4,	6 " " "
" 5,	5 " " "

It must be remembered that the water in the river was very low all this time, not running over the dam, thus showing that the wheels were running at high tide when the water had the least power, and stopping at low tide, when, if the pumps were in good condition, they had three times the power, but in proportion as they were out of condition the power would decline.

We continue the above statements for the years 1875 and 1876:

1875, June 14, 6 wheels stopped at low tide.

" " 27, 3 " " "

" July 8, 5 " " "

" " 9, 4 " " "

" " 13, 4 " " "

1875, July 15, 4 wheels stopped at low tide.  
 " " 19, 4 " " "  
 " Aug. 20, the water 3 feet deep over dam breast.  
 " " 20, 2 wheels stopped, steam engines running.  
 " Sept. 24, 3 " " at low tide.  
 " " 28, 4 " " "  
 1876, Mar. 24, 2 " " "  
 1877, Sept. 2, 4 " " "  
 " " 28, 3 " " "

They always had pumping capacity enough to keep the basins full, if the pumping machinery at Fairmount was in even a moderate condition, or if they had pumped one-half of their full capacity.

Below is given the height of the water in the basins at the respective dates.

1875, June 24, Corinthian basin down 10 feet.  
 " July 11, " " " 12 "  
 " " 12, Kensington " " 7 "  
 " Aug 18, " " " 7 "  
 " " 20, Corinthian " " 10 " 4 inches.  
 " Sept. 17, " " " 6 " 8 "  
 " " 30, Kensington " " 6 "  
 " Oct. 19, Corinthian " " 12 "  
 1876, Mar. 1, " " " 5 " 3 inches.  
 " April 10, " " " 6 " 6 "  
 " " 11, Kensington " " 9 "  
 " " 11, one-half of the pumps stopped.  
 " " 12, Corinthian basin down 7 feet.  
 " " 22, " " " 5 " 6 inches.  
 " May 4, " " " 5 "  
 1877, Sept. 2, 4 wheels stopped at low tide.  
 " " 22, 3 " " "

The above statements go to show, that they could not have stopped the pumps while the muddy water passed down, as might have readily been done if the

basins had been kept full, so as to contain a few days' supply.

*A Summary of the Crimes Perpetrated by the Water Department.*

It is manifest that the Water Department is deeply interested in destroying the water-power at Fairmount, as the following summary will show.

1st.—There never was the least need of steam-power for pumping water.

2nd.—Nor ever any need of making artificial basins, when there are plenty of locations for building natural basins at one-twentieth the cost.

3rd.—There never was any need of supplying muddy water, when clean water could be supplied just as well without any extra cost.

4th.—Systematically stopping the water wheels—when at the same time the water was running over the dam—and preferring to pump the water by steam-power at twenty times the cost.

5th.—Systematically allowing the pumps to wear out, and remain in that condition, so that some of them ceased to pump any water.

6th.—Running the wheels at high tide, and stopping them at low tide, when the water in the river was low, and thereby not pumping one-fourth of the water they are capable of doing.

7th.—In the time of the Water Famine, in 1869, they drew the Schuylkill dam down 3 feet, so low that they could not get water to the pumps, thereby also stopping the navigation, which entailed a loss on the city of near half a million dollars, and entirely ruined the



water-power, so that they pumped less than one million gallons per day, on an average, for the four weeks when the navigation was stopped; when at the same time they could have pumped fifteen million gallons per day, at the same expense and without stopping the navigation, or without exposing the city to the danger of being laid in ashes.

8th.—Since the Turbine wheels were put in they have in reiterated instances drawn the dam down [11] eleven inches, to “the navigation mark,” and willfully lost that much fall.

9th.—On an average the basins have been kept not more than half filled, systematically.

10th.—Building new steam pumping works for the Centennial Exhibition, at a cost of over \$70,000, when they already had a daily pumping capacity, at the Belmont works, of nineteen millions and a half, of which only nine and a half million gallons were used; thus leaving a balance of ten millions they had no use for, according to the Report of the Commission of Engineers.

11th.—Building an artificial basin on George’s Hill, at enormous expense, instead of building a better natural basin, close by, on George’s Run, at one-twentieth the cost.

12th.—The criminality of building the Kensington steam works at the mouth of Gunner’s Run, and still worse, in building the Frankford steam works, in place of raising the Kensington basin six feet, and supplying the water from Fairmount or Flat Rock. Also, the building of Roxborough steam works. The cost of supplying Germantown and Roxborough from these

works has averaged \$48.00 per million gallons, in place of building water works on the Wissahickon, the cost of pumping from which would only be \$2.00 per million gallons.

After investigating the action of the Water Department for nearly nine years, we can safely say, that the city is sacrificing \$600,000 per annum in the Water Department alone.

We would suggest that the Water Department be given in charge of a Company that would be interested in supplying water on a similar plan with that of the *New System*, as indicated by the undersigned, in pamphlets heretofore published and laid before the people, of which the following memorial is a copy, dated April, 1875.

Whereas, Mr. James Haworth has heretofore proposed to your Honorable bodies, a scheme for ultimately supplying the city with water to the extent of 350,000,000 gallons daily by the employment of water power alone, in pursuance of which he declares his readiness and ability to keep the existing basins perpetually filled, not only without any expense to the city, but that he will pay into the city treasury a net income of five hundred thousand dollars a year; and furthermore, that he will pay the interest on all appropriations, (if any), which might be requisite to accomplish this purpose, and has also expressed his readiness to enter sureties in the sum of one hundred thousand dollars for the faithful performance of this proposition.

A copy of this pamphlet will be placed in the hands of the Editors of every newspaper in the city, in the sincere hope that they will take such an interest in it as to fully inform the people of its contents, and thereby demonstrate that the newspaper press is rather the friend and ally of the people than of those pitiless predacious rascals who have been pillaging the city treasury, both in this and other departments, and piling up our vast municipal debt of Seventy-three Millions of Dollars.