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REPORT

OF THE

WATERING COMMITTEE,

ON THE SUBJECT OF OBTAINING

WATER POWER

FROM

THE RIVER SCHUYLKILL.

PHILADELPHIA:

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NO. 10, NORTH STREET.

1820.

REPORT

OF

THE WATERING COMMITTEE.

IN the year 1799, Councils, sensible of the importance of a supply of pure Water to the City, appointed a Committee, to ascertain whether it could be introduced by means of Water Power, and whether such power was to be found within a reasonable distance of the City, and to report upon the subject. Mr. Latrobe was employed by the Committee, and, after considerable pains, it was believed that no Water Power could be had adequate to the purpose; and Councils finally decided upon constructing two Steam Engines, the one on Chesnut street, and the other in Centre Square, and by their means to supply the City with Water from the Schuylkill.

In the course of a few years, these Works were found to be insufficient, and very expensive, which induced Councils once more to look for a more frugal means of supply; and accordingly, on the 24th October, 1811, the Watering Committee were directed to cause examinations into the subject; and, upon this occasion, Mr. John Davis, in conjunction with Mr. Frederick Graff, were instructed to report the best plan of Watering the City. These gentlemen, in their Report, speak of the practicability of getting Water Power from the Wissahickon; but the estimate was so large, (\$59,718 dollars) that this was put aside, and the present plan of two Steam Engines at Fair Mount adopted.

The constant and great expense attending Steam Engines, and the vexation occasioned by repeated accidents, have always been present to the Watering Committee, who have ever thought Water Power should be resorted to, if practicable.

The present Committee have been fully alive to the importance of the subject; and their desire of accomplishing it more and more excited, by the success of the improvement of the Schuylkill by Dams and Locks, which suggested the practicability of erecting a Dam and Water Works near Fair Mount. Upon this subject, the Committee determined to consult Mr. Ariel Cooley, who accordingly sounded and examined the river, and gave his decided opinion that no difficulty at all prevented the construction of a perfectly safe Dam, and that he would willingly contract to do the work; but his price was not named, as he was then on the point of departure, but he promised, on his return from Connecticut, to inform the Committee.

From all that could however be gathered, and from other sources of information, added to a personal inspection of the River, from Flat Rock to Fair Mount, the Committee are led to think the work can be fully completed for 60,000 dollars, and that an additional sum of 40,000 dollars will be adequate to the erection of Houses, Mill Machinery, and ascending Mains; making the whole cost, including the purchase from White and Gillingham, as mentioned below, 250,000 dollars.

Difficulties however presented themselves, from the right to the Water at the Falls having been granted by the Legislature, to a certain extent, to Robert Kennedy, who afterwards sold his right to Josiah White, who obtained from the Schuylkill Navigation Company the full grant of the Water at the Falls, which had been granted to the Company by a subsequent Act of the Legislature. The same Act also stood in the way of any improvement at Fair Mount, without consent could be obtained from the Company.

Not discouraged by these difficulties, the Committee determined, if possible, to remove them; for which purpose, they ascertained, in the first place, that Mr. White and his partner Mr. Gillingham would sell their right. They then applied to the Navigation Company, who entered into an engagement to permit a Dam to be placed at or near Fair Mount, and to give all the aid of their rights under the Act of Assembly.

This point being settled, the Committee proceeded to negotiate with Messrs. White and Gillingham, and finally entered into a provisional agreement with them, for the purchase of all their Water Power at the Falls, for the sum of 150,000 dollars, with a condition that the City should make use of such part of the Locks, Gates, &c. at that place, as it may require.

The price is deemed, under all circumstances, to be reasonable, and the Water Power obtained surpassed by no River within thirty miles. Various calculations have been formed; but, at the lowest estimate, it is believed the power is equal to raise nine or ten millions of gallons, at the driest season of the year, in twenty-four hours, to the Reservoir on Fair Mount.

Messrs. Nixon and Biddle, and the other owners of the Ground adjoining to the north of Fair Mount, have agreed to let the Abutment of the Dam be affixed on their property, without any claim for remuneration; thereby affording the City the full use of the whole of the Water Front of the late purchase, for the erection of Houses for Machinery, &c.

In presenting this subject to the Councils, the Committee cannot but feel gratified that they have it now in their power to say, that the object so long desired may be accomplished, and at an expense less than upon any occasion heretofore counted upon.

The adequacy of the supply of Water to the City, and the ability it affords of supplying the Districts, and thereby adding materially to the income of the City, will, in the opinion of the Committee, of themselves justify the expenditure of the money proposed, even if a real saving was not to be made, the effects of which will be very soon felt by our fellow citizens.

It will appear by the Report of Mr. Graff, herewith submitted, that all the supply that can be expected from the present Steam Engines, will not much exceed two millions of gallons, on the average, in twenty-four hours; all of which, experience has shown, will be required for the City alone, at the cost of upwards of 30,000 dollars per annum, and without the surplus of a gallon for the Districts.

The Committee beg leave to call the attention of Councils to the following calculation, intended to show, that if Water Power can be obtained, at almost any cost, it will, in the end, be much cheaper than by the present mode.

The annual expenditure, for working one Steam Engine, appears, by the statement of Mr. Graff, above referred to, to be, per annum, - - - - - \$ 30,858

The cost of Water Power, as before stated, is 250,000 dollars, the interest of which is \$ 15,000

The expense of Labour, Oil, Wear and Tear, &c. is estimated at - - - - - 3,000

Amounting to 18,000

From which is to be deducted such sum as may be received from the Northern Liberties, Spring Garden, and Southwark, who have evinced a strong desire for a supply of water; the amount to be received for which, will be equal, it is supposed, to that paid by the City; but it is only at present taken at - - - - - 10,000

leaving - - - - - 8,000

which being deducted from the sum required for the annual working of the Steam Engines, leaves - - - - - \$ 22,858

which is the clear annual gain to the City; and which, if applied as a Sinking Fund, will, in about eight years, redeem the whole cost of the Water Power, and relieve the City from any further annual appropriation of the sum of - - - - - 30,858

and add to its revenue the Water Rents of the Districts, which, at the end of eight years, may be fairly taken at - - - - - 20,000

Making the whole sum 50,858

from which deducting the annual expense of the Water Power, - - - - - 3,000

leaves a clear annual saving of \$ 47,858

But as it will probably be the object of Councils to give immediate relief to their fellow citizens, by lessening at once the annual tax for the support of the Steam Power, it can be done by appropriating a smaller sum to the Sinking Fund than the 22,858 dollars which is before assumed, say 12,000 dollars, which will make an annual difference of 10,858 dollars, and accomplish the redemption in a reasonable period, say fourteen years.

The Committee have prepared a Bill on this subject, which they beg leave to offer for consideration of Councils.

By order of the Watering Committee,

JOSEPH S. LEWIS, Chairman.

February 5th, 1819.

JOSEPH S. LEWIS, Esq.

Chairman of the Watering Committee.

SIR,

In compliance with your request to estimate the expense of working the Engine of Oliver Evans for one year, supposing it to be employed during the whole twenty-four hours, including fuel, wages, tallow, &c. and reasonable allowances for wear and tear, with an estimate how much water it would raise in twenty-four hours with safety, also the same information respecting the south Engine, I beg leave to submit the following estimate, without taking into view accidents, which all Engines heavily loaded are subject to, or the renewal of the Boilers, which cannot be calculated to last more than twelve or fourteen years.

*Estimate of Expense in working Oliver Evans' Engine
for one year.*

Six men to work and keep the Engine in repair,	
at \$ 9 75, - - - - -	3,558 75
For tallow, oil, chandlery, &c. - - - - -	1,250 00
3,650 cords of wood, cordage and hauling, at \$7,	24,550 00
Wear and tear of machinery, - - - - -	1,500 00
	<hr/>
	\$ 30,858 75
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This Engine has raised upwards of 3,000,000 gallons of water per twenty-four hours; but the speed necessary for raising that quantity of water, is considered unsafe to the machinery. The estimate for the fuel is founded on the Engine raising 2,300,000 gallons, which is as much as can be calculated on for regular and safe work.

The imperfect state of the Boiler of the south Engine, has prevented a fair estimate being made of its performance. The water raised has never exceeded 1,787,000 gallons per twenty-four hours. It is calculated, that after the necessary repairs and alterations are made, it will be capable of raising 2,300,000 gallons, at an expense about equal to the Engine of Oliver Evans in raising the same quantity of water.

It is my opinion, that 2,300,000 gallons of water is as much as can be raised, on an average, in each twenty-four hours, unless an additional raising Main is carried to the Reservoir, and both Engines kept in operation at the same time; in that case, the annual expense in working the Engines would be nearly doubled.

With great respect,

Your humble Servant,

FREDERICK GRAFF,

Superintendent of the Water Works.

February 4th, 1819.

THE Watering Committee having received from Messrs. Briggs and Lehman, and from Mr. Oakes, a further communication, herewith present them, for the information of Councils; and also a plan of the dam, &c. made by the first named gentlemen. By order,

JOSEPH S. LEWIS.

March 13, 1819.

C. W. C.

White's Town, March 11th, 1819.

SIR,

We, the Subscribers, will undertake to build a dam on the Schuylkill, at Fair Mount Water Works, in the following manner, and for a sum of money hereinafter mentioned, viz.—

We will build a good and substantial dam of stone and timber, as represented on the plan given in by us, together with locks, guard-walls, arches, abutments, head-gates, with cast-iron frames, and dig two hundred feet of the race in length, sixty feet wide in the bottom, and deep enough to draw off four feet of water below the top of the dam; we will do the work in a good workmanlike manner, for one hundred and ten thousand dollars; and, if required, we can give good security for the performance of the work.

With sentiments of respect,

WILLIAM LEHMAN,

WILLIAM BRIGGS.

HONOURED SIR,

From further reflection, I believe it would be more to the interest of the Corporation to put the locks on the east side of the river, making the head race (that leads the water to the wheels) the canal, and continue it down by the east side of the present engine house, emptying into the river by two locks, at the lower end of the land belonging to the Corporation. This would afford a spacious basin for boats, and on the east bank an eligible site for ware-houses, with a saving in the total expense of probably six or seven thousand dollars.

THOMAS OAKES.

March 13, 1819.

ADDITIONAL REPORT

ON

WATER POWER,

BY

THE WATERING COMMITTEE,

With communications on the subject from Messrs. Ariel Cooley, Lewis Wernwag, Thomas Oakes, William Briggs, and William Lehman. And other Documents.

THE Watering Committee, on the 5th ult. made a report to Councils, intended to draw their attention to the subject of obtaining Water Power from the Schuylkill, and stated their impression at that time of the probable cost of the work. The committee, however, determined not to call up the subject for decision, until further inquiry should enable them to determine with some degree of certainty, as to the practicability of the measure, and the cost of its execution. In their former report, the committee stated, they had consulted with Mr. Cooley, who had promised, on his return from New England, to furnish such further information as was in his power. Accordingly, on his return, the committee engaged Mr. Cooley to make a more accurate survey of the river, which he proceeded to accomplish, and finally gave his decided opinion as to the practicability of the measure. Messrs. Briggs and Lehman, the former a mason, who con-

structed the locks at Flat Rock, and the latter an ingenious mechanic, also were desired to make an examination; after which, they also approved of the measure, and have offered to contract for its execution.

Mr. Lewis Wernwag, well known for his judgment and skill, has also stated his belief of the practicability of a dam, and his willingness to undertake the construction of it.

The committee, in their inquiries for persons properly skilled in works of the kind, were recommended to apply to Mr. Oakes, of Bloomfield, New Jersey, for whom they accordingly sent, and requested him to examine the subject, and to furnish his ideas. His approbation of the measure will be found in the accompanying communication, which also goes into other details, very interesting, and confirms the calculation heretofore offered by the committee, as to the quantity of water that can be raised to Fair Mount.

The several communications received from the above named gentlemen, are submitted herewith; as also the provisional engagements entered into by the committee, to which they beg leave to refer, as part of this report.

It will be found, that the cost of erecting a dam will exceed that before estimated, in consequence of a more extensive one being required, than was before supposed. When Mr. Cooley made his former examinations, it was supposed the bottom of rock extended across the whole river; but on a more careful survey, it is conjectured to be a bottom of mud, for two hundred and forty feet west of the engine house, and the remainder of rock, as is more fully detailed by Mr. Oakes, whose estimate for completing the work is also the largest.

Mr. Wernwag, however, who is well acquainted with the river, having built the bridge near Fair Mount, asserts that the bottom is of rock, and covered to some depth with mud, which can readily be removed.

The committee have found Mr. Oakes a gentleman of information, knowledge, and caution, and are satisfied from his character, that the estimate he furnishes, is calculated to exceed the cost of the work, rather than to fall short of it.

Mr. Cooley has estimated, in his last communication, that the cost would be, for the dam, locks, race, &c. without the mills and machinery, about - - - - 100,000

Messrs. Briggs and Lehman have offered to do the same for - - - - 96,000

Mr. Wernwag estimates it at - - - - 147,960

Mr. Oakes estimates it at - - - - 150,000

Making in all, 493,960

The average of which four estimates is - 123,490

To which add the mills, &c. - - - 40,000

The cost of Water Power - - - - 150,000

Whole cost, Dollars, 313,490

The committee have not taken into calculation the cost of overflowing about forty acres of ground, which might be put down at 3000 dollars, nor taken credit for the materials at the Falls, which are worth double the money.

The calculation before offered will be found correct, with the difference of the interest on the extra cost of the water, say 63,490 dollars, at six per cent. per annum, is 3,809

From which should be deducted an allowance

for working the mills, before stated at 3,000

By estimate of Mr. Oakes, is only - 2,100 900

Making a difference of Dollars, 2,909

So that the clear annual gain to the City, instead of 22,858 dollars, would still be 19,949 dollars.

The committee are sensible that the cost of the contemplated work is large; but when it is considered, that a safe and an economical means of obtaining 10,000,000 of gallons of water can be had, in lieu of a costly and precarious supply of but little more than 2,000,000, and at the cost of not much more than one half, without calculating on the sale of a gallon to our neighbours in the districts; it is conceived, that councils should not reject a plan so long sought for; hitherto unattainable; and if now suffered to escape from our grasp, never to be reclaimed. The committee believe

that their fellow citizens view with anxiety the accomplishment of a measure so important to the health of this great City, already combining so many advantages; and which, if this plan be carried into effect, will, at so small an expense, be better watered, by artificial means, than any other in the world.

The committee forbear to display the advantages which would be derived, in extreme hot weather, from a constant flow of water in our streets, and the playing of fountains in our public walks, creating an elasticity in the air so necessary to health; but they cannot forbear alluding to the advantages which would be derived from the surplus water of the river being used to feed canals, connecting, in various parts, the Schuylkill with the Delaware, and many other important uses to which it could be applied in the heart of the City.

Though it is believed by the committee, that the work can be completed for about 320,000 dollars, yet, willing to place the subject in the most unfavourable point of view, they assume as the cost, the whole sum stated by Mr. Oakes,

	Dollars,	196,000
Add cost of Water Power,	-	150,000

Which amounts to	346,000
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The interest of which is	-	20,760
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And the expense of working mills,	-	2,100
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Making,	22,860
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From which deducting the sum assumed before, to be received from the Liberties,	-	10,000
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Leaves,	12,860
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Which being deducted from 30,858 dollars, the cost of only one steam engine, will leave a gain of 17,998 dollars per annum, as soon as the work is completed, which it is believed can be done in one year from August next, if the work is now commenced; and, if it is to be executed at all, no time is to be lost.

The sum of 17,998 dollars, applied as a sinking fund, will redeem the cost of the Water Power, in about twelve years ; after which the income to the City will be as stated by the committee in their last report ; to which may be added the tolls receivable from canals, or such other objects as the surplus water may be applied to.

Mr. Cooley, Mr. Wernwag, and Messrs. Briggs and Lehman, have offered, in case of making a contract, to give full security for the construction and safety of the work.

The committee, on further consideration, beg leave to offer a Bill, in lieu of the one before proposed, which is herewith presented. They also present a plan of the works, prepared by Mr. Oakes, and also another prepared by Mr. Wernwag.

By Order of the Committee,

JOSEPH. S. LEWIS, Chairman.

March 8th, 1819.

COMMUNICATIONS, &c.

Messrs. Joseph S. Lewis, and others concerned.

GENTLEMEN,

HAVING been requested to make an estimate, or, in other words, to say for what I would erect a dam, locks, and other necessary works, at Fair Mount, so as to raise the waters of the Schuylkill to a level of the surface of the water in Josiah White's dam, when at its proper height: having considered and reflected upon the subject, beg leave to report the following, viz.—

I have no doubt on my mind respecting the practicability of the same; but when I consider the vast length of the intended dam, together with the depth of the water, and the softness of the bottom in the deepest part, added to the double difficulty on account of the tide, I am in duty bound and in truth must say, that this vast work cannot be effected and completed in manner and form as it ought to be, so as to render the whole work perfectly safe and secure, and so as to fully answer all the purposes intended, short of a heap of cash. I think that you can find a man that will be willing to undertake said work, and find surety for its accomplishment and safety, for one hundred and fifty thousand dollars; and after the subject is fully detailed, perhaps a less sum may answer. If you, gentlemen, shall think this partial report worth consideration, and will shortly wait upon me by Committee, or otherwise, I will let you know who that man is; and will be happy to confer with you further upon the subject.

I am, with due regard and esteem,

Yours, &c.

ARIEL COOLEY.

[Received February 23d, 1819.]

Philadelphia, February 24, 1819.

Messrs. Joseph S. Lewis, and others concerned.

GENTLEMEN,

I FIND it impossible for me at present to make a judicious estimate of the expense which may occur, in the erection of a dam and other works in contemplation, at Fair Mount.

I do not think that it would be prudent to calculate, taking the whole collectively, which has been talked of, to expect to erect at an expense less than one hundred thousand dollars; it may cost more, and it may cost less. In order to be able to make a just estimate of the whole, it will be necessary, in the first place, to have an accurate survey and admeasurement, of both the length of said dam, the height that it is to be raised, and the space that there is between the top line, and the rock bottom below, as also of the soft bottom; all of this taken at the different points:—also the place should be selected for the locks, so as to have ascertained the length and the depth of the tail-race, and what the matter is, whether rock or earth; as also of the head-race, the depth and width should be ascertained; and it should be known how much rock and how much other matter. After the above is known, it will not be so difficult to make an estimate of the probable expense. There is but one thing respecting the whole business on which remains no doubt; that is this,—the practicability of the work, on which to me there remains no doubt.

I am, gentlemen, your humble servant,

ARIEL COOLEY.



Extract of a letter from Lewis Wernwag, dated March 4, 1819.

To Joseph S. Lewis.

I RECEIVED your favour of 27th ult. As for the practicability of making a dam at the present Water Works, I never had a doubt; and I can bring Sheridan and several other gentlemen who will say, that I remarked when building the upper ferry bridge, that if they would give me the money

that was spent in engines and house, I would build a dam at that place, that would afford an opportunity of selling water power that would amount to more than the expense of the work. I often viewed the situation, and observed what an advantageous improvement it would be to the City. I candidly tell you I feel desirous to have the building of that dam, in order to put my plan into execution; and if you feel desirous, I will make a draught and model, and send or bring it to town; and when you see it, I have no doubt but you will be convinced that the project is within the bounds of practicability, and can be made to withstand any thing. I am well acquainted with the situation. I wanted to build the bridge where the dam is intended, as the rock at that place runs all the way across the river.

With sincere respect I remain

Your friend,

LEWIS WERNWAG.

JOSEPH S. LEWIS.

March 10, 1819.

Upon further consideration, I estimate the cost of the dam, guard lock, guard walls, chamber locks, gates, and race, at 147,960 dollars; to be done according to a plan which I herewith furnish.

LEWIS WERNWAG.

Communication of Thomas Oakes.

To the Watering Committee of the Corporation of the City of Philadelphia.

GENTLEMEN,

I HAVE considered carefully the subject to which you have required my attention, in all its various parts, in order to give you the best ideas I can form, for accomplishing the object, and those of the most direct practical execution.

The mode of raising water for a supply of the City, by using the water power of the river Schuylkill by a water fall at Fair Mount, appears to me to be the most effectual and desirable of any within the reach of the City.

It is however accompanied by difficulties, owing to the peculiar situation of the river at this place; and the difficulties to be overcome appear to me to form the only objection to it.

As, however, no natural water fall exists, it is to be considered whether it is possible to create an artificial one: whether it can be relied on as to its construction and permanency, and if it will produce the effect.

The situation pointed out for the dam, although the best which can be obtained, I consider by no means propitious, but *not* of insurmountable difficulty. All the objects to be accomplished are by art, and the labour in perfecting them will arise from the following circumstances.

First, I treat of the local situation of the place. The river at the location of the proposed dam is about 1,000 feet wide. The depth of mud and water, about 240 feet from the eastern shore, (at low water) 30 feet; and at this depth it is uncertain in places; from that point, for 420 feet it is rock, with from 26 to 14 feet water, from which to the western shore it is rock alone at low water. A tide of 6 feet deep flows over the whole in and out twice in 24 hours.

I consider some inconvenience to result from too limited a plot for the use of the water at the site for the mills, between the abutment of the dam and the present engine house. These I believe are the chief difficulties to be overcome, and in conformity to your wishes I have considered and adopted the following plan for effecting the object in view.

The construction of the lower part or artificial foundation to be first attended to, and erected over the deepest part of the river.

This I consider may be done over the first section of 240 feet in two ways; either by filling up the bed of the river with small stones carried out from the hill, and thereon erecting a dock above the water; or, which I should much prefer, to drive two tier of piles, about 12 feet apart and 3 feet asunder in the tier; over these piles, cases of plank will be slid down, so as to form a kind of open case or chest across the river, to regulate and secure the sides and foundation; which chest I propose to fill with small broken stones, gravel, &c. to form what is called shingle grouting.

The middle section of 420 feet over the rock under water, I would form of hollow blocks, cased on the outside with plank of the same width as the other, with timbers perpendicular, the bottoms whereof, when sunk, to rest on the rock. These blocks to be filled and sunk with shingle grouting, and interlock each other when sunk.

A sketch of my ideas, handed with this, is the form of the dam, which is circular, or arched up stream, which I have adopted for its superior strength, and being better suited to the bed of the river.

The depth of water, added to the extraordinary length of the dam, requires much attention to have all the water that possibly can be stopped from running through. This can be best effected with the execution of the cases and grouting; and, if tolerably well stopped at that point, the mud and sand, brought down in the river and put in, will insinuate itself among the stones above, and make a solid mass.

Above these blocks and cases, I would put in small stones mixed with larger ones, for a considerable distance up stream; in the deepest part, 100 feet, and filled up two feet above low water, to make a top of 85 feet wide, on which to erect the upper part of the dam.

Below, I would promiscuously throw in large stones, so as to form a gradual slope. Thus, a bank of stone and gravel compacted, laid across the river, having in its middle part a column of grouting and two rows of plank, in a measure to render it tight, and form a foundation on which the upper part is built, and to which it may be firmly connected.

This I consider the first step, and also the most difficult; and that it may be the labour of the ensuing season, and left in that situation for the tides to flow over until the next, which will considerably solidate it, and render it more tight. The next operation which may be attended to, will be the execution of the piers and locks on the west side, with the piers and guard gates on the east, which may probably be executed before winter.

The upper part of the dam, I propose to build of logs and plank, well filled in with stone, in the usual form of a crib dam, and well backed with gravel and stone.

In forming an idea of these works, I cannot but refer to those at Flat Rock, and it leads me to make the following comparison respecting them.

The dam at Flat Rock is 500 feet long, and I judge about 12 feet high, founded on solid rock. The dam now to be erected will have to be placed on an artificial foundation, raised 26 to 30 feet from the bottom, and in the sweeping tide of the river, and will then have the dam erected upon it, 12 feet high and 1,000 feet long.

From a careful attention to the quantity of water in the river, I am very well satisfied it affords 300 cubic feet, running at the rate of two and an half feet per second, making 45,000 feet per minute, equal to 64,800,000 in 24 hours. Then taking

Thomas Oake's estimate at 64,800,000 in 24 hours.

Mr. Graff's, 66,732,000

Josiah White's, 115,500,000

3)247,032,000

Mean of three estimates, 82,344,000 cubic feet in 24 hours.

I will assume 70,000,000, which is probably not far from the truth, in common times of the water. Now allowing five feet of virtual fall, according to my calculation and experience, it will lift one forty-second part of its own volume 100 feet high, if the machinery is properly constructed, which would furnish in the reservoir on Fair Mount, upwards of 10,000,000 of gallons in 24 hours; but deducting, for leakage in the dam, one-fifth of the whole quantity, upwards of 8,000,000 will be left for the daily supply; which quantity may be furnished from the whole power of the river at common times.

I would recommend the water wheels of 15 feet diameter, and 18 feet wide on the bucket, to move by gravity, with one foot head above the aperture; the daily expense of water on the wheel would be 47,628,000 gallons, which would raise 1,182,240 gallons; which I would raise by a pump of 16 inches diameter, and a six foot stroke, making eight double strokes per minute. Then four such wheels and pumps

would raise 4,728,960 gallons, which might be safely estimated at 4,000,000 of gallons in 24 hours, raised into the reservoir, at an expense of about 31,000,000 of cubic feet of water in the same time, which might be considered about half the river, allowing for leakage.

It would take a water wheel 28 feet wide, and 15 feet diameter to work a pump 20 inches diameter, 6 feet stroke, 8 double strokes per minute, lifting 1,843,200 gallons in 24 hours. I would not recommend a wheel of so great width as is necessary for a 20 inch pump, being too heavy, wide, and ponderous, to be durable.

The head race ought to be 80 feet wide in the clear, and four feet deep, to carry the water to the first wheel, without diminishing the head; after which the race may be proportionably narrower as it extends by the wheels; this allowance in width is calculated to take all the water in the river at common times, and sufficient for 8 wheels.

The calculation of raising 8,000,000 of gallons in 24 hours, is founded on placing the lower part of the water wheels at high water mark, or allowing six feet of total head and fall, and raising the water 100 feet high. By placing the wheels as above, it will raise 9,250,000 eighty-six feet high, which I understand is the height from the top of the water in the reservoir. By placing the wheels, as intended, two feet below the top of high water mark, the quantity raised would be about 10,500,000 gallons to the height of 100 feet, and 12,500,000 to the height of 86 feet.

In the above calculations, I have made an allowance of nearly one-fifth for leakage and waste of the piston and valves in the pumps, and about one-eighth for leakage through the dam and locks of the river, and allowing the river to discharge 70 millions of cubic feet of water in 24 hours. I have estimated for the dam,

60,000 cubic feet of timber,
 184,000 superficial feet of 2, 3 and 4 inch plank for dam,
 75,000 Ditto and timber for ways, scaffolding and
 contingencies,
 75,000 perch of stone, gravel, &c. for filling in, above and
 below the dam.

Four water wheels, stone aprons, stop gates, drawing gears and gates, with levers, pitmen and cranks, 22,500 dollars; this is independent of pumps, race, and mill house; calculated to be done with the very best materials, and best manner.

Three men are amply sufficient to attend four wheels and pumps, day and night, and do the small necessary repairs; for which allow

Four dollars per day, - - -	\$ 1,460 per annum.
For grease, oil, candles and fire wood,	200
Wear and tear, as below, average,	440

The wear, tear, &c. for the first seven years, will be very trifling, unless from neglect or accidents.

The timber part of the wheels may be calculated to be removed every 12 or 14 years, at an expense of probably 12 or 1600 dollars, each wheel.

The calculations of the expenses I have made, are as follows; and are to the best of my judgment, and probably as near as such things can be estimated.

Dam, - - - - -	Dolls. 125,000
Locks, piers, and head gates, - - -	25,000
Four wheels, four pumps, mill house, head race, and 80 feet of raising main to each pump.	46,000

White's Town, February 24th, 1819.

SIR,

We, the undersigned, have viewed the Schuylkill, at or near Fair Mount water works, and find that there would be a practicability in building a dam and locks on that part of the river, and that the expense would not exceed 96,000 dollars, to build a good substantial stone dam, locks, guard walls, head gates, and dig the race of sufficient width and depth. If the company think it worthy of their notice, we will give them a plan, and the particulars of the manner in which we have calculated upon.

Yours, with sentiments of respect,

**WILLIAM BRIGGS,
WILLIAM LEHMAN.**

JOSEPH S. LEWIS.

January 29, 1819.

At a meeting of the Committee of conference with Messrs. Gillingham and White.

Present

Messrs. Lewis,
Williams,
Watson.

Messrs. Gillingham,
White.

Messrs. G. and White proposed to sell the entire and exclusive power of the use of the water of the Schuylkill, freed from all persons claiming under them, and reserving the fast lands they now own on both sides of the River, and the liberty of removing the present buildings, for the sum of 160,000 dollars, payable in cash or in certificates of stock of the City, payable with interest half yearly, redeemable at the pleasure of Councils.

The City to place a dam below the Falls at any time they think proper, and to indemnify Gillingham and White against the claims of the Navigation Company for the further improvement and passage of the locks at the Falls. Any damage by overflowing up to the limits granted by the Navigation Company to Gillingham and White, to be paid by the City.

If the City should decide to use the water power at the Falls, to be at liberty to do so; and Gillingham and White will convey to the City any ground below the bridge at the Falls on the east side, the City may think useful to it, belonging to them, free of cost.

Should the City determine to use the power at the Falls, possession to be given within one year.

The above is the substance of the conversation and agreements made this day.

JOSEPH S. LEWIS
SAMUEL WILLIAMS,
JOSEPH WATSON.

It being understood that the agreements on our part are not to be binding, unless sanctioned by Councils in a reasonable time, say four months.

Consideration, one hundred and sixty thousand dollars.

JOSIAH WHITE,
JOSEPH GILLINGHAM.

February 3, 1819.

At a meeting of the persons above named, the consideration was reduced to one hundred and fifty thousand dollars, which the committee of the Watering Committee were authorized and did offer, provided the City be at liberty to use any part of the present materials of the locks, dams, gates, &c. except the guard wall, which they may think proper. The title to be made complete to the satisfaction of the City solicitor, and the money to be paid on the first March next, or interest to be allowed thereon from that day. Should the City place a dam below the Falls, to be at liberty to do so; and the City to make a dam, and thereby stop the works at the Falls, as soon as it pleases.

This agreement to be binding, when approved by Councils.

JOSEPH S. LEWIS,
SAMUEL WILLIAMS,
JOSEPH WATSON,
JOSIAH WHITE,
JOSEPH GILLINGHAM.

At a meeting of a Sub-Committee from the Watering Committee, and a Committee of the Schuylkill Navigation Company, January 23, 1819.

Present.

Messrs. Watson, Williams, Lewis, on behalf of the City.

Messrs. Cresson, Mifflin, and Preston, on behalf of Navigation Company.

The committee of the Schuylkill Navigation Company stated, they were authorized to say their company would consent to the erection of a dam at or near Fair Mount, and give all the aid of their act of incorporation to the purpose, the City defraying the whole expense of erecting the dam, guard locks, locks, &c. and any damage whatsoever occasioned thereby. The locks, when finished, to be put into the possession of the Navigation Company, and the City to enjoy all the water power not necessary for the passage of the locks. The City also to furnish room for the erection

of a toll-house, to be erected at the expense of the Navigation Company.

The water power to be used by the City, for any object deemed useful to the City; but not to lease the water power for the erection of mills, or other machinery, for profit.

The committee stated that a canal, leading to the Delaware, would not be deemed an infringement of the agreement.

The water not to be drawn down below the top of the dam. The dam to be kept in repair by the City for ever, and if out of order to be repaired without delay. The locks to be kept in order by the Navigation Company.

Philadelphia, January 26, 1819.

Henry Nixon, Esq.

DEAR SIR,

That I may not misstate to the Watering Committee the subject of our conversation, give me leave to ask whether you did not engage that the owners of the Morrisville estate would (in case of the City putting up a dam, &c. for water power) permit the dam and race to be placed on your ground, northward of our late purchase at Fair Mount, free of cost to the City for the ground occupied. It being understood the City would, as far as could be done in accordance with their plans, place the dam in such situation as would be most agreeable to you.

I am, respectfully,

JOSEPH S. LEWIS,

Chairman Watering Committee.

The above is correct, with the exception of not exceeding fifty feet for the dam, free of cost.

HENRY NIXON.

REPORT

OF

THE WATERING COMMITTEE,

OF

THE AGREEMENTS

WITH THE

SCHUYLKILL NAVIGATION COMPANY,

AND

WHITE AND GILLINGHAM,

RELATING TO THE

WATER POWER OF THE RIVER SCHUYLKILL.

AGREEMENT.

ARTICLES OF AGREEMENT made, concluded and agreed upon, this _____ day of _____

in the year of our Lord one thousand eight hundred and nineteen, between the president, managers and company of the Schuylkill Navigation Company of the one part, and the mayor, aldermen and citizens of Philadelphia of the other part: Whereas Robert Kennedy, of Penn township, in the county of Philadelphia, innkeeper, being seized in fee of and in a certain lot and piece of land and site for mills, situate on the north-east side of the Falls of Schuylkill, in the township of Penn, was, by an act of the general assembly of the commonwealth of Pennsylvania, passed on the ninth day of April, one thousand eight hundred and seven, authorized to dig, continue, support and keep in repair a mill race on and contiguous to the said tract of land, to extend a certain distance into the river Schuylkill, and to keep the same in good repair for ever, and to lead off thereby on his own land so much of the water of the said river as should be necessary for a grist and saw mill, or such other machinery as it should by him be found expedient to establish, according to the provisions, limitations and conditions

in the said act of general assembly mentioned, as by reference to the same will more fully appear; and whereas the said Robert Kennedy, being so seized of the said premises and water right, by indenture bearing date the thirty-first day of March, one thousand eight hundred and ten, recorded at Philadelphia in Deed Book I. C. No. 8. page 539, &c. together with his wife, granted and assured the said land and water right to Josiah White, his heirs and assigns, excepting and always reserving out of the said grant, the rights and privileges which the said Robert Kennedy, in and by a certain indenture bearing date the twenty-first day of April, eighteen hundred and eight, granted unto Samuel Wheeler and others, trustees of the Schuylkill falls bridge.

And whereas, by articles of agreement between the president, managers, and company of the Schuylkill Navigation Company, and the said Josiah White, dated the fourteenth day of August, one thousand eight hundred and sixteen, recorded in Deed Book M. R. No. 12. page 331, &c. the said president, managers, and company, in pursuance of their act of incorporation, passed the eighth day of March, one thousand eight hundred and fifteen, and the supplement thereto, passed the eighth day of February, one thousand eight hundred and sixteen, being fully empowered to improve the navigation of the said river at the said falls and elsewhere, by erecting dams and locks and digging canals, and making other improvements that might be requisite, and to sell water power, and make all necessary contracts for those and other purposes, as in the said acts are particularly mentioned and set forth, did grant to the said Josiah White, his heirs and assigns, the right to erect a dam, consisting of several parts as there defined, across the said river, at the falls of Schuylkill aforesaid, and down along or near the western shore of the said river between the canal then made and the river; and the said Josiah White, his heirs and assigns, were thereby invested for ever with and entitled to all the rights of water power at the said improvement of the said falls, which the said company was entitled to grant under the act of assembly and supplement aforesaid, provided that it be so drawn off, used and employed, that it should not at any time

ment between the said president, managers and company of the Schuylkill Navigation Company and the said Josiah White, together with all the rights, incidents, members and appurtenances whatsoever, thereto belonging or in any wise appertaining, as by reference thereto will more fully appear.

And whereas the said mayor, aldermen and citizens of Philadelphia, being desirous to increase the supply of water raised from the river Schuylkill for the use of the said City, and for vending the same if they see fit to the adjoining districts, as well as for such other purposes as are herein after mentioned, by means of a new and enlarged power to be obtained by the erection of a dam to be built therein, near to their present water works; and whereas the said Navigation Company, fully sensible of the importance of such improvements, and willing to give effect to the same so far as may be done under their Charter of Incorporation, and having at the same time respect to the navigation of the said river, which by the erection of such works may be improved and extended, have agreed with the said mayor, aldermen and citizens of Philadelphia, to allow of such improvements, under the conditions, stipulations and agreements herein after mentioned:

Now these Presents Witness, that in order to fulfil the intention and meaning of said parties, and also the acts of assembly before mentioned, the said parties have contracted and agreed mutually with each other, with respect to the improvements to be made by the said mayor, aldermen and citizens of Philadelphia, and their successors, at or near to Fair Mount, Penn township, Philadelphia county, as follows, to wit: They the said president, managers and company of the Schuylkill Navigation Company, grant to the said mayor, aldermen and citizens of Philadelphia, the right, and they the said mayor, aldermen and citizens of Philadelphia, agree to erect a dam as herein after directed across the said river, near to Fair mount, at or nearly opposite to Hunter street, as laid down in the town plot of Morrisville; the said dam to be built conformably to the charter of incorporation of the said Navigation Company and the supplement thereto, and to be so formed as to be level on the top from one abutment to

the other, and so constructed as to raise the water of the said river as high as the said Josiah White might of right do under the said recited articles of agreement between the said Navigation Company and the said Josiah White.

It is hereby mutually understood and agreed between the said parties, that the said president, managers and company of the Schuylkill Navigation Company shall and may at all times draw off from the said dam as much water as they may deem necessary for the purpose of the navigation, and that the said mayor, aldermen and citizens shall and may enjoy all the remainder of the water of the said river for the purposes herein after mentioned; provided they do not at any time reduce the same or keep the same reduced below the level of the surface or top of the said dam; it being the design and meaning of the parties, that the said mayor, aldermen and citizens shall only have such use of the water as with the use thereof by the said president, managers and company, will not reduce it below the said surface or top of the dam, or keep it so reduced. And the said dam is to be kept up and in good and sufficient repair, at all times and for ever, by the said mayor, aldermen and citizens of Philadelphia and their successors, at their own proper expense and charges.

And it is further agreed between the said parties, that a tail race or canal, to accommodate the navigation of the said river at the said dam, is to be completed and finished in good order by the said mayor, aldermen and citizens of Philadelphia, and their successors, and, as soon as finished, delivered and secured to the said Navigation Company and their successors for ever.

And the said mayor, aldermen and citizens of Philadelphia, and their successors, shall build one good and sufficient guard lock, and two chamber locks, each to be eighty feet long and seventeen feet wide, as required by the act of incorporation of the said Navigation Company; the said locks to be so deep as to admit the water of the said river at the lowest time of the said water to the depth of three feet on the ribbond of the gateways of the said lock or locks, so as to make a safe and convenient passage for boats and other things which may

pass through them : and it is further agreed that the locks so to be built, shall be well founded and faced with hewn or well dressed stone, coming into contact with each other nowhere less than six inches, and running into the body of the wall so as to be perfectly secure ; and that the walls of said locks shall average at least seven feet in thickness, and of a height sufficient for the purposes of the said locks ; and the abutments and walls of the guard locks are to be so constructed as to be at least seven feet in height above the said dam, and all the materials of which the said locks shall be formed, those of wood as well as of stone, shall be of the best quality and kind, the stones of the walls to be well cemented together. And it is hereby agreed that the tail race or canal, extending from the said locks to the main channel of the said river, shall be formed and completed on a safe and convenient route, to be approved of by the said Navigation Company ; and the said tail race or canal shall be thirty feet wide at the bottom at the least, and three feet in depth below the low water of the said river, so that boats may at all times safely pass the same. And the said parties hereby further agree, that the said Navigation Company shall have the right, by themselves or their agents, to inspect the building of the said locks and other works as they shall progress, which said locks and canal shall be completed to the full satisfaction of the said Navigation Company.

And the said parties hereby further agree, that in case the said mayor, aldermen and citizens of Philadelphia, shall determine on placing the said canal and locks on the east side of the said river, that they shall make for and secure to the said Navigation Company, on such route as the said Navigation Company shall approve, a separate canal from the said dam, to enter the river Schuylkill below the water wheels of the City corporation : not less than thirty feet wide at the bottom, which shall in its whole length and breadth be at least three feet below the level of the top of the dam ; and the said canal shall be provided with a good and sufficient guard lock at the entrance thereof : and the locks of the said canal shall be placed so far within the banks, as at all times to secure a safe and convenient entrance into and outlet therefrom. And

the said mayor, aldermen and citizens of Philadelphia, shall build a good and substantial guard wall between the walls of the said locks and the tail race of the water wheels or mill power, and of a sufficient extent into the river, so that boats may lay with safety at the entrance of the said locks; and all boats which shall or may pass the said guard lock, but not through the two lower locks, shall pay to the said Navigation Company as much toll as they may now legally demand from boats passing one lock (except such boats as may be employed by the said mayor, aldermen and citizens of Philadelphia, for the purposes of the said City, which shall not pay any toll.)

And it is further agreed between the said parties, that in case the said mayor, aldermen, and citizens of Philadelphia, and their successors, shall at any time hereafter make and construct a canal along or near to the route of the present canal at Morrisville, to communicate with the Schuylkill to the northward of Fair Mount, or in case any other persons, bodies politic or corporate, shall make and construct such canal, then and in such case the said Navigation Company shall not demand or require the tolls on such canal and locks, or any part of them, to be paid to them, and such tolls shall and may be receivable by those entitled to them. But in case the said mayor, aldermen and citizens of Philadelphia, shall make a canal running between Quarry-hill at Fair Mount, and the river Schuylkill, they shall be at liberty to demand and receive all the tolls receivable on the said canal, except so much thereof as may be equal to the tolls which the said Navigation Company now may legally take at any one of their locks, which said toll shall be paid to the said Navigation Company, except on boats employed on the said canal for the use of the said mayor, aldermen and citizens of Philadelphia, which shall not pay any toll. But it is expressly agreed, that nothing herein contained shall in any manner be understood to authorize any interference with the canal and locks herein and hereby stipulated to be constructed and delivered to the said president, managers and company, nor to impair or lessen the obligation of the said mayor, aldermen and citizens to maintain, support and keep the

said dam in repair, nor to affect or impair the exclusive authority and control over the said canal and locks, and the exclusive possession and ownership thereof, by the said president, managers and company.

And the said parties hereby further covenant and agree, that the said mayor, aldermen and citizens of Philadelphia, and their successors, shall not sell, lease, or dispose of any water power of the said river Schuylkill, nor use the said water power for manufacturing purposes, except only for boring pipes, pumps, and such other matters and things, as may be useful to and connected with the said public works of the said mayor, aldermen, and citizens of Philadelphia.

And whereas, the said mayor, aldermen, and citizens of Philadelphia, having become possessed of the whole of the water power at the falls of the said river, by the before recited conveyance, from the said Josiah White and Joseph Gillingham, it is covenanted and agreed by and between the parties hereto, that the provisions of the agreement of the 14th day of August, 1816, between the said Navigation Company, and the said Josiah White, imposing particular conditions and restrictions on the said Josiah White, and his assigns, in reference to the dam, locks, and canals, at the said falls, shall cease and become void, so far as the said conditions and restrictions may be rendered unnecessary, by the construction of a dam, together with canals and locks, at or near to Fair Mount; and the said mayor, aldermen, and citizens of Philadelphia, at any time after the said dam, abutments, guard walls, canals, and locks, at or near Fair Mount, are completed to the satisfaction of the said president, managers, and company of the Schuylkill Navigation Company, take up and remove the present materials of the locks, dams, gates, &c. at the said falls, except the guard wall, and apply the same to such uses as they may see proper, freed from any claims of the said Navigation Company. And it is hereby declared to be understood and agreed between the said parties, that nothing in this agreement contained is in any manner to impair or affect the rights belonging to the said mayor, aldermen, and citizens of Philadelphia, under the said act of Assembly, of the 9th day of

April, 1807, reserved to them therein, or those since by them acquired under the before mentioned conveyance, from the said Josiah White and Joseph Gillingham; but the same are to be held by them as fully and to all intents and purposes as heretofore, except so far as they may be altered, changed or modified by this present agreement.

And the said mayor, aldermen, and citizens of Philadelphia, for themselves and their successors, do hereby covenant, promise and agree to pay all penalties and damages, which the said Schuylkill Navigation Company would or might be liable to pay, so far as said penalties or damages may be occasioned by the said dam, canal, and locks, or other works to be erected at or near Fair Mount, and all damages occasioned by Josiah White's dam at the falls, to which he would be liable by virtue of the said articles of agreement, and to pay all expenses attending suits which may be brought against the said Schuylkill Navigation Company, by reason of either of the said dams, canals, and locks. All the works to be completely finished as soon as practicable, but on or before the 1st day of January, 1822, unavoidable accidents excepted. The said mayor, aldermen, and citizens covenant and agree that they will provide and furnish the said president, managers, and company of the Schuylkill Navigation Company, sufficient and suitable ground adjoining the said locks, whereon to erect a convenient toll house, with free access to and from the same from time to time and at all times hereafter for ever. The locks and canals when finished, and ground for the toll house, to be delivered over and put in possession of the said Schuylkill Navigation Company, and to be and remain their property for ever.

And the said mayor, aldermen, and citizens of Philadelphia, and their successors, do hereby covenant, promise and agree to, and with the said president, managers and company of the Schuylkill Navigation Company, that they the said mayor, aldermen, and citizens of Philadelphia, and their successors, shall and will well and truly do and perform all and singular the covenants, matters and things on their part to be done and performed: and the said presi-

dent, managers and company of the Schuylkill Navigation Company, do hereby covenant, promise and agree to, and with the said mayor, aldermen, and citizens of Philadelphia, that they and their successors shall and will well and truly do and perform all and singular the covenants, matters and things on their part to be done and performed; and that the said mayor, aldermen and citizens of Philadelphia doing and performing at their own expense all and singular the matters and things on their part to be done and performed, shall and may enjoy all the rights, privileges, estate and interest hereby granted and conveyed or intended so to be, without any let or molestation of the said president, managers and company of the Schuylkill Navigation Company and their successors, or any claiming under them. And for the true and faithful performance of all and singular the covenants, articles, and agreements aforesaid, the said parties bind themselves to each other firmly by these presents.

IN WITNESS whereof the said president, managers and company of the Schuylkill Navigation Company, and the said mayor, aldermen and citizens of Philadelphia, have hereunto caused their common or public seal to be interchangeably affixed.

DEED.

Josiah White and Wife, and Joseph Gillingham and Wife, to the Mayor, Aldermen, and Citizens of Philadelphia.

THIS INDENTURE, made the _____ day of _____ in the year of our Lord one thousand eight hundred and nineteen, between Josiah White of the City of Philadelphia, gentleman, and Elizabeth his wife, and Joseph Gillingham of the same place, merchant, and Rebecca his wife, of the one part, and the mayor, aldermen and citizens of Philadelphia, of the other part: Whereas Robert Kennedy of Penn township in the county of Philadelphia, innkeeper, being seized in fee of and in a certain lot or piece of land and site for mills situate on the north east side of the falls of Schuylkill in the said township of Penn, was, by an act of the General Assembly of the Commonwealth of Pennsylvania, passed the ninth day of April, in the year of our Lord one thousand eight hundred and seven, authorized to dig, continue, support, and keep in repair a mill race on and contiguous to the said tract of land, to extend a certain distance into the river Schuylkill, and to keep the same in good repair forever, and to lead off thereby on his own land so much of the water of the said river, as should be necessary for a grist and saw mill or such other machinery as it should be by him found expedient to establish according to the provisions, restrictions, limitations and conditions in the said act of General Assembly mentioned, as by reference to the same will more fully appear :

And whereas the said Robert Kennedy, being so seized of the said premises and water right, by indenture bearing date the thirty first day of March, in the year of our Lord one thousand eight hundred and ten, recorded at Philadelphia in deed book I. C. No. 8, page 539, &c. together with his

wife, granted and assured the said land and water right to the said Josiah White, his heirs and assigns, excepting and always reserving out of the said grant the rights and privileges which the said Robert Kennedy, in and by a certain indenture bearing date the 21st day of April, 1808, granted unto Samuel Wheeler and others, trustees of the Schuylkill falls bridge :

And whereas, by articles of agreement between the president, managers and company of the Schuylkill Navigation Company and the said Josiah White, dated the fourteenth day of August, in the year of our Lord one thousand eight hundred and sixteen, recorded at Philadelphia in deed book M. R. No. 12, page 331, &c. the president, managers and company of the Schuylkill Navigation Company, in pursuance of their act of incorporation, passed the eighth day of March, one thousand eight hundred and fifteen, and the supplement thereto, passed the day of one thousand eight hundred and sixteen, being fully empowered to improve the navigation of the said river at the said falls and elsewhere, by erecting dams and locks, and digging canals and making other improvements that might be requisite, and to sell water power and make all necessary contracts for those and other purposes, as in the said acts are particularly mentioned and set forth ; did grant to the said Josiah White, his heirs and assigns, the right to erect a dam consisting of several parts as therein defined across the said river at the falls of Schuylkill aforesaid, and down along or near the western shore of the said river between the canal then made and the river ; and the said Josiah White, his heirs and assigns, were thereby invested forever with and entitled to all the rights of water power at the said improvement of the said falls which the said company were entitled to grant under the act of Assembly and supplement aforesaid, provided that it be so done, drawn off, used and employed that it should not at any time impede, interrupt or injure the navigation of the said river or canal, and under such conditions, terms and stipulations as in the said recited agreement are more fully expressed and mentioned :

And whereas the said Josiah White and wife, by indenture dated the first day of January, one thousand eight hundred and seventeen, recorded at Philadelphia in deed book M. B. No. 19, page 502, &c. granted, conveyed and assured unto the said Joseph Gillingham, his heirs and assigns, together with the lands and premises in the said indenture mentioned, one-sixteenth part of the whole of the water of the said river without any deduction, with liberty to draw the same through the canal or race cut through the long or main rock at the said falls for the nail factory therein conveyed, or any other water works which he the said Joseph Gillingham, his heirs and assigns, might erect on the said premises, with the privileges and restrictions therein mentioned: and also one full equal and undivided moiety or half part of and in the right of water power of the said Falls of Schuylkill, and generally of and in all the water of the River Schuylkill at the said Falls, excepting the six-tenths of the said water attached as therein described to the wire factory and lot of the said Josiah White, and one-sixteenth attached as aforesaid to the said nail factory and lot; and all the rights, privileges and advantages given and granted in and by the said recited agreement with the Navigation Company to the said Josiah White, his heirs and assigns, under and subject to all the restrictions, conditions, stipulations and agreements therein mentioned.

And whereas in and by certain articles of agreement made and entered into between them the said Josiah White and Joseph Gillingham, and Joseph S. Lewis, Samuel Williams and Joseph Watson, on behalf of the Watering Committee of the Select and Common Councils of the City of Philadelphia, the said Josiah White and Joseph Gillingham agreed to sell and convey for the consideration money therein mentioned to the mayor, aldermen and citizens of Philadelphia, their successors and assigns, the entire and exclusive power of the use of the water of the River Schuylkill, freed from all persons claiming under them, and reserving in such sale the fast-lands then owned by them on both sides of the river and the right of removing the buildings thereon, and giving to the mayor, aldermen and citizens of Philadelphia, their succes-

sors and assigns, full power to place a dam below the falls at any time they should think proper, and thereby stop the works at the falls as soon as they should see fit; and the mayor, aldermen and citizens of Philadelphia agreed to indemnify the said Josiah White and Joseph Gillingham against the claims of the said Navigation Company for the further improvement and passage at the locks at the falls, stipulated for in the agreement of the said Josiah White with the said Navigation Company; and in case any damage should happen by overflowing up to the limits granted by the said Navigation Company to the said Josiah White, the same to be paid by the mayor, aldermen and citizens of Philadelphia: and in case that the mayor, aldermen and citizens of Philadelphia should decide to use the water power at the falls,

the said Josiah White and Joseph Gillingham further agreed to convey to them any ground below the falls bridge on the east side of the river which they may think useful to it, belonging at the time of the said agreement to the said Josiah White and Joseph Gillingham, free of cost, possession whereof to be given in one year, together with the liberty to use any part of the present materials of the locks, dams, gates, &c. except the guard wall, which the said mayor, aldermen and citizens of Philadelphia may think proper.

Now this Indenture witnesseth, that the said Josiah White and Elizabeth his wife, and Joseph Gillingham and Rebecca his wife, for and in consideration of the sum of one hundred and fifty thousand dollars, lawful money of the United States, to them in hand well and truly paid, by the mayor, aldermen, and citizens of Philadelphia, at or before the sealing and delivery hereof, the receipt whereof the said Josiah White and Joseph Gillingham do hereby acknowledge, Have granted, bargained, sold, aliened, enfeoffed, and confirmed, and by these presents Do grant, bargain, sell, alien, enfeoff, and confirm unto the mayor, aldermen, and citizens of Philadelphia, their successors and assigns, all their right of water power of the falls of the river Schuylkill, and generally of and in all the water of the said river at the said falls, and all the rights, privileges and advantages given and

granted in and by the above recited articles of agreement between the president, managers and company of the Schuylkill Navigation Company and the said Josiah White, and the said indenture of the said Robert Kennedy, and the said acts of assembly, together with all the rights, incidents, members and appurtenances whatsoever thereunto belonging or in any wise appertaining, which they the said Josiah White and Joseph Gillingham hold jointly or severally or otherwise howsoever, and also all the present materials of the locks, dams, gates, canal walls, except the guard wall, TO HAVE AND TO HOLD the said right of water power of the falls of the said river, hereditaments and premises hereby granted or mentioned or intended so to be, with the appurtenances, unto the mayor, aldermen and citizens of Philadelphia, their successors and assigns, to the only proper use and behoof of the mayor, aldermen and citizens of Philadelphia, their successors and assigns, for ever. And the said Josiah White and Joseph Gillingham for themselves, their heirs, executors and administrators, and for every of them, do jointly and severally covenant, promise and agree to and with the mayor, aldermen and citizens of Philadelphia, their successors and assigns, by these presents in manner following, that is to say, that the mayor, aldermen and citizens of Philadelphia may erect a dam below the falls of the said river at any time they see proper, and should they decide to use the water at the said falls, then to convey and assure to the mayor, aldermen and citizens of Philadelphia, their successors and assigns, all the ground now held by the said Josiah White and Joseph Gillingham or either of them, below the bridge at the said falls on the east side of the said river, which they the mayor, aldermen and citizens of Philadelphia, their successors and assigns, may think useful to them, and to deliver up possession thereof within one year from the date hereof free and clear from all costs and charges or further consideration money; and also to indemnify and save harmless the mayor, aldermen and citizens of Philadelphia, their successors and assigns, from all costs and damages, claims and demands, for or by reason of any

person or persons holding or claiming rights or privileges under the said Josiah White and Joseph Gillingham, or under either of them, at the said falls, for or by reason of any improvements which may be made in or upon the said river by the mayor, aldermen and citizens of Philadelphia, their successors and assigns, for or by reason of the water power and privileges hereby granted, or others which may be granted, to the mayor, aldermen, and citizens of Philadelphia.

And the mayor, aldermen and citizens of Philadelphia, for themselves, their successors and assigns, do covenant, promise and agree to and with the said Josiah White and Joseph Gillingham, their heirs and assigns, by these presents, in the manner following, that is to say, that they the mayor, aldermen and citizens of Philadelphia, their successors and assigns, shall and will do and perform all and every the covenants and agreements to be done and performed by the said Josiah White in the said recited agreement with the said Schuylkill Navigation Company mentioned or contained; and also to indemnify and save harmless the said Josiah White and Joseph Gillingham, and their heirs, of and from all claims of the president, managers and company of the Schuylkill Navigation Company, for the further improvement and passage of the locks at the falls of the said river, and of and from all other costs and charges, claims and demands whatsoever, for or by reason of any the covenants or engagements made and entered into by the said Josiah White to and with the said Navigation Company, for or by reason of any improvements which may be made by the mayor, aldermen and citizens of Philadelphia, their successors and assigns, at the falls of the said river or elsewhere on the same; and also that they the said Josiah White and Joseph Gillingham, shall and may have liberty to remove and take away their present buildings at the said falls, and make use of the water power at the same for a term not exceeding eighteen months, unless the mayor, aldermen and citizens of Philadelphia shall decide to use the said water power at the said falls, or to erect a dam at or near to Fair Mount within the said time.

And it is hereby declared to be understood and agreed between the said parties, that nothing in this indenture contained is in any manner to impair or affect the rights belonging to the said mayor, aldermen and citizens of Philadelphia under the said act of Assembly of the 9th day of April, 1807, reserved to them therein, but the same are to be held by them as fully and to all intents and purposes as heretofore. And the said Josiah White and Joseph Gillingham for themselves, their heirs, executors and administrators, do covenant, promise and agree to and with the mayor, aldermen and citizens of Philadelphia, their successors and assigns, by these presents, that they the said Josiah White and Joseph Gillingham, and their heirs, all and singular the premises hereby granted, with the appurtenances, unto the mayor, aldermen and citizens of Philadelphia, their successors and assigns, against them the said Josiah White and Joseph Gillingham, and their heirs, and against all and every other person or persons whomsoever lawfully claiming or to claim the same by from or under them or either of them, shall and will warrant and forever defend by these presents.

In witness whereof the said Josiah White and Elizabeth his wife, and Joseph Gillingham and Rebecca his wife, have hereunto set their hands and seals, and the mayor, aldermen and citizens of Philadelphia have caused their corporate seal to be affixed, the day and year first above written.

*Sealed and delivered }
in the presence of }*

ARTICLES OF AGREEMENT,

BETWEEN

ARIEL COOLEY,

AND

THE MAYOR, ALDERMEN, AND CITIZENS

OF

THE CITY OF PHILADELPHIA.

ARTICLES OF AGREEMENT, made, concluded, and agreed upon, this twenty-third day of September, in the year of our Lord one thousand eight hundred and nineteen, between Ariel Cooley, of Springfield, in the state of Massachusetts, of the one part, and the mayor, aldermen, and citizens of Philadelphia, of the other part: WHEREAS, by articles of agreement between the president, managers, and company of the Schuylkill Navigation Company, and Josiah White, dated the fourteenth day of August, eighteen hundred and sixteen, the said president, managers, and company, did grant to the said Josiah White, his heirs and assigns, the right to erect a dam across the river Schuylkill, at the falls, and the said Josiah White, his heirs and assigns, were thereby invested for ever with, and entitled to all the right of, the water power at the said falls, which the said company were entitled to grant, under the terms in the said agreement mentioned: AND WHEREAS the said Josiah White afterwards conveyed to Joseph Gillingham and his assigns, among other things, part of the said water power: AND WHEREAS the said Josiah White and Joseph Gillingham, by indenture, bearing date the seventeenth day of April, in the year of our Lord eighteen hundred and nineteen, granted and conveyed, among other things, all their right of water power at the said falls, to the mayor, aldermen, and citizens of Philadelphia, subject to the performance, by the mayor,

aldermen, and citizens of Philadelphia, of all and every the covenants and agreements to be done and performed by the said Josiah White, in the said recited agreement with the Schuylkill Navigation Company mentioned or contained: **AND WHEREAS** the president, managers, and company of the Schuylkill Navigation Company, by articles of agreement with the mayor, aldermen, and citizens of Philadelphia, bearing date the third day of June, eighteen hundred and nineteen, granted to the mayor, aldermen, and citizens of Philadelphia, the right to erect a dam across the said river, at or near to Fair Mount; the said dam to be built conformably to the charter of incorporation of the said Navigation Company, and the supplement thereto, and to be so formed as to be level on the top, from one abutment to the other, and so constructed as to raise the water of the said river as high as the said Josiah White might of right do, under the said recited articles of agreement with the said Navigation Company: **AND WHEREAS** the said Ariel Cooley has agreed, for the consideration hereinafter mentioned, to construct the said dam, together with the canal and race, and the necessary locks and guard-walls, in the manner hereinafter provided: **NOW THESE PRESENTS WITNESS**, that the said Ariel Cooley, for and in consideration of the sum of one hundred and fifty thousand dollars, lawful money of the United States, to be paid to him by the mayor, aldermen, and citizens of Philadelphia, and their successors, in the manner hereinafter mentioned, Doth covenant, promise, and agree, to and with the said mayor, aldermen, and citizens of Philadelphia, and their successors, in manner following, to wit: That he the said Ariel Cooley, his executors and administrators, shall and will erect and construct a dam across the river Schuylkill, at or near to Fair Mount, on such site as may be fixed upon by the Watering Committee of the Select and Common Councils of the said city, and to be so formed as to be a level at the top of the said dam from one abutment to the other, and so constructed as to raise the water of the said river as high as the said Josiah White might of right have done, under the said recited articles of agreement between him and the said Navigation Company; the said dam,

commencing at the western shore, and extending across the said river as far as the rocky bottom thereof, to be constructed of the best hemlock timber, of a large size, and filled in with stone, and floored over with oak plank, running up and down stream, to be not less than six inches thick at the upper end or overfall of the said dam; the said dam to be built, on the up stream, or north side, to an angle of twenty-five degrees, forming a straight line from the top of the said dam to where it intersects the crib work at that angle, and battered on the back, or south side, one foot to each four feet rise. The remainder of the said dam or abutment, on the eastern side, to be well and substantially constructed, of stones and earth, placed together in the most secure and workmanlike manner, and raised seven feet higher than the western part of the dam is required to be, and to be at least fifteen feet wide at the top, with a slope, on both the upper and lower sides, of not less than twenty-five degrees, commencing at the top of the said bank, and extending on that angle until it intersects the bottom of the river; and the whole to be so permanently made, as not to cave in, or give way; and to be water-tight in its whole extent, from shore to shore, and from its base, at the bottom of the river, to the top of the said dam; and where that part thereof which is to be made of wood connects with that which shall be made of earth, shall be constructed with a head pier, laid with dressed stone, with deep joints and beds, laid in mortar and grouted, and shall be so firmly bound together, as to withstand the greatest pressure which may be occasioned by ice or water freshets; and the whole dam to be so completely made, and in all respects finished in so workmanlike a manner, as not to suffer or permit a loss of more than one-tenth of the whole water of the said river. And the said Ariel Cooley doth further covenant and agree to dig and construct a race, on the eastern side of the said river, to commence at the north side of the said dam, and to extend to the north side of Morris street; and to make the said race ninety-three feet wide at the entrance, and from thence gradually narrowing on the east side, to the distance of twenty feet from the south side of the arches hereinafter mentioned, where the race shall be

seventy-five feet wide ; thence again gradually narrowing to the width of sixty-seven feet wide, commencing five feet three inches from the north-east corner of the engine-house, continuing from thence to the north side of Morris street, gradually narrowing to sixty feet wide ; the said race to be six feet deep, clear of the cills of the head-gates, from the water line of the dam ; the said widths to be measured on the average of the top and bottom of the said race ; the line of the west side of the race to be straight from the abutments of the arches of the head-gates to the said engine-house : And it is further agreed, that the head-piers, abutments, and arches, at the entrance of the dam, shall be substantially built, with dressed stone, with sufficient beds, laid in mortar, and well grouted, as the work progresses ; the openings into the head of the race to consist of three arch-ways, at least fifteen feet in width north and south, the centre one of which to be seventeen feet wide in the clear east and west, and ten feet high above the water line of the dam, for the free admission of boats ; the clear openings of the said arch-ways to be of sufficient width so as to admit at all times a column of water to pass, equal at least to four hundred and two cubic feet in each foot in length ; and that all the gates and gateways shall be made and finished in a workmanlike manner, with yellow pine, or of the best white oak timber, free from sap where exposed above the water in the said race or river ; and that all the gearing, for opening and shutting the said gates, shall be made of iron, and on the most approved plan. And the said Ariel Cooley further covenants and agrees to make and construct a canal, from the said dam, on the western side of the said river, on such route as the said Navigation Company shall approve, to enter the said river at a convenient distance, through the flat marsh, three feet deep below low water mark, and to be twenty-five feet wide at the bottom, with the usual slopes, and which shall, in its whole length and breadth, be at least three feet below the level of the top of the dam : And also shall and will build one good and sufficient guard-lock, to be level and not to let down, and two chamber-locks, in the said canal, commencing at a point nearly opposite the water-house, and a few perches

above a large projecting rock ; each lock to be eighty feet long, and seventeen feet wide in the clear, as required by the act of incorporation of the said Navigation Company ; the said locks to be so deep as to admit the water of the said river, at the usual low time of the said water, to the depth of three feet on the ribbon of the gate-ways of the said locks, so as to make a safe and convenient passage for boats and other things which may pass through them : And it is further agreed, that the locks so to be built shall be well founded, and faced with hewn or well dressed stone, coming into contact with each other no where less than twelve inches, with binders or heading courses, which shall be at the least four feet long ; and that the walls of the said locks shall average at the least seven feet in thickness, and of a height sufficient for the purposes of the said locks ; and the abutments and walls of the said guard-locks are to be so constructed as to be at least seven feet high above the said dam ; and all materials of which the said locks shall be formed, those of wood as well as of stone, shall be of good quality and kind ; the stones of the said walls to be well bedded in mortar, grouted and pointed with cement of the most approved sort ; and the locks of the said canal shall be placed so far within the banks, as at all times to secure a safe and convenient entrance in and outlet therefrom : And it is further agreed by the said Ariel Cooley, that the gates and gate-ways shall be made of the best workmanship and materials ; and the gearings for opening and shutting the gates of the race and canal shall be of iron, and on the most approved plan ; and the said Navigation Company shall have the right, by themselves or their agents, to inspect the building of the said locks and other works, as they shall progress ; which locks, canal, and dam, shall be completed to their satisfaction. And it is further agreed between the said parties, that all the earth, stone, and other materials, that may be raised in cutting and digging the said canal and locks, and race, shall appertain and belong to the said Ariel Cooley, to be applied by him in constructing the said improvements ; and should not the same be sufficient for that purpose, that the said Ariel Cooley may take such further materials as the said works may require,

from such part of the land of the mayor, aldermen, and citizens of Philadelphia, at Fair Mount, as they may point out to him; or he may be at liberty to purchase elsewhere, at his own proper cost, such materials as he may want: it being understood and agreed, that the said Ariel Cooley is not to be interrupted, in the progress of the said work, by applying or using the land aforesaid for the purposes of roads or otherwise. And the said Ariel Cooley, for himself, his heirs, executors, and administrators, doth farther covenant and agree, that he shall and will, from time to time, and at all timēs hereafter, for the space of five years from the time the said canal and locks, together with the dam, and race to the north-east corner of the engine-house, where the said race narrows to sixty-seven feet, shall be completed, and delivered up to the mayor, aldermen, and citizens of Philadelphia, at his own proper costs and charges, uphold, maintain, and keep the said dam, canal, head-gates, and locks, so to be duly erected and finished, in, by, and with all necessary repairs, and keep harmless and indemnified the mayor, aldermen, and citizens of Philadelphia, from all actions, suits, costs, damages, and payments whatsoever, that may arise or happen unto them, by the giving way of any part of the said work, in case of the failure of the said Ariel Cooley to repair the same, during the said term of five years. And the said Ariel Cooley further covenants and agrees to commence erecting the said dam and locks forthwith, and to finish the same in every respect in a good and workmanlike manner, according to the true intent and meaning of this agreement, by the twenty-fifth day of December, which will be in the year of our Lord one thousand eight hundred and twenty: And it is further agreed between the said parties, that as soon as the said canal, locks, and dam, and also the head-race so far as the north-east corner of the engine-house, where it is to narrow to sixty-seven feet, shall be fully completed, that the said works may be delivered up by the said Ariel Cooley to the mayor, aldermen, and citizens of Philadelphia, who hereby agree to accept the same, and to allow him until the month of December, eighteen hundred and twenty-one, to complete and finish the remainder of the said

head-race, from the north-east corner of the engine-house to Morris street aforesaid, in the manner herein before mentioned: and in case there should exist any difference of opinion, as to what shall be deemed to be the completion of the said works, at the time the said Ariel Cooley may offer to deliver up the same to the mayor, aldermen, and citizens of Philadelphia, as finished, it is hereby agreed, that such difference between the said parties shall be submitted to the arbitration of three disinterested persons, of good judgment, unconnected with the said parties, and mutually chosen by them, whose determination, or a majority of them, shall be binding on the parties hereto; and in case the said arbitrators shall be of opinion that something further shall be requisite to be done by the said Ariel Cooley, to make the said work complete, it is hereby agreed, that the said Ariel Cooley shall be allowed a reasonable time therefor, which additional time shall not be construed to be an infringement, on his part, of the said agreement, although the said time should exceed or outrun that within which the said Ariel Cooley has herein covenanted to complete the works aforesaid, he making suitable compensation to the mayor, aldermen, and citizens of Philadelphia, for any damages that may happen to them from his delinquency or omissions, should any such occur. And the said mayor, aldermen, and citizens of Philadelphia, covenant, promise, and agree to and with the said Ariel Cooley, his executors and administrators, to pay, or cause to be paid, to the said Ariel Cooley, his executors and administrators, the sum of five thousand dollars, at the commencement of the said work; and the further sum of five thousand dollars, as soon after as work to that amount shall be done by the said Ariel Cooley; and so on, in succeeding payments of five thousand dollars, as the work progresses, until the whole is finished; the said mayor, aldermen, and citizens of Philadelphia always keeping in advance to the said Ariel Cooley the sum of five thousand dollars. And the said Ariel Cooley further agrees, in order to secure, for the space of five years from the time aforesaid, the true and faithful performance of all and singular the covenants herein contained, there shall remain with the mayor, aldermen, and

citizens of Philadelphia twenty thousand dollars of the money which he would be entitled to receive under this agreement, and which shall not be demanded or taken from the said mayor, aldermen, and citizens of Philadelphia, by the said Ariel Cooley, his executors, administrators, or assigns, until the expiration of the said time, and the fulfilment, on his part, of all the covenants and agreements to be by him done and performed : it being understood and agreed, that the said Ariel Cooley shall and may receive the interest on the said twenty thousand dollars, so to remain as security, when it shall fall due, until there shall be a failure in the fulfilment on his part of the said agreement, when the said interest shall cease to be received by him. And the said mayor, aldermen, and citizens of Philadelphia, hereby further agree, that the said sum of twenty thousand dollars shall be delivered up to the said Ariel Cooley, on his substituting, to the satisfaction of the mayor, aldermen, and citizens of Philadelphia, security of equal amount and value in its place ; and the said Ariel Cooley, further to secure the performance of this agreement, hereby covenants forthwith to execute a mortgage to the mayor, aldermen, and citizens of Philadelphia, on certain lands in the township of Springfield and county of Hampden, in the state of Massachusetts, containing about fifteen hundred acres ; which mortgage is to be defeasible at the end of five years from the time aforesaid, on the true performance by him of all the covenants and agreements herein contained. IN WITNESS WHEREOF, the said Ariel Cooley hath hereunto set his hand and seal ; and Joseph S. Lewis and Joseph Watson, (a committee therefor appointed by the Watering Committee) for the mayor, aldermen, and citizens of Philadelphia, have hereunto affixed their hands and seals, the day and year first above written.

ARIEL COOLEY,
JOSEPH S. LEWIS,
JOSEPH WATSON.